BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, PRINCIPAL BENCH, AT NEW DELHI

ORIGINAL APPLICATION NO.227 OF 2025

IN THE MATTER OF:

NAVEEN SOLANKI & ANR. …APPLICANTS

VERSUS

RAIL LAND DEVELOPMENT AUTHORITY & ORS. …RESPONDENTS

INDEX

NDOH 10.07.2025

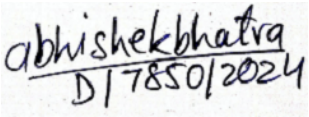
S.NO	PARTICULARS	PAGE NO.
1.	Reply on behalf of Respondent No.1 to the Original Application filed by Applicants, with supporting Affidavit	1-65
2.	**Annexure R-1 (Colly)** True Copy of Award No.19/86-87 and Jamabandi for the year 2002-03, along with typed and translated copy.	66-236
3.	**Annexure R-2** True Copy of Handing-over Letter.	237
4.	**Annexure R-3** True Copy of Affidavit dated 12.02.2024.	238-239
5.	**Annexure R-4** True Copy of Affidavit dated 29.01.2025.	240-245
6.	**Annexure R-5** True Copy of the Report dated 09.01.2025.	246-252
7.	**Annexure R-6 (Colly)** True Copy of the Orders dated 19.02.2024 and 04.03.2025 passed by Hon'ble Supreme Court in *Ashok Kumar Sharma, Indian Forest Service (Retd) & Ors. v. Union of India & Anr. [W.P.(C) 1164/2023]*	253-278

8.	**Annexure R-7** True Copy of the extract of GPS picture from Google Earth, dated 11.04.2009.	279
9.	**Annexure R-8** True Copy of the Order dated 28.07.2017 passed by Hon'ble Madras High Court in *V. Meghanathan vs Chief Secretary, Government of Tamil Nadu & Ors. [W.P. 10614/2017]*.	280-378
10.	**Annexure R-9** True Copy of the Paper titled "Invasion of Prosopis Juliflora and Its Impact on Indigenous Plant Species of Sariska Region" as published in International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management, bearing Volume 5, Issue 3, ISSN 2395-7639.	379-383
11.	**Annexure R-10** True Copy of the Budget Speech 2017-18.	384-424
12.	**Annexure R-11** True Copy of the Tree Transplantation Policy, 2020.	425-433
13.	**Annexure R-12** True Copy of the News Article dated 23.03.2021 published in the Hindu.	434
14.	**Annexure R-13** True Copy of the Minutes of the 67th meeting of State Level Environmental Impact Assessment Authority (SEIAA)-Delhi.	435-486
15.	**Annexure R-14** True Copy of the Delhi Government's Green Action Plan 2023-24.	487-498
16.	**Annexure R-15** True Copy of the Paper titled "The Invasive Shrub Prosopis juliflora Enhances the Malaria Parasite Transmission Capacity of Anopheles Mosquitoes: A Habitat Manipulation Experiment" as published in Malaria Journal, bearing number 16, Article No. 237.	499-507

17.	**Annexure R-16** True Copy of the Paper titled "Juliprosopine and juliprosine from prosopis juliflora leaves induce mitochondrial damage and cytoplasmic vacuolation on co-cultured glial cells and neurons" as published in Chemical Research in Toxicology Journal, bearing number 26(12):1810-20.	508-518
18.	**Annexure R-17** True Copy of the Article titled "Allergenic pollen in the atmosphere of Rohtak city, Haryana (India): a pioneer study" as published in International Journal of Aerobiology, bearing number 30, 229–238 (2014).	519-528
19.	**Annexure R-18** True Copy of the Paper titled "Nitrous Oxide Emissions from Soils of the Semi-Arid Highlands of Durango, Mexico: A Laboratory Study" as published in Arid Land Research and Management Journal, bearing number 22(3), 179–194.	529-546
20.	**Annexure R-19** True Copy of the Report titled "Tailpipe Greenhouse Gas Emissions from a Typical Passenger Vehicle" published by the United States Environmental Protection Agency.	547-551
21.	**Annexure R-20** True Copy of the Report titled "Economic Survey of Delhi, 2022-23 - Chapter 12 - Transport".	552-577
22.	**Annexure R-21** True Copy of the Report titled "A Global High Shift Scenario: Impacts and Potential for more Public Transport, Walking, and Cycling with Lower Car Use" published by the University of California.	578-612
23.	**Annexure R-22** True Copy of Application dated 22.04.2025.	613-617

24.	**Annexure R-23 (Colly)** True Copy of Application dated 27.04.2025 and Revised Application dated 08.06.2025.	618-657
25.	**Annexure R-24** True Copy of the Paper titled "Measuring the air pollution benefits of public transport projects" as published in Regional Science and Urban Economics Journal, bearing Volume 107, ISSN 0166-0462.	658-669
26.	**Annexure R-25** True Copy of the Paper titled "Air pollution and health risks due to vehicle traffic" as published in The Science of the Total Environment Journal, bearing Volumes 450–451, Pages 307-316.	670-694
27.	Proof of Service	695

THROUGH



(YESHI RINCHHEN) (JUVAS RAWAL)
(ABHISHEK BHATRA)
COUNSEL FOR RESPONDENT NO.1
ZEUS LAW ASSOCIATES
2, PALAM MARG, VASANT VIHAR
NEW DELHI 110057
Email: juvas.rawal@zeus.firm.in
Ph. +011 41733090

PLACE- DELHI
DATE- 03.07.2025

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, PRINCIPAL BENCH, AT NEW DELHI

ORIGINAL APPLICATION NO.227 OF 2025

IN THE MATTER OF:

NAVEEN SOLANKI & ANR. …APPLICANTS

VERSUS

RAIL LAND DEVELOPMENT AUTHORITY & ORS. …RESPONDENTS

REPLY ON BEHALF OF THE RESPONDENT NO.1 TO THE ORIGINAL APPLICATION FILED BY THE APPLICANTS.

MOST RESPECTFULLY SHOWETH:

1. The present Reply is filed on behalf of the Respondent No.1 – Rail Land Development Authority, in the captioned Original Application, whereby the Applicants are *inter alia,* seeking the following reliefs:
   i) *Declare the disputed 95-acres land as a "deemed forest" under The Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980;*
   ii) *Declare that no construction activity can be carried out or trees, flora and fauna be allowed to be harmed in the disputed land;*
   iii) *Declare the Letter dt. 28.05.2020 bearing F.No.19-172/2018-IA. III issued by Ministry of Environment and Forests as void for being violative of the Environment Protection Act, 1986*;

iv) *Declare the Letter dt. 10.03.2022 issued by the Ministry of Environment and Forests/Respondent No.4 as void for being violative of the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980.*

2. At the very outset, each and every averment, submission statements and / or allegations made by the Applicants against the answering Respondent is denied in *toto* unless specifically admitted in the present Reply. The answering Respondent craves leave to file any further and / or additional Reply if so necessitated, with the liberty of this Hon'ble Tribunal.

BRIEF FACTS

3. Before responding to the submissions made by the Applicants in the Original Application, it is pertinent to bring forth the actual facts to the notice of this Hon'ble Tribunal and which are as follows:

a. The land parcel admeasuring 95 acres, which is the subject matter of the captioned Original Application (hereinafter referred to as "**Subject Land**") is a part of a larger tract of land acquired by the Government of Delhi vide Award No.19/86-87. It was acquired for the specified purpose of "Planned Development of Delhi". At the time of acquisition, the acquired land, measuring approximately 275 acres, was a barren land with little or no vegetation and very few isolated trees which numbered less than one per acre. The aforementioned acquired land was handed over to the Delhi Development Authority ("**DDA**") on 22.09.1986.

True Copy of Award No.19/86-87 and Jamabandi for the year 2002-03, along with typed and translated copy is annexed herewith and marked as **Annexure R-1.**

b. Thereafter, on 21.01.2008, DDA allotted 110.07 hectares / 272 acres (hereinafter referred to as "**Project Land**") of the acquired land parcel to the Railway Authority on a perpetual lease basis for the purpose of "**redevelopment of Bijwasan Railway Station**". Subsequently, on 01.07.2009, the possession of the Project Land was duly handed over by DDA to the Railway Authority. It is pertinent to highlight that at the time of handing over the possession, the Project Land was a barren land and no significant vegetation was existing then. Further, the clearly stated purpose of the allotment was "integrated metropolitan development" of the Project Land. The Project Land never was and even today is not a declared reserved forest nor recorded in the Government records as Forest.

   True Copy of Handing-over Letter is annexed herewith and marked as **Annexure R-2**.

c. In this manner, from 1986, the Project Land, including the Subject Land, was under the ownership and possession of the DDA. Post 2008, the Project Land has been under the leasehold rights and possession of the Railway Authorities for the sole purpose of integrated metropolitan development. The Government revenue records also clearly demonstrate the ownership and the title and possession of the Government and DDA in this regard.

d. Admittedly, the Project Land is not a declared reserved forest under the Indian Forest Act, 1927 ("**the Forest Act**"). Further, as it is evident from the Affidavits filed by the Respondent No.3 i.e. - Department of Forests and Wildlife, Government of NCT of Delhi: (a) before this Hon'ble Tribunal in Original Application No.697/2023, dated 12.02.2024; and (b) before the Hon'ble Supreme Court of India in Civil Appeal No.10656/2024, dated 29.01.2025; the Project Land does not reflect as "forest" in the records of the Revenue / Government and is not classified as a "Notified Forest Land".

True Copy of Affidavit dated 12.02.2024 is annexed herewith and marked as **Annexure R-3**.

True Copy of Affidavit dated 29.01.2025 is annexed herewith and marked as **Annexure R-4**.

INITIAL PROCEEDINGS BEFORE THE NGT - R.M. ASIF VS RAIL LAND DEVELOPMENT AUTHORITY & ORS. (O.A. 697/2023)

e. The Original Application No. 697/2023 titled as "*R.M. Asif vs Rail Land Development Authority & Ors.*" was filed by some other Applicant challenging the Request for Proposal, dated 19.12.2022, granted by answering Respondent to M/s Bagmane Developers Pvt. Ltd. for development of railway land at New Bijwasan Railway Station, Delhi with respect to grant of lease for mixed use development on combined plot MU4+MU5+MU6+ railway land parcel admeasuring 1,24,000 square meters equivalent to 31 acres or 12.39 hectares.

f. The said Original Application was dismissed by this Hon'ble Tribunal vide Order, dated 13.02.2024, on the following grounds: (i) as per alleged calculation of number of trees i.e/ 1100 trees standing on the said RFP Land Parcel of 30.64 acres, the said RFP Land Parcel does not fall under the category of deemed forest; (ii) the concept of deemed forest is excluded from applicability of Forest (Conservation) Act by virtue of Forest (Conservation) Amendment Act, 2023; (iii) part IV of said RFP relating to special conditions of lease agreement clearly stipulates that selected developer shall have to obtain necessary permission for felling / cutting of trees on said RFP Land Parcel; and (iv) adequate precautions have already been taken by Respondent No.1 to prevent illegal felling of trees.

g. Subsequently, a Civil Appeal bearing No.10656/2024 under Section 22 of the National Green Tribunal Act, 2010 was preferred against the final judgment and Order, dated 13.02.2024, passed by this Hon'ble Tribunal in Original Application No.697/2023.

h. The above-mentioned Appeal was filed by one Naveen Solanki, a separate Appellant and the Applicant in present case, in what appears to be a strategic maneuver to circumvent the caveat filed by answering Respondent in the Hon'ble Supreme Court.

i. It is pertinent to point out here that the Applicant, who was not a party to the original O.A. No.697/2023 has filed not only the Appeal as aforementioned, but has expanded the

scope of the Appeal by artificially increasing the area under contention from the original 31 acres to include an additional 95.5 acres, with the apparent objective of securing a stay Order, dated 17.09.2024, on (i) felling of trees; and (ii) construction activity. Vide Order, dated 03.03.2025, the Hon'ble Supreme Court clarified that the restrictions given vide Order, dated 17.09.2024 was confined to the subject land in the original O.A. No.697/2023 - i.e., 31 acres (Approx)

j. This calculated attempt to characterize the entire 125.5 acres as "continuous deemed forest" appears designed to deliberately delay construction activities and protract the legal proceedings, despite this Hon'ble Tribunal's clear finding that adequate environmental safeguards were already in place and that the land was neither notified forest nor deemed forest.

SUBJECT MATTER LAND NOT DEEMED FOREST:

k. The captioned Application has been filed by the Applicants relying on the contents of Affidavit, dated 29.01.2025, filed by the Respondent No.3, in the matter titled "*Naveen Solanki & Anr. vs. Rail Land Development Authority & Ors.*" being Civil Appeal No.10656/2024 (hereinafter referred to as "**said Affidavit**"), pending adjudication before the Hon'ble Supreme Court of India.

l. The Applicants have specifically relied on Paragraph No.10 of the said Affidavit, which states as follows:

"10. That an exercise to determine the extent of "deemed forest" was carried out in the said area (Dwarka Sector 21 by the Department of Forest and Wildlife, West Division. The said exercise was carried out over a period of 03 days from 03.01.2025 to 05.01.2025. It is submitted that a report dated 09.01.2025 regarding the "Deemed Forest" in the area was prepared. As per the said report, certain patches of "deemed forest" have been found to exist in the subject land. The details of the same is as under:-

a. Patch 1 (14.5 Ha)- 5494 trees;

b. Patch 2 (16.9 Ha)- 6083 trees;

c. Patch 3 (19.39 Ha)- 7810 trees

It is pertinent to mention that approx. 70% of number of trees mentioned above is covered by invasive species such as Kabuli Kikar and Subabol. *For the purpose of the report, the definition of tree is as per Section 2(i) of the Delhi Preservation of Trees Act, 1994. That out of the area mentioned by the appellant, certain parts of the said area fall under the category of "deemed forest". For the said area, requisite permission is required to be taken under relevant provisions of Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 and for the remaining area which does not fall under the category of "deemed forest", permission is required under relevant provisions of Delhi Preservation of Trees Act, 1994 (DPTA, 1994)."*

m. The Respondent No.3, in compliance of the directions issued by this Hon'ble Tribunal vide Order, dated 29.05.2025, have supplied a copy of the Report, dated 09.01.2025 (hereinafter referred to as "**said Report**") to the Respondent No.1.

True Copy of the Report dated 09.01.2025 is annexed herewith and marked as **Annexure R-5**.

n. As per the said Report, the Respondent No.3 has identified three (3) patches of land within the subject matter land to be "deemed forest" on the basis of:

i) criteria devised in terms of WP(C) No.202/1995, titled as "*T.N. Godavarman Thirumulpad vs. Union of India*"; and

ii) definition of tree as per Section 2(i) of the Delhi Preservation of Trees Act, 1994.

o. While the concept of "deemed forest" so devised in terms of W.P.(C) No.202/1995, titled as "*T.N. Godavarman Thirumulpad vs. Union of India*" stands excluded from the scope of Forest Conservation Act by virtue of Forest (Conservation) Amendment Act, 2023. The Hon'ble Supreme Court in W.P.(C) No.1164/2023 vide Order, dated 19.02.2024, has issued an interim direction that the principles elucidated in WP(C) No.202/1995, titled as "*T.N. Godavarman Thirumulpad vs. Union of India*" in relation to "forest" will continue to be observed pending the completion of administrative exercise as stipulated under Rule 16 of The Van (Sanrakshan Evam Samvardhan) Rules, 2023. The exercise in question pertains to preparation of a

consolidated record by each State and Union Territory of such land(s) to which provisions of the Forest (Conservation) Amendment Act, 2023, would be applicable. The Hon'ble Supreme Court in W.P.(C) No.1164/2023, vide Order, dated 04.03.2025, observed that once the exercise under Rule 16 of The Van (Sanrakshan Evam Samvardhan) Rules, 2023, is complete, it will lead to resolution of the issues.

True Copy of the Orders dated 19.02.2024 and 04.03.2025 passed by Hon'ble Supreme Court in *Ashok Kumar Sharma, Indian Forest Service (Retd) & Ors. v. Union of India & Anr. [W.P.(C) 1164/2023]* is annexed herewith and marked as **Annexure R-6 (Colly).**

p. Notwithstanding the above, the Hon'ble Supreme Court of India on numerous occasions has held that the concept of deemed forest:

   i) cannot be uniformly applied all over India; or

   ii) cannot be uniformly applied by each State irrespective of the geographical area they are addressing; or

   iii) cannot be applied in a mechanical manner without considering the relevant facts or circumstances at play.

q. It is humbly submitted that : (i) the past status of the land; (ii) its present condition; and (iii) its proposed use; would all be relevant factors to be considered while determining the question of "deemed forest". The Hon'ble Supreme Court of India in ***"Noida Memorial Complex Near Okhla Bird Sanctuary, [2011 (1) SCC 744]"*** observed as follows:

"24. The point raised by Mr Bhushan may be valid in certain cases but in the facts of the case his submissions are quite out of context. In support of the applicants' case that there used to be a forest at the project site he relies upon the report of the CCF based on site inspection and the Google image and most heavily on the FSI Report based on satellite imagery and analysed by GSI application. A satellite image may not always reveal the complete story. Let us for a moment come down from the satellite to the earth and see what picture emerges from the government records and how things appear on the ground. ***In the revenue records, none of the khasras (plots) falling in the project area was ever shown as jungle or forest.*** *According to the settlement year 1359 Fasli (1952 AD) all the khasras are recorded as agricultural land, banjar (uncultivable) or parti (uncultivated).*

25. Noida was set up in 1976 and the lands of the project area were acquired under the Land Acquisition Act mostly between the years 1980 to 1983 (two or three plots were notified under Sections 4/6 of the Act in 1979 and one or two plots as late as in the year 1991). But the possession of a very large part of the lands under acquisition (that now form the project site) was taken over in the year 1983. ***From the details of the acquisition proceedings furnished in a tabular form (Annexure 9 to the counter-affidavit on behalf of Respondents 2 and 3) it would appear that though on most of the plots there were properties of one kind or the other, there was not a single tree on any of the plots under acquisition.*** *The records of the land acquisition proceedings, thus, complement the revenue record of 1952 in which the lands were shown as agricultural and not as jungle or forest. There is no reason not to give due credence to these records since they pertain to a time when the impugned project was not even in anyone's imagination and its proponents were nowhere on the scene.*

26. Further, in the second response of the MoEF, dated 22-8-2009/24-8-2009 there is a reference to the information furnished by the Deputy Horticulture Officer, Noida according to which plantations were taken up along with seed

sowing of subabul during the years 1994-1995 to 2007-2008. A total of 9480 saplings were planted (including 314 saplings planted before 1994-1995). Noida had treated this area as an "urban park". It is, thus, to be seen that on a large tract of land (33.45 ha in area) that was forever agricultural in character, ***trees were planted with the object of creating an urban park (and not for afforestation!)****.* ***The trees, thus, planted were allowed to stand and grow for about 12-14 years when they were cut down to make the area clear for the project.***

27. The satellite images tell us how things stand at the time the images were taken. We are not aware whether or not the satellite images can ascertain the different species of trees, their age and the girth of their trunks, etc. But what is on record does not give us all that information. What the satellite images tell us is that in October 2006 there was thin to moderately dense tree cover over about half of the project site. But this fact is all but admitted; the State Government admits felling of over 6000 trees in 2008. How and when the trees came up there we have just seen with reference to the revenue and land acquisition proceedings records. ***Now, we find it inconceivable that trees planted with the intent to set up an urban park would turn into forest within a span of 10 to 12 years and the land that was forever agricultural, would be converted into forest land.*** *One may feel strongly about cutting trees in such large numbers and question the wisdom behind replacing a patch of trees by large stone columns and statues but that would not change the trees into a forest or the land over which those trees were standing into forest land.*

28. The decisions relied upon by Mr Bhushan are also of no help in this case and on the basis of those decisions the trees planted in the project area cannot be branded as "forest".

29. In the order dated 12-12-1996 in T.N Godavarman Thirumulpad (1997) 2 SCC 267 this Court held and observed as under:

> *"3. It has emerged at the hearing, that there is a misconception in certain quarters about the true scope of the Forest (Conservation) Act, 1980 (for*

short 'the Act') and the meaning of the word 'forest' used therein. There is also a resulting misconception about the need of prior approval of the Central Government, as required by Section 2 of the Act, in respect of certain activities in the forest area which are more often of a commercial nature. It is necessary to clarify that position.

4. The Forest (Conservation) Act, 1980 was enacted with a view to check further deforestation which ultimately results in ecological imbalance; and therefore, the provisions made therein for the conservation of forests and for matters connected therewith, must apply to all forests irrespective of the nature of ownership or classification thereof. The word 'forest' must be understood according to its dictionary meaning. This description covers all statutorily recognised forests, whether designated as reserved, protected or otherwise for the purpose of Section 2(i) of the Forest (Conservation) Act. The term 'forest land', occurring in Section 2, will not only include 'forest' as understood in the dictionary sense, but also any area recorded as forest in the government record irrespective of the ownership. This is how it has to be understood for the purpose of Section 2 of the Act. The provisions enacted in the Forest (Conservation) Act, 1980 for the conservation of forests and the matters connected therewith must apply clearly to all forests so understood irrespective of the ownership or classification thereof. This aspect has been made abundantly clear in the decisions of this Court in Ambica Quarry Works v. State of Gujarat [(1987) 1 SCC 213] , Rural Litigation and Entitlement Kendra v. State of U.P. [1989 Supp (1) SCC 504] and recently in the order dated 29-11-1996 (Supreme Court Monitoring Committee v. Mussoorie Dehradun Development Authority [(1997) 11 SCC 605]). The earlier

> *decision of this Court in State of Bihar v. Banshi Ram Modi [(1985) 3 SCC 643] has, therefore, to be understood in the light of these subsequent decisions. We consider it necessary to reiterate this settled position emerging from the decisions of this Court to dispel the doubt, if any, in the perception of any State Government or authority. This has become necessary also because of the stand taken on behalf of the State of Rajasthan, even at this late stage, relating to permissions granted for mining in such area which is clearly contrary to the decisions of this Court. It is reasonable to assume that any State Government which has failed to appreciate the correct position in law so far, will forthwith correct its stance and take the necessary remedial measures without any further delay."*

In the above order the Court mainly said three things: one, the provisions of the FC Act must apply to all forests irrespective of the nature of ownership or classification of the forest; two, the word "forest" must be understood according to its dictionary meaning and three, the term "forest land", occurring in Section 2, will not only include "forest" as understood in the dictionary sense, but also any area recorded as forest in the government record irrespective of the ownership.

30. The order dated 12-12-1996 (1997) 2 SCC 267 indeed gives a very wide definition of "forest". But any definition howsoever wide relates to a context. There can hardly be a legal definition, in terms absolute, and totally independent of the context. The context may or may not find any articulation in the judgment or the order but it is always there and it is discernible by a careful analysis of the facts and circumstances in which the definition was rendered. In the order the Court said :

> *"4. ... The term 'forest land' occurring in Section 2, will not only include 'forest' as understood in the dictionary sense, but also any area recorded as forest in the government record irrespective of the*

ownership." (emphasis added) Now what is meant by that is made clear by referring to the earlier decision of the Court in State of Bihar v. Banshi Ram Modi (1985) 3 SCC 643."

31. In the earlier decision in Banshi Ram Modi (1985) 3 SCC 643 the Court had said:

> *"10. ... Reading them together, these two parts of the section mean that after the commencement of the Act no fresh breaking up of the forest land or no fresh clearing of the forest on any such land can be permitted by any State Government or any authority without the prior approval of the Central Government. But if such permission has been accorded before the coming into force of the Act and the forest land is broken up or cleared then obviously the section cannot apply."*

32. The observation in Banshi Ram Modi (1985)3 SCC 643 (which again was made in the peculiar context of that case!) was sought to be interpreted by some to mean that once the land was broken in course of mining operations it ceased to be forest land. It was in order to quell the mischief and the subversion of Section 2 of the FC Act that the Court in the order dated 12-12-1996 (1997) 2 SCC 267 made the observation quoted above in italics.

33. In Samatha (1997) 8 SCC 191, this Court was dealing with cases of grant of mining leases to non-tribals in reserved forests and forests that were notified as scheduled area under the Andhra Pradesh Scheduled Areas Land Transfer Regulation, 1959. It was contended on behalf of the leaseholders that the Regulation and the Mining Act do not prohibit grant of mining leases of government land in the scheduled area to non-tribals. The Forest (Conservation) Act or the Andhra Pradesh Forest Act, 1967, does not apply to renewal of leases. The observations in regard to what constitutes a forest made in SCC paras 119, 120, 121 and 123, relied upon by Mr Bhushan, were made when it was sought to be argued by the leaseholders that unless the lands are declared either as reserved forests or forests under the Andhra Pradesh Forest Act,

1967, the FC Act had no application. Hence, there was no prohibition to grant mining lease or to renew it by the State Government. The context in which the Court expanded the definition of forest is, thus, manifest and evident.

34. In M.C Mehta v. Union of India (2004) 12 SCC 118, in the paragraphs relied upon by Mr Bhushan, this Court was considering the question of permitting mining in Aravalli hills where large-scale afforestation was done by spending crores of rupees of foreign funding in an effort to repair the deep ravages caused to the Aravalli hill range over the years by mostly illegal mining. The context is once again evident.

35. ***Almost all the orders and judgments of this Court defining "forest" and "forest land" for the purpose of the FC Act were rendered in the context of mining or illegal felling of trees for timber or illegal removal of other forest produce or the protection of national parks and wildlife sanctuaries. In the case in hand the context is completely different.*** *Hence, the decisions relied upon by Mr Bhushan can be applied only to an extent and not in absolute terms. To an extent Mr Bhushan is right in contending that a man-made forest may equally be a forest as a naturally grown one. He is also right in contending that non-forest land may also, with the passage of time, change its character and become forest land. But this also cannot be a rule of universal application and must be examined in the overall facts of the case otherwise it would lead to highly anomalous conclusions.*

36. Like in this case, Mr Bhushan argued that the two conditions in the guidelines adopted by the State Level Expert Committee i.e (i) "trees mean naturally grown perennial trees", and (ii) "the plantation done on public land or private land will not be identified as forest like area" were not consistent with the wide definition of forest given in the 12-12-1996 (1997) 2 SCC 267 order of the Court and the project area should qualify as forest on the basis of the main parameter fixed by the Committee. ***If the argument of Mr Bhushan is accepted and the criterion fixed by the State Level Expert Committee that in the plains a stretch of land***

> ***with an area of 2 ha or above, with the minimum density of 50 trees per hectare would be a deemed forest is applied mechanically and with no regard to the other factors a greater part of Lutyens Delhi would perhaps qualify as forest. This was obviously not the intent of the order dated 12-12-1996 (1997) 2 SCC 267.***
>
> *37. In the light of the discussion made above, it must be held that the project site is not forest land and the construction of the project without the prior permission from the Central Government does not in any way contravene Section 2 of the FC Act."*

As it would be apparent from the above extraction, the rule of "deemed forest" cannot be applied mechanically and has to be considered in the backdrop of its unique context – i.e., the facts and circumstances of the case at hand.:

i) the Subject Land, at the time of handing over of possession by the DDA to the Respondent No.1, was a barren plot of land with minimal vegetation of isolated shrubs;

True Copy of the extract of GPS picture from Google Earth, dated 11.04.2009 is annexed herewith and marked as **Annexure R-7**.

ii) the Subject Land was acquired by the Delhi Government for the purposes of "Planned Development of Delhi". Subsequently, the Subject Land was allotted/handed over by the DDA to the Respondent No., on perpetual lease basis for the specific purpose of "Integrated Metropolitan Passenger Terminal";

iii) the work(s) pertaining to Bijwasan Railway Station Project have progressed to 80%, and the entire project is nearing completion;

iv) the answering Respondent has incurred about Rs. 800,00,00,000/- (Rupees Eight Hundred Crores) of expenditure - from the public exchequer - towards execution of Bijwasan Railway Station Project;

v) the Subject Land, over the years, has been subject to proliferation of invasive tree species - which the Delhi Government has been actively endeavoring to remove / eradicate.

As would be apparent from the above, all the circumstances existing in the captioned matter indicate that : (i) the nature of the land was never forest; (ii) it was never intended to be treated as a forest; (iii) the clear and stated purpose of the land was always development of a metropolitan transportation hub; and (iv) the trees (more than 70%) present on the land are of an invasive nature which are more harmful than useful. Thus, the Subject Land cannot be treated as "deemed forest" under any circumstances.

70% OF THE TREES IDENTIFIED AS INVASIVE SPECIES:

r. As has been mentioned above, the Respondent No.3 in it's Affidavit has categorically admitted that **70% of the trees** found in the three (3) patches of land belong to the invasive tree species:

i) Kabuli / Desi Kikkar (otherwise known as *Prosopis Juliflora)*; and

ii) Subabol (otherwise known as *Leucaena leucocephala*).

The details of trees as specified by the GNCTD of Delhi / Respondent No.3 in the report dated 09.01.2025 is

reproduced herein below for the convenience of this Hon'ble Tribunal:

PATCH 1 - 14.5 HA. / 35.83 ACRES		
Sl. No.	**Tree Species**	**No. of Trees**
1	**Kabuli Kikar**	**3010**
2	**Desi Kikar**	**1011**
3	Shisham	1135
4	Neem	107
5	Sehtut	95
6	Beri	25
7	**Subabol**	**76**
8	Peepal	8
9	Siras	2
10	Aam	2
11	Khejdi	9
12	Lehsua	5
13	Bakain	2
14	Wood Apple	7
	Total	5494

As would be apparent, 4097 out of 5494 trees - i.e., almost 75% - are of an invasive and harmful nature.

PATCH 2 - 16.9 HA. / 41.76 ACRES		
Sl. No.	**Tree Species**	**No. of Trees**

1	**Kabuli Kikar**	**4231**
2	**Desi Kikar**	**644**
3	Shisham	242
4	Neem	196
5	Sehtut	15
6	Beri	96
7	**Subabol**	**532**
8	Peepal	11
9	Siras	12
10	Amaltas	12
11	Papri	7
12	Imli	7
13	Jatti	1
14	Frace	2
15	Pahari Neem	34
16	Kaner	37
17	Pilkhan	4
	Total	6083

As would be apparent, 5407 out of 6083 trees - i.e., almost 89% - are of an invasive and harmful nature.

PATCH 3 - 19.39 HA. / 47.91 ACRES		
Sl. No.	**Tree Species**	**No. of Trees**
1	**Kabuli Kikar**	**5000**
2	**Desi Kikar**	**331**

3	Shisham	432
4	Neem	168
5	Sehtut	162
6	Beri	248
7	**Subabol**	**441**
8	Peepal	476
9	Siras	17
10	Amaltas	84
11	Papri	160
12	Imli	7
13	Jatti	17
14	Pahari Neem	2
15	Kaner	39
16	Pilkhan	14
17	Lehsua	20
18	Arjun	4
19	Jungle Jalebi	9
20	Bargad	2
21	Kachnar	2
22	Hingot	19
23	Sangwan	1
24	Chudail Papri	10
25	Alestonia	4
26	Bamboo	17
27	Bakain	56
28	**Safeda**	**66**

29	Jamun	2
	Total	7810

As would be apparent, 5838 out of 7810 trees - i.e., almost 75% - are of an invasive and harmful nature.

s. The aforementioned two invasive foreign species have been identified by independent researchers as well as by various public and Government authorities, to be responsible for causing substantial imbalance in the local biodiversity. Studies show that these foreign species : (i) multiply rapidly; (ii) negatively affect the soil moisture; and (iii) are responsible for releasing allelopathic biochemicals. They are among the world's most dominant invasives and thoroughly discourage propagation of native and / or more ecologically beneficial species.

t. It is pertinent to highlight herein, that the full bench of the Hon'ble Madras High Court, in *V. Meghanathan vs Chief Secratary, Government of Tamil Nadu & Ors. [W.P. 10614/2017]* vide Order, dated 28.07.2017, directed the State Government to work out a plan to remove Seemai Karuvela trees (*Prosopis Juliflora*) by: (i) mechanical uprooting; and (ii) bulldozing or other means. The bench also opined that the plant must be taken out of its roots to ensure that public money is not wasted on a futile drive. Its roots can go very deep and deplete the water levels. In addition to the above, the court also noted that the trees cause ecological imbalance and affect groundwater levels.

True Copy of the Order dated 28.07.2017 passed by Hon'ble Madras High Court in *V. Meghanathan vs Chief Secretary, Government of Tamil Nadu & Ors. [W.P. 10614/2017]* is annexed herewith and marked as **Annexure R-8**.

u. Whereas, in parallel to the State of Tamil Nadu, *Prosopis Juliflora* has become an invasive weed in the State of Rajasthan. It is considered a noxious invader in different parts of Rajasthan agricultural areas. Mesquite (*Prosposis Juliflora)* has colonized more than 8,00,000 hectares of arable land having severe economic and environmental impacts. With its thorns and many low branches it forms impenetrable thickets which prevent cattle from accessing watering holes etc. It also takes over pastoral grasslands and uses scarce water. In addition to this, in the Pandupole and Ranthambore area, where the mesquite was introduced in the late 1970's, its aggressive growth leads to a monoculture, denying native plants water and sunlight, and not providing food for native animals and cattle.

True Copy of the Paper titled "Invasion of Prosopis Juliflora and Its Impact on Indigenous Plant Species of Sariska Region" as published in International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management, bearing Volume 5, Issue 3, ISSN 2395-7639 is annexed herewith and marked as **Annexure R-9**.

v. Similarly, to the other States - the rampant invasion by the two foreign species have been acknowledged by the Government of NCT Delhi and have actively recommended

removal/eradication of these invasive foreign species from Delhi's landscape in the following manner:

i) During the Budget of 2017-18, the Delhi Government had proposed Rs.50,00,000/- (Rupees Fifty Lakh only) for making Delhi "*Kikar Free*", in recognition of its active role in habitat degradation and depletion of groundwater;

ii) The Delhi Government's Tree Transplantation Policy of 2020, explicitly excludes *Prosopis juliflora, Eucalyptus globulus (Safeda), and Leucaena leucocephala* from being considered for transplantation;

iii) In 2021, the Delhi Government had set up an advisory committee for implementation of the 'restoration of central ridge' project, which recommended removal of the many invasive species, including *Prosopis juliflora*;

iv) In the 67th Meeting of the State Level Environmental Impact Assessment Authority ("**SEIAA**"), held on 23.12.2022, a recommendation was sent to the Delhi Government's Depart of Forest and Wildlife, to explore the possibility to exterminate these invasive foreign species at the earliest; and

v) For the year 2023-2024, the Delhi Government's Department of Forest and Wildlife issued their 'Green Action Plan' which categorically prescribes that biological suppression of *Prosopis juliflora* and *Leucaena leucocephala* is necessary for ecological restoration of Delhi's landscape.

True Copy of the Budget Speech 2017-18 is annexed herewith and marked as **Annexure R-10**.

True Copy of the Tree Transplantation Policy of 2020 is annexed herewith and marked as **Annexure R-11.**

True Copy of the News Article dated 23.03.2021 published in the Hindu is annexed herewith and marked as **Annexure R-12**.

True Copy of the Minutes of the 67th meeting of State Level Environmental Impact Assessment Authority (SEIAA)-Delhi is annexed herewith and marked as **Annexure R-13**.

True Copy of the Delhi Government's Green Action Plan 2023-24 is annexed herewith and marked as **Annexure R-14**.

w. Furthermore, *Prosopis juliflora* - Kikkar, which makes up approximately 73%; 80% and 68% of the Trees identified in the three patches of land, in various studies has been found to be significantly more detrimental in contrast to the limited benefit it provides:

i) *Prosopis juliflora* thickets provide breeding grounds for mosquitoes;

ii) *Prosopis juliflora* pods and leaves are very toxic for mammals;

iii) *Prosopis juliflora* pollens are responsible for triggering allergic asthma, rhinitis, skin allergy etc., in human beings;

iv) *Prosopis juliflora* plantations are hazardous for avifauna; and

v) *Prosopis juliflora* plantations contribute significantly towards Global Warming due to its higher rate of Carbon Dioxide and Nitrogen Oxide emissions.

True Copy of the Paper titled "The Invasive Shrub Prosopis juliflora Enhances the Malaria Parasite Transmission Capacity of Anopheles Mosquitoes: A Habitat Manipulation Experiment" as published in Malaria Journal, bearing number 16, Article No. 237 is annexed herewith and marked as **Annexure R-15**.

True Copy of the Paper titled "Juliprosopine and juliprosine from prosopis juliflora leaves induce mitochondrial damage and cytoplasmic vacuolation on cocultured glial cells and neurons" as published in Chemical Research in Toxicology Journal, bearing number 26(12):1810-20 is annexed herewith and marked as **Annexure R-16**.

True Copy of the Article titled "Allergenic pollen in the atmosphere of Rohtak city, Haryana (India): a pioneer study" as published in International Journal of Aerobiology, bearing number 30, 229–238 (2014) is annexed herewith and marked as **Annexure R-17**.

True Copy of the Paper titled "Nitrous Oxide Emissions from Soils of the Semi-Arid Highlands of Durango, Mexico: A Laboratory Study" as published in Arid Land Research and Management Journal, bearing number 22(3), 179–194 is annexed herewith and marked as **Annexure R-18**.

x. This Hon'ble Tribunal in the matter of **Vasant Vihar Welfare Assn. vs. State (NCT of Delhi) [2022 SCC OnLine NGT 63]** took cognizance of the detrimental effects of *Prosopis juliflora*, and noted as follows:

> *"...It is well established that Vilayti Kikar (Prosopis Juliflora) is a non-native and invasive species which are known to compete with local or native species and drive them to extinction by adversely affecting the physio-chemical structure of the Soil. Being an invasive tree, it has superior competitive ability and can displace the native species by influencing their growth and seed germination. It has been also been established by the research studies that Vilayti Kikar has also an adverse impact on the water table as it sucks the water and nutrients from the soil at much faster rate and thus substantially lowers the water table in the area.*"

y. It is most respectfully submitted that the Forest Department itself has, over the years, implemented several structured initiatives and projects aimed at the identification and eradication of invasive plant species which are ecologically detrimental and not in conformity with native forest biodiversity. These species, by their very nature, are targeted for systematic clearance by the State authorities through various expert committees, working groups, and schemes focused on ecological restoration.

z. In this context, it is submitted that such invasive species, which are earmarked for removal in future plantation and forest management plans, cannot be considered as part of the legitimate tree count for determining the character of the land as 'forest' under the parameters laid down in the T.N. Godavarman Thirumulpad v. Union of India & Ors. (1997) 2 SCC 267 judgment. The inclusion of these non-native, invasive species to artificially bolster the tree count is misleading and defeats the very purpose of the Godavarman

jurisprudence, which seeks to protect ecologically significant and biodiversity-rich forest land.

Unfortunately, this critical and material distinction appears to have been overlooked by the authorities of the GNCTD/Respondent No.3 while preparing their Report dated 09.01.2025. There is no indication that an assessment has been made as to whether the recorded vegetation genuinely qualifies as forest based on ecological value and species composition, or whether it merely reflects a proliferation of invasive species not protected under forest conservation principles. This omission calls into question the credibility of the said report insofar as it purports to evaluate the land in question as 'deemed forest' within the meaning of the Hon'ble Supreme Court's guidelines.

aa. It is humbly submitted that in the present case, the undisputed position is that the land in question:

i) has always been Government land and was handed over to the Railways by the DDA;

ii) has never been shown in the Revenue Records as "forest land";

iii) was always earmarked for "development" purposes – presently for the multi-modal transportation hub;

iv) had no vegetation on it till recently;

v) over 70% 'trees' belong to species which are recognised as one of the world's most dominant invasive species; if these trees are not counted, the actual tree count comes to much lesser than the one prescribed;

vi) presently, more than 80% of the development work – i.e. the said Bijwasan Railway Station Project – has already been executed by the answering Respondent; and

vii) over Rs. 80,00,00,00,000 (Rupees Eight Hundred Crores) of public money has already been employed towards execution of the work(s) in relation to the Bijwasan Railway Station.

Thus, it is humbly submitted that the Subject Land cannot be a "deemed forest".

REDEVELOPING THE BIJWASAN RAILWAY STATION - PUBLIC WELFARE AND IMPORTANCE:

bb. In addition to the submissions made in the Para(s) above relating to the species of the trees and other factors which have to be considered before determining if any land is "deemed forest", another very significant and relevant factor is the purpose and use of the land. Delhi is a major junction in the Rail Network of India and is the headquarter of the Northern Railways. The six main railway stations are : (i) New Delhi Railway Station; (ii) Old Delhi Railway Station; (iii) Hazrat Nizamuddin Railway Station; (iv) Delhi Sarai Rohilla Railway Station; (v) Delhi Cantt.; and (vi) Anand Vihar Terminal Station. The above-mentioned stations are already congested and saturated leaving almost no or little scope for enhancing passenger facilities through increased train frequency and traffic optimization. Consequently, there is a need to increase terminals and their capacities in Delhi. The Master Plan of Delhi 2021 (MPD)

prepared by DDA and accepted by the Government included five (5) new directional passenger terminals in order to decongest the central area of Delhi. One of the five (5) new directional passenger terminals is "**Bijwasan (Dwarka)**", located in the South-Western side of Delhi, on Delhi-Jaipur line.

cc. It is necessary to highlight here that the importance of this development has to be viewed in its proper context. The development does not yield just another station but also enhances rail connectivity, which is 100% electrified, to various locations far and near. Resultantly, it allows passengers to move in public transport which discourages the use of private vehicles – in a manner, taking vehicles off the road. With this switch, traffic is reduced thus increasing speed which results in reduction of emissions by vehicles.

dd. At the outset, it is submitted that the fundamental premise on which any matter relating to the environment or climate, especially relating to pollution, has to be viewed in terms of "lowering of carbon footprint". It is a recognised fact that more than 30% of the pollution in the Delhi air is the result of vehicular emission. On average, a typical passenger vehicle emits 4600 kilograms of Carbon Dioxide per year. Now, as per the MPD 2021, the Planning Zone (Division) K-II of the NCT of Delhi (**Dwarka**) has a population of approximately 13,00,000 (Thirteen Lakh) inhabitants. Further, as per 'Economic Survey of Delhi, 2022-23', the total number of vehicles per thousand population is 473

(Four Hundred Seventy Two) i.e., roughly 47%. This leads to a rational conclusion that:

(i) Approximately 6,00,000 (Six Lakh) vehicles are plied by Dwarka inhabitants; and
(ii) Approximately 2,76,00,00,000 (Two Hundred Seventy Six Crores) Kilograms of Carbon Dioxide is emitted every year, by vehicles from Dwarka.

As per a report published by the University of California, it is envisaged that Carbon Dioxide emissions, in the Indian landscape, can be brought down significantly by making improvements to public transportation. Thus, the development of the Station is directly related to and has a profound impact on the air the citizens of Delhi breathe.

True Copy of the Report titled "Tailpipe Greenhouse Gas Emissions from a Typical Passenger Vehicle" published by the United States Environmental Protection Agency is annexed herewith and marked as **Annexure R-19.**
True Copy of the Report titled "Economic Survey of Delhi, 2022-23 - Chapter 12 - Transport" is annexed herewith and marked as **Annexure R-20.**
True Copy of the Report titled "A Global High Shift Scenario: Impacts and Potential for more Public Transport, Walking, and Cycling with Lower Car Use" published by the University of California is annexed herewith and marked as **Annexure R-21.**

ee. The Ministry of Railways (**"MOR"**) decided to re-develop/develop the existing Railway Stations through Indian Railway Stations Development Corporation Limited (**"IRSDC"**) as Nodal Agency. The Master Plan for Delhi – 2021 proposed several Directional Metropolitan Passenger Terminals in Delhi at various locations. Two such Directional Metropolitan Passenger Terminals proposed under the Master Plan for Delhi – 2021 are Bijwasan (South–West–Delhi–Dwarka Project) and Anand Vihar (East Delhi) stations.

ff. Dwarka Sub-City would be an important Multi-Modal Transport Hub of Delhi having Bijwasan Railway Station, Airport Metro Line, Blue Line Metro Line, Inter-State Bus Terminus, International & Domestic Airport, Dwarka Expressway, Mumbai-Delhi Expressway and wide road connectivity with other nearby expressway areas.

gg. The Master Plan of the said Bijwasan Railway Station Project was developed and approved by various Civil Authorities including IRSDC, Unified Traffic and Transportation Infrastructure (Planning & Engineering) Centre [**"UTTIPEC"**].

hh. It is envisaged that the said Bijwasan Railway Station Project will:

i) be connected with Delhi Metro Dwarka Sec.21 station for providing easy and last mile connectivity;

ii) have eleven (11) number of railway tracks, seven (7) platforms, one (1) world class station building and state of the art passenger facilities;

iii) ultimately have various railway routes which are currently operating from existing railway stations from already congested New Delhi and other Railway Stations while opening new routes;

iv) have a dedicated walkway approach to Airport Line and Blue Line Metro at Sector-21, Dwarka;

v) cater and provide for various trains to States like Haryana, Rajasthan, Gujarat, Maharashtra, and Daman & Diu etc;

vi) have a dedicated Vande Bharat Terminal; and

vii) have a major terminal for parcel handling facilities.

ii. The Station building of said Bijwasan Railway Station Project will be an environmentally sustainable certified green building including water conservation and reuse from Sewage Treatment Plant ("**STP**") treated water, solar plant of 1450 KW capacity. The external development will encompass preservation of the maximum number of existing trees except those bare minimum numbers of trees required for execution of the external development work.

jj. The said Bijwasan Railway Station Project would provide easy access for the commuters from the nearby cities of Ghaziabad, Noida, Rohtak, Sonipat, Panipat, Rewari, Alwar, Jaipur etc. without entering into Central Delhi. The impact this development will have on Delhi transportation, traffic and reduction of emissions is profound.

kk. The Bijwasan Railway Station has an easy approach to Airport Metro, Blue Line Metro at Dwarka, Sector-21. Bijwasan Station is directly connected to Dwarka Expressway, Western Peripheral Expressway and Delhi Mumbai Expressway and is in close proximity to the IGI Airport.

ll. Various segments / components forming part of the said Project Land of Bijwasan Railway Station Project are as follows:

Sl. No.	**Segment / Division**	**Area (In Ha.)**	**Area (In Acres)**	**Party in Possession**
1.	Leased out land parcel.	12.34	30.64	M/s Bagmane Developers
2.	Station Building	2	4.94	Respondent No.1
3.	Road and Parking in front of Station	13.5	33.35	Respondent No.1
4.	Balance Circulation Road in Phase-II	3	7.41	Respondent No.1
5.	Bijwasan Coaching Terminal	36	88.96	Respondent No.2
6.	Future Leasing Area	43.16	106.65	Respondent No.1
	TOTAL	**110 (approx.)**	**272 (approx.)**	

The status of work(s) being done / carried out in the various segments / components of the Project Land of said Bijwasan Railway Station Project is as follows:

Sl. No.	Segment / Division	Work done as on 29.05.2025	Pending Work(s)	Remarks
1.	Leased out land parcel (12.34 Ha)	Under possession of Bagmane Developers.	Under possession of Bagmane Developers.	Under possession of Bagmane Developers.
2.	Station Building and Air Concourse (2 Ha) Under possession of Respondent No.1	Reinforced Cement Concrete (RCC) and Autoclaved Cellular Concrete (ACC) work is complete.	Finishing work and Electrical work is pending; Girder assembly of Air Concourse Roof is pending; Sewage Treatment Plant work is pending.	No trees in this area. Work is in an advanced stage, with 80% work already done.
3.	Road and Parking in front of	Partial small Work taken up.	Work(s) is pending.	Tree cutting permission applied on 07.05.2024.

	Station (13.5 Ha) Under the Possession of Respondent No.1			
4.	Balance Circulation Road in Phase-II (3 Ha) Under the Possession of Respondent No.1	Work has not commenced.	Entire work(s) is pending.	No construction in this area presently. Construction work will commence only after obtaining permission from the authorities concerned.
5.	Bijwasan Coaching Terminal (36 Ha)	Under the Possession of Respondent No.2	Under the Possession of Respondent No.2	Under the Possession of Respondent No.2
6.	Future Leasing Area (43.16 Ha)	Reserved for future expansion.	Reserved for future expansion.	Reserved for future expansion.

	(Under the Possession of Respondent No.1)			

It is humbly submitted that the parcel of land admeasuring 2 (two) hectare / 4.94 acres, where the construction of the Station Building and Air Concourse is presently underway, does not form part of the three (3) patches of land identified as "deemed forest" by the Department of Forests and Wildlife, GNCTD/Respondent No.3 vide Report, dated 09.01.2025.

Without prejudice to the foregoing submission, the answering Respondent respectfully submits that, in the event that the felling of any tree(s) becomes necessary for the execution of works related to the Bijwasan Railway Station project, it shall duly obtain all necessary approvals, consents, and permissions from the competent statutory and regulatory authorities, strictly in accordance with the applicable laws, rules, and guidelines in force at the relevant time, prior to initiating any such activity. It is pertinent to mention that the answering Respondent has recently applied for necessary statutory permissions, in accordance with prevailing law:

i) for diversion of 3.58 Ha of land with 1802 trees on 22.04.2025; and

ii) for felling / transplantation of 1454 (felling – 786, transplantation – 507, and saving – 161)

trees dated 27.04.2025 (revised Application dated 08.06.2025).

Vide the said Application dated 27.04.2025 (revised Application dated 08.06.2025), the answering Respondent has also pledged 11.7 Ha of land for compensatory plantation of 12930 trees. It is reiterated that the answering Respondent has, and shall always, comply with the applicable laws, rules, and guidelines in force at the relevant time, prior to initiating any such activity.

True Copy of Application dated 22.04.2025 is annexed herewith and marked as **Annexure R-22.**

True Copy of Application dated 27.04.2025 and Revised Application dated 08.06.2025 are annexed herewith and marked as **Annexure R-23 (Colly).**

mm. Thus, the said Bijwasan Railway Station Project is of national importance and is in the interest of the public at large, directly related with passenger safety and capacity enhancement with a view to decongest existing New-Delhi – Delhi Railway Stations and to provide ease to general public in commuting to other states.

SUSTAINABLE DEVELOPMENT - DEVELOPMENT *VIS-À-VIS* ECOLOGY AND ECONOMY MUST BE HARMONIOUS

nn. The said Bijwasan Railway Station Project was proposed primarily to decongest the existing four (4) main railway stations i.e., (i) New Delhi Railway Station; (ii) Old Delhi Railway Station; (iii) Delhi Cantt. Railway Station; and (iv) Delhi Sarai Rohilla Railway Station. All the aforementioned railway stations are already at peak capacity and the

Bijwasan Railway Station Project would divert a substantial number of trains from the existing railway stations.

oo. The Hon'ble Supreme Court in **Essar Oil Ltd. vs. Halar Utkarsh Samiti [2004 (2) SCC 392]** has rightly observed and recognised that the necessity to preserve ecology and environment should not hamper economic and other developments:

> ***"27.*** *This, therefore, is the aim, namely, to balance economic and social needs on the one hand with environmental considerations on the other. But in a sense all development is an environmental threat. Indeed, the very existence of humanity and the rapid increase in the population together with consequential demands to sustain the population has resulted in the concreting of open lands, cutting down of forests, the filling up of lakes and pollution of water resources and the very air which we breathe. However, there need not necessarily be a deadlock between development on the one hand and the environment on the other. The objective of all laws on environment should be to create harmony between the two since neither one can be sacrificed at the altar of the other. ..."*

pp. On completion of Bijwasan Terminal Station, North-West and West bound trains from New Delhi Station will be originating/terminating from Bijwasan Railway Station and thereafter, the ambitious and important Project of New Delhi Railway Station will be taken up.

qq. The said Bijwasan Railway Station Project attempts to reduce the vehicular traffic on road by providing rail network connectivity within the National Capital Region (NCR). Various studies have linked increased vehicular

traffic congestion on road with direct proportionality to increase in air pollution. Likewise, some studies have also linked increased public transit projects with direct proportionality to reduction in air pollution caused otherwise by vehicular emissions on road, as more use of public transit systems would help in reduction of vehicular traffic congestion on road.

True Copy of the Paper titled "Measuring the air pollution benefits of public transport projects" as published in Regional Science and Urban Economics Journal, bearing Volume 107, ISSN 0166-0462 is annexed herewith and marked as **Annexure R-24**.

True Copy of the Paper titled "Air pollution and health risks due to vehicle traffic" as published in The Science of the Total Environment Journal, bearing Volumes 450–451, Pages 307-316 is annexed herewith and marked as **Annexure R-25**.

PARA-WISE REPLY

1. The contents of Para Nos.1-2 of the captioned Application are wrong and wholly denied. It is denied that the Applicants have filed the captioned Application driven by their alleged concerns for the environment. It is humbly submitted that the captioned Application: (i) is not *bona fide;* and (ii) is the third litigation pursued by the Applicants, directly or indirectly, for the same cause of action. It is humbly submitted that the captioned Application is ill-motivated, and has been filed for the oblique reason to settle personal scores. It is humbly submitted that the Applicants have acted in a manner indicative of forum shopping.

2. The contents of Para Nos.3-9 of the captioned Application are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

3. The contents of Para No.10 of the captioned Application are wrong and wholly denied. It is humbly submitted that the captioned Application is ill-motivated and has been filed with an oblique reason to settle personal scores.

4. The contents of Para Nos.11-13 of the captioned Application are wrong and wholly denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

5. The contents of Para No.14 of the captioned Application are wrong and wholly denied. It is stoutly denied that there are birds and animals as mentioned in paragraph under reply in Subject Land which is under the possession of the answering Respondent. The list of birds and animals provided by Applicants is without any supporting data and/or document(s). The list of birds, snakes, lizards and other animals have been provided without any basis deliberately in order to mislead this Hon'ble Tribunal on the alleged existence of any such fauna in the Subject Land. The Applicants must be put to strict proof of the same.

6. The contents of Para Nos.15-17 of the captioned Application are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

7. The contents of Para Nos.18-20 of the captioned Application are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent. Further to this, instrument to monitor the surrounding Air Quality is installed at the Project Site. Additionally, regular third party Ambient Air Analysis Tests are being conducted.

8. The contents of Para No.21 of the captioned Application are wrong and denied. It is denied that there is any violation of trees caused by the answering Respondent.

9. The contents of Para Nos.22-28 of the captioned Application are matters of record and the answering Respondent does not admit anything which is contrary to or inconsistent with the records.

10. The contents of Para No.29 of the captioned Application are wrong and wholly denied. It is denied that the Order dated 28.05.2020 bearing F.No.19-172/2018-IA.III was issued by the Ministry of Environment, Forests and Climate Change ("**MoEFCC**") in contravention to settled principle of laws. It is denied that the Order dated 28.05.2020 bearing F.No.19-172/2018-IA.III was issued by MoEFCC arbitrarily.

11. The contents of Para No.30 of the captioned Application are wrong and wholly denied. It is denied that the Letter dated 10.03.2022 with the subject "Clarification on applicability of the Forest (Conservation) Act, 1980 on "Railways Land"

was issued by the MoEFCC in contravention to settled principles of law.

12. The contents of Para Nos.31-32 of the captioned Application are matters of record and the answering Respondent does not admit anything which is contrary to or inconsistent with the records.

13. The contents of Para No.33 of the captioned Application are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

14. The contents of Para No.34 of the captioned Application are matters of record and the answering Respondent does not admit anything which is contrary to or inconsistent with the records.

15. The contents of Para No.35 of the captioned Application are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent. It is humbly submitted that the answering Respondent has taken all appropriate approvals / permissions from appropriate authorities, as per prevailing law.

16. The contents of Para Nos.36-45 of the captioned Application are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

17. In response to the contents of Para No.46 of the captioned Application, it is submitted that the work awarded to M/s Kamaladitya Construction Private Limited ("**KCPL**") was terminated and dispute in relation to work awarded to KCPL is pending adjudication before the Learned Arbitrator, appointed by the Hon'ble High Court of Delhi.

18. The contents of Para No.47 of the captioned Application are matters of record and the answering Respondent does not admit anything which is contrary to or inconsistent with the records.

19. The contents of Para Nos.48 and 49 of the captioned Application are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

20. The contents of Para Nos.50-51 of the captioned Application are wrong and denied. As per the Master Plan 2021, the DDA had earmarked the areas for development of Metropolitan Passenger Terminal to decongest already overloaded Railway Infrastructure. The Ministry of Railways, accordingly, had been handed over the land by DDA (marked as P2 in Master Plan 2021) for development of the Passenger Terminal. It is humbly submitted that there is no alternative place/area available for Passenger Terminal as per the Transit-Oriented Development (TOD) Policy of GNCTD.

21. The contents of Para No.52 of the captioned Application are wrong and wholly denied. It is denied that the Bijwasan Railway Station Project would necessitate destruction of any existing forest. It is denied that the Bijwasan Railway Station Project has/will cause any harm to any existing forest. It is submitted that the Project Land of the Bijwasan Railway Station Project is not a forest. It is further submitted that: (i) the Project Land has never been shown as "forest land" in the revenue records; (ii) it was always earmarked for "development" purposes; and (iii) it had no vegetation on it till recently. The contents of the above submissions may be read as a part and parcel of this reply.

22. The contents of Para Nos.53-54 of the captioned Application are wrong and denied. It is denied that there was any deforestation carried out by the answering Respondent in the Project Land. It is humbly submitted that the answering Respondent has taken all appropriate approvals / permissions from appropriate authorities, as per prevailing law.

23. The contents of Para No.55 of the captioned Application are wrong and denied. It is denied that the answering Respondent failed to receive necessary permissions from the authorities. It is submitted that statutory permission(s) including clearance from the Forest Department was to be obtained by KCPL. It is denied that any application dated 30.03.2016 was sent by the answering Respondent to the Deputy Conservator of Forest ("**DCF**"), West Division. The aforesaid application was filed by Northern Railway for the

land under their possession. It is humbly submitted that the answering Respondent has taken all appropriate approvals / permissions from appropriate authorities, as per prevailing law.

24. The contents of Para No.56 of the captioned Application are wrong and denied. It is denied that any alleged tree offences occurred under the watch of Respondent No.1. It is submitted that any tree offence(s) / deforestation by KCPL were carried out without Respondent No.1's knowledge.

25. The contents of Para No.57 of the captioned Application are wrong and denied. It is denied that Respondent No.1 had adopted any unprofessional and unethical means of deforesting trees. Rather, Respondent No.1 had fully deposited the penalty for alleged offence committed by KCPL in this regard. It is denied that any RMC plant deployed by the Respondent No.1 were harming the trees as mentioned in paragraph under reply.

26. The contents of Para no.58 of the captioned Application are wrong and wholly denied. It is humbly submitted that:

   i) On 17.11.2017, the Respondent No.1 made an application seeking permission to fell 381 (three hundred eighty one) for area admeasuring 80.39 hectares (equivalent to 198.64 acres). In lieu of felling of 381 (three hundred eighty one) trees, the Respondent No.1 proposed to plant 1905 (one thousand nine hundred five) trees. The application

was returned by the Delhi Forest Department on 11.01.2018 with observation on defects;

ii) The notice dated 03.02.2022 was not addressed to the Respondent No.1;

iii) The notice dated 10.02.2022 came as a complete surprise to the Respondent No.1. Being aggrieved by said Notice, the Respondent No.1 filed an Appeal, *inter alia*, on the ground that no trees have been cut and all 381 (three hundred eighty one) trees for which felling permission was sought are still in place. It was also contended that the land area is an open pocket with village road passing from the middle and having round the clock mixed vehicular traffic and pedestrian movement. The damage to tree(s), if any, may also be a result of firewood requirement of villagers in winter season. It was submitted that Respondent No.1 has been executing the work(s) by taking appropriate permission(s) / approval(s) only;

iv) Thereafter, another notice dated 02.03.2022, was received from Delhi Forest Department for alleged damaging/cutting of 131 (one hundred thirty one) trees of different species situated at said Project Land;

v) Being aggrieved by the baseless and uncorroborated figures mentioned in the notices dated 10.02.2022 and 02.03.2022, the Respondent No.1 filed an Appeal before the DCF, West Division, stating as follows:

   a) the total number of trees to be felled was only 381 (three hundred eighty one) and all 381 (three hundred eighty one) trees are in place.

There is no harm either by way of any activity or unintentionally inflicted;

b) no major activity was undertaken for last two (2) years;

c) argument regarding cutting of more than 200 (two hundred) trees by Respondent No.1 is without any basis;

d) prior permission of Central Government under Section 2 of Forest (Conservation) Act, 1980 is not required for works on Railways lands. The Ministry of Environment, Forest and Climate Change under its letter dated 10.03.2022 has clarified that the need for obtaining approval of the Central Government under Section 2 of Forest (Conservation) Act, 1980 will not arise for execution or maintenance of Railway works on the Railway owned land. Terminal Station Building and its circulation will fall under the Right of way of the Railway Work.

vi) Thereafter, the DCF, West Division, authorised Mr. Ashok (Forest Guard, West Forest Division) to carry out digging / excavation of the alleged offence site vide order dated 20.05.2022 and 24.05.2022;

vii) Immediately thereafter, on 25.05.2022, appeal was filed by Respondent No.1 before the DCF, West Division stating as follows:

a) unilateral decision has been taken by the Forest Department;

b) complaint pertaining to felling / cutting / removing of 131 (one hundred thirty one) trees is without any basis;

c) it was requested that before passing any order(s), an opportunity of hearing may be provided to Respondent No.1

viii) The Notice dated 01.06.2022, did not direct for removal of any dumped material for tree rehabilitation. It was a notice calling upon the Respondent No.1 to appear before the DCF, West Division for hearing on the alleged offence;

ix) On 08.06.2022, during the hearing conducted before the Forest Department, Mr. Ashok (Forest Guard, West Division) submitted that the Forest Division had found 207 (two hundred seven) logs of trees during the excavation exercise conducted from 26.05.2022 to 31.05.2022. As per some reports approximately 990 (nine hundred ninety) trees have been removed/felled by Respondent No.1, though a copy of said report was not provided to Respondent No.1. The said Report provided an extrapolated figure of 990 (nine hundred ninety) trees in an area admeasuring 4.09 hectares (equivalent to 10.1 acres) without any basis or document. Relying on the extrapolated figure of Forest Guard, the Forest Department imposed fine @Rs.60,000/- (Rupees Sixty Thousand only) per tree i.e., Rs.5,93,70,967/- (Rupees Five Crore Ninety Lakh Seventy Thousand

Nine Hundred Sixty Seven only) on the Respondent No.1;

x) Aggrieved by order dated 14.06.2022, on 21.06.2022, the Respondent No.1 filed a Review Petition before the DCF, West Division on the following grounds:

a) there was very little vegetation on the Project Land in 2016;

b) Google images of April 2016, April 2017, April 2018, June 2019, May 2020, April 2021, and December 2021, indicates that there were very less number of trees in the area;

c) Respondent No.1 was not provided with a report and/or documents about the location/types of the 990 (nine hundred ninety) trees alleged to have been felled. The Respondent No.1 was initially issued a notice for felling of 17 (seventeen) trees of various species vide Notice No.F.2(304)/ DCF/(W)/TO/ID-81/2021-22/8139-41 dated 10.02.2022 and later on, came to know about 207 (two hundred seven) logs (without details of species/location of trees);

d) The batching plant was installed and was in operation since November 2021 and no damage to trees has been done which may also be seen from the Google Earth images.

xi) On 29.06.2022, Respondent No.1 wrote to the Principal Chief Conservator of Forests informing that

the Respondent No.1 had filed a Review against Order, dated 14.06.2022. It was also requested to review the penalty imposed. However, the Respondent No.1 being a responsible government entity deposited the penalty amount also. It is imperative to mention that the said Review Petition is still pending and no order has been passed by the Forest Department; and

xii) On 12.07.2022, the Forest Department passed an order disposing off the case booked against the Respondent No.1.

27. The contents of Para No.59 of the captioned Application are wrong and denied. It is humbly submitted that:

i) The land admeasuring 60.90 acres was solely under the possession of KCPL to carry out the work;

ii) Statutory permission(s) including clearance from the Forest Department was to be obtained by KCPL (the EPC Contractor);

iii) Some violation with regard to dumping of earth was made by KCPL;

iv) The 990 number of damaged Trees due to illegal dumping of earth by KCPL was disputed by RLDA; and

v) Upon order from the DCF, West Division, and as a law abiding Government entity, the penalty imposed was paid by Respondent No.1 under intimation to KCPL that the penalty will be recovered from KCPL.

28. The contents of Para No.60 of the captioned Application are wrong and denied. It is denied that there was any illegal felling of trees by Respondent No.1.

29. The contents of Para Nos.61-62 of the captioned Application are wrong and denied for want of knowledge.

30. The contents of Para No.63 of the captioned Application are wrong and denied. It is humbly submitted that:

    i) The alleged survey was conducted on the instructions of Applicant No.1 by one Agency - M/s Sky Blue Engineering Consultant, a sole proprietorship concern of one Mr. Md. Arshad cannot be relied on and has no standing in law;

    ii) The alleged surveyor is not authorised to conduct / carry out a survey of any site for the calculation of trees; and

    iii) The contents of the Certificate issued by the alleged surveyor casts serious doubts on its authenticity and genuineness.

31. The contents of Para No.64 of the captioned Application are wrong and denied for want of knowledge.

32. The contents of Para No.65 of the captioned Application are wrong and denied.

33. The contents of Para No.66-75 are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

SUBMISSION ON SUBSTANTIAL ENVIRONMENTAL QUESTIONS

34. The contents of Para No.V(1) to V(7) are denied as incorrect, misconceived and untenable. It is humbly submitted that there is no substantial question of environment involved in the captioned Application. In order to avoid repetition and prolixity, the below mentioned reply to the Grounds of the captioned Application may be read as reply to the Questions of Environment.

REPLY TO GROUNDS

35. The contents of Ground Nos.(A) to (D) of the captioned Application are wrong and denied. It is humbly submitted that the rule of "deemed forest" cannot be applied mechanically and has to be considered in the backdrop of its unique context – i.e., the facts and circumstances of the case at hand. The contents of above paragraphs are reaffirmed and reiterated.

36. The contents of Ground Nos.(E) and (F) are wrong and denied. It is humbly submitted that the newly inserted Section 1A expressly provides the scope of The Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 [earlier known as Forest (Conservation) Act, 1980] to cover only the following land:

   i) the land which has been declared or notified as forest in accordance with provisions of Indian Forest Act, 1927; and

ii) any other land, which is recorded as forest land, in the government records.

It is submitted that, without prejudice to the Hon'ble Supreme Court's Order dated 19.02.2024 in W.P.(C) No.1164/2023, by virtue of the 2023 Amendment Act, it was the intent of the legislature to exclude "deemed forests" from its ambit and to narrow the scope of the application of The Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 [earlier known as Forest (Conservation) Act, 1980].

37. The contents of Ground No.(G) of the captioned Application are wrong and denied. It is humbly submitted that words used in a particular statute cannot be used to interpret the same word in a different statute. Reliance is placed on the judgment of the Hon'ble Supreme Court in **Bangalore Turf Club ltd. vs. ESI [2014 (9) SCC 657]**; **Ram Shridhar Chirmurkar vs. Union of India [2023 (4) SCC 312]**; and **Hotel & Restaurant Assn. vs. Star India (P) Ltd. [2006 (13) SCC 753]**.

38. The contents of Ground No.(H) of the captioned Application are wrong and denied. It is humbly submitted that this Hon'ble Tribunal is not a Tribunal set up either under Article 323A or Article 323B of the Indian Constitution, but is a statutory Tribunal set up under the National Green Tribunal Act, 2010. Thus, this Hon'ble Tribunal does not have the power to test the vires of subordinate legislations and rules.

39. The contents of Ground Nos.(I) to (M) of the captioned Application are wrong and denied. It is denied that the Order, dated 28.05.2020, is arbitrary and/or in contravention of law. It is denied that the Letter, dated 10.03.2022, is arbitrary and/or in contravention of law. It is submitted that the said Order and said Letter have been issued in consonance with the provisions of the Railways Act, 1989 and the Environment Impact Assessment Notification, 2006. It is submitted that adequate precautions and safeguards have been put in place to ensure environmental protection and sustainability. The Hon'ble High Court of Bombay in the matter of **Goa Foundation vs. Konkan Rly. Corpn., [1992 SCC OnLine Bom 205]** had observed that the provisions of Environment Protection Act, 1986 will have no application in respect of work undertaken in exercise of powers conferred under Section 11 of the Railways Act, 1989:

> *"The Corporation is also right in the contention that the provisions of the Environment Act have no application in respect of work undertaken in exercise of powers conferred under section 11 of the Railways Act, 1989. Section 11, inter alia, provides that notwithstanding anything contained in any other law, the Railway Administration may, for the purposes of constructing or maintaining a railway, make or construct in or upon, across, under or over any lands, or any streets, hills, valleys, roads, streams, or other waters, rivers as it thinks proper. The wide ambit of the provisions of section 31, and the non-obstante Clause makes it extremely clear that the provisions of the Environment Act do not bind the construction or maintenance of a railway line. The Railways Act is a legislation enacted subsequent to the Environment Act and the Corporation is right in claiming that for the purpose of providing railway line, clearance is not required even though the line passes over the railways, rivers, creeks, etc. in view of the specific provisions of section 11 of the Railways Act…"*

The Hon'ble Supreme Court had upheld the findings of the Hon'ble High Court of Bombay in Goa Foundation (supra)

by dismissing the Special Leave Petition (Civil) No.8925/1992.

40. The contents of Ground No.(N) of the captioned Application are wrong and denied. It is humbly submitted that the answering Respondent has and will always abide by the prevailing law.

41. The contents of Ground No.(O) of the captioned Application are wrong and denied. As per the Master Plan 2021, the DDA had earmarked the areas for development of Metropolitan Passenger Terminal to decongest already overloaded Railway Infrastructure. The Ministry of Railways, accordingly, had been handed over the land by DDA (marked as P2 in Master Plan 2021) for development of the Passenger Terminal. It is humbly submitted that there is no alternative place/area available for Passenger Terminal as per the Transit-Oriented Development (TOD) Policy of GNCTD.

42. The contents of Ground Nos.(P) and (Q) are denied as incorrect, false and misconceived. It is vehemently denied that transplantation has not succeeded in Delhi and other places in India, and that plant saplings as substitutes for mature trees is also not a viable solution, and as such, it is humbly stated and submitted that the Applicants be put to the strictest proof thereof.

Transplantation of mature trees and plant saplings as their substitutes have been accepted all across the globe as two

(2) of the most effective and viable solutions to create harmony between environmental considerations on one hand and economic and social needs on the other.

43. The contents of Ground No.(R) of the captioned Application are denied as incorrect, false and misconceived. It is denied that the Respondent No.1 has engaged in indiscriminate cutting of any alleged forest. It is submitted that Applicants have made baseless contentions without any supporting data and/or document(s) and/or evidentiary proof. The Applicants shall be put to the strictest proof of the same.

44. The contents of Ground Nos.(S) and (T) of the captioned Application are wrong and denied. It is humbly submitted that the Subject Land is neither a forest, nor falls within the definition of 'forest land'.

It is humbly submitted that the concept of "deemed forest" was devised in terms of W.P.(C) No.202/1995, titled as "*T.N. Godavarman Thirumulpad vs. Union of India*" stands excluded from the scope of Forest Conservation Act by virtue of Forest (Conservation) Amendment Act, 2023. Without prejudice to the amendment and its consequences, this Hon'ble Court on numerous occasions has held that the concept of deemed forest:

i) cannot be uniformly applied all over India; or
ii) cannot be uniformly applied by each State irrespective of the geographical area they are addressing; or

iii) cannot be applied in a mechanical manner without considering the relevant facts or circumstances at play.

It is humbly submitted that the past status of the land, its present condition and its proposed use would all be relevant factors to be considered while determining the question of "deemed forest".

45. The contents of Ground No.(U) of the captioned Application are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

46. The contents of Ground No.(V) of the captioned Application are denied as incorrect, false and misconceived. It is denied that the Subject Land consists of any dense forest and is home to many trees, plant and animal species. It is humbly submitted that the Applicants have made baseless contentions without any supporting data and/or documents and/or evidentiary proof. The Applicants shall be put to the strictest proof of the same.

47. The contents of Ground Nos.(W) to (Z) of the captioned Application are denied as incorrect, false and misconceived. It is denied that the Subject Land is forest land. It is denied that the Respondent No.1 has engaged in indiscriminate cutting of any alleged forest. It is submitted that Applicants have made baseless contentions without any supporting data

and/or document(s) and/or evidentiary proof. The Applicants shall be put to the strictest proof of the same.

48. The contents of Ground No.(AA) of the captioned Application are wrong and denied.

49. The contents of Ground No.(BB) of the captioned Application are denied as incorrect, false and misconceived. It is reiterated that the alleged tree offences were not carried out by Respondent No.1. The contents of above paragraphs are reiterated and reaffirmed.

50. The contents of Ground No.(CC) of the captioned Application are wrong and denied. It is denied that there is any forest on the Subject Land. It is humbly submitted that the concept of "deemed forest" was devised in terms of W.P.(C) No.202/1995, titled as "*T.N. Godavarman Thirumulpad vs. Union of India*" stands excluded from the scope of Forest Conservation Act by virtue of Forest (Conservation) Amendment Act, 2023. Without prejudice to the amendment and its consequences, this Hon'ble Court on numerous occasions has held that the concept of deemed forest:

i) cannot be uniformly applied all over India; or

ii) cannot be uniformly applied by each State irrespective of the geographical area they are addressing; or

iii) cannot be applied in a mechanical manner without considering the relevant facts or circumstances at play.

It is humbly submitted that the (i) past status of the land; (ii) its present condition; and (iii) its proposed use would all be relevant factors to be considered while determining the question of "deemed forest".

51. The contents of Ground No.(DD) of the captioned Application are denied as incorrect, false and misconceived. It is denied that the Subject Land would fall within the definition of deemed forest on the basis of the criteria laid down for deemed forest in the Affidavit of Conservator of Forest, Government of NCT of Delhi, dated 15.09.1997, filed before the Hon'ble Supreme Court in W.P.(C) No.202/1995, titled as "*T.N. Godavarman Thirumulpad vs. Union of India"*. It is humbly submitted that Certificate, dated 06.06.2024, issued at the behest of the Applicant No.1 by one Agency - M/s Sky Blue Engineering Consultant, a sole proprietorship concern of one Mr. Md. Arshad cannot be relied on in the present case. It is humbly submitted that the figures placed by the Applicants lack veracity and genuineness and are based on alleged Certificate. The contents of above paragraphs are reiterated and reaffirmed.

52. The contents of Ground No.(EE) of the captioned Application are denied as incorrect and misconceived. It is submitted that the captioned Application has been preferred by the Applicants in exercise of the Original Jurisdiction of this Hon'ble Tribunal, and thus, there cannot be any impugned order. Nonetheless, it is humbly submitted that the Order, dated 13.02.2024, passed in Original Application No.697/2023 is just and proper. It was delivered after proper

examination regarding the understanding of what constitutes a forest.

53. The contents of Ground Nos.(FF) and (GG) are wrong and denied, other than matters of record which do not require a reply on behalf of the answering Respondent.

54. The contents of Ground Nos.(HH) to (KK) are denied as incorrect and misconceived. It is humbly submitted that the newly inserted Section 1A of the Forest (Conservation) Amendment Act, 2023, expressly provides the scope of The Van (Sanrakshan Evam Samvardhan) Adhniyam, 1980 [earlier known as Forest (Conservation) Act, 1980] to cover only the following land:

i) the land which has been declared or notified as forest in accordance with provisions of Indian Forest Act, 1927; and

ii) any other land, which is recorded as forest land, in the government records.

It is submitted that, without prejudice to Hon'ble Supreme Court's Order dated 19.02.2024 in W.P.(C) No.1164/2023, by virtue of the 2023 Amendment Act, it was the intent of the legislature to exclude "deemed forests" from its ambit and to narrow the scope of the application of the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 [earlier known as Forest (Conservation) Act, 1980]. It is humbly submitted that apart from law laid down in W.P.(C) No.202/1995, titled as "*T.N.Godavarman Thirumulpad vs. Union of India*", the jurisprudence surrounding the concept

of "forest" has been varied on various occasions by the Hon'ble Supreme Court of India - specifically emphasizing on (i) the past status of the land; (ii) its present condition; and (iii) its proposed use. Reference (i) **Elizabeth Jacob vs. District Collector, Idukki & Ors. [2008 (15) SCC 166]**; (ii) **In re : Noida Memorial Complex Near Okhla Bird Sanctuary [2011 (1) SCC 744]**; (iii) **Chandra Prakash Budakoti vs. Union of India & Ors. [2019 (10) SCC 154].**

55. The contents of Ground Nos.(LL) and (MM) of the captioned Application are denied as incorrect, false and misconceived. It is denied that the answering Respondent had carried out any illegal felling of trees. It is denied that the answering Respondent has not taken any precaution to prevent illegal felling of trees. It is denied that the answering Respondent has engaged in any illegal felling of trees. It is submitted that the answering Respondent has and will always abide by the prevailing law.

REPLY TO RELIEF SOUGHT

56. In response to the contents of Interim Relief Sought and Relief Sought by the Applicants, it is submitted that the Applicants are not entitled to any relief prayed in the captioned Application.

PRAYER

In view of the above mentioned facts and circumstances, it is most respectfully prayed that this Hon'ble Court may kindly be pleased to:

a) dismiss the captioned Application with costs;

b) pass any other order as this Hon'ble Tribunal may deem fit and proper.

RESPONDENT NO.1

Prabhat Kamal Pawan
JGM/Projects
Rail Land Development Authority
A Statutory Authority under Ministry of Railways
New Delhi

THROUGH

abhishekbhatra
D/7850/2024

(YESHI RINCHHEN) (JUVAS RAWAL)
(ABHISHEK BHATRA)
COUNSEL FOR RESPONDENT NO.1
ZEUS LAW ASSOCIATES
2, PALAM MARG, VASANT VIHAR
NEW DELHI 110057
Email: juvas.rawal@zeus.firm.in
Ph. +011 41733090

PLACE- DELHI
DATE- 03.07.2025

VERIFICATION

Verified on this 3 day of July 2025, that contents of Paragraph Nos. 1 to 56 of the Para-wise reply of the instant Reply are true and correct to the best of my knowledge and belief. The contents of Paragraph Nos. 3(aa) to 3(qq) of the Preliminary Objections and Submissions are true and correct on the basis of legal

information received and believed to be correct. Last paragraph is my humble prayer before this Hon'ble Court.

RESPONDENT NO.1

Prabhat Kamal Pawan
JGM/Projects
Rail Land Development Authority
A Statutory Authority under Ministry of Railways
New Delhi

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, PRINCIPAL BENCH, AT NEW DELHI

NOTARY Deo Raj Singh Regd. No. 1903 GOVT. OF INDIA

ORIGINAL APPLICATION NO.227 OF 2025

IN THE MATTER OF:

NAVEEN SOLANKI & ANR. ...APPLICANTS

VERSUS

RAIL LAND DEVELOPMENT AUTHORITY & ORS. ...RESPONDENTS

AFFIDAVIT

I, P.K. Pawan, Son of Late Shri R.B. Singh, aged about 56 years, Resident of C–37, South City-1, Gurugram, Haryana, presently at New Delhi, do hereby solemnly state and affirm as under:-

1. That I am working as JGM/PROJECTS with Rail Land Development Authority i.e., the Respondent No.1 I am duly authorised vide Office Order No.1 of 2021 dated 30.04.2021. I am well conversant with the facts and circumstances of the case and as such competent to swear this affidavit.

NOTARY Deo Raj Singh Regd. No. 1903 GOVT. OF INDIA

2. That the accompanying Reply has been drafted under my instructions and the contents thereof, except the legal averments contained therein, are true and correct on the basis of records maintained by Respondent No.1. The legal

averments contained therein are true and correct on the basis of the legal advice, received by me and believed by me to be true and correct.

3. I state that no part of this Affidavit is false and no material facts have been concealed therefrom.

4. The annexures are true copies of their respective originals.

DEPONENT

Prabhat Kamal Pawan
JGM/Projects
Rail Land Development Authority
A Statutory Authority under Ministry of Railways
New Delhi

VERIFICATION

Verified at Delhi on this 3rd day of July 2025 that the contents of the above Affidavit are true and correct to my knowledge and belief. Nothing material has been concealed from this Hon'ble Tribunal.

NOTARY Deo Raj Singh Regd. No. 1903 GOVT. OF INDIA

ATTESTED
NOTARY PUBLIC
GOVT. OF INDIA
- 3 JUL 2025

DEPONENT

Prabhat Kamal Pawan
JGM/Projects
Rail Land Development Authority
A Statutory Authority under Ministry of Railways
New Delhi

कार्यवाई कब्जा भूमि ग्राम मसूदपुर अवार्ड नं० 19/86-87.
पृ — पृ

आज दिनांक 22/9/86 को LAC(PS) महोदय के आदेश अनुसार मुताबिक प्रोग्राम कहमरा ~~[illegible]~~ राम चन्द्र पटवारी (LA) व अब्दुल रहीम चपरासी (LA) कराये देने कब्जा भूमि ग्राम मसूदपुर जो कि अवार्ड नं० 19/86-87 मे अधिग्रहण हो चुकी है मौके पर पहुंचे। मौके पर मुहकमा एक्वायरिंग की ओर से श्री आर०पी० अग्रवाल NT(LAB) व श्री एस०के० शर्मा पटवारी (LAB) कराये देने कब्जा हाजर मिले। D.D.A के कार्यालय की ओर से श्री चन्दर मान तहसीलदार, व श्री डी० सी० गुप्ता Sp०(DDA) प्रोग्राम अनुसार हाजर मिले। अधिग्रहण की गई भूमि की मौके पर निशान देही की गई जिसे उपस्थित तुमार-जान मुहकमा को दिखा कर व समझा दिया गया। जिन नम्बरान खसरा का कब्जा उपरोक्त अवार्ड के अन्तर्गत दिया गया उसका विवरण निम्नलिखित है:-

3		4				
21	22	8	9/1	12/2/1	13/1	13/2/2
3-10	0-09	0-16	0-09	0-02	1-16	1-05

P.T.O

4.

13/3/2	13/4	14	16	17	18/2	23/1	24
1-02	0-06	2-00	2-14	4-16	3-0	1-06	4-16

4

25/1	25/2
4-04	0-12

12

3/2/1	4/1	4/2/2	5/1	5/2
0-06	0-06	4-07	0-14	4-02

12

6	7/1/2	7/2/1	14/1	15/1	15/2	16/2
4-16	3-12	0-01	2-01	3-04	1-12	3-16

12

17/1	25/1/1	25/2	26	27
1-00	0-14	2-04	0-05	0-04

13

1	2/1	2/2	3
4-09	3-16	0-10	1-10

13.

7	8	9/1	9/2	10/1	10/2	10/3	11/1	11/2
3-04	4-16	0-16	3-17	1-17	2-08	0-04	3-16	0-08

13

12	13/1	13/2	14	15	16	17/1	17/2	18
4-16	0-03	4-10	4-16	4-14	4-16	1-04	3-12	4-12

13.

19	20	21	22	23	24/1	24/2	24/3	25/1
4-16	4-09	4-09	4-16	4-10	3-02	0-09	1-05	0-09

13

25/2	26	27
4-07	0-07	0-10

14

11/1	11/2	19	20	21	22	23
1-07	0-05	3-04	4-16	4-16	4-13	4-12

14

26
0-03

16

10/1	10/2	11	12	13	18	19	20
2-08	0-19	4-14	5-04	1-15	2-09	4-16	4-11

16

21	22	26
4-16	4-00	0-05

17

1	2	3/1	3/2	4	5/1
4-16	4-16	0-08	4-08	4-07	0-12

PTO

17

5/2	6/1	6/2	7/1	7/2	8/1	8/2	9/1	9/2	10/1
0-13	3-07	1-09	2-06	2-10	3-00	1-16	0-16	4-00	0-16

17

10/2	11/1	11/2	12/1	12/2	13	14	15/1	15/2	16
4-00	2-18	1-16	2-11	1-18	4-16	4-16	3-00	1-04	4-07

17

17	18	19	20	21/1	21/2	22/1	22/2	23	24/1
4-11	4-16	4-16	4-15	3-08	1-08	1-05	3-11	4-13	1-11

17 , 18

24/2	25	26	27	1	2/1	2/2	3	4	5	6
2-11	4-16	0-07	0-08	4-09	0-14	4-02	4-12	4-16	4-16	4-16

18

7	8/1	8/2	9/1	9/2	10/2	11/1	12	13	14
4-16	3-18	0-14	3-19	0-13	3-07	1-02	4-16	4-12	4-16

18

15	16/1	16/2	16/3	17/1	17/2	18	19/2	22/1	23	24
4-16	1-07	1-04	2-01	1-08	3-03	4-15	4-01	2-03	4-16	4-16

18 , 19 , 31 , 32

25	26	27	30	5/1	2/1/1	2/2/1	3/1	3/2/2	1	2
4-10	0-01	0-01	0-06	1-02	0-04	0-01	1-09	3-02	4-16	4-16

32.

3/1	3/2	4	5	6/1	6/2	7	8	9	10/1	10/2	11
3-12	1-01	4-12	4-16	1-13	3-03	4-07	3-05	4-15	1-16	3-00	4-16

32.

12/1	12/2	13	14/1	14/2	15/1	15/2	17/1	17/2
1-12	2-09	4-16	1-00	3-16	2-08	1-13	2-02	3-11

32.

18	19	20/1	20/2	21/1	21/2	22	23	24/1
4-16	4-14	1-01	3-02	0-07	4-3	4-12	4-16	2-04

32.			33				39		
24/2	26	27,	1/1	1/2	10/1	10/2.	1/1,	1/2	2/1.
0-06	0-09	0-04.	3-08	2-04	1-04	1-05.	3-00	1-16	3-00

39.

2/2,	3/1	3/2,	8,	9,	10,	11,	12,	20/1/2.
1-16	3-00	1-02.	1-00	4-14	4-14.	4-06.	2-07	1-01

39		40.				
20/2/1	26,	4/1,	5/1/2,	5/2/1,	5/2/2/2,	6/1.,
0-11	0-02.	0-01	1-07.	1-08	0-16	1-15

40.

15/1,	223/1,	226/1,	517/1,	521,	522,	523,
0-03	4-05.	3-01	less than Biswa.	0-04	1-04	0-03

526. 0-02. कुल रकबा 604 बिघा 02 बिस्वा का कब्जा L&B Deptt. के श्री आर० पी० अग्रवाल AT (L&B) को पैमायश न होना पिलर का दुरुस्त रखाव लगाकर कब्जा बाकई नये दरख्तान, कुएं व Structure के साथ किया गया कब्जा देते समय कुछ नम्बरान रकबा पर प्लाट रकबीज बोई हुई है जिसके काटने की अजमत वास्तेदारान चढ़ते हैं जो की दी गई है। कब्जा कार्यवाही के समय किसी प्रकार की कोई आपत्ति मौके पर पेश नहीं आई। इस कब्जे की कार्यवाही गुनाही व मुशतहरी बाबत लखनौली कब्जा मौके पर व देह इज़ा मे बजरिये चपरासी से अमल हुआ-3

P.T.O.

कोई गैर पटवारी हल्का की वजह से गैर कार
सरकार हाजिर नहीं है तथा लिहाजा एक नकल
कार्यवाही कब्जा वास्ते अमल दरामद कागजात मौ
बजरिये तहसीलदार महरौली दिल्ली ~~लिजाय~~ लिजाई
जायगी और एक नकल महकमा L&B Deptt के
उपस्थित नायब तहसीलदार आर०पी० अग्रवाल को
दी गई। कार्यवाही कब्जा पूरी हो चुकी है
मौके पर उपस्थित सब के दस्तखत करायें।

22/9/86
NT (LA)

22/9/86

22/9/86
(Revn)

Ch. SDA
22-9-86

Kgo.
DDA
dt. 22-9-86

22/9/86
N.T. (L&B)

22/9/86 (L&B)

AWARD NO. 19/86-87

NAME OF VILLAGE : BHARTHAL

NATURE OF ACQUISITION : PERMANENT

PURPOSE OF ACQUISITION : PLANNED DEVELOPMENT OF DELHI.

These are proceedings for acquisition of land in Village Bharthal which is required by the Government at the public expense for a public purpose namely Planned Development of Delhi. This land was notified u/s 4 of the Land Acquisition Act vide notification No.F.9(16)/84-L&B dated 27.1.1984. A declaration u/s 6 of the Act was issued vide No.F.9(16)/84-L&B dated 18.9.1984 for the land measuring 653 Bighas. Notices u/s 9 & 10 of the Land Acquisition Act were issued to the interested persons for filing the claims who have responded to the notices and have filed their claims which will be discussed separately under heading ''CLAIMS & EVIDENCE.''

MEASUREMENT & TRUE AREA

The field staff has carried measurement of the land at the spot. There are some discrepencies in calculation of area under notification u/s 6.

Kh.No.	Area notified u/s 6	Actual Area	Difference
13/15	4-16	4-14	0-02
17/12/1	2-18	2-11	0-07
32/15/1	4-01	2-08	1-13
			2-02

Due to these reasons there is decrease in area notified u/s 6 of the L.A. Act. The total area of Khasra Nos. notified u/s 6 comes to 604 Bighas 02 Biswas. instead of 653 -00 as Khasra Nos. 31/4 (4-16), 5/(4-16), 6(4-16), 7 (4-[illegible] 8(2-14), 13/1 (0-01), 13/2 (0-16), 14(4-12), 15(4-16), 16/1([illegible] 16/2(4-0), 17/1 (0-15), 17/2(2-15), 24(1-3), 25(4-14), 28(0-04), 29(0-06) total 46 Bighas 16 Biswas falling within the scheme are not specifically mentioned in the declaration u/s 6 of the L.A. Act. Hence, the acquisition proceeding is being

Contd..2...

confined to an area measuring 604 Bighas 2 Biswas.

OWNERSHIP & OCCUPANCY

Sl No.	Name of owner	Name of occupant	Kh.No.	Area
1.	Hukam Chand s/o Amar Singh 1/2 share		17/19	4-16
	Mahesh Kumar, Rajesh Kumar Arun Kumar ss/o Prem Chand 1/2 share		20	4-15
			21/1	3-08
			22/1	1-05
			11/2	1-16
			12/2	1-18
				17-18
2.	Kirpa Ram s/o Kuria Urf Kure 1/4 share		18/2/2	4-02
	Siri Lal, Sant Lal ss/o Ratti Ram 1/4 share		3	4-12
			8/1	3-18
	Sultan, Surjit ss/o Bhartu, 1/2 share		9/1	3-19
			13/27	0-10
				17-01
3.	Kanihya s/o Kanwar Singh		18/8/2	1-16
			9/2	4-0
			10/2	4-0
			11/1	2-18
			12/1	2-11
			13	4-16
			26	0-07
				20-08
4.	Suraj Bhan, Raj Pal, Vijay Pal ss/o Dharam Singh		13/16	4-16
			17/1	1-04
			24/2	0-09
			25/1	0-09
			14/11/1	1-07
			19	3-04
			20	4-16
			21	4-16
			22	4-13
			23	4-17
			26	0-03
			17/1	4-16
			2	4-16
			3/1	0-08
			9/1	0-16
			10/1	0-16
				42-06
5.	Smt. Chalti wd/o Nandrup Roop Chand s/o Parbhu		12/14	2-01
			27	0-04
				2-05
6.	Sri Chand s/o Ram Nath		12/17	1-0
			25/1	0-14
				1-14

Contd....

7. Jage Ram, Ram Singh, Mehar Singh ss/o Chandgi	4/12/2	0-02
	13/2	1-05
		1-07
8. Jage Ram s/o Ram Sarup	32/6/2	3-03
	7	4-07
	8	3-05
	14/2	3-16
	15/1	2-08
	17/1	2-02
	24/2	0-06
	26	0-09
		19-16
9. Ram Chand s/o Gopi	12/5/2	4-02
	6	4-16
	7/1	3-12
	15/1	3-04
	13/10/2	2-08
		18-02
10. Rama Nand s/o Dulia	4/14	2-0
	13/4	0-06
	16	2-14
	17	4-16
	24	4-16
	25/1	4-04
	12/4/1	0-06
		19-02
11. Ram Chand s/o Gopi 1/2 share	12/26	0-05
Rama Nand s/o Dulia, 1/2 share		
12. Ran Singh, Rattan Singh, Balbir Singh ss/o Jot Ram 1/3 share	16/10/1	2-08
	11	4-14
	12	5-04
	13	1-15
Khazan Singh, Narain Singh ss/o Giani Ram, 2/3 share	18	2-09
	19	4-16
	20	4-11
	21	4-16
	22	4-00
	26	0-05
	17/15/2	1-04
	16	4-07
	33/1/2	2-04
	10/2	1-05
		43-18
13. Bhagwan Singh s/o Niader	12/28/2	2-04
	13/20	4-09
	21	4-09
	11/2	0-08
	18/1	4-09
	10	3-07
	11	1-02
	19/5	1-02
		21-10

Contd....4....

14. Dalip Singh, Chand Ram, Deep Chand, Sis Ram, Banwari, Krishan ss/o Smt. Same Kaur wd/o Mam Chand	17/3/2	4-08
	4	4-07
	5/1	0-12
	6/2	1-09
	7/1	2-06
	8/1	3-00
		16-02
15. Mehar Singh, Hukam Chand, Jot Ram ss/o Des Ram	32/17/2	3-11
	18	4-16
	19	4-14
	20/1	1-01
	21/2	4-03
	22	4-12
	23	4-16
	24/1	2-04
	27	0-04
	39/1/1	3-00
	2/1	3-00
	3/1	3-00
	40/5/2/1	1-08
		40-09
16. Ram Karan, Ram Kishan ss/o Ram Pat s/o Dhani Ram	31/2/2	0-01
	3/2	3-02
	32/11	4-16
	32/12/1	1-12
	20/2	3-2
		12-13
17. Raj Singh, Rajesh ss/o Smt. Laxmi wd/o Ram Singh	17/24/2	2-11
	25	4-16
	32/3/2	1-01
	4	4-12
	5	4-16
	6/1	1-13
	15/2	1-13
	33/1/1	3-08
	10/1	1-04
		25-14
18. Duli Chand s/o Nand Lal	13/10/3	0-04
	11/1	3-16
		4-00
19. Bharat Singh s/o Nand Lal 1/2 share Mahinder Singh s/o Harphool Singh... 1/4 share Rishi Raj s/o Mam Chand ... 1/4 share	13/26	0-07
20. Bharat Singh s/o Nand Lal	13/2/2	0-10
	3	1-10
	7	3-04
	8	4-16
	9/1	0-16
	14	4-16
	15	4-14
	14/11/2	0-05
		20-11

Contd....4.....

21. Dharam Singh, Hukam Singh, Bhagwan Singh ss/o Mehrai	16/10/2	0-19
	17/5/2	0-13
	6/1	3-07
	7/2	2-10
	14	4-16
	15/1	3-00
	17	4-11
	18	4-16
	22/2	3-11
	23	4-13
	24/1	1-11
	27	0-08
	32/2	4-16
	3/1	3-12
	9	4-15
	10/2	3-00
		50-18
22. Surjan s/o Kherati	39/20/2	0-11
23. Bhagwan Singh, Deep Chand, Kabul Singh ss/o Chatter	32/12/2	2-09
	13	4-16
	14/1	1-00
		8-05
24. Mukhtiar Singh etc.	17/21/2	1-08
	18/16/3	2-01
	24	4-16
	25	4-10
	30	0-06
	32/1	4-16
	10/1	1-16
		19-13
25. Munshi s/o Ram Mehar	39/1/2	1-16
	2/2	1-16
	3/2	1-02
	8	1-00
	9	4-14
	10	4-14
	11	4-06
	12	2-07
	20/1	1-01
	26	0-02
	40/5/2/2	0-16
	6	1-15
	15	0-03
		25-12
26. Mahinder Singh s/o Harphool	3/21	3-10
	22	0-09
	13/1	4-09
	13/2/1	3-16
	9/2	3-17
	10/1	1-17
	13/1	0-03
		18-01

Contd...

27. Rishi Raj s/o Mam Chand	13/12	4-16
	13/2	4-10
	17/2	3-12
	18	4-12
	19	4-16
		22-06
28. Karan Singh, Dharam Singh Bir Singh, Davinder Kumar, Om Parkash, Sat Dev ss/o Ranjit	13/24/3	1-05
	25/2	4-07
	18/4	4-16
	5	4-16
	6	4-16
	7	4-16
	14	4-16
	15	1-07
	16/1	1-08
	17/1	0-01
	26	37-04
29. Incha Ram s/o Chajju	12/3/2	0-06
	4/2	4-07
	7/2	0-01
		4-14
30. Rajinder Singh s/o Sheo Narain, Jai Narain s/o Ghissa	32/21/1	0-07
	40/4	0-01
	5/1	1-07
		1-15
31. Sunder Lal, Daryao Singh, s/o Sabha Chand	4/13/3	1-02
	18	3-00
	23	1-06
	18/8/2	0-14
	9/2	0-13
	12	4-16
	13	4-12
	16/2	1-04
	17/2	3-03
	18	4-15
	19	4-01
	22	2-03
	23	4-16
	27	0-01
	31/2/1	0-04
	3/1	1-09
		37-19
32. Partap Singh, Narinder Singh ss/o Nand Lal	13/22	4-16
	23	4-10
	[illegible]	[illegible]
	[illegible]	3-02
	24/1	0-14
	18/2/1	13-02
33. Hukam Chand s/o Ghish	12/15/2	1-12
	16	3-16
		5-08

34. Rattan Singh s/o Chandgi Ram r/o Dhulsars	4/8 13/1	0-16 1-16 2-12
35. Kherati s/o Budha Mst. Dharkan wd/o Kanahya Ram Narain s/o Mst. Bholli wd/o Des Ram Umrao s/o Thakar Dass Harphool, Mam Chand ss/o Jhanda.	4/25/2	0-12
36. Gram Sabha	4/9 12/5/1 223 225 517 521 522 523 525	0-09 0-14 4-05 3-01 Less than biswa 0-04 1-04 0-03 0-02 10-02

Details of Khasra Nos.

Rect. No.	Kh. No.	Area	Kind of soil
3	21	3-10	Abpash
	22	0-09	-do-
4	8	0-16	G. Abpash
	9/1	0-09	-do-
	12/2/1	0-02	-do-
	13/1	1-16	-do-
	13/2/2	1-05	-do-
	13/3/2	1-02	-do-
	13/4	0-06	-do-
	14	2-00	-do-
	16	2-14	-do-
	17	4-16	-do-
	18/2	3-00	-do-
	23/1	1-06	Abpash
	24	4-16	G. Abpash
	25/1	4-04	-do-
	25/2	0-12	-do-
12.	3/2/1	0-06	-do-
	4/1	0-06	-do-
	4/2/2	4-07	Abpash
	5/1	0-14	G. -do-
	5/2	4-02	Abpash
	6	4-16	-do-
	7/1/2	3-12	-do-
	7/2/1	0-01	-do-
	14/1	2-01	-do-
	15/1	3-04	-do-
	15/2	1-12	-do-
	16/2	3-16	G. Abpash
	17/1	1-00	Abpash
	25/1/1	0-14	-do-
	25/2	2-04	-do-
	26	0-05	G. Abpash
	27	0-04	-do-

Contd....

13	1	4-09	Abpash	
	2/1	3-16	Abpash	Tube-Well
			3-14	0-02
	2/2	0-10	Abpash	
	3	1-10	-do-	
	7	3-04	-do-	
	8	4-16	-do-	
	9/1	0-16	-do-	
	9/2			
		3-17	-do-	
	10/1	1-17	-do-	
	10/2	2-08	G. Abpash	
	10/3	0-04	Abpash	
	11/1	3-16	-do-	
	11/2	0-08	-do-	
	12	4-16	-do-	
	13/1	0-03	-do-	
	13/2	4-10	-do-	
	14	4-16	-do-	
	15	4-14	-do-	
	16	4-16	-do-	
	17/1	1-04	-do-	
	17/2	3-12	-do-	
	18	4-12	-do-	
	19	4-16	-do-	
	20	4-09	-do-	
	21	4-09	-do-	
	22	4-16	-do-	
	23	4-10	-do-	
	24/1	3-02	-do-	
	24/2	0-09	-do-	
	24/3	1-05	-do-	
	25/1	0-09	-do-	
	25/2	4-07	Abpash	G.M.Makan
			4-06	0-01
	26	0-07	G.M.Makan	&Tubewell
	27	0-10	"	"
14	11/1	1-07	Abpash	
	11/2	0-05	-do-	
	19	3-04	-do-	
	20	4-16	-do-	
	21	4-16	-do-	
	22	4-13	-do-	
	23	4-17	-do-	
	26	0-03	G. Abpash	
16	10/1	2-08	Abpash	
	10/2	0-19	-do-	
	11	4-14	-do-	
	12	5-04	-do-	
	13	1-15	-do-	
	18	2-09	-do-	
	19	4-16	-do-	
	20	4-11	-do-	
	21	4-16	-do-	
	22	4-00	-do-	
	26	0-05	G. Abpash	
17	1	4-16	Abpash	

Contd....

	2	4-16	Abpash	
	3/1	0-08	-do-	
	3/2	4-08	-do-	
	4	4-07	G. Abpash	
	5/1	0-12	-do-	
	5/2	0-13	Abpash	
	6/1	3-07	-do-	
	6/2	1-09	G. Abpash	
17	7/1	2-06	Abpash	
	7/2	2-10	-do-	
	8/1	3-00	-do-	
	8/2	1-16	-do-	
	9/1	0-16	-do-	
	9/2	4-00	-do-	
	10/1	0-16	-do-	
	10/2	4-00	-do-	
	11/1	2-18	-do-	
	11/2	1-16	-do-	
	12/1	2-11	-do-	
	12/2	1-18	-do-	
	13	4-16	-do-	
	14	4-16	-do-	
	15/1	3-00	-do-	
	15/2	1-04	-do-	
	16	4-07	-do-	
	17	4-11	Abpash 2-11	G.M.Gadda 2-0
	18	4-16	Abpash 2-16	G.M.Gadda 2-0
	19	4-16	Abpash	
	20	4-15	-do-	
	21/1	3-08	Abpash 3-07	G.M.Kotha 0-01
	21/2	1-08	Abpash	
	22/1	1-05	-do-	
	22/2	3-11	-do-	
	23	4-13	-do-	
	24/1	1-11	-do-	
	24/2	2-11	-do-	
	25	4-16	-do-	
	26	0-07	G. Abpash	
	27	0-08	-do-	
18	1	4-09	Abpash	
	2/1	0-14	-do-	
	2/2	4-02	-do-	
	3	4-12	-do-	
	4	4-16	-do-	
	5	4-16	-do-	
	6	4-16	-do-	
	7	4-16	-do-	
	8/1	3-18	-do-	
	8/2	0-14	-do-	
	9/1	3-19	-do-	
	9/2	0-13	-do-	
	10/2	3-07	-do-	
	11/1	1-02	-do-	
	12	4-16	-do-	
	13	4-12	-do-	
	14	4-16	-do-	
	15	4-16	-do-	

Contd.....

	16/1	1-07	Abpash
	16/2	1-04	-do-
18	16/3	2-01	-do-
	17/1	1-08	-do-
	17/2	3-03	-do-
	18	4-15	-do-
	19/2	4-01	-do-
	22/1	2-03	-do-
	23	4-16	-do-
	24	4-16	-do-
	25	4-10	-do-
	26	0-01	Tube-Well
	27	0-01	-do-
	30	0-06	Tubewell 0-01 / G.M.Makan 0-05
19	5/1	1-02	Abpash
31	2/1/1	0-04	-do-
	2/2/1	0-01	-do-
	3/1	1-09	-do-
	3/2/2	3-02	-do-
32	1	4-16	-do-
	2	4-16	-do-
	3/1	3-12	-do-
	3/2	1-01	-do-
	4	4-12	-do-
	5	4-16	-do-
	6/1	1-12	-do-
	6/2	3-03	-do-
	7	4-07	-do-
	8	3-05	G. Abpash
	9	4-15	Abpash
	10/1	1-16	G. Abpash
	10/2	3-00	Abpash
	11	4-16	-do-
	12/1	1-12	-do-
	12/2	2-09	-do-
	13	4-16	-do-
	14/1	1-00	-do-
	14/2	3-16	-do-
	15/1	2-08	-do-
	15/2	1-13	-do-
	17/1	2-02	-do-
	17/2	3-11	-do-
	18	4-16	-do-
	19	4-14	-do-
	20/1	1-01	-do-
	20/2	3-02	-do-
	21/1	0-07	-do-
	21/2	4-03	-do-
	22	4-12	-do-
	23	4-16	-do-
32	24/1	2-04	-do -
	24/2	0-06	-do-
	26	0-09	G. Abpash
	27	0-04	-do-
33	1/1	3-08	-do-
	1/2	2-04	-do-
	10/1	1-04	-do-
	10/2	1-05	-do-

Cont d...

39	1/1	3-00	Abpash
	1/2	1-16	-do-
	2/1	3-00	-do-
	2/2	1-16	-do-
	3/1	3-00	-do-
	3/2	1-02	-do-
	8	1-00	-do-
	9	4-14	-do-
	10	4-14	-do-
	11/2	4-06	-do-
	12	2-07	-do-
	20/1/2	1-01	-do-
	20/2/1	0-11	-do-
	26	0-02	G. Abpash
40	4/1	0-01	Abpash
	5/1/2	1-07	-do-
	5/2/1	1-08	-do-
	5/2/2/2	0-16-	-do-
	6/1	1-15	-do-
	15/1	0-03	-do-
	223/1	4-05	-do-
	225/1	3-01	-do-
	517/1	Less than biswa	
	521	0-04	
	522	1-04	
	523	0-03	
	526/1	0-02	

CLAIMS & EVIDENCE

Sr.No.	Name of the claimant	Kh.Nos & Area	Rate claimed
1.	Hukam Chand s/o Amar Singh Rajesh Kumar s/o Prem Chand Aruj Kumar s/o '' Mahesh Kumar s/o ''(Minor	Nil	Rs.74,500/-per bigha for land Rs.1,00,000/- for boring and two trees. Claims area 18 Big.3 Biswas instead of 17 Big.18 Bis. No documentary proof produce nor detail of Kh.Nos. shown in the claims.
2.	Mohinder Singh s/o Harphool		1)Well dig in 7 Biswas of land Rs.50,000/- 2)One pucca Kothna Rs.20,000/- 3)One Pond/water tank Rs. 4,000/- 4)Two Keekar Trees Rs. 2,000/- 5)Land per Bigha Rs.50,000/- 6)Damages/shifting Rs.10,000/- Total claims Rs.10,00,000/-

3. Bhagwan Singh, Deep Chand, Kabool Singh ss/o Chatter Singh

Rs.50,000/- P.B. for lad
Rs.10,000/- towards damages/ shifting
Rs.10,000/- for arragements for their New Residence.
Total claims Rs.5,50,000/-

4. Mukhtiar Singh, Sube ss/o Kurey

Rs.50,000/- P.B. for land
Rs. 50,000/- for Well
Rs. 10,000/- for Tube-Well
Rs.20,000/- for Pucca Kothra
Rs. 4,000/- for Water Pond.
Rs.20,000/- for 20 Neem trees
Rs.29,000/- for 29 Seesam
Rs. 1000/- for 2 Lehsua trees
Rs. 7500/- for 15 Kiker trees.
Rs. 1000/- for one Safeda tree
Rs. 1000/- for Kabli Kiker one
Rs. 2000/- for two Amrood
Rs.2000/-for 2 Shahtoot.

5. Rishi Raj s/o Mam Chand

Rs. 100/- p.sq.yd for land
Rs. 100000/- for Pucca Room, Water-channel, Tube-Well, 4 Kiker trees.
Rs. 2000/- per bigha as damage to the standing crops.

EVIDENCE :- i) Copy of sale deed dated 20.11.81 of Village Bharthal in respect of Kh.Nos. 53/16,53/17, 54/19, 54/20,54/21,54/26 which was executed on the basis of agreement to sell on 25.9.81 at Rs. 3,70,650/- for land measuring 17 Bigha 13 Bisswas.

ii) Copy of Judgment in RFA No. 209/80 Harpal Singh & Ors Vs. UOI of Shahbad Mohdpur. Fixing the market value Rs. 13,000/- per Bigha in respect of Award No. 5/74-75.

iii) Copy of Judgment in L.A. Case No. 232/83- Ram Narain Singh & Others Vs. UOI fixing the value of land in respect of Village Bagrola @ Rs. 16,800/- as on 3.6.1978.

6) Ram Chander s/o Gopi

Rs. 40,000/- for Well
Rs. 1,000/- for Trees
Rs. 2,000/- per Bigha as damage to the standing crops.

7) Ram Karan, Ram Kishan ss/o Ram Pal

Rs.100/- per sq.yd for land
Rs. 1,50,000/- for Tube-well, structure, water tank etc.
Rs.30,000/- for 15 Trees (Shehtut, Shisham, Peepal, Neem etc.)
Rs. 2000/- for damage to the standing crops.

8) Rajinder Singh s/o Sheo Narain & Jai Narain s/o Ghisa Ram

Rs.200/-p.sq.yd for land.
Rs. 1,50,000/- for one Well, tube-well, water tank, Room 9' x 12'.
Rs. 1,50,000/- for 130 Safeda trees, 8 Shehtut & Neem tree.
Rs.2,000/- per Bigha as damage to the standing crops.

Contd....

9. Rama Nand s/o Dulia	Rs. 200/- per sq.yd for land Rs.2000/- per Bigha as damage to the standing crops.
10. Sultan Singh (1/4 share)	Demanding 1/4 share of compensation in respect of Killa Nos. 26 Kh.Nos.18/2/2(4-2), ~~2(4-2)~~ 3(4-12), 8/1(3-18), 9/1 (3-19), 13/27 (0-10) as well as pucca Well and trees.
11. Surjit Singh (1/4 share)	-do-
12. Siri Lal (1/8 share)	-do-
13. Kirpa Ram (1/4 share)	-do-
14. Sant Lal (1/8 share)	-do-
15. Rattan Singh s/o Chandgi Ram	Rs.100/- per sq.yd for land.
16. Dharam Singh, Hukam Singh ss/o Mehru	Rs. 1,00,000/- per bigha for land. Rs.40,000/- for Tube-well Rs. 5,000/- for Borring in Killa No. 17. Rs.10,000/- for 10 or 12 trees.
17. Sunder Lal, Daryao Singh s/o Sabha Chand	Rs.1,00,000/- per bigha for land. Rs. 40,000/- for tube-well Rs. 20,000/- for 25 trees of shisham.
18. Sud Ram Singh s/o Kherati	Rs. 1,00,000/- per bigha for land.
19. Jage Ram, Ram Singh and Meer Singh ss/o Chandgi	-do-
20. Incha Ram s/o Chajju	-do-
21. Jot Ram s/o Desh Ram	Rs.3,50,000/- per acre for land Rs. 4,000/- per bigha, damage for standing crops. Rs.40,000/- for tube-well & Room Rs. 500/- per tree.
22. Mir Singh s/o Desh Ram	-do-
23. Hukam Chand s/o ''	-do-
24. Roop Chand s/o Prabhu	-do-
25. Smt. Chalti wd/o Nand Roop	-do-
26. Narinder Singh s/o Nand Lal	Rs.3,50,000/- per Acre for land Rs.4,000/- per Bigha for damages for standing crops Rs.40,000/- for tube-well Rs. 500/- per tree for 2 trees.
27. Partap Singh s/o Nand Lal	-do-

Contd....

28. Siri Chand s/o Ram Nath	Rs. 200/- per sq.yd for land
29. Rattan Singh alias Mir Singh s/o Net Ram	-do-
30. Om Parkash, Sat Bir ss/o Kanhiya Lal	Rs. 1,00,000/- per bigha for land. Rs. 30,000/- for one Well. Rs. 20,000/- for one Kotha (10'x12') Rs. 500/- for Ome Kikkar tree. Rs. 300/- for one Bakkan . Rs. 200/- per Sehtoot for 4 Rs. 500/- for one Peepal tree Rs. 2500/- for one Boring. Rs. 5,000/- for Khel Khota.
31. Khazan Singh s/o Gyani Narain Singh s/o " Ram Singh, Rattan Singh, Balbir Singh ss/o Jot Ram	Rs. 100000/- per bigha for land Rs. 30,000/- for Well Rs. 25,000/- for Tube-well Rs. 20,000/- for Pucca Kotha (10' x 24 ') Rs. 500/-per tree for 4 Kikkar.
32.	Rs. 300/- per Bakkan tree for 4 trees. Rs. 1500/- per Sisham tree for 4 Sisham Rs. 12,000/- per Acre for Pucca water channel of two acres.. Rs. 5000/- per Khel Kotha for two.
32. Karan Singh, Dharam Bir Singh, Davinder Kumar, Om Parkash, Satya Dev ss/o Ranjit	Rs. 1,00,000/- per bigha for land. Rs. 30,000/- for Well. Rs. 25,000/- for tube-well (Two Tubewell) Rs. 20,000/- for pucca Kotha. Rs. 500/- per tree Kikar (two) Rs. 2000/- for one Amrood tree Rs. 300/- per tree Sehtoot (Four) Rs. 500/- for one tree of Neem Rs. 800/- for one Shisham tree Rs. 2000/- for one Anar tree Rs. 250/- for one Leshwa tree Rs. 12,000/- per acre length of Pucca water channel Rs. 5000/- for one Khel Kotha Rs. 25,000/- for per Borring
33. Suraj Bhan, Raj Pal, Vijay Pal ss/o Dharam Singh	Rs. 1,00,000/- per Bigha for land. Rs. 30,000/- for one Well Rs. 25,000/- for Elec. Tube-Well. Rs. 20,000/- for pucca Kotha (8'x 12')

Contd...

Rs. 1000/- for two Kikkar tree
Rs. 2000/- for one Amrood
Rs. 1500/- for five Shehtoot tree
Rs. 5000/- for Khel Kotha (4' x 6')

34. Bhagwan Singh s/o Niader
Rs. 1,00,000/- per bigha for land
Rs. 1,000/- for two Neem trees.
Rs. 500/- for one Kikkar tree.

35. Chand Ram, Deep Chand, Sis Ram, Banwari, Kishan, Dalip ss/o Mam Chand, Smt. Sama Kaur wd/o Mam Chand
Rs. 1,00000/- per bigha for land
Rs. 5,000/- for ten Kikkar trees.

36. Smt. Luxmi wd/o Ran Singh, Rajesh, Raj Singh ss/o Ran Singh (Minors)
Rs. 1,00,000/- per bigha for land.
Rs. 20,000/- for one Pucca Kotha.
Rs. 25,000/- for one Borring.
Rs. 10,000/- for two Khel.

37. Jage s/o Ram Saroop
Rs. 1,00,000/- per bigha for land.
Rs. 50,000/- for one well
Rs. 20,000/- for Pucca Kotha
Rs. 3,500/- for seven Kikkar trees.
Rs. 4,000/- for two Amrood trees.
Rs. 600/- for two Bakkan tree
Rs. 1500/- for three Neem tree
Rs. 2000/- for one Anar tree
Rs. 5000/- for Khel Kotha.

38. Duli Chand s/o Anand Lal
Rs. 1,00,000/- per Bigha for land.
Rs. 30,000/- for Well
Rs. 1500/- for 3 Kikkar trees.

39. Munshi s/o Ram Mehar
Rs. 1,00,000/- per Bigha for land.
Rs. 50,000/- for Well
Rs. 25,000/- for tube-well
Rs. 20,000/- for pucca Kotha
Rs. 3000/- for six Neem tree
Rs. 12,000/- per acre length water channel
Rs. 5000/- for Khel Kotha
Rs. 25,000/- for Borring.

40. Bharat Singh s/o Nand Lal
Rs. 1,00,000/- per bigha for land.
Rs. 30,000/- for Well
Rs. 25,000/- for tube-well
Rs. 20,000/- for pucca Kotha
Rs. 2000/- for four Kikkar trees
Rs. 30,000/- for Well.

Contd....

DOCUMENTARY EVIDENCE

One of the claimant namely Shri Rishi Raj has filed three evidence in support of his claim :-

1. He produced copy of sale deed dated 20.11.81 for transaction of land measuring 17 bigha 13 biswas for Rs. 3,70,650/- for Kh.No. 53/16,17, 54/19, 20,21 & 26 The khasra numbers involved in the sale transactions falls on the other side of Village. There is physical boundary between the land under sale deed and land under acquisition as this sale transaction is discarded.

2. The claimant has filed two copies of judgement in RFA No. 209/80 styled as Harpal Singh Vs. UOI and L.A.C. No. 232/83- styled as Ram Narain Vs. UOI. This RFA No. 209/80 pertains to Village Shahbad Mohd.pur. This RFA was arisen against Award No. 5/74-75 of whichthe date of notification was 21.2.1973. In this context, it is mentioned that there is one Award No. 10/86-87 in Village Shahbad Mohd. pur with the date of notification u/s 4 as 27.1.1984 which date is also the same in the present case. The land of Award No. 10/86-87 is adjoining to the land under acquisition upon which reliance can be placed . As regard to L.A.C. No. 232/83,it pertains to Village Bagrola which is not adjoining at all to the under acquisition. So, no reliance can be placed on it.

Contd....

MARKET VALUE

Market value of the land under acquisition is to be determined with reference to the date of preliminary notification u/s 4 i.e. 27.1.1984. In assessing the market value of the land under acquisition, the material date, bonafide sale transactions of the land similarly circumstanced and also the awards for similarly situated lands made with reference to the date of notification u/s 4 of the Land Acquisition Act are to be taken into consideration. For this purpose sale transactions made in this Village were consulted from the Revenue Record and the following sales transactions have been taken place in this Village as under :-

Sl.No.	Regd.No. & date	Area	Amount	Average per bigha
1.	7204 / 23.12.83	4-12	33,500-00	Rs.7,282- 60
2.	7205 / 23.12.83	4-16	35,000-00	Rs.7,291- 60
3.	7206 / 23.12.83	4-16	35,000-00	Rs.7,291- 60
4.	5 / 2.1.84	2-18	21,000-00	Rs.7,241- 35
5.	6 / 2-1-84	5-04	37,000-00	Rs.7,115- 30
6.	8 / 2-1-84	2-02	15,000-00	Rs.7,142- 80
7.	9 / 2.1.84	5-10	40,000-00	Rs.7,272- 70
8.	272 / 16.1.84	5-08	39,000-00	Rs.7,222- 25
9.	273 / 16.1.84	3-16	27,000-00	Rs.7,105-50
10.	274 / 16.1.84	4-16	35,000-00	Rs.7,291- 60
11.	275 / 16.1.84	4-15	35,000-00	Rs.7,368 -40

From the above table it is clear that the average rate per bigha for the land comprising of Rect.No. 55,56,58, comes to Rs. 7,105 to 7,368/-. All these sale transactions were executed in between December, 1983 to 16.1.1984. The present date of notification u/s 4 is 27.1.1984. The land of these sale transactions falls on the Eastern side beyond Riwari

Railway line. There is clear cut demarcation by virtue of afore - said Railway Line. Beside above, there is one Award No.50/81-82 through which land measuring 337-19 was acquired. The date of notification u/s 4 of Award No. 50/81-82 is 6.11.1980. The L.A.C. has assessed Rs.7200/-, 6000/- and Rs. 4000/- for Block A,B & C respectively. Block A land comprises of land adjacent to Riwari Railway Line & Block C land pertains to low lying area and Block -B not comprising in Block A & C. I have inspected the site alongwith Revenue Field Staff and found that there is no basic difference in the land situated near Railway Line and other lands. I am of the view that the land under acquisition is cultivable and even land. Hence, no Block for the land under acquisition is formed. If, appreciation @ 9 % on the market value of the land falling in Block A of Award No. 50/81-82 is allowed it comes to Rs. 9,350/- per bigha in round figure say Rs.9300/- per bigha. The land under acquisition is ~~surrounded by~~ adjacent to the Village boundary of Shahbad Mohd.pur. The land under acquisition forms a triangle touching Shahbad Mohd.pur mostly. In Village Shahbad Mohd.pur there is one Award No. 10/86-87 with date of notification u/s 4 27.1.84, in which L.A.C. awarded Rs.13,000/- per bigha for the land.

From above discussion, it is concluded that the average price of sale of land in Village Bharthal comes to Rs. 7105 /- to 7368/- per bigha whereas the price if appreciated on the basis of market value of Award No. 50/81-82 of Village Bharthal comes to Rs. 9350/- per bigha. In addition to this land prices in adjoining Village namely Shahbad Mohd.pur , L.A.C. awarded Rs. 13,000/- per bigha as on 27.1.84. There is much disperity in the average sale price of the land within the revenue estate of Bharthal and Shahbad Mohd.pur. I personally inspected the site in question and found that there is no basic difference in potentiality and situation of the land in between

Contd...

the land of Village Shahbad Mohd.pur and land under acquisition. There is one metalled road passing through Shahbad Mohd.pur and is leading to Village Bharthal. The average sale price in Village Bharthal do not reflect correct market value of the land as the average price of land on the basis of Award No. 50/81-82 of Village Bharthal is on the higher side, otherwise the average sale price of the land should be much higher than the market value of the land of Award No. 50/81-82. If the land enjoy all facilities then it should not be placed at low price otherwise it will cause injustice to recorded Bhumidars. In the interest of justice and to maintain the average price of the land within or close vicinity it should be at par with the market value of the land of Award No. 10/86-87. If the market value of the land is fixed in accordance with the market price of the land of Award No. 10/86-87 it will definitely be at par. So, the market value of the land is to be fixed in accordance with the compensation assessed by the L.A.C. in Award No. 10/86-87.

From the above discussionr regarding the price of the land prevailing in the adjoining Village as well as situation and potentiality of the land under acquisition with the land of Village Shahbad Mohd.pur acquired through Award No. 10/86-87 I am of the opinion that Rs. 13,000/- per bigha is quite reasonable and fair market value of the land under acquisition and award the same accordingly.

TREES :- There are some trees on the land under acquisition I assess compensation as under :-

Kh.No.	Name of tree with No.		Approx. wt.in Qtl.	Rate per Qtl.	Total
13/10/1	Kikar	1	2	Rs. 20/-	Rs. 40/-
13/13/2	Kikar	2	10	Rs. 20/-	Rs. 200/-
13/18	Kikar	2	10	Rs. 20/-	Rs. 200/-
13/19	Kikar	1	5	Rs. 20/-	Rs. 100/-
13/23	Neem	1	1	Rs. 20/-	Rs. 20/-
	Shehtoot	6	6	Rs. 20/-	Rs. 120/-
13/25/2	Lehswa	1	1	Rs. 20/-	Rs. 20/-

Contd...

13/25/2	Shehtoot	4	4	Rs. 20/-	Rs. 80/-
	Gullar	1	2	Rs. 20/-	Rs. 40/-
18/17/1	Kikar	1	1	Rs. 20/-	Rs. 20/-
	~~Shehtoot~~	~~1~~			
	Shi sham	1	1	Rs. 30/-	Rs. 30/-
14/22	Gullar	3	5	Rs. 20/-	Rs. 100/-
	Amrood	1	1	Rs. 100/- per plant	Rs. 100/-
14/23	Shehtoot	1	2	Rs. 20/-	Rs. 40/-
16/19	Shi sham	1	15	Rs. 30/-	Rs. 450/-
	Neem	2	20	Rs. 20/-	Rs. 400/-
18/17/2	Kikar	1	1	Rs. 20/-	Rs. 20/-
	Shi sham	18	26	Rs. 30/-	Rs. 780/-
18/13	Kikar	3	3	Rs. 20/-	Rs. 60/-
	Shi sham	2	2	Rs. 30/-	Rs. 60/-
18/18	Shi sham small	5	2	Rs. 30/-	Rs. 60/-
18/19	Shi sham	3	4	Rs. 30/-	Rs. 120/-
18/23	Kikar	1	5	Rs. 20/-	Rs. 100/
16/22	Kikar	2	5	Rs. 20/-	Rs. 100/-
17/6/1	Kikar	1	4	Rs. 20/-	Rs. 80/-
17/8/1	Kikar	4	8	Rs. 20/-	Rs. 160/ -
17/8/2	Shehtoot	2	3	Rs. 20/-	Rs. 60/-
	Bakkan	1	2	Rs. 20/-	Rs. 40/-
	Kikar	1	1	Rs. 20/-	Rs. 20/-
17/7/2	Kikar	6	12	Rs. 20/-	Rs. 240/ -
17/14	Shehtoot	2	4	Rs. 20/-	Rs. 80/-
	Amrood	1	Rs. 100/-per plant		Rs. 100/-
17/18	Kikar	1	4	Rs. 20/-	Rs. 80/ -
17/23	Pipal	3	5	Rs. 20/-	Rs. 100/-
	Shi sham	1	4	Rs. 30/-	Rs. 120/-
	Gullar	2	4	Rs. 20/-	Rs. 80/-
18/3	Shehtoot	2	2	Rs. 20/-	Rs. 40/-
	Laswa	2	3	Rs. 20/-	Rs. 60/ -
18/25	Shehtoot	1	2	Rs. 20/-	Rs. 40/-
	Neem	2	6	Rs. 20/-	Rs. 120/-
	Shi sham	1	5	Rs. 30/-	Rs. 150/-
	Amrood (small)	1	Rs. 70/-per plant		Rs. 70/-
	Kikar	2	2	Rs. 20/-	Rs. 40/-
	Safeda	1	6	Rs. 20/-	Rs. 120/-
32/1	Kikar	3	6	Rs. 20/-	Rs. 120/-
32/4	Kikar	2	2	Rs. 20/-	Rs. 40/ -
32/5	Kikar	1	4	Rs. 20/-	Rs. 80/-
32/7	Kikar	4	10	Rs. 20/-	Rs. 200/-

Contd...

32/7	Neem	1	2	Rs. 20/-	Rs. 40/-
32/10/2	Kikar	2	6	Rs. 20/-	Rs. 120/-
32/22	Shisham	3	8	Rs. 30/-	Rs. 240/-
	Shehtoot	5	15	Rs. 20/-	Rs. 300/-
	Bakkan	2	2	Rs. 20/-	Rs. 40/-
32/23	Bakkan (small)	2	1	Rs. 20/-	Rs. 20/-
	Shehtoot (small)	2	1	Rs. 20/-	Rs. 20/-
39/9	Neem	1	1	Rs. 20/-	Rs. 20/-
39/10	Kikar	1	4	Rs. 20/-	Rs. 80/-
	Shehtoot	1	2	Rs. 20/-	Rs. 40/-
39/11	Shehtoot	3	3	Rs. 20/-	Rs. 60/-
				Total:-	Rs. 6480/-

WELLS/TUBE-WELLS

There are following Wells & Tube-Wells on the land under acquisition :I assess the market value as detailed below :-

Sr.No.	Kh.No.	Details of Well/ Tube-Well	Compensation assessed.
1.	12/7/1	One Well in good condition dia 8 '	Rs. 4000 - 00
2.	13/9/2	One tube-Well(Boaring) with small water-tank	Rs. 2000 - 00
3.	13/13/2	One tube-Well in good condition Dia 8 ' with water tank	Rs. 5000 - 00
4.	13/25/2	One tube-Well(Boaring)	Rs. 2000 - 00
5.	13/23	One tube-Well(Boaring) with cement plaster	Rs. 2500 - 00
6.	14/22	One tube-Well in good condition Dia 8 ' with water-tank	Rs. 5000 - 00
7.	16/12-13	One Well Dia 9 ',water tank and water channel 100 ft.	Rs. 6000 - 00
8.	16/18	One Boaring,one water tank	Rs. 2000 - 00
9.	17/8/2	One Well in good condition dia 8 ' with water tank	Rs. 5000 - 00

Contd...

10.	17/14	One tube-well (Boaring) in good condition	Rs. 2500 - 00
11.	17/20	One tube-well dia 4 '	Rs. 3000 - 00
12.	17/23	One Well dia 8 ' alongwith water tank	Rs. 4500 - 00
13	32/5	Temp(Kachha) Boaring	Rs. No compensation
14.	18/3	One tube-Well in good condition Dia 9 ' alongwith water tank	Rs. 5000 - 00
15.	18/19	One Boaring with bricks without use	Rs. 1500 - 00
16.	18/25	One Well dia 8 ' alongwith water-tank	Rs. 4000 - 00
17.	32/7	One Well dia 8 ' alongwith water-tank	Rs- 4000 - 00
18.	32/23	One tube-well(Boaring)	Rs. 2000 - 00
19.	32/27	One tube-well in good condition dia 8 'alongwith water channel 300' (Kh.No. 39/3/1)	Rs. 6500 - 00
20.	39/9	One tube-well(Boaring) with water-tank in good condition	Rs. 2500 - 00
21.	39/10	One Well in good condition Dia 8 ' alongwith water-tank and channel 250 '	Rs. 6500 - 00

STRUCTURES

There are some structures on the land under acquisition. Details of which alongwith their approximate compensation are as under :-

S.No.	Kh.No.	Description of structures	Compensation assessed
1.	12/7/1	One room 10' x 10' in bad condition	Rs. 3000/-
2.	13/9/2	One room 10' x 10' in good condition	Rs. 3500/-
3.	13/13/2	One room 8' x 8' in good condition	Rs. 3200/-
4.	13/18	One room 10' x 8' in bad condition	Rs. 2800/-
5.	13/25/2	One room 10' x10' in good condition	Rs. 3500/-
6.	13/23	One room 10 x 15 in good condition	Rs. 5000/-
7.	14/22	One room 9 x 12 in good condition	Rs. 4000/-
8.	16/19	One room 10 x 20 in good condition	Rs. 6000/-
9.	17/8/2	One room 10 x 15 in good condition	Rs. 4500/-
			Rs. 35500/-

Bf 35500=00

10.	17/14	One room 8 x 15 in bad condition alongwith Chhapar	Rs. 3200- 00
11.	17/20	One room 10 x 8 in good condition	Rs. 3200- 00
12.	18/3	One room 10 x 8 in good condition (Plaster outside)	Rs. 3500- 00
13.	18/19	One room 10 x 10 in bad condition	Rs. 3000- 00
14.	18/26	One room 10 x 8 in bad condition (one side wall cracked)	Rs. 3000- 00
15.	32/5	One room 10 x 12 in good condition	Rs. 4000- 00
16.	32/7	One room 10 x 10 in bad condition without door	Rs. 2000- 00
17.	32/22	One room 10 x 15 with stairs in good condition	Rs. 5000- 00
18.	39/10	One room 10 x 10 in good condition .	Rs. 3500- 00
		Total:-	Rs. 64900- 00

INTEREST : As the possession of the land under acquisition has not yet been taken over and there is no difference of more than three years between the notification u/s 4 and 6 of the L.A. Act. The question of assessment of interest u/s 34 or 4(3) of the said act does not arise.

SOLATIUM: 30 % solatium on the market value of the land is payable to the interested persons u/s 23(2) of the L.A. Act.

ADDITIONAL AMOUNT: An additional amount u/s 23 (1A) of the L.A. Amendment Act @ 12 % p.a. on the market value of the land is payable to the persons interested from the date of notification u/s 4 (i.e. 27.1.1984) to the date of announcement of award or to the date of taking over the possession of the land, whichever is earlier.

LAND REVENUE :- A sum of Rs. 207-14 as land revenue of the land under acquisition will be deducted from the Khalsa Rent Roll of the Village from the date of taking over possession

Contd...23..

APPORTIONMENT : Compensation will be paid to the recorded owners/Bhumidars on the basis of latest entries in the revenue record. In case of any dispute which will not be settled amicably within a reasonable period, the compensation will be referred to the Court of Addl. District Judge u/s 30-31 of the L.A. Act for adjudication.

SUMMARY OF AWARD

Compensation of land measuring 604 bigha 2 biswas @ Rs. 13,000/- per bigha	Rs. 78,53,300 - 00
Compensation for Structures	Rs. 64,900 - 00
Compensation for Wells	Rs. 75,500 - 00
Total:-	Rs. 79,93,700 - 00
Solatium @ 30 %	Rs. 23,98,110 - 00
Addl. amount u/s 23(1a) @ 12 % p.a. from 27.1.84 to 14.8.86 (2 yrs. 200 days)	Rs. 24,44,101 - 00
Compensation for Trees	Rs. 6,480 - 00
GRAND TOTAL :-	Rs. 1,28,42,391 -00

(Rupees One Crore Twenty Eight Lac Forty Two Thousand Three Hundred Ninty One only)

(N.K. SHARMA)
LAND ACQUISITION COLLECTOR(PS)
DELHI.

8/8

APPROVED
SECRETARY (REVENUE)

Announced in the open Court today.
5/9/86

5/9/86
(N. K. SHARMA)
Land Acquisition Collector
Delhi

517

आज दिनांक 5/9/86 को अवार्ड नं. 18/86-87 ग्राम पंचायत को निम्नलिखित वास्तेदारान की उपस्थिति में सुनाया गया।

क्रम नं०	नाम	हस्ताक्षर
1	रामचन्द्र S/o गोपी	Ram Chandra
2	हुकमचन्द S/o अमर सिंह	5/9/86
3	धर्म सिंह S/o मेक	P. Dharmsingh
4	हुकमचन्द S/o मेक	
5	जीतराम S/o देशराम	
6	हुकमचन्द S/o देशराम	
7	वीर सिंह S/o देशराम	
8	भरत सिंह S/o नेकलाल	
9	रिसाराम S/o रामचन्द	
10	रामकरण S/o रामपत	Ramkaran
11		
12	रामानन्द S/o गुलाबचन्द	
13	सवलीर S/o कन्हैयालाल	संतवीर
14	करण सिंह S/o रणजीत सिंह	Karan Singh
15	मोतीलाल S/o केतीराम	
16	सरजीत सिंह S/o मोहन सिंह	
17	सूरजमल S/o धर्म सिंह	सूरजमल
18	मुन्शी S/o रामदेव	5-9-86
19	वीर सिंह S/o नेतराम	

(TO BE PUBLISHED IN PART IV OF DELHI EXTRA ORDINARY GAZETTE)

DELHI ADMINISTRATION: DELHI

NOTIFICATION

Dated the 18th Sept.,84

No.F.9(16)/84=L&B:- Whereas the Lt.Governor, Delhi is satisfied that the land is required to be taken by Government at the public expense for a public purpose, namely for Planned Development of Delhi . It is hereby declared that the land described in the specification below is required for the above purpose.

This declaration is made under the provisions of section 6 of the Land Acquisition Act,1894, to all whom it may concern and under the provisions of section 7 of the said Act, the Collector of Delhi is hereby directed to take order for the acquisition of the said land.

This declaration is with reference to this Administration Notification No.F.9(16)/84-L&B dated the 27th Jan.'84 issued under sub-section(i) of section 4 of the a

A plan of the land can be inspect
of the Collector of Delhi.

-10
4-16
4-16

SPECIFICATION

S.No.	Name of Village	Total area Big - Bis	Sect. No.		Big- Bis
1	2	3	4	5	6
	BHARTHAL	653-00	3	21	3-10
				22	0-09
			4	8	0-16
				9	0-09
				12/2	0-02
				13/1	1-16
				13/2	1-05
				13/3	1-02
			~~12/4~~	~~0-06~~	
				13/4	0-06
				14	2-00
				16	2-14
				17	4-16
				18	3-00
			~~12~~	23	1-06
				24	4-16
				25/1	4-04
				25/2	0-12
			12	3/2	0-06
				4/1	0-06
				4/2	4-07
				5/1	0-14
				5/2	4-02
				6	4-16
				7/1	3-12
				7/2	0-01
				14	2-01
				15/1	1-04
				15/2	1-12

Contd..2...

	16	3-16
	17	1-00
	25/1	0-14
	25/2	2-04
	26	0-05
	27	0-04
13	1	4-09
	2/1	3-16
	2/2	0-10
	3	1-10
	7	3-04
	8	4-16
	9/1	0-16
	9/2	3-17
	10/1	1-17
	10/2	2-08
	10/3	0-04
	11/1	3-16
	11/2	0-08
	12	4-16
	13/1	0-03
	13/2	4-10
	14	4-16
	15	4-16
	16	4-16
	17/1	1-04
	17/2	3-12
	18	4-12
	19	4-16
	20	4-09
	21	4-09
	22	4-16
	23	4-10
	24/1	3-02
	24/2	0-09
	24/3	1-05
	25/1	0-09
	25/2	4-07
	26	0-07
	27	0-10
14	11/1	1-07
	11/2	0-05
	19	3-04
	20	4-16
	21	4-16
	22	4-13
	23	4-17
	26	0-03
16	10/1	2-08
	10/2	0-19
	11	4-14
	12	5-04
	13	1-15
	18	2-09
	19	4-16
	20	4-11
	21	4-16
	22	4-00
	26	0-05

Contd.....

17	1	4-16
	2	4-16
	3/1	0-08
	3/2	4-08
	4	4-07
	5/1	0-12
	5/2	0-13
	6/1	3-07
	6/2	1-09
	7/1	2-06
	7/2	2-10
	8/1	3-00
	8/2	1-16
	9/1	0-16
	9/2	4-00
	10/1	0-16
	10/2	4-00
	11/1	2-18
	11/2	1-16
	12/1	2-18
	12/2	1-18
	13	4-16
	14	4-16
	15/1	3-00
	15/2	1-04
	16	4-07
	17	4-11
	18	4-16
	19	4-16
	20	4-15
	21/1	3-08
	21/2	1-08
	22/1	1-05
	22/2	3-11
	23	4-13
	24/1	1-11
	24/2	2-11
	25	4-16
	26	0-07
	27	0-08
18	1	4-09
	2/1	0-14
	2/2	4-02
	3	4-12
	4	4-16
	5	4-16
	6	4-16
	7	4-16
	8/1	3-18
	8/2	0-14
	9/1	3-19
	9/2	0-13
	10	3-07
	11	1-02
	12	4-16
	13	4-12
	14	4-16
	15	4-16

Contd...

	16/1	1-07
	16/2	1-04
	16/3	2-01
	17/1	1-18 1-08
	17/2	3-03
	18	4-15 4-15
	19	4-01
	22	2-03
	23	4-16
	24	4-16
	25	4-10
	26	0-01
	27	0-01
	30	0-06
19	5	1-02
31	2/1	0-04
	2/2	0-01
	3/1	1-09
	3/2	3-02
32	1	4-16
	2	4-16
	3/1	3-12
	3/2	1-01
	4	4-12
	5	4-16
	6/1	1-13
	6/2	3-03
	7	4-07
	8	3-05
	9	4-15
	10/1	1-16
	10/2	3-00
	11	4-16
	12/1	1-12
	12/2	2-09
	13	4-16
	14/1	1-00
	14/2	3-16
	15/1	4-01
	15/2	1-13
	17/1	2-02
	17/2	3-11
	18	4-16
	19	4-14
	20/1	1-01
	20/2	3-02
	21/1	0-07
	21/2	4-03
	22	4-12
	23	4-16
	24/1	2-04
	24/2	0-06
	26	0-09
	27	0-04
33	1/1	3-08
	1/2	2-04
	10/1	1-04
	10/2	1-05

Cont d..... 5....

39	1/1	3-00
	1/2	1-16
	2/1	3-00
	2/2	1-16
	3/1	3-00
	3/2	1-02
8	8	1-00
	9	4-14
	10	4-14
	11	4-06
	12	2-07
	20/1	1-01
	20/2	0-11
	26	0-02
40	4	0-01
	5/1	1-07
~~5/2/1~~	~~1-08~~	
	5/2/1	1-08
5/2/2	5/2/2	0-16
	6	1-15
	15	0-03
	223	4-05
	225	3-01
	517	Less than bi swa.
	521	0-04
	522	1-04
	523	0-03
	525	0-02
SHAHBAD MOHDPUR 2035-16	1etc/1	14-08
	1etc/2	3-06
	1etc/3	4-12
	1etc/4	5-19
	1etc/5	5-19
	1etc/6	3-06
	1etc/7	3-07
	1etc/8	29-01
	1etc/9	0-09
	1etc/10	4-08
	1etc/11	13-10
	1etc/12	0-06
	1etc/13	76-16
	1 etc/14	5-18
	1 etc/15	7-18
	1etc/16	13-04
	1etc/17	14-01
	1etc/18	6-06
	1etc/19	6-06
	1etc/20	6-06
	1etc/21	13-14
	1etc/22	19-06
	1etc/23	5-15
	1etc/24	65-14
	1etc/25	13-04
	1 etc/26	8-13
	1etc/27	9-14
	1etc/28	3-11

Contd...6...

1 etc/29	10-14
1 etc/30	25-04
1etc/31	00-14
1etc/32	6-15
1etc/33	6-02
1etc/34	5-03
1etc/35	6-00
1etc/36	5-03
1etc/37	0-05
1etc/38	5-11
1etc/39	5-04
1etc/40	8-01
1etc/41	12-19
1etc/43	19-16
1etc/44	10-11
1etc/45	4-12
1etc/46	5-11
1etc/47	5-12
1etc/48	0-06
1etc/49	27-08
1etc/50	22-17
1etc/51	2-03
1etc/52	6-02
1etc/53	4-17
1etc/54	2-05
1etc/55	2-15
1etc/56	5-09
1etc/57	15-19
1etc/58	3-01
1etc/59	14-02
1etc/60	3-19
1etc/61	4-08
1etc/62	11-11
1etc/63	4-17
1etc/64	0-06
1etc/65	5-01
1etc/66	0-05
1etc/67	20-05
1etc/68	4-19
1etc/69	1-17
1etc/70	10-12
1etc/71	12-15
1etc/72	1-02
1etc/73	6-12
1etc/74	9-14
1etc/75	12-12
1etc/76	13-14
1etc/77	0-09
1etc/78	19-01
1etc/79	19-08
1etc/80	18-04
1etc/81	0-06
1etc/82	17-03
1etc/83	17-13
1etc/84	0-04
1etc/85	7-14
1etc/86	4-17

Contd..... 7....

letc/87	0-06
letc/88	26-12
letc/89	1-09
letc/90	8-05
letc/91	7-09
letc/92	5-07
letc/93	9-18
letc/94	0-09
letc/95	16-03
letc/96	0-12
letc/97	55-15
letc/98	3-02
letc/99	1-04
letc/100	6-00
letc/101	3-16
letc/102	4-00
letc/103	6-05
letc/104	5-00
letc/105	36-00
letc/106	1-03
letc/107	3-01
letc/108	6-11
letc/109	13-13
letc/110	4-11
letc/111	7-17
letc/112	6-17
letc/113	10-19
letc/114	10-19
letc/115	8-18
letc/116	14-17
letc/117	0-07
letc/118	18-18
letc/119	12-11
letc/120	8-05
letc/121	4-12
letc/122	0-14
letc/123	4-08
letc/124	3-16
letc/125	23-10
letc/126	16-04
letc/127	0-08
letc/128	41-16
letc/129	4-13
letc/130	14-16
letc/131	7-04
letc/132	5-04
letc/133	3-00
letc/134	23-02
letc/135	0-06
letc/136	44-03
letc/137	20-16
letc/138	2-01
letc/139	2-03
letc/140	2-05
letc/141	2-08
letc/142	2-01
letc/143	7-06
letc/144	1-05

Contd....8...

letc/145	9-11
letc/146	5-14
letc/147	4-11
letc/148	0-07
letc/149	6-03
letc/150	2-11
letc/151	7-18
letc/152	8-19
letc/153	2-13
letc/154	3-00
letc/155	2-10
letc/156	4-13
letc/157	1-16
letc/158	4-01
letc/159	7-08
letc/160	4-01
letc/161	4-06
letc/162	4-06
letc/163	3-16
letc/164	3-16
letc/165	3-16
letc/166	0-14
letc/167	11-08
letc/168	11-06
letc/169	1-09
letc/170	18-04
letc/172	26-18
letc/175	9-10
letc/176	20-01 (20-01)
letc/177	0-08
letc/178	26-14
letc/179	9-14
letc/180	10-05
letc/181	10-05
letc/182	24-06
letc/183	9-11
letc/184	26-13
letc/185	14-02
letc/186	6-19
letc/187	7-01
letc/188	4-14
letc/189	4-10
letc/190	1-12
letc/191	5-17
letc/192	0-09
letc/193	5-04
letc/194	0-07
letc/195	24-10
letc/196	5-01
letc/197	4-19
letc/198	11-15
letc/199	10-10
letc/200	9-18
letc/201	0-03
letc/202	3-01
letc/203	0-02
letc/204	0-09
letc/205	5-15
letc/206	5-13
letc/207	5-16

Contd..

	let c/209	1-16
	let c/210	14-12
	let c/211	8-00
	let c/212	4-09
	let c/213	10-11
	let c/214	20-18
	let c/215	5-07
	let c/216	9-08
	let c/217	6-11
	let c/218	5-05
	let c/219	1-03
	let c/220	23-02
	let c/221	0-10
	let c/222	22-15
	let c/223	0-08
	let c/224	20-08
	let c/225	0-12
	let c/226	10-16
OCHANPUR		
378-19 (3)	19/1	0-16
	19/2	0-11
	20	4-01
	22	1-16
	26	0-07
(4)	8	1-12
	9	1-12
	12	4-16
	13	4-16
	18	4-16
	19	4-16
	20	1-17
	21	4-09
	22	4-16
	23	4-10
(5)	10	2-14
	11/1 min	1-03
	11/2 min	2-14
	12	4-03
	13	2-18
	14	2-06
	15	1-13
	16	4-05
	17	4-16
	18/1	3-00
	18/2	1-16
	19/1	3-10
	20 min	2-08
	21 min	0-16
	22	4-08
	23	4-01
	24	3-00
	25	4-16
(6)	6 min	0-16
12	2 min	4-00
	3	4-09
	5	4-18

Contd.....

	6	3-18
	7	2-01
	8	4-09
	9 min	2-08
	12/1 min	Less than biswa
	12/2 min	0-16
	13	4-07
	14/1	0-10
	14/2	3-18
	15/1	1-02
	15/2	3-14
	16	4-16
	17	5-05
	18 min	2-07
	23/1 min	0-04
	23/2	2-01
	24	4-12
	25/1	2-02
	25/2	2-06
	26	0-07
13	1	2-19
	2/1	1-08
	2/2	2-08
	5	4-04
	6	1-13
	8/1	0-11
	8/2	1-14
	9/1	0-16
	9/2	4-00
	10/1	2-07
	10/2	2-03
	10/3	1-04
	10/11	4-16
	12	4-16
	13	4-08
	15	4-04
13	16	2-01
	17	4-16
	18	4-16
	19	4-10
	20/1	3-12
	20/2	1-04
	21/1	2-18
	21/2	1-15
	22/1	3-00
	22/2	1-16
	23	4-16
	24/1	0-04
	24/2	4-07
	26	0-06
	28	1-07
14	10	1-18
15	1	4-16
	2	4-16
	3/1	3-00
	3/2	1-16
	4	2-08
	8	5-00

Contd.... 11....

: 11 :

	9	4-16
	10	4-16
	11	4-16
	12/1	1-09
	13	2-16
	19/1	3-16
	19/2	1-09
	20	4-16
	21/1	0-12
	21/2	3-10
	22/1	0-02
	22/2	1-17
	26	0-06
16	3 min	0-16
	4	4-16
	5	4-16
	6/1	1-00
	~~7xxxxx~~	
	6/2	3-16
	7 min	4-02
	14 min	2-07
	15	4-16
	16 min	4-15
	17 min	0-11
	25 min	3-00
	26	0-10
	29	0-06
23	5 min	2-00
	6 min	0-06
24	1	4-11
	10/1 min	1-16
	10/2 min	Less than biswa
	33	6-16
	37 min	10-04
	38	0-14
	39	2-14
	42 min	0-16
	191 ~~x~~	0-17
	178 min	0-03
	188	0-06

Contd...4.....

Proceedings for possession of land in Village Bharthal

Award No. 19/86-87

***

Today, dated 22/9/86, as per the orders of Hon'ble LAC (PS), according to the program Vahbhara, Ram Chandra Patwari (LA) and Abdul Rahim (Peon) (LA) reached the site to hand over possession of land in village Bharthal, which has been acquired under Award No. 19/86-87. On the spot, Shri R.P. Agrawal, NT (L&B) and Shri S.K. Sharma, Patwari (L&B) were present on behalf of the acquiring department to take possession. From the DDA office, Shri Chander Bhan, Tahsildar, and Shri D.C. Gupta (DDA) were present according to the program. The demarcation of the acquired land was done on the spot, which was shown and explained to the representatives of the department who were present. The details of the Khasra numbers whose possession was handed over under the above-mentioned award are as follows: -

3		4									
21	22	8	9/1	12/2/1	13/1	13/2/2					
3-10	0-09	0-16	0-09	0-02	1-16	1-05					
4											
13/3/2	13/4	14	16	17	18/2	23/1	24				

1-02	0-06	2-00	2-14	4-16	3-0	1-06	4-16				
4		12									
25/1	25/2	3/2/1	4/1	4/2/2	5/1	5/2					
4-04	0-12	0-06	0-06	4-07	0-14	4-02					
12											
6	7/1/2	7/2/1	14/1	15/1	15/2	16/2					
4-16	3-12	0-01	2-01	3-04	1-12	3-16					
12					13						
17/1	25/1/1	25/2	26	27	1	2/1	2/2	3			
1-00	0-14	2-04	0-05	0-04	4-09	3-16	0-10	1-10			
13											
7	8	9/1	9/2	10/1	10/2	10/3	11/1	11/2			
3-04	4-16	0-16	3-17	1-17	2-08	0-04	3-16	0-08			
13											
12	13/1	13/2	14	15	16	17/1	17/2	18			
4-16	0-03	4-10	4-16	4-14	4-16	1-04	3-12	4-12			
13											
19	20	21	22	23	24/1	24/2	24/3	25/1			
4-16	4-09	4-09	4-16	4-10	3-02	0-09	1-05	0-09			

13			14								
25/2	26	27	11/1	11/2	19	20	21	22	23		
4-07	0-07	0-10	1-07	0-05	3-04	4-16	4-16	4-13	4-12		
14	16										
26	10/1	10/2	11	112	13	18	19	20			
0-03	2-08	0-19	4-14	5-04	1-15	2-09	4-16	4-11			
16			17								
21	22	26	1	2	3/1	3/2	4	5/1			
4-16	4-00	0-05	4-16	4-16	0-08	4-08	4-07	0-12			
17											
5/2	6/1	6/2	7/1	7/2	8/1	8/2	9/1	9/2	10/1		
0-13	3-07	1-09	2-06	2-10	3-00	1-16	0-16	4-00	0-16		
17											
10/2	11/1	11/2	12/1	12/2	13	14	15/2	15/2	16		
4-00	2-18	1-16	2-11	1-18	4-16	4-16	3-00	1-04	4-07		
17											
17	18	19	20	21/1	21/2	22/1	22/2	23	24/1		
4-11	4-16	4-16	4-15	3-08	1-08	1-05	3-11	4-13	1-11		

17				18							
24/2	25	26	27	1	2/1	2/2	3	4	5	6	
2-11	4-16	0-07	0-08	4-09	0-14	4-02	4-12	4-16	4-16	4-16	
18											
7	8/1	8/2	9/1	9/2	10/2	11/1	12	13	14		
4-16	3-18	0-14	3-19	0-13	3-07	1-02	4-16	4-12	4-16		
18											
15	16/1	16/2	16/3	17/1	17/2	18	19/2	22/1	23	24	
4-16	1-07	1-04	2-01	1-08	3-03	4-15	4-01	2-03	4-16	4-16	
18				19	31				32		
25	26	27	30	5/1	2/1/1	2/2/1	3/2	3/2/2	1	2	
4-10	0-01	0-01	0-06	1-02	0-04	0-01	1-09	3-02	4-16	4-16	
32											
3/1	3/2	4	5	6/1	6/2	7	8	9	10/1	10/2	11
3-12	1-01	4-12	4-16	1-13	3-03	4-07	3-05	4-15	1-16	3-00	4-16
32											
12/1	12/2	13	14/1	14/2	15/1	15/2	17/1	17/2			

1-12	2-09	4-16	1-00	3-16	2-08	1-13	2-02	3-11			
32											
18	19	20/1	20/2	21/1	21/2	22	23	24/1			
4-16	4-14	1-01	3-02	0-07	4-3	4-12	4-16	2-04			
32			33				39				
24/2	26	27	1/1	½	10/1	10/2	1/1	½	2/1		
0-06	0-09	0-04	3-08	2-04	1-04	1-05	3-00	1-16	3-00		
39											
2/2	3/1	3/2	8	9	10	11	12	20/1/2			
1-16	3-00	1-02	1-00	4-14	4-14	4-06	2-07	1-01			
39		40									
20/2/1	26	4/1	5/1/2	5/2/1	5/2/2/2	6/1					
0-11	0-02	0-01	1-07	1-08	0-16	1-15					
40											
15/1	223/1	226/1	517/1	521	522	523	526				
0-03	4-05	3-01	GSS	0-04	1-04	0-03	0-02				

The total area of 604 Bighas 02 Biswas was handed over to Shri R.P. Aggarwal, NT (L&B) of the L&B Department, after

measurement and demarcation, with boundaries marked and possession given with trees, wells, and structures. At the time of handing over possession, some Khasra numbers had Kharif crops sown on them, and the landowners requested permission to harvest, which was granted. During the possession proceedings, no objections were raised on the spot. The possession proceedings were publicly announced and proclaimed through a loudspeaker and by having the Chaprasi (peons) make announcements at the site and in the surrounding area. The Patwari of the circle could not be present due to other government work; therefore, one copy of the possession proceedings will be sent to the Tehsildar, Mehrauli, Delhi for record and another copy was given to the present Naib Tehsildar of L&B Department, R.P. Aggarwal. The possession proceedings have been completed. The signatures of all those present on the spot have been obtained.

Sd/-

Dated: 22.09.1986

AWARD NO. 19/86-87

NAME OF VILLAGE	: BHARTHAL
NATURE OF ACQUISTION	: PERMANENT
PURPOSE OF ACQUISITION	: PLANNED DEVELOPMENT OF DELHI.

These are proceedings for acquisition of land in Village Bharthal which is required by the Government at the public expense for a public purpose namely Planned Development of Delhi. This land was notified u/s 4 of the Land Acquisition Act vide notification No. F.9(16)/84-L&B dated 27.1.1984. A declaration u/s 6 of the Act was issued vi de No. F.9(16)/84-L&B dated 18.9.1984 for the land measuring 653 Bighas. Notices u/s 9 & 10 of the Land Acquisition Act were issued to the interested persons for filing the claims who have responded to the notices and have filed their claims which will be discussed separately under heading "CLAIMS & EVIDENCE".

MEASUREMENT & TRUE AREA

The field staff has carried measurement of the land at the spot. There are some discrepancies in calculation of area under notification u/s 6.

Kh.No.	Area notified u/s 6	Actual Area	Difference
13/15	4-16	4-14	0-07
17/12/1	2-18	0-02	2-08
32/15/1	4-01	2-11	1-13
			2-02

Due to these reasons there is decrease in area notified u/s 6 of the L.A. Act. The total area of Khasra Nos. notified u/s 6 comes to 604 Bighas 2 Biswas instead of 653-00 as Khasra Nos. 31/4 (4-16), 5/(4-16), 6(4-16), 7(4-16), 8(2-14), 13/1 (0-01), 13/2 (0-16), 14(4-12), 18(4-16), 16/1 () 16/2(4-0), 17/1 (0-15), 17/2(2-15), 24(1-3), 25(4-14), 28(0-04), 29(0-06) total 46 Bighas 16 Biswas falling within the scheme are not specifically mentioned in the declaration u/s 6 of the L.A. Act. Hence, the acquisition proceeding is being confined to an area measuring 604 Bighas 2 Biswas.

OWNERSHIP & OCCUPANCY

S. No.	Name of owner	Name of Occupant	Kh.No.	Area
1	Hukam Chand s/o Amar Singh 1/2 share		17/19 20	4-16 4-35

	Mahesh Kumar, Rajesh Kumar, Arun Kumar s/o Prem Chand 1/2 share		21/1 22/1 11/2 12/2	3-08 1-05 1-16 1-18
				17-18
2.	Kirpa Ram s/o Kuria Urf Kure, ¼ share Siri Lal, Sant Lal, ss/o Ratti Ram ¼ share Sultan, Surjit ss/o Bhartu, 1/2 share		18/2/2 3 8/1 9/1 13/27	4-02 4-12 3-18 3-19 0-10
				17-01
3.	Kanihya s/o Kanwar Singh		17/8/2 9/2 10/2 11/1 12/1 13 26	1-16 4-0 4-0 2-18 2-11 4-16 0-07
				20-08
4.	Suraj Bhan, Raj Pal, Vijay Pal ss/o Dharam Singh		13/16 17/1	4-16 1-04

			24/2 25/1 14/11/1 19 20 21 22 23 26 17/1 2 3/1 9/1 10/1	0-09 0-09 1-07 3-04 4-16 4-16 4-13 4-17 0-03 4-16 4-16 0-08 0-16 0-16
				42-06
5.	Smt. Chalti wd/o Nandrup Roop Chand s/o Parbhu		12/14 27	2-01 0-04
				2-05
6.	Sri Chand s/o Ram Nath		12/17 25/1	1-0 0-14
				1-14
7.	Jage Ram, Ran Singh,		4/12/2	0-02

	Mehar Singh ss/o Chandgi		13/2	1-05
				1-07
8.	Jage Ram s/o Ram Sarup		32/6/2 7 8 14/2 15/1 17/1 24/2 26	3-03 4-07 3-05 3-16 2-08 2-02 0-06 0-09
				19-16
9.	Ram Chand s/o Gopi		12/5/2 6 7/1 15/1 13/10/2	4-02 4-16 3-12 3-04 2-08
				18-02
10.	Rama Nand s/o Dulia		4/14 13/4 16 17	2-0 0-06 2-14 4-16

			24 25/1 12/4/1	4-16 4-04 0-06
				19-02
11.	Ram Chand s/o Gopi 1/2 share Rama Nand s/o Dulla, 1/2 share		12/26	0-05
12.	Ran Singh, Rattan Singh, Balbir Singh ss/o Jot Ram 1/3 share Khazan Singh, Narain Singh ss/o Giani Ram, 2/3 share		16/10/1 11 12 13 18 19 20 21 22 26 17/15/2 16 33/1/2 10/2	2-08 4-14 5-04 1-15 2-09 4-16 4-11 4-16 4-00 0-05 1-04 4-07 2-04 1-05

				43-18
13.	Bhagwan Singh s/o Niader		12/28/2 13/20 21 11/2 18/1 10 11 19/5	2-04 4-09 4-09 0-08 4-09 3-07 1-02 1-02
				21-10
14.	Dalip Singh, Chand Ram, Deep Chand, Sis Ram, Banwari, Krishan ss/o Smt. Same Kaur wd/o Mam Chand		17/3/2 4 5/1 6/2 7/1 8/1	4-08 4-07 0-12 1-09 2-06 3-00
				16-02
15.	Mehar Singh, Hukam Chand, Jot Ram ss/o Des Ram		32/17/2 18 19 20/1 21/2	3-11 4-16 4-14 1-01 4-03

			22 23 24/1 27 39/1/1 2/1 3/1 40/5/2/1	4-12 4-16 2-04 0-04 3-00 3-00 3-00 1-08
				40-09
16.	Ram Karan, Ram Kishan ss/o Ram Pat s/o Dhani Ram		31/2/2 3/2 32/11 32/12/1 20/2	0-01 3-02 4-16 1-12 3-2
				12-13
17.	Raj Singh, Rajesh ss/o Smt. Laxmi wd/o Ran Singh		17/24/2 25 32/3/2 4 5 6/1 15/2	2-11 4-16 1-01 4-12 4-16 1-13 1-13

			33/1/1 10/1	3-08 1-04
				25-14
18.	Duli Chand s/o Nand Lal		13/10/3 11/1	0-04 3-16
				4-00
19.	Bharat Singh s/o Nand Lal 1/2 share Mahinder Singh s/o Harphool Singh Rishi Raj s/o Mam Chand 1/4 share		13/26	0-07
20.	Bharat Singh s/o Nand Lal		13/2/2 3 7 8 9/1 14 15 14/11/2	0-10 1-10 3-04 4-16 0-16 4-16 4-14 0-05
				20-11
21.	Dharam Singh, Hukam		16/10/2	0-19

	Singh, Bhagwan Singh ss/o Mehra		17/5/2 6/1 7/2 14 15/1 17 18 22/2 23 24/1 27 32/2 3/1 9 10/2	0-13 3-07 2-10 4-16 3-00 4-11 4-16 3-11 4-13 1-11 0-08 4-16 3-12 4-15 3-00
				50-18
22.	Surjan s/o Kherati		39/20/2	0-11
23.	Bhagwan Singh, Deep Chand, Kabul Singh ss/o Chatter		32/12/2 13 14/1	2-09 4-16 1-00
				8-05
24.	Mukhtiar Singh etc.		17/21/2	1-08

			18/16/3 24 25 30 32/1 10/1	2-01 4-16 4-10 0-06 4-16 1-16
				19-13
25.	Munshi s/o Ram Mehar		39/1/2 2/2 3/2 8 9 10 11 12 20/1 26 40/5/2/2 6 15	1-16 1-16 1-02 1-00 4-14 4-14 4-06 2-07 1-01 0-02 0-16 1-15 0-03
				25-12

26.	Mahinder Singh s/o Harphool		3/21 22 13/1 13/2/1 9/2 10/1 13/1	3-10 0-09 4-09 3-16 3-17 1-17 0-03
				18-01
27.	Rishi Raj s/o Mam Chand		13/12 13/2 17/2 18 19	4-16 4-10 3-12 4-12 4-16
				22-06
28.	Karan Singh, Dharam Singh Bir Singh, Davinder Kumar, Om Parkash, Sat Dev ss/o Ranjit		13/24/3 25/2 18/4 5 6 7 14 15	1-05 4-07 4-16 4-16 4-16 4-16 4-16 4-16

			16/1 17/1 26	1-07 1-08 0-01
				37-04
29.	Incha Ram s/o Chajju		12/3/2 4/2 7/2	0-06 4-07 0-01
				4-14
30.	Rajinder Singh s/o Sheo Narain, Jai Narain s/o Ghissa		32/21/1 40/4 5/1	0-07 0-01 1-07
				1-15
31.	Sunder Lal, Daryao Singh, s/o Sabha Chand		4/13/3 18 23 18/8/2 9/2 12 13 16/2 17/2 18	1-02 3-00 1-06 0-14 0-13 4-16 4-12 1-04 3-03 4-15

			19 22 23 27 31/2/1 3/1	4-01 2-03 4-16 0-01 0-04 1-09
				37-19
32.	Partap Singh, Narinder Singh ss/o Nand Lal		13/22 23 24/1 18/2/1	4-16 4-10 3-02 0-14
				13-02
33.	Hukam Chand s/o Ghisu		12/15/2 16	1-12 3-16
				5-08
34.	Rattan Singh s/o Chandgi Ram r/o Dhulsars		4/8 13/1	0-16 1-16
				2-12
35.	Kherati s/o Budha Mst. Dharkan wd/o Kanahya Ram Narain s/o Mst.Bholli		4/25/2	0-12

	wd/o Des Ram Umrao s/o Thakar Dass Harphool, Mam Chand ss/o Jhanda.			
36.	Gram Sabha		4/9 12/5/1 223 225 517 521 522 523 525	0-09 0-14 4-05 3-01 Less than biswa 0-04 1-04 0-03 0-02
				10-02

Details of Khasra Nos.

Rect. No	Kh. Nos.	Area	Kind of soil	
3	21 22	3-10 0-09	Abpash -do-	
4	8	0-16	G. Abpash	

	9	0-09	-do-	
	12/2/1	0-02	-do-	
	13/1	1-16	-do-	
	13/2/2	1-05	-do-	
	13/3/2	1-02	-do-	
	13/4	0-06	-do-	
	14	2-00	-do-	
	16	2-14	-do-	
	17	4-16	-do-	
	18/2	3-00	-do-	
	23/1	1-06	Abpash	
	24	4-16	G. Abpash	
	25/1	4-04	-do-	
	25/2	0-12	-do-	
12.	3/2/1	0-06	-do-	
	4/1	0-06	-do-	
	4/2/2	4-07	Abpash	
	5/1	0-14	-do-	
	5/2	4-02	Abpash	
	6	4-16	-do-	
	7/1/2	3-12	-do-	
	7/2/1	0-01	-do-	

	14/1	2-01	-do-	
	15/1	3-04	-do-	
	15/2	1-12	-do-	
	16/2	3-16	G. Abpash	
	17/1	1-00	Abpash	
	25/1/1	0-14	-do-	
	25/2	2-04	-do-	
	26	0-05	G. Abpash	
	27	0-04	-do-	
13	1	4-09	Abpash	
	2/1	3-16	Abpash	Tube-well
			3-14	0-02
	2/2	0-10	Abpash	
	2	1-10	-do-	
	7	3-04	-do-	
	8	4-16	-do-	
	9/1	0-16	-do-	
	9/2	3-17	-do-	
	10/1	1-17	-do-	
	10/2	2-08	G. Abpash	
	10/3	0-04	Abpash	
	11/1	3-16	-do-	

	11/2	0-08	-do-	
	12	4-16	-do-	
	13/1	0-03	-do-	
	13/2	4-10	-do-	
	14	4-16	-do-	
	15	4-14	-do-	
	16	4-16	-do-	
	17/1	1-04	-do-	
	17/2	3-12	-do-	
	18	4-12	-do-	
	19	4-16	-do-	
	20	4-09	-do-	
	21	4-09	-do-	
	22	4-16	-do-	
	23	4-10	-do-	
	24/1	3-02	-do-	
	24/2	0-09	-do-	
	24/3	1-05	-do-	
	25/1	0-09	-do-	
	25/2	4-07	Abpash	G.M. Maken
			4-06	0-01
	26	0-07	GM Maken	& Tubewell

	27	0-10	-do-	-do-
14.	11/1 11/2 19 20 21 22 23 26	1-07 0-05 3-04 4-16 4-16 4-13 4-17 0-03	Abpash -do- -do- -do- -do- -do- -do- G. Abpash	
16.	10/1 10/2 11 12 13 18 19 20 21 22 26	2-08 0-19 4-14 5-04 1-15 2-09 4-16 4-11 4-16 4-00 0-05	Abpash -do- -do- -do- -do- -do- -do- -do- -do- -do- G. Abpash	
17.	1 2	4-16 4-16	Abpash Abpash	

	3/1	0-08	-do-	
	3/2	4-08	-do-	
	4	4-07	G. Abpash	
	5/1	0-12	-do-	
	5/2	0-13	Abpash	
	6/1	3-07	-do-	
	6/2	1-09	G. Abpash	
17.	7/1	2-06	Abpash	
	7/2	2-10	-do-	
	8/1	3-00	-do-	
	8/2	1-16	-do-	
	9/1	0-16	-do-	
	9/2	4-00	-do-	
	10/1	0-16	-do-	
	10/2	4-00	-do-	
	11/1	2-18	-do-	
	13/2	1-16	-do-	
	12/1	2-11	-do-	
	12/2	1-18	-do-	
	13	4-16	-do-	
	14	4-16	-do-	
	15/1	3-00	-do-	

	15/2	1-08	-do-	
	16	4-07	-do-	
	17	4-11	Abpash	G.M. Gadda
			2-11	2-0
	18	4-16	Abpash	G.M. Gadda
			2-16	2-0
	19	4-16	Abpash	
	20	4-35	-do-	
	21/1	3-08	Abpash	G.M. Kotha
			3-07	0-01
	21/2	1-08	Abpash	
	22/1	1-05	-do-	
	22/2	3-11	-do-	
	23	4-13	-do-	
	24/1	1-11	-do-	
	24/2	2-11	-do-	
	25	4-16	-do-	
	26	0-17	G. Abpash	
	27	0-08	-do-	
18	1	4-09	Abpash	
	2/1	0-14	-do-	
	2/2	4-02	-do-	

	3	4-12	-do-	
	4	4-16	-do-	
	5	4-16	-do-	
	6	4-16	-do-	
	7	4-16	-do-	
	8/1	3-18	-do-	
	8/2	0-14	-do-	
	9/1	3-19	-do-	
	9/2	0-13	-do-	
	10/2	3-07	-do-	
	11/1	1-02	-do-	
	12	4-16	-do-	
	13	4-12	-do-	
	14	4-16	-do-	
	15	4-16	-do-	
	16/1	1-07	Abpash	
	16/2	1-04	-do-	
18.	16/1	1-07	Abpash	
	16/2	1-04	-do-	
	16/3	2-01	-do-	
	17/1	1-08	-do-	
	17/2	3-03	-do-	

	18 19/2 22/1 23 24 25 26 27 30	4-15 4-01 2-03 4-16 4-16 4-10 0-01 0-01 0-06	-do- -do- -do- -do- -do- -do- Tube-well -do- Tube-well	G.M. Maken
			0-01	0-05
19	5/1	1-02	Abpash	
31	2/1/1	0-04	-do-	
	2/2/1	0-01	-do-	
	3/1	1-09	-do-	
	3/2/2	3-02	-do-	
32	1 2 3/1 3/2 4 5 6/1	4-16 4-16 3-12 1-01 4-12 4-16 1-13	-do- -do- -do- -do- -do- -do- -do-	

	6/2	3-03	-do-	
	7	4-07	-do-	
	8	3-05	G. Abpash	
	9	4-15	Abpash	
	10/1	1-16	G. Abpash	
	10/2	3-00	Abpash	
	11	4-16	-do-	
	12/1	1-12	-do-	
	12/2	2-09	-do-	
	13	4-16	-do-	
	14/1	1-00	-do-	
	14/2	3-16	-do-	
	15/1	2-08	-do-	
	15/2	1-13	-do-	
	17/1	2-02	-do-	
	17/2	3-11	-do-	
	18	4-16	-do-	
	19	4-14	-do-	
	20/1	1-00	-do-	
	20/2	3-02	-do-	
	21/1	0-07	-do-	
	21/2	4-03	-do-	

	22 23	4-12 4-16	-do- -do-	
32	24/1 24/2 26 27	2-04 0-06 0-09 0-04	-do- -do- G. Abpash -do-	
33	1/1 1/2 10/1 10/2	3-08 2-04 1-04 1-05	-do- -do- -do- -do-	
39	1/1 1/2 2/1 2/2 3/1 3/2 8 9 10 11/2 12 20/1/2	3-00 1-16 3-00 1-16 3-00 1-02 1-00 4-14 4-14 4-06 2-07 1-01	Abpash -do- -do- -do- -do- -do- -do- -do- -do- -do- -do- -do-	

	20/2/1 26	0-11 0-02	-do- G. Abpash	
40	4/1 5/1/2 5/2/1 5/2/2/2 6/1 15/1 223/1 225/1 517/1 521 522 523 525/1	0-01 1-07 1-08 0-16 1-15 0-03 4-05 3-01 Less than biswa 0-04 1-04 0-03 0-02	Abpash -do- -do- -do- -do- -do- -do- -do-	

CLAIMS & EVIDENCE

Sr. No.	**Name of the claimant**	**Kh. Nos & Area**	**Rate claimed**
1	Hukam Chadd s/o Amar Singh, Rajesh Kumar s/o	NIL	Rs. 74,500/-per bigha for land Rs. 1,00,000/- for boring and

	Prem Chand Aruj Kumar s/o Prem Chand, Mahesh Kumar s/o Prem Chand (minor)		two trees. Claims area 18 Big. 3 Biswas instead of 17 Big. 18 Bis. No documentary proof produce nor detail of Kh. No s. shown in the claims.
2.	Mohinder Singh s/o Harphool		1) Well dig in 7 Biswas of land Rs.50,000/- 2) One pucca Kotha - Rs. 20,000/- 3) One Pond/water tank Rs. 4,000/- 4) Two Kikar Trees Rs. 2,000/- 5)Land per Bigha Rs. 50,000/- 6) Damages/shifting Rs. 10,000/- Total claims Rs. 10,00,000/-
3.	Bhagwan Singh, Deep Chand, Kabool Singh ss/o Chatter Singh		Rs.50,000/- P.B. for land Rs. 10,000/- towards damages/ shifting

			Rs. 10,000/- for arrangements for the New Residence. Total claims Rs.5,50,000/-
4.	Mukhtiar Singh, Sube ss/o Kurey		Rs.50,000/- P.B. for land Rs. 50,000/- for Well Rs. 10,000/- for Tube-Well Rs. 20,000/- for Pucca Kotha Rs. 4,000/- for Water Pond. Rs. 20,000/- for 20 Neem trees Rs. 29000/- for 29 Seesam Rs. 1000/- for 2 Lehsua trees Rs. 7500/- for 15 Kiker trees. Rs. 1000/- for one Safeda tree Rs. 1000/- for Kabli Kiker one Rs. 2000/- for two Amrood Rs.2000/-for 2 Shahtoot.
5.	Rishi Raj s/o Mam Chand		Rs. 100/- p. sq.yd for land Rs. 100000/- for Pucca Room, Water-channel, Tube-Well, 4 Kiker trees. Rs. 2000/- per bigha as

			damage to the starting crops.
EVIDENCE:- i) Copy of sale deed dated 20.11.81 of Village Bharthal in respect of Kh. No s. 53/16,53/17 54/19, 54/20,54/21,54/26 which was executed on the basis of agreement to sell on 25.9.81 at Ps. 3, 70, 650/- for land measuring 17 Bigha 13 Biswas. ii) Copy of Judgment in RFA No. 209/80 Harpal Singh & Ors Vs. UOI of Shahbad Mohdpur. market value Rs. 13,000/- per Bigha in respect Fixing the of Award No. 5/74-75. iii) Copy of Judgment in L.A. Case No. 232/83- Ram Narain Singh & Others Vs. UOI fixing the value of land in respect of Village Bagrola Rs. 16,800/- as on 3.6. 1978.			
6.	Ram Chander s/o Gopi		Rs. 40,000/- for Well Ps. 1,000/- for Trees Rs. 2,000/- per Bigha as damage to the standing crops.
7.	Ram Karan, Ram Kishan ss/o Ram Pal		Rs. 100/- per s.yd for land Rs. 1,50,000/- for Tube-well, structure, water tank etc. Rs. 30,000/- for 15 Trees (Sheh tut, Shi sham, Peepal, Neem etc.)

			Rs. 2000/- for damage to the standing crops.
8.	Rajinder Singh s/o Sheo Narain & Jai Narain s/o Ghisa Ram		Rs. 200/-p. sq.yd for land. Rs. 1,50,000/- for one Well, tube-well, water tank, Room 9' x 12' Rs. 1,50,000/- for 130 Safeda trees, 8 Shehtut & Neem tree. Rs. 2,000/- per Bigha as damage to the standing crops.
9.	Rama Nand s/o Dulia		Rs. 200/- per sq.yd for land Rs.2000/- per Bigha as damage to the standing crops.
10.	Sultan Singh (1/4 share)		Demanding 1/4 share of compensation in respect of Killa No s. 26 Kh. No s. 18/2/2(4-2), 24*2* 3(4-12), 8/13-18), 9/1 (3-19), 13/27 (0-10) as well as pucca Well and trees.
11.	Surjit Singh (1/4 share)		-do-
12.	Siri Lal (1/8 share)		-do-

13.	Kirpa Ram (1/4 share)		-do-
14	Sant Lal (1/8 share)		-do-
15	Rattan Singh s/o Chandgi Ram		Rs. 100/- per sq.yd for land.
16	Dharam Singh, Hukam Singh ss/o Mehru		Rs. 1,00,000/- per bigha for land. Rs.40,000/- for Tube-well Rs. 5,000/- for Borring in Killa No. 17. Rs. 10,000/- for 10 or 12 trees.
17	Sunder Lal, Daryao Singh s/o Sabha Chand		Rs. 1,00,000/- per bigha for land. Rs. 40,000/- for tube-well Rs. 20,000/- for 25 trees of shisham.
18	Sud Ram Singh s/o Kherati		Rs. 1,00,000/- per bigha for land.
19	Jage Ram, Ram Singh and Meer Singh ss/o Chandgi		-do-
20	Incha Ram s/o Chajju		-do-
21	Jot Ram s/o Desh Ram		Rs. 3,50,000/- per acre for land Rs. 4,000/- per bigha,

			damage for standing crops Rs.40,000/- for tube-well & Room Rs. 500/- per tree.
22	Mir Singh s/o Desh Ram		-do-
23	Hukam Chand s/o Desh Ram		-do-
24	Roop Chand s/o Prabhu		-do-
25	Smt. Chalti wd/o Nand Roop		-do-
26	Narinder Singh s/o Nand Lal		Rs. 3,50,000/- per Acre for land Rs. 4,000/- per Bigha for damages for starting crops Rs.40,000/- for tube-well Rs. 500/- per tree for a trees.
27	Partap Singh s/e Nand Lal		-do-
28	Siri Chand s/o Ram Nath		Rs. 200/- per sq.yd for land
29	Rattan Singh alias Mir Singh s/o Net Ram		-do-
30	Om Parkash, Sat Bir. ss/o Kanhiya Lal		Ps. 1,00,000/- per bigha for land. Rs. 30,000/- for one Well.

			Rs. 20,000/- for one Kotha (10'x12') Rs. 500/- for One Kikkar tree. Rs. 300/- for one Bakkan. Rs. 200/- per Sehtoot for 4 Rs.500/- for one Peepal tree Rs. 2500/- for one Boring. Rs. 5,000/- for Khel Khota.
31	Khazan Singh s/o Gyani Narain Singh s/o Gyani Ram Singh, Rattan Singh, Balbir Singh a/o Jot Ram		Rs.100000/- per bigha for land Rs. 30,000/- for Well Rs. 25,000/- for Tube-well Rs. 20,000/- for Pucca Kotha (10 x 24) Rs. 500/-per tree for 4 Kikkar. Rs.300/- per Bakkan tree for 4 trees. Rs. 1500/- per Si sham tree for 4 Sheesham Rs. 12,000/- per Acre for Pucca water channel of two acres. Rs.5000/- per Khel Kotha for two.

32	Karan Singh, Dharam Bir Singh, Davinder Kumar, Om Parkash, Satya Dev ss/o Ranjit		Rs. 1,00,000/- per bigha for land. Rs. 30,000/- for Well. Rs. 25,000/- for tube-well (Two Tubewell) Rs. 20,000/- for pucca Kotha. Rs. 500/- per tree Kikar (two) Rs.2000/- for one Amrood tree Rs. 300/- per tree Sehtoot (Four) Rs. 500/- for one tree of Neem Rs. 800/- for one Shisham tree Rs.2000/- for one Anar tree Rs. 250/- for one Leshwa tree Rs. 12,000/- fer acre length of Pucca water channel Rs.5000/- for one Khel Kotha Rs.25,000/- for per Borring
33	Suraj Bhan, Raj Pal, Vijay Pal ss/o Dharam Singh		Rs. 1,00,000/- per Bigha for land. Rs. 30,000/- for one Well Rs. 25,000/- for Elec. Tube-

			Well. Rs. 20,000/- for pucca Kotha (8' x 12') Rs.1000/- for two Kikkar tree Rs.2000/- for one Amrood Rs. 1500/- for five Shehtoot tree Rs. 5000/- for Khel Kotha (4' x 6
34	Bhagwan Singh Niader		Rs. 1,00,000/- per bigha for land Rs. 1,000/- for two Neem trees. Rs. 500/- for one Kikkar tree.
35	Chand Ram, Deep Chand, Sis Ram, Banwari, Ki shan, Dalip ss/o Mam Chand, Smt. Sama Kaur wd/o Mam Chand		Ps. 1,00000/- per bigha for land Rs. 5,000/- for ten Kikkar trees.
36	Smt. Luxmi wd/o Ran Singh, Rajesh, Raj Singh ss/o Ran Singh(Minors)		Rs. 1,00,000/- per bighas or land. Rs. 20,000/- for one Pucca

			Kotha. Rs.25,000/- for one Borring. Rs. 10,000/- for two Khel.
37	Jage s/o Ram Saroop		Rs. 1,00,000/- per bigha for land. Rs. 50,000/- for one well Rs. 20,000/- for Pucca Kotha Rs. 3,500/- for seven Kikkar trees. Rs. 4,000/- for two Amrood trees. Rs. 600/- for two Bakken tree Rs. 1500/- for three Neem tree Rs.2000/- for one Anar tree Rs. 5000/- for Khel Kotha.
38	Duli Chand s/o Anand Lal		Rs. 1,00,000/- per Bigha for land. Rs. 30,000/- for Well Rs. 1500/- for 3 Kikker trees.
39	Munshi s/o Ram Mehar		Rs. 1,00,000/-per Bigha for land. Rs. 50,000/- for Well

			Rs. 25,000/- for tube-well Rs. 20,000/- for pucca Kotha Rs. 3000/- for six Neem tree Rs. 12,000/- per acre length water channel Rs. 5000/- for Khel Kotha Rs. 25,000/- for Borring.
40	Bharat Singh s/o Nand Lal		Rs 100,000/- per bigha for land. Rs. 30,000/- for Well Rs. 25,000/- for tube-well Rs. 20,000/- for pucca Kotha Rs. 2000/- for four Kikkar trees Rs. 30,000/- for Well.

DOCUMENTARY EVIDENCE

One of the claimant namely Shri Rishi Raj has filed three evidence in support of his claim :-

1. He produced copy of sale deed dated 20.11.81 for transaction of land measuring 17 bigha 13 biswas for Rs. 3,70,650/- for Kh. No. 53/16, 17, 54/19, 20, 21 & 26 The khasra numbers involved in the sale transactions falls on

the other side of Village. There is physical boundary between the land under sale deed and land under acquisition as this sale transaction is discarded.

2. The claimant has filled two copies of judgement in RFA No. 209/80 styled as Harpal Singh Vs. UOI and L. A. C. No. 232/83- styled as Ram Narain Vs. UOI. This RFA No. 209/80 pertains to Village Shahbad Mohd.pur. This RFA was arisen against award No. 5/74-75 of the date of notification was 21.2.1973. In this context, it is mentioned that there is one Award No. 10/86-87 in Village Shahbad Mohd.pur with the date of notification u/s 4 as 27.1. 1984 which date is also the same in the present case. The land of Award No. 10/86-87 is adjoining to the land under acquisition upon which reliance can be placed. As regard to L.A. C. No. 232/83,it pertains to Village Bagrola which is not ad- joining at all to the under acquisition. So, no reliance can be placed on it.

MARKET VALUE

Market value of the land under acquisition is to be determined with reference to the date of preliminary notification u/s 4 i.e. 27. 1. 1984. In assessing the market value of the land

under acquisition, the material date, bonafide sale transactions of the land similarly circumstanced and al so the awards for similarly situated lands made with reference to the date of notification u/s 4 of the Land Acquisition Act are to be taken into consideration. For this purpose sale transactions made in this Village were consulted from the Revenue Record and the following sales transactions have been taken place in this Village as under :-

S. No.	**Regd. No. & date**	**Area**	**Amount Average per bigha**	
1.	7204 23.12.83	4-12	33,500-00	Rs. 7,282-60
2.	7205 23.12.83	4-16	33,500-00	Rs.7,291-60
3.	7206 23.12.83	4-16	33,500-00	Rs.7, 291-60
4	2 2.1.84	2-18	21,000-00	Rs.7, 241-35
5	6 2.1.84	5-04	37,000-00	Rs.7,115-30
6	8	2-02	15,000-00	Rs.7,142- 80

	2.1.84			
7	9 2.1.84	8-10	40,000-00	Rs.7,272-70
8	272 16.1.84	5-08	39,000-00	Rs.7,228-25
9	273 16.1.84	3-16	27,000-00	Rs.7,105-50
10	274 16.1.84	4-16	35,000-00	Rs.7,291-60
11	275 16.1.84	4-15	35,000-00	Rs. 7,368 -40

From the above table it is clear that the average rate per bigha for the land comprising of Rect. No. 55,56,58, comes to Rs. 7,105 to 7,368/-. All these sale transactions were executed in between December, 1983 to 16. 1. 1984. The present date of notification u/s 4 is 27.1.1984. The land of these sale transactions falls on the Eastern de beyond Riwari Railway line. There is clear cut demarcation by virtue of afore Beside above, there is one Award No.50/81-82 through which land measuring 337-19 was acquired. The date of notification u/s 4 of Award No. 50/81-82 is 6.11.1980. The L.A.C. has assessed Rs. 7200/-, 6000/- and Rs. 4000/- for Block A, B, & C respectively. Block A land

comprises of land adjacent to Riwari Railway Line & Block C land pertains to low lying area and Block -B not comprising in Block A & C. I have inspected the site along with Revenue Field Staff and found that there is no basic difference in the land, situated near Railway Line and other lands. I am of the view that the land under acquisition is cultivable and even land.

Hence, no Block for the land under acquisition is formed. If, appreciation @ 9% on the market value of the land falling in Block A of Award No. 50/81-82 is allowed it comes to Rs. 9, 350/- per bigha in round figure say Rs.9300/- per bigha. The land under acquisition is adjacent to Alham by the Village boundary of Shahbad Mohd.pur. The land under acquisition forms a triangle touching Shahbad Mohd.pur mostly. In village Shahbad Mohd.pur there is one Award No. 10/86-87 with date of notification u/s 4 27.1.84, in which L.A. C. awarded Rs. 13,000/- per big ha for the land.

From above discussion, it is concluded that the average price of sale of land in Village Bharthal comes to Rs. 7105/- to 7368/- per bigha whereas the price if appreciated on the basis of market value of Award No. 50/81-82 of Village Bharthal comes to Rs. 9350/- per bigha. In addition to this land prices in

adjoining Village namely Shahbad Mohd.pur, L.A.C. awarded Rs. 13,000/- per bigha as on 27.1.84. There is much disparity in the average sale price of the land within the revenue estate of Bharthal and Shahbad Mohd.pur. I personally inspected the site in question and found that there is no basic difference in potentiality and situation of the land in between the land of Village Shahbad Mohd.pur and land under acquisition. There is one metalled road passing through Shahbad Mohd.pur and is leading to Village Bharthal. The average sale price in Village Bharthal do not reflect correct market value of the land as the average price of land on the basis of Award No. 10/81-82 of Village Bharthal is on the higher side, otherwise the average sale price of the land should be much higher than the market Value of the land of Award No. 10/81-82. If the land enjoy all facilities then it should not be placed at low price other- wise it will cause injustice to recorded Bhumidars. In the interest of justice and to maintain the average price of the land thin or close vicinity it should be at par with the market Value of the land of Award No. 10/86-87. If the market value of the, land is fixed in accordance with the market price of the land of Award No. 10/86-87 it will definitely be at par. So, the market value of the land is to be fixed in accordance with the compensation assessed by the L.A. C. in Award No. 10/86-87.

From the above discussion regarding the price of the land prevailing in the adjoining Village as well as situation and potentiality of the land under acquisition with the land of Village Shahbad Mohd.pur acquired through Award No. 10/86-87 I am of the opinion that Rs. 13,000/- per bigha is quite reasonable and fair market value of the land under acquisition and award the same accordingly.

TREES :- There are some trees on the land under acquisition, I assess compensation as under :-

Kh. No.	Name of tree	with No.	Approx. wt.in Qtl.	Rate per Qtl.	Total
13/10/1	Kikar	1	2	Rs.20/-	Rs.40/-
13/13/2	Kikar	2	10	Rs.20/-	Rs.200/-
13/19	Kikar	2	10	Rs.20/-	Rs.200/-
13/19	Kikar	1	5	Rs.20/-	Rs.100/-
13/23	Neem Shehtoot	1 6	1 6	Rs.20/- Rs.20/-	Rs.20/- Rs.120/-
13/25/2	Lehswa	1	1	Rs.20/-	Rs.20/-
13/25/2	Shehtoot Gullar	4 1	4 2	Rs.20/- Rs.20/-	Rs.80/- Rs.40/-
18/17/1	Kikar Shisham	1 1	1 1	Rs.20/- Rs.30/-	Rs.20/- Rs.30/-
14/22	Gullar Amrood	3 1	5 1	Rs.20/- Rs.100/-	Rs.100/- Rs.100/-
14/23	Shehtoot	1	2	Rs.20/-	Rs.40/-
16/19	Shisham Neem	1 2	15 20	Rs.30/- Rs.20/-	Rs.450/- Rs.400/-
18/17/2	Kikar Shisham	1 18	1 26	Rs.20/- Rs.30/-	Rs.20/- Rs.780/-

18/13	Kikar Shisham	3 2	3 2	Rs.20/- Rs.30/-	Rs.60/- Rs.60/-
18/18	Shisham Small	5	2	Rs.30/-	Rs.60/-
18/19	Shisham	3	4	Rs.30/-	Rs.120/-
18/23	Kikar	1	5	Rs.20/-	Rs.100/-
16/22	Kikar	2	5	Rs.20/-	Rs.100/-
17/6/1	Kikar	1	4	Rs.20/-	Rs.80/-
17/8/1	Kikar	4	8	Rs.20/-	Rs.160/-
17/8/2	Shehtoot Bakkan Kikar	2 1 1	3 2 1	Rs.20/- Rs.20/- Rs.20/-	Rs.60/- Rs.40/- Rs.20/-
17/7/2	Kikar	6	12	Rs.20/-	Rs.240/-
17/14	Shehtoot Amrood	2 1	4 -	Rs.20/- Rs.100/-	Rs.80/- Rs.100/-
17/18	Kikar	1	4	Rs.20/-	Rs.80/-
17/23	Pipal Shisham Gullar	3 1 2	5 4 4	Rs.20/- Rs.30/- Rs.20/-	Rs.100/- Rs.120/- Rs.80/-
18/3	Shehtoot Laswa	2 2	2 3	Rs.20/- Rs.20/-	Rs.40/- Rs.60/-
18/25	Shehtoot	1	2	Rs.20/-	Rs.40/-

	Neem Shisham Amrood (small) Kikar Safeda	2 1 1 2 1	6 5 2 6	Rs.20/- Rs.30/- Rs.70/- Rs.20/- Rs.20/-	Rs.120/- Rs.150/- Rs.70/- Rs.40/- Rs.120/-
32/1	Kikar	3	6	Rs.20/-	Rs.120/-
32/4	Kikar	2	2	Rs.20/-	Rs.40/-
32/5	Kikar	1	4	Rs.20/-	Rs.80/-
32/7	Kikar	4	10	Rs.20/-	Rs.200/-
32/7	Neem	1	2	Rs.20/-	Rs.40/-
32/10/2	Kikar	2	6	Rs.20/-	Rs.120/-
32/22	Shisham Shehtoot Bakken	3 5 2	8 15 2	Rs.30/- Rs.20/- Rs.20/-	Rs.240/- Rs.300/- Rs.40/-
32/23	Bakken (Small) Shehtoot (Small)	2 2	1 1	Rs.20/- Rs.20/-	Rs.20/- Rs.20/-
39/9	Neem	1	1	Rs.20/-	Rs.20/-
39/10	Kikar Shehtoot	1 1	4 2	Rs.20/- Rs.20/-	Rs.80/- Rs.40/-
39/11	Shehtoot	3	3	Rs.20/-	Rs.60/-

				Total	Rs.6480/-

WELLS/TUBE WELLS

There are following Wells & Tube-Wells on the land under acquisition I assess the market value as, detailed below :-

Sr. No.	**Kh. No.**	**Details of Well/ Tube-Well**	**Compensation assessed.**
1	12/7/1	One Well in good condition dia 8'	Rs. 4000.00
2	13/9/2	One tube-Well (Boaring) with small water-tank-	Rs. 2000.00
3	13/13/2	One tube-Well in good condition Dia 8 water tank	Rs. 5000.00
4	13/25/2	One tube-Well (Boaring)	Rs. 2000.00
5	13/23	One tube-Well (Boaring) with cement plaster	Rs. 2500.00
6	14/22	One tube-Well in good condition Dia 8 with water-tank	Rs. 5000.00
7	16/12-13	One Well Di a 9 ,water tank and water channel 100 ft.	Rs. 6000.00

8	16/18	One Boaring, one water tank	Rs. 2000.00
9	17/8/2	One Well in good con-dition dia 8 with water tank	Rs. 5000.00
10	17/14	One tube-well (Boaring) in good condition	Rs. 2500.00
11	17/20	One tube-well dia 4	Rs. 3000.00
12	17/23	One Well dia 8’ along with water tank	Rs. 4500.00
13	32/5	Temp (Kachha) Boaring	No compensation
14	18/3	One tube-Well in good condition Dia 9 with water tank	Rs. 5000.00
15	18/19	One Boaring with bricks without use	Rs. 1500.00
16	18/25	One Well dia 8’ along-with water-tank	Rs. 4000.00
17	32/7	One Well dia 8’ along with water-tank	Rs. 4000.00
18	32/23	One tube-well(Boaring)	Rs. 2000.00

19	32/27	One tube-well in good condition dia 8’ along with water channel 300’ (Kh. No. 39/3/1)	Rs. 6500.00
20	39/9	One tube-well (Boaring) with water-tank in good condition	Rs. 2500.00
21	39/10	One Well in good conditions. Dia 8’ along with water tank and channel 250	Rs. 6500.00

STRUCTURES

There are some structures on the land under acquisition. Details of which along with their approximate compensation are as under :-

S. No.	Kh.No.	Description of structures	Compensation assessed
1.	12/7/1	One room 10 x 10 in good condition.	Rs. 3000/-
2	13/9/2	One room 10' x 10' in good condition	Rs. 3500/-

3	13/13/2	One room 8' x 8' in good condition	Rs. 3200/-
4	13/18	One room 10' x 8' in bad condition	Rs. 2800/-
5	13/25/2	One room 10’ x 10’ in good condition	Rs. 3500/-
6	13/23	One room 10 x 15 in good condition	Rs. 5000/-
7	14/22	One room 9 x 12 in good condition	Rs. 4000/-
8	16/19	One room 10 x 20 in good condition	Rs. 6000/-
9	17/8/2	One room 10 x 15 in good condition	Rs. 4500/-
10	17/14	One room 8 x 15 in bad condition along- with Chhapar	Rs. 3200/-
11	17/20	One room 10 x 8 in good condition	Rs. 3200/-
12	18/3	One room 10 x 8 in good condition	Rs. 3500/-
13	18/19	One room 10 x 10 in bad	Rs. 3000/-

		condition	
14	18/25	One room 10 x 8 in bad condition (one side wall cracked)	Rs. 2000/-
15	32/5	One room 10 x 12 in good condition	Rs. 4000/-
16	32/7	One room 10 x 10 in bad condition without door	Rs. 2000/-
17	32/22	One room 10 x 15 with stairs in good condition	Rs. 5000/-
18	39/10	One room 10 x 10 in good condition.	Rs. 3500/-
		Total:-	Rs. 64900.00

INTEREST: As the possession of the land under acquisition has not yet been taken over and there is no difference of more than three years between the notification u/s 4 and 6 of the L.A. Act. The question of assessment of interest u/s 34 or 4(3) of the said act does not arise.

SOLATIUM: 30 % solatium on the market value of the land is payable to the interested persons u/s 23(2) of the L.A. Act.

ADDITIONAL AMOUNT: An additional amount u/s 23 (1A) of the L.A. Amendment Act @ 12 % p. a. on the market value of the land is payable to the persons interested from the date of notification u/s 4 (i.e. 27.1.1984) to the date of announcement of award or to the date of taking over the possession of the land, whichever is earlier.

LAND REVENUE:- A sum of Rs. 207-14 as lard revenue of the land under acquisition will be deducted from the Khalsa Rit Roll of the Village from the date of taking over possession.

APPORTIONMENT: Compensation will be paid to the recorded owners/Bhumidars on the basis of latest entries in the revenue record. In case of any dispute which will not be settled amicably within a reasonable period, the compensation will be referred to the Court of Addl. Di strict Judge u/s 30-31 of the L.A. Act for adjudication.

SUMMARY OF AWARD

Compensation of land measuring 604 bigha 2 biswas @Rs. 13,000/- per bigha	Rs. 78,53,300 - 00
Compensation for Structures	Rs. 64,900 – 00

Compensation for Wells	Rs. 75,500 – 00
Total	Rs. 79,93,700 – 00
Solatium @ 30 %	Rs. 23,98,110-00
Addl. amount u/s 23(1a) @ 12 % p. a. from 27.1.84 to 14.8.86 (2 yrs. 200 days)	Rs. 24, 44, 101-00
Compensation for Trees	Rs. 6, 480-00
GRAND TOTAL:-	Rs. 1, 28,42,391-00

(Rupees One Crore Twenty Eight Lac Forty Two Thousand Three Hundred Ninety One only)

Sd/-
(N.K. SHARMA)
LAND ACQUISITION COLLECTOR(PS)
DELHI.

Today, dated 5/9/86, Award No. 19/86-87 of Village Bharthal was announced in the presence of the following landowners.

S.No.	Name	Signature
1.	Ramchander, S/o Gopi	Sd/-
2.	Hukum Chand, S/o Amar Singh	Sd/-
3.	Dharam Singh, S/o Meru	Sd/-
4.	Hukum Chand, S/o Meru	Sd/-
5.	Jeetram, S/o Desh Ram	Sd/-
6.	Hukum Chand, S/o Desh Ram	Sd/-
7.	Meer Singh, Desh Ram	Sd/-
8.	Bharat Singh, S/o Nand Lal	Sd/-
9.	Rishiraj, S/o Mam Chand	Sd/-
10.	Ram Karan, S/o Ramayat	Sd/-
11.	Rama Nand, S/o Duli Chand	Sd/-
12.	Satbir, S/o Kanhaiya Lal	Sd/-
13.	Karan Singh, S/o Ranjit Singh	Sd/-
14.	Shri Lal, S/o Ratiram	Sd/-
15.	Sarjit Singh, S/o Bharat Singh	Sd/-
16.	Suraj Bhan, S/o Dharam Singh	Sd/-
17.	Munshi, S/o Ramehar	Sd/-

18.	Meer Singh, S/o Netram	Sd/-

(TO BE PUBLISHED IN PART IV OF DELHI EXTRA ORDINARY GALETTS)

DELHI ADMINISTRATION: DELHI

NOTIFICATION

Dated the 18th Sept.,84.

No.F.9(16)/84-L&B:- Whereas the Lt. Governor, Delhi is satisfied that the land is required to be taken by Government at the public expense for a public purpose, namely for Planned Development of Delhi It is hereby declared that the load described in the specification below is required for the above purpose.

This declaration is made under the provisions of section 6 of the Land Acquisition Act, 1894, to all whom it y concern and under the provisions of section 7 of the said Act, the Collector of Delhi is hereby directed to take order for the acquisition of the said land.

This declaration is with reference to this administration Notification No. F.9(16)/84-L&B dated the 27th Jan 184 issued under sub-section(i) of section 4 of the aforesaid Act.

A plan of the land can be inspected --------- of the Collector of Delhi.

SPECIFICATION

S. No.	Name of Village	Total area Big - Bis	No.	-----	Big - Bis
1	2	3	4	5	6
	BHARTHAL	653-00	3	21 22	3-10 0-09
			4	8 9 12/2 13/1 13/2 13/3 13/4 14 16 17 18 23 24 25/1 25/2	0-16 0-09 0-02 1-16 1-05 1-02 0-06 2-00 2-14 4-16 3-00 1-06 4-16 4-04 0-12

			12	3/2	0-06
				4/1	0-06
				4/2	4-07
				5/1	0-14
				5/2	4-02
				6	4-16
				7/1	3-12
				7/2	0-01
				14/	2-01
				15/1	3-04
				15/2	1-12
				16	3-16
				17	1-00
				25/1	0-14
				25/2	2-04
				26	0-05
				27	0-04
			13	1	4-09
				2/1	3-16
				2/2	0-10
				3	1-10
				7	3-04

				8	4-16
				9/1	0-16
				9/2	3-17
				10/1	1-17
				10/2	2-08
				10/3	0-04
				11/1	3-16
				11/2	0-08
				12	4-16
				13/1	0-03
				13/2	4-10
				14	4-16
				15	4-16
				16	4-16
				17/1	1-04
				17/2	3-12
				18	4-12
				19	4-16
				20	4-09
				21	4-09
				22	4-16
				23	4-10

				24/1	3-02
				24/2	0-09
				24/3	1-05
				25/1	0-09
				25/2	4-07
				26	0-07
				27	0-10
			14	11/1	1-07
				11/2	0-05
				19	3-04
				20	4-16
				21	4-16
				22	4-13
				23	4-17
				26	0-03
			16	10/1	2-08
				10/2	0-09
				11	4-14
				12	5-04
				13	1-15
				18	2-09
				19	4-16

				20	4-11
				21	4-16
				22	4-00
				26	0-05
			17	1	4-16
				2	4-16
				3/1	0-08
				3/2	4-08
				4	4-07
				5/1	0-12
				5/2	0-13
				6/1	3-07
				6/2	1-09
				7/1	2-06
				7/2	2-10
				8/1	3-00
				8/2	1-16
				9/1	0-16
				9/2	4-00
				10/1	0-16
				10/2	4-00
				11/1	2-18

				11/2	1-16
				12/1	2-18
				12/2	1-18
				13	4-16
				14	4-16
				15/1	3-00
				15/2	1-04
				16	4-07
				17	4-11
				18	4-16
				19	4-16
				20	4-15
				21/1	3-08
				21/2	1-08
				22/1	1-05
				22/2	3-11
				23	4-13
				24/1	1-11
				24/2	2-11
				25	4-16
				26	0-07
				27	0-08

			18	1	4-09
				2/1	0-14
				2/2	4-02
				3	4-12
				4	4-16
				5	4-16
				6	4-16
				7	4-16
				8/1	3-18
				8/2	0-14
				9/1	3-19
				9/2	0-13
				10	3-07
				11	1-02
				12	4-16
				13	4-12
				14	4-16
				15	4-16
				16/1	1-07
				16/2	1-04
				16/3	2-01
				17/1	1-18

				17/2 18 19 22 23 24 25 26 27 30	3-03 4-15 4-01 2-03 4-16 4-16 4-10 0-01 0-01 0-06
			19	5	1-02
			31	2/1 2/2 3/1 3/2	0-04 0-01 1-09 3-02
			32	1 2 3/1 3/2 4 5 6/1	4-16 4-16 3-12 1-01 4-12 4-16 1-13

				6/2	3-03
				7	4-07
				8	3-05
				9	4-15
				10/1	1-16
				10/2	3-00
				11	4-16
				12/1	1-12
				12/2	2-09
				13	4-16
				14/1	1-00
				14/2	3-16
				15/1	4-01
				15/2	1-13
				17/1	2-02
				17/2	3-11
				18	4-16
				19	4-14
				20/1	1-01
				20/2	3-02
				21/1	0-07
				21/2	4-03

				22 23 24/1 24/2 26 27	4-12 4-16 2-04 0-06 0-09 0-04
			33	1/1 1/2 10/1 10/2	3-08 2-04 1-04 1-05
			39	1/1 ½ 2/1 2/2 3/1 3/2 8 9 10 11 12 20/1	3-00 1-16 3-00 1-16 3-00 1-02 1-00 4-14 4-14 4-06 2-07 1-01

				20/2 26	0-11 0-02
			40 5/2/2	4 5/1 5/2/1 5/2/2 6 15 223 225 517 521 522 523 525	0-01 1-07 1-08 0-16 1-15 0-03 4-05 3-01 Less than Biswa 0-04 1-04 0-03 0-02
	SHAHBAD MODHPUR	20	35-16	Letc /1 Letc / 2 Letc / 3 Letc / 4 Letc / 5	14-08 3-06 4-12 5-19 5-19

				Letc / 6	3-06
				Letc / 7	3-07
				Letc / 8	29-01
				Letc / 9	0-09
				Letc / 10	4-08
				Letc / 11	13-10
				Letc / 12	0-06
				Letc / 13	76-16
				Letc / 14	5-18
				Letc / 15	7-18
				Letc / 16	13-04
				Letc / 17	14-01
				Letc / 18	6-06
				Letc / 19	6-06
				Letc / 20	6-06
				Letc / 21	13-14
				Letc / 22	19-06
				Letc / 23	5-15
				Letc / 24	65-14
				Letc / 25	13-04
				Letc / 26	8-13
				Letc / 27	9-14

				Letc / 28	3-11
				Letc / 29	10-14
				Letc / 30	25-04
				Letc / 31	00-14
				Letc / 32	6-15
				Letc / 33	6-02
				Letc / 34	5-03
				Letc / 35	6-00
				Letc / 36	5-03
				Letc / 37	0-05
				Letc / 38	5-11
				Letc / 39	5-04
				Letc / 40	8-01
				Letc / 41	12-19
				Letc / 43	19-16
				Letc / 44	10-11
				Letc / 45	4-12
				Letc / 46	5-11
				Letc / 47	5-12
				Letc / 48	0-06
				Letc / 49	27-08
				Letc / 50	22-17

				Letc / 51	2-03
				Letc / 52	6-02
				Letc / 53	4-17
				Letc / 54	2-05
				Letc / 55	2-15
				Letc / 56	5-09
				Letc / 57	15-19
				Letc / 58	3-01
				Letc / 59	14-02
				Letc / 60	3-19
				Letc / 61	4-08
				Letc / 62	11-11
				Letc / 63	4-17
				Letc / 64	0-06
				Letc / 65	5-01
				Letc / 66	0-05
				Letc / 67	20-05
				Letc / 68	4-19
				Letc / 69	1-17
				Letc / 70	10-12
				Letc / 71	12-15
				Letc / 72	1-02

				Letc / 73	6-12
				Letc / 74	9-14
				Letc / 75	12-12
				Letc / 76	13-14
				Letc / 77	0-09
				Letc / 78	19-01
				Letc / 79	19-08
				Letc / 80	16-04
				Letc / 81	0-06
				Letc / 82	17-03
				Letc / 83	17-13
				Letc / 84	0-04
				Letc / 85	7-14
				Letc / 86	4-17
				Letc / 87	0-06
				Letc / 88	26-12
				Letc / 89	1-09
				Letc / 90	8-05
				Letc / 91	7-09
				Letc / 92	5-07
				Letc / 93	9-18
				Letc / 94	0-09

				Letc / 95	16-03
				Letc / 96	0-12
				Letc / 97	55-15
				Letc / 98	3-02
				Letc / 99	1-04
				Letc /100	6-00
				Letc /101	3-16
				Letc / 102	4-00
				Letc / 103	6-05
				Letc / 104	5-00
				Letc / 105	36-00
				Letc / 106	1-03
				Letc / 107	3-01
				Letc / 108	6-11
				Letc / 109	13-13
				Letc / 110	4-11
				Letc / 111	7-17
				Letc / 112	6-17
				Letc / 113	10-19
				Letc / 114	10-19
				Letc / 115	8-18
				Letc / 116	14-17

				Letc / 117	0-07
				Letc / 118	18-18
				Letc / 119	12-11
				Letc / 120	8-05
				Letc / 121	4-12
				Letc / 122	0-14
				Letc / 123	4-08
				Letc / 124	3-16
				Letc / 125	23-10
				Letc / 126	16-04
				Letc / 127	0-08
				Letc / 128	41-16
				Letc / 129	4-13
				Letc / 130	14-16
				Letc / 131	7-04
				Letc / 132	5-04
				Letc / 133	3-00
				Letc / 134	23-02
				Letc / 135	0-06
				Letc / 136	44-03
				Letc / 137	20-16
				Letc / 138	2-01

				Letc / 139	2-03
				Letc / 140	2-05
				Letc / 141	2-08
				Letc / 142	2-01
				Letc / 143	7-06
				Letc / 144	1-05
				Letc / 145	9-11
				Letc / 146	5-14
				Letc / 147	4-11
				Letc / 148	0-07
				Letc / 149	6-03
				Letc / 150	2-11
				Letc / 151	7-18
				Letc / 152	8-19
				Letc / 153	2-13
				Letc / 154	3-00
				Letc / 155	2-10
				Letc / 156	4-13
				Letc / 157	1-16
				Letc / 158	4-01
				Letc / 159	7-08
				Letc / 160	4-01

				Letc / 161	4-06
				Letc / 162	4-06
				Letc / 163	3-16
				Letc / 164	3-16
				Letc / 165	3-16
				Letc / 166	0-14
				Letc / 167	11-08
				Letc / 168	11-06
				Letc / 169	1-09
				Letc / 170	18-04
				Letc / 172	26-18
				Letc / 175	9-10
				Letc / 176	20-01
				Letc / 177	0-08
				Letc / 178	26-14
				Letc / 179	9-14
				Letc / 180	10-05
				Letc / 181	10-05
				Letc / 182	24-06
				Letc / 183	9-11
				Letc / 184	26-13
				Letc / 185	14-02

				Letc / 186	6-19
				Letc / 187	7-0
				Letc / 188	4-14
				Letc / 189	4-10
				Letc / 190	1-12
				Letc / 191	5-17
				Letc / 192	0-09
				Letc / 193	5-04
				Letc / 194	0-07
				Letc / 195	24-10
				Letc / 196	5-01
				Letc / 197	4-19
				Letc / 198	11-15
				Letc / 199	10-10
				Letc / 200	9-18
				Letc / 201	0-03
				Letc / 202	3-01
				Letc / 203	0-02
				Letc / 204	0-09
				Letc / 205	5-15
				Letc / 206	5-13
				Letc / 207	5-16

				Letc / 209 Letc / 210 Letc / 211 Letc / 212 Letc / 213 Letc / 214 Letc / 215 Letc / 216 Letc / 217 Letc / 218 Letc / 219 Letc / 220 Letc / 221 Letc / 222 Letc / 223 Letc / 224 Letc / 225 Letc / 226	1-16 14-12 8-00 4-09 10-11 20-18 5-07 9-08 6-11 5-05 1-03 23-02 0-10 22-15 0-08 20-08 0-12 10-16
	POCHANPUR	378-19 (3)		19/1 19/2 20 22	0-16 0-11 4-01 1-16

				26	0-07
				(4) 8 9 12 13 18 19 20 21 22 23	1-12 1-12 4-16 4-16 4-16 4-16 1-17 4-09 4-16 4-10
				(5) 10 11/1 min 11/2 12 13 14 15 16 17 18/1 18/2	2-14 1-03 2-14 4-03 2-18 2-06 1-13 4-05 4-16 3-00 1-16

				19/1 20 min 21 min 22 23 24 25	3-10 2-08 0-16 4-08 4-01 3-00 4-16
				(6) 6 min (12) 2 min 3 5 6 7 8 9 min 12/1 min 12/2 min 13 14/1 14/2	0-16 4-00 4-09 4-18 3-18 2-01 4-02 2-08 Less than Biswa 0-16 4-07 0-10 3-18

				15/1	1-02
				15/2	3-14
				16	4-16
				17	5-05
				18 min	2-07
				23/1 min	0-04
				23/2	2-01
				24	4-12
				25/1	2-02
				25/2	2-06
				26	0-07
				1	2-19
				2/1	1-08
				2/2	2-08
				5	4-04
				6	1-13
				8/1	0-11
				8/2	1-14
				9/1	0-16
				9/2	4-00
				10/1	2-07
				10/2	2-03

				10/3	1-04
				11	4-16
				12	4-16
				13	4-08
				15	4-04
				16	2-01
				17	4-16
				18	4-16
				19	4-10
				20/1	3-12
				20/2	1-04
				21/1	2-18
				21/2	1-15
				22/1	3-00
				22/2	1-16
				23	4-16
				24/1	0-04
				24/2	4-07
				26	0-06
				28	1-07
				10	1-18
				1	4-16

				2	4-16
				3/1	3-00
				3/2	1-16
				4	2-08
				8	5-00
				9	4-16
				10	4-16
				11	4-16
				12/1	1-09
				13	2-16
				19/1	3-16
				19/2	1-09
				20	4-16
				21/1	0-12
				21/2	3-10
				22/1	0-02
				22/2	1-17
				26	0-06
			16	3 min	0-16
				4	4-16
				5	4-16
				6/1	1-00

				6/2 7 min 14 min 15 16 min 17 min 25 min 26 29	3-16 4-02 2-07 4-16 4-15 0-11 3-00 0-10 0-06
			23	5 min 6 min	2-00 0-06
			24	1 10/1 min 10/2 min 33 37 min 38 39 42 min 191	4-11 1-16 Less than Biswa 6-16 10-04 0-14 2-14 0-16 0-17

				178 min 188	0-03 0-06

1

ग्राम सोई कलां भूमि ग्राम पंचायत अवार्ड नं. 19/86-87

आज दिनांक 22/9/86 को LAC (PS) महोदय के आदेश अनुसार मुआवजा प्रोग्राम का हमराह रामचन्द्र पटवारी (LR) व अब्दुल रहीम चपरासी (LR) बराबर ग्राम भूमि ग्राम पंचायत सोई के अवार्ड नम्बर 19/86-87 में अधिग्रहण है मौके पर पहुंचे। मौके पर मुआवजा के कार्यालय से श्री आर. पी. अग्रवाल N.T. (LAB) व श्री रतन पटवारी (LB) बराबर लेकर मुआवजा हाजर मिसल D.D.A के कार्यालय से आर. के. चन्द्र नगर मुहल्ला कुटी व श्री डी.सी. गुप्ता Sgo (D.D.A) प्रोग्राम अनुसार हाजर मिसल अधिग्रहण की अवार्ड भूमि का मौके पर निशान देही की गई जिसे उपस्थित गुराहदान मुआवजा की लिस्ट पर हस्ताक्षर किया गया। मौके पर नम्बरदार बलवा का मुआवजा उपरोक्त अवार्ड के अन्तर्गत दिया जाना लिखवाया गया है।

Attested.

3		4				
21	22	8	9/1	12/2/1	13/1	13/2/2
3-10	0-09	0-16	0-09	0-02	1-16	1-05

P.T.O

4 2 4-7

13/3/2	13/4	14	16,	17,	18/2	23	24
1-02	0-06	2-00	2-14	4-16	3-0	1-06	4-16

4 12

25/1	25/2	3/4/1	4/1	4/2/2	5/1	5/2
4-04	0-12	0-06	0-06	4-07	0-14	4-02

12

6	7/1/2	7/2/1	14/1	15/1	15/2	16/2
4-16	3-12	0-01	2-07	3-04	1-12	3-16

12 13

17/1	25/1/1	25/2	26	27	1	2/1	2/2	3
1-00	0-14	2-04	0-05	0-04	4-09	3-16	0-10	1-10

13

7	8	9/1	9/2	10/1	10/2	10/3	11/1	11/2
3-04	4-16	0-16	3-17	1-17	2-08	0-04	3-16	0-08

13

12	13/1	13/2	14	15	16	17/1	17/2	18
4-16	0-03	4-10	4-16	4-14	4-16	1-04	3-12	4-12

13

19	20	21	22	23	24/1	24/2	24/3	25/1
4-16	4-09	4-09	4-16	4-10	3-02	0-09	1-05	0-09

Attested
[illegible]
22/3/86

13 14

25/2	26	27	11/1	11/2	19	20	21	22	23
4-07	0-07	0-10	1-07	0-05	3-04	4-16	4-16	4-13	4-17

16

14	10/1	10/2	11	12	13	18	19	20
0-03	2-08	0-19	4-14	5-04	1-15	2-09	4-16	4-11

17

16	21	22	26	1	2	3/1	3/2	4	5/1
	4-16	4-0	0-05	4-16	4-16	0-08	4-08	4-07	0-12

P.T.O

17

5/2	6/1	6/2	7/1	7/2	8/1	8/2	9/1	9/2
0-13	3-07	1-09	2-06	2-70	3-0	1-16	0-16	4-0

17

10/1	10/2	11/1	11/2	12/1	12/2	13	14	15/1	15/2	16
0-16	4-0	2-18	1-16	2-11	1-18	4-16	4-16	3-0	1-04	4-07

17

17	18	19	20	21/1	21/2	22/1	22/2	23	24/1
4-11	4-16	4-16	4-15	3-08	1-08	1-05	3-11	4-13	1-11

17 18

24/2	25	26	27	1	2/1	2/2	3	4	5	6
2-11	4-16	0-07	0-08	4-09	0-14	4-02	4-12	4-16	4-16	4-16

18

7	8/1	8/2	9/1	9/2	10/2	11/1	12	13	14
4-16	3-18	0-14	3-19	0-13	3-07	1-02	4-16	4-12	4-16

18

15	16/1	16/2	16/3	17/1	17/2	18	19/2	22/1	23	24
4-16	1-07	1-04	2-01	1-08	3-03	4-15	4-01	2-03	4-16	4-16

18

25	26	27	30	19	31	32
4-10	0-01	0-01	0-06	5/1 1-02	2/1/1 0-04 2/2/1 0-01	3/1 1-9 3/2/2 3-02 1-2 4-16 4-16

32

3/1	3/2	4-5	6/1	6/2	7	8	9	10/1	10/2
3-12	1-01	4-12	4-16	1-13	3-03	4-07	3-05	4-15	1-16	3-0

32

11	12/1	12/2	13	14/1	14/2	15/1	15/2	17/1	17/2
4-16	1-12	2-09	4-16	1-[illegible]	3-16	2-08	1-13	2-02	3-11

32

18	19	20/1	20/2	21/1	21/2	22	23	24/1
4-16	4-14	1-01	3-02	0-07	4-03	4-12	4-16	2-04

32

24/2	26	27
0-06	0-09	0-04

33

1/1	1/2	10/1	10/2
3-08	3-04	1-04	1-05

34

1/1	1/2
3-0	1-16

39

2/1	2/2	3/1	3/2	8	9	10	11/2	12	24/1/2
3-0	1-11	3-0	1-02	1-0	4-14	4-14	4-06	2-0	1-01

39

20/1	26
0-11	0-02

40

4/1	57/1/2	57/1	57/2/2	6/1
0-01	1-07	1-08	0-16	1-15

40

15/1	223/1	225/1	577/1	521	522	523	525/1
0-03	4-05	3-01	[illegible]	0-04	1-04	0-03	0-02

कुल रकबा 604-02 बिस्वा का कब्जा L&B Department के श्री आर-पी अग्रवाल NT(L&B) को पैमाइश व खुदाई फिनिशिंग कुरजीमाल सहित लगाकर कब्जा वाकई नये कनस्ट्रक्शन, कुरजी structure के साथ दिया गया कब्जा देते समय कुछ नक्शात रकबा पर फसल खरीफ बोई हुई है जिसके काटने की अनुमति मांगते हैं जो कि दी गई है। कब्जा कायम बाकी के समय किसी प्रकार की कोई अड़चन मौके पर पेश नहीं आई इस कब्जे की कार्यवाही पूर्णतया के मुताबिक मौजा तवज्जी कब्जा मौके पर दे दिया गया बजरिये चकरा सिंह को आवाज बुलन्द सराही गई फटकारी हल्का को बगैर दौरा कार सरकार हाजिर नहीं है लेकिन लिहाजा रकम नकल कायम बाकी कब्जा बराबर अमल दरामद आराजात मौला बजरिये वहलीदार मौसूली किस्सा लिखा जाये कार्यवाही

P.T.O

Attested
Upto

5.

[illegible] L&B Deptt. के उपरान्त
[illegible] हस्तगत [illegible] की गई
[illegible] पूरी हो चुकी है [illegible]
उपरान्त [illegible] 22-9-86

Sd/-
(K.K. Jagia)
22/9/86

Sd/-
(Abdul Rahim)
Peon

[illegible]
22/9/86

Sd/-
(R.P. Aggarwal)
22/9/86 NT (L&B)

Sd/-
(Abdul Rahim)
22/9/86 Peon (L&B)

Sd/-
(S.K. Sharma)
22/9/86 Pat (L&B)

Sd/-
(Chander Bhan)
22/9/86 Tch (DDA)

(D.C. Gupta)
22/9/86 Kgo (DDA)

Attested
22/9/86
NT (LA)

The physical possession of land measuring 604 Bighas 2 Biswas of village Bharthal acquired through Award No. 19/86-87 taken over from Sh. K.K. Jagia N.T. (L.A.) & simultaneously handed over to Sh. Chander Bhan Tehsildar D.D.A. at site on 22/9/86. The said land has been acquired under P.D.D. for Papan Kalan Scheme.

Handed over.

22/9/86
N.T. (L&B)

Taken over.

Tch. DDA
22/9/86

Translation from Hindi to English

For the proceedings of possession pertaining to land situated at Village Bharthala Award No. 19/86-87.

Today on 22.09.86 on the basis of the order of LAC (PS) accordingly from the programmer through Ram Chander Patwari (LA) and Abdul Rahim, Peon (L.A) and for possession over the said land duly situated at Village Bharthala which falls under award No. 19/86-87 the same has been requisitioned. The said Authority reached on the spot. On the spot the person who were present namely Sh R.P.Agarwal N.T (L & B) and Sh S.K.Patwari (L B) met at the place of the acquiring land. DDA on its behalf from the said office Mr. Chander Bhan Tehsildar and Mr. D.C.Gupta Kgo (DDA) programmer accordingly all these authorities presented there and on the spot the said land was identified and marked the said land which was already made understand to the authority concerned by showing the present land on the spot. The said land numbers after merged pertaining to the possession award of the said land, the details of which are stated as follows:-

3		4				
21	22	8	9/1	12/2/1	13/1	13/2/2
3-10	0-09	0-16	0-09	0-02	1016	1-05

4							
13/3/2	13/4	14	16	17	18/2	23	24
1-02	0-06	2-00	2-14	4-16	3-0	1-06	4-16

4		4				
25/1	25/2	3/2/1	4/1	4/2/2	5/1	5/2
4-04	0-17	0-06	0-06	4-07	0-14	4-02

12						
6	7/1/2	7/2/1	14/1	15/1	15/2	16/2
4-16	3-12	0-01	2-01	3-04	1-12	3-16

12					13			
17/1	25/1/11	25/2	26	27	1	2/1	2/2	3
1-00	0-14	2-04	0-05	0-04	4-09	3-16	0-10	1-10

13								
7	8	9/1	9/2	10/1	10/2	10/3	11/1	11/2
3-04	4-16	0-16	3-17	1-17	2-08	0-04	3-16	0-08

13								
12	13/1	13/2	14	15	16	17/1	17/2	18
4-16	0-03	4-10	4-16	4-14	4-16	1-04	3-12	4-12

13

19	20	21	22	23	24/1	24/2	24/3	25/1
4-16	4-09	4-09	4-16	4-10	3-02	0-09	1-05	0-09

13

25/2	26	27	11/1	11/2	19	20	21	22	23
4-07	0-07	0-10	1-07	0-05	3-04	4-16	4-16	4-13	4-17

14

26
0-03

16

10/1	10/2	11	12	13	18	19	20
2-08	0-19	4-14	5-04	1-15	2-09	4-16	4-11

16

21	22	26
4-16	4-0	0-05

17

1	2	3/1	3/2	4	5/1
4-16	4-16	0-08	4-08	4-07	0-12

17

5/2	6/1	6/2	7/1	7/2	8/1	8/2	9/1	9/2
0-13	3-07	1-09	2-06	2-10	3-0	1-16	0-16	4-0

17

10/1	10/2	11/1	11/2	12/1	12/2	13	14	15/1	15/2	16
0-16	4-0	2-18	1-16	2-11	1-18	4-16	4-16	3-0	1-04	4-07

17

17	18	19	20	21/1	21/2	22/1	22/2	23	24/1
4-11	4-16	4-12	4-15	3-08	1-08	1-05	3-11	4-13	1-11

17			18							
24/2	25	26	27	1	2/1	2/2	3	4	5	6
2-11	4-16	0-07	0-08	4-09	0-14	4-02	4-12	4-16	4-16	4-16

18									
7	8/1	8/2	9/1	9/2	10/2	11/1	12	13	14
4-16	3-18	0-14	3-19	0-13	3-07	1-02	4-16	4-12	4-16

18										
15	16/1	16/2	16/3	17/1	17/2	18	19/2	22/1	23	24
4-16	1-07	1-04	2-01	1-08	3-03	4-15	4-01	2-03	4-16	4-16

18			19	31					31	
25	26	27	30	5/1	2/1/1	2/2/1	3/1	3/2/2	1	2
4-10	0-01	0-01	0-06	1-02	0-4	0-01	1-09	3-02	4-16	4-16

32										
3/1	3/2	4	5	6/1	6/2	7	8	9	10/1	10/2
3-12	1-01	4-12	4-16	1-13	3-03	4-07	3-05	4-15	1-16	3-0

32									
11	12/1	12/2	13	14/1	14/2	15/1	15/2	17/1	17/2
4-16	1-12	2-09	4-16	1-0	3-16	2-08	1-13	2-02	3-11

32								
18	19	20/1	20/2	21/1	21/2	22	23	24/1
4-16	4-14	1-01	3-02	0-07	4-03	4-12	4-16	2-04

23			33				39	
24/2	26	27	1/1	1/2	10/1	10/2	1/1	1/2

0-06	0-09	0-04	3-08	2-04	1-04	1-05		3-0	1-16

39

2/1	2/2	3/1	3/2	8	9	10	11/2	12	20/1/2
3-0	1-16	3-0	1-02	1-0	4-14	4-14	4-06	2-7	1-01

39 40

20/2/1	26	4/1	5/1/2	5/2/1	5/2/2	6/1
0-11	0-02	0-01	1-07	1-08	0-16	1-15

40

15/1	223/1	225/1	5/7/1	521	522	523	525/1
0-03	4-05	3-01	428 Them	0-04	1-04	0-03	0-02

Total land as measuring to 604-02 Biswa and the possession L & B through Mr. R.P.Agarwal N.T (L & B) for the measurement thereof, the said land was got done and for the purpose of possession by seeing the structure of the said land it was decided and the time was given. The said place contains standing crops which have sown for its harvesting, necessary permission with required from the authority concerned. At the time of possession and proceedings of possession over the land in question no any kind of objection was done by anybody else on the spot. On the spot the concerned Peon declared loudly on the spot in presence of the Patwari and other relative circle officers.

Other than this, nor any other related senior personnel appeared there so the copying and the amaldaramad papers through the tehsildar Mehrauli Delhi would be concerned or called for. One copy in L & B Dept –II the relative Naib Tehsildar Shri R.P.Agarwal the necessary proceeding on the said land regarding the possession thereof have been completed. The persons present on the spot their signatures were taken on the spot.

22.8.86
Sd/-
(K.K.Jagia)

22.9.86
Sd/-
(Abdul Rahim)
Peon

Ram Chand Patwari LA
22.9.86

Sd/-

Sd/-
(Abdul Rahim)
22.9.86 Peon (LA)

(R.P.Aggarwal)
22.9.86 NTC (L & B)

Sd/-
(S.K.Sharma)
22.9.86 Pat (L & B)

Sd/-
(Chander Bhan)
22.9.86 The (DDA)

Sd/-
(D.C.Gupta)
22.9.86 Kgo DDA

Attested
Sd/-
22.9.86
NT (LA)

The physical possession of land measuring 604 Bighas 2 Biswas of Village Bharthal acquired through Award No. 19.86-87 taken over from K.K. Jagia N.T. (L.A) & Simultaneously handed over to Sh Chander Bhan Tehsildar D.D.A. at site on 22.9.86. The said land has been acquired under P.D.D for papan Kalan Scheme.

Handed over	Taken over
Sd/-	Sd/-
22.9.86	The DDA
N.T. (L & B)	Dt 22.9.86

फोटो प्रतिलिपी जमाबन्दी

570

210

ग्राम - भरथल

Page ①

Khata Jamabandi No.	खसरे का Khasra No.	खाता संख्या व खाते में दर्ज मालिकों के नाम व पदनाम Name of Pattadar with details of Mortgages and Revenue	भूमि मालिक व पदनाम Name of Land owner & address	भूमि काश्तकार व पदनाम Name of Cultivator & Address	नहर, चाह व कैनाल अथवा अन्य साधनों से सिंचाई well or other sources of Irrigation	खसरा No. Khasra: अन्तिम बन्दोबस्त Last Settlement	खसरा No. Khasra: वर्तमान बन्दोबस्त Present Settlement	रकबा व किस्म जमीन Area & Kind of Land	लगान जो लगाया गया अथवा किराया है व तरीका अदा व दर Rent which Cultivator pays-Rate & Amount	हिस्सा या पैमाना कैफियत और तालिका बाट Hiss & Paimana Haqiyat and Taika Bachi	मुजारात व सरकारी मालगुजारी Demand with details of revenue cases	बकाया मालगुजारी जो अन्तिम साल तक अदा नहीं हुई Balance revenue not paid till the end of the year	तहसील बवानी खेड़ा जिला हिसार जिलाधीश-परिषद
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	1						16						
							13	1-15					
	जबूत		सरकार बोलतमार	दिल्ली दिल्ली			18	2-9					
				पुलिस कैम्प जबूत			19	4-16					
							20	4-11					
							21	4-16					
							22	4-0					
							26	0-5					
							17						
							1	4-16					
							2	4-16					
							3/1	0-8					
							3/2	4-8					
							4	4-7					
							5/1	0-12					
							5/2	0-13					
							6/1	3-7					

1	1							17/2	1-9							
[illegible]	[illegible]		[illegible]	[illegible]				1/1	2-1							
				[illegible]				1/2	2-16							
								2/1	3-0							
								2/2	1-16							
								9/1	4-16							
								9/2	4-1							
								10/1	4-16							
								10/2	4-0							
								11/1	2-13							
								11/2	1-16							
								12/1	2-11							
								12/2	1-12							
								13	4-16							
								14	4-16							
								15/1	3-0							
								15/2	1-4							
								16	4-7							
								17	4-11							
								18	4-16							
								19	4-16							
								20	4-15							

Contd 9/3

Village — Taluka — District

खसरा नम्बर Khasra Number	खाता नं. Khatauni No.	भूमि पर अधिकार के प्रकार व धारक का नाम Nature of Rights of Tenants with name of Tenants and Reference	भूमि मालिक व पता Name of Land owner & address	भूमि काश्तकार व पता Name of Cultivator & Address	भूमि पर के कौन से साधन Sources of well or other sources of Irrigation	खसरा नं. No. Khasra: पूर्व बन्दोबस्त Last Settlement	खसरा नं. No. Khasra: वर्तमान बन्दोबस्त Present Settlement	रकबा व किस्म Area & Kind of Land	लगान जो भूमि पर देय है व देयकर्ता Rent which Cultivator pays-Rate & Amount	किराया व लगान दर तथा तारीख Hire & Payment Header and Table Date	मुआवजा व तारीख Compensation with Date of Revenue class	बकाया लगान जो देय है तारीख तक Balance revenue payable till the date of this	वर्तमान काश्तकार का कब्जा किस प्रकार व तारीख:
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1						17						
गजकूट	गजकूट		सरकार हेलाराम	दिल्ली राजेश पुत्र बलवन्त गजकूट			21/1	3-8					
							21/2	1-8					
							22/1	1-5					
							22/2	3-11					
							23	4-13					
							24/1	1-11					
							24/2	2-11					
							25	4-16					
							26	0-2					
							27	5-1					
							18/1	6-5					
							2/1	0-14					
							2/2	6-2					

Contd P/7

Page (4)

Contd. P/5

खसरा नम्बर Khasra Number	खातेदारी Khatedari	खाता नम्बर तथा खाता अकाउन्ट व राजस्व Name of Land owner with name of Khata and Revenue	नाम भूमिधर व पता Name of Land owner & address	नाम काश्तकार व पता Name of Cultivator & Address	कुआं नाल व तेल अथवा अन्य Well or other sources Irrigation	जमीन का बन्दोबस्त Land Settlement	वर्तमान बाग Present Settlement	रकबा व किस्म जमीन Area & Kind of Land	लगान की मात्रा प्रति बीघा व कुल लगान व मुद्रा Rent which Cultivator pays-Rate & Amount	सिंचित व असिंचित तिरा और नम्बर बूटा Hisa & Parmana Holding and Tarika Bosh	मुआवजा व राजस्व बकाया Demand with Arrears of revenue cases	बकाया लगान की मात्रा जो इस वर्ष तक अदा नहीं हुआ Balance revenue not paid till the end of the year	[illegible]
1	2	3	4	5	6	7	8	9	10	11	12	13	14
							18						
गजहू	गजहू		सरकार दोहत गया	दिल्ली विकास प्राधिकरण गजहू			22	4-16					
							23	4-16	12				
							24	4-16					
							25	4-16					
							26	0-1					
							27	0-1					
							28	0-1					
							29	0-13					
							30	0-6					
							10						
							1	4-8					
							2	4-16					
							3/1	1-12					
							3/2	2-13					
							7						
							4	4-16					
							5	4-16					
							6	4-16					
							7/1	4-12					
						18	7/2	0-4	52-13				

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			31										
							13/7	0-3									
							13/2	4-12									
							13/[illegible]/[illegible]	0-3									
							13/2/[illegible]	4-11									
							14	4-12									
							15	4-16									
							16/[illegible]	4-16									
							17/1/[illegible]	2-16									
							17/2/[illegible]	3-16									
							18	4-16									
							19	4-16									
							20	4-4									
							21/1	0-14									
							21/2	3-15									
							22/1	3-0									
							22/2	3-16									
							23/1	1-4									
							23/2	3-12									
							24	4-14									
							25	4-14									
							26	0-7									
							27	0-3									
							28	0-4									
							29	0-6									
										65-9							

Contd 1/7

Page (7)

| | | |

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1		सरस्वती बौलतकर	दिल्ली विकास प्राधिकरण मा. मंगोली			37/1	4-16					
							1/2	4-16					
							3/1	3-2					
							3/2	1-4					
							4	4-12					
							5	4-16					
							6/1	1-13					
							6/2	3-3					
							7	4-7					
							8	3-5					
							9	4-15					
							10/1	1-6					
							10/2	3-0					
							11	4-16					
							12/1	1-12					
							12/2	2-4					
							13	4-16		58-15			

Contd P/9

1	1		4					32							
[illegible]	[illegible]		[illegible]	[illegible]				14/1	1-0						
								14/2	3-16						
								15/1	2-8						
								15/2	1-13						
								17/1	2-2						
								17/2	3-11						
								18	4-16						
								19	4-14						
								21/1	1-1						
								21/2	3-2						
								22/1	0-7						
								22/2	4-3						
								23	4-12						
								23	4-16						
								24/1	2-4						
								24/2	0-6						
								[illegible]							
								31	0-9						
								27	0-9						
								33/1	3-8						
								1/2	2-4						

Contd P/10

1	2	3	4	5	6	7	8	9	10	11	12	13	14
							33						
							10/1	1-4					
							10/2	1-5					
							39/1	3-0					
							1/2	1-16					
							41	3-0					
							42	1-16					
							43/1	3-0					
							43/2	1-2					
							9	1-0					
							9	4-14					
							10	4-14					
							11	4-15					
							12	2-7					
							24/1	1-11					
							24/2	2-4					
							21	0-5					
							26	0-2					

प्रतिलिपि उक्त नकल मूल से कार्यालय नकल के है तथा
तहसीलदार महेश कुमार पटवारी महाप्रबंधक रेलवे को दी गयी है

Photocop Jamabandi
Villae Bharthala
Copy Jamabandi Village Bharthal Year 2002-03

Khewat Jamabandi No.	Khatoni No	Name of Patti or side with name of numbardar and revenue	Name of land owner and address	Name of cultivators and address	Well or other source of irrigation	No. Khasra		Area and kind of land	Rent which cultivator pays –rate and amount	Share and scale of measurement	Demand with details of revenue cases	Balance Revenue not paid till the end of year	remarks
						Last settlement	Present settlement						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Owner	Owner		the person possessing of the property	Delhi Development Authority owner			16/13 18 19 20 21 22 26	1-15 2-9 4-16 4-11 4-16 4-0 0-5					

							17/1	4-16					
							2	4-16					
							3/1	0-8					
							3/2	4-5					
							4	4-7					
							5/1	0-12					
							5/2	0-13					
							6/1	3-7					
							17/6/2	1-9					
							2/1	2-6					
							1/2	2-10					
							8/1	3-0					
							8/1	1-16					
							9/1	0-16					
							9/2	4-0					
							10/1	0-16					

							10/2	4-0					
							11/1	2-18					
							11/2	1-16					
							12/1	2-11					
							12/2	1-18					
							13	4-16					
							14	4-16					
							15/1	3-0					
							15/2	1-4					
							16	4-2					
							17	4-11					
							18	4-16					
							19	4-16					
							20	4-15					

Photocop Jamabandi
Villae Bharthala
Copy Jamabandi Village Bharthal Year

Khewat Jamabandi No.	Khatoni No	Name of Patti or side with name of numbardar and revenue	Name of land owner and address	Name of cultivators and address	Well or other source of irrigation	No. Khasra		Area and kind of land	Rent which cultivator pays –rate and amount	Share and scale of measurement	Demand with details of revenue cases	Balance Revenue not paid till the end of year	remarks
						Last settlement	Present settlement						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Owner	Owner		the person possessing of the property	Delhi Development Authority owner			17/21/1	3-8					
							21/2	1-8					
							22/1	1-52					
							22/2	3-11					
							23	4-132					
							24/1	1-11					
							24/2	2-11					

							25	4-16					
							26	0-2					
							27	0-6					
							18/1	4-4					
							2/1	0-14					
							2/2	4-2					
							18/1	4-12					
							4	4-16					
							5	4-16					
							6	4-16					
							7	4-16					
							8/1	4-16					
							8/2	0-14					
							9/1	3-09					
							9/2	0-12					
							10	4-9					

							11	4-9					
							12	4-16					
							13	4-12					
							14	4-16					
							15	4-16					
							16/1	1-7					
							16/2	0-4					
							16/3	2-1					
							12/1	1-4					
							17/2	3-3					
							18	4-15					
							19	4-15					
							20	4-6					
							21	3-14					

Photocop Jamabandi
Villae Bharthala
Copy Jamabandi Village Bharthal Year

Khewat Jamabandi No.	Khatoni No	Name of Patti or side with name of numbardar and revenue	Name of land owner and address	Name of cultivators and address	Well or other source of irrigation	No. Khasra		Area and kind of land	Rent which cultivator pays –rate and amount	Share and scale of measurement	Demand with details of revenue cases	Balance Revenue not paid till the end of year	remarks
						Last settlement	Present settlement						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Owner	Owner		the person possessing of the property	Delhi Development Authority owner			18/22	4-16					
							23	4-16					
							24	4-16					
							25	4-10					
							26	0-1					
							27	0-1					
							28	0-1					

							29	0-13					
							30	0-6					
							19/1	4-8					
							2	4-16					
							3/1	1-12					
							3/2	2-13					
							4	4-16					
							5	4-16					
							6	4-16					
						Min 18	7/1	4-12					
							7/2	0-4	52-13				
							31/17/1	0-3					
							17/2	4-12					
							13/1 min	0-3					
							13/2	4-11					

							Min						
							14	4-12					
							15	4-16					
							16/1-2	4-16					
							17/1 min	0-16					
							17/2 min	3-16					
							18	4-16					
							19	4-16					
							20	4-0					
							21/1	0-14					
							21/2	3-15					
							22/1	3-0					
							22/2	1-16					
							23/1	1-4					
							23/2	3-12					

							24	4-14					
							25	4-14					
							26	0-1					
							27	0-3					
							28	0-4					
							29	0-6					

Photocop Jamabandi
Villae Bharthala
Copy Jamabandi Village Bharthal Year

Khewat Jamabandi No.	Khatoni No	Name of Patti or side with name of numbardar and revenue	Name of land owner and address	Name of cultivators and address	Well or other source of irrigation	No. Khasra		Area and kind of land	Rent which cultivator pays –rate and amount	Share and scale of measurement	Demand with details of revenue cases	Balance Revenue not paid till the end of year	remarks
						Last settlement	Present settlement						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Owner	Owner		the person possessing of the property	Delhi Development Authority owner			30/26 17 .. .. 30//1 2/1 2/2	0-10 0-1 0-3 0-1 4-1 0-2					

							3	1-4					
							3/2	3-2					
							4	4-16					
							5	4-16					
							6	4-16					
							7	4-16					
							8	4-16					
							9	4-16					
							10	0-4					
							11	4-2					

Photocop Jamabandi
Villae Bharthala
Copy Jamabandi Village Bharthal Year

Khewat Jamabandi No.	Khatoni No	Name of Patti or side with name of numbardar and revenue	Name of land owner and address	Name of cultivators and address	Well or other source of irrigation	No. Khasra		Area and kind of land	Rent which cultivator pays –rate and amount	Share and scale of measurement	Demand with details of revenue cases	Balance Revenue not paid till the end of year	remarks
						Last settlement	Present settlement						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Owner	Owner		the person possessing of the property	Delhi Development Authority owner			32/1 2 3/1 3/2 4 5 6/1	4-16 4-16 3-2 1-1 4-12 4-16 1-13					

							6/2	3-3					
							7	4-7					
							8	3-5					
							9	4-15					
							10/1	1-16					
							10/2	3-0					
							11	4-16					
							12/1	1-12					
							12/2	2-9					
							13	4-16					
							32/14/1	1-0					
							14/2	3-16					
							15/1	2-8					
							15/2	1-13					
							17/1	2-2					

							17/2	3-11					
							18	4-16					
							19	4-14					
							20/1	1-1					
							20/2	3-2					
							21/1	0-7					
							21/2	4-3					
							22	4-12					
							23	4-16					
							24/1	2-4					
							24/2	0-6					
							26	0-9					
							27	0-4					
							33/1/1	3-8					
							1/2	2-4					

Photocop Jamabandi
Villae Bharthala
Copy Jamabandi Village Bharthal Year

Khewat Jamabandi No.	Khatoni No	Name of Patti or side with name of numbardar and revenue	Name of land owner and address	Name of cultivators and address	Well or other source of irrigation	No. Khasra		Area and kind of land	Rent which cultivator pays –rate and amount	Share and scale of measurement	Demand with details of revenue cases	Balance Revenue not paid till the end of year	remarks
						Last settlement	Present settlement						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Owner	Owner		the person possessing of the property	Delhi Development Authority owner			33/10/1 10/1 39/1/1 1/2 2/1 2/2 3/1	1-4 1-5 3-0 1-14 3-0 1-16 3-0					

							3/2	1-2					
							9	1-0					
							9	4-14					
							10	4-14					
							11min	4-16					
							12	2-7					
							20/1	1-11					
							20/2	2-4					
							21	0-18					
							26	0-2					

DELHI DEVELOPMENT AUTHORITY

OFFICE OF THE DIRECTOR (PLANNING)
DWARKA PROJECT
MANGLA PURI, NEW DELHI-45

No.F.11 (illegible) 2009/Plg/DWK Date_____

Subject:- Handing over the possession of Plot for INTEGRATED METROPOLITAN PASSENGER TERMINAL (IMPT) in Sector -21.. Phase _____ Dwarka Project.

In accordance with the Dy. Director (IL) DDA letter No.F34(61)07/1L/1452 dated 22.07.08 the possession of the above said plot has been handed-over by Asstt. Director (Survey)/Dwk on 01.07.09 to the authorized representative of the NORTHER RAILWAY measuring a total area of 110.07 HAC/sq.mtr

One copy of the possession plan (in original) along with photocopy of the Authority, Letter given by SH. SURYA Kant (ASST. ENGINEER) NORTHERN RAILWAY enclosed for Information & necessary action.

End:

1. Possession Plan (In original)
2. Photocopy of Authority Letter.
3. Photocopy of Identity Card.

Jt. Director (Survey)/Dwk

To:

Dy. Director (IL).
Vikas Sadan New Delhi.

Copy forwarded for information and necessary action to :

1. Supdt. Engineer/CC-2 . Dwarka Project Along with Photocopy of possession plan
2. Director (Bldg.) DDA
3. Jt. Director (S) Dwk for office record.
4. EE/WB SWD-7
5. Dwarka Office Record

Jt. Director (Survey)/Dwk

DWARKA PROJECTS

True Copy

BEFORE THE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

O.A. No. 697 of 2023

IN THE MATTER OF:-

R.M. ASIF APPLICANT

VERSUS

RAIL LAND DEVELOPMENT AUTHORITY & ORS. RESPONDENT(S)

AFFIDAVIT FILED ON THE BEHALF OF DY. CONSERVATOR OF FOREST WEST FOREST DIVISION IN COMPLIANCE OF THE ORDER DATED 28.11.2023 AND 02.01.2024.

I, Mandeep Mittal S/o. Sh. Ashok Mittal, aged about 35 years, having my Office at Department of Forests and Wildlife, Mandir Marg, Mandir Lane, New Delhi-60, do hereby solemnly affirm and state as follows:-

1. That it is submitted that the Hon'ble NGT Court directed the Forest Department to clarify whether the land MU4+MU5+MU6 Rail land Parcel, admeasuring approximately 1,24,000 Sq. m. situated along New Bijwasan Railway Station is a Forest land or not.

2. That it is submitted that a letter was sent to the office of the Chairman of Rail Land Development Authority, Ministry of Railway regarding the joint site inspection by the Rail Land Development Authority and officials of Department of Forest and Wildlife, GNCTD of the above mentioned site/area on 08.02.2024 vide Dispatch

No.F.1(2625)/Legal/HQ/2023-24/14335-36 dated 07.02.2024. The copy of the letter is hereby annexed as **ANNEXURE-A.**

3. That it is further submitted that a joint inspection was done by Asstt. Executive Engineer (RLDA) and officials of Department of Forest and Wildlife, GNCTD on 08.02.2024. During inspection it was observed that the land in question may be deemed forest but the AE (RLDA) failed to identify the exact land and also failed to provide the maps of the project site. The copy of the inspection report is hereby annexed as **ANNEXURE-B.**

4. That it is submitted that the Department of Forests and Wildlife, GNCTD checked all the relevant documents available in this office regarding the land in question and it was concluded that as per the documents available the said land is not Notified Forest land. However the status of the said land as a "Deemed Forest" is not ruled out and to clarify the same the Department of Forest and Wildlife requires the relevant documents especially maps from the Rail Land Development Authority to clarify the same.

5. I state that in view of the facts and circumstances stated above, the case is liable to be dismissed for non joinder of necessary parties, suppression of facts, and being without merit as stated hereinabove.

DEPONENT

Annexure R-4

IN THE HON'BLE SUPREME COURT OF INDIA
AT NEW DELHI

CIVIL APPELLATE JURISDICTION
CIVIL APPEAL NO.10656/ 2024

IN THE MATTER OF:-

NAVEEN SOLANKI **...APPELLANT**

VERSUS

RAIL LAND DEVELOPMENT AUTHORITY

& ORS **...RESPONDENTS**

COUNTER AFFIDAVIT ON BEHALF OF RESPONDENT NO. 3 THROUGH THE DEPUTY CONSERVATOR OF FOREST WEST FOREST DIVISION IN COMPLIANCE OF THE ORDER DATED 21.10.2024 PASSED BY THE HON'BLE SUPREME COURT OF INDIA.

I, Amit Gemawat S/o. Late Sh. Ajit Gemawat, aged about 35 years, working as Deputy Conservator of Forests (West) at Department of Forests and Wildlife, West Forest Division, Mandir Marg, Mandir Lane, New Delhi-110060, do hereby solemnly affirm and state as follows:-

1. At the outset, it is most respectfully and humbly stated that the Department of Forests and Wildlife, GNCTD has the utmost regard and respect for the Majesty of the Hon'ble Court and has in the past, as also in the present instance done and will continue to do everything in its power to ensure compliance of the directions issued by this Hon'ble Court.

2. The present Counter Affidavit is being filed on behalf of the Department of Forests & Wildlife, GNCTD in compliance of

//TRUE COPY//

Order dated **21.10.2024** of this Hon'ble Court in this present matter.

3. That it is submitted that the Hon'ble National Green Tribunal Court vide order **28.11.2023 and 02.01.2024** in O.A. No. 697 of 2023 titled as R. M. Asif vs. Rail Land Development Authority & Ors. had directed the Forest Department to clarify whether the land MU4+MU5+MU6 Rail land parcel, admeasuring approximately 1,24,000 Sq. m. situated along New Bijwasan Railway Station is a Forest land or not. Copy of orders dated 28.11.2023 and 02.01.2024 is annexed herewith as **ANNEXURE-R1**.

4. That it is submitted that as per the affidavit filed by R.K. Goel, Conservator of Forests, Govt. of NCT of Delhi in ***T.N. Godavarman Thirumulpad vs. Union of India & Ors***, whereby a committee was constituted in terms of Supreme Court's **judgement dated 12.12.1996** to identify the forest areas. It is further submitted that as per the said affidavit and other documents available with the land cell pertaining to areas under the Forest Division, the said land area in the present appeal does not classify as 'Notified Forest Land". The criteria laid down by the committee to identify the area as deemed forest is stated in para number 3 of the said affidavit, which is reproduced herein below:-

   "that the committee has taken decision to identify areas above 2.5 acre having density of 100 trees per acre as well as stretches of land along roads, drains etc. having length of 1.0 km. besides areas already shown as forests/etc. in revenue land records".

NOTARY A.N. SINGH Supreme Court of India Reg. No. 16959 Expiry 31.2025 GOVT. OF INDIA

//TRUE COPY//

Copy of the said affidavit filed by Sh. R.K. Goel, Conservator of Forests on 15.09.1997 in W.P. (C) 202 / 1995 matter titled as ***T.N. Godavarman Thirumulpad vs. Union of India & Ors.*** is annexed herein as **ANNEXURE – R2.**

5. That accordingly, to clarify the said ambiguity, a letter was sent to the office of the Chairman of Rail Land Development Authority, Ministry of Railway to conduct a Joint Site inspection by the Rail Land Development Authority and officials of Department of Forest and Wildlife, GNCTD of the above mentioned site/area on **08.02.2024** vide Letter No. F. 1(2625)/Legal/HQ/2023 - 24/14335 - 36 dated 07.02.2024. The copy of the letter dated **07.02.2024** is hereby annexed as **ANNEXURE-R3.**

6. That it is submitted that a joint inspection was done by Asstt. Executive Engineer (RLDA) and officials of Department of Forest and Wildlife, GNCTD on **08.02.2024**. It is further submitted that during inspection it was observed that the land in question may be deemed forest but the AE (RLDA) failed to identify the exact land and also failed to provide the maps of the project site.

7. That it is submitted that an affidavit dated 13.02.2024 was filed in the Hon'ble NGT vide which it was stated at para 4 which is as reproduced below:

'the said land is not Notified Forest land. However, the status of the said land as a "Deemed Forest" is not ruled out and to clarify the same the Department of Forest and

//TRUE COPY//

Wildlife requires the relevant documents especially maps from the Rail Land Development Authority'.

Copy of the affidavit dated 13.02.2024 is annexed herein as **ANNEXURE-R4**.

8. That vide order dated **17.09.2024**, passed by this Hon'ble Court, the respondents have been restrained from felling/damaging trees in any manner whatsoever and no construction is to take place on the subject land.

9. That, a further letter dated **10.12.2024** was sent to office of Chairman, Rail Land Development Authority, Ministry of Railways requesting to comply with the directions of letter dated **07.02.2024** and to provide relevant documents, maps and KML files. That it is humbly submitted that the requisite response is still awaited from the RLDA. The copy of letter dated **10.12.2024** is annexed herewith as **ANNEXURE-R5**.

10. That, an exercise to determine the extent of "deemed forest" was carried out in the said area (Dwarka Sector 21 by the Department of Forest and Wildlife, West Division. The said exercise was carried out over a period of **03 days from 03.01.2025 to 05.01.2025**. It is submitted that a report dated 09.01.2025 regarding the "Deemed Forest" in the area was prepared. As per the said report, certain patches of "deemed forest" have been found to exist in the subject land. The details of the same is as under:-

    a. Patch 1 (14.5 Ha)- 5494 trees
    b. Patch 2 (16.9 Ha)- 6083 trees
    c. Patch 3(19.39 Ha)- 7810 trees

NOTARY A.N. SINGH Supreme Court of India Regn. No. 16959 Exp. 31.01.2025 GOVT. OF INDIA

//TRUE COPY//

It is pertinent to mention that approx. 70% of number of trees mentioned above is covered by invasive species such as Kabuli Kikar and Subabol. For the purpose of the report, the definition of tree is as per Section 2 (i) of the Delhi Preservation of Trees Act, 1994. That out of the area mentioned by the appellant, certain parts of the said area fall under the category of "deemed forest". For the said area, requisite permission is required to be taken under relevant provisions of Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 and for the remaining area which does not fall under the category of "deemed forest", permission is required under relevant provisions of Delhi Preservation of Trees Act, 1994 (DPTA, 1994).

11. That it is submitted that certain trees were cut without the permission of the concerned Tree Officer i.e. The DCF, West Forest Division in the said land. Accordingly, offences were booked and restrainment order was issued under the relevant provisions of the Delhi Preservation of Trees Act, 1994. Further, notices were issued under Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980.

12. It is humbly submitted that the undersigned has the highest respect and regard for the orders of this Hon'ble Court and will always obey the same in letters and spirit.

NOTARY A.K. SINGH Supreme Court of India 16959 09/01/2025 GOVT. OF INDIA

DEPONENT

//TRUE COPY//

VERIFICATION:-

I, Sh. Amit Gemawat, The Deputy Conservator of Forests (West Forest Division) GNCTD, do hereby solemnly verify that the contents of the above are true to my knowledge and belief as derived from the records maintained by office of Respondent in the usual and ordinary course of business and no part of it is false and nothing material has been concealed therefrom. The legal submissions are on the basis of the advice received and believed to be true.

DEPONENT

I identify the deponent who has signed/T.I in my presence

Signature

Mr./Ms Rohan Gupta /Self

ID No. D/3422/2013

29 JAN 2025

NOTARY A.N. SINGH Supreme Court of India Regd. No. 16959 Exp. 31.01.2025 GOVT. OF INDIA

Certified That The Above Named Deponent, ID. No. ..... Identified And Verified By Sh. / Smt. ..... Solemnly Affirmed Before Me, Reg. Sr. No. ..... The Content Of The Affidavit Which Have Been Read & Explained To Me Are True And Correct.

Notary

ATTESTED

A.N. Singh, Adv.
Notary Public
Govt. of India, New Delhi

29 JAN 2025

//TRUE COPY//

606

Annexure R-5

सेवा मे,

श्रीमान उप वन संरक्षक अधिकारी,
पश्चिम वन प्रभाग,
मंदिर मार्ग, नई दिल्ली -110060

विषय:- RLDA प्रोजेक्ट और Bagmane प्रोजेक्ट साईट पर पेड़ों की गिनती करने के संबंध में।

महोदय,

आपको अवगत किया जाता है विभागीय पत्र संख्या F.2(302)/DCF(W)/Offence Misc. File/2021-2022/8492 date-03/01/2025 के अनुसार RLDA प्रोजेक्ट साइट पर पेड़ों की गिनती का कार्य किया गया | गिनती का कार्य वनरक्षकों द्वारा किया गया! जिसका एरिया 50.79 hectare है गिनती का विवरण निम्न प्रकार है -

Patch Color	Area (Ha)	Trees	Trees/Ha according to deemed forest
Orange	14.5	5494	.378/Ha
Yellow	16.9	6083	359/Ha
Green	19.39	7810	402/Ha
Total	50.79	19387	381/Ha

रिपोर्ट सूचनार्थ प्रस्तुत है!

भवदीय

Rohit Kapoor
(Forester)

(Rajesh Singh Forester)

OFFICE OF THE CONSERVATOR OF FOREST NEW DELHI
Dy. No. 6949
Date 09/1/25

Offence/Legal

Deputy Range Officer
West Division
New Delhi-110060

Scanned with OKEN Scanner

सेवा मे,

श्रीमान उप वन संरक्षक अधिकारी,
पश्चिम वन प्रभाग,
मंदिर मार्ग, नई दिल्ली -110060

विषय:- RLDA प्रोजेक्ट और Bagmane प्रोजेक्ट साईट पर पेड़ों की गिनती करने के संबंध मे।

महोदय,

आपको अवगत किया जाता है विभागीय पत्र संख्या F.2(302)/DCF(W)/Offence Misc. File/2021-2022/8492 date-03/01/2025 के अनुसार RLDA प्रोजेक्ट साइट पर पेड़ों की गिनती का कार्य किया गया | गिनतीं का कार्य वनरक्षकों द्वारा किया गया। जिसका एरिया 50.79 hectare है गिनती का विवरण निम्न प्रकार है -

Patch Color	Area (Ha)	Trees	Trees/Ha according to deemed forest
Orange	14.5	5494	378/Ha
Yellow	16.9	6083	359/Ha
Green	19.39	7810	402/Ha
Total	50.79	19387	381/Ha

रिपोर्ट सूचनार्थ प्रस्तुत है।

भवदीय

Rohit Ojha
(Forester)

(Rajesh Singh Forester)

OFFICE OF THE DY. CONSERVATOR OF FOREST (WEST) (NDD)
Dy. No. 6949
Date 09/1/25

Office / Legal

Deputy Range Officer
West Division
New Delhi-110060

9/1/25

Scanned with OKEN Scanner

सेवा मे,

श्रीमान उपवन संरक्षक अधिकारी,

पश्चिम वन प्रभाग,

मंदिर मार्ग, नई दिल्ली -110060

विषय:- RLDA प्रोजेक्ट और Bagmane प्रोजेक्ट साईट पर दिनांक 3/01/2025 को पेड़ों की गिनती करने के संबंध मे।

महोदय,

आपको अवगत किया जाता है आज दिनांक 03/01/2025 को विभागीय पत्र संखया F.2(302)/DCF(W)/offenceMisc.File/2021-2022/8492 dt-03/01/2025 के अनुसार RLDA प्रोजेक्ट साइट पर पेड़ों की गिनती का कार्य किया गया | Orange Patch की गिनतीं का कार्य वनरक्षकों द्वारा किया गया जिसका Area(14.5 ha) है!

गिनती का विवरण निम्न प्रकार है -

S.No.	Name of species	Number of Tree
1	Kabuli kikar	3010
2	Desi kikar	1011
3	Shisham	1135
4	Neem	107
5	Sehtut	95
6	Beri	25
7	Subabol	76
8	Peepal	08
9	Siras	02
10	Aam	02
11	Khejdi	09
12	Lehsua	05
13	bakain	02
14	wood apple	07
	Total	5494

रिपोर्ट सूचनार्थ परस्तुत है!

भवदीय

Omanbahlot

Rohit Sehra (Forester)

(Rajesh First Forester)

Pradeep (F.G.)

Rajesh (F.G)

Anil (F.G)

Ashu F.G

Mandeep (F.G)

Vijender (F.G)

ROHIT DALAL (F.G)

Scanned with OKEN Scanner

सेवा मे,

श्रीमान उपवन संरक्षक अधिकारी,
पश्चिम वन प्रभाग,
मंदिर मार्ग, नई दिल्ली -110060

विषय:- RLDA प्रोजेक्ट ओर Bagmane प्रोजेक्ट साईट पर दिनांक 04/01/2025 को पेड़ों की गिनती करने के संबंध मे।

महोदय,

आपको अवगत किया जाता है आज दिनांक 04/01/2025 को विभागीय पत्र संख्या F.2(302)/DCF(W)/offenceMisc.File/2021-2022/8492 dt-03/01/2025 के अनुसार RLDA प्रोजेक्ट साइट पर पेड़ों की गिनती का कार्य किया गया, Yellow Patch की गिनतीं का कार्य वनरक्षकों द्वारा किया गया जिसका Area(16.9ha)है।

गिनती का विवरण निम्न प्रकार है -

S.No.	Name of species	Number of Tree
1	Kabuli kikar	4231
2	Desi kikar	644
3	Shisham	242
4	Neem	196
5	Sehtut	15
6	Beri	96
7	Subabol	532
8	Peepal	11
9	Siras	12
10	Amaltas	12
11	papri	07
12	Imli	07
13	jatti	01
14	Frace	02
15	Pahari Neem	34
16	Kaner	37
17	pilkhan	04
	Total	6083

रिपोर्ट सूचनार्थ परस्तुत है।

भवदीय

Rajesh Singh forester
Pandeep (F.G)
(F.G)
(F.G)
Mandeep (F.G)
Omvir Gahlot
Vijender (F.G)
ROHIT DALAL (F.G)
Surendra (F.G)

Scanned with OKEN Scanner

सेवा मे,

श्रीमान उपवन संरक्षक अधिकारी,
पश्चिम वन प्रभाग,
मंदिर मार्ग, नई दिल्ली -110060

विषय:- RLDA प्रोजेक्ट और Bagmane प्रोजेक्ट साईट पर दिनांक 05/01/2025 को पेड़ों की गिनती करने के संबंध मे।

महोदय,

आपको अवगत किया जाता है आज दिनांक 05/01/2025 को विभागीय पत्र संख्या F.2(302)/DCF(W)/offenceMisc.FIle/2021-2022/8492 dt-03/01/2025 के अनुसार RLDA प्रोजेक्ट साइट पर पेड़ों की गिनती का कार्य किया गया, Green Patch की गिनतीं का कार्य वनरक्षकों द्वारा किया गया जिसका Area (19.39ha) है|

गिनती का विवरण निम्न प्रकार है -

S.No.	Name of species	Number of Tree
1	Kabuli kikar	5000
2	Desi kikar	331
3	Shisham	432
4	Neem	168
5	Sehtut	162
6	Beri	248
7	Subabol	441
8	Peepal	476
9	Siras	17
10	Amaltas	84
11	papri	160
12	Imli	07
13	jatti	17
14	Pahari Neem	02
15	Kaner	39
16	pilkhan	14
17	Lesua	20
18	Arjun	04
19	Jungle Jalebi	09

Scanned with OKEN Scanner

		02
20	Bargad	02
21	Kachnar	19
22	hingot	01
23	Sangwan	10
24	chudail Papri	04
25	alestonia	17
26	bamboo	56
27	bakain	66
28	Safeda	02
29	jamun	
	Total	7810

रिपोर्ट सूचनार्थ परस्तुत है।

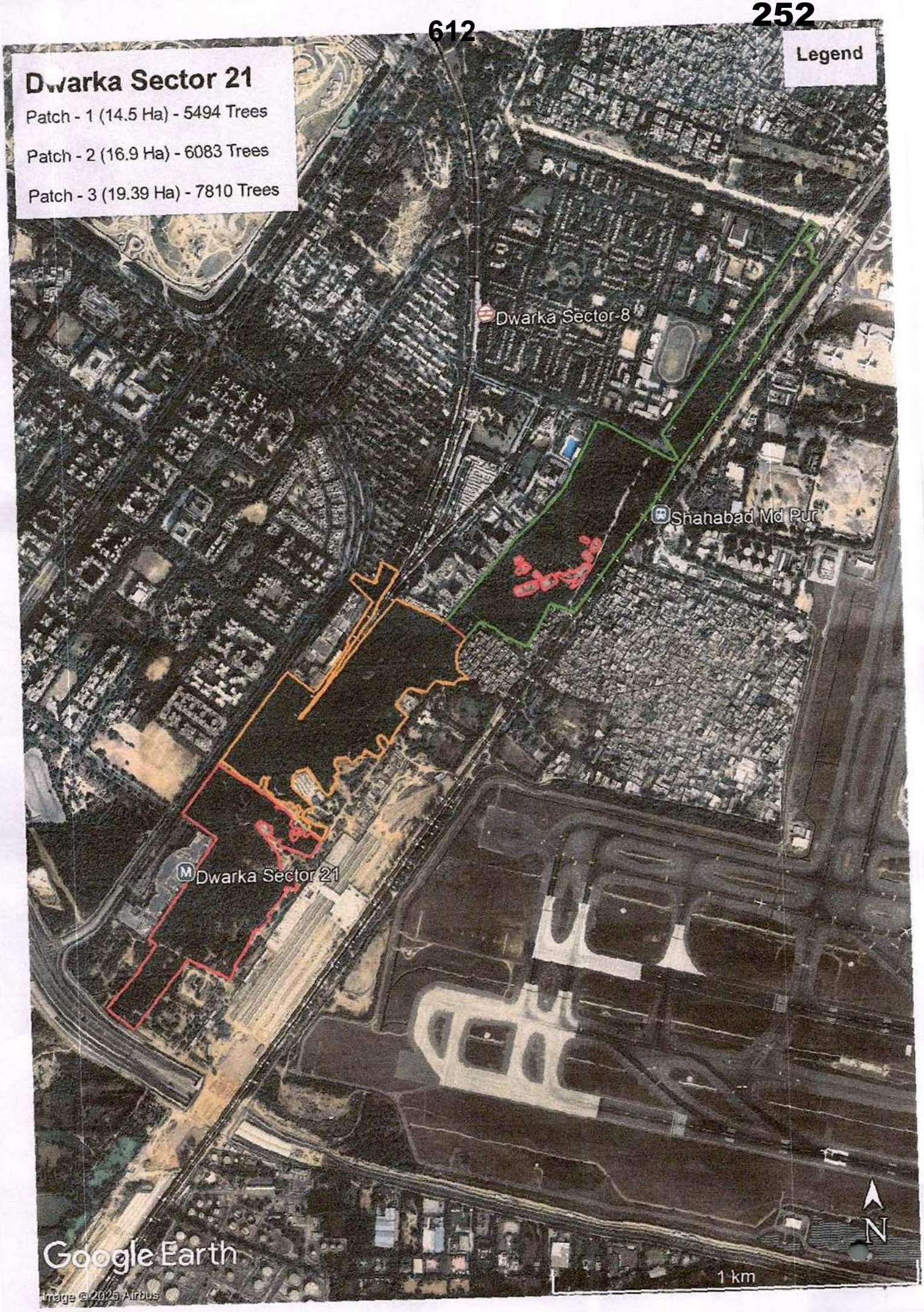
भवदीय

Rohit Mehra
(Forester)

(Rajesh Singh forester)
Pradeep (F.G.)
(F.G)
(F.G)

F.G
Mandeep (F.G)
Vijender (F.G)
ROHIT DALAL (F.G)
Jitender (F.G)
Gahlot
Oman Gahlot (F.G)

Scanned with OKEN Scanner


Dwarka Sector 21
Patch - 1 (14.5 Ha) - 5494 Trees
Patch - 2 (16.9 Ha) - 6083 Trees
Patch - 3 (19.39 Ha) - 7810 Trees
Legend
Dwarka Sector-8
Shahabad Md Pur
Dwarka Sector 21
Google Earth
Image © 2025 Airbus
1 km
N

IN THE SUPREME COURT OF INDIA

CIVIL ORIGINAL JURISDICTION

Writ Petition (Civil) No 1164 of 2023

Ashok Kumar Sharma, Indian Forest Service (Retired) and Others **... Petitioners**

Versus

Union of India and Another **... Respondents**

W I T H

Writ Petition (Civil) No 1336 of 2023

Writ Petition (Civil) No 1375 of 2023

Writ Petition (Civil) No 42 of 2024

Writ Petition (Civil) No 85 of 2024

O R D E R

1 In ***T N Godavarman Thirumulpad vs Union of India***[1], this Court while noting that the Forest Conservation Act 1980 was enacted to curb the deforestation which results in an ecological imbalance, indicated that the

1 (1997) 2 SCC 267

provisions incorporated to conserve forests and for other connected matters "must apply to all forests irrespective of the nature of ownership or classification". Apart from the above principle, the Court spelt out in paragraph 4 of the order, the meaning which must be attributed to the expression 'forest'. For convenience of reference, it would be appropriate to disaggregate the contents of paragraph 4 so as to indicate the components of the expression 'forest' as explained in the order of this Court:

> Firstly, the decision in ***T N Godavarman*** *(supra)* indicates that expression 'forest' must be understood according to its dictionary meaning;
>
> Secondly, the description of the expression 'forest' would cover all statutorily recognized forests whether they are designated as reserved, protected or otherwise for the purpose of Section 2(i) of the Forest Conservation Act 1980;
>
> Thirdly, besides including forests as understood in the dictionary sense, the term 'forest' in Section 2 would include "also any area recorded as forest in the government record irrespective of the ownership"; and
>
> Fourthly, the provisions for the conservation of forests and ancilliary matters in the Forest Conservation Act 1980 must apply to all forests "so understood" irrespective of ownership or classification.

2 The directions which were issued by this Court, included the following:

(i) The necessity of prior approval of the Central Government for any non-forest activity within the area of any "forest"; and

(ii) A mandamus to the State Governments to constitute Expert Committees to:

(a) Identify areas which are forests irrespective of whether they are so notified, recognized or classified under any law and irrespective of the ownership of the land;

(b) Identify areas which were earlier forests, but were degraded, denuded or cleared; and

(c) Identify areas covered by plantation trees belonging to the government and those belonging to private persons.

3 Further directions were issued in the judgment of this Court in ***T N Godavarman Thirumulpad vs Union of India [Lafarge Umiam Mining Private Limited - Applicant]***[2].

4 The process of identification of forests was crucial to the implementation of the directions which were issued by this Court. The purpose of identification was to ensure that the areas which fell within the description of 'forests' as

2 (2011) 7 SCC 338

explained in the decision would be capable of being preserved upon the process of identification being carried out under the auspices of Expert Committees in every State.

5 In this batch of petitions, there is a challenge to the constitutional validity of the Forest Conservation Amendment Act 2023 (Act No 15 of 2023).

6 Section 4 of the Amending Act has introduced Section 1A after Section 1 of the principal Act in the following terms:

> "4. After section 1 of the principal Act, the following section shall be inserted, namely:—
>
> '1A. (1) The following land shall be covered under the provisions of this Act, namely:—
>
> (a) the land that has been declared or notified as a forest in accordance with the provisions of the Indian Forest Act, 1927 or under any other law for the time being in force;
>
> (b) the land that is not covered under clause (a), but has been recorded in Government record as forest, as on or after the 25th October, 1980:
>
> Provided that the provisions of this clause shall not apply to such land, which has been changed from forest use to use for non-forest purpose on or before the 12th December, 1996 in pursuance of an order, issued by any authority authorised by a State Government or an Union territory Administration in that behalf.
>
> Explanation.—For the purposes of this sub-section, the expression "Government record" means record held by Revenue Department or Forest Department of the State Government or Union territory Administration, or any authority, local body, community or council recognised by the State Government or Union territory Administration.

(2) The following categories of land shall not be covered under the provisions of this Act, namely:—

(a) such forest land situated alongside a rail line or a public road maintained by the Government, which provides access to a habitation, or to a rail, and roadside amenity up to a maximum size of 0.10 hectare in each case;

(b) such tree, tree plantation or reafforestation raised on lands that are not specified in clause (a) or clause (b) of sub-section (1); and (c) such forest land,—

(i) as is situated within a distance of one hundred kilometres along international borders or Line of Control or Line of Actual Control, as the case may be, proposed to be used for construction of strategic linear project of national importance and concerning national security; or
(ii) up to ten hectares, proposed to be used for construction of security related infrastructure; or

(iii) as is proposed to be used for construction of defence related project or a camp for paramilitary forces or public utility projects, as may be specified by the Central Government, the extent of which does not exceed five hectares in a Left Wing Extremism affected area as may be notified by the Central Government.

(3) The exemption provided under sub-section (2) shall be subject to such terms and conditions, including the conditions of planting trees to compensate felling of trees undertaken on the lands, as the Central Government may, by guidelines, specify."

7 Sub-section (1) of Section 1A, as introduced, indicates that two categories of lands are sought to be covered under the provisions of the parent enactment, namely, (i) lands which have been declared or notified as forests under the Act of 1927 or any other law for the time being in force; and (ii) lands not covered by (i) but which are recorded in government records as forests on or after 25 October 1980. An exception is provided in the proviso

as set out above. The Explanation indicates that for the purpose of sub-section (1) of Section 1A, ‘government records’ would mean records held by the Revenue department or forest department of the State or Union Territory or any authority, local body, community or council recognized by the State Government.

8 The amendment is in challenge on the ground that while the dictionary meaning of the expression ‘forests’ which was adopted in ***T N Godavarman*** *(supra)* provided a broad and all encompassing meaning to the expression, the amendment circumscribes the coverage of the statute to two categories falling in clauses (a) and (b) of sub-section (1) of Section 1A. As a consequence, it has been submitted that whereas the total coverage of forests in the country is expected to be in the vicinity of 7.13 lakhs square kilometers, about 1.97 lakh square kilometers would stand excluded by the constriction of the coverage by the amending legislation.

9 Rule 16 of the Rules which were notified on 29 November 2023 deals with ‘miscellaneous matters’ and provides that for the purpose of the explanation of the expression ‘government records’ in sub-section (1) of Section 1A, the State Governments and the Union Territory administrations shall within a period of one year prepare a consolidated record of such lands, including (i) ‘forest like areas’ identified by the Expert Committee constituted for this purpose; (ii) ‘unclassed forest lands’; and (iii) ‘community forest lands’ to which the provisions of the Amending Act would be applicable. The

provisions of Rule 16(1) are footnoted[3] below.

10 Sub-Rule 4 of Rule 16 indicates that for the purpose of forest cover under the Rules, the figures and description used in the latest India State of Forest Report published by the Forest Survey of India shall be referred.

11 Mr Prashanto Chandra Sen, senior counsel and Mr Prashant Bhushan, counsel for the petitioners have submitted that the application of the provisions of amended Section 1A is likely to result in a substantial dilution of the coverage of lands protected as forests under the broad definition adopted in the judgment of ***T N Godavarman*** *(supra).* On the other hand, the argument of the Union of India, as set forth by Ms Aishwarya Bhati, Additional Solicitor General, is that the purpose of introducing the amendment and the Rules as noted above was not to constrict the definition as adopted by this Court, but to implement the decision. In other words, the case of the Union of India is that the coverage which has been statutorily provided for in Section 1A as well as Rule 16 is in furtherance of the above decision of this Court.

12 On 30 November 2023, this Court, in the course of the preliminary hearing, noted the submissions which were urged on behalf of the petitioners which have been reiterated in the submissions urged at this hearing.

3 16. **Miscellaneous**.- (1) For the purpose of explanation of government records provided under sub-section (1) of Section 1A of the Adhiniyam, the State Governments and Union Territory Administrations, within a period of one year, shall prepare a consolidated record of such lands, including the forest like areas identified by the Expert Committee constituted for this purpose, unclassed forest lands or community forest lands on which the provisions of the Adhiniyam shall be applicable.

13 At that stage, a statement was made by the Additional Solicitor General appearing on behalf of the Union Government that "there is no intention to dilute the scope of forest as defined in the judgment of this Court in ***T N Godavarman*** *(supra)"*. Hence, it was also stated that the exemptions which would be granted under sub-section (2) of Section 1A would accord with the guidelines which may be spelt by the Union Government. The Union Government, the Court was informed, was in the process of formulating the guidelines, but in order to allay the apprehensions of the petitioners, a statement was made by the Additional Solicitor General that no precipitate action will be taken by the Union Government "until further orders in respect of the forest as understood in accordance with the dictionary sense".

14 The decision in ***T N Godavarman*** *(supra)* needs to be understood from two perspectives. First, the expression 'forest' was read in a broad sense bearing in mind the object and purpose of the Forest Conservation Act 1980. While adopting the dictionary meaning of the expression 'forest', the Court intended to impart a purposive interpretation to the phrase so as to accord with the intent underlying the enactment of the law in 1980. Hence, the Court clarified that this would cover but not be confined only to lands recorded as forest in government records. Moreover, the expression 'forest' would be independent of the nature of ownership or title.

15 As regards the modalities for implementing the directions, the decision of this Court envisaged that all State Governments would constitute Expert Committees in order to identify forests as understood in the judgment. Proper implementation of the directions would take place once such a process of identification was made.

16 By the amending statute, the coverage of the Act has been extended to two categories. The first category consists of lands which have been declared or identified as forests in accordance with the Indian Forest Act or any other law for the time being in force. The second category consists of lands which have not been so declared or notified but which are recorded in government records as forests on or after 25 October 1980. The Explanation somewhat broadens the definition of the expression government records so as to include lands recorded either in the records of the Revenue or Forest departments of the States or Union Territories or any other authorities, local bodies, communities or council recognized by the State/Union Territories.

17 Rule 16 to which a reference has been made above requires the States and the Union Territory Administrations to prepare a consolidated record of such lands for the purpose of the explanation of government records under sub-section (1) of Section 1A. This would include forest like areas identified by the Expert Committees for this purpose, unclassed forest lands or community forest lands to which the provisions of the amended statute would be applicable. Such an exercise is to be carried out within a period of one year.

It is thus evident that the exercise which is to be carried out by the State Governments and the Union Territory Administrations is expected to be completed within that period. However, there is a need to impart clarity to the position as it should obtain pending such a determination and beyond. The position must be governed by the directions which were issued by this Court in ***T N Godavarman*** *(supra),* which have held the field for over twenty-five years.

18 Both in the submissions at the preliminary hearing on 30 November 2023, as well as in the submissions which were urged during the course of the present hearing, it is not the contention of the Union Government that the statutory amendment seeks to bring about any change in the law which was laid down in ***T N Godavarman*** *(supra)*. That apart, both the counsel for the petitioners have adverted to the stand of the Government before the Joint Parliamentary Committee which preceded the enactment of the law and the clear elaboration of the Union of India that the proposed coverage in the legislative provision which was under consideration, would accord with the decision of this Court. That being the position, we clarify that pending the completion of the exercise by the Administrations of the State Governments and the Union Territories under Rule 16 and pending these proceedings, the principles which are elucidated in the judgment of this Court in ***T N Godavarman*** *(supra)* must continue to be observed.

19 As a matter of fact, it is evident that Rule 16 includes within its ambit forest like areas to be identified by the Expert Committee, unclassed forest lands; and community forest lands. While being guided by the provisions of the statute and those contained in Rule 16, the State Governments as well as Union Territory Administrations shall peremptorily ensure compliance with the ambit of the expression 'forest' as explained in the decision in ***T N Godavarman***.

20 The Union Ministry of Environment and Forest shall in pursuance of the interim order issue a circular to all the States and the Union Territory Administrations to act strictly in accordance with the present directions. This shall be issued within two weeks.

21 Apart from the above interim direction, it must be noted that following the decision in ***T N Godavarman***, Expert Committees were required to be constituted by all the States (and Union Territory Administrations). The reports of the Expert Committees is crucial for the maintenance of a contemporaneous public record of lands which were identified as forests within the ambit of that expression as explained in the decision of this Court. The Union of India through the Ministry of Environment, Forest and Climate Change shall within a period of two weeks from the date of this order require all the States and the Union Territory Administrations to provide to it a comprehensive record of lands which have been identified as forests by the Expert Committees constituted by the State Governments/Union Territories

in pursuance of the directions in ***T N Godavarman***.

22 All States and Union Territory Administrations shall comply with the present direction by forwarding records of the reports of the Expert Committees to MoEFCC no later than by 31 March 2024. These records shall be maintained by MoEFCC and shall be duly digitized and made available in the electronic format on the website of the MoEFCC no later than by 15 April 2024.

23 The Expert Committees which are constituted in pursuance of Rule 16 by the States/Union Territory Administrations shall duly bear in mind the work of identification which was carried out by the Expert Committees in pursuance of the directions in ***T N Godavarman***. This shall however not preclude the Expert Committees from expanding the ambit of forest lands which are worthy of protection particularly having regard to the coverage as specified in Section 1A of the amended statute read with Rule 16(1).

24 Apart from the above directions, the attention of the Court has been drawn to the provisions contained in Section 5 of the Amending Act of 2023 which is in the following terms:

> "5. In the principal Act, section 2 shall be renumbered as sub-section (1) thereof and—
>
> (a) in sub-section (1) as so renumbered,—
>
> (I) in clause (iii), for the words "not owned, managed or controlled by Government", the words ", subject to such terms and conditions, as the Central Government may, by order, specify" shall be substituted;

(II) in the Explanation, for the long line occurring after clause (b), the following shall be substituted, namely:— but does not include any work relating to or ancillary to conservation, development and management of forests and wildlife, such as—

(i) silvicultural operations including regeneration operations;

(ii) establishment of check-posts and infrastructure for the front line forest staff;

(iii) establishment and maintenance of fire lines;

(iv) wireless communications;

(v) construction of fencing, boundary marks or pillars, bridges and culverts, check dams, waterholes, trenches and pipelines;

(vi) establishment of zoo and safaris referred to in the Wild Life (Protection) Act, 1972, owned by the Government or any authority, in forest areas other than protected areas;

(vii) eco-tourism facilities included in the Forest Working Plan or Wildlife Management Plan or Tiger Conservation Plan or Working Scheme of that area; and

(viii) any other like purposes, which the Central Government may, by order, specify.";

(b) after sub-section (1) as so renumbered, the following sub-section shall be inserted, namely:—

"(2) The Central Government may, by order, specify the terms and conditions subject to which any survey, such as, reconnaissance, prospecting, investigation or exploration including seismic survey, shall not be treated as non-forest purpose.".

25 Our attention is drawn to the fact that a co-ordinate Bench of this Court presided over by Hon'ble Mr Justice B R Gavai has reserved orders on the subject. Specifically, with reference to clause (6) above, we issue an interim order to the effect that any proposal for the establishment of zoos and safaris referred to in the Wile Life Protection Act 1972, enacted by the Government or any authority in forest areas other than protected areas, shall not be finally approved by the States/Union Territories, save and except with the prior permission of this Court. Where any such proposal is sought to be implemented, this Court shall be moved by the Union Government or, as the case may be, the competent authority for the prior approval of this Court. This part of the interim direction will hold the field only till the final judgment of the co-ordinate Bench. Necessarily therefore the judgment of the co-ordinate Bench shall govern the arena, once it is pronounced.

26 The Petitions shall now be listed for hearing and final disposal in the month of July 2024.

27 Mr Kaushik Chaudhary, Advocate-on-Record for the petitioner and Ms Suhasini Sen, counsel instructing the Additional Solicitor General are nominated as nodal counsel to prepare a consolidated compilation in the electronic form in terms of the Circular dated 22 August 2023.

28 The written submissions on behalf of the petitioners shall be provided to the nodal counsel no later than 30 April 2024. The written submissions of the

Union Government in response shall be provided no later than 30 June 2024 to the nodal counsel. The common compilation duly indexed shall be prepared in terms of the above circular and shall be emailed to cmvc.dyc@gmail.com.

IA No 5280 of 2023 In Writ Petition (Civil) No 1336 of 2023

1 The application for impleadment is allowed.

2 Liberty to serve the Standing Counsel for the newly impleaded States. They shall file their counter affidavit by 31 May 2024.

……..CJI.
[Dr Dhananjaya Y Chandrachud]

……J.
[J B Pardiwala]

……J.
[Manoj Misra]

New Delhi;
February 19, 2024
CKB

ITEM NO.22 COURT NO.1 SECTION PIL-W

S U P R E M E C O U R T O F I N D I A
RECORD OF PROCEEDINGS

Writ Petition (Civil) No.1164/2023

ASHOK KUMAR SHARMA, INDIAN FOREST SERVICE (RETD) & ORS. Petitioner(s)

VERSUS

UNION OF INDIA & ANR. Respondent(s)

(With IA No.10020/2024 - APPROPRIATE ORDERS/DIRECTIONS, IA No.214764/2023 - STAY APPLICATION and IA No.240922/2023 - STAY APPLICATION)

WITH W.P.(C) No.1336/2023 (PIL-W)
(With IA No.5280/2024 – INTERVENTION/IMPLEADMENT, IA No.10426/2024 - PERMISSION TO FILE ADDITIONAL DOCUMENTS/FACTS/ANNEXURES and IA No.247593/2023 - STAY APPLICATION)
W.P.(C) No.1375/2023 (PIL-W)
W.P.(C) No.42/2024 (PIL-W)
(With IA No.14901/2024 - GRANT OF INTERIM RELIEF)
W.P.(C) No.85/2024 (PIL-W)
(With IA No.30155/2024-EXEMPTION FROM FILING O.T.)

Date : 19-02-2024 These matters were called on for hearing today.

CORAM :
HON'BLE THE CHIEF JUSTICE
HON'BLE MR. JUSTICE J.B. PARDIWALA
HON'BLE MR. JUSTICE MANOJ MISRA

For Petitioner(s)	**Mr. Prashanto Chandra Sen, Sr. Adv.**
WPC 1164/2023	**Mr. Kaushik Choudhury, AOR** **Ms. Shibani Ghosh, Adv.** **Mr. Jyotirmoy Chatterjee, Adv.** **Ms. Khyati Jain, Adv.** **Ms. Akshata Chhabra, Adv.** **Mr. Yogesh Malik, Adv.** **Mr. Saksham Garg, Adv.**
WPC 1336/2023	**Mr. Satyajit Sarna, Adv.** **Mr. Prashant Padmanabhan, AOR** **Ms. Reaa Mehta, Adv.** **Mr. Vishal Sinha, Adv.**
WPC 42/2024	**Mr. Prashant Bhushan, AOR** **Ms. Neha Rathi, Adv.** **Ms. Kajal Geri, Adv.** **Mr. Kamal Kishore, Adv.**
WPC 1375/2023	**Mr. Balaraj Malik, Adv.** **Mr. R.C. Kaushik, AOR**
WPC 85/2024	**Mr. Shyam Divan, Sr. Adv.** **Ms. Madhusmita Bora, AOR** **Mr. Riju Raj Singh Jamwal, Adv.** **Mrs. Madhur Dadlani, Adv.** **Mr. Dipankar Singh, Adv.**
For Respondent(s)	**Ms. Aishwarya Bhati, ASG** **Mr. Gurmeet Singh Makker, AOR** **Ms. Ruchi Kohli, Adv.** **Ms. Bani Dixit, Adv.** **Mr. Rajat Nair, Adv.** **Mr. Sridhar Pottaraju, Adv.** **Mr. Kanu Agarwal, Adv.** **Dr. N. Visakamurthy, AOR**

UPON hearing the counsel the Court made the following
O R D E R

1 In terms of the signed order, the Petitions shall now be listed for hearing and final disposal in the month of July 2024.

2 Mr Kaushik Chaudhary, Advocate-on-Record for the petitioner and Ms Suhasini Sen, counsel instructing the Additional Solicitor General are nominated as nodal counsel to prepare a consolidated compilation in the electronic form in terms of the Circular dated 22 August 2023.

3 The written submissions on behalf of the petitioners shall be provided to the nodal counsel no later than 30 April 2024. The written submissions of the Union Government in response shall be provided no later than 30 June 2024 to the nodal counsel. The common compilation duly indexed shall be prepared in terms of the above circular and shall be emailed to cmvc.dyc@gmail.com.

IA No 5280 of 2023 In Writ Petition (Civil) No 1336 of 2023

1 The application for impleadment is allowed.

2 Liberty to serve the Standing Counsel for the newly impleaded States. They shall file their counter affidavit by 31 May 2024.

(CHETAN KUMAR) **(SAROJ KUMARI GAUR)**
A.R.-cum-P.S. **Assistant Registrar**
(Signed order is placed on the file)

ITEM NO.6 COURT NO.2 SECTION PIL-W

S U P R E M E C O U R T O F I N D I A
RECORD OF PROCEEDINGS

WRIT PETITION(S)(CIVIL) NO(S). 1164/2023

ASHOK KUMAR SHARMA, INDIAN FOREST SERVICE
(RETD) & ORS. PETITIONER(S)

VERSUS

UNION OF INDIA & ANR. RESPONDENT(S)

[IA No. 133296/2024 - APPLICATION FOR PERMISSION
IA No. 134865/2024 - APPLICATION FOR PERMISSION
IA No. 134867/2024 - APPROPRIATE ORDERS/DIRECTIONS
IA No. 115428/2024 - APPROPRIATE ORDERS/DIRECTIONS
IA No. 10020/2024 - APPROPRIATE ORDERS/DIRECTIONS
IA No. 133300/2024 - APPROPRIATE ORDERS/DIRECTIONS
IA No. 133298/2024 - EXEMPTION FROM FILING O.T.
IA No. 207035/2024 - EXEMPTION FROM FILING O.T.
IA No. 115430/2024 - EXEMPTION FROM FILING O.T.
IA No. 133301/2024 - EXEMPTION FROM FILING O.T.
IA No. 133297/2024 - INTERVENTION APPLICATION
IA No. 157284/2024 - INTERVENTION APPLICATION
IA No. 134866/2024 - INTERVENTION APPLICATION
IA No. 108937/2024 - INTERVENTION APPLICATION
IA No. 166299/2024 - INTERVENTION/IMPLEADMENT
IA No. 209063/2024 - INTERVENTION/IMPLEADMENT
IA No. 108949/2024 - PERMISSION TO APPEAR AND ARGUE IN PERSON
IA No. 28902/2025 - PERMISSION TO FILE ADDITIONAL
DOCUMENTS/FACTS/ANNEXURES
IA No. 240922/2023 - STAY APPLICATION
IA No. 214764/2023 - STAY APPLICATION)

WITH
W.P.(C) No. 1336/2023 (PIL-W)
(IA No. 22042/2024 - APPROPRIATE ORDERS/DIRECTIONS
IA No. 209243/2024 - INTERVENTION/IMPLEADMENT
IA No. 10426/2024 - PERMISSION TO FILE ADDITIONAL
DOCUMENTS/FACTS/ANNEXURES
IA No. 44469/2024 - PERMISSION TO FILE ADDITIONAL
DOCUMENTS/FACTS/ANNEXURES
IA No. 247593/2023 - STAY APPLICATION

W.P.(C) No. 1375/2023 (PIL-W)
(IA No. 217032/2024 - INTERVENTION/IMPLEADMENT

W.P.(C) No. 42/2024 (PIL-W)
(IA No. 14901/2024 - GRANT OF INTERIM RELIEF

W.P.(C) No. 85/2024 (PIL-W)
(FOR EXEMPTION FROM FILING O.T. ON IA 30155/2024
IA No. 30155/2024 - EXEMPTION FROM FILING O.T.)

W.P.(C) No. 152/2024 (PIL-W)
(FOR STAY APPLICATION ON IA 55916/2024
IA No. 55916/2024 - STAY APPLICATION)

Date : 04-03-2025 These matters were called on for hearing today.

CORAM :
HON'BLE MR. JUSTICE B.R. GAVAI
HON'BLE MR. JUSTICE AUGUSTINE GEORGE MASIH

For Petitioner(s) :
Mr. Gopal Sankaranarayanan, Sr. Adv.
Mr. Satyajit Sarna, Adv.
Mr. Prashant Padmanabhan, AOR
Mr. Sudev Juneja, Adv.
Mr. Vishal Sinha, Adv.

Mr. Prashanto Chandra Sen, Sr. Adv.
Mr. Kaushik Choudhury, AOR
Ms. Shibani Ghosh, Adv.
Mr. Saksham Garg, Adv.
Mr. Jyotirmoy Chatterjee, Adv.

Ms. Anitha Shenoy, Sr. Adv.
Ms. Srishti Agnihotri, AOR
Ms. Ayushma Awasthi, Adv.
Ms. Sanjana Grace Thomas, Adv.
Ms. Shreepurna Dasgupta, Adv.
Ms. Tara Elizabeth Kurien, Adv.

Mr. Shyam Divan, Sr. Adv.
Ms. Madhusmita Bora, AOR
Mr. Pawan Kishore Singh, Adv.
Mr. Dipankar Singh, Adv.
Ms. Pavithra V., Adv.
Mr. Sudipto Sircar, Adv.

Mr. Prashant Bhushan, AOR
Ms. Neha Rathi, Adv.
Ms. Kajal Giri, Adv.
Mr. Kamal Kishore, Adv.

Mr. Balraj Singh Malik, Adv.
Ms. Seema Sindhu, Adv.
Ms. Tannu, Adv.

Mr. R. C. Kaushik, AOR

For Respondent(s) :

Ms. Aishwarya Bhati, A.S.G.
Ms. Ruchi Kohli, Sr. Adv.
Mr. Gurmeet Singh Makker, AOR
Ms. Bani Dixit, Adv.
Mr. Rajat Nair, Adv.
Mr. Sridhar Pottaraju, Adv.
Mr. Kanu Agarwal, Adv.
Mr. Rohan Gupta, Adv.

Mrs. Aishwarya Bhati, A.S.G.
Ms. Ruchi Kohli, Sr.Adv.
Ms. Bani Dikshit, Adv.
Mr. Rajat Nair, Adv.
Mr. Sridhar Potaraju, Adv.
Mr. Kanu Agrawal, Adv.
Mr. Umesh Babu Chourasia, Adv.
Dr. N. Visakamurthy, AOR

Mr. K.N. Balgopal,Sr.Adv.
Ms. K. Enatoli Sema,Adv.
Mr. Amit Kr. Singh,Adv.

Mr. Abhimanyu Tewari, AOR
Ms. Eliza Bar, Adv.

Mr. Debojit Borkakati, AOR

Mr. Lenin Singh Hijam, Adv. Gen, Sr. Adv.
Mr. Pukhrambam Ramesh Kumar, AOR
Mrs. Anupama Ngangom, Adv.
Mr. Karun Sharma, Adv.
Ms. Rajkumari Divyasana, Adv.

Mr. Tejaswi Kumar Pradhan, AOR

Mr. Prakash Ranjan Nayak, AOR
Mr. Debasis Jena, Adv.

Ms. Anitha Shenoy, Sr. Adv.
Ms. Rashmi Nandakumar, AOR
Ms. Ayushma Awasthi, Adv.
Ms. Yashmita Pandey, Adv.

Dr. Abhishek Atrey, AOR
Ms. Ishita Bist, Adv.
Ms. Ambika Atrey, Adv.
Ms. Jyoti Verma, Adv.

Mr. Nishe Rajen Shonker, AOR
Mrs. Anu K Joy, Adv.
Mr. Alim Anvar, Adv.
Mr. Santhosh K, Adv.

Applicant-in-person

Mr. Naveen Kumar, AOR
Ms. Stuti Bisht, Adv.
Mr. Maitreya, Adv.
Mr. Nitesh Bhandari, Adv.
Mr. Prabhat Kumar Rai, Adv.
Mr. Aditya Goyal, Adv.
Mr. Ujjawal Kumar Rai, Adv.
Ms. Esha Kumar, Adv.
Ms. Nidhi Singh, Adv.
Ms. Aprajita Bhardwaj, Adv.
Mr. Shourajeet Chakravarty, Adv.
Mr. Utkarsh Chandra, Adv.

Mr. Anantha Narayana M.G., AOR
Mr. Atul Shankar Vinod, AOR

Mr. Sameer Abhyankar,Adv.
Mr. Rahul Kumar,Adv.
Mr. Aakash Thakur,Adv.
Ms. Yashika Sharma,Adv.
Ms. Ripul Swati Kumari,Adv.
Mr. Krishna Rastogi,Adv.

Mr. Divyanshu Kumar Srivastava,Adv.
Mr. Yash Jain,Adv.

UPON hearing the counsel the Court made the following

O R D E R

1. The main grievance as raised by the petitioners/applicant(s) was that the Forest (Conservation) Amendment Act, 2023 has an effect of diluting the definition of 'forest' as defined by this Court in its order dated 12th December, 1996 rendered in T.N. Godavarman v. Union of India (W.P.(C) No.202/1995). It is their contention that as per the order in T.N. Godavarman (supra) the definition of 'forest' has to be understood in the dictionary sense. It is submitted that Section 1A of the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 (for short, 'the Adhiniyam') is likely to restrict the definition of forest and exclude the aforesaid

category of forest, as understood in accordance with the dictionary sense, from the ambit of the Forest (Conservation) Act, 1980.

2. It is further the contention of the petitioners/applicant(s) that the Union of India or the States/Union Territories would be using the land, which in fact is a forest but not recorded as forest like the denuded forest or the private forest etc., for compensatory afforestation. It is submitted that this would, in turn, reduce the forest coverage.

3. This Court, on 30th November, 2023 itself had recorded the statement of the then Additional Solicitor General of India appearing on behalf of the Union of India that there was no intention to dilute the scope of forest, as defined/held in the judgment/order of this Court in T.N. Godavarman (supra). The learned Additional Solicitor General had also stated that the exemptions which will be granted under sub-Section (2) of Section 1A of the Adhihiyam would be granted in accordance with the guidelines that the Central Government would be notifying in accordance with sub-section (3) thereof.

4. The matter was thereafter heard by this Court on 19th February, 2024. On that day, this Court reiterated the directions given in the case of T.N. Godavarman (supra) and also directed that pending the completion of exercise by the administrations of the State Governments and Union Territories under Rule 16 of the Van (Sanrakshan Evam Samvardhan) Rules, 2023 (for short, 'the Rules of 2023'), the principle which was elucidated in the judgment of this Court in the case of T.N. Godavarman (supra) must continue to be observed.

5. Subsequently, when the matter was listed before this Court, on 3rd February 2025, an apprehension was expressed that the States or the Union of India would use forest land for linear projects etc., without doing compensatory afforestation thereby leading to reduction of the forest areas. As such, we passed the following order:-

> "4. We make it clear that until further orders, no steps will be taken by the Union of India or any

of the States, which will lead to reduction of the forest land unless a compensatory land is provided either by the State Government or the Union of India for the purpose of afforestation."

6. The learned senior counsel as well as other counsel appearing on behalf of the petitioners/applicant(s) submit that the State Governments or the Union of India would use the forest land which is not yet recorded as forest land for the purpose of compensatory afforestation, which would not be permissible in view of the judgment/order of this Court in the case of T.N. Godavarman (supra).

7. Ms. Aishwarya Bhati, learned Additional Solicitor General, submits that in pursuance to the directions issued by this Court, the Union of India has sought information from various State Governments/Union Territories. She relies on the additional affidavit dated 28.02.2025 filed on behalf of the Ministry of Environment, Forest and Climate Change. A perusal of the same would reveal that certain State Governments and Union Territories have not even appointed Experts Committees, as are required to be constituted as per the directions of this Court. The said affidavit would further show that most of the State Governments and Union Territories have not completed the work required to be undertaken in accordance with Rule 16(1) of the Rules of 2023.

8. Sub-rule (1) of Rule 16 of the Rules of 2023 requires all the State Governments and the Union Territories to prepare a consolidated record of such lands including the forest like areas identified by the Experts Committee constituted for this purpose, unclassed forest lands or community forest lands on which the provisions of the Adhiniyam shall be made applicable.

9. We find that once an exercise, as required to be done under sub-rule (1) of Rule 16 of the Rules of 2023 is complete, it will lead to resolution of many issues. It is therefore necessary that all the State Governments and the Union Territories should make an earnest effort to complete the said exercise within a stipulated

period. While doing so, the State Governments/Union Territories would also be bound to follow the guidelines as issued by this Court in its order dated 6th July, 2011 in the case of Lafarge Umiam Mining Private Limited, (2011) 7 SCC 338, which reads thus:-

> "(*vii*) Creation and regular updating of a GIS based decision support database, tentatively containing inter alia the district-wise details of the location and boundary of (*i*) each plot of land that may be defined as forest for the purpose of the Forest (Conservation) Act, 1980; (*ii*) the core, buffer and eco-sensitive zone of the protected areas constituted as per the provisions of the Wild Life (Protection) Act, 1972; (*iii*) the important migratory corridors for wildlife; and (*iv*) the forest land diverted for non-forest purpose in the past in the district. The Survey of India toposheets in digital format, the forest cover maps prepared by the Forest Survey of India in preparation of the successive State of Forest Reports and the conditions stipulated in the approvals accorded under the Forest (Conservation) Act, 1980 for each case of diversion of forest land in the district will also be part of the proposed decision support database."

10. We, therefore, direct all the State Governments and the Union Territories, in which the Experts Committees have not yet been constituted, to constitute such committees within a period of one month from today. The said committees shall complete the exercise, as required under Rule 16(1) of the Rules of 2023 along with the directions issued by this Court in the case of Lafarge Umiam Mining Private Limited (supra), within a period of six months from today and submit a report to the Union of India.

11. The Union of India shall consolidate the reports, prepare state-wise position and place the same before this Court.

12. In the meantime, we reiterate the statement made by the then learned Additional Solicitor General of India, which was recorded by this Court in the order dated 30th November, 2023 as well as the directions issued by this Court in paragraph 18 of the order dated 19th February, 2024 and also the directions which were issued by this Court in its order dated 3rd February, 2025.

13. List on 09.09.2025.

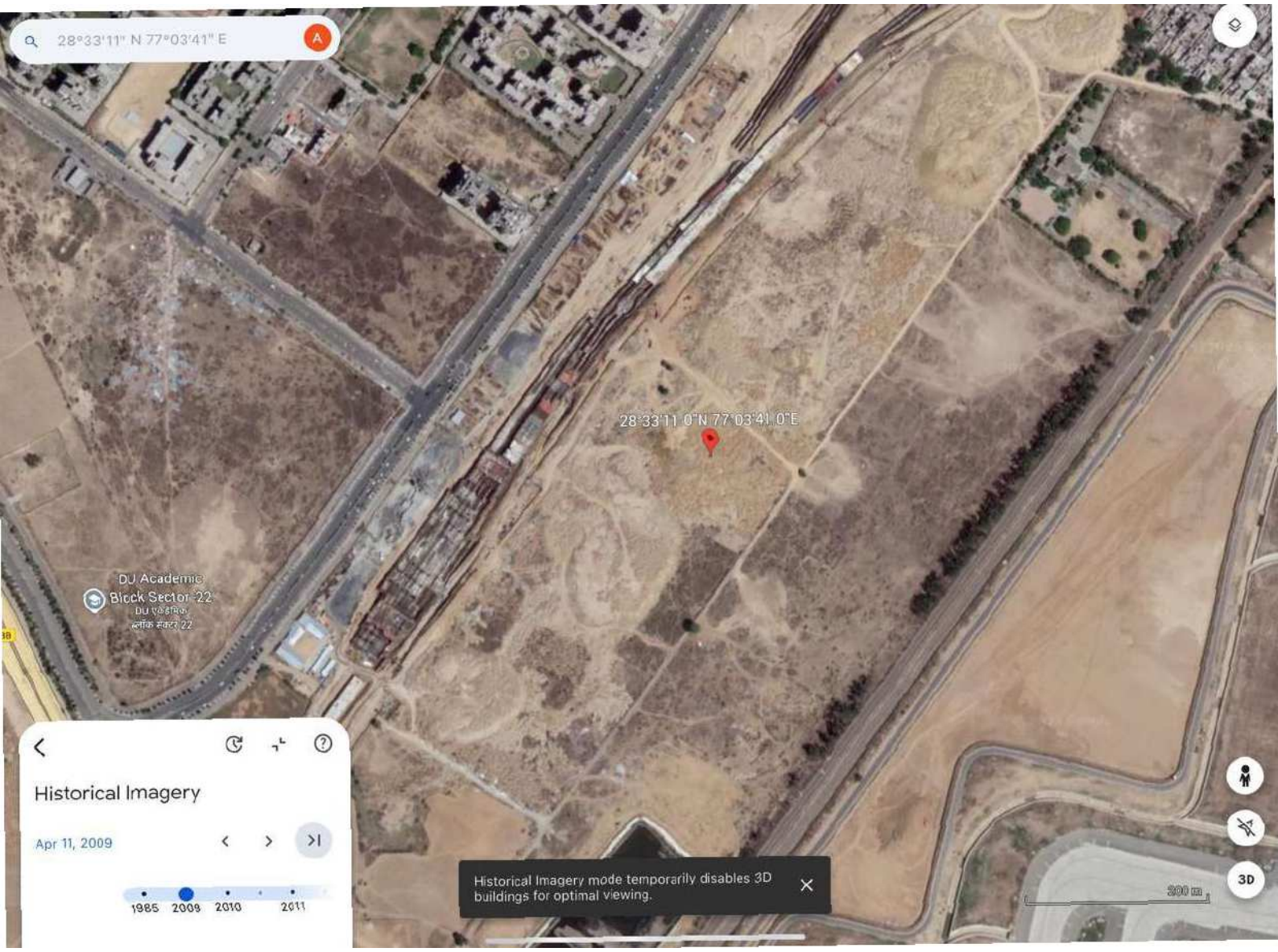
14. The Registrar concerned of this Court shall communicate this order to the Chief Secretary of all the State Governments and also to the Administrator of all the Union Territories.

15. We clarify that if the aforesaid directions are not complied with in letter and spirit by the State Governments and the Union Territories before the next date, we will hold Chief Secretaries/Administrators concerned personally responsible for the said lapse and consider taking such steps as would be found appropriate in the circumstances.

(NARENDRA PRASAD)
DEPUTY REGISTRAR

(ANJU KAPOOR)
COURT MASTER

Annexure R-7


28°33'11" N 77°03'41" E
28°33'11.0"N 77°03'41.0"E
DU Academic Block Sector 22
Historical Imagery
Apr 11, 2009
1985
2009
2010
2011
Historical Imagery mode temporarily disables 3D buildings for optimal viewing.
300 m
3D

IN THE HIGH COURT OF JUDICATURE AT MADRAS

(Special Original Jurisdiction)

Friday, the Twenty Eighth day of July Two Thousand Seventeen

PRESENT

THE HON`BLE MS.INDIRA BANERJEE, THE CHIEF JUSTICE

and

THE HON`BLE MR.JUSTICE M.M.SUNDRESH

and

THE HON`BLE MR.JUSTICE M.SUNDAR

WP No.10614 of 2017

WP(MD).Nos.20767, 18748 of 2013

WP.MD.Nos.14699, 16485 of 2015

WP.No.3075 of 2017

WP(MD).Nos.4646, 5456 & 2847 of 2017

Cont.P.(MD).Nos.1340 of 2014

and Cont.P.(MD).773 of 2017

V.MEGANATHAN [PETITIONER IN WP.10614/17]
ADVOCATES, NO.1/463, PONNIAMMAN
KOIL STREET, NANMANGALAM,
CHENNAI - 600 129.

KARUPURAJA S/O.MUTHU RAJA, [PETITIONER IN WP(MD) 20767/2013]
PALAYANOOR VILLAGE, THIRUPUVANAM TALUK,
SIVAGANGAI DISTRICT.

C. ANAND RAJ [PETITIONER IN WP(MD).18748/2013]

M.PATTURAJAN [PETITIONER IN WP(MD).14699/2015]

VAIKO GENERAL SECRETARY, [PETITIONER IN WP.(MD).16485/15]
MARUMALARCHI DRAVIDA MUNETRA
KALAGAM (MDMK),
NO.12, RUKMANI LAKSHMIPATHISALAI,
EGMORE, CHENNAI - 600 008.

MR.SHARATH.P.NAIR, [PETITIONER IN WP.3075/17]

A.KARTHIKEYAN, [PETITIONER IN WP(MD).4646/2017]

M. SEENI MOHAMMED [PETITIONER IN WP(MD).5456/2017]

G.RAMESH [PETITIONER IN WP(MD).2847/2017]

C. ANAND RAJ [PETITIONER IN CONT P(MD).1340/14]

Vs

1 CHIEF SECRETARY [1 TO 6 RESPONDENTS WP.10614/17]
GOVERNMENT OF TAMIL NADU, SECRETARIAT, FORT
ST. GEORGE, CHENNAI - 600 009.

2 PRINCIPAL SECRETARY TO
GOVERNMENT, ENVIRONMENT & FOREST DEPARTMENT,
GOVERNMENT OF TAMIL NADU, SECRETARIAT, FORT
ST. GEORGE, CHENNAI- 600 009.

3 THE DISTRICT COLLECTOR
KANCHEEPURAM DISTRICT, KANCHEEPURAM.

4 CHIEF WILDLIFE WARDEN
GUINDY ,CHILDRENS PARK, RAJ BHAVAN POST,
CHENNAI - 600 032.

5 DIRECTOR
INDIAN INSTITUTE OF TECHNOLOGY, BESIDES
ADYAR CANCER INSTITUTE SARDAR PATEL ROAD,
ADYAR, CHENNAI- 600 036.

6 DREEM WORLD FOUNDATION,
REP. BY ITS FINANCE TRUSTEE, S. MOHAMED
YUSUF ALI, S/O. SAHABUTHEEN, NO. 3/64,
ATHIYUTHU, RAMANATHAPURAM (TK) & DIST.

R6 IS IMPLEADED AS PER ORDER DT.11.05.2017 BY CJ, MMSJ AND MSJ IN WMP. NO.13238/2017 IN WP. NO. 10614/2017.

1 THE CHIEF SECRETARY GOVERNMENT [1 TO 35 RESPONDENTS IN
OF TAMIL NADU, SECRETARIAT, WP(MD) 20767/2013]
ST. GEORGE FORT, CHENNAI 009.

2 THE SECRETARY TO GOVERNEMENT GOVERNEMNT OF TAMIL NADU,
ENVIRONMENT & FOREST DEPARTMENT, SECRETARIAT, ST. GEORGE FORT,
CHENNAI 009.

3 THE SECRETARY TO GOVERNEMENT GOVERNMENT OF TAMIL NADU, PWD
SECRETARIAT, ST. GEORGE FORT, CHENNAI 009.

4 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, MADURAI
DISTRICT.

5 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, ARIYALUR DISTRICT.

6 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, CHENNAI DISTRICT.

7 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, COIMBATORE DISTRICT.

8 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, CUDDALORE DISTRICT.

9 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, DHARMAPURI DISTRICT.

10 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, DINDIGUL DISTRICT.

11 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, ERODE DISTRICT.

12 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, KANCHEEPURAM DISTRICT.

13 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, KANYAKUMARI DISTRICT.

14 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, KARUR DISTRICT.

15 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, KRISHNAGIRI DISTRICT.

16 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, NAGAPATTINAM DISTRICT.

17 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, NAMAKKAL DISTRICT.

18 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, PERAMBALUR DISTRICT.

19 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, PUDUKOTTAI DISTRICT.

20 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, RAMANATHAPURAM DISTRICT.

21 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, SALEM DISTRICT.

22 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, SIVAGANGAI DISTRICT.

23 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THANJAVUR DISTRICT.

24 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THENI DISTRICT.

25 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THE NILGIRIS DISTRICT.

26 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, TIRUNELVELI DISTRICT.

27 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THIRUVANNAMALAI DISTRICT.

28 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THIRUVARUR DISTRICT.

29 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THIRUPPUR DISTRICT.

30 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THIRUVALLUR DISTRICT.

31 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, TIRUCHURAPPALI DISTRICT.

32 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, TUTICORIN DISTRICT.

33 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, VELLORE DISTRICT.

34 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, VILLUPURAM DISTRICT.

35 THE DISTRICTCOLLECTOR COLLECTOR OFFICE COMPLEX, VIRUDHUNAGAR DISTRICT.

(R4 TO 35 ARE IMPLEADED VIDE COURT ORDER DT.31/01/17 IN WMP(MD) 1231/17

1 THE CHIEF SECRETARY [1 TO 7 RESPONDENTS IN WP.18748/13]
GOVERNMENT OF TAMILNADU, SECRETARIAT, CHENNAI-9.

2 THE SECRETARY TO GOVERNMENT
GOVERNMENT OF TAMILNADU,ENVIRONMENT
OF FOREST DEPARTMENT, SECRETARIAT,
ST.GEORGE FORT, CHENNAI 009.

3 THE SECRETARY TO GOVERNMENT
GOVERNMENT OF TAMILNADU, PUBLIC
WORKS DEPARTMENT,SECRETARIAT,
ST.GEORGE FORT, CHENNAI 009.

4 THE DISTRICT COLLECTOR OFFICE
OF THE DISTRICT COLLECTOR,MADURAI.

5 THE COMMISSIONER MADURAI MUNICIPAL
CORPORATION, ANNA MALIGAI, MADURAI.

6 THE EXEC UTIVE ENGINEER PUBLIC
WORKS & WATER RESOURCES ORGANIZATION,
PERIYAR VAIGAI BASIN PROJECT,
THALLAKULAM, MADURAI-2.

7 THE CHIEF ENGINEEER PUBLIC
WORK DEPARTMENT MADURAI

R7 IMPLEADED AS PER ORDER DATED 13.12.2013.

1 THE COMMISSIONER MADURAI [1 TO 3 RESPONDENTS IN WP(MD) .
CITY MUNICIPAL CORPORATION, ANNA MALIGAI, MADURAI. 14699 /2015]

2 THE CHIEF ENGINEER PUBLIC WORKS DEPARTMENT, THALLAKULAM, MADURAI

3 OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR FOREST, SOUTHERN
REGION, MADURAI

1 THE CHIEF SECRETARY RESPONDENTS IN WP.(MD).16485/15]
GOVERNMENT OF TAMIL NADU, SECRETARIAT,
FORT ST. GEORGE, CHENNAI - 600 009.

2 THE SECRETARY TO GOVERNMENT GOVERNMENT OF TAMIL NADU, ENVIRONMENT
& FOREST DEPARTMENT, SECRETARIAT, FORT ST. GEORGE, CHENNAI - 600
009.

3 THE SECRETARY TO GOVERNMENT GOVERNMENT OF TAMIL NADU, PUBLIC
WORKS DEPARTMENT, SECERETARIAT, FORT ST.GEORGE, CHENNAI - 600 009.

4 THE DISTRICT COLLECTOR MADURAI DISTRICT, MADURAI.

5 THE DISTRICT COLLECTOR SIVAGANGAI DISTRICT, SIVAGANGAI.

6 THE DISTRICT COLLECTOR DINDIGUL DISTRICT, DINDIGUL.

7 THE DISTRICT COLLECTOR THENI DISTRICT, THENI.

8 THE DISTRICT COLLECTOR RAMANATHAPURAM, RAMANATHAPURAM DIST.

9 THE DISTRICT COLLECTOR KANYAKUMARI DISTRICT, KANYAKUMARI.

10 THE DISTRICT COLLECTOR TRICHY DISTRICT, TRICHY.

11 THE DISTRICT COLLECTOR PUDUKOTTAI DISTRICT, PUDUKOTTAI.

12 THE DISTRICT COLLECTOR THANJAVUR DISTRICT, THANJAVUR.

13 THE DISTRICT COLLECTOR KARUR DISTRICT, KARUR.

14 THE DISTRICT COLLECTOR VIRUDHUNAGAR DISTRICT, VIRUDHUNAGAR.

15 THE DISTRICT COLLECTOR TUTICORIN DISTRICT, TUTICORIN.

16 THE DISTRICT COLLECTOR TIRUNELVELI DISTRICT, TIRUNELVELI.

17 S.M.ANANTHAMURUGAN S/O.MARIAPPAN, NO.3/1, JAMIN SALVARPATTI, NARANAPURAM POST, SIVAKSI EAST, VIRUDHUNAGAR TALUK, VIRUDHUNAGAR DISTRICT.

(R17 IS IMPLEADED VIDE COURT ORDER DT.28/10/15 IN MP(MD)2/15 BY RSJ & VMVJ)

18. THE DISTRICT COLLECTOR ERODE DISTRICT, ERODE.

19. THE DISTRICT COLLECTOR THIRUPPUR DISTRICT, THIRUPPUR.

20. THE DISTRICT COLLECTOR COIMBATORE DISTRICT, COIMBATORE.

21. THE DISTRICT COLLECTOR NILGIRIS DISTRICT, OOTY.

22. THE DISTRICT COLLECTOR KRISHNAGIRI DISTRICT, KRISHNAGIRI

23. THE DISTRICT COLLECTOR DHARMAPURI DISTRICT, DHARMAPURI.

24. THE DISTRICT COLLECTOR SALEM DISTRICT, SALEM.

25. THE DISTRICT COLLECTOR NAMAKAL DISTRICT, NAMAKAL.

26. THE DISTRICT COLLECTOR PERAMBALUR DISTRICT, PERAMBALUR.

27. THE DISTRICT COLLECTOR ARIYALUR DISTRICT, ARIYALUR.

28. THE DISTRICT COLLECTOR THIRUVARUR DISTRICT, THIRUVARUR.

29. THE DISTRICT COLLECTOR NAGAPATTINAM DISTRICT, NAGAPATTINAM.

30. THE DISTRICT COLLECTOR CUDDALORE DISTRICT, CUDDALORE.

31. THE DISTRICT COLLECTOR VILLUPURAM DISTRICT, VILLUPURAM.

32. THE DISTRICT COLLECTOR VELLORE DISTRICT. VELLORE

33. THE DISTRICT COLLECTOR KANJIPURAM DISTRICT, KANJIPURAM.

34. THE DISTRICT COLLECTOR THIRUVALLUR DISTRICT. THIRUVALLUR.

35. THE DISTRICT COLLECTOR CHENNAI DISTRICT, CHENNAI. (R18 TO 35 ARE IMPLEADED VIDE COURT ORDER DT.10/2/2017 IN WMP(MD)1775/17)

36. THE DISTRICT COLLECTOR THIRUVANNAMALAI DISTRICT, THIRUVANNAMALAI.

37. THE CHAIRMAN NATIONAL HIGHWAYS AUTHORITY OF INDIA, G-5 & 6, SECTO10, DWARKA, NEW DELHI-110 075.

38. THE CHAIRMAN PORT OF CHENNAI, NO.1, RAJAJI SALAI, CHENNAI-600 001.

39 THE TASHILDAR, TALUK OFFICE, ARIYALUR, ARIYALUR DISTRICT.

40 THE TAHSILDAR, TALUK OFFICE, SENDURAI, ARIYALUR DISTRICT.

41 THE TAHSILDAR, TALUK OFFICE UDAYARPALAYAM, ARIYALUR DISTRICT.

42THE TASHILDAR, TALUK OFFICE, COIMBATORE NORTH, COIMBATORE DISTRICT.

43THE TAHSILDAR, TALUK OFFICE, COIMBATORE SOUTH, COIMBATORE DISTRICT.

44 THE TAHSILDAR, TALUK OFFICE, METTUPALAYAM, COIMBATORE DISTRICT.

45 THE TAHSILDAR, TALUK OFFICE, POLLACHI, COIMBATORE DISTRICT.

46 THE TAHSILDAR, TALUK OFFICE, SULUR, COIMBATORE DISTRICT.

47 THE TAHSILDAR, TALUK OFFICE, VALPARAI, COIMBATORE DISTRICT.

48 THE TAHSILDAR, TALUK OFFICE, DHARMAPURI, DHARMAPURI DISTRICT.

49 THE TAHSILDAR, TALUK OFFICE, HARUR, DHARMAPURI DISTRICT.

50 THE TAHSILDAR, TALUK OFFICE, PALAKCODE, DHARMAPURI DISTRICT.

51 THE TAHSILDAR, TALUK OFFICE, PAPPIREDDIPATTI, DHARMAPURI DISTRICT.

52 THE TAHSILDAR, TALUK OFFICE, PENNAGARAM, DHARMAPURI DISTRICT.

53 THE TAHSILDAR, TALUK OFFICE, BHAVANI, ERODE DISTRICT.

54TAHSILDAR, TALUK OFFICE, ERODE, ERODE DISTRICT.

55 THE TAHSILDAR, TALUK OFFICE, GOBICHETIPALAYAM, ERODE DISTRICT.

56 THE TAHSILDAR, SATHAYAMANGALAM, ERODE DISTRICT.

57 THE TAHSILDAR, TALUK OFFICE, PERUNDURAI, ERODE DISTRICT.

58THE TAHSILDAR, TALUK OFFICE, AGASTEESWARAM, KANYAKUMARI DISTRICT.

59 THE TAHSILDAR, TALUK OFFICE, KALKULAM, KANYAKUMARI DISTRICT.

60 THE TAHSILAR, TALUK OFFICE, THOVALAI, KANYAKUMARI DISTRICT.

61 THE TAHSILDAR, TALUK OFFICE, VILAVANCODE, KANYAKUMARI DISTRICT.

62 THE TAHSILDAR, TALUK OFFICE, DENKANIKOTTAI, KRISHNAGIRI DISTRICT.

63 THE TAHSILDAR, TALUK OFFICE, HOSUR, KRISHNAGIRI DISTRICT.

64 THE TAHSILDAR, TALUK OFFICE, KRISHNAGIRI, KRISHNAGIRI DISTRICT.

65 THE TAHSILDAR, TALUK OFFICE POCHAMPALLI, KRISHNAGIRI DISTRICT.

66 THE TAHSILDAR, TALUK OFFICE, UTHANGARAI, KRISHNAGIRI DISTRICT.

67 THE TAHSILDAR, TALUK OFFICE, KILVELUR, NAGAPATTINAM DISTRICT.

68 THE TAHSILDAR, TAKUK OFFICE, KUTTHALAM, NAGAPATTINAM DISTRICT.

69 THE TAHSILDAR, TALUK OFFICE, MAYILADUTHURAI, NAGAPATTINAM DISTRICT.

70 THE TAHSILDAR, TALUK OFFICE, NAGAPPATTINAM, NAGAPATTINAM DISTRICT.

71 THE TAHSILDAR, TALUK OFFICE, SIRKALI, NAGAPATTINAM DISTRICT.

72 THE TAHSILDAR, TALUK OFFICE, THIRUKKUVALAI, NAGAPATTINAM DISTRICT.

73 THE TAHSILDAR, TALUK OFFICE, THARANGAMBADI, NAGAPATTINAM DISTRICT.

74 THE TAHSILDAR, TALUK OFFICE, VEDARANYAM, NAGAPATTINAM DISTRICT.

75 THE TAHSILDAR, TALUK OFFICE, EGMORE NUMGAMBAKKAM, CHENNAI DISTRICT.

76 THE TAHSILDAR, TALUK OFFICE, FORT TONDIARPET,CHENNAI DISTRICT.

77 THE TAHSILDAR, TALUK OFFICE, MAMBALAM GUINDY, CHENNAI DISTRICT.

78 THE TAHSILDAR, TALUK OFFICE, MYLAPORE TRIPLICANCE, CHENNAI DISTRICT.

79 THE TAHSILDAR, TALUK OFFICE, PERAMBUR PURASWALKAM, CHENNAI DISTRICT.

80 THE TAHSILDAR, TALUK OFFICE, CHIDAMBARAM, CUDDALORE DISTRICT.

81 THE TAHSILDAR, TALUK OFFICE, CUDDALORE,CUDDALORE DISTRICT.

82THE TAHSILDAR, TALUK OFFICE, KATTUMANNARKOIL, CUDDALORE DISTRICT.

83 THE TAHSILDAR, TALUK OFFICE KURINIJIPADI, CUDDALORE DISTRICT.

84 THE TAHSILDAR, TALUK OFFICE, PANRUTI, CUDDALORE DISTRICT.

85 THE TAHSILDAR, TALUK OFFICE, TITAKUDI, CUDDALORE DISTRICT.

86 THE TAHSILDAR, TALUK OFFICE, VRIDACHALAM, CUDDALORE DISTRICT.

87THE TAHSILDAR, TALUK OFFICE, ATTUR, DINDIGUL DISTRICT.

88 THE TAHSILDAR, TALUK OFFICE, DINDIGUL, DINDIGUL DISTRICT.

89 THE TAHSILDAR, TALUK OFFICE, KODAIKANAL, DINDIGUL DISTRICT.

90 THE TAHSILDAR, TALUK OFFICE, NATHAM, DINDIGUL DISTRICT.

91 THE TAHSILDAR, TALUK OFFICE, NILAKOTTAI, DINDIGUL DISTRICT.

92THE TAHSILDAR, TALUK OFFICE, ODDANCHATRAM, DINDIGUL DISTRICT.

93 THE TAHSILDAR, TALUK OFFICE, PALANI, DINDIGUL DISTRICT.

94 THE TAHSILDAR, TALUK OFFICE, VEDASANDUR, DINDIGUL DISTRICT.

95 THE TAHSILDAR, TALUK OFFICE, ALANTHUR, KANCHEEPURAM DISTRICT.

96 THE TAHSILDAR, TALUK OFFICE, CHENGALPATTU, KANCHEEPURAM DISTRICT.

97 THE TAHSILDAR, TALUK OFFICE, CHEYYUR, KANCHEEPURAM DISTRICT.

98 THE TAHSILDAR, TALUK OFFICE, CHOLINGANALLUR, KANCHEEPURAM DISTRICT.

99 THE TAHSILDAR, TALUK OFFICE, KANCHEEPURAM, KANCHEEPURAM DISTRICT.

100 THE TAHSILDAR, TALUK OFFICE, MADHURANTHANGAM, KANCHEEPURAM DISTRICT.

101 THE TAHSILDAR, TALUK OFFICE, SRIPERUMBUDUR, KANCHEEPURAM DISTRICT.

102 THE TAHSILDAR, TALUK OFFICE, THAMBARAM, KANCHEEPURAM DISTRICT.

103 THE TAHSILDAR, TALUK OFFICE, TIRUKLUKUNDRAM, KANCHEEPURAM DISTRICT.

104 THE TAHSILDAR, TALUK OFFICE, UTHIRAMERUR, KANCHEEPURAM DISTRICT

105 THE TAHSILDAR, TALUK OFFICE, ARAVAKURICHI, KARUR DISTRICT.

106 THE TAHSILDAR, TALUK OFFICE, KADAVUR, KARUR DISTRICT.

107 THE TAHSILDAR, TALUK OFFICE, KARUR, KARUR DISTRICT.

108 THE TAHSILDAR, TALUK OFFICE, KRISHNARAYAPURAM, KARUR DISTRICT.

109THE TAHSILDAR, TALUK OFFICE, KULITHALAI, KARUR DISTRICT.

110 THE TAHSILDAR, TALUK OFFICE, MADURAI NORTH, MADURAI DISTRICT.

111 THE TAHSILDAR, TALUK OFFICE, MADURAI SOUTH, MADURAI DISTRICT.

112 THE TAHSILDAR, TALUK OFFICE, MELUR, MADURAI DISTRICT.

113 THE TAHSILDAR, TALUK OFFICE, Y.OTHAKKADAI, MADURAI DISTRICT.

114 THE TAHSILDAR, TALUK OFFICE, PERAIYUR, MADURAI DT.

115 THE TAHSILDAR, TALUK OFFICE, THIRUMANGALAM,MADURAI DT.

116 THE TAHSILDAR, TALUK OFFICE, USILAMPATTI, MADURAI DT.

117 THE TAHSILDAR, TALUK OFFICE, VADIPATTI, MADURAI DT.

118 THE TAHSILDAR, TALUK OFFICE NAMAKKAL, NAMAKKAL DT

119 THE TAHSILDAR, TALUK OFFICE, PARAMATHI VELUR, NAMAKKAL DT.

120 THE TAHSILDAR, TALUK OFFICE, RASIPURAM, NAMAKKAL DT.

121 THE TAHSILDAR, TALUK OFFICE, THIRUCHENGODE,NAMAKKAL DT.

122 THE TAHSILDAR, TALUK OFFICE, KUNNAM, PERAMBALUR DT.

123 THE TAHSILDAR, TALUK OFFICE, PERAMBALUR, PERAMBALUR DT.

124 THE TAHSILDAR, TALUK OFFICE, VEPPANTHATTAI, PERAMBALUR DT.

125 THE TAHSILDAR, TALUK OFFICE, KADALADI, RAMANATHAPURAM DT.

126 THE TAHSILDAR, TALUK OFFICE, KAMUTHI, RAMANATHAPURAM DT.

127 THE TAHSILDAR, TALUK OFFICE, MUDUKULATHUR, RAMANATHAPURAM DT.

128 THE TAHSILDAR, TALUK OFFICE, PARAMAKUDI, RAMANATHAPURAM DT.

129 THE TAHSILDAR, TALUK OFFICE, RAMANATHAPURAM, RAMANATHAPURAM DT.

130 THE TAHSILDAR, TALUK OFFICE, RAMESWARAM, RAMANATHAPURAM DT.

131 THE TAHSILDAR, TALUK OFFICE, TIRUVADANAI, RAMANATHAPURAM DT.

132 THE TAHSILDAR, TALUK OFFICE, DEVAKOTTAI, SIVAGANGAI DT.

133 THE TAHSILDAR, TALUK OFFICE, ILAYANKUDI, SIVAGANGAI DT.

134 THE TAHSILDAR, TALUK OFFICE, KARAIKUDI, SIVAGANGAI DT.

135 THE TAHSILDAR, TALUK OFFICE MANAMADURAI, SIVAGANGAI DT.

136 THE TAHSILDAR, TALUK OFFICE, SIVAGANGAI, SIVAGANGAI DT.

137 THE TAHSILDAR, TALUK OFFICE, TIRUPATHUR, SIVAGANGAI DT.

138 THE TAHSILDAR, TALUK OFFICE, ANDIPATTI, THENI DT.

139 THE TAHSILDAR, TALUK OFFICE, BODINAYAKANUR, THENI DT.

140 THE TAHSILDAR, TALUK OFFICE, PERIYAKULAM, THENI DT.

141 THE TAHSILDAR, TALUK OFFICE,THENI, THENI DT.

142 THE TAHSILDAR, TALUK OFFICE, UTHAMAPALAYAM, THENI DT.

143 THE TAHSILDAR, TALUK OFFICE, ALANGULAM, TIRUNELVELI DT.

144 THE TAHSILDAR, TALUK OFFICE, AMBASAMUTHIRAM, TIRUNELVELI DT.

145 THE TAHSILDAR, TALUK OFFICE, NANGUNERI, TIRUNELVELI DT.

146 THE TAHSILDAR, TALUK OFFICE,PALAYAMKOTTAI, TIRUNELVELI DT.

147 THE TAHSILDAR, TALUK OFFICE, RADHAPURAM, TIRUNELVELI DT.

148 THE TAHSILDAR, TALUK OFFICE, SANKARANKOVIL, TIRUNELVELI DT.

149 THE TAHSILDAR, TALUK OFFICE, SHENKOTTAI, TIRUNELVELI DT.

150 THE TAHSILDAR, TALUK OFFICE, SIVAGIRI, TIRUNELVELI DT.

151 THE TAHSILDAR, TALUK OFFICE, THENKASI, TIRUNELVELI.

152 THE TAHSILDAR, TALUK OFFICE, TIRUNELVELI, TIRUNELVELI DT.

153 THE TAHSILDAR, TALUK OFFICE, VEERAKERALAMPUTHUR, TIRUNELVELI DT.

154 THE TAHSILDAR, TALUK OFFICE, MANUR, TIRUNELVELI DT.

155 THE TAHSILDAR, TALUK OFFICE, KADAYANALLUR, TIRUNELVELI DT.

156 THE TAHSILDAR, TALUK OFFICE,THIRUVENGADAM,TIRUNELVELI DT.

157 THE TAHSILDAR, TALUK OFFICE, ARANI, THIRUVANNAMALAI DT.

158 THE TAHSILDAR, TALUK OFFICE, CHENGAM, THIRUVANNAMALAI DT.

159 THE TAHSILDAR, TALUK OFFICE, CHEYYAR, THIRUVANNAMALAI DT.

160 THE TAHSILDAR, TALUK OFFICE, POLUR, THIRUVANNAMALAI DT.

161 THE TAHSILDAR, TALUK OFFICE, THANDARAMPATTU,THIRUVANNAMALAI DT.

162 THE TAHSILDAR, TALUK OFFICE, THIRVANNAMALAI, THIRUVANNAMALAI DT.

163 THE TAHSILDAR, TALUK OFFICE, VANDAVASI, THIRUVANNAMALAI DT.

164 THE TAHSILDAR, TALUK OFFICE, AVINASHI, TIRUPPUR DT.

165 THE TAHSILDAR, TALUK OFFICE, DHARAPURAM, TIRUPPUR DT.

166 THE TAHSILDAR, TALUK OFFICE, KANGAYAM, TIRUPPUR DT.

167 THE TAHSILDAR, TALUK OFFICE, MADATHUKULAM, TIRUPPUR DT.

168 THE TAHSILDAR, TALUK OFFICE, PALLADAM, TIRUPPUR DT.

169 THE TAHSILDAR, TALUK OFFICE, TIRUPPUR, TIRUPPUR DT.

170 THE TAHSILDAR, TALUK OFFICE, UDUMALPET, TIRUPPUR DT.

171 THE TAHSILDAR, TALUK OFFICE, ETTAYAPURAM, TUTICORIN DT.

172 THE TAHSILDAR, TALUK OFFICE, KOVILPATTI, TUTICORIN DT.

173 THE TAHSILDAR, TALUK OFFICE, OTTAPIDARAM, TUTICORIN DT.

174 THE TAHSILDAR, TALUK OFFICE, SATHANKULAM, TUTICORIN DT.

175 THE TAHSILDAR, TALUK OFFICE, SRIVAIKUNDAM, TUTICORIN DT.

176 THE TAHSILDAR, TALUK OFFICE, THOOTHUKUDI, TUTICORIN DT.

177 THE TAHSILDAR, TALUK OFFICE, TIRUCHENDUR, TUTICORIN DT.

178 THE TAHSILDAR, TALUK OFFICE, VILATHIKULAM, TUTICORIN DT.

179 THE TAHSILDAR, TALUK OFFICE, ALANGUDI, PUDUKKOTTAI DT.

180 THE TAHSILDAR, TALUK OFFICE, ARANTHANGI, PUDUKKOTTAI DT.

181 THE TAHSILDAR, TALUK OFFICE, AVADAIYARKOVIL, PUDUKKOTTAI DT.

182 THE TAHSILDAR, TALUK OFFICE, GANDARVAKOTTAI, PUDUKKOTTAI DT.

183 THE TAHSILDAR, TALUK OFFICE, ILLUPPUR, PUDUKKOTTAI DT.

184 THE TAHSILDAR, TALUK OFFICE, KULATHUR, PUDUKKOTTAI DT.

185 THE TAHSILDAR, TALUK OFFICE, MANAMELKUDI, PUDUKKOTTAI DT.

186 THE TAHSILDAR, TLUK OFFICE, PUDUKOTTAI, PUDUKKOTTAI DT.

187 THE TAHSILDAR, TALUK OFFICE, THIRUMAYAM,PUDUKKOTTAI DT.

188 THE TAHSILDAR, TALUK OFFICE, ATTUR, SALEM DT.

189 THE TAHSILDAR, TALUK OFFICE, EDAPADY SALEM DT.

190 THE TAHSILDAR, TALUK OFFICE, GANGAVALLI, SALEM DT.

191 THE TAHSILDAR, TALUK OFFICE, METTUR, SALEM DISTRICT.

192 THE TAHSILDAR, TALUK OFFICE, OMALUR, SALEM DT.

193 THE TAHSILDAR, TALUK OFFICE, SALEM, SALEM DT.

194 THE TAHSILDAR, TALUK OFFICE SANGAGIRI, SALEM DT.

195 THE TAHSILDAR, TALUK OFFICE VALAPADY,SALEM DT.

196 THE TAHSILDAR, TALUK OFFICE, YERCAUD, SALEM DT.

197 THE TAHSILDAR, TALUK OFFICE, KUMBAKONAM, THANJAVUR DT.

198 THE TAHSILDAR, TLUK OFFICE, ORATHANADU, THANJAVUR DT.

199 THE TAHSILDAR, TALUK OFFICE, PAPANASAM, THANJAVUR DT.

200 THE TAHSILDAR, TALUK OFFICE, PATTUKKOTTAI, THANJAVUR DT.

201 THE TAHSILDAR, TALUK OFFICE, PERAVURANI, THANJAVUR DT.

202 THE TAHSILDAR, TALUK OFFICE, THANJAVUR, THANJAVUR DT.

203 THE TAHSILDAR, TALUK OFFICE, THIRUVAIYARU, THANJAVUR DT.

204 THE TAHSILDAR, TALUK OFFICE, THIRUVIDAIMARUDHUR, THANJAVUR DT.

205 THE TAHSILDAR, TALUK OFFICE, COONOOR, THE NILGIRIS DISTRICT.

206 THE TAHSILDAR, TALUK OFFICE, GUDALUR, THE NILGIRIS DT.

207 THE TAHSILDAR, TALUK OFFICE, KOTAGIRI, THE NILGIRIS DT.

208 THE TAHSILDAR, TALUK OFFICE,KUNDAH, THE NILGIRIS DT.

209 THE TAHSILDAR, TALUK OFFICE,PANTHALUR, THE NILGIRIS DT.

210 THE TAHSILDAR, TALUK OFFICE, UDHAGAMANDALAM, THE NILGIRIS DT.

211 THE TAHSILDAR, TALUK OFFICE, AMBATHUR, THIRUVALLUR DT.

212 THE TAHSILDAR, TALUK OFFICE, GUMMIDIPOONDI, THIRUVALLUR DT.

213 THE TAHSILDAR, TALUK OFFICE, MADHAVARAM THIRUVALLUR DT.

214 THE TAHSILDAR, TALUK OFFICE, PALLIPATTU, THIRUVALLUR DT.

215 THE TAHSILDAR, TALUK OFFICE, PONNERI, THIRUVALLUR DT.

216 THE TAHSILDAR, TALUK OFFICE, PONNAMALLEE, THIRUVALLUR DT.

217 THE TAHSILDAR, TALUK OFFICE, TIRUTTANI, THIRUVALLUR DT.

218 THE TAHSILDAR, TALUK OFFICE, TIRUVALLUR, THIRUVALLUR DT.

219 THE TAHSILDAR, TALUK OFFICE, UTHUKKOTAI, THIRUVALLUR DT.

220 THE TAHSILDAR, TALUK OFFICE, KUDAVASAL, THIRUVARUR DT.

221 THE TAHSILDAR, TALUK OFFICE, MANNARGUDI, THIRUVARUR DT.

222 THE TAHSILDAR, TALUK OFFICE, NANNILAM, THIRUVARUR DT.

223 THE TAHSILDAR, TALUK OFFICE, NEEDAMANGALAM, THIRUVARUR DT.

224 THE TAHSILDAR, TALUK OFFICE, THIRUTHURAIPOONDI, THIRUVARUR DT.

225 THE TAHSILDAR, TALUK OFFICE, THIRUVARUR, THIRUVARUR DT.

226 THE TAHSILDAR, TALUK OFFICE, VALANGAIMAN, THIRUVARUR DT.

227 THE TAHSILDAR, TALUK OFFICE, LALGUDI, TRICHY DT.

228 THE TAHSILDAR, TALUK OFFICE, MANACHANALLUR, TRICHY DT.

229 THE TAHSILDAR, TALUK OFFICE, MANAPPARAI, TRICHY DT.

230 THE TAHSILDAR, TALUK OFFICE, MUSIRI, TRICHY DT.

231 THE TAHSILDAR, TALUK OFFICE, SRIRANGAM, TRICHY DT.

232 THE TAHSILDAR, TALUK OFFICE THIRUERUMPUR, TRICHY DT.

233 THE TAHSILDAR, TALUK OFFICE, THOTTIYAM, TRICHY DT.

234 THE TAHSILDAR, TALUK OFFICE, THURAIYUR, TRICHY DT.

235 THE TAHSILDAR, TALUK OFFICE, TRICHY, TRICHY DT.

236 THE TAHSILDAR, TALUK OFFICE, AMBUR, VELLORE DT.

237 THE TAHSILDAR, TALUK OFFICE,ARAKONAM, VELLORE DT.

238 THE TAHSILDAR, TALUK OFFICE, GUDIYATHAM, VELLORE DT

239 THE TAHSILDAR, TALUK OFFICE, KATPADI, VELLORE DT.

240 THE TAHSILDAR, TALUK OFFICE, TIRUPATTUR, VELLORE DT.

241 THE TAHSILDAR, TALUK OFFICE, VANIYAMPADI, VELLORE DT.

242 THE TAHSILDAR, TALUK OFFICE, VELLORE, VELLORE DT.

243 THE TAHSILDAR, TALUK OFFICE, WALLAJAH, VELLORE DT.

244 THE TAHSILDAR, TALUK OFFICE, GINGEE, VILLUPURAM DT.

245 THE TAHSILDAR, TALUK OFFICE, KALLAKURICHI, VILLUPURAM DT.

246 THE TAHSILDAR, TALUK OFFICE,SANKARAPURAM, VILLUPURAM DT.

247 THE TAHSILDAR, TALUK OFFICE, THINDIVANAM, VILLUPURAM DT.

248 THE TAHSILDAR, TALUK OFFICE,THIRUKOLLUR, VILLUPURAM DT.

249 THE TAHSILDAR, TALUK OFFICE, ULUNDURPET, VLLUPURAM DT.

250 THE TAHSILDAR, TALUK OFFICE, VANUR, VILLUPURAM DT.

251 THE TAHSILDAR, TALUK OFFICE, VILLUPURAM, VILLUPURAM DT.

252 THE TAHSILDAR, TALUK OFFICE, ARUPPUKOTTAI, VIRUDHUNAGAR DT.

253 THE TAHSILDAR, TALUK OFFICE, KARIAPATTI, VIRUDHUNAGAR DT.

254 THE TAHSILDAR, TALUK OFFICE, RAJAPALAYAM, VIRUDHUNAGAR DT.

255 THE HSILDAR, TALUK OFFICE, SATHUR, VIRUDHUNAGAR DT.

256 THE TAHSILDAR, TALUK OFFICE, SIVAKASI, VIRUDHUNAGAR DT.

257 THE TAHSILDAR, TALUK OFFICE, SRIVILLIPUTHUR, VIRUDHUNAGAR DT.

258 THE TAHSILDAR, TALUK OFFICE, TIRUCHULI, VIRUDHUNAGAR DT.

259 THE TAHSILDAR, TALUK OFFICE, VIRUDHUNAGAR, VIRUDHUNAGAR DT.

260 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICER, KANCHIPURAM, KANCHIPURAM DT.

261 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, WALAJABAD, KANCHIPURAM DT.

262 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICER, UTHIRAMERUR, KANCHIPURAM DT.

263 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SRIPERUMBUDUR, KANCHIPURAM DT.

264 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUNDRATHUR, KANCHIPURAM DT.
R265 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPORUR, KANCHIPURAM DT.

266 THE BLOCK DEVELOPMENT BLOCK DEVELOPMENT OFFICE, KATTANKOLATHUR, KANCHIPURAM DT.

267 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUKALUKUNDRAM, KANCHIPURAM DT.

268 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOMAS MALAI, KANCHIPURAM DT.

269 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ACHARAPAKKAM, KANCHIPURAM DT.

270 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADURANTAKAM, KANCHIPURAM DT.

271 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, LATHUR, KANCHIPURAM DT.

272 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHITHAMUR, KANCHIPURAM DT.

273 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VILLIVAKKAM, TIRUVALLUR DISTRICT.

274 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUZHAL, TIRUVALLUR DISTRICT.

275 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MINJUR, TIRUVALLUR DISTRICT.

276 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHOLAVARAM, TIRUVALLUR DISTRICT.

277 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUMMIPOONDI, TIRUVALLUR DISTRICT.

278 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUVALLANGADU, TIRUVALLUR DISTRICT.

279 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUTTANI,TIRUVALLUR DISTRICT.

280 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALLIPET, TIRUVALLUR DISTRICT

281 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, R.K.PET, TIRUVALLUR DISTRICT

282 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUVALLUR, TIRUVALLUR DISTRICT

283 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POONDI, TIRUVALLUR DISTRICT

284 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAMBATHUR, TIRUVALLUR DISTRICT

285 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ELLAPURAM, TIRUVALLUR DISTRICT

286 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POONAMALLEE, TIRUVALLUR DISTRICT

287 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CUDDALORE, CUDDALORE DT.

288 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANNAGRAMAM, CUDDALORE DT.

289 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PANRUTI, CUDDALORE DT.

290 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KURINJIPADI, CUDDALORE DT.

291 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KATTUMANNERKOIL, CUDDALORE DT.

292 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUMARATCHI, CUDDALORE DT.

293 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KEERAPALAYAM, CUDDALORE DT.

294 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELBHUVANAGIRI, CUDDALORE DT.

295 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PARANGIPETTAI, CUDDALORE DT.

296 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VRIDHACHALAM, CUDDALORE DT.

297 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAMMAPURAM, CUDDALORE DT.

298 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NALLUR, CUDDALORE DT.

299 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANGALUR, CUDDALORE DT.

300 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUKOILUR, VILLUPURAM DT.

301 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUGAIYUR, VILLUPURAM DT.

302 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.V.NALLUR VILLUPURAM DT.

303 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUNAVALUR, VILLUPURAM DISTRICT

304 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ULUNDURPET, VILLUPURAM DT

305 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANAI VILLUPURAM DT

306 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE KALIYANUR, VILLUPURAM DT

307 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANDAMANGALAM, VILLUPURAM DT

308 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VIKKIRAVANDI, VILLUPURAM DT

309 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, OLAKKUR, VILLUPURAM DT

310 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MAILAM, VILLUPURAM DT

311 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MARKANAM, VILLUPURAM DT

312 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VANUR, VILLUPURAM DT

313 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GINGEE, VILLUPURAM DT

314 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VALLAM, VILLUPURAM DT

315 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELMALAYANUR, VILLUPURAM DT

316 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALLAKURICHI, VILLUPURAM DT

317 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHINNASALEM, VILLUPURAM DT

318 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RISHIVANDIYAM, VILLUPURAM DT

319 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SANKARAPURAM, VILLUPURAM DT

320 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIYAGADURAGAM, VILLUPURAM DT

321 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALRAYAN HILLS, VILLUPURAM DT

322 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VELLORE, VELLORE DT

323 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANIYAMBADI, VELLORE DISTRICT

324 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANAICUT VELLORE DISTRICT

325 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADHANUR, VELLORE DISTRICT

326 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KATPADI VELLORE DISTRICT

327 THE BLOCK DEVELOPMENT\ OFFICER, BLOCK DEVELOPMENT OFFICE, K.V.KUPPAM, VELLORE DISTRICT

328 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUDIYANATHAM, VELLORE DISTRICT

329 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERNAMBET, VELLORE DISTRICT

330 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, WALAJAH, VELLORE DISTRICT

331 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHOLINGAHUR, VELLORE DISTRICT

332 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARAKONAM, VELLORE DISTRICT

XR333 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, EMILI, VELLORE DISTRICT

334 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAVERIPAKKAM, VELLORE DISTRICT

335 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARCOT, VELLORE DISTRICT

336 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIMIRI, VELLORE DISTRICT

337 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPATHUR VELLORE DISTRICT

338 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, JOLARPET, VELLORE DISTRICT

339 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANDHILI, VELLORE DISTRICT

340 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NATRAMPALLI, VELLORE DISTRICT

341 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALANGAYAM, VELLORE DISTRICT

342 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVANNAMALAI, TIRUVANNAMALAI DISTRICT

343 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KILPENNATHUR TIRUVANNAMALAI DISTRICT

344 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THURINIJAPURAM TIRUVANNAMALAI DISTRICT

345 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POLUR TIRUVANNAMALAI DISTRICT

346 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALASAPAKKAM, TIRUVANNAMALAI DISTRICT

347 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHEPET, TIRUVANNAMALAI DISTRICT

348 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHENGAM TIRUVANNAMALAI DISTRICT

349 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUDUPALAYAM, TIRUVANNAMALAI DISTRICT

350 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THANDRAMPET, TIRUVANNAMALAI DISTRICT

351 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, JAWADUMALAI, TIRUVANNAMALAI DISTRICT

352 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHEYYAR, TIRUVANNAMALAI DISTRICT

353 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANAKKAVOOR, THIRUVANNAMALAI DISTRICT

354 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEMBAKKAM, THRUAVANNAMALAI DISTRICT

355 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VANDAVASI THIRUVANNAMALAI DISTRICT

356 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THELLAR, THIRUVANNAMALAI DISTRICT

357 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERAMALLUR THIRUVANNAMALAI DISTRICT

358 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARNI, THIRUVANNAMALAI DISTRICT

359 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, WEST ARNI, THIRUVANNAMALAI DISTRICT

360 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SALEM, SALEM DISTRICT

361 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEERAPANDY, SALEM DISTRICT

362 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PANAMARATHUPATTI, SALEM DISTRICT

363 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AYOTHIYAPATTINAM, SALEM DISTRICT

364 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VALAPADY, SALEM DISTRICT

365 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, YERCAUD, SALEM DISTRICT

366 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, P.N.PALAYAM, SALEM DISTRICT

367 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ATTUR, SALEM DISTRICT

368 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GANGAVALLI, SALEM DISTRICT

369 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THALAIVASAL, SALEM DISTRICT

370 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOLATHUR, SALEM DISTRICT

371 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NANGAVALLI, SALEM DISTRICT

372 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MECHERI, SALEM DISTRICT

373 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, OMALUR, SALEM DISTRICT

374 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, HARAMANGALAM, SALEM DISTRICT

375 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAYAMPATTI, SALEM DISTRICT

376 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SANGARI, SALEM DISTRICT

377 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, IDAPPADY, SALEM DISTRICT

378 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KONGANAPURAM, SALEM DISTRICT

379 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MAC.CHOULTRY, SALEM DISTRICT

380 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ELACIPALAYAM, NAMAKKAL DISTRICT

381 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ERUMAPATTY, NAMAKKAL DISTRICT

382 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KABILARMALAI, NAMAKKAL DISTRICT

383 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOLLIHILLS, NAMAKKAL DISTRICT

384 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MALLASAMUDRAM, NAMAKKAL DISTRICT

385 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MOHANUR, NAMAKKAL DISTRICT

386 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAMAKKAL, NAMAKKAL DISTRICT

387 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAMAGIRIPET, NAMAKKAL DISTRICT

388 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUDUCHATRAM, NAMAKKAL DISTRICT

389 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PARAMATHY, NAMAKKAL DISTRICT

390 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALLIPALAYAM, NAMAKKAL DISTRICT

391 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RASIPURAM, NAMAKKAL DISTRICT

392 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SENDAMANGALAM, NAMAKKAL DISTRICT

393 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUCHENCODE, NAMAKKAL DISTRICT

394 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VENNANDUR, NAMAKKAL DISTRICT

395 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, DHARMAPURI, DHARMAPURI DISTRICT

396 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NALLAMPATTI, DHARMAPURI DISTRICT

397 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PENNAGARAM, DHARMAPURI DISTRICT

398 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, HARUR, DHARMAPURI DISTRICT

399 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MORAPPUR, DHARMAPURI DISTRICT

400 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PAPPIREDDIPATTI, DHARMAPURI DISTRICT

401 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARIMANGALAM, DHARMAPURI DISTRICT

402 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALACODE, DHARMAPURI DISTRICT

403 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ERODE, ERODE DISTRICT

404 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MODAKKURICHI, ERODE DISTRICT

405THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KODUMUDI, ERODE DISTRICT

406 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERUNDURAI, ERODE DISTRICT

407 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHENNIMALAI, ERODE DISTRICT

408 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AMMAPET, ERODE DISTRICT

409 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANTHIYUR, ERODE DISTRICT

410 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BHAVANI, ERODE DISTRICT

411 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GOBI, ERODE DISTRICT

412 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAMBIYUR, ERODE DISTRICT

413 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.N.PALAYAM, ERODE DISTRICT

414 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SATHY, ERODE DISTRICT

415 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BHAVANISAGAR, ERODE DISTRICT

416 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TALAVADI, COIMBATORE DISTRICT

417 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARAMADAI, COIMBATORE DISTRICT

418 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADUKKARAI, ERODE DISTRICT

419 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, P.N.PALAYAM, COIMBATORE DISTRICT

420 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, S.S.KULAM, COIMBATORE DISTRICT

421 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THONDAMUTHUR, COIMBATORE DISTRICT

422 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANAIMALAI, COIMBATORE DISTRICT

423 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KINATHUKADAVU, COIMBATORE DISTRICT.

424 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POLLACHI (N), COIMBATORE DISTRICT.

425 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POLLACHI (S), COIMBATORE DISTRICT.

426 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANNUR, COIMBATORE DISTRICT.

427 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SULUR, COIMBATORE DISTRICT.

428 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SULTANPET, COIMBATORE DISTRICT.

429 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UDHAGAI, THE NILGIRIS.

430 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, COONOOR, THE NILGIRIS.

431 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOTAGIRI, THE NILGIRIS

432 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUDALUR, THE NILGIRIS.

433 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THANJAVUR, THANJAVUR DISTRICT.

434 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BUDALUR, THANJAVUR DISTRICT.

435 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVAIYARU, THANJAVUR DISTRICT.

436 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ORATHANADU, THANJAVUR DISTRICT.

437 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVONAM, THANJAVUR DISTRICT.

438 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUMBAKONAM, THANJAVUR DISTRICT.

439 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVIDAIMARUDHUR, THANJAVUR DISTRICT.

440 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPANANDAL, THANJAVUR DISTRICT.

441 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PAPANASAM, THANJAVUR DISTRICT.

442 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AMMAPET, THANJAVUR DISTRICT.

443 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PATTUKOTTAI, THANJAVUR DISTRICT.

444 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADUKKUR, THANJAVUR DISTRICT.

445 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERAVURANI, THANJAVUR DISTRICT.

446 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SETHUBAVACHATRAM, THANJAVUR DISTRICT.

447 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAGAPATTINAM, NAGAPATTINAM DISTRICT.

448 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KEELAIYUR, NAGAPATTINAM DISTRICT.

449 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KILVELUR, NAGAPATTINAM DISTRICT.

450 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUMARUGAL, NAGAPATTINAM DISTRICT.

451 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEDARANYAM, NAGAPATTINAM DISTRICT.

452 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MAYILADUTHURAI, NAGAPATTINAM DISTRICT.

453 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUTHALAM, NAGAPATTINAM DISTRICT.

454 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SEMBANARKOIL, NAGAPATTINAM DISTRICT.

455 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SIRKALI, NAGAPATTINAM DISTRICT.

456 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOLLIDAM, NAGAPATTINAM DISTRICT.

457 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VALANGAIMAN, TIRUVARUR DISTRICT

458 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NANNILAM, TIRUVARUR DISTRICT

459 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KODAVASAL, TIRUVARUR DISTRICT

460 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVARUR, TIRUVARUR DISTRICT

461 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KORADACHERI, TIRUVARUR DISTRICT

462 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANNARGUDI, TIRUVARUR DISTRICT

463 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NEEDAMANGALAM, TIRUVARUR DISTRICT

464 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOTTUR, TIRUVARUR DISTRICT

465 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUTHURAIPOONDI, TIRUVARUR DISTRICT

466 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUTHUPETTAI, TIRUVARUR DISTRICT

467 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANDANALLUR, TIRUCHIRAPPALLI DISTRICT

468 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANIKANDAM, TIRUCHIRAPPALLI DISTRICT

469 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVERAMBUR, TIRUCHIRAPPALLI DISTRICT

470 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANAPPARAI, TIRUCHIRAPPALLI DISTRICT

471 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MARUNGAPURI, TIRUCHIRAPPALLI DISTRICT

472 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VAIYAMPATTY, TIRUCHIRAPPALLI DISTRICT

473 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, LALGUDI, TIRUCHIRAPPALLI DISTRICT

474 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANACHANALLUR, TIRUCHIRAPPALLI DISTRICT

475 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PULLAMPADY, TIRUCHIRAPPALLI DISTRICT

476 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUSIRI, TIRUCHIRAPPALLI DISTRICT

477 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOTTIAM, TIRUCHIRAPPALLI DISTRICT

478 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.PET, TIRUCHIRAPPALLI DISTRICT

479 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THURAIYUR, TIRUCHIRAPPALLI DISTRICT

480 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UPPILIYAPURAM, TIRUCHIRAPPALLI DISTRICT

481 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARUR, KARUR DISTRICT

482 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THANTHONI, KARUR DISTRICT

483 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARAVAKURICHI, KARUR DISTRICT

484 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, K.PARAMATHI, KARUR DISTRICT

485 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KULITHALAI, KARUR DISTRICT

486 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KRISHNARAYAPURAM, KARUR DISTRICT

487 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAVUR, KARUR DISTRICT

488 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOGAMALAI, KARUR DISTRICT

489 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERAMBALUR, PERAMBALUR DISTRICT

490 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEPANTHATTAI, PERAMBALUR DISTRICT

491 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALATHUR, PERAMBALUR DISTRICT

492 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEPPUR, PERAMBALUR DISTRICT

493 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANNAVASAL, PUDUKOTTAI DISTRICT

494 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARIMALAM, PUDUKOTTAI DISTRICT

495 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUNNANDARKOIL, PUDUKKOTTAI DISTRICT

496 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PONNAMARAVATHI, PUDUKKOTTAI DISTRICT

497THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUDUKKOTTAI, PUDUKKOTTAI DISTRICT

498 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUMAYAM, PUDUKKOTTAI DISTRICT

499 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VIRALIMALAI, PUDUKKOTTAI DISTRICT

500 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARANTHANGI, PUDUKKOTTAI DISTRICT

501 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AVUDAYARKOIL, PUDUKKOTTAI DISTRICT

502 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GANDARVAKOTTAI, PUDUKKOTTAI DISTRICT

503 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARAMBAKKUDI, PUDUKKOTTAI DISTRICT

504THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANAMELKUDI, PUDUKKOTTAI DISTRICT

505 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVARANKULAM, PUDUKKOTTAI DISTRICT

506 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADURAI EAST, MADURAI DISTRICT

507 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADURAI WEST, MADURAI DISTRICT

508 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPARNKUNDRAM, MADURAI DISTRICT

509 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELUR, MADURAI DISTRICT

510 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOTTAMPATTI, MADURAI DISTRICT

511 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VADIPATTI, MADURAI DISTRICT

512 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALANGANALLUR, MADURAI DISTRICT

513 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, USILAMPATTI, MADURAI DISTRICT

514 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHELLAMPATTI, MADURAI DISTRICT

515 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SEDAPATTI, MADURAI DISTRICT

516 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUMANGALAM, MADURAI DISTRICT

517 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.KALLUPATTY, MADURAI DISTRICT

518 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALLIKUDI, MADURAI DISTRICT

519 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANDIPATTI, THENI DISTRICT

520 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, K.MYALADUMPARAI, THENI DISTRICT

521 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERIYAKULAM, THENI DISTRICT.

522 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THENI, THENI DISTRICT.

523 THE BLOCK DEVELOPMENT OFFICER,BLOCK DEVELOPMENT OFFICE, BODINAICKANUR, THENI DISTRICT.

524 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHINNAMANUR, THENI DISTRICT.

525 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UTHAMAPALAYAM, THENI DISTRICT

526 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CUMBUM, THENI DISTRICT

527 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, DINDIGUL, DINDIGUL DISTRICT

528 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ATHOOR, DINDIGUL DISTRICT

529 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, REDDIARCHATRAM, DINDIGUL DISTRICT.

530 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHANNARPATTI, DINDIGUL DISTRICT.

531 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NATHAM, DINDIGUL DISTRICT

532 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NILAKOTTAI, DINDIGUL DISTRICT.

533 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BATALAGUNDU, DINDIGUL DISTRICT.

534 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALANI, DINDIGUL DISTRICT.

535 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ODDANCHATRAM, DINDIGUL DISTRICT.

536 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOPPAMPATTI, DINDIGUL DISTRICT.

537 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEDASANDUR, DINDIGUL DISTRICT.

538 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VADAMADURAI, DINDIGUL DISTRICT.

539 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUZILIAMPARAI, DINDIGUL DISTRICT.

540 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KODAIKANAL, DINDIGUL DISTRICT.

541 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANDAPAM, RAMANATHAPURAM DISTRICT.

542 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RAMANATHAPURAM, RAMANATHAPURAM DISTRICT

543 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, R.S.MANGALAM, RAMANATHAPURAM DISTRICT.

544 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPULLANI, RAMANATHAPURAM DISTRICT,

545 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVADANAI, RAMANATHAPURAM DISTRICT.

546 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BOGALUR, RAMANATHAPURAM DISTRICT.

547 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADALADI, RAMANATHAPURAM DISTRICT.

548 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAMUTHI, RAMANATHAPURAM DISTRICT.

549 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUDUKULATHUR, RAMANATHAPURAM DISTRICT.

550 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAINARKOIL, RAMANATHAPURAM DISTRICT.

551 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PARAMAKUDI, RAMANATHAPURAM DISTRICT.

552 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARUPPUKKOTTAI, VIRUDHUNAGAR DISTRICT.

553 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VIRUDHUNAGAR, VIRUDHUNAGAR DISTRICT.

554 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARIAPATTI, VIRUDHUNAGAR DISTRICT.

555 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUCHULI, VIRUDHUNAGAR DISTRICT.

556 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NARIKUDI, VIRUDHUNAGAR DISTRICT.

557 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RAJAPALAYAM, VIRUDHUNAGAR DISTRICT.

558 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SRIVILLIPUTHUR, VIRUDHUNAGAR DISTRICT.

559 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, WATRAP, VIRUDHUNAGAR DISTRICT.

560 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SIVAKASI, VIRUDHUNAGAR DISTRICT.

561 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEMBAKOTTAI, VIRUDHUNAGAR DISTRICT.

562 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SATTUR, VIRUDHUNAGAR DISTRICT.

563 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SIVAGANGAI, SIVAGANGAI DISTRICT.

564 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALAYARKOVIL, SIVAGANGAI DISTRICT.

565 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANAMADURAI, SIVAGANGAI DISTRICT.

566 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPUVANAM, SIVAGANGAI DISTRICT.

567 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, IIAYANGUDI, SIVAGANGAI DISTRICT.

568 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPATHUR, SIVAGANGAI DISTRICT.

569 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SINGAMPUNARI, SIVAGANGAI DISTRICT.

570 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SAKKOTTAI, SIVAGANGAI DISTRICT.

571 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALLAL, SIVAGANGAI DISTRICT.

572 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, DEVAKOTTAI, SIVAGANGAI DISTRICT.

573 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANNANGUDI, SIVAGANGAI DISTRICT.

574 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, S.PUDUR, SIVAGANGAI DISTRICT.

575 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALAYAMKOTTAI, TIRUNELVELI DISTRICT.

576 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANUR, TIRUNELVELI DISTRICT.

577 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELANEELITHANALLUR, TIRUNELVELI DISTRICT.

578 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KURUVIKULAM, TIRUNELVELI DISTRICT.

579 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SANKARANKOVIL, TIRUNELVELI DISTRICT.

580 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AMBASAMUDRAM, TIRUNELVELI DISTRICT.

581 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHERANMAHADEVI, TIRUNELVELI DISTRICT.

582 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PAPPAKUDI, TIRUNELVELI DISTRICT.

583 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAYAM , TIRUNELVELI DISTRICT.

584 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NANGUNERI, TIRUNELVELI DISTRICT.

585 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALAKADU, TIRUNELVELI DISTRICT.

586 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VALLIYOOR, TIRUNELVELI DISTRICT.

587 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RADHAPURAM, TIRUNELVELI DISTRICT.

588 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALANGULAM, TIRUNELVELI DISTRICT.

589 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KEELAPAVOOR, TIRUNELVELI DISTRICT.

590 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAYANALLUR, TIRUNELVELI DISTRICT.

591 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHENCOTTAI, TIRUNELVELI DISTRICT.

592 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TENKASI, TIRUNELVELI DISTRICT.

593 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VASUDEVANALLUR, TIRUNELVELI DISTRICT.

594 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOOTHUKUDI, THOOTHUKUDI DISTRICT.

595 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARUNGULAM, THOOTHUKUDI DISTRICT.

596 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SRIVAIKUNDAM, THOOTHUKUDI DISTRICT.

597 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALWARTHIRUNAGARI, THOOTHUKUDI DISTRICT.

598 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUCHENDUR, THOOTHUKUDI DISTRICT.

599 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UDANGUDI, THOOTHUKUDI DISTRICT.

600 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SATTANKULAM, THOOTHUKUDI DISTRICT.

601 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOVILPATTI, THOOTHUKUDI DISTRICT.

602 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAYATHAR, THOOTHUKUDI DISTRICT.

603 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, OTTAPIDARAM, THOOTHUKUDI DISTRICT.

604 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VILATHIKULAM, THOOTHUKUDI DISTRICT.

605 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUDUR, THOOTHUKUDI DISTRICT.

606 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AGASTHEESWARAM, KANYAKUMARI DISTRICT.

607 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOVALAI, KANYAKUMARI DISTRICT.

608 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RAJAKKAMANGALAM, KANYAKUMARI DISTRICT.

609 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THUCKALAY, KANYAKUMARI DISTRICT.

610 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KURUNTHANCODE, KANYAKUMARI DISTRICT.

611 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVATTAR, KANYAKUMARI DISTRICT.

612 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KILLIYOOR, KANYAKUMARI DISTRICT.

613 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUNCHIRAI, KANYAKUMARI DISTRICT.

614 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELPURAM, KANYAKUMARI DISTRICT.

615 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KRISHNAGIRI, KRISHNAGIRI DISTRICT.

616 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAVERIPATTANAM, KRISHNAGIRI DISTRICT.

617 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEPPANAPALLI, KRISHNAGIRI DISTRICT.

618 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BARGUR, KRISHNAGIRI DISTRICT.

619 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MATHUR, KRISHNAGIRI DISTRICT.

620 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UTHANGARAI, KRISHNAGIRI DISTRICT.

621 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, HOSUR, KRISHNAGIRI DISTRICT.

622 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHOOLAGIRI, KRISHNAGIRI DISTRICT.

623 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KELAMANGALAM,KRISHNAGIRI DISTRICT.

624 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THALLY, KRISHNAGIRI DISTRICT

625 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARIYALUR, ARIYALUR DISTRICT.

626 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUMANUR, ARIYALUR DISTRICT.

627 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, JAYAMKONDAM, ARIYALUR DISTRICT.

628 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANDIMADAM, ARIYALUR DISTRICT.

629 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.PUDUR, ARIYALUR DISTRICT.

630 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SENDURAI, ARIYALUR DISTRICT.

631 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UTHUKULI, TIRUPPUR DISTRICT.

632 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUDIMANGALAM, TIRUPPUR DISTRICT.

633 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VELLAKOIL, TIRUPPUR DISTRICT.

634THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADATHULAM, TIRUPPUR DISTRICT.

635THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUNDADAM, TIRUPPUR DISTRICT.

636 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MULANUR, TIRUPPUR DISTRICT.

637THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UDUMALPET, TIRUPPUR DISTRICT.

638THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AVINASHI, TIRUPPUR DISTRICT.

639THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALLADAM, TIRUPPUR DISTRICT.

640 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PONGALUR, TIRUPPUR DISTRICT.

641 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUPPUR, TIRUPPUR DISTRICT.

642 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANGAYAM, TIRUPPUR DISTRICT.

643THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, DHARAPURAM, TIRUPPUR DISTRICT.

644 THE JOINT CHIEF ENGINEER (GENERAL), PUBLIC WORKS DEPARTMENT, CHEPAUK, CHENNAI - 005.

645 THE JOINT CHIEF ENGINEER, (IRRIGATION), PWD SUPERINTENDING ENGINEER, (PROCUREMENT CELL), IAMWARAM PROJECT, CHEPAUK, CHENNAI - 005.

646 THE JOINT CHIEF ENGINEER, (PLAN FORMULATION), PWD, W.R.O., CHEPAUK, CHENNAI - 005.

647 THE JOINT CHIEF ENGINEER, (OPERATION & MAINTENANCE), PWD, W.R.O., CHEPAUK, CHENNAI - 005.

648 THE JOING CHIEF ENGINEER, (DESIGN, RESEARCH AND CONSTRUCTION SUPPORT), CHEPAUK, CHENNAI - 005.

649 THE JOINT CHIEF ENGINEER, (STATE GROUND & SURFACE WATER RESOURCES DATA CENTRE), TARAMANI, CHENNAI 113.

650 THE DEPURY CHIEF ENGINEER CHENNAI REGION, CHEPAUK, CHENNAI -005.

651 THE DEPUTY CHIEF ENGINEER TIRUCHI REGION, P[UDUKKOTTAI ROAD, P.B.NO.803, SUBRAMANIAPURAM, TRICHY - 020.

652 THE DEPUTY CHIEF ENGINEER POLLACHI REGION, TOWN HALL, COIMBATORE 001.

653THE DEPUTY CHIEF ENGINEER, MADURAI REGION, THALLAKULAM, MADURAI.

654THE JOINT DIRECTOR, INSTITUTE FOR WATER STUDIES, TARAMANI, CHENNAI 113.

655 THE DIRECTOR, IRRIGATION MANAGEMENT, TRAINING INSTITUTE, THUVAKUDI, TRICHY 015.

656 THE GENERAL MANAGER, SOUTHERN RAILWAYS, GENERAL MANAGER OFFICE, GENERAL BRANCH, 1ST FLOOR NGO MAIN BUILDING, SOUTHERN RAILWAY, PARK TOWN, CHENNAI 003.

657 THE DIVISIONAL RAILWAY MANAGER, CHENNAI DIVISION, DIVISIONAL RAILWAY MANAGER OFFICE DRM COMPLEX, SOUTHERN RAILWAY, PARK TOWN, CHENNAI -003.

658 THE DIVISIONAL RAILWAY MANAGER, TRICHY DIVISION, DIVISIONAL RAILWAY MANAGER OFFICE, DRM COMPLEX, SOURTHERN RAILWAY, TRICHY 001.

659 THE DIVISIONAL RAILWAY MANAGER, MADURAI DIVISION, DIVISIONAL RAILWAY MANAGER OFFICE, DRM COMPLEX, SOSURTHERN RAILWAY, MADURAI -16

660 THE DIVISIONAL RAILWAY MANAGER, SALEM DIVISION, DIVISIONAL RAILWAY MANAGER OFFICE DRM COMPLEX, SOURTHERN RAILWAY, SALEM -005.

661 THE DIVISIONAL RAILWAY MANAGER, TRIVANDRUM DIVISION, DRM(GEL) DRM COMPLEX, SOUTHERN RAILWAY, THYCAUD, TRIVANDRUM 914.

662 THE GENERAL MANAGER, INTEGRAL COACH FACTORY (ICF), CHENNAI -38.

663THE GENERAL MANAGER, ORDINANCE FACTORY TRICHIRAPALLI, TRICHIRAPALLI -016.

664 THE GENERAL MANAGER, BHARAT HEAVY ELECTRICALS LIMITED, TRICHY -014.

665 THE ADDITIONAL CHIEF SECRETARY TO GOVERNMENT, HIGHWAYS & MINOR PORTS DEPARTMENT, FORT ST.GEORGE, SECRETARIAT, CHENNAI - 009.

666 THE PROJECT DIRECTOR, TAMIL NADU ROAD SECTOR PROJECT -II, NO.171, KESAVAPERUMALPURAM, GREENWAYS ROAD, RAJA ANNAMALAIPURAM CHENNAI -028.

667 THE DIRECTOR GENERAL (I.C HIGHWAY DEPARTMENT INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY, CHENNAI - 025.

668 THE CHIEF ENGINEER(H) NATIONAL HIGHWAYS, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

669 THE CHIEF ENGINEER(H) PROJECTS, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

670THE CHIEF ENGINEER(H) NABARD &RURAL ROAD, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

671THE CHIEF ENGINEER(H) PLANNING, DESIGNS AND INVESTIGATION, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

672 THE DIRECTOR, HIGHWAYS RESEARCH STATION, 76 SARDAR PATEL ROAD, GUINDY, CHENNAI - 025.

673 THE CHIEF ENGINEER (H) METRO, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

674 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, CHENNAI, CHENNAI DT.

675THE ASSISTANT COMMISSIONER HR & CE DEPARTMENT, CHENNAI, CHENNAI DT

676 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, VELLORE, THIRUVALLUR DT.

677 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, THIRUVALLUR, THIRUVALLUR DT.

678 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, KANCHEEPURAM, KANCHEEPURAM DT.

679 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, VELLORE, VELLORE DT.

680 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, SALEM, SALEM DT.

681 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, DHARMAPURI, DHARMAPURI DT AND KRISHNAGIR DT.

682 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, SALEM, SALEM DT.

683 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, NAMAKKAL, NAMAKKAL DT.

684 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, COIMBATORE, COIMBATORE DT.

685 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, COIMBATORE, COIMBATORE DISTRICT AND NILGIRIS DT.

686 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, ERODE, ERODE DT.

687 THE ASSISTANT COMMISSIONER HR & CE DEPARTMENT, TIRUPPUR, TIRUPPUR DT.

688THE JOINT COMMISSIONER, HR & CE DEPARTMENT, THANJAVUR, THANJAVUR DT.

689THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, THANJAVUR, THANJAVR DT,

690 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, NAGAPATTINAM, NAGAPATTINAM DISTRICT (EXCEPT SIRKALI MAYILADUTHURAI AND THARANGAMBADI TALUK).

691 THE ASSISTANT COMMISSIONER,HR & CE DEPARTMENT, THIRUVALLUR, THIRUVALLUR DT.

692 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, MAYILADUTHURAI.

693 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, KUMBAKONAM THIRUVIDAMARUTHUR, KUMBAKONAM TALU, THANJAVUR DT.

694 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, VILLUPURAM, CUDDALORE DT.

695 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, CUDDALORE, CUDDALORE DT.

696 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, VILLUPURAM, VILLUPURAM DT.

697 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, TRICHIRAPPALLI, TRICHIRAPPALLI DT.

698 THE JOINT COMMISSIONER HR & CE DEPARTMENT, TRICHIRAPPALLI, THRICHIRAPPALLI DT.

699 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, TRICHIRAPPALLI, TRICHIRAPPALLI DT.

700 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, ARIYALUR, PERAMBALUR DT AND ARIYALUR DT.

701 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, PUDUKOTTAI, PUDUKKOTTAI DT.

702 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, KARUR, KARUR DT.

703 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, MADURAI, MADURAI DT.

704 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT MADURAI, MADURAI DT.

705THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT DINDIGUL, DINDIGUL DISTRICT AND IN DISTGRICT.

706 THE JOINT COMMISSIONER, HR & CE DEPARTMENT SIVAGANGAI, SIVAGANGAI DT.

707 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, VIRUDHUNAGAR, VIRUDHUNAGAR DT.

708 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, PARAMAKUDI, SIVAGANGAI DT AND RAMANATHAPURAM DT.

709 THE JOINT COMMISSIONER HR & CE DEPARTMENT , TIRUNELVELI, TIRUNELVELI DT.

710 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, TIRUNELVELI, TIRUNELVELI DT.

711 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, HR & CE DEPARTMENT,THOOTHUKUDI, THOOTHUKUDI DT.

712 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, NAGERCOIL, KANYAKUMARI DT.

713 THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS, NO.1, JEENIS SALAIPANAGAL BUILDING, SAIDAPET,CHENNAI 015.

714 THE CONSERVATOR OF FORESTS, CHENNAI CIRCLE 259, ANNA SALAI ,DMS COMPOUND, III FLOOR, TEYNAMPET, CHENNAI - 006.

715 THE WILDLIFE WARDEN, 259 ANNA SALAI, DMS COMPOUND, IV FLOOR, TEYNAMPET, CHENNAI 006.

716 THE FOREST UTILIZTION OFFICER, 259, ANNA SALAI, DMS COMPOUND, III FLOOR, TEYNAMPET, CHENNAI - 006.

717 THE ASSISTANT CONSERVATOR OF FORESTS, FOREST PROTECTION SQUAD, 259, ANNA SALAI, DMS COMPOUND, III FLOOR, TEYNAMPET, CHENNAI - 006.

718 THE CHAIRMAN, TAMIL NADUR FOREST PLANTATION, CORPORATION LIMITED 30, GANDHIMANDAPAM ROAD, KOTTURPURAM, CHENNAI, TAMIL NADU, SOUTH -085.

719 THE CHENNAI DIRECTOR ARIGNARAANNA ZOOLOGICAL PARK, VANDALUR, CHENNAI 048.

720 THE GUINDY NATIONAL PARK RANGE GUINDY, CHENNAI - 025.

721 THE SPECIAL GOVERNMENT PLEADER (FOREST CASES) HIGH COURT, CHENNAI -014.

722 THE CHIEF CONSERVATOR OF FORESTS (RESEARCH), STATE FOREST RESEARCH INSTITUTE VANDALUR, CHENNAI - 048.

723 THE CONSERVATOR OF FORESTS (RESEARCH), STATE FOREST RESEARCH INSTITUTE CAMPUS, KOLAPPAKKAM (VIA), VANDALUR, CHENNAI - 048.

724 THE CHIEF CONSERVATOR OF FORESTS (RESEARCH), STATE FOREST INSTITUTE CAMPUS, KOLAPPAM VIA, VANDALUR, CHENNAI 048.

725 THE CHIEF CONSERVATOR OF FORESTS, (FOREST EXTENSION), STATE FOREST INSTITUTE CAMPUS KOLAPPAM VIA, VANDALUR, CHENNAI 048.

726 THE DEPUTY CONSERVATOR OF FORESTS, STATE FOREST INSTITUTE, KOLAPPAM VIA, VANDALUR, CHENNAI -048.

727 THE PRINCIPAL SECRETARY TO THE GOVERNMENT, HIGHWAYS & MINOR PORTS DEPARTMENT, GOVERNMENT OF TAMIL NADU, CHENNAI -009.

728 THE DEPUTY CHAIRMAN, V.O.CHIDAMBARANAR PORT TRUST, TUTICORIN -004.

729 THE CHAIRMAN, V.O.CHIDAMBARANAR PORT TRUST, TUTICORIN - 004.

730 THE REGIONAL EXECUTIVE DIRECTOR, SOUTH REGION, CHENNAI AIRPORT, CHENNAI.

731 THE AIRPORT DIRECTOR, TRICHY AIRPORT, TRICHY.

732 THE AIRPORT DIRECTOR MADURAI AIRPORT, MADURAI.

733 THE AIRPORT DIRECTOR, TUTICORIN AIRPORT, TUTICORIN.

734 THE AIRPORT DIRECTOR, COIMBATORE, AIRPORT, COIMBATORE.

735 THE AIRPORT DIRECTOR, OMALUR AIRPORT, SALEM.

736THE CHIEF GENERAL MANAGER/ OIC, NABARD BANK, NO.48, NUNGAMBAKKAM HIGH ROAD, AMBAL NAGAR, ANNA SALAI, NUNGAMBAKKAM, CHENNAI - 034.

737 THE SPECIAL DIRECTOR GENERAL (SR), CENTRAL PUBLIC WORKS DEPARTMENT, 1ST FLOO G WING, RAJAJI, BHAVAN 3RD AVENUE, BESANT NAGAR, CHENNAI.

738 THE DEFENCE ESTATE OFFICER, MADRAS CIRCLE, NO.306, ANNA SALAI, TEYNAMPET, CHENNAI -18.

739 THE NAVAL PORT OFFICE, PROT COMPLEX, RAJAJI SALAI, ST. GEORGE FORT, CHENNAI - 009.

740 INS KATTABOMMAN, NAVAL BASE, SOUTH VIJAYANARAYANAM, TIRUNELVELI 119, TAMIL NADU.

741 THANTHI TV, METRONATION CHENNAI TELEVISION LTD.,RMZ MILLENLA, 1C, 1ST FLOOR, 143, DR.M.G.R, ROAD, KANDANCHAVADI PERUNGUDI, CHENNAI - 096.

(R36 TO 741 ARE IMPLEADED VIDE COURT ORDER DT.27/02/17 IN WMP(MD) NOS.2011 AND 2482/17)

742. THE TRUSTEE, MOUNA GURUSAMY TRUST (MR.CHELLA MUTHIAH, S/O.MUTHIAH, CHINNAYAPURAM, ADIYANOOTHU (NEAR VENU BIRIYANI HOTEL), DINDIGUL.

(R742 IS SUO MOTU IMPLEADED VIDE COURT ORDER DT.21/04/17 IN WP(MD) 16485/15)

1 THE CHIEF SECRETARY, [1 TO 22 RESPONDENTS IN WP.3075/17]
GOVERNMENT OF TAMIL NADU, SECRETARIAT, ST.
FORT GEORGE, CHENNAI 600 009

2 THE SECRETARY TO GOVERNMENT
GOVERNMENT OF TAMIL NADU, ENVIRONMENT AND
FOREST DEPARTMENT, SECRETARIAT, ST. FORT
GEORGE, CHENNAI 600 009

3 THE SECRETARY TO GOVERNMENT,
GOVERNMENT OF TAMIL NADU, PUBLIC WORKS
DEPARTMENT, SECRETARIAT, ST. FORT GEORGE,
CHENNAI 600 009

4 THE DISTRICT COLLECTOR,
CHENNAI DISTRICT, CHENNAI.

5 THE DISTRICT COLLECTOR,
ARIYALUR DISTRICT, ARIYALUR.

6 THE DISTRICT COLLECTOR,
COIMBATORE DISTRICT, COIMBATORE.

7 THE DISTRICT COLLECTOR,
CUDDALORE DISTRICT. CUDDALORE.

8 THE DISTRICT COLLECTOR,
DHARMAPURI DISTRICT, DHARMAPURI.

9 THE DISTRICT COLLECTOR,
ERODE DISTRICT. ERODE.

10 THE DISTRICT COLLECTOR,
KANCHEEPURAM DISTRICT. KANCHEEPURAM.

11 THE DISTRICT COLLECTOR,
KRISHNAGIRI DISTRICT, KRISHNAGIRI.

12 THE DISTRICT COLLECTOR,
NAGAPATTINAM DISTRICT, NAGAPATTINAM.

13 THE DISTRICT COLLECTOR,
NAMAKKAL DISTRICT, NAMAKKAL.

14 THE DISTRICT COLLECTOR,
PERAMBALUR DISTRICT, PERAMBALUR.

15 THE DISTRICT COLLECTOR,
SALEM DISTRICT, SALEM.

16 THE DISTRICT COLLECTOR,
NILGIRIS DISTRICT, NILGIRIS.

17 THE DISTRICT COLLECTOR,
THIRUVALLUR DISTRICT, THIRUVALLUR.

18 THE DISTRICT COLLECTOR,
THIRUVANNAMALAI DISTRICT, THIRUVANNAMALAI.

19 THE DISTRICT COLLECTOR,
THIRUVARUR DISTRICT, THIRUVARUR.

20 THE DISTRICT COLLECTOR,
TIRUPPUR DISTRICT, TIRUPPUR.

21 THE DISTRICT COLLECTOR,
VELLORE DISTRICT, VELLORE.

22 THE DISTRICT COLLECTOR,
VILLUPURAM DISTRICT, VILLUPURAM.

1 THE STATE OF TAMIL NADU [1 TO 6 RESPONDENTS IN
REP. BY THE SECRETARY, DEPARTMENT WP(MD).4646 /2017]
OF FOREST, SECRETARIAT,
FORT ST. GEORGE, CHENNAI - 9

2 THE PRINCIPAL CHIEF CONSERVATOR OF FOREST (HEAD OF FOREST FORCE),
NO.1, PANAGAL MALIGAI, JENIS ROAD, WEST SAIDAPET, CHENNAI.

3 THE CHIEF CONSERVATOR OF FOREST, O/O. THE CHIEF CONSERVATOR OF
FOREST, ANAIMALAI TIGER RESERVE, POLLACHI-TIRUPPUR DIVISION,
COIMBATORE DISTRICT.

4 THE ADDL. PRINCIPAL CHIEF CONSERVATOR OF FOREST & FIELD DIRECTOR,
ANAIMALAI TIGER RESERVE, TAMIL NADU FOREST ACADEMY, R.S.PURAM,
COIMBATORE - 641 002

5 THE DISTRICT FOREST OFFICER & DEPUTY DIRECTOR, ANAIMALAI TIGER
RESERVE, POLLACHI DIVISION, TAMIL NADU FOREST ACADEMY, R.S.PURAM,
COIMBATORE - 641 002

6 THE DISTRICT FOREST OFFICER & DEPUTY DIRECTOR, ANAIMALAI TIGER
RESERVE, TIRUPPUR DIVISION, UDUMALPET, TIRUPPUR DISTRICT - 642 126

1 THE DISTRICT COLLECTOR [1 TO 5 RESPONDENTS WP(MD).5456 /2017]
RAMANATHAPURAM DISTRICT,RAMANATHAPURAM.

2 THE DISTRICT REVENUE OFFICER O/O.THE DISTRICT REVENUE OFFICER,
RAMANATHAPURAM. RAMANATHAPURAM DISTRICT.

3 THE REVENUE DIVISIONAL OFFICER O/O. THE REVENUE DIVISIONAL
OFFICE, RAMANATHAPURAM. RAMANATHAPURAM DISTRICT.

4 THE BLOCK DEVELOPMENT OFFICER (VILLAGE PANCHAYAT) O/O. THE BLOCK
DEVELOPMENT OFFICE, MANDABAM (PLACE)UTCHIPULI POST, RAMANATHAPURAM.
RAMANATHAPURAM DISTRICT.

5 THE BLOCK DEVELOPMENT OFFICER (VILLAGE PANCHAYAT) O/O.THE BLOCK DEVELOPMENT OFFICE, MANDABAM (PLACE) UTCHIPULI POST, RAMANATHAPURAM. RAMANATHAPURAM DISTRICT.

1 THE DISTRICT COLLECTOR[1 TO 4 RESPONDENTS IN WP(MD)2847/2017] COLLECTORATE, TRICHY DISTRICT.

2 THE REVENUE DIVISIONAL OFFICER MUSIRI, TRICHY DISTRICT.

3 THE DISTRICT FOREST OFFICER TRICHY DISTRICT.

4 THE ASSISTANT ENGINEER PUBLIC WORKS DEPARTMENT, THURAIYUR, TRICHY DISTRICT.

(R4 IS IMPLEADED VIDE COURT ORDER DT.21/02/17 IN WMP(MD)2382/17)

1 MR. MOHAN VARGEES SUNDAR [1 TO 12 RESPONDENTS IN
THE CHIEF SECRETARY, GOVERNMENT CONT P(MD) .1340 /2014]
OF TAMILNADU, SECRETARIAT,
FORT ST. GEORGE, CHENNAI

2 MR. HANS RAJ VERMA THE SECRETARY TO GOVERNMENT, GOVERNMENT OF TAMIL NADU, ENVIRONMENT & FOREST DEPARTMENT, SECRETARIAT, FORT ST. GEORGE, CHENNAI

3 MR. SAIKUMAR THE SECRETARY TO GOVERNMENT, GOVERNMENT OF TAMIL NADU, PUBLIC WORKS DEPARTMENT, SECRETARIAT, FORT ST. GEORGE, CHENNAI

4 MR. SUBRAMANIYAN I.A.S THE DISTRICT COLLETOR, OFFICE OF THE DISTRICT COLLECTOR, MADURAI

5 MR. KATHIRAVAN I.A.S THE COMMISSIONER, MADURAI MUNICPAL CORPORATION, ANNA MALAIGAI, MADURAI

6 MR. MUTHUPANDI THE CHIEF ENGINEER PUBLIC WORK DEPARTMENT, MADURAI

7 MR. GRIJA VAITHIYANATHAN THE CHIEF SECRETARY, GOVERNMENT OF TAMIL NADU, SECRETARIAT, FORT ST. GEORGE, CHENNAI.

8 MR. ATULYA MISRA I.A.S., THE SECRETARY TO GOVERNMENT, ENVIRONMENT AND FOREST DEPARTMENT, SECRETARIAT, FORT ST. GEORGE, CHENNAI.

9 MR. S.K.PRABAKAR I.A.S., THE SECRETARY TO GOVERNMENT, PUBLIC WORKS DEPARTMENT, SECREATARIAT, FORT ST. GEORGE, CHENNAI.

10 MR. K.VERA RAGHAVA RAO I.A.S., THE DISTRICT COLLECTOR, OFFICE OF THE DISTRICT COLLECTOR, MADURAI.

11 MR. SANDEEP NANDURI I.A.S., THE COMMISSIONER, MADURAI MUNICIPAL CORPORATION, ANNA MALIGAI, MADURAI.

12 MR. C. T. SANGAR THE CHIEF ENGINEER, PUBLIC WORK DEPARTMENT, MADURAI.

IMPLEADED THE PROPOSED CONTEMNORS NOS. 7 TO 12 IN CONT.P.1340/14 AS PER ORDER OF THIS HON BLE COURT ORDER DATED 31/01/2017 MADE IN SUB.A.(MD).NO.20/2017

1 P.SATHISH, TAHSILDAR OF VIRALIMALAI, PUDUKKOTTAI DT. [1 TO 8 CONT P(MD) . 773 / 2017]

2 P.KRISHNAVENI TAHSILDAR OF KULATHUR, PUDUKKOTTAI DT. (NOW TAHSILDAR (SSS) OF AVUDAIYARKOIL, PUDUKKOTTAI DT.)

3 S.CABRIEL CHARLES, TAHSILDAR OF THIRUMAYAM, PUDUKKOTTAI DT.

4 R.YOGESHWARAN, TAHSILDAR OF KARAMBAKUDI, PUDUKKOTTAI (NOW TAHSILDAR (SSS) OF ALANGUDI, PUDUKKOTTAI DIST.)

5 R.MOHANKUMAR, TAHSILDAR OF PONNAMARAVATHY, PUDUKKOTTAI DT.

6 M.PALANICHAMY SPECIAL TAHSILDAR (SSS) PONNAMARAVATHY, PUDUKKOTTAI DT.

7 M.RAMESH, TAHSILDAR OF PONNAMARAVATHY, PUDUKKOTTAI DT.

8 K.TAMILMANI (FORMERLY TAHSILDAR OF PONNAMARAVATHY), TAHSILDAR OF ILLUPPUR, PUDUKKOTTAI DT.

Writ Petitions under Article 226 of the Constitution of India praying that in these circumstances stated therein and in the respective affidavits filed therewith the High Court will be pleased to

(I)Issue a writ, or order or direction in the nature of writ of mandamus directing the 1st respondent to constitute a committee of experts to study the alleged ill effects of Prosopis juliflorais in the state of Tamil Nadu and submit a report to this Honourable Court (in WP.No.10614/2017);

(2) issue a Writ of Mandamus directing the respondents to take all steps to eradicate the species of prosopis juliflora from the state of Tamil Nadu and to form a comittee of independent expert of different fields to suggest effective measures and time bound action plan to implement the plan to eradicate the species fromt the state of Tamil Nadu (in WP(MD) 20767/2013);

(3) To issue a Writ of Mandamus or any other writ or direction or order in the nature of writ, directing the respondents to remove or uproot all the Kaaruvelam trees (prosopis Juliflora) in the Vaigai River and in all the water bodies in Tamilnadu within the time stipulted by this Honble Court.(WP(MD).18748/2013);

(4) issue a writ or any other order in the nature of writ of mandamus directing the respondents to curb the evil growth of Prosopis juliflora all over the Madurai City and surroundings and save the ground water resources. (IN IN WP(MD).14699/2015);

(5)issue a Writ or order or direction in the nature of Writ of Mandamus or any other appropriate order or direction, directing the respondents to remove the Seemai Karuvelan trees from the State of Tamil Nadu and take steps to prevent the growth of the species and take remedial measures to undo the damage caused by the Said Seemai Karuvelan Trees within the time stipulated by this Honourable Court (in WP(MD).16485/2015);

(6)Issue writ of mandamus or any other appropriate writ or order or direction of like nature directing the respondents herein to take necessary steps to remove the SeemaiKaruvelam trees all over Tamil Nadu and to take necessary steps to prevent its further growth within a reasonable time that may be stipulated by this Honourable Court (in WP.No.3075/2017);

(7)To issue a writ of Mandamus or any other order or direction, in the nature of writ, directing the respondents to permit the petitioner to remove the Seemai Karuvelam Trees which are available in the Indira Gandhi Wildlife Sanctuary and National Park, Anaimalai, Pollachi, Coimbatore District and Amaravathi Range, Udumalpet, Tiruppur District by considering the representation dated 09.03.2017 within the time stipulated by this Honble Court.(IN WP (MD).4646 /2017);

(8)To issue a writ of Mandamus or any other appropriate writ or order or direction in the nature of writ directing the respondents to permit the petitioner to cut and remove the Juliflora Trees stands in Survey Number 90/1,90/3, 91/1, to an extent of 0.88.0, 2.02.5 and 16.22.5 Hectares situated at Panaikulam Village, Alangankulam Group, Ramanathapuram District within the period that may be stipulated (IN WP(MD) .5456 /2017);

(9) issue a Writ, order or direction in the nature of a writ of mandamus directing the respondents to give permission to the petitioner to cut Seemai Karuvel in and around the lake situated at Venkatachalapuram Village, Turaiyur Taluk, Trichy district by considering the petitioners representation dated 9.1.2017 and pass such further or other orders as this Honourable Court.(IN WP(MD) 2847/2017);

(10)To initiate contempt proceedings against the contemnor/respondents for their willful disobedience to the order of this Honourable Court in WP(MD) No. 18748/2013 dated 09.01.2014 and punish them under contempt of court Act. (IN CONT P(MD) .1340 /2014]

(11) During inspection, it is found that the Tahsidlar of Ponnamaravathi, Karambakudi, Kulathur, Viralimalai and Thirumayam in Pudukottai District have failed the obey the orders of this Court and therefore the Registry is directed to issue Suo Motu Contempt notice against them returnable by 09.06.2017. (IN CONT P(MD) .773 / 2017)

Order : These petitions coming on for orders upon perusing the petitions and the respective affidavits filed in support thereof and upon hearing the arguments of M/S.F.MOHAN for M/S.R.SELVAKUMAR, Advocate for the petitioner in WP.No.10614/2017 and of M/S.M.KANNAN, Advocate for the petitioner in WP(MD).No.20767/2013 and of M/S.R.ALAGUMANI, Advocate for the petitioner in WP(MD).No.18748/2013 AND CONT.P(MD).NO.1340/2014 and of M/S.B.ASHA, Advocate for the petitioner in WP(MD).No.14699/2015 and of M/S.VAIKO, PARTY IN PERSON WP(MD).16485/2015 and of M/S.J.M.HASSANU BEZARI, Advocate for the petitioner in WP.No.3075/2017 and of M/S.S.RAJASEKAR, Advocate for the petitioner in WP.No.4646/2017 and of M/S.AJMAL ASSOCIATES, Advocate for the petitioner in WP(MD).5456/17 and of M/S.N.MOHAN, Advocate for the petitioner in WP(MD).2847/2017 and of M/S.R.VIJAYAKUMAR, Additional Government Pleader on behalf of the the 1 & 3 respondents in WP.No.10614/2017 and of M/S.MENON KARTHIC MUKUNDAN, Advocate for the 5th respondent in WP.No.10614/2017 and of M/S.P.VIJAYENDRAN, Advocate for the 6th respondent in WP.No.10614/2017 and of 4th respondent not appearing either in person or by an advocate the court made the following order:-

(Order of the Court was made by the *Hon'ble Chief Justice*)

In W.P.No.10614 of 2017, filed by way of public interest litigation, the petitioner, an advocate has sought an order in the nature of writ of mandamus directing the first respondent to constitute a Committee of Experts to study the alleged ill-effects of Prosopis Juliflora (which is locally known as *"Seemai Karuvelam")* in the State of Tamil Nadu and submit a report to this Court. Later, the writ petition was directed to be heard along with the other similar writ petitions relating to the removal of Seemai Karuvelam trees in the State.

2. By an order dated 11th May, 2017, this Bench, by consent of parties, as specified in paragraph 6, constituted a Committee of Experts to monitor and approve the removal, if necessary, of the Seemai Karuvelam trees in a phased manner.

3. The Committee was directed to make a scientific study on the ill-effects of Seemai Karuvelam trees as also the utility thereof and make recommendations with regard to removal thereof, if necessary, in a phased manner without causing ecological imbalance and also suggest alternatives such as alternative plantations, etc., to preserve the ecological balance. The Committee was permitted to take the assistance of the Advocate Commissioners, Educational Institutions and/or Non-Government Organizations with expertise in the field and such other interested persons and/or stake-holders as it might deem appropriate at its discretion. The Committee was directed to submit an interim report within 45 days, which the Committee has done.

4. From the interim report of the Committee, it appears that enormous literature on Prosopis Juliflora indicates both positive and negative effects of the species on various aspects of ecology. The positive aspects related to agroforestry, soil reclamation, phytoremediation and other economic environmental and social benefits overweigh the negative effects. As per the interim report, scientific studies available on depleting ground water and soil moisture indicate that there is no proven adverse record. There are no scientific studies to conclude and recommend on the issue in this part of the country.

5. As per the interim report, scientific study on root length penetrating deep into the soil was sporadic and from countries such as Brazil and South Africa. No relevant studies had been conducted in India. It was observed that alien species behave differently with regard to growth patterns in different countries.

6. As per the interim report, there is also no experimental proof that Seemai Karuvelam trees evaporate excess amount of absorbed water. On the contrary, this species is a xerophyte and has many adaptations in its leaf morphology to reduce water loss.

7. The report also suggests that literature on impact of Prosopis Juliflora (Seemai Karuvelam) on other species is limited and consists of conflicting reports. The studies indicate that Prosopis Juliflora, if trained/allowed to grow into a straight stem by pruning the branches, does not inhibit growth of other biota underneath. Bushy uncontrolled growth which does not permit enough light prevents the growth of other species as per the report. The use of ripe pods as fodder and food has been recorded in the available literature. Its effect on fertility of animals and humans is not really known.

8. In Chapte8 of the interim report, strategy for the management of Seemai Karuvelam and its removal and rehabilitation of cleared areas is set forth. The interim report opines that magnitude of resilience and distribution of the plant makes Seemai Karuvelam virtually impossible to eradicate once established. However, the following methods would help to eradicate the species.

(a) Mechanical uprooting
(b) Bulldozer pushing and blade ploughing
(c) Slashing and digging out the roots

Care is to be exercised to uproot the entire tree, failing which new sprouts could easily establish within a short period. Uprooting may preferably be carried out during the summer season. Recommendations as per the interim report as enumerated in Chapte9 are as follows:-

(i) Removal of Seemai Karuvelam in a phased manner across water bodies of the State might be initiated in order to facilitate flow of water and augment the storage capacity of water bodies.

(ii) Removal process might be either mechanical or manual depending on terrain and location.

(iii) Detailed study might be initiated on the actual impact of Seemai Karuvelam on ground water as well as the overall ecosystem with specific reference to the State of Tamil Nadu

(iv) In southern districts such as Virudhunagar, Pudukkotai, Ramanathapuram, Tirunelveli, Thoothukudi and other areas where Seemai Karuvelam is dominant and the soil is not suitable for plant diversity, total removal of Seemai Karuvelam is not recommended.

(v) Other socio economic aspects need an in-depth analysis before arriving at any decision with regard to full scale removal of Seemai Karuvelam.

(vi) Land use management system might be designed and promoted to control the spread of the species, wherever required.

(vii) The Committee has also identified wide range of alternate species for rehabilitating areas cleared of Seemai Karuvelam to maintain a healthy ecosystem.

A list has been given in page Nos.68 & 69 of the interim report.

9. A careful reading of the interim report, in particular the recommendations in Chapte9, indicates that removal of Seemai Karuvelam in a phased manner in some areas and in particular from water bodies is necessary.

10. As per the first recommendation, a plan may be worked out and implemented for removal of Seemai Karuvelam trees across the water bodies of the State in a phased manner in order to facilitate flow of water and augment the storage capacity of water bodies.

11. The respondents shall with the help of the Committee and other Experts, identify the areas where removal process should be mechanical and the areas where removal should be manual. A programme of appropriate land use management system shall also be designed and evolved to control the spread of the species wherever required. The areas shall have to be identified.

12. A programme should also be identified and evolved for planting alternate species on the land cleared of Seemai Karuvelam. The process of removal, where necessary, should be commenced at the earliest and in particular across the water bodies of the State to facilitate flow of water and to augment storage capacity of water bodies. The Committee shall undertake the actual impact of Seemai Karuvelam on ground water as well as over all ecosystem with special reference to the State. In the places in which Seemai Karuvelam trees have already been removed, the respondents are directed to start the process of afforestation as suggested by the Committee by planting species mentioned in the Annexure to the interim report. A further report of the action taken shall be submitted to this Court within a period of eight weeks from date.

13. Mr.R.K.Upadhyay, I.F.S., Chairman of the Committee/Principal Chief Conservator of Forests (Research & Education), Chennai is requested to be present to assist this Court on the next date of hearing.

14. We appreciate the assistance rendered by the Advocate Commissioners and we request the Advocate Commissioners to continue to render their assistance. The Committee/respondents shall take the help of the Advocate Commissioners as and when necessary.

15. List on 13.10.2017.

-sd/-
28/07/2017

/ TRUE COPY /

Sub-Assistant Registrar (Statistics / C.S.)
High Court, Madras - 600 104.

TO

1 CHIEF SECRETARY
GOVERNMENT OF TAMIL NADU, SECRETARIAT, FORT
ST. GEORGE, CHENNAI - 600 009.

2 PRINCIPAL SECRETARY TO
GOVERNMENT, ENVIRONMENT & FOREST DEPARTMENT,
GOVERNMENT OF TAMIL NADU, SECRETARIAT, FORT
ST. GEORGE, CHENNAI- 600 009.

3 THE DISTRICT COLLECTOR

KANCHEEPURAM DISTRICT, KANCHEEPURAM.

4 CHIEF WILDLIFE WARDEN
GUINDY ,CHILDRENS PARK, RAJ BHAVAN POST,
CHENNAI - 600 032.

5 DIRECTOR
INDIAN INSTITUTE OF TECHNOLOGY, BESIDES
ADYAR CANCER INSTITUTE SARDAR PATEL ROAD,
ADYAR, CHENNAI- 600 036.

6 THE SECRETARY TO GOVERNEMENT GOVERNEMNT OF TAMIL NADU,
ENVIRONMENT & FOREST DEPARTMENT, SECRETARIAT, ST. GEORGE FORT,
CHENNAI 009.

7 THE SECRETARY TO GOVERNEMENT GOVERNMENT OF TAMIL NADU, PWD
SECRETARIAT, ST. GEORGE FORT, CHENNAI 009.

8 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, MADURAI
DISTRICT.

9 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, ARIYALUR
DISTRICT.

10 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, CHENNAI
DISTRICT.

11 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, COIMBATORE
DISTRICT.

12 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, CUDDALORE
DISTRICT.

13 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, DHARMAPURI
DISTRICT.

14 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, DINDIGUL
DISTRICT.

15 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, ERODE DISTRICT.

16 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, KANYAKUMARI
DISTRICT.

17 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, KARUR DISTRICT.

18 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, KRISHNAGIRI
DISTRICT.

19 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, NAGAPATTINAM
DISTRICT.

20 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, NAMAKKAL

DISTRICT.

21 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, PERAMBALUR DISTRICT.

22 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, PUDUKOTTAI DISTRICT.

23 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, RAMANATHAPURAM DISTRICT.

24 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, SALEM DISTRICT.

25 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, SIVAGANGAI DISTRICT.

26 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THANJAVUR DISTRICT.

27 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THENI DISTRICT.

28 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THE NILGIRIS DISTRICT.

29 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, TIRUNELVELI DISTRICT.

30 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THIRUVANNAMALAI DISTRICT.

31 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THIRUVARUR DISTRICT.

32 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THIRUPPUR DISTRICT.

33 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, THIRUVALLUR DISTRICT.

34 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, TIRUCHURAPPALI DISTRICT.

35 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, TUTICORIN DISTRICT.

36 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, VELLORE DISTRICT.

37 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, VILLUPURAM DISTRICT.

38 THE DISTRICT COLLECTOR COLLECTOR OFFICE COMPLEX, VIRUDHUNAGAR DISTRICT.

39 THE COMMISSIONER MADURAI MUNICIPAL
CORPORATION, ANNA MALIGAI, MADURAI.

40 THE EXEC UTIVE ENGINEER PUBLIC
WORKS & WATER RESOURCES ORGANIZATION,
PERIYAR VAIGAI BASIN PROJECT,
THALLAKULAM, MADURAI-2.

41 THE CHIEF ENGINEER PUBLIC
WORK DEPARTMENT MADURAI

42 THE COMMISSIONER MADURAI
CITY MUNICIPAL CORPORATION, ANNA MALIGAI, MADURAI.

43 THE CHIEF ENGINEER PUBLIC WORKS DEPARTMENT, THALLAKULAM, MADURAI

44 OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR FOREST, SOUTHERN
REGION, MADURAI

45 THE SECRETARY TO GOVERNMENT GOVERNMENT OF TAMIL NADU, PUBLIC
WORKS DEPARTMENT, SECERETARIAT, FORT ST.GEORGE, CHENNAI - 600 009.

46 THE DISTRICT COLLECTOR TRICHY DISTRICT, TRICHY.

47. THE CHAIRMAN NATIONAL HIGHWAYS AUTHORITY OF INDIA, G-5 & 6,
SECTO10, DWARKA, NEW DELHI-110 075.

48. THE CHAIRMAN PORT OF CHENNAI, NO.1, RAJAJI SALAI, CHENNAI-600
001.

49 THE TASHILDAR, TALUK OFFICE, ARIYALUR, ARIYALUR DISTRICT.

50 THE TAHSILDAR, TALUK OFFICE, SENDURAI, ARIYALUR DISTRICT.

51 THE TAHSILDAR, TALUK OFFICE UDAYARPALAYAM, ARIYALUR DISTRICT.

52 THE TASHILDAR, TALUK OFFICE, COIMBATORE NORTH, COIMBATORE
DISTRICT.

53 THE TAHSILDAR, TALUK OFFICE, COIMBATORE SOUTH, COIMBATORE
DISTRICT.

54 THE TAHSILDAR, TALUK OFFICE, METTUPALAYAM, COIMBATORE DISTRICT.

55 THE TAHSILDAR, TALUK OFFICE, POLLACHI, COIMBATORE DISTRICT.

56 THE TAHSILDAR, TALUK OFFICE, SULUR, COIMBATORE DISTRICT.

57 THE TAHSILDAR, TALUK OFFICE, VALPARAI, COIMBATORE DISTRICT.

58 THE TAHSILDAR, TALUK OFFICE, DHARMAPURI, DHARMAPURI DISTRICT.

59 THE TAHSILDAR, TALUK OFFICE, HARUR, DHARMAPURI DISTRICT.

60 THE TAHSILDAR, TALUK OFFICE, PALAKCODE, DHARMAPURI DISTRICT.

61 THE TAHSILDAR, TALUK OFFICE, PAPPIREDDIPATTI, DHARMAPURI DISTRICT.

62 THE TAHSILDAR, TALUK OFFICE, PENNAGARAM, DHARMAPURI DISTRICT.

63 THE TAHSILDAR, TALUK OFFICE, BHAVANI, ERODE DISTRICT.

64TAHSILDAR, TALUK OFFICE, ERODE, ERODE DISTRICT.

65 THE TAHSILDAR, TALUK OFFICE, GOBICHETIPALAYAM, ERODE DISTRICT.

66 THE TAHSILDAR, SATHAYAMANGALAM, ERODE DISTRICT.

67 THE TAHSILDAR, TALUK OFFICE, PERUNDURAI, ERODE DISTRICT.

68 THE TAHSILDAR, TALUK OFFICE, AGASTEESWARAM, KANYAKUMARI DISTRICT.

69 THE TAHSILDAR, TALUK OFFICE, KALKULAM, KANYAKUMARI DISTRICT.

70 THE TAHSILAR, TALUK OFFICE, THOVALAI, KANYAKUMARI DISTRICT.

71 THE TAHSILDAR, TALUK OFFICE, VILAVANCODE, KANYAKUMARI DISTRICT.

72 THE TAHSILDAR, TALUK OFFICE, DENKANIKOTTAI, KRISHNAGIRI DISTRICT.

73 THE TAHSILDAR, TALUK OFFICE, HOSUR, KRISHNAGIRI DISTRICT.

74 THE TAHSILDAR, TALUK OFFICE, KRISHNAGIRI, KRISHNAGIRI DISTRICT.

75 THE TAHSILDAR, TALUK OFFICE POCHAMPALLI, KRISHNAGIRI DISTRICT.

76 THE TAHSILDAR, TALUK OFFICE, UTHANGARAI, KRISHNAGIRI DISTRICT.

77 THE TAHSILDAR, TALUK OFFICE, KILVELUR, NAGAPATTINAM DISTRICT.

78 THE TAHSILDAR, TAKUK OFFICE, KUTTHALAM, NAGAPATTINAM DISTRICT.

79 THE TAHSILDAR, TALUK OFFICE, MAYILADUTHURAI, NAGAPATTINAM DISTRICT.

80 THE TAHSILDAR, TALUK OFFICE, NAGAPPATTINAM, NAGAPATTINAM DISTRICT.

81 THE TAHSILDAR, TALUK OFFICE, SIRKALI, NAGAPATTINAM DISTRICT.

82 THE TAHSILDAR, TALUK OFFICE, THIRUKKUVALAI, NAGAPATTINAM DISTRICT.

83 THE TAHSILDAR, TALUK OFFICE, THARANGAMBADI, NAGAPATTINAM

DISTRICT.

84 THE TAHSILDAR, TALUK OFFICE, VEDARANYAM, NAGAPATTINAM DISTRICT.

85 THE TAHSILDAR, TALUK OFFICE, EGMORE NUMGAMBAKKAM, CHENNAI DISTRICT.

86 THE TAHSILDAR, TALUK OFFICE, FORT TONDIARPET,CHENNAI DISTRICT.

87 THE TAHSILDAR, TALUK OFFICE, MAMBALAM GUINDY, CHENNAI DISTRICT.

88 THE TAHSILDAR, TALUK OFFICE, MYLAPORE TRIPLICANCE, CHENNAI DISTRICT.

89 THE TAHSILDAR, TALUK OFFICE, PERAMBUR PURASWALKAM, CHENNAI DISTRICT.

90 THE TAHSILDAR, TALUK OFFICE, CHIDAMBARAM, CUDDALORE DISTRICT.

91 THE TAHSILDAR, TALUK OFFICE, CUDDALORE,CUDDALORE DISTRICT.

92 THE TAHSILDAR, TALUK OFFICE, KATTUMANNARKOIL, CUDDALORE DISTRICT.

93 THE TAHSILDAR, TALUK OFFICE, PALANI, DINDIGUL DISTRICT.

94 THE TAHSILDAR, TALUK OFFICE, VEDASANDUR, DINDIGUL DISTRICT.

95 THE TAHSILDAR, TALUK OFFICE, ALANTHUR, KANCHEEPURAM DISTRICT.

96 THE TAHSILDAR, TALUK OFFICE, CHENGALPATTU, KANCHEEPURAM DISTRICT.

97 THE TAHSILDAR, TALUK OFFICE, CHEYYUR, KANCHEEPURAM DISTRICT.

98 THE TAHSILDAR, TALUK OFFICE, CHOLINGANALLUR, KANCHEEPURAM DISTRICT.

99 THE TAHSILDAR, TALUK OFFICE, KANCHEEPURAM, KANCHEEPURAM DISTRICT.

100 THE TAHSILDAR, TALUK OFFICE, MADHURANTHANGAM, KANCHEEPURAM DISTRICT.

101 THE TAHSILDAR, TALUK OFFICE, SRIPERUMBUDUR, KANCHEEPURAM DISTRICT.

102 THE TAHSILDAR, TALUK OFFICE, THAMBARAM, KANCHEEPURAM DISTRICT.

103 THE TAHSILDAR, TALUK OFFICE, TIRUKLUKUNDRAM, KANCHEEPURAM DISTRICT.

104 THE TAHSILDAR, TALUK OFFICE, UTHIRAMERUR, KANCHEEPURAM DISTRICT

105 THE TAHSILDAR, TALUK OFFICE, ARAVAKURICHI, KARUR DISTRICT.

106 THE TAHSILDAR, TALUK OFFICE, KADAVUR, KARUR DISTRICT.

107 THE TAHSILDAR, TALUK OFFICE, KARUR, KARUR DISTRICT.

108 THE TAHSILDAR, TALUK OFFICE, KRISHNARAYAPURAM, KARUR DISTRICT.

109THE TAHSILDAR, TALUK OFFICE, KULITHALAI, KARUR DISTRICT.

110 THE TAHSILDAR, TALUK OFFICE, MADURAI NORTH, MADURAI DISTRICT.

111 THE TAHSILDAR, TALUK OFFICE, MADURAI SOUTH, MADURAI DISTRICT.

112 THE TAHSILDAR, TALUK OFFICE, MELUR, MADURAI DISTRICT.

113 THE TAHSILDAR, TALUK OFFICE, Y.OTHAKKADAI, MADURAI DISTRICT.

114 THE TAHSILDAR, TALUK OFFICE, PERAIYUR, MADURAI DT.

115 THE TAHSILDAR, TALUK OFFICE, THIRUMANGALAM,MADURAI DT.

116 THE TAHSILDAR, TALUK OFFICE, USILAMPATTI, MADURAI DT.

117 THE TAHSILDAR, TALUK OFFICE, VADIPATTI, MADURAI DT.

118 THE TAHSILDAR, TALUK OFFICE NAMAKKAL, NAMAKKAL DT

119 THE TAHSILDAR, TALUK OFFICE, PARAMATHI VELUR, NAMAKKAL DT.

120 THE TAHSILDAR, TALUK OFFICE, RASIPURAM, NAMAKKAL DT.

121 THE TAHSILDAR, TALUK OFFICE, THIRUCHENGODE,NAMAKKAL DT.

122 THE TAHSILDAR, TALUK OFFICE, KUNNAM, PERAMBALUR DT.

123 THE TAHSILDAR, TALUK OFFICE, PERAMBALUR, PERAMBALUR DT.

124 THE TAHSILDAR, TALUK OFFICE, VEPPANTHATTAI, PERAMBALUR DT.

125 THE TAHSILDAR, TALUK OFFICE, KADALADI, RAMANATHAPURAM DT.

126 THE TAHSILDAR, TALUK OFFICE, KAMUTHI, RAMANATHAPURAM DT.

127 THE TAHSILDAR, TALUK OFFICE, MUDUKULATHUR, RAMANATHAPURAM DT.

128 THE TAHSILDAR, TALUK OFFICE, PARAMAKUDI, RAMANATHAPURAM DT.

129 THE TAHSILDAR, TALUK OFFICE, RAMANATHAPURAM, RAMANATHAPURAM DT.

130 THE TAHSILDAR, TALUK OFFICE, RAMESWARAM, RAMANATHAPURAM DT.

131 THE TAHSILDAR, TALUK OFFICE, TIRUVADANAI, RAMANATHAPURAM DT.

132 THE TAHSILDAR, TALUK OFFICE, DEVAKOTTAI, SIVAGANGAI DT.

133 THE TAHSILDAR, TALUK OFFICE, ILAYANKUDI, SIVAGANGAI DT.

134 THE TAHSILDAR, TALUK OFFICE, KARAIKUDI, SIVAGANGAI DT.

135 THE TAHSILDAR, TALUK OFFICE MANAMADURAI, SIVAGANGAI DT.

136 THE TAHSILDAR, TALUK OFFICE, SIVAGANGAI, SIVAGANGAI DT.

137 THE TAHSILDAR, TALUK OFFICE, TIRUPATHUR, SIVAGANGAI DT.

138 THE TAHSILDAR, TALUK OFFICE, ANDIPATTI, THENI DT.

139 THE TAHSILDAR, TALUK OFFICE, BODINAYAKANUR, THENI DT.

140 THE TAHSILDAR, TALUK OFFICE, PERIYAKULAM, THENI DT.

141 THE TAHSILDAR, TALUK OFFICE,THENI, THENI DT.

142 THE TAHSILDAR, TALUK OFFICE, UTHAMAPALAYAM, THENI DT.

143 THE TAHSILDAR, TALUK OFFICE, ALANGULAM, TIRUNELVELI DT.

144 THE TAHSILDAR, TALUK OFFICE, AMBASAMUTHIRAM, TIRUNELVELI DT.

145 THE TAHSILDAR, TALUK OFFICE, NANGUNERI, TIRUNELVELI DT.

146 THE TAHSILDAR, TALUK OFFICE,PALAYAMKOTTAI, TIRUNELVELI DT.

147 THE TAHSILDAR, TALUK OFFICE, RADHAPURAM, TIRUNELVELI DT.

148 THE TAHSILDAR, TALUK OFFICE, SANKARANKOVIL, TIRUNELVELI DT.

149 THE TAHSILDAR, TALUK OFFICE, SHENKOTTAI, TIRUNELVELI DT.

150 THE TAHSILDAR, TALUK OFFICE, SIVAGIRI, TIRUNELVELI DT.

151 THE TAHSILDAR, TALUK OFFICE, THENKASI, TIRUNELVELI.

152 THE TAHSILDAR, TALUK OFFICE, TIRUNELVELI, TIRUNELVELI DT.

153 THE TAHSILDAR, TALUK OFFICE, VEERAKERALAMPUTHUR, TIRUNELVELI DT.

154 THE TAHSILDAR, TALUK OFFICE, MANUR, TIRUNELVELI DT.

155 THE TAHSILDAR, TALUK OFFICE, KADAYANALLUR, TIRUNELVELI DT.

156 THE TAHSILDAR, TALUK OFFICE,THIRUVENGADAM,TIRUNELVELI DT.

157 THE TAHSILDAR, TALUK OFFICE, ARANI, THIRUVANNAMALAI DT.

158 THE TAHSILDAR, TALUK OFFICE, CHENGAM, THIRUVANNAMALAI DT.

159 THE TAHSILDAR, TALUK OFFICE, CHEYYAR, THIRUVANNAMALAI DT.

160 THE TAHSILDAR, TALUK OFFICE, POLUR, THIRUVANNAMALAI DT.

161 THE TAHSILDAR, TALUK OFFICE, THANDARAMPATTU,THIRUVANNAMALAI DT.

162 THE TAHSILDAR, TALUK OFFICE, THIRVANNAMALAI, THIRUVANNAMALAI DT.

163 THE TAHSILDAR, TALUK OFFICE, VANDAVASI, THIRUVANNAMALAI DT.

164 THE TAHSILDAR, TALUK OFFICE, AVINASHI, TIRUPPUR DT.

165 THE TAHSILDAR, TALUK OFFICE, DHARAPURAM, TIRUPPUR DT.

166 THE TAHSILDAR, TALUK OFFICE, KANGAYAM, TIRUPPUR DT.

167 THE TAHSILDAR, TALUK OFFICE, MADATHUKULAM, TIRUPPUR DT.

168 THE TAHSILDAR, TALUK OFFICE, PALLADAM, TIRUPPUR DT.

169 THE TAHSILDAR, TALUK OFFICE, TIRUPPUR, TIRUPPUR DT.

170 THE TAHSILDAR, TALUK OFFICE, UDUMALPET, TIRUPPUR DT.

171 THE TAHSILDAR, TALUK OFFICE, ETTAYAPURAM, TUTICORIN DT.

172 THE TAHSILDAR, TALUK OFFICE, KOVILPATTI, TUTICORIN DT.

173 THE TAHSILDAR, TALUK OFFICE, OTTAPIDARAM, TUTICORIN DT.

174 THE TAHSILDAR, TALUK OFFICE, SATHANKULAM, TUTICORIN DT.

175 THE TAHSILDAR, TALUK OFFICE, SRIVAIKUNDAM, TUTICORIN DT.

176 THE TAHSILDAR, TALUK OFFICE, THOOTHUKUDI, TUTICORIN DT.

177 THE TAHSILDAR, TALUK OFFICE, TIRUCHENDUR, TUTICORIN DT.

178 THE TAHSILDAR, TALUK OFFICE, VILATHIKULAM, TUTICORIN DT.

179 THE TAHSILDAR, TALUK OFFICE, ALANGUDI, PUDUKKOTTAI DT.

180 THE TAHSILDAR, TALUK OFFICE, ARANTHANGI, PUDUKKOTTAI DT.

181 THE TAHSILDAR, TALUK OFFICE, AVADAIYARKOVIL, PUDUKKOTTAI DT.

182 THE TAHSILDAR, TALUK OFFICE, GANDARVAKOTTAI, PUDUKKOTTAI DT.

183 THE TAHSILDAR, TALUK OFFICE, ILLUPPUR, PUDUKKOTTAI DT.

184 THE TAHSILDAR, TALUK OFFICE, KULATHUR, PUDUKKOTTAI DT.

185 THE TAHSILDAR, TALUK OFFICE, MANAMELKUDI, PUDUKKOTTAI DT.

186 THE TAHSILDAR, TLUK OFFICE, PUDUKOTTAI, PUDUKKOTTAI DT.

187 THE TAHSILDAR, TALUK OFFICE, THIRUMAYAM,PUDUKKOTTAI DT.

188 THE TAHSILDAR, TALUK OFFICE, ATTUR, SALEM DT.

189 THE TAHSILDAR, TALUK OFFICE, EDAPADY SALEM DT.

190 THE TAHSILDAR, TALUK OFFICE, GANGAVALLI, SALEM DT.

191 THE TAHSILDAR, TALUK OFFICE, METTUR, SALEM DISTRICT.

192 THE TAHSILDAR, TALUK OFFICE, OMALUR, SALEM DT.

193 THE TAHSILDAR, TALUK OFFICE, SALEM, SALEM DT.

194 THE TAHSILDAR, TALUK OFFICE SANGAGIRI, SALEM DT.

195 THE TAHSILDAR, TALUK OFFICE VALAPADY,SALEM DT.

196 THE TAHSILDAR, TALUK OFFICE, YERCAUD, SALEM DT.

197 THE TAHSILDAR, TALUK OFFICE, KUMBAKONAM, THANJAVUR DT.

198 THE TAHSILDAR, TLUK OFFICE, ORATHANADU, THANJAVUR DT.

199 THE TAHSILDAR, TALUK OFFICE, PAPANASAM, THANJAVUR DT.

200 THE TAHSILDAR, TALUK OFFICE, PATTUKKOTTAI, THANJAVUR DT.

201 THE TAHSILDAR, TALUK OFFICE, PERAVURANI, THANJAVUR DT.

202 THE TAHSILDAR, TALUK OFFICE, THANJAVUR, THANJAVUR DT.

203 THE TAHSILDAR, TALUK OFFICE, THIRUVAIYARU, THANJAVUR DT.

204 THE TAHSILDAR, TALUK OFFICE, THIRUVIDAIMARUDHUR, THANJAVUR DT.

205 THE TAHSILDAR, TALUK OFFICE, COONOOR, THE NILGIRIS DISTRICT.

206 THE TAHSILDAR, TALUK OFFICE, GUDALUR, THE NILGIRIS DT.

207 THE TAHSILDAR, TALUK OFFICE, KOTAGIRI, THE NILGIRIS DT.

208 THE TAHSILDAR, TALUK OFFICE,KUNDAH, THE NILGIRIS DT.

209 THE TAHSILDAR, TALUK OFFICE,PANTHALUR, THE NILGIRIS DT.

210 THE TAHSILDAR, TALUK OFFICE, UDHAGAMANDALAM, THE NILGIRIS DT.

211 THE TAHSILDAR, TALUK OFFICE, AMBATHUR, THIRUVALLUR DT.

212 THE TAHSILDAR, TALUK OFFICE, GUMMIDIPOONDI, THIRUVALLUR DT.

213 THE TAHSILDAR, TALUK OFFICE, MADHAVARAM THIRUVALLUR DT.

214 THE TAHSILDAR, TALUK OFFICE, PALLIPATTU, THIRUVALLUR DT.

215 THE TAHSILDAR, TALUK OFFICE, PONNERI, THIRUVALLUR DT.

216 THE TAHSILDAR, TALUK OFFICE, PONNAMALLEE, THIRUVALLUR DT.

217 THE TAHSILDAR, TALUK OFFICE, TIRUTTANI, THIRUVALLUR DT.

218 THE TAHSILDAR, TALUK OFFICE, TIRUVALLUR, THIRUVALLUR DT.

219 THE TAHSILDAR, TALUK OFFICE, UTHUKKOTAI, THIRUVALLUR DT.

220 THE TAHSILDAR, TALUK OFFICE, KUDAVASAL, THIRUVARUR DT.

221 THE TAHSILDAR, TALUK OFFICE, MANNARGUDI, THIRUVARUR DT.

222 THE TAHSILDAR, TALUK OFFICE, NANNILAM, THIRUVARUR DT.

223 THE TAHSILDAR, TALUK OFFICE, NEEDAMANGALAM, THIRUVARUR DT.

224 THE TAHSILDAR, TALUK OFFICE, THIRUTHURAIPOONDI, THIRUVARUR DT.

225 THE TAHSILDAR, TALUK OFFICE, THIRUVARUR, THIRUVARUR DT.

226 THE TAHSILDAR, TALUK OFFICE, VALANGAIMAN, THIRUVARUR DT.

227 THE TAHSILDAR, TALUK OFFICE, LALGUDI, TRICHY DT.

228 THE TAHSILDAR, TALUK OFFICE, MANACHANALLUR, TRICHY DT.

229 THE TAHSILDAR, TALUK OFFICE, MANAPPARAI, TRICHY DT.

230 THE TAHSILDAR, TALUK OFFICE, MUSIRI, TRICHY DT.

231 THE TAHSILDAR, TALUK OFFICE, SRIRANGAM, TRICHY DT.

232 THE TAHSILDAR, TALUK OFFICE THIRUERUMPUR, TRICHY DT.

233 THE TAHSILDAR, TALUK OFFICE, THOTTIYAM, TRICHY DT.

234 THE TAHSILDAR, TALUK OFFICE, THURAIYUR, TRICHY DT.

235 THE TAHSILDAR, TALUK OFFICE, TRICHY, TRICHY DT.

236 THE TAHSILDAR, TALUK OFFICE, AMBUR, VELLORE DT.

237 THE TAHSILDAR, TALUK OFFICE,ARAKONAM, VELLORE DT.

238 THE TAHSILDAR, TALUK OFFICE, GUDIYATHAM, VELLORE DT

239 THE TAHSILDAR, TALUK OFFICE, KATPADI, VELLORE DT.

240 THE TAHSILDAR, TALUK OFFICE, TIRUPATTUR, VELLORE DT.

241 THE TAHSILDAR, TALUK OFFICE, VANIYAMPADI, VELLORE DT.

242 THE TAHSILDAR, TALUK OFFICE, VELLORE, VELLORE DT.

243 THE TAHSILDAR, TALUK OFFICE, WALLAJAH, VELLORE DT.

244 THE TAHSILDAR, TALUK OFFICE, GINGEE, VILLUPURAM DT.

245 THE TAHSILDAR, TALUK OFFICE, KALLAKURICHI, VILLUPURAM DT.

246 THE TAHSILDAR, TALUK OFFICE,SANKARAPURAM, VILLUPURAM DT.

247 THE TAHSILDAR, TALUK OFFICE, THINDIVANAM, VILLUPURAM DT.

248 THE TAHSILDAR, TALUK OFFICE,THIRUKOLLUR, VILLUPURAM DT.

249 THE TAHSILDAR, TALUK OFFICE, ULUNDURPET, VLLUPURAM DT.

250 THE TAHSILDAR, TALUK OFFICE, VANUR, VILLUPURAM DT.

251 THE TAHSILDAR, TALUK OFFICE, VILLUPURAM, VILLUPURAM DT.

252 THE TAHSILDAR, TALUK OFFICE, ARUPPUKOTTAI, VIRUDHUNAGAR DT.

253 THE TAHSILDAR, TALUK OFFICE, KARIAPATTI, VIRUDHUNAGAR DT.

254 THE TAHSILDAR, TALUK OFFICE, RAJAPALAYAM, VIRUDHUNAGAR DT.

255 THE HSILDAR, TALUK OFFICE, SATHUR, VIRUDHUNAGAR DT.

256 THE TAHSILDAR, TALUK OFFICE, SIVAKASI, VIRUDHUNAGAR DT.

257 THE TAHSILDAR, TALUK OFFICE, SRIVILLIPUTHUR, VIRUDHUNAGAR DT.

258 THE TAHSILDAR, TALUK OFFICE, TIRUCHULI, VIRUDHUNAGAR DT.

259 THE TAHSILDAR, TALUK OFFICE, VIRUDHUNAGAR, VIRUDHUNAGAR DT.

260 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICER, KANCHIPURAM, KANCHIPURAM DT.

261 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, WALAJABAD, KANCHIPURAM DT.

262 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICER, UTHIRAMERUR, KANCHIPURAM DT.

263 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SRIPERUMBUDUR, KANCHIPURAM DT.

264 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUNDRATHUR, KANCHIPURAM DT.
R265 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPORUR, KANCHIPURAM DT.

266 THE BLOCK DEVELOPMENT BLOCK DEVELOPMENT OFFICE, KATTANKOLATHUR, KANCHIPURAM DT.

267 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUKALUKUNDRAM, KANCHIPURAM DT.

268 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOMAS MALAI, KANCHIPURAM DT.

269 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ACHARAPAKKAM, KANCHIPURAM DT.

270 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADURANTAKAM, KANCHIPURAM DT.

271 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, LATHUR, KANCHIPURAM DT.

272 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHITHAMUR, KANCHIPURAM DT.

273 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VILLIVAKKAM, TIRUVALLUR DISTRICT.

274 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUZHAL, TIRUVALLUR DISTRICT.

275 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MINJUR, TIRUVALLUR DISTRICT.

276 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHOLAVARAM, TIRUVALLUR DISTRICT.

277 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUMMIPOONDI, TIRUVALLUR DISTRICT.

278 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUVALLANGADU, TIRUVALLUR DISTRICT.

279 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUTTANI,TIRUVALLUR DISTRICT.

280 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALLIPET, TIRUVALLUR DISTRICT

281 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, R.K.PET, TIRUVALLUR DISTRICT

282 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

TIRUVALLUR, TIRUVALLUR DISTRICT

283 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POONDI, TIRUVALLUR DISTRICT

284 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAMBATHUR, TIRUVALLUR DISTRICT

285 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ELLAPURAM, TIRUVALLUR DISTRICT

286 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POONAMALLEE, TIRUVALLUR DISTRICT

287 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CUDDALORE, CUDDALORE DT.

288 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANNAGRAMAM, CUDDALORE DT.

289 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PANRUTI, CUDDALORE DT.

290 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KURINJIPADI, CUDDALORE DT.

291 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KATTUMANNERKOIL, CUDDALORE DT.

292 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUMARATCHI, CUDDALORE DT.

293 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KEERAPALAYAM, CUDDALORE DT.

294 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELBHUVANAGIRI, CUDDALORE DT.

295 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PARANGIPETTAI, CUDDALORE DT.

296 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VRIDHACHALAM, CUDDALORE DT.

297 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAMMAPURAM, CUDDALORE DT.

298 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NALLUR, CUDDALORE DT.

299 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANGALUR, CUDDALORE DT.

300 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

TIRUKOILUR, VILLUPURAM DT.

301 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUGAIYUR, VILLUPURAM DT.

302 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.V.NALLUR VILLUPURAM DT.

303 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUNAVALUR, VILLUPURAM DISTRICT

304 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ULUNDURPET, VILLUPURAM DT

305 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANAI VILLUPURAM DT

306 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE KALIYANUR, VILLUPURAM DT

307 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANDAMANGALAM, VILLUPURAM DT

308 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VIKKIRAVANDI, VILLUPURAM DT

309 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, OLAKKUR, VILLUPURAM DT

310 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MAILAM, VILLUPURAM DT

311 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MARKANAM, VILLUPURAM DT

312 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VANUR, VILLUPURAM DT

313 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GINGEE, VILLUPURAM DT

314 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VALLAM, VILLUPURAM DT

315 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELMALAYANUR, VILLUPURAM DT

316 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALLAKURICHI, VILLUPURAM DT

317 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHINNASALEM, VILLUPURAM DT

318 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

RISHIVANDIYAM, VILLUPURAM DT

319 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SANKARAPURAM, VILLUPURAM DT

320 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIYAGADURAGAM, VILLUPURAM DT

321 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALRAYAN HILLS, VILLUPURAM DT

322 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VELLORE, VELLORE DT

323 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANIYAMBADI, VELLORE DISTRICT

324 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANAICUT VELLORE DISTRICT

325 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADHANUR, VELLORE DISTRICT

326 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KATPADI VELLORE DISTRICT

327 THE BLOCK DEVELOPMENT\ OFFICER, BLOCK DEVELOPMENT OFFICE, K.V.KUPPAM, VELLORE DISTRICT

328 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUDIYANATHAM, VELLORE DISTRICT

329 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERNAMBET, VELLORE DISTRICT

330 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, WALAJAH, VELLORE DISTRICT

331 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHOLINGAHUR, VELLORE DISTRICT

332 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARAKONAM, VELLORE DISTRICT

XR333 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, EMILI, VELLORE DISTRICT

334 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAVERIPAKKAM, VELLORE DISTRICT

335 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARCOT, VELLORE DISTRICT

336 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

THIMIRI, VELLORE DISTRICT

337 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPATHUR VELLORE DISTRICT

338 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, JOLARPET, VELLORE DISTRICT

339 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANDHILI, VELLORE DISTRICT

340 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NATRAMPALLI, VELLORE DISTRICT

341 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALANGAYAM, VELLORE DISTRICT

342 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVANNAMALAI, TIRUVANNAMALAI DISTRICT

343 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KILPENNATHUR TIRUVANNAMALAI DISTRICT

344 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THURINIJAPURAM TIRUVANNAMALAI DISTRICT

345 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POLUR TIRUVANNAMALAI DISTRICT

346 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALASAPAKKAM, TIRUVANNAMALAI DISTRICT

347 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHEPET, TIRUVANNAMALAI DISTRICT

348 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHENGAM TIRUVANNAMALAI DISTRICT

349 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUDUPALAYAM, TIRUVANNAMALAI DISTRICT

350 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THANDRAMPET, TIRUVANNAMALAI DISTRICT

351 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, JAWADUMALAI, TIRUVANNAMALAI DISTRICT

352 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHEYYAR, TIRUVANNAMALAI DISTRICT

353 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANAKKAVOOR, THIRUVANNAMALAI DISTRICT

354 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

VEMBAKKAM, THRUAVANNAMALAI DISTRICT

355 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VANDAVASI THIRUVANNAMALAI DISTRICT

356 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THELLAR, THIRUVANNAMALAI DISTRICT

357 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERAMALLUR THIRUVANNAMALAI DISTRICT

358 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARNI, THIRUVANNAMALAI DISTRICT

359 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, WEST ARNI, THIRUVANNAMALAI DISTRICT

360 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SALEM, SALEM DISTRICT

361 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEERAPANDY, SALEM DISTRICT

362 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PANAMARATHUPATTI, SALEM DISTRICT

363 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AYOTHIYAPATTINAM, SALEM DISTRICT

364 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VALAPADY, SALEM DISTRICT

365 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, YERCAUD, SALEM DISTRICT

366 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, P.N.PALAYAM, SALEM DISTRICT

367 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ATTUR, SALEM DISTRICT

368 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GANGAVALLI, SALEM DISTRICT

369 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THALAIVASAL, SALEM DISTRICT

370 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOLATHUR, SALEM DISTRICT

371 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NANGAVALLI, SALEM DISTRICT

372 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

MECHERI, SALEM DISTRICT

373 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, OMALUR, SALEM DISTRICT

374 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, HARAMANGALAM, SALEM DISTRICT

375 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAYAMPATTI, SALEM DISTRICT

376 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SANGARI, SALEM DISTRICT

377 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, IDAPPADY, SALEM DISTRICT

378 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KONGANAPURAM, SALEM DISTRICT

379 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MAC.CHOULTRY, SALEM DISTRICT

380 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ELACIPALAYAM, NAMAKKAL DISTRICT

381 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ERUMAPATTY, NAMAKKAL DISTRICT

382 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KABILARMALAI, NAMAKKAL DISTRICT

383 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOLLIHILLS, NAMAKKAL DISTRICT

384 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MALLASAMUDRAM, NAMAKKAL DISTRICT

385 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MOHANUR, NAMAKKAL DISTRICT

386 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAMAKKAL, NAMAKKAL DISTRICT

387 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAMAGIRIPET, NAMAKKAL DISTRICT

388 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUDUCHATRAM, NAMAKKAL DISTRICT

389 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PARAMATHY, NAMAKKAL DISTRICT

390 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

PALLIPALAYAM, NAMAKKAL DISTRICT

391 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RASIPURAM, NAMAKKAL DISTRICT

392 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SENDAMANGALAM, NAMAKKAL DISTRICT

393 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUCHENCODE, NAMAKKAL DISTRICT

394 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VENNANDUR, NAMAKKAL DISTRICT

395 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, DHARMAPURI, DHARMAPURI DISTRICT

396 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NALLAMPATTI, DHARMAPURI DISTRICT

397 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PENNAGARAM, DHARMAPURI DISTRICT

398 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, HARUR, DHARMAPURI DISTRICT

399 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MORAPPUR, DHARMAPURI DISTRICT

400 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PAPPIREDDIPATTI, DHARMAPURI DISTRICT

401 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARIMANGALAM, DHARMAPURI DISTRICT

402 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALACODE, DHARMAPURI DISTRICT

403 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ERODE, ERODE DISTRICT

404 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MODAKKURICHI, ERODE DISTRICT

405THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KODUMUDI, ERODE DISTRICT

406 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERUNDURAI, ERODE DISTRICT

407 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHENNIMALAI, ERODE DISTRICT

408 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

AMMAPET, ERODE DISTRICT

409 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANTHIYUR, ERODE DISTRICT

410 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BHAVANI, ERODE DISTRICT

411 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GOBI, ERODE DISTRICT

412 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAMBIYUR, ERODE DISTRICT

413 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.N.PALAYAM, ERODE DISTRICT

414 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SATHY, ERODE DISTRICT

415 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BHAVANISAGAR, ERODE DISTRICT

416 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TALAVADI, COIMBATORE DISTRICT

417 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARAMADAI, COIMBATORE DISTRICT

418 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADUKKARAI, ERODE DISTRICT

419 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, P.N.PALAYAM, COIMBATORE DISTRICT

420 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, S.S.KULAM, COIMBATORE DISTRICT

421 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THONDAMUTHUR, COIMBATORE DISTRICT

422 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANAIMALAI, COIMBATORE DISTRICT

423 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KINATHUKADAVU, COIMBATORE DISTRICT.

424 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POLLACHI (N), COIMBATORE DISTRICT.

425 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, POLLACHI (S), COIMBATORE DISTRICT.

426 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANNUR,

COIMBATORE DISTRICT.

427 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SULUR, COIMBATORE DISTRICT.

428 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SULTANPET, COIMBATORE DISTRICT.

429 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UDHAGAI, THE NILGIRIS.

430 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, COONOOR, THE NILGIRIS.

431 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOTAGIRI, THE NILGIRIS

432 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUDALUR, THE NILGIRIS.

433 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THANJAVUR, THANJAVUR DISTRICT.

434 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BUDALUR, THANJAVUR DISTRICT.

435 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVAIYARU, THANJAVUR DISTRICT.

436 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ORATHANADU, THANJAVUR DISTRICT.

437 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVONAM, THANJAVUR DISTRICT.

438 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUMBAKONAM, THANJAVUR DISTRICT.

439 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVIDAIMARUDHUR, THANJAVUR DISTRICT.

440 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPANANDAL, THANJAVUR DISTRICT.

441 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PAPANASAM, THANJAVUR DISTRICT.

442 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AMMAPET, THANJAVUR DISTRICT.

443 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PATTUKOTTAI, THANJAVUR DISTRICT.

444 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

MADUKKUR, THANJAVUR DISTRICT.

445 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERAVURANI, THANJAVUR DISTRICT.

446 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SETHUBAVACHATRAM, THANJAVUR DISTRICT.

447 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAGAPATTINAM, NAGAPATTINAM DISTRICT.

448 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KEELAIYUR, NAGAPATTINAM DISTRICT.

449 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KILVELUR, NAGAPATTINAM DISTRICT.

450 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUMARUGAL, NAGAPATTINAM DISTRICT.

451 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEDARANYAM, NAGAPATTINAM DISTRICT.

452 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MAYILADUTHURAI, NAGAPATTINAM DISTRICT.

453 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUTHALAM, NAGAPATTINAM DISTRICT.

454 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SEMBANARKOIL, NAGAPATTINAM DISTRICT.

455 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SIRKALI, NAGAPATTINAM DISTRICT.

456 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOLLIDAM, NAGAPATTINAM DISTRICT.

457 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VALANGAIMAN, TIRUVARUR DISTRICT

458 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NANNILAM, TIRUVARUR DISTRICT

459 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KODAVASAL, TIRUVARUR DISTRICT

460 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVARUR, TIRUVARUR DISTRICT

461 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KORADACHERI, TIRUVARUR DISTRICT

462 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

MANNARGUDI, TIRUVARUR DISTRICT

463 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NEEDAMANGALAM, TIRUVARUR DISTRICT

464 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOTTUR, TIRUVARUR DISTRICT

465 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUTHURAIPOONDI, TIRUVARUR DISTRICT

466 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUTHUPETTAI, TIRUVARUR DISTRICT

467 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANDANALLUR, TIRUCHIRAPPALLI DISTRICT

468 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANIKANDAM, TIRUCHIRAPPALLI DISTRICT

469 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVERAMBUR, TIRUCHIRAPPALLI DISTRICT

470 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANAPPARAI, TIRUCHIRAPPALLI DISTRICT

471 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MARUNGAPURI, TIRUCHIRAPPALLI DISTRICT

472 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VAIYAMPATTY, TIRUCHIRAPPALLI DISTRICT

473 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, LALGUDI, TIRUCHIRAPPALLI DISTRICT

474 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANACHANALLUR, TIRUCHIRAPPALLI DISTRICT

475 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PULLAMPADY, TIRUCHIRAPPALLI DISTRICT

476 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUSIRI, TIRUCHIRAPPALLI DISTRICT

477 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOTTIAM, TIRUCHIRAPPALLI DISTRICT

478 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.PET, TIRUCHIRAPPALLI DISTRICT

479 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THURAIYUR, TIRUCHIRAPPALLI DISTRICT

480 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UPPILIYAPURAM, TIRUCHIRAPPALLI DISTRICT

481 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARUR, KARUR DISTRICT

482 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THANTHONI, KARUR DISTRICT

483 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARAVAKURICHI, KARUR DISTRICT

484 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, K.PARAMATHI, KARUR DISTRICT

485 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KULITHALAI, KARUR DISTRICT

486 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KRISHNARAYAPURAM, KARUR DISTRICT

487 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAVUR, KARUR DISTRICT

488 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOGAMALAI, KARUR DISTRICT

489 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERAMBALUR, PERAMBALUR DISTRICT

490 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEPANTHATTAI, PERAMBALUR DISTRICT

491 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALATHUR, PERAMBALUR DISTRICT

492 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEPPUR, PERAMBALUR DISTRICT

493 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANNAVASAL, PUDUKOTTAI DISTRICT

494 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARIMALAM, PUDUKOTTAI DISTRICT

495 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUNNANDARKOIL, PUDUKKOTTAI DISTRICT

496 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PONNAMARAVATHI, PUDUKKOTTAI DISTRICT

497THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUDUKKOTTAI, PUDUKKOTTAI DISTRICT

498 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

THIRUMAYAM, PUDUKKOTTAI DISTRICT

499 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VIRALIMALAI, PUDUKKOTTAI DISTRICT

500 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARANTHANGI, PUDUKKOTTAI DISTRICT

501 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AVUDAYARKOIL, PUDUKKOTTAI DISTRICT

502 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GANDARVAKOTTAI, PUDUKKOTTAI DISTRICT

503 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARAMBAKKUDI, PUDUKKOTTAI DISTRICT

504THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANAMELKUDI, PUDUKKOTTAI DISTRICT

505 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVARANKULAM, PUDUKKOTTAI DISTRICT

506 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADURAI EAST, MADURAI DISTRICT

507 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADURAI WEST, MADURAI DISTRICT

508 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPARNKUNDRAM, MADURAI DISTRICT

509 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELUR, MADURAI DISTRICT

510 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOTTAMPATTI, MADURAI DISTRICT

511 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VADIPATTI, MADURAI DISTRICT

512 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALANGANALLUR, MADURAI DISTRICT

513 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, USILAMPATTI, MADURAI DISTRICT

514 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHELLAMPATTI, MADURAI DISTRICT

515 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SEDAPATTI, MADURAI DISTRICT

516 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

THIRUMANGALAM, MADURAI DISTRICT

517 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.KALLUPATTY, MADURAI DISTRICT

518 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALLIKUDI, MADURAI DISTRICT

519 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANDIPATTI, THENI DISTRICT

520 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, K.MYALADUMPARAI, THENI DISTRICT

521 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PERIYAKULAM, THENI DISTRICT.

522 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THENI, THENI DISTRICT.

523 THE BLOCK DEVELOPMENT OFFICER,BLOCK DEVELOPMENT OFFICE, BODINAICKANUR, THENI DISTRICT.

524 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHINNAMANUR, THENI DISTRICT.

525 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UTHAMAPALAYAM, THENI DISTRICT

526 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CUMBUM, THENI DISTRICT

527 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, DINDIGUL, DINDIGUL DISTRICT

528 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ATHOOR, DINDIGUL DISTRICT

529 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, REDDIARCHATRAM, DINDIGUL DISTRICT.

530 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHANNARPATTI, DINDIGUL DISTRICT.

531 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NATHAM, DINDIGUL DISTRICT

532 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NILAKOTTAI, DINDIGUL DISTRICT.

533 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BATALAGUNDU, DINDIGUL DISTRICT.

534 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

PALANI, DINDIGUL DISTRICT.

535 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ODDANCHATRAM, DINDIGUL DISTRICT.

536 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOPPAMPATTI, DINDIGUL DISTRICT.

537 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEDASANDUR, DINDIGUL DISTRICT.

538 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VADAMADURAI, DINDIGUL DISTRICT.

539 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUZILIAMPARAI, DINDIGUL DISTRICT.

540 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KODAIKANAL, DINDIGUL DISTRICT.

541 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANDAPAM, RAMANATHAPURAM DISTRICT.

542 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RAMANATHAPURAM, RAMANATHAPURAM DISTRICT

543 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, R.S.MANGALAM, RAMANATHAPURAM DISTRICT.

544 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPULLANI, RAMANATHAPURAM DISTRICT,

545 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVADANAI, RAMANATHAPURAM DISTRICT.

546 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BOGALUR, RAMANATHAPURAM DISTRICT.

547 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADALADI, RAMANATHAPURAM DISTRICT.

548 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAMUTHI, RAMANATHAPURAM DISTRICT.

549 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUDUKULATHUR, RAMANATHAPURAM DISTRICT.

550 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NAINARKOIL, RAMANATHAPURAM DISTRICT.

551 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PARAMAKUDI, RAMANATHAPURAM DISTRICT.

552 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

ARUPPUKKOTTAI, VIRUDHUNAGAR DISTRICT.

553 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VIRUDHUNAGAR, VIRUDHUNAGAR DISTRICT.

554 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARIAPATTI, VIRUDHUNAGAR DISTRICT.

555 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUCHULI, VIRUDHUNAGAR DISTRICT.

556 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NARIKUDI, VIRUDHUNAGAR DISTRICT.

557 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RAJAPALAYAM, VIRUDHUNAGAR DISTRICT.

558 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SRIVILLIPUTHUR, VIRUDHUNAGAR DISTRICT.

559 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, WATRAP, VIRUDHUNAGAR DISTRICT.

560 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SIVAKASI, VIRUDHUNAGAR DISTRICT.

561 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEMBAKOTTAI, VIRUDHUNAGAR DISTRICT.

562 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SATTUR, VIRUDHUNAGAR DISTRICT.

563 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SIVAGANGAI, SIVAGANGAI DISTRICT.

564 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALAYARKOVIL, SIVAGANGAI DISTRICT.

565 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANAMADURAI, SIVAGANGAI DISTRICT.

566 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPUVANAM, SIVAGANGAI DISTRICT.

567 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, IIAYANGUDI, SIVAGANGAI DISTRICT.

568 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUPPATHUR, SIVAGANGAI DISTRICT.

569 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SINGAMPUNARI, SIVAGANGAI DISTRICT.

570 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

SAKKOTTAI, SIVAGANGAI DISTRICT.

571 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALLAL, SIVAGANGAI DISTRICT.

572 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, DEVAKOTTAI, SIVAGANGAI DISTRICT.

573 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KANNANGUDI, SIVAGANGAI DISTRICT.

574 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, S.PUDUR, SIVAGANGAI DISTRICT.

575 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALAYAMKOTTAI, TIRUNELVELI DISTRICT.

576 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MANUR, TIRUNELVELI DISTRICT.

577 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELANEELITHANALLUR, TIRUNELVELI DISTRICT.

578 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KURUVIKULAM, TIRUNELVELI DISTRICT.

579 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SANKARANKOVIL, TIRUNELVELI DISTRICT.

580 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AMBASAMUDRAM, TIRUNELVELI DISTRICT.

581 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, CHERANMAHADEVI, TIRUNELVELI DISTRICT.

582 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PAPPAKUDI, TIRUNELVELI DISTRICT.

583 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAYAM , TIRUNELVELI DISTRICT.

584 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, NANGUNERI, TIRUNELVELI DISTRICT.

585 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KALAKADU, TIRUNELVELI DISTRICT.

586 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VALLIYOOR, TIRUNELVELI DISTRICT.

587 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RADHAPURAM, TIRUNELVELI DISTRICT.

588 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

ALANGULAM, TIRUNELVELI DISTRICT.

589 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KEELAPAVOOR, TIRUNELVELI DISTRICT.

590 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KADAYANALLUR, TIRUNELVELI DISTRICT.

591 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHENCOTTAI, TIRUNELVELI DISTRICT.

592 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TENKASI, TIRUNELVELI DISTRICT.

593 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VASUDEVANALLUR, TIRUNELVELI DISTRICT.

594 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOOTHUKUDI, THOOTHUKUDI DISTRICT.

595 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KARUNGULAM, THOOTHUKUDI DISTRICT.

596 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SRIVAIKUNDAM, THOOTHUKUDI DISTRICT.

597 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ALWARTHIRUNAGARI, THOOTHUKUDI DISTRICT.

598 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUCHENDUR, THOOTHUKUDI DISTRICT.

599 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UDANGUDI, THOOTHUKUDI DISTRICT.

600 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SATTANKULAM, THOOTHUKUDI DISTRICT.

601 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KOVILPATTI, THOOTHUKUDI DISTRICT.

602 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAYATHAR, THOOTHUKUDI DISTRICT.

603 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, OTTAPIDARAM, THOOTHUKUDI DISTRICT.

604 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VILATHIKULAM, THOOTHUKUDI DISTRICT.

605 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PUDUR, THOOTHUKUDI DISTRICT.

606 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

AGASTHEESWARAM, KANYAKUMARI DISTRICT.

607 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THOVALAI, KANYAKUMARI DISTRICT.

608 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, RAJAKKAMANGALAM, KANYAKUMARI DISTRICT.

609 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THUCKALAY, KANYAKUMARI DISTRICT.

610 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KURUNTHANCODE, KANYAKUMARI DISTRICT.

611 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUVATTAR, KANYAKUMARI DISTRICT.

612 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KILLIYOOR, KANYAKUMARI DISTRICT.

613 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MUNCHIRAI, KANYAKUMARI DISTRICT.

614 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MELPURAM, KANYAKUMARI DISTRICT.

615 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KRISHNAGIRI, KRISHNAGIRI DISTRICT.

616 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KAVERIPATTANAM, KRISHNAGIRI DISTRICT.

617 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VEPPANAPALLI, KRISHNAGIRI DISTRICT.

618 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, BARGUR, KRISHNAGIRI DISTRICT.

619 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MATHUR, KRISHNAGIRI DISTRICT.

620 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UTHANGARAI, KRISHNAGIRI DISTRICT.

621 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, HOSUR, KRISHNAGIRI DISTRICT.

622 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SHOOLAGIRI, KRISHNAGIRI DISTRICT.

623 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KELAMANGALAM,KRISHNAGIRI DISTRICT.

624 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THALLY, KRISHNAGIRI DISTRICT

625 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ARIYALUR, ARIYALUR DISTRICT.

626 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, THIRUMANUR, ARIYALUR DISTRICT.

627 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, JAYAMKONDAM, ARIYALUR DISTRICT.

628 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, ANDIMADAM, ARIYALUR DISTRICT.

629 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, T.PUDUR, ARIYALUR DISTRICT.

630 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, SENDURAI, ARIYALUR DISTRICT.

631 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UTHUKULI, TIRUPPUR DISTRICT.

632 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, GUDIMANGALAM, TIRUPPUR DISTRICT.

633 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, VELLAKOIL, TIRUPPUR DISTRICT.

634THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MADATHULAM, TIRUPPUR DISTRICT.

635THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, KUNDADAM, TIRUPPUR DISTRICT.

636 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, MULANUR, TIRUPPUR DISTRICT.

637THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, UDUMALPET, TIRUPPUR DISTRICT.

638THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, AVINASHI, TIRUPPUR DISTRICT.

639THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PALLADAM, TIRUPPUR DISTRICT.

640 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, PONGALUR, TIRUPPUR DISTRICT.

641 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, TIRUPPUR, TIRUPPUR DISTRICT.

642 THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE,

KANGAYAM, TIRUPPUR DISTRICT.

643THE BLOCK DEVELOPMENT OFFICER, BLOCK DEVELOPMENT OFFICE, DHARAPURAM, TIRUPPUR DISTRICT.

644 THE JOINT CHIEF ENGINEER (GENERAL), PUBLIC WORKS DEPARTMENT, CHEPAUK, CHENNAI - 005.

645 THE JOINT CHIEF ENGINEER, (IRRIGATION), PWD SUPERINTENDING ENGINEER, (PROCUREMENT CELL), IAMWARAM PROJECT, CHEPAUK, CHENNAI - 005.

646 THE JOINT CHIEF ENGINEER, (PLAN FORMULATION), PWD, W.R.O., CHEPAUK, CHENNAI - 005.

647 THE JOINT CHIEF ENGINEER, (OPERATION & MAINTENANCE), PWD, W.R.O., CHEPAUK, CHENNAI - 005.

648 THE JOING CHIEF ENGINEER, (DESIGN, RESEARCH AND CONSTRUCTION SUPPORT), CHEPAUK, CHENNAI - 005.

649 THE JOINT CHIEF ENGINEER, (STATE GROUND & SURFACE WATER RESOURCES DATA CENTRE), TARAMANI, CHENNAI 113.

650 THE DEPURY CHIEF ENGINEER CHENNAI REGION, CHEPAUK, CHENNAI -005.

651 THE DEPUTY CHIEF ENGINEER TIRUCHI REGION, P[UDUKKOTTAI ROAD, P.B.NO.803, SUBRAMANIAPURAM, TRICHY - 020.

652 THE DEPUTY CHIEF ENGINEER POLLACHI REGION, TOWN HALL, COIMBATORE 001.

653THE DEPUTY CHIEF ENGINEER, MADURAI REGION, THALLAKULAM, MADURAI.

654THE JOINT DIRECTOR, INSTITUTE FOR WATER STUDIES, TARAMANI, CHENNAI 113.

655 THE DIRECTOR, IRRIGATION MANAGEMENT, TRAINING INSTITUTE, THUVAKUDI, TRICHY 015.

656 THE GENERAL MANAGER, SOUTHERN RAILWAYS, GENERAL MANAGER OFFICE, GENERAL BRANCH, 1ST FLOOR NGO MAIN BUILDING, SOUTHERN RAILWAY, PARK TOWN, CHENNAI 003.

657 THE DIVISIONAL RAILWAY MANAGER, CHENNAI DIVISION, DIVISIONAL RAILWAY MANAGER OFFICE DRM COMPLEX, SOUTHERN RAILWAY, PARK TOWN, CHENNAI -003.

658 THE DIVISIONAL RAILWAY MANAGER, TRICHY DIVISION, DIVISIONAL RAILWAY MANAGER OFFICE, DRM COMPLEX, SOURTHERN RAILWAY, TRICHY 001.

659 THE DIVISIONAL RAILWAY MANAGER, MADURAI DIVISION, DIVISIONAL RAILWAY MANAGER OFFICE, DRM COMPLEX, SOSURTHERN RAILWAY, MADURAI -16

660 THE DIVISIONAL RAILWAY MANAGER, SALEM DIVISION, DIVISIONAL RAILWAY MANAGER OFFICE DRM COMPLEX, SOURTHERN RAILWAY, SALEM -005.

661 THE DIVISIONAL RAILWAY MANAGER, TRIVANDRUM DIVISION, DRM(GEL) DRM COMPLEX, SOUTHERN RAILWAY, THYCAUD, TRIVANDRUM 914.

662 THE GENERAL MANAGER, INTEGRAL COACH FACTORY (ICF), CHENNAI -38.

663THE GENERAL MANAGER, ORDINANCE FACTORY TRICHIRAPALLI, TRICHIRAPALLI -016.

664 THE GENERAL MANAGER, BHARAT HEAVY ELECTRICALS LIMITED, TRICHY -014.

665 THE ADDITIONAL CHIEF SECRETARY TO GOVERNMENT, HIGHWAYS & MINOR PORTS DEPARTMENT, FORT ST.GEORGE, SECRETARIAT, CHENNAI - 009.

666 THE PROJECT DIRECTOR, TAMIL NADU ROAD SECTOR PROJECT -II, NO.171, KESAVAPERUMALPURAM, GREENWAYS ROAD, RAJA ANNAMALAIPURAM CHENNAI -028.

667 THE DIRECTOR GENERAL (I.C HIGHWAY DEPARTMENT INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY, CHENNAI - 025.

668 THE CHIEF ENGINEER(H) NATIONAL HIGHWAYS, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

669 THE CHIEF ENGINEER(H) PROJECTS, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

670THE CHIEF ENGINEER(H) NABARD &RURAL ROAD, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

671THE CHIEF ENGINEER(H) PLANNING, DESIGNS AND INVESTIGATION, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

672 THE DIRECTOR, HIGHWAYS RESEARCH STATION, 76 SARDAR PATEL ROAD, GUINDY, CHENNAI - 025.

673 THE CHIEF ENGINEER (H) METRO, INTEGRATED CHIEF ENGINEERS OFFICE HRS CAMPUS, 76 SARDAR PATEL ROAD, GUINDY CHENNAI - 025.

674 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, CHENNAI, CHENNAI DT.

675THE ASSISTANT COMMISSIONER HR & CE DEPARTMENT, CHENNAI, CHENNAI

DT

676 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, VELLORE, THIRUVALLUR DT.

677 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, THIRUVALLUR, THIRUVALLUR DT.

678 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, KANCHEEPURAM, KANCHEEPURAM DT.

679 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, VELLORE, VELLORE DT.

680 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, SALEM, SALEM DT.

681 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, DHARMAPURI, DHARMAPURI DT AND KRISHNAGIR DT.

682 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, SALEM, SALEM DT.

683 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, NAMAKKAL, NAMAKKAL DT.

684 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, COIMBATORE, COIMBATORE DT.

685 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, COIMBATORE, COIMBATORE DISTRICT AND NILGIRIS DT.

686 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, ERODE, ERODE DT.

687 THE ASSISTANT COMMISSIONER HR & CE DEPARTMENT, TIRUPPUR, TIRUPPUR DT.

688THE JOINT COMMISSIONER, HR & CE DEPARTMENT, THANJAVUR, THANJAVUR DT.

689THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, THANJAVUR, THANJAVR DT,

690 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, NAGAPATTINAM, NAGAPATTINAM DISTRICT (EXCEPT SIRKALI MAYILADUTHURAI AND THARANGAMBADI TALUK).

691 THE ASSISTANT COMMISSIONER,HR & CE DEPARTMENT, THIRUVALLUR, THIRUVALLUR DT.

692 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, MAYILADUTHURAI.

693 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, KUMBAKONAM THIRUVIDAMARUTHUR, KUMBAKONAM TALU, THANJAVUR DT.

694 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, VILLUPURAM, CUDDALORE DT.

695 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, CUDDALORE, CUDDALORE DT.

696 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, VILLUPURAM, VILLUPURAM DT.

697 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, TRICHIRAPPALLI, TRICHIRAPPALLI DT.

698 THE JOINT COMMISSIONER HR & CE DEPARTMENT, TRICHIRAPPALLI, THRICHIRAPPALLI DT.

699 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, TRICHIRAPPALLI, TRICHIRAPPALLI DT.

700 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, ARIYALUR, PERAMBALUR DT AND ARIYALUR DT.

701 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, PUDUKOTTAI, PUDUKKOTTAI DT.

702 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, KARUR, KARUR DT.

703 THE JOINT COMMISSIONER, HR & CE DEPARTMENT, MADURAI, MADURAI DT.

704 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT MADURAI, MADURAI DT.

705THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT DINDIGUL, DINDIGUL DISTRICT AND IN DISTGRICT.

706 THE JOINT COMMISSIONER, HR & CE DEPARTMENT SIVAGANGAI, SIVAGANGAI DT.

707 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, VIRUDHUNAGAR, VIRUDHUNAGAR DT.

708 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, PARAMAKUDI, SIVAGANGAI DT AND RAMANATHAPURAM DT.

709 THE JOINT COMMISSIONER HR & CE DEPARTMENT , TIRUNELVELI, TIRUNELVELI DT.

710 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, TIRUNELVELI, TIRUNELVELI DT.

711 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, HR & CE

DEPARTMENT,THOOTHUKUDI, THOOTHUKUDI DT.

712 THE ASSISTANT COMMISSIONER, HR & CE DEPARTMENT, NAGERCOIL, KANYAKUMARI DT.

713 THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS, NO.1, JEENIS SALAIPANAGAL BUILDING, SAIDAPET,CHENNAI 015.

714 THE CONSERVATOR OF FORESTS, CHENNAI CIRCLE 259, ANNA SALAI ,DMS COMPOUND, III FLOOR, TEYNAMPET, CHENNAI - 006.

715 THE WILDLIFE WARDEN, 259 ANNA SALAI, DMS COMPOUND, IV FLOOR, TEYNAMPET, CHENNAI 006.

716 THE FOREST UTILIZTION OFFICER, 259, ANNA SALAI, DMS COMPOUND, III FLOOR, TEYNAMPET, CHENNAI - 006.

717 THE ASSISTANT CONSERVATOR OF FORESTS, FOREST PROTECTION SQUAD, 259, ANNA SALAI, DMS COMPOUND, III FLOOR, TEYNAMPET, CHENNAI - 006.

718 THE CHAIRMAN, TAMIL NADUR FOREST PLANTATION, CORPORATION LIMITED 30, GANDHIMANDAPAM ROAD, KOTTURPURAM, CHENNAI, TAMIL NADU, SOUTH -085.

719 THE CHENNAI DIRECTOR ARIGNARAANNA ZOOLOGICAL PARK, VANDALUR, CHENNAI 048.

720 THE GUINDY NATIONAL PARK RANGE GUINDY, CHENNAI - 025.

721 THE SPECIAL GOVERNMENT PLEADER (FOREST CASES) HIGH COURT, CHENNAI -014.

722 THE CHIEF CONSERVATOR OF FORESTS (RESEARCH), STATE FOREST RESEARCH INSTITUTE VANDALUR, CHENNAI - 048.

723 THE CONSERVATOR OF FORESTS (RESEARCH), STATE FOREST RESEARCH INSTITUTE CAMPUS, KOLAPPAKKAM (VIA), VANDALUR, CHENNAI - 048.

724 THE CHIEF CONSERVATOR OF FORESTS (RESEARCH), STATE FOREST INSTITUTE CAMPUS, KOLAPPAM VIA, VANDALUR, CHENNAI 048.

725 THE CHIEF CONSERVATOR OF FORESTS, (FOREST EXTENSION), STATE FOREST INSTITUTE CAMPUS KOLAPPAM VIA, VANDALUR, CHENNAI 048.

726 THE DEPUTY CONSERVATOR OF FORESTS, STATE FOREST INSTITUTE, KOLAPPAM VIA, VANDALUR, CHENNAI -048.

727 THE PRINCIPAL SECRETARY TO THE GOVERNMENT, HIGHWAYS & MINOR PORTS DEPARTMENT, GOVERNMENT OF TAMIL NADU, CHENNAI -009.

728 THE DEPUTY CHAIRMAN, V.O.CHIDAMBARANAR PORT TRUST, TUTICORIN -004.

729 THE CHAIRMAN, V.O.CHIDAMBARANAR PORT TRUST, TUTICORIN - 004.

730 THE REGIONAL EXECUTIVE DIRECTOR, SOUTH REGION, CHENNAI AIRPORT, CHENNAI.

731 THE AIRPORT DIRECTOR, TRICHY AIRPORT, TRICHY.

732 THE AIRPORT DIRECTOR MADURAI AIRPORT, MADURAI.

733 THE AIRPORT DIRECTOR, TUTICORIN AIRPORT, TUTICORIN.

734 THE AIRPORT DIRECTOR, COIMBATORE, AIRPORT, COIMBATORE.

735 THE AIRPORT DIRECTOR, OMALUR AIRPORT, SALEM.

736THE CHIEF GENERAL MANAGER/ OIC, NABARD BANK, NO.48, NUNGAMBAKKAM HIGH ROAD, AMBAL NAGAR, ANNA SALAI, NUNGAMBAKKAM, CHENNAI - 034.

737 THE SPECIAL DIRECTOR GENERAL (SR), CENTRAL PUBLIC WORKS DEPARTMENT, 1ST FLOO G WING, RAJAJI, BHAVAN 3RD AVENUE, BESANT NAGAR, CHENNAI.

738 THE DEFENCE ESTATE OFFICER, MADRAS CIRCLE, NO.306, ANNA SALAI, TEYNAMPET, CHENNAI -18.

739 THE NAVAL PORT OFFICE, PROT COMPLEX, RAJAJI SALAI, ST. GEORGE FORT, CHENNAI - 009.

740 INS KATTABOMMAN, NAVAL BASE, SOUTH VIJAYANARAYANAM, TIRUNELVELI 119, TAMIL NADU.

741 THANTHI TV, METRONATION CHENNAI TELEVISION LTD.,RMZ MILLENLA, 1C, 1ST FLOOR, 143, DR.M.G.R, ROAD, KANDANCHAVADI PERUNGUDI, CHENNAI - 096.

742 THE TAHSILDAR, TALUK OFFICE KURINIJIPADI, CUDDALORE DISTRICT.

743 THE TAHSILDAR, TALUK OFFICE, PANRUTI, CUDDALORE DISTRICT.

744 THE TAHSILDAR, TALUK OFFICE, TITAKUDI, CUDDALORE DISTRICT.

745 THE TAHSILDAR, TALUK OFFICE, VRIDACHALAM, CUDDALORE DISTRICT.

746 THE TAHSILDAR, TALUK OFFICE, ATTUR, DINDIGUL DISTRICT.

747 THE TAHSILDAR, TALUK OFFICE, DINDIGUL, DINDIGUL DISTRICT.

748 THE TAHSILDAR, TALUK OFFICE, KODAIKANAL, DINDIGUL DISTRICT.

749 THE TAHSILDAR, TALUK OFFICE, NATHAM, DINDIGUL DISTRICT.

750 THE TAHSILDAR, TALUK OFFICE, NILAKOTTAI, DINDIGUL DISTRICT.

751 THE TAHSILDAR, TALUK OFFICE, ODDANCHATRAM, DINDIGUL DISTRICT.

752 THE DISTRICT COLLECTOR,
TIRUPPUR DISTRICT, TIRUPPUR.

753 THE PRINCIPAL CHIEF CONSERVATOR OF FOREST (HEAD OF FOREST FORCE), NO.1, PANAGAL MALIGAI, JENIS ROAD, WEST SAIDAPET, CHENNAI.

754 THE CHIEF CONSERVATOR OF FOREST, O/O. THE CHIEF CONSERVATOR OF FOREST, ANAIMALAI TIGER RESERVE, POLLACHI-TIRUPPUR DIVISION, COIMBATORE DISTRICT.

755 THE ADDL. PRINCIPAL CHIEF CONSERVATOR OF FOREST & FIELD DIRECTOR, ANAIMALAI TIGER RESERVE, TAMIL NADU FOREST ACADEMY, R.S.PURAM, COIMBATORE - 641 002

756 THE DISTRICT FOREST OFFICER & DEPUTY DIRECTOR, ANAIMALAI TIGER RESERVE, POLLACHI DIVISION, TAMIL NADU FOREST ACADEMY, R.S.PURAM, COIMBATORE - 641 002

757 THE DISTRICT FOREST OFFICER & DEPUTY DIRECTOR, ANAIMALAI TIGER RESERVE, TIRUPPUR DIVISION, UDUMALPET, TIRUPPUR DISTRICT - 642 126

758 THE DISTRICT REVENUE OFFICER O/O.THE DISTRICT REVENUE OFFICER, RAMANATHAPURAM. RAMANATHAPURAM DISTRICT.

759 THE REVENUE DIVISIONAL OFFICER O/O. THE REVENUE DIVISIONAL OFFICE, RAMANATHAPURAM. RAMANATHAPURAM DISTRICT.

760 THE BLOCK DEVELOPMENT OFFICER (VILLAGE PANCHAYAT) O/O. THE BLOCK DEVELOPMENT OFFICE, MANDABAM (PLACE)UTCHIPULI POST, RAMANATHAPURAM. RAMANATHAPURAM DISTRICT.

761 THE BLOCK DEVELOPMENT OFFICER (VILLAGE PANCHAYAT) O/O.THE BLOCK DEVELOPMENT OFFICE, MANDABAM (PLACE) UTCHIPULI POST, RAMANATHAPURAM. RAMANATHAPURAM DISTRICT.

762 THE REVENUE DIVISIONAL OFFICER MUSIRI, TRICHY DISTRICT.

763 THE DISTRICT FOREST OFFICER TRICHY DISTRICT.

764 THE ASSISTANT ENGINEER PUBLIC WORKS DEPARTMENT, THURAIYUR, TRICHY DISTRICT.

COPY TO

THE FOLLOWING ADVOCATES ARE APPOINTD AS ADVOCATES COMMISSIONERS

1 N.RAMIAH
THE MADRAS BAR ASSOCIATION,
HIGH COURT, COURT BUILDINGS CHENNAI-104
CELL 9381023387

2 J.DAVID GANESAN
52, LAW CHAMBERS MADURAI BENCH
CELL 9578970739

3 SARAVANAKUMAR
52, LAW CHAMBERS MADURAI BENCH
CELL 9600499495

4 K.LIVINGSTON
NO.74,1ST SECTOR SEMATHAMMAN NAGAR,
KOYAMBEDU, CHENNAI
PH.9841444177

5 D.CHITTRARASI
OLD NO.148, NEW NO.95, PULIANTOPE
HIGHROAD, OPP.TO TB HOSPITAL,
CHENNAI 600 012.
PH.9841807489

6 S.RAJESH
NO.21/50, PARIPOORANA VINAYAKAR KOIL ST.,
MYLAPORE, CHENNAI
PH.9444232193

7 M.SANTHINI
NO.523,
DR, A,RAMASWAMY ROAD,
K.K.NAGAR CHENNAI 05
PH.9444232193

8 P.KALAIVANAN
NO.60 CANAL STREET,
TRIPLICANE,
CHENNAI 600 005.
PH.9940362239

9 L.BASKARAN
NO.S4 SUBHIKSHA APARTMENT 2ND FLOOR,
NO.6, I AVENUE, INDIRA NAGAR,
ADYAR, CHENNAI 600 020
PH.9840258174

10 P.KUMARAVEL
IST FLOOR MHAA,
MADRAS HIGH COURT
PH.9380830439

11 J. HARIKRISHNA
NO.18/3, NEW NO.12 KAILAYA CHETTY
STREET, OLDWASHERMENPET,
MADRAS 21
PH.9444216501

12 M.V.ARULMOZHI
NO.48, PERUMAL KOVIL STREET,
SAIDAPET, CHENNAI 15
PH.9790725245

13 BANUMATHY BASKARAN
F2, GLORY BLOCK,
R.C.PRINCE GARDENIA, RED
HILLS ROAD,
KOLATHUR, CHENNAI 600 099
PH.044-5567752

14 R.SATHYA BAMA
NO.393, NEW ADDITIONAL LAW
CHAMBERS, HIGH COURT BUILDINGS,
CHENNAI 104
PH.8124034119

15 J.POTHIRAI
NO.11, VENKATRATHINAM NAGAR,
PH.9444061273

16 V.SARAVANAKUMAR
521 LAW CHAMBERS,
MADURAI BENCH.
PH.9655754138

17 E.MUTHUMARI
85 LAW CHAMBERS,
MADURAI BENCH.
PH.7339660248

18 A.S.BAALAJI
NO.294, ADDITIONAL LAW
CHAMBERS, HIGH COURT
BUILDINGS,
CHENNAI 104.
PH.9841132242

19 M.KAVITHA
NO.2, SANTHAIPETTAI STREET,
MANGALAMPET POST,
VIRUTHACHALAM TALUK,
CUDDALORE DISTRICT.
PH.9952793553

20 V.KUMARAVELAN,
AO-3362, AF-BLOCK, 12TH MAIN ROAD,
8TH STREET, ANNA NAGAR,
CHENNAI 600 040
PH.9884132177

21 A.GOKULAKRISHNAN
348/160, HUSSAIN PLAZA,
3RD FLOOR, THAMBU CHETTY STREET, CHENNAI-600 001.
PH.9600413333

22 P.SRINIIVAS
D5, 31/15 FIRST, GANDHI NAGAR,
CHENNAI-600020,
PH.9444077464

23 D.DHANASWAMY
OLD NO.27, NEW NO.16, CHANDRA ILLAM,
BHARATI DASAN STREET, KUMARAN COLONY, SAIDAPET, CHENNAI-600015.
PH.9841730822

24 S.GOVINDARAJU
NO.8/23, ANJUGAM NAGAR, MAIN ROAD, KOLATHUR,
CHENNAI-600099.
PH.9962343568

25 S.S.JHITHIVANI
NO.293, NEW ADDITIONAL LAW CHAMBERS,
HIGH COURT BUILDINGS, CHENNAI-104
PH.9444031317

26 B.R.JAYAPRAKASH NARAYANAN
99, VYASAR NAGAR,
VYASARPADI, CHENNAI-600 039
PH.9884126067

27 S.B.SURESH KUMARA
NO .1, PASUMPON NAGAR,
POOMPUHAR NAGAR, KOLATHUR, CHENNAI-600 099.
PH.9841364844

28 SUCHIT ANANT PALANDE
NEW NO.321, OLD NO.156 LINGHI CHETTY STREET,
2nd FLOOR, CHENAI-600 001.
PH.9840327282

29 R.JAIKUMAR
NO.191, PRUDENT HOMES, 12th STREET,
BALAJI NAGAR, KUBERAN NAGAR EXTN.,
MADIPAKKAM, CHENNAI-91

30 D.RAJA
183, FLAT T3, VINOTH VALENCIA,
THIRUKKURAL MUNUSAMY STREET,
PANEER NAGAR,
MOGAPPAIR, CHENNAI-600037.
PH.9444024440

31 G.GEETHA PRIYA
NO.4/20 STATE BANK COLONY, S2, THAMARI FLATS,
SECOND FLOOR, PERAMBUR,
CHENNAI-600 011.
PH.9600136303

32 R.ANBUKARASU
THA MADRAS BAR ASSOCIATION,
HIGH COURT, BUILDINGS, CHENNAI-104
PH.9444077689

33 PONRAM RAJA
MADRAS BAR ASSOCIATION,
MADRAS HIGH COURT, CHENNAI
PH.9677245241

34 N.VIGNESH,
THE MADRAS BAR ASSOCIATION,
HIGH COURT BUILDINGS, CHENNAI-104
PH:9176020550

35 K.JAMBULINGAM,
73, 5TH CROSS STREETM THILLAI NAGAR,
KOLATHUR, CHENNAI-99,
PH:9445101249/9790798317

36 S.MANURAJ,
THE MADRAS BAR ASSOCIATION,
HIGH COURT BUILDINGS,
CHENNAI-104.
PH:9962198210

37 S.SENTHIL,
NO.74, 2ND FLOOR,
MARSHALLS ROAD,
EGKORE, CHENNAI-8.
PH:9786694334

38 S.JEYA SINGH
PH:9894444577

39 T.GANESAN,
NO.47, 1ST FLOOR,
MOORE STREET,
CHENNAI.
PH:9884426316

41 P.RAVIKUMAR,
NO.2, PILLAIYAR KOVIL STREET,
POONAMALLEE, CHENNAI-56.
PH:9841070674

42 R.SANGEETHA,
82, LAW CHAMBERS,
MADURAI BENCH.
PH:9791220040

43 V.MANIVANNAN,
82, LAW CHAMBERS,
MADURAI BENCH.
PH:8489858093

44 R.SUBRAMONIAM,
27-N, 3RD FLOOR,
PANDUKLIX PLAZA, 168/330,
THAMBU CHETTY STREET,
CHENNAI 600 001.
PH:9444194819

45 KU.R.JAYAH,
DOOR NO.55, U-BLOCK,
9TH STREET, ANNA NAGAR,
CHENNAI 600 040.
PH:9962044893

46 P.PUSHPAKARAN,
NO.160, ROOM, NO.10,
SECOND FLOOR, HUZZAIN PLAZA,
THAMBU CHETTY STREET,
CHENNAI-600 001.
PH:9444204061

47 C.S.K.SATHISH,
MADRAS BAR ASSOCIATION,
HIGH COURT BUILDINGS,
I FLOOR, CHENNAI-600 104.
PH:9840125700

48 B.MAHESWARI,
PLOT NO.23, DOOR NO.4,
T.K.PANI I STTRET,
PERIYAR NAGAR,
NESAPAKKAM WEST,
K.K.NAGAR, CHENNAI-600 078.
PH:9293103404

49 K.JAYALAKSHMI
368 ADD LAW CHAMBERS
HIGH COURT BUILDIGS
CHENNAI-104
PH:9841292116

50 P. TAMIZH KUMARAN
CEEBROS LAKSHMI
APARTMENTS, 25 FOURTH
MAIN ROAD, KASTHURIBA NAGAR,
ADYAR CHENNAI-600 020
PH: 7667010559

51 A.SANKAR RAMASUBRAMANIAN
54 LAW CHAMBERS,
MADURAI BENCH
PH: 9600861435

52 V.MALLEESWARI
S-3, HITECH RAMYAM, PLOT
NO.30/31 SUNDAR AVENUE,
KAMARAJAPURAM,
SEMBAAKAM,
CHENNAI- 600 073
PH: 9940341977

53 V..R.HELAN VIMALA RANI
OLD NO.129, NEW NO.22,
THIRUVENGADAPURA
M,2ND STREET, CHOOLAIMEDU,
CHENNAI-94.
PH:9941407257

54 G.MUNIRAJ
D.74 18TH FIRST CROSS STREET,
PEIYAR NAGAR
CHENNAI-600 082
PH:9444643149

55 S.MALAYAPPAN
NO.19, VATHIYAR THOOTTAM MAIN ROAD,
RENGARAJPURAM,
KODAMBAKKAM,
CHENNAI-24
PH:9841845430

56 N.DHANASEKARAN
NO.22/1G.A.ROAD, WASHERMENPET,
CHENNAI-600 021
pH:9841201909

57 S.SUKUMAR
NO.10/6, PERUMAL KOIL 1ST STREET,
AGRAHARAM, KORATTUR,
CHENNAI-600 076
PH:9940686222/8124644959

58 R.GHANDHIMADHI
NO.5/174, ANBAZHAGAN STREET,
MONDIAMMAN NAGAR, REDHILLS
CHENNAI-52
PH:9940384161

59 K.ANEESFAATHIMA
SINGAPORE PLAZA,
NO.164, LINGGI CHETTY STREET,
CHENNAI-600 001.
PH:9176001720/9094676344

60 D.KANAKALAKSHMI
241 NEW ADDITIONAL CHAMBERS,
HIGH COURT BUILDINGS
CHENNAI-104
PH:9840346965

61 S.HEMALATHA
AP 418, 19TH STREET, I BLOCK,
THIRUVALLUR
KUDIRIPPU, ANNA NAGAR,
CHENNAI-600 040
PH:9840111120

62 V.MURALI
NO.5/24 WELCOME COLONY
EAST MAIN ROAD,
THIRUMANGALAM, CHENNAI
PH:9444162175

63 M.K.ASEENA
SHOP NO.9, SINGAPORE PLAZA,
NO.164, LINGGI CHETTY STREET,
CHENNAI-600 001
PH:9176001702/9094826603

64 M.SHIVA SUDHAAKAR,
NO.5/3, SUNDARA VINAYAGAR KOIL STREET,
OLD WASHERMENPET, CHENNAI-21.
CELL NO.9884116046.

65 S.ARUNKUMAR
NO.320, NEW LAW CHAMBER,
SECOND FLOOR HIGH COURT,
CHENNAI, CELL NO.9444153684

66 LITA SRINIVASAN
NO.194, LAW CHAMBERS HIGH
BUILDINGS, CHENNAI-600 104
CELL NO.9841073412

67 K.THIRUKKUMARAN
NO.11/2, PUZHAL,
MURUGESAN STREET,
CHENNNAI-600 011.
CELL NO.9043332211/9600450100

68 V.ALAMELU
NO.F3 DEEPTHI HOMES,
NO.3, EKAMBARA IYER STREET,
VENKATAPURAM, AMBATTUR, CHENNAI-600 053.
CELL NO.98402211098.

69 P.PUNNIYAKOTTI
NO.36, VGP I MAIN ROAD,
UTHANDI, CHENNAI-600 119.
CELL NO.9444011469.

70 C.ADHIKESAVAN
NO.233, SC BOSE ROAD, YMCA
BUILDINGS (ANNEXE), CHENNAI-600 001.

71 C.SASTHA SIVANATHANU PILLAI @
C.S.S.PILLAI, NO.16, 6TH MAIN ROAD,
R.A.PURAM, CHENNAI-28, CELL NO.9443994801

72 K.MUBARAK
NO.3/472 ECR, PALAVAKKAM,
CHENNAI-41,CELL NO.9710406049.

73 M.MUNIASAMY
NO.3, LAW CHAMBERS,
MUDARAI BENCH.
CLL NO.9442122367.

74 V.K.SARAVANAN
NO.3, LAW CHAMBERS,
MUDARAI BENCH.
CELL NO.9788774542

75 JAYANTHY MATHIVANAN,
NO.16, ARUMUGAN STREET,
PERAMBUR, CHENNAI-600 001.
CELL NO.9840847270.

76 MR.R.K.UPADHYAY, I.F.S., CHAIRMAN OF \
THE COMMITTEE/PRINCIPAL CHIEF CONSERVATOR OF
FORESTS (RESEARCH & EDUCATION), CHENNAI

C.C. to M/S.R.SELVAKUMAR, Advocate on payment of necessary charges

C.C. to M/S.M.KANNAN Advocate on payment of necessary charges

C.C. to S.R.ALAGUMANI Advocate on payment of necessary charges

C.C. to M/S.B.ASHA, Advocate on payment of necessary charges

C.C. to M/S.VAIKO, PARTY IN PERSON Sr.No.9914.

C.C. to M/S.J.M.HASSANU BEZARI, Advocate on payment of necessary charges

C.C. to M/S.S.RAJASEKAR, Advocate on payment of necessary charges
C.C. to M/S.AJMAL ASSOCIATES, on payment of necessary charges
C.C. to M/S.N.MOHAN, Advocate on payment of necessary charges
C.C. to M/S.MENON KARTHIC MUKUNDAN, Advocate on payment of necessary charges
C.C. to M/S.P.VIJAYENDRAN, Advocate on payment of necessary charges
+2 The Government Advocate, High Court, Madras - 104.Sr.Nos.9969, 9970

Order
in
WP No.10614 of 2017
WP(MD).Nos.20767, 18748 of 2013
WP.MD.Nos.14699, 16485 of 2015
WP.No.3075 of 2017
WP(MD).Nos.4646, 5456 & 2847 of 2017
Cont.P.(MD).Nos.1340 of 2014
and Cont.P.(MD).773 of 2017
Date :28/07/2017

From 26.2.2001 the Registry is issuing certified copies of the Interim Orders in this format
KP(08.08.2017)

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

Invasion of Prosopis Juliflora and Its Impact on Indigenous Plant Species of Sariska Region

Dr. D.S. Barola & Dr. Mohan Singh

Botany Department, SPNKS Government PG College, Dausa, Rajasthan, India

ABSTRACT: Prosopis juliflora (Spanish: bayahonda blanca, Cuji Venezuela, Trupillo Colombia, Aippia Wayuunaiki and long-thorn kiawe[1] in Hawaii) is a shrub or small tree in the family Fabaceae, a kind of mesquite. It is invades Sariska indigenous plants. It has become established as an invasive weed in Africa, Asia, Australia and elsewhere.[2] It is a contributing factor to continuing transmission of malaria, especially during dry periods when sugar sources from native plants are largely unavailable to mosquitoes.[3] Growing to a height of up to 12 metres (39 feet), P. juliflora has a trunk diameter of up to 1.2 m (4 ft).[4] Its leaves are deciduous, geminate-pinnate, light green, with 12 to 20 leaflets. Flowers appear shortly after leaf development. The flowers are in 5–10 centimetres (2–4 inches) long green-yellow cylindrical spikes, which occur in clusters of 2 to 5 at the ends of branches. Pods are 20 to 30 cm (8 to 12 in) long and contain between 10 and 30 seeds per pod. A mature plant can produce hundreds of thousands of seeds. Seeds remain viable for up to 10 years. The tree reproduces solely by way of seeds, not vegetatively. Seeds are spread by cattle and other animals, which consume the seed pods and spread the seeds in their droppings.[5]

Its roots are able to grow to a great depth in search of water: in 1960, they were discovered at a depth of 53 m (174 ft) at an open-pit mine near Tucson, Arizona,[6][7] putting them among the deepest known roots. The tree is said to have been introduced to Sri Lanka in the 19th century, where it is now known as vanni-andara, or katu andara in Sinhala. It is claimed that P. juliflora existed and was recognised even as a holy tree in ancient India, but this is most likely a confusion with P. cineraria. The tree is believed to have existed in the Vanni and Mannar regions for a long time.

KEYWORDS: Prosopis juliflora, Sariska, invasive weed, Sariska, seeds, droppings, flowers, transmission, tree

I.INTRODUCTION

Prosopis juliflora has a wide range of vernacular names, although no widely used English one except for mesquite, which is used for several species of Prosopis. It is called bayahonda blanca in Spanish, bayarone Français in French, and bayawonn in Creole. Other similar names are also used, including bayahonde, bayahonda and bayarone, but these may also refer to any other Neotropical member of the genus Prosopis. The tree is known by a range of other names in various parts of the world, including algarrobe, cambrón, cashaw, épinard, mesquite, mostrenco, or mathenge.[9] Many of the less-specific names are because over large parts of its range, it is the most familiar and common species of Prosopis, and thus to locals simply "the" bayahonde, algarrobe, etc. "Velvet mesquite" is sometimes given as an English name, but properly refers to a different species, P. velutina.[4]

Synonyms

This plant has been described under a number of now-invalid scientific names:[2]

- Acacia cumanensis Willd.
- Acacia juliflora (Sw.) Willd.
- Acacia salinarum (Vahl) DC.
- Algarobia juliflora (Sw.) Heynh.
  Algarobia juliflora as defined by G. Bentham refers only to the typical variety, Prosopis juliflora var. juliflora (Sw.) DC

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

- Desmanthus salinarum (Vahl) Steud.
- Mimosa juliflora Sw.
- Mimosa piliflora Sw.
- Mimosa salinarum Vahl
- Neltuma bakeri Britton & Rose
- Neltuma juliflora (Sw.) Raf.

Parts drawing from the 1880–1883 edition of F. M. Blanco's Flora de Filipinas. Blanco already suspected that Prosopis vidaliana, then quite recently described, was identical with bayahonda blanca.

P. juliflora tree

- Neltuma occidenatlis Britton & Rose
- Neltuma occidentalis Britton & Rose
- Neltuma pallescens Britton & Rose
- Prosopis bracteolata DC.
- Prosopis cumanensis (Willd.) Kunth
- Prosopis domingensis DC.
- Prosopis dulcis Kunth var. domingensis (DC.)Benth.

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

C.S. Kunth's Prosopis dulcis is Smooth Mesquite (P. laevigata), while P. dulcis as described by W.J. Hooker is Caldén (P. caldenia).

- Prosopis vidaliana Fern.-Vill.[10]

Prosopis chilensis was sometimes considered to belong here too, but is now usually considered a separate species.[4] Several other authors misapplied P. chilensis to P. glandulosa (honey mesquite).[2]

Names in and around Indian Subcontinent, where the species is widely used for firewood and to make barriers, often compare it to similar trees and note its introduced status; thus in Hindi it is called angaraji babul, Kabuli kikar, vilayati babul, vilayati khejra or vilayati kikar. The angaraji and vilayati names mean they were introduced by Europeans, while Kabuli kikar (or keekar) means "Kabul acacia"; babul specifically refers to Acacia nilotica and khejra (or khejri) to P. cineraria, both of which are native to South Asia.In Maharashtra it is known as "Katkali (काटकळी)". In Gujarati it is called gando baval (ગાંડી બાવળ- literally translating to "the mad tree")[11] and in Marwari, baavlia. In Kannada it is known as Ballaari Jaali (ಬಳ್ಳಾರಿ ಜಾಲಿ) meaning "Jaali", local name, abundant in and around Bellary district. In Tamil Nadu, in Tamil language it is known as seemai karuvel (சீமைக்கருவேலை), which can be analysed as சீமை ("foreign (or non-native)") + கருவேலை (Vachellia nilotica). Another Tamil name is velikathan (வேலிகாத்தான்), from veli (வேலி) "fence" and kathan (காத்தான்) "protector", for its use to make spiny barriers. In Andhra Pradesh and Telangana, in the Telugu language it is known as mulla tumma (ముల్ల తుమ్మ),sarkar tumma,"chilla chettu","Japan Tumma Chettu", "Seema Jaali", or "Kampa Chettu." In Malayalam, it is known as "Mullan." A vernacular. The Somali name is 'Garan-waa' which means 'the unknown'. In the Wayuu language, spoken on the La Guajira Peninsula in northern Colombia and Venezuela, it is called trupillo or turpío.[12] In Kenya it is called Mathenge.

II.DISCUSSION

In Sariska of Rajasthan, P. juliflora has become an invasive weed . It is considered a noxious invader different parts of Rajasthan agricultural areas. Mesquite has colonized more than 800,000 hectares (2,000,000 acres) of arable land, having severe economic and environmental impacts. With its thorns and many low branches it forms impenetrable thickets which prevent cattle from accessing watering holes, etc. It also takes over pastoral grasslands and uses scarce water. Livestock which consume excessive amounts of seed pods are poisoned due to neurotoxic alkaloids. It causes land erosion due to the loss of the grasslands that are habitats for native plants and animals. It also provides shelter for feral animals such as pigs and cats.[13]

In the Pandupole area and Ranthamhore where the mesquite was introduced in the late 1970s and early 1980s, its aggressive growth leads to a monoculture, denying native plants water and sunlight, and not providing food for native animals and cattle. The regional government with the small districts of Pali, Balotra and Dausa are looking for ways to commercialize the tree's wood, but pastoralists who call it the "Devil Tree" insist that P. juliflora be eradicated.[14]

In Kotputli fields this mesquite was planted in the 1950s near Hambantota as a shade and erosion control tree. It then invaded the grasslands in and around Hambantota and the Bundala National Park, causing similar problems as in Australia and Ethiopia.[5] P. juliflora native to Central India is also known as katu andara. It was introduced in 1880 and has become a serious problem as an invasive species.[15]

In the Indian state of Tamil Nadu, Prosopis juliflora has emerged as an invasive species. The plant was first introduced by the British in 1877 as part of an effort to plant it along the arid tracts of Southern India. During the 1960s the state government of Tamil Nadu encouraged the planting of Prosopis juliflora to overcome the shortage of firewood faced by the state at the time, it was also grown as a fence to protect agricultural fields from animals.[16] In 2017, the Madurai bench of the Madras High Court ordered the state government to eradicate the species from the state. In 2015, unsatisfied with the state government, the Madras High Court directed the government to immediately frame a policy to eradicate the plant.[17] The state on 13 July 2015 unveiled a policy to eliminate the invasive species.[18]

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

III.RESULTS AND CONCLUSIONS

The sweet pods are edible and nutritious, and have been a traditional source of food for indigenous peoples in Rajasthan[21] Pods were once chewed during long journeys to stave off thirst.[21] They can be eaten raw, boiled, dried and ground into flour to make bread,[21] stored underground, or fermented to make a mildly alcoholic beverage.[22] Prior to Gujarat colonization, the people brewed a beer from mashed Carob pods and wild honey.[23]The species' uses also include forage, wood and environmental management. The plant possesses an unusual amount of the flavanol (-)-mesquitol in its heartwood.[24]P. juliflora can be found in dry forests where it is one of the species most frequently harvested for multiple forest products.[25]

REFERENCES

1. "Long-thorn Kiawe". Hawaii Invasive Species Council. 2013-02-21. Retrieved 2017-11-08.
2. ^ "Prosopis juliflora - ILDIS LegumeWeb". www.ildis.org. Retrieved 2008-05-01.
3. ^ Muller, Gunter C.; Junnila, Amy; Traore, Mohamad M.; Traore, Sekou F.; Doumbia, Seydou; Sissoko, Fatoumata; Dembele, Seydou M.; Schlein, Yosef; Arheart, Kristopher L. (2017-07-05). "The invasive shrub Prosopis juliflora enhances the malaria parasite transmission capacity of Anopheles mosquitoes: a habitat manipulation experiment". Malaria Journal. 16 (1): 237. doi:10.1186/s12936-017-1878-9. PMC 5497341. PMID 28676093.
4. ^ "Prosopis juliflora". www.hort.purdue.edu. Retrieved 2008-05-01.
5. ^ Lalith Gunasekera, Invasive Plants: A guide to the identification of the most invasive plants of Sri Lanka, Colombo 2009, pp. 101-102.
6. ^ Phillips, W. S. (1963). "Depth of Roots in Soil". Ecology. 44 (2): 424–967. doi:10.2307/1932198. JSTOR 1932198.
7. ^ Raven, Peter H.; Evert, Ray F.; Eichhorn, Susan E., eds. (2005). "Chapter 24". Biology of Plants (7th ed.). New York, USA: Freeman. pp. 528–546. ISBN 0-7167-1007-2.
8. ^ Pasiecznik, Harris, and Smith (2004). Identifying Tropical Prosopis Species (PDF). Coventry, UK: Henry Doubleday Research Association.
9. ^ "Factsheet: Prosopis juliflora (prosopis or mesquite)".
10. ^ "Prosopis juliflora (Sw.) DC". The Plant List - A working list of all plant species. 2013.
11. ^ "An army of mad trees". www.downtoearth.org.in. Retrieved 2016-02-04.
12. ^ Villalobos et al. (2007)
13. ^ "Mesquite (Prosopis species)" Department of Sustainability, Environment, Water, Population and Communities, Canberra, at http://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/wons/pubs/prosopis.pdf
14. ^ Caroline Irby, "Devil of a problem: the tree that's eating Africa" Archived 2008-08-20 at the Wayback Machine (accessed 14 January 2009)
15. ^ Gunasekera, Lalith (6 December 2011). "Will Katu-andara Destroy the Biodiversity of Bundala Wet Land?". The Sri Lanka Guardian. Retrieved 11 September 2013.
16. ^ Kolappan, B. (2017-02-28). "Seemai karuvelam, a saviour-turned-villain whose tentacles spread far and wide". The Hindu. ISSN 0971-751X. Retrieved 2015-02-03.
17. ^ James, Sebin (2015-02-02). "Full Bench Of Madras High Court Directs State To Immediately Frame Action Plan For Removal Of Invasive 'Seemai Karuvelam' Trees". www.livelaw.in. Retrieved 2015-02-03.
18. ^ "State Unveils Policy To Rid Tamil Nadu Of 'seemai Karuvelam' | Chennai News - Times of India". The Times of India. TNN. Jul 15, 2015. Retrieved 2015-07-15.
19. ^ "List of Invasive Alien Species of Union concern - Environment - European Commission". ec.europa.eu. Retrieved 2016-07-27.
20. ^ "REGULATION (EU) No 1143/2014 of the European parliament and of the council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species".
21. ^ Pieroni, Andrea (2005). Prance, Ghillean; Nesbitt, Mark (eds.). The Cultural History of Plants. Routledge. p. 32. ISBN 0415927463.
22. ^ Peattie, Donald Culross (1953). A Natural History of Western Trees. New York: Bonanza Books. pp. 559, 562.

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

23. ^ Whigham, Thomas (2002-01-01). The Paraguayan War: Causes and early conduct. U of Nebraska Press. ISBN 978-0-8032-4786-4.
24. ^ Unusual amount of (-)-mesquitol from the heartwood of Prosopis juliflora. Sirmah Peter, Dumarcay Stephane, Masson Eric and Gerardin Philippe, Natural Product Research, Volume 23, Number 2, January 2009 , pp. 183-189
25. ^ Mendoza, Zhofre Aguirre (8 September 2014). "Productos forestales no maderables de los bosques secos de Macara, Loja, Ecuador". Retrieved 2017-11-10.

Annexure R-10

Budget Speech 2017-18

Hon'ble Speaker Sir,

1 I rise to present the Budget for the year 2017-18. It is my pleasure and privilege to present the third consecutive full Budget before this August House.

2 Speaker Sir, I am presenting the budget which has been prepared to effectively utilize the hard earned money of the citizens of Delhi for implementation of various government schemes and programmes. "People's money for the welfare of the people" is the guiding principle of our Government's visions in deciding the priorities of the Budget. I also wish to give the brief account of noteworthy achievements of our Government in last two years in the fields of education, health, electricity, water, social security and urban infrastructure. However, in the beginning, I want to highlight two unique initiatives of the Government in preparation of the Budget for the next financial year.

- The first initiative is that we have forsaken the traditional framework of Budgeting into plan and non-plan. In my last Budget speech, I had mentioned that comprehending the distinction of plan and non-plan expenditure is beyond the understanding of common man. For him, the total Budget is expenditure by the Government. This time the Budget has been divided into two sections i.e. Revenue and Capital so that the common man can easily understand the projects and schemes that Government is bringing for him and how much the expenditure is required at inception of these projects, schemes and to continue it.

- The second unique initiative is that this year we are bringing out a comprehensive 'Outcome Budget'. Budget accountability is often talked about but an Outcome Budget goes much further. We will be the first among state governments in India to adopt this. I will give a detailed account of this later but let me explain this through an example. Let's assume that ₹ 20 lakhs is spent to build a Mohalla Clinic. We then monitor if the building was constructed or not. This is budget accountability, but through the Outcome Budget we will also monitor how many people were benefited after the building was constructed. This will be its outcome, which will then be monitored every quarter.

3 Speaker Sir, I feel privileged to place the third consecutive full budget of our Government in this August House. I have always emphasised the fact that the basic role of any government is to provide opportunity and enabling environment for the people to live with dignity. Creating such opportunities and environment for the people is to enable them to have good education and lead healthy life. This will help them to earn enough for their family to fulfil the basic needs of food, clothing and housing etc. and to contribute their services to the society. Success for any government means that the people should be fearless and feel secured in the field of education and health etc. I am happy that the vision we have kept before this August House during last two years has now started showing results. Not only in Delhi, but people at national and international level have shown interest towards the works of this Government.

4 In a landmark decision, our Government has increased the minimum wages by around 37% for unskilled, semi-skilled and skilled workers. The minimum wages for unskilled persons will be increased to ₹ 13,350 per month against the existing ₹ 9,724 per month. For semi-skilled and skilled workers, it will increase from ₹ 10,764 to ₹14,698 and from ₹ 11,830 to ₹ 16,182 per month respectively. This is the first time in the country that revision of the minimum wages has been fixed in a scientific manner.

5 Similarly, our Government has increased the pension for senior citizens by ₹ 1,000 per month to enable them to live with honours and dignity. Pension for persons with disability and widows has also been increased from ₹1500 to ₹ 2500 per month.

6 Our Government has launched skill development courses in 10 night-shelters for the homeless as an innovative and pilot initiative. The courses offered in these centres are sewing, cooking, beautician services and plumbing. In each night shelter, 25 homeless per batch will be trained and certificates will be given on completion of 120 hours of training. On successful implementation of this programme, it may be extended to other night-shelters. This way the poor and homeless people can earn their living with dignity. There are around 266 night-shelters across the city having total capacity to accommodate over 21724 homeless people. Government has also provided healthcare facility in the night shelters through Mohalla Clinics.

7 All out efforts have been made to put in place a transparent system for admission of children of Economically Weaker Sections in private schools

against twenty five percent seats reserved for them. For this, admission process has been made online. We have strictly regulated the fee structure of private schools by auditing their accounts. As a result, many schools have rolled back the fee hike and started refunding the excess fee to the parents.

8 Similarly, our Government, in an important policy decision, has increased the salary of Guest Teachers deployed in government schools. Till now, the Guest Teachers were paid ₹ 17000 to ₹ 22000 per month at the rate of ₹ 700 to ₹ 900 per working day and from this month, they will get ₹ 25000 to ₹ 36000 per month at the rate of ₹ 1000 to ₹ 1445 per working day for 25 normal working days in a month. This will motivate the teachers to remain committed towards teaching.

9 The primary goals of our Government in the past two years are to provide the best possible facilities in education and healthcare to the rich and the poor. We have built number of new classrooms in government schools. We have succeeded in providing drinking water, clean toilets in each government school. We have also started organizing training programmes for our principals at Cambridge University to improve the quality of education in our schools. Mentor-teachers are being sent to Singapore for training. Leading educational Institutions such as IITs and IIMs are collaborating with us to improve the quality of education. Organisations dedicated to the cause of education such as Pratham, Saajha, Creatnet, Jodo Gyan have worked together with us to develop reading skills among our children. As a result, over one lakh children are now able to confidently read their school textbooks.

10 We have opened 9 new Vocational Colleges for education up to graduation level. This will add 2,700 seats for higher education in Delhi. Our World Class Skills Centre is already providing the best skill training to 1000 children. The government is offering loan guarantee up to ₹ 10 lakh for student to ensure that no child is deprived of higher education due to financial constraints. The Mohalla Clinics have proven to be a successful attempt to earn the trust of residents of Delhi towards health facilities. Around 26 lakh people have been benefitted from 110 Mohalla Clinics. On addition of 10,000 new beds in the hospitals, the satisfaction level of the people towards health facilities will increase. Further, taking a very important step forward in this direction, the government has initiated a Public Private Partnership model collaborating with private clinics, test centres and hospitals for providing healthcare services to the patients visiting government hospitals. Due to this arrangement, patients of the government hospitals will get early date for their tests and operations in place of waiting for months or a year in some cases.

11 The faith of people in education and health system reduces their insecurity. I feel proud that our Government, in the last two years, has reduced the sense of insecurity in the minds of the people to a great extent. By reduction of electricity tariff to 50 percent and providing free water upto 20000 litre per month, our Government has successfully improved the financial conditions and the quality of life of the people. With this, people have developed the habits for conservation of electricity and water. Now, there is no shortage of electricity in Delhi. The quality of drinking water is proposed to be improved to such an extent that the people can directly drink the water from the tap

supplied by Delhi Jal Board. The historical beginning of this programme has recently been made by Hon'ble Chief Minister in 11 Zones of Delhi Jal Board. Delhi Jal Board has guaranteed the purity of the water supply in the households of colonies under these 11 Zones. Gradually this guarantee of purity will be extended for the water supply in all colonies of Delhi.

12 The construction work of flyovers has been completed expeditiously for fast movement of the traffic in the city. The travel time from West Delhi to Wazirabad has been substantially reduced. Construction of Barapulla Phase-III and Metro Phase-III are in final stages of completion. The plan for Metro Phase-IV and signal free corridor from Loni Border to Wazirabad has been finalised. The works of these projects will commence soon.

13 At present, there are a number of social welfare schemes being implemented by various departments having individual set of database of the targeted beneficiaries. To have comprehensive service delivery mechanism with transparency in delivery of services, our Government has decided to integrate existing database of Aadhar, Permanent Account Number, Election Photo Identity Cards where uniqueness of common database is maintained. Seeding this common database with the departmental database being used for delivery of public services will be made for unique identification of beneficiaries that will help in reduction of time and cost in the delivery of services. Common data attributes of this unique database will be used for planning of new welfare schemes and to avoid duplication of welfare services.

14 I have elaborated all these facts so that we can understand the next year's budget which is dedicated to help the "common man in leading life with ease and dignity".

Economic Scenario

15 Speaker Sir, this time due to demonetisation there is a negative trend seen in the economic scenario during the last four months. I have seen the commodity-wise data which reflects economic scarcity in most of the markets due to demonetisation. I think the long term effect of this will also be seen in the next financial year. Despite the negative impact of demonetisation on the economic activities of the state, the Gross State Domestic Product of Delhi at current prices is likely to increase to ₹ 6,22,385 crore in 2016-17 from ₹ 5,51,963 crore in 2015-16, indicating a growth of 12.76 percent. In real terms, at constant prices with base year 2011-12, the growth in GSDP of Delhi is expected to be 8.26 percent in 2016-17 as per advance estimates as against 7.1 percent at national level. The contribution of Delhi to the national level GDP has increased from 3.94 percent in 2011-12 to 4.08 percent in 2016-17 though we are only 1.43 percent of total population. The contribution of tertiary sector in the Gross State Value Added of Delhi at current prices is 82.26 percent followed by 14.84 percent of secondary sector and 2.90 percent of primary sector.

16 The per capita income of Delhi at current prices is likely to increase to ₹ 3,03,073 in 2016-17 from ₹ 2,73,618 in 2015-16. This shows 10.76 percent annual growth in the per capita income of Delhi in 2016-17 over 2015-16.

The per capita income at national level has increased from ₹ 94,178 in 2015-16 to ₹ 1,03,818 in 2016-17 with an annual increase of 10.2 percent. The per capita income of Delhi is about three times higher than the per capita income at the national level.

Revised Estimates 2016-17

17 Sir, our current year's non-plan expenditure was budgeted and approved for ₹ 26,000 crore. I am happy to inform that we will manage to restrict the total non-plan expenditure to the level of ₹ 24,700 crore in the current financial year despite giving an unforeseen loan of ₹ 400 crore to North and East Municipal Corporation to partly meet their salary expenditure. This is possible only because of prudent use of public money. The plan outlay which was budgeted and approved for ₹ 20,600 crore is proposed to be reduced to ₹ 16,500 crore in the revised estimates 2016-17. The revised plan outlay of ₹ 16,500 crore in 2016-17 is 10.5 percent higher than the plan expenditure of ₹ 14,935 crore in 2015-16. Our revised estimates for the current year is ₹ 41,200 crore against the budget estimates of ₹ 46,600 crore. The current year revised estimates are 17.1 percent higher than the amount of ₹ 35,196 crore spent in the year 2015-16.

Supplementary Demand for Grants 2016-17

18 Sir, Supplementary Demands for Grant of ₹ 688.73 crore will be required under revised estimates. I, therefore, seek the approval of the House for Supplementary Demands.

Budget Estimates 2017-18

19 Speaker Sir, I am presenting budget estimates for the next financial year 2017-18. As I have already stated that the budget estimates for 2017-18 will not be in the form of plan and non-plan. Hence, discarding the earlier practice, our Government has prepared the budget of 2017-18 in two major categories i.e. Revenue and Capital expenditure.

20 Similarly, this year's budget brings in a historic innovation for ushering in transparency and accountability in public spending. This will be due to the Outcome Budget, which I talked about at the beginning of my statement.

21 Our Government believes that the relationship between a government and citizens is nothing short of a sacred contract. A contract to deliver the best possible outcomes and benefit to society for money that the taxpayers have contributed. The Outcome Budget will now become a contract between the government and its various departments. Departments will set their targets and the government will provide them fund to achieve those targets. The benefits that the people get out of that spending will be reviewed every quarter.

22 "Outcome Budget" of Government of Delhi will be put on website by 31st March 2017 and a copy will be sent to all Hon'ble MLAs. This budget will prove to be a milestone in bringing openness and answerability in public spending. It is important to understand here why this is significant budget reform.

23 A traditional budget emphasizes only financial outlays for various programmes, and ongoing performance is assessed as expenditure incurred against these outlays. In only few cases, infrastructure or services resulting from these programmes are specified in the budget. The eventual benefits or outcomes that citizens care the most are never mentioned. For example, traditional budgets would typically mention the amount allocated for construction of schools and clinics, but did not specify the targeted number of people that these institutions would serve.

24 Such a traditional approach to budgeting falls short on two major counts. First, it ignores the fact that the government is ultimately a custodian of people's hard earned money. A government's job should not be just to spend money within a certain timeframe, but to deliver on the tangible expectations and aspirations that citizens have from their elected governments. Second, with traditional budgets, it was difficult to monitor the quality of spending within the government let alone, outside the government. So far, only the "plan" components of budget were accompanied by description of programme details and physical targets, while the "non-plan" component, which accounted for more than half of the annual budget, escaped such critical review.

25 The Outcome Budget for Delhi for 2017-18 will attempt to address all these deficiencies. A comprehensive exercise was carried out in the last few months by each department and agency wherein all major programmes and schemes (revenue and capital components) were mapped against tangible outputs i.e. infrastructure or services provided, and outcomes i.e. how would the people of Delhi benefit from that spending in the short-term. A comprehensive set of quantifiable output and outcome indicators have been developed, based on which, the result can be measured. Targets for 2017-18 have been set taking the baseline value of 2016-17. Extra attention has been paid to ensure that indicators for programmes are made specific, measurable and comparable across similar institutions like hospitals, colleges, pension schemes etc.

This will be easy to explain through a few examples:

- We spend ₹ 10 crore to buy a scanning machine in a hospital. Now if our records show that ₹ 10 crore have been spent and the machine is installed, then we tend to get satisfied even if not a single person has availed diagnostic service on that machine. Now, through the Outcome Budget, we will be tracking every quarter the number of people availing the services of this machine.

- Similarly, let's consider that we spend ₹ 54 crore to build a skywalk near Pragati Maidan. In this budget, the targeted number of people expected to use this skywalk will be set at the beginning of the year, and actual usage will be reviewed every quarter.

- In the same way, we will be spending about ₹ 283 crore under Education to build a World Class Skill Centre in Jaunapur. A typical budget would be satisfied with obtaining the Utilization Certificate of spending this amount. But under the Outcome Budget, the Education department will have to tell the Government how many have received training, and how many among them employed and how many were got self-employed.

26 Government of Delhi has become the first government in India to carry out such a detailed exercise of Outcome Budgeting. Due to the large volume of data that will be generated in the coming months, an IT application will be developed to track all these commitments on a quarterly basis, based on inputs provided by departments, and in some cases, through independent surveys. We hope this will create an entirely new benchmark for performance management within any government in India.

27 I congratulate all the officials of Government of Delhi and the Planning department especially for making this effort successful. I also understand that being the first year of such a major exercise, there may be certain shortcomings and our effort will be to continuously improve upon them.

28 I have a firm belief that all stakeholders will gain substantially from this exercise. Ministers and senior officials will now use this as a basis to continuously assess the performance of all their activities, and ensure timely course corrections. Programme officials will also be benefitted while implementing the schemes as this will provide them an ideal opportunity to share their successes as well as challenges in a transparent manner. But the

biggest beneficiary of this exercise will be the people of Delhi. Due to complete transparency in the system, they will get to know how their hard earned money is being spent. The Outcome Budget will become the enforcement mechanism for the contract between the citizens and their elected government, and in turn, between the government and its departments.

29 Sir, I am also happy to announce that the Outcome Budgeting initiative will be implemented by strengthening the Monitoring and Evaluation unit of the Planning Department. The Unit will create a government-wide roadmap for effective use of modern Monitoring and Evaluation tools and techniques in Government of Delhi for improved policy making and better delivery of public services. Besides guiding Outcome Budgeting, it will help Government of Delhi to conduct independent surveys and evaluations, enable data analysis and assessment of large government datasets.

30 Sir, the total budget estimates for the year 2017-18 is proposed at ₹ 48000 crore which includes ₹ 29,500 crore towards establishment expenses, devolution to Local Bodies, Interest and Principal to be paid to Government of India, transport, water and power subsidy etc. and ₹18,500 crore for implementation of various schemes, programmes and capital projects. The proposed budget of ₹ 48000 crore will be financed from our tax revenue of ₹ 38,700 crore, non-tax revenue of ₹ 800 crore, capital receipts of ₹ 400 crore, small savings loan of ₹ 2856 crore, Centrally Sponsored Schemes of ₹ 1500 crore, Normal Central Assistance of ₹ 413 crore, Share in Central

taxes of ₹ 325 crore, other receipts of ₹ 478 crore from Government of India and the remaining amount from our opening balance.

Financial Support to Local Bodies

31 Speaker Sir, our Government will provide financial support of ₹ 7571 crore to the Local Bodies in 2017-18 which is 15.8 percent of the total Budget and 14.9 percent higher than the funds given in the Revised Estimates of 2016-17. Moreover, in view of poor financial position of North and East Municipal Corporations, we have not recovered the principal and interest amount of the outstanding loan liabilities during the year 2015-16 and 2016-17 from the grants being released to them.

32 The total financial support to Local Bodies includes ₹ 3343 crore as share in tax collection in 2017-18, ₹ 1810 crore as share in Stamps and Registration Fee and one time parking charges and ₹ 700 crore as Ways and Means advance to North and East Delhi Municipal Corporations. For implementation of various developmental works under the Urban Development, Health, Transport and Education sectors, we proposed to allocate ₹ 1718 crore to Local Bodies in this financial year.

33 Our Government is committed to support the Municipal Corporations in every possible way. We are in constant dialogue with Corporations to encourage them to increase their resources and to rationalize their ever burgeoning expenditures. I appeal to the Municipal Corporations through this August House to streamline their functioning so that Civic management does not suffer and people of this great city are not put to any hardship.

34 Now I wish to give the brief account of the major developmental initiatives proposed in the budget 2017-18. The complete details of all these schemes are elaborated in the budget documents presented in this August House.

Education

35 Speaker Sir, Education is the most priority sector for our Government. We have succeeded in creating huge infrastructure in the form of construction of new schools, new classrooms, sports grounds, clean toilet facilities etc. in the last two years. 24 new schools will start in this year. The construction work of 8000 new class rooms is almost complete. Besides this, construction of 10000 new class rooms will be started in the next financial year. It will be our sincere efforts to bring most of the schools running in second shift to the general shift. In the year 2017-18, we have focused on the quality of education by using all these facilities.

36 To ensure quality of education, Delhi Government has decided to restructure State Council of Educational Research and Training (SCERT) and District Institutes of Education and Training (DIETs). We have also decided to open two new DIETs in Delhi.

37 Our Government has decided to introduce pre-primary classes in 156 government schools in 2017-18, with upgraded infrastructure facilities.

38 We have taken a remarkable step for introducing pre-school learning for the children. Government has planned to provide better pre-school learning

facilities for the children of all section of the society in the form of early childhood education centres to be opened all over Delhi. These centres will be world class where modern and attractive facilities will be provided to each child in the age group of 2 to 6 years. Importance will be given to enhance their learning ability before starting of formal school education. It has been revealed from many international studies that if the learning abilities of children aged 2 to 6 years are developed in early years, then their capacity to study and standard of life will be improved. As a pilot, we have assigned the task to run 10 Early Childhood Education and Development (CECED) Centres to Ambedkar University. The Early Childhood Department of Ambedkar University has been allocated ₹ 4 crore for undertaking research and capacity building for this task.

39 It is proposed to set up special library within the classroom for the students of Nursery to Vth Class. Such libraries will be introduced first time in government school wherein attractive fiction books will be placed for the students in the class room itself. It will promote reading habit, inculcate sense of creativity and involve children in activities like story reading, story narration etc. An amount of ₹ 17 crore has been earmarked for this purpose in the Budget. Besides, 400 new libraries are to be opened in the government schools for Class – VI to X, in which the books of interesting stories, poetry etc. will be provided as per the age and interest of the children so that reading habits may be developed amongst the students. An amount of ₹ 100 crore has been estimated to be spent for these libraries.

40 Our Government has planned to set up five schools of Excellence in 2017-18 in the newly constructed school buildings at Rohini Sector-17, Madanpur Khadar Phase-II, Khichripur, Dwarka Sector-22 and Kalkaji. The medium of instruction in these schools of Excellence will be English and there will be classes from Pre-school to senior secondary level. These schools will have Arts, Commerce and Science Streams equipped with all modern facilities and labs to promote quality education. Commerce stream will be introduced in 142 schools at senior secondary level from 2017-18.

41 The rates of Uniform Subsidy to students will be revised in 2017-18 and all students in government and government aided schools will be benefitted. I propose to increase the rate of subsidy for students from ₹ 500/- to ₹ 1100/- for the class Nursery to V, from ₹ 700/- to ₹1400/- for Class VI to VIII and from ₹ 900/- to ₹ 1500/- for class IX to XII in the budget 2017-18.

42 The Mid Day Meal scheme is implemented in government schools for the students of Class – I to VIII with hundred percent assistance from Central Government. The grant in aid given by the Central Government is hardly sufficient to ensure the desired level of calorie and nutrition requirement with quality. Therefore, our Government has decided to supplement to the existing nutrition content by providing banana / boiled egg to each student from our own resources. It is also proposed to expand the coverage of Mid Day Meal scheme to all students of class IX to XII of girl schools. State Government will provide an additional amount of ₹ 55 crore for this programme in 2017-18.

43 At present there are maximum 11 computers in each lab of government schools which will be increased by 06 to 07 more computers in next financial year. Besides, 02 computer labs will be set up in those schools running in two shifts. Number of computer labs will also be increased where the number of students is more than 2000. Budget provision of ₹ 182 crore has been made in the budget for this purpose.

44 Commerce stream will be introduced in all government schools. Punjabi and Urdu clubs will also be set up in all government schools, where the students will get the opportunity to participate in literary activities of these languages besides learning Punjabi and Urdu. Similarly, teaching of Art and Music will be started in all the government schools. We have a plan to appoint one dance teacher in each school for the first time so that the students can learn the traditional Indian dance and music, for which, a separate department i.e. Extra Curriculum Activity Department will be started under Education Department.

45 Delhi Government has implemented a number of schemes for the teachers in the last two years which enable them to do their work with pride. In the next financial year, the staff rooms of all schools will be provided with modern facilities so that all the teachers have separate work stations, lockers, separate sitting facilities along with the facility of vending machines for making available tea, coffee, water etc.

46 We have planned to provide computer tablets to all teachers this year, so that they can maintain various data and other information of students. It will save the time of teachers being wasted in doing paper works.

47 Ambedkar University is presently functioning from its campus at Kashmere Gate and Karam Pura and 2100 students are getting education in this University. Four new campus of Ambedkar University at Dheerpur, Rohini, Karala and Lodhi Road will be opened by 2022 by which number of students is estimated to be increased from 2100 to 10000. An excellent high quality Teacher Training Institute is going to be started in Lodhi Road under the aegis of Ambedkar University. The construction work of East Delhi Campus of Guru Govind Singh Indraprastha University at Surajmal Vihar with a project cost of ₹ 271 crore shall be started soon. The new campus of Shaheed Sukh Dev College at Rohini will be completed by June, 2017 with the capacity of 2000 students.

48 Speaker Sir, we have planned for expansion of NSIT, DTU and IIIT so that to more students can be accommodated in these institutes. Capacity of new campus of DTU to be started in East Delhi next year will be 2000 students. 4000 more students would be accommodated by expansion of its existing campus and its total capacity will be increased to 12000. Number of students in Netaji Subhash University of Technology (NSUT) will be increased from 4000 to 10000. New campus of IIIT Delhi will accommodate 1400 more students. New campus of G. B. Pant Engineering College has been planned to increase the students capacity to 7000 from present capacity of 3000. The permanent campus of Indira Gandhi Technical University for Women will be constructed in 50 acres of land at Dera Mandi village.

49 Delhi Institute of Pharmaceutical Science & Research as a first college under the first Pharmaceutical University of India - Delhi Pharmaceutical Science and Research University (DPSRU) has become operational. The intake capacity has increased by 160 in the U.G. and P.G. courses. Sports Medicines course at U.G. and P.G. levels will be started from the academic session 2017-18.

50 It is proposed to augment the sports infrastructure for promotion of sports and to intensify sports coaching facilities to nurture good sports talents. Government has planned to construct two multi- storey hostels with modern facilities wherein 2350 players can be provided accommodation. Government has decided to develop sports facilities in village Kair. It has also been decided to open residential sports schools in village Samaspur Khalsa in Najafgarh area and in recently taken over Kathuria Public School at Vasant Kunj by Education Department. To impart specialised coaching to the players, 110 additional posts of Physical Education Teachers and Sports Coaches will be created in addition to the existing 19 posts.

51 The Education sector continues to be the highest priority of our Government and I propose total expenditure of ₹ 11300 crore on Education in 2017-18, this includes revenue budget of ₹ 10186 crore and capital budget of ₹ 1114 crore. A total amount of ₹ 3525 crore has been earmarked for implementation of various schemes programmes and projects. The allocation of 24 percent of total Budget Estimates on Education in Delhi is the highest among all States. This indicates our firm commitment to improve quality education in Delhi Government schools.

Health

52 Health is the next priority of Delhi Government after Education. The aim of our Government is that the citizens of Delhi may not feel insecure in the event of their illness. They may not have to fear about hospital bill or availability of facilities. Therefore in the last two years, our Government has worked to establish three – tier healthcare system. Our Government will further strengthen this three tier system in the next financial year.

53 First tier is the Mohalla Clinics where a common man can get treatment from a qualified doctor for an ordinary illness. Services of qualified doctors, medicines and diagnostics facilities are available free of cost in these Mohalla Clinics. 110 such Mohalla Clinics are already functional in Delhi and it is expected that this number will be increased above 150 by the end of current financial year. Our aim is to set up 1000 Mohalla Clinics in the next financial year for which work is going on in full swing.

54 Second tier is the Poly Clinics where specialist will be available for all diseases. Medicines and diagnostics will be free but there will be no indoor facilities. 23 such Poly Clinics are already working and their number will be enhanced to 150 by the end of next financial year.

55 Third tier is the hospitals and total number of beds in all hospitals of Delhi Government is 10,000. The work is under progress to increase the number of beds to 20,000. This work is expected to be completed in next 18 months. In addition, 3 hospitals at Burari, Ambedkar Nagar and Dwarka are under

construction and another 4 hospitals are to be established at Sarita Vihar, Nangloi, Madipur and Siraspur. There will be 5000 new beds in these 7 new hospitals. So, we will work fast to achieve the target of increasing number of beds in all Delhi Government hospitals from 10,000 beds at present to 25,000 beds.

56 Our Government is also working on schemes for issuing of Health Cards and to provide Health Insurance to all citizens of Delhi. An Outlay of ₹ 20 crore is proposed for these schemes.

57 Our Government has decided to honour such good samaritans or bystander who helps to rush road accident victims to hospitals for treatment and save the life of victims. Good samaritans shall be given cash award of ₹ 2000/- and appreciation letter from the government.

58 Five De-addiction Centres for Juveniles will be established in Delhi Government Hospitals /Institutions. Each centre will have 5 beds.

59 Pharmacies of 05 Delhi Government Hospitals (LNH, GTBH, BSAH, DDUH & LBSH) will be outsourced and a Free Generic Pharmacy – Jan Aushadhi will be established outside Indraprastha Apollo Hospital.

60 Government has already allowed free MRI / CT Scans for citizens availing health care facilities through Delhi Govt hospitals. Lab facilities and Tele-radiology through PPP will further be strengthened. An outlay of ₹15 crore is proposed for these facilities in the next year.

61 Our Government in partnership with 41 private sector hospitals having NABH accreditation, has taken a historical step to deliver the quality treatment in 30 critical and life saving surgeries. Under the scheme, the patients who are undergoing medical treatment in Delhi Government hospitals and having long waiting period for the required treatment, will be referred to private hospital. The Government will reimburse the expenditure incurred by the private hospitals at CGHS rate for complete treatment and care of critical patients referred by the Government Hospitals.

62 I propose total expenditure of ₹ 5736 crore on Health in 2017-18. This includes revenue budget of ₹ 5048 crore and capital budget of ₹ 688 crore. An amount of ₹ 2627 crore is earmarked for implementation of various schemes, programmes and projects under Health sector.

Public Transport

63 Sir, at present 5815 DTC and cluster buses are operational in Delhi which carries approximate 46 lakh passengers per day to their destination. It is proposed to add 736 more buses under cluster scheme during 2017-18.

64 Due to unavailability of adequate space for bus depots/terminals, the augmentation of the bus fleet was a challenge. Our Government has taken up this matter on priority and 11 bus depots are at various stages of completion at Dichauon Kalan-II, Dwarka Sector-22, Bawana Sector-1, Bawana Sector-5, Rewla Khanpur, Kharkhari Nahar, Rani Khera-I, Rani Khera-II, Rani Khera-III of Rohini Phase-V, Narela, East Vinod Nager. I propose an outlay of ₹ 100 crore for development of bus terminals and depots during 2017-18.

65 To provide last mile connectivity to commuters, our Government has approved the Letter of Intent scheme and consequently 10,000 new auto permits are expected to be issued in this year.

66 Our Government is committed to bring transparency in operation of buses for which electronic ticketing machine have been introduced in stage carriage buses. Now all cluster buses have electronic ticketing machines. It is also proposed to implement electronic ticketing machines in all DTC buses.

67 The existing network of DMRC is 189 KM and on completion of phase-III of DMRC it will be increased to about 325 KM. The Government have approved Metro phase-IV comprising six corridors with the length of 104 KM. The work of Metro Phase –IV will be started in 2017-18 and will be completed by December 2021. We have proposed to procure 582 Additional Rolling Stocks to facilitate the passengers of Metro commuters. I propose an amount of ₹ 1156 crore for DMRC in 2017-18.

Road Infrastructure

68 All elevated corridors and flyovers at outer ring road from Vikaspuri to Wazirabad have been opened for public which decongested the outer ring road. Construction of Parallel road on other side of nallah from Sanjay Gandhi Transport Nagar to Wazirabad Chowk will facilitate local residents of Bhalaswa, Mukundpur, Burari, Jagatpur, Wazirabad and nearby colonies.

69 Construction of underpass at Ashram Chowk along with Mathura road will be started in 2017-18. After construction of this under pass, traffic from Neela Gumbad rotary towards Badarpur boarder will move un-interrupted and de-congest Ashram Chowk.

70 Sir, I have announced in my last budget for construction of East West corridor starting from ISBT Anand Vihar to Peeragarhi and North South Corridor from Wazirabad to Airport. Consultants have been appointed for both the projects and feasibility study is in progress.

71 To ensure the safety of pedestrians at ITO, it is proposed to construct sky walk and FOB at the junction of Sikandra Road, Mathura Road, Tilak Marg and Bahadur Shah Zafar Marg at W-point & near Hans Bhawan with an estimated cost of ₹ 54.84 crore.

72 Construction of elevated road over Barapullah Nallah Phase-III from Sarai Kale Khan to Mayur Vihar will be completed this year, for which, I propose ₹ 150 crore in the budget 2017-18. The construction work of new flyover / underpass between Mahipalpur to airport road will also be started in the year 2017-18.

73 I propose total expenditure of ₹ 5506 crore for Public Transport including Road Infrastructure in 2017-18. This includes revenue budget of ₹ 3512 crore and capital budget of ₹ 1994 crore. An amount of ₹ 3056 crore is earmarked for implementation of various schemes, programmes and projects under Transport sector.

Social Security & Welfare

74 Sir, we are implementing various schemes for the poor and deprived section of society specially, women in distress, senior citizen, persons with special needs, scheduled castes, scheduled tribes, OBCs and Minorities. Our Government gives financial assistance under various schemes to approximately 6.3 lakh senior citizens, persons with special needs, women in distress, widows. Government has already enhanced the pension by ₹1000 per month per beneficiary under these schemes and enhanced income limit for eligibility from ₹ 60000 per annum to ₹1 lakh per annum. The allocation under these schemes has accordingly been proposed to be enhanced to ₹

1595 crore in 2017-18 as compared to ₹ 1137 crore in revised estimates 2016-17.

75 Our Government will set up a “Commission for Senior Citizen” in 2017-18 which will look into the issues related to the welfare and protection of senior citizen in Delhi.

76 The Government is also implementing various schemes for students belonging to SC/ST/OBC/Minorities like financial assistance for purchase of stationery, scholarship, reimbursement of tuition fees in private schools etc. An amount of ₹ 900 crore has been earmarked under Scheduled Caste sub plan (under 789 budget head) in 2017-18 which is 27 percent higher than the revised estimate of 2016-17.

77 I propose total expenditure of ₹ 3467 crore on Social Security & Welfare in 2017-18, an amount of ₹ 3081 crore is earmarked for implementation of various schemes, programmes and projects under Social Security & Welfare sector.

Water Supply and Sanitation

78 Speaker Sir, our Government recognises the fact that water is the basic human right and not a commodity. It is our Government’s policy to provide drinking water through pipe line to all households in authorised and unauthorised colonies by 2017. DJB is providing facility of drinking water in 1200 unauthorised colonies and providing this facility to all JJ Clusters through public water hydrants. We have a target to lay the water pipeline in all the JJ cluster this year.

79 We will continue the scheme of free life line water for giving 20 Kilo litres per month to each family. I feel proud to share with the August House that more than 12.57 lakh consumers have zero water bill, whether living in centuries old village of Chirag Delhi or unauthorised colony of Kirari. Pipe water has been supplied to people within their premises in many localities for the first time. It is important to inform that DJB has earned Rs.178 crore more revenue despite the fact that more than 12.57 lakh consumers had zero water bill.

80 The year 2017-18 is important in two ways. On the one hand we have the target of laying water pipe line in whole of Delhi including all unauthorised colonies and JJ clusters. On the other hand, we are going to start a big plan to improve the water quality. We will continue to modernise the laboratories of Delhi Jal Board, the initiative started last year.

81 Water infrastructure works taken up last year was historical. After coming to power, our Government has completed the work for laying water supply network in 309 colonies, which is a national record. To strengthen the distribution network, about 70 km of water pipelines have been replaced in various districts of Delhi against old, corroded, damaged and leaking water lines. DJB has added 250 new stainless steel water tankers to the existing fleet of 700 tankers, 29 water ATMs and 15 e-pios also have been installed in water deficit areas and public places. Delhi Jal Board has a plan to open more e-pios in public places from corporate social responsibility funds.

82 DJB has worked tirelessly to realize the ultimate dream of attaining 24X7 water supply in various parts of the city. A beginning has been made in Nav Jeevan Vihar & Gitanjali Enclave, which will witness 24X7 water supply from March, 2017. Earlier these areas were receiving water supply as per the fix time schedule. The 24X7 water supply plan will guarantee not only availability of water round the clock but also guarantee pure drinking water supply directly from the tap. The scheme for supplying pure drinking water directly from tap shall be launched in some of the colonies this year which will be extended to entire Delhi.

83 The detail plan is being prepared to include more areas under the 24X7 water supply scheme. The existing network is being revamped. The water supply network is being evaluated in the entire city through a new programme "Walk the Line'. This exercise will provide comprehensive database about the deficiencies of the network.

84 It is not a secret that Delhi was dependant on other States for water. A unique initiative is taken by Delhi Jal Board to increase the water production by storing rain water. DJB has started rain water harvesting system in Burari to augment the water supply. For the first time, DJB has started this initiative for augmentation of water supply within the city**.** 20 MGD of water will be generated by following environmental friendly measures. Water supply is being augmented by adding new 92 tube-wells, redevelopment of 100 tube-wells, 4 Ranney Wells at Palla, replacement of pumps and installation of SCADA, etc. Similarly, abandoned Ranney Wells are being revived. An action plan will be prepared for rejuvenating water bodies and Baolis.

85 Under Ground Reservoirs at Karala, Mangolpuri & Mangolpur Kalan will be commissioned and the work at Mayapuri, Mahipalpur has been started. Water supply network has been laid in 309 colonies last year which is a record in the history of Delhi Jal Board. This resulted in extensive water supply system in entire 1200 unauthorized colonies. Another 200 colonies will be brought under water supply network.

86 The work of construction of 70 MGD waste water treatment plant at Coronation Pillar has started in September, 2016 and is proposed to be completed in 30 months. This plant is of its kind in the country in terms of modern technique with least cost.

87 The Sewerage Treatment Plant (STP) of 15 MGD capacity at Delhi Gate and 25 MGD STP at Yamuna Vihar have been commissioned. The construction of the mega STP of 315 MLD capacity at Coronation Pillar has been awarded and will be completed within next two years. This plant will treat sewage to the tertiary quality and capable of removal of Nitrogen and Phosphorus. All the old STPs shall be rehabilitated to increase the quality standard of the treated effluent up to BOD less than 10 and SS less than 10 ppm and for improvement in quality of river water.

88 All Sewage Pumping Stations shall be automated to ensure optimization of pumping and channel flow in the trunk sewers which will, in turn, reduce the work of desilting of drains.

89 The project for laying of Interceptor Sewers along three major drains (Najafgarh, Supplementary & Shahdara) shall be completed soon, thereby

trapping 240 MGD sewage flowing into the drains and diverted to different STPs for proper treatment.

90 The consultancy work for rejuvenation of Supplementary drain has been awarded to an Israel Firm. The work will be taken up this year for cleaning uplifting and development of Supplementary drain from Mukarba Chowk to Wazirabad in a stretch of 8.5 km as a pilot project.

91 I propose total expenditure of ₹ 2108 crore for Water Supply and Sanitation in 2017-18. This includes revenue budget of ₹ 1180 crore and capital budget of ₹ 928 crore.

Housing and Urban Development

92 Speaker Sir, Delhi Government is committed to make Delhi a slum free city. But this work will not be done by demolishing slums, rather by providing small houses to the slum dwellers for dignity of life.

93 During the last two years, DUSIB has relocated 5000 slum dwellers from various JJ Bastis located at Jwalapuri, Kirti Nagar, Punjabi Bagh, Janpath, Jharkhand Bhawan and NH 24 by providing them flats at Baprolla and Dwarka.

94 Similarly, a number of steps have been taken to make Delhi open Defecation free. I would like to congratulate the whole team of DUSIB for this as they continued to work for weeks together to survey the area by visiting early in the morning from 3 a.m the places where people defecates in the open. A plan was prepared to make Delhi Open Defecation Free based on the

findings of these surveys. Accordingly, 8000 clean and modern toilets have already been constructed and 6000 more toilets are to be completed by June 2017. Besides, 5000 toilets will be constructed in 2017-18. Similarly, 19000 more toilets are to be constructed so that entire Delhi will be made Open Defecation Free.

95 Speaker Sir, I am glad to inform that due to active efforts of the DUSIB and it's Night Shelter Team, we could prevent the number of deaths due to cold in winter months. DUSIB is the nodal agency for providing shelter to homeless people in Delhi. The total capacity in 266 night shelters has been enhanced to 21724 in the current year. Under National Urban Livelihood Mission (NULM), there is a proposal for construction of new shelters for homeless in Nangloi Phase-II, Dwarka Sector-3, Rohini Sector-5, Geeta Colony near JJ Basti. Each night shelter is equipped with sufficient numbers of blankets, durries, jute mats, drinking water facility, first aid, electricity and emergency lights etc.

96 I propose total expenditure of ₹ 3113 crore on Housing & Urban Development in 2017-18 for various schemes, programmes and projects under Housing and Urban Development sector which is 21 percent more than the Revised Estimate of 2016-17.

Energy

97 Delhi Government has taken a big step towards development of Solar energy by notifying its Solar Policy in September, 2016. Due to limitation of space in Delhi, a massive programme for developing rooftop Solar power capacity has been launched. Delhi is targeting for 1000 MW Solar Photovoltaic installation in next 5 years and 2000 MW till 2025. It has been made mandatory for all government buildings having rooftop area more than 500 square meters to install Rooftop Solar. To promote solar installation a Generation Based Incentive (GBI) of ₹ 2/- per unit/ KW will be given to domestic consumers for installation of Solar Photovoltaic Power Plant.

98 To overcome the problem of disposal of Municipal Solid Waste, Delhi Government has approved Waste to Energy Plants to generate electricity at 3 locations i.e. Okhla, Ghazipur and Bawana with a total capacity of 52 MW. Waste to Energy Plant of 16 MW at Okhla is already operational. This project is India's largest integrated waste management project with a capacity to dispose and process 2000 Tonnes garbage per day.

99 I propose total expenditure of ₹ 2194 crore for Energy Sector in 2017-18 including subsidy of ₹ 1600 crore for domestic electricity consumers. Under the subsidy programme, in the last two years, domestic consumers consuming electricity upto 400 units per month are getting electricity at half rate.

Environment & Forest

100 Environmental problems are a threat to the well-being of the city's and area's inhabitants as well as the flora and fauna. Rapid rise in population and speedy economic development has also raised the concern for the environmental degradation in Delhi. Several steps have been taken in the recent past to improve the environment condition which includes massive focus on afforestation, universal use of CNG by commercial vehicles, subsidy on newly purchased Battery Operated Four Wheelers and Two wheelers, ban on plastic use, better management of solid waste, treatment of waste water and improvement of sewage system etc.

101 Sir, we are constantly monitoring the pollution level on real time basis through already installed Ambient Air Quality Monitoring Stations. The quality of ambient air is evaluated in these stations. The numbers of such stations are proposed to increase from 6 at present to 26 in the year 2017-18. They provide information about the existence of dust particles and quantum of gases ($PM_{2.5}$, PM_{10}, SO_2, NO_2, CO, O_3, Benzene & Ammonia) in the ambient air.

102 Sir, to promote non polluted battery operated vehicles in Delhi we had announced subsidy schemes for adopting various kinds of battery operated vehicles. We have granted subsidy of ₹ 1.06 crore to 686 battery operated vehicles during 2016-17. This subsidy will be continued in the next year also.

103 Sir, we are continuously doing efforts to make Delhi as a Green Delhi. We have launched a massive tree plantation drive during 2016 and planted 8.43 lakh tree saplings and 11.72 lakh shrubs. I am happy to inform that forest cover in Delhi has increased by around 1 percent. It means greenery in Delhi has increased on 600 acre land.

104 In light of the environment of Delhi, I am placing one such new proposal for this year in the House which relates to the history of Britishers in Delhi. Britishers had planted 'Vilayati Kikar' in Delhi in the year about 1912-13. It causes the shortage of groundwater in Delhi. Our Government is planning to remove 'Vilayati Kikar' and to plant trees of local species like Amaltas and trees of fruits and flowers in place of Vilayati Kikar. This scheme of making Kikar free Delhi will be started this year from Central Ridge Area. It is a long term plan for which an amount of ₹ 50 lakh is proposed for the year 2017-18.

105 It is also proposed to develop a maiden Wildlife (Bird) Rescue Centre at Rajokri on an area of around 6 acres with world class facility. New City Forest at Garhi Mandu, Bela Farm, Shastri Park, Issapur, Khadkhadi Jatmal, Alipur and Mukhmelpur are also proposed for opening to cater the environment needs of local residents of the area.

106 I propose total expenditure of ₹ 106 crore on Environment & Forest in 2017-18. This includes revenue budget of ₹ 75 crore and capital budget of ₹ 31 crore. An amount of ₹ 57 crore is earmarked for implementation of various schemes, programmes and projects under Environment & Forest sector.

Rural Development

107 Sir, Delhi Rural Development Board carries out Development work in the rural villages in Delhi with aim to create infrastructural facilities in rural areas including the construction of link roads, approach roads, parks, minor drains and to provide basic facilities to the people of rural villages etc. We feel that development work in Urban villages are as important as in rural villages. Hence, our Government has decided to enhance the scope of "Delhi Development Rural Board" by including both rural and urban villages of Delhi. I propose to increase the outlay of the Board to ₹ 600 crore in 2017-18 from the present outlay of ₹ 132 crore. It is four times higher than the outlay of previous year. About ₹ 2 crore from this fund will be allocated to each rural or urban villages in proportionate of their population.

108 Sir, Azadpur mandi is the biggest mandi in Asia which has become over crowded. In order to decongest this mandi, we have decided to construct a modern mandi at Tikri Khampur in an area of 70 acres with estimated cost of ₹ 800 crore. The project is likely to be completed by December, 2019.

109 Sir, we have decided to develop a Modern Flower Market cum Exhibition Centre at a cost of about ₹ 150 crore at Gazipur to encourage the place as State of the Art Centre of international standards. This market not only acts as trading centre but public can also visit this place to enjoy the beauty of flowers so as to encourage floriculture as well as tourism.

110 Sir, we will develop a modern Fish & Poultry Market at Gazipur with an estimated cost of ₹ 120 crore. It is also proposed to setup a Waste to

Energy Plant at Fish & Poultry Market, Gazipur. This project will be completed during 2017-18.

111 Sir, our Government is committed to implement E-mandi project in all mandies to ensure transparency in transactions, better pricing to the farmers and shortening the payment cycle for the farmers. We will implement the E-mandi project by joining the E-portal of National Agriculture Market in a phased manner.

112 Sir, our Government is committed to respect the culture and religious customs of all the communities. In continuation of our commitment, we have decided to construct Chhat Ghat all over Delhi. A provision of ₹ 20 crore has been proposed for the financial year 2017-18 for development of Chhat Ghat.

113 I propose total expenditure of ₹ 925 crore on Rural Development & Flood Irrigation in 2017-18. This includes revenue budget of ₹ 251 crore and capital budget of ₹ 674 crore. An amount of ₹ 704 crore is earmarked for implementation of various schemes, programmes and projects under Rural Development & Flood Irrigation sector.

Tourism

114 Sir, Delhi is a city with symbol of the country's rich past and thriving present, where ancient and modern blend seamlessly together. Necessity of tourism policy for Delhi is being felt for a long period. To make Delhi a world class tourist destination, we are preparing tourism policy and master plan for promotion of tourism and tourism infrastructure for Delhi Tourism.

115 With aim to promote Delhi as a film shooting destination, it is proposed to introduce “Single Window Clearance Mechanism” for film making facility so that the legal formalities to shoot in the city can be completed by visiting only one Government Office. Smooth system is being developed for granting permission to Film Producers and to provide them with consolidated information on guidelines for shooting and to make film shooting a hassle free experience.

116 We have developed the Soft Adventure Park at garden of five senses as an eco-friendly project to attract more visitors to garden which is surrounded by a sprawling lush green garden which provides a mystic ambience to the adventure park. Different type of activities have been organised in Garden of Five Senses during this year. More than 15000 footfalls per day have been seen in Garden of Five Senses during the festival. It is planned to make Garden of Five Senses as a hub of night life and luxury food court.

117 Sir, in continuation to develop Delhi as a world class tourist city, we have planned to develop the Riverfront of River Yamuna. This will create a place that allows people to connect with nature and the River Yamuna. This will spread awareness about the importance of the River and its protection and mobilise people towards the improvement of the River. It will also help to develop wetlands with water bodies to improve the recharge of ground water and improve the health of the River. This will protect the River from pollution and improve the plant diversity to include native and site appropriate plant

species that will support wild life. We propose to make World Class Ecological River Front of 5 km upstream of Wazirabad.

118 I propose total expenditure of ₹ 119 crore on Tourism in 2017-18. This includes revenue budget of ₹ 69 crore and capital budget of ₹ 50 crore. An amount of ₹ 117 crore is earmarked for implementation of various schemes, programmes and projects under Tourism sector.

119 Now, I turn to part-B of my speech.

Part-B

120 Hon'ble Speaker Sir, the policies of our Government have been discussed in detail in the first part of my speech. I would like to repeat that this Government is of, by and for the common man of Delhi. For the past 2 years, we have been presenting zero tax increase in budget. This year too, no new taxes are being proposed or enhanced.

121 As you are aware that the Good and Service Tax (GST) has been approved. With its implementation from 1st July 2017, we expect a positive impact on Tax Revenue collection of the Government. The projected tax revenue collection for 2017-18 amounting to ₹ 38,700 crore which is 19.33% higher against the Revised Estimates 2016-17 of ₹ 32,430 crore. This estimate is based on the belief that there will be tax buoyancy on implementation of GST. Considering all these factors, no further tax proposal is being mooted during the financial year 2017-18.

122 Mr. Speaker sir, our Government reduced rate of tax on Timber in 2015-16. In the next year, rates of tax were reduced on many items. This year we propose to reduce tax on the following items:

(a) Sanitary napkins up to ₹ 20 are tax free. In the case of sanitary napkins above ₹ 20, government proposes to reduce the tax rate from 12.5% to just 5%, as the government is very concerned about hygiene of women.

(b) For Laminates, Plywood and Black Boards, MDF Boards and Particle Boards, the tax rate is proposed to be reduced from 12.5% to 5%.

(c) To bring Granite, Swadeshi Kota Stone, Dholpur Stone, Gwalior Stone Slate at par with tax rate reduced last year for marble, it is proposed to tax them also at 5% instead of 12.5%.

123 To give boost to the Civil Aviation Operators, who have opted to operate under Regional Connectivity Scheme i.e. RCS (Udan) and will ply the fights on RCS routes (involving Delhi) between an identified pair of origin and destination airports/helipads within India pursuant to the scheme satisfying the prescribed conditions, it is proposed to reduce the VAT rate to 1% from existing 25% on their purchases of Air Turbine Fuel (ATF) in Delhi.

124 This house is aware that our government is a trader friendly government and from day one, it has been our endeavour to create a conducive atmosphere for traders in Delhi. Therefore, a special drive has been initiated and I am happy to inform this House that in comparison to the disbursal of ₹ 227 crore refunds in the previous year, ₹ 723 crore have been released as refund in the current year, which is almost 300 percent more, by settling more than 72,000 refund cases.

125 Sir, with these words, I commend the budget for consideration of the House.

रजिस्ट्री सं. डी.एल.- 33002/99 REGD. No. D. L.-33002/99

भारत सरकार
GOVERNMENT OF INDIA

दिल्ली राजपत्र
सत्यमेव जयते
Delhi Gazette

एस.जी.-डी.एल.-अ.-29122020-223975
SG-DL-E-29122020-223975

असाधारण
EXTRAORDINARY

प्राधिकार से प्रकाशित
PUBLISHED BY AUTHORITY

सं. 280]	दिल्ली, बृहस्पतिवार , दिसम्बर 24, 2020/पौष 3, 1942	[रा.रा.रा.क्षे.दि. सं. 236
No. 280]	DELHI, THURSDAY, DECEMBER 24, 2020/PAUSHA 3, 1942	[N. C. T. D. No. 236

भाग IV
PART IV

राष्ट्रीय राजधानी राज्य क्षेत्र दिल्ली सरकार
GOVERNMENT OF THE NATIONAL CAPITAL TERRITORY OF DELHI

पर्यावरण, वन एवं वन्यजीव विभाग

अधिसूचना

दिल्ली, 24 दिसम्बर, 2020

स. फा. 3(20)/सीएफ/एचक्यू/ट्रांसप्लांटेंशन पॉलिस ऑफ ट्री/पार्ट फा0–क/2018–19/6453.— दिल्ली वृक्ष परिरक्षण अधिनियम, 1994 की धारा 33 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, राष्ट्रीय राजधानी क्षेत्र दिल्ली सरकार जनहित में, एतद्द्वारा 'वृक्ष प्रत्यारोपण नीति, 2020'' को बनाती है।

वृक्ष प्रत्यारोपण नीति, 2020

''प्रत्यारोपण'' से अभिप्राय है किसी पेड़ की जड़ को पर्याप्त रूप से वैज्ञानिक तरीके से खोदकर निकालना और नए स्थान पर, उस स्थान को वैज्ञानिक तरीके से तैयार करते हुए, उसी पेड़ को नए स्थान पर प्रतिरोपित करना।

उल्लंघन की सीमा तक, यह नीति, वन एवं वन्यजीव विभाग, राष्ट्रीय राजधानी क्षेत्र दिल्ली सरकार, जिसे यहां से ''विभाग'' कहा जाएगा, द्वारा जारी सभी पिछले आदेशों को समाप्त करती है, जिनमें दिल्ली वृक्ष संरक्षण अधिनियम, 1994 के अपेक्षित प्रावधानों के तहत वृक्षों की क्षतिपूर्ति के लिए प्रत्यारोपण के संबंध में नियम शामिल हैं, ताकि राष्ट्रीय राजधानी क्षेत्र दिल्ली में विकासीय गतिविधियों के कारण हरित क्षेत्र की क्षति की पूर्ति की जा सके।

प्रत्यारोपण नीति में निम्नलिखित उल्लिखित है :–

1. **वृक्षों को गिराने तथा उनका प्रत्यारोपण करने के लिए चयन के मापदंड :**

(1) विकासीय परियोजनाओं के लिए चिह्नित क्षेत्र में आवेदक द्वारा कोई भी पेड़ अनावश्यक रूप से हटाया नहीं जाएगा।

(2) ऐसे वृक्ष जिन्हें गिरने अथवा प्रत्यारोपण से बचाया जा सकता हो, उन्हें सावधानीपूर्वक योजना बनाकर, डिजाइन और क्रियान्वयन किया जाना चाहिए और निर्माण कार्यों के बाद रखरखाव किया जाना चाहिए।

(3) यदि उसी स्थान पर संरक्षण कार्य संभव न हो, तो विकासीय कार्यों से प्रभावित और जिन्हें उसी स्थान पर संरक्षित न किया जा सकता हो, कम से कम 80 प्रतिशत वृक्षों को वैज्ञानिक तरीके से प्रतिरोपित किया जाना चाहिए और नए स्थान पर आवेदक द्वारा रखरखाव के पर्याप्त उपाय किए जाने चाहिए ताकि कम से कम 80 प्रतिशत वृक्षों को प्रत्यारोपण के पूरा होने की तारीख से एक वर्ष के बाद संरक्षित किया जाना सुनिश्चित किया जाना चाहिए।

(4) उक्त शर्तों, यदि कोई हों, जैसा लागू हों, को पूरा करने पर सरकार यदि आवश्यक समझे, तो जनहित में ऐसा कर सकती है, जिसके लिए इस उद्देश्यार्थ राज्य सरकार द्वारा गठित समिति की सिफारिशों पर विचार करने के बाद कम से कम 80 प्रतिशत वृक्षों की अपेक्षा से आवेदक को छूट दी जा सकती है।

2. क्षतिपूर्ति के रूप में प्रत्यारोपण के नियम :–

(1) प्रत्यारोपण की आवश्यकता के अतिरिक्त, राष्ट्रीय राजधानी क्षेत्र दिल्ली में विकास कार्यों से प्रभावित होने वाले प्रत्येक वृक्ष की क्षतिपूर्ति के रूप में किए जाने वाले वृक्षारोपण के वर्तमान स्वरूप का अनुपात दस गुना अर्थात् 10:1 होगा। प्रत्येक गिरने वाले और प्रतिरोपित वृक्ष के लिए क्षतिपूर्ति के रूप में वृक्षारोपण करना आवश्यक होगा।

(2) क्षतिपूर्ति के रूप में किए गए प्रत्यारोपण के माध्यम से लगाए गए पौधों/वृक्षों को बचाए रखना सुनिश्चित करने के लिए सभी पौधों/वृक्षों की न्यूनतम 6 फीट ऊंचाई रखने के अलावा क्षेत्र का ध्यान भी रखा जाना चाहिए साथ ही प्रत येक बीजारोपण/वृक्षों को जियो–टैग भी किया जाएगा।

3. कुछ वृक्षों की प्रजातियों को प्रत्यारोपण से बाहर रखना :–

तेजी से फैलने वाले कुछ असाधारण वृक्षों की प्रजातियों जैसे ल्यूसीना ल्यूकोसेफिला, युकेलिप्टस ग्लोबलस् और प्रोसोपिस जूलीफ्लोरा (विलायती कीकर) के प्रत्यारोपण पर विचार नहीं किया जाना चाहिए और इन्हें विकास कार्यों के कारण प्रभावित होने वाले वृक्षों के प्रत्यारोपण की न्यूनतम 80 प्रतिशत आवश्यकता के लक्ष्य से बाहर रखे जाना चाहिए, ऐसे वृक्षों की प्रजातियों, जिन्हें प्रत्यारोपण से बाहर रखे जाना है, की निगेटिव लिस्ट विभाग द्वारा नियमित रूप से अद्यतन की जाएगी।

4. किसी परियोजना स्थल पर वृक्ष प्रत्यारोपण के लिए अपनाई जाने वाली प्रक्रिया :–

किसी परियोजना स्थल पर वृक्ष प्रत्यारोपण करना चाहने वाले आवेदक द्वारा निम्नलिखित प्रक्रिया का पालन किया जाएगा :–

(1) स्थल वाले वृक्षों की रिपोर्ट : परियोजना की व्यवहार्यता के आकलन के समय वृक्ष सर्वेक्षण किया जाएगा और साइट के विकास की योजना और वृक्षों के संरक्षण के प्रस्तावों के लिए अपेक्षित जानकारी प्राप्त करने के लिए साइट की पहचान की जाएगी। साइट ट्री रिपोर्ट में निम्न शामिल होगा :

(क) साइट के सभी वृक्षों की वास्तविक गिनती के साथ–साथ वृक्षों के घेरों की जानकारी;

(ख) सभी वृक्षों की जियो–टैगिंग;

(घ) प्रत्यारोपण किए जाने वाले वृक्षों की संख्या और प्रकार तथा उनकी स्थल क्षमता का प्रारंभिक आकलन;

सरकारी एजेंसियों के मामले में, विभाग द्वारा जारी दिशा–निर्देशों के आधार पर व्यय की स्वीकृति और उसकी अनुमानित लागत की स्वीकृति से पूर्व साइट ट्री रिपोर्ट तैयार की जाएगी और उसे व्यय की स्वीकृति के प्रस्ताव में शामिल किया जाएगा। व्यय की स्वीकृति से पूर्व साइट ट्री रिपोर्ट की एक प्रति संबंधित वृक्ष अधिकारी को रिकार्ड हेतु प्रस्तुत की जाएगी। हालांकि, इस चरण में वृक्ष अधिकारी की स्वीकृति की आवश्यकता नहीं होगी।

(2) वृक्ष प्रत्यारोपण के लिए एक तकनीकी एजेंसी नियुक्त करना : आवेदक वृक्ष प्रत्यारोपण कार्य करने के लिए सूचीबद्ध एजेंसियों में से किसी एक तकनीकी एजेंसी का चयन करेगा।

(3) सरकारी एजेंसियों के मामले में, यह कार्य व्यय की स्वीकृति के बाद तथा एक प्रतिस्पर्धी बोली प्रक्रिया के माध्यम से किया जाएगा। यह प्रतिक्रिया एक समयबद्ध तरीके से पूरी करने के लिए, विभाग द्वारा वृक्ष प्रत्यारोपण कार्य के लिए एक तकनीकी एजेंसी के चयन हेतु प्रस्ताव का एक मॉडल अनुरोध तैयार किया जाएगा।

(4) वृक्ष संरक्षण योजना तैयार करना और अनुमोदन : चुनी गई तकनीकी एजेंसी पहली प्राथमिकता के तौर पर स्थल पर ही संरक्षण के लिए वृक्ष संरक्षण योजना तैयार करने में आवेदक की सहायता करना होगा। ऐसी स्थिति में जहां वृक्षों को उनके मौजूदा स्थलों पर ही बनाए रखना असंभव हो, वहां प्रभावित वृक्षों को प्रतिरोपित करने के लिए प्राथमिकता दी जानी चाहिए, ताकि प्रत्यारोपण के बाद वृक्षों के बचने की दर तथा स्थानीय माहौल में हरियाली की हानि को कम किया जा सके; और यदि लागू न हो, तो प्रभावित वृक्षों को उपयुक्त स्थलों पर उसी जगह पर प्रतिरोपित करना चाहिए। प्रत्यारोपण का स्थान मुख्यतः परियोजना स्थल के आसपास ही होना चाहिए ताकि आसपास के क्षेत्र में रमणीयता बनी रह सके। किसी भी स्थिति में, विकास कार्यों से प्रभावित न्यूनतम 80 प्रतिशत वृक्षों को वृक्ष प्रत्यारोपण के माध्यम से बचाया जाना चाहिए।

वृक्ष संरक्षण योजना की प्रमुख विशेषताएं इस प्रकार होंगी :–

(क) ऐसे वृक्षों के संबंध में, जिन्हें उसी स्थल पर संरक्षित किया जा सकता हो, की परियोजना की रूपरेखा में उन वृक्षों का विवरण होगा जिनके प्रत्यारोपण तथा जिन वृक्षों को गिराने की आवश्यकता होगी;

(ख) वृक्षों का स्थान बदलने/प्रत्यारोपण की नीति की पहचान;

(ग) उस भूमि/क्षेत्र की पहचान, जहां वृक्षों को प्रतिरोपित किया जाएगा;

(घ) प्रत्यारोपण के लिए निधि की आबंटन;

(ङ) वृक्ष संरक्षण योजना के साथ समय–सीमा के संयोजन से विकास योजना का आकलन;

वृक्ष हटाने, यदि कोई हो, के लिए आवेदन के साथ वृक्ष संरक्षण योजना संबंधित वृक्ष अधिकारी को प्रस्तुत की जाएगी। वृक्ष अधिकारी, दिल्ली वृक्ष संरक्षण अधिनियम, 1994 के अंतर्गत निर्धारित समय–सीमा के भीतर अपना निर्णय देने के साथ ही वृक्ष संरक्षण योजना में आवश्यक परिवर्तन करते हुए, लिखित रूप में कारण बताते हुए सशर्त अनुमोदन देगा। यदि अनुरोध करने पर वृक्ष अधिकारी निर्धारित समय में अपनी अनुमति की जानकारी नहीं दे पाता, तो अनुमति दी गई मान ली जाएगी। पूर्ण आवेदन प्रस्तुत होने के बाद यदि वृक्ष अधिकारी निर्धारित अवधि में अनुमति नहीं दे पाता, तो अनुमति दी गई मान ली जाएगी।

(5) वृक्ष संरक्षण योजना का क्रियान्वयन : अनुमोदन मिलने अथवा संबंधित वृक्ष अधिकारी का अनुमोदन मिल गया माने जाने के बाद ही वृक्ष संरक्षण योजना पर कार्रवाई की जाएगी। वृक्ष प्रत्यारोपण की प्रभारी तकनीकी एजेंसी नीचे दर्शाई गई संबद्ध गतिविधियों के लिए जिम्मेदार होगी :–

(क) प्री–कंडीशनिंग

(ख) हार्डनिंग

(ग) रिजोम कंसोलिडेशन

(घ) आश्रय स्थल की तैयारी

(ङ) परिवहन

(च) आश्रय स्थल पर प्रत्यारोपण

(छ) बाद की देखभाल

यह संभावित है कि उपर्युक्त (क) से (घ) तक में विशेष तौर पर 3–4 माह लगेंगे, जबकि बाद की देखभाल में 3–12 माह का समय यह सुनिश्चित करने के लिए लग सकता है कि प्रतिरोपित वृक्ष अपने नए स्थान पर सफलतापूर्वक लगा दिए गए हैं। सभी प्रतिरोपित वृक्षों के लिए जियो–टैग लगाए जाना अनिवार्य होगा।

(6) प्रतिरोपित वृक्षों के रखरखाव को सौपनाः प्रत्यारोपण की प्रभारी तकनीकी एजेंसी की जिम्मेदारी, नए स्थान पर वृक्षप्रत्या रोपण के एक वर्ष पूरा होने तक निम्नलिखित शर्तों पर सीमित होगी :

(क) एक वर्ष की समाप्ति के बाद तकनीकी एजेंसी द्वारा सर्वाइवल असेसमेंट रिपोर्ट प्रस्तुत की जाएगी, जिसके साथ नए स्थलों पर वृक्ष की सर्वाइवल दर के आकलन के साथ रिसेप्टर साइट पर संबंधित वृक्ष अधिकारी द्वारा हस्ताक्षरित एक कम्पलीशन सर्टिफिकेट दिया जाएगा।

(ख) वृक्ष प्रत्यारोपण के एक वर्ष पूरा होने पर बेंचमार्क ट्री सर्वाइवल दर 80 प्रतिशत अथवा जैसा समय–समय पर विभाग द्वारा अधिसूचित अनुसार होगी। तकनीकी एजेंसी के अंतिम भुगतान को वृक्ष की सर्वाइवल दर से जोड़ा जाएगा जिसमें बेंचमार्क दर से कम दर पर वृक्ष के सर्वाइवल के लिए दंड का प्रावधान होगा। भुगतान का शेड्यूल इस प्रकार होगा :

(i) प्रथम भुगतान : 100 प्रतिशत के बाद अंतिम तय दर का 20 प्रतिशत। समस्त वृक्षों का तकनीकी रूप से उचित तरीके से फोटोग्राफी के साथ प्रत्यारोपण का पूरा होना।

(ii) दूसरा भुगतानः तकनीकी रूप से उचित तरीके से फोटोग्राफी के साथ सर्वाइवल दर के आधार पर अंतिम तय दर का 30 प्रतिशत।

- यदि सर्वाइवल 80 प्रतिशत से अधिक हो तो 100 प्रतिशत भुगतान।
- यदि सर्वाइवल 60 प्रतिशत से 79 प्रतिशत के बीच हो तो 75 प्रतिशत भुगतान।
- यदि सर्वाइवल 50 प्रतिशत से 69 प्रतिशत के बीच हो तो 50 प्रतिशत भुगतान।
- यदि 50 प्रतिशत से भी कम वृक्ष सर्वाइव होने में विफल रहते हों तो कोई भुगतान नहीं होगा। यदि प्रत्यारोपण का कार्य विफल घोषित किया जाएगा तो आगामी वर्षों में कोई और भुगतान नहीं होगा।

(iii) तीसरा भुगतानः तकनीकी रूप से उचित तरीके से फोटोग्राफी के साथ तथा समिति द्वारा सत्यापन के बाद सर्वाइवल दर के आधार पर अंतिम तय दर का 25 प्रतिशत।

- प्रथम वर्ष में सर्वाइव हुए समस्त वृक्षों के 100 प्रतिशत सर्वाइवल पर 100प्रतिशत भुगतान।
- प्रथम वर्ष में समस्त वृक्षों की सर्वाइवल दर 60 प्रतिशत से 79 प्रतिशत के बीच रहने पर 75 प्रतिशत भुगतान।
- प्रथम वर्ष में समस्त वृक्षों की सर्वाइवल 50 प्रतिशत से 69 प्रतिशत के बीच रहने पर 50 प्रतिशत भुगतान।
- यदि 50 प्रतिशत से भी कम वृक्ष सर्वाइव होने में विफल रहते हों तो कोई भुगतान नहीं होगा। यदि प्रत्यारोपण का कार्य विफल घोषित किया जाएगा तो आगामी वर्षों में कोई और भुगतान नहीं होगा।

(iv) चौथा और अंतिम भुगतानः तकनीकी रूप से उचित तरीके से फोटोग्राफी के साथ और किए गए रखरखाव की वीडियों रिकार्डिंग तथा समिति द्वारा सत्यापन के सत्यापन के बाद सर्वाइवल दर के आधार पर अंतिम तय दर का 25 प्रतिशत।

- प्रथम वर्ष में सर्वाइव हुए समस्त वृक्षों के 100 प्रतिशत सर्वाइवल पर 100प्रतिशत भुगतान।
- प्रथम वर्ष में समस्त वृक्षों की सर्वाइवल दर 60 प्रतिशत से 79प्रतिशत के बीच रहने पर 75 प्रतिशत भुगतान।
- प्रथम वर्ष में समस्त वृक्षों की सर्वाइवल 50 प्रतिशत से 69 प्रतिशत के बीच रहने पर 50 प्रतिशत भुगतान।
- यदि 50 प्रतिशत से भी कम वृक्ष सर्वाइव होने में विफल रहते हों तो कोई भुगतान नहीं होगा। यदि प्रत्यारोपण का कार्य विफल घोषित किया जाएगा तो आगामी वर्षों में कोई और भुगतान नहीं होगा।

इसके अतिरिक्त समस्त ऐसे प्रतिरोपित वृक्षों के लिए, जो देशी वृक्ष की प्रजाति के हों तथा 15 फीट ऊंचे हों और कम से कम 6 इंच व्यास वाले हों, उन्हें 1:5 के अनुपात से प्लांट किया जाना चाहिए।

(ग) ऐसी परियोजनाओं, जहां 100 अथवा अधिक वृक्ष प्रतिरोपित किए गए हों, वृक्ष प्रत्यारोपण के पूरा होने के एक वर्ष बाद एक सोशल ऑडिट कराया जाएगा ताकि वृक्षों की वास्तविक सर्वाइवल दर का पता लग सके और कंपलीशन सर्टिफिकेट पर संबंधित वृक्ष अधिकारी द्वारा तथा सोशल ऑडिट टीम के एक प्रतिनिधि के संयुक्त रूप से हस्ताक्षर होने चाहिए।

प्रतिरोपित वृक्षों के रखरखाव के लिए तकनीकी एजेंसी से हस्तांतरित जिम्मेवारी भूमि के स्वामित्व वाली एजेंसी की होगी।

5. सोशल ऑडिट :–

राष्ट्रीय राजधानी क्षेत्र दिल्ली सरकार सोशल ऑडिट के माध्यम से भागीदारी को मान्यता देती है, क्योंकि यह वृक्ष प्रत्यारोपण परियोजनाओं के आकलन का सबसे प्रभावी तरीका है। नागरिक समूहों, पेशेवर तथा विशेषज्ञ व्यक्तियों वाली स्थानीय समितियां (वार्ड अथवा असेम्बली स्तर पर) वन एवं वन्यजीव विभाग द्वारा गठित की जाएंगी। वृक्ष समितियां समस्त परियोजनाओं की नियमित मॉनिटरिंग करने के लिए जिम्मेदार होंगी, जिनमें क्षतिपूर्ति के रूप में वृक्षरोपण 100 अथवा अधिक वृक्षों/पौधों का उनके स्थानीय एरिया में प्रत्यारोपण शामिल होगा और एक वर्ष के बाद वे वृक्ष सर्वाइवल दर को प्रमाणित करेंगी।

6. वेबसाइट पर डेटा का प्रकाशन :–

(1) वन एवं वन्यजीव विभाग अपनी वेबसाइट पर प्रतिमाह दिल्ली वृक्ष संरक्षण अधिनियम, 1994 के अंतर्गत निम्नलिखित विवरणों के साथ वृक्ष हटाने के लिए प्रत्येक आवेदन के अनुमोदन के विवरण रखेगा तथा अद्यतन रिकार्ड रखेगा :–

(क) आवेदन का विवरण।

(ख) प्रभावित साइट की लोकेशन।

(ग) हटाए गए वृक्षों की संख्या एवं उनके प्रकार के साथ ही वृक्ष हटाने का कार्य पूरा होने की तारीख।

(घ) प्रतिरोपित वृक्षों की संख्या और प्रकार के साथ ही प्रत्यारोपण का कार्य पूरा होने की तारीख।

(ङ) क्षतिपूर्ति के रूप में वृक्षारोपण के लिए साइट की लोकेशन, विवरण जैसे प्रत्येक वृक्ष/पौधे का प्रकार, ऊंचाई और जियो–टैगिंग तथा क्षतिपूर्ति वाले वृक्षारोपण के पूरा होने की तारीख।

(च) वृक्ष प्रत्यारोपण करने वाली प्रभारी एजेंसी।

(छ) क्या नागरिक समिति द्वारा सोशल ऑडिट किया गया है, यदि हां तो उसका विवरण।

7. वृक्ष प्रत्यारोपण के लिए तकनोकी एजेंसियों का पैनल बनाना :–

(1) विभाग अर्हक प्रत्यारोपण एजेंसियों का पैनल तैयार करेगा ताकि न्यूनतम तकनीकी मापदंड को पूरा किया जा सके और दिल्ली में प्रत्यारोपण का कार्य किया जा सके।

(2) राष्ट्रीय राजधानी क्षेत्र दिल्ली में किसी परियोजना स्थल पर प्रत्यारोपण का कार्य कराने के लिए आवेदक को पैनल पर उपलब्ध एजेंसियों में से किसी एजेंसी को चुनना होगा, जो तकनीकी व्यवहार्यता रिपोर्ट प्रस्तुत करेगी और विशिष्ट परियोजना के लिए वृक्ष प्रत्यारोपण का कार्य करेगी। पैनलीकृत एजेंसी दिल्ली में वृक्ष प्रत्यारोपण के लिए विभाग द्वारा समय–समय पर जारी समस्त तकनीकी विनिर्दिष्टियों का पालन करेगी।

8. वृक्ष प्रत्यारोपण के लिए भूमि :–

दिल्ली के लोक निर्माण विभाग की सड़कों पर प्राथमिक तौर पर उसी स्थान पर वृक्ष प्रत्यारोपण किया जाएगा बशर्ते सड़कों के किनारे भूमि उपलब्ध हो। इसके अतिरिक्त, विभाग द्वारा दिल्ली में वृक्ष प्रत्यारोपण के लिए सड़कों के किनारे भूमि की पहचान की जाएगी, जहां पुनः वृक्षारोपण किया जाएगा, उदाहरण के लिए सरकारी नर्सरियों में यह कार्य किया जाएगा। यदि ऐसी कोई भूमि उपलब्ध नहीं होती, तो यह आवेदक की जिम्मेवारी होगी कि वह एक वैज्ञानिक तरीके से वृक्षों की प्रजातियों के प्रत्यारोपण के लिए उक्त भूमि की व्यवस्था करे।

9. वृक्ष प्रत्यारोपण से छूट :–

एक सामान्य नियम के रूप में, समस्त विकासीय परियोजनाओं के लिए यह सुनिश्चित करना अनिवार्य होगा कि न्यूनतम 80 प्रतिशत प्रभावित वृक्षों को निम्नलिखित मामलों के अलावा, वैज्ञानिक तरीके से प्रतिरोपित किया जाता हो :

(क) प्राइवेट संगठन अथवा व्यक्तियों द्वारा 10 अथवा कम वृक्ष हटाये जाना।

(ख) राज्य सरकार द्वारा गठित समिति द्वारा इस उद्देश्यार्थ और लिखित रूप में कारण दर्ज किए जाने के लिए विशेष मामलों में परियोजना विशिष्ट छूट।

10. राष्ट्रीय राजधानी क्षेत्र दिल्ली में वैज्ञानिक वृक्ष प्रत्यारोपण की सुविधा :–

(1) वृक्ष प्रत्यारोपण एक ऐसा विषय है जिसमें प्रौद्योगिकी शामिल होती है इसमें राष्ट्रीय राजधानी क्षेत्र दिल्ली में मौजूदा एग्रो–क्लाइमेटिक परिस्थितियों में पाई जाने वाली विभिन्न वृक्ष प्रजातियों के वैज्ञानिक प्रत्यारोपण की श्रेष्ठ और सफल प्रक्रिया शामिल होती है। विभाग में वृक्ष प्रत्यारोपण के लिए एक समर्पित सैल की स्थापना की जाएगी ताकि राष्ट्रीय राजधानी क्षेत्र दिल्ली में वृक्ष प्रत्यारोपण से संबंधित सभी मामलों के लिए सुविधा दी जा सके तथा उनका निपटान किया जा सके।

(2) वृक्ष प्रत्यारोपण सैल के कार्य इस प्रकार है :

(क) राष्ट्रीय राजधानी क्षेत्र दिल्ली में किसी वृक्ष प्रत्यारोपण कार्य के कड़े अनुपालन के लिए तकनीकी स्पेसिफिकेशंस को तैयार करना तथा उन्हें नियमित रूप से अद्यतन करना।

(ख) कम से कम प्रत्येक दो वर्ष में दिल्ली में वृक्ष प्रत्यारोपण के लिए तकनीकी एजेंसियों का पैनल तैयार करना।

(ग) सरकारी एजेंसियों को समर्थन देने के लिए मॉडल आर एफ पी और अन्य समर्थित दस्तावेज तैयार करना ताकिदिल्ली में वृक्ष प्रत्यारोपण के लिए स्थापित प्रक्रिया को कुशलतापूर्वक अपनाया जा सके।

(घ) बैंचमार्क वृक्ष सर्वाइवल दर को परिभाषित करना और वैज्ञानिक रूझानों और डेटा को शामिल करते हुए समय–समय पर उसे अद्यतन करना, जो दिल्ली में वृक्ष प्रत्यारोपण के सफल तथ्यों पर आधारित होगा।

(ङ) विभाग के अधिकारियों, लोक निर्माण विभाग के इंजीनियरों आदि को वृक्ष प्रत्यारोपण के विषय पर तकनीकी प्रशिक्षण देने और क्षमता विकास के कार्यक्रम आयोजित करना।

(च) दिल्ली में किए गए समस्त वृक्ष प्रत्यारोपण कार्यों के साथ–साथ उक्त वृक्षों का जियो–टैग डेटा के लिए एक सेंन्ट्रल रेपोजिट्री का रखरखाव करना तथा साथ ही साथ विभिन्न परियोजनाओं की सफलता की दरों, विभिन्न वृक्ष प्रजातियों, विभिन्न भू–स्वामित्व एजेंसियों और वृक्ष प्रत्यारोपण का कार्य करने वाली प्रभारी तकनीकी एजेसियों के आंकड़ों का रखरखाव करना।

(छ) उन आवेदकों अथवा तकनीकी एजेंसियों को वृक्ष प्राधिकरणों को आवधिक रूप से फ्लैग करना, जो बैंचमार्क सर्वाइवल दर की प्राप्ति नहीं कर पाते।

(ज) स्थानीय वृक्ष समितियां (वार्ड अथवा असेम्बली स्तर पर) गठित करना, जिनमें इस नीति की अधिसूचना जारी होने के तीन माह के भीतर नागरिक समूहों, पेशेवर और विशेषज्ञ शामिल होंगे, जिनका उद्देश्य नीति के तहत सोशल ऑडिट करना और ऐसे सोशल ऑडिट करने के लिए नियम निर्धारित करना है।

(3) दिल्ली वृक्ष प्राधिकरण वृक्ष प्रत्यारोपण के लिए निर्धारित प्रक्रिया के क्रियान्वयन की मॉनिटरिंग के लिए जिम्मेदार शीर्ष निकाय होगा जो नए नियम, मेकेनिज्म और दिल्ली में सफल वृक्ष प्रत्यारोपण सुनिश्चित करने के उद्देश्य से श्रेष्ठ प्रक्रियाओं की प्राप्ति के लिए जिम्मेदार होगा।

राष्ट्रीय राजधानी क्षेत्र दिल्ली के उपराज्यपाल
आदेश से तथा उनके नाम पर,

संजीव खिरवार, प्रधान सचिव (पर्यावरण एवं वन)

DEPARTMENT OF ENVIRONMENT, FORESTS AND WILDLIFE

NOTIFICATION

Delhi, the 24th December, 2020

F. No. 3(20)/CF/HQ/Transplantation policy of tree/part-file-A/2018-19/6453.—In exercise of the powers conferred by Section 33 of the Delhi Preservation of Trees Act, 1994, the Government of National Capital Territory of Delhi in public interest, hereby, make "Tree Transplantation Policy 2020" .

Tree Transplantation Policy 2020

"Transplantation" means scientific digging out of a tree with sufficient root and shoot system and replanting of same tree in a new location after scientific site preparation.

This policy, to the extent of contravention, suppresses all previous orders issued by the Department of Forest & Wildlife, Government of National Capital Territory of Delhi, herein refer to as "Department", regarding the norms for carrying out compensatory plantation under relevant provisions of the Delhi Preservation of Trees Act, 1994 to compensate the loss of greenery in the National Capital Territory of Delhi due to developmental activities.

Transplantation policy prescribes following:

1. Criteria for selection of trees for felling and transplantation: -

(1) No tree shall be unnecessarily removed in area identified for development projects by applicant.

(2) Existing trees that can be prevented from felling or transplantation shall be properly preserved through careful planning, design, implementation and post construction maintenance.

(3) When on-site preservation is not possible, at least 80% of the trees that are affected by developmental activities and cannot be preserved on-site shall be required to be scientifically transplanted and adequate maintenance measures shall be undertaken by applicant at the new site so as to ensure survival of at least 80% of the transplanted trees after completion of a year from date of completion of transplantation.

(4) Subject to such conditions, if any, as may be imposed, the government may, if it considers it necessary so to do in the public interest, exempt an applicant from requirement of minimum of 80% of trees to be transplanted after considering recommendations of committee constituted by State government for this purpose.

2. Norms for compensatory plantation: -

(1) The present norm of carrying out compensatory plantation in the component of ten times i.e., 10:1, for every tree affected by developmental activity in NCT of Delhi shall continue, in addition to the requirement for carrying out transplantation. The compensatory plantation shall be required to be done for each felled and transplanted tree.

(2) To ensure maximum chances of survival of saplings/trees planted through compensatory plantation, it shall be mandatory for all saplings/trees planted to be minimum 6 feet in height and area as well as individual seedlings/trees to be geo-tagged.

3. Exclusions of Certain Tree Species from Transplantation:-

Invasive exotic tree species such as *Leucaena leucocephala*, *Eucalyptus globulus* and *Prosopis juliflora* (*Vialyati kikar*) should not be considered for transplantation and will be excluded from the target of requiring minimum 80% of the trees affected by developmental activity to be transplanted. A negative list of such tree species to be excluded from transplantation shall be regularly updated by the Department.

4. Procedure to be followed for Tree Transplantation at any Project Site:-

Following procedure shall be followed by any applicant seeking to carry out tree transplantation at any project site:

(1) Site Tree Report: A tree survey shall be carried out at the time of project feasibility assessment and site identification to obtain the required information for developing site planning and trees preservation proposals. The site tree report shall include:

(a) A physical tree count of all trees on site along with the noting of tree girths;
(b) Geo-tagging of all trees;
(c) Tree photographs uploaded online for record of date;
(d) Preliminary assessment of number and type of trees to be transplanted and potential location(s);

In case of Government agencies, preparation of Site Tree Report shall be done prior to seeking Expenditure Sanction (E/S) and the estimated costs for the same, based on guidelines issued by Department, should be included in the proposal for E/S. A copy of the Site Tree Report shall be submitted to the concerned Tree Officer for record prior to seeking Expenditure Sanction. However, no approval shall be required from the Tree Officer at this stage.

(2) Appointing a Technical Agency for Tree Transplantation: The applicant shall select one of the technical agencies among the agencies empanelled for carrying out tree transplantation work.

(3) In case of Government agencies, this shall be done after receiving Expenditure Sanction and through a competitive bidding process. To ensure that this happens in a time-bound manner, the Department shall prepare a model request for proposal for selection of a technical agency for tree transplantation work.

(4) Preparation and Approval of Tree Preservation Plan: The selected technical agency shall assist the applicant in preparing a Tree Preservation Plan for the site with first priority given to on-site preservation. In a situation where retaining the trees at their existing locations is unfeasible, priority should be given to transplant the affected trees to other permanent locations within the project site where appropriate, so as to increase the tree's survival rate after transplanting and minimize the loss of greenery in the local environ; and if not applicable, transplant the affected trees to suitable permanent location ex-situ. Location of the receptor site should preferably be in proximity to the project site for retention of amenity effect in the vicinity. In any case, a minimum of 80% of trees affected by any developmental activity shall be preserved through tree transplantation.

Following will be the salient features of the Tree Preservation Plan:

(a) The project outline with respect to trees that can be preserved on-site, trees that will need transplantation and trees that need to be felled;
(b) Identification of tree relocation/transplantation strategy;
(c) Identification of land/area where the trees will be transplanted;

(d) Allocation of funds for transplantation;
(e) Assessment of development plan in conjunction with the tree preservation plan with timelines;

The Tree Preservation Plan shall be submitted to the concerned Tree Officer along with the application for tree felling. If any, The Tree Officer shall give his/her decision within the time stipulated under Delhi Preservation of Trees Act, 1994 including, for reasons to be recorded in writing, granting a conditional approval subject to making necessary changes in the Tree Preservation Plan. If the Tree Officer fails to communicate his/her permission on request within the stipulated period, the permission shall be deemed to have been granted. If the Tree officer fails to communicate his/her permission within the stipulated period after submission of complete application, the permission shall be deemed to be have been granted.

(5) Implementation of Tree Preservation Plan: The Tree Preservation Plan can be put to implementation only after receipt of approval or deemed approval from the concerned Tree Officer. The technical agency in-charge of tree transplantation will be responsible for all the associated activities as illustrated below:
(a) Pre conditioning
(b) Hardening
(c) Rhizome consolidation
(d) Refuge site preparation
(e) Transportation
(f) Transplanting at refuge
(g) After care

It is expected that the steps (a) to (f) above will typically take 3-4 months, whereas after care could take anywhere from 3-12 months to ensure that the transplanted tree have successfully adapted to their new habitat. It will be mandatory for all the transplanted trees to be geo-tagged.

(6) Handover of Maintenance of Transplanted Trees: The responsibility of the technical agency in-charge of transplantation will be limited to one year of the completion of tree transplantation to a new site, subject to the following:

(a) Survival assessment report shall be submitted by the technical agency at the end of one year with an assessment of tree survival rate at the new sites, along with a completion certificate signed by the concerned Tree Officer at the receptor site.

(b) The benchmark tree survival rate at the end of one year of tree transplantation shall be 80% or as notified by the Department, from time to time. The final payment of the technical agency shall be linked to the tree survival rate achieved with a provision for a penalty for tree survival rate below the benchmark rate. The schedule for payment will be as follows

i. First payment: 20% of finalized rate after 100% completion of transplantation of all trees by technically proper method with photography.

ii. Second payment: 30% of finalised rate depending upon survival rate by technically proper method with photography.

- 100% payment if survival is more then 80%.
- 75% payment if survival is between 60 to 79%.
- 50% payment if survival is 50 to 69%
- No payment if less than 50% trees have failed to survive. No further payments in the subsequent years will not be released as the transplantation operation will be declared a failure.

iii. Third payment: 25% of finalised depending upon survival rate by technically proper method with photography and verification by the committee.

- 100% payment on 100% survival of all the trees that survived in the first year.
- 75% payment if survival of all the trees that survived in the first year is between 60 to 79%.
- 50% payment if survival of all the trees that survived in the first year is 50 to 69%
- No payment if less than 50% trees have failed to survive. Further payments in the subsequent years will not be released as the transplantation operation will be declared a failure.

iv. Fourth and final payment: 25% of finalised rate depending upon survival rate by technically proper method with photography and video recording of maintenance done and verification by the committee.

- 100% payment on 100% survival of all the trees that survived in the first year.
- 75% payment if survival of all the trees that survived in the first year is between 60 to 79%.
- 50% payment if survival of all the trees that survived in the first year is 50 to 69%
- No payment if less than 50% trees have failed to survive. Further payments in the subsequent years will not be released as the transplantation operation will be declared a failure.

Moreover for all transplanted trees that do not survive indigenous tree species with 15 feet height and atleast 6 inch diameter to be planted at 1:5 ratio should be planted.

(c) For projects where 100 or more trees have been transplanted, a social audit at the end of one year of completion of tree transplantation shall be carried out to establish the actual tree survival rate and the completion certificate shall be jointly signed by the concerned Tree Officer and a representative of the social audit team.

Subsequent responsibility for maintenance of transplanted trees after handover from the technical agency shall lie with the land owning agency.

5. Social audit:-

Government of National Capital Territory of Delhi recognizes participation through social audits as the most effective manner to assess the success of tree transplantation projects. Local committees (ward or assembly level) comprising citizen groups, professionals and experts shall be constituted by the Department of Forests and Wildlife. Tree committees will be responsible for carrying out regular monitoring of all projects involving compensatory plantation or tree transplantation of 100 or more trees/saplings in their local areas and to certify their tree survival rate at the end of one year.

6. Publishing of data on website:-

(1) Department of Forests & Wildlife shall keep a detailed and up to date record on its website every month of every application approved for tree felling under Delhi Preservation of Trees Act, 1994 with the following details:
(a) Application details.
(b) Location of affected site.
(c) Number and type of trees felled along with date when felling was completed.
(d) Number and type of trees transplanted along with date when transplantation was completed.
(e) Location of site for compensatory plantation, details such as type, height and geo-tagging of each tree/sapling and date when compensatory plantation was completed.
(f) Agency in-charge of carrying out tree transplantation.
(g) Whether social audit by citizen committee carried out, and if so details of the same.

7. Empanelment of Technical Agencies for Tree Transplantation:-

(1) The Department shall empanel qualified transplantation agencies that meet minimum technical criteria and expertise to carry out transplantation work in Delhi.
(2) To carry out transplantation from any project site in the National Capital Territory of Delhi of Delhi, the applicant shall be required to select an agency from among the empaneled agencies only that will appear the technical feasibility report and carry out tree transplantation for the specific project. The empanelled agency shall adhere to all the technical specifications for carrying out tree transplantation in Delhi as issued from time to time by the Department.

8. Land for Tree Transplantation:-

Ex-situ transplantation of trees shall be facilitated along Delhi Public Works Department roads on first priority subject to availability of land along the roads. In addition, special land banks for tree transplantation will be identified across Delhi by Department, where re-plantation can be carried out, for example at government nurseries. In case, such land is not available, it will be responsibility of the applicant to arrange such land to accommodate transplanted tree species in a scientific manner.

9. Exemptions from Carrying Out Tree Transplantation:-

As a general rule, it shall be mandatory for all developmental projects to ensure that a minimum 80% of the affected trees are scientifically transplanted, except for the following cases:

(a) Private organizations or individuals requiring 10 or less trees to be felled.
(b) Project specific exemption granted in exceptional cases by the committee constituted by State Government for this purpose and for reasons to be recorded in writing.

10. Facilitating Scientific Tree Transplantation in National Capital Territory of Delhi:-

(1) Tree transplantation is a subject with evolving technology and best practices for successful and scientific transplantation of various tree species found in the agro-climatic conditions prevailing in National Capital Territory of Delhi. A dedicated Tree Transplantation cell shall be established in the Department, to facilitate and deal with all matters related to tree transplantation in National Capital Territory of Delhi.

(2) The functions of the Tree Transplantation cell shall be as under:
   (a) To prepare and regularly update the technical specifications for tree transplantation to be strictly followed for any tree transplantation activity in the National Capital Territory of Delhi.
   (b) To carry out empanelment of technical agencies for tree transplantation in Delhi at least once every two years.
   (c) To prepare model request for proposal and other supporting documentation to support government agencies in efficiently adopting and following the established procedure for tree transplantation work in Delhi.
   (d) To define the benchmark tree survival rate and update it from time to time keeping evolving scientific trends and data on success factors of tree transplantation in Delhi.
   (e) To organize and carryout technical training and capacity building of Tree officers of Department, engineering staff of Pubic Works Department etc. on the subject of tree transplantation.
   (f) To maintain a central repository of all tree transplantation works undertaken in Delhi along with the geo-tagged data of such trees as well as data on success rates of different projects, different tree species, different land owning agencies and technical agencies in-charge of carrying out tree transplantation.
   (g) To periodically flag to the Tree Authority those applicants or technical agencies who are unable to achieve the benchmark tree survival rate, and the reasons thereof.
   (h) To constitute local Tree committees (ward or assembly level) comprising citizen groups, professionals and experts within 3 months of the notification of this policy for the purpose of carrying out social audits as requires under this policy and to specify the norms for carrying out such social audits.

(3) The Tree Authority of Delhi shall be the apex body responsible for regular monitoring of the implementation of the prescribed procedure for tree transplantation and for evolving new norms, mechanisms and best practices to achieve the objective of ensuring successful tree transplantation in Delhi.

By Order and in the Name of the Government of
National Capital Territory of Delhi,
SANJEEV KHIRWAR, Principal Secy. (Environment & Forests)

Uploaded by Dte. of Printing at Government of India Press, Ring Road, Mayapuri, New Delhi-110064
and Published by the Controller of Publications, Delhi-110054.
MANOJ KUMAR VERMA Digitally signed by MANOJ KUMAR VERMA Date: 2020.12.29 15:55:12 +05'30'

Search
THE HINDU

ADVERTISEMENT

Panel created for Central Ridge restoration

Project will replace Mexican trees with indigenous species

Published - March 23, 2021 12:31 am IST - New Delhi

PTI

The Delhi government on Monday set up a six-member advisory committee for the restoration of the Central Ridge through biodiversity enrichment, which will include replacing invasive Mexican trees ' *vilayati kikar* [prosopis juliflora]' with indigenous species.

The committee will oversee the implementation of the project in all aspects, a statement said.

Environment Minister Gopal Rai said the project, approved last month, will help achieve the ultimate goal of "kikar eradication" from the Central Ridge within five years.

The Central Ridge is spread over 864 hectares and 423 hectares of area will be restored, the statement said.

The panel will be headed by the Principal Secretary (Environment and Forest) and include the Principal Chief Conservator of Forests, and eminent environmentalists C.R. Babu, Pradeep Krishen, Reena Gupta and Suditya Sinha. The committee will meet every two weeks to monitor the progress of the project and ensure timely and effective on-ground compliance, and will also ensure the highest and aesthetical standards in the design of all civil works, the statement said.

Published - March 23, 2021 12:31 am IST

READ COMMENTS

PRINT

By speed post/ mail

STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY (SEIAA)-DELHI
OFFICE OF DELHI POLLUTION CONTROL COMMITTEE
5th FLOOR, ISBT BUILDING, KASHMERE GATE, DELHI-110006

F.No. DPCC/MS/SEIAA-IV/10/67/2021-22/ 5289- 5296 Dated: 04/01/2023

MINUTES OF MEETING

Please find enclosed the Minutes of Meeting of **67th Meeting** of the State Level Environmental Impact Assessment Authority (SEIAA) held on **23.12.2022**, for information and necessary action, if any.

(K. S. Jayachandran)
Member Secretary

To,

1. **Sh. Sarvagya Kumar Srivastava (Chairman, SEIAA),** 370, Asiad Village Complex, Sirifort, New Delhi-110049
2. **Ms. Reena Gupta (Member, SEIAA),** S-11/9 DLF Phase-III, Gurgaon
3. **Sh. Vijay Garg (Chairman, SEAC),** Plot No. 21, D-Block, Pankha Road, Institutional Area, Janakpuri, Delhi-110058
4. **Member Secretary, SEAC**, Office of DPCC, 5th Floor, ISBT Building, Kashmere Gate, Delhi 110006
5. **PS to Chairman, DPCC** – for kind information.
6. **PS to Principal Secretary (Environment), GNCTD** – for kind information
7. **PA to Member Secretary, DPCC** – for kind information
8. **IT Cell** - for placing the minutes on website.

(K. S. Jayachandran)
Member Secretary

Draft Minutes of Meeting of 67th SEIAA Meeting held on 23.12.2022

STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY (SEIAA)-DELHI
OFFICE OF DELHI POLLUTION CONTROL COMMITTEE
5th FLOOR, ISBT BUILDING, KASHMERE GATE, DELHI-110006

Minutes of the 67th meeting of State Level Environmental Impact Assessment Authority (SEIAA) held on 23.12.2022.

The 67th meeting of State Level Environmental Impact Assessment Authority (SEIAA) was held on 23.12.2022 at 10:30 AM under the Chairmanship of Sh. Sarvagya Kumar Srivastava. The following members of SEIAA were present in the meeting:

1. Sh. Sarvagya Kumar Srivastava - In Chair
2. Ms. Reena Gupta - Member
3. Sh. K.S. Jayachandran - Member Secretary

DPCC Officials namely Sh. S.K. Goyal (EE), Sh. Manish Kumar Awasthi (JEE), Sh. Rohit Kumar Meena (JEE) assisted the SEIAA:

Minutes of the 66th meeting held on 16.11.2022 were confirmed by the SEIAA.

General issues deliberated in SEIAA meeting:-

1. SEIAA has come to know that some of the members of the SEAC are not attending the meeting either because the meeting is taking place on weekdays or for some other reasons. SEAC should consult the members about their availability and examine the need to replace some of the member if not needed and discuss with the Department of Environment if required.
2. SEIAA desired that like NHAI /NHIDCL, DPCC being an autonomous body and secretariat of SEIAA-SEAC should consider enhancement of the sitting fee of SEIAA & SEAC members.
3. Draft agenda of SEIAA should be available to SEIAA members 5 days before scheduled meeting and draft MoM shall be sent via e-mail before finalization/signature.
4. SEIAA will meet more regularly now.

Agenda-01: Discussion on decisions taken by SEIAA during the 65th Meeting, Dated 17.10.2022:

SEIAA during its 65th Meeting dated 17.10.2022 took the following decisions:

1. Any NGO to be engaged for training/sensitization workshop for the major stake holders/Project Proponents in NCT of Delhi like CPWD, NBCC, DDA, MCDs etc regarding minimal impact on environment by proposed project to save maximum number of existing trees, impact on ground water/ground water table , minimum impact on Noise , Air & Water Environment, Traffic etc. The term of reference for engagement of NGO be first finalised by SEAC.
2. A full time Consultant/Consulting agency may be hired for assistance of SEIAA in analyzing data available with Authority/Committee for any needs/ queries of Authority including impact

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

of the proposed project on existing surrounding projects and to assess carrying capacity of city and its zone wise mapping of projects to whom ECs were accorded in last 10 years.
The terms of reference for engaging any such Consultant/Agency, to be first finalised by SEAC. The Consultant/Consulting agency should have at least 10 years of experience on Environmental issues including capabilities of using GIS.

3. SEAC prior to recommending the project to SEIAA, to examine the firm assurance of water during operational phase of the project. If, the availability/assurance of water supply for the project during its operational phase from any government approved agency/Delhi Jal Board is not available in the area/locality where the project is located then it leads to illegal extraction of Ground water/ unauthorized supply of raw water once project completes its construction.

SEAC in its meeting dated 18.11.2022 deliberated with respect to above decisions taken by SEIAA and regarding Terms of Reference to be framed with respect to Point no. 1 and 2 the Chairman SEAC desired that the members may provide their comments to be discussed in forthcoming meeting tentatively scheduled for 25.11.2022.Chairman SEAC in its 119th meeting dated 25.11.2022 requested the members to provide comments expaditiously for finalization of the issue in next SEAC meeting. **Subsequent to the discussion held among the SEAC Members, The Chairman SEAC in SEAC meeting dated 09.12.2022 decided to request SEIAA for holding a Joint meeting of SEIAA and SEAC to deliberate further on the matter.**

The SEAC took the note of observation of SEIAA at point no. 3 regarding examination of firm assurance of water during operational phase of the project.

The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

With respect to point no. 1 ,SEIAA decided and directed that project proponent mentioned at agenda no. 09 i.e. M/s Tirupati Building and Offices Pvt. Ltd. Plot No-3, District Centre, Sector-10, Dwarka shall carry out training/sensitization workshop for the major stake holders/Project Proponents as part of remediation plan through empaneled NGOs in MoEF & CC, GoI. The detail of directions in this regard is incorporated in the decision of agenda no. 09 of the said case.

Further w.r.t. point no. 2 SEIAA deliberated the recommendation of SEAC in detail and decided that SEIAA will finalize the ToR (Terms of reference) for engaging of full time consultant. The ToR may first be discussed in the next SEIAA meeting before finalization.

Agenda no.2- List of clearances/NOCs required by any project before grant of Environmental Clearance by SEIAA.

The SEIAA in its meeting held on 17.10.2022 desired EIA Cell, DPCC to make a list of clearances/NOCs required by any project before grant of Environmental Clearance by SEIAA. The same shall be listed for each proposal in the agenda placed before SEIAA. Accordingly, the list was prepared and discussed in SEAC meeting held on 18.11.2022.

SEAC deliberated that the provisions of EIA Notification [8(5)] prescribed that *"clearances from other regulatory bodies or authorities shall not be required prior to receipt of applications for prior environmental clearance of projects or activities, or screening, or scoping, or appraisal, or decision*

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

by the regulatory authority concerned, unless any of these is sequentially dependent on such clearance either due to a requirement of law, or for necessary technical reasons."

It was further deliberated by the SEAC that the clearances/ NOCs required by any project before grant of Environmental Clearance the major approval for the building projects are as follows:

1. Land Use Plan Approval **(Mandatory)**
2. Local Body Approval/ Building Plan Sanction (**Not mandatory** but UBBL provisions needs to be adhered)
3. Airport Authority of India Approval of Height. (**Not Mandatory**)
4. Approval from Forest Department, if proposal for tree cutting/ felling and transplantation at the site. (**Not Mandatory**)
5. Fire NOC (**Not Mandatory**)
6. DUAC Approval (**Not Mandatory**)
7. Approval of Power Supply Agencies (TPDDL, BSES etc.) (**Desirable**)
8. Approval/ Assurance/ Permission of water supply agency. (**Mandatory**)
9. District Advisory Committee/ DJB Approval, if ground water extraction involved. (**Mandatory**)
10. Clearances from Forestry and wildlife angle if the project involves forest land or wildlife habitat. (**Not Mandatory**)
11. Traffic plan approval by Unified Traffic and Transportation Infrastructure (Planning& Engineering) Centre (UTTIPEC). (**Mandatory in case of Township and Area Development**)

The SEAC is taking into account such approvals while appraising the proposals on case to case basis and the clearance at serial no. 10 is governed by the Office Memorandum issued by MoEF&CC.

In view of above, SEAC decided that SEAC will continue to abide by the Notification dated 14.09.2006 as amended to date and ensure the provisions of the Master Plan/land use plan before considering Environmental Clearance. However the SEAC recommended that the status of all the above listed clearances be ascertained at the stage of EDS clearly mentioning the mandatory clearances.

In view of above, EDS Checklist for online processing of applications of Category B Projects finalised by SEIAA in its 62nd meeting dated 26.07.2022 is required to be amended and the same was put up for perusal and approval of SEIAA.

The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

SEIAA decided to refer back the matter to SEAC to relook into making more clearances/NOCs mandatory (like point no.2 & 7), if needed SEAC can engage with power supply agencies, local bodies etc to understand the feasibility of getting such approvals before grant of Environmental Clearance.

Further, SEIAA decided to write a letter to MoEF & CC, GoI to consider the requirement of local body approval/sanctioned building plan as mandatory document prior to submission of application for EC.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

Agenda: 03: General Issues deliberated by SEIAA in its 66th Meeting held on 16.11.2022 :

SEIAA during its 66th Meeting dated 16.11.2022 on general issues deliberated as follows:

1. The SEIAA referring back to its decisions taken in the previous meeting regarding hiring of full time consultant/consulting agency, desired a time bound action by the end of the year 2022 with due finalization of Terms of Reference (ToR) by SEAC .
2. Regarding website development for the SEIAA, it was desired that FRS of the website should be proper keeping in mind the requirement of awareness, transparency, user friendly interface complimenting to the present gaps in the PARIVESH Portal. Post EC, six monthly compliance report being submitted by the Project Proponent should also be integrated/linked for monitoring purposes.
3. Referring to the specific conditions being imposed for installation of reference-grade (USEPA approved system) Continuous Particulate Monitoring System consisting of three nods capable of monitoring dust emission from the construction site, the SEIAA decided to seek compliance from the Project Proponents to whom such Environmental Clearances have been issued.
4. The SEAC should examine the possibility of not recommending the EC if the proposal envisages the installation of DG Set(s) and imposing condition of gas based generator sets to take care deterioration in air quality of Delhi.
5. The SEAC should study about the projection of traffic to be generated by the project and obtaining traffic plan approval by Unified Traffic And Transportation Infrastructure (Planning & Engineering) Centre (UTTIPEC).
6. Specific condition(s) imposed by SEAC shall be standardized and if any specific condition is not applicable to any project then it shall be specified by SEAC.
7. SEIAA appreciated the efforts made by Sh Manish Awasthi, JEE, EIA Cell in compiling the best practices adopted by SEIAA in state of Kerala, Gujarat, Haryana, Maharashtra etc in compliance of decision taken by SEIAA in its meeting dated 17.10.2022 and approved following best practices/additional conditions imposed by various SEIAAs to be incorporated by SEIAA/SEAC Delhi in its Environmental Clearance of Building Construction projects for betterment of the environment of Delhi:-
    i. Climate responsive design as per Green Building Guidelines in practice should be adopted.
    ii. Vegetation should be adopted appropriately on the ground as well as over built structures such as roofs, basements, podiums etc.
    iii. Green belt development surrounding the campus, avenue tree planting and garden development should commence from the beginning of the construction phase. Only indigenous species should be used for green belt and avenue trees.
    iv. Exposed roof area and covered parking should be covered with material having high solar reflective index.
    v. Building design should cater to the differently-abled citizens.
    vi. Project Proponent shall make provisions for Solar Power System @10 % of the Total Power Load.
    vii. PP to keep open space unpaved so as to ensure permeability of water. However, whenever paving is deemed necessary, PP to provide grass pavers of suitable types &

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

strength to increase the water permeable area as well as to allow effective fire tender movement.

viii. PP to provide minimum 30% of total parking arrangement with electric charging facility by providing charging points at suitable places. PP to ensure that this should be provided in AC/DC combination.

ix. All the vibrating parts will be checked periodically and serviced to reduce the noise generation and sound producing equipment.

x. Construction activities will be allowed only during day-time period.

xi. Lubrication will be carried out periodically for plant machinery.

The SEAC in its 119th meeting held on 25.11.2022, acknowledged the issue pointed out by SEIAA and made following observations.

1. Issue at Point 5, deliberated and it was decided that traffic plan approval by UTTIPEC shall be followed up in category 8 (b) projects.
2. For Point no 7 (vi) SEAC made observation that in high rise projects roof area is less than that required for the purpose of achieving 10 % solar power system, appraisal will be done with an effort to achieve maximum solar power system.
3. For Point 7.viii - PP to provide minimum 30% of total parking arrangement with electric charging facility by providing charging points at suitable places. PP to ensure that this should be provided in AC/DC combination. In addition, provision should be made to allow extension of electric charging facility to all parking slots in the future.

W.r.t. point no 03 regarding specific conditions being imposed for installation of reference-grade (USEPA approved system) Continuous Particulate Monitoring System, MS, SEIAA issued letters on 29.11.2022 to 11 EC projects to submit compliance.

The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

i. With respect to point no. 2 SEIAA discussed the FRS of the website and directed DPCC to ensure development of SEIAA website by 31st March, 2023. FRS as discussed to be put up to MS SEIAA for onward transmission to IT Cell DPCC.

ii. With respect to point no.3 SEIAA took the note of the status provided regarding specific conditions being imposed for installation of reference-grade (USEPA approved system) Continuous Particulate Monitoring System.

iii. With reference to SEAC deliberations w.r.t. point no. 5 stating that that traffic plan approval by UTTIPEC shall be followed up in category 8 (b) projects the SEIAA desired that SEAC to examine the traffic plan for building usage /nature of occupancy which may invite lots of footfall during its end use. SEIAA is of the view that as traffic not only depends on the area of the project but also upon its usage and nature which may invite more footfall during usage, therefore in all building construction projects including category 8(a) traffic plan approval should be examined.

Agenda 04: Letter dated 29.09.2022 issued to Chairman SEAC to exlore possibility to exterminate invasive foreign species.

The Chairman, DUAC wrote a letter to Chairman, SEAC–Delhi highlighting the issue 03 species of trees prolific in Delhi that are not native to Delhi creating imbalances in Delhi Ecology. Two of the

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

three species are invasive and multiplying rapidly, crowding out native species of Trees and there symbiotic Flora & Fauna. These species include Vilayati Babul/ Vilayati Kikar (Prosopis juliflora), Subabul (Leucacena leucocephala), and finally Eucalyptus.

This was deliberated in the Commission and it was, accordingly decided that it would be delighted to support any such initiatives taken by the concerned authorities to explore the possibility to exterminate these invasive foreign species at the earliest.

The SEAC recommended in its 119th held on 25.11.2022, that the reference recieved from DUAC be forwarded to Forest Department, GNCTD by SEIAA Delhi for suitable examination and necessary action under intimation to SEIAA/ SEAC-Delhi.

The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

SEIAA approved the recommendation of SEAC to forward the reference received from DUAC to Forest Department, GNCTD by SEIAA Delhi for suitable examination and necessary action under intimation to SEIAA/ SEAC-Delhi.

(Sarvagya Kumar Srivastava) Chairman, SEIAA	(Reena Gupta) Member, SEIAA	(K.S. Jayachandran) Member Secretary, SEIAA

Agenda 05
Case No C-423

Name of the Project	EC for Construction of Additional Court At New Plot at Plot FC-17, in front of Existing Karkardooma Court Complex, Karkardooma, East Delhi, Delhi
Project Proponent	Siddharth Mahajan, Executive Engineer, Public Works Department, Govt. of NCT of Delhi at Office of the Executive Engineer (C) other project Division -II, Central Prison Complex Mandoli Delhi
Proposal No.	SIA/DL/INFRA2/403615/2022
File No.	DPCC/SEIAA-IV/C-423/DL/2022

A. ***Details of the Proposed Project are as under:***

1. The Proposal is for grant of EC for Construction of Additional Court at New Plot at Plot FC-17, in front of Existing Karkardooma Court Complex, Karkardooma, East Delhi, Delhi by M/s Public Works Department (PWD), New Delhi
2. The Project is located at **Latitude:**28°39'15.46"N; **Longitude:** 77°17'38.68"E
3. **Area Details:**
   The Total Plot Area of the project is 4952.420 sqm. The Proposed Total Built-up Area (FAR + Non-FAR) is 29,450.646 sqm. The Proposed FAR Area is 13,953.223 sqm and Proposed Total Non-FAR Area is 15,497.424 sqm.The Total Basement Area is 6488.465 sqm. The Proposed Ground Coverage is 2,476.21 sqm. The total no. of Basements will be 2 nos. The total nos. of floors will be 2B+G+SF+8+T. The total no of expected population is 2717 persons. The Max. Height of the building (upto the terrace level) is 39.15 m.
4. **Water Details:**
   ***During* Construction Phase,** approx. 9.00KLD of fresh water will be required for drinking purpose which will be provided in form of bottled cans from the local fresh water supplier. Approx. 812.956 ML of treated will be required for the water curing of building structures. Sewage generation will be approx. 5.4 KLD which will be treated by providing small septic tanks, soak trenches.
   During Operational Phase, Total Water requirement of the project will be 173 KLD which will be met by 58 KLD of Fresh water from DJB and 115 KLD of Treated water to be met from in house STP and DJB Treated water. Total Waste water generated will be 82 KLD which will be treated inhouse STP of 100 KLD capacity. Treated Water from in house STP will be 66 KLD and treated water to be taken from DJB STP will be 49 KLD which will be recycled and reused for Flushing (39 KLD), Horticulture (6 KLD), HVAC Cooling (60 KLD) and Gas based generator cooling (10 KLD).Total treated water required for HVAC is 60 KLD (11 KLD from Inhouse STP and 49 KLD of DJB Treated water).
   Number of Rain Water Harvesting (RWH) Pits proposed are 3 nos with double bore well.
5. **Solid Waste Details**
   During the Operation Phase, Total 501 kg/day of Solid Waste will be generated from the project. Out of which, Bio-Degradable Waste generated will be 200.4 kg/day which will be treated in OWC and Non-Biodegradable Waste generated will be 250.5 kg/day which will be disposed through govt. approved agency/recyclers.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	***Member Secretary, SEIAA***

Inert waste generated will be 45.09 kg/day and E-Waste generated from the project will be 5 kg/day.

6. **Power Details**
   During Operation Phase, Total Power requirement will be 1,462.8 kVA which will be supplied by BSES Yamuna Power Ltd. For Power Back up, 2 x 800 kVA GG SET with Heat Exchanger Type will be installed.
   65 kWp will be met from Solar Energy.
7. **Parking Facility Details:** Total Proposed Parking is 255 ECS (Stilt: 49 ECS, Basement 1: 92 ECS, Basement 2: 114 ECS)
8. **Eco-Sensitive Areas Details:** Distance of Okhla Wildlife Sanctuary from project site is 8.27 Km SSW and from Asola Wildlife Sanctuary is 16.90 Km SSW.
9. **Plantation Details:** The proposed Green Area is 1,574.06 m² (31.78 % of plot area) of which soft scape area is 932.00 m² (18.82% of total plot area) and Hardscape area is 642.06 m² (12.96% total plot area). Total no. of trees proposed are65 nos. At present there are 7 trees present at site which will be retained.
10. **Cost Details:** Total Cost of the project is Rs.173.94Crores including Land cost as well as Developmental cost.

The earlier Proposal No. SIA/DL/MIS/67418/2021 for the above said project was filed by the Project Proponent i.e. M/s Public Works Department, New Delhi and was considered by SEAC in its 99th Meeting held on 22.02.2022 in which SEAC deferred the case for resubmission of Form 1&1A for want of information required for Designed parameters /STP details/ Rainwater Harvesting/ Green area/ Traffic management. Accordingly, ADS was raised to the Project Proponent which Project Proponent did not replied and as a result the Proposal got delisted from the Parivesh Portal automatically. Now, Project proponent has applied again for EC for the same project vide Proposal No. SIA/DL/INFRA2/403615/2022.

In 117th SEAC Meeting dated 01.11.2022, nobody appeared/responded on behalf of project *proponent. The proposal deferred for further consideration.*

Subsequently, the project proponent has submitted a letter dated 07.11.2022 requesting to withdraw the case in view of the demise of the environment consultant engaged by them.

B. After due deliberations, the SEAC in its 118th meeting held on 18.11.2022 recommended as follows:

The case be delisted in view of the request made by the Project Proponent.

C. The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

The SEIAA approved the delisting of the proposal.

(Sarvagya Kumar Srivastava)	(Reena Gupta)	(K.S. Jayachandran)
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

Agenda No. 06
Case No. C-412

Name of the Project	EC for Construction of 184 Multi Storied Flats for Hon'ble MPs at sector 24, Baba Kharak Singh (B.K.S) Marg, Gol Market, Lutyens zone, Central Delhi, Delhi-110001 by MINISTRY OF HOUSING & URBAN AFFAIRS (CPWD).
Project Proponent	Mr. Jay Prakash Singh, Executive Engineer & Senior manager C-IV, Ministry Of Housing & Urban Affairs (CPWD) 3, BD Marg, New Delhi, Delhi-110001
Consultant	Perfact Enviro Solutions Pvt. Ltd
Proposal No.	SIA/DL/MIS/286113/2022
File No.	DPCC/SEIAA-IV/C-412/DL/2022

A. Details of the Proposed Project are as under:

1. The Proposal is for grant of EC for Construction of 184 Multi Storied Flats for Hon'ble MPs at sector 24, Baba Kharak Singh (B.K.S) Marg, Gol Market, Lutyens zone, Central Delhi, Delhi-110001 by Ministry of Housing & Urban Affairs (CPWD).
2. The Project is located at **Latitude:** 28°37'31.75"N; **Longitude:** 77°12'17.02"E.
3. **Area Details:**
   The total site area is 41,535.970 sqm out of which 15,449.970 sqm is for future development and 26,086 sqm is for proposed phase-I. The Proposed Total Built-up Area is 1,23,146.321sqm. At present, 243 no. of flats exist at site in 16 Towers having built up area of 16,908.00 m2 which are to be completely demolished. Total FAR area (Phase I) of the proposed project is 68871.599 sqm. The Proposed Non FAR Area (phase-I) is 27504.454 sqm. The proposed Total Basement Area (02 Levels) is 26,770.268 sqm. The Proposed Ground Coverage is 4202.996 sqm. The total no. of floors will be 2B+S+23+Refuge Floor. The total no of expected population is 2468 persons. The Max. Height of the building is 92 m.
4. **Water Details:**
   During Construction Phase, Total water requirement will be 30 KLD out of which 20 KLD portable water and 10 KLD for construction activities (which will be taken from treated water from STP). The wastewater (18 KLD) will be treated in mobile STP.
   During Operational Phase, Total Water requirement of the project will be 239 KLD which will be met by 124 KLD of Fresh water from NDMC and 115 KLD of Treated water from in house STP. No groundwater will be extracted. Total Waste water generated from the project will be 152 KLD which will be treated in house STP of 2X150 KLD capacity. Treated Water from STP will be 144 KLD out of which 115 KLD treated water will be reused for Flushing (47 KLD), Gardening (57 KLD) Cooling (4 KLD), Filter Back Wash (5 KLD) ,Misc. (2 KLD) and the excess 29 KLD treated water will be used in nearby Green area. The project proponent has requested NDMC for water supply during operation phase.
   Number of Rain Water Harvesting (RWH) Pit proposed is 6 nos.
5. **Solid Waste Details:**
   During Construction Phase, Total solid waste generation will be 23 kg/day out of which 14 kg/day of Biodegradable waste will be given to Solid waste disposal site and 9 kg/day of non-biodegradable waste will be given to approved vendors.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

During the Operation Phase, Total Solid waste generation of 954 kg/day is envisaged. Out of which 572 kg/day of biodegradable waste will be treated in organic waste converter and 191 kg/day of non-biodegradable waste & 191 kg/day of plastic waste will be given to authorized recyclers Additional 30 lit/month of used oil will be generated from the DG set which will be given to authorized recyclers.

6. **Power Details:**
   During Operation Phase, Total Power requirement will be 3213 kW and will be met from NDMC. For Power Back up, DG sets of Capacity 3X810 KVA will be installed.
   Solar photovoltaic power panels of 270 KWp capacity (8.40 % of total power requirement) will be provided. The project proponent has requested NDMC for electricity supply to the project.
7. **Parking Facility Details:** Total Proposed Parking is 612 ECS.
8. **Eco-Sensitive Areas Details:** Distance of Okhla Wildlife Sanctuary from project site is 10.80 Km, SE and from Asola Wildlife Sanctuary is 14.44 km, SE.
9. **Plantation:** Total green area proposed is 9371.710 sqm (35.93 % of plot area of phase I). There are 372 trees present at the site. Out of these, 125 trees are proposed to be retained and 247 trees are proposed to be transplanted. No. of tree plantation required (Plot Area of Phase I/80) is 326 nos. Total no. of trees to be (retained + planted) within project area is 330 (125+205) nos.
10. **Cost Details:** Total Cost of the project is Rs.482.80 Crores.

After due deliberations, the SEAC in its 113th Meeting held on 29.08.2022 decided to defer the case to the next forthcoming SEAC meeting due to paucity of time.

Regarding the Tree cutting/ transplantation permission, the project proponent has submitted a letter dated 25.04.2022 to the forest department, GNCTD along with a list of 372 trees present at site and list of 2470 trees to be planted as compensatory transplantation. The committee deliberated and discussed that tree requirement as per standard conditions of OM dated 04.01.2019 will be implemented in future.

During presentation PP informed that the Environment Management Cell consisting of 06 persons having specific knowledge and experience related to environmental safeguards/ air/ water pollution shall be created and made functional before commissioning of any of the proposed development as committed.

Further during the presentation the project proponent assured that trees to be retained will be increased to 150 nos. and affected trees (to be transplanted) will be reduced to 222. The committee suggested that project proponent to maintain/ plant maximum nos. of trees within project site. The PP also committed that the transplantation will be done at a close by site which also has MP quarters where construction has been completed.

Project Proponent submitted the Capital and Recurring cost of EMP during presentation and assured to enhance nos. of RWH Pits.

After due deliberations, the SEAC in its 114th Meeting held on 09.09.2022 recommended as follows:

Based on the information furnished, documents shown & submitted, presentation made by the project proponent and recommended the case to SEIAA for grant of Environmental clearance imposing the following specific conditions:

1. The project proponent shall obtain water supply permission/ assurance before start of construction of the project.
2. The Project Proponent (PP) shall undertake compensatory plantation in the ratio of 1:10 after obtaining necessary clearance under Delhi Preservation of Trees Act, 1994.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

3. The existing trees at the site are 372 nos out of which 150 nos will be retained at the site after amendment in the fire tender route and 222 nos. of trees will be transplanted. The PP shall make effort to plant maximum trees within the project site. Compensatory trees will be planted as per the permission to be obtained from forest department, GNCTD. Transplantation of 222 nos. of trees should be done preferably within the project site as far as possible and at nearby site as a second option. The PP has committed that the transplantation will be done at a close by site which also has MP quarters where construction has been completed. Tree transplantation shall be done with due adherence to the extant tree transplantation policies/ Tree Transplantation Policy 2020 in accordance with the permission of Forest Dept. of Govt. of NCT Delhi
4. In tree plantation, preferably large shade-giving native trees should be planted and not just ornamental trees. Tree-pit size of 6'x6' to be ensured.
5. Rain water harvesting/ retention plan needs to be implemented taking into account the actual percolation rate of the soil at site with required provisioning of min. 1 Recharge bore per 5000 sqm of Plot Area along with the storage capacity of min. 1 day of total fresh water requirement
6. Rain water harvesting for Roof top, landscape & road & open area shall be done through enhanced 07 nos. of RWH pits as committed, which shall allow the water to be stored, and to percolate into the ground of combined capacity of 500 m3.
7. The green areas shall have appropriate surface slope with higher level ridges to direct the surface run-off towards the lowered planter beds. This will enhance natural percolation. Bio-swales type arrangements shall be done in green areas to further increase percolation of the rain water. Green areas will be lowered by 30 cm below ground level, so as to increase the green area water retention capacity on site.
8. Solar PV system shall be provided to meet 8.4% of the demand load during the operation phase as committed and efforts be made to increase upto 10%.
9. The project will be equipped with low water flow and flush fixtures along with incorporation of efficient irrigation system & xeriscaping and shall achieve maximum reduction from the base case water consumption figures adopted in design.
10. Top soil of up to 20 cm shall be taken off and stock piled at a protected place. Natural growth of grass/ vegetation on such protected stockpiled soil shall be allowed. The area under which the excavated top soil will be stored, shall be barricaded and left undisturbed throughout the project construction. The preserved top soil shall be used for horticulture development/ plantation of the proposed vegetation on site.
11. PP shall provide electric charging points in parking areas for e-vehicles for at-least 20% of car parking. Given the rapid spread of EVs, especially in Delhi, The PP may also provide the conduits for future expansion of electrical charging points in majority of the parking spots.
12. The project proponent shall identify the nearby STP for supply of Treated water from STP during Construction Phase. PP is required to make arrangement for reusing the aforesaid treated water along with proper treatment mechanism for making this water fit for use in construction.
13. PP is required to identify the nearby Park for using the surplus treated water and make arrangements for connecting the same through fixed pipeline. Excess treated water from the STP after all assigned uses should be upgraded to CPCB Class A water quality after *appropriate treatment for ground water recharge through recharge pits.*

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

14. PP is required to obtain the power supply assurance from NDMC and copy of the same be submitted in first six monthly monitoring report.
15. The Environment Management Cell consisting of 06 persons having specific knowledge and experience related to environmental safeguards/ air/ water pollution shall be created and made functional before commissioning of any of the proposed development as committed.
16. Trees, green roofs, and vegetation shall be provided to reduce urban heat island effects by shading building surfaces upto possible extent, deflecting radiation from the sun, and releasing moisture into the atmosphere option of creating water bodies be explored.
17. Boring for Rain Water Harvesting system should not be permitted/ done before completion of structure work. All recharge should be limited to shallow aquifer. Depth of boring should leave a buffer of atleast 5 m above ground water table.
18. During operation phase Flow Meters/ Sensors should be installed to monitor consumption of fresh water as well as treated water and data logger using IoT systems for these flow meters be maintained in a regular manner. Flow meters shall be installed at Inlet of STP, outlet of STP, inlet of flushing tanks, and reuse line for horticulture purposes and at the final outfall/ sewer connection maintained for emergency purposes. Calibration for all the Flow meters shall be maintained on quarterly basis.
19. Only LED lighting fixtures should be used.
20. Green building norms should be followed with a minimum 3 star GRIHA/IGBC/ASSOCHAM GEM rating and Gold rating should be followed up.
21. Construction & Demolition waste should be disposed off at authorized C&D waste processing unit.
22. Wind- breaker of appropriate height i.e. 1/3rd of the building height and maximum up to 10 metres shall be provided all around the project site before the start of construction.
23. The Project Proponent should take measures for control of Dust Pollution during construction phase at project site as well as at lay down site as per MoEF&CC Notification No. GSR 94 (E) dated 25.01.2018/Hon'ble National Green Tribunal order in O.A. No.21 of 2014 and O.A. No. 95 of 2014 in the matter of VardhamanKaushik Vs. Union of India & others and Sanjay KulshreshthaVs Union of India & others, CAQM/CPCB/DPCC extant statutory orders/guidelines/directions issued time to time including registration on Dust Pollution Control Self-Assessment Portal with provision of video fencing and low cost sensors for monitoring PM 2.5, PM 10.
24. The project proponent should adhere to the cost of Environmental Monitoring as committed i.e. capital cost of Rs. 67 Lacs and recurring cost of Rs. 12.5 Lacs/ year during construction phase and Rs. 400 Lacs and recurring cost of Rs. 37.1 Lacs/ year during operation phase. The cost of Environment Management Plan should be distinctly allocated in the budget of the project and details of the same along with time frame of the implementation should be reported in six monthly monitoring reports.
25. In view of MoEF&CC Office Memorandum No. 21-270/2008-IA.III dated 19.06.2013 read with MoEF&CC Office Memorandum No. 22-154/2015-IA.III dated 10.11.2015, this environmental clearance is granted focusing only on the environment concerns. The project will be regulated by the concerned local Civic Authorities under the provisions of the relevant provisions of the extant MPD-2021, Building Control Regulations and Safety Regulations.
26. The Environmental Clearance is subject to the condition that concerned local civic agencies will give the permission for use/ occupation of the building only after the written assurance of

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

DJB/ New Delhi Municipal Council / other such local civic authority (as the case may be) regarding supply of adequate water for the residents/ occupiers.

27. Grant of environmental clearance does not necessarily implies that water/ power supply shall be granted to the project and that their proposals for water/ power supply shall be considered by the respective authorities on their merits and decision taking.
28. The investment made in the project, if any, based on environmental clearance so granted, in anticipation of the clearance from water/ power supply angle shall be entirely at the cost and risk of the project proponent and SEAC/SEIAA, Delhi shall not be responsible in this regard in any manner.
29. The PP shall provide toxic gas (Combustible gas, Carbon dioxide and Hydrogen sulphide, Methane, VOCs, Ammonia) detectors in and around STP area.
30. All sensor/meters based equipments should be calibrated on quarterly basis.
31. Occupancy of the premises would be allowed only after getting Electric supply from concerned power supply agencies to restrict the use of generator sets.
32. The green building audit shall be done on annual basis since inception of the project. Further, the audit report shall be included in six monthly compliance report.
33. Project Proponent shall implement Tree Plantation Policy, 2020 as notified by Govt. of NCT of Delhi in letter and spirit which is to be monitored under the terms and conditions of tree cutting permission to be granted by Forest Department, Govt. of NCT of Delhi.
34. Project Proponent shall use recycled products manufactured in C&D Waste processing plants of NCT of Delhi or Municipal Corporation, Delhi as per suitability of required size and strength.
35. The PP shall install the gas based generator sets as a first option, hybrid generator sets (with 70 % gas based fuel and 30 % diesel) as a second option. Alternatively the diesel generator sets shall be operated as per extant directions of CPCB guidelines and shall not be operated with due compliances of directions issued under GRAP for Delhi & NCR.
36. The project proponent shall revisit the capacity of STPs in view of the fact the 1 STP of 200 KLD will suffice to take care of the waste water generation projected by PP. A confirmatory report in this regard shall be submitted in the first sixth monthly compliance report.
37. The PP shall implement suggestions recommended in the revised traffic study submitted during the presentation indicating the LOS category reduction from B to C.

The SEIAA during its 65th Meeting dated 17.10.2022 decided to refer back the matter to SEAC to physically examine and document geo coordinates of tree transplantation & availability of area to transplant 222 numbers of trees.

A letter dated 09.11.2022 from Executive Engineer, CPWD has been received enclosing the principal approval of Tree cutting/ transplantation from Forest Department vide letter dated 28.10.2022 and site plan with Geo Coordinates for compensatory plantation.
The project proponent submitted another letter dated 09.11.2022 from Forest Department and letter dated 20.10.2021 from NTPC regarding the land allocated for compensatory plantation.

B. <u>After due deliberations, the SEAC in its 118th Meeting held on 18.11.2022 recommended as follows:</u>

In view of approval of tree cutting/ transplantation obtained from Forest Department vide letter date 28.10.2022/09.11.2022, SEAC is of considered view that the trees transplantation will be governed

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

and regulated under that aforesaid permission granted in Delhi Preservation of Tree Act, 1994. Therefore the proposal is again recommended to SEIAA for grant of Environmental Clearance.

SEIAA deliberated on its earlier decision taken in its 66th meeting. SEIAA is supreme authority as far as any decision related to environment is concerned. A Clearance from Forest department does not imply that the project is sustainable from EIA standard because the departments look at only one project whereas SEIAA-SEAC is responsible for the cumulative impact of all the projects in NCT of Delhi. Therefore, SEAC to conduct field visit as directed vide decision in its meeting dated 17.10.2022. The SEIAA further directed that SEAC to examine if some of the trees can be saved.

C. **The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):**

The SEIAA approved the recommendations of SEAC made on 18.11.2022 for issuance of Environmental Clearance (EC) to the project with omission of specific conditions at point no.20 and 35 of SEAC recommendation and with the additional specific conditions as follows:

1. *The Project Proponent should implement the guidelines/ mechanism for using Anti Smog Gun in construction and Demolition projects having built-up area greater than 20,000 sqm issued by Department of Environment, NCT of Delhi, vide letter no. F. No.DPCC/(12)(1)(285)lab2020/2790- 2810 dated 16.09.2021 available at* https://dustcontroldpcc.delhi.gov.in/Upload/GuidelinesPDF/43/FilePDF_43_723774.PDF *read aongwith guidelines of CPCB.Besides use of Anti-Smog Gunn the Project Proponent shall ensure that environment friendly Dust suppresant and soil stabilising chemical would be sprayed at prescribed interval on unpaved area of the construction sites to agglomerate the fine dust particles into aggregate too large to become airborne. This must be done in all those areas where there is movement of trucks and other construction machinery at frequent intervals to prevent formations of fine dust particles*
2. *The project proponnet shall register the project on the "Web Portal" for online remote monitoring by the agencies concerned and deploy anti smog guns in proportion to the area of construction site as prescribed vide direction no. 69 dated 02.11.2022 issued by Commission for Air Quality Management (CAQM)*
3. *The Project proponent shall install reference-grade (USEPA approved system) Continuous Particulate Monitoring System consisting of three nods capable of monitoring dust emission from the construction site. The system must have the capacity for simultaneous monitoring of PM2.5 and PM10 and equip for data transfer on a real-time basis to the server of DPCC.*
4. *Green building norms should be followed with a 5 star GRIHA/IGBC/ASSOCHAM GEM rating and Gold rating should be followed up.*
5. *The Project Proponent shall install the gas based generators for power backup.*

(Sarvagya Kumar Srivastava) Chairman, SEIAA	(Reena Gupta) Member, SEIAA	(K.S. Jayachandran) Member Secretary, SEIAA

Agenda No: 07
Case No. 433

Name of the Project	EC For Proposed Construction Of M.P. Chambers At Plot No.119, New Delhi
Project Proponent	Central Public Works Department
Consultant	Kadam Environmental Consultants
Proposal No.	SIA/DL/INFRA2/405478/2022
File No.	DPCC/SEIAA-IV/C-433/DL/2022

A. Details of the Proposed Project are as under:

1. The Proposal is for grant of EC for Proposed Construction of M.P. Chambers at Plot No.119, New Delhi by M/s Central Public Works Department.
2. The Project is located at **Latitude:** 28°42'21.06"N; **Longitude:** 77° 7'45.87"E.
3. **Area Details:**
   The Total Plot Area of the project is 21,448 sqm. The Proposed Total Built-up Area is 1,26,175 sqm. The Proposed FAR Area is 41609.12 sqm. The Proposed Ground Coverage is 8,370 sqm. The proposed basement area is 41,145 sqm. Existing built-up area of 34,175 sqm will be demolished. Total no. of expected population will be 2454 persons. Total no. of buildings will be 3 nos. Maximum No. of Floors will be 3B+ GF+10 & 1B+ GF + 2. The maximum height of the building will be 40 m.
4. **Water Details:**
   During Construction Phase, Total Water requirement at construction site will be 157 KLD which will be met by 75 KLD of potable water from NDMC and total 82 KLD non-potable water requirement for construction purposes will be fulfilled from reuse and recycling at construction site. At laydowns site, Potable water of 375 KLD for domestic purpose will be met from DJB supply and non-potable water of 577 KLD will be used for construction purposes.
   During Operational Phase, Total Water requirement of the project will be 426.45 KLD KLD which will be met by 172.06 KLD of Fresh water from NDMC and Treated waste water of 254.39 KLD generated from in house STP of 325 KLD after treatment of 197.64 KLD waste water generated in house and 85.02 KLD Okhla DJB STP treated water. Treated Water from in house STP i.e. 254.39 KLD will be recycled and reused for Block A, B & C and other occupancies (46.48 KLD), HVAC (185 KLD), Utilities (8.5 KLD), Irrigation (14.41 KLD).
   For Rain Water Harvesting (RWH) 5 nos. of RWH pits will be provided and total 02 Nos. of underground rain water storage tanks of 62.0 KL each will be provided.
5. **Solid Waste Details**
   During Construction Phase, total solid waste generation will be 1,000.0 kg/day. Out of which, the Biodegradable waste (400 kg/day) will be subjected to composting by organic waste converter. The Non-Recyclable waste (400 kg/day) and inert waste (200 kg/day) will be disposed through Govt. approved agency. C&D waste will be sent to any C&D Waste Management Facility (C&DWMF) of Delhi Government.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

During the Operation Phase, Total 519.70 Kg/day of Solid Waste will be generated from the project. Out of which, the Biodegradable waste (209.66 kg/day) will be subjected to composting by organic waste converter. The Non-Recyclable waste (257.18 kg/day) and inert waste (52.86 kg/day) will be disposed through Govt. approved agency.

6. **Power Details**
   During Operation Phase, Total Power requirement will be 6254 kW which will be met by the NDMC. For Power Back up, DG sets of Capacity 4 x 2000 kVA will be installed.
   A total of 240 KW of Solar PV will be installed for the project.
7. **Parking Facility Details:** Total Proposed Parking is 700 ECS.
8. **Eco-Sensitive Areas Details:** Distance of Okhla Wildlife Sanctuary from project site is 10.10 Km and from Asola Wildlife Sanctuary is 13.65 Km.
9. **Plantation Details:** The proposed Green Area is 2401.0 (11.19 % of plot area). There are 248 no. of trees existing at site out of which 247 will be transplanted at NTPC, Eco-Park, Badarpur and Ghitorni and 1 will be retained. Total no. of proposed trees is 269 (268 new and 01 tree to be retained)
10. **Cost Details:** Total Cost of the project is Rs 1700 crores.

B. <u>After due deliberations, the SEAC in its 120th Meeting held on 09.12.2022 recommended as follows:</u>

The SEAC deliberated regarding the issues pertaining to Tree Transplantation Policy, 2020 water assurance, dewatering, air pollution load assessment and its abatement plan during operation and construction. After discussion the project proponent requested to submit the revised proposal.

Accordingly, the SEAC recommended to de-list the case to provide opportunity to proponent for submission of revised proposal.

<u>C. The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):</u>

The SEIAA approved the delisting of the proposal.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

Agenda No: 08
Case No. C-406

Name of the Project	EC for Warehouse Project at Khata no. 23//6/1, 15/2, 16/1, 25, 34, 24//11, 20, 21, 57//1, 10, 58//3, 5/1, 9/3, 10, 11, 12/1, 5/3, 6, 4, 7, 8, 9/1, 12/3, 13, 14, 19, 18, 17, 9/2, 12/2, 5/2, 59//4, 5/2, 6, 7, 14, 59//15, Village - Bijwasan, Delhi
Project Proponent	Ramesh Chand, GPA, 574/5, VPO, Bijwasan, New Delhi, South West,Delhi-110061
Consultant	M/s Grass Roots Research & Creation India (P) Ltd
Proposal No.	SIA/DL/MIS/277979/2022
File No.	DPCC/SEIAA-IV/C-406/DL/2022

A. Details of the Proposed Project are as under:

1. The Proposal is for grant of EC for Warehouse Project at Khata no. 23//6/1, 15/2, 16/1, 25, 34, 24//11, 20, 21, 57//1, 10, 58//3, 5/1, 9/3, 10, 11, 12/1, 5/3, 6, 4, 7, 8, 9/1, 12/3, 13, 14, 19, 18, 17, 9/2, 12/2, 5/2, 59//4, 5/2, 6, 7, 14, 59//15, Village - Bijwasan, Delhi by Ramesh Chand.
2. The Project is located at **Latitude:**28°32'9.82"N; **Longitude:** 77° 1'43.38"E.
3. **Area Details:**

The Total Plot Area of the project is 101256.48 sqm. The Proposed Total Built-up Area is 79996.18 sqm. The Proposed FAR Area is 79996.18 sqm. The Proposed Ground Coverage is 40,497.13 sqm. Existing Built-up area of 790 sqm will be demolished. Total no. of expected population will be 5600 persons. Total no. of warehouses will be 3 nos. The maximum height of the building will be15 m.

4. **Water Details:**

During Construction Phase, STP water will be used, which will be ensured to fit for Construction and Sewage generated will be treated and disposed through septic tanks with soak pits.

During Operational Phase, Total Water requirement of the project will be 236 KLD which will be met by 108 KLD of Fresh water from DJB and 128 KLD treated water from in house STP. Total Waste water generated from the project will be 142 KLD which will be treated in house STP of 175 KLD capacity. Treated Water from STP will be 128 KLD which will be recycled and reused for Flushing (56 KLD), Horticulture (72 KLD).

Number of Rain Water Harvesting (RWH) Pit proposed is 25 nos.

5. **Solid Waste Details**

During Construction Phase, All construction wastes generated during construction will be used within the site itself for filling the floors roads, aggregate for mortar etc. to the extent feasible and remaining if any will be sent to the agency for proper disposal.

During the Operation Phase, Total 1394 Kg/day of Solid Waste will be generated from the project. Out of which, the Biodegradable waste (557.6 kg/day) will be subjected to composting by organic waste converter and the compost will be used as manure. The Recyclable waste (697 kg/day) & Non-Recyclable waste/ Inert waste (139.4 kg/day) will be disposed through Govt. approved agency

6. **Power Details**

(Sarvagya Kumar Srivastava)	*(Reena Gupta)*	(K.S. Jayachandran)
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

During Operation Phase, Total Power requirement will be 1100 kVA which will be supplied by Tata Power Delhi Distribution Limited (TPPDL). For Power Back up, DG sets of Capacity 925 kVA (1x600 kVA+1x200 kVA + 1x125 kVA) will be installed.

Solar Power generation system of 50 Kilo Watt peak (KWp) capacity will be provided.

7. **Parking Facility Details:** Total Proposed Parking is 1977 ECS including parking for e-vehicles which is 320 ECS (20 % of required parking).
8. **Eco-Sensitive Areas Details:** Distance of Okhla Wildlife Sanctuary from project site is 26 Km and from Asola Wildlife Sanctuary is 16.5 Km.
9. **Plantation Details:** The proposed Green Area is 15,289.73 sqm (15.1% of the plot area) There are 25 no. of trees existing at site which will be retained/ transplanted.
10. **Cost Details:** Total Cost of the project is Rs170 crores including land & development cost.

After due deliberations, the SEAC in its 108th Meeting held on 09.07.2022,based on the information furnished, documents shown & submitted, presentation made by the project proponent recommended to seek the additional information which were responded back by the project proponent on 11.08.2022 vide letter dated 04.08.2022.

After due deliberations, the SEAC in its 112th Meeting held on 26.08.2022 recommended the case to SEIAA for grant of Environmental clearance imposing the specific conditions.

The SEIAA during its meeting held on 07.09.2022 took the following decisions (s): The availability/assurance of water supply for the project during its operational phase from any government approved agency/Delhi Jal Board is not available in the area/locality where the project is located which may lead to illegal extraction of Ground water/ unauthorized supply of raw water once project completes its construction. Therefore, SEIAA decided to refer back the matter to SEAC to examine the proposal with firm assurance of water during operational phase of the project.

The case was again considered in SEAC meetings held on 17.09.2022 and 04.10.2022.

The PP submitted a representation dated 16.09.2022 mentioning the OM dated 02.11.2018 providing that "Approval/ permission of the CGWA/SGWA shall be obtained before drawing ground water for the activities. State Pollution Control Board (SPCB) concerned shall not issue Consent to Operate (CTO) till the project proponent obtains such permission.

After due deliberations, the SEAC in its 115th Meeting held on 17.09.2022 recommended that the PP doesn't have water assurance from water supplying agency. SEIAA has raised apprehensions that unavailability of water may promote unauthorized extraction of ground water. SEAC deliberated the matter at length covering various aspects and options available in such scenario. It was consensus decision that in order to have perennial availability of water, treated water from STPs should be utilized for all the purposes and appropriate technologies should be implemented for up-gradation of water. PP should submitted detailed scheme along with shortlisted technology and proposed financial expenditure for up-gradation of treated water to different reuse quality.

In response the Project Proponent has uploaded its reply on 26.09.2022 stating that they have applied for ground water permission to Deputy Commissioner South West District vide letter dated 18.07.2022 and assured to submit the permission in due course of time, if they will be unable to get permission for Ground Water during operation phase then they will increase their STP capacity from 175 KLD to 230 KLD and they will install 11.5 m^3/hr Water Treatment Plant (WTP) for treatment of STP treated water to make it convenient for domestic purposes as per CPCB norms. For the aforesaid purposes proposal has been enclosed and the cost of EMP has been revised.

(Sarvagya Kumar Srivastava)	(Reena Gupta)	(K.S. Jayachandran)
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

During presentation on 04.10.2022, the PP provided the permission to extract Ground Water from bore well granted by the District Advisory Committee vide letter No. DJB/AEE (M)36/2022/743 dated 03.10.2022.

After due deliberations, the SEAC in its 116th Meeting held on 04.10.2022 recommended the case to SEIAA for grant of Environmental Clearance with substitution of the condition regarding ground water drawl not to exceed the quantity as permitted by the District Advisory Committee, District South West of Delhi and water demand will be restricted accordingly during operation phase irrespective of the water demand projected during appraisal. All the conditions laid by the District Advisory Committee are to be adhered to.

In the meantime MoEF & CC GoI issued an OM dated 04.10.2022 regarding exemption of warehouses from requirement of Environmental Clearance.

The case was considered in 65th meeting of SEIAA held on 17.10.2022 & SEIAA decided to defer the case for next meeting.

The SEIAA during its 66th Meeting dated 16.11.2022 took the following decisions (s):

As per notification S.O.3252 (E) dated 22.12.2014 the building and construction projects or activities as per S.No. 8(a) of the schedule of EIA Notification, 2006 shall not include industrial shed, school, college, hostel for educational institution.

The proposal under consideration is the proposed warehouse to be constructed with a built up area of 79996.18 sqm falling in category B under S.No. 8(a) of the schedule. SEIAA opined that proposal needs to be delisted after due consideration of OM vide letter dated 04.10.2022 issued by MoEF & CC GoI clarifying that the word Industrial Shed mentioned in the Notification S.O. 3252 (E) dated 22/12/2014 implies buildings/ warehouses/ sheds (whether RCC or otherwise) which are used for housing machinery of industrial units and/or storage of raw materials and finished goods and industrial products including but not limited to industrial and factory-made products, irrespective of the location and proximity of the Industrial Shed vis-a-vis any Industry. These Industrial Sheds shall strictly implement the guidelines issued vide OM dated 9/06/2015 to ensure sustainable environmental management.

In view of above SEIAA decided to refer back the matter to SEAC.

B. After due deliberations, the SEAC in its 120th Meeting held on 09.12.2022 recommended as follows:

The proposal under consideration is the proposed warehouse to be constructed with a built up area of 79996.18 sqm falling in category B under S.No. 8(a) of the schedule. SEAC took a note of OM vide letter dated 04.10.2022 issued by MoEF & CC GoI clarifying that the word Industrial Shed mentioned in the Notification S.O. 3252 (E) dated 22/12/2014 implies buildings/ warehouses/ sheds (whether RCC or otherwise) which are used for housing machinery of industrial units and/or storage of raw materials and finished goods and industrial products including but not limited to industrial and factory-made products, irrespective of the location and proximity of the Industrial Shed vis-a-vis any Industry. These Industrial Sheds shall strictly implement the guidelines issued vide OM dated 9/06/2015 to ensure sustainable environmental management. Accordingly, the proposal is falling under exempted category of Notification S.O. 3252 (E) dated 22/12/2014.

In view of above SEAC recommended to SEIAA for delisting of the proposal

C. The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

The SEIAA deferred the case for the next meeting for examination of notification in this regard.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

Agenda No: 09
Case No. 430

Name of the Project	EC for Expansion of Existing Hotel Building at Plot no. 3, Sector - 10, Dwarka, New Delhi
Project Proponent	M/s Tirupati Building and Offices Pvt. Ltd. Plot No-3, District Centre, Sector-10, Dwarka
Consultant	Perfect Enviro Solutions Pvt. Ltd
Proposal No.	SIA/DL/INFRA2/404320/2022
File No.	DPCC/SEIAA-IV/C-430/DL/2022

The SEAC in its meeting dated 26.08.2022 deliberated the terms of OM dated 07.07.2021 and decided that Directions under section 5 of EPA,1986 are required be issued by SEIAA Delhi to Project Proponent for *mandating payment towards penalty for violation of EIA Notification 2006 as envisaged in OM F.No 22-21/2020-IA.III dated 07th July,2021 and Bank Guarantee of* ***amount assessed*** *towards the liability of Remediation plan and Natural & Resource Community Augmentation Plan* commensurate with the damage assessment is required to be submitted with DPCC before grant of Environmental Clearance and such plan shall be part of the Environment Impact Assessment (EIA) Report to be submitted along with EC application.

The PP submitted the cost attributable to:

i. Cost of Construction under Violation wrt 3326.92 sqm is **Rs 46387326.8**
ii. Cost of Construction under Violation wrt 2769.63 sqm is **Rs 38741584**
iii. Turnover cost during the period of violation at 11th Floor and 12th Floor is Rs 7036349.0 and that part was operational from April 2022.

The committee deliberated and recommended as follows:

I. The project cost attributable to expansion of 3326.92 sqm be taken as Rs. 6.44 Cr @ Rs. 1800 per sqft as per assessment order dated 28.07.2011 issued by Labour Department, Govt. of NCT Delhi. The project cost attributable to expansion of 2769.63 sqm be taken as **Rs 3.87 Cr** as submitted by Project Proponent. Therefore the total cost of the project is Rs. 10.31 Cr.
II. The Turnover for the aforesaid portion submitted by the project proponent be extrapolated wef 11.06.2012 (Date of Occupancy Certificate) upto the date of stoppage of use of aforesaid portion (to be taken as the date of uploading the undertaking for the stoppage of construction while replying to ADS) on 30.07.2022 i.e. for a period of 10 years 1 month 20 days. This will come to Rs. 28.5 Cr. However the committee deliberated and recommended that for the purpose of imposing the penalty this turnover should be taken as Rs. 14.25 Cr. for averaging the turnover in retrospective manner.

(Sarvagya Kumar Srivastava) **Chairman, SEIAA**	**(Reena Gupta)** **Member, SEIAA**	**(K.S. Jayachandran)** **Member Secretary, SEIAA**

After due deliberations, the SEAC in its above said 112th Meeting held on 26.08.2022 recommended as follows:

1. **Damage Assessment:**

   The committee deliberated on the proposed damage assessment by the Project Proponent in view of 3326.92 sqm Builtup Area constructed at 11th and 12th Floor and 2769.63 sqm Builtup Area of new construction undertaken. In this regard committee after deliberation accepted the cost of assessed damage proposed by the project proponent and finalized the amount of **Rs. 20 Lakhs**. Therefore the project proponent is required to submit revised Remediation Plan and Natural Community Resource Augmentation Plan which should be minimum of **Rs. 20 Lakhs**. This Remediation Plan and Natural Community Resource Augmentation Plan is required to be included in EIA Report for further appraisal at the time of applying for Environmental Clearance within 60 days. The amount of Bank Guarantee equivalent to the amount of Remediation Plan and Natural Community Resource Augmentation Plan will be finalized at the stage of appraisal of EC application taking into account the revised proposal. The Bank Guarantee shall be deposited prior to grant of Environmental Clearance and will be released after successful implementation of the Remediation Plan and Natural Community Resource Augmentation Plan.

2. **Penalty for violation of EIA Notification:**

   The amount of penalty for the aforesaid violation will be 1% of total project cost (Rs. 10.31 Cr.) attributable to the expansion + 0.25% the turnover (Rs. 14.25 Cr) which amounts to total of Rs. 13.87 Lakhs.

3. Action under section 15 read along with section 19 of EPA,1986 be initiated by SEIAA Delhi against the project proponent for violation of EIA Notification 2006 by with respect to previous EC dated 08.07.2008 in constructing and operating 3326.92 sqm at 11th and 12th Floor and with respect to the construction of 2769.63 sqm built up area out of further proposed expansion of 22045.574 sqm in existing operational building without obtaining Environmental Clearance for the proposed expansion.

4. Directions under section 5 of EPA,1986 be issued by SEIAA Delhi to Project Proponent for *mandating payment of **Rs. 13.87 Lakhs (Rupees Thirteen Lakhs Eighty Seven Thousands only)** towards penalty for violation of EIA Notification 2006 as envisaged in OM F.No 22-21/2020-IA.III dated 07th July,2021 and keep operation of 3326.92 sqm at 11th and 12th Floor stopped and not to restart/start any construction with respect to further proposed expansion of 22045.574 sqm without obtaining valid Environmental Clearance.*

5. Committee recommended to issue following ToR to complete impact assessment studies and submit Environment Impact Assessment report and Environment Management Plan within 60 days ***inter-alia*** imposing the following points:

   1. *Remediation Plan and Natural Community Resource Augmentation Plan and quantification of liability shall be included as specific chapter which should be minimum of Rs. 20 Lakhs (Rupees Twenty Lakhs only) as per total damage assessed.*
   2. *The proof of submission of penalty amounting to Rs. 13.87 Lakhs (Rupees Thirteen Lakhs Eighty Seven Thousands only) with DPCC shall be enclosed with as Annexure with the EIA report.*

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

Draft Minutes of Meeting of 67th SEIAA Meeting held on 23.12.2022

The case was considered in 63rd meeting of SEIAA held on 31.08.2022 & SEIAA decided to defer the case for next meeting.

The SEIAA deferred that case in its 63rd meeting held on 31.08.2022 and susequently during its meeting dated 07.09.2022 approved the recommendations made by SEAC Delhi in its meeting dated 26.08.2022 as follows:

1. *Damage assessed by SEAC and issuance of Terms Of Reference (ToR) to complete impact assessment studies and submit Environment Impact Assessment report and Environment Management Plan along with revised Remediation Plan and Natural Community Resource Augmentation Plan as per damage assessed and to apply for Environmental Clearance within 60 days .*
   The amount of Bank Guarantee equivalent to the amount of Remediation Plan and Natural Community Resource Augmentation Plan will be finalized at the stage of appraisal of EC application taking into account the revised proposal.
2. *Action under section 15 read along with section 19 of EPA,1986 against the project proponent by SEIAA for violation of EIA Notification 2006 with respect to previous EC dated 08.07.2008 in constructing and operating 3326.92 sqm at 11th and 12th Floor and with respect to the construction of 2769.63 sqm built up area out of further proposed expansion of 22045.574 sqm in existing operational building without obtaining Environmental Clearance for the proposed expansion.*
3. *Issuance of directions under section 5 of EPA,1986 by SEIAA Delhi to Project Proponent for mandating payment of Rs. 13.87 Lakhs (Rupees Thirteen Lakhs Eighty Seven Thousands only) towards penalty for violation of EIA Notification 2006 as envisaged in OM F.No 22-21/2020-IA.III dated 07th July,2021 and keep operation of 3326.92 sqm at 11th and 12th Floor stopped and not to restart/start any construction with respect to further proposed expansion of 22045.574 sqm without obtaining Environmental Clearance for expanded portion and proposed expansion.*

Accordingly the SEIAA issued directions dated 22.09.2022 under section 5 of EPA, 1986 to Project Proponent directing as follows:

1. *Submit payment of Rs. 13.87 Lakhs (Rupees Thirteen Lakhs Eighty Seven Thousands only) towards penalty for violation of EIA Notification 2006 as envisaged in OM F.No 22-21/2020-IA.II dated 07th July, 2021 by way of demand draft in favour of Delhi Pollution Control Committee within 30 days of issuance of this.*
2. *Keep operation of 3326.92 sqm at 11th and 12th Floor stopped and not to restart/start any construction with respect to 2769.63 sqm area or any area related to further proposed expansion of 22045.574 sqm without obtaining valid Environmental Clearance and submit compliance of stoppage of aforesaid areas with due demarcation on a building plan within 7 days.*
3. *That the Dy. Commissioner (South West District) shall take necessary action to ensure the effective stoppage/ operation of 3326.92 sqm at 11th and 12th Floor stopped and not to restart/start any construction with respect to further proposed expansion of 22045.574 sqm without obtaining valid Environmental Clearance.*

(Sarvagya Kumar Srivastava)	(Reena Gupta)	(K.S. Jayachandran)
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

The PP has submitted the demand draft dated 29.09.2022 for payment of Rs. 13.87 Lakhs (Rupees Thirteen Lakhs Eighty Seven Thousands only) towards penalty for violation of EIA Notification 2006 and case is under process in legal cell of DPCC for filing prosecution compliant.

Now the PP has applied for the Environmental Clearance with enhanced proposed built-up area compared to proposal submitted at the time of ToR.

Details of the proposed project after proposed expansion are as under:

1. **Area Details (after expansion):** As per information submitted by the project proponent, the total plot area will remain the same i.e 13,603.00 sqm the project has constructed a built up area of 61,646.72 sqm (55550.169 sqm + 3326.92 sqm + 2769.63 sqm), proposed ground coverage will be 6792.61 sqm. Total proposed built-up area is 96510.902 sqm Proposed Non FAR (including basement area) area is 31,973.941 sqm and proposed FAR area is 38261.902 sqm . The total no. of Basements will be 3 nos. The Total Basement Area will remain the same as 26275.059 Sqm. The total nos. of floors will be 3B G+13+Terrace Floor (14).
   The Max. Height of the building is 54 m and Total populations after expansion will be 3206 (existing is 2764 persons) and nos of rooms will remain 330 without any enhancement in proposed expansion.
2. **Water Details :**
   During construction phase: Total water requirement will be 10 KLD out of which 5 KLD Water will be sourced through treated water from STP for construction activities. For domestic use, 5 KLD water will be sourced through tankers. Existing toilet facilities will be used for the labourers during the construction phase. Regular cleaning shall be done and hygiene conditions shall be maintained.
   During Operation phase:
   Existing Operational: Total water requirement is 178 KLD out of which fresh water requirement is approx. 87 KLD which is being supplied by Delhi Jal Board and tanker supply. Rest of the water requirement i.e 91 KLD of treated water is being sufficed from on-site STP. Total waste water generated is 101 KLD which is being treated in on-site STP of 210 KD capacity. Treated water (91 KLD) is being used in flushing (30 KLD), gardening (8 KLD) and Cooling (53 KLD). It is a ZLD complex.
   After Expansion: Total water requirement will be 329 KLD out of which 159 KLD will be from fresh water which will be met by Delhi Jal Board and tanker supply. Total waste water generated will be 192 KLD which will be treated in an existing STP of 210 KLD 170 KLD of treated water will be reused for flushing (62 KLD), gardening (8 KLD) and Cooling (100 KLD). It will be a ZLD complex.
   Total 3 no. of rainwater harvesting pits of size 4m dia and 4.5m depth have already been provided with a total capacity of 169.56 m3 . Runoff from roof top, landscape area, Open and road area will be connected to rain water harvesting pits.
3. **Solid and Hazardous Waste Management:**
   During Construction Phase: Total 15 kg/day of waste will be generated from labourers out of which 9 kg/day will be biodegradable waste which shall be treated in existing Organic waste converter & 6 kg/day of non-biodegradable waste will be given to authorized recycler.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

During Operation Phase:

Existing, total solid waste of 514 kg/day is being generated, Out of which the biodegradable waste of 308 kg/day is being generated which is being treated in an organic waste converter of 700kg capacity. Non-biodegradable waste of 206 kg/day is being given to approved recyclers.

After expansion approx. 640 kg/day of solid waste will be generated from the project out of which 384 kg/day of Biodegradable waste will be treated in already installed OWC and 256 kg/day of non-biodegradable waste will be given to the approved recycler.

4. **Power Details:-**

Existing, the total Sanctioned Load of the project is 3333 kVA & connected load is 2000 kVA, which is being met by the BSES Rajdhani. 2 no. of D.G. sets of capacity 1X1500 kVA & 1X1250 kVA (standby) are already installed which have been operated during power cut only. No new DG will be installed for expansion.

After Expansion- There sanctioned and connected load will remain same and No new DG will be installed.

5. **Parking facility:**

During Operation Phase (after expansion): Presently sufficient car parking provision have been made in basement and at surface. 537 ECS will be provided in the basement and at the surface. Nos of electric car parking provision not provided.

6. **Eco-Sensitive Areas:** Distance of Okhla Wildlife Sanctuary from project site is 23.22 Km and from Asola Wildlife Sanctuary is 17.77 Km.

Plantation: The green area of 2720 sqm (20 % of total plot area) has been developed all along the periphery of the project site. Approximately 78 trees have already been planted at the site. After expansion, a total green area of 3047.85 m 2 will be developed

6. **Cost of the project:** Total project cost after expansion will be Rs 452.88 Crores out of which the cost of expansion will be Rs. 45 crores.

Summary of the details submitted by the project proponent:

Description	Unit	As per EC	Details as per application for		
			ToR (after expansion)	EC	
				Proposed expansion	Total After Expansion
Cost of the Project	Rs (Cr)	407.88	482.88	45	452.88
FAR (achieved)-A	**sqm**	--	**30591.316** **(substracting 14.684 converted into Non FAR from 30606 sqm as per completion)**	**7655.902**	**38261.902**
Total Non FAR Area – B (including basement)	**sqm**	--	**26292.939**	**27208.28**	**58249**

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

Built up Area (A+B)	**sqm**	**55550.169**	**55550.169 sqm + 3326.92 sqm + 2769.63 sqm + 19275.944**	**34864.182**	**96510.902**
Number of Basements	Nos.	3	3	No Change	3
Basement Area	sqm	--	26292		26275.059
Max. No. of Floors	No.	3B+G+10	3B+G+12	-	3B+G+13 + Terrace Level
Max. Height of the Building	**meter**	**--**	**54**	**No Change**	**54**
No. of DG Sets	No. (KVA)	-	2x 1250	-	1 x 1500 KVA + 1 x1250 KVA (working- 1 x 1500 KVA, Standby- 1 x 1250 KVA)
No. of RWH Pits	No.	-	3	No Change	3
Total Water Requirement	KLD	328	315	-	329
Fresh Water Requirement	KLD	156	153	-	159
Wastewater Generation	KLD	-	180	-	192
Treated Wastewater Reuse	KLD	175	162	-	170
STP Capacity (MBBR)	KLD	200	210	No change	210
Total Solid Waste	Kg/day	387	649	-	640

SEAC deliberated in the meeting and SEAC was of the considered view that there is no impact on the damage assessment as violation and its damage assessment remained the same. EIA study has been

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

carried out wrt to the enhanced built-up area of 96510.902 sqm therefore there is no need to seek amended ToR by the project proponent in the present and decided to go ahead with the appraisal of the application of Environmental Clearance submitted with enhnaced built-up area as per revised Form 1, Form 1A submitted.

SEAC further deliberated and accepted the Remediation plan Natural Community Resource Augmentation Plan with the condition to relocate the Anti-Smog Gun at Pappankalan Lake with coordination of DJB with a liability of Rs. 20 Lakhs (Rupees Twenty Lakhs Only) as per total damage assessed.

After due deliberations, the SEAC in its 119th Meeting held on 25.11.2022, based on the information furnished, documents shown & submitted, presentation made by the project proponent recommended to seek the additional information which has been responded back by the project proponent on 01.12.2022 vide letter dated 30.11.2022 which is as follows:

S. No	Information Sought by SEAC during SEAC Meeting dated 25.11.2022	Reply dated 01.12.2022 submitted on 30.11.2022
1.	*Compliance to keep operation of 3326.92* sqm at 11th and 12th Floor stopped and not to restart/start any construction with respect to 2769.63 sqm area or any area related to further proposed expansion of 22045.574 sqm without obtaining valid Environmental Clearance and submit compliance of stoppage of aforesaid areas with due demarcation on a building plan as per directions issued by SEIAA.	*PP vide its letter dated 30.11.2022* submitted that they have stopped the operation of 3326.92 sqm at 11th & 12th Floor and not restart/ start any construction wrt 2769.63 sqm area or any area related to further proposed expansion of 22045.574 sqm without obtaining valid Environmental Clearance. Copy of undertaking stating the same along with building plans demarcating the violation area has been enclosed as follows: 1. 11th floor Plan: Demarcating 1996.028 sqm 2. 12th Floor Plan: Demarcating 1996.08 – 816.51= 1179.51 sqm area 3. Terrace Floor Plan: Demarcating area of 151.548 sqm (which was shown as a covered area on terrace floor in completion plan)
2.	Rain water harvesting/ retention plan needs *to be provided with numbers of RWH pits,* taking into account the recent higher flash rain (115 mm/hr) data along with actual percolation rate of the soil at site with layout and location plan.	PP has annexed the revised rain water harvesting calculations taking into account the recent higher flash rain (115 mm/hr) data along with actual percolation rate of the soil at site with layout and location plan.
3.	Provision to achieve 30 % of ECS for electric vehicle in parking.	PP has submitted an undertaking for providing 30% of ECS for electric vehicles in parking.

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

4.	Revised solar energy utilization with an effort to achieve 10 % of power load requirement making full use of terrace area. Total 3 no. of rainwater harvesting pits of size 4m dia and 4.5m depth have already been provided with a total capacity of 169.56 m3 . Runoff from roof top, landscape area, Open and road area will be connected to rain water harvesting pits	PP has submitted an undertaking that they will provide upto 5% of the total power load through renewable resources i.e. approx.. 130 kW.
5.	Revised realistic project cost in view of enhanced development proposed in the EC proposal as per the proposed built-up area.	PP has submitted that the total project cost after expansion will be Rs. 467.88 Cr. (Cost of expansion will be Rs. 60 Cr.)

During the presentation PP submitted undertaking stating that Remediation and Community Resource Augmentation Plan will be executed at Pappankalan Lake with coordination of DJB with a liability of Rs. 20 Lakhs as per total damage assessed.

B. After due deliberations, the SEAC in its 120th meeting held on 09.12.2022 recommended as follows:

1. SEAC recommended total amount of Rs. 20,00,000/- lakhs towards Remediation plan (Rs. 14/- Lakhs) and Natural Resource Augmentation (Rs. 3.5/- lakhs) and Community Resource Augmentation (2.5/- lakhs) Augmentation plan to be spent within a span of two years. Details are given below:

(a) Cost summary of Remediation plan and Natural and Community Resource Augmentation plan.

S.No.	ITEM	Total Cost (Rs.)	Year I (Rs.)	Year II (Rs.)
1	Cost on Remediation of Environmental damages	14,00,000	9,00,000	5,00,000
2	Cost towards Natural Resource Augmentation	3,50,000	1,75,000	1,75,000
3	Cost towards Community Resource Augmentation	2,50,000	1,50,000	1,00,000
	TOTAL COST TO BE SPENT	**20,00,000**	**12,25,000**	**7,75,000**

(b). Remediation plan and cost:

S.No.	*Environmental Component*	*Remediation Proposed*	*Further Remarks*	*Rate (Rs.)*	Quantity	Total Cost (Rs.)	Year I (Rs.)	Year II (Rs.)

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

1	Air Environment	Fixed Water sprinkling system at pappankalan STP	will be used to reduce the air pollution in nearby area in peak pollution time	150,000	1	150,000	150,000	0
		Installation of 2 no. Anti-smog Gun	will be used to reduce the air pollution in nearby area in peak pollution time	**500,000**	2	**1,000,000**	**500,000**	**500000**
			TOTAL COST			**1150,000**	**650,000**	**500000**
2	Ecological Environment	*Plantation outside* the premises at Pappankalan STP	*will help to* reduce Air pollution and also enhancethe beauty ofthe area	*250,000*	*1*	*250,000*	*250,000*	*0*
			TOTAL COST			**250,000**	**250,000**	**0**
COST OF REMEDIATION						**14,00,000**	**9,00,000**	**5,00,000**

(c). Natural Resources & Community Resources Augmentation plan & budgetary provision.

S.No.	Component	Activity Proposed	Further Remarks	Rate (Rs.)	Quantity	Total Cost (Rs.)	Year I (Rs.)	Year II (Rs.)
1	Natural Augmentation	Provision of Solar lights at Pappankalan STP	Solar Provision	35,000	10	3,50,000	1,75,000	1,75,000
2	Community Resource augmentation	Providing funds to Tripur Sundari Sadhana Peeth at C 701 The Delhi State Newspaper Employees Federation CGHS Ltd, Plot No.1, Sector -19, Dwarka, New Delhi - 110075	Society will do the plantation in vacant areas near Pappankalan STP	250,000	1	2,50,000	1,50,000	1,00,000
COST OF NATURAL AUGMENTATION AND COMMUNITY						**6,00,000**	**3,25,000**	**2,75,000**

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

2. Total budgetary provision with respect to Remediation plan Natural Community Resource Augmentation Plan is Rupees 20/- lakhs. Therefore, project proponent shall be required to submit a bank guarantee of an amount of Rupees 20,00,000/- towards Remediation plan Natural Community Resource Augmentation Plan with the DPCC **prior to the grant of EC.**
3. Remediation plan shall be completed in 2 years whereas bank guarantee shall be for 3 years. The bank guarantee shall be released after successful implementation of the EMP, followed by recommendations of the SEAC and approval of the regulatory authority.
4. The PP shall submit the proof of credible action taken by the concerned state government/ state pollution control board under the provisions of the section 19 of the Environment Protection Act 1986 to the MoEF & CC prior to the grant of EC.

5. **Based on the information furnished, documents shown & submitted, presentation made by the project proponent and recommended the case to SEIAA for grant of Environmental clearance imposing the following specific conditions:**

   1. Total waste water generated will be 192 KLD which will be treated in an existing STP of 210 KLD. 170 KLD of treated water will be reused for flushing (62 KLD), gardening (8 KLD) and Cooling (100 KLD). As proposed, no treated water shall be disposed in to municipal drain. It will be a ZLD complex.
   2. Treated water of DJB/ its own STP should be used for construction purposes with tertiary treatment of treated water of DJB STP to ensure it is fit for construction use.
   3. The PP shall provide toxic gas (Combustible gas, Carbon dioxide and Hydrogen sulphide, Methane, VOCs, Ammonia) detectors for STP area.
   4. Total 3 no. of rainwater harvesting pits of size 4m dia and 4.5m depth having a total capacity of 169.56 m3 shall be maintained properly with periodic cleaning. Runoff from roof top, landscape area, Open and road area will be connected to rain water harvesting pits
   5. Construction & Demolition waste should be disposed of at authorized C&D waste processing unit.
   6. The Project Proponent should take measures for control of Dust Pollution during construction phase in the Environmental Management Plan by taking measures as per MoEF&CC Notification No. GSR 94 (E) dated 25.01.2018/Hon'ble National Green Tribunal order in O.A. No.21 of 2014 and O.A. No. 95 of 2014 in the matter of Vardhaman Kaushik Vs. Union of India & others and Sanjay Kulshreshtha Vs Union of India & others, CAQM/CPCB/DPCC extant statutory orders/guidelines/directions issued time to time including registration on Dust Pollution Control Self-Assessment Portal with provision of video fencing and low cost sensors for monitoring PM 2.5, PM 10.
   7. PP shall provide IOT based Electro-chemical sensors in parking areas for air quality parameters i.e. CO, CO2, Temperature, NOx, SOx, PM 2.5, PM 10, VOCs, H2S, NH3, Humidity to be connected to server 24x7 with quarterly calibration and data uploading every hour.
   8. A report on energy conservation measures confirming to energy conservation norms finalized by Bureau of Energy Efficiency should be prepared and submitted in first six monthly compliance report.
   9. Soil and ground water samples will be tested to ascertain that there is no threat to ground water quality by leaching of heavy metals and other toxic contaminants.
   10. Separation of grey and black water should be done through a dual plumbing line.

(Sarvagya Kumar Srivastava)	(Reena Gupta)	(K.S. Jayachandran)
Chairman, SEIAA	Member, SEIAA	Member Secretary, SEIAA

11. The PP shall provide the Solar PV of atleast 130 kWp and shall ensure that at least 5 % of the total energy demand to be sourced from renewable energy which is feasible on this project.
12. IoT based Flow Meters/ Sensors should be installed to monitor consumption of fresh water as well as treated water and log book for these flow meters be maintained in a regular manner. Flow meters shall be installed at Inlet of STP, outlet of STP, inlet of *flushing tanks, inlet of cooling water tanks and reuse line for horticulture purposes and at* the outfall/ sewer connection to be provided only for emergency discharge purposes with prior intimation to regulatory authority. Calibration for all the Flow meters shall be maintained on quarterly basis.
13. After expansion, a total green area will be enhaced to 3047.85 sqm as proposed.
14. Climate responsive design as per Green Building Guidelines in practice should be ensured to the maximum extent.
15. Vegetation should be adopted appropriately on the ground as well as over built structures such as roofs, basements, podiums etc.
16. Green belt development surrounding the campus, avenue tree planting and garden development should commence from the beginning of the construction phase. Only indigenous species should be used for green belt and avenue trees.
17. Exposed roof area and covered parking should be covered with material having high solar reflective index.
18. Building design should cater to the differently-abled citizens.
19. PP shall keep open space unpaved to the maximum extent possible so as to ensure permeability of water. However, whenever paving is deemed necessary, PP to provide grass pavers of suitable types & strength to increase the water permeable area as well as to allow effective fire tender movement.
20. PP to provide minimum 30% of total parking arrangement with electric charging facility by providing charging points at suitable places. PP to ensure that this should be provided in AC/DC combination. In addition, provision should be made to allow extension of electric charging facility to all parking slots in the future.
21. All the vibrating parts will be checked periodically and serviced to reduce the noise generation and sound producing equipment.
22. Construction activities will be allowed only during day-time period.
23. Lubrication will be carried out periodically for plant machinery.

C. The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

The SEIAA approved the recommendations of SEAC made on 09.12.2022 for ***the project amending the*** Natural Resources & Community Resources Augmentation plan *as follows:*

I. ***Project Proponent shall carry out training/sensitization workshop for the major stake holders/Project Proponents in NCT of Delhi regarding minimal impact on environment by proposed project to save maximum number of existing trees, impact on ground water/ground water table , minimum impact on Noise , Air & Water Environment, Traffic etc in lieu of Natural Resources & Community Resources Augmentation plan with budgetary provision of Rs 6.0 Lakhs. The training /workshop to be conducted periodically starting from January, 2023 with consultation of DPCC before finalization of such program and MS/representative of***

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

DPCC shall attend the said program. The compliance of the same shall be submitted to SEIAA and regional office of MoEF & CC, GoI. MS SEIAA to seek bank guarantee for the budgetary provisions finalized for the proposed remedial measures Natural Resources & Community Resources Augmentation plan and EC to be released only after submission of requisite bank guarantee. The bank guarantee shall be released after successful implementation of the EMP, followed by recommendations of the SEAC and approval of the regulatory authority.

2. *Following additional condition shall be imposed while issuing Environmental Clearance*

   1. *The Project Proponent should implement the guidelines/ mechanism for using Anti Smog Gun in construction and Demolition projects having built-up area greater than 20,000 sqm issued by Department of Environment, NCT of Delhi, vide letter no. F. No.DPCC/(12)(1)(285)lab2020/2790- 2810 dated 16.09.2021 available at https://dustcontroldpcc.delhi.gov.in/Upload/GuidelinesPDF/43/FilePDF_43_723774.PDF. read aongwith guidelines of CPCB.Besides use of Anti-Smog Gunn the Project Proponent shall ensure that environment friendly Dust suppresant and soil stabilising chemical would be sprayed at prescribed interval on unpaved area of the construction sites to agglomerate the fine dust particles into aggregate too large to become airborne. This must be done in all those areas where there is movement of trucks and other construction machinery at frequent intervals to prevent formations of fine dust particles*
   2. *The project proponnet shall register the project on the "Web Portal" for online remote monitoring by the agencies concerned and deploy anti smog guns in proportion to the area of construction site as prescribed vide direction no. 69 dated 02.11.2022 issued by Commission for Air Quality Management (CAQM).*
   3. *The Project proponent shall install reference-grade (USEPA approved system) Continuous Particulate Monitoring System consisting of three nods capable of monitoring dust emission from the construction site. The system must have the capacity for simultaneous monitoring of PM2.5 and PM10 and equip for data transfer on a real-time basis to the server of DPCC.*
   4. *The Project Proponent shall install the gas based generators for power backup and the existing diesel generator shall be replaced by gas based generator whenever the replacement is required.*

(Sarvagya Kumar Srivastava) Chairman, SEIAA	(Reena Gupta) Member, SEIAA	(K.S. Jayachandran) Member Secretary, SEIAA

Agenda No 10
Case No. C-374

Name of the Project	EC for DLF Commercial Complex at 1 E Jhandewalan Extension, New Delhi
Project Proponent	Rajeev Singh, Executive Director, M/s DLF Limited, DLF Centre, Sansad Marg, New Delhi, Karol Bagh,Central,Delhi-110001
Proposal No.	SIA/DL/MIS/68705/2021
File No.	DPCC/SEIAA-IV/C-374/DL/2021

A. Details of the proposed project are as under:

1. The Proposal is for grant of EC for DLF Commercial Complex at 1 E Jhandewalan Extension, New Delhi by M/s DLF Limited after demolition of existing buildings.
2. The project is located at **Latitude**:28°38'48.72"N, **Longitude**: 77°12'7.15"E
3. **Area Details:**The Gross Plot Area of the project is 4062 sq.m. Proposed Total Built-up Area (FAR + Non FAR + Basement Area) is 32455 sq.m. Existing Area which will be demolished is 21250 sqm. Proposed FAR Area is 10155 sqm. The Total Non FAR Area is 22300 sqm. The Total Basement Area is 11835 sq.m. Proposed Ground Coverage is 2031sq.m. The Total No. of Basements will be 3 nos.The Total No. of Towers is 1. The Maximun Number of Floors are (3B+LG+G+8) nos. Maximum Height of the Building (upto Terrace Level) is 39m.
4. **Water Details :**
   During Construction Phase, Total water requirement will be 14 KLD out of which 5 KLD Water will be sourced through treated water from nearby STP for construction activities. For domestic use, 9 KLD water will be sourced through tankers. Mobile toilets will be provided at the site. Around 7 KLD of waste water will be generated.
   During Operational phase, Total Water requirement of the project will be 346 KLD and the same will be met by 182 KLD fresh water from Delhi Jal Board and 164 KLD Treated Water. Total Waste water generated will be 179 KLD which will be treated in in-house STP of capacity 200 KLD. Treated Water from STP will be 164 KLD which will be used for Flushing (76 KLD), Cooling Towers (88 KLD). No Excess treated water will be there, it will be a ZLD motel complex
   Number of Rain water collection tank will be 1 of capacity 54 cum. Rainwater will be collected and after primary treatment it will be used for sprinkling, floor mopping & misc. purposes.
5. **Solid Waste Details :**
   During Construction Phase, Total 15 kg/day of solid waste will be generated. Out of which 9 kg/day of Biodegradable waste generated will be disposed of at the Municipal Solid Waste Site while 3 kg/day of non-recyclable waste and 3 kg/day of recyclable waste will be sent to authorized recycler. 4066.95 Tones of C & D waste will be generated at the site. The debris of construction material will be used in backfilling; roads etc. & rest will be disposed off as per C&D Waste Management Rules, 2016.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

During the Operation Phase, *Total of 695 kg/day of Solid Waste will be generated* from the project. Out of which, Bio-Degradable Waste of 278 kg/day will be treated in organic waste converters and converted to manure. 209kg/day of Non-Biodegradable Waste and 208 kg/day of *Plastic waste which will be given to authorized recyclers*

Hazardous waste includes Oil from DG sets (30 Lts/month) which will be carefully stored in HDPE drums in isolated covered facilities and will be given to vendors authorized by *CPCB/SPCB.*

6. **Power Details :**

During Construction phase, DG sets of capacity 1 x 62.5 KVA will be used which will be *bought acoustically enclosed with adequate stack height*

During Operation phase, the total power requirement will be2000 kW and will be supplied by BSES Yamuna Power Limited. For Power Back up, DG sets of Capacity 1 × 500 kVA and 2 *x 1010 kVA will be installed.*

1% of the total power requirement will be met through solar power.

7. **Parking facility:** Total Parking Required is 305 ECS and Total Proposed Parking is 419 ECS
8. ***Eco-Sensitive Areas:*** Distance from Okhla Wildlife Sanctuary is 12.66 Km Sefrom the project site. Asola Wildlife Sanctuary does not fall within the buffer zone of project.
9. **Plantation:** The green area of 406.2 sqm. (10 % of total plot area) will be provided all along *the periphery* of the project site. At present 29 no. of trees exist at the project site out of which 5 no. of trees will be transplanted/ trimmed and 24 will be retained at the site. Total no. of trees proposed at site is 50 (24 Existing + 26 New).
10. **Cost of the project**: Total Cost of the project is Rs. 98 Crores.

During the presentation the project proponent clarified that application for the environmental clearance is being made on the basis of the conceptual plan and thereafter sanction of building plan will be taken.

After due deliberations, the SEAC in its 98th Meeting (2nd Sitting) held on 02.02.2022,based on the information furnished, documents shown & submitted, presentation made by the project proponent recommended to seek the additional information which has been responded back by the project proponent on 07.06.2022 vide letter dated 30.05.2022 which is as follows:

S.No.	Information Sought by SEAC during SEAC Meeting dated 02.05.2022	Reply dated 30.05.2022 submitted on 07.06.2022
1.	To reconfirm whether project proponent wants to obtain environmental clearance on the basis of conceptual plan only as there is likelihood of changes in the layout and building plans while getting the same sanctioned from local bodies which may require re-appraisal of environmental clearance so granted. Ideally the preliminary 'In Principle Approval' from the local bodies duly rooted through development authorities in accordance with approved master plan is desirable to	PP has informed that they will be obtaining environmental clearance on the basis of conceptual plan only. PP has informed that if built up area gets increased while getting the building plans sanctioned from local bodies, re-appraisal of Environment Clearance will be taken. PP has attached an undertaking stating the same.

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

	minimize aforesaid eventuality.	
2.	Approval from DUAC and Delhi Fire Service.	PP has informed that they will be obtaining EC on the basis of Conceptual plan only. PP has informed that once the EC will be received, they will submit the Building plan for sanction and after that from the portal the application will be sent to outside departments such as DFS, DJB, DUAC etc for grant of approval
3.	*Water assurance from DJB for the proposed* fresh water requirement.	PP has informed that there is an existing water connection from DJB available at the site. PP has attached water bill having K.No 1865800000 of the available connection for reference.
4.	Water requirement during construction phase is proposed to be met from the treated water from nearby STP. PP is required to clarify the arrangement for reusing the aforesaid treated water along with the mechanism proposed for making this water fit for use in construction phase.	PP has informed that STP treated water will be used for the construction phase and if STP water will not be suitable for construction purpose, they will pretreat the water to make it fit for construction.
5.	Segregated figures for potable and non potable water requirement during construction and operation phase.	PP has given details of potable and non potable water requirements during construction and operation phase which is as follows: **During Construction Phase:**

S.No.	Particulars	Quantity
1.	**Total Water Requirement**	10 KLD
2.	**Potable Water (for Labours)** (Source: Tankers)	4.5 KLD
3.	**Non Potable Water (Construction Activities)** (Source: DJB/ Tankers)	5.5 KLD

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

During Operation Phase (After taking conservation measures):

S.No.	Particulars	Quantity
1.	**Total Water Requirement**	310 KLD
2.	**Fresh Water Requirement** (Source: DJB)	99 KLD
	Domestic	65 KLD
	Filter Backwash	10 KLD
	Food Court	14 KLD
	Swimming Pool	10 KLD
3.	**Treated Water Requirement**	211 KLD **In-house STP: 140 KLD** **Outsourced: 71 KLD** (from DJB/ Nearby STP/ Other projects of DLF)
	Flushing	69 KLD
	Gardening	2 KLD
	Cooling Tower	140 KLD
4.	**Waste Water Generated**	155 KLD
5.	**STP Capacity**	200 KLD

PP has also give water requirement as per base case scenario (before taking conservation measures).

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

		PP has also attached Water Balance Diagram of base case scenario as well as after taking conservation measures.
6.	Proportion wise Step Diagram showing the amount of reduction in net Per Capita Water Demand achieved through (1) Each Demand reduction strategy (eg. Low flow fixtures, xeriscaping etc.), (2) Recycling and Reuse.	PP has attached revised water calculation for operation phase after taking conservation measures. PP has also attached Water Balance Diagram for the same.
7.	Revised landscape plan with demarcated green area with soft green area as per MPD. Landscape details to be provided with a measured impact on the micro-climate. Green area should be demarcated as per building bye laws and minimum consolidated area of 15 % of plot area should be kept as soft green area.	PP has informed that 15% of plot area as soft area is not manageable, though they are providing 10 % area of plot area as green area and 1/3rd of terrace area will be kept as a green. Apart from this they will provide/adopt/maintain the green area of surroundings. PP has attached Landscape plan for the same.
8.	Rain water harvesting/ retention plan needs to be provided with numbers of RWH pits, taking into account the recent higher flash rain data along with actual percolation rate of the soil at site with layout and location plan.	PP has attached revised rainwater harvesting calculations PP has informed that they are proposing 2 nos. of RWH Pits. PP has informed that average percolation rate of the soil is 26.1 min/cm and 56.4 min/cm.
9.	Revised Traffic Management Plan including Traffic Impact Assessment considering the latest traffic scenario. Detailed calculation of roads, bicycle paths, pedestrian spaces including entry and exit to be provided. Further, PP is required to submit mitigation measures to handle critical entry and exit scenarios inside and outside the site minimizing the impact on the city roads. Distribution of mode of traffic as per MPD.	PP has attached detailed traffic report with impact assessment.
10.	Undertaking to assure safety of others property along the boundary wall of the complex.	PP has attached an undertaking stating that no damage will occur to others' property due to their project. PP has insured that they will ensure the safety of others property along the boundary wall of the proposed project complex.

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

11.	Outlet parameters of proposed STP during operation phase needs to be revisited in order to check the feasibility of its reuse in flushing, horticulture, HVAC etc.	PP has informed about the outlet parameters of the proposed STP and informed that they will meet these characteristics.
12.	Technical feasibility statement for the proposed STP units with quality of output each unit wise.	PP has attached the technical feasibility statement for the STP.
13.	Explore the possibility for tapping the DJB sewer line of the area to treat the sewage and use in the complex as Jhandewalan is a water scarce area.	PP has informed that the possibility for tapping the DJB sewer line of the area to treat the sewage and use in the complex will be explored.
14.	Revised EMP (Environment Management Plan) for dust mitigation measures during construction as per MoEF Notification No. GSR 94 (E) dated 25.01.2018/Hon'ble National Green Tribunal order in O.A. No.21 of 2014 and O.A. No. 95 of 2014 in the matter of VardhamanKaushik Vs. Union of India & others and Sanjay KulshreshthaVs Union of India & others/ CAQM Directions issued time to time including registration on Dust Pollution Control Self-Assessment Portal with provision of video fencing and low cost sensors for monitoring PM 2.5, PM 10.	PP has attached Revised EMP Report along with Revised Form 1, I A & Conceptual Plan.
15.	Geotechnical Investigation Report along with details of pre and post monsoon water table in project area.	PP has attached Soil Investigation Report
16.	Proportion wise Step Diagram to be provided showing the amount of reduction in net per capita Energy Demand achieved as compared to base case scenario, through (i) Load Reduction Strategies, (ii) Passive Strategies, (iii) Renewables, and (iv) Energy Recovery strategies. Atleast 2 % of total energy demand to be sourced from Renewables. Percentage reduction through each of the aforesaid strategies to be provided in a consolidated diagram format for easy comprehension	PP has informed that total 28.47 % of energy saving per year will be achieved after taking various energy saving measures. PP has attached Energy saving calculation for the same. PP has informed that 1 % of total demand load will be met from solar energy.

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

17.	Proposal for provisioning the energy audit during operation phase.	PP has informed that provision of energy audit will be proposed during the operation phase.
18.	Provision for electric charging of the e-Vehicles as per Building Bye Laws.	PP has informed that 20 % of total parking i.e. 84 ECS will be provided for E-Vehicles in the basement and Electric vehicle charging points will also be provided.
19.	Specify name and numbers of the post to be engaged by the proponent for implementation and monitoring of environmental parameters.	PP has attached Environment Cell Organization Flow Chart showing that 7 no. of personals will be engaged in implementation and monitoring of environmental parameters

The Water Bill submitted for the existing connection does not substantiate the water supply assurance for the new building proposed.

Regarding the revised Landscape plan with minimum consolidated area of 15 % of the Plot Area to be kept as soft green, The PP is proposing 406.2 sqm (i.e. 20 % of the open space) of Green Area against the ground coverage of 2031 sqm.

After due deliberations, the SEAC in its 106th Meeting held on 18.06.2022,based on the information furnished, documents shown & submitted, presentation made by the project proponent recommended to seek the additional information which has been responded back by the project proponent on 06.07.2022 vide letter dated 05.07.2022 which is as follows:

S. No.	Information Sought by SEAC during SEAC Meeting dated 18.06.2022	Reply dated 05.07.2022 submitted on 06.07.2022
1.	Water assurance for the total fresh water requirement of 99 KLD and identification/ assurance from the nearby STPs from where the treated waste water of 71 KLD will be outsourced.	PP has informed that they approached to DJB for the freshwater assurance and the DJB officials said that the PP already has the water connection in running condition and reassurance of fresh water cannot be done as of now. PP has attached acknowledgment copy dated 23.06.2022 for the fresh water from DJB. PP has also informed that once the construction activity will start, they will disconnect the existing water connection at premises and will obtain all necessary approvals for re-connection of water from DJB for the revised water demand and will pay all charges as demanded by DJB for such connection.

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

		PP has attached undertaking regarding the same. PP has informed they will tap the DJB sewer line of the area subject to the approval of concerned authority to treat the sewage for reusing within the premises for HVAC cooling purposes (71 KLD) or else they will outsource the STP treated water from Rithala Phase-I STP Plant. PP has attached letter to DJB dated 22.06.2022 for assurance of STP treated water during operation phase.
2.	STP treated water assurance from the nearby DJB STP to meet the requirement of non-potable water during construction phase.	PP has informed that STP treated water will be sourced from STP Rithala Phase-1 to meet the requirement of non-potable water during the construction phase. PP has attached assurance from DJB dated 18.06.2022 for treated water from Rithala Phase-I STP Plant during construction phase.
3.	Technical feasibility statement for the proposed STP units with quality (characteristics of waste water) of output each unit wise.	PP has attached technical feasibility statement for the proposed STP units with quality of each unit wise.
4.	Outlet parameter of proposed STP during operation needs to be revisited to make it fit for reuse in flushing, horticulture, HVAC etc. supported with simulated model study.	PP has attached the outlet parameters of proposed STP during operation for reuse in flushing, horticulture, HVAC etc. PP has also informed that project is in initial stage and before the commission of STP will put their endeavour to achieve these parameters.
5.	Revised proposal to meet at least 2 % of total energy demand to be sourced from Renewable.	PP has informed that they will meet at least 2% of total energy demand through Renewable.
6.	In view of high ground water table the PP is required to review RWH proposal with adequate provision of rainwater harvesting tanks.	PP has informed that they are proposing Rain water collection tank. PP has informed that collected rainwater will be reused within premises after primary treatment as fresh water in monsoon season.
7.	Confirm the feasibility of tapping the DJB	PP has informed they will tap the DJB sewer

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

	sewer line of the area to treat the sewage and use in the Complex.	line of the area subject to the approval of concerned authority to treat the sewage for reusing within the premises for HVAC cooling purposes
8.	The PP is required to work upon the inventory of the demolition waste likely to be generated from the existing building with a specific reference to Hazardous waste along with its safe disposal plan.	PP has attached the construction & demolition waste calculation of the project. PP has informed that their building is not operational since 2 decades and currently there is no hazardous waste within the premises. PP has also informed that construction & demolition waste will be disposed off through authorized vendor

The proposal was listed in 109th meeting of SEAC held on 25.07.2022 however the proposal deferred for further consideration without going into the merit due to lack of quorum and presence of experts.

The Area statement/ Built-up Area indicated in the site plan and in Form 1/ EMP is at variance the same was clarified during meeting.

The PP during presentation clarified that tapping of DJB sewer line and treat the sewage for using in complex will not be feasible.

PP submitted that there will be no tapping, dewatering or withdrawal of groundwater (as per Form 1A Point 2.9) in spite of the fact submitted that Ground water level is at 4.5 mbgl and the basement floor will be at -12.3 m level and foundation is expected to at -13--13.5 m level (as per Geotechnical Report). In this respect the PP during presentation clarified that dewatering will be done.

The PP has projected the population as 4632 and environmental attributes have been calculated accordingly. There is no correlation/ calculation between the Built-up Area used and population projection. The clarification was given by the PP during presentation.

After due deliberations, the SEAC in its 110th Meeting held on 08.08.2022 recommended to *defer the case for further consideration with a liberty to submit additional document/ information if any* which has been responded back by the project proponent on 04.11.2022 vide letter dated 03.11.2022 which is as follows:

S. No.	Points discussed during meeting	Reply dated 03.11.2022 submitted on 04.11.2022
1.	Dewatering Assessment report to be submitted along with estimated quantity of water to be dewater.	PP has attached Dewatering Assessment Report done by NEERI, Nagpur.
2.	Revised Form I and IA to be submitted.	PP has attached Revised Form I and IA. PP in revised Form IA has submitted that the maximum seepage during the construction of the

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

		basement will be 56 m3/day. The water so dewatered meets the drinking water quality as well. It can be pumped out by 3 HP pump and handed over to any agency like DJB or it can be used for the construction purpose also. The radius of influence is approximately 71.8m and hence the influence will be only localised. The withdrawal is only for removal of the natural seepage and not from any boring and hence the impact will be negligible. The detailed dewatering report is attached as Annexure. 2 no. of rain water collection pits will be provided. Rain water will be collected and after primary treatment it is being used for sprinkling, floor mopping & misc. purposes
3.	Testing of Rithala STP to be done from approved laboratory of Delhi Jal Board.	PP has attached the test report of Rithala STP dated 03.09.2022 issued by Central Laboratory WTP Wazirabad.
4.	STP Feasibility Report to be submitted	PP has attached the STP Feasibility Report along with STP Schematic Diagram of capacity 290 KLD (2X 145 KLD).

The Project Proponent submitted the layout/ site plan with area statement and projected population detail statement during presentation.

After due deliberations, the SEAC in its 118th Meeting held on 18.11.2022, based on the information furnished, documents shown & submitted, presentation made by the project proponent recommended to seek the additional information which has been responded back by the project proponent on 01.12.2022 vide letter dated 01.12.2022 which is as follows:

S. No	Information Sought by SEAC during SEAC Meeting dated 18.11.2022	Reply dated 01.12.2022 submitted on 01.12.2022
3.	PP is required to confirm water assurance from DJB for meeting the water demand during operation phase of the project.	PP has attached a letter dated 30.11.2022 issued by Delhi Jal Board regarding issuance of fresh water supply during operational phase stating that the proposal needs to be submitted through OBPS system after all statutory approvals such as Environmental Clearance. Height NOC etc further DJB has stated that DJB would workout IFC as per DJB Rules and conditions for the said project and DJB shall provide the water connection for proposed commercial complex as per availability and technical feasibility of said commercial complex at the stage only completion after apply for the same.

(Sarvagya Kumar Srivastava)
Chairman, SEIAA

(Reena Gupta)
Member, SEIAA

(K.S. Jayachandran)
Member Secretary, SEIAA

The SEAC deliberated on the letter of DJB obtained by PP in lieu of the water assurance, and it was discussed during the meeting that the PP has applied for Enviromental Clearance with conceptual plan, therefore further assurances from DJB may not be feasible at this conceptual stage. It was decided during the meeting that environmental clearance may be recommended subject to the condition that construction shall not be started without obtaining the categorical water supply permission/assurance from DJB/authorized source.

The revised capital and recurring cost of EMP during construction phase provided during presentation.

B. After due deliberations, the SEAC in its 120th Meeting held on 09.12.2022 recommended as follows:

Based on the information furnished, documents shown & submitted, presentation made by the project proponent and recommended the case to SEIAA for grant of Environmental clearance imposing the following specific conditions:

Specific Conditions:

1. Construction shall not be started without obtaining the categorical water supply permission/assurance from DJB/authorized source for meeting the water requirement during operation phase. In case of failure to comply with the said condition, the environmental clearance will be treated as null and void.
2. Treated water of DJB STP should be used for construction purposes with tertiary treatment of treated water of DJB STP to ensure it is fit for construction use.
3. The project proponent shall adhere to the revised total water requirement – 310 KLD, Fresh water requirement – 99 KLD, Treated water requirement – 211 KLD (for recycling in flushing – 69 KLD, Cooling tower – 140 KLD (Treated water 69 KLD from in House STP and 71 KLD outsourced), Gardening – 2 KLD).
4. The project proponent should adhere to the Cost of Environmental Monitoring as committed i.e. capital cost of Rs.37.5 Lacs and recurring cost of Rs. 8.5 Lacs/ year during construction phase and capital cost of Rs. 245 Lacs and recurring cost of Rs. 59.5 Lacs/ year during operation phase.
5. Any ground water dewatering should be properly managed and shall conform to the approvals and the guidelines of the CGWA in the matter taking into account the recommendations of NEERI Report. Formal approval shall be taken from the DJB/CGWA for any ground water abstraction of dewatering. The project proponent shall adopt suitable measures for controlling ground water backing up around basements.
6. The project proponent shall implement the revised Traffic Management Plan submitted.
7. At least 10 % of the total energy demand to be sourced from Solar (Renewable) energy.
8. PP to provide minimum 30% of total parking arrangement with electric charging facility by providing charging points at suitable places. PP to ensure that this should be provided in AC/DC combination. In addition, provision should be made to allow extension of electric charging facility to all parking slots in the future.
9. IoT based Flow Meters/ Sensors should be installed to monitor consumption of fresh water as well as treated water and log book for these flow meters be maintained in a regular manner. Flow meters shall be installed at Inlet of STP, outlet of STP, inlet of flushing tanks, inlet of cooling water tanks and reuse line for horticulture purposes and at the outfall/ sewer

(Sarvagya Kumar Srivastava) Chairman, SEIAA	(Reena Gupta) Member, SEIAA	(K.S. Jayachandran) Member Secretary, SEIAA

connection to be provided only for emergency discharge purposes with prior intimation to regulatory authority. Calibration for all the Flow meters shall be maintained on quarterly basis

10. Green building norms should be followed with a minimum 3 star GRIHA/IGBC/ASSOCHAM GEM rating and Gold rating should be followed up.
11. Construction & Demolition waste should be disposed of at authorized C&D waste processing unit.
12. Wind- breaker of appropriate height i.e. 1/3rd of the building height and maximum up to 10 metres shall be provided all around the project site before the start of construction and demolition work.
13. The Project Proponent should take measures for control of Dust Pollution during construction phase in the Environmental Management Plan by taking measures as per MoEF&CC Notification No. GSR 94 (E) dated 25.01.2018/Hon'ble National Green Tribunal order in O.A. No.21 of 2014 and O.A. No. 95 of 2014 in the matter of VardhamanKaushik Vs. Union of India & others and Sanjay KulshreshthaVs Union of India & others, CAQM/CPCB/DPCC extant statutory orders/guidelines/directions issued time to time including registration/ self-audit on Dust Pollution Control Self-Assessment Portal with provision of video fencing and low cost sensors for monitoring PM 2.5, PM 10.
14. Project proponent shall be responsible for establishment, operation and maintenance of all common facilities and also for compliance of EC conditions during operation stage.
15. The cost of Environment Management Plan should be distinctly allocated in the budget of the project and details of the same along with time frame of the implementation should be reported in six monthly monitoring reports.
16. In view of MoEF&CC Office Memorandum No. 21-270/2008-IA.III dated 19.06.2013 read with MoEF&CC Office Memorandum No. 22-154/2015-IA.III dated 10.11.2015, this environmental clearance is granted focusing only on the environment concerns. The project will be regulated by the concerned local Civic Authorities under the provisions of the relevant provisions of the extant MPD-2021, Building Control Regulations and Safety Regulations.
17. The Environmental Clearance is subject to the condition that concerned local civic agencies will give the permission for use/ occupation of the building only after the written assurance of DJB/ New Delhi Municipal Council / other such local civic authority (as the case may be) regarding supply of adequate water for the residents/ occupiers.
18. Grant of environmental clearance does not necessarily implies that water/ power supply shall be granted to the project and that their proposals for water/ power supply shall be considered by the respective authorities on their merits and decision taking.
19. The investment made in the project, if any, based on environmental clearance so granted, in anticipation of the clearance from water/ power supply angle shall be entirely at the cost and risk of the project proponent and SEAC/SEIAA, Delhi shall not be responsible in this regard in any manner.
20. The PP shall store all the construction material within the project site. Provision shall be made for providing facilities such as mobile toilets, safe drinking water, medical healthcare, crèche etc for the construction workers hired locally.
21. As proposed, fresh water requirement from municipal supply shall not exceed 99 KLD. Occupancy Certificate shall be issued only after getting necessary permission for required water supply from DJB/ concerned Authority.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

22. Sewage shall be treated in the STP with tertiary treatment. The treated effluent from STP shall be recycled/ reused for flushing, AC makeup water and gardening. As proposed, no treated water shall be disposed in to municipal drain.
23. The PP shall provide toxic gas (Combustible gas, Carbon dioxide and Hydrogen sulphide, Methane, VOCs, Ammonia) detectors for STP area.
24. Energy audit shall be carried out periodically to review energy conservation measures.
25. All sensor/meters based equipments should be calibrated on quarterly basis.
26. Climate responsive design as per Green Building Guidelines in practice should be ensured to the maximum extent.
27. Vegetation should be adopted appropriately on the ground as well as over built structures such as roofs, basements, podiums etc.
28. Green belt development surrounding the campus, avenue tree planting and garden development should commence from the beginning of the construction phase. Only indigenous species should be used for green belt and avenue trees.
29. Exposed roof area and covered parking should be covered with material having high solar reflective index.
30. Building design should cater to the differently-abled citizens.
31. PP shall keep open space unpaved to the maximum extent possible so as to ensure permeability of water. However, whenever paving is deemed necessary, PP to provide grass pavers of suitable types & strength to increase the water permeable area as well as to allow effective fire tender movement.
32. All the vibrating parts will be checked periodically and serviced to reduce the noise generation and sound producing equipment.
33. Construction activities will be allowed only during day-time period.
34. Lubrication will be carried out periodically for plant machinery

C. The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

SEIAA referred back the case to SEAC to examine the firm assurance of water supply to the project and possibility of gas based generator instead of DG sets.

(Sarvagya Kumar Srivastava) **Chairman, SEIAA**	**(Reena Gupta)** **Member, SEIAA**	**(K.S. Jayachandran)** **Member Secretary, SEIAA**

Agenda: 11
Case No.- 421 (Transfer Case)

Name of the Project	Development of Warehouse Complex with Built-up area of 1,05,250.375 sqm" at Khera Kalan Road Village Nangli puna, Khera Kalan,North west District, Delhi Village Nangli Puna, Zone-P-1, Tehsil- Narela (Sub-city), Delhi- 110036
Project Proponent	M/s Goodluck Buildtech Private Limited & Others
Proposal No.	SIA/DL/MIS/291942/2022
EC File No.	21-42/2021-IA-III dated 29.06.2021
SEIAA Delhi File No.	DPCC/SEIAA-IV/C- 421/DL/2022

A. Details of the proposed project are as under:

M/s Goodluck Buildtech Private Limited & Others obtained Environmental Clearance from MoEF&CC, GoI vide letter no. F. No. 21-42/2021-IA-III dated 29.06.2021 for the Project namely "Development of Warehouse Complex with Built-up area of 1,05,250.375 sqm" at Khera Kalan Road Village Nangli puna, Tehsil- Narela (Sub-city),District-Northwest Delhi, Delhi- 110036 in absence of SEIAA, Delhi.
Now, **M/s GOODLUCK BUILDTECH PRIVATE LIMITED** has applied for transfer of EC for above said project from **M/s Goodluck Buildtech Private Limited & Others** to **M/s GOOD LUCK BUILDTECH PRIVATE LIMITED**.

As per the provision of EIA Notification ,2006 prior environmental clearance granted to specific project or activity to an applicant may be transferred during its validity to another legal person entitled to under take the project or activity on application by the transferor, or by the transferee with a written no objection by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which prior Environmental Clearance was initially granted, and for the same validity period. No reference to SEAC concerned is necesaary in such cases.

The applicant inter-alia uploaded following documents in support of their request.

1. No Objection Certificate from M/s Goodluck Buildtech Private Limited & Others for tansferring the Environment Clearance to M/s Good Luck Buildtech Private Limited. However, the same is signed on behalf of M/s Good Luck Buildtech Private Limited instead of M/s Goodluck Buildtech Private Limited & Others.
2. Undertaking by the transferee namely M/s Good Luck Buildtech Private Limited stating that they will comply with the environmental conditions given in the Environment Clearance letter to M/s Goodluck Buildtech Private Limited & Others.
3. Undertaking by M/s Goodluck Buildtech Private Limited regarding aunthecity of documents submitted to SEIAA

The case was considered in 65th meeting of SEIAA held on 17.10.2022 & SEIAA decided to defer the case for next meeting. Subsequently, the SEIAA during its meeting dated 16.11.2022 took the decisions and decided to refer the matter to SEAC for examination and suitable recommendation to SEIAA.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

B. After due deliberations, the SEAC in its 120th meeting held on 09.12.2022 recommended as follows:

The application for transfer of environmental clearance be rejected as it does not lie in view of OM issued vide letter dated 04.10.2022 issued by MoEF & CC GoI clarifying that the word Industrial Shed mentioned in the Notification S.O. 3252 (E) dated 22/12/2014 implies buildings/ warehouses/ sheds (whether RCC or otherwise) which are used for housing machinery of industrial units and/or storage of raw materials and finished goods and industrial products including but not limited to industrial and factory-made products, irrespective of the location and proximity of the Industrial Shed vis-a-vis any Industry. These Industrial Sheds shall strictly implement the guidelines issued vide OM dated 9/06/2015 to ensure sustainable environmental management. Accordingly, the proposal is falling under exempted category of Notification S.O. 3252 (E) dated 22/12/2014.

C. The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):

The SEIAA deferred the case for the next meeting for examination of notification in this regard.

(Sarvagya Kumar Srivastava) Chairman, SEIAA	(Reena Gupta) Member, SEIAA	(K.S. Jayachandran) Member Secretary, SEIAA

Agenda: 12
Case No.- 422 (Transfer Case)

Name of the Project	Expansion of Leela Hotel with built up area 6,2985.83 sqm at Diplomatic Enclave, Africa Avenue, Netaji Nagar, Chanakyapuri, New Delhi by M/s Hotel Leela Venture Ltd.
Project Proponent	M/s Hotel Leela Venture Ltd
Proposal No.	SIA/DL/MIS/292023/2022
EC File No.	F.No. 23-96/2018-IA-III(V) dated 05.11.2020
SEIAA Delhi File No.	DPCC/SEIAA-IV/C- 422 /DL/2022

A. **Details of the proposed project are as under:**

M/s Hotel Leela Venture Ltd obtained Environmental Clearance from MoEF&CC, GoI vide letter no. F.No.23-96/2018-IA-III(V) dated 05.11.2020 for the Project namely "Expansion of Leela Hotel with Builtup area 62985.83 sq m" at Diplomatic Enclave, Africa Avenue, Netaji Nagar, Chankyapuri, New Delhi in absence of SEIAA, Delhi.

Now, **SCHLOSS CHANAKYA PRIVATE LIMITED** has applied for transfer of EC for above said project from **M/s Hotel Leela Venture Ltd** to **M/s Schloss Chanakya Pvt. Ltd.**
As per the provision of EIA Notification, 2006 prior environmental clearance granted to specific project or activity to an applicant *may be transferred during its validity to another legal person entitled* to under take the project or activity on application by the transferor, or by the transferee with a written no objection by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which prior Environmental Clearance was initially granted, and for the same validity period. No reference to SEAC concerned is necesaary in such cases.
The applicant uploaded following documents in support of their request.

1. No Objection Certificate from M/s HLV Limited(formerly known as Hotel Leelaventure Limited) having registered office at the Leela, sahar, Mumbai 400059 (transferor) for tansferring the Environment Clearance to M/s Schloss Chanakya Private Limited Registered office at The Leela Palace, Diplomatic Enclave, Africa Avenue, Netaji Nagar, New Delhi.
2. Undertaking by the transferee namely M/s Schloss Chanakya Private Limited stating that they will comply with the conditions prescribed by MoEF & CC in the Environment Clearance letter F.No. 23-96/2018-IA-III(V) dated 05.11.2020.

The case was considered in 65th meeting of SEIAA held on 17.10.2022 & SEIAA decided to defer the case for next meeting.
The SEIAA during its meeting dated *16.11.2022* took the *following decision(s) and decided to refer* the matter to SEAC for examination and suitable recommendation to SEIAA.

B. **After due deliberations, the SEAC in its 120th Meeting held on 09.12.2022 recommended as follows:**
The project proponent is required to give an affidavit to the effect that all the documents submitted are authentic. The case be forwarded to SEIAA along with aforesaid affidavit for transferring of EC under the provisions of EIA Notification, 2006.

(Sarvagya Kumar Srivastava) Chairman, SEIAA	(Reena Gupta) Member, SEIAA	(K.S. Jayachandran) Member Secretary, SEIAA

C. **The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):**

SEIAA referred back the case to SEAC for examining the application that was submitted while granting EC to the project to make sure that no further studies are needed since this is an old case and some of the environment parameters like availability of water may have changed in the interim period, hence it is important to assess the environment feasibility of the project.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

Draft Minutes of Meeting of 67th SEIAA Meeting held on 23.12.2022

Agenda: 13
Case No.- 426 (Transfer Case)

Name of the Project	Redevelopment of Trillion Motel at Village –Sultanpur, Tehsil Mehrauli New Delhi-110030 of Project Proponent from M/s Trillion Motel Pvt. Ltd., to M/s AKM Hotels Pvt. Ltd.,
Project Proponent	*M/s Trillion Motel Pvt. Ltd*
Proposal No.	SIA/DL/MIS/293298/2022
EC File No.	F.No.DPCC/SEIAA-D-III/C217/2015/1513-1517
SEIAA Delhi File No.	DPCC/SEIAA-IV/C-426/DL/2022

A. Details of the proposed project are as under:

M/s Trillion Motel Pvt. Ltd obtained Environmental Clearance from SEIAA-Delhi vide letter no. F.No.DPCC/SEIAA-D-III/C217/2015/1513-1517 dated 30.11.2015 for the Project namely Redevelopment of Trillion Motel at Village –Sultanpur, Tehsil Mehrauli New Delhi-110030.

Now, M/s AKM Hotels Pvt. Ltd., has applied for transfer of EC for above said project from M/s Trillion Motel Pvt. Ltd., to M/s AKM Hotels Pvt. Ltd.,

As per the provision of EIA Notification, 2006 prior environmental clearance granted to specific project or activity to an applicant may be transferred during its validity to another legal person entitled to under take the project or activity on application by the transferor, or by the transferee with a written no objection by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which prior Environmental Clearance was initially granted, and for the same validity period. No reference to SEAC concerned is necesaary in such cases.
The applicant uploaded following documents in support of their request.

1. No Objection Certificate from M/s Trillion Motel Pvt. Ltd (transferor) for tansferring the Environment Clearance to M/s AKM Hotels Pvt. Ltd
2. Undertaking by the transferee namely M/s AKM Hotels Pvt. Ltd stating that they will comply with the conditions prescribed by SEIAA-Delhi in the Environment Clearance letter F.No.DPCC/SEIAA-D-III/C217/2015/1513-1517 dated 30.11.2015 .

The SEIAA during its meeting dated 16.11.2022 took the following decision(s) and decided to refer the matter to SEAC for examination and suitable recommendation to SEIAA.

B. After due deliberations, the SEAC in its 120th Meeting held on 09.12.2022 recommended as follows:

The project proponent is required to give an affidavit to the effect that all the documents submitted are authentic. The case be forwarded to SEIAA along with aforesaid affidavit for transferring of EC under the provisions of EIA Notification, 2006.

(Sarvagya Kumar Srivastava)	**(Reena Gupta)**	**(K.S. Jayachandran)**
Chairman, SEIAA	**Member, SEIAA**	**Member Secretary, SEIAA**

C. **The SEIAA during its meeting dated 23.12.2022 took the following decisions (s):**

SEIAA referred back the case to SEAC for examining the application that was submitted while granting EC to the project to make sure that no further studies are needed since this is an old case and some of the environment parameters like availability of water may have changed in the interim period, hence it is important to assess the environment feasibility of the project.

(Sarvagya Kumar Srivastava) Chairman, SEIAA	(Reena Gupta) Member, SEIAA	(K.S. Jayachandran) Member Secretary, SEIAA

Agenda: 14
Case No.- C-438 (Transfer Case)

Name of the Project	Alteration or Addition in Motel Building at Khasra No. 83, 84, 85, 91/1-2, 100/1-2, 101& 102Village Satbari, New Delhi
Project Proponent	M/s GRAND BUILDTECH LIMITED
Proposal No.	SIA/DL/MIS/292772/2022
EC File No.	F.No.21-60/2019-IA-III dated 15.11.2019
SEIAA Delhi File No.	DPCC/SEIAA-IV/C- 438 /DL/2022

A. Details of the proposed project are as under:

M/s Anant Raj Limited obtained Environmental Clearance from MoEF&CC, GoI vide letter no. F.No.21-60/2019-IA-III dated 15.11.2019 for the Project namely "Alteration/ Addition in Motel Building at Khasra No. 83, 84, 85, 91/1-2, 100/1-2, 101& 102Village Satbari, New Delhi in absence of SEIAA, Delhi.

Now, **GRAND BUILDTECH LIMITED** has applied for transfer of EC for above said project from **M/s Anant Raj Limited** to **M/s Grand Buildtech Limited**.

As per the provision of EIA Notification, 2006 prior environmental clearance granted to specific project or activity to an applicant may be transferred during its validity to another legal person entitled to under take the project or activity on application by the transferor, or by the transferee with a written no objection by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which prior Environmental Clearance was initially granted, and for the same validity period. No reference to SEAC concerned is necesaary in such cases.

The applicant uploaded following documents in support of their request.

1. No Objection Certificate from M/s TARC Limited (formerly known as Anant Raj Global Limited) having registered office at E-4, Second Floor, Defence Colony, New Delhi-110024 (transferor) for tansferring the Environment Clearance to M/s Grand Buildtech Limited Registered office at E-24, Second Floor, Defence Colony, New Delhi-110024 Karnataka 110024.

2. Undertaking by the transferee namely M/s Grand Buildtech Limited stating that they will comply with the conditions prescribed by MoEF & CC in the Environment Clearance letter F.No.21-60/2019-IA-III dated 15.11.2019.

B. The SEIAA during its meeting dated 23.12.2022 took the following decision(s):

SEIAA referred back the case to SEAC for examining the application that was submitted while granting EC to the project to make sure that no further studies are needed since this is an old case and some of the environment parameters like availability of water may have changed in the interim period, hence it is important to assess the environment feasibility of the project.

----------X----------

Meeting ended with the vote of thanks to the Chair.

(Sarvagya Kumar Srivastava) **Chairman, SEIAA**	**(Reena Gupta)** **Member, SEIAA**	**(K.S. Jayachandran)** **Member Secretary, SEIAA**

Green Action Plan

Department of Forests and Wildlife

Govt. of NCT of Delhi

Contents

1. Introduction: 3
2. Implementing agencies: 3
3. Major initiatives for improving Green Cover of Delhi 3
   3.1 Various plantation schemes to be implemented under GAP 3
      3.1.1 Conventional Plantation 3
      3.1.2 Avenue Plantation 4
      3.1.3 Eco-restoration 10
      3.1.4 High-density multilayered plantation 13
      3.1.5 Vertical Gardening 13
   3.2 Development of online portals 13
      3.2.1 Development of Online Portal for Green Action Plan 13
      3.2.2 Creation of Online Portal for Distribution of Seedlings 13
   3.3 Third Party Audit of Plantations 13
   3.4 Soil Moisture Conservation Works 13
   3.5 Outreach and Education 14
4. Target for GAP 2023 14

DEPARTMENT OF FORESTS & WILDLIFE
GOVERNMENT OF NCT OF DELHI
A-BLOCK, 2ND FLOOR, VIKAS BHAWAN
I.P.ESTATE, NEW DELHI-110002

STANDARD OPERATING PROCEDURE (SOP)

FOR

ECOLOGICAL RESTORATION

OF

THE DELHI RIDGE ECOSYSTEM

CONTENTS

1. Goal of ecological restoration

2. Invasive alien species in the Delhi ridge ecosystem

3. Reference for ecological restoration

4. Methodology

- **A. Prosopis *Juliflora* (Vilayati Kikar)**
- **B. *Leucanea leucocephala* (Subabool)**
- **C. *Lantana Camara***

5. Planning for ecological restoration of Delhi ridge eco-system

1. Ecological restoration and its goal

The Society for Ecological Restoration (SER)'s *International Primer on Ecological Restoration* (2004) defines ecological restoration as "**the process of managing or assisting the recovery of an ecosystem that has been degraded, damaged or destroyed** as a means of sustaining ecosystem resilience and conserving biodiversity."

Ecological restoration basically aims to assist an ecosystem move backwards in its historical path to its near pristine form. While the restored ecosystem will not necessarily revert back to its exact former state due to restrictions such as climate change, urbanization, acclimatization of species etc., however, the general direction may be replicated. In order to restore an ecosystem a combination of knowledge of its former state, data from existing intact ecosystems (reference sites), and other ecological, cultural and historical information is needed. These sources will enable the identification of the historical trajectory, and aid in assisting the ecosystem towards health and integrity.

2. Invasive alien species in the Delhi ridge ecosystem

Biological invasion is the disruption in the functioning and processes of ecosystems and communities due to the increased abundance and distribution of a non-native species (Keane and Crawley, 2002). A species which causes such a disruption is called an invasive species. Invasive species typically exhibit one or more of the following characteristics:

1) Fast growth
2) Rapid reproduction
3) High dispersal ability
4) Phenotypic plasticity (the ability to alter growth form to suit current conditions)
5) Tolerance of a wide range of environmental conditions (Ecological competence)

There are three main invasive alien species in the Delhi ridge eco-system are

a) *Prosopis juliflora* or Vilayati Kikar

b) *Lantana camara*

c) *Leucanea leucocephala* or Subabool

3. Reference ecosystem for eco-restoration of Delhi ridge

One of the key principles of ecological restoration is to have an appropriate local native reference ecosystem to guide project targets and serve as a model for planning a restoration project and later can be used as a basis for monitoring and evaluation purposes. The reference ecosystem may be an actual (physical) site or a conceptual model based on the data from different reference sites, historic records, field guides etc.

Mangar Bani is a sacred grove that lies on the boundary of Faridabad and Gurugram district of Haryana (~100 hectares), and **it is like a snapshot of what the northern Aravallis in Delhi would have looked like without urban expansion**. The Bani is covered by the beautiful Dhau (*Anogeissus pendula*) and Salai trees (*Boswellia serrata*), found on the slopes and top of the hills along with other species that are adapted to these dry, rocky hills. Using insights from field surveys in Mangar Bani, and data from literature such as *Flora of Delhi* (1963) by botanist J.K. Maheshwari, a publication on the native vegetation of Delhi was compiled by the Department of Forests and Wildlife, GNCT of Delhi. This publication is titled, **Native Plants of the Northern Aravalli Range in Delhi (2022)** and will serve as a reference for planting in this restoration project.

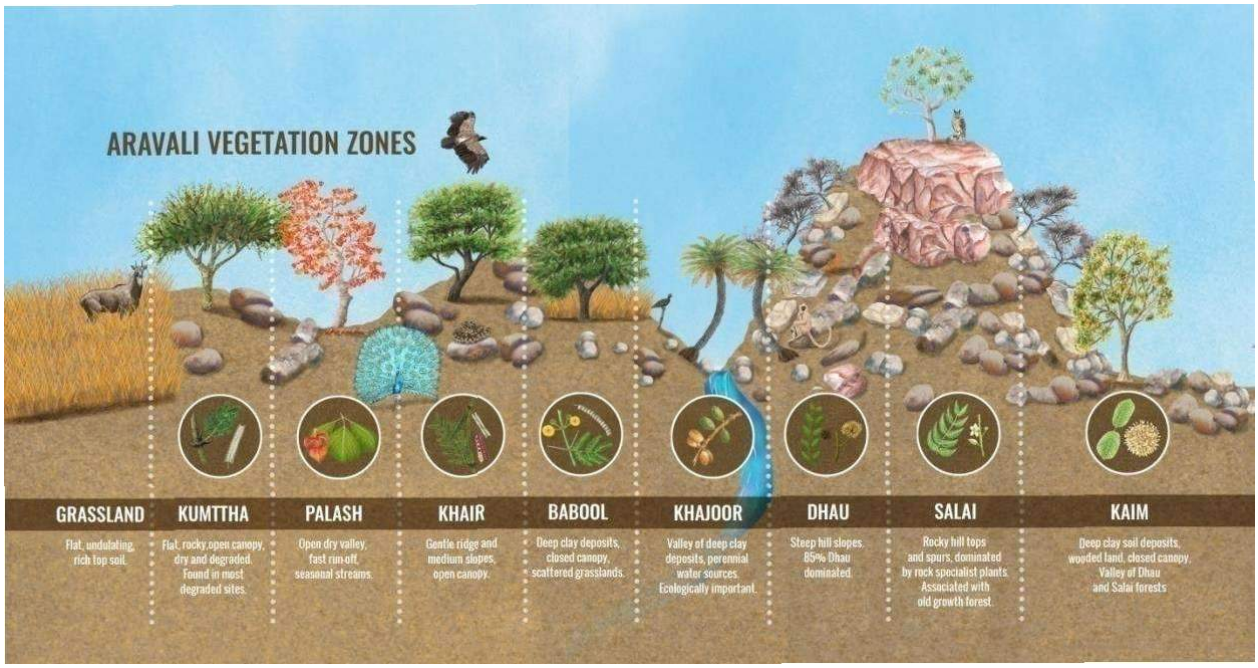


Figure 1: ***Microhabitats of the Northern Aravalli Range, Source: Richa Kedia, Plants of the Northern Aravalli Range in Delhi.***

Figure 1 describes different microhabitats of the Northern Aravalli Range. Microhabitat is a smaller part of the habitat which differs from the surrounding habitat. The physical conditions of a particular microhabitat can also be so different and unique to support unique species that may not be found in larger extent. These microhabitats also vary in temperature, humidity, exposure to light among many other factors.

The dry deciduous forest of the Delhi Ridge is an indicative of diverse microhabitats including Dhau (*Anogeissus pendula*), Kumttha (*Senegalia senegal*), Palash (*Butea monosperma*), Kaim (*Mitragyna parviflora*), Khajur (*Phoenix sylvestris*), Desi babool (*Vachellia nilotica*), Khair (*Senegalia catechu*) and Salai (*Boswellia serrata*) forests. These species are specialized to the ridge habitat and are indicators of a particular kind of habitat and also an indicative of the topography of the ridge. These microhabitats are explained in detail in the book *Native Plants of the Northern Aravalli Range in Delhi,* published by the department in year 2022. To briefly put, starting with Dhau forests, these exist as pure forests and this micro-habitat is mostly found on steep rocky slope whereas Salai forests are found on top of the highest hills with ridges and spurs where soil is thin and dry and heavily dominated with big boulders. Kaim forests, on the other hand, found in valleys of the slopes on which Salai and Dhau forest stands. Kumttha forest stands on gentler slope or flat rocky surface and they are often an indicative of degradation of the forests, with a wide open canopy. Khair forests are also found on the gentler ridges and slope of hills. Forest of Palash exists in drier open valleys or grows along the seasonal water flow, with deep soil deposits. Khajur forests are found in water abundant areas and in deep rocky valleys; areas either with water bodies or perennial streams. Desi Babool forests also occupy valleys with deep soil deposits, where water gets collected during monsoon.

To understand the type and physical aspects of the site and species composition, various habitats of the northern Aravalli range should be studied to include in the restoration plan.

4. Standard Operating Protocol for Eco-restoration.

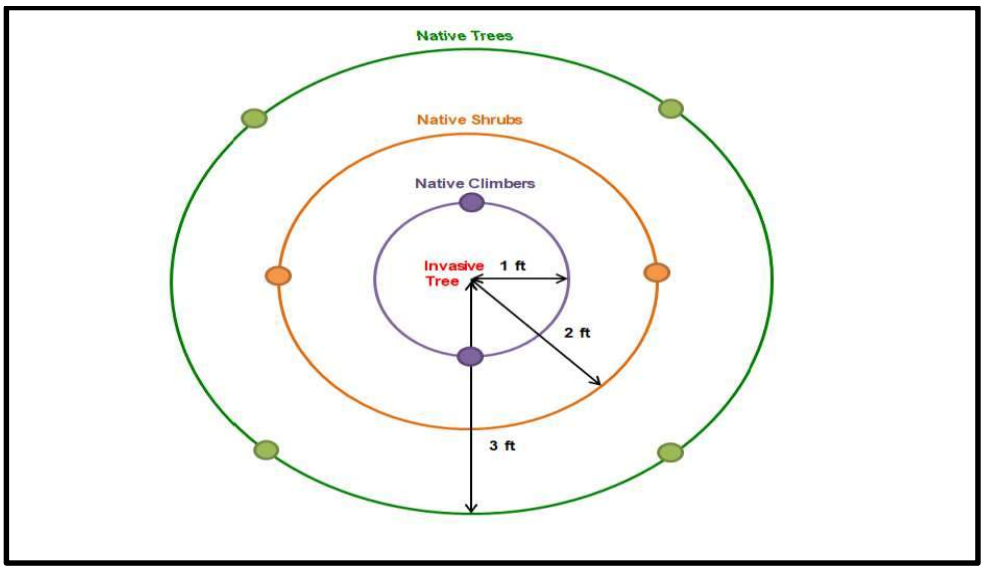
Depending upon the type of Invasive Alien Species, different methodologies are prescribed for eco-restoration of any site.

A. Biological suppression through canopy lifting and planting of native species

Areas with *Prosopis juliflora* and *Leucaena leucocephala* (Subabool) are to be restored through **biological suppression through canopy lifting and planting of native species** is proposed. The standard operating protocol is detailed below:-

i. PRUNING - The two major ways of pruning are thinning out (removing a branch to its origin) and heading back. Heading back is a method where the branch is cut back to a stub, small branch or bud. This method changes the shape of the tree or shrub noticeably. This way, the dense shoots emerges from just below the cut and are usually weakly attached and split out easily. It is one efficient and appropriate method to help in directing the growth of the trees (especially young trees).

ii. PLANTING- Invasive species like *Prosopis juliflora* compete with natives for resources. Thus, native species must be planted in a concentric circle in the following manner



- The **innermost circle** at a distance of 1 foot from the *Prosopis* tree will consist of two native climbing species.
- The **middle circle** at a distance of 2 feet from the tree will consist of two native shrub/understory species.
- The **outermost circle** at a distance of 3 feet from the tree will consist of four native tree species.

iii. WEEDING- In order to prevent re-emergence of young *Prosopis* saplings, weeding will be carried out twice a year. The pre-monsoon weeding will be conducted in June and the post-monsoon weeding will be conducted in October.

The restoration site will be maintained for a period of seven years. Within seven monsoon seasons, the natives will come to dominate the landscape.

In the case of *Leucanea leucocephala* / Subabool, the young sapling has to be removed manually on a regular basis and pruning of trees must be done before seed pods starts to emerge on the tree. Elimination of Subabool is one extremely labour intensive and high maintenance process involving heavy costs but is probably the only effective method to control spread of this species.

B. Elimination of *Lantana camara* through the cut rootstock methodology

Sites for removal of Lantana should be identified through field surveys using the data collected on the extent/ magnitude of infestation and density of Lantana. The Lantana removal operation should follow the 'inside-out' method wherein Lantana is removed first from areas with maximum Lantana density and then moving outwards along a decreasing Lantana density gradient. In areas having undulating terrain and hilly tracts Lantana removal operation should be taken up on the slopes first and then downwards to the valley. The removal operation should be done preferably at a time when a majority of the Lantana clumps are not in flowering or fruiting stage. The cut root stock method shall be employed for the removal of the lantana.

- The person, who engages in removal of Lantana, is positioned in a way that he stands near centre of the Lantana clump with his back facing the clump and holding the handle of digger (kudaal).
- Using the specially designed digger, the person cuts the main rootstock of Lantana 3–5 cm below the soil surface by hitting the rootstock 3 or 4 times; while hitting the rootstock the blade of the digger gets lodged into the main tap root, and at this point it is useful to move the handle of the digger in the forward direction away from the body of the person so as to severe the connection of the clump with the main tap root. In case the clumps of Lantana form impenetrable thickets, it is advantageous to cut the rootstocks of 3–4 contiguous clumps to make the removal operation convenient.

- It may be noted that the branches of Lantana clumps should not be slashed/cut to gain access to the centre of the clump for its removal by cut rootstock method. The branches of Lantana thicket formed by more than one clump should be lifted and tipped over from one end by using a wooden or bamboo pole of about 1.5–2.5 m long and diameter 5–6 cm which is inserted just below the branches from one side and rolled over easily by two workers holding the pole at either end and pressing it so as to reach the centre of the clump. Such manual handling of impenetrable thicket is possible because of the umbrella type of canopy which makes it difficult to reach the centre of clump easily. Such physical maneuvers minimize or prevent regeneration from rooted cut branches when they fall on the ground.
- Lift the clump/s and place the clump/s upside down.
- If the clump is not placed upside down, the prostrate rooted branches and the aerial old branches having aerial roots at nodes may develop into adult plants when they come in contact with the soil. Therefore, the upside– down orientation of cut clumps is critical in the prevention of regeneration of *Lantana* from cut clumps. It may be noted that *Lantana* does not produce root suckers.
- After drying the clumps, the clumps may be used as fuel or burnt at the same site or all the dried clumps may be collected at one place and then burnt.

Continuous surveillance of the areas, where *Lantana* clumps have been removed and the areas beneath trees used for perching by birds from where the saplings are removed, is necessary consecutively for three growing seasons (monsoons) for the emergence of new saplings. Post removing the lantana clumps, broadcasting of seeds and plantation of native tree species has to be done immediately to avoid re-emergence of *Lantana*.

Weed-free landscapes in open areas can be easily restored to grassland communities by planting rooted ramets or clumps of native grass species or by broadcasting pellets containing seeds of grass species.

4. Planning for eco-restoration

Methodology followed to map the distribution of Invasive species:

Ground Survey and collection of Geo-Coordinates to map the distribution of Invasive and Native Species in the Ridge

↓

Further, Satellite imagery has to be acquired from platforms available. (may be downloaded from Glovis USGS of 10 metres resolution (Sentinel 2 Product) of the Delhi Ridge AOI.

↓

Next step is to process the spectral signatures of samples in ESRI ArcGIS and ERDAS Software to understand spectral signatures of different species under different spectral bands of the satellite imageries.

→

Samples classes of the native and invasive species has to be created for sample plotting (with the help of coordinates collected on ground and spectral signature reading)

→

With the help of image segmentation and pixel based random forest classifier process; supervised classification has to be carried out. (In supervised classification, pixels are classified using maximum likelihood algorithm.

↓

Post classification, the study area then has to be verified with high resolution base map data and ground truthing.

←

Digital elevation model may also be carried out for the watershed analysis of the ridge, for confirming species that grows along the perennial water sources, or even seasonal streams such as Dhak and Khajur.

Result of classification then gives the extent of the distribution of invasive species.

5. **Strengthening of nurseries and availability of adequate funding**
   - Since for eco-restoration of *Prosopis*, the requirement is for 2+2+4 climbers, shrubs and trees per Prosopis to be suppressed adequate arrangement should be in place in the nursery also taking into consideration the casualty replacement and gap filling requirement as well. For Lantana area restoration there also needs to be in place adequate grass banks (Seeds/seedlings) in the nursery.
   - Adequate funding should also be in place for planning, implementation and monitoring phases of the restoration process.

Muller et al. Malar J (2017) 16:237
DOI 10.1186/s12936-017-1878-9

Malaria Journal

RESEARCH

Open Access

The invasive shrub *Prosopis juliflora* enhances the malaria parasite transmission capacity of *Anopheles* mosquitoes: a habitat manipulation experiment

Gunter C. Muller[1,2*], Amy Junnila[1], Mohamad M. Traore[2], Sekou F. Traore[2], Seydou Doumbia[2], Fatoumata Sissoko[2], Seydou M. Dembele[2], Yosef Schlein[1], Kristopher L. Arheart[3], Edita E. Revay[4], Vasiliy D. Kravchenko[5], Arne Witt[6] and John C. Beier[3]

Abstract

Background: A neglected aspect of alien invasive plant species is their influence on mosquito vector ecology and malaria transmission. Invasive plants that are highly attractive to *Anopheles* mosquitoes provide them with sugar that is critical to their survival. The effect on *Anopheles* mosquito populations was examined through a habitat manipulation experiment that removed the flowering branches of highly attractive *Prosopis juliflora* from selected villages in Mali, West Africa.

Methods: Nine villages in the Bandiagara district of Mali were selected, six with flowering *Prosopis juliflora*, and three without. CDC-UV light traps were used to monitor their *Anopheles* spp. vector populations, and recorded their species composition, population size, age structure, and sugar feeding status. After 8 days, all of the flowering branches were removed from three villages and trap catches were analysed again.

Results: Villages where flowering branches of the invasive shrub *Prosopis juliflora* were removed experienced a threefold drop in the older more dangerous *Anopheles* females. Population density dropped by 69.4% and the species composition shifted from being a mix of three species of the *Anopheles gambiae* complex to one dominated by *Anopheles coluzzii*. The proportion of sugar fed females dropped from 73 to 15% and males from 77 to 10%.

Conclusions: This study demonstrates how an invasive plant shrub promotes the malaria parasite transmission capacity of African malaria vector mosquitoes. Proper management of invasive plants could potentially reduce mosquito populations and malaria transmission.

Keywords: Invasive plants, *Anopheles gambiae* complex, *Prosopis juliflora*, Mali

Background

Blood feeding of female mosquitoes is mainly utilized for egg development, but repeated meals also allow the transmission of various pathogens such as malaria parasites. Energy for all other life-sustaining activities of both females and males is provided by plant sugars, usually nectar from flowers [1, 2]. Considering the importance of sugar in mosquito biology, it is surprising that there is a dearth of information on where they obtain sugars in nature. Particularly obscure is the role invasive alien plants play in the survival and vectorial capacity of mosquitoes. Some invasive plants that are abundant and widespread on the African continent are attractive to *Anopheles* species and can be used as sources of sugar meals [3, 4]. Because they are more widespread and abundant, and actively grow and flower for longer

*Correspondence: guntercmuller@hotmail.com
[1] Department of Microbiology and Molecular Genetics, IMRIC, Kuvin Centre for the Study of Infectious and Tropical Diseases, Faculty of Medicine, Hebrew University, Jerusalem, Israel
Full list of author information is available at the end of the article

BioMed Central

© The Author(s) 2017. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated.

periods than related native species, invasive plants could significantly contribute to mosquito longevity, and thereby enhance malaria transmission potential [5]. Increased survival of the vector, even by a day or two, can greatly increase the number of mosquitoes that live to become infectious. This is because it is estimated that in high transmission areas, it takes at least 12 days for malaria parasites to undergo sporogonic development before migrating to the salivary glands of vector mosquitoes [6, 7], yet only about 10% of these same mosquitoes live 12 days [7].

Prosopis juliflora (Fabaceae; mesquite) is native to Central and South America [6] and was introduced to new environments across the world in the late 1970s to early 80s in an attempt to reverse deforestation and desertification [8, 9]. In its introduced range, *Prosopis juliflora* is utilized for construction materials, fuel wood, charcoal, and fodder [8]. However, it grows rapidly, produces copious amounts of seeds and is tolerant of a wide range of climatic regimes and soil types [10], which have contributed to making *Prosopis juliflora* one of the worst invasive alien plants in many parts of the world [9, 11]. This spiny shrub, or small tree, now occupies millions of hectares in Mali, Chad, Niger, Ethiopia, Sudan, Kenya, Tanzania and elsewhere, eroding the natural resource base on which millions of people depend, and in some instances, even driving conflict as people compete for access to grazing land and water [11, 12].

The objective of this study was to define the importance of an invasive plant as a resource for mosquito survival, and a contributing factor to continuing transmission of malaria, especially during dry periods when sugar sources from native plants are largely unavailable. In preparation for this trial, the local plant species most attractive to mosquitoes, that had been identified in a previous survey [13], were compared with the alien species *Prosopis juliflora*, *Acacia salicina* (Fabaceae; willow wattle) and *Eucalyptus cladocalyx* (Myrtaceae; sugar gum) and it was found that their high attraction amounted to indices of 24, 11 and 7, respectively (unpublished). In this study, in villages in Mali during the dry season, the following parameters were assessed: the role of flowering *Prosopis juliflora* on the density of mosquito populations, their species composition, their sugar feeding status and age structure. Nine villages in the Bandiagara District were selected, six with flowering *Prosopis juliflora*, and three without, and then vector populations were monitored (Fig. 1). Afterwards, the *Prosopis juliflora* flowering branches were removed from three of the six villages where the invasive shrub was actively growing, mosquito populations continued to be monitored. The hypothesis was that the villages with flowering *Prosopis juliflora* would harbor larger and older mosquito populations than the sugar-poor environment found in villages that are devoid of *Prosopis juliflora*. The rationale was that if the invasive plants are an important source of sugar during the dry season, then they would contribute to malaria vector survival effectively extending the transmission season.

Methods

Study sites

The study was conducted from mid-January to early February 2016 in nine villages along the Dogon plateau, in the Bandiagara District of central Mali. The study villages were located near the margins of the inland delta of the Niger River beginning about 650 km northeast of Bamako. Along the roads connecting the villages were clusters of three to five ponds for collecting rainwater, varying in size from 3000 to 10,000 m^2, that were created artificially to be used as a water supply for livestock and as rice paddies in the shallower areas. These ponds are surrounded by arid vegetation and larval surveys revealed high densities of *Anopheles gambiae* s.l. Villages were between 5 and 8 km from each other, and around 5 km away from any other area where mosquitoes breed in large numbers. The areas around the villages were dominated by grassland. The region is semi-arid with the rainy season between July and September with peak malaria transmission occurring in October [14]. Prevalence of *Plasmodium falciparum* infection ranges from 45% during the dry season, to more than 65% at the end of the rainy season [14].

Study design and mosquito trapping

The study was conducted over a total of 18 days. There were 8 days of pre-intervention monitoring from 10 to 18 January 2016, followed by the removal (cutting) of flowering branches in three selected villages (19–20 January). Post-intervention monitoring was from 1 to 8 February. The study was conducted during the dry season, when plants other than *Prosopis juliflora*, which may act as sugar sources for mosquitoes, were not flowering.

Monitoring of the mosquito populations was done using eight CDC-UV light traps per village (model 1212, John W. Hock, Gainesville, FL, USA), without bait, suspended from buildings, approximately 1.5–2.0 m above the ground. Traps were hung outdoors, at dusk, in fixed locations, and were spread randomly throughout villages, at least 20 m apart. Trap catches were collected 1 h after sunrise. Mosquitoes were either frozen, stored in 70% ethanol or processed right away.

Assessing population size and species composition

Anopheles gambiae s.l. mosquitoes caught in the CDC traps were counted to determine overall population size

in each village. Sub-samples of catches (n = 90) from each village were stored in 70% ethanol for morphological species identification [15]. A random subsample of 25 mosquitoes per village were identified by PCR [16].

Age grading of female mosquitoes

Pre- and post-intervention samples of 100 female mosquitoes from each village were analysed and the physiological age of random samples of female mosquitoes was determined by examination of ovaries, which were removed from the mosquito and dissected in a drop of PBS under a dissecting microscope, to expose and count the dilatations in ovarioles [17].

Sugar feeding status

Gut sugar content was determined by a modified cold anthrone test for fructose [18]. Crushed mosquitoes were examined after incubation and meal size was estimated subjectively based on the degree of blue–green colour [19].

Statistical analysis

A generalized linear mixed model was used for the population size and gender composition data. Separate analyses were conducted for counts of females and males. The data showed marked over-dispersion, therefore, a negative binomial regression model was used. The fixed effects were groups (groups of the three villages being monitored) and time (pre- and post-intervention) with an interaction of group and time. A random intercept was included with villages nested within groups as the error term. An unstructured covariance matrix was used to represent the correlated data structure. Planned comparisons were made between times within each group and among groups within each time.

A generalized linear model was used for the female age data: a logistic regression model was used. The fixed effects were groups (groups of villages being monitored) and time (pre- and post-intervention) with an interaction of group and time. Planned comparisons were made between times within each group and among groups within each time.

A generalized linear model was used for the sugar feeding data. Separate models were run for males and females. A logistic regression model was used. The fixed effects were groups (groups of villages being monitored) and time (pre- and post-intervention) with an interaction of group and time. Planned comparisons were made between times within each group and among groups within each time.

In addition, we used a generalized linear model for the species composition of populations. The fixed effects were groups (groups of villages being monitored), time (pre- and post-intervention), and species (*Anopheles arabiensis*, *Anopheles coluzzii*, and *An. gambiae*) with interactions of group and time, group and species, and time and species. Planned comparisons were made between times within each species, among species at each time, among species within each group, and among groups within each species. SAS 9.3 (SAS Institute, Inc.; Cary, NC) was used for all analyses. The 0.05 alpha level was used to determine statistical significance.

Results

Population size

In the three negative control villages, those without *Prosopis juliflora*, the average (±SE) catch per trap in the pre-intervention monitoring period was 3.58 ± 0.32 females and 0.56 ± 0.11 males, similar to what was found at the end of the study (3.31 ± 0.43 females and 0.70 ± 0.09 males).

In the three positive controls, that is villages with *Prosopis juliflora* where the inflorescences were not removed, the average (±SE) catch per trap was 6.52 ± 0.60 females and 3.10 ± 0.37 males at the initiation of the trial. Similar catches were recorded at the end of the trial (6.79 ± 0.58 females and 2.6 ± 0.23 males).

In the three experimental villages with *Prosopis juliflora*, where intervention occurred by removing the flowering branches, the initial average (±SE) catch was 11.00 ± 0.93 females and 6.00 ± 0.66 males, dropping to 4.5 ± 0.67 females and 0.7 ± 0.16 males, post-intervention (after the inflorescences had been removed).

Total trap catches for each three-village group were pooled, and the mean population sizes among each village group of females and males were compared (Fig. 2a, b). Villages without *Prosopis juliflora* had distinctly smaller mosquito populations than villages with *Prosopis juliflora*, and after removal of the flowering branches from *Prosopis juliflora* in the selected villages, the total population of female and male *Anopheles* spp. decreased significantly. The mean number of females decreased by 59.9% and the mean number of males decreased by 88.5% ($P < 0.05$).

Female age grading

In villages with no *Prosopis juliflora*, a low proportion of old females, 6.25% in the pre-intervention monitoring period, and 8% in the post-intervention monitoring period, had undergone three or more gonotrophic cycles (Fig. 3). In villages with *Prosopis juliflora*, where flowering branches were not removed, the proportion of older females was much higher (37% in the pre-intervention and 43% in the post-intervention monitoring period). Prior to the removal of inflorescences, a comparable 35% of females had undergone three or more gonotrophic

Fig. 1 *Prosopis juliflora* with inflorescences (*Left*). *Prosopis juliflora* in a village in the Bandigara District, Mali (*Right*)

cycles, dropping down to a statistically significant level of 11% after removal of flowering branches (Fig. 3; $P < 0.05$), which is similar to that found in villages (8%) with no *Prosopis juliflora*.

Sugar feeding status

Anthrone testing showed that villages with flowering *Prosopis juliflora* have a significantly higher proportion of sugar-fed female and male mosquitoes than villages without this invasive shrub. When the flowering branches are removed, the effect on the proportion of sugar positive mosquitoes is dramatic. In these villages, there was a fivefold decrease in the mean number of sugar positive females and a nearly eightfold decrease in sugar positive males (Fig. 4a, b). In villages where *Prosopis juliflora* flowers were removed, the initially large sugar meals were replaced by small ones.

Species composition

In villages without *Prosopis juliflora*, and those where *Prosopis juliflora* was present, but where the inflorescences were not removed, the relative abundance of various mosquito species remained stable during the pre- and post-intervention monitoring periods (Fig. 5). In contrast, there were obvious changes in the species composition in villages where branches with flowers were removed. Post-removal, the proportion of *An. coluzzii* in the diminished population increased by 50% and there was a marked drop of 27% in the relative number of *An. gambiae* s.s.

Discussion

Previous studies have demonstrated that mosquitoes in arid areas feed on rare floral nectar of local plant species [20–22], but here it is shown what happens to mosquito population dynamics when there is an abundant source of sugar. This is the situation that occurs in the presence of the inflorescences of the widespread invasive alien species, *Prosopis juliflora*. In this study, experimental habitat manipulation data from the field is presented that demonstrates the beneficial effect of *Prosopis juliflora* on vector mosquito populations. The wide distribution and density of these plants and how they affect malaria transmission in Mali is considered, particularly during the dry season when scarcity of other sugar sources in the local flora limits mosquito longevity. The presence or absence of *Prosopis juliflora* in villages has a significant influence on the size of the mosquito population in general, on their species composition, on the sugar feeding status and, the age structure of female populations.

Villages invaded by *Prosopis juliflora* have higher populations of *An. gambiae* s.l. than those where this plant is absent. Mean CDC trap catches of *An. gambiae* s.l. females in villages where flowering *Prosopis juliflora* was present was about twice as high as that in villages without flowering *Prosopis juliflora*. The effect was even more pronounced in males where the population was five to eight times higher in villages with *Prosopis juliflora* than in those without. When the flowering branches, evidently an abundant dry season sugar source, were removed from villages with *Prosopis juliflora*, the population of males and females dropped almost ninefold and more than twofold, respectively.

This is in agreement with a previous study [23], in southern Israel, that found that *Anopheles sergentii* in a sugar-poor oasis, i.e. in the absence of *Acacia tortilis* and *Acacia radianna* (Fabaceae) trees, had smaller population sizes (37,494) than in those where this native plant species was abundant (85,595). This is further supported by studies which have indicated that a lack of sugar results in reduced male *An. gambiae* survival and mating capability contributing to lower insemination rates in females [28] which may contribute to reduced population levels. This study also found that *An. sergentii* had lower survival

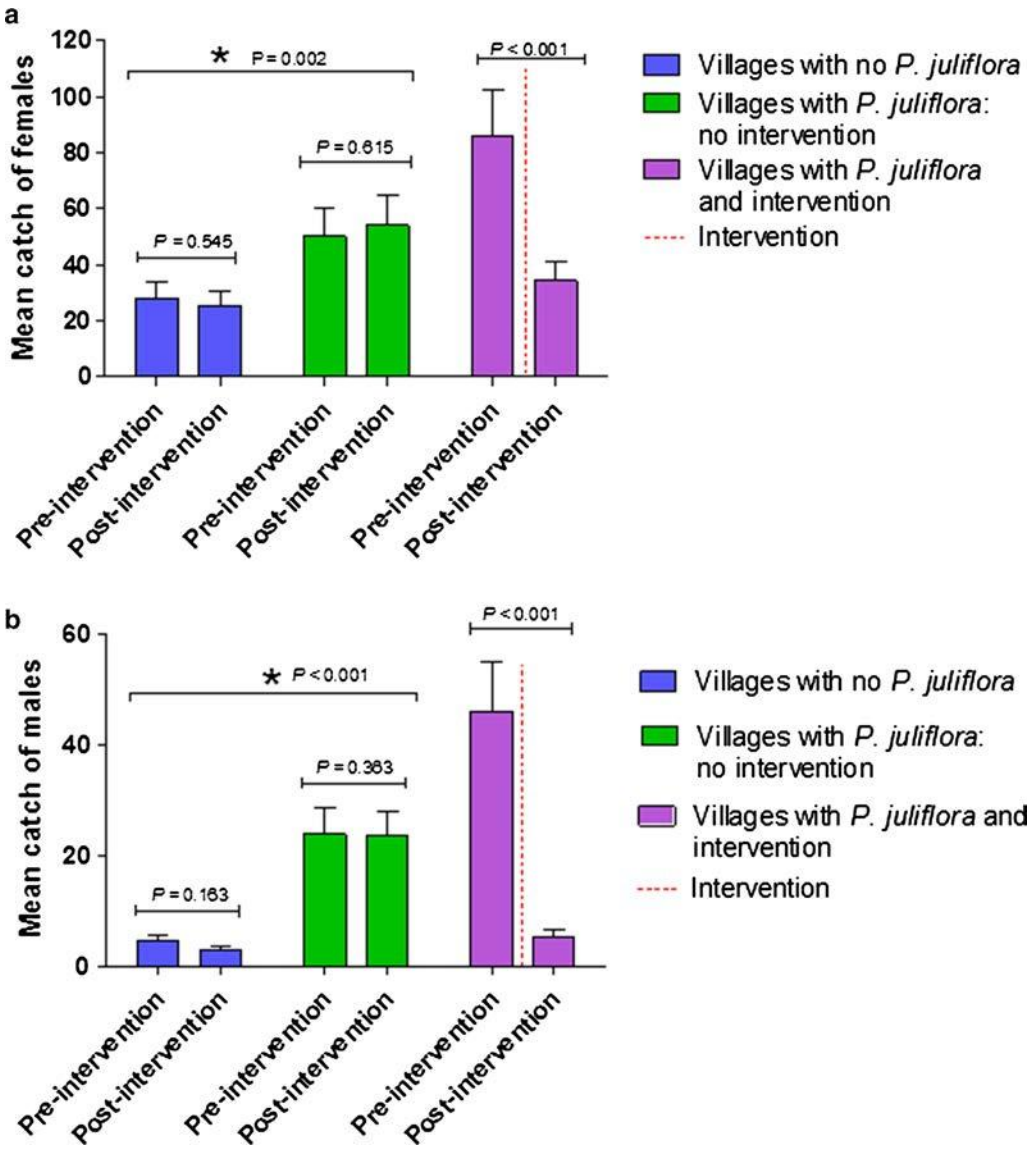


Fig. 2 Mean catches of female (**a**) and male (**b**) mosquitoes in the pre- and post-intervention monitoring periods. *Asterisk* represents significant differences between village groups

rates (0.72 vs. 0.93), and prolonged gonotrophic cycles (3.33 vs. 2.36 days). Most telling was the fact that vectorial capacity was more than 250-fold higher in sugar-rich oasis than that in sugar-poor sites.

Older female mosquitoes that feed often on human hosts have an increased vectorial potential. The female *Anopheles* in villages with *Prosopis juliflora* were older since many of them had passed three or more gonotrophic cycles and they were thus more effective dangerous vectors. Villages with the invasive plant contained around six times more of these older females than those without and there was a threefold decrease in the proportion of this group as soon as the flowering branches were removed.

In the current study, there was a marked difference in the proportion of sugar positive male and female mosquitoes depending on whether *Prosopis juliflora* was present or absent. Previous studies found that *An. gambiae* s.s. females lived longer when sugar-fed [24, 25] with survivorship greatly enhanced with access to sugar-rich plant species. It is, therefore, not surprising that the presence or absence of a rich sugar source like *Prosopis juliflora* had a significant effect on mosquito populations with four to six times more females, and up to eight times more males, than in villages without this invasive shrub.

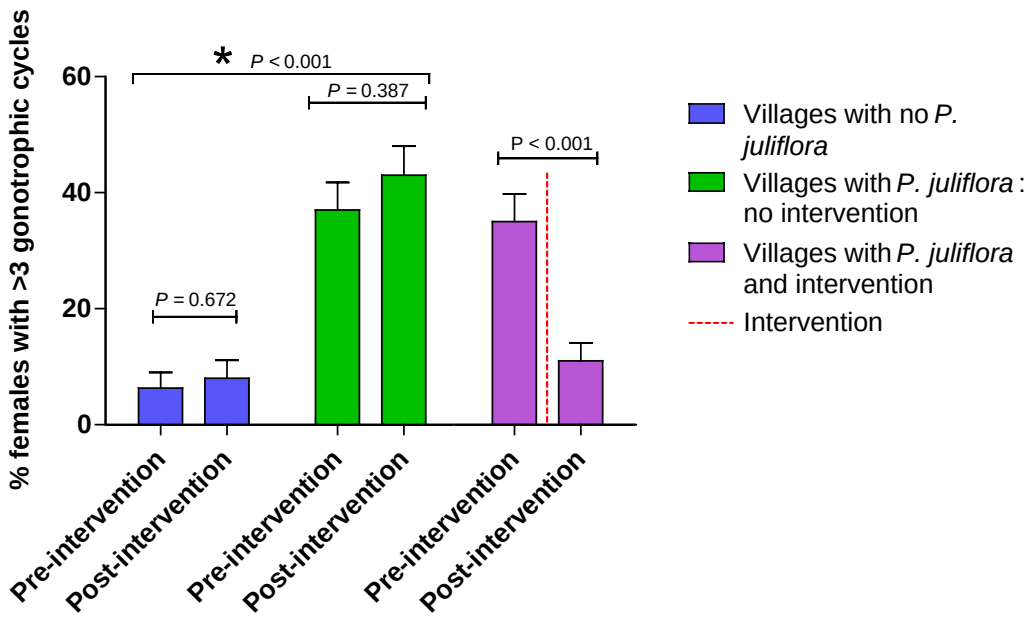


Fig. 3 Age structure of *Anopheles* spp. female populations in villages with and without *Prosopis juliflora* in the pre- and post-intervention monitoring periods. *Asterisk* represents significant differences between village groups

Conclusive evidence for the role of *Prosopis juliflora* is that the removal of inflorescences resulted in a drastic eight- and fivefold decrease in sugar-fed males and females respectively.

Species composition, while remaining consistent during the pre- and post-intervention monitoring in villages where there were no interventions, changed markedly in villages where flowering branches were removed. In the latter villages, the number of *An. coluzzii*, roughly doubled while the number of *An. gambiae* s.s. fell by nearly a third. In fact, the relative proportions of mosquito species after removal of *Prosopis juliflora* blossoms came to more closely resemble that in villages where this plant was wholly absent. It, therefore, shows that the removal of flowering branches removed the major sugar source of *An. gambiae* s.s. making way for a higher proportion of *An. coluzzii*. The malaria vector *An. gambiae* s.s. seems to be highly dependent on the blossoms of *Prosopis juliflora,* whereas *An. coluzzii* is more adapted to arid habitats [26] and can thrive even in the absence of the inflorescences.

Current strategies for malaria vector control used in most African countries are not sufficient to achieve successful malaria control [27]. Vector control in Africa needs to be improved because even very low levels of malaria parasite transmission confound efforts to reduce malaria prevalence [28].

This study helps understanding of how aspects of mosquito biology, other than blood feeding, influence the vectorial capacity of mosquitoes. Control of invasive plants could be a new way to change inherently high transmission areas to low transmission areas, making elimination by combinations of vector control methods more feasible. If biocontrol or community efforts to manage invasive plants are developed and implemented, they can provide an environmentally reasonable sustainable strategy in reducing the incidence of malaria. Improved management of invasive plants will also provide a host of other benefits, including increased incomes for local communities.

Supporting malaria vectors with a source of energy in the form of sugar is not the only disadvantage of the spread of *Prosopis juliflora.* These plants, among others, encroach on paths, homes and other structures in villages, invade crop- and pasturelands and their thorns are known to cause injuries [9, 29]. *Prosopis juliflora* invasions have also contributed to the abandonment of agricultural land, and in some cases also of homes and small villages [9, 29]. These negative impacts, and the results of our study, clearly demonstrate that the control of *Prosopis juliflora* may not only reduce the incidence of malaria but may benefit a range of other sectors, and in so doing, will contribute to a better quality of life for

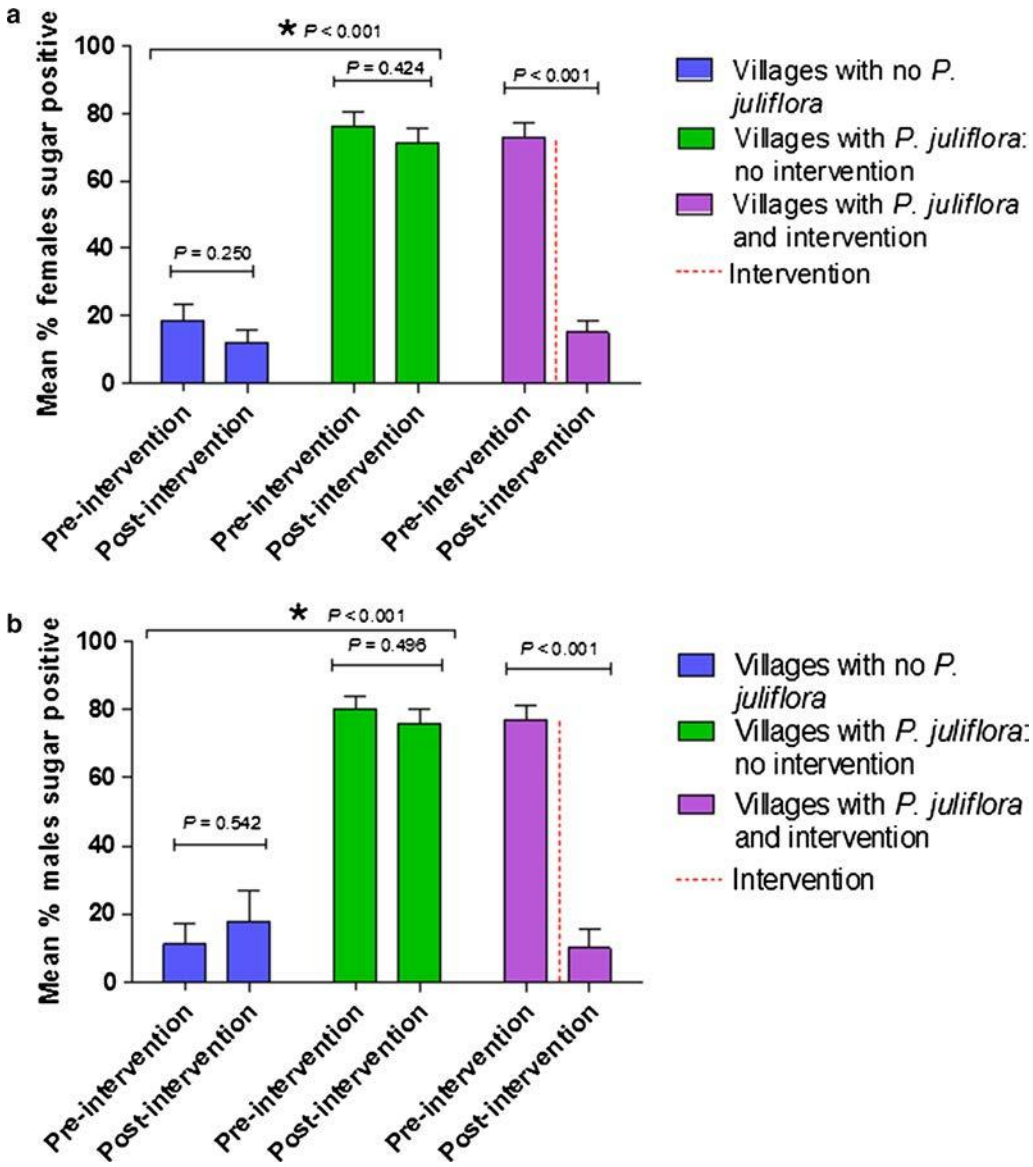


Fig. 4 Sugar feeding status of **a** female and **b** male *Anopheles gambiae* in villages with and without *Prosopis juliflora* in the pre- and post-intervention monitoring periods. *Asterisk* represents significant differences between village groups

many communities in large parts of Africa. The introduction of host specific and damaging biological control agents, such as *Evippe* sp., may be a cost-effective and safe way of reducing the impact of invasive *Prosopis* species in Africa and elsewhere [30].

Conclusions

Future studies might concentrate on many invasive plant species that are problematic in Africa and can be attractive to vector populations. It may be worthwhile to abstain from the introduction of exotic plants that have

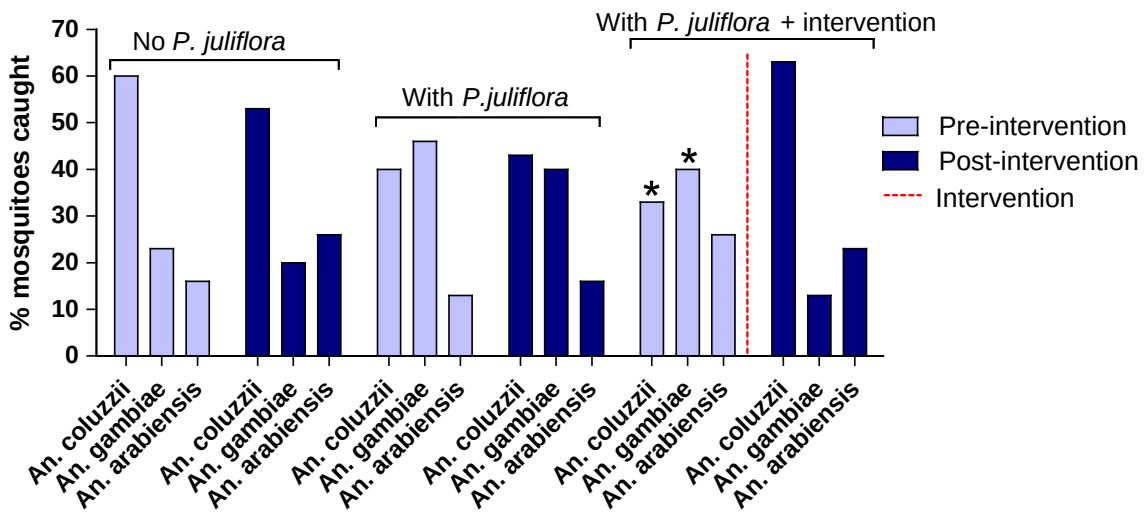


Fig. 5 Species composition in villages with and without *Prosopis juliflora* in the pre- and post-intervention monitoring periods. *Red dashed line* indicates inflorescence removal (intervention). *Asterisks* represent significant differences between pre- and post-intervention population density; $P = 0.041$ for the difference in *Anopheles coluzzii* population density and $P = 0.045$ for the *Anopheles gambiae* s.s. population

the potential to become invasive, not only because of their potential negative impacts on the environment and livelihoods, but because some of them may have negative significant consequences for public health and specifically for malaria.

Authors' contributions

GCM, YS and JCB conceived and designed the study. GCM, MMT, SFT, SD, VDK, and EER supervised and carried out the field work. SMD and FS consulted on plants and sugar feeding. AW consulted on invasive plants and assisted in drafting the manuscript. AJ drafted the manuscript. KLA carried out statistical analysis. All authors contributed to the interpretation of the data. All authors read and approved the final manuscript.

Author details

[1] Department of Microbiology and Molecular Genetics, IMRIC, Kuvin Centre for the Study of Infectious and Tropical Diseases, Faculty of Medicine, Hebrew University, Jerusalem, Israel. [2] Malaria Research and Training Center, Faculty of Medicine, Pharmacy and Odonto-Stomatology, University of Bamako, Bamako BP 1805, Mali. [3] Department of Public Health Sciences, Miller School of Medicine, University of Miami, Miami, FL, USA. [4] Department of Anatomy and Cell Biology, Bruce Rappaport Faculty of Medicine, Technion, 34995 Haifa, Israel. [5] Department of Zoology, Tel Aviv University, Tel Aviv, Israel. [6] CABI Africa, Box 633-00621, Nairobi, Kenya.

Acknowledgements

We wish to thank the participating communities of the Bandiagara District in Mali. This study was supported by the National Institute of Allergy And Infectious Diseases of the National Institutes of Health under Award Number R01AI100968. The content is solely the responsibility of the authors, and does not necessarily represent the official views of the National Institutes of Health.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was supported by the National Institute of Allergy and Infectious Diseases of the National Institutes of Health under Award Number R01AI100968.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Received: 9 March 2017 Accepted: 26 May 2017
Published online: 05 July 2017

References

1. Yuval B. The other habit: sugar feeding by mosquitoes. Bull Soc Vector Ecol. 1992;17:150–6.
2. Foster WA. Mosquito sugar feeding and reproductive energetics. Annu Rev Entomol. 1995;40:443–74.
3. Nyasembe VO, Cheseto X, Kaplan F, Foster WA, Teal PEA, Tumlinson JH, et al. The invasive American weed *Parthenium hysterophorus* can negatively impact malaria control in Africa. PLoS ONE. 2015;10:e0137836.
4. Manda H, Gouagna LC, Foster WA, Jackson RR, Beier JC, Githure JI, et al. Effect of discriminative plant-sugar feeding on the survival and fecundity of *Anopheles gambiae*. Malar J. 2007;6:113.
5. Roberts PD, Diaz-Soltero H, Hemming DJ, Parr J, Wakefield NH, Wright HJ, et al. What is the evidence that invasive species are a significant contributor to the decline or loss of threatened species? A systematic review map. Environ Evid. 2013;2:5.
6. Charlwood JD, Smith T, Billingsley PF, Takken W, Lyimo EOK, Meuwissen JHET. Survival and infection probabilities of anthropophagic anophelines from an area of high prevalence of *Plasmodium falciparum* in humans. Bull Entomol Res. 1997;87:445–53.
7. Killeen GF, McKenzie FE, Foy BD, Schieffelin C, Billingsley PF, Beier JC. A simplified model for predicting malaria entomologic inoculation rates based on entomologic and parasitologic parameters relevant to control. Am J Trop Med Hyg. 2000;62:535–44.
8. Pasiecznik NM, Felker P, Harris PJC, Harsh LN, Cruz G, Tewari JC, et al. The *Prosopis juliflora–Prosopis pallida* complex: a monograph. Coventry: Henry Doubleday Research Association; 2001.
9. Mwangi E, Swallow B. *Prosopis juliflora* invasion and rural livelihoods in the Lake Baringo area of Kenya. Conservat Soc. 2008;6:130–40.
10. Felker P. Mesquite: an all-purpose leguminous arid land tree. In: Ritchie GA, editor. New Agricultural Crops, American Association for the

Advancement of Science Symposium Proceedings, vol. 38. Boulder: Westview Press; 1979. p. 89–132.
11. Pasiecznik N. Prosopis—pest or providence, weed or wonder tree? Eur Trop For Res Netw Newslett. 1999;28:12–4.
12. Witt A. Impacts of invasive plants and their sustainable management in agro-ecosystems in Africa: a review. 2010; CABI Africa. https://www.academia.edu/23852668/Impacts_of_Invasive_Plants_and_Their_Sustainable_Management_in_Agro-Ecosystems_in_Africa_A_Review. Accessed 8 Mar 2017.
13. Müller GC, Beier JC, Traore SF, Toure MB, Traore MM, Bah S, et al. Field experiments of *Anopheles gambiae* attraction to local fruits/seedpods and flowering plants in Mali to optimize strategies for malaria vector control in Africa using attractive toxic sugar bait methods. Malar J. 2010;9:262.
14. Dicko A, Mantel C, Kouriba B, Sagara I, Thera MA, Doumbia S, et al. Season, fever prevalence and pyrogenic threshold for malaria disease definition in an endemic area of Mali. Trop Med Int Health. 2005;10:550–6.
15. Gillies MT, DeMeillon B. The Anophelinae of Africa South of the Sahara (Ethiopian Zoogeographical Region), 1968. In: Publications of the South African Institute for Medical Research. Vol. 54. Johannesburg: Hortors Printers; 1968. p. 1–343.
16. Scott JA, Brogdon WG, Collins FH. Identification of single specimens of the *Anopheles gambiae* complex by the polymerase chain reaction. Am J Trop Med Hyg. 1993;49:520–9.
17. Detinova TS. Age grouping methods in Diptera of medical importance. Geneva: World Health Organization Monograph Series; 1962. p. 47.
18. Schlein Y, Jacobson RL. Mortality of *Leishmania major* in *Phlebotomus papatasi* caused by plant feeding of the sand flies. Am J Trop Med Hyg. 1994;50:20–7.
19. Schlein Y, Jacobson RL. Sugar meals and longevity of the *sandfly Phlebotomus papatasi* in an arid focus of *Leishmania major* in the Jordan Valley. Med Vet Entomol. 1999;13:65–71.
20. Müller G, Schlein Y. Plant tissues: the frugal diet of mosquitoes in adverse conditions. Med Vet Entomol. 2005;19:413–22.
21. Müller G, Schlein Y. Sugar questing mosquitoes in arid areas gather on scarce blossoms that can be used for control. Int J Parasitol. 2006;36:1077–80.
22. Junnila A, Müller GC, Schlein Y. Species identification of plant tissues from the gut of *An. sergentii* by DNA analysis. Acta Trop. 2010;3:227–33.
23. Gu W, Müller G, Schlein Y, Novak RJ, Beier JC. Natural plant sugar sources of Anopheles mosquitoes strongly impact malaria transmission potential. PLoS ONE. 2011;6:e15996.
24. Gary RE, Foster WA. Effects of available sugar on the reproductive fitness and vectorial capacity of the malaria vector *Anopheles gambiae* (Diptera: Culicidae). J Med Entomol. 2001;38:22–8.
25. Stone CM, Taylor RM, Roitberg BD, Foster WA. Sugar deprivation reduces insemination of *Anopheles gambiae* (Diptera: Culicidae), despite daily recruitment of adults, and predicts decline in model populations. J Med Entomol. 2009;46:1327–37.
26. Fossog BT, Ayala D, Acevedo P, Kengne P, Mebuy INA, Makanga B, et al. Habitat segregation and ecological character displacement in cryptic African malaria mosquitoes. Evol Appl. 2015;8:326–45.
27. Beier JC, Keating J, Githure JI, Macdonald MB, Impoinvil DE, Novak RJ. Integrated vector management for malaria control. Malar J. 2008;7:54.
28. Beier JC, Killeen GF, Githure J. Short report: entomological inoculation rates and *Plasmodium falciparum* malaria prevalence in Africa. Am J Trop Med Hyg. 1999;61:109–13.
29. Maundu P, Kibet S, Morimoto Y, Imbumi M, Adekar R. Impact of *Prosopis juliflora* on Kenya's semi-arid and arid ecosystems and local livelihoods. Biodiversity. 2009;10:33–50.
30. van Klinken R. *Prosopis* spp.—mesquite. In: Julien M, McFadyen R, Cullen J, editors. Biological control of weeds in Australia. Melbourne: CSIRO; 2012. p. 477–85.

Chemical Research in Toxicology

Article

pubs.acs.org/crt

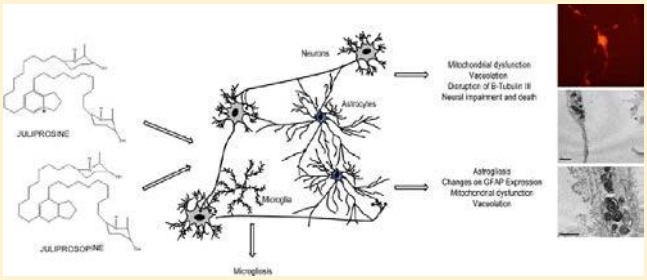
Juliprosopine and Juliprosine from *Prosopis juliflora* Leaves Induce Mitochondrial Damage and Cytoplasmic Vacuolation on Cocultured Glial Cells and Neurons

Victor Diogenes A. Silva,[†] Bruno P. S. Pitanga,[†] Ravena P. Nascimento,[†] Cleide S. Souza,[†] Paulo Lucas C. Coelho,[†] Noélio Menezes-Filho,[†] André Mário M. Silva,[†] Maria de Fátima D. Costa,[†] Ramon S. El-Bachá,[†] Eudes S. Velozo,[‡] and Silvia L. Costa*,[†]

[†]Laboratório de Neuroquímica e Biologia Celular, Instituto de Ciências da Saúde, Universidade Federal da Bahia, Salvador, Brazil

[‡]Laboratório de Pesquisa em Matéria Médica, Faculdade de Farmácia, Universidade Federal da Bahia, Salvador, Brazil

ABSTRACT: *Prosopis juliflora* is a shrub largely used for animal and human consumption. However, ingestion has been shown to induce intoxication in animals, which is characterized by neuromuscular alterations induced by mechanisms that are not yet well understood. In this study, we investigated the cytotoxicity of a total alkaloid extract (TAE) and one alkaloid fraction (F32) obtained from *P. juliflora* leaves to rat cortical neurons and glial cells. Nuclear magnetic resonance characterization of F32 showed that this fraction is composed of a mixture of two piperidine alkaloids, juliprosopine (majority constituent) and juliprosine. TAE and F32 at concentrations between 0.3 and 45 μg/mL were tested for 24 h on neuron/glial cell primary cocultures. The 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide test revealed that TAE and F32 were cytotoxic to cocultures, and their IC_{50} values were 31.07 and 7.362 μg/mL, respectively. Exposure to a subtoxic concentration of TAE or F32 (0.3−3 μg/mL) induced vacuolation and disruption of the astrocyte monolayer and neurite network, ultrastructural changes, characterized by formation of double-membrane vacuoles, and mitochondrial damage, associated with changes in β-tubulin III and glial fibrillary acidic protein expression. Microglial proliferation was also observed in cultures exposed to TAE or F32, with increasing levels of OX-42-positive cells. Considering that F32 was more cytotoxic than TAE and that F32 reproduced *in vitro* the main morphologic and ultrastructural changes of "cara torta" disease, we can also suggest that piperidine alkaloids juliprosopine and juliprosine are primarily responsible for the neurotoxic damage observed in animals after they have consumed the plant.



INTRODUCTION

Prosopis juliflora Sw. D.C. (mesquite) is a shrub that was introduced to northeast Brazil in the 1940s.[1] Northeast Brazil has an area characterized as the Drought Polygon. This is due to poorly distributed rains during the year and an average annual rainfall of just 500 mm, which has led to a vegetation type known as *Caatinga* characterized by low productivity and low species diversity, compared to that found in the rainforest. *P. juliflora* is a very resilient plant, can grow in the adverse conditions of *Caatinga*, and constitutes the main alternative food source for humans and animals in this region, because of its high rate of production of pods and high palatability and nutritional value.[2−4] Because of their palatability and nutritional value, the pods of *P. juliflora* or its bran is typically used for feeding dairy and beef cattle.[5]

However, *P. juliflora* causes disease when it is the sole or main source of sustenance for the animal.[6,7] The illness induced is called "cara torta", characterized in cattle and calves by emaciation, neuromuscular alterations (including muscular atrophy of the masseters), and histological lesions such as spongiosis, gliosis, the loss of Nissl substance, and fine vacuolation of the perikaryons of neurons from trigeminal motor nuclei.[8,9] Neuromuscular alterations were observed in experimentally intoxicated goats and cattle fed with rations containing high concentrations of *P. juliflora* pods (>50%), especially after chronic exposure (>200 days). These alterations were also recently observed in cattle reared in an extensive system with free access to forage and *P. juliflora*.[10] Histological lesions were also characterized by fine vacuolation of the perikaryons of neurons, reactive astrocytes with vesicular dilated nuclei, and scant eosinophilic cytoplasm from trigeminal motor nuclei. Occasionally, damage to neurons of the oculomotor nuclei and Wallerian degeneration in mandibular and trigeminal nerves were observed.[9,11]

In vitro studies have shown that alkaloids from *P. juliflora* pods and leaves have a direct action in central nervous system cells, causing toxic and inflammatory effects and suggesting that some alkaloids or one alkaloidal fraction (F32) is the most effective in inducing cytotoxicity and reactivity in glial cells.[12,13] However, little is known about which alkaloids are present in this

Received: April 25, 2013
Published: August 7, 2013

 © 2013 American Chemical Society

toxic fraction, and it is unknown whether these alkaloids have potential to induce mitochondrial disorders or vacuole formation on neuronal perikaryon that are the main neurohistologic and ultrastructural lesions visualized in intoxicated animals.[9−11]

Neuronal vacuolization is not a specific finding of intoxication by *P. juliflora* and occurs in other diseases caused by eating herbivores plants of the genera *Solanum*,[14−17] *Swainsona*, *Oxytropis*, *Astragalus*,[18] and *Ipomoea*.[19] During intoxication with many of these plants, for example, *Solanum fastigiatum*, cytoplasm vacuoles are a result of the accumulation of nonmetabolized substrates in lysosomes, which results in lysosomal storage disease (DSL). Others such as *P. juliflora* still have not had their structures characterized, which are important for understanding the mechanism of action of toxic compounds of this plant.

This study complements the previous *in vitro* studies that suggest the alkaloids are the toxic agents of animal intoxication by *P. juliflora*. We characterized the alkaloids present in the most active fraction (F32) from *P. juliflora* leaves and induced and characterized *in vitro* the main morphologic and ultrastructural changes of "cara torta" disease using an extract and the F32 fraction in models of neuron/glial cell primary cocultures.

■ MATERIALS AND METHODS

Extraction and Characterization of Alkaloids. Leaves of *P. juliflora* were harvested in Salvador (BA) in the experimental fields of the Federal University of Bahia (UFBA). The alkaloid extract (TAE) was obtained by an acid/basic modified extraction, as described by Ott-Longoni and co-workers,[20] with minor modifications.[13] *P. juliflora* leaves were dried in a greenhouse at 50 °C, and the air-dried plant material (874 g) was extracted three times with hexane (2.0 L/kg) for 48 h at room temperature with occasional shaking to eliminate nonpolar components. The extract was then filtered, and the residue was flooded with methanol (1.5 L/kg) using the process described above. The methanol extract was concentrated in a rotary evaporation system at 40 °C, and this concentrated residue was stirred with 0.2 N HCl for 16 h, followed by filtration. The solution was shaken with chloroform to remove the nonbasic material. The aqueous layer was basified with ammonium hydroxide until it reached pH 11 and was then extracted with chloroform. The chloroform phase was evaporated, leading to the production of 4.4 g of TAE. This extract was fractionated by chromatography in a silica gel column using a chloroform/methanol mixture (99:1 to 1:1) as the solvent system, with a subsequent 100% methanol elution. Thirty-six fractions were obtained from the TAE, and after thin-layer silica gel chromatography, they were developed with iodine and tested for the presence of alkaloids using Dragendorf's test.[21] More details about the TAE and fractions may be found in our previous publication.[13] Considering that in our previous experiments F32 was the fraction most toxic to glial cells in this study, we investigated the cytotoxic effect of TAE and F32 in neurons and glial cells.[13] F32 corresponded to 51 mg, an equivalent of 1.16% from TAE and 0.0058% from the leaves, and it was characterized by nuclear magnetic resonance of ^{1}H (500 MHz, CD_3OD) and ^{13}C NMR (125 MHz, CD_3OD).

Treatments. For treatments, TAE and F32 were dissolved in dimethyl sulfoxide (DMSO) (Sigma, St. Louis, MO), forming 30 mg/mL stock solutions, and stored at −20 °C. Cells were treated with concentrations ranging from 0.3 to 45 μg/mL for 24 h. The negative control group was treated with DMSO diluted in the culture medium at the higher equivalent volume used in the treated groups (0.1%) and showed no significant effect on the analyzed parameters compared to those of cells that did not receive diluents.

Cell Cultures. Cell cultures were prepared from cerebral hemispheres from Wistar rats, obtained from the Department of Physiology of the Health Sciences Institute of the Federal University of Bahia, and performed according to the local Ethical Committee for Animal Experimentation.

Neuronal Primary Cultures. Cerebral hemispheres of 15−18-day-old Wistar rat embryos were isolated aseptically, and the meninges were removed. Each cortex was dissected out and then gently forced through a sterile 75 μm Nitex mesh. Cells were suspended in DMEM HAM F12 medium (Cultilab, SP, Brazil), supplemented with 100 IU/mL penicillin G, 100 μg/mL streptomycin, 2 mM L-glutamine, 0.011 g/L pyruvate, 10% fetal calf serum (FCS), 3.6 g/L Hepes, and 33 mM glucose (Cultilab), plated at a density of 1000 cells/mm^2, and then incubated in a humidified atmosphere of 5% CO_2 at 37 °C for 8 days.

Glial Cell Primary Cultures and Neuron/Glial Cell Primary Cocultures. Glial cell primary cultures were prepared according to the method of Cookson and Pentreath.[22] Briefly, cerebral hemispheres from 1-day-old postnatal Wistar rat pups were isolated aseptically, and the meninges were removed. The cortex was dissected out and then gently forced through a sterile 75 μm Nitex mesh. Cells were suspended in DMEM HAM F12 medium (Cultilab), supplemented with 100 IU/mL penicillin G, 100 μg/mL streptomycin, 2 mM L-glutamine, 0.011 g/L pyruvate, 10% FCS, 3.6 g/L Hepes, and 33 mM glucose (Cultilab), and cultured in 10 cm diameter dishes in a humidified atmosphere of 5% CO_2 at 37 °C. The culture medium was changed every 2 days, and cells were cultured for 15 days. Cells were then trypsinized (Trypsin EDTA) and plated at a density of 1000 cells/mm^2 to glial cell culture or 670 cells/mm^2 to neuron/glial cell primary cocultures and maintained for 48 h for culture stabilization before treatment or neuron/glial cell cocultures. To make the neuron/glial cell cocultures, neurons obtained from cerebral hemispheres of 15−18-day-old Wistar rat embryos using the same method described above were suspended in supplemented DMEM HAM F12 medium and seeded at half the amount of glial cells (335 cells/mm^2) onto the astroglial monolayer. Cells were incubated in a humidified atmosphere of 5% CO_2 at 37 °C for 8 days, when treatments were performed.

Cell Viability. *Concentration−Effect.* Concentration−effect curves were determined by the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) (Sigma) test. The experiment was performed on 96-well plates (TPP Switzerland) with neuron/glial cell cocultures. The cells were incubated with 1.5−45 μg/mL TAE or F32 or 0.1% DMSO (control) for 24 h. The cell viability was quantified using the conversion of yellow MTT by mitochondrial dehydrogenases of living cells to purple MTT formazan as an index.[23] Control and treated cells were incubated with MTT at a final concentration of 1 mg/mL for 2 h. Thereafter, cells were lysed with 20% (w/v) sodium dodecyl sulfate (SDS) and 50% (v/v) dimethylformamide (DMF) (pH 4.7). Plates were incubated overnight at 37 °C to dissolve formazan crystals. The optical density of each sample was measured at 492 nm using a spectrophotometer (Thermo Plate-Reader). Three independent experiments were conducted with eight replicate wells for each analysis. Results from the MTT test were expressed as percentages of the viability of the treated groups compared to the control groups. A nonlinear regression was performed, using GraphPad Prism version 3.0, to fit concentration−effect curves and to calculate the IC_{50} values of TAE and F32, which were effective concentrations that killed 50% of the cells.

Induction of Membrane Damage. The membrane integrity was evaluated by Trypan blue staining. The experiment was performed on 4 cm diameter dishes (TPP Switzerland) with neuron/glial cell cocultures exposed for 24 h to 30 μg/mL TAE or 7.5 μg/mL F32. After this exposure, the medium was exchanged for one with 0.2% Trypan blue and incubated for 10 min in a humidified atmosphere of 5% CO_2 at 37 °C. The number of cells not stained was analyzed in an optic phase microscope (Nikon TS-100). Cells were quantified in three fields, and the results are expressed as a percentage according to the total amount of cells in the field.

Determination of Morphological Changes. *Rosenfeld's Staining.* Morphological changes and vacuolization were primarily assessed by analysis of Rosenfeld's staining. The experiment was performed on 4 cm diameter dishes (TPP Switzerland). The cells were rinsed three times with PBS (without Ca^{2+} and Mg^{2+}) and fixed for 10 min with methanol at −20 °C. Fixed cells were stained. Rosenfeld's reagent (1 mL) was added and the mixture incubated for 20 min at room temperature. Thereafter, the plates were rinsed with water, air-dried, analyzed in an optic microscope (Olympus BX70), and photographed using a digital camera (CE Roper Scientific). Vacuolation was quantified

Table 1. ^{1}H (500 MHz, CD_3OD) and ^{13}C (125 MHz, CD_3OD) NMR Spectra and DEPT 135 from F32 Obtained from the Methanol Extract of *P. juliflora* Leaves

H/C	δ ^{1}H(a)	δ ^{13}C(a)	δ ^{1}H(lit)	δ ^{13}C(1)	δ ^{1}H(b)	δ ^{13}C(b)	δ ^{1}H(1)	δ ^{13}C(1)
2, 2′	3.25	57.6	3.19 dq	51.5	3.11 m	54.2	3.13 q (7.8)	50.5
3, 3′	3.84	65.9	3.75 ddd (4.8)	68.4	3.84	65.9	3.66 br s	68.9
4, 4′	1.82−1.80	27.2	1.70 m, 1.59 m	26.7	1.76−1.67	27.3	1.72 m, 1.62 m	27.9
5, 5′		25.5	1.82 m, 1.21 m	28.2	1.59−1.54	24.9	1.49 m, 1.22 m	26.9
6, 6′	2.80 m	47.7	2.80 m	49.0	3.00 m	47.9	2.85 m	50.1
7, 7′	1.45−1.42	14.5	1.14 d(7)	11.9	1.29	14.5	1.12 d (6.5)	15.3
1″, 1‴	1.33 m	29.0	1.37 m	29.3	1.33 m	28.8	1.40 m	28.3
2″, 2‴	1.73−1.76	29.6, 29.2	1.35−1.27 m	30.7, 29.8	1.34−1.33	29.0	1.39−1.27 m	27.0
3″, 8″	1.73−1.76	29.3, 29.1	1.35−1.27 m	29.4, 29.2	1.34−1.33	31.9, 31.7	1.39−1.27 m	30.5, 30.1
3‴, 8‴	1.73−1.76	28.9, 28.9	1.35−1.27 m	29.1, 29.0	1.34−1.33	30.3, 30.2	1.39−1.27 m	30.0, 29.8
9″, 9‴	1.73−1.76	27.2	1.35−1.27 m	26.3	1.71 m	29.0, 29.1	1.43 m	29.8, 29.7
10″	2.80 m	33.8	2.80 m	32.1	2.4 m	33.3	2.00 t (7.5)	35.4
10‴	2.80 m	31.4	2.80 m	31.7	1.76−1.67	29.5	1.39−1.27 m	29.8
1⁗	2.80 m	34.5	2.80 m	31.6	1.56 m	33.8	1.52 m	33.4
2⁗	2.51 m	20.0	2.50 m	20.9	2.44 m	22.2	2.05 m, 1.80 m	21.8
3⁗	nd[a]	52.8	4.88 m	59.4	3.10−2.40	52.7	3.13 dd (18, 7.8) 2.10 dd (18, 9)	54.7
5⁗	8.62 s	138.9	8.64 s	137.3	3.10	59.1	3.29 d (15)	55.5
6⁗	–	140.8	–	139.1	2.50	134.0	2.64 d (15)	136.1
7⁗	8.16 s	145.9	8.18 s	144.3	5.59 (s)	125.7	5.37 s	123.8
8⁗	–	143.0	–	141.3	1.71 m	52.8	2.00 m	42.8
8a⁗	–	nd[a]	–	155.0	1.80 m	66.1	1.82 m	65.8

[a]Not detected under MeOH water.

in 10 fields. Astrocytes with more than 10 vacuoles in the cytoplasm were considered to be vacuole-possessing astrocytes.[24]

Immunocytochemistry. Morphological changes in astrocytes and neurons were also studied by immunocytochemistry for cytoskeletal proteins glial fibrillary acidic protein (GFAP) and β-III-tubulin, respectively. All control and treated cocultures were seeded on 4 cm diameter dishes (TPP Switzerland) as neuron/glial cell cocultures. The cells were rinsed three times with PBS and fixed with cold methanol at −20 °C for 10 min. Nonspecific binding of antibody reagents was blocked by preincubating the plates with 3% bovine serum albumin (BSA) in PBS. Cells were incubated with the mouse monoclonal anti-β-tubulin antibody conjugated with Cy3 (1:500 in PBS, Sigma). For GFAP immunocytochemistry, fixed cells were incubated with rabbit polyclonal anti-GFAP (1:100 in PBS, DAKO) overnight and then with the tetramethylrhodamine isothiocyanate-conjugated goat anti-rabbit IgG antibody (1:250 in PBS, Sigma) for 30 min at room temperature. Nuclear chromatin of fixed cells was stained with the fluorescent dye DAPI, at a final concentration of 5 μg/mL in PBS, for 10 min at room temperature in a dark chamber. Thereafter, cells were analyzed by fluorescence microscopy (Olympus BX70) and photographed using a digital camera (CE Roper Scientific).

To identify amoeboid activated microglia, immunocytochemistry for OX-42 (CD11B) was performed before Rosenfeld's staining. First, the endogenous peroxidase activity was blocked for 10 min with 3% hydrogen peroxide. The coculture was incubated for 1 h with the mouse monoclonal anti-OX 42 (CD11b/c) antibody (1:200, CALTAG, Burlingame, CA). Cells were then incubated with the goat anti-mouse IgG peroxidase-conjugated antibody (1:1000, Sigma) for 1 h. Microglial cells were labeled brown after incubation with the substrate, a 0.3% 4-Cl-α-naphthol/methanol solution diluted in PBS buffer (1:5), and H_2O_2 (0.33 mL/mL), at room temperature for 30 min. These cells were analyzed (Olympus BX70) and photographed (CE Roper Scientific) in a light optic phase microscope using a digital camera. The number of immunoreactive cells was counted under the microscope using 20× magnification in a 0.29 mm^2 field. Ten randomized representative fields were analyzed, and the proportion of OX-42-positive cells was presented as the percentage of labeled cells among the total number of cells counted.

Protein Assay and Western Blot. GFAP expression and β-III-tubulin expression were investigated by Western immunoblotting. After being treated, cells were rinsed twice with PBS, harvested, and lysed in 2% (w/v) SDS, 2 mmol/L EGTA, 4 mol/L urea, 0.5% (v/v) Triton X-100, and 62.5 mmol/L Tris-HCl buffer (pH 6.8) supplemented with 0.1% (v/v) protease inhibitor cocktail (Sigma, catalog no. P8340). The protein content was determined by a method adapted from Lowry et al. with a DC protein assay reagent kit (Bio-Rad, Hercules, CA). For analysis, 50 μg of protein, prepared as described above, was loaded onto a discontinuous 4% stacking and 8% running SDS−polyacrylamide gel. Electrophoresis was performed at 200 V for 45 min. Proteins were then transferred onto a polyvinylidene fluoride membrane (PVDF, Immobilon-P, Millipore) at 100 V for 1 h. Equal protein loading was confirmed by staining the membranes with Ponceau red (Sigma). Thereafter, membranes were blocked for 1 h at room temperature in 20 mmol/L Tris-buffered saline (pH 7.5), containing 0.05% Tween 20 (TBS-T) and 5% powdered skim milk. Subsequently, membranes were incubated with rabbit anti-GFAP (1:5000, DAKO), diluted in TBS-T containing 1% powdered skim milk, overnight. Alkaline phosphatase-conjugated goat anti-rabbit IgG or goat anti-rabbit IgG (1:5000 in TBS-T, Bio-Rad) was used as a secondary antibody. Immunoreactive bands were visualized using the AP-conjugated substrate kit (Bio-Rad), according to the manufacturer's instructions. Quantification was achieved by scanning densitometry (ScanJet 4C, Hewlett-Packard) in three independent experiments and analyzed with ImageJ versiono 1.33u (W. Rasband, National Institutes of Health, Bethesda, MD). The antibody specificity and linearity of the densitometric analysis system were assessed by serial dilutions of total protein from cells under control conditions, with 5−20 μg of protein per lane.

Cytoplasm Ultrastructural Analysis. Ultrastructural changes were evaluated by transmission electron microscopy. The experiment was performed on 4 cm diameter dishes (TPP Switzerland) with neuron/glial cell cocultures incubated with 3 μg/mL TAE or F32 or 0.1% DMSO. The cells were fixed with 2.5% glutaraldehyde (Sigma) in 0.1 M cacodylate buffer (pH 7.2) for 2 h at room temperature, washed in 0.1 M cacodylate buffer, and postfixed with 1% osmium tetroxide and 0.8% potassium ferricyanide and 5 mM $CaCl_2$ in the same buffer for 1 h at room temperature. They were then scraped off, dehydrated in an

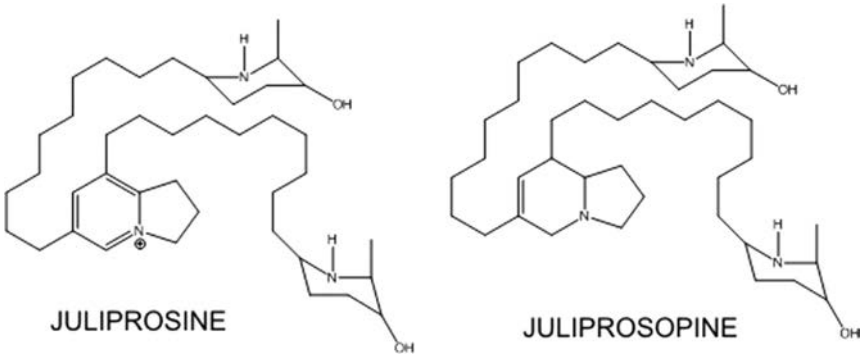


Figure 1. Chemical structures of piperidine alkaloids juliprosine and juliprosopine.

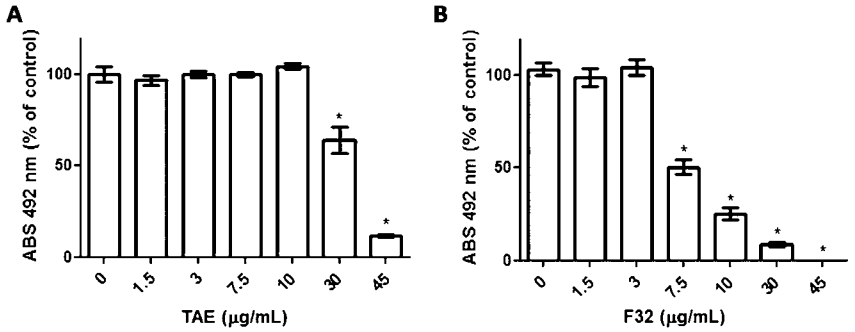


Figure 2. Effect of alkaloids from *P. julifora* on the succinate dehydrogenase activity of neuron/glial cell cocultures. Cells were incubated in the absence (control, 0.1% DMSO) or presence of TAE (A) or F32 (B) and evaluated 24 h post-treatment. Values of control samples were set at 100%. $^*p < 0.05$.

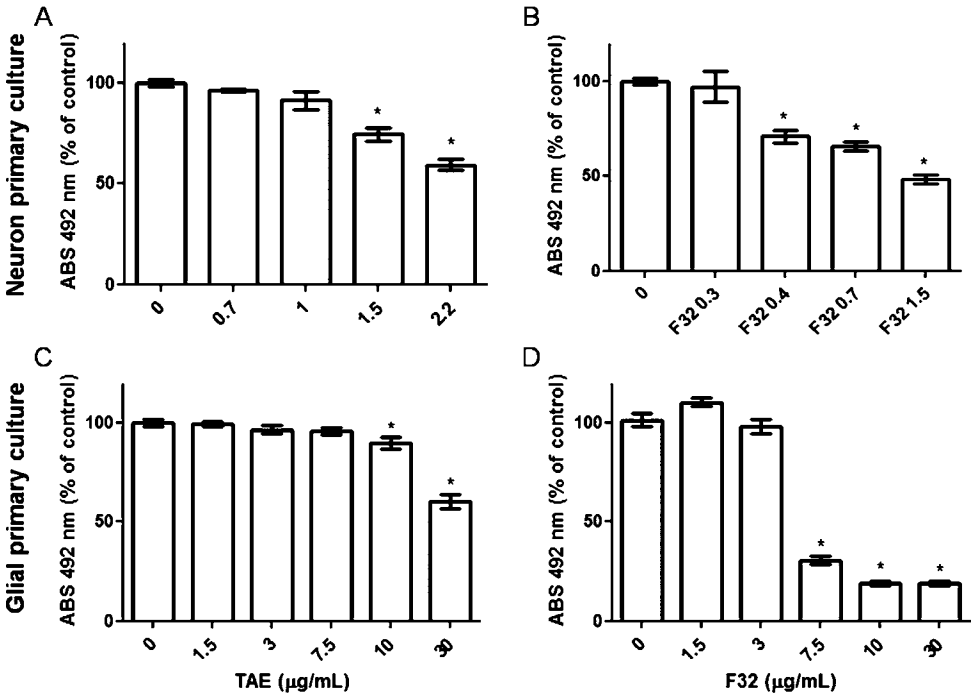


Figure 3. Effect of alkaloids from *P. julifora* on the succinate dehydrogenase activity of isolated neurons (A and B) and glial cells (C and D). Cells were incubated in the absence (control, 0.1% DMSO) or presence of TAE (A and C) or F32 (B and D) and evaluated 24 h post-treatment. Values of control samples were set at 100%. $^*p < 0.05$.

acetone series, and embedded in Polybed resin. Thin sections were stained with uranyl acetate and lead citrate and observed under a Zeiss EM109 transmission electron microscope.

Statistical Analysis. Results are expressed as means ± the standard deviation. One-way ANOVA followed by the Student−Newmann−Keuls test was used to determine the statistical differences among groups differing in only one parameter. The Student's *t* test was used for comparisons between two groups. *p* values of <0.05 were considered to be significant. This statistical analysis was evaluated with GraphPad Prism version 5.

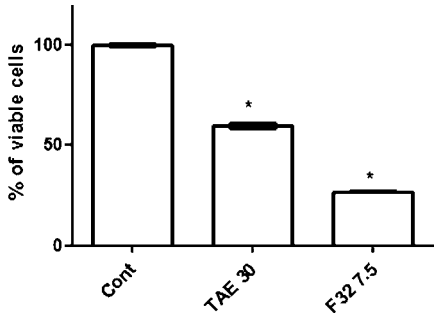


Figure 4. Effect of alkaloids from *P. juliflora* on the membrane integrity of neurons and glial cells in neuron/glial cell primary cocultures. Cells were incubated in the absence (control, 0.1% DMSO) or presence of 30 μg/mL TAE or 7.5 μg/mL F32 and evaluated 24 h post-treatment. Results are expressed as means of the percentage of the ratio of viable cells to total cells ± SD. *$p < 0.05$.

RESULTS

Characterization of Alkaloids in F32. F32 was obtained from the methanol extract of *P. juliflora* leaves as a dark gum. The ^{1}H (500 MHz, CD_3OD) and ^{13}C (125 MHz, CD_3OD) NMR spectra and DEPT 135 experiment displayed a mixture of 1,2,3,5,8,8a-hexahydroindolizine and 2,3-dihydro-1*H*-indolizinium heterocycles. The hexahydroindolizine moiety can be observed through hydrogens $\delta_{H\text{-}1''''}$ 1.56 (m), $\delta_{H\text{-}2''''}$ 2.44 (m), $\delta_{H\text{-}3''''}$ 3.10–2.40 (m), $\delta_{H\text{-}5''''}$ 3.10 (m), $\delta_{H\text{-}6''''}$ 2.50 (m), $\delta_{H\text{-}7''''}$ 5.59 (s), $\delta_{H\text{-}8''''}$ 1.71 (m), and $\delta_{H\text{-}8a''''}$ 1.82 (m) and carbons $\delta_{C\text{-}1''''}$ 33.8 (CH_2), $\delta_{C\text{-}2''''}$ 22.2 (CH_2). $\delta_{C\text{-}3''''}$ 52.7, $\delta_{C\text{-}5''''}$ 52.7 (CH_2), $\delta_{C\text{-}6''''}$ 134.0 (C), $\delta_{C\text{-}7''''}$ 125.7 (CH), $\delta_{C\text{-}8''''}$ 52.7, and $\delta_{C\text{-}8a''''}$ 66.1 (CH). The hydrogens of the indolizinium nucleus appear at $\delta_{H\text{-}1''''}$ 2.80 (m), $\delta_{H\text{-}2''''}$ 2.51 (m), $\delta_{H\text{-}5''''}$ 8.62 (s), and $\delta_{H\text{-}7''''}$ 8.16 (s) and the carbons at $\delta_{C\text{-}1''''}$ 34.5 (CH_2), $\delta_{C\text{-}2''''}$ 20.0 (CH_2), $\delta_{C\text{-}3''''}$ 52.8 (CH_2), $\delta_{C\text{-}5''''}$ 138.9 (CH), $\delta_{C\text{-}6''''}$ 140.8 (C), $\delta_{C\text{-}7''''}$ 145.9 (CH), and $\delta_{C\text{-}8''''}$ 143,0 (C). Signals such as $\delta_{C\text{-}7,7'}$ 14.5 (CH_3), $\delta_{C\text{-}3,3'}$ 65.9 (CH), and $\delta_{c\text{-}6,6''}$ 47.7 (CH) are distinguished in the piperidine ring. The methylenes of the aliphatic portion are at δ 29.6–28.8 (Table 1). The presence of a single group methyl substituent at δ 14.5 denotes the same stereochemistry at C7,7′ for both structures. Analysis of these data and comparison with the literature allowed us to deduce that this fraction is composed of a mixture of alkaloids, juliprosopine (majority constituent) and juliprosine (Figure 1).[25,26]

Cell Viability. *Concentration–Effect.* The toxic effects of TAE and F32 obtained from *P. juliflora* leaves on cell viability were assessed by the MTT test, which measures the reduction of the tetrazolium salt (MTT) to the purple formazan by cellular dehydrogenase enzymes in living cells. After a 24 h

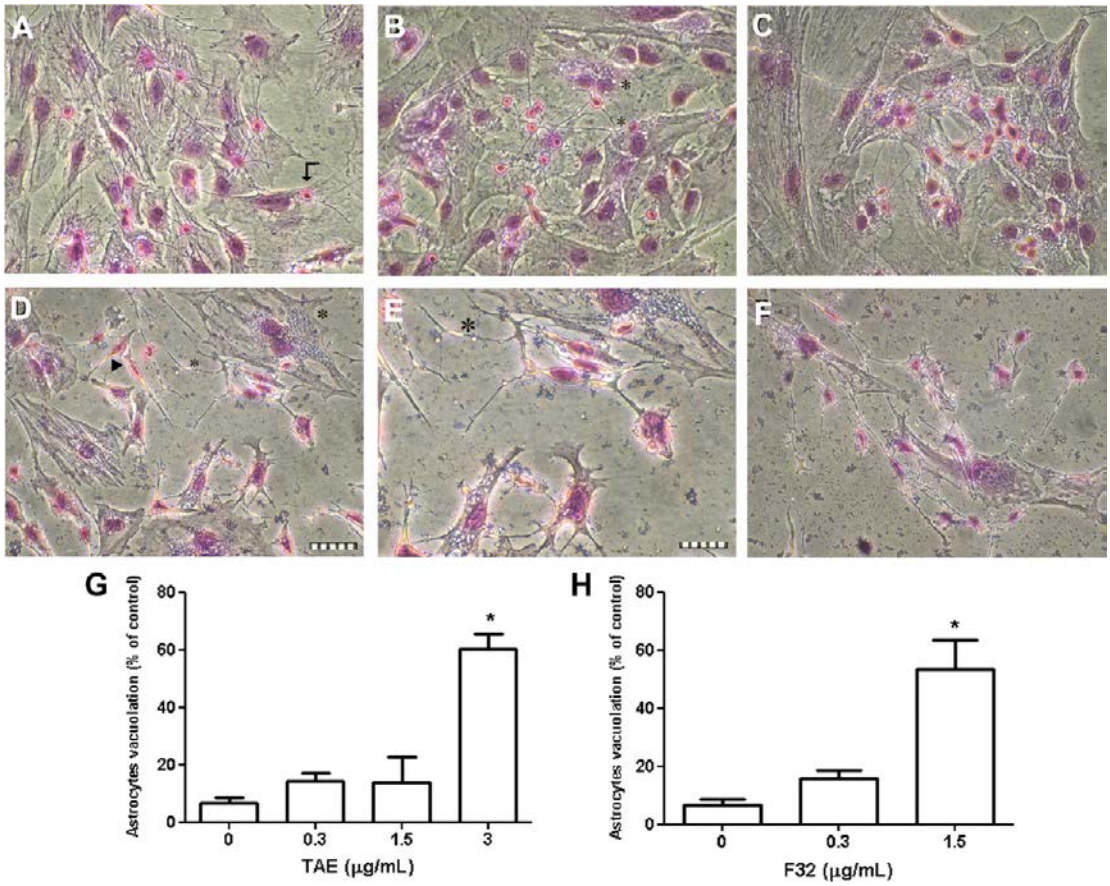


Figure 5. Effect of alkaloids from *P. juliflora* on the cell morphology and vacuolization of astrocytes in neuron/glial cell cocultures after Rosenfeld's staining. Neuron/glial cell cocultures under control conditions (A) and after a 24 h treatment with 1.5 μg/mL TAE (B), 3 μg/mL TAE (C), 1.5 μg/mL F32 (D and E), or 3 μg/mL F32 (F). The arrow indicates a neuronal cell body. The arrowhead indicates a disrupted neuron. The asterisk indicates astrocytes with cytoplasmic vacuolation and vacuoles in neurites. The objective was 20 × 0.70; the scale bars are 10 μm. (G and H) Quantification of astrocytes in vacuolization in neuron/glial cell cocultures under control conditions (0.1% DMSO) and after a 24 h treatment with TAE (0.3–3 μg/mL) or F32 (0.3–1.5 μg/mL). Results are expressed as means of the percentage of the ratio of vacuole-possessing astrocytes to total astrocytes ± SD. *$p < 0.05$.

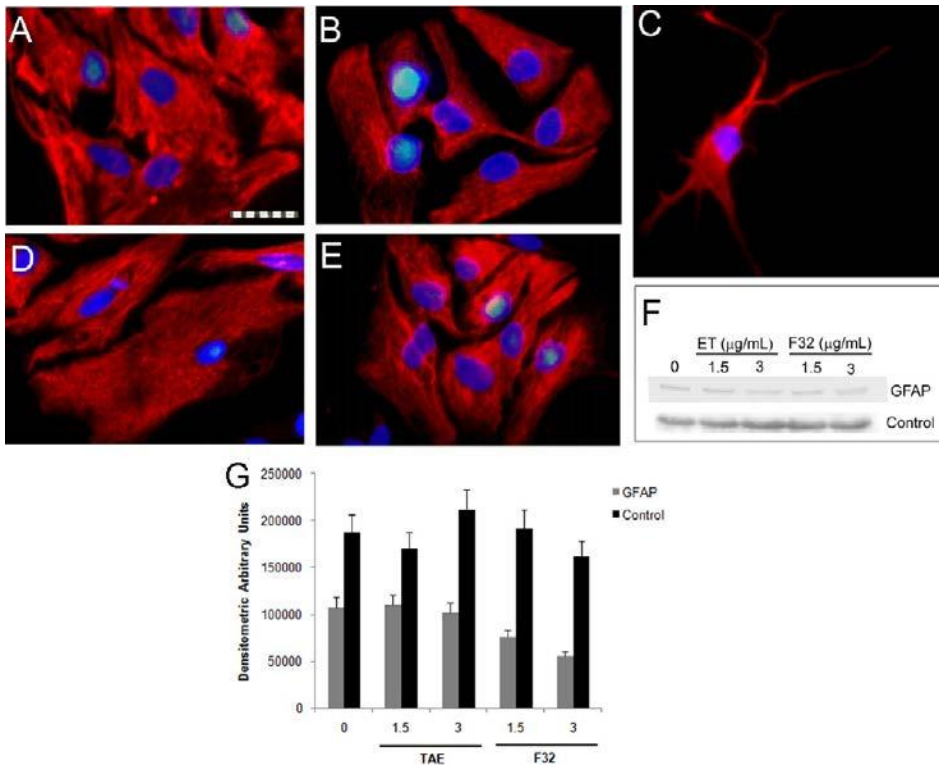


Figure 6. Effect of alkaloids from *P. juliflora* on the astrocyte morphology and GFAP expression in neuron/glial cell primary cocultures. Photomicrographs of cells under control conditions (A) and after a 24 h treatment with 1.5 μg/mL F32 (B), 3 μg/mL F32 (C), 1.5 μg/mL TAE (D), or 3 μg/mL TAE (E). Nuclear chromatin of neuron/glial cell cocultures was stained with Hoechst 33258. The objective was 20 × 0.70; scale bars are 10 μm. (F) Immunoreactive bands after Western blot analysis of GFAP expression in cocultures after a 24 h treatment with alkaloids. Results are representative of three independent experiments. (G) Densitometric arbitrary units of GFAP immunoreactive bands and controls.

exposure, a dose-dependent decrease in dehydrogenase activity was induced by 1.5−45 μg/mL TAE or F32 in neuron/glial cell cocultures (Figure 2A,B). The median inhibitory concentrations (IC_{50} values) were 31.07 μg/mL for TAE and 7.362 μg/mL for F32.

To differentiate neuronal death from glial cell death, we performed the same test for toxicity in isolated cultured cells (Figure 3). A 24 h exposure to 1.5−2.2 μg/mL TAE and 0.4−1 μg/mL F32 induced a dose-dependent decrease in mitochondrial activity in neuron cultures (Figure 3A,B). Glial cell cultures were more resistant than neurons to the toxicity of alkaloids from *P. juliflora* and presented dose-dependent decreases in mitochondrial activity only after exposure to 10 μg/mL TAE (89% of viable glial cells) and 7.5 μg/mL F32 (30% of viable glial cells) (Figure 3C,D).

Moreover, effects of alkaloids from *P. juliflora* on membrane integrity were also determined by counting viable and nonviable cells after Trypan blue staining. We observed a significant reduction in the proportion of viable cells in neuron/glial cell cocultures exposed to 30 μg/mL TAE (41.5%) or 7.5 μg/mL F32 (63%) (Figure 4).

To make possible the analysis of morphological and ultrastructural alterations, we used neuronal toxic but not glial toxic concentrations in other tests (1.5 and 3 μg/mL).

Effect of Alkaloids on Glial Cells and Neuron Morphology. To investigate the effects of *P. juliflora* alkaloids on cell morphology, Rosenfeld's staining, and GFAP, β-III-tubulin, and OX-42 immunocytochemistry were performed in neuron/glial cell cocultures. Rosenfeld's staining in untreated, control cocultures revealed neurons homogeneously distributed over the dense astroglial monolayer, with cells presenting a flat/polygonal phenotype (Figure 5A). In cultures exposed to 1.5 μg/mL TAE the neurite network was maintained, but some astrocytes presented cytoplasmic vacuolation (Figure 5B). However, in cultures exposed to 3 μg/mL TAE, the proportion of astrocytes with cytoplasmic vacuolation increased significantly (Figure 5C,G), with a reduction in the integrity of the neurite network; some giant astrocytes were also observed. Exposure of cells to 1.5 μg/mL F32 was sufficient to disrupt the astrocyte monolayer and the neurite network. Intense cytoplasmic vacuolation in astrocytes and large vacuoles in neurites was also observed (Figure 5D,E,H). These effects were amplified in cultures treated with 3 μg/mL F32 (Figure 5F); however, it was not possible to quantify vacuole-possessing astrocytes, because there are few adherent cells under this condition.

Neuron/glial cell primary cultures analyzed by immunocytochemistry for the astrocyte cytoskeletal protein GFAP showed a monolayer of large, flat cells, with protein distributed throughout the cell bodies (Figure 6). However, dramatic changes in astrocyte morphology were observed only in cultures treated with 3 μg/mL F32. The remaining adherent astrocytes presented thin and multipolar GFAP filaments (Figure 6C), suggesting astrocyte activation. GFAP steady-state levels in the control and in cultures treated with 1.5−3 μg/mL TAE and 1.5 μg/mL F32 remained similar, as determined by a 49 kDa immunoreactive band on the Western blot. However, in cultures exposed to 3 μg/mL F32, a change in the pattern of GFAP migration was observed. GFAP appeared

as an extended protein band of very similar molecular weights, suggesting protein degradation (Figure 6F).

Immunocytochemistry analyses conducted for β-III-tubulin revealed that the neurons exhibited dysfunctional protein polymerization in cultures treated with 3 μg/mL TAE and 3 μg/mL F32 (Figure 7B,C).

The few activated microglial cells immunostained with OX-42 (1.3%) appeared as small, black round cells in neuron/glial cell primary cocultures under control conditions (Figure 8A). However, exposure to 1.5−3 μg/mL TAE or F32 increased the proportion of OX-42-positive microglial cells by up to 5-fold (Figure 8B−E).

Cytoplasm Ultrastructural Analysis. The ultrastructural analysis revealed that the cells under control conditions (0.1% DMSO) (Figure 9A) presented a normal morphology for the cytoplasm, mitochondria, and nucleus. However, cells treated for 24 h with 3 μg/mL TAE presented a range of mitochondrial shapes and sizes. These changes in mitochondrial morphology suggested a mitochondrial fusion. In addition, cells treated for 24 h with 3 μg/mL F32 presented mitochondria with shortened and disintegrating cristae and cytoplasmic vacuoles, characterized by double-layer membranes or multilayer membranes. This morphology of cytoplasmic vacuoles suggested autophagic vacuoles formatio (Figure 9B,C)

■ DISCUSSION

In our previous studies, we demonstrated that the alkaloidal extract (TAE) and some alkaloidal fractions from *P. juliflora* leaves were cytotoxic and induced activation of glial cells in primary cultures. Glial cells have important functions that impact neuronal cell health and integrity.[27] Considering a growing body of evidence that astrocytes and microglia play important roles in the physiology of the CNS and in the mechanisms of pathogenesis of various neurological diseases,[28−30] it is important to investigate the reactions of glial cells interacting with neurons to various stimuli, including chemical agents. In this study, we investigated the effects of TAE and the more cytotoxic alkaloidal fraction for glial cells [F32 fraction (for review, see ref 13)] in a system of neuron/glial cell cocultures to induce and characterize the main morphologic and ultrastructural changes in central nervous system cells visualized in "cara torta" disease. NMR characterization of F32 showed that this fraction is composed of a mixture of two alkaloids, juliprosopine (majority constituent) and juliprosine. In a phytochemical investigation of the pods of *P. juliflora* cultivated in the semi-arid region of the State of Paraiba of Brazil, Tabosa and co-workers found that the toxic activity, observed in laboratory animals, is chemically related to the piperidine alkaloids juliprosopine and juliprosine, present in the pods of this Leguminosae.[25]

We determined the cytotoxic concentrations of TAE and F32 obtained from *P. juliflora* leaves in neuron/glial cell cultures by the MTT test. MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide] is a water-soluble tetrazolium salt, which is converted to an insoluble purple formazan by cleavage of the tetrazolium ring by succinate dehydrogenase within the mitochondria in healthy cells.[31,32] More recent evidence suggests that reduction of MTT can also be mediated by NADH or NADPH within the cells and out of mitochondria.[33] We observed by the MTT test that a 24 h exposure to low concentrations of alkaloids from F32 and TAE (3 μg/mL) was not sufficient to reduce succinate dehydrogenase activity on neuron/glial cell cultures. However, this subtoxic concentration

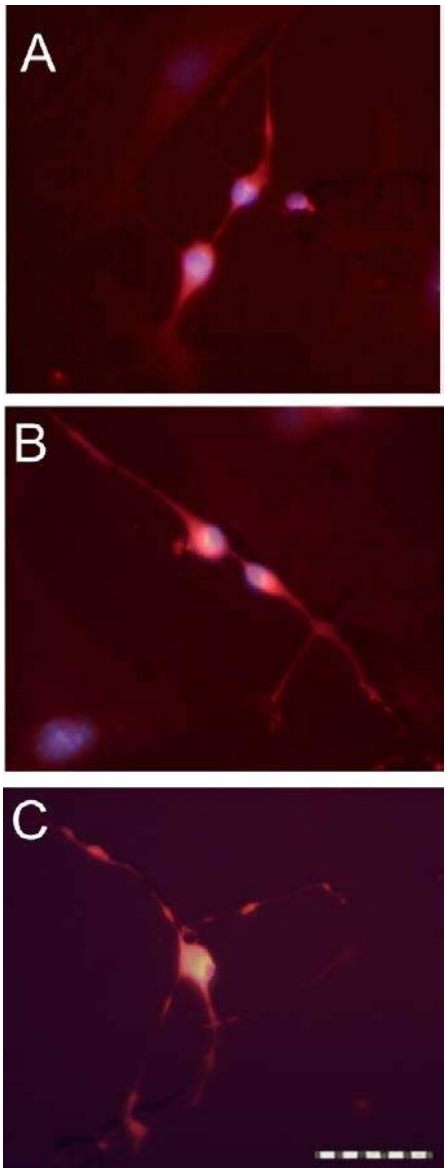


Figure 7. Effect of alkaloids from *P. juliflora* on the neuron morphology and β-III-tubulin expression in neuron/glial cell primary cocultures. Photomicrographs of cells under control conditions (A) and after a 24 h treatment with 3 μg/mL TAE (B) or 3 μg/mL F32 (C). Nuclear chromatin of neurons and glial cells in cocultures was stained with Hoechst 33258. The objective was 20 × 0.70; scale bars are 10 μm.

induced mitochondrial disorder visualized by electron microscopy, suggesting the involvement of extramitochondrial NADH or NADPH on the reduction of MTT to formazam. Moreover, to clarify a cell death induced by F32 and TAE, we also investigated whether these compounds induce membrane damage at IC_{50} concentrations in neuron/glial cell primary cocultures of ∼59.5 and ∼27%, respectively. To clarify the sensibility of the cell types to the toxins, we also evaluated the activity of succinate dehydrogenase on neuron culture and glial cell culture isolated systems. We observed that only at higher concentrations of F32 (7.5 μg/mL) and TAE (30 μg/mL) was the succinate dehydrogenase activity reducted in cultures of glial cells; however, low concentrations of alkaloids from F32 and TAE (0.4−1.5 μg/mL) were sufficient to reduce succinate dehydrogenase activity in cultures of cortical neurons,

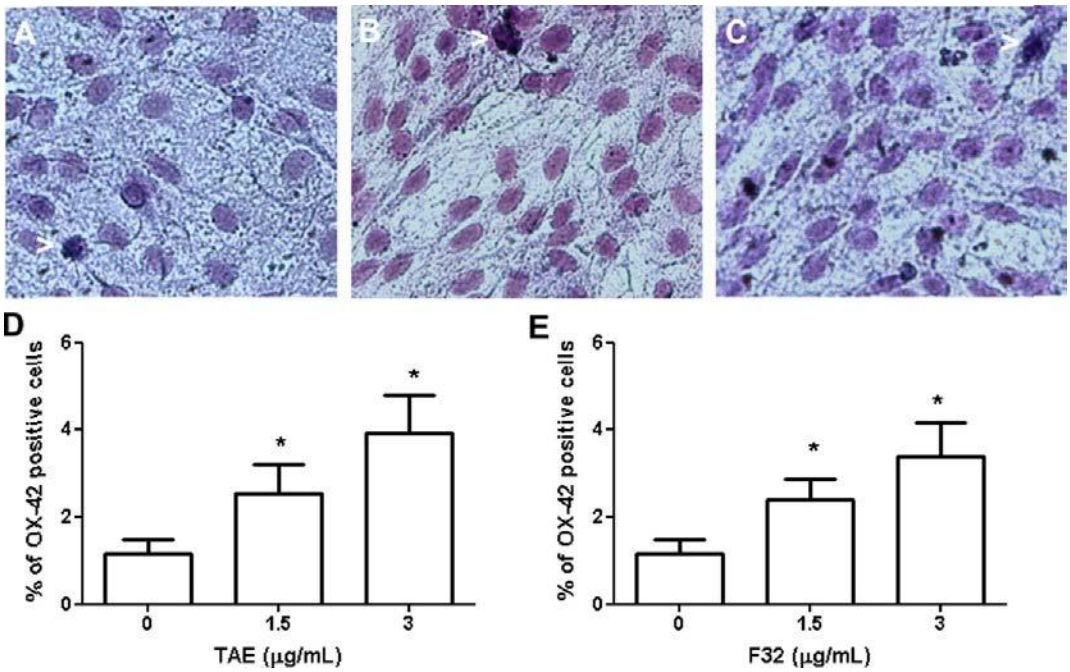


Figure 8. Effect of alkaloids from *P. juliflora* on the microglial morphology and activation in neuron/glial cell primary cocultures after immunocytochemistry for OX-42 protein and after Rosenfeld's staining. Photomicrography of OX-42-positive round microglial cells (arrows) under control conditions (A) or after a 24 h treatment with 1.5 μg/mL TAE (B) or 1.5 μg/mL F32 (C). The objective was 20 × 0.70; scale bars are 10 μm. Quantification of OX-42-positive cells in cultures under control conditions or treated with 1.5−3 μg/mL TAE (D) or F32 (E). $^*p < 0.05$.

indicating that isolated neurons were more sensible them glial cells. Our previous study, developed in astrocyte primary cultures, also showed that, after a 24 h exposure, a crude extract containing alkaloids, obtained from *P. juliflora* pods, induced only cytotoxicity related to reducing succinate dehydrogenase activity and induction of membrane damage when administered at 30 μg/mL.[12] However, in another study, conducted in astrocyte primary cultures enriched with microglia, significant reductions in mitochondrial activity and a loss of membrane integrity were observed after exposure to 3 μg/mL TAE or F32 obtained from *P. juliflora* leaves.[13] In the central nervous system, astrocytes are the cells that respond to insults and metabolize xenobiotics as a mechanism of neuronal protection and stand out by having enzymatic machinery that allows them to develop both the phase I metabolism enzyme isoforms by system cytochrome P450 metabolism and phase II by glutathione transferase isoforms.[34−36] It is possible that the resistance of glial cell cultures and neuron/glial cell cocultures to alkaloids is a result of the metabolism of the astrocytes, and further studies may be performed to improve our understanding its relation with neurotoxicity.

Cytoplasmic vacuolization upon exposure to a variety of chemicals and bioactive substances has been extensively reported (for a review, see ref 37). We also observed, after Rosenfeld staining, that exposure of neuron/glial cell cultures to alkaloids from *P. juliflora* induced structural changes in astrocytes and an important dose-dependent cytoplasmic vacuolation. Moreover, a disruption in the neurite network and intense vacuolation in neurites were observed. In the field of cell pathology, cell deterioration characterized by cytoplasmic vacuolation is called vacuolar degeneration,[38] and the vacuolation induced by alkaloids from *P. juliflora* in neuron/glial cell primary cultures may be a type of vacuolar degeneration. Similar morphological changes in CNS cells were reported in experimental and spontaneous ingestion of *P. juliflora* among cattle.[10,11] We observed gliosis, vacuolation, and neuronal loss in trigeminal motor nuclei and other motor cranial nerve nuclei to be the main histologic lesions after *P. juliflora* intoxication, with Wallerian-like degeneration in the cranial nerves.

Autolysosomes are not true vacuoles that sometimes expand to fill the cytoplasm and therefore are often termed autophagic vacuoles, which could be observed via light microscopy.[37] Ultrastructural analysis suggested autophagic vacuole formation on cells treated for 24 h with 3 μg/mL F32. The autophagy is an intracellular bulk degradation process whereby cytoplasmic proteins and organelles are degraded and recycled through lysosomes. It plays an important role in the elimination of damaged organelles such as mitochondria and protects against cell death programmed by mitochondrial dysfunction on neuronal cells.[39,40] In addition, cells treated for 24 h whit 3 μg/mL F32 presented mitochondria with shortened and disintegrating cristae. However, cells treated for 24 h with 3 μg/mL TAE presented changes in mitochondrial morphology that suggested a mitochondrial fusion that is the combination of two mitochondria into a single organelle.[41] Studies indicated that fusion is related to changes in the mitochondrial function and protects mitochondria from autophagosomal degradation.[41,42] These ultrastructural results reported apply to all cell types of neuron/glial cell cocultures and corroborate the findings for succinate dehydrogenase activity and morphological analyses that suggest that both neurons and glial cells had mitochondrial dysfunction and vacuolation after being exposed to alkaloids.

Intermediate filaments (IFs) are structures that, together with microtubules and microfilaments, form the cytoskeleton that is present in nearly all eukaryotic cells. The major IF protein in astrocytes is glial fibrillary acidic protein (GFAP). Recent studies have revealed the presence of multiple isoforms of GFAP, which may be differentially expressed in reactive and resting astrocytes (for a review, see ref 43). Changes in the expression of GFAP illustrate astroglial reactivity (astrogliosis).

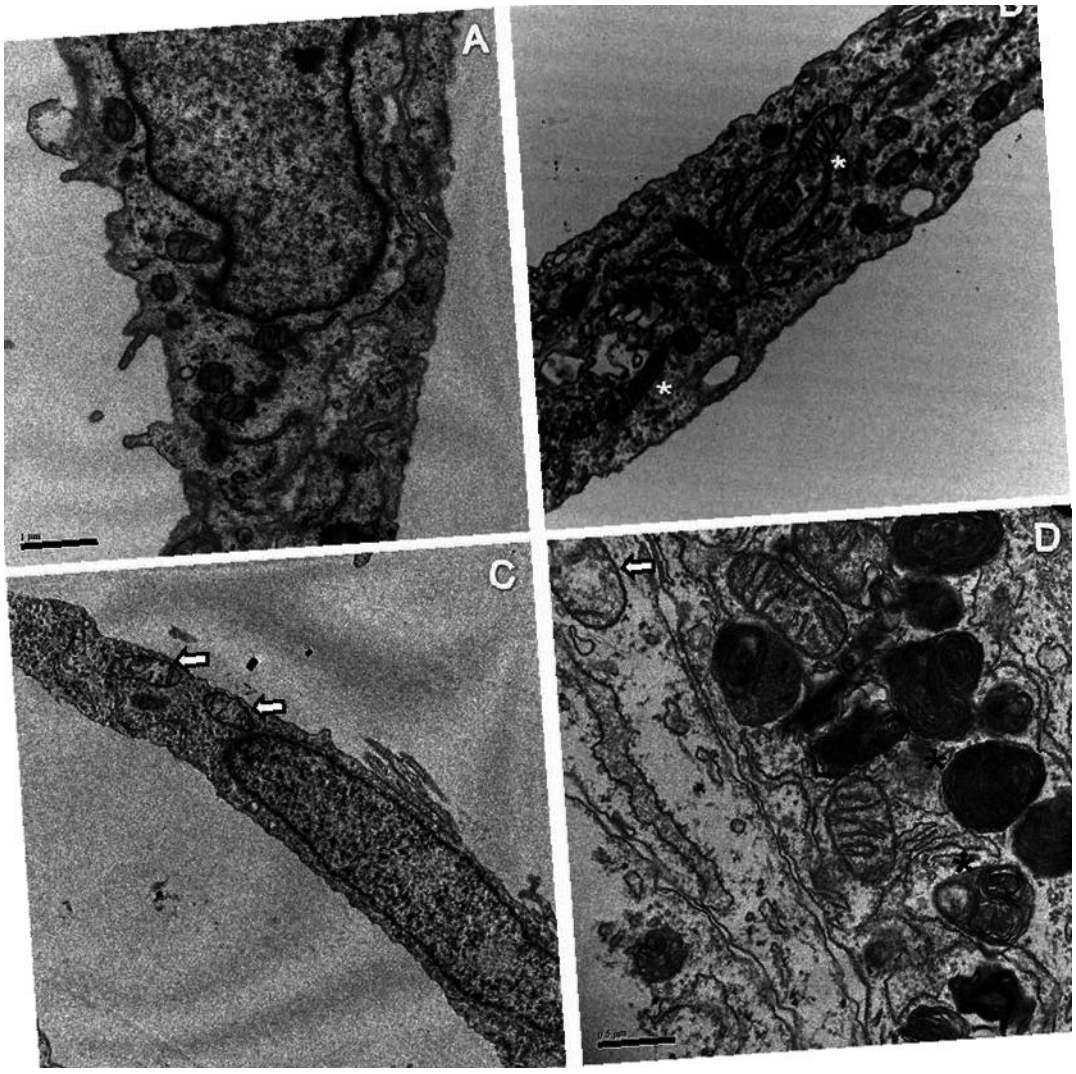


Figure 9. Effect of alkaloids from *P. juliflora* on ultrastructural changes in neuron/glial cell primary cocultures. Transmission electron microscopy of the cytoplasm from cells under control conditions (A) and after a 24 h treatment with 3 μg/mL TAE (B) or 3 μg/mL F32 (C and D). The white asterisk in panel B denotes changes in mitochondrial morphology. The arrows in panels C and D denote mitochondria with shortened and disintegrating cristae. The black asterisk in panel D denotes cytoplasmic vacuoles.

Some astrocytes reacted to the largest dose of F32 tested (3 μg/mL) with a strong retraction of the cell body and emission of thick and ramified processes. This phenomenon was associated with the appearance of two GFAP-immunoreactive bands (as revealed by Western blotting), suggesting protein instability. In our previous study of glial cell cultures, we observed that astrocytes exposed to 3 μg/mL TAE developed compact cell bodies, with many processes overexpressing GFAP, but exposure to 3 μg/mL F32 induced GFAP disruption.[13] Although an increase in the level of GFAP production may be a sign of astrogliosis, reactive injury, and even neurodegeneration,[27,44,45] a decrease in its levels may signify abnormal synaptogenesis and neurotransmission.[46,47]

Exposure of neuron/glial cell cocultures to alkaloids from *P. juliflora* induced disruption of the astrocyte monolayer and neurite network, with intense vacuolation in both cell types. These phenomena were also associated with changes in the expression of β-tubulin III, the main component of the neuronal cytoskeleton. Interruptions in β-III-tubulin staining were typically observed in cultures exposed to 3 μg/mL F32, suggesting a failure in the polymerization of this protein in neurons, a phenomenon that may be associated with vacuolation. Published studies report that astrocytes are capable of producing molecules that affect axonal growth, such as the components of extracellular matrix laminin. Furthermore, disrupted astrocyte integrity and astrogliosis affect neurite outgrowth.[44,48,49] The response of astrocytes to alkaloids from *P. juliflora*, characterized by changes in morphology and GFAP expression, may be associated with changes in the expression of β-III-tubulin and the integrity of the neurite network.

Microglia, the resident immune cells of the brain, function like tissue macrophages in other organs, serving as tissue phagocytes (when required) and constituting the first line of defense against invading pathogens and other challenges.[50] However, their activation may interfere with neuronal cell health and integrity.[27,51] Activated microglia have been observed to transform into small round cells without processes that express OX-42.[52,53] An enhanced number of OX-42-positive microglia cells were observed in neuron/glial cell primary cultures exposed to both TAE and F32. This effect appeared to be enhanced in the presence of the highest concentration of TAE and F32 (3 μg/mL). This observation

indicates that alkaloids from *P. juliflora* can also induce microgliosis. Among several factors released by activated glia, NO seems to play a critical role in stress-induced brain damage.[29,54−56]

Considering that F32 was more cytotoxic than TAE and that F32 reproduced *in vitro* the main morphologic and ultrastructural changes of "cara torta" disease, we can suggest that piperidine alkaloids juliprosopine and juliprosine are primarily responsible for the neurotoxic damage observed in animals after consumption of the plant. We suggested that the potential mechanism of action of these alkaloids is induction of mitochondrial dysfunccion, which results in neuronal death, gliosis, and autophagic vacuolation. More studies should be conducted to characterize the mechanism of vacuole formation and to determine if the vacuoles have a protective effect against programmed cell death induced by mitochondrial damage.

■ AUTHOR INFORMATION

Corresponding Author

*Laboratório de Neuroquímica e Biologia Celular, Departamento de Biofunção/Bioquímica, Instituto de Ciências da Saúde, Universidade Federal da Bahia, Av. Reitor Miguel Calmon s/n°, Salvador, BA, 40.110-100, Brazil. Telephone: (55) 71 3283 8919. Fax: (55) 71 3283 8927. E-mail: costasl@ufba.br.

Funding

This work was supported by grants from CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) and Fundação de Amparo à Pesquisa do Estado da Bahia (FAPESB). We gratefully acknowledge the research support provided by Fundação Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and by Programa de Pós-gradução em Ciência Animal nos Trópicos-Universidade Federal da Bahia and by the Plataforma de Microscopia Eletrônica-Centro de Pesquisa Gonçalo Muniz, Fundação Oswaldo Cruz, Salvador, Brazil.

Notes

The authors declare no competing financial interest.

■ ABBREVIATIONS

CNS, central nervous system; F32, alkaloid fraction obtained from *P. juliflora* leaves; GFAP, glial fibrillary acid protein; MTT, 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide; TAE, total alkaloid extract obtained from *P. juliflora* leaves; OX-42 antibody, antibody that reacts with the CR3 complement (C3bi) receptor found on most monocytes, granulocytes, and macrophages; β-III-tubulin, microtubule element of the tubulin family (class III) found almost exclusively in neurons

■ REFERENCES

(1) A Algarobeira (*Prosopis juliflora* Sw, D.C.) no Nordeste do Brasil (1989) Secretaria Nacional de Produção Agropecuária, Brasilia, Brazil.

(2) Mendes, B. V. (1988) Potential offered by *Prosopis juliflora* (SW) DC in the Brazilian Semi-arid Region. In *The Current State of Knowlegde of Prosopis juliflora*, Procedings of II International Conference on *Prosopis juliflora,* Recife, Brazil, August 25−29, 1986, Food and Agriculture Organization of the United Nations, Plant Production and Protection Division.

(3) Santos, R. V., and Tertuliano, S. S. X. (1998) Crescimento de Espécies Arbóreas em Solo Salino-sódico Tratado com Ácido Sulfúrico. *Revista Brasileira de Engenharia Agrícola e Ambiental 2*, 239−242.

(4) Pegado, C. M. A., Andrade, L. A., Félix, L. P., and Pereira, I. M. (2006) Efeitos da Invasão Biológica de Algaroba-*Prosopis juliflora* (Sw.) DC. Sobre A Composição e a Estrutura do Estrato Arbustivo-Arbóreo da Caatinga no Município de Monteiro, PB, Brasil. *Acta Botanica Brasilica 20*, 887−898.

(5) Silva, D. S. Substituição Progressiva Do Farelo De Trigo Pela Vagem da Algaroba na Alimentação de Bovinos em Engorda. M.S. Dissertation, Universidade Federal da Paraíba, Centro de Ciências Agrárias, Areia, Brazil, 1981.

(6) Baca, S. F., Vallenas, A., and Novoa, C. (1967) Estudio Experimental de La "Coquera" en Caprinos. *Rev. Fac. Med. Vet. 18*, 131−159.

(7) Dollahite, J. W., and Anthony, W. V. (1957) Malnutrition in Cattle on an Unbalanced Diet of Mesquite Beans. *Tex. Agric. Exp. Stn. 11*, 209−212.

(8) Figueiredo, L. J. C., Ferreira, M. M., Távora, J. P. F., Dantas, J., and Simões, S. D. (1995) Estudo Clínico e Anátomopatológico da Doença "Cara Torta" em Bovinos no Nordeste Brasileiro. *Arq. Bras. Med. Vet. Zootec. 18*, 175−183.

(9) Tabosa, I. M., Souza, J. C. A., Graça, D. L., Barbosa-Filho, J. M., Almeida, R. N., and Riet-Correa, F. (2000) Neuronal Vacuolation of the Trigeminal Nuclei in Goats Caused by Ingestion of *Prosopis juliflora* Pods (Mesquite Beans). *Vet. Hum. Toxicol. 42*, 155−158.

(10) Câmara, A. C. L., Costa, N. A., Riet-Correa, F., Afonso, J. A. B., Dantas, A. F. M., Mendonça, C. L., and Souza, M. I. (2009) Intoxicação Espontânea por Vagens de *Prosopis juliflora* (Leg. Mimosoideae) em Bovinos no Estado de Pernambuco. *Pesquisa Veterinária Brasileira 29*, 233−240.

(11) Tabosa, I. M., Riet-Correa, F., Barros, S. S., Summers, B. A., Simões, S. V. D., Medeiros, R. M. T., and Nobre, V. M. T. (2006) Neurohistologic and Ultrastructural Lesions in Cattle Experimentally Intoxicated with the Plant *Prosopis juliflora*. *Vet. Pathol. 43*, 695−701.

(12) Hughes, J. B., Silva, V. D. A., Silva, A. R., Souza, C. S., Silva, A. M. M., Veloso, E. S., Batatinha, M. J. M., Costa, M. F. D., Tardy, M., Elbachá, R. S., and Costa, S. L. (2006) Cytotoxicity Effect of Alkaloidal Extract from *Prosopis juliflora* Sw. D.C. (Algaroba) Pods on Glial Cells. *Brazilian Journal of Veterinary Research and Animal Science 43*, 50−58.

(13) Silva, A. M. M., Silva, A. R., Pinheiro, A. M., Freitas, S. R. V. B., Silva, V. D. A., Souza, C. S., Veloso, E. S., El-bachá, R. S., Costa, M. F. D., and Costa, S. L. (2007) Alkaloids from *Prosopis juliflora* Leaves Induce Glial Activation, Cytotoxicity and Stimulate NO Production. *Toxicon 49*, 601−614.

(14) Pienaar, J. G., Kellerman, T. S., Basson, P. A., Jenkins, W. L., and Vahrmeijer, J. (1976) Maldronksiekte in Cattle: A Neuronopathy Caused by Solanum Kwebense N.E. Br. *Onderstepoort J. Vet. Res. 43*, 67−74.

(15) Menzies, J. S., Bridges, C. H., and Bayley, E. M., Jr. (1979) A Neurological Disease of Cattle Associated with *Solanum dimidiatum*. *Southwest. Vet. 32*, 45−49.

(16) Bourke, C. A. (1997) Cerebellar Degeneration in Goats Grazing *Solanum cinereum* (Narrawa burr). *Aust. Vet. J. 5*, 363−365.

(17) Porter, M. B., MacKay, R. J., Uhl, E., Platt, S. R., and de Lahunta, A. (2003) Neurologic Disease Putatively Associated with Ingestion of *Solanum viarum* in Goats. *J. Am. Vet. Med. Assoc. 223*, 501−504.

(18) Summers, B. A., Cummings, J. F., and de Lahunta, A. (1995) *Veterinary Neuropathology*, 1st ed., pp 1−527, Mosby, St. Louis.

(19) Van der Lugt, J. J. (2002) Lysosomal storage diseases. The Clinicopathology and Pathology of Selective Toxicoses and Storage Diseases of the Nervous System of Ruminants in Southern Africa. M.S. Dissertation, University of Utrecht, Utrecht, The Netherlands.

(20) Ott-Longoni, R., Viswanathan, N., and Hesse, M. (1980) Die konstitution des alkaloides Juliprosopin aus Prosopis juliflora A. DC. *Helv. Chim. Acta 63*, 2119−2129.

(21) Wagner, H., Bladt, S., and Zgainski, E. M. (1983) Drogenanalyse. *Drogenanalyse: Dünnschichtchromatograph. Analyse von Arzneidrogen*, pp 90−110, Springer, Berlin.

(22) Cookson, M. R., and Pentreath, V. W. (1994) Alterations in the Glial Fibrillary Acidic Protein Content of Primary Astrocyte Cultures for Evaluation of Glial Cell Toxicity. *Toxicol. In Vitro 8*, 351−359.

(23) Hansen, M. B., Nielsen, S. E., and Berg, K. (1989) Re-examination, and Further Development of a Precise and Rapid dye Method for Measuring Cell Growth/cell kill. *J. Immunol. Methods 119*, 203−210.
(24) Isobe, I., Maeno, Y., Nagao, M., Iwasa, M., Koyama, H., Seko-Nakamura, Y., and Monma-Ohtaki, J. (2003) Cytoplasmic Vacuolation in Cultured Rat Astrocytes Induced by an Organophosphorus Agent Requires Extracellular Signal-regulated Kinase Activation. *Toxicol. Appl. Pharmacol. 193*, 383−392.
(25) Tabosa, I. M., Quintans-Júnior, L. J., Pamplona, F. V., Almeida, R. N., Cunha, E. V. L. d., Silva, M. S. d., Souza, J. C. d. A., and Barbosa Filho, J. M. (2000) Isolamento Biomonitorado de Alcalóides Tóxicos de *Prosopis juliflora* (algaroba). *Rev. Bras. Farmacogn. 9−10*, 11−22.
(26) Samoylenko, V., Ashfaq, M. K., Jacob, M. R., Tekwani, B. L., Khan, S. I., Manly, S. P., Joshi, V. C., Walker, L. A., and Muhammad, I. (2009) Indolizidine, Antiinfective and Antiparasitic Compounds from *Prosopis glandulosa* var. glandulosa. *J. Nat. Prod. 72*, 92−98.
(27) Coyle, J. T., and Schwarcz, R. (2000) Mind glue: Implications of Glial cell Biology for Psychiatry. *Arch. Gen. Psychiatry 57*, 90−93.
(28) Chang, R. C. C., Hudson, P., Wilson, B., Haddon, L., and Hong, J. S. (2000) Influence of Neurons on Lipopolysaccharide-stimulated Production of Nitric oxide and Tumor Necrosis Factor-a by Cultured Glia. *Brain Res. 853*, 236−244.
(29) Gebicke-Haerter, P. J. (2001) Microglia in Neurodegeneration: Molecular Aspects. *Microsc. Res. Tech. 54*, 47−58.
(30) Chang, R. C., Chiu, K., Ho, Y. S., and So, K. F. (2009) Modulation of Neuroimmune Responses on Glia in the Central Nervous System: Implication in Therapeutic Intervention Against Neuroinflammation. *Cell. Mol. Immunol. 6*, 317−326.
(31) Mosman, T. (1983) Rapid, Colorimetric Assay for Cellular Growth and Survival: Application to Proliferation and Cytotoxicity Assays. *J. Immunol. Methods 65*, 55−63.
(32) Shearman, M. S., Hawtin, S. R., and Tailor, V. J. (1995) The Intracellular Component of Cellular 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium Bromide (MTT) Reduction is Specifically Inhibited by β-Amyloid Peptides. *J. Neurochem. 65*, 218−227.
(33) Berridge, M. V., and Tan, A. S. (1993) Characterization of the Cellular Reduction of 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium Bromide (MTT): Subcellular Localization, Substrate Dependence, and Involvement of Mitochondrial Electron Transport in MTT Reduction. *Arch. Biochem. Biophys. 303*, 474−82.
(34) Meyer, R. P., Gehlhaus, M., Knoth, R., and Volk, B. (2007) Expression and Function of Cytochrome P450 in Brain Drug Metabolism. *Curr. Drug Metab. 8*, 297−306.
(35) Shang, W., Liu, W., Zhao, X., Sun, Q., Bi, J., and Chi, Z. (2008) Expressions of Glutathione S-transferase alpha, mu, and pi in Brains of Medically Intractable Epileptic Patients. *BMC Neurosci. 9*, 67.
(36) Pitanga, B. P. S., Nascimento, R. P., Silva, V. D. A., and Costa, S. L. (2012) The Role of Astrocytes in Metabolism and Neurotoxicity of the Pyrrolizidine Alkaloid Monocrotaline, the Main Toxin of *Crotalaria retusa*. *Front. Pharmacol. 3*, 144.
(37) Aki, T., Nara, A., and Uemura, K. (2012) Cytoplasmic Vacuolization During Exposure to Drugs and other Substances. *Cell Biol. Toxicol. 28*, 125−131.
(38) Cotran, R. S., Kumar, V., and Collins, T. (1999) Cellular Pathology I: Cell Injury and Cell Death. In *Robbin's Pathologic Basis of Disease* (Cotran, R. S., Kumar, V., and Collins, T., Eds.) 6th ed., pp 1−29, W. B. Saunders, Philadelphia.
(39) Paris, I., Perez-Pastene, C., Couve, E., Caviedes, P., Ledoux, S., and Segura-Aguilar, J. (2009) Copper Dopamine Complex Induces Mitochondrial Autophagy Preceding Caspase-independent Apoptotic Cell Death. *J. Biol. Chem. 284*, 13306−13315.
(40) Paris, I., Munoz, P., Huenchuguala, S., Couve, E., Sanders, L. H., Greenamyre, J. T., Caviedes, P., and Segura-Aguilar, J. (2011) Autophagy Protects Against Aminochrome-induced Cell Death in Substantia Nigra-derived Cell Line. *Toxicol. Sci. 121*, 376−388.
(41) Arduino, D. M., Esteves, A. R., and Cardoso, S. M. (2011) Mitochondrial Fusion/fission, Transport and Autophagy in Parkinson's Disease: When Mitochondria Get Nasty. *Parkinson's Dis.*, 767230.
(42) Rambold, A. S., Kostelecky, B., and Lippincott-Schwartz, J. (2011) Together We Are Stronger: Fusion Protects Mitochondria from Autophagosomal Degradation. *Autophagy 7*, 1568−1569.
(43) Liem, R. K., and Messing, A. (2009) Dysfunctions of Neuronal and Glial Intermediate Filaments in Disease. *J. Clin. Invest. 119*, 1814−1824.
(44) Costa, S. L., Planchenault, T., Charriere-Bertrand, C., Mouchel, Y., Fages, C., Sharon, J., Lefrançois, T., Barlovatz-Meimon, G., and Tardy, M. (2002) Astroglial Permissivity for Neurotic Outgrowth in Neuron-astrocyte Cocultures Depends on Regulation of Laminin Bioavailability. *Glia 37*, 105−113.
(45) Tardy, M. (1991) Astrocyte et Homeostasie. *Med. Sci. 8*, 799−804.
(46) O'Callaghan, J. P. (1991) Assessment of Neurotoxicity: Use of Glial Fibrillary Acidic Protein as a Biomarker. *Biomed. Environ. Sci. 4*, 197−206.
(47) Rajkowska, G., Miguel-Hidalgo, J. J., Makkos, Z., Meltzer, H., Overholser, J., and Stockmeier, C. (2002) Layer-specific Reductions in GFAP-reactive Astroglia in the Dorsolateral Prefrontal Cortex in Schizophrenia. *Schizophrenia Research 57*, 127−138.
(48) Nones, J., Stipursky, J., Costa, S. L., and Gomes, F. C. A. (2010) Flavonoids and Astrocytes Crosstalking: Implications for Brain Development and Pathology. *Neurochem. Res. 35*, 955−966.
(49) Tardy, M. (2002) Role of Laminin Bioavailability in the Astroglial Permissivity for Neuritic Outgrowth. *Ann. Acad. Bras. Cienc. 74*, 683−690.
(50) Streit, W. J., Walter, S. A., and Pennel, N. A. (1999) Reactive Microgliosis. *Prog. Neurobiol. 57*, 563−581.
(51) Moises, H. W., Zoega, T., and Gottesman, I. I. (2002) The Glial Growth Factors Deficiency and Synaptic Destabilization Hypothesis of Schizophrenia. *BMC Psychiatry 2*, 8.
(52) Salimi, K., and Humpel, C. (2002) Down Regulation of Complement Receptor 3 and Major Histocompatibility Complex I and II Antigen-like Immunoreactivity Accompanies Ramification in Isolated Rat Microglia. *Brain Res. 946*, 283−289.
(53) Silva, A. R., Pinheiro, A. M., Souza, C. S., Freitas, S. R. V. B., Vasconcellos, V., El-Bachá, R. S., Costa, M. F. D., and Costa, S. L. (2008) The Flavonoid Rutin Induces Astrocyte and Microglia Activation and Regulates TNF-α and NO Release in Primary Glial Cell Cultures. *Cell Biol. Toxicol. 24*, 75−86.
(54) Dimayuga, F. O., Wang, C., Clark, J. M., Dimayuga, E. R., Dimayuga, V. M., and Bruce-Keller, A. J. (2007) SOD1 Overexpression Alters ROS Production and Reduces Neurotoxic Inflammatory Signaling in Microglial Cells. *J. Neuroimmunol. 182*, 89−99.
(55) Manning, P., Cookson, M. R., McNeil, C. J., Figlewicz, D., and Shaw, P. J. (2001) Superoxide-induced nitric oxide release from cultured glial cells. *Brain Res. 911*, 203−210.
(56) Nicholson, T. E., Dibb, S., and Renton, K. W. (2004) Nitric Oxide Mediates an LPS-induced Depression of Cytochrome P450 (CYP1A) Activity in Astrocytes. *Brain Res. 1029*, 148−154.

Aerobiologia
DOI 10.1007/s10453-013-9323-1

ORIGINAL PAPER

Allergenic pollen in the atmosphere of Rohtak city, Haryana (India): a pioneer study

Manisha Ahlawat · Pushpa Dahiya · Dhruva Chaudhary

Received: 28 December 2012 / Accepted: 7 November 2013
© Springer Science+Business Media Dordrecht 2013

Abstract An attempt has been made in the present study to assess the allergenicity of dominant pollen types recorded from the atmosphere of Rohtak city. Skin prick test was performed with the antigenic extracts of 22 pollen types on 150 local patients who visited Asthma Clinic, University of Health Sciences, Rohtak. Markedly positive skin reactions (2+ and above) varied from 4.6 to 20.6 % to various pollen antigens. *Cenchrus ciliaria* (20.6 %), *Zea mays* (20 %) and *Pennisetum typhoides* (19.3 %) were the pollen allergens exhibiting maximum sensitivity. Antigenic extract of *Cassia occidentalis*, *Cynodon dactylon* and *Ricinus communis* showed marked skin reactivity in 18.6 % of patients. *Prosopis juliflora*, *Chenopodium murale*, *Amaranthus spinosus*, *Cassia fistula* and *Cassia siamea* showed 2+ and above reactions in 16.6, 15.3, 14.6 and 14.0 % of the local patients, respectively. Least reactivity (4.6 %) was shown to the antigenic extract of *Cyperus rotundus*. Out of 52 sera screened for the presence of specific IgE antibodies against different antigenic extracts, only 5.5 % showed >60 % binding. About 30 % and above binding was shown to the antigenic extracts of *Z. mays*, *A. spinosus*, *R. communis* and *Xanthium strumarium*. The concordance between positive skin reaction and serum-specific IgE antibodies ranged from 15 to 69 %.

Keywords Pollen · Aeroallergens · Bioassay · Immunoassay

M. Ahlawat · P. Dahiya (✉)
Department of Botany, Maharshi Dayanand University, Rohtak 124001, Haryana, India
e-mail: pushpa.dahiya@hotmail.com

D. Chaudhary
Department of Pulmonary and Critical Care Medicine, P.G.I.M.S., University of Health Sciences, Rohtak, India

1 Introduction

Air is a repository of an invisible biomass of particulate matter of plant and animal origin. Of these, pollen grains constitute a significant fraction and represent an inevitable allergen source due to their ubiquitous presence in nature (Hyde 1969; Cosentino et al. 1995; Puc 2003). During the last few decades, there has been an increase in the incidence of pollen allergy worldwide, including Asian countries (Bunnag et al. 1997; Wong et al. 2004; Wan-Ishlah and Gendeh 2005; D'Amato et al. 2007). In India also, an increase in allergic diseases from 10 to 30 % has been reported in the last 40 years (Vishwanathan 1964; Chhabra et al. 1998; Gaur et al. 2004). The escalating trends in these diseases are mainly attributed to increased environmental pollution due to industrialization and urbanization and changing lifestyle (Singh and Kumar 2003; Sharma et al. 2009).

India with divergent geoclimatic zones showing marked fluctuation in climatic conditions such as

Published online: 20 November 2013

temperature and relative humidity has wide and varied floral spectrum. The sources and nature of pollen allergens thus vary in different parts of the country. It is therefore imperative to collect information on pollen allergens of different regions for management of allergic ailments of local population. A great deal of work has been carried out at different eco-geographical regions in India with regard to allergenic pollen flora (Kasliwal et al. 1959; Shivpuri et al. 1979; Gupta et al. 1984; Shivpuri and Parkash 1967; Karmakar et al. 1994; Rawat et al. 2004; Sharma et al. 2009; Wani et al. 2010). However, no such data are available from Haryana, a northern state of India as it has not been explored for pollen allergens. This is also evident from the scarcity of published literature from this area.

Efforts have been made by the authors to initiate the work in this direction. As information on the prevalence of airborne pollen types is useful in the management of pollinosis, aerial pollen spectrum of Rohtak city (Fig. 1), Haryana was investigated at two sites for two consecutive years (July 2007–June 2009). Site I was located in a densely populated area of the city with poor vegetation cover, whereas site II was on the outskirts of the city with luxuriant vegetation in nearby vacant lands and cultivated fields. As a result, 31 pollen types belong to 23 angiospermic families were identified (Ahlawat et al. 2013). The present investigation was envisaged to gain an understanding of allergenicity of 22 pollen types using in vitro skin prick test (SPT) and in vivo enzyme-linked immuno-sorbent assay (ELISA) tests. Selection of the pollen types was done on the basis of their commercial availability and reported allergenicity. The information obtained will be of paramount importance as it can be used as a valuable tool in the diagnosis and treatment for local patients suffering from nasobronchial allergy.

2 Materials and methods

2.1 Antigen procurement

A total of 22 pollen types prevalent in the airspora of Rohtak city were selected for assessing their allergenicity among local patients. Sterilized antigenic extracts along with 50 % glycerinated phosphate buffer (1:10) and histamine dichloride (1 mg/ml) were procured from All Cure Pharmaceutical Company, Bahadurgarh, Haryana.

2.2 Skin prick test (SPT)

2.2.1 Selection of patients

A total of 150 patients with nasobronchial symptoms attending Asthma Clinic, P.G.I.M.S., University of Health Sciences, Rohtak, Haryana during 2009–2010 were selected for SPT. The selection of patients was based on prior physician diagnosis and a positive bronchoprovocation test. Patients selected for the study were advised not to take antihistamines and tranquilizers (at least 48 h) and other sympathomimetic drugs (at least 18–12 h) before the test. It was also ensured that patients selected have not received corticosteroids for last 3 weeks. Prior informed written consent for performing SPT was obtained from all the subjects. Confidentiality of the patients who underwent the tests was maintained. SPT was performed by a trained paramedic under the supervision of a senior doctor. The study was approved by the Ethical Committee of the concerned institute.

2.2.2 Inclusion/exclusion criteria

Patients in the age group of 18–60 years with a history of respiratory allergy were included for the test. Patients were excluded from the study if they were found to be pregnant, on antihistamines or daily steroids. Other exclusion criteria included dermatophagism, generalized eczema, history of severe allergic or anaphylaxis and chronic debilitating diseases.

2.2.3 Procedure of SPT

The patient was comfortably seated and the volar surface of the forearm was cleaned with 70 % alcohol. A small drop of antigenic extract was placed on the forearm, and a disposable hypodermic syringe (26 G) was inserted through the extract. The needle was held at 45° to the skin, bevel upwards, and the point was inserted about 0.5 mm. The needle was then lifted slightly so that there is tenting of the skin to allow adequate entry of the antigen beneath the epidermis. Similarly, other antigenic extracts were also tested on the patient. Glycerinated phosphate buffer (50 %) and histamine dichloride (1 mg/ml) were taken as negative and positive control, respectively. SPT was also performed on ten healthy non-atopic volunteers to

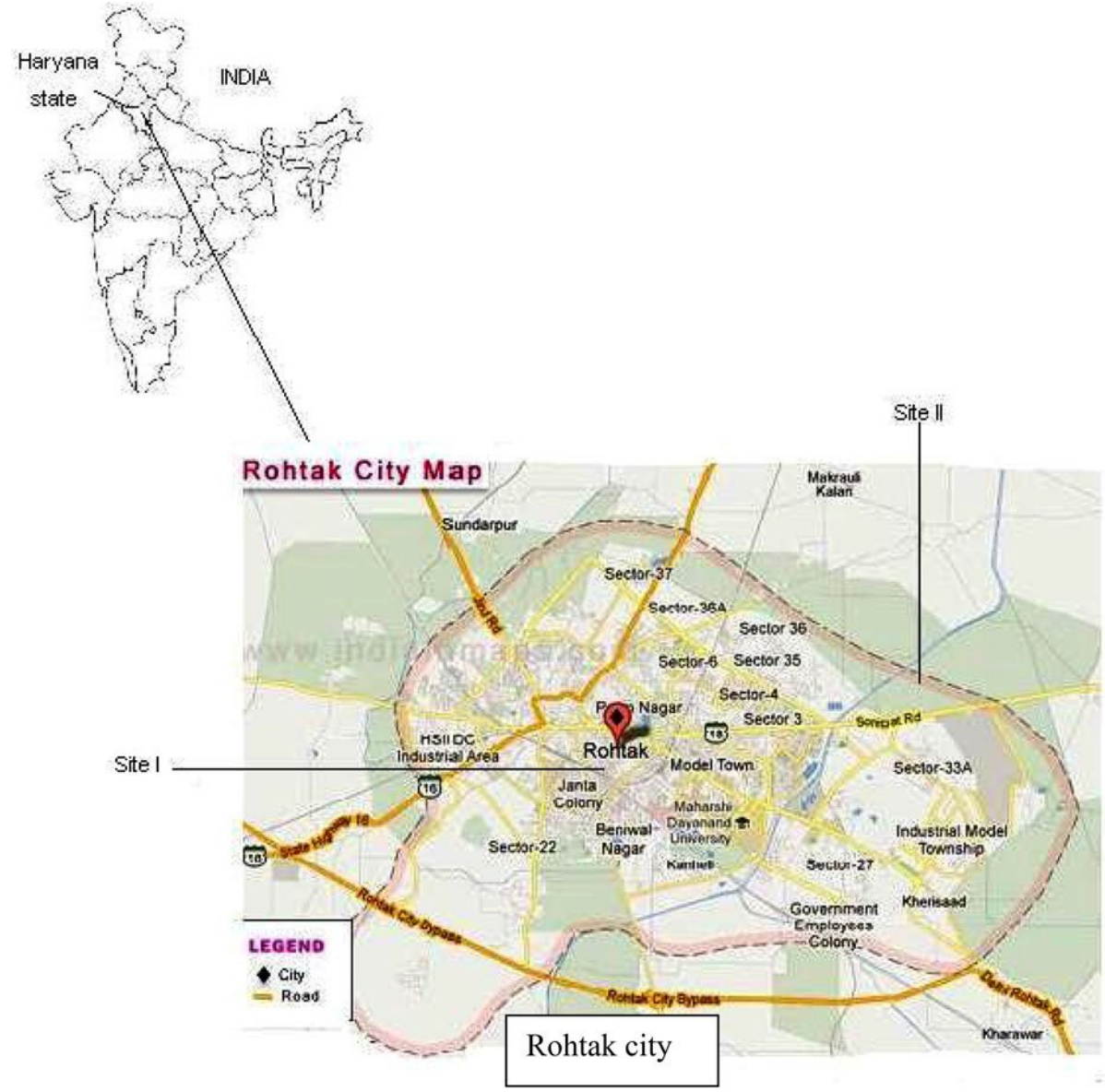


Fig. 1 Location of two pollen monitoring sites in Rohtak city, Haryana

ensure that each antigenic extract was devoid of non-specific irritants.

2.2.4 Grading of SPT

The skin reactions were allowed to develop for 15–20 min, and their intensity was measured with respect to the wheal and erythema produced. The wheal size was measured with a reaction gauge, and pseudopodia and erythema (if appeared) were also noted. The SPT results were graded as compared to negative and positive control as per the criteria given by Shivpuri (1962): wheal size same as negative control = negative; wheal size 2–3 mm = 1+; wheal

size 4–5 mm = 2+; wheal size 5–8 mm = 3+; wheal size >8 mm = 4+.

2.3 Estimation of protein

The soluble protein content of the antigenic extracts was estimated by Lowry's method with slight modification (Lowry et al. 1951). The soluble proteins were precipitated using 10 % phosphotungstic acid, and the precipitate was dissolved in 2 ml of 2 % sodium hydroxide solution. An aliquot was taken, and protein was estimated with the help of a standard curve prepared using serial dilutions of BSA (0–100 µg/ml) against OD values at 660 nm.

2.4 Enzyme-linked immuno-sorbent assay (ELISA)

2.4.1 Serum samples

Blood samples were collected from patients showing markedly positive skin reactions to any one of the pollen antigenic extracts after obtaining their written consent. Blood was allowed to clot for about 1 h at room temperature, and expressed serum was separated. Sera obtained were stored at −20 °C for future use. Blood was also collected from 5 normal individuals who had no history of respiratory allergy and showed no skin reactivity to the antigenic extracts. Sera obtained from these volunteers were used as control.

2.4.2 Procedure for ELISA

Enzyme-linked immuno-sorbent assay was performed as per the procedure outlined by Sepulveda et al. (1979). Polystyrene microtitre plates (Tarsons, 96 well) were coated with 100 µl of pollen antigen (200 µg protein/ml) and incubated overnight at 4 °C. Plates were thoroughly washed with 0.05 M phosphate buffer saline, and 100 µl of 1 % BSA was added to block the unbound sites. After washing, 100 µl of patient's sera (diluted to 1:10 with PBS containing 0.05 % BSA) was added to each well and incubated overnight at 4 °C. After repeated washing, each well was incubated with 100 µl antihuman IgE alkaline phosphatase (Sigma) diluted to 1: 1000 at 37 °C for 4 h. About 100 µl substrate p-nitrophenol phosphate (PNPP) (1 mg/ml) was added to each well for colour development. Reaction was terminated after 45 min with 5 N sodium hydroxide solution. OD value was measured at 405 nm using ELISA reader (Thermo Scientific Multiskan Ascent). Serum from normal volunteers was also analysed against all antigenic extracts. Depending upon percent binding, OD values obtained were classified into four groups as per the criteria of Kauffman et al. 1983 (>15 %, 15–30 %, 30–60 % and <60 %).

Calculation of Percent Binding:

$$\frac{A_o - A_y}{A_x - A_y} \times 100$$

where A_o, Absorbance of individual sera; A_x, Mean maximum absorbance obtained with 10 highly positive sera; A_y, Mean absorbance obtained with normal sera.

3 Results

3.1 Bioassay

In the present investigation, a total of 3,300 skin tests were performed on 150 patients with the antigenic extracts of 22 pollen types. The skin reactions were classified as positive, markedly positive and highly positive and are summarized in Table 1. Patients showing more than 2+ reactions were considered as markedly positive, and those showing 3+ and above reactions were considered as highly positive. Out of 150 patients, 49.4 % subjects showed 1+ and above skin reaction towards all antigenic extracts. The percent of patients showing markedly positive skin reactions to various pollen antigens varied from 4.6 to 20.6 %. High skin reactivity was shown towards antigenic extracts of *Cenchrus ciliaria* (20.6 %) followed by *Zea mays* (20 %) and *Pennisetum typhoides* (19.3 %). Antigenic extract of *Cassia occidentalis*, *Cynodon dactylon* and *Ricinus communis* exhibited marked skin reactivity in 18.6 % of patients. *Prosopis juliflora*, *Chenopodium murale*, *Amaranthus spinosus*, *Cassia fistula* and *Cassia siamea* showed 2+ and above reactions in 16.6, 15.3, 14.6 and 14.0 % of the subjects, respectively. Among all the antigenic extracts used for SPT, *Cyperus rotundus* showed least reactivity (4.6 %).

Table 1 Number and percentage of patients showing positive, markedly positive and highly positive skin reactions to different antigenic extracts

Sr.No.	Pollen antigens	Positive (1+ to 4+)		Markedly positive (2+ to 4+)		Highly positive (3+ and above)	
		(%)	No.	(%)	No.	(%)	No.
1.	*Amaranthus spinosus*	15.3	23	14.6	22	6	09
2.	*Artemisia scoparia*	11.3	17	8	12	2.6	04
3.	*Azadirachta indica*	11.3	17	9.3	14	2.6	04
4.	*Cannabis sativa*	12	18	11.3	17	3.3	05
5.	*Cassia fistula*	12.6	19	14	21	3.3	05
6.	*Cassia occidentalis*	17.3	26	18.6	28	6.6	10
7.	*Cassia siamea*	16	24	14	21	5.3	08
8.	*Cenchrus ciliaria*	21.3	32	20.6	31	8.6	13
9.	*Chenopodium album*	13.3	20	12.6	19	5.3	08
10.	*Chenopodium murale*	15.3	23	15.3	23	5.3	08
11.	*Cynodon dactylon*	18	27	18.6	28	6.6	10
12.	*Cyperus rotundus*	4.6	07	4.6	07	1.3	02
13.	*Eucalyptus tereticornis*	9.3	14	8.6	13	3.3	05
14.	*Imperta cylindrica*	12	18	12.6	19	4.6	07
15.	*Morus alba*	10	15	10	15	4	06
16.	*Parthenium hysterophorus*	11.3	17	11.3	17	4.6	07
17.	*Pennisetum typhoides*	18	27	19.3	29	8.6	13
18.	*Prosopis juliflora*	16.6	25	16.6	25	6.6	10
19.	*Ricinus communis*	19.3	29	18.6	28	7.3	11
20.	*Sorghum vulgare*	11.3	17	10	15	3.3	05
21.	*Xanthium strumarium*	14	21	13.3	20	4	06
22.	*Zea mays*	20.6	31	20	30	9.3	14

Total number of patients tested: 150

3.2 Immunoassay

Out of the 74 patients showing markedly positive skin reactions, only 52 consented for the in vitro study. Their sera were therefore screened for the presence of specific IgE antibodies against antigenic extracts to which they showed positive skin reactions. The mean value of OD obtained both for patients and control sera against each pollen antigen is listed in Table 2. Sera showing percent binding >15 % were considered as positive, and those showing more than 30 % binding were considered as highly positive for ELISA. Out of the total sera tested, 66.4 % were considered negative as they showed <15 % binding with the antigenic extracts. Only 5.5 % of the patient's sera tested showed >60 % binding and rest showed binding between 15 and 60 %. Higher grade of IgE binding (30 % and above) was shown to the antigenic extracts of *Z. mays*, *A. spinosus*, *R. communis* and *Xanthium strumarium* (Table 3).

3.3 Percent correlation between SPT and ELISA

Percent correlation between SPT and ELISA was found to vary from 15 to 69.2 % (Table 4). Greater than 50 % correlation was observed for *Artemisia scoparia*, *C. fistula*, *R. communis* and *Z. mays*. However, it was less for the pollen extracts of *C. siamea, P. typhoides*, *C. ciliaria, C. dactylon* and *C. rotundus*.

4 Discussion

Identifying aeroallergens of different geographical regions has been the main aim of several studies

Table 2 Mean values of O.D. shown by patient's sera and control for each antigenic extract

Antigens	No. of patients tested for ELISA	Mean O.D.	
		Patient	Control
Amaranthus spinosus	21	0.80	0.07
Artemisia scoparia	12	0.75	0.07
Azadirachta indica	14	0.69	0.04
Cannabis sativa	17	0.40	0.03
Cassia fistula	13	0.37	0.03
Cassia occidentalis	22	0.35	0.02
Cassia siamea	20	0.40	0.04
Cenchrus ciliaria	11	0.39	0.03
Chenopodium album	15	0.44	0.03
Chenopodium murale	19	0.81	0.08
Cynodon dactylon	22	0.30	0.03
Cyperus rotundus	04	0.68	0.05
Eucalyptus tereticornis	11	0.21	0.03
Imperta cylindrica	13	0.41	0.04
Morus alba	14	0.60	0.05
Parthenium hysterophorus	12	0.41	0.03
Pennisetum typhoides	23	0.57	0.04
Prosopis juliflora	24	0.69	0.07
Ricinus communis	21	0.78	0.05
Sorghum vulgare	13	0.25	0.02
Xanthium strumarium	17	0.15	0.04
Zea mays	27	0.70	0.08

carried out throughout the world for management of allergic ailments. This information is of immense importance as it helps the allergologists in selection of antigen for diagnosis and treatment for local patients suffering from allergic ailments. Such studies also gain momentum as aeroallergens and particularly pollen varies greatly depending upon geo-climatic conditions, and allergens used for SPT or specific allergen immunotherapy should be selected from those that are encountered in the patient's geographical area. Therefore, an attempt was made to identify the pollen allergens of Rohtak city. In the present investigation, skin prick method was adopted for bioassay as it is considered safe, less painful and gives more reliable results. Moreover, this methodology is widely used throughout the world to find out the sensitization in hypersensitive patients with allergic ailments (Singh et al. 1987; Wan-Ishlah and Gendeh 2005; Mandal et al. 2008; Fereidouni et al. 2009; Wani et al. 2010).

The percentage of patients showing markedly positive skin reactions to 22 antigenic extracts varied from 4.6 to 21.3 % with an average of 13.7 %. The overall incidence of SPT reactivity was highest against the antigenic extracts of pollen belonging to Poaceae family such as *C. ciliaria*, *Z. mays*, *P. typhoides* and *C. dactylon*. High prevalence of grass pollen allergy is also reported from different parts of the world (Shivpuri et al. 1979; Singh et al. 1987; Stam and Timmermans 1989; Hirsch et al. 2000; Erbas et al. 2007; Mandal et al. 2008). In compliance to our study, *Cynodon* sp., *Imperata* sp. and *Pennisetum* sp. have been reported to be common aeroallergens from a nearby station, Delhi (Dua and Shivpuri 1962; Shivpuri et al.1979; Singh et al. 1987; Rajkumar 2003). It is interesting to note that high allergenic response against pollen of Poaceae family also commensurates with their high aerial prevalence (20.65 %) in the airspora of Rohtak city (Ahlawat et al. 2013).

Chenopodium murale, *C. album* and *A. spinosus* were also among important allergens eliciting skin reactivity in 15.3, 12.6 and 14.6 % of the subjects, respectively. From Delhi, *A. spinosus* has been shown to be predominant allergen (Singh and Dahiya 2002). Sharma et al. (2009) also reported high positivity (23.5 %) against the antigenic extract of this pollen from Assam. *R. communis* and *P. juliflora* were also important pollen allergens as they showed high incidence of positivity among local patients. From Delhi, Shivpuri and Parkash (1967) reported *P. juliflora* to be a major source of pollinosis with 12 % patients showing a positive skin reaction to its pollen extract. *P. juliflora* and *R. communis* are also reported as predominant aeroallergens by other workers from the same region (Shivpuri et al. 1979; Singh et al. 1987; Dahiya and Singh 2003; Rawat et al. 2004). Studies carried out at Lucknow also showed *P. juliflora* to be a potent allergen (Agnihotri and Singh 1971; Prasad et al. 2009).

In our study, low incidence of positivity was registered against the antigenic extracts of *C. rotundus* and *Eucalyptus tereticornis*. Similar to our findings, *Eucalyptus* sp. did not show any markedly positive skin reaction among the patients of nasobronchial allergy from other parts of the country (Agnihotri and Singh 1971; Prasad et al. 2009).

Table 3 Percent binding of specific IgE against 22 pollen antigens in patients showing markedly positive skin reactions

Antigen used	No. of SPT +ve sera tested for ELISA	Percent Binding			
		0–15 %	15–30 %	30–60 %	>60 %
Amaranthus spinosus	21	13	2	4	2
Artemisia scoparia	12	07	3	1	1
Azadirachta indica	14	08	3	2	1
Cannabis sativa	17	13	2	1	1
Cassia fistula	13	07	3	2	1
Cassia occidentalis	22	18	3	1	0
Cassia siamea	20	17	2	1	0
Cenchrus ciliaria	11	08	2	1	0
Chenopodium album	15	11	2	2	0
Chenopodium murale	19	14	1	2	2
Cynodon dactylon	22	17	2	1	0
Cyperus rotundus	04	03	1	0	0
Eucalyptus tereticornis	11	07	1	2	1
Imperta cylindrica	13	08	3	2	0
Morus alba	14	09	3	1	1
Parthenium hysterophorus	12	08	2	2	0
Pennisetum typhoides	23	19	2	1	1
Prosopis juliflora	24	18	2	3	1
Ricinus communis	21	08	7	3	3
Sorghum vulgare	13	07	3	2	1
Xanthium strumarium	17	07	3	4	1
Zea mays	27	13	6	5	3

On reviewing the pattern of allergenicity exhibited by antigenic extracts of pollen types prevalent in the atmosphere of Rohtak city, it was observed that dominance of the pollen in airspora does not correlate with the level of skin sensitivity observed in patients exposed to these allergens. This is evident by the fact that pollen of *R. communis*, *P. juliflora* and *Cassia* sp. is not among the dominant types encountered in the present study, but they registered high incidence of allergenicity (12.6–19.3 %). On the other hand, aerial prevalence of pollen of *Morus alba* and *Parthenium hysterophorus* was quiet high, but they registered moderate skin reactivity. Similar observations have also been made from other parts of the country (Rajkumar 2003; Boral et al. 2004; Chauhan and Goyal 2006).

Techniques such as ELISA are widely advocated by researchers around the world for supporting the results of SPT (Rajkumar 2003; Wan-Ishlah and Gendeh 2005; Fereidouni et al. 2009). It is therefore recommended to use both the tests to gain a definitive diagnosis, as not all sensitivities could be identified with the use of SPT alone. SPT is more sensitive but less specific than serum IgE tests to diagnose allergenicity against potent antigens. Although total IgE is the original screening test for allergy, it is not 100 % specific as total IgE may be elevated due to parasitic infections or family history of atopy. Thus, ELISA is preferred as the specificity of the test is as high as 90 % for the inhaled allergens and is not influenced by concurrent drug treatment.

Heterogeneity was recorded in the binding of specific IgE antibodies of individual patient's sera to different antigenic extracts. This could be due to variation in the sensitivity of patients against the antigens (Peltre et al. 1982; Cookson 1999). The concordance between positive skin reactions and serum-specific IgE antibodies varied for different antigenic extracts. Antigenic extracts of *Artemisia scoparia*, *C. fistula*, *R. communis* and *Z. mays* showed

Table 4 Percent correlation between SPT and ELISA among individual pollen antigens

Pollen antigen	No. of SPT +ve sera tested for ELISA	No. of ELISA +ve sera (percent binding >15 %)	Correlation (%) between SPT and ELISA
Amaranthus spinosus	21	8	42.8
Artemisia scoparia	12	5	66.6
Azadirachta indica	14	7	46.6
Cannabis sativa	17	4	23.5
Cassia fistula	13	9	69.2
Cassia occidentalis	22	5	22.7
Cassia siamea	20	3	15
Cenchrus ciliaria	11	2	18.1
Chenopodium album	15	4	26.6
Chenopodium murale	19	5	26.3
Cynodon dactylon	22	4	18.1
Cyperus rotundus	04	3	20
Eucalyptus tereticornis	11	3	27.2
Imperta cylindrica	13	5	38.4
Morus alba	14	4	35.7
Parthenium hysterophorus	12	4	33.3
Pennisetum typhoides	23	4	17.3
Prosopis juliflora	24	5	25
Ricinus communis	21	13	61.9
Sorghum vulgare	13	7	46.1
Xanthium strumarium	17	8	47
Zea mays	27	14	51.8

more than 50 % correlation between in vitro and in vivo diagnostic tests. Similar to our results, Rawat et al. (2004) also observed 50 % correlation between skin test and in vitro test. Least concordance was observed against pollen extracts of *C. siamea, P. typhoides*, *C. ciliaria, C. dactylon* and *C. rotundus.* Sharma et al. (2009) reported 60 % correlation between the in vivo and in vitro tests for antigenic extract of *P. juliflora;* however, in this study, concordance observed was 25 %. In the present study, a moderate concordance was observed between SPT and ELISA, and it is speculated that SPT might give false positive results in some cases. Therefore, an in vitro diagnostic test should be used to confirm the incidence of allergenicity in such cases.

5 Conclusions

The present work is a pioneer attempt to assess the allergenicity of some of the pollen types prevalent in the atmosphere of Rohtak city. Grasses such as *C. dactylon* and *C. ciliaria* and some weeds such as *R. communis* and *Parthenium hyterophorus* are important aeroallergens of the city. As these are wide spread and most potential source of allergy, their management may help in controlling the planned developmental programmes for incidence of allergy. Trees such as *P. juliflora*, *C. occidentalis* and *Morus alba* are also important source of pollen allergens; therefore, urban plantation programmes should take into consideration this fact. In general, it was observed that the dominance of a particular pollen type in the air does not influence its allergenicity.

An important limitation of our work is that the allergenicity of all the pollen types present in the atmosphere of the study area was not tested. Nevertheless, there is a great scope for these results to be used by public health authorities in the prediction of potential pollen types as sources of respiratory allergy in susceptible individuals. Since we have not yet been able to find any study conducted on this subject in this region, we recommend that further comprehensive research is needed to understand the relationship between patients with respiratory allergies and airborne pollen and to guide the patients on the subject.

References

Agnihotri, M. S., & Singh, A. B. (1971). Observations of pollinosis in Lucknow with special reference to offending factors. *Aspects of Allergy and Applied Immunology, 5*, 135–141.

Ahlawat, M., Dahiya, P., & Chaudhary, D. (2013). Aeropalynological study in Rohtak city, Haryana, India: A 2 year study. *Aerobiologia, 29*(1), 121–129.

Boral, D., Chatterjee, S., & Bhattacharya, K. (2004). The occurrence and allergising potential of airborne pollen in West Bengal, India. *Annals of Agricultural and Environmental Medicine, 11*(1), 45–52.

Bunnag, C., Kongpatanakul, S., Jareoncharsri, P., Voraprayoon, S., & Supatchaipisit, P. (1997). A survey of allergic diseases in University students of Bangkok, Thailand. *Journal of Rhinology, 4*(2), 90–93.

Chauhan, S. V. S., & Goyal, R. (2006). Pollen calendar of Agra city with special reference to allergenic significance. *Journal of Environmental Biology, 27*(2), 275–281.

Chhabra, S. K., Gupta, C. K., Chhabra, P., & Rajpal, S. (1998). Prevalence of bronchial asthma in schoolchildren in Delhi. *Journal of Asthma, 35*(3), 291–296.

Cookson, W. (1999). The alliance of genes and environment in asthma and allergy. *Nature, 402*(6760 Suppl), B5–B11.

Cosentino, S., Fadda, M. E., & Palmas, F. (1995). Pollen and mould allergy in Southern Sardinia (Italy): Comparison of skin test frequencies and air sampling data. *Grana, 34*(5), 338–344.

D'Amato, G., Cecchi, L., Bonini, S., Nunes, C., Annesi-Maesano, I., Behrendt, H., et al. (2007). Allergenic pollen and pollen allergy in Europe. *Allergy, 62*(9), 976–990.

Dahiya, P., & Singh, A. B. (2003). Skin reactivity to antigenic extracts of *Ricinus communis* pollen obtained from diverse source materials. *Indian Journal of Allergy, Asthma and Immunology, 17*(2), 49–54.

Dua, K. L., & Shivpuri, D. N. (1962). Atmospheric pollen studies in Delhi area in 1958–1959. *Journal of Allergy, 33*, 507–512.

Erbas, B., Chang, J. H., Dharmage, S., Ong, E. K., Hyndman, R., Newbigin, E., et al. (2007). Do levels of airborne grass pollen influence asthma hospital admissions? *Clinical and Experimental Allergy, 37*(11), 1641–1647.

Fereidouni, M., Hossini, R. F., Azad, F. J., Assarehzadegan, M. A., & Varasteh, A. (2009). Skin prick test reactivity to common aeroallergens among allergic rhinitis patients in Iran. *Allergologia et Immunopathologia (Madr), 37*(2), 73–79.

Gaur, S. N., Sanjay, R., & Ashish, R. (2004). Prevalence of bronchial asthma and allergic rhinitis among school children in Delhi. *Internal Medicine Journal of Thailand, 20*, 8–13.

Gupta, M. C., Mittal, O. P., & Katiyar, S. K. (1984). Pollen allergy in Kanpur. *Aspects of Allergy and Applied Immunology, 17*, 99–105.

Hirsch, T., Neumeister, V., Weiland, S. K., von Mutius, E., Hirsch, D., Grafe, H., et al. (2000). Traffic exposure and allergic sensitization against latex in children. *The Journal of Allergy and Clinical Immunology, 106*(3), 573–578.

Hyde, H. A. (1969). Aeropalynology in Britain-an outline. *New Phytologist, 68*, 579–590.

Karmakar, P. R., Das, A., & Chatterjee, B. P. (1994). Placebo-controlled immunotherapy with *Cocos nucifera* pollen extract. *International Archives of Allergy and Immunology, 103*(2), 194–201.

Kasliwal, R. M., Sethi, J. P., & Sogani, I. C. (1959). Studies in atmospheric pollen: A daily census of pollens in Jaipur 1957-58. *Indian Journal of Medical Research, 47*, 515–521.

Kauffman, H. F., Beaumont, F., Meurs, H., van der Heide, S., & de Vries, K. (1983). Comparison of antibody measurements against *Aspergillus fumigatus* by means of double-diffusion and enzyme-linked immuno sorbent assay (ELISA). *The Journal of Allergy and Clinical Immunology, 72*(3), 255–261.

Lowry, O. H., Rosebrough, N. J., Farr, A. L., & Randall, R. J. (1951). Protein measurement with Folin phenol reagent. *The Journal of Biological Chemistry, 193*, 265–275.

Mandal, J., Chakraborty, P., Roy, I., Chatterjee, S., & Gupta-Bhattacharya, S. (2008). Prevalence of allergenic pollen grains in the aerosol of the city of Calcutta, India: A two year study. *Aerobiologia, 24*, 151–164.

Peltre, G., Lapeyre, J., & David, B. (1982). Heterogeneity of grass pollen allergens (*Dactylis glomerata*) recognized by IgE antibodies in human patients sera by a new nitrocellulose immunoprint technique. *Immunology Letters, 5*(3), 127–131.

Prasad, R., Verma, S. K., Dua, R., Kant, S., Kushwaha, R. A. S., & Agarwal, S. P. (2009). A study of skin sensitivity to various allergens by skin prick test in patients of naso-bronchial allergy. *Lung India, 26*(3), 70–73.

Puc, M. (2003). Characterisation of pollen allergens. *Annals of Agricultural and Environmental Medicine, 10*(2), 143–149.

Rajkumar, P. S. (2003). A study of skin sensitivity to various allergens by intradermal test in patients with respiratory allergy (Bronchial asthma and allergic rhinitis) in India. *Internal Medicine Journal of Thailand, 19*(3), 202–206.

Rawat, A., Singh, A., Roy, I., Kumar, L., Gaur, S. N., Ravindran, P., et al. (2004). Assessment of allergenicity to *Mallotus philippensis* pollen in atopic patients in India: A new allergen. *Journal of Investigational Allergology and Clinical Immunology, 14*(3), 198–207.

Sepulveda, R., Longbottom, J. L., & Pepys, J. (1979). Enzyme linked immunosorbent assay (ELISA) for IgG and IgE antibodies to protein and polysaccharide antigens of *Aspergillus fumigatus*. *Clinical Allergy, 9*(4), 359–371.

Sharma, D., Dutta, B. K., & Singh, A. B. (2009). Biochemical and immunological studies on eight pollen types from South Assam, India. *Iranian Journal of Allergy, Asthma and Immunology, 8*(4), 185–192.

Shivpuri, D. N. (1962). Comparative evaluation of sensitivity of common methods of diagnostic antigen tests in patients of respiratory allergy. *Indian Journal of Chest Diseases, 4*, 102.

Shivpuri, D. N., & Parkash, D. (1967). A study in allergy to *Prosopis juliflora* tree (Hindi name: Kabuli Keekar). *Annals of Allergy, 25*(11), 643–648.

Shivpuri, D. N., Singh, A. B., & Babu, C. E. (1979). New allergenic pollens of Delhi state, India and their clinical significance. *Annals of Allergy, 42*(1), 49–52.

Singh, A. B., & Dahiya, P. (2002). Antigenic and allergenic properties of *Amaranthus spinosus* pollen—a commonly growing weed in India. *Annals of Agricultural and Environmental Medicine, 9*(2), 147–151.

Singh, A. B., & Kumar, P. (2003). Aeroallergens in clinical practice of allergy in India. An overview. *Annals of Agricultural and Environmental Medicine, 10*(2), 131–136.

Singh, B. P., Singh, A. B., & Parkash, D. (1987). Skin reactivity to airborne pollen and fungal antigens in patients of Naso

Bronchial Allergy of Hill Regions (India). In N. Chandra (Ed.), *Atmospheric bio pollution* (pp. 125–134). Karad: Environmental Publication.

Stam, J., & Timmermans, A. (1989). The diagnosis of IgE-mediated allergy of the upper airways. *Nederlands Tijdschrift voor Geneeskunde, 133*(35), 1759–1760.

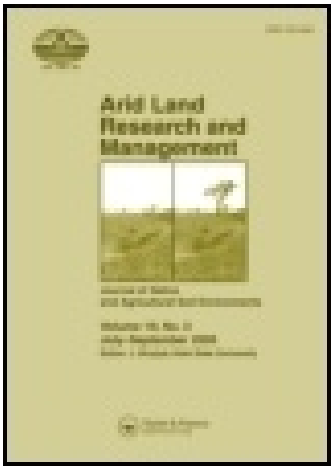
Vishwanathan, R. (1964). Definition, incidence, etiology and natural history of asthma. *Indian Journal of Chest Diseases, 6*, 108–124.

Wani, A. N., Munshi, A. H., Shah, Z. A., Rasool, R., & Hameed, M. (2010). Specific Immunoglobulin E (IgE) and skin prick test (SPT) responses against battery of pollen antigens in allergenic subjects of Kashmir—India. *African Journal of Basic and Applied Sciences, 2*(1–2), 30–32.

Wan-Ishlah, L., & Gendeh, B. S. (2005). Skin prick test reactivity to common airborne pollens and molds in allergic rhinitis patients. *The Medical Journal of Malaysia, 60*(2), 194–200.

Wong, G. W. K., Leung, T. F., & Fok, T. F. (2004). Asthma epidemiology and hygiene hypothesis in Asia. *Allergy and Clinical Immunology International, 16*(4), 155–160.

This article was downloaded by: [Western State Colorado University]
On: 11 November 2014, At: 19:57
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Arid Land Research and Management
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/uasr20

Nitrous Oxide Emissions from Soils of the Semi-Arid Highlands of Durango, Mexico: A Laboratory Study

Guillermo Herrera-Arreola [a b], Maria Soledad Vasquez-Murrieta [a], Carlos Cruz-Mondragon [a], Oswald Van Cleemput [c] & Luc Dendooven [a]

[a] CINVESTAV, Department of Biotechnology and Bioengineering, México D. F., México

[b] IPN.CIIDIR-Michoacán, Department of Natural Resources, Michoacán, México

[c] Laboratory of Applied Physical Chemistry, Ghent University, Gent, Belgium

Published online: 15 Jul 2008.

To cite this article: Guillermo Herrera-Arreola, Maria Soledad Vasquez-Murrieta, Carlos Cruz-Mondragon, Oswald Van Cleemput & Luc Dendooven (2008) Nitrous Oxide Emissions from Soils of the Semi-Arid Highlands of Durango, Mexico: A Laboratory Study, Arid Land Research and Management, 22:3, 179-194, DOI: 10.1080/15324980802182964

To link to this article: http://dx.doi.org/10.1080/15324980802182964

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms &

Conditions of access and use can be found at http://www.tandfonline.com/page/terms-and-conditions

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

Arid Land Research and Management, 22:179–194, 2008
Copyright © Taylor & Francis Group, LLC
ISSN: 1532-4982 print/1532-4990 online
DOI: 10.1080/15324980802182964

Taylor & Francis
Taylor & Francis Group

Nitrous Oxide Emissions from Soils of the Semi-Arid Highlands of Durango, Mexico: A Laboratory Study

Guillermo Herrera-Arreola[1,2], Maria Soledad Vasquez-Murrieta[1], Carlos Cruz-Mondragon[1], Oswald Van Cleemput[3], and Luc Dendooven[1]

[1]CINVESTAV, Department of Biotechnology and Bioengineering, México D. F., México
[2]IPN.CIIDIR-Michoacán, Department of Natural Resources, Michoacán, México
[3]Laboratory of Applied Physical Chemistry, Ghent University, Gent, Belgium

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

*Approximately 60% of Mexico (1.973×10^6 km^2) is arid or semi-arid with vegetation dominated by N_2 fixing shrubs, such as mesquite (*Prosopis juliflora*). Little is known, however, how these ecosystems contribute to production of nitrous oxide (N_2O), a known greenhouse gas. We investigated this by adding inorganic fertilizer (20 mg ammonium (NH_4^+) N kg^{-1} soil) to soil at different water contents (40%, 60%, 80%, and 100% of water-holding capacity (WHC)) sampled under the canopy of mesquite and outside its canopy, while production of carbon dioxide (CO_2) and nitrous oxide (N_2O), and dynamics NH_4^+, nitrite (NO_2^-), and nitrate (NO_3^-)) were monitored. The CO_2 production rate was 1.5 times larger for soil sampled under the canopy of mesquite compared to soil sampled outside the canopy of shrubs and lower in soil incubated at 100% WHC compared to the other treatments. Production of N_2O increased with increased water content within the first day, but decreased in soil at 80% and 100% WHC thereafter. The production of N_2O was 1.9 times larger for soil sampled under the canopy of mesquite compared to soil sampled outside its canopy. The addition of 20 mg NH_4^+-N increased production of N_2O 1.8-fold. It was found that the cumulative production of N_2O was larger from soil sampled under the canopy of mesquite than outside it when amended with inorganic fertilizer and increased with increased water content of the soil within a day. The relationship between the emission of CO_2 and N_2O, water-holding capacity are discussed.*

Received 21 June 2007; accepted 10 January 2008.

The authors thank J. Vermeulen, E. Gillis, and D. Demeyer for technical assistance. This work was done during a working visit at the Laboratory of Applied Physical Chemistry, Gent University, Belgium. The research was funded by the Flemish Interuniversity Council-Own Initiatives (VLIR-EI) Belgium and Cinvestav. M.S.V.-M., C.C.-M., G.H.-A., and L.D. received grant-aided support from VLIR-EI. M.S.V.-M. and G.H.-A. also received grant-aided support from Consejo Nacional de Ciencia y Tecnología (CONACyT) México.

Address correspondence to G. Herrera-Arreola, CINVESTAV, Departamento de Biotecnología y Bioingeniería, Avenida Instituto Politécnico Nacional 2508, C. P. 07000, México D. F., México. E-mail: dendoove@cinvestav.mx

Keywords C and N dynamics, inorganic N fertilizer, mesquite (*Prosopis juliflora*), production of N_2O, water content

More than 60% of Mexico ($1.973 \times 10^6\,km^2$) is arid or semi-arid containing some of the largest deserts in the world, such as the Sonoran ($0.310 \times 10^6\,km^2$) and Chihuahuan ($0.450 \times 10^6\,km^2$) deserts, and more than 50% of the population (more than 50 million people) live in these areas (Zárate, 1991). Of these arid and semi-arid areas, $0.256 \times 10^6\,km^2$ can be used for cattle raising (Jaramillo, 1984). These "grassland" ecosystems, however, with their limited and erratic precipitation are fragile and easily destroyed through overgrazing by domestic animals and pruning of the shrubs for wood. The distribution of plants in those arid ecosystems is not uniform (Bolton, Smith, Wildung, and Rogers, 1990). Islands of fertility exist around shrubs, mainly woody N_2-fixing legumes, such as mesquite (*Prosopis juliflora* (Sw.) DC.), huisache (*Acacia farnesiana* (L.) Willd.), catclaw (*Mimosa biuncifera* Benth.), where organic material has accumulated (Geesing, Felker, and Bingham, 2000; Reyes-Reyes et al., 2003). Nutrients become available through mineralization of leaves, facilitating development of other plants (Bolton et al., 1990). These other plants concentrate soil biota, which in turn play an important role in turnover of organic matter and soil nutrients (Tiedemann and Klemmedson, 1986). However, little is known about how these islands of fertility affect emissions of carbon dioxide (CO_2) and nitrous oxide (N_2O), known greenhouse gases, and the dynamics of N, i.e., ammonification and nitrification.

The N_2O contribute to at least 5% of the global warming observed (Sánchez et al., 2001). This gas has an approximate half-life of 120 yr and is effective in depletion of stratospheric ozone layer (Wrage et al., 2001). The atmospheric concentration of N_2O is now 313 ppbv and is increasing at a rate of 25% annually (Houghton et al., 1996). It has been reported that 65% to 70% of this gas could be coming from soils (Sánchez, Díez, Vallejo, and Cartagena, 2001). The concentration of CO_2, another greenhouse gas, has more than doubled in the atmosphere over the last 300 years (Steinkamp, Butterbach-Bahl, and Papen, 2001), and it is possible that the concentrations of this gas could double again before the end of this century (Jenkinson, Adams, and Wilde, 1991). Changes in soil use, water content, and application of inorganic fertilizer, amongst other factors, are known to affect production of N_2O and CO_2. Water is the most important factor to control nitrification and denitrification and thus production of N_2O (Smith, Thomson, Clayton, McTaggart, and Conen, 1998). It is well known that the addition of fertilizer to soil increases production of N_2O. For instance, Williams, Jarvis, and Dixon (1998) reported a 9.5-fold increase when NH_4NO_3 was added to soil at field capacity. Converting noncultivated soils to agricultural soils also increases the emissions of N_2O and CO_2, especially when N fertilizers are added (Steinkamp et al., 2001).

The municipality of Rodeo in Durango faces problems, such as overgrazing, erosion, desertification, loss of natural vegetation, and a decrease in soil fertility, as other parts in the north of Mexico so this area was selected for the investigation reported here. Three experimental sites in the municipality were defined and soil was sampled under the canopy of mesquite (*P. juliflora)* and outside of it and incubated in the laboratory at different water contents (40%, 60%, 80%, and 100% water-holding capacity (WHC)). The objective of this study was to investigate the effect of soil moisture content, addition of inorganic N fertilizer, and natural vegetation

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

on emissions of N_2O and CO_2 and dynamics of inorganic N. The water content used in the laboratory experiment is similar to that found in the field. As such, relationships between water content and trace gas emissions can be determined. These relationships, although not the objective of this study, can then be included in a C and N mineralization model (Dendooven, Murphy, and Powlson, 2000) to simulate trace gas emissions in the field.

Material and Methods

The Study Area

The sampling site is located in Rodeo (northern latitude 24° 57′–25° 27′ western longitude 104° 20′–104° 47′) in the state of Durango (Mexico). Its average altitude is 1480 m above sea level and is characterized by a semi-arid climate with a mean annual temperature of 20.1°C for the period 1940–2000. The maximum mean annual temperature over that period was 21.4°C and the mean annual minimum 17.6°C. Average annual precipitation was 394 mm yr^{-1} for the period 1940–2000 with a minimum of 129 mm yr^{-1} and a maximum 775 mm yr^{-1}. Precipitation is mainly from June through August (The National Statistical Institute of Geography and Informatics (INEGI), 2001).

In the west of the state of Durango woodland is predominant (47% of the total state), while in the east vegetation is mostly heath (21%) and grassland (15%). Most dominant shrubs are mesquite (*P. biuncifera*), huisache (*Acacia farnesiana*), catclaw (*Mimosa biuncifera*), American tarbush or tarwort (*Florensia cernua*), and ocotillo or candlewood (*Fouqueria splendens*), while grassland is dominated by blue grama grass (*Buteloua gracilis*), sideoats grama (*Bouteloua curtipendula*), and African foxtail or buffel grass (*Cenchrus ciliaris*). Only 10% of the soil is cultivated, mainly with maize and beans.

Woodlands and grasslands are grazed to different degrees by cattle and goats. The density of the foraging animals is defined by land ownership. On privately owned land, the amount of animals grazing is restricted, but common land is intensively grazed leaving the land vulnerable to erosion and deterioration (Ministry of Agriculture, Husbandry, Rural Development, Fishery and Food (SAGARPA), 2004).

Soil Sampling

Soil was sampled on 2nd of October 2002 from the 0–15 cm layer of three sites el Cardence (25° 00′–25° 40′N and 104° 29′–104° 30′ W), la Boquilla (25° 05′–25° 06′ N and 104° 32′–104° 33′ W), and San Pedro (25° 12′–25° 13′ N and 104° 40′–104° 41′ W) in the western site of the road from Durango to Parral (Chihuahua). The experimental sites had not been cultivated before. The first sampling took place by augering with a stony soil auger diameter 7 cm (Eijkelkamp, Netherlands) under the canopy of three isolated mesquite shrubs at 0.5 and 1 meter from the stem in four perpendicular directions selected at random. The mean height of the mesquite shrubs under which soil was sampled was 4.4 m with a canopy diameter of 4.9 m. The soil sampled under each shrub was pooled and kept separately for characterization (Table 1). The second sampling took place by augering 20 times between the vegetation, but outside their canopy and soil was pooled. All three shrubs at each site were found within one ha. Outside the canopy of the shrubs, American tarbush or

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

Table 1. Characteristics of soil sampled under and outside canopy of mesquite (*Prosopis juliflora*) in Rodeo (Durango, Mexico)

	Under Canopy of Mesquite[a]	Outside the Canopy[b]
Bulk density (kg dm^3)	1.12	1.14
Porosity (%)	58	57
Total nitrogen content (g kg^{-1} dry soil[a])	1.68	1.42
Organic C content (g kg^{-1} dry soil)	24.6	20.6
Particle size distribution: sand (g kg^{-1})	810	790
silt (g kg^{-1})	140	180
clay (g kg^{-1})	50	30
USDA classification	Loamy sand	Loamy sand
pH (1:2.5 soil:water)	7.3	6.9
Cation exchange capacity (mmol[c] kg^{-1})	22.9	26.6
Electrolytic conductivity (dS m^{-1})	0.24	0.25
Water-holding capacity (g kg^{-1} dry soil)	760	670
Calcium (g kg^{-1} dry soil)	37.2	41.0
Magnesium (g kg^{-1} dry soil)	2.62	3.17
Sodium (g kg^{-1} dry soil)	0.28	0.96
Potassium (g kg^{-1} dry soil)	1.73	0.94

[a] The mean of soil sampled under three shrubs found at three sites el Cardence, la Boquilla, and San Pedro (n = 9).
[b] The mean of soil sampled outside three shrubs found at three sites el Cardence, la Boquilla, and San Pedro (n = 9).
[c] Dry soil was oven dried at 105°C.

tarwort (*Flourensia cernua*) and ocotillo or candlewood (*Fouqueria splendens*), nopal (*Opuntia* spp.), tree cholla or cardence (*Opuntia imbricata*) were found. As such, 18 soil samples were obtained. Soil was sampled under the canopy of three shrubs and outside their canopy from three sites (el Cardence, la Boquilla, and San Pedro).

Experimental Set-Up and Treatments

The 18 soil samples, approximately 12 kg, were taken to the laboratory and treated as follows. The soil was sieved (5 mm) and characterized (Table 1). The three soil samples taken under the canopy of the shrubs and the three taken outside the canopy from each site Cardence, la Boquilla, San Pedro were pooled so that six soil samples remained, i.e., three sites and under or outside the canopy. One hundred and twenty subsamples of 20 g of each soil sample, i.e., six, were added to 200-ml glass flasks.

Soil in 30 glass flasks was adjusted to 40% WHC, 30 to 60% WHC, 30 to 80% WHC, and 30 to 100% WHC by adding distilled water. Half of the soil at the different water contents was then amended with 20 mg N kg^{-1}. Three flasks were chosen at random from each treatment and inorganic-N (NH_4^+, NO_2^-, and NO_3^-) was extracted from soil by adding 100 ml 2 M potassium chloride (KCl), shaken for 60 min and filtered through Whatman No. 42 paper® (Whatman PIC. Part of GE Healthcare, New Orleans). These provided zero-time results. The remaining 96 jars were sealed and stored in the dark for a maximum of 14 days at 25 ± 1°C. An

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

additional 12 glass jars without soil served as controls to account for the CO_2 and N_2O in the atmosphere. After 1, 3, 7, and 14 days, three jars were selected at random from each treatment and the headspace was analyzed for N_2O and CO_2. The flasks were opened and soil was extracted for inorganic-N with 100 ml 2 M KCl solution as described for zero-time samples.

Chemical and Physical Analyses

Soil pH was measured in 1:2.5 soil-H_2O suspension using a glass electrode. Total C was determined by oxidation with potassium dichromate ($K_2Cr_2O_7$) and titration of excess dichromate with ammonium ferrosulfate ($(NH_4)_2FeSO_4$), and inorganic C by adding 5 ml 1 M hydrochloric acid (HCl) solution to 1 g air-dried soil and trapping of CO_2. The CO_2 in the 1 M NaOH was determined by titration with 0.1 M HCl. Total N was measured by the Kjeldhal method using concentrated H_2SO_4, K_2SO_4, and HgO to digest the sample. The NH_4^+, NO_2^-, and NO_3^- in the 2 M KCl extract were determined colorimetrically on a Skalar automatic analyzer (Skalar, The Netherlands). Soil particle size distribution was measured by the hydrometer method. The WHC was measured on soil samples water-saturated in a funnel and left to stand overnight to drain freely and was defined by differences of weight. It was determined to incubate soil at 40%, 60%, 80%, and 100% WHC. The EC was measured in saturated soil extract. References to the techniques used in this experiment can be found in Reyes-Reyes et al. (2003).

The headspace was analyzed for N_2O on a Shimadzu GC-14B (Shimadzu, Japan) gas chromatograph fitted with an electron capture detector. N_2O was separated from the other gases on a 1-m Porapack Q column and the temperature values of the detector, injector, and oven were 250, 100, and 35°C, respectively. The carrier gas helium was flowing at 55 ml min^{-1} and N_2O dissolved in soil-water was accounted for as described by Moraghan and Buresh (1977).

The amount of Na, K, Mg, and Ca was measured in a subsample of 0.5 g soil after microwave digestion (Q Lab 6000, Questron, USA) with 10 ml nitric acid (HNO_3) and 2 ml 10% hydrogen peroxide (H_2O_2) (USEPA, 1998, Method 3051). Total Na, Mg, Ca, and K were measured by atomic absorption spectrometry (Varian Spectra A220 Fast Sequential, California, USA). The plastic beakers used for analysis of metals were new and treated with 2% HNO_3 24 h, before use.

Statistical Analysis

Cumulative production of CO_2 and N_2O was regressed on elapsed time using a linear regression model, which was forced to pass through the origin but allowed different slopes (production rates) for each treatment. This approach is supported by theoretical consideration that no CO_2 and N_2O was produced at time-zero. The CO_2 and N_2O in flasks incubated without soil accounted for the CO_2 and N_2O in the atmosphere. Significant differences between cumulative CO_2 and N_2O production rates were determined using Proc MIXED (SAS Institute, 1989).

Significant difference for the treatment on concentrations of NH_4^+, NO_2^-, and NO_3^- was determined by analysis of variance (ANOVA) and based on the least significance difference using the general linear model procedure (PROC GLM, SAS Institute, Cary, NC, 1994). This procedure can be used for an ANOVA for unbalanced data, i.e., when some data are missing.

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

The emission of N_2O and CO_2 after 1 day was related to the WHC by fitting a quadratic function to the data:

$$\text{Emission of } N_2O \text{ or } CO_2 = b \times WHC + c \times (WHC)^2.$$

Results

Cumulative Production of CO_2

The cumulative production of CO_2 showed an increase after 1 day most accentuated in soil sampled under the canopy of mesquite (Figure 1A, B, C, and D). The subsequent increase was lower. The CO_2 production rate was 1.5 times and significantly larger for soil sampled under the canopy of mesquite compared to soil sampled outside the canopy of shrubs ($P < 0.05$). The application of 20 mg NH_4^+-N kg^{-1} soil had no significant effect on cumulative production of CO_2 ($P < 0.05$). CO_2 production rate was lower in soil incubated at 100% WHC compared to the other treatments.

Cumulative Production of N_2O

The cumulative production of N_2O from the unamended soil incubated at 40% and 60% WHC sampled under canopy of mesquite shrub showed an increase at day 1 (Figure 2A). The emission of N_2O did not change significantly thereafter

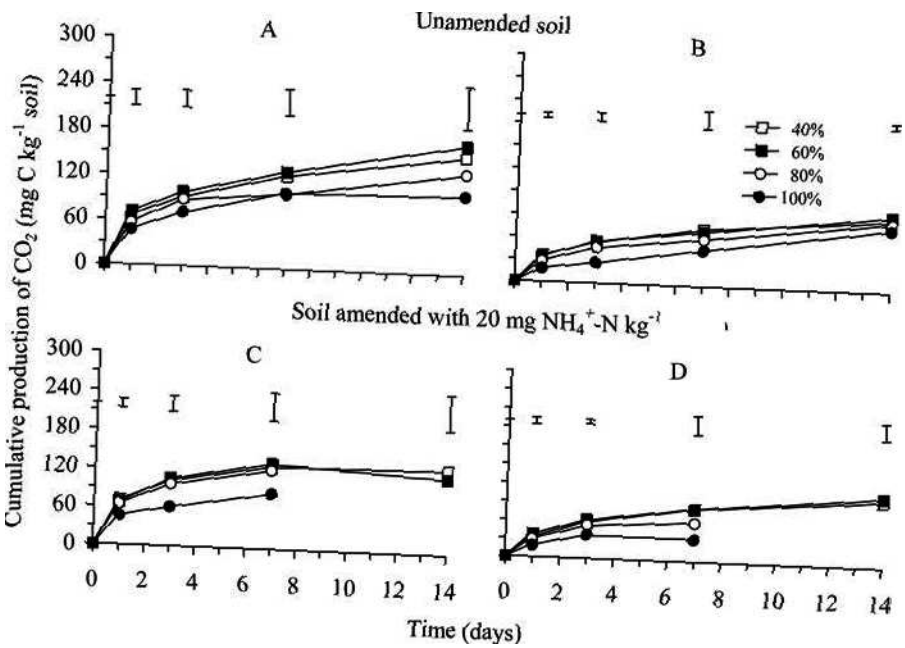


Figure 1. Cumulative production of CO_2 (mg C kg^{-1} soil) from soil sampled (A) under the canopy of mesquite shrubs and (B) outside the canopy of shrubs, (C, D) amended with 20 mg NH_4^+-N kg^{-1} soil, respectively, incubated at 40% water-holding capacity (WHC) (□), 60% WHC, (■), 80% WHC (○), and 100% WHC (●) at 25°C for 14 days. Error bars are minimum significant differences for n = 9 ($P < 0.05$).

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

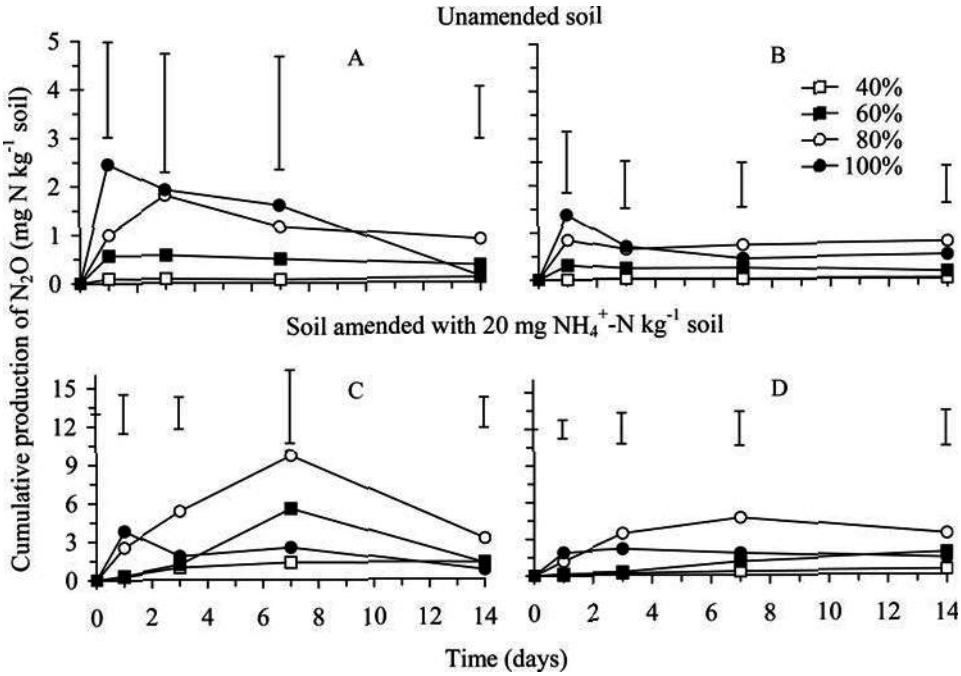


Figure 2. Cumulative production of N_2O (mg N kg^{-1} soil) from soil sampled (A) under the canopy of mesquite shrubs and (B) outside the canopy of shrubs, (C, D) amended with 20 mg NH_4^+-N kg^{-1} soil, respectively, incubated at 40% water-holding capacity (WHC) (□), 60% WHC, (■), 80% WHC (○), and 100% WHC (●) at 25°C for 14 days. Error bars are minimum significant differences for n = 9 ($P < 0.05$).

($P < 0.05$). The cumulative production of N_2O from the unamended soil incubated at 80% and 100% WHC sampled under canopy of mesquite shrub showed a larger increase at the onset of the incubation, but the concentration decreased thereafter more accentuated in soil incubated at 100% than at 80% WHC. The cumulative emission of N_2O from the soil sampled outside the canopy showed the same trends as for soil sampled under the canopy, but the maximum production and the subsequent decrease was smaller (Figure 2B).

The addition of inorganic N increased the cumulative production of N_2O in each treatment for soil sampled under the canopy of the shrub and outside it (Figure 2C, D). The increase in the cumulative emission of N_2O for soil amended with inorganic N was larger from soil sampled under a canopy of mesquite shrub compared to soil sampled outside the canopy. The cumulative production of N_2O from soil sampled under a canopy of mesquite shrub added with inorganic N was different for soil incubated at different water contents (Figure 2C). In soil incubated at 40% WHC, cumulative production of N_2O increased for the entire incubation. For soil incubated at 60% and 80% WHC it increased until day 7 and then decreased, while for soil incubated at 100% WHC cumulative production of N_2O reached a maximum after 1 day and decreased thereafter. The cumulative production of N_2O from soil sampled outside the canopy of mesquite incubated at 40% and 60% WHC, increased for the entire incubation, for soil incubated at 80% WHC it increased until day 7 and then decreased, while for soil incubated at 100% WHC cumulative production of N_2O reached a maximum after 1 day and decreased thereafter (Figure 2D).

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

Dynamics of NH_4^+, NO_2^- and NO_3^-

The concentration of NH_4^+ in the unamended soil sampled under the canopy of mesquite showed a small drop at day 1, but increased again thereafter (Figure 3A). In soil sampled outside the canopy it showed a similar drop after 1 day, but no subsequent increase thereafter (Figure 3B). Changes, however, were small and smaller than 2 mg NH_4^+-N kg^{-1} soil. The concentration of NH_4^+ in soil sampled under the canopy of mesquite amended with 20 mg NH_4^+-N kg^{-1} showed a drop after the first day with a more gradual decrease thereafter, while the decrease was more gradual for soil sampled outside the canopy (Figure 3C, D). The decrease in concentration of NH_4^+ in soil amended with 20 mg NH_4^+-N kg^{-1} incubated at 100% WHC was slower compared to the other treatments (Figure 3C, D).

The concentration of NO_2^- remained below 0.2 mg NO_2^--N kg^{-1} in unamended soil sampled under a canopy of mesquite and outside of it (Figure 4A, B). Similar low concentrations of NO_2^- were found in soil sampled under a canopy of mesquite and amended with 20 mg NH_4^+-N (Figure 4C). In soil sampled outside the canopy of mesquite and amended with 20 mg NH_4^+-N incubated at 40%, 60%, and 80%, WHC concentrations of NO_2^- increased for the first 3 days and decreased sharply thereafter

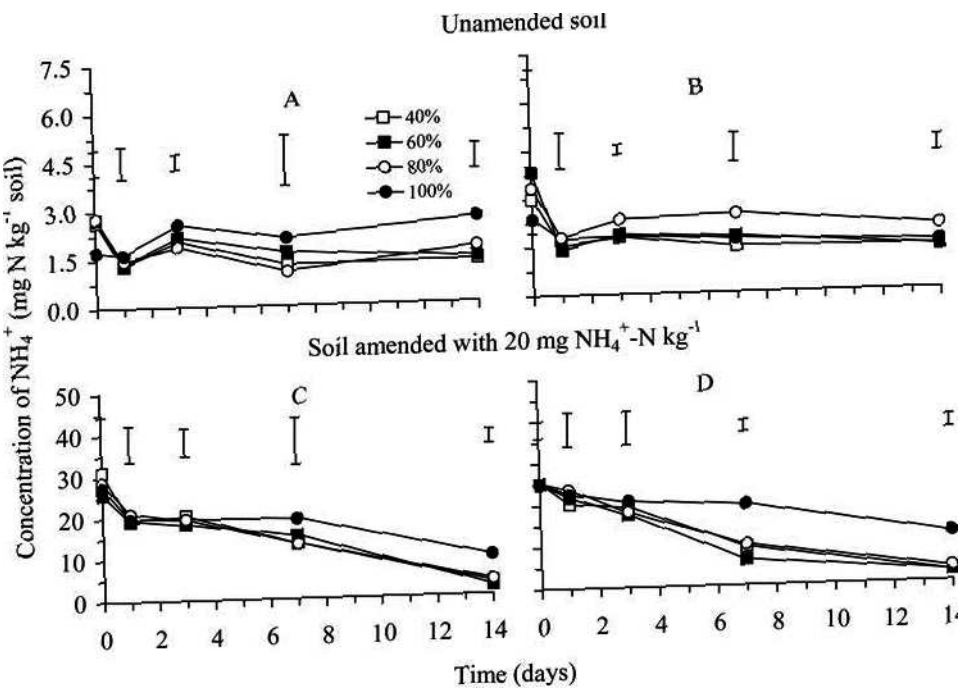


Figure 3. Concentrations of NH_4^+ (mg N kg^{-1} soil) from soil sampled (A) under the canopy of mesquite shrubs and (B) outside the canopy of shrubs, (C, D) amended with 20 mg NH_4^+-N kg^{-1} soil, respectively, incubated at 40% water holding capacity (WHC) (□), 60% WHC, (■), 80% WHC (○), and 100% WHC (●) at 25°C for 14 days. Error bars are minimum significant differences for n = 9 ($P < 0.05$).

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

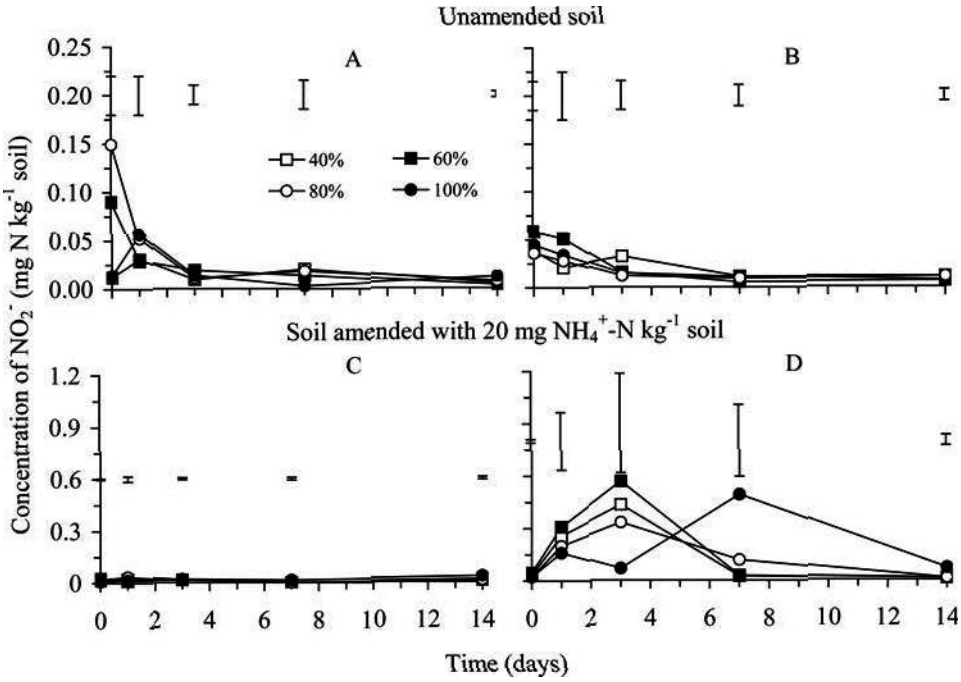


Figure 4. Concentrations of NO_2^- (mg N kg^{-1} soil) from soil sampled (A) under the canopy of mesquite shrubs and (B) outside the canopy of shrubs, (C and D) amended with 20 mg NH_4^+-N kg^{-1} soil, respectively, incubated at 40% water-holding capacity (WHC) (□), 60% WHC, (■), 80% WHC (○), and 100% WHC (●) at 25°C for 14 days. Error bars are minimum significant differences for n = 9 ($P < 0.05$).

(Figure 4D). In soil incubated at 100%, WHC a similar pattern was observed, but a maximum was found after 7 days.

The concentration of NO_3^- increased over time in soil sampled under a canopy of mesquite incubated at 40% WHC (Figure 5A). In soil incubated at 60% and 80%, the concentration of NO_3^- reached a maximum after 7 days and showed a small decrease thereafter. Concentrations of NO_3^- decreased in soil incubated at 100% WHC at the onset of the incubation and remained smaller than 0.1 mg NO_3^- kg^{-1} after 3 days. In soil sampled outside the canopy of mesquite incubated at 40%, 60%, and 80% WHC, concentrations of NO_3^- showed a small increase over time (Figure 5B). Concentrations of NO_3^- in soil incubated at 100% WHC decreased and remained smaller than 0.1 mg NO_3^- kg^{-1} after 3 days. Concentrations of NO_3^- (mean of the four treatments) in soil sampled outside the canopy of mesquite were significantly lower than in soil sampled under its canopy ($P < 0.05$). The concentrations of NO_3^- in soil amended with 20 mg NH_4^+-N showed the same pattern for soil sampled outside the canopy and under it (Figure 5C, D). In soil incubated at 40%, 60%, and 80% WHC, the concentration of NO_3^- increased over time, while in soil incubated at 100% WHC, it decreased and increased again at the end of the incubation. Concentration of NO_3^- in soil incubated at 100% WHC were significantly lower than in the other treatments ($P < 0.05$).

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

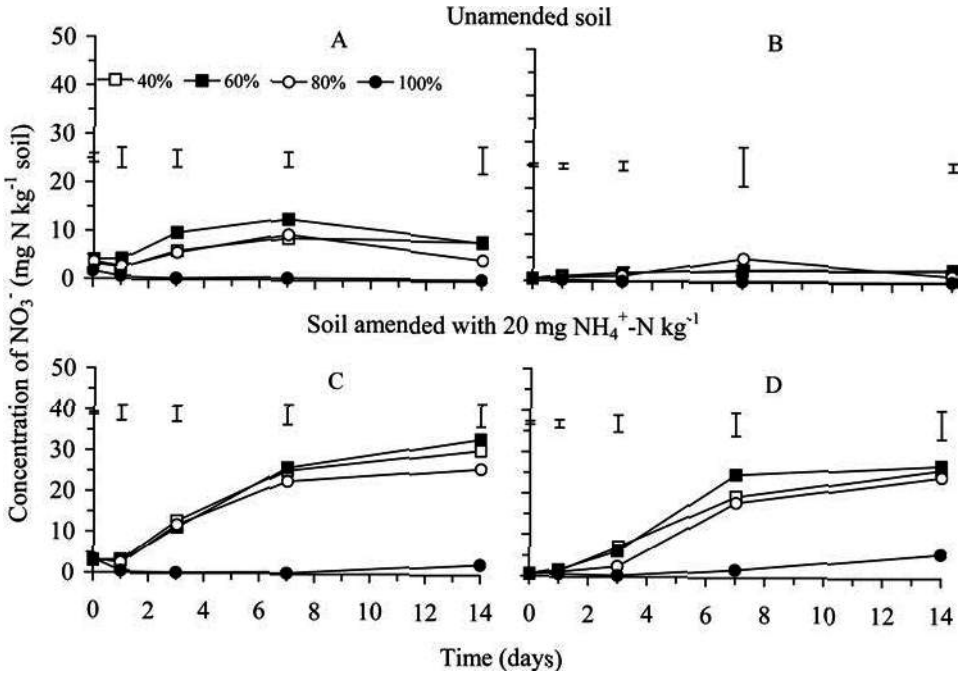


Figure 5. Concentrations of NO_3^- (mg N kg^{-1} soil) from soil sampled (A) under the canopy of mesquite shrubs and (B) outside the canopy of shrubs, (C and D) amended with 20 mg NH_4^+-N kg^{-1} soil, respectively, incubated at 40% water-holding capacity (WHC) (□), 60% WHC, (■), 80% WHC (○), and 100% WHC (●) at 25°C for 14 days. Error bars are minimum significant differences for n = 9 ($P < 0.05$).

Emission of N_2O and CO_2 in the Function of WHC

The emissions of CO_2 after 1 day in function of the WHC were larger from soil sampled under the canopy of mesquite, but not affected by the application of inorganic N (Figure 6). As such, the constants in the quadratic equations were larger for soil sampled under the canopy compared to sampled outside of it, but similar when inorganic N was added (Table 2).

The emissions of N_2O after 1 day in function of the WHC were larger from soil sampled under the canopy of mesquite compared to soil sampled outside the canopy and larger when amended with inorganic N than when left unamended (Figure 6). The constants in the quadratic equations thus followed the same pattern, i.e., larger for soil sampled under the canopy of mesquite and larger when inorganic N was added (Table 2).

Discussion

Emissions of CO_2

A rapid increase in cumulative production of CO_2 at the beginning of an incubation has often been observed (Wirén-Lehr, Von Scheunert, and Dörfler, 2002). In this experiment, the addition of water and soil handling will render some easily

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

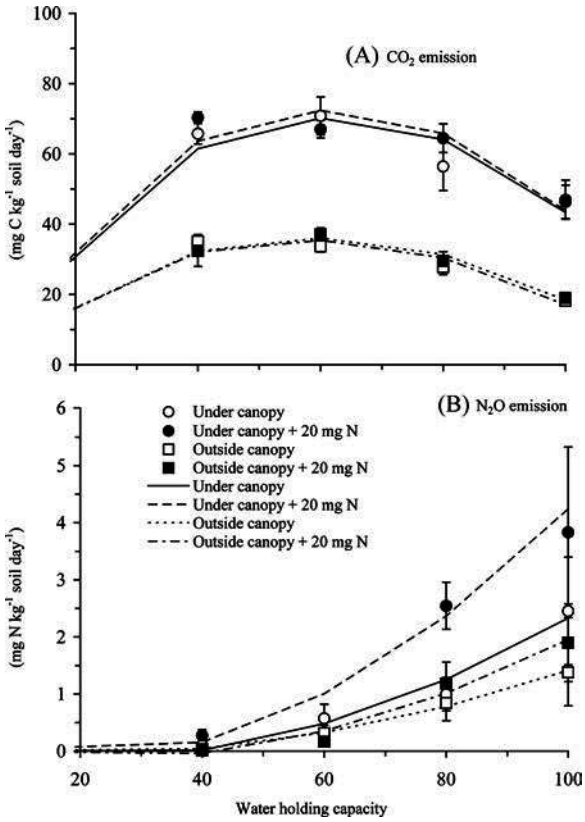


Figure 6. (A) Emission of CO_2 and (B) N_2O incubated at 25°C for 1 day in function of the water-holding capacity from soil sampled under the canopy of mesquite shrubs (○) and amended with 20 mg N kg^{-1} soil (●), or outside the canopy of shrubs (□) and amended with 20 mg N kg^{-1} soil (■). Error bars are minimum significant differences ($P < 0.05$).

decomposable soil organic matter available, which will increase C mineralization (Azam, Simmons, and Mulvaney, 1995). Application of water to air-dried soil stimulates and increases the microbial activity, which will decompose the microorganisms

Table 2. Emission of N_2O and CO_2 after 1 day as a function of the water-holding capacity (WHC) for soil sampled under and outside canopy of mesquite (*Prosopis juliflora*) in Rodeo (Durango, México) amended with or without 20 mg N kg^{-1} soil incubated at 25°C

	Emission of CO_2		Emission of N_2O	
	A	B	A	B
Under the canopy	2.2735	−0.0184	−0.0149	0.000382
Under the canopy + 20 mg N kg^{-1} soil	2.3591	−0.0192	−0.0218	0.000642
Outside the canopy	1.2204	−0.0105	−0.0077	0.000218
Outside the canopy + 20 mg N kg^{-1} soil	1.2243	−0.0104	−0.0147	0.000342

[a] Quadratic equation emission of N_2O and $CO_2 = A \times WHC + B \times (WHC)^2$.

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

killed upon drying (Parton et al., 1996). It can also change the amount and quality of dissolved organic matter (Marschner and Noble, 2000), which is an easily available substrate for soil microorganisms (Metting, 1993). As the size of an easily decomposable fraction decreased rapidly so did the rate of C mineralization.

The cumulative emission of CO_2 was larger from soil sampled under a canopy of mesquite shrub compared to soil sampled outside the shrub as well as the percentage of soil organic C mineralized. The percentage of soil organic C mineralized was 0.69% for soil sampled under a canopy of the shrub incubated at soil water content equivalent to 60% WHC and was 0.48% for soil sampled outside it after 14 days. This indicated that the organic material under the canopy of mesquite was easier to decompose than outside of it. The organic material in soil under the canopy of mesquite was mostly leaves and thus an easily decomposable C substrate, while that found in soil outside the canopy was degraded and much more resistant.

Limitation in H_2O reduces microbial activity at lower water contents of the soil (Parton et al., 1996). No such inhibition was found in this experiment as C mineralization was similar in soil incubated at 40%, 60%, and 80% WHC. At 100% WHC, diffusion of O_2 was restricted stimulating denitrification and efficiency for C or the amount of C used for metabolic activity is known to be lower under anaerobic conditions (Anderson, Poth, Homstead, and Burdige, 1993). As such, emission of CO_2 from soil incubated at 100% WHC was lower than from soil incubated at lower water contents.

Although the emission of CO_2 was larger for soil sampled under the canopy of mesquite, the relationship between CO_2 production and WHC was similar (Figure 6). The addition of inorganic N fertilizer to soil sometimes increases emissions of CO_2 indicating an N-depleted soil (Conde et al., 2005). Normally, however, C mineralization is not affected by inorganic N addition as found in the experiment reported here. As such, the emission of CO_2 in the function of WHC was independent of the addition of inorganic N fertilizer.

A quadratic function was fitted to data assuming that the CO_2 was 100% at 60% WHC. The obtained equation was emission CO_2 (mg C kg^{-1} soil) $= 3.4131 \times \text{WHC} - 0.0285 \times (\text{WHC})^2$. As such, whenever emission of CO_2 at a given soil water content is obtained, the amount that will be produced at any other given soil water content can be calculated with this equation.

Dynamics of Inorganic N

The N mineralization (sum of NH_4^+, NO_2^-, and NO_3^-) in soil sampled under a canopy of mesquite was low and only 3 mg N kg^{-1} soil (mean of N mineralized in soil incubated at 40% and 60% WHC) was released within 14 days. In soil sampled outside the canopy of mesquite, no N mineralization was found. Considering the large amounts of C mineralized, most of the N mineralized appeared to be immobilized into the microbial biomass.

The activity of NH_4^+ and NO_2^- oxidizers appeared to be larger in soil sampled under the canopy of mesquite than outside of it. The larger turnover of N under the canopy of mesquite shrub will favor a larger population of nitrifiers compared to soil sampled outside the canopy.

The emission of N_2O after 1 day increased with increased WHC (Figure 6; Table 2). The net emission of N_2O from soil depends on the rate of N_2O formation, the rate of diffusion out of the soil, and the consumption of N_2O through denitrification

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

(Bandibas, Vermoesen, Degroot, and Van Cleemput, 1994). When O_2 concentrations drop below a critical value, denitrification is induced and nitrification is inhibited, but not necessarily absent, as nitrifiers are microaerophilic so nitrification and denitrification can take place at the same time (Kuenen and Robertson, 1994). The rate of N_2O reduction is low at the onset of anaerobiosis (marginal anaerobiosis), so N_2O can accumulate in the environment (Van Cleemput, 1998). It is only after a certain time that reduction matches production (Dendooven, Duchateau, and Anderson, 1996). At 100% WHC, nitrification as witnessed by the decrease in NH_4^+ was inhibited, but not stopped. Under these microaerophilic conditions, some autotrophs oxidize NH_4^+ to NO_2^-, which is then reduced to N_2O and N_2, i.e., they are nitrifiers-denitrifiers (Wrage, Velthof, van Beusichem, and Oenema, 2001). At 100% WHC, most of the NO_3^- formed was reduced to N_2O and N_2. The larger microbial activity as witnessed by the production of CO_2 in the soil sampled under a canopy of mesquite will consume more O_2, thus further stimulating the reduction of NO_3^- or NO_2^- and thus further increasing the emission of N_2O (Figure 2A, C). At water contents of 40%, 60%, and 80% WHC, concentrations of NO_3^- increased significantly in soil amended with 20 mg NH_4^+-N ($P < 0.05$) (Figure 5C, D), indicating that nitrification was larger than denitrification, while at 100%, concentrations of NO_3^- decreased so denitrification was larger than nitrification. At 40% WHC, production of N_2O did not change significantly throughout the whole experiment, so it was related to nitrification-denitrification with a minimum or no N_2O reduction ($P < 0.05$). At 60%, 80%, and 100% WHC, reduction of N_2O became quickly larger than its production.

Arid and semi-arid soils have not been studied frequently, so emissions of N_2O and other greenhouse gases have not often been reported (Geesing et al., 2000). The C and N content of soils have a great effect on the N_2O production (Williams et al., 1998; Hadi et al., 2000; Williams et al., 1998), but not always (McLain and Martens, 2005). Virginia, Jarrel, and Franco-Vizcaino (1982) reported a more than 50-fold increase in production of N_2O for soil sampled under a canopy of mesquite with 5 g C kg^{-1} compared to soil with 2.7 g C kg^{-1}. McLain and Martens (2005), however, found a similar production of N_2O for soil sampled under mesquite with 29.9 g C kg^{-1} and from an open site with 5.83 g C kg^{-1}. In this experiment, the production of N_2O was larger for soil sampled under the canopy of mesquite compared to soil sampled outside its canopy independent of the application of 20 mg N, but only 1.8 times (mean of all treatments). Microbial activity as witnessed by the production of CO_2 and the dynamics of N was larger for soil sampled under a canopy of the shrub than outside it, so more N_2O will be produced, both through nitrification and denitrification. Consequently, the constants in the quadratic equation between the emission of N_2O and WHC were larger for soil under a canopy compared to soil sampled outside the canopy (Figure 6; Table 2).

A quadratic function was also fitted to data assuming that the N_2O was 100% at 100% WHC. The obtained equation was emission N_2O (mg N kg^{-1} soil) $= -0.6444 \times \text{WHC} + 0.0165 \times (\text{WHC})^2$. As such, whenever emission of N_2O at a given soil water content is obtained, the amount that will be produced at any other given water content below 100% WHC can be calculated with this equation.

It is well known that the addition of fertilizer to soil increases production of N_2O as the dynamics of N increases. For instance, Williams et al. (1998) reported a 9.5-fold increase when NH_4NO_3 was added to soil at field capacity. The addition of inorganic N in this experiment also increased production of N_2O significantly (mean

of all treatments), but only 1.8-fold ($P < 0.05$). As a consequence, the constants in the quadratic equation between emission of N_2O and WHC also increased (Figure 6; Table 2).

It has to be noted that laboratory incubations are not directly comparable to field measurements as the soil structure, which is important in trace gas emissions, was changed through sampling and sieving soil in the laboratory study. Production of N_2O is normally higher in laboratory studies than in field experiments (Williams et al., 1998; Hadi et al., 2000). However, laboratory studies are an important source of information for sites where field measurements are impossible due to a possible disturbance from cattle and humans. Additionally, under laboratory conditions, factors that affect production of N_2O, such as water content and inorganic N content, can easily be varied.

The relationships obtained between production of CO_2 and N_2O and WHC as affected by inorganic N addition and vegetation cover in the laboratory could be used to simulate their emission in the field, although field measurements will be required to validate a model. The emission of CO_2 in the field could be expressed as a percentage of soil organic matter mineralized, i.e., 0.68% for soil under a canopy of shrubs and 0.47% for soil outside shrubs at 60% WHC within 14 days. The percentage mineralized soil organic C and the subsequent emission of CO_2 can then be adjusted for time, soil water content with the equation given above, and temperature. The production of N_2O in the field can be derived from the emission of N_2O as obtained in the lab within a day adjusting for time, soil water content, temperature, N fertilizer, and considering percentage plant cover.

Conclusion

Overgrazing in the north of Mexico leads to the disappearance of plant species, reduces the quality and fertility of soil, and thus the income of the local farming community. The ecosystems in the arid and semi-arid regions of Mexico have the capacity to sequester large amounts of C if grazing by husbandry is limited to sustainable levels. Converting those ecosystems to agriculture land decreases soil organic matter and increases the amount of CO_2 released in the environment. Even the application of small amounts of inorganic N to cultivated crops would release substantial amounts of N_2O, especially under irrigated conditions.

References

Anderson, I. C., M. Poth, J. Homstead, and D. Burdige. 1993. A comparison of NO and N_2O production by the autotrophic nitrifier *Nitrosomonas europea* and the heterotrophic nitrifier *Alcaligenes faecalis*. *Applied Environmental Microbiology* 59:3525–3533.

Azam, F., F. W. Simmons, and R. L. Mulvaney. 1995. Effect of ammonium and nitrate on mineralization of N from leguminous residues. *Biology and Fertility of Soils* 20:49–52.

Bandibas, J., A. Vermoesen, C. J. Degroot, and O. Van Cleemput. 1994. The effect of different moisture regimes and soil characteristics on nitrous-oxide emission and consumption by different soils. *Soil Science* 158:106–114.

Bolton, H., J. L. Smith, R. E. Wildung, and L. E. Rogers. 1990. Nitrogen mineralizacion potentials of shrub-steppe soils with different disturbance histories. *Soil Science Society of American Journal* 54:887–891.

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

Conde, E., M. Cardenas, A. Ponce-Mendoza, M. L. Luna-Guido, C. Cruz-Mondragon, and L. Dendooven. 2005. The impacts of inorganic nitrogen application on mineralization of ^{14}C-labelled maize and glucose, and on priming effect in a saline alkaline soil. *Soil Biology & Biochemistry* 37:681–691.

Dendooven, L., L. Duchateau, and J. M. Anderson. 1996. Gaseous products of the denitrification process as affected by the antecedent water regime of the soil. *Soil Biology & Biochemistry* 28:239–245.

Dendooven, L., E. Murphy, and D. S. Powlson. 2000. Failure to simulate C and N mineralization in soil using biomass C-to-N ratios as measured by the fumigation extraction method. *Soil Biology & Biochemistry* 32:659–668.

Geesing, D., P. Felker, and R. L. Bingham. 2000. Influence of mesquite (*Prosopis glandulosa*) on soil nitrogen and carbon development: Implications for global carbon sequestration. *Journal of Arid Environments* 46:157–180.

Hadi, A., K. Inibushi, E. Purnomo, F. Razie, K. Yamakawa, and H. Tsuruta. 2000. Effect of land-use changes on nitrous oxide (N_2O) emission from tropical peatlands. *Chemosphere: Global Change Science* 2:347–358.

Houghton, J. T., M. Filho, L. G. Callander, B. A. Harris, N. Kattenberg, and A. K. Maskell. 1996. *Climate change 1995: the science of climate change*. Cambridge University Press, New York.

INEGI (The National Statistical Institute of Geography and Informatics, Annual Statistics of the State of Durango) 2001. Anuario estadístico del Estado de Durango.

Jaramillo, V. V. 1984. The use and the development of pastures in Mexico in Department of Natural Renewable Resources (ed.), First National Congress on the use of pastures. UAAAN-CONACyT. Buenavista, Saltillo, Coahuila, México.

Jenkinson, D. S., D. E. Adams, and A. Wilde. 1991. Modelling estimates of CO_2 emissions from soil in response to global warming. *Nature* 351:304–306.

Kuenen, J. G., and L. A. Robertson. 1994. Combined nitrification-denitrification processes. *FEMS Microbiology Reviews* 15:109–117.

Marschner, B., and A. Noble. 2000. Chemical and biological processes leading to the neutralisation of soil acidity after incubation with different litter materials. *Soil Biology & Biochemistry* 32:805–813.

McLain, J. E. T. and D. A. Martens. 2005. Nitrous oxide flux from soil amino acid mineralization. *Soil Biology & Biochemistry* 37:289–299.

Metting, F. B. 1993. Structure and physiological ecology of soil microbial communities, pp. 3–24, in F. B. Metting, ed., *Soil microbial ecology application in agricultural and environmental management*. Marcel Dekker, New York.

Moraghan, J. T., and R. Buresh. 1977. Correction for dissolved nitrous oxide in nitrogen studies. *Soil Science Society of American Journal* 41:1201–1203.

Parton, W. J., A. R. Mosier, D. S. Ojima, D. W. Valentine, D. S. Schimel, K. Weier, and A. E. Kulmala. 1996. Generalized model for N_2 and N_2O production from nitrification and denitrification. *Global Biogeochemistry Cycle* 10:401–412.

Reyes-Reyes, B. G., E. Zamora-Villafranco, M. L. Reyes-Reyes, J. T. Frías-Hernández, V. Olalde-Portugal, and L. Dendooven. 2003. Decomposition of leaves of huisache (*Acacia tortuosa*) and mesquite (*Prosopis* spp) in soil of central highlands of Mexico. *Plant and Soil* 256:359–370.

SAGARPA-CADER. 2004. Informe anual de Actividades. Centro de Apoyo y Desarrollo Regional. Annual Activity Report. Regional Center for Support and Development. Rodeo, Durango, México.

Sánchez, L., J. A. Díez, A. Vallejo, and M. C. Cartagena. 2001. Denitrification losses from irrigated crops in central Spain. *Soil Biology & Biochemistry* 33:1201–1209.

SAS Institute. 1989. *Statistic Guide for Personal Computers*, Version 6.04. SAS Institute Inc., Cary, NC.

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

Smith, K. A., P. E. Thomson, H. Clayton, I. P. McTaggart, and F. Conen. 1998. Effects of temperature, water content and nitrogen fertilisation on emissions of nitrous oxide by soils. *Atmospheric Environment* 32:3301–2209.

Steinkamp, R., K. Butterbach-Bahl, and H. Papen. 2001. Methane oxidation by soils of an N limited and N fertilized spruce forest in Black Forest, Germany. *Soil Biology & Biochemistry* 33:145–153.

Tiedemann, A. R., and J. O. Klemmedson. 1986. Long term effects of mesquite removal on soil characteristics: Nutrients and bulk density. *Soil Science Society American Proceedings* 37:107–111.

U.S. Environmental Protection Agency (USEPA). 1998. Method 3051. Microwave assisted acid digestion of sediments, sludges, soils, and oils. U.S. Environmental Protection Agency Office of Wastewater Management. Washington DC.

Van Cleemput, O. 1998. Subsoil: chemo- and biological denitrification, N_2O and N_2 emissions. *Nutrient Cycling Agroecosystems* 52:187–289.

Virginia, R. A., W. M. Jarrel, and E. Franco-Vizcaino. 1982. Direct measurement of denitrification in a *Prosopis* (mesquite) dominated Sonoran Desert ecosystem. *Oecologia* 53:120–122.

Williams, P. H., S. C. Jarvis, and E. Dixon. 1998. Emission of nitric oxide and nitrous oxide from soil under field and laboratory conditions. *Soil Biology & Biochemistry* 30:1885–1893.

Wirén-Lehr, S., I. Von Scheunert, and U. Dörfler. 2002. Mineralization of plant-incorporated residues of ^{14}C-isopruton in arable soils originating from different farming systems. *Geoderma* 105:351–366.

Wrage, N., G. L. Velthof, M. L. van Beusichem, and O. Oenema. 2001. Role of nitrifier denitrification in the production of nitrous oxide. *Soil Biology & Biochemistry* 33:1723–1732.

Zárate, Z. R. 1991. Definition and the impact of soil degradation. Soil Department, Autonomous University of Chapingo (UACH), Chapingo, México.

Downloaded by [Western State Colorado University] at 19:57 11 November 2014

Questions and Answers

Tailpipe Greenhouse Gas Emissions from a Typical Passenger Vehicle

The U.S. Environmental Protection Agency (EPA) developed this fact sheet to answer common questions about greenhouse gas emissions from passenger vehicles. This fact sheet provides emission rates and calculations consistent with EPA's regulatory work.

How much tailpipe carbon dioxide (CO_2) is created from burning one gallon of fuel?

The amount of CO_2 created from burning one gallon of fuel depends on the amount of carbon in the fuel. Typically, more than 99% of the carbon in a fuel is emitted as CO_2 when the fuel is burned. Very small amounts are emitted as hydrocarbons and carbon monoxide, which are converted to CO_2 relatively quickly in the atmosphere. Carbon content varies by fuel, and some variation within each type of fuel is normal. EPA and other agencies use the following average carbon content values to estimate CO_2 emissions:

CO_2 Emissions from a gallon of gasoline: 8,887 grams CO_2 /gallon[1]
CO_2 Emissions from a gallon of diesel: 10,180 grams CO_2 /gallon[2]

Diesel creates about 15% more CO_2 per gallon. However, many vehicles that use diesel fuel achieve higher fuel economy than similar vehicles that use gasoline, which generally offsets the higher carbon content of diesel fuel.

How can burning one gallon of gasoline produce 8,887 grams (approximately 20 pounds) of tailpipe carbon, when one gallon of gasoline weighs only about six pounds?

Most of the weight of the CO_2 doesn't come from the gasoline itself, but the oxygen in the air. When gasoline burns, the carbon and hydrogen separate. The hydrogen combines with oxygen to form water (H_2O), and carbon combines with oxygen to form carbon dioxide (CO_2). Visit fueleconomy.gov for more details, including the calculations.

[1] This gasoline factor is from a regulation establishing GHG standards for model year 2017-2025 vehicles (77 FR 62773, October 15, 2012).
[2] This diesel factor is from the calculations that vehicle manufacturers use to measure fuel economy (40 C.F.R 600.113).

United States Environmental Protection Agency
Office of Transportation and Air Quality
EPA-420-F-23-014
June 2023

How much tailpipe carbon dioxide (CO_2) is emitted from driving one mile?

The average passenger vehicle emits about 400 grams of CO_2 per mile. The average fuel economy for all vehicles on the road today is 22.2 miles per gallon.[3] The majority of vehicles run on gasoline, and every gallon of gasoline creates about 8,887 grams of CO_2 when burned. Therefore, the average vehicle when driving one mile has tailpipe CO_2 emissions of about:

$$CO_2 \text{ emissions per mile} = \frac{CO_2 \text{ per gallon}}{\text{MPG}} = \frac{8{,}887}{22.2} = \mathbf{400\ grams}$$

Electric vehicles (EVs) have zero tailpipe emissions.

What is the average *annual* carbon dioxide (CO_2) emissions of a typical passenger vehicle?

A typical passenger vehicle emits about 4.6 metric tons of CO_2 per year. This number can vary based on a vehicle's fuel, fuel economy, and the number of miles driven per year. The average vehicle on the road today has a fuel economy of about 22.2 miles per gallon (MPG) and drives around 11,500 miles per year.[4] Every gallon of gasoline burned creates about 8,887 grams of CO_2, and there are one million grams per metric ton. Therefore, the average gasoline vehicle over a year of driving has tailpipe CO_2 emissions of about[5]:

$$CO_2 \text{ emissions per mile} = \frac{CO_2 \text{ per gallon}}{\text{MPG}} \times \text{miles} = \frac{8{,}887}{22.2} \times 11{,}500 = \mathbf{4.6\ metric\ tons}$$

EPA uses this to compare CO_2 emissions from other sources to emissions from passenger vehicles. For example, an energy efficiency program that reduces greenhouse gas emissions by 4,600 metric tons of CO_2 per year has the same impact as removing 1,000 vehicles from the road.

Are there other sources of greenhouse gas (GHG) emissions from a vehicle?

In addition to CO_2, automobiles using gasoline produce methane (CH_4) and nitrous oxide (N_2O) from the tailpipe and all vehicles can emit hydrofluorocarbon (HFC) from leaking air conditioners. For gasoline vehicles, the emissions of HFCs are small in comparison to CO_2; however, the impact of these emissions can be important because they have a higher global warming potential (GWP) than CO_2.

---

[3] Federal Highway Administration Highway Statistics 2020, data for calendar year 2019. Data for 2020 was not used due to the impacts of the COVID-19 outbreak. The average passenger vehicle fuel economy is expected to increase over time because of greenhouse gas and fuel economy standards developed in coordination between EPA, DOT, and California.

[4] Federal Highway Administration Highway Statistics 2020.

[5] This calculation provides a simple way to determine the average annual CO_2 emissions from a passenger vehicle. Anyone that needs a more detailed approach should use the EPA's Motor Vehicle Emission Simulator (MOVES) model. MOVES contains detailed data about the light duty fleet and driving patterns in the United States. Although simplified, the calculated annual CO_2 emissions above are consistent with analyses performed by EPA using MOVES.

The GWP of a gas relates the impact of that gas relative to an equivalent amount of CO_2. Using GWP, the impact of various GHGs can be directly compared using a common metric. This metric is expressed in units of carbon dioxide equivalent, written as CO_2e. Multiplying the amount of a GHG times the GWP of that GHG results in the amount of GHG in terms of CO_2e. For automotive-related gases, these GWPs are:

Greenhouse Gas	Abbreviation	Global Warming Potential[6]
Carbon Dioxide	CO_2	1
Methane	CH_4	25
Nitrous Oxide	N_2O	298
Air Conditioning Refrigerant	HFC-134a	1,430

It is more difficult to estimate vehicle emissions of CH_4, N_2O, and HFCs than CO_2. Emissions of CH_4 and N_2O are dependent on the design of the gasoline engine and emission control system, rather than fuel consumption per mile. The amount of HFC leakage from air conditioners is dependent on system design, amount of use, and maintenance. On average, CO_2 emissions are 95-99% of the total GHGs from a gasoline passenger vehicle, after accounting for the GWP of all GHGs. The remaining 1-5% is CH_4, N_2O, and HFC emissions. EVs also emit a small amount of GHGs due to air conditioner/HFC leakage.

What are the tailpipe emissions from a plug-in hybrid electric vehicle (PHEV) or an electric vehicle (EV)? What about hydrogen fuel cell vehicles (FCEV)?

Electric vehicles (EVs) have a battery instead of a gasoline tank, and an electric motor instead of an internal combustion engine. EVs do not emit any tailpipe emissions. A fuel cell electric vehicle (FCEV) operating on hydrogen will emit only water vapor. Calculating tailpipe emissions for PHEVs is more complicated because they use both gasoline and electricity as fuel sources. When operating on electricity only, a PHEV does not generate any tailpipe emissions. When a PHEV is operating on gasoline only, it creates tailpipe emissions based on its gasoline fuel economy. Tailpipe emissions for a PHEV operating on both electricity and gasoline cannot be calculated without detailed information about how the specific PHEV operates. The overall tailpipe emissions for a PHEV can vary significantly based on its battery capacity, how it is driven, and how often it is charged. For more information, see the My Plug-In Hybrid calculator.

[6] These 100-year time horizon GWP values are from the 2007 Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report. The IPCC released updated values in the Fifth Assessment Report (2014), however international reporting guidelines still use the values shown here.

Are there any greenhouse gas (GHG) emissions associated with the use of my vehicle other than what comes out of the tailpipe?

Driving gasoline vehicles results in tailpipe GHG emissions. Producing and distributing the gasoline used to power your vehicle also creates GHGs. For example, the production of gasoline requires extracting oil from the ground, transporting it to a refinery, refining the oil into gasoline, and transporting the gasoline to service stations. Each of these steps can produce additional GHGs.

Electric vehicles (EVs) have no tailpipe emissions; however, emissions are created during both the production and distribution of the electricity used to fuel the vehicle. Visit the Beyond Tailpipe Emissions calculator to estimate GHG emissions for an EV in your region of the country.

I thought my gasoline was blended with ethanol. Does that change my tailpipe carbon dioxide (CO_2) emissions?

Most of the gasoline sold in the U.S. is a mixture of gasoline and up to 10% ethanol (often referred to as E10). The exact formulation of the gasoline in your vehicle will vary depending on season, region in the U.S., and other factors. While your fuel economy when using an ethanol blend in your vehicle will be slightly lower than when using gasoline without ethanol, the CO_2 tailpipe emissions per mile will be similar. This is because ethanol has less carbon per gallon than gasoline.

How does the EPA measure carbon dioxide (CO_2) emissions from vehicles?

EPA measures vehicle fuel economy and CO_2 emissions using a set of standardized laboratory tests. These tests were designed by EPA to mimic typical driving patterns. Both EPA and the Department of Transportation use these values to ensure that manufacturers meet federal greenhouse gas and corporate average fuel economy (CAFE) standards.

For every new vehicle, the test results are used to determine real world fuel economy and CO_2 emissions. These adjusted results are used on the Fuel Economy and Environment Labels and on Fueleconomy.gov.

Visit Testing at the National Vehicle and Fuel Emissions Laboratory and Frequent Questions on Fuel Economy Testing and Labeling for more information.

How can I find and compare carbon dioxide (CO_2) emission rates for specific vehicle models?

Visit Fueleconomy.gov and click on "Find a Car." Select your vehicle of interest. From the vehicle search results page, click on the "Energy and Environment" tab. A vehicle's GHG emissions rate (g/mile) and GHG rating (1-10 scale) can be found on that search results page.

When shopping at a dealership, check out tailpipe carbon dioxide (CO_2) emission rates on vehicle Fuel Economy and Environment Labels. The labels also feature a 1-to 10 Fuel Economy and GHG rating to enable easy comparison shopping.

Where can I find information on the emissions of the transportation sector as a whole?

Visit EPA's Fast Facts on Transportation Greenhouse Gas Emissions and Carbon Pollution from Transportation.

Annually EPA also publishes industry-wide data in the report, "Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends." This report analyzes trends in fuel economy and CO_2 emissions for new light duty vehicles from 1975 to the present.

Other useful sources include:

- Beyond Tailpipe Emissions Calculator
- Fueleconomy.gov
- Greenhouse Gas Equivalencies Calculator
- Green Vehicle Guide
- Household Carbon Footprint Calculator
- Inventory of U.S. Greenhouse Gas Emissions and Sinks

For additional information on calculating emissions of greenhouse gases, please contact greenvehicles@epa.gov, or you can contact the OTAQ library for document information at:

U.S. Environmental Protection Agency
Office of Transportation and Air Quality
2000 Traverwood Drive Ann Arbor, MI 48105
734-214-4311 & 734-214-4434
E-mail: Group_AAlibrary@epa.gov

CHAPTER 12

TRANSPORT

Delhi has a population of 16.78 million as per 2011 census, it estimated that it has now increased to 20.57 million in 2021. To cater to the transportation needs of this population there is a road network of 17882 KM in Delhi which includes all the civic agencies, PWD, DSIIDC, I&FC, DDA etc. Buses, Delhi Metro, Cabs, Auto and e-Rickshaw are the backbone of public transport in Delhi, which runs on CNG/Electricity. This is result of sustained effort of Government of National Capital Territory of Delhi to provide a safe, sustainable, economic, people-friendly and efficient public transportation system in the city. Delhi is now making effort to large scale adoption of Electric Vehicles to further control the vehicular pollution. The policy focuses on incentivizing the purchase and use of Electric two wheelers and supporting the electrification of public/shared transport and good carriers. Further to accelerate the pace of Electric Vehicle adoption across vehicle segments, especially in the mass category of two wheelers, public/shared transport vehicles and good carriers so that they contribute to 25% of all new vehicle registrations by 2024 under EV Policy of Delhi.

1.1. A sustainable transport system attains the most possible balance between the social –environmental– economic dimensions of transport. Development of all the components together over time constitutes the ideal Urban Transport system. All components are dependent to each other, i.e. one has the impact over the other. Delhi has a sustainable transport system balancing all these components as below:-

- Regarding **Environment Sustainability,** Delhi has initiated for plying CNG Buses, implement Electric Vehicle Policy, allowed e-rickshaw facility etc.
- Regarding **Economic Sustainable** transport system, there are affordable fare in Delhi for commuters. Govt. has not enhanced the bus fare since a long. Further facilities for confessional pass in buses for students, senior citizen and free for women commuters etc. also provided.
- In terms of **Social-Cultural sustainability**, bus marshals have been deployed in DTC and Cluster Buses for providing safety and security to women commuters.
- For **effectiveness of Transportation System**, Delhi has robust road infrastructure. Public transport facilities in Delhi are provided by DTC & Cluster buses. Delhi Metro Rail Corporation (DMRC) is also offering a rapid transport system connecting various points of Delhi including NCR.

2. Transport Infrastructure

2.1. Road Network

The road network in Delhi is being developed and maintained by Public Works Department (PWD), Municipal Corporations of Delhi, New Delhi Municipal Council (NDMC), Delhi Cantonment Board (DCB), National Highway Authority of India (NHAI) and Delhi Development Authority (DDA). Road network length maintained by different agencies in NCT of Delhi is presented in Statement 12.1.

STATEMENT 12.1

STATUS OF ROAD NETWORK IN DELHI-AGENCY-WISE

(As on 31st March 2021 in Lane KM)

S.No.	Agency	Road Length
1	East DMC	512.47 Lane Km
2	South DMC	7437.45 Lane Km
3	North DMC	4753.18 Lane Km
4	New Delhi Municipal Council	1290 Lane Km
5	Public Works Deptt. (Delhi Govt.)	
a.	National Highway	37.49 Lane Km
b.	Other Roads	1318.42 Lane Km
6	DSIIDC	2285.44 Lane Km
7	I&FC	297.52 Lane Km
8	DDA	435 Lane Km

Source: Delhi Hand Book 2021

2.2. Road Infrastructure

2.2.1. Pedestrian Facilities- Foot Over Bridges (FOBs):

Traffic regulation and road construction in Delhi have to take care of cyclists and pedestrians including bus commuters. Approximately 90 numbers of foot over Bridges have also been completed at various places in Delhi by end of 2020-21. Following 9FOBs are completed during the year 2021-22 upto the month of Dec.:-

1) RTR Marg near petrol pump, New Delhi.
2) Baba Gangnath Mandir on Nelson Mandela Marg
3) Near Smt. Indira Gandhi senior secondary school on Pankha Road
4) Bhishma Pitamah Marg
5) Harkesh Nagar On Mathura Road
6) Shiv Parvati Mandir on MB Road

7) FOB at Shakurpur Dada Devta Mandir, IRR, Lawrence Road
8) FOB in between metro pillar No. 364-365 near Nangloi Flyover, Rohtak Road, NH-10
9) FOB at Prashant Vihar

Following FOBs are under construction and likely to be completed by 31.03.2022:

1. FOB at Press Enclave Road near Select City Mall
2. FOB at Sri Aurobindo Marg at PTS Bus Stop.
3. Near Pehladpur Bus Stand across Dwarka Road
4. FOB at Multan Nagar between Metro Pillar No. 232 & 233.
5. Construction of Foot Over Bridge at Metcalfe House main gate of Ring Road under Sub-Division-3 of Division C&ND Roads New Delhi.

2.2.2. Flyover & Bridges / Corridors

A number of transport infrastructure projects at Ring Road and Outer Ring Road were made to encourage use of public transport in Delhi. At present there are 87 numbers of flyovers.

- **Barapullah Phase-III**:-The stretch from Sarai Kale Khan to Mayur Vihar Phase-I was sanctioned for ₹ 1260.63 crore (Tender Cost ₹ 964crore). An expenditure of ₹ 804.83 cr. has been incurred till Dec. 2021. The work is in progress and land acquisition of 8.5 Acre in progress and at final stage.81.8% work has been completed till Dec. 2021. The work is likely to be completed tentatively by 31.03.2023.

- **Corridor improvement of outer Ring Road from IIT to NH-8:-**The project of Construction of (Part-A) Flyover on portal structure linking existing Munirka Flyover in the east to the point beyond Army RR Hospital in the west on the Outer Ring Road and (Part-B) Underpass at junction of BJ Marg and Inner Ring Road has been approved at the cost of ₹ 364 crore. The Flyover from Munirka to RR Hospital on ORR has been completed and opened to traffic. The work of underpass at Junction of BJ Marg and inner Ring Road is in progress and 98% work is completed and an amount of ₹ 338.98 Crore has been spent till Dec. 2021. The work is likely to be completed by 28.02.2022.

- **Construction of Underpass at Ashram Chowk along Mathura Road**:-The estimated cost of this project is ₹ 77.92 crore along with shifting of services. The construction work is in progress and 88% work has been completed till Dec. 2021. An expenditure of ₹ 53.50 crore has been incurred till Dec. 2021. The work is likely to be completed by 31.03.2022.

- **Construction of Bridges on (i) NH-10 at Rampura, (ii)Tri Nagar/Inderlok and (iii) Karampura, Delhi**:- Construction of bridge on Najafgrah drain at Tri-

Nagar / Inderlok, Karampura and Rampura, Delhi to cover complete ROW excluding area of already constructed bridge along with road improvement on either side of bridge including making of drainage scheme, footpath etc. was approved at the estimated cost of ₹ 85.90 crore. The project is in progress and 93% work of the project is completed till Dec.2021. An expenditure of ₹ 62.12 Cr. has been incurred till Dec. 2021. The work is likely to be completed by 31.03.2022.

- **Extension of flyover from Ashram Flyover to DND Flyover: -** The estimated cost of this project is ₹ 128.95 crore. An expenditure of ₹ 62.52 Cr. has been incurred till Dec. 2021. The project is in progress and likely to be completed by 31.08.2022.

- **C/o Half Underpass on ORR at Gopalpur Red Light-JagatpurBridge :-** The estimated cost of this project is ₹ 38.17 crore. 63% work is completed till Dec. 2021. An expenditure of 20.31 Cr.has been incurred till Dec. 2021. The project is in progress and likely to be completed by 31.03.2022.

- **Construction of bridge on Najafgarh drains at Basai Darapur to cover the complete ROW.** The estimated cost of this project is ₹ 48.60 crores. 93% work is completed till Dec. 2021. An expenditure of ₹ 40.00 cr has been incurred till Dec. 2021. The project is in progress and likely to be completed by 31.03.2022.

- **Construction of Bridges on Najafgarh Drain at NH-10 at Nangloi:** The estimated cost of this project is ₹ 42.21 crore. 67% work is completed till December, 2021. An expenditure of ₹ 27.60 crore has been incurred till Dec. 2021. The project is in progress and likely to be completed by 31.05.2022.

2.3. Bus Terminals and Depots

The objective of the project is to create infrastructure for the benefit of the bus commuters. There are 58 number of bus depot in operation and construction of 12 Bus depots are under progress. Further there are 16 numbers of bus terminals are in operation. Construction of New Bus Terminals at Sector 4, Dwarka, Sector 12, Dwarka, Vikas puri and Narela are under process. Depots at Mundelakala and Ghummanhera have been completed. One of the two depots at Rohini is also nearly completion.

2.4. Inter State Bus Terminals (ISBTs)

Delhi has three Inter State Bus Terminals (ISBTs) functioning at present at Kashmere Gate, Sarai Kale Khan & Anand Vihar. The Kashmere Gate ISBT has been renovated and made operational with state of the art facilities. Sarai Kale Khan & Anand Vihar ISBTs project will be redeveloped by PWD.

2.5. Rail Network

Delhi is a major junction on the rail map of India linked with the entire major metropolitan cities directly. There are five main railway stations viz. at New Delhi, Old Delhi, Hazrat Nizamuddin, Sarai Rohila and Anand Vihar, besides Container Depots at Patparganj and Tuglakabad.

2.6. Mass Rapid Transit System (MRTS)

The Mass Rapid Transit System (MRTS) is an ambitious project that aims at providing a non-polluting and efficient rail-based transport system, properly integrated with the road transport system.

Delhi Metro Rail Corporation Limited (DMRC) was registered on 3rd May 1995 under the Companies Act, 1956 with equal equity participation of the Government of the National Capital Territory of Delhi (GNCTD) and the Govt. of India. Presently, the Delhi Metro network consists of 348.121 Km. At present the work of PHASE IV is in progress and PHASE I to III has been completed. The details are as under:-

DMRC – PHASE I

- The construction of Phase-I of DMRC is started in the year 2002 with a total project cost of ₹ 10,571 Cr which includes GNCTD share of ₹ 1777 Cr which has been released to DMRC.
- The total length of Phase I is 64.751 Km with 59 numbers of stations.
- Phase-I completed in the year 2006.

Phase - I (In Delhi)

S. No.	Line	Name of the Corridor	Length (Kms)	No. of Stations
1	Line 1 (Red)	Shahdara-TisHazari	8.349	6
		Tis Hazari-Inderlok	4.872	4
		Inderlok-Rithala	8.835	8
2	Line 2 (Yellow)	Vishwa Vidhyalaya- Kashmere Gate	4.06	4
		Kashmere Gate- Central Secretariat	6.621	6
3	Line 3 (Blue)	Barakhamba - Dwarka	22.736	22
		Barakhamba - Indraprastha	2.804	3
		Dwarka Sub-City	6.474	6
		Total	**64.751**	**59**

DMRC – PHASE II

- Construction of Phase-II of DMRC is started in the year 2005 with a total project cost of ₹ 19,231 Cr. out of which GNCTD share is ₹ 4691 Cr which has been released to DMRC.
- Total length of Phase-II is 123.3 Km which includes 22.47 Km High Speed Airport Metro Express Line and 16.315 Kms of NCR lines with 86 numbers of stations (of which 13 are on NCR Line).
- Phase-II is completed in the year 2012.

S. No.	Line	Name of the Corridor	Length (Kms)	No. of Stations
1	Line 1 Extn (Red)	Shahdara-Dilshad Garden	2.858	3
2	Line 2 Extn (Yellow)	Vishwa Vidhyalaya-Jahangir Puri	6.38	5
		Central Secretariat - Qutub Minar	11.764	10
		Qutub Minar - Haryana Border	8.771	4
3	Line 3 Extn (Blue)	Indraprastha - Yamuna Bank	2.173	1
		Yamuna Bank - New Ashok Nagar	5.849	4
		Dwarka Sec 9 - Dwarka Sec 21	2.279	2
4	Line 4	Yamuna Bank - Anand Vihar	6.246	6
5	Line 5 (Green)	Inderlok - Mundka	14.192	14
		Kirti Nagar- Ashok Park	3.406	2
6	Line 6 (Violet)	Central Secretariat - Sarita Vihar	15.336	13
		Sarita Vihar - Badarpur	4.822	3
7	Airport Express Line	High Speed Airport Metro Express Line - New Delhi Railway Station to Dwarka Sector - 21	22.909	6
		Sub Total	**106.985**	**73**
		In NCR		
1	Line 2	Haryana Border - Huda City Center Gurgoan	7.05	5
2	Line 3	New Ashok Nagar - Noida City Center, Noida	7	6
3	Line 4	Anand Vihar - Vaishali	2.265	2
		Sub Total	**16.315**	**13**
		Total	**123.3**	**86**

DMRC – PHASE III

- Construction of Phase-III of DMRC is started in the year 2012 with a total project cost of ₹ 39,785 Cr out of which GNCTD share is ₹ 8,407 crore which has been released to DMRC.
- Total length of Phase-III is 160.07 Km (including 37.307 kms of NCR length) and has 109 numbers of stations. (including 27 stations of NCR)
- Phase-III has been completed in the year 2021.
- The total length of metro lines Phase-I to Phase-III is 348.121 kms including 53.62 kms of length in NCR and 22.91 kms of Airport Line.

S. No.	Line	Name of the Corridor	Length (Kms)	No. of Stations
1	Line 2	Ext.: Jahangirpuri-Badli	4.373	3
2	Line 5	Extn.:Mundka-Tikri Border	6.308	4
3	Line 5	Extn.:Tikri Border- Bahadurgarh	4.875	3
4	Line 6	Ext: Central Sectt.-Kashmere Gate	9.272	7
5	Line-7	Majlis Park- Shiv Vihar	59.242	38
6	Line-8	Janakpuri West-Kalindikunj	33.499	23
7	Line-9	Dwarka-Najafgarh	4.303	3
8	Line-9	Extension to Dhansa Bus Stand	0.891	1
		Sub Total	**122.76**	**82**
		In NCR		
1	Line 6	Extn: Badarpur-Faridabad	13.561	9
2	Line 6	Escorts Mujesar - Ballabhgarh	3.35	2
3	Line 8	KalindiKunj – Botanical Garden	3.962	2
4	Line 1	Dilshad Garden to New Bus Adda Ghaziabad	9.635	8
5	Line 3	Noida City Centre to Noida Electronic City	6.799	6
		Sub Total	**37.307**	**27**
		Total	**160.07**	**109**

DMRC – PHASE IV

- Phase-IV has two part of 3 Corridors each.
- Construction of first 3 priority corridor started in the year 2020-21 with total project cost ₹ 24,949 Cr and GNCTD share is ₹ 5,887 Cr. which includes additional 244 cars. Out of which ₹ 2,774 crore released to DMRC upto December 2021.

- After completion of Phase-IV, the total length of metro lines including NCR lines will be about 457 kms.
- DMRC has submitted DPR for next 3-corridors of Delhi Metro Phase-IV with the corridor between Rithala and Narela (METRO LITE) and Lajpat Nagar to Saket G-Block and Inderlok to Indraprastha being metro corridors with total project cost of ₹12,587 crore wherein GNCTD share was ₹ 2993 cr.
- Rithala and Narela Corridor will be based on METRO LITE, which is light rail transit system being planned in India for cities with lower ridership projection and as a feeder system for the existing metro systems. It will cater to lower passenger capacity at a reduced cost than a metro line.

S.No.	Name of the Corridor	Length (Kms)	No. of Stations
Phase – IV (First 3 priority corridor)			
1	Majlis Park – Burari - Maujpur	12.318	8
2	R.K. Ashram - Janakpuri (West)	29.262	22
3	Aerocity - Saket - Tughlakabad	23.622	15
Phase – IV (Other 3 corridors)			
1	Lajpat Nagar - Saket G Bloick	12.377	10
2	Inderlok - Indraprastha	8.385	8
3	Rithala - Bawana – Narela (METRO LITE)	22.915	19
	Total	**85.257**	**67**

2.7. DMRC Feeder Bus Service

DMRC is in the process to procure 100 AC E-buses to be operated on 10 new routes under FAME-2 scheme. Out of these 100 buses, 25 buses were made operational in August 2021 and the balance 75 buses shall be delivered by December 2021 in a phased manner.

2.8. Regional Rapid Transit System (RRTS)

To address the issues, meet organic future demand as well as the mobility demand for unlocking economic potential of the NCR, National Capital Region Planning Board (NCRPB) had recommended development of multi-modal transport system with special emphasis on rail based high-speed, high-frequency Regional Rapid Transit System (RRTS) for connecting major regional centres in Functional Plan on Transport for National Capital Region-2032.

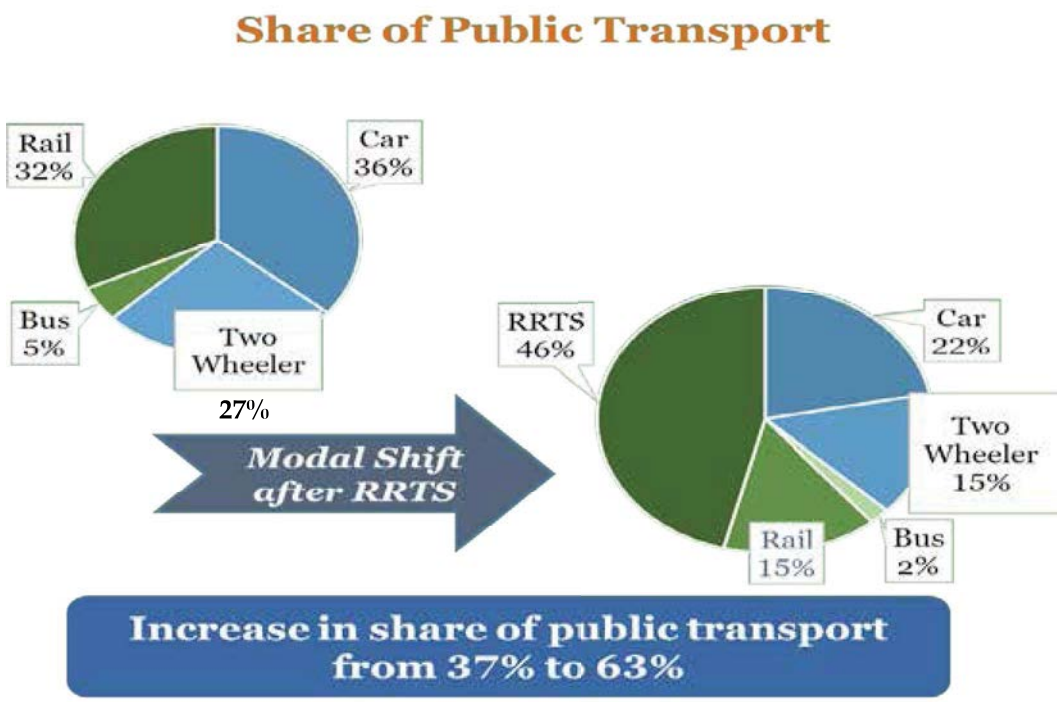
The regional rails are envisaged to run at the speed of 180 kmph on the line of European trains, caters to passenger services within a larger urban agglomerate or metropolitan area connecting the outskirts to the centre of the

city. The services have greater number of halts at smaller distances compared to long distances stations on high-speed railway networks running at the speed of more than 300 kmph, but fewer halts and higher speeds compared to metro rail.

Regional rail is a new concept in India but common in large metropolitan cities to help in decongesting the city centre by providing safe, and speedy access to the city centre for commuters residing in less congested suburbs.

The Task Force constituted by Planning Commission had identified 8 RRTS corridors in NCR, out of which three corridors were prioritized viz. Delhi – Meerut, Delhi – Alwar and Delhi – Panipat for implementation in Phase 1.The three prioritized RRTS projects are part of 'Comprehensive Action Plan' (CAP) for Air Pollution Control in Delhi & NCR' and the recommendation of 'High Powered Committee on Decongesting Traffic in Delhi'. Furthermore, all the three prioritized RRTS projects have been included in the National Infrastructure Pipeline (NIP), finalized by Department of Economic Affairs and unveiled by Hon'ble Finance Minister.

RRTS will provide an integrated mobility solution for National Capital Region (NCR) supported by multimodal integration. It will not only bring in significant direct economic benefits, such as savings due to reduction in pollution, travel time, vehicle-operating costs, road stress and accidents by reducing congestion (increasing the modal share of public transport), but also result in wider economic benefits and economy-wide benefits, such as agglomeration benefits, improved productivity output of labour and industries, indirect and induced employment and increase in GDP of the entire NCR.



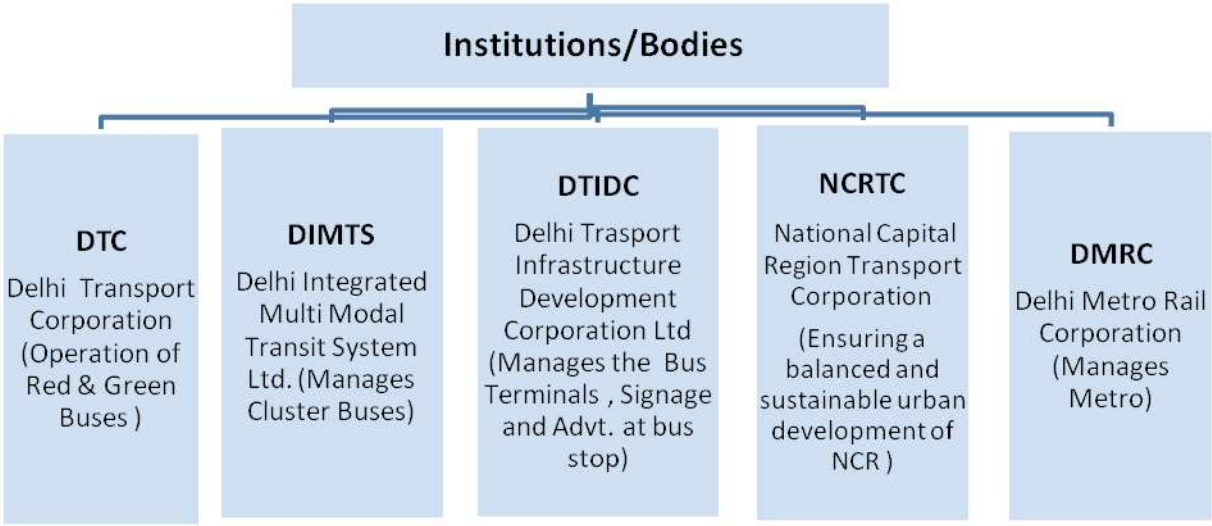
The three prioritized RRTS corridors are planned to originate from a common elevated terminus station Sarai Kale Khan in Delhi. Such a common terminus station will facilitate inter-connectivity/inter-operability among three corridors.

Delhi-Meerut RRTS Corridor : The Delhi-Meerut RRTS corridor is 82.15 km long corridor with 15 RRTS stations. Delhi portion (13 km in length) comprises 03 stations at Shastri Nagar, Anand Vihar and Sarai Kale Khan. The project completion cost is estimated as 30,274 crore and contribution of GNCTD is 1,180 crore. The complete track shall be ballast less with minimum noise pollution and regenerating brakes are being used to optimize the electricity requirement. Project got sanctioned and approved by Government of India in March 2019. The civil construction work on the entire corridor is in full swing and on schedule. The commercial operations of Delhi-Meerut corridor will commence by 2025.

- Delhi-Gurgaon-Rewari-Alwar corridor: RRTS Corridor will be implemented in three stages (Stage-1: Delhi-Gurugram-SNB (Shahjahanpur-Neemarna-Behror) Urban Complex, Stage-2: SNB Urban Complex-Sotanala RIICO Industrial area and Stage-3: SNB Urban Complex-Alwar). Delhi-Gurugram-SNB corridor is being implemented in Stage-I of Delhi-Alwar corridor. This corridor will be around 106 km long and will have 16 RRTS stations. Delhi portion of the corridor is 21.67 km and will comprise of 04 stations. It will start from Sarai Kale Khan in Delhi and will end at SNB (in Rajasthan and will pass through INA, Aerocity, Gurugram, Manesar, Dharuhera etc. The project completion cost is estimated as ₹ 37,987 cr. and contribution of GNCTD is ₹ 3,261 cr. The project is under consideration for sanction by Government of India. Pre-construction activities in the project are in progress and construction will commence on sanction by Government of India. The DPR for SNB-Sotanala (Stage 2) has been approved by Board of NCRTC and submitted to the Government of Rajasthan for their approval.

- Delhi-Panipat RRTS Corridor: The total route length of the RRTS alignment is 103.02 kms with 17 RRTS stations. This RRTS corridor originates from Sarai Kale Khan Station in Delhi and ends at Panipat. The six stations proposed in Delhi at Sarai Kale Khan, Indraprastha, Kashmere Gate, Burari Crossing, Mukarba Chowk & Alipur. The proposed alignment passes through dense development of Delhi, Gannaur, Samalkha and Panipat regions.

3. Institutes and Bodies engaged in public Transport System



3.1. Delhi Transport Corporation (DTC):

Govt. of NCT of Delhi release equity capital for procurement of buses and for development of infrastructural facilities to DTC. It has existing infrastructure of 35 depots. DTC has a current fleet size of 3760 buses, comprising 1256 AC low floor buses and 2504 Non-AC low floor buses. DTC is the largest public transport entity in the NCR transporting about 12.24 lakh passengers and covering 5.20 lakh km per day in 2020-21 (33.31 lakh during 2019-20 i.e. Pre-Covid period). DTC is plying on 453 city routes and 07 NCR routes.

3.2. Delhi Integrated Multi-modal Transit System Ltd (DIMTS):

Delhi Integrated Multi-Modal Transit System (DIMTS) Ltd. is an urban transport and infrastructure development company committed to build and deliver quality infrastructure. In July 2007, it became an equal equity joint venture company between the Government of National Capital Territory of Delhi (GNCTD) and the IDFC Foundation (a not-for-profit organization).

The Government of NCT of Delhi initiated the Scheme for Corporatization of Private Stage Carriage Service to substitute the Blue line private stage carriage system under Public Private Partnership (PPP) model. The Cluster Scheme is based on gross-cost model (OPEX MODEL) where fleet owners are remunerated on the basis of operational parameters irrespective of the fare box inflow. Presently, 3033 cluster buses are in operation under 14 clusters in the NCT of Delhi.

3.3. Delhi Transport Infrastructure Development Corporation Limited (DTIDC):

Delhi Transport Infrastructure Development Corporation Limited (DTIDC) was incorporated on 16 August 2010 under the Companies Act 1956 as wholly-

owned by Govt. of NCT of Delhi. The Company falls under the administrative control of Transport Department, Govt of NCT of Delhi. The Corporation has been created with the objectives of development; implementation, operation and maintenance of urban transport infrastructure. At present, three existing operational ISBTs situated at Kashmere Gate, Anand Vihar and Sarai Kale Khan are controlled by DTIDC.

3.4. National Capital Region Transport Corporation (NCRTC):

A Memorandum of Understanding (MoU) was signed in 2011 between Government of India, and State Governments of National Capital Territory of Delhi, Haryana, Rajasthan and Uttar Pradesh (UP) for implementation of RRTS in NCR. Unlike metro rail projects, which are promoted by the respective State Governments, RRTS is a socially oriented, multi-state, central sector project being implemented in partnership with the State Governments.

In accordance with the MoU, RRTS is being implemented by the National Capital Region Transport Corporation (NCRTC), a joint venture of Government of India (50%) and participating State Governments of Delhi, Rajasthan, U.P. and Haryana (each having shareholding of 12.5%). Approval of the Union Cabinet for formation of NCRTC was obtained in July 2013.

NCRTC is mandated for implementing the Regional Rapid Transit System (RRTS) project across the National Capital Region, ensuring a balanced and sustainable urban development through better connectivity and access. The three prioritized RRTS corridors are Delhi-Meerut RRTS Corridor, Delhi-Gurgaon-Rewari-Alwar corridor and Delhi-Panipat RRTS Corridor.

3.5. Delhi Metro Rail Corporation Limited (DMRC)

The Delhi Metro Rail Corporation Limited (DMRC) was registered on 3rd May 1995 under the Companies Act, 1956 with equal equity participation of the Government of the National Capital Territory of Delhi (GNCTD) and the Central Government to implement the dream of construction and operation of a world- class Mass Rapid Transport System (MRTS). DMRC has equal equity participation from GOI and GNCTD. Under this scheme, the share of GNCTD is provided to DMRC through Transport Department. The basic objective is to provide the much needed mass rapid transport infrastructure facility for entire Delhi and NCR area and also to provide the inter-change facility from peripheral routes to the radial metro routes. Presently, the Delhi Metro network consists of about 350 Km. The year wise fund released by GNCTD of MRTS Phase III And Phase-IV is given in statement 12.2:

STATEMENT 12.2

YEAR-WISE FUND RELEASED FOR MRTS PHASE-III (& PHASE-IV) BY GNCTD

(₹ in Crore)

S. No	Year	Equity	Subordinate Debt for Land acquisition	Subordinate debt for State Taxes	Subordinate debt for Central Taxes	Total
PHASE IIII						
1	2011-12	749.70	216.00	-	294.00	1,259.70
2.	2012-13	749.70	216.00	-	294.00	1,259.70
3.	2013-14	672.20	200.00	-	170.00	1,042.20
4	2014-15	600.00	40.51	-	-	640.51
5	2015-16	827.00	40.00	577.00	-	1,444.00
6	2016-17	323.27	39.49	300.00	671.00	1,333.76
7	2017-18	240.00	5.50	660.00	424.00	1,329.50
8	2018-19	38.13	-	37.78	22.10	98.01
PHASE IV						
9	2018-19	50.00	100.00	-	50.00	200.00
10	2019-20 *	150.01	1,123.60	-	50.00	1,323.60
11	2020-21	500.00	-	125.00	125.00	750.00
	Total	4,900.01	1,981.10	1,699.78	2,100.10	10,680.98

(*) For Delhi MRTS Phase-IV Project (includes ₹ 50,000/- as balance equity for DMRTS Phase-II Project).

4. Achievement/ Progress of Major leading indicators

4.1. Motor Vehicles:

The total number of motor vehicles on road in NCT of Delhi on 31st March, 2021 was 122.53 lakh, showing the growth per cent of 3.03.The category-wise growth of motor vehicles in Delhi is presented in statement 12.3

STATEMENT 12.3

YEAR WISE GROWTH OF VEHICLE POPULATION

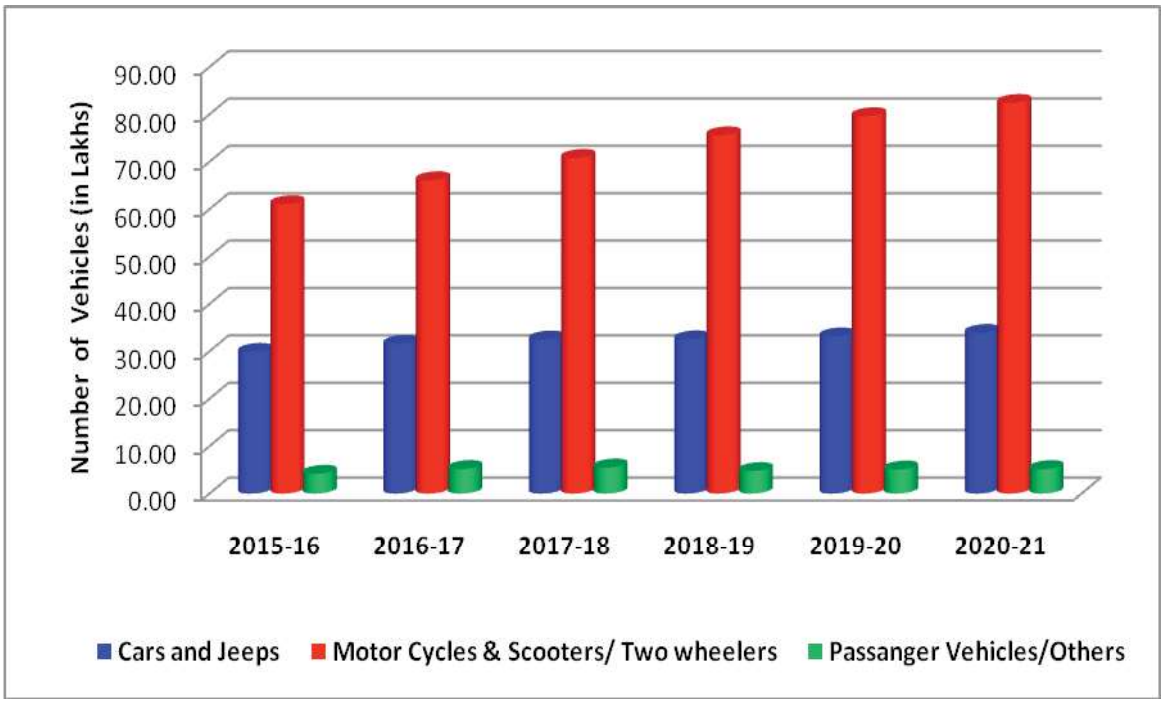
		Number of Vehicles					
S.No	Details	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
1	Cars and Jeeps	29,86,579	31,52,710	32,46,637	32,49,670	33,11,579	33,84,736
2	Motor Cycles & Scooters/ Two wheelers	61,04,070	66,07,879	70,78,428	75,56,002	79,59,753	82,39,550
3	Ambulances	2,990	3,059	3,220	2,358	2,287	2,289

		Number of Vehicles					
S.No	Details	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
4	Auto Rickshaws (Passenger)	1,98,137	1,05,399	1,13,074	1,13,240	1,14,891	1,14,869
5	Taxies	91,073	1,18,308	1,18,060	1,09,780	1,22,476	1,12,401
6	Buses	34,365	35,206	35,285	32,218	33,302	33,294
7	Other Passenger Vehicles	6,368	59,759	76,231	81,422	85,477	91,887
8	Tractors, Goods Vehicles (All Type) & Others	2,81,159	3,00,437	3,15,080	2,46,861	2,63,112	2,74,324
	Total	97,04,741	1,03,82,757	1,09,86,015	1,13,91,551	1,18,92,877	1,22,53,350*

**Number of vehicles registered are excluding NOC, RC Cancellation, Surrendered, De-registered and Scrapped Vehicles (Record available in Vahan 4.0 database).*

CHART 12.1

VEHICULAR GROWTH IN DELHI



- The **annual growth of vehicles** in Delhi **decreased** from **8.13** per cent in **2005-06** to **3.03** per cent in **2020-21**. During the same period the number of vehicles per thousand population increased considerably from 317 to 655. The details regarding annual growth rate is presented in statement 12.4.

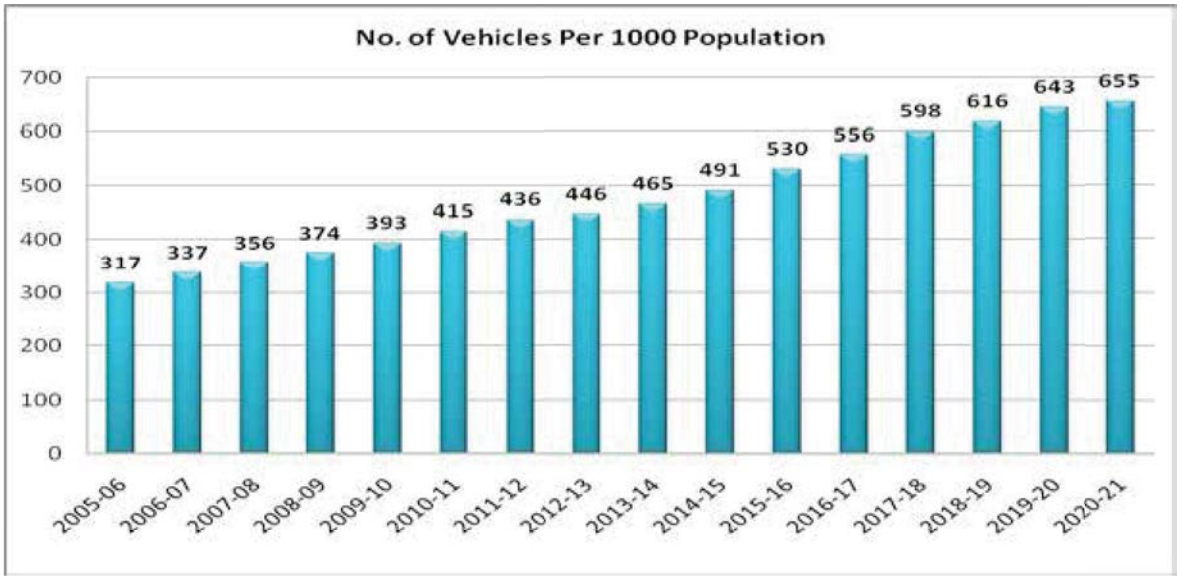
STATEMENT 12.4

GROWTH AND VEHICLES PER 1000 POPULATION

S.No	Years	Vehicles		Annual Growth (Per cent)	No. of Vehicles Per 1000 Population
		Number	Increase		
1	2005-06	48,30,136	3,62,982	8.13	317
2	2006-07	52,32,426	4,02,290	8.33	337
3	2007-08	56,27,384	3,94,958	7.55	356
4	2008-09	60,26,561	3,99,177	7.09	374
5	2009-10	64,66,713	4,40,152	7.30	393
6	2010-11	69,47,536	4,80,823	7.44	415
7	2011-12	74,52,985	5,05,449	7.27	436
8	2012-13	77,85,608	3,32,783	4.46	446
9	2013-14	82,58,284	4,72,676	6.07	465
10	2014-15	88,27,431	5,69,147	6.89	491
11	2015-16	97,04,741	8,77,310	9.94	530
12	2016-17	1,03,82,757	6,78,016	6.99	556
13	2017-18	1,09,86,015	6,03,258	5.81	598
14	2018-19	1,13,91,551	4,05,536	3.69	616
15	2019-20	1,18,92,877	5,01,326	4.40	643
16	2020-21	1,22,53,350	3,60,473	3.03	655

CHART 12.2

TRANSPORT TRENDS



- Delhi is a hub for personal motorized vehicles in India. Total motorized vehicles in Delhi are 122.53 lakh. Car and jeeps accounted for around 28% of the total registered motorized vehicles, whereas two wheelers are about 67% of total registered vehicles. Percentage of vehicles in Delhi during 2020-21 is depicted in Chart 12.3.

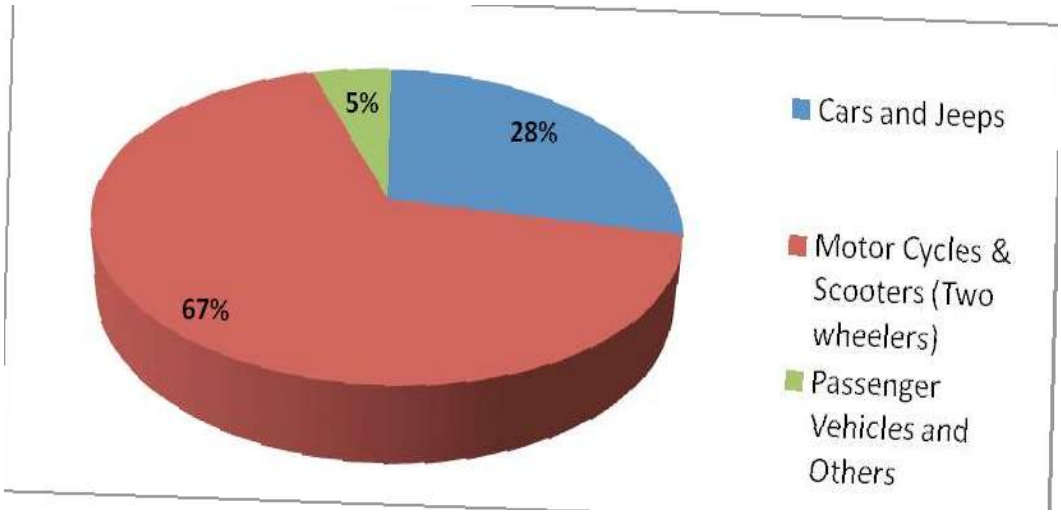
STATEMENT 12.5

CATEGORY WISE NUMBER OF VEHICLE AND PERCENTAGE

S.No	Details	Number of Vehicles	
		2020-21	Percentage
1	Cars and Jeeps	33,84,736	27.62
2	Motor Cycles & Scooters (Two wheelers)	82,39,550	67.24
3	Ambulances	2,289	0.02
4	Auto Rickshaws	1,14,869	0.94
5	Taxies	1,12,401	0.92
6	Buses	33,294	0.27
7	Other Passenger Vehicles	91,887	0.75
8	Tractors, Goods Vehicles (All Type) & Others	2,74,324	2.24
	Total	**1,22,53,350**	**100**

CHART 12.3

PERCENTAGE OF VEHICLES POPULATION 2020-21



- There is a contradiction regarding the actual number of vehicles plying on Delhi's road as the large numbers of vehicles registered in Delhi are plying in NCR areas and vis-a-vis the vehicles registered in NCR are plying in Delhi.
- Transport Department is making efforts to estimates the actual number of vehicles in Delhi by taking into account vehicles that have outlived their life due to any account, transferred to and from other states etc.

4.2. Delhi Metro Rail Corporation

Before Lockdown due to COVID pandemic, the average daily Passenger Journeys of Delhi Metro was about 57 lakhs (incl. Airport Line and Rapid Metro Gurugram). Due to social distancing norms, average daily passenger journeys have been affected and the average daily passenger journey recorded during the July 2021 to September 2021 quarter is 23.34 lakh. In

Delhi, the Metro Trains run from 6:00 AM in the morning till about 11:00 PM in the night. The train frequency varies from 2 minutes 44 seconds in peak time up to 10 minutes in non-peaks hours. The details regarding year-wise Average Daily Ridership is presented in Statement 12.6

STATEMENT 12.6
AVERAGE DAILY RIDERSHIP AND ROLLING STOCK
(with Airport Line and Rapid Metro)

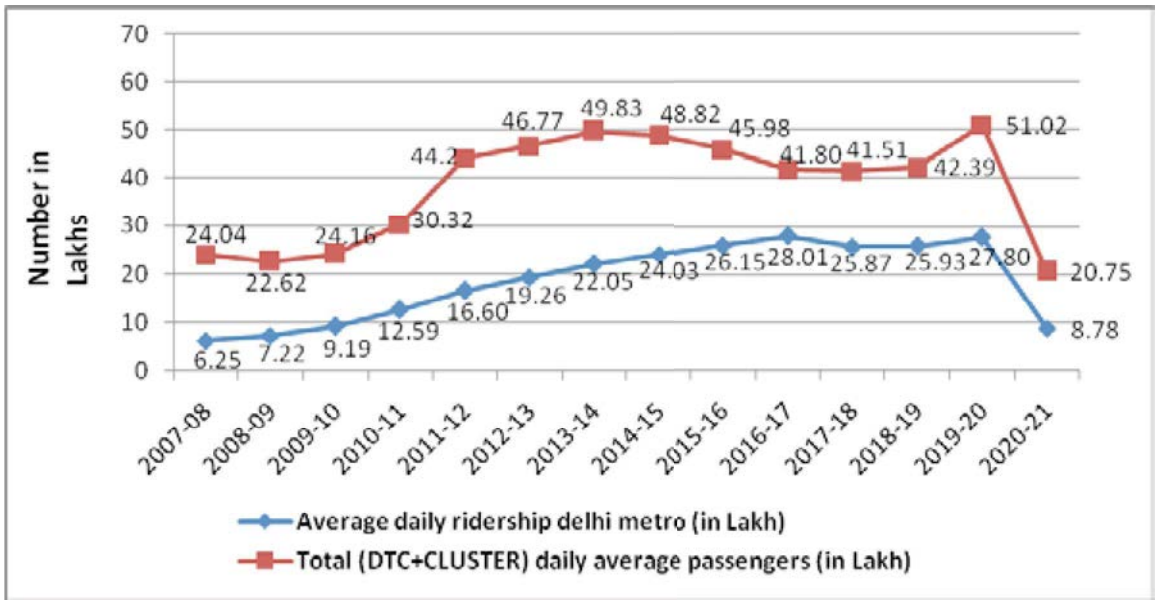
Year	Ridership	Operational Route (Km)	Rolling Stock (No. of Cars)
2007-08	6,25,000	64.750	280
2008-09	7,22,000	73.990	280
2009-10	9,19,000	95.260	376
2010-11	12,59,000	159.471	844
2011-12	16,60,000	165.142	1,022
2012-13	19,26,000	165.142	1,094
2013-14*	22,04,908	188.050	1,282
2014-15*	24,02,850	191.120	1,306
2015-16*	26,15,050	209.970	1,392
2016-17*	28,00,792	209.970	1,468
2017-18*	25,87,271	249.460	1,888
2018-19*	25,93,090	342.070	2188
2019-20**	27,80,000***	359.230	2,242
2020-21** (07.09.2020 – 31.03.2021)	8,78,000***	359.230	2,280

** Including Airport Line. DMRC has taken over the operation from the close of business operating hours of 30.06.2013.*

*** Including Rapid Metro. DMRC has taken over the operation on 22.10.2019*

**** Passenger Journey (Passenger Journey calculates a Metro journey in terms of the number of corridors used by a passenger.)*

CHART-12.4
AVERAGE DAILY RIDERSHIP OF DELHI METRO VS BUSES



4.3. Performance of Delhi Transport Corporation (DTC) Buses

DTC is the largest public transport entity in the NCR. DTC operates 3760 buses on 453city routes and 7 NCR routes. DTC is also operating International Bus Service on Delhi–Kathmandu. Daily average passengers in DTC buses are about 12.24 lakh during 2020-21. Electronic Ticketing Machine (ETMs) based automatic fare collection system (AFCS) in DTC Buses has been fully implemented. The performance of DTC is presented in Statement 12.7 and activity wise status of DTC is presented in Statement 12.8.

STATEMENT 12.7

PERFORMANCE OF DELHI TRANSPORT CORPORATION (DTC)

S. No.	Years	Fleet (In No's)	Fleet Utilization (In %)	Vehicle Utilization (Km/Bus/Day)	Load Factor (In %)	Passenger Carried per bus daily (In No's)	Daily Average Passengers (In Lakh)
1	2005-06	3,469	90.51	226	74.42	973	30.52
2	2006-07	3,444	81.47	199	77.18	951	26.77
3	2007-08	3,537	82.47	177	87.82	848	24.04
4	2008-09	3,804	77.03	171	68.83	772	22.62
5	2009-10	4,725	80.99	184	69.84	776	24.16
6	2010-11	6,204	75.03	185	71.43	700	30.32
7	2011-12	5,892	84.27	199	77.75	863	44.20
8	2012-13	5,445	85.77	202	92.90	973	46.77
9	2013-14	5,223	85.51	190	86.63	952	43.47
10	2014-15	4,712	83.99	188	85.02	930	38.87
11	2015-16	4,352	83.63	191	82.00	927	35.37
12	2016-17	4,027	85. 12	199	81. 36	890	31. 55
13	2017-18	3,951	85.69	191	83.83	878	29.86
14	2018-19	3,849	84.62	195	81.34	915	30.15
15	2019-20	3,762	85.04	193	86.17	1,033	33.31
16	2020-21	3,760	76.95	180	22.97	423	12.24

Source: Operational Statistics of DTC

STATEMENT 12.8

ACTIVITIES OF DELHI TRANSPORT CORPORATION: 2017-18 to 2020-21

S. No	Details	Types	2017-18	2018-19	2019-20	2020-21
1	Total Buses in the Fleet (At the end)	Non- AC	2506	2506	2505	2504
		AC	1275	1275	1257	1256
		Standard	170	68	-	
		Total	3951	3849	3762	3760
2	Buses on Road (Daily Average)	Non- AC	2232	2197	2149	1963
		AC	1078	1071	1073	931
		Standard	92	27	-	-
		Total	3402	3295	3222	2894
3	Passengers (in Crore)	Non- AC	84.86	84.96	85.66	31.41
		AC	21.77	24.35	36.16	13.27
		Standard	2.35	0.74	-	-
		Total	108.98	110.15	121.82	44.68
4	Daily Average Passengers (in Lakh)	Non- AC	23.25	23.28	23.4	8.6
		AC	5.97	6.67	9.88	3.64
		Standard	0.64	0.2	-	-
		Total	29.86	30.15	33.29	12.24
5	Kilometer operated (in Crore)	Non- AC	15.78	15.68	14.96	12.3
		AC	7.41	7.57	7.76	6.69
		Standard	0.54	0.15	-	-
		Total	23.73	23.4	22.72	18.99
6	Kilometer operated Daily Average (in lakh)	Non- AC	4.32	4.3	4.09	3.37
		AC	2.03	2.07	2.12	1.83
		Standard	0.15	0.04	-	
		Total	6.5	6.41	6.21	5.2
7	Break-down per 10000 buses	Non- AC	713	710	806	472
		AC	923	898	1029	627
		Standard	730	735	-	
		Total	780	781	880	522
8	Accidents	Non- AC	75	79	83	55
		AC	43	45	35	12
		Standard	3	1	-	
		Total	121	125	118	67
9	Inter-State Bus Route Service		8	8	7	7
10	D.T.C. Work Shops		2	2	2	1
11	D.T.C. Depots		39	39	35	35

Government is providing various concessions in the bus fares to students, senior citizens, disabled, freedom fighters etc in DTC and Cluster Buses. The concession amount is reimbursed by GNCTD. The Govt. of NCT of Delhi has reimbursed an amount of ₹ 78.82 Crore for concessional passes during 2020-21.

4.4. Performance of Cluster Buses

Cluster Buses: - The Government of NCT of Delhi initiated the Scheme in 2011- 12 for Corporatization of Private Stage Carriage Service to substitute the Blue line private stage carriage system under Public Private Partnership (PPP) model. Under this scheme, 657 stage carriage bus routes of Delhi have been divided into 17 distinct clusters. Presently, 3033 cluster buses are in operation under 14 clusters in the NCT of Delhi. Electronic Ticketing Machine (ETMs) based automatic fare collection system (AFCS) in Cluster Buses has been fully implemented. Department of Transport has initiated the trial of Contactless Mobile Ticketing in 497 Cluster buses w.e.f. 05.08.2021 in 04 depots. It has been further extended on all the cluster buses from 01.03.2021 onwards. The performance data of the cluster buses are given under:

STATEMENT 12.9

PERFORMANCE OF CLUSTER BUSES

S.No	Years	Fleet (No)	Fleet Utilization (In %)	Vehicle Utilization (Km/Bus/Day)	Load Factor* (In %)	Passenger Carried per bus daily	Daily Average Passengers (In Lakh)
1.	2013-14	1,090	93.49	218.43	81	950	6.36
2.	2014-15	1,402	97.30	217.61	78	899	9.95
3.	2015-16	1,490	98.84	214.52	74	831	10.61
4.	2016-17	1,651	98.10	210.02	78	755	10.25
5.	2017-18	1744	97.16	205.15	81	753	11.65
6.	2018-19	1,803	98.66	211.02	88	760	12.24
7.	2019-20	2,910	96.48	202.10	89	841	17.71
8.	2020-21	3,191	98.88	214.05	67	308	8.51

** LF is calculated using Central Institute of Road Transport (CIRT) Formula, Source: DIMTS Ltd.*

5. Road Safety measures

- Government of NCT of Delhi is taking various initiatives such as conducting road safety campaigns at schools and college level, educating the general public about the road safety and other measures.

- **The State Road Safety Council**: The Delhi State Road Safety Council was earlier constituted under the chairmanship of Commissioner (Transport) in 2005. However, on the directions of the Supreme Court Committee on Road Safety, the Government of NCT of Delhi has re-constituted the Delhi State Road Safety Council on 07.07.2017 under the Chairpersonship of Hon'ble Transport Minister for political commitment to assure co-ordination among various agencies for safety of pedestrian, non-motorized vehicles & road users, to assure safety measures for Road users and facilities for design for engineering, re-engineering, repair etc. on technical standards.

- **The District Road Safety Committees**: The District Road Safety Committees have also been established vide notification dated 17.06.2014 in all the eleven revenue districts of NCT of Delhi headed by the Deputy Commissioner of each district and Deputy Commissioner of Police; Deputy Commissioner Police (Traffic); Superintending Engineer (PWD); Superintending Engineer (MCD/NDMC); Superintending Engineer (DDA); Additional CDMO (Health); Deputy Director (Education) and Motor Licensing Officer (Transport) of each district concerned as its Members and Additional District Magistrate Convener/Member of each district concerned. The District Road Safety Committees are performing the functions related to Road Safety measures at the district level.

- **Road Safety Policy:** Delhi Road Safety Policy has been notified on 13.07.2018.Objective of road safety policy is to ensure road safety for all road users in the NCT of Delhi, with priority to pedestrians and cyclists, to achieve zero fatalities due to road accidents in the long run it includes awareness regarding road safety, strengthening institutional arrangements, establish road safety management information system, ensure safe road infrastructure, planning & designing of roads, safer motor vehicles, safe divers, safety for vulnerable road users, road safety education and training etc.

- A Participatory Agreement was signed with vital strategies in co-ordination with World Resources Institute (WRI) to participate in the next phase of Bloomberg Initiative of Global Road Safety (BIGRS) project for 2020-2025 which will provide targeted technical assistance, training for staff from relevant agencies and periodic road users' behavior observational surveys to the participant cities.

- A Road Safety Summit 2021 was held on 1st October, 2021 with the road safety stakeholders including Delhi Traffic Police, Health, Education, Municipal corporation, IIT-Delhi, CRRI, SPA, Research organizations, NGOs and international experts to share a robust action plan for safety on the streets of Delhi.

- MoU between Transport Department, GNCT of Delhi and Foundation for Innovation and Technology Transfer, IIT Delhi was signed on 01st October, 2021 for providing technical support for monitoring and implementation of transport policies for improving Traffic Safety and Public Transport System in Delhi.

- The process of implementation of iRAD (Integrated Road Accident Database Application in NCT of Delhi is in progress. The iRAD Project will be implemented in coordination with stakeholders department like Police,

Transport, and Road owning agencies (Highways / PWD etc.) and Health in coordination with NIC/NICSL. The objective of the project is to collect and analyze comprehensive data related to road accidents from the field using appropriate technology.

5.1. **Installation of CCTV Cameras in DTC and Cluster Buses**:-

CCTV, Panic Button, and Automated Vehicle Tracking System (AVTS) devices have been installed in 5499 buses include DTC and Cluster scheme. However, the newly procured 1380 Standard Floor & Low Floor buses of cluster scheme are already equipped with these devices.

5.2. **Augmentation of DTC Night bus service (11 PM – 5 AM)**: Gender Sensitization Program for bus crew undertaken by DTC is also being conducted on a regular basis or safety of women passengers. Numbers of buses have been increased to 88 buses on 27 routes. 30 Ladies Special Buses are also being plied during peak hours on 30 routes. 25% seats have been reserved for women in stage carriage buses (i.e. Low floor buses – 10 seats, &standard floor buses – 12 seats. Comparative detail for the years 2019-20 and 2020-21 is presented in Statement 12.10.

STATEMENT 12.10

PERFORMANCE OF DTC BUSES

Details	2019-20	2020-21
No. of Buses in Night Bus Service	88	88
No. of routes of Night Bus Service	27	27
No. of Civil Defense Marshals & Home guards	7,835	9,286 (31.10.2021)
No. of Ladies Special bus routes	30	30
Percentage of seats reserved for ladies	25	25

5.3. Deployment of Marshals in Buses:

The Govt. of NCT of Delhi has decided to depute “Marshals” in all DTC & Cluster buses in both shifts from 29.10.2019. As on 31.10.2021, 9286 marshals & Home Guards in DTC and 3368 marshals in Cluster buses were deployed for women safety and security.

6. Ongoing schemes and new Initiatives:

6.1. **Electric Vehicle Policy:**

The EV policy was notified by the Transport Department vide order dated 07.8.2020 The Policy shall remain valid for a period of three (3) years with effect from 07.08.2020. The Policy provides for promoting EV mobility in Delhi through following measures: -

a. Purchase Incentives
b. Scrapping Incentives
c. Establishment of network of charging stations;

The policy provides for creation of a non-lapsable State EV Fund for funding high proportion of the incentives proposed under the policy. The department has been disbursing incentives since 22nd October, 2020. 5640 vehicles have been provided subsidies under the scheme upto March, 2021. Total subsidy of ₹ 20.2 Crore has been given upto March, 2021. Upto 20.09.2021, subsidies have been provided to 9162 vehicles (Including E-Rickshaws) Under the scheme. Total subsidy of ₹ 32.95 Crore approx. has been given upto 20.09.2021. Total ₹ 34.31 Crore subsidy has been disbursed to 9633 E-Vehicles till October 2021. However Total Amount of ₹ 35.95 Crore has been disbursed to 10,248 E-Vehicles.

6.1.1. **Registration of EVs:** The department has registered close to 22,000 EVs since the inception of the EV Policy till 20.10.2021.

6.1.2. **Implementation of Public Charging Infrastructure**: Delhi Trans Co Ltd. And enterprise of Power Department, GNCTD has floated a tender for the installation of 100 Charging Stations across Delhi, for which the locations/sites have already been identified. It is planned to provide a capital subsidy of ₹ 10 Crores as one time expense for electrical infrastructure augmentation upto 100 kw across these sites. The final Notice Inviting Tender (NIT) is out and the expected date to open the bids is 17.11.21. However, SDMC and NDMC in their own capacity have installed charging stations at 119 locations which in total have 272 charging points.

6.1.3. **Promotion of Private Charging Infrastructure**: A reduced electricity tariff of ₹ 4.50 is applicable for EV charging in the NCT of Delhi. As per Delhi EV Policy, an incentive of upto ₹ 6000/- will be provided for the initials 30,000 installation of electric charging points in residential/ workplace premises. DISCOMS have empanelled the vendors for installing EV chargers and creating a single window process for installing charging stations in private premises and disbursement of incentives. However, the citizen portal for applying for Private charging infrastructure will be ready by 02.11.21. Lastly, there are at present 28 privately installed charging points in the State.

6.1.4. **For promotion of adoption of Electric Auto-rickshaws**: The department organized an e-auto mela for prospective buyers of the vehicle. This was done by the following decision of the department to allocate the unassigned 4261 permits only for e-autos. Additionally, the department also took the decision to reserve 33% of the e-auto permits for Women, which translates to 1406 permits that have been reserved for women drivers of the State. The unique colour scheme as Pink colour Auto-rickshaw has been notified for the e-Auto Rickshaw registered in case of reserved Auto-rickshaw for women. However the scheme has been notified for inviting the online application and the

process of scrutiny has been started. The entire procedure for registration of e-Auto Rickshaw will be completed upto December, 2021. The department has also collaborated with Convergence Energy Service Limit (CESL) to provide Interest Subvention scheme of 5% through their one stop solution of a web portal and a mobile application where the prospective buyers can view, book a test drive, buy and finance their vehicle.

6.1.5. **Last Mile Connectivity by e-Rickshaw**: 1,033,000 E Rickshaws have been registered upto October 2021 for improving first & last mile connectivity in Delhi. However, 99,522 e-Rickshaws have been registered for improving first & last mile connectivity in Delhi.

6.1.6. **Electric Autos** are also being introduced in Delhi and it has been decided to allot 4261 e-autos permits within this year itself.

6.2. **Electric Vehicle Fund:**

The electric vehicles are proposed to be encouraged to fight against rising pollution level in Delhi. "Pollution Cess"on the sale of diesel is already applicable in the NCT of Delhi at 25 paise per litre being levied collection from which accrues to the Air Ambience Fund under the Environment Department. From the date of issuance of this policy, 50% of the amount collected in Air Ambience Fund shall be transferred to State EV Fund on a monthly basis. 50% amount standing in the credit of Air Ambience Fund as on the date of issuance of the policy shall also stand transferred to the state EV Fund, GNCTD shall strive to levy a Pollution Cess on all ICE Vehicle users in future."However a separate budget head is available in Govt. of NCT of Delhi for Electric Vehicle Fund and a provision of ₹ 10.22 crore has been kept in BE 2021-22 under this head.

6.3. **Electric Buses:**

The National Electric Mobility Mission Plan (NEMMP) 2020 is a National Mission document providing the vision and the road map for the faster adoption of electric vehicles and their manufacturing in the country. As part of the NEMMP 2020, Department of Heavy Industry formulated a Scheme viz. Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme in the year 2015 to promote manufacturing of electric and hybrid vehicle technology and to ensure sustainable growth of the same. GNCTD has decided to engage pure electric buses in Delhi which will go a long way to reduce overall vehicular emissions in Delhi. Ministry of Heavy Industries & Public Enterprises, GoI conveyed the approval of the competent authority to extend financial support for deployment of 300 electric buses on operational cost Model under phase-II of FAME India scheme to DTC.

A draft Cabinet Note subjected "Proposal for the induction of electric buses in

public transport and approval of a roadmap for the adoption of pure electric buses & modernization of fleet in Delhi aligned with Delhi electric vehicles policy, 2020" is also proposed, wherein it has decided to induct a total of 4005 e-buses in DTC and Cluster Scheme. It has also been proposed that now onwards all the buses whether new or being replaced, shall be e-buses. To achieve this, it has proposed to electrify 41 DTC Depots (3 already electrified) and 8 Cluster Depots (2 already electrified).

The immediate induction in place is as under:

i. **300 AC Low Floor Pure Electric DTC Buses:** After selection of the L-1 bidder, LOA has been issued for engagement of 300 e-buses on 30.03.2021 under Fame-II Scheme under OPEX model. Buses are likely to be inducted upto April 2022.

ii. **330 AC Low Floor Pure Electric Cluster Buses:** Tenders for 330 Low floor Ac Electric buses in two cluster at Burari Depots and Rohini Sec-37-II Depot, have been floated. The Proposal due date is 29.11.2021 as buses are likely to be engaged from January 2023 to June 2023.

7. Free Travel for Women:

The free travel facility for women in DTC/ Cluster buses has been given by GNCTD from 29.10.2019. A single journey based pass of ₹ 10/- for both AC and Non-AC buses is being issued in the form a similar size of ticket currently being distributed in the colour "Pink". DTC is printing these passes and issues to DIMTS for cluster buses and proper accounting of these tickets is being maintained by both the DTC & DIMTS. During 2020-21, the women passengers traveled free in DTC and Cluster buses for which ₹ 114.86 crore and ₹ 102.18 crore given to DTC and Cluster buses respectively towards subsidy.

8. Reform Package of Transport Services:

The Transport Department has taken up a major initiative to provide all public services in faceless manner. The applicants will be required to have physical visit only for the purpose of taking a driving test or fitness of vehicle. It has resulted in minimizing the department's manual interface with public.

8.1. **Faceless Services**: Currently, 47 services (12 RC services, 17 Permit and Fitness Services in First Phase with 2 Services are under process in Second Phase and 16 DL services in First Phase) have been completely switched to faceless delivery mode and more than 5.73 lacs applicants have been benefitted from this programme till October 2021. The remaining services shall also be made available in faceless manner shortly.

8.2. **Online learner license test and issuance of e-learner license:** The department had achieved successfully the simplification of the process of issuance of learner's license. The applicant is able to take the on-line leaner license test from any location without the need to physically visiting the DTO offices. An e-learner license will be issued on the spot after clearing the on-line test.

8.3. **Empowerment of vehicle dealers to issue Registration Certificates and to do temporary registration for Inter State Sale**: The Transport department has started pilot testing of issuance of Registration Certificates at the point of sale, with secure log in. credentials. Further, Vehicle dealers have also been empowered to do temporary registration for Inter State sale. Now, the purchaser of a vehicle in Delhi will get an RC at the time of delivery of vehicle itself.

Annexure R-21

ITDP

A Global High Shift Scenario:

Impacts And Potential For More Public Transport, Walking, And Cycling With Lower Car Use

September 2014

By Michael A. Replogle, Institute for Transportation and Development Policy
& Lewis M. Fulton, University of California, Davis

Published by

Lewis M. Fulton
Co-Director, NextSTEPS Program
University of California, Davis
1605 Tilia St., Suite 100, Davis, CA 95616, USA

Michael A. Replogle
Managing Director for Policy and Founder
Institute for Transportation and Development Policy (ITDP)
9 E. 19th Street, 7th Floor, New York, NY 10003 USA

Acknowledgments

The authors wish to thank the Ford Foundation, ClimateWorks Foundation, and Hewlett Foundation for their generous financial support that made this work possible, and our project officers there, Don Chen, Joe Ryan, and Margarita Parra.

We also thank the individuals who participated in meetings of the advisory committee for this sustainable transport scenarios study, some of whom offered invaluable access to survey and cost data collected by the World Bank, Asian Development Bank, and InterAmerican Development Bank, and field offices of the Institute for Transportation and Development Policy, World Resources Institute/EMBARQ, and other NGOs. Members of that group include Shomik Raj Mehndiratta, Andreas Kopp, Roger Gorham, Dario Hidalgo, Ramiro Alberto Rios Flores, Ko Sakamoto, Rafael Acevedo Daunas, Cornie Huizenga, Francois Cuenot, Karl Fjellstrom, Xiaomei Duan, Shreya Gadepalli, Bernardo Baranda, Ulises Navarro, Clarisse Linke, and Yoga Adiwinarto.

Without that support we would not have been able to advance the new approach to evaluating the equity impacts of alternative transportation investments that was developed for this study. Thanks also to staff at the International Energy Agency, International Transport Forum, and OECD who shared insights and methods they are developing to apply the IEA MoMo model more effectively to consider the full range of avoid-shift-improve sustainable transport strategies, especially Aimee Aguilar Jaber, Philippe Crist, Jean Francois Gagne, and Francois Cuenot.

We would like to thank Kate Blumberg, Cristiano Facanha, and Joshua Miller of the International Council on Clean Transportation (ICCT) for their generous support in applying the ICCT Roadmap model to evaluate air pollution and health impacts of the baseline and High Shift scenario, and summarizing their work in the results chapter on Air Pollution and Public Health.

Finally, the authors thank all the members of the Research Team at UC Davis and ITDP who carried out much of the data gathering, data cleaning, and data refinement and analysis work. In particular, Rosaria Berliner made an invaluable contribution to the project throughout. She and Jacob Mason did valuable work to extend and refine the global public transportation database developed for this project. We thank also the contributions of Duaa Getanni of UC Davis and Colin Hughes, Jemilah Magnusson, and Aimee Gauthier, of ITDP, and Dan Klotz of Burness Communications who helped manage elements of the project and its strategic communications. Paulo Humanes and Andre Münch of Planning Transport Verkeher AG helped us consider how to integrate safety issues into this study, in work that is still ongoing which we hope to report on soon.

There are many other people too numerous to name who helped this project succeed and we thank them. Of course the flaws in the end product are the responsibility of the authors alone.

Contents

Acknowledgments 3

Executive Summary 5

Introduction 7

- Study Background and Context 7
- Urban Trends and Projections 8
- Methodology 9
- Baseline Scenario 10
- High Shift Scenario 10

Key Findings: 11

- Urban Rapid Transit Projections 11
- Passenger Travel Comparisons 13
- Urban Buses: Assumptions And Results 16
- Urban Rail: Assumptions And Results 17
- Low-Powered And Non-Motorized Vehicles: Assumptions And Results 18
- Changes In Car/2-Wheel Travel 20
- Scenario Impacts: Energy & CO_2 Emissions 21
- Results: Transit System Requirements 25
- Results: Cost Implications of the High Shift Scenario 25
- Results: Equity Implications of the High Shift Scenario 27
- Sensitivity Analysis: High Shift High BRT Scenario 29
- Sensitivity Analysis: Air Pollution and Public Health Impacts 29

Conclusions And Next Steps 33

References 34

Executive Summary

This report is the first study to examine how major changes in urban transport investments worldwide would affect urban passenger transport emissions as well as mobility by different income groups. It starts with the most recent United Nations urban population forecasts and the most recent model framework and forecasts used by the International Energy Agency (IEA) for global mobility modeling. The study extends these with new research on the extent of various urban passenger transport systems in cities across the world, as well as new estimates of the extent of mobility by non-motorized transport and low power e-bikes.

The study considers two main future scenarios: a baseline urban scenario calibrated to the IEA *2012 Energy Technology Perspectives 4° Scenario* and a newly developed alternative scenario called "High Shift" (HS), with far greater urban passenger travel by clean public transport and non-motorized modes than in the Baseline and a decrease in the rates of road construction, parking garages and other ways in which car ownership is encouraged.

The study concludes that this High Shift scenario could save over $100 trillion in public and private capital and operating costs of urban transportation between now and 2050 and eliminate about 1.7 gigatons of carbon dioxide (CO_2) annually – a 40 percent reduction of urban passenger transport emissions -- by 2050. This suggests one of the more affordable ways to cut global warming pollution is to design cities to give people clean options for using public transportation, walking and cycling. In recent years transportation, driven by rapid growth in car use, has been the fastest growing source of CO_2 in the world.

Transportation in urban areas accounted for about 2.3 gigatons of CO_2 in 2010, almost one quarter of carbon emissions from all parts of the transportation sector. Rapid urbanization—especially in fast developing countries like China and India—will cause these emissions to nearly double worldwide by 2050 without changes in policy and investments.

Among the many countries and regions examined in this global study, three stand out:

- **United States:** Currently the world leader in urban passenger transportation CO_2 emissions, with 670 megatons annually, the US is projected to lower these emissions to 560 megatons by 2050 because of slower population growth, higher fuel efficiencies, and the decline in driving per person that has already started as people move back to cities. But this pace can be sharply accelerated with more sustainable transportation, dropping by half to 280 megatons, under the "High Shift" (HS) scenario. For the U.S. in particular this scenario includes not only mode shifting, but also considerable reductions in urban kilometers of travel per person through urban re-centralization and substitution of telecommunications for travel.

- **China:** CO_2 emissions from transportation are expected to mushroom from less than 200 megatons annually today to nearly 1200 megatons (1.2 gigatons) in 2050, due in large part to the explosive growth of China's urban areas, the growing wealth of Chinese consumers, and their dependence on automobiles. But this increase can be slashed to fewer than 700 megatons under the "High Shift" scenario, in which cities develop extensive BRT and metro systems. Total kilometers of travel do not drop significantly for China in HS. The latest data show China is already sharply increasing investments in public transport.

- **India:** CO_2 emissions are expected to leap from about 70 megatons today to over 500 megatons in 2050, also because of growing wealth and urban populations. But this increase can be moderated, to only 350 megatons, under HS, by addressing crucial infrastructure deficiencies in India's public transport systems and slowing the growth in car use.

943

583

While this study has not focused on further actions to boost motor vehicle fuel economy, it takes into account existing policies that, in the IEA Baseline scenario, would reduce energy use by improving average new car fuel economy by 32% in the OECD and 23% in non-OECD countries. The High Shift scenario increases this to 36% and 27% respectively, due to improved in-use driving conditions and a slight shift to smaller vehicles. However, the Global Fuel Economy Initiative (www.globalfueleconomy.org) calls for much more: a 50% reduction in fuel use per kilometer for light-duty vehicles worldwide by 2030. Achieving the GEFI 2030 goal could reduce 700 megatons of CO_2 annually beyond the 1,700 reduction possible from a High Shift scenario. Taken together, achieving this fuel economy goal with better public transport, walking, and cycling could cut annual urban passenger transport CO_2 emissions in 2050 by 55 percent from the baseline in 2050 and 10 percent below 2010 levels. Strong fuel economy programs for other types of vehicles (medium- and heavy-duty trucks, buses, and 2-wheelers) as well as vehicle electrification and other low-carbon fuels are key complementary strategies to enable deep cuts transportation sector CO_2 emissions. These options will be investigated further in relation to High Shifts in the future.

Diesel black carbon soot emissions not only contribute to climate change, but as local air pollution these emissions are a leading cause of early death, responsible for more than 3.2 million early deaths annually. Exposure to vehicle tailpipe emissions is associated with increased risk of early death from cardiopulmonary disease and lung cancer, as well as respiratory infections in children. Car and diesel exhaust also increases the risk of non-fatal health outcomes, including asthma and cardiovascular disease.

Thanks to analysis by the International Council on Clean Transportation (ICCT), this study considers the effect of motor vehicle emissions controls and changes in vehicle activity on tailpipe emissions of fine particles, or soot, and related public health impacts. While better public transport, walking and cycling have the potential to cut air pollution; these benefits can be eroded or even reversed if buses lack the strongest emission controls. Future growth in vehicle activity could produce a four-fold increase in associated early deaths by 2050 even with a global shift to mass transit. Adoption of best-practice motor vehicle emission controls and ultralow-sulfur fuels – consistent with or better than the latest Euro 6/VI standards adopted in Europe – across most of the world could save 1.36 million early deaths annually. Cleaner buses alone would account for 20 percent of these benefits. Thus, such emission controls are a sensible part of any High Shift strategy.

Using a new methodology developed for this study to evaluate the equity impacts of changes in transportation systems, the study also assesses how these alternative scenarios might affect the mobility of people at different income levels in various countries and regions. This shows that the majority of the world's population currently lacks access to cars and will continue to lack access even in 2050. Under the baseline scenario there would be much greater inequality of mobility than if cities develop more efficient and widespread public transportation and safe and attractive conditions for walking and cycling, as occurs under the High Shift scenario. In this scenario, mass transit access would more than triple for the lowest income groups and more than double for the second lowest groups. Notably, overall mobility (kilometers per person per year) evens out between income groups to 2050 compared to the Baseline, providing those more impoverished with better access to employment and services that can improve their family livelihoods.

The study concludes that unmanaged growth in motor vehicle use threatens to exacerbate growing income inequality and environmental ills, while more sustainable transport delivers access for all, reducing these ills. This report's findings should help support wider agreement on climate policy, where costs and equity of the cleanup burden between rich and poor countries are key issues.

Introduction

Study Background and Context

While a number of studies have focused on the effects on global warming pollution of more stringent standards for motor vehicle fuel economy,[1] emissions of local air pollutants,[2] and alternative fuels, this is the first study to examine how major changes in transport infrastructure and transit system investments world-wide would affect urban passenger transport emissions as well as mobility by different income groups.[3] The findings of the study are relevant to three concurrent policy discussions by world leaders: how to manage climate change, how to advance equitable and environmentally sustainable economic and social development, and how to manage unprecedented urbanization. To make progress, the world needs to find ways to do all these things together.[4] This report shows a way to do so.

The study, first released on the September 17, 2014 United Nations (UN) preparatory meeting for Habitat III, and discussed at events connected to the UN Secretary General's Climate Summit on September 23, 2014, contributes to concurrent discussions of Sustainable Development Goals (SDGs) recommended to the UN General Assembly. This includes an SDG focused on sustainable cities and human settlements with a key target for sustainable transportation.

This paper is the product of an 18-month research initiative by ITDP and UC Davis, with funding from the Ford Foundation and ClimateWorks Foundation to explore an alternative future and estimate its potential impacts, while considering what types of investments and policies would be needed to achieve such a future. It considers two main future scenarios: a baseline urban scenario calibrated to the International Energy Agency's (IEA) ETP2012's 4° scenario (4DS)[5] and a newly developed alternative scenario called "High Shift", with far greater urban passenger travel by clean public transport and non-motorized modes than in the Baseline.

This project was inspired by the 2012 Rio+20 voluntary commitment by eight multilateral development banks to devote $175 billion towards more sustainable transport investments over the next decade[6] as well as other voluntary commitments to double public transport use and expand sustainable transport.[7] While this is only a small part of what it will take to develop the needed transport systems, these inspire exploration of what a shift toward more sustainable transport might look like, what it might cost, and what impacts it might have.

Urban Trends and Projections

An important aspect of the analysis is urbanization. This study uses the UN 2014 Revisions of its World Urbanization Prospects population projections as a foundation for its urban travel projections, in particular the potential number of transit systems of different types around the world. The UN projections are shown in Figure 1. Urbanites are projected to represent about 2/3 of the world's population in 2050 (6.3 billion out of 9.6 billion).

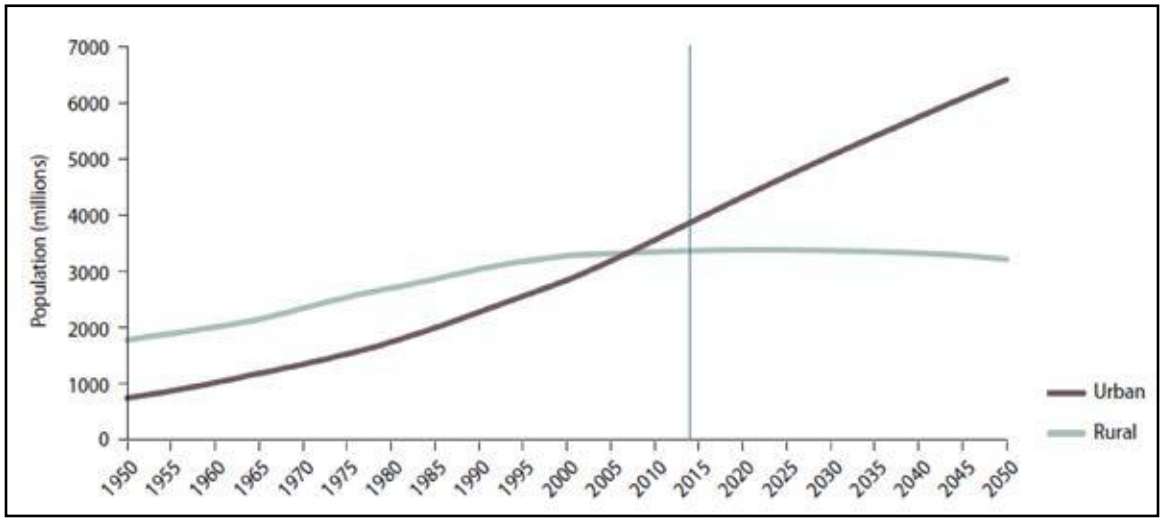


Figure 1: UN Projections of Urban and Rural Population

The growth in urban sizes is fairly evenly distributed across city size class; megacities grow considerably as do other large cities; however over 1/3 of urban population remains in cities below 300,000 size, as shown in Figure 2.

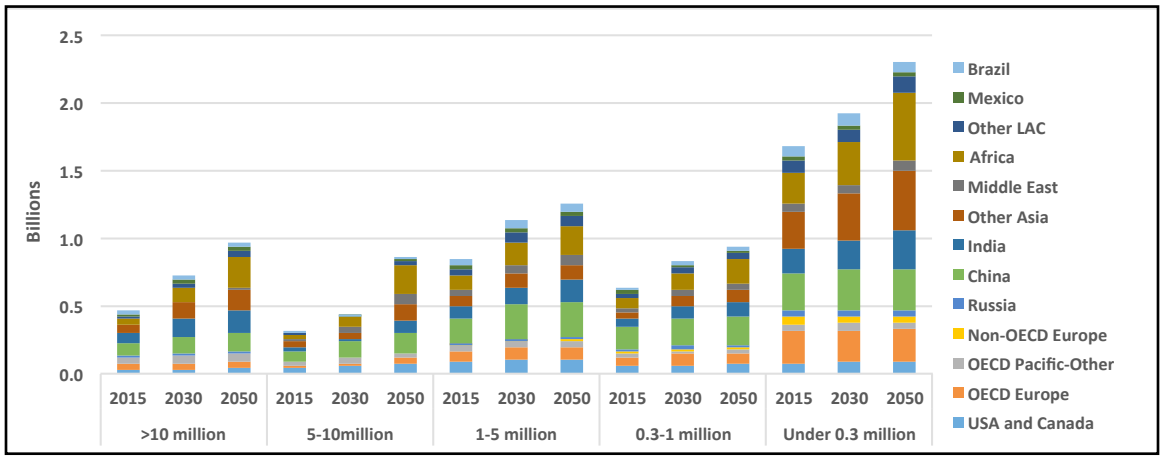


Figure 2: Projection of Urban Population by City Size

946

586

Methodology

This analysis uses a somewhat simplified "what-if" approach, though with considerable regional and modal detail. It provides a base picture of urban travel around the world at a significantly higher resolution than any previous study – for example, with more modes and better estimates of passenger travel by mode. The following sections describe the methodology, data and assumptions used in the study, the baseline and High Shift scenarios, and a range of results and implications, with conclusions for policy making and proposed extensions of this research.

The analysis is developed using an urban model based on IEA's Mobility Model (MoMo). MoMo is a national-level model that allows a detailed representation to be made of travel, energy use and CO2 emissions, and for this project this framework has been extended to focus on urban travel. MoMo contains some urban modes (e.g. city buses), and some modes accounted for only nationally (e.g. car travel). In this project, additional urban modes have been elaborated (e.g. metro, tram, commuter rail) and the urban share of all modes is estimated using the MoMo world framework of 32 countries and regions.[8] The existing national projection system and scenarios form the basis for our urban scenarios, including the baseline and alternative, "High Shift" scenario (HS).

Although there have been few macro studies of modal shift potential, there are important pre-cursers to this one. The 2009 *Moving Cooler* study[9] evaluated 48 transport strategies and policies that would affect United States motor vehicle activity and use, bundled in various ways under different scenarios. It analyzed their impact on overall U.S. CO_2 emissions out to 2050 considering baseline and forecast travel markets using a motor vehicle stock model. This formed the foundation of a related report to Congress.[10] The IEA published an analysis of modal shift across all types of travel (with no urban breakouts) in their 2009 study *Transport, Energy and CO2: Moving Toward Sustainability*.[11]

Baseline Scenario

The IEA ETP 2012 MoMo 4°C global warming scenario (4DS) provides the basis for this study's Baseline scenario. While IEA's 6°scenario appears to be closer to the current path the world is on, there are reasons to believe that a 4° future is more likely at this point, given recent policy activity. 4DS assumes—among other things—a global climate agreement that creates a global CO2 pricing system to restrain GHG emissions growth, but without sector-focused shifts in investments and policies that might flow from concerted pursuit of broader sustainable development goals.

This baseline builds on recent trends in travel around the world, including a continued strong rise in car ownership and use as incomes rise. In the urban context, car and (in some regions) motorcycle travel mode shares rise rapidly in the Baseline scenario, with travel by mass transit, walking and cycling slow growing or stagnant in most regions. Fuel efficiency improvements occur rapidly for a while where fuel economy standards are in place but stagnate after 2030; alternative fuels do not gain much traction and petroleum fuels still dominate in 2050.

High Shift Scenario

The High Shift (HS) scenario has been built up assuming major departures from the Baseline in terms of travel trends, particularly after 2020. The same overall growth trajectories in travel are assumed but shifts to transit and non-motorized modes gradually occur (or shifts away from these modes are greatly slowed) based on much better provision of high quality options in cities worldwide. This in turn requires major investments in new systems and provision of infrastructure such as Bus Rapid Transit (BRT), rail, and bike lanes, which are estimated in connection with the scenario. Targets for urban and metropolitan area transit system development and associated passenger travel are linked to the UN 2014 revisions of urban population through 2050 (with explicit projections for individual cities to 2030), with urban population rising to 66% of global population, from 50% today.[12]

This High Shift scenario considers what could be if the policies and investments currently in place in the nations with the most efficient urban transport, were replicated throughout the world. Assumptions in developing the HS scenario include:

- In most regions, total urban passenger mobility through 2050 (measured as passenger-kilometers) is roughly preserved from the Base scenario in the same year and region. However in some cases (particularly the U.S and Canada) lower levels of travel are accepted as part of improved urban planning and urban re-agglomeration that lowers trip lengths, particularly in OECD countries. Africa experiences a large increase in total mobility in High Shift because a similar increase in transit and NMT as occurs in other regions with a 50% reduction in LDV travel results in much higher total travel levels than in the Baseline scenario.

- For private motorized modes, the ownership rates projected in the baseline that are related to income growth are over-ridden by assuming lower rates, along with lower travel per vehicle and somewhat higher occupancy rates. All of these would need to be achieved through policy and pricing initiatives, since autonomous changes in lifestyle that might affect car ownership are already included in the baseline.

- For public transportation modes, the average number and length of systems, as well as the modal capacity, frequency, speeds and load factors are all increased in HS in order to generate higher passenger-kilometers (pkm) estimates. These are all checked against data on existing high-performing systems, with the idea that the future average system would perform closer to today's best systems.

Key Findings

Urban Rapid Transit Projections

A key aspect of the projections in the High Shift scenario is growth in urban rapid transit systems, particularly rapid transit such as metro, tram/light-rail (LRT), commuter rail and bus rapid transit (BRT) systems. To project the extent of these systems, we estimated their extent in cities around the world today, and developed targets for their expansion and new construction in cities out to 2050. A city size analysis was undertaken in conjunction with data on system location and extent, to identify patterns. We extended from 2030 to 2050 the UN projection of cities by city size based on the UN projection of total urban population to 2050.

Using the projection of cities of different sizes, several observational approaches were used to identify target levels of rapid transit system extent for different size cities. A detailed global database of existing systems was developed and sorted by city size and region. We considered the largest systems per capita by city size by region and the average ratios of system length to population. A wide range of maxima occur with no particular pattern; cities in Organization for Economic Cooperation and Development (OECD) regions – the world's wealthier countries -- generally have larger systems per capita than in non-OECD. Europe has particularly large systems, as Table 1 shows. It also has much higher percentages of cities with systems than do most other regions.

To become a successful, efficient transit-oriented city, an urban area needs to supply a sufficiently high level of rapid transit services. A reasonable approximation of these services is the kilometers of urban rail and high quality bus rapid transit trunk lines, which this study considers together with frequency and capacity. The High Shift Scenario focuses in part on increasing the ratio of rapid transit kilometers per million urban residents (the "Rapid Transit per Resident" or RTR) in emerging economies closer to the levels found today in advanced developed economies and to boosting it further in wealthy countries where it falls short of current global best practice.

Rapid Transit to Resident Ratio	2010					2050	
	BRT	Metro	Tram/LRT	Commuter Rail	Total	Baseline Total	High Shift Total
USA/Canada	0.4	5.4	5.1	21.0	31.9	30.7	60.5
Mexico	2.5	2.2	0.7	0.3	5.7	8.7	35.2
OECD Europe	0.4	7.5	20.0	56.2	84.2	84.4	117.8
OECD Pacific/Other	0.9	7.8	2.6	66.6	78.0	81.0	106.6
Non-OECD Europe	0.0	2.1	39.7	3.2	45.0	50.8	79.9
Russia	0.0	4.6	34.8	4.7	44.1	51.0	77.8
China	0.8	3.4	0.4	0.1	4.7	7.6	43.3
India	0.3	0.7	0.2	4.1	5.3	6.1	37.5
Other Asia	0.5	1.0	1.1	2.2	4.8	5.1	19.3
Middle East	0.8	2.2	0.2	0.2	3.4	5.2	30.9
Africa	0.2	0.2	0.5	1.9	2.9	4.0	19.0
Brazil	1.7	2.0	0.0	4.4	8.0	10.8	32.4
Other Latin Am/Carrib.	1.4	1.1	0.2	8.5	11.2	13.2	32.4

Table 1: Rapid Transit to Resident (RTR) Ratio 2014 and High Shift Scenario: Km per million residents by mode and region (averaged over all cities over 300,000 population)

949

589

For example, in China in 2010, the RTR was about 5 and is projected to grow to near 8.0 by 2050 in the baseline, while in the High Shift scenario the RTR would grow to 21 by 2030 and to 43 by 2050. Similarly in 2010 the RTR in Brazil and Mexico was about 8 and 6 respectively and is forecast to grow very slowly in the baseline, but to grow to 19 and 20 respectively by 2030 and to reach 32 and 35 respectively by 2050 under the High Shift scenario. By comparison, the RTR in the U.S. and Canada in 2010 was 32 and was 84 in OECD Europe (highest of any region), with both projected to remain flat under the baseline out to 2050, but to grow to 61 and 118 respectively by 2050 under the High Shift scenario. Note that the US rapid transit systems are relatively underutilized with low passenger loadings (contributing to the very high car share). In HS, this performance aspect also rises over time, contributing to much

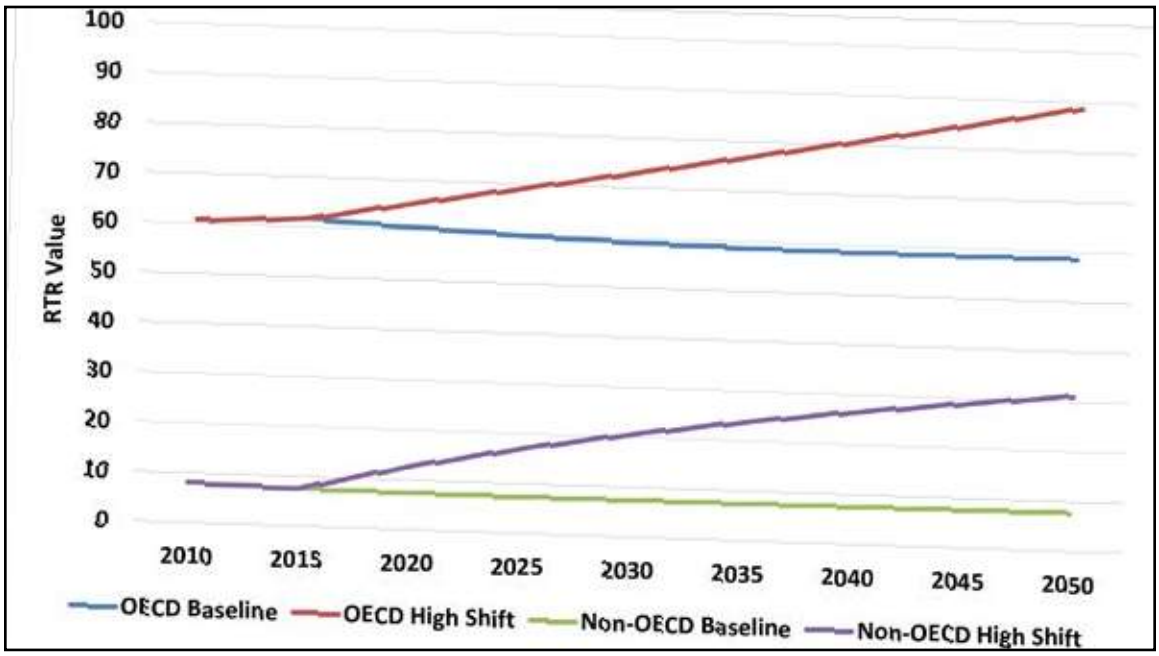


Figure 3: Rapid Transit Kilometers Per Million Resident Trends to 2050 by Scenario and Region

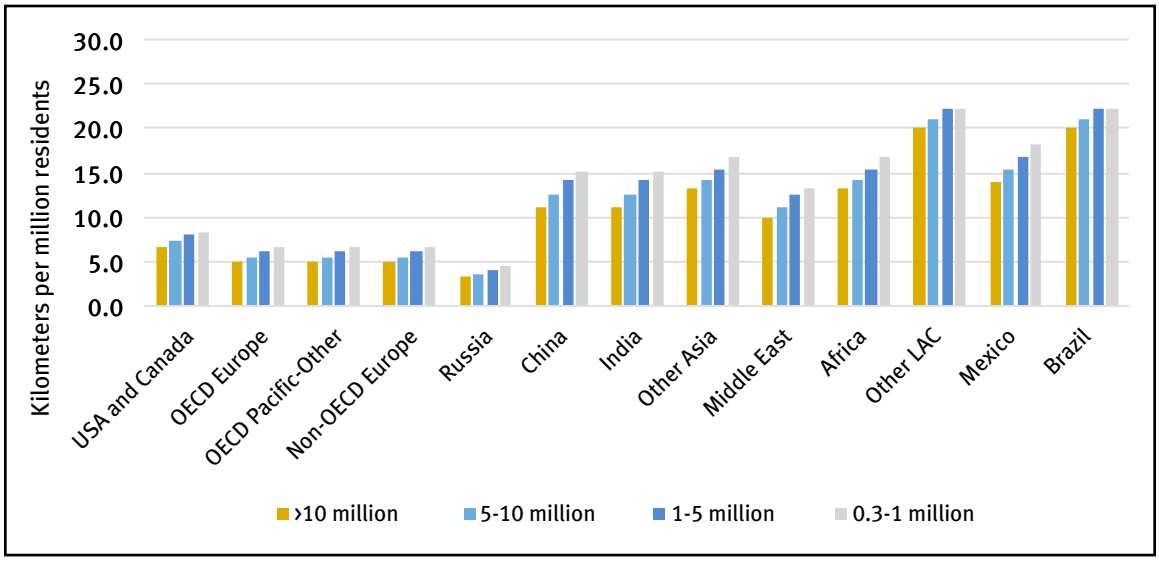


Figure 4: Illustrative Target Setting for BRT System Length in 2050 by City Size Class (Average for all cities in region) for High Shift scenario

higher transit ridership. This occurs to a lesser extent in all countries in HS.

These changes are shown over time for OECD and non-OECD in Figure 3. In both cases, the RTR grows slowly (or with a slight decline) in the Baseline and grows rapidly in the High Shift Scenario. Figure 4 illustrates target setting for BRT by city size by region/country. Similar target setting was done for other public transport modes.

Passenger Travel Assumptions and Results

The summary results for the OECD and non-OECD regions of the world resulting from the various projections are shown in Figure 5 for total Passenger Kilometers of Travel (PKT) and Figure 6 for PKT per capita. More detailed results for seven select regions are shown in Figures 7 and 8. To achieve the High Shift projection of urban passenger travel, the increase in travel by each mode was combined (with consideration of how much each of these modes could logically increase given increases to the others, and considering the starting points) and then compared to total travel in the Baseline, for each of the regions and countries in MoMo. Growth rates in non-OECD countries were adjusted to support a target 50 percent reduction in private light-duty vehicle travel, except in the U.S. and Canada, where the 50 percent reduction is much greater than a plausible offset from increased transit and NMT.

These figures show that in 2010 those in the OECD travelled almost twice as much per person as in the non-OECD, while by 2050 in the High Shift scenario, the travel per capita converges around 8,000 PKT per person per year, suggesting more equal levels of mobility than exist today or in the baseline scenario. Results in greater regional detail along with detailed assumptions and calculations are being prepared in a subsequent documentation report.

The analysis underlying the High Shift scenario suggests that urban travel needs in most parts of the world can, in principle, be met with a combination of travel modes that cut urban light-duty vehicle (LDV) kilometers by half. The required extent and use of mass transit and non-motorized modes in all areas in 2050 does not exceed the use in certain areas of the world today. However, given the rapid urbanization occurring between now and 2050, this will require public transportation to be typically 2-3 times higher in 2050 in High Shift than in the baseline, and in some regions many times higher than today in places where today's public transport levels of service are very low.

A key goal of the High Shift scenario is to improve the equity of mobility – this is achieved as all regions begin to converge toward 8,000 PKT per capita per year by 2050, with Africa and parts of Asia achieving higher mobility rates in the High Shift scenario via investments in public transport that are close those of other world regions, especially for buses. This goal is also achieved within each region across income groups as shown in the section on equity on the following pages.

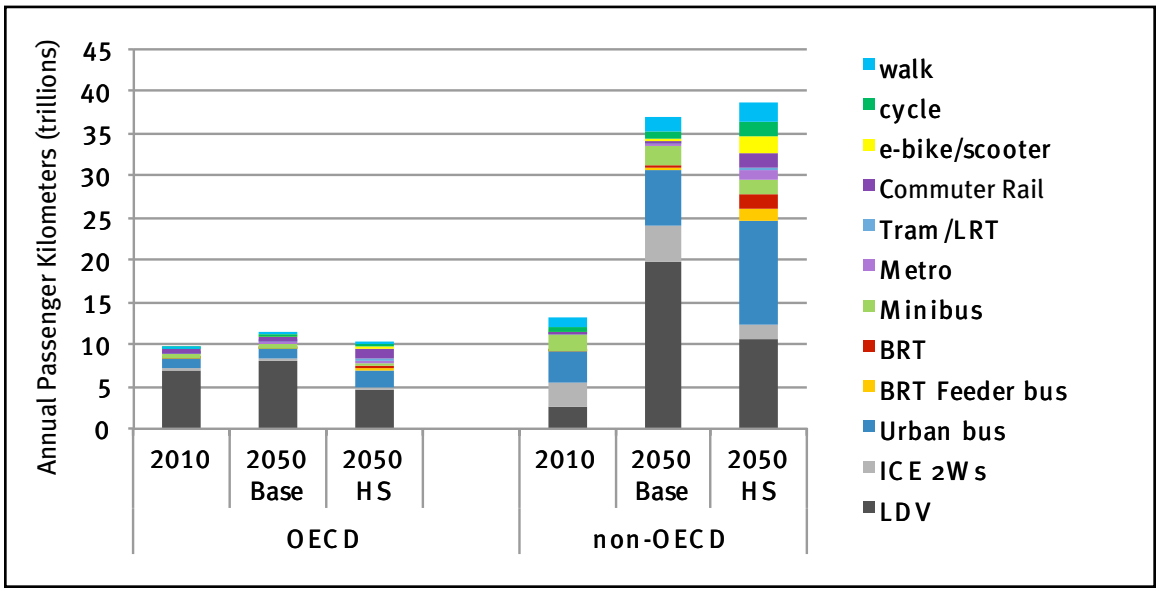


Figure 5: Total Passenger Kilometers of Urban Travel 2010, 2050 Base, and 2050 High Shift Scenario

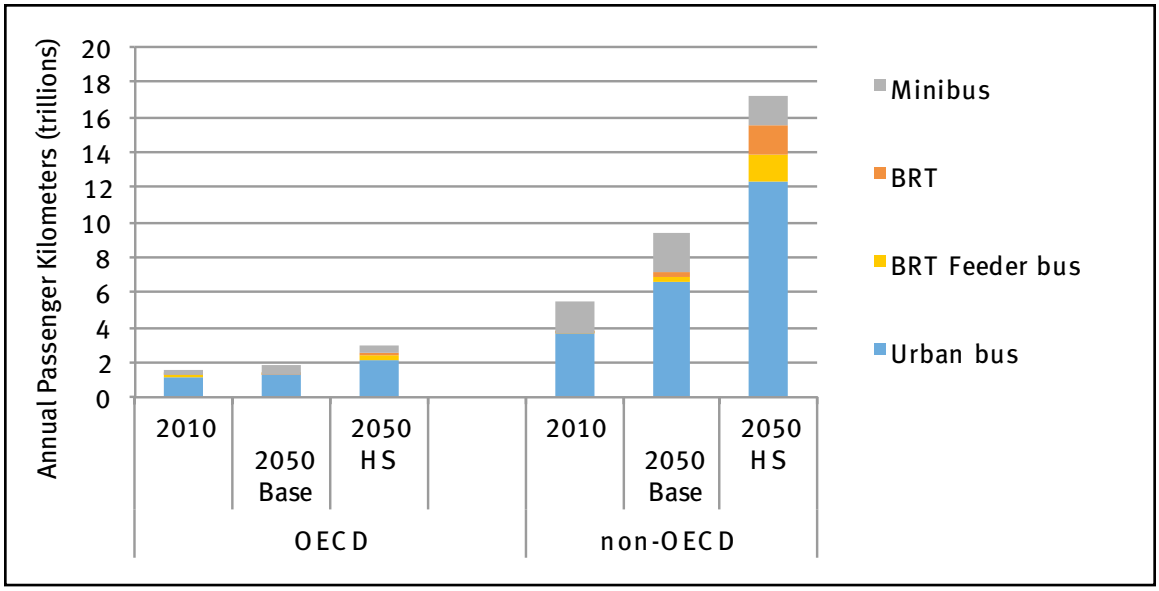


Figure 6: Passenger Kilometers Per Capita of Urban Travel, 2010, 2050 Base, and 2050 High Shift Scenario for OECD vs non-OECD

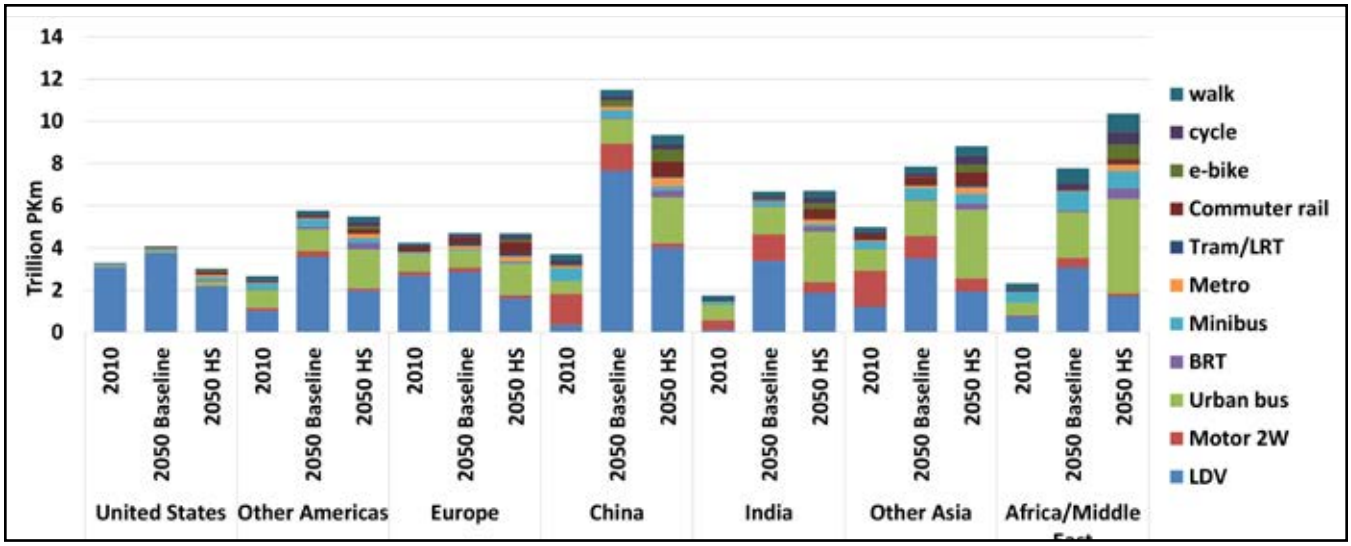


Figure 7: Total Urban Passenger Travel for Select Countries/Regions

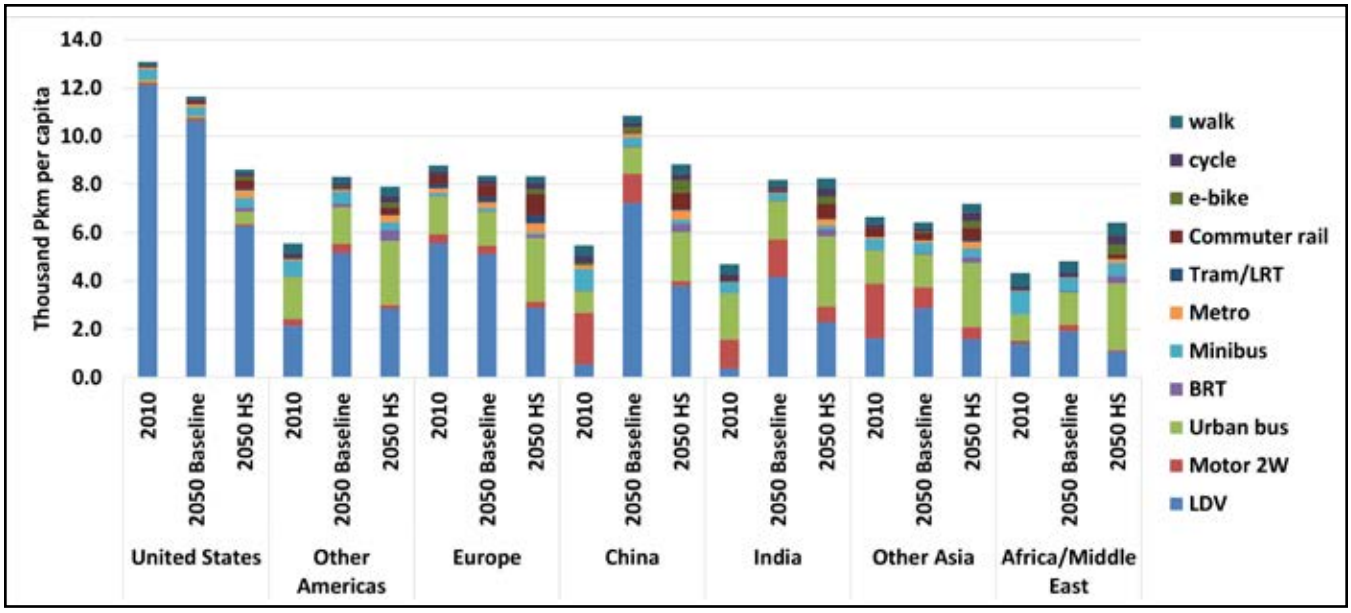


Figure 8: Travel Per Capita for Select Countries/Regions

953

593

The High Shift scenario shows a pathway to dramatically boost mobility and sustainable urban economic development in several regions of the world now held back by low mobility and diminished access to markets and opportunities. In Africa, motorization rates even in 2050 are so low that cutting LDV kilometers in half does not reduce total PKT dramatically. Increasing public transport, cycling and e-bike use by factors only somewhat lower than in other regions results in an overall dramatic increase in African urban mobility, with total PKT in 2050 about 1.5 times higher than in the baseline. This is true to a lesser extent in "Other Asia" (Asia excluding OECD countries, China and India).

Urban Buses: Assumptions And Results

In the High Shift scenario, apart from "rapid transit" buses (BRT systems), there is steady growth in the number of conventional large buses around the world, particularly in non-OECD countries. This increase in bus service, of a high quality and frequency such as typically is provided in Europe, accounts for an important share of the overall increase in transit ridership in most regions.

Assumptions include:

- Ridership per bus is based on MoMo country data, and increases from a 2010 range of 6-47 (from the lowest to highest country average, US and Eastern Europe, respectively) to a range of 20-50 in 2050, with most countries in the 25-30 range by 2050. This average accounts for all bus travel, so peak times may have far higher averages, but are offset by low volume periods and backhaul trips. In contrast, in the baseline scenario, load factors generally decline.

- Minibuses (under 24 seats) typically have about 50% occupancy with slow worldwide baseline growth in numbers and ridership in the baseline. In contrast, there is a decline in the High Shift scenario, as riders shift to larger buses and BRT. This also helps reduce traffic congestion since far more people are carried on larger and fewer buses.

- In the High Shift scenario by 2050, most cities have sizeable BRT systems, particularly in the developing world. On a per capita basis, average system lengths approach those of cities like Bogota today. Apart from the projection of BRT system growth, BRT ridership per unit system also increases, approaching the TransMilenio system in Bogota, with similar bus capacities, load factors and vehicle speeds. All systems achieve at least a Bronze or better rating on the *BRT Standard*,[13] by 2050 yielding 30-35 million pkm per lane-km for BRT (compared to 40-42 million pkm per lane-km for Metro, up from 12-14 and 25-35 million pkm per lane-km respectively today).

- BRT is assumed to pull riders from motorized 2-wheelers, light-duty vehicles (private cars), minibuses, and regular buses.

- BRT feeder buses are assumed to carry an equal total mobility service as BRT trunk services and provide many passengers with expanded opportunities for one-seat, easy transfer rides

As shown in Figure 9, urban bus travel provides the major part of bus travel in most regions, increasing in the 2050 High Shift scenario by anywhere from 129% (OECD Pacific, with a very high initial level) to 445% (US/Canada, with very low initial levels) compared to the baseline. BRT, which shows signs of exponential growth as a newly developed form of public transportation, in all countries in the Baseline 2050 increases by at least a factor of 3 compared to current levels. In the 2050 High Shift scenario BRT increases by about 300% in Latin American countries (which have fairly high initial BRT levels in Baseline), to 800% in India and Other Asia, which have fairly low levels in Baseline compared to the baseline. A variant High BRT HS scenario is also examined below, in which BRT's share of new rapid transit line-kilometers is 50 percent higher than in the primary initial HS scenario shown here.

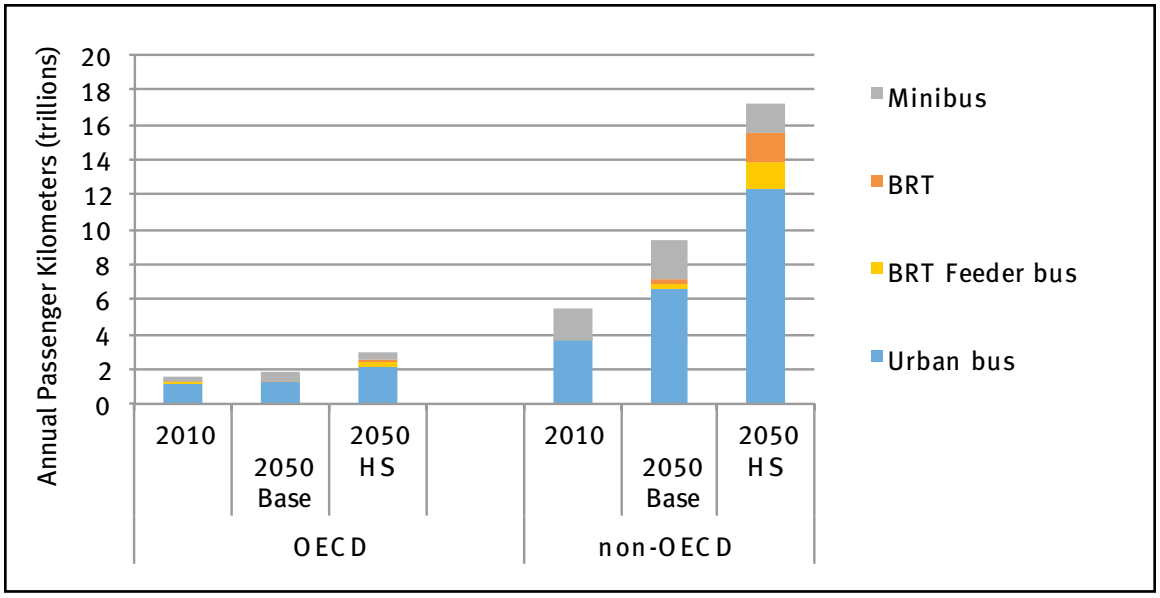


Figure 9: Bus and BRT Annual Passenger Travel By Year, Scenario, and Region

Urban Rail: Assumptions And Results

A major effort was made to build up a worldwide inventory of rail systems and system characteristics (system length, ridership). The International Union of Railways (UIC) provided IEA with an initial database of tram, light Rail, and metro systems, which was augmented with internet searches and national, regional, and local government, and transit operator data. A completely new commuter rail database was constructed. In 2010, by far the highest urban rail ridership is observed in Europe and OECD Pacific. Many world regions have comparatively few systems and lower ridership levels on those systems.

Assumptions include:

- In the Baseline scenario, rail systems do not expand much and not that many new systems are built, so there is only slow growth in urban rail ridership around the world.

- In the High Shift scenario, there is steady growth in the number of rail systems and ridership around the world to reach certain targets of rail access and ridership, though the levels per capita in many regions in 2050 are still well below Europe and OECD Pacific today.

- Metro, trams and light rail are featured more in OECD countries whereas BRT is featured more in non-OECD countries, though all regions grow all systems to some extent. Commuter rail systems are expanded significantly in all regions as part of a polycentric development strategy for metropolitan areas.

Figure 10 shows the projected use of urban rail systems for OECD and non-OECD countries for 2010 and under the baseline and High Shift 2050 scenarios. It is important to note that the y-axis scale of Figures 9 and 10 differ greatly. Rail only provides 2.5 trillion passenger-kilometers of travel in 2050 HS whereas buses provide 16 trillion PKM.

955

595

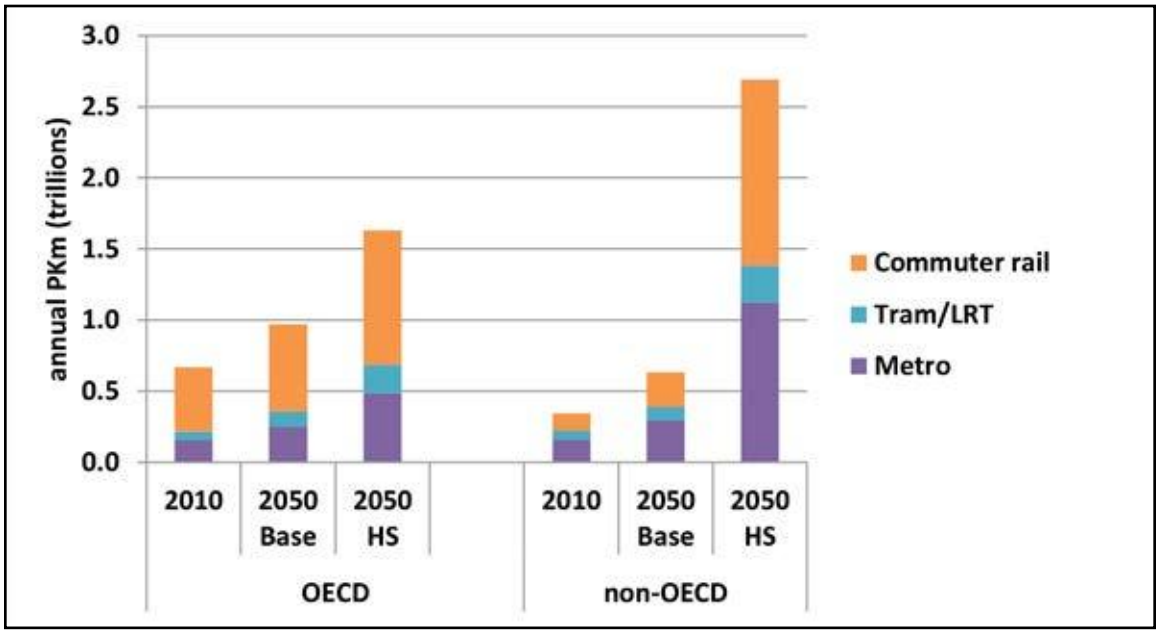


Figure 10: Passenger Travel By Rail Type, Scenario, and Region

Low-Powered And Non-Motorized Modes Assumptions And Results

Walking is poorly evaluated worldwide due to lack of common definitions and analysis frameworks. Virtually everyone walks daily to help meet their basic needs for some combination of access to food, water, community, work, education, health care, shopping, and recreation. Some of these walk trips are access to public transportation, or to cars parked near a trip end. Including all short trips, there may be as many as several walk trips a day per person worldwide, making walking the dominant travel mode by trip share. This study like many, excludes many shorter trips on foot, relying for 2010 data mainly partial estimates from a few urban travel surveys – since few include an explicit accounting of all foot travel linked to other trips, or even the distances covered in full walking trips. Somewhat more walking trips are assumed in non-OECD than OECD countries, with the most trips per capita in Africa. Baseline walking to 2050 is assumed to be relatively unchanged compared to 2010, though with a slight decline in distance per capita; walking trip share is increased in HS compared to 2010 to reflect the greater possibility for safe, convenient urban walking trips with proper infrastructure and more compact land-use planning.

The most important aspect to improve the walking experience is improved safety, which can be provided through better and much more extensive sidewalks and footpaths, along with safer pedestrian street crossings, slower car traffic in some places, and other measures. These steps may not directly show up as increased walking in some parts of the world but certainly will provide high value in quality of life and reductions in accident rates.

The HS scenario assumes a dramatic increase in the use of low power e-bikes and bicycles in countries that don't already have high levels of use. While in the reference case there are high levels of walking in most countries and high levels of biking in a few countries such as the Netherlands, in HS the walking and biking trips would increase among people with motorized options such as access to cars. Electric bicycles and low-powered electric scooters (collectively called "e-bikes") are in widespread use now only in China, but in HS would increase worldwide. These are distinguished from high-powered scooters and motorcycles and, if regulated appropriately, could contribute to slower traffic speeds and safer conditions in areas where they become prevalent. It is important that safety issues associated with fast scooters not prevent the spread of low-speed, environmentally friendly e-bikes. We hypothesize future ownership and e-bike travel levels that appear plausible, and

average use per day and per year to generate PMT projections. In HS, the increased cycling and e-bike travel serve to offset a large reduction in faster two-wheeler travel to 2050 as part of a push toward greater safety. The results are shown in Figure 11.

Assumptions include:

- Regular bike ownership is explicitly estimated and modeled and follows use patterns that appear consistent with existing literature.[14] Fairly good data exists on bicycle stocks around the world, but average daily use of bicycles is poorly documented. We assume relatively low daily use factors.

- Bike use will rise as investments are made into bike lanes and parking, safety features, and supportive policies, as has happened in various cities[15] and as projected by other modeling.[16] Here it has been assumed that most cities could achieve something approaching average European cycling levels by 2050 but have only a fraction of levels achieved today in Amsterdam or Copenhagen. Much higher shifts for cycling would be plausible with more supportive infrastructure and policy.

- For e-bikes, it is assumed that ownership is currently near zero except in China and parts of Southeast Asia. Growth in ownership and use is based on slowly raising rates, and a complementarity of use between e-bikes and bicycles. In addition, the use of internal combustion engine (ICE) scooters and motorcycles in the High Shift scenario is set to decline with much replacement by e-bikes over the coming 35 years. As a result, total travel via e-bikes + ICE 2-wheelers does not grow much on net.

- The total NMT pkm rise for all three modes over time, but more dramatically for e-bikes with much slower increases for walking and biking.

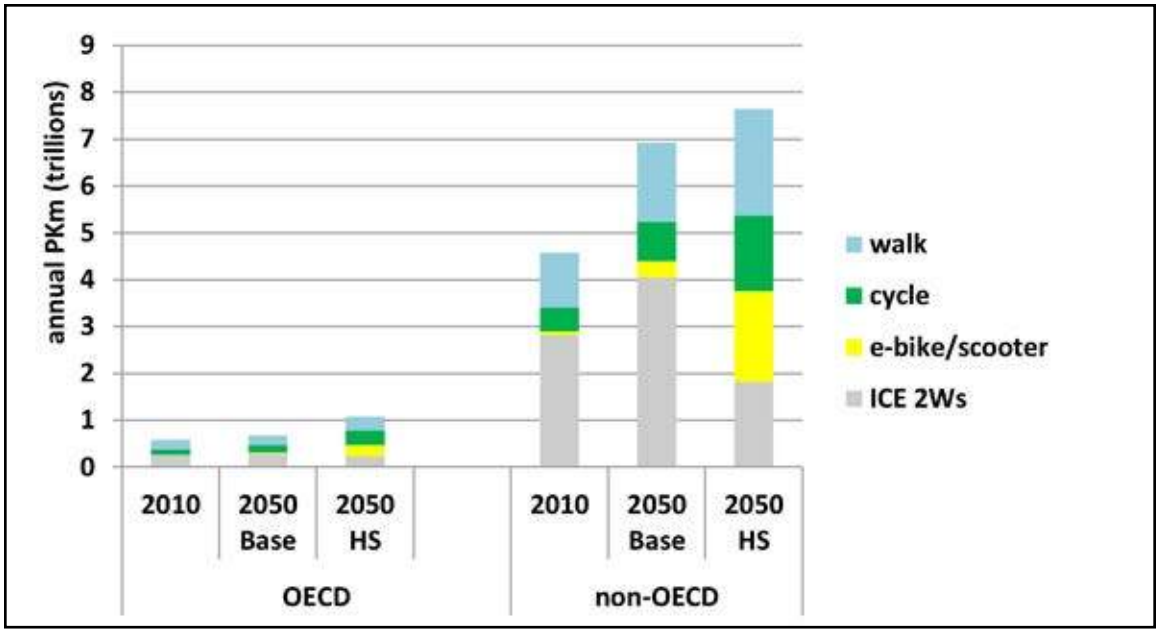


Figure 11: Travel by Non-Motorized and Low Power Modes by Year, Scenario, and Region1

Changes In Car/2-Wheel Travel

As mentioned a key assumption for the High Shift scenario is that urban vehicle travel is cut by 50% compared to the Baseline in 2050 in all regions. Since this is gauged in terms of vehicle kilometers, the stock of vehicles – the number of motor vehicles in use – may change differently if, for example, travel per vehicle changes. This is in fact what happens as for existing private cars, these are assumed to be left home more often and are thus driven less per year. Thus the sales and stocks of cars in both the OECD and non-OECD regions does not drop by 50%, but by closer to 40%, as shown in Figure 12. This still means far fewer cars and thus far less parking requirements, which is assumed to drop proportionately to the numbers of vehicles. Roadway capacity is gauged as a function of vehicle travel, not vehicles. It is assumed to drop in the High Shift scenario somewhat less than the drop in VKT. This is because: a) some roads exist already and are not going to be removed, particularly in the OECD and b) reducing road construction somewhat less than the change in VKT suggests that there will be less congestion. While congestion reduction is not explicitly measured in this study, it is an economically valuable benefit that likely should not be lost for the sake of full proportionality on reducing road construction.

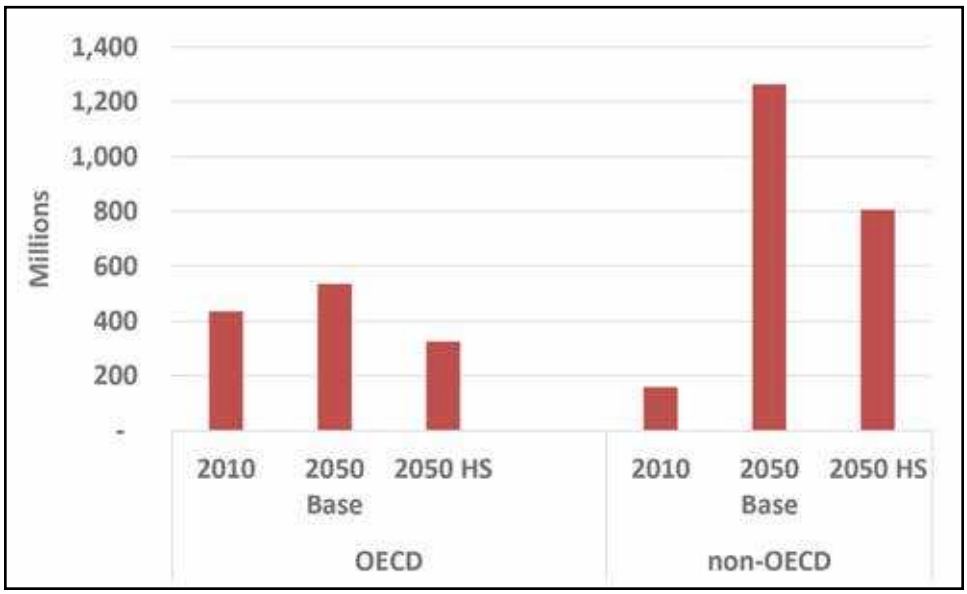


Figure 12: Urban Car Stocks by Region, Year, and Scenario

Another feature of High Shift is that a high occupancy of vehicles is assumed, related to an assumed increase in ride sharing. While the changes are not assumed to be dramatic, they significantly affect mobility – in OECD in High Shift there is 1.6 rather than 1.4 persons per car in 2050, and in non-OECD there is 1.7 v. 1.6 in the Baseline in 2050, as shown in Figure 13. This higher occupancy also results in more passenger travel from a given amount of VKT, so vehicle passenger kilometers drops less than vehicle kilometers in High Shift.

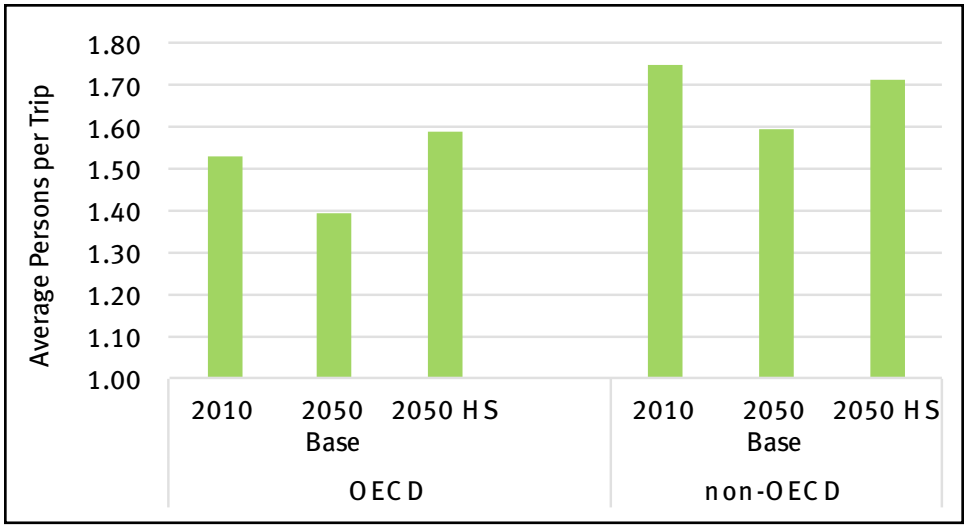


Figure 13: Average load factor (passengers per trip)

These are the main changes in light-duty vehicle use across the scenarios. The actual characteristics of vehicles is not assumed to change much in HS from the Baseline, although there is a slight shift toward smaller vehicles with slightly better fuel economy as a result. There is also a slight "in-use" fuel economy benefit from reduced congestion on urban roads. In fact such an effect could be quite large, but a detailed investigation of this and how the traffic reduction in HS could affect it will require further analysis. Additional benefits from fuel economy improvement and the introduction of new technologies such as electric vehicles is also being assessed and will be included in future updates to this study.

Scenario Impacts: Energy and CO_2 Emissions

Since all urban areas in the world are included in the analysis, energy use and CO_2 emissions impacts can be reported at a global and regional level. Energy use is a function of the vehicle travel and vehicle efficiency for each mode, calculated taking into account load factors and the number of vehicles and vehicle kilometers needed to move people the specified passenger-kms. Energy efficiency of different types of vehicles (based on MoMo vehicle efficiency estimates, adjusted for urban in-use conditions) varies greatly, but not that much regionally. It does improve significantly over time in the Baseline scenario, with identical improvements under the High Shift scenario.

Apart from the levels of travel, the critical assumptions behind the energy use and CO_2 numbers are the efficiency of the vehicles and the ridership on those vehicles. For each region and mode, Figure 14 (p. 22) shows efficiency per passenger kilometer and Figure 15 (p. 22) shows total energy use. Public transit modes are far more efficient than light-duty vehicles, so shifts to these modes cuts energy and CO_2 per passenger-km significantly. For transit vehicles, efficiency per passenger-km improves more in HS because ridership per vehicle trip is significantly higher than in the baseline, based on assumed improvements in system management, higher quality and more frequent services, and urban densification. Cars also become more efficient, as mentioned above, due to fuel economy standards and higher average occupancy.

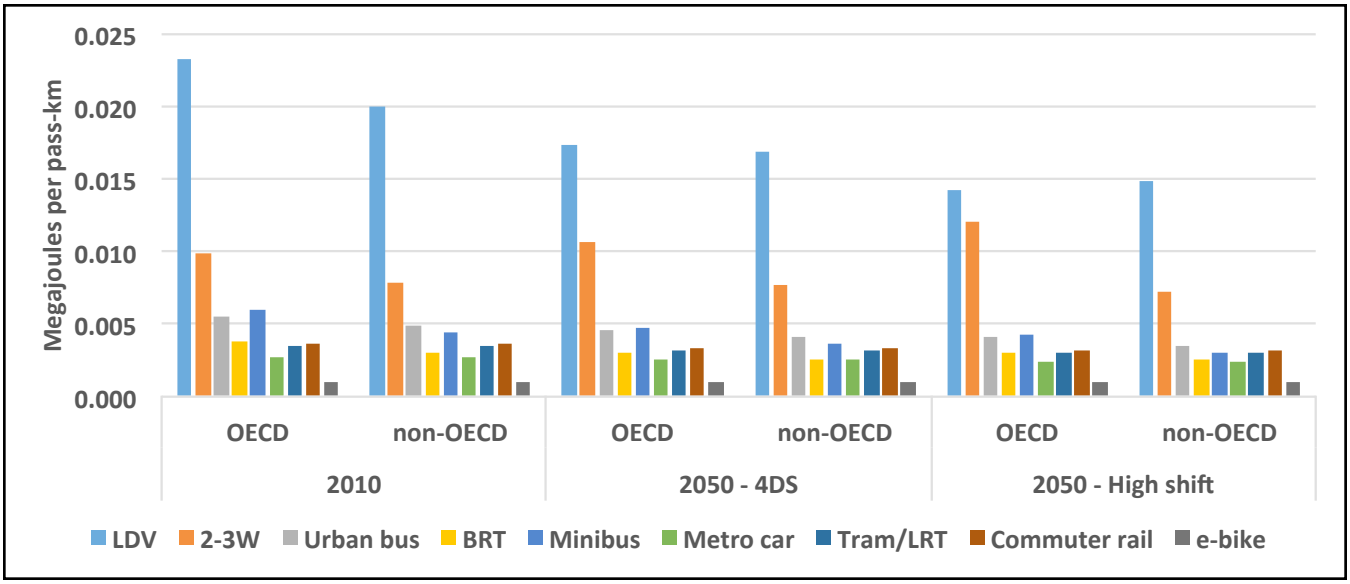


Figure 14: Energy Efficiency by Passenger-Kilometer By Mode by Year and Scenario

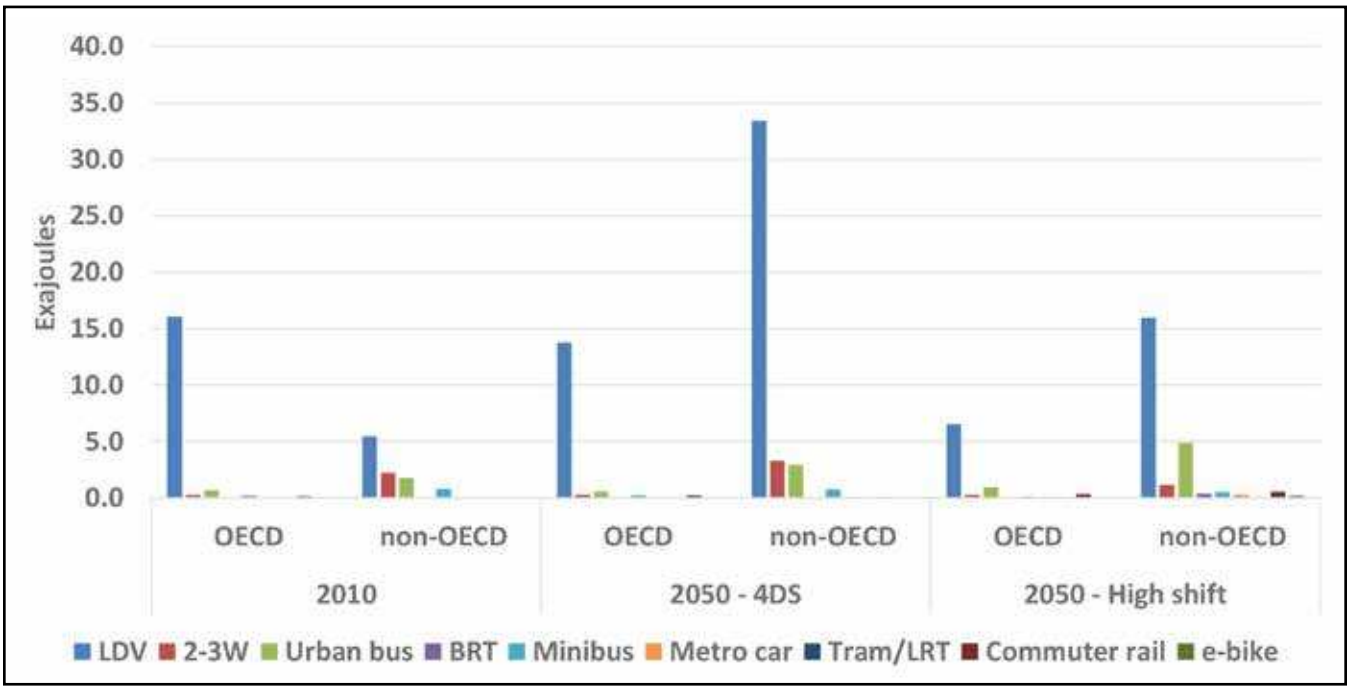


Figure 15: Energy Use by Scenario, Region, and Mode

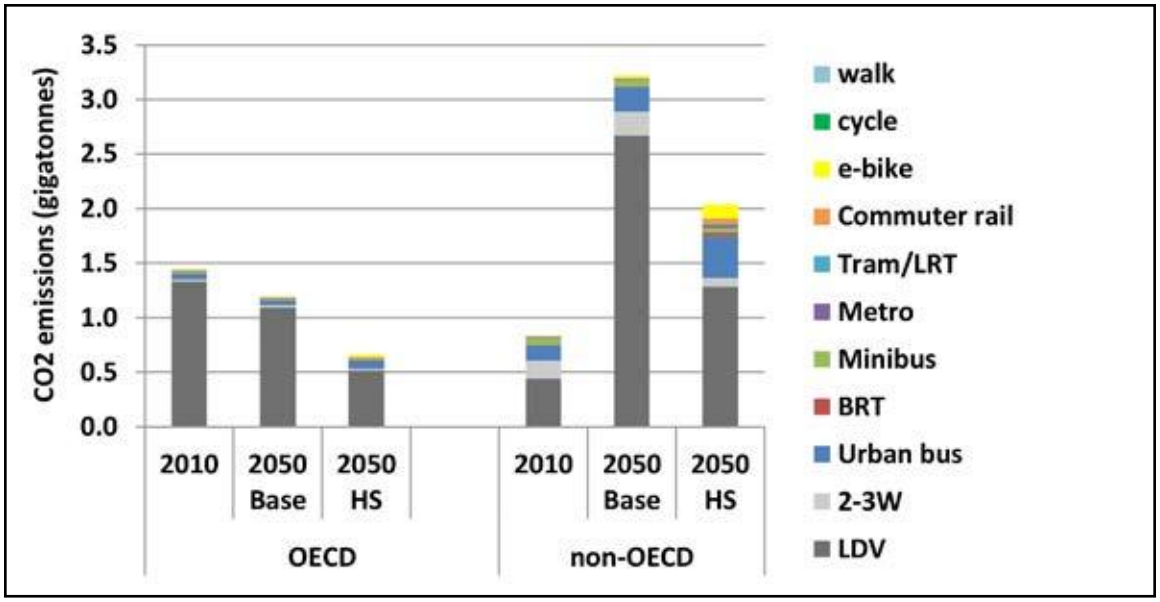


Figure 16: CO2 Equivalent Emissions from Urban Passenger Transport by Year and Scenario and Mode

The resulting CO_2 emissions by mode are shown in Figure 16. The dominance of light-duty vehicles in current and baseline future energy use and CO_2 emissions is evident, as is the reduction in energy and CO_2 emissions in the High Shift scenario. Compared to the baseline, the High Shift scenario by 2050 would cut global urban passenger land transport CO_2 emissions by 1.7 GT, or about 40 percent, from 4.4 GT in the Baseline to 2.7 GT in HS. Specific fuel types are not shown but road modes are dominated by petroleum fuel while rail modes are almost entirely electrified, as are e-bikes. Electricity generation is decarbonized over time in line with the IEA 4° scenario. This is helpful but not critical for experiencing substantial reductions in CO_2 from the High Shift scenario.

It is important to consider that there is significant further greenhouse gas mitigation potential if further fuel economy improvements are added to the mitigation potential of the High Shift scenario. One can and should consider the double counting effects, which are path dependent. Indeed, the mitigation potential estimated for "avoid-shift" vehicle activity focused strategies vs. technology focused "improve" strategies depends on which approach is assumed to be the initially applied strategy.

While this study has not focused on further actions to boost motor vehicle fuel economy, it takes into account existing policies that, in the IEA Baseline scenario, improve average new car fuel economy by 32% (less energy intensive) in the OECD and 23% in non-OECD countries. The High Shift scenario increases this to 36% and 27% respectively, due to improved in-use driving conditions and a slight shift to smaller vehicles. However, the Global Fuel Economy Initiative (www.globalfueleconomy.org) calls for much more: a 50% reduction in fuel use per kilometer for light-duty vehicles worldwide by 2030. Achieving the GEFI 2030 goal could reduce 700 megatons of CO_2 annually beyond the 1,700 reduction possible from a High Shift scenario. Taken together, achieving this fuel economy goal with better public transport, walking, and cycling could cut annual urban passenger transport CO_2 emissions in 2050 by 55 percent from what they might otherwise be in 2050 and 10 percent below 2010 levels. Strong fuel economy programs for other types of vehicles (buses, trucks, 2-wheelers) could also help, as could vehicle electrification and other low-carbon fuels. These options will be investigated further in relation to High Shifts in the future.

Figure 17 shows CO_2 emissions results for HS for major world countries and regions. This shows that by 2050 there are tremendous CO_2 savings in rapidly growing economies such as China and India from the High Shift strategy, while there are significant (and proportionately similar) savings in every country and region. In fact on a percentage basis, the biggest reduction in High Shift relative to both 2010 and to the Baseline in 2050 occurs in the United States. Apart from the modal shift effects, this result reflects the fact that the U.S. has the biggest reduction in overall travel in High Shift, about 30% lower than in 2050 Baseline. This "avoid" element is large and remains one of the questions this study raises that deserves further investigation.

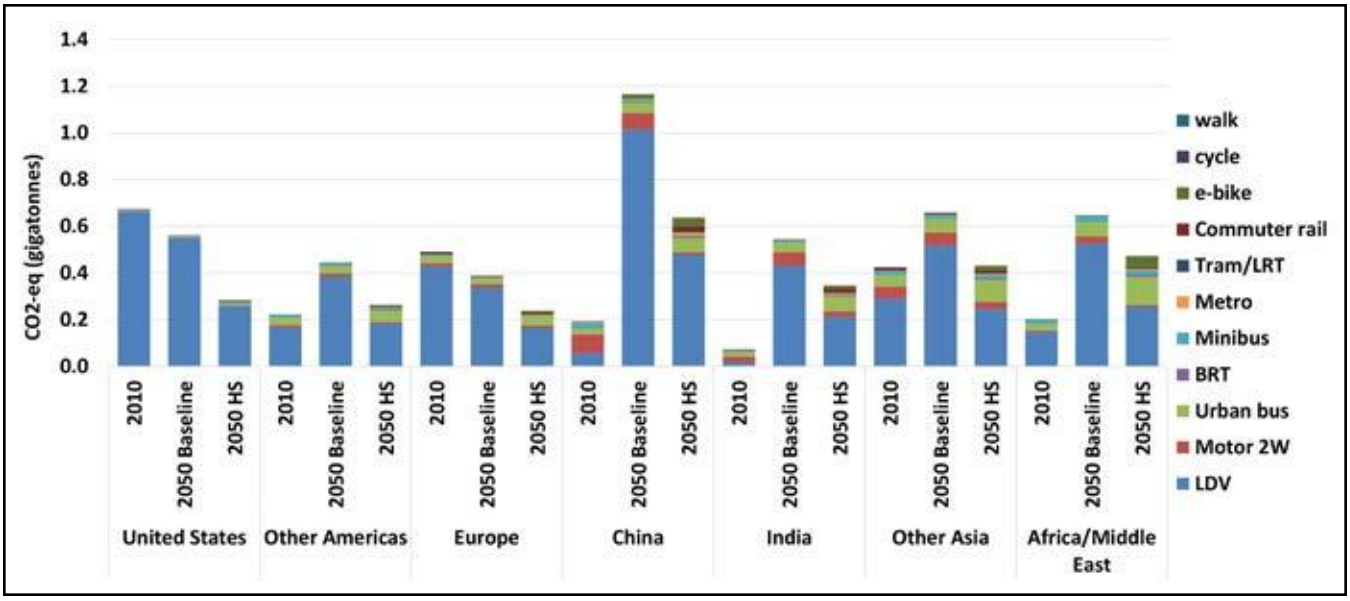


Figure 17: CO2 Equivalent Emissions for Selected Countries

Results: Transit System Requirements

As described above, the system size (and thus infrastructure length) needed to support BRT and urban rail travel was estimated using assumptions of the number and lane kms of systems in place around the world. These projections were in turn used to develop the infrastructure cost estimates associated with these scenarios presented below. The total kilometers of system length by region and year for the High Shift scenario is shown in Figure 18. In the OECD, the increase for each mode is significant compared to 2010 but not huge in percentage terms (except for BRT which is tiny in 2010). In non-OECD countries the required growth rates are far higher and would require major, sustained investments over the coming decades to achieve. Growth is fastest for BRT and commuter rail.

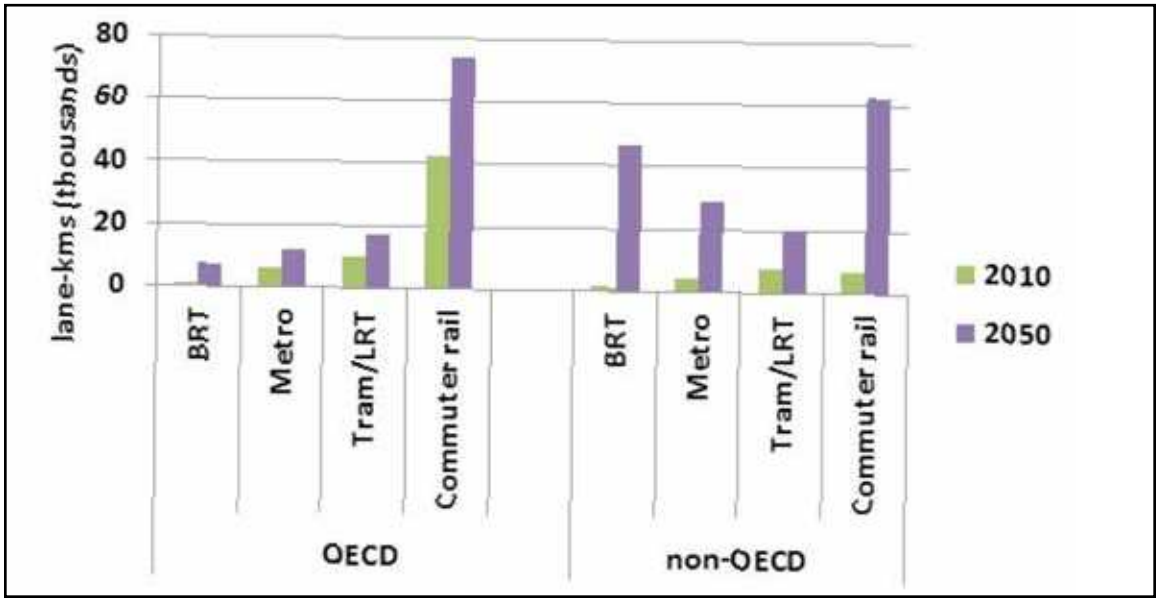


Figure 18: 2010 and 2050 High Shift Rapid Transport System Length by Mode by Region

Results: Cost Implications Of The High Shift Scenario

The major direct cost and investment implications of the High Shift scenario have been estimated, relative to the baseline, from 2010-2050 in a cumulative and annual average fashion including all market costs to private users and public agencies (i.e. taxpayers):

- Vehicle purchase costs for all types of vehicles, all modes
- Fuel costs for all modes and vehicle types
- Vehicle and transit system operating and maintenance cost, including daily O&M costs and infrastructure maintenance costs.
- Infrastructure capital costs, i.e. the one-time investment costs to construct roads, sidewalks, parking lots and structures, BRT systems, rail and bus systems

These estimates are based on averages from various reports, by country or region.

The cost analysis is summarized in Figure 19 (p. 25). Costs rise as a function of passenger travel growth by mode and region. So, for example, the cost of infrastructure for roads and transit systems rise in proportion to their importance in the two scenarios. Road and parking costs are far lower under HS than in Baseline. Transit system construction and operation costs are far higher under HS than Baseline. HS has far lower energy requirements and so creates large energy cost savings.

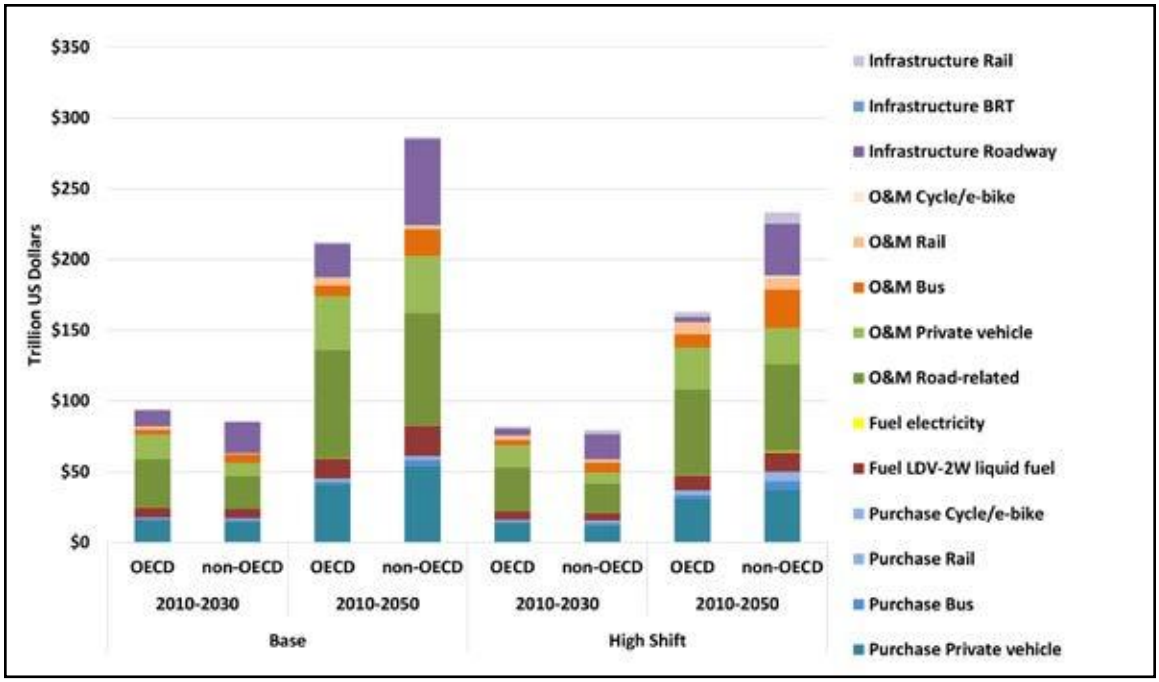


Figure 19: Summary of Cost Estimates 2010-2050 by Type, Scenario, and Mode

Overall the total costs of the Baseline between 2010-2050 are roughly $500 trillion ($200T in OECD and $300T in non-OECD), whereas the costs in the HS scenario are about $400 trillion ($160T in OECD and $240T in non-OECD). The HS scenario would trim cumulative costs by approximately US$110 trillion or 22 percent.

Figure 20 breaks out infrastructure investment cost in more detail, and presents this as average annual expenditure to build new infrastructure in the time periods 2010-2030 and 2030-2050. This takes into account the full direct cost per kilometer to build new roads (a function of projected car travel), parking lots (a function of projected car stocks), sidewalks along urban non-highway roads, cycle lanes and paths to handle much of the projected cycling travel, and the specified BRT and rail systems. This, like other costs, is based on current average costs per kilometer in various countries, but is averaged and applied at the level of all OECD and all non-OECD given the weakness in much of the data. For example BRT construction costs are assumed to be $7.5 million/kilometer in non-OECD and twice this in OECD. These costs (and all infrastructure costs) rise over time in real terms, and converge somewhat as incomes and project quality rises in the non-OECD.

The results indicate that in the Baseline, infrastructure costs for roads and parking space dominate over all other infrastructure costs. This is because vastly more kilometers of roads (and square kilometers of parking) are built than are any type of transit system. However in HS the number of roads and parking needed drops dramatically, and the costs for rail systems are high enough to be visible in the bars. Yet despite about 25,000 kms of BRT built in the non-OECD between 2030 and 2050, it is barely visible since the cost is “only” about $12 billion per year, a very small number in the context of other costs in the figure.

It is also worth noting that in the OECD between 2030 and 2050, the infrastructure costs “go negative”. This reflects an actual reduction in the need for roads. In reality it seems unlikely that roads would be removed but it does suggest a reduction in traffic that would likely provide equal or greater value in the form of reduced traffic congestion on an un-diminished road system.

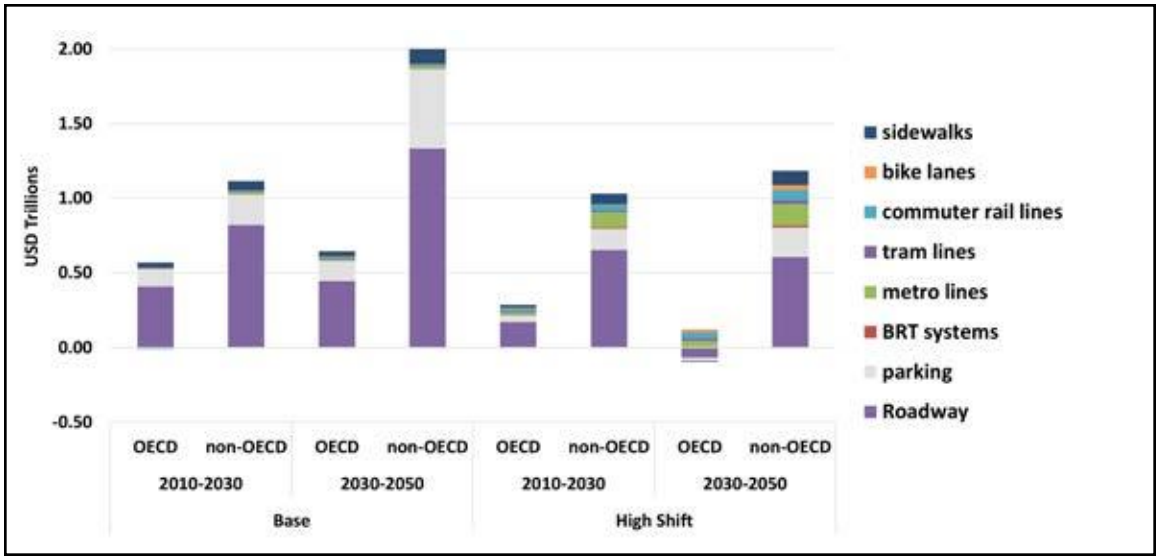


Figure 20: Infrastructure cost estimates, annual averages for 2010-2030 and 2030-2050 by type, scenario and mode

These cost results will be further detailed in a separate documentation report and may be a feature analysis in a future summary report.

Results: Equity Implications Of The High Shift Scenario

In addition to developing an urban version of MoMo, a new demographic breakout of urban travel was developed and linked to this urban projection system. This first generation "Demographic Equity Economics" model provides the opportunity to track travel by groups within the population. The data foundation for this was a review of 25 national and urban household travel surveys from around the world. This showed that few of the databases (or associated analyses) were directly comparable, using different methodologies, different questions, different group definitions and different mode classifications for travel. However, data on car ownership by income category was found to be sufficiently comparable to establish approximate base year travel mode shares for a number of regions.[17, 18, 19, 20]

For 2010, passenger travel by mode across income groups sums to total travel on that mode from the broader study; the main uncertainty is how the ridership breaks out across income group going forward in time. Total travel is assumed to be significantly lower for lower income groups, as suggested in travel surveys, but this difference declines somewhat as the poorest quintiles' income grows. Projections were constructed for 14 regional breakouts by income quintile. Another important crosscheck for this projection is that car ownership is a function of the income of each quintile, based on a global income-ownership study.[21] Current Income distributions are taken from World Bank data,[22] total income projected in line with OECD projections used in *ETP 2012*; income breakouts are assumed to retain the same distributional patterns over time (i.e., no changes in GINI coefficient).

Despite uncertainties, the breakout of travel into income groups provides important insights. Compared to 2010, baseline passenger-kms in 2050 about doubles. Much of this is from increases in car ownership among higher income groups. Under the baseline, as in today's cities, higher auto-centered mobility by upper income travelers can be expected to result in higher traffic congestion and competition for street space, which degrades the quality of public transport, walking, and cycling that are used by lower income groups. Under HS, there is much more growth of transit and NMT, rather than car growth. As availability of transit and NMT facilities expands and ridership expands, more street space ends up being allocated to lower income groups than for the cars used by mostly by the affluent. Thus, the bottom two-quintile groups benefit disproportionately from transit/NMT improvements, as do the top two-quintile groups from increases in car travel infrastructure growth.

965

605

In 2010 and even in the 2050 baseline, lower income groups have relatively low mobility and very low car access, as Figure 21 shows. The vast majority of humanity is unlikely to have access to a car even in 2050. In the HS scenario, there is much more even mobility across groups.

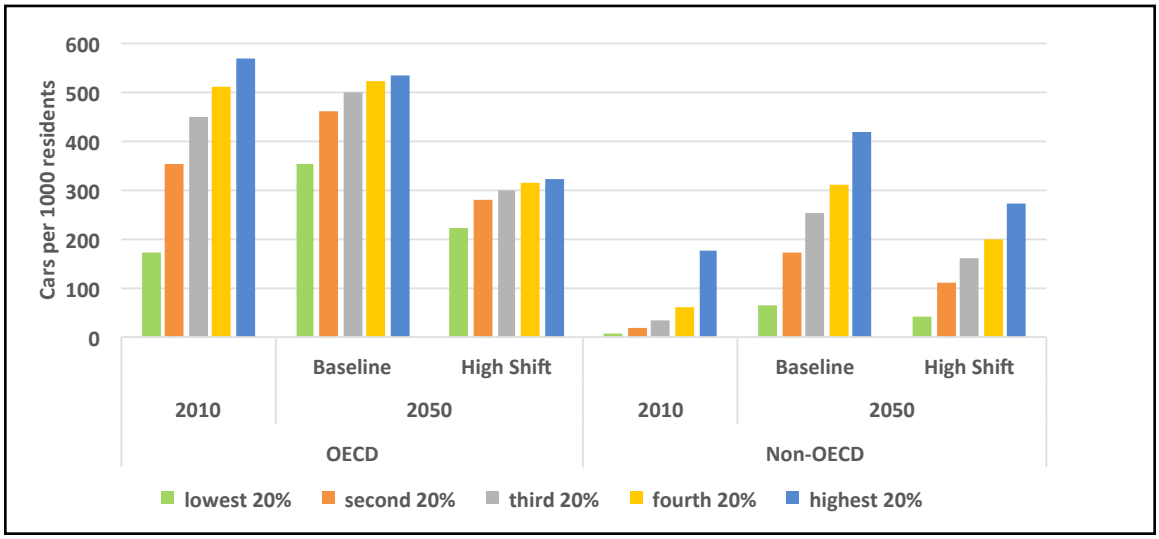


Figure 21: Cars Owned or Used by Income Group 2010 vs. IEA 2050 4DS vs. High Shift Scenario

Figure 22 reflects this rebalancing of travel by mode with a smaller difference in travel per capita in 2050 between the lowest and highest income groups under HS compared to the Baseline.

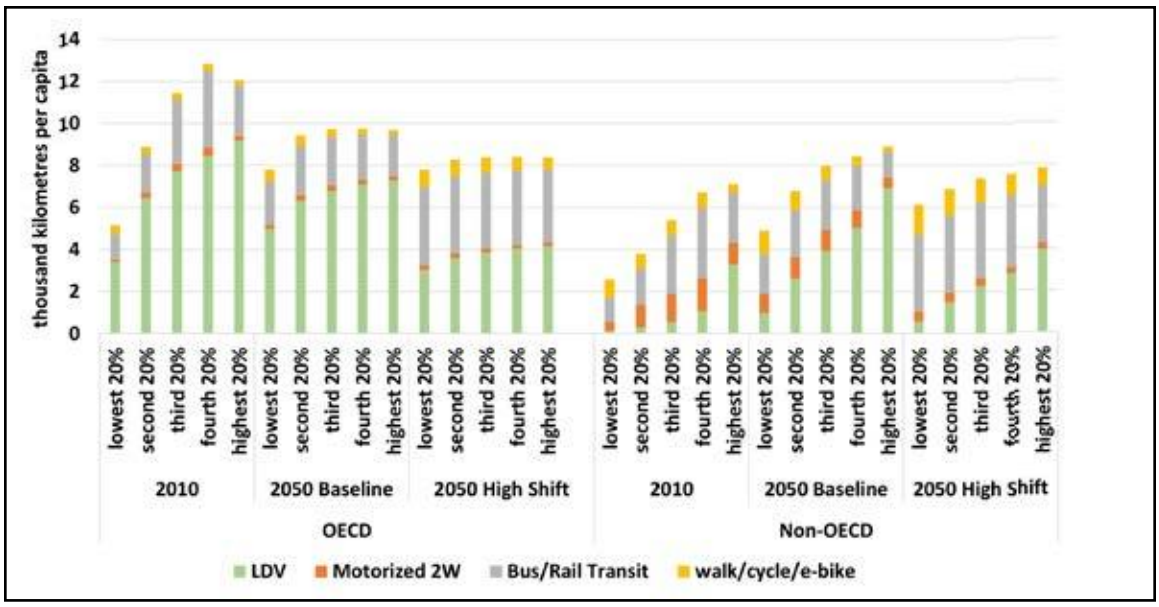


Figure 22: Travel Per Capita by Mode, Income Group, Region, and Scenario

Sensitivity Analysis: High Shift High BRT Scenario

The High Shift Scenario represents one of many possible future scenarios. To examine the sensitivity of the findings – especially costs, energy, and CO_2 – to changes in some of the input assumptions, a High Shift High BRT Scenario was examined. This pivoted off of the initial High Shift Scenario by holding constant the sum total of commuter rail, metro rail, light rail, and BRT km of service in 2050, but increasing BRT's share of new rapid transit line-kms by half.

Total global BRT and rail related costs from 2010-2050 are about $33 trillion in the initial High Shift Scenario. These costs are $4.4 trillion lower in the High BRT Scenario, a drop of 14 percent. Because there is more BRT to start with in the non-OECD countries and differences in operating and capital costs of transportation between rich and poorer countries, the High BRT Scenario offers bigger potential cost savings of $3.7 trillion (from $21 trillion in High Shift) in non-OECD countries compared to 0.7 trillion (from $12 trillion in High Shift) in OECD countries. Energy and CO_2 impacts are very similar between the High Shift and High BRT Scenario.

Sensitivity Analysis: Air Pollution And Public Health Impacts

The impacts of various transportation scenarios on air pollution and public health are a function of the characteristics of motor vehicles in use and the manner, location, and amount they are used relative to human settlement patterns. This section examines how different scenarios might affect fine particle, or soot, pollution (PM2.5) and related public health impacts. Further work is needed to evaluate in detail the impacts of other pollutants on health, to consider traffic safety impacts, and impacts on health related to levels of physical activity. Because the High Shift scenario would promote greater use of walking and cycling, it would likely reduce premature deaths due to physical inactivity. Reducing vehicle kilometers of travel and increasing the use of active walking and cycling modes might be anticipated to reduce the incidence of road crash fatalities and serious injuries, but more research is needed to support this supposition.

Most government actions to limit the climate impacts of transportation have focused on reducing the volume of fossil fuels consumed by motor vehicles, in particular, gasoline and diesel fuel. Such actions include improving the efficiency of new cars, trucks, and buses; influencing the amount of travel by passenger cars and freight trucks, and improving the efficiency of transportation systems. In addition to impacts on climate and energy consumption, motor vehicles are major contributors to outdoor air pollution, exposure to which is one of the leading causes of premature mortality worldwide.

Governments in the US, European Union (EU), and Japan have led the development of regulatory programs to control motor vehicle pollution by setting mandatory limits on emissions from new vehicles and the sulfur content of gasoline and diesel fuel. These international best-practice programs have resulted in new vehicles that are up to 99% cleaner than unregulated vehicles. Many other countries are following the regulatory pathway developed in the EU, which progresses from "Euro 1" to "Euro 6" for cars and light commercial vehicles, and "Euro I" to Euro VI" for heavy-duty trucks and buses, with Euro 6/VI requiring the cleanest vehicles and fuels.

As part of this study, the International Council on Clean Transportation (ICCT) conducted an analysis of the implications for vehicle air pollution and associated health impacts. Emissions of local air pollutants from on-road vehicles were estimated using the ICCT's Global Transportation Roadmap model. The Roadmap model is an Excel-based tool designed to help policymakers see trends in transportation activity, energy use, greenhouse gas emissions (GHGs), and local air pollutant emissions; assess the impacts of different policy options; and develop policy roadmaps for clean air and low-carbon transportation.[23, 24] The Roadmap model:

- Estimates fuel lifecycle emissions of GHGs (CO_2, CH4, and N2O) and local air pollutants (PM2.5, NOx, CO, black carbon, and SO2), as well as consumption of fossil fuels, biofu-

els, electricity, and hydrogen, for the years 2000 to 2050;

- Covers passenger cars, light commercial vehicles, buses, motorcycles, three-wheelers, medium- and heavy-duty trucks, passenger and freight rail, passenger aviation, and international shipping;

- Focuses on 11 of the countries/regions with the greatest annual new vehicle sales: the United States, the European Union, China, India, Japan, Brazil, Canada, South Korea, Mexico, Australia, and Russia;

- Considers five aggregate regions consisting of countries in Latin America, non-EU Europe, the Asia-Pacific, Africa, and the Middle East;

- Can be customized to assess transportation trends and policy impacts for specific countries with minimal data requirements;

- Has been reviewed by transportation modeling experts to ensure the validity and adequacy of calculation methods and algorithms;

- Is updated annually, and its outputs are validated against the results of other major national and international transportation emission models.[25]

Four alternative futures were evaluated in the analysis:

- **Baseline-Adopted:** Vehicle activity develops according to the Baseline projections and no new policies are adopted to control motor vehicle pollution.

- **High Shift-Adopted:** Vehicle activity develops according to the High Shift scenario, but no new policies are adopted to control motor vehicle pollution.

- **Baseline-Euro 6/VI:** Vehicle activity develops according to the Baseline projections and most countries adopt best-practice policies to control motor vehicle pollution, equivalent to Euro 6/VI or better.

- **High Shift-Euro 6/VI:** Vehicle activity develops according to the High Shift scenario and most countries adopt best-practice policies to control motor vehicle pollution, equivalent to Euro 6/VI or better.

The following figures summarize the major differences between these alternative futures with respect to global motor vehicle pollution and associated health impacts in urban areas. Figure 23 summarizes global trends in annual exhaust emissions of primary $PM_{2.5}$, exposure to which is associated with increased risk of death from cardiopulmonary disease, lung cancer, and acute respiratory infection. While total emissions are forecast to decrease initially as a result of adopted vehicle emissions standards, growth in vehicle activity is forecast to drive net emissions increases under both the "Baseline-Adopted" and "High Shift-Adopted" pathways. While the "High Shift-Adopted" pathway would cut $PM_{2.5}$ emissions by only 5% in 2050 compared to the "Baseline-Adopted" pathway, the "Baseline-Euro 6/VI" and "High Shift-Euro 6/VI" pathways could cut $PM_{2.5}$ emissions by 88% to 90%, respectively.

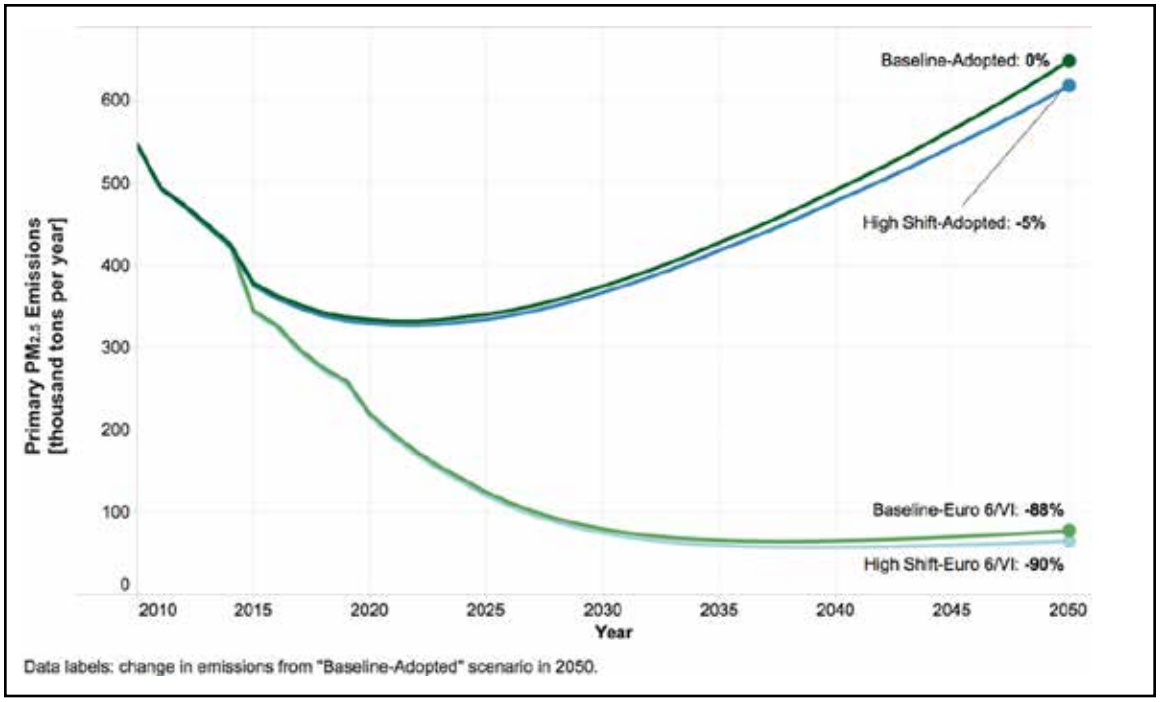


Figure 23 Global Primary PM2.5 Emissions from On-Road Vehicles in Urban Areas, 2010-2050

Figure 24 summarizes global trends in premature mortality resulting from exposure to exhaust emissions of primary $PM_{2.5}$ in urban areas. The effects of vehicle emissions over time are compounded by increases in urban population and the density of urban areas, both of which contribute to a greater proportion of vehicle emissions being inhaled in 2050 compared to current levels. Under both the "Baseline-Adopted" and "High Shift-Adopted" pathways, the number of premature mortalities could roughly quadruple by 2050. Emission standards requiring vehicle technology and fuels equivalent to Euro 6/VI or better could prevent an estimated 1.36 million premature deaths annually – equivalent to 19 million years of life lost – in 2050.

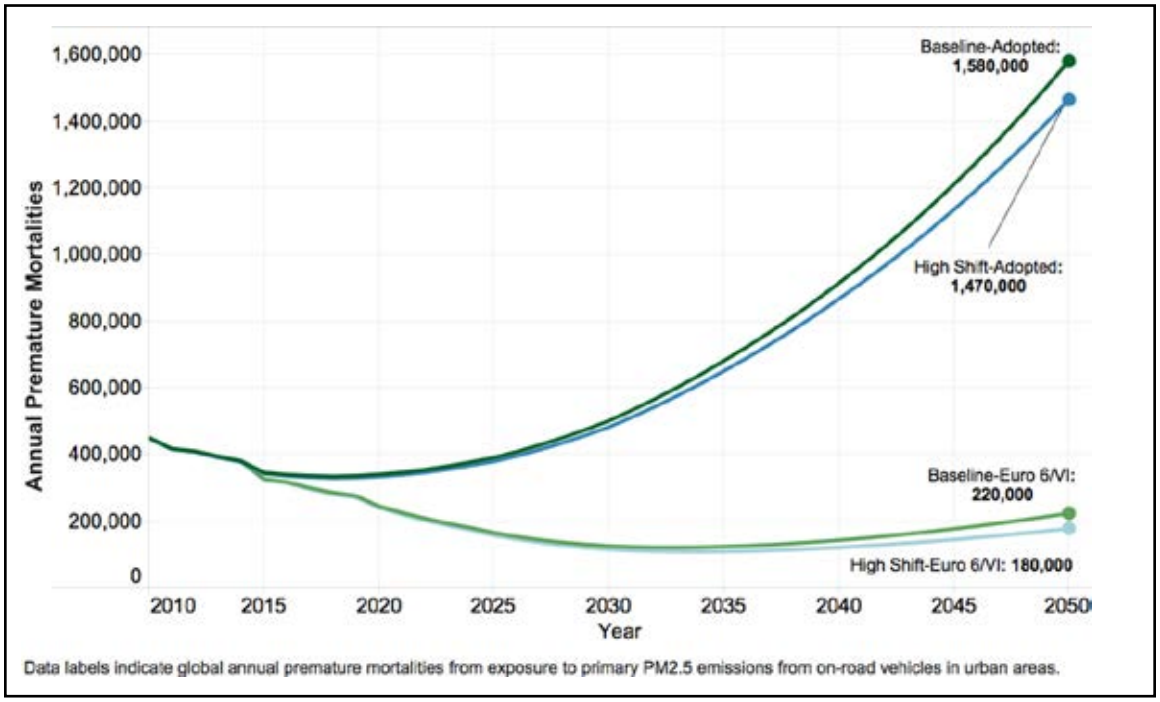


Figure 24: Global Annual Premature Mortalities From Exposure to On-Road Vehicle Primary PM2.5, 2010-2050

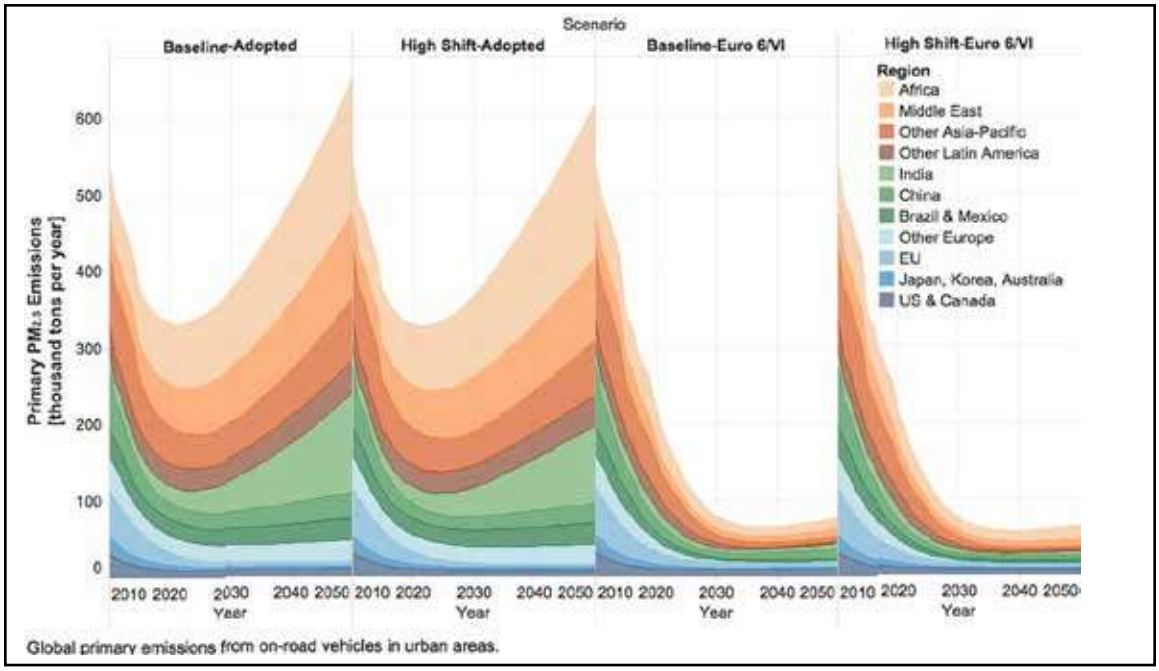


Figure 25: Primary $PM_{2.5}$ Emissions from On-Road Vehicles in Urban Areas by Region, 2010-2050

Figure 25 shows the distribution of $PM_{2.5}$ emissions under these four alternative futures by region. It shows that regions without advanced emission controls currently account for the bulk of global primary $PM_{2.5}$ emissions and are forecast to experience sustained growth in vehicle emissions, even as countries with more-stringent vehicle pollution control programs achieve drastic emissions cuts.

The follow-up documentation report for this study will provide greater detail on policies to control motor vehicle pollution along with additional description of the methods and results of the ICCT motor vehicle emissions control analysis. Several key conclusions can be drawn:

- Most regions have not yet adopted best practice emission controls that can reduce vehicle $PM_{2.5}$ by 99%. If such regions fail to improve their vehicle emissions control programs, future growth in vehicle activity could produce a four-fold increase in associated early deaths by 2050 even with a global shift to mass transit.

- Expanding the adoption of vehicle pollution control programs equivalent to Euro 6/VI or better could reduce global fleet emissions and associated health impacts on the order of 90% in 2050, equivalent to 1.36 million premature deaths avoided annually. Equipping buses with Euro VI-equivalent emission controls could achieve about 20% of the potential reduction in annual premature deaths.

- Diesel vehicles at early stages of emission control have very high $PM_{2.5}$ emissions compared to gasoline vehicles. Commercial vehicles, many of which are powered by diesel, account for over 80% of global PM emissions but only 20% of vehicle activity.

- At the global level in 2010, the average bus emitted nearly 50 times the $PM_{2.5}$ per vehicle-km as the average passenger car. Shifting passenger travel from passenger cars to buses needs to be accompanied with Euro VI-equivalent emission controls for buses to have significant air quality benefits.

- Once vehicles are equipped with best practice emission controls, policies to limit growth in vehicle activity consistent with the "High-Shift" scenario could avoid an additional 40,000 annual premature deaths caused by exposure to vehicle emissions in 2050.

- Where adequate clean diesel (fewer than 50 parts per million sulfur) is available, Euro VI-equivalent technologies have been found to add $3,200 to $6,400 to the cost of new buses compared to Euro III-equivalent controls.[26, 27, 28] These costs are modest relative to the capital cost of new buses.

Conclusions And Next Steps

Given the assumptions made and scenarios compared, the main finding is that a high-transit, high-non-motorized-vehicle scenario that (at least in the developing world) provides similar total mobility (in passenger kilometers) as a baseline, more car-dominated scenario, is likely to be more equitable, less expensive to construct and operate over the next 40 years, and to sharply reduce CO_2 emissions. Unmanaged growth in motor vehicle use threatens to exacerbate growing income inequality and environmental ills, while more sustainable transport delivers access for all, reducing these ills. This report's findings should help support wider agreement on climate policy, where costs and equity of the cleanup burden between rich and poor countries are key issues.

This scenario is one example of many possible futures. It is not a prediction and may be extremely challenging to achieve, requiring high rates of public investment. A principal purpose is to use this scenario as the basis to investigate the implications of this future for a range of impacts and indicators of interest. Is high quality mobility and access preserved? What might be the safety and non-air pollution related health impacts? What might the impacts of this future be for public finance, job creation and economic well being and overall sustainable development? These aspects are being further investigated.

References

[1] Façanha, C., Blumberg, K., & Miller, J. (2012). Global Transportation Energy and Climate Roadmap. International Council on Clean Transportation. November. Retrieved from **http://www.theicct.org/global-transportation-energy-and-climate-roadmap**

[2] Chambliss, S., Miller, J., Façanha, C., Minjares, R., & Blumberg, K. (2013). The Impact of Stringent Fuel and Vehicle Standards on Premature Mortality and Emissions. The International Council on Clean Transportation. Retrieved from **http://theicct.org/global-health-roadmap**

[3] An earlier study by the International Association for Public Transport and International Energy Agency used IEA's MoMo model to evaluate the impact of doubling public transport mode share by 2025 but only in terms of energy consumption and CO2. Jérôme Pourbaix, "Towards a Smart Future for Cities," Journeys, May 2012, Singapore Land Transport Authority.

[4] UN HABITAT, *Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements*, Nairobi, 2013.

[5] International Energy Agency, *Energy Technology Perspectives* 2012, Paris, 2012.

[6] *Commitment to Sustainable Transport: Joint Statement to the Rio+20 United Nations Conference on Sustainable Development by the African Development Bank, Asian Development Bank, CAF, Development Bank of Latin America, European Bank for Reconstruction and Development, European Investment Bank, InterAmerican Development Bank, Islamic Development Bank, and World Bank*, June 2012.

[7] Partnership on Sustainable Low Carbon Transport, *Creating Universal Access to Safe, Clean and Affordable Transport*, Shanghai, 2013.

[8] International Energy Agency, The IEA Mobility Model As of February 2014, Paris, **http://www.iea.org/media/transport/IEA_MoMo_Presentation.pdf**

[9] Cambridge Systematics, Inc. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions*. Washington, DC: Urban Land Institute, 2009.

[10] U.S. Department of Transportation. *Transportation's Role in Reducing U.S. Greenhouse Gas Emissions, Volume 1: Synthesis, Report to Congress*. April 2010.

[11] International Energy Agency, *Transport, Energy and CO2: Moving Toward Sustainability*, Paris, 2012.

[12] UN DESA, *World Urbanization Prospects*, New York, July 2014.

[13] Institute for Transportation and Development Policy, *The 2014 BRT Standard*, New York, 2014.

[14] Buehler, R. and J. Pucher. 'Walking and cycling in Western Europe and the United States: Trends, policies, and lessons', *TR News 280*, May-June 2012, p. 34–42

[15] Buehler, R. and J. Pucher. Op.cite.

[16] MacMillan, Alexandra, Jennie Connor, Karen Witten, Robin Kearns, David Rees, and Alaistair Woodward, "The Societal Costs and Benefits of Commuter Bicycling: Simulating the Effects of Specific Policies Using System Dynamics Modeling," *Environmental Health Perspectives*, Vol 122, No.4, April 2014.

[17] Secretaria Distrital de Movilidad. Informe de indicadores: Encuesta de Movilidad de Bogota 2011, Link : **http://www.movilidadbogota.gov.co/hiwebx_archivos/audio_y_video/Encuesta%20de%20Movilidad.pdf**. Accessed March 12, 2014.

[18] The World Bank. A Gender Assessment of Mumbai's Public Transport. Mumbai, India. June, 2011. Link: **https://openknowledge.worldbank.org/handle/10986/12347.** Accessed April 27, 2014.

[19] Development Bank of Latin America. Observatorio de movilidad urbana (Urban Mobility Observatory), 2007. Link: **http://omu.caf.com/media/15966/omu_movilidad.xls**. Accessed March 15, 2014.

[20] Hanoi, Vietnam: The Comprehensive Urban Development Programme In Hanoi Capitol City of The Socialist Republic of Vietnam (2007) Link: **http://dc596.4shared.com/doc/Vwk5nDqL/preview.html**

[21] World Bank Poverty and Inequality Database, 2014. Link: **http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=poverty-and-inequality-database#**

[22] World Bank Poverty and Inequality Database, 2014. Link: **http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=poverty-and-inequality-database#**

[23] Chambliss, S., Miller, J., Façanha, C., Minjares, R., & Blumberg, K. (2013). The Impact of Stringent Fuel and Vehicle Standards on Premature Mortality and Emissions. The International Council on Clean Transportation. Retrieved from **http://theicct.org/global-health-roadmap**

[24] Façanha, C., Blumberg, K., & Miller, J. (2012). Global Transportation Energy and Climate Roadmap. International Council on Clean Transportation. November. Retrieved from **http://www.theicct.org/global-transportation-energy-and-climate-roadmap**

[25] International Council on Clean Transportation (ICCT) (2014). Global Transportation Roadmap Model. Available from **http://www.theicct.org/global-transportation-roadmap-model**

[26] Bansal, G., and Bandivadekar, A. (2013). Overview of India's Vehicle Emissions Control Program. The International Council on Clean Transportation. Retrieved from **http://www.theicct.org/indias-vehicle-emissions-control-program**

[27] Miller, J., Blumberg, K., and Sharpe, B. (2014). Cost-Benefit Analysis of Mexico's Heavy-duty Emission Standards (NOM 044). The International Council on Clean Transportation. Retrieved from **http://www.theicct.org/cost-benefit-analysis-mexicos-heavy-duty-emission-standards-nom-044**

[28] Shao, Z., Wagner, D. V., and Yang, Z. (2014). Costs and benefits of China 5/V and 6/VI standards in Guangdong Province. The International Council on Clean Transportation. Retrieved from **http://www.theicct.org/costs-and-benefits-china-5v-and-6vi-standards-guangdong-province**

PARIVESH
Ministry of Environment, Forest and Climate Change
Government of India

Annexure R-22

View Proposal Revision Summary

Form-A (Part-I): Diversion of Forest Land

Project Name:	Diversion of 3.58 Ha. Deemed Forest Land for Construction of allied facilities of Bijwasan Railway Station Project.	**Single Window Number:**	SW/244011/2025
		Proposal Number:	FP/DL/RAIL/534848/2025
State:	DELHI	**Current Status:**	Pending at DFO for Scrutiny and Recommendation
Submission Date:	22/04/2025	**Area (in ha):**	3.58

Common Application Form

Project Details

1. Details of Project

1.1. Name of the Project	Diversion of 3.58 Ha. Deemed Forest Land for Construction of allied facilities of Bijwasan Railway Station Project.
1.2. Project Proposal For	New
1.3. Project ID (Single Window Number)	SW/244011/2025
1.4. Description of Project	Diversion of 3.58 Ha. of Deemed Forest Land is required for Construction of Allied facilities such as Approach Roads, Parking, Drop off Area, Walkways etc. for proposed Bijwasan Railway Station project at Bijwasan, New Delhi.

2. Details of the Company/Organization/User Agency making application

2.1. Legal Status of the Company/Organization/User Agency	Central Government (Department/Autonomous body)
2.2. Name of the Company/ Organization/User agency	Rail Land development authority

Registered address

2.3. Address	Unit No. 702-B, 7th Floor, Konnectus Tower -2, DMRC Building, Ajmeri Gate, Delhi - 110002
2.4. State	DELHI
2.5. District	SOUTH WEST
2.6. Pin Code	110002
2.7. E-mail address	jgmprj4@rlda.railnet.gov.in
2.8. Mobile number	xxxxxx4419

3. Details of the person making application

3.1. Name	Amit Sharma
3.2. Designation	JGM/Project-4

Correspondence address

3.3. Address	Unit No. 702-B, 7th Floor, Konnectus Tower -2, DMRC Building, Ajmeri Gate, Delhi - 110002
3.4. State	DELHI
3.5. District	NEW DELHI
3.6. Pin Code	110002
3.7. E-mail address	am3civil@rlda.railnet.gov.in
3.8. Landline Number	xxxx2854
3.9. Mobile number	xxxxxx4419

Project Location

4. Location of the Project or Activity

4.1. Upload KML	rlda_fca_area-final.kml
4.2. Whether the project/activity falling in the state/UT sharing international borders	NO
5. Shape of the Project	Non - Linear

Location Details

Toposheet No	State/UT	District	Sub District	Village	Plot/Survey/Khasra No.
H43X2	DELHI	South West	Kapeshera	BHARTAL	Part of 0/97, 0/96, 14/26, 14/22, 14/23, 17/3, 17/4, 17/2, 17/9, 17/8, 17/7, 17/15, 17/17, 17/23, 32/3, 0/223, 17/27
H43X2	DELHI	New Delhi	Delhi Cantonment	SAHBAD MOHD	Part of 16/18, 16/22, 33/1, 33/10, 33/11, 32/15, 32/17, 32/24

Remarks
N/A

6. Land Requirement (in Ha) of the project or activity

6.1. Nature of Land involved	
6.2. Non-Forest Land [A]	6.95
6.3. Forest Land [B]	3.58
6.4. Total Land [A+B]	10.53

Project Activity Cost

6. Project/Activity Cost

6.1. Total Cost of the Project at current price level (in Lakhs)	37000 Amount in Words : **Thirty Seven Thousand Lakh(s) Only**

7. Employment likely to be generated

7.1. During construction phase

Permanent employment

7.1.1. No. of permanent employment (No.s) [A]	10
7.1.2. Period of employment (No. of days) [B]	1825
7.1.3. No. of man-days [X]=[A]*[B]	18250

Temporary employment

7.1.4. Temporary / Contractual employment (No. of Man days) [Y]	912500
7.1.5. Total [X] +[Y]	930750

7.2. During operational phase

Permanent employment

7.2.1. No. of permanent employment (No.s) [A]	1625
7.2.2. Period of employment (No. of days) [B]	10950
7.2.3. No. of man-days [X]=[A]*[B]	17793750

Temporary employment

7.2.4. Temporary / Contractual employment (No. of Man days) [Y]	10950000
7.2.5. Total [X] +[Y]	28743750

Others

8. Whether Rehabilitation and Resettlement (R&R) involved?	NO
9. Whether project area involves shifting of watercourse/road/rail/Transmission line/water pipeline, etc. required?	NO
10. Whether any alternative site(s) examined or part thereof for the non-site-specific component?	Not applicable as the project or activity is site specific
11. Whether there is any Government Order or Policy/ Court order relevant or restricting to the site?	NO
12. Whether there is any litigation pending against the project and/or land in which the project is proposed to be set up?	NO
13. Whether the proposal involves violation of Act/Rule/Regulation/Notification of Central/State Government?	NO

Form-A (Part-I): Diversion of Forest Land

Project Details

1. Forest Clearance

1.1. State	DELHI
1. Upload a copy of note containing justification for locating the 2. Project in forest land	justification.pdf
1.3. Project Category	Railway
1.4. Exempted Category	NA
1.5. Is Related to Encrochment?	No
1.6. Whether any proposal seeking prior approval of Central Government under the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 for diversion of forest land required for this project has been submitted in the past?	No

Proposed Land

2. Details of Forestland proposed to be diverted (Village / Division / District Wise Breakup)

2.1. Total area of forestland proposed for diversion (ha.)	3.58
2.2. Total area of non- forestland required for this project (ha.)	6.95

2.3. Legal Status of forest land proposed for diversion

Area (ha)	Legal Status of Forest Land
3.58	Deemed Forest

2.3.1. Total Area (ha)	3.58
2.4. Total period for which the forestland is proposed to be diverted (No. of years)	99

KML Details

Division	DCF West Division
No. of Patches	2
KML	124858929_FC_KML_1745304822136_new diversion kml.kml

Location Details

Toposheet No.	District	Village	Range	Forest land proposed for diversion (ha)	Non Forest Land (ha)
H43X2	South West	BHARTAL	Kapashera forest range	1.87	2.95
H43X2	New Delhi	SAHBAD MOHD	Vasant vihar forest range	1.71	4

Patch Details

Patch/ Segment ID	Forest Area (ha)	Non-Forest Area (ha)	Remarks if any
1	3.58	0	
2	0	6.95	

Remarks Details

Total Patch-wise Forest Land in the division (ha)	
2.5. Total Forest Land Area (ha)	3.5800
2.6. Total Non Forest Land Area (ha)	6.9500

Total KML-wise Forest Land in the division (ha.)	
2.7. Total Forest Land Area (ha)	3.58
2.8. Total Non Forest Land Area (ha)	6.95
2.9. Total Area (ha)	10.53

3. Component Wise Break Up (Including underground works such as tunnel and similar purpose)-if applicable

Component	Forest Land Proposed for Diversion (ha)	Non-forest Land (ha)

Component	Forest Land Proposed for Diversion (ha)	Non-forest Land (ha)
Parking, Walkway, Approach Road and allied facilities	3.58	6.95

4. Total Forest Land(ha)	3.58
5. Total Non Forest Land (ha)	6.9500
6. Upload map of the forest land proposed to be diverted prepared by using DGPS or Total Station (pdf only)	map fca area_compressed.pdf

Afforestation Details

7. Details of land identified for Compensatory Afforestation

7.1. Whether Compensatory Afforestation is applicable or not?	Yes
7.1.1. Type of Compensatory Afforestation	Non-forest Land
7.1.1.1. Whether Non-forest land is available?	Yes

7.1.1.2. Patch wise details

Kml File Name
narela ca site.kml

TopoSheet No.	State	District	Village	Plot No. /Kasra No.	Present Owner	Area
H43X1	DELHI	North	RAJAPUR KALAN	Part of 0/69, 0/506	Northeren Railways	3.8

7.1.1.3. Number of patches.	1
7.1.1.4. No. of districts involved for raising Compensatory Afforestation.	1
7.1.1.5. Total CA Land	3.8
7.1.1.6. Upload a scanned copy of the map of the land identified for creation of Compensatory Afforestation prepared by using GPS or Total Station (pdf only)	map ca area_compressed.pdf
7.1.1.7. Whether the area of non-forest land or Revenue forest land required to be provided by User Agency for raising Compensatory Afforestation is less than area of forest land proposed to be diverted?	No
7.1.1.8. Whether NFL is free from Non- Encumbrance	Yes
7.1.1.9. Whether the present owner of NFL is different from the User Agency	No
7.1.1.9.1. Upload MoU/agreement executed between the present owner and the user agency	N/A

Others

8. Cost-Benefit analysis

8.1. Whether Cost-Benefit analysis for the Project has been made?	N/A

9. Environmental clearance Details

9.1. Whether the Project requires Clearance under the Environment (Protection) Act 1986 (Environmental clearance)?	No

10. Wildlife clearance Details

10.1. Whether the Project or a part thereof is located in any Protected Area or their Eco sensitive zone?	No

Category Specific Details

N/A

11. Copy of Additional Information, if any

S. No.	Document Name	Remark	Document
1	General Documents	Muck Disposal Scheme	final muck disposal scheme.pdf
2	Undertaking	FRA Undertaking	final fra undertaking.pdf
3	Checklists	Checklist No. 6,7,10,11,12 & 16	final checklists.pdf

Undertaking

☑ I hereby give undertaking that the data and information given in the application and enclosures are true to be best of my knowledge and belief and I am aware that if any part of the data and information is found to be false or misleading at any stage, the project will be rejected and clearance given if any to the project will be revoked at our risk and cost. In addition to the above, I hearby give undertaking that no activity/construction/expansion has been taken up

12.	Name	Amit Sharma
13.	Designation	JGM/Project-4
14.	Company	Rail Land development authority
15.	Address	Unit No. 702-B, 7th Floor, Konnectus Tower -2, DMRC Building, Ajmeri Gate, Delhi - 110002
16.	Date	22/04/2025

Sh. Santosh Pathak

RAIL LAND DEVELOPMENT AUTHORITY

Sent Back Applications

No. of Sent Back Application: 49

S.No.	Application Id	Form Type	No. of Trees	Application Date	Status	Remark
					Send	You are requested to:- 1. Mention species name of all trees in application form-B that has mentioned as others. 2. Upload geo-referenced photographs of all trees falls in project site. 3. a. Enumeration list (species and girth) of trees of the entire area (duly signed and stamp by the applicant or authorized agent of the applicant) including geo-referenced photographs showing the enumeration number clearly (each tree to be given a unique number by the applicant). b. Boundary description (duly signed by the applicant). c. Undertaking that all other permissions/ approvals, as may be required, have been obtained or are being obtained. d. Details (KML file, area, ownership proof including khasra details) of the site where the trees are proposed to be transplanted and compensatory plantation proposed to be carried out, if applicable. e. Undertaking to be submitted by the Applicant, clearly stating that the said parcel of land identified for compensatory plantation is not allotted for any other purpose including for compensatory plantation / afforestation / transplantation for any other project, if applicable. f. Details of other feasible options explored before finalizing the project, if any, to ensure minimizing the number of trees affected duly sign and stamp by the applicant. g. A copy of the detailed architectural drawings (in .dwg

1	27088	Felling	1291	27/04/2025	Back	drawing file format showing the khasra numbers) which includes overlay of trees on to-the-scale layout and alignment of the proposed project. h. Provide project plan map with showing location and tree number of each tree on 1:200 scale. (Hard Copy) i. An exercise shall be done by the Applicant to ensure that the compensatory plantation / transplantation is duly undertaken in the area or in the vicinity of the site itself from where trees are felled, to the extent possible and provide information for the same. j. The approved layout plan of the project area submitted by the Applicant on the DPTA e-Forest portal including the building plan, road and other structures, etc. shall be demarcated on the ground (on the scale of 1:1) by the Applicant. The enumeration list of trees (each tree will be given a unique number) submitted by the applicant, for the project area which includes trees to be saved, transplanted and felled, on the DPTA e-Forest portal shall be jointly verified and authenticated on the ground, by the Tree Officer and the Applicant. and you are also informed:- The sub-Section (4) of Section 9 of the Act, has been stayed by the Hon'ble Supreme Court by the order dated 19/12/2024,in the Writ Petition(s) (Civil) No 4677/1985 M.C. Mehta vs UoI, and therefore shall not be applicable for applications submitted for the tree felling/transplantation.
						Your requested to provide :- a) The project area mentioned in form-B, KML and in project layout plan are different. please check and update the correct project area. b) Technical justification for the project proposal. c) Details of other options explored of available technologies and designs for executing the project without tree transplantation/felling or minimizing the transplantation/felling of trees. d) A copy of the detailed architectural drawings (in DWG drawing file format showing the Khasra numbers) which includes overlay of trees on to-the-scale layout and alignment of the proposed project duly authenticated by the Competent Authority. e) Details (KML file, area, nature/character, ownership

Himanshu Dawar
RAIL LAND DEVELOPMENT AUTHORITY

Tree Felling Application

Application ID : 27088

Application | Documents | Undertaking

Applicantion Summary

Applicant's Photo			
Applicant's Name	Himanshu Dawar	Applicant's Address	Rail Land Development Authority Unit No.702-B, 7th Floor, Konnectus Tower-2, DMRC Building, Ajmeri Gate, Delhi-110002
Mobile No	8800794419	Email Id	am3civil@rlda.railnet.gov.in
Applicantion Category	Govt. Department		
Revenue District where trees to be Felled	South West	Land owner category where trees to be Felled	Individual
Property Owner Name	NORTHERN RAILWAY	Property Owner Address	Rail Land Development Authority Unit No.702-B, 7th Floor, Konnectus Tower-2, DMRC Building, Aj
Date of Application Submission	08/06/2025		

Tree Information

Total number of trees	1454	Number of trees to be felled	1293

Details of trees to be felled (grith measured at height of 1.35m)

981

S.No.	Tree S.No	Tree Name	To be Transplanted\Felled\Pruned	Girth (in centi meters)
1	647	Shisham	Transplant	24
2	647	Shisham	Transplant	27
3	649	Kikar	Felling	67
4	649	Kikar	Felling	43
5	649	Kikar	Felling	50
6	649	Kikar	Felling	46
7	649	Kikar	Felling	26
8	649	Kikar	Felling	22
9	649	Kikar	Felling	48
10	649	Kikar	Felling	50
11	649	Kikar	Felling	16
12	651	Shisham	Transplant	16
13	652	Shisham	Transplant	27
14	653	Shisham	Transplant	49
15	653	Shisham	Transplant	30
16	653	Shisham	Transplant	32
17	653	Shisham	Transplant	15
18	654	Shisham	Transplant	16
19	656	Shisham	Transplant	16
20	657	Shisham	Transplant	36
21	658	Shisham	Transplant	52
22	659	Shisham	Transplant	16
23	660	Shisham	Transplant	83
24	661	Shisham	Transplant	51
25	662	Shisham	Transplant	24
26	663	Shisham	Transplant	30
27	664	Shisham	Transplant	18
28	665	Shisham	Transplant	32
29	666	Shisham	Transplant	24
30	667	Shisham	Transplant	57
31	668	Shisham	Transplant	42
32	669	Shisham	Transplant	30
33	669	Shisham	Transplant	19
34	671	Shisham	Transplant	27
35	671	Shisham	Transplant	19

621

S.No.	Tree Name	To be Transplanted\Felled\Pruned	Tree Count
1	Babool	Transplant	127
2	Shisham	Transplant	182
3	Babool	Felling	12
4	Shahtoot	Transplant	5
5	Shisham	Felling	5
6	Peepal	Transplant	8
7	Kikar	Felling	890
8	Neem	Transplant	25
9	Subabul	Transplant	1
10	Ber	Transplant	21
11	Khair	Transplant	1
12	Goolar	Transplant	2
13	Subabul	Felling	8
14	Mango	Transplant	3
15	Lasora	Transplant	3

36	672	Shisham	Transplant	44
37	673	Shisham	Transplant	39
38	674	Kikar	Felling	47
39	674	Kikar	Felling	39
40	674	Kikar	Felling	50
41	674	Kikar	Felling	32
42	674	Kikar	Felling	40
43	674	Kikar	Felling	22
44	674	Kikar	Felling	28
45	674	Kikar	Felling	23
46	674	Kikar	Felling	19
47	674	Kikar	Felling	18
48	674	Kikar	Felling	15
49	675	Kikar	Felling	86
50	675	Kikar	Felling	56
51	675	Kikar	Felling	60
52	675	Kikar	Felling	40
53	675	Kikar	Felling	25
54	675	Kikar	Felling	58
55	676	Kikar	Felling	83
56	677	Kikar	Felling	80
57	677	Kikar	Felling	70
58	677	Kikar	Felling	60
59	681	Kikar	Felling	50
60	681	Kikar	Felling	28
61	681	Kikar	Felling	20
62	681	Kikar	Felling	32
63	682	Shahtoot	Transplant	25
64	684	Kikar	Felling	44
65	684	Kikar	Felling	35
66	687	Kikar	Felling	50
67	687	Kikar	Felling	42
68	687	Kikar	Felling	43
69	688	Kikar	Felling	82
70	690	Kikar	Felling	21
71	690	Kikar	Felling	23
72	692	Kikar	Felling	22

983

73	692	Kikar	Felling	15
74	693	Kikar	Felling	17
75	693	Kikar	Felling	15
76	694	Kikar	Felling	55
77	694	Kikar	Felling	44
78	694	Kikar	Felling	34
79	694	Kikar	Felling	29
80	694	Kikar	Felling	15
81	694	Kikar	Felling	15
82	694	Kikar	Felling	15
83	695	Kikar	Felling	33
84	3	Kikar	Felling	34
85	3	Kikar	Felling	29
86	3	Kikar	Felling	31
87	3	Kikar	Felling	16
88	5	Shisham	Felling	59
89	7	Babool	Transplant	42
90	10	Babool	Felling	100
91	63	Kikar	Felling	16
92	64	Kikar	Felling	45
93	64	Kikar	Felling	15
94	64	Kikar	Felling	24
95	64	Kikar	Felling	25
96	64	Kikar	Felling	20
97	77	Kikar	Felling	24
98	146	Kikar	Felling	38
99	146	Kikar	Felling	21
100	146	Babool	Transplant	24
101	150	Babool	Transplant	63
102	150	Babool	Transplant	36
103	150	Babool	Transplant	31
104	150	Babool	Transplant	25
105	150	Babool	Transplant	26
106	150	Babool	Transplant	28
107	150	Babool	Transplant	17
108	178	Babool	Transplant	63
109	178	Babool	Transplant	46

110	182	Babool	Transplant	59
111	204	Babool	Transplant	77
112	206	Babool	Transplant	90
113	208	Babool	Transplant	87
114	209	Babool	Transplant	58
115	212	Babool	Transplant	91
116	212	Babool	Transplant	60
117	212	Babool	Transplant	45
118	213	Babool	Transplant	49
119	222	Babool	Transplant	70
120	223	Babool	Transplant	52
121	225	Babool	Transplant	95
122	225	Babool	Transplant	75
123	225	Babool	Transplant	64
124	225	Babool	Transplant	52
125	225	Babool	Transplant	59
126	231	Babool	Transplant	61
127	238	Babool	Transplant	100
128	238	Babool	Transplant	108
129	239	Babool	Transplant	38
130	242	Babool	Transplant	54
131	243	Babool	Transplant	27
132	247	Babool	Felling	62
133	249	Babool	Transplant	94
134	249	Babool	Transplant	58
135	249	Babool	Transplant	40
136	249	Babool	Transplant	53
137	255	Babool	Transplant	38
138	256	Babool	Transplant	26
139	259	Babool	Transplant	94
140	259	Babool	Transplant	71
141	259	Babool	Transplant	62
142	259	Babool	Transplant	30
143	260	Babool	Transplant	56
144	262	Babool	Transplant	42
145	262	Babool	Transplant	43
146	265	Babool	Transplant	30

147	268	Babool	Transplant	69
148	268	Babool	Transplant	44
149	270	Babool	Transplant	90
150	300	Babool	Transplant	100
151	311	Babool	Transplant	48
152	311	Babool	Transplant	50
153	337	Babool	Transplant	84
154	337	Babool	Transplant	122
155	345	Babool	Transplant	80
156	345	Babool	Transplant	74
157	347	Babool	Transplant	71
158	348	Babool	Transplant	100
159	351	Babool	Transplant	84
160	352	Babool	Transplant	62
161	353	Babool	Transplant	53
162	356	Babool	Transplant	40
163	362	Babool	Transplant	70
164	362	Babool	Transplant	35
165	363	Babool	Transplant	35
166	363	Babool	Transplant	28
167	364	Babool	Transplant	43
168	366	Babool	Transplant	52
169	366	Babool	Transplant	52
170	367	Babool	Transplant	49
171	368	Babool	Transplant	25
172	372	Babool	Transplant	45
173	374	Babool	Transplant	15
174	375	Babool	Transplant	69
175	375	Babool	Transplant	67
176	375	Babool	Transplant	40
177	375	Babool	Transplant	15
178	376	Babool	Felling	26
179	376	Babool	Felling	22
180	380	Babool	Transplant	96
181	386	Babool	Transplant	51
182	386	Babool	Transplant	65
183	397	Babool	Transplant	95

184	411	Babool	Transplant	46
185	411	Babool	Transplant	24
186	411	Babool	Transplant	18
187	412	Babool	Transplant	42
188	412	Babool	Transplant	18
189	416	Babool	Transplant	25
190	424	Babool	Transplant	70
191	427	Babool	Transplant	50
192	429	Babool	Transplant	31
193	430	Babool	Transplant	30
194	430	Babool	Transplant	15
195	431	Babool	Transplant	28
196	431	Babool	Transplant	27
197	436	Babool	Transplant	50
198	440	Babool	Transplant	64
199	442	Babool	Transplant	45
200	443	Babool	Transplant	92
201	450	Babool	Transplant	44
202	451	Babool	Transplant	41
203	455	Babool	Transplant	60
204	455	Babool	Transplant	56
205	478	Babool	Felling	50
206	493	Babool	Transplant	90
207	512	Babool	Transplant	46
208	528	Babool	Transplant	86
209	531	Babool	Transplant	28
210	531	Babool	Transplant	51
211	531	Babool	Transplant	29
212	531	Babool	Transplant	31
213	532	Babool	Transplant	64
214	538	Shisham	Transplant	53
215	538	Shisham	Felling	46
216	539	Shisham	Felling	39
217	554	Shisham	Felling	57
218	554	Shisham	Felling	30
219	581	Babool	Transplant	61
220	581	Babool	Transplant	42

221	583	Babool	Felling	70
222	583	Babool	Felling	47
223	584	Babool	Felling	53
224	585	Babool	Felling	49
225	586	Babool	Felling	45
226	587	Babool	Felling	53
227	588	Babool	Felling	32
228	604	Babool	Transplant	117
229	604	Babool	Transplant	23
230	605	Kikar	Felling	94
231	612	Shisham	Transplant	20
232	612	Shisham	Transplant	18
233	623	Shisham	Transplant	21
234	626	Shisham	Transplant	170
235	629	Kikar	Felling	74
236	629	Kikar	Felling	59
237	629	Kikar	Felling	37
238	633	Shisham	Transplant	43
239	638	Neem	Transplant	22
240	640	Kikar	Felling	57
241	640	Kikar	Felling	32
242	640	Kikar	Felling	20
243	640	Kikar	Felling	18
244	644	Kikar	Felling	22
245	648	Kikar	Felling	67
246	648	Kikar	Felling	43
247	648	Kikar	Felling	50
248	648	Kikar	Felling	46
249	648	Kikar	Felling	26
250	648	Kikar	Felling	22
251	650	Shisham	Transplant	16
252	655	Shisham	Transplant	16
253	670	Shisham	Transplant	27
254	670	Shisham	Transplant	19
255	678	Babool	Transplant	60
256	679	Babool	Transplant	47
257	680	Kikar	Felling	50

258	680	Kikar	Felling	28
259	680	Kikar	Felling	20
260	680	Kikar	Felling	32
261	683	Babool	Transplant	44
262	683	Babool	Transplant	35
263	685	Babool	Transplant	69
264	686	Babool	Transplant	50
265	686	Babool	Transplant	42
266	686	Babool	Transplant	43
267	689	Kikar	Felling	21
268	689	Kikar	Felling	23
269	691	Kikar	Felling	22
270	691	Kikar	Felling	15
271	695	Babool	Transplant	68
272	695	Babool	Transplant	47
273	2	Kikar	Felling	63
274	2	Kikar	Felling	44
275	2	Kikar	Felling	15
276	2	Kikar	Felling	15
277	2	Kikar	Felling	25
278	2	Kikar	Felling	32
279	2	Kikar	Felling	21
280	4	Kikar	Felling	75
281	4	Kikar	Felling	49
282	4	Kikar	Felling	39
283	6	Kikar	Felling	31
284	6	Kikar	Felling	15
285	6	Kikar	Felling	28
286	6	Kikar	Felling	15
287	6	Kikar	Felling	35
288	6	Kikar	Felling	27
289	6	Kikar	Felling	16
290	6	Kikar	Felling	15
291	11	Kikar	Felling	36
292	11	Kikar	Felling	21
293	13	Kikar	Felling	16
294	15	Kikar	Felling	30

295	15	Kikar	Felling	22
296	15	Kikar	Felling	15
297	16	Kikar	Felling	42
298	16	Kikar	Felling	17
299	45	Kikar	Felling	24
300	45	Kikar	Felling	15
301	46	Kikar	Felling	24
302	49	Kikar	Felling	43
303	49	Kikar	Felling	19
304	49	Kikar	Felling	34
305	49	Kikar	Felling	46
306	49	Kikar	Felling	37
307	49	Kikar	Felling	70
308	49	Kikar	Felling	32
309	49	Kikar	Felling	19
310	49	Kikar	Felling	38
311	50	Kikar	Felling	18
312	51	Kikar	Felling	41
313	51	Kikar	Felling	27
314	51	Kikar	Felling	30
315	51	Kikar	Felling	36
316	51	Kikar	Felling	25
317	52	Kikar	Felling	50
318	52	Kikar	Felling	57
319	52	Kikar	Felling	20
320	52	Kikar	Felling	50
321	53	Kikar	Felling	27
322	53	Kikar	Felling	19
323	53	Kikar	Felling	18
324	54	Kikar	Felling	34
325	54	Kikar	Felling	22
326	54	Kikar	Felling	21
327	55	Kikar	Felling	21
328	55	Kikar	Felling	25
329	55	Kikar	Felling	20
330	55	Kikar	Felling	19
331	56	Kikar	Felling	58

332	56	Kikar	Felling	56
333	56	Kikar	Felling	57
334	57	Kikar	Felling	20
335	58	Kikar	Felling	49
336	58	Kikar	Felling	44
337	58	Kikar	Felling	42
338	58	Kikar	Felling	28
339	58	Kikar	Felling	27
340	58	Kikar	Felling	28
341	59	Kikar	Felling	30
342	59	Kikar	Felling	24
343	59	Kikar	Felling	35
344	60	Kikar	Felling	43
345	61	Kikar	Felling	29
346	62	Kikar	Felling	62
347	62	Kikar	Felling	28
348	65	Kikar	Felling	31
349	66	Kikar	Felling	38
350	66	Kikar	Felling	36
351	67	Kikar	Felling	26
352	67	Kikar	Felling	15
353	68	Kikar	Felling	44
354	68	Kikar	Felling	15
355	68	Kikar	Felling	41
356	69	Kikar	Felling	26
357	70	Kikar	Felling	39
358	70	Kikar	Felling	40
359	71	Kikar	Felling	36
360	72	Kikar	Felling	27
361	73	Kikar	Felling	20
362	74	Kikar	Felling	44
363	74	Kikar	Felling	15
364	75	Kikar	Felling	42
365	75	Kikar	Felling	26
366	75	Kikar	Felling	27
367	75	Kikar	Felling	26
368	75	Kikar	Felling	15

991

369	76	Kikar	Felling	65
370	76	Kikar	Felling	70
371	76	Kikar	Felling	56
372	76	Kikar	Felling	24
373	78	Kikar	Felling	15
374	93	Kikar	Felling	21
375	93	Kikar	Felling	27
376	93	Kikar	Felling	25
377	93	Kikar	Felling	22
378	97	Kikar	Felling	18
379	97	Kikar	Felling	16
380	98	Kikar	Felling	68
381	98	Kikar	Felling	30
382	99	Kikar	Felling	32
383	100	Kikar	Felling	49
384	100	Kikar	Felling	40
385	100	Kikar	Felling	34
386	100	Kikar	Felling	15
387	101	Kikar	Felling	63
388	101	Kikar	Felling	55
389	101	Kikar	Felling	23
390	101	Kikar	Felling	24
391	102	Kikar	Felling	25
392	103	Kikar	Felling	25
393	104	Kikar	Felling	71
394	104	Kikar	Felling	59
395	105	Kikar	Felling	41
396	105	Kikar	Felling	30
397	112	Kikar	Felling	24
398	112	Kikar	Felling	20
399	112	Kikar	Felling	22
400	113	Kikar	Felling	56
401	113	Kikar	Felling	23
402	113	Kikar	Felling	17
403	114	Kikar	Felling	15
404	114	Kikar	Felling	22
405	114	Kikar	Felling	15

406	114	Kikar	Felling	15
407	115	Kikar	Felling	28
408	115	Kikar	Felling	16
409	115	Kikar	Felling	16
410	116	Kikar	Felling	18
411	117	Kikar	Felling	23
412	117	Kikar	Felling	17
413	117	Kikar	Felling	16
414	118	Kikar	Felling	28
415	118	Kikar	Felling	29
416	118	Kikar	Felling	21
417	118	Kikar	Felling	17
418	119	Kikar	Felling	15
419	120	Kikar	Felling	30
420	121	Kikar	Felling	19
421	122	Kikar	Felling	35
422	122	Kikar	Felling	22
423	122	Kikar	Felling	18
424	123	Kikar	Felling	18
425	123	Kikar	Felling	16
426	124	Kikar	Felling	18
427	125	Kikar	Felling	18
428	126	Kikar	Felling	42
429	126	Kikar	Felling	27
430	126	Kikar	Felling	33
431	126	Kikar	Felling	25
432	126	Kikar	Felling	18
433	127	Kikar	Felling	23
434	127	Kikar	Felling	24
435	127	Kikar	Felling	16
436	127	Kikar	Felling	15
437	128	Kikar	Felling	25
438	128	Kikar	Felling	19
439	129	Kikar	Felling	15
440	129	Kikar	Felling	17
441	130	Kikar	Felling	20
442	131	Kikar	Felling	70

443	131	Kikar	Felling	80
444	131	Kikar	Felling	47
445	132	Kikar	Felling	16
446	133	Kikar	Felling	55
447	135	Neem	Transplant	16
448	136	Kikar	Felling	20
449	136	Kikar	Felling	16
450	138	Shisham	Transplant	57
451	138	Shisham	Transplant	16
452	143	Kikar	Felling	41
453	143	Kikar	Felling	39
454	143	Kikar	Felling	29
455	144	Kikar	Felling	37
456	144	Kikar	Felling	30
457	144	Kikar	Felling	19
458	145	Shisham	Transplant	21
459	146	Kikar	Felling	38
460	146	Kikar	Felling	21
461	147	Kikar	Felling	56
462	147	Kikar	Felling	30
463	148	Kikar	Felling	28
464	148	Kikar	Felling	28
465	148	Kikar	Felling	20
466	149	Kikar	Felling	33
467	149	Kikar	Felling	33
468	149	Kikar	Felling	23
469	149	Kikar	Felling	17
470	149	Kikar	Felling	19
471	151	Kikar	Felling	21
472	151	Kikar	Felling	17
473	151	Kikar	Felling	20
474	151	Kikar	Felling	15
475	152	Kikar	Felling	60
476	153	Kikar	Felling	42
477	153	Kikar	Felling	37
478	153	Kikar	Felling	47
479	153	Kikar	Felling	23

480	153	Kikar	Felling	19
481	154	Kikar	Felling	52
482	154	Kikar	Felling	54
483	154	Kikar	Felling	46
484	154	Kikar	Felling	31
485	155	Kikar	Felling	33
486	155	Kikar	Felling	28
487	155	Kikar	Felling	20
488	155	Kikar	Felling	23
489	156	Kikar	Felling	27
490	156	Kikar	Felling	29
491	156	Kikar	Felling	20
492	156	Kikar	Felling	24
493	156	Kikar	Felling	21
494	156	Kikar	Felling	20
495	156	Kikar	Felling	16
496	156	Kikar	Felling	18
497	157	Kikar	Felling	22
498	158	Kikar	Felling	15
499	159	Kikar	Felling	36
500	159	Kikar	Felling	29
501	159	Kikar	Felling	17
502	160	Kikar	Felling	18
503	160	Kikar	Felling	22
504	160	Kikar	Felling	18
505	161	Kikar	Felling	46
506	162	Kikar	Felling	15
507	163	Kikar	Felling	57
508	163	Kikar	Felling	36
509	164	Kikar	Felling	47
510	164	Kikar	Felling	32
511	164	Kikar	Felling	22
512	164	Kikar	Felling	20
513	164	Kikar	Felling	15
514	164	Kikar	Felling	19
515	165	Kikar	Felling	15
516	166	Kikar	Felling	64

517	166	Kikar	Felling	32
518	166	Kikar	Felling	23
519	166	Kikar	Felling	37
520	167	Kikar	Felling	18
521	168	Kikar	Felling	15
522	169	Kikar	Felling	39
523	170	Kikar	Felling	18
524	172	Shisham	Transplant	54
525	173	Shisham	Transplant	52
526	174	Kikar	Felling	65
527	174	Kikar	Felling	63
528	174	Kikar	Felling	42
529	174	Kikar	Felling	24
530	174	Kikar	Felling	39
531	174	Kikar	Felling	43
532	174	Kikar	Felling	18
533	174	Kikar	Felling	33
534	174	Kikar	Felling	16
535	174	Kikar	Felling	25
536	175	Shisham	Transplant	30
537	176	Kikar	Felling	60
538	176	Kikar	Felling	31
539	176	Kikar	Felling	15
540	177	Kikar	Felling	62
541	177	Kikar	Felling	48
542	177	Kikar	Felling	50
543	177	Kikar	Felling	23
544	179	Kikar	Felling	66
545	179	Kikar	Felling	55
546	179	Kikar	Felling	38
547	179	Kikar	Felling	26
548	179	Kikar	Felling	50
549	179	Kikar	Felling	28
550	179	Kikar	Felling	49
551	179	Kikar	Felling	26
552	180	Kikar	Felling	87
553	180	Kikar	Felling	47

554	181	Kikar	Felling	50
555	183	Kikar	Felling	21
556	184	Kikar	Felling	25
557	184	Kikar	Felling	15
558	185	Neem	Transplant	34
559	186	Shisham	Transplant	35
560	187	Shisham	Transplant	20
561	188	Shisham	Transplant	24
562	189	Shisham	Transplant	27
563	190	Shisham	Transplant	25
564	190	Shisham	Transplant	20
565	191	Kikar	Felling	89
566	191	Kikar	Felling	80
567	191	Kikar	Felling	29
568	191	Kikar	Felling	33
569	192	Kikar	Felling	58
570	193	Kikar	Felling	22
571	194	Kikar	Felling	65
572	194	Kikar	Felling	35
573	194	Kikar	Felling	35
574	195	Kikar	Felling	54
575	195	Kikar	Felling	33
576	195	Kikar	Felling	22
577	196	Kikar	Felling	83
578	196	Kikar	Felling	64
579	196	Kikar	Felling	73
580	196	Kikar	Felling	24
581	197	Kikar	Felling	24
582	198	Kikar	Felling	42
583	198	Kikar	Felling	40
584	198	Kikar	Felling	23
585	198	Kikar	Felling	47
586	198	Kikar	Felling	51
587	198	Kikar	Felling	43
588	198	Kikar	Felling	16
589	199	Shisham	Transplant	34
590	200	Shisham	Transplant	34

591	201	Shisham	Transplant	15
592	202	Kikar	Felling	40
593	202	Kikar	Felling	29
594	203	Shisham	Transplant	43
595	205	Kikar	Felling	40
596	205	Kikar	Felling	20
597	207	Kikar	Felling	62
598	207	Kikar	Felling	61
599	207	Kikar	Felling	44
600	207	Kikar	Felling	70
601	207	Kikar	Felling	42
602	207	Kikar	Felling	40
603	210	Shisham	Transplant	27
604	210	Shisham	Transplant	17
605	211	Kikar	Felling	44
606	211	Kikar	Felling	46
607	211	Kikar	Felling	22
608	211	Kikar	Felling	18
609	211	Kikar	Felling	15
610	211	Kikar	Felling	17
611	211	Kikar	Felling	16
612	214	Kikar	Felling	50
613	214	Kikar	Felling	16
614	215	Kikar	Felling	20
615	216	Shisham	Transplant	17
616	216	Shisham	Transplant	16
617	217	Kikar	Felling	119
618	217	Kikar	Felling	49
619	217	Kikar	Felling	55
620	217	Kikar	Felling	39
621	218	Neem	Transplant	92
622	220	Shisham	Transplant	16
623	221	Shisham	Transplant	16
624	224	Kikar	Felling	95
625	224	Kikar	Felling	72
626	224	Kikar	Felling	29
627	224	Kikar	Felling	22

628	226	Shisham	Transplant	38
629	227	Shisham	Transplant	18
630	228	Shisham	Transplant	20
631	229	Kikar	Felling	65
632	229	Kikar	Felling	32
633	230	Kikar	Felling	34
634	230	Kikar	Felling	20
635	232	Kikar	Felling	25
636	233	Kikar	Felling	62
637	233	Kikar	Felling	55
638	233	Kikar	Felling	37
639	233	Kikar	Felling	24
640	233	Kikar	Felling	15
641	233	Kikar	Felling	18
642	233	Kikar	Felling	16
643	233	Kikar	Felling	20
644	233	Kikar	Felling	18
645	233	Kikar	Felling	24
646	233	Kikar	Felling	20
647	233	Kikar	Felling	25
648	233	Kikar	Felling	48
649	233	Kikar	Felling	15
650	233	Kikar	Felling	16
651	234	Shisham	Transplant	60
652	235	Kikar	Felling	76
653	237	Shisham	Transplant	15
654	237	Shisham	Transplant	15
655	240	Shisham	Transplant	33
656	241	Kikar	Felling	17
657	244	Kikar	Felling	25
658	245	Kikar	Felling	28
659	246	Shisham	Transplant	17
660	248	Shisham	Transplant	54
661	250	Shisham	Transplant	49
662	251	Shisham	Transplant	25
663	251	Shisham	Transplant	18
664	252	Kikar	Felling	74

665	252	Kikar	Felling	39
666	252	Kikar	Felling	36
667	252	Kikar	Felling	41
668	252	Kikar	Felling	39
669	253	Kikar	Felling	26
670	253	Kikar	Felling	25
671	253	Kikar	Felling	25
672	254	Kikar	Felling	52
673	254	Kikar	Felling	30
674	257	Kikar	Felling	38
675	258	Kikar	Felling	21
676	258	Kikar	Felling	17
677	261	Kikar	Felling	49
678	263	Kikar	Felling	32
679	264	Kikar	Felling	20
680	266	Kikar	Felling	15
681	267	Kikar	Felling	15
682	269	Shisham	Transplant	33
683	271	Kikar	Felling	80
684	271	Kikar	Felling	59
685	271	Kikar	Felling	16
686	272	Shisham	Transplant	74
687	273	Shisham	Transplant	72
688	274	Shisham	Transplant	73
689	274	Shisham	Transplant	64
690	276	Kikar	Felling	60
691	276	Kikar	Felling	63
692	276	Kikar	Felling	64
693	276	Kikar	Felling	33
694	277	Kikar	Felling	82
695	277	Kikar	Felling	57
696	277	Kikar	Felling	41
697	277	Kikar	Felling	46
698	277	Kikar	Felling	60
699	277	Kikar	Felling	32
700	277	Kikar	Felling	19
701	290	Kikar	Felling	56

702	290	Kikar	Felling	50
703	290	Kikar	Felling	34
704	290	Kikar	Felling	20
705	290	Kikar	Felling	26
706	290	Kikar	Felling	36
707	290	Kikar	Felling	16
708	290	Kikar	Felling	24
709	291	Kikar	Felling	62
710	291	Kikar	Felling	59
711	291	Kikar	Felling	32
712	291	Kikar	Felling	30
713	291	Kikar	Felling	42
714	291	Kikar	Felling	25
715	291	Kikar	Felling	55
716	291	Kikar	Felling	48
717	291	Kikar	Felling	15
718	291	Kikar	Felling	21
719	292	Kikar	Felling	44
720	292	Kikar	Felling	42
721	292	Kikar	Felling	34
722	292	Kikar	Felling	15
723	293	Kikar	Felling	67
724	293	Kikar	Felling	76
725	294	Kikar	Felling	60
726	295	Kikar	Felling	49
727	295	Kikar	Felling	42
728	295	Kikar	Felling	42
729	295	Kikar	Felling	43
730	295	Kikar	Felling	24
731	296	Kikar	Felling	52
732	296	Kikar	Felling	38
733	296	Kikar	Felling	37
734	296	Kikar	Felling	36
735	296	Kikar	Felling	22
736	297	Shisham	Transplant	15
737	298	Kikar	Felling	35
738	298	Kikar	Felling	36

1000

739	298	Kikar	Felling	16
740	298	Kikar	Felling	17
741	299	Kikar	Felling	73
742	299	Kikar	Felling	57
743	299	Kikar	Felling	25
744	299	Kikar	Felling	21
745	299	Kikar	Felling	15
746	299	Kikar	Felling	19
747	299	Kikar	Felling	51
748	301	Kikar	Felling	75
749	301	Kikar	Felling	60
750	302	Kikar	Felling	50
751	302	Kikar	Felling	50
752	302	Kikar	Felling	40
753	302	Kikar	Felling	18
754	303	Kikar	Felling	35
755	304	Shisham	Transplant	18
756	305	Kikar	Felling	54
757	305	Kikar	Felling	26
758	305	Kikar	Felling	18
759	306	Kikar	Felling	28
760	306	Kikar	Felling	18
761	306	Kikar	Felling	19
762	306	Kikar	Felling	35
763	306	Kikar	Felling	20
764	307	Kikar	Felling	27
765	307	Kikar	Felling	23
766	307	Kikar	Felling	20
767	307	Kikar	Felling	29
768	308	Kikar	Felling	26
769	309	Kikar	Felling	30
770	309	Kikar	Felling	20
771	312	Shisham	Transplant	40
772	312	Shisham	Transplant	20
773	313	Shisham	Transplant	27
774	314	Shisham	Transplant	15
775	315	Shisham	Transplant	16

776	316	Shisham	Transplant	50
777	318	Kikar	Felling	40
778	318	Kikar	Felling	40
779	319	Kikar	Felling	43
780	319	Kikar	Felling	18
781	320	Kikar	Felling	65
782	320	Kikar	Felling	63
783	320	Kikar	Felling	40
784	320	Kikar	Felling	18
785	320	Kikar	Felling	17
786	321	Neem	Transplant	43
787	322	Kikar	Felling	46
788	322	Kikar	Felling	25
789	322	Kikar	Felling	18
790	323	Kikar	Felling	52
791	323	Kikar	Felling	40
792	324	Shisham	Transplant	18
793	325	Shisham	Transplant	19
794	326	Shisham	Transplant	24
795	326	Shisham	Transplant	20
796	327	Kikar	Felling	83
797	327	Kikar	Felling	68
798	327	Kikar	Felling	65
799	327	Kikar	Felling	55
800	327	Kikar	Felling	57
801	327	Kikar	Felling	15
802	328	Shisham	Transplant	26
803	329	Shisham	Transplant	60
804	330	Kikar	Felling	63
805	330	Kikar	Felling	35
806	330	Kikar	Felling	18
807	331	Kikar	Felling	18
808	332	Kikar	Felling	89
809	332	Kikar	Felling	22
810	332	Kikar	Felling	20
811	333	Kikar	Felling	53
812	334	Kikar	Felling	63

813	334	Kikar	Felling	63
814	334	Kikar	Felling	28
815	334	Kikar	Felling	50
816	334	Kikar	Felling	30
817	334	Kikar	Felling	20
818	335	Kikar	Felling	27
819	336	Kikar	Felling	40
820	338	Kikar	Felling	23
821	338	Kikar	Felling	19
822	338	Kikar	Felling	16
823	338	Kikar	Felling	18
824	338	Kikar	Felling	18
825	339	Neem	Transplant	32
826	339	Neem	Transplant	21
827	340	Kikar	Felling	27
828	340	Kikar	Felling	16
829	341	Kikar	Felling	68
830	341	Kikar	Felling	45
831	342	Kikar	Felling	27
832	343	Kikar	Felling	18
833	344	Kikar	Felling	20
834	344	Kikar	Felling	16
835	346	Kikar	Felling	70
836	346	Kikar	Felling	58
837	349	Kikar	Felling	16
838	350	Kikar	Felling	55
839	350	Kikar	Felling	16
840	354	Kikar	Felling	34
841	354	Kikar	Felling	22
842	355	Kikar	Felling	34
843	357	Kikar	Felling	54
844	357	Kikar	Felling	48
845	358	Kikar	Felling	41
846	359	Kikar	Felling	30
847	360	Kikar	Felling	48
848	361	Kikar	Felling	28
849	361	Kikar	Felling	16

850	365	Neem	Transplant	87
851	369	Neem	Transplant	92
852	370	Kikar	Felling	21
853	370	Kikar	Felling	20
854	370	Kikar	Felling	17
855	371	Neem	Transplant	95
856	373	Kikar	Felling	34
857	373	Kikar	Felling	25
858	373	Kikar	Felling	20
859	377	Kikar	Felling	33
860	377	Kikar	Felling	26
861	377	Kikar	Felling	18
862	377	Kikar	Felling	22
863	377	Kikar	Felling	20
864	377	Kikar	Felling	22
865	378	Kikar	Felling	43
866	379	Kikar	Felling	56
867	379	Kikar	Felling	30
868	379	Kikar	Felling	20
869	379	Kikar	Felling	36
870	379	Kikar	Felling	36
871	379	Kikar	Felling	23
872	381	Shisham	Transplant	18
873	382	Shisham	Transplant	15
874	383	Shisham	Transplant	38
875	384	Shisham	Transplant	38
876	385	Shisham	Transplant	26
877	387	Shisham	Transplant	66
878	387	Shisham	Transplant	56
879	388	Kikar	Felling	79
880	389	Kikar	Felling	23
881	390	Kikar	Felling	42
882	390	Kikar	Felling	22
883	391	Kikar	Felling	29
884	392	Kikar	Felling	56
885	393	Kikar	Felling	38
886	394	Kikar	Felling	45

887	394	Kikar	Felling	22
888	395	Kikar	Felling	27
889	396	Kikar	Felling	29
890	396	Kikar	Felling	28
891	396	Kikar	Felling	26
892	398	Kikar	Felling	68
893	398	Kikar	Felling	43
894	399	Kikar	Felling	70
895	400	Kikar	Felling	58
896	400	Kikar	Felling	35
897	400	Kikar	Felling	27
898	401	Kikar	Felling	40
899	402	Kikar	Felling	80
900	403	Kikar	Felling	49
901	403	Kikar	Felling	26
902	403	Kikar	Felling	22
903	404	Kikar	Felling	49
904	404	Kikar	Felling	59
905	405	Kikar	Felling	82
906	406	Kikar	Felling	60
907	407	Kikar	Felling	64
908	408	Shahtoot	Transplant	36
909	408	Shahtoot	Transplant	36
910	409	Shisham	Transplant	60
911	410	Kikar	Felling	38
912	410	Kikar	Felling	38
913	410	Kikar	Felling	20
914	413	Kikar	Felling	20
915	413	Kikar	Felling	17
916	414	Shisham	Transplant	15
917	415	Kikar	Felling	107
918	415	Kikar	Felling	80
919	417	Kikar	Felling	71
920	417	Kikar	Felling	50
921	418	Kikar	Felling	60
922	419	Kikar	Felling	61
923	420	Shisham	Transplant	63

1006

924	420	Shisham	Transplant	31
925	420	Shisham	Transplant	15
926	421	Shisham	Transplant	94
927	421	Shisham	Transplant	34
928	421	Shisham	Transplant	24
929	422	Kikar	Felling	25
930	422	Kikar	Felling	15
931	422	Kikar	Felling	16
932	423	Shahtoot	Transplant	102
933	425	Kikar	Felling	19
934	425	Kikar	Felling	15
935	428	Kikar	Felling	34
936	428	Kikar	Felling	35
937	428	Kikar	Felling	33
938	432	Kikar	Felling	25
939	432	Kikar	Felling	21
940	432	Kikar	Felling	15
941	433	Kikar	Felling	28
942	433	Kikar	Felling	28
943	433	Kikar	Felling	34
944	433	Kikar	Felling	24
945	433	Kikar	Felling	24
946	434	Neem	Transplant	55
947	435	Kikar	Felling	40
948	435	Kikar	Felling	28
949	435	Kikar	Felling	27
950	435	Kikar	Felling	31
951	435	Kikar	Felling	26
952	435	Kikar	Felling	31
953	435	Kikar	Felling	47
954	435	Kikar	Felling	34
955	435	Kikar	Felling	27
956	437	Kikar	Felling	60
957	437	Kikar	Felling	34
958	438	Kikar	Felling	25
959	438	Kikar	Felling	15
960	439	Kikar	Felling	40

1007

961	439	Kikar	Felling	30
962	439	Kikar	Felling	47
963	441	Kikar	Felling	22
964	444	Shisham	Transplant	110
965	444	Shisham	Transplant	54
966	444	Shisham	Transplant	66
967	445	Kikar	Felling	61
968	446	Subabul	Felling	20
969	447	Subabul	Felling	18
970	448	Kikar	Felling	29
971	452	Kikar	Felling	50
972	452	Kikar	Felling	47
973	452	Kikar	Felling	48
974	452	Kikar	Felling	49
975	452	Kikar	Felling	22
976	453	Subabul	Felling	24
977	454	Subabul	Felling	50
978	456	Neem	Transplant	25
979	458	Kikar	Felling	56
980	458	Kikar	Felling	30
981	458	Kikar	Felling	36
982	459	Shisham	Transplant	44
983	460	Kikar	Felling	46
984	461	Subabul	Felling	46
985	462	Kikar	Felling	96
986	463	Shisham	Transplant	96
987	464	Shisham	Transplant	44
988	465	Shisham	Transplant	31
989	466	Shisham	Transplant	28
990	467	Shisham	Transplant	56
991	468	Shisham	Transplant	16
992	469	Shisham	Transplant	39
993	470	Kikar	Felling	36
994	471	Kikar	Felling	61
995	471	Kikar	Felling	38
996	471	Kikar	Felling	37
997	472	Goolar	Transplant	31

998	472	Goolar	Transplant	18
999	473	Kikar	Felling	38
1000	474	Kikar	Felling	36
1001	474	Kikar	Felling	32
1002	474	Kikar	Felling	25
1003	475	Kikar	Felling	35
1004	477	Shisham	Transplant	16
1005	479	Kikar	Felling	60
1006	479	Kikar	Felling	42
1007	479	Kikar	Felling	40
1008	479	Kikar	Felling	23
1009	480	Kikar	Felling	46
1010	481	Kikar	Felling	68
1011	482	Shisham	Transplant	72
1012	483	Shisham	Transplant	27
1013	484	Shisham	Transplant	19
1014	486	Kikar	Felling	55
1015	486	Kikar	Felling	22
1016	486	Kikar	Felling	22
1017	486	Kikar	Felling	18
1018	486	Kikar	Felling	22
1019	486	Kikar	Felling	21
1020	486	Kikar	Felling	20
1021	486	Kikar	Felling	23
1022	486	Kikar	Felling	25
1023	486	Kikar	Felling	45
1024	486	Kikar	Felling	30
1025	486	Kikar	Felling	24
1026	489	Shisham	Transplant	83
1027	489	Shisham	Transplant	56
1028	490	Kikar	Felling	26
1029	491	Kikar	Felling	18
1030	492	Kikar	Felling	54
1031	494	Kikar	Felling	57
1032	495	Kikar	Felling	65
1033	496	Kikar	Felling	55
1034	497	Kikar	Felling	56

1008

1009

1035	498	Kikar	Felling	55
1036	499	Kikar	Felling	32
1037	500	Kikar	Felling	61
1038	501	Kikar	Felling	58
1039	502	Kikar	Felling	64
1040	503	Kikar	Felling	51
1041	504	Kikar	Felling	35
1042	505	Kikar	Felling	24
1043	506	Kikar	Felling	34
1044	507	Kikar	Felling	28
1045	508	Kikar	Felling	30
1046	509	Kikar	Felling	16
1047	510	Kikar	Felling	53
1048	510	Kikar	Felling	40
1049	511	Kikar	Felling	43
1050	513	Kikar	Felling	42
1051	514	Kikar	Felling	43
1052	515	Kikar	Felling	25
1053	516	Kikar	Felling	38
1054	517	Kikar	Felling	94
1055	518	Shisham	Transplant	48
1056	519	Kikar	Felling	17
1057	520	Kikar	Felling	30
1058	521	Kikar	Felling	22
1059	521	Kikar	Felling	23
1060	522	Kikar	Felling	21
1061	523	Kikar	Felling	21
1062	524	Kikar	Felling	17
1063	525	Kikar	Felling	28
1064	526	Kikar	Felling	17
1065	527	Kikar	Felling	19
1066	529	Kikar	Felling	90
1067	529	Kikar	Felling	78
1068	529	Kikar	Felling	63
1069	530	Kikar	Felling	25
1070	530	Kikar	Felling	22
1071	530	Kikar	Felling	23

1072	530	Kikar	Felling	23
1073	530	Kikar	Felling	22
1074	533	Shisham	Transplant	31
1075	534	Kikar	Felling	55
1076	534	Kikar	Felling	42
1077	534	Kikar	Felling	37
1078	534	Kikar	Felling	25
1079	535	Kikar	Felling	26
1080	536	Kikar	Felling	68
1081	536	Kikar	Felling	60
1082	536	Kikar	Felling	43
1083	536	Kikar	Felling	22
1084	537	Shisham	Transplant	99
1085	538	Shisham	Transplant	53
1086	540	Shisham	Transplant	61
1087	540	Shisham	Transplant	49
1088	540	Shisham	Transplant	35
1089	541	Kikar	Felling	19
1090	541	Kikar	Felling	16
1091	542	Kikar	Felling	25
1092	543	Kikar	Felling	57
1093	543	Kikar	Felling	20
1094	543	Kikar	Felling	18
1095	544	Neem	Transplant	29
1096	545	Shisham	Transplant	61
1097	546	Kikar	Felling	63
1098	547	Neem	Transplant	84
1099	548	Neem	Transplant	62
1100	549	Neem	Transplant	68
1101	549	Neem	Transplant	70
1102	550	Neem	Transplant	76
1103	551	Shisham	Transplant	47
1104	552	Kikar	Felling	68
1105	552	Kikar	Felling	54
1106	552	Kikar	Felling	36
1107	553	Shisham	Transplant	80
1108	553	Shisham	Transplant	41

1010

1011

1109	554	Kikar	Felling	30
1110	555	Shahtoot	Transplant	32
1111	556	Neem	Transplant	51
1112	556	Neem	Transplant	49
1113	557	Kikar	Felling	68
1114	557	Kikar	Felling	53
1115	557	Kikar	Felling	67
1116	558	Kikar	Felling	22
1117	560	Shisham	Transplant	52
1118	560	Shisham	Transplant	30
1119	561	Kikar	Felling	49
1120	561	Kikar	Felling	49
1121	562	Kikar	Felling	65
1122	562	Kikar	Felling	41
1123	563	Kikar	Felling	70
1124	563	Kikar	Felling	37
1125	564	Kikar	Felling	51
1126	565	Kikar	Felling	100
1127	566	Kikar	Felling	75
1128	567	Shisham	Transplant	77
1129	568	Kikar	Felling	36
1130	568	Kikar	Felling	37
1131	569	Shisham	Transplant	79
1132	569	Shisham	Transplant	43
1133	569	Shisham	Transplant	45
1134	570	Kikar	Felling	21
1135	570	Kikar	Felling	21
1136	571	Kikar	Felling	68
1137	571	Kikar	Felling	36
1138	571	Kikar	Felling	15
1139	571	Kikar	Felling	16
1140	571	Kikar	Felling	17
1141	571	Kikar	Felling	16
1142	572	Kikar	Felling	23
1143	572	Kikar	Felling	20
1144	573	Kikar	Felling	65
1145	573	Kikar	Felling	38

1146	573	Kikar	Felling	26
1147	573	Kikar	Felling	19
1148	573	Kikar	Felling	15
1149	574	Kikar	Felling	30
1150	575	Shisham	Transplant	45
1151	576	Shisham	Transplant	20
1152	577	Shisham	Transplant	16
1153	578	Kikar	Felling	62
1154	578	Kikar	Felling	55
1155	578	Kikar	Felling	32
1156	578	Kikar	Felling	75
1157	578	Kikar	Felling	30
1158	578	Kikar	Felling	31
1159	578	Kikar	Felling	33
1160	578	Kikar	Felling	27
1161	578	Kikar	Felling	31
1162	579	Shisham	Transplant	18
1163	580	Shisham	Transplant	25
1164	582	Kikar	Felling	52
1165	582	Kikar	Felling	52
1166	589	Kikar	Felling	64
1167	589	Kikar	Felling	21
1168	589	Kikar	Felling	20
1169	590	Shisham	Transplant	24
1170	590	Shisham	Transplant	23
1171	591	Shisham	Transplant	41
1172	591	Shisham	Transplant	31
1173	591	Shisham	Transplant	23
1174	592	Shisham	Transplant	36
1175	592	Shisham	Transplant	17
1176	592	Shisham	Transplant	32
1177	593	Shisham	Transplant	30
1178	593	Shisham	Transplant	24
1179	593	Shisham	Transplant	18
1180	594	Shisham	Transplant	22
1181	595	Shisham	Transplant	19
1182	595	Shisham	Transplant	17

1012

1013

1183	595	Shisham	Transplant	15
1184	595	Shisham	Transplant	15
1185	596	Kikar	Felling	20
1186	597	Kikar	Felling	25
1187	598	Kikar	Felling	21
1188	598	Kikar	Felling	20
1189	598	Kikar	Felling	21
1190	599	Kikar	Felling	29
1191	599	Kikar	Felling	23
1192	600	Shisham	Transplant	25
1193	601	Kikar	Felling	26
1194	601	Kikar	Felling	21
1195	602	Kikar	Felling	22
1196	602	Kikar	Felling	16
1197	603	Kikar	Felling	26
1198	603	Kikar	Felling	25
1199	603	Kikar	Felling	22
1200	603	Kikar	Felling	15
1201	603	Kikar	Felling	24
1202	603	Kikar	Felling	27
1203	605	Kikar	Felling	46
1204	605	Kikar	Felling	41
1205	605	Kikar	Felling	41
1206	605	Kikar	Felling	21
1207	607	Neem	Transplant	40
1208	607	Neem	Transplant	25
1209	608	Neem	Transplant	18
1210	609	Kikar	Felling	46
1211	609	Kikar	Felling	22
1212	610	Shisham	Transplant	22
1213	613	Shisham	Transplant	20
1214	614	Shisham	Transplant	16
1215	615	Shisham	Transplant	30
1216	616	Shisham	Transplant	34
1217	617	Neem	Transplant	83
1218	618	Shisham	Transplant	69
1219	619	Mango	Transplant	30

1220	619	Mango	Transplant	15
1221	619	Mango	Transplant	15
1222	620	Shisham	Transplant	29
1223	621	Shisham	Transplant	18
1224	622	Shisham	Transplant	29
1225	624	Shisham	Transplant	21
1226	625	Shisham	Transplant	17
1227	627	Shisham	Transplant	170
1228	628	Shisham	Transplant	74
1229	630	Kikar	Felling	74
1230	630	Kikar	Felling	59
1231	630	Kikar	Felling	37
1232	631	Shisham	Transplant	22
1233	632	Shisham	Transplant	48
1234	634	Shisham	Transplant	43
1235	635	Shisham	Transplant	45
1236	639	Neem	Transplant	22
1237	641	Kikar	Felling	57
1238	641	Kikar	Felling	32
1239	641	Kikar	Felling	20
1240	641	Kikar	Felling	18
1241	642	Shisham	Transplant	21
1242	643	Kikar	Felling	50
1243	643	Kikar	Felling	39
1244	643	Kikar	Felling	48
1245	643	Kikar	Felling	19
1246	643	Kikar	Felling	21
1247	643	Kikar	Felling	20
1248	643	Kikar	Felling	15
1249	643	Kikar	Felling	21
1250	645	Kikar	Felling	22
1251	646	Kikar	Felling	90
1252	646	Kikar	Felling	45
1253	647	Shisham	Transplant	94
1254	647	Shisham	Transplant	25
1255	1	Ber	Transplant	39
1256	1A	Ber	Transplant	29

1015

1257	1B	Ber	Transplant	20
1258	1C	Ber	Transplant	30
1259	1D	Ber	Transplant	27
1260	8	Ber	Transplant	18
1261	9	Subabul	Felling	77
1262	12	Subabul	Transplant	60
1263	14	Ber	Transplant	15
1264	134	Ber	Transplant	29
1265	134A	Ber	Transplant	22
1266	137	Ber	Transplant	34
1267	137A	Ber	Transplant	22
1268	137B	Ber	Transplant	23
1269	171	Ber	Transplant	16
1270	219	Ber	Transplant	17
1271	236	Babool	Transplant	55
1272	310	Babool	Transplant	68
1273	317	Ber	Transplant	22
1274	426	Ber	Transplant	22
1275	457	Lasora	Transplant	40
1276	457A	Lasora	Transplant	30
1277	457B	Lasora	Transplant	18
1278	485	Ber	Transplant	45
1279	487	Subabul	Felling	30
1280	488	Subabul	Felling	35
1281	559	Ber	Transplant	26
1282	559A	Ber	Transplant	20
1283	559B	Ber	Transplant	19
1284	611	Peepal	Transplant	60
1285	611A	Peepal	Transplant	33
1286	611B	Peepal	Transplant	23
1287	611C	Peepal	Transplant	17
1288	611D	Peepal	Transplant	19
1289	611E	Peepal	Transplant	19
1290	611F	Peepal	Transplant	21
1291	611G	Peepal	Transplant	20
1292	636	Ber	Transplant	59
1293	637	Khair	Transplant	28

Information of Project Area

Details of Project Area :-	69,531.00									
	S.No.	**Area(in Sq.mtrs)**	**District Name**	**Tehsil Name**	**Address**	**Name and addresses of the occupants of adjoining property**	**Khasra number**	**Kml File**	**Action**	
	1	69531.000	South West	Dwarka	Bijwasan, Dwarka Sector-21, New Delhi 110077	Redevlopment work of Bijwasan Railway Station	NA	DPTA AREA.kml	Reject	Download (/downloadsite_IPA_KMLFile.aspx?PI_id=27847&Digest=lHJ8n+fr7QyaSudfdQE4tg)

Area Proposed for Transplantation of trees

Transplantation Information With Total Area(Hectare):-	9,806.00					
	S.No.	**Area(in Sq.mtrs)**	**District**	**Address**	**Kml File**	**Accept/Reject**
	1	9806.000	South West	Bijwasan, Dwarka Sector-21, New Delhi 110077	TP LAND.kml (/downloadsite_PI_KMLFile.aspx?PI_id=5468&Digest=C+MgbB0zAb7i0fn2CUtrDQ)	Accept

Plantation Information (Compensatory)

(Details of the site provided by you for 100% Compensatory Plantation in lieu of removal of trees where trees are intended to be planted after felling.)			
Details of Area Proposed for Transplantation	Total No Area-: 1,16,370.00		No. of Trees intended to be planted after felling -: 12930

S.No.	Area (in Sq.mtrs)	District	Address	Kml File 1017	Accept/Reject	
1	1,16,370.00	North	Narela Station to Badli Station	CP.kml (downloadsite_Pinfo_KMLFile.aspx?PI_id=7192&Digest=o7VF66ezQ5S5+EQ0n4GY/w)	Accept	Compliance Report

657

Miscellaneous Information

Purpose for which the felling of the trees are intended	Construction of infrastructure like Road, Highways, metro etc	Intended use of felled trees (e.g) for sale for or domestic use	:- AS PER FOREST POLICY
Intended use of land after felling of trees			

ARTICLE IN PRESS
Regional Science and Urban Economics xxx (xxxx) xxx

Contents lists available at ScienceDirect

Regional Science and Urban Economics

journal homepage: www.elsevier.com/locate/regec

Measuring the air pollution benefits of public transport projects☆

Maureen Cropper [a], Palak Suri [b,*]

[a] University of Maryland, Resources for the Future, United States of America
[b] West Virginia University, United States of America

ARTICLE INFO

Keywords:
Air quality benefits
Public transit
Developing world cities
Metro rail
Subways
Environmental impacts of public transit

ABSTRACT

We discuss two approaches to estimating the air quality impacts of public transit projects, focusing on Metro projects in the context of developing countries: air quality modeling and reduced-form econometric methods. As we illustrate, pollution reductions due to Metro projects implied by pollutant chemistry, vehicle emissions factors, and modal shifts may differ from econometric estimates of the impact of transit projects on ambient pollution concentrations. We discuss both approaches and illustrate how economics researchers can use estimated emissions reductions associated with a transit project and pollutant chemistry as a check on their estimates of changes in ambient concentrations.

1. Introduction

Throughout the world, road transport is an important source of local and global air pollution. Vehicle exhaust produces carbon monoxide (CO), volatile organic compounds (VOCs), oxides of nitrogen (NO_x), sulfur dioxide (SO_2) and particulate matter (PM). These pollutants have health effects in their primary form (i.e., when emitted directly) and when they combine to form secondary pollutants—both particulate matter (e.g., ammonium nitrate and ammonium sulfate) and ozone (WHO, 2013; HEI, 2010). In 2018, the transport sector accounted for 25% of global CO_2 emissions from fuel combustion (IEA, 2019). A substantial portion of the CO_2 transport emissions is attributable to road transportation: 72% for the EU, 81% for the US and 90% for India.[1]

When public transport projects are planned, reductions in air pollution are often cited as benefits of the project, in addition to time savings and reduced congestion. The magnitude of pollution reduction depends on the size of modal shifts from private to public transport, the difference in emissions per passenger kilometer traveled between private and public transport and the number of kilometers traveled. This determines the reduction in emissions due to a project. In the case of CO_2, the reduction in emissions is what matters: the impact on climate of CO_2 is independent of where it is emitted. In the case of local air pollution, the impact of a change in emissions on ambient air quality depends on where the change occurs, and it is the change in ambient air quality that affects human health and welfare.

In this paper we focus on the impact of public transit projects on ambient air quality. The rapidly expanding economics literature on this topic uses reduced-form econometric methods to estimate the impact of projects on ambient CO, NO_x, PM and ozone. One group of studies examines how air quality changes when a public transit strike occurs. Other studies look at how air quality changes after a Metro system is introduced or expanded. These studies are often executed using a regression discontinuity (RD) in time or a difference-in-differences approach. Both sets of studies are capable of providing causal estimates of the impact of public transit on ambient air quality; however, they are ex post studies and measure impacts of inherently different policies. Reduced-form studies face the challenge of controlling for other factors that may affect ambient air quality, such as emissions from other sources and changes in meteorology that also vary over time.

Another approach to estimating the impact of transit projects on ambient air quality is to calculate emission changes at a fine geographic scale and use atmospheric chemistry to calculate their impacts on ambient air quality. Translating emissions reductions into impacts on ambient air quality requires dispersion models that track the transport of pollutants through the atmosphere using information on weather,

☆ This paper has greatly benefited from discussions with Joshua Apte, Sarath Guttikunda, and Russell Dickerson.
* Corresponding author.
E-mail addresses: mcropper@umd.edu (M. Cropper), palak.suri@mail.wvu.edu (P. Suri).

[1] In the EU in 2019, 28.5% of CO_2 emissions came from transport and 20% of CO_2 emissions came from road transport (European Parliament, 2022). In the US in 2021, 29% of greenhouse gas (GHG) emissions came from transport; 81% of transport emissions came from road transport (EPA, 2023). In India in 2020, transportation was the third largest emitter of GHGs; 90% of transport emissions were from road transport (Singh et al., 2022).

https://doi.org/10.1016/j.regsciurbeco.2023.103976
Received 21 July 2023; Received in revised form 21 December 2023; Accepted 27 December 2023
Available online 30 December 2023
0166-0462/© 2024 Elsevier B.V. All rights reserved.

topography, and pollutant chemistry.[2] The advantage of these models, which have been used to model the impact of road transport emissions on fine particle formation, is that they can hold constant factors that are difficult to control in reduced-form econometric models, such as weather and pollution emissions from other sources. They can also be used to estimate the air pollution impacts of a transit projects ex ante. Atmospheric chemistry models are validated by comparing model predictions to measurements of air quality at ground-level monitors.

In this paper we discuss the strengths, limitations and complementarities of two approaches used to measure the local air pollution benefits of public transit: reduced-form econometric models and air-quality modeling. We begin in Section 2 by discussing the atmospheric chemistry of ambient air quality associated with local air pollutants: CO, NO_x, PM and ozone. This has important implications for the selection of data and monitoring sites in econometric studies, and the geographic scale at which air quality modeling is conducted. Atmospheric chemistry can also be used to provide an order of magnitude estimate of the reduction in air pollution from a transit project by examining the percentage reduction in emissions it delivers in a particular location. This can provide a check on the plausibility of econometric results and is particularly relevant given the sensitivity of econometric estimates to model specification.

In Section 3 we review the results of econometric studies of the air quality benefits of transport projects, discussing the methods used and the sensitivity of results to modeling assumptions. We concentrate on the literature in developing countries, focusing on China, India and Taiwan, and studies that examine the air quality benefits of Metro rail. We illustrate the emissions inventory/air quality modeling approach in Section 4, using the Delhi Metro as an example. Section 5 concludes.

2. How public transit can reduce emissions

If a public transit project produces fewer emissions per passenger kilometer traveled than existing transport modes, modal shifts can reduce pollution emissions.[3] In the case of Metro rail, the emissions reductions generated when Metro riders shift from private vehicles to Metro usually occur along roads that parallel the Metro lines, for example, in the downtown or central business district of a city. It is there that empirical studies should focus to estimate reductions in ambient air pollution caused by the transit project. The electricity used to run the trains and provide auxiliary power is usually generated in other areas, where fewer people are exposed to emissions. In most studies, the impact of these emissions is not measured.

What pollutants are reduced when passengers shift to Metro? Primary pollutants emitted by petrol and diesel powered vehicles are CO, VOCs, NO_x, PM and SO_2. Secondary pollutants include ammonium nitrate and ammonium sulfate, which form when NO_x and SO_2 combine with ammonia, respectively, and ozone, which is formed when NO_x and VOCs combine in the presence of sunlight.

The impacts of emissions reductions on ambient air quality depend on where emissions reductions occur. Since most emissions reductions associated with a Metro will occur along roads that are alternatives to riding the Metro, peak reductions in ambient concentrations of primary pollutants will occur along these roads. To understand the magnitude of air quality improvements across space, it is important to understand how fast ambient pollution concentrations from road transport decline with distance from a road. Research has shown that ambient concentrations of nonreactive pollutants (e.g., directly emitted PM and CO) decay rapidly 100–400 m from a major road: concentrations fall to < 20% of peak concentrations in this range (Zhou and Levy, 2007). NO converts rapidly to NO_2, which declines to < 20% of peak concentrations within 200–500 m from the emissions source. So, the biggest reductions in ambient pollution from CO, NO_2 and directly emitted PM are likely to occur close to roads. This implies that, depending on their location, ground-level monitors may not capture all of the reductions in ambient air pollution due to a transport project.[4]

As noted above, road transport also creates secondary pollutants. Fine particles ($PM_{2.5}$) and ozone are especially important because of their impacts on human health (WHO, 2013; HEI, 2010). Fine particles ($PM_{2.5}$) and ozone travel much longer distances, hence focusing on monitors near traffic intersections may not capture all of the impact of a transport project on secondary PM and ozone. These effects can be captured through air quality modeling.

What magnitude of reductions in ambient air pollution is a transport project likely to cause? For primary pollutants, a rough rule is that the percentage reduction in emissions in a given area results in an equivalent percentage reduction in ambient concentrations (Small and Kazimi, 1995; Nagpure and Gurjar, 2012). To estimate the air quality reductions from transport projects, econometric studies often measure the change in primary pollutant concentrations (e.g., CO, NO_2 and PM_{10}) at ground level monitors. Note that ambient concentrations of primary pollutants at a monitor will reflect mainly emissions within a radius of approx. 2–4 km of the monitor, based on the decay rates cited above. If passenger transport constitutes 40% of CO emissions within this area, and if 10% of CO emissions from passenger transport in the area are reduced by a Metro project, ambient CO should fall by 4%. The important question for evaluating the air quality impact of a Metro project is what percent of pollutant emissions in a given location come from passenger transport and what percent of these emissions is reduced by modal shifts. This can be used as a reality check on the magnitude of results found in econometric studies.

3. Econometric studies estimating the impact of transport projects on air pollution

There have been many studies in the economics literature attempting to estimate the air pollution consequences of transport policies, including expansions of Bus Rapid Transit (BRT), Metro rail, light rail and intercity rail projects, strikes affecting transportation services, and various driving restrictions. While these are all based on similar approaches and have the common aim of understanding the environmental impacts of public transit, we focus on studies conducted to measure the air quality effects of Metro rail projects. We also focus on developing countries since many developing countries have Metro projects underway. These studies are summarized in Table 1. Other studies analyzing the importance of public transit are in Appendix Table A.1.

Empirical papers studying the influence of Metro transit projects on air quality often rely on event study approaches, such as regression discontinuity (RD) in time or difference-in-differences (DiD). The RD in time approach allows researchers to estimate the change in the level of a pollutant potentially caused by the introduction of a project. The implicit assumption is that in the absence of the project, pollution levels would have changed smoothly, without any discontinuous jumps.

This approach has been used to study the air quality impacts of Metro systems by Chen and Whalley (2012) in Taipei, by Goel and

[2] Dispersion models may be either process-based or reduced form (NRC, 2010). Process-based models (e.g., CAMx, CMAQ) use detailed atmospheric chemistry to simulate interactions among pollutants and gases in the atmosphere and thus account for nonlinearity in the dispersion process. Reduced-form models (e.g., ATMoS, CALPUFF, HYSPLIT) use simplified dispersion calculations to predict concentration changes.

[3] This is definitely true if kilometers traveled remain constant, but may not hold if there is a rebound effect—i.e. if passengers travel farther on public transit.

[4] Reductions in road transport emissions will, nevertheless, have significant human health benefits given the number of people directly exposed to them (see Brunekreef et al., 2009; HEI, 2010; WHO, 2013).

Table 1
Published studies examining the effects of subways or commuter rail on air pollution using econometric methods (Economics or Transportation Journals).

Study	Context	Empirical approach	Pollutants examined	Results
Chen and Whalley (2012)	Introduction of the first Metro line in Taipei in 1996	Main: RD in time for 1 year before and after the policy; Robustness: DiD comparing two cities	CO, O_3, NO_x, PM_{10}, SO_2	5%–15% reduction in CO, a statistically insignificant reduction of 8% in NO_x, an unclear effect on O_3, no effects on PM_{10} and SO_2
Goel and Gupta (2017)	Two early extensions to the Delhi Metro in 2005 and 2006	RD in time for about 18 months before and after the policy	NO_2, CO, and $PM_{2.5}$	34% decline in CO measured at the ITO monitoring station; weak or no effects on other pollutants
Gendron-Carrier et al. (2022)	Subway openings in 58 cities from 2001–16, mostly in developing countries	RD in time, 18 month before and 18 months after	AOD data measured monthly at 3 × 3 km resolution	No average effects of subway openings within a radius of 10 km around the city center, but a 4% average reduction in cities with above-median baseline levels of AOD
Li et al. (2019)	Beijing Metro expansion	Main: Historical routes as an instrumental variable for subway density; Robustness: spatial DiD comparing monitors within 2 km of a subway station with locations farther than 20 km away	Daily AQI based on SO_2, NO_2, PM_{10} for a part of the period and one based on CO, SO_2, NO_2, PM_{10}, $PM_{2.5}$, O_3 for the remainder	Reduction in pollution ranging from 0.02% from the opening of Line 16 (20 km length) to 0.24% from the opening of Line 6 (78 km length); aggregate decline of 1%; 7.7% decline in pollution from DiD
Guo and Chen (2019)	Beijing Metro expansion	RD in time, 50–80 days before and after the policy	$PM_{2.5}$, PM_{10}, SO_2, NO_2, CO, O_3, AQI	Reductions in $PM_{2.5}$, PM_{10}, SO_2, NO_2, CO, AQI by more than 155%, 125%, 78%, 110%, 109%, 112%, respectively. Over 100% increase in O_3.
Zheng et al. (2019)	Changsha Metro	DiD, one year before and 1 year after	Hourly CO, O_3 and $PM_{2.5}$	18% reduction in CO, no effects on O_3 and $PM_{2.5}$
Guo et al. (2020)	23 Inter-city high-speed railway lines in China opened during 2015–16	DiD comparing stations within 10 km of highways affected by new HSR lines v. those within 10 km of old HSR lines	CO, O_3, $PM_{2.5}$	4.3% reduction in CO. No effect on other pollutants
Lee et al. (2023)	Opening of a high-speed rail line connecting two megacities in China in 2015: Chengdu and Chongqing	Main: Two-step approach with random forest in the first stage and an augmented RD in time approach in the second stage; Robustness: DID comparing affected roads with randomly chosen roads	Hourly $PM_{2.5}$, PM_{10}, SO_2, NO_2, CO and O_3 from an AQM at 15 km resolution	6.4% reduction in CO along the main affected highway, 7.1% decrease in $PM_{2.5}$, 2.2% decrease in PM_{10} levels. No effect on NO_2 and O_3. DiD estimates are larger and NO_2 declines significant, O_3 shows significant increase.

Note: Main empirical approach is described unless otherwise noted.

Gupta (2017) in Delhi, by Guo and Chen (2019) in Beijing, by Gendron-Carrier et al. (2022) in 58 cities, and by Cropper and Suri (2022) in Mumbai. Some papers also feature a DiD approach, which estimates the change in the level of a pollutant due to the transit project in a location that received the transit project relative to a location that did not: for example, Chen and Whalley (2012) in Taipei, Li et al. (2019) in the context of the Beijing Metro expansion, and, Zheng et al. (2019) in Changsha. This method assumes parallel trends in pollution levels in the treatment and control locations in the absence of the project.

These approaches have also been used to study the air quality impacts of other public transit projects in developing countries, such as the expansion of BRT in Mexico city (Bel and Holst, 2018), the re-organization of bus routing and scheduling in Santiago, Chile (Gallego et al., 2013), and the introduction of high-speed inter-city rail in China (Guo et al., 2020; Lee et al., 2023).[5] In this paper, we focus only on the measurement of air quality impacts of Metro projects.

3.1. Pollution measurement units and locations

In all of the studies in Tables 1 and A.1, the goal is to estimate the effect of a policy on ambient air quality measured by ground level monitors or aerosol optical depth (AOD).[6] Researchers have studied the effects of Metro rail on both primary (CO, NO_x, PM_{10}) and secondary pollutants ($PM_{2.5}$), for time spans ranging from 30 days to 2 years before and after the policy. In terms of primary pollutants, studies estimating the impacts on CO have found wide-ranging reductions: 5%–15% in Chen and Whalley (2012), 34% in Goel and Gupta (2017), 78% in Guo and Chen (2019), and 18% in Zheng et al. (2019). Evidence about the effects on NO_x or NO_2 is weaker: Chen and Whalley (2012) and Goel and Gupta (2017) find reductions in NO_x and NO_2 that are not stable across specifications.[7] Chen and Whalley (2012) and Cropper and Suri (2022) also do not find significant reductions in PM_{10}. Of studies that evaluate $PM_{2.5}$, Goel and Gupta (2017), and Zheng et al. (2019) do not find significant reductions. Guo and Chen (2019) document reductions in PM_{10} and $PM_{2.5}$, but their estimated reductions exceed 100%, and are likely confounded by other factors. Gendron-Carrier et al. (2022) find no average effects across 58 cities on AOD, a proxy for PM, however, there is a reduction in cities with above-median baseline levels of AOD and substantial ridership.

Changes in air quality are expected to arise due to modal substitutions, which, for primary pollutants, will occur on roads close to the Metro network. Many researchers, therefore, restrict their treatment

[5] For studies examining other transportation policies in both developing and developed countries, see Li et al. (2020).

[6] AOD is a measure of aerosols present in the atmosphere based on the extinction rate of a ray of light passing through the atmosphere. It is often used to proxy surface-level PM, but the relationship varies based on meteorological conditions and atmospheric chemistry.

[7] Guo and Chen (2019) find reductions in NO_2 ranging from 78% to over 100%. Cropper and Suri (2022) find reductions in NO_2, that represent the effect of the opening of Metro Line 1 and a highway expansion project that opened during the same month.

locations to areas in the vicinity of Metro projects, where traffic is most likely to be affected (Goel and Gupta, 2017; Gendron-Carrier et al., 2022; Li et al., 2019).[8] But sometimes, for practical reasons, researchers analyze ambient air pollution reductions averaged over a very large area.

While it is true that pollutants travel and are persistent, it would be naïve to claim that econometric studies estimate the pollution reduction due to the policy, without accounting for the chemistry of dispersion and persistence of a pollutant between the location of emission and the location of measurement. Gendron-Carrier et al. (2022), for example, document a spatial decay in the effect of Metro openings on AOD as the treatment area is expanded beyond the city center.

Additionally, when hourly pollution data is used, the level of data aggregation and analysis can also affect the results. For example, should data be aggregated at the hourly level or daily level using measurements from rush hour times? Which are the relevant summary statistics to be examined: mean, median, maximum, or standard deviation? Generally, pollutants emitted by light passenger vehicles peak during rush hour and stabilize during nighttime. Similarly, levels of pollutants emitted by heavy freight vehicles would be higher during the hours they are allowed to operate. Appropriate measurement duration would depend upon the policy in question and the temporal persistence of the pollutants. Fig. 1 for Delhi, for example, emphasizes diurnal patterns for three pollutants: $PM_{2.5}$, CO, and NO_x. $PM_{2.5}$ peaks at night and stays high during the morning rush hours. NO_x and CO peak at night and are lower during the day. This is likely due to heavy vehicles that are allowed to operate only at night.

Some of the variation in econometric estimates across contexts is expected due to differences in the importance of passenger vehicles in the emissions inventories of various pollutants. But, sometimes, the effect sizes estimated within a study are wide ranging, calling into question the reliability of the estimates. Most researchers attempt to use contextual knowledge to explain the sensitivity of estimates, but this varies across contexts and journals. In the following subsection, we describe the reduced form approaches commonly used for estimating the impact of a Metro project on air pollution, highlighting the implications of specification choices that may lead to unstable estimates of impacts on air pollution.

3.2. Methodological approaches

Regression Discontinuity: Given data on ambient pollutant concentrations before and after the opening of a project, most papers using an RD in time regress the log of a pollutant concentration, measured hourly or daily at a ground-level monitor, on an indicator variable for the period after the project opening, a flexible polynomial time trend, controls for meteorological conditions, and a combination of fixed effects for hour of the day, day of the week, month, and year. The rationale is to identify the effect of the policy on pollution levels while accounting for trends in observed ambient levels regardless of the emission source, i.e., including non-transport sources, which may vary by time of day, day of the week and season of the year.

To illustrate the need for these controls, Fig. 2 plots the average hourly levels of PM_{10} for a 30-day period before and after the opening of the first Taipei Metro Line using data from Chen and Whalley (2012). PM_{10} levels peak during Wednesday–Friday and are lower during morning hours. Over a longer period, we would also observe a pattern based on climate conditions during different seasons. The pattern in hourly variation is also seen in Fig. 1 for Delhi. Additionally, pollution levels are affected by meteorological conditions such as humidity, temperature, and wind conditions, but given the complexity of this dependence, there is variation in how different studies control for these factors.

[8] Other studies examine the heterogeneity in estimates using information from different monitoring stations (Chen and Whalley, 2012).

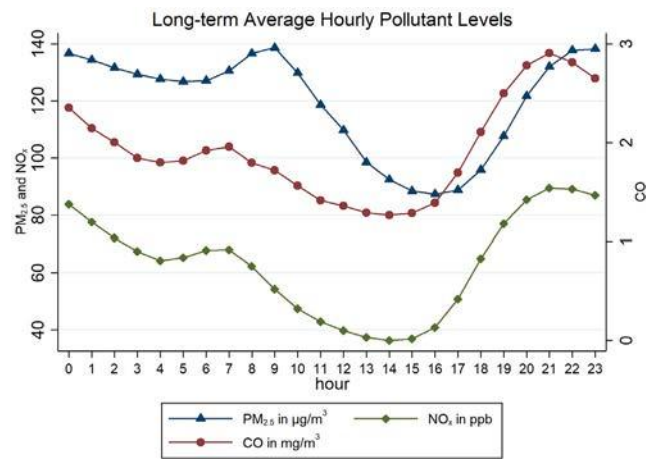


Fig. 1. Delhi pollution averages by hour of the day.
Note: This graph shows the average hourly pollution levels for the period 2013–2023 at the ITO Monitor calculated using data from the Central Pollution Control Board of India.

The estimation equation for the RD in time approach generally takes the following form.

$$\log(\text{Pollutant})_t = \alpha_0 + \delta * \text{Post Policy}_t + \alpha_x * X_t + \beta_k * f(t;k) + \beta_k^{post} * f(t;k) * \text{Post Policy}_t + \epsilon_t \quad (1)$$

For example, in Chen and Whalley (2012), the authors regress the log of the average hourly pollutant level on an indicator variable for the post-Metro period (Post Policy_t), a third-order polynomial time trend in days ($f(t;k)$), an interaction of this polynomial trend with the post-Metro indicator allowing the trend to be different in the pre-period and post-period, a vector of covariates (X_t) accounting for meteorological conditions, and fixed effects for month, day of the week, hour, and hour multiplied by day of the week. They also include indicators for other confounding events such as gas content regulations: two before the Metro opening and two after. Meteorological variables include current and 1-hour lags of quartic functions of temperature, wind speed, and humidity. Other papers in the literature follow similar approaches with some variations: for example, in the order of polynomials, choice of controls, and by allowing a differential time trend in the pre and post periods.

Note that this approach is different from a typical RD design, as explained in Hausman and Rapson (2018), but is to a great extent compatible with current RD methods (Lee and Lemieux, 2010; Cattaneo and Titiunik, 2022). Therefore, many of the same issues apply here. Most of the papers using the RD in time approach employ parametric estimation, but given the sensitivity of this approach to polynomial order and controls, it is advisable to employ non-parametric methods as well for robustness.[9] Most notably, including a higher order polynomial time trend can lead to overfitting and inconsistent estimates of the treatment effect (Hausman and Rapson, 2018), but this point has often been ignored in the literature.[10,11]

[9] Calonico et al. (2017) discusses estimation procedures in Stata. See https://rdpackages.github.io/rdrobust/ for details on latest available estimation programs.

[10] Sensitivity to the order of polynomial trend is noted in the Appendix of Chen and Whalley (2012).

[11] Lee et al. (2023) is an exception in that the authors use a local linear regression to estimate the effects of the opening on high-speed rail. However, they follow a different approach by first using the random forest algorithm with the pre-period data to find the best predictors of pollution levels and then obtaining predictions for the entire sample. The prediction errors are the dependent variable in the local linear regression.

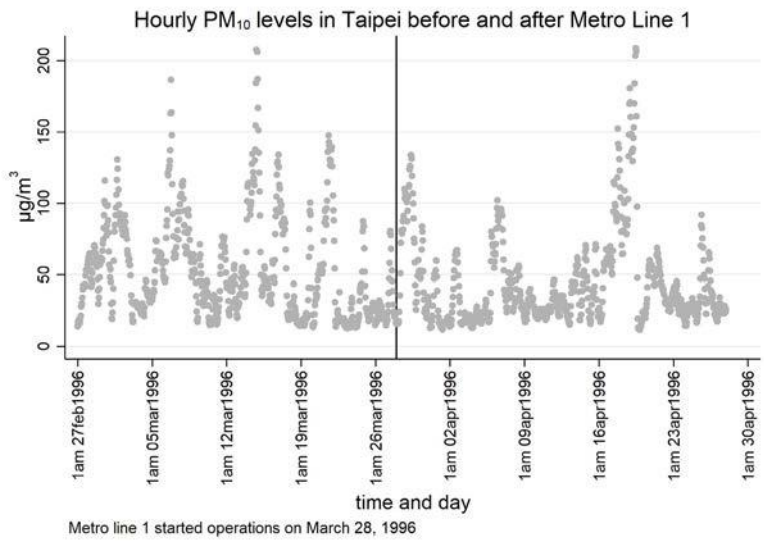


Fig. 2. Trends in Hourly PM_{10}.
Note: This graph shows the emissions of PM_{10} at the hourly level averaged across all monitoring stations used in the analysis of Chen and Whalley (2012) for one month before and after the opening of the first Taipei Metro line. For ease of identifying patterns, x-axis labels are shown for each Tuesday at 1am.

To illustrate the issue of overfitting, we use data on two monitoring stations close to the Taipei Metro Line provided by Chen and Whalley (2012) in their replication files. We show scatterplots using hourly data from 7am to 7pm with fitted polynomial trends of orders 1 through 4 at the hourly level in the left panel of Fig. 3. In a general RD in time specification the polynomial time trend captures secular trends in the level of pollution unexplained by other covariates. If the researcher does not include any covariates, the estimated effect of the policy on pollution is the magnitude of the discontinuity in the polynomial. It is clear from the graphs that fitting polynomials of different orders can have vastly different implications. The magnifications in the plots also make it clear that ex ante there would be no reason to prefer one specification over another.[12]

Estimates from RD in time studies are sometimes sensitive to the choice of sample window around the transit project opening date. Therefore, researchers use multiple samples to test the robustness of their estimates. For example, in Chen and Whalley (2012) the main sample is restricted to one year before and one year after the Metro opening; however, they also use a smaller 30-day window around the opening date to obtain local effects. Goel and Gupta (2017) consider samples of roughly 2.5 weeks, 4.5 weeks, and 18 months before and after the opening date, while Gendron-Carrier et al. (2022)'s main analysis considers a period of 18 months before and after the policy. Fig. 3 shows a comparison of estimates derived using windows of one year v. 30 days before and after the policy without any covariates other than the time trend. The differences in the magnitude of the discontinuity across graphs highlights the influence of polynomial order and sample window on estimates obtained using an RD in time approach.

Smaller windows lead to estimates of the effect closer to the opening and may be less susceptible to the influence of temporal unobserved factors. Therefore, in these analyses, controls for meteorological conditions or polynomial trends are not included. This is similar to a local randomization framework (Cattaneo and Titiunik, 2022): the implicit assumption is that the treatment timing in this short window is random and that potential outcomes are not affected by time.[13] For this approach to be valid, the assumption of random assignment to treatment in time needs to be carefully examined. For example, if a transit project opens at the beginning of the monsoon season or the holiday season, the use of local randomization will likely not be appropriate. Given the sensitivity of the sign and magnitude of RD estimates to bandwidth selections and covariates, researchers must justify these methodological choices and provide results from a variety of sensitivity tests. Additionally, researchers must also use contextual knowledge to check if the estimated policy effect is confounded by the occurrence of another event.

Difference-in-Differences (DiD): Some studies use a DiD approach, comparing changes in the level of a pollutant after the transit project in locations that received the project with the corresponding change in suitable comparison locations. A two-way fixed effects equation with standard errors clustered at the unit level, but preferably at the unit and time levels, is the commonly used estimation approach,[14]

$$\log(\text{Pollutant})_{it} = \alpha_0 + \alpha_1 * \text{Post Policy}_t + \alpha_2 * \text{Treatment Group}_i + \delta * \text{Post Policy}_t * \text{Treatment Group}_i + \gamma_i + \beta_t + \epsilon_{it} \quad (2)$$

where γ_i and β_t represent unit and time fixed effects, respectively and δ represents the main parameter of interest.

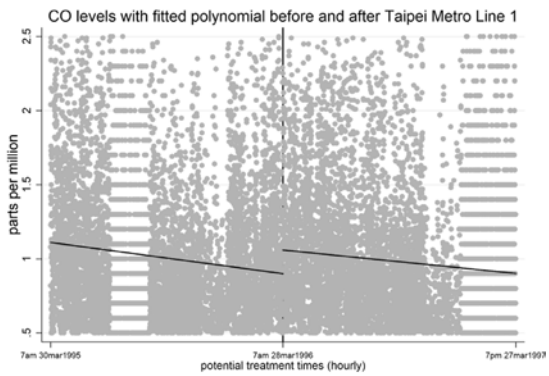
Researchers have used different treatment and control groups across projects. For example, as a robustness check, Chen and Whalley (2012) compare Taipei with the city of Kaohsiung in a 30-day window around

[12] With covariates included in the model, the estimated policy effect takes into account the relationship between the covariates and pollution as well as the relationship between time and the covariates (Frisch–Waugh–Lovell theorem). So, in almost every context, the results will likely be different from those implied by the graphs in Fig. 3.

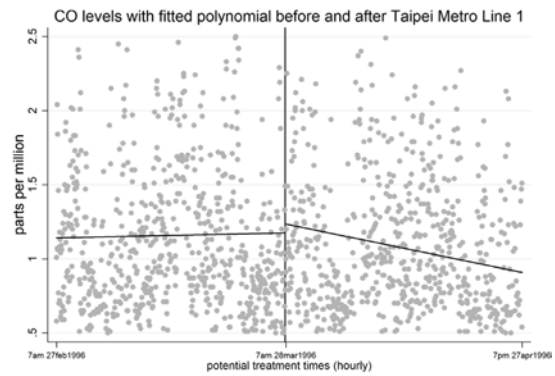
[13] This assumption is stronger than the continuity assumption implicit in the usual polynomial approach since it assumes that inside the window time does not affect potential outcomes.

[14] See Cameron et al. (2011) on a discussion of clustering standard errors at the unit level v. two-way at the unit and time levels.

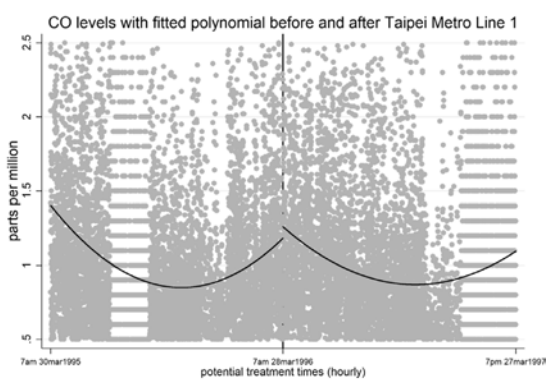
First-order Polynomial: One year before and after



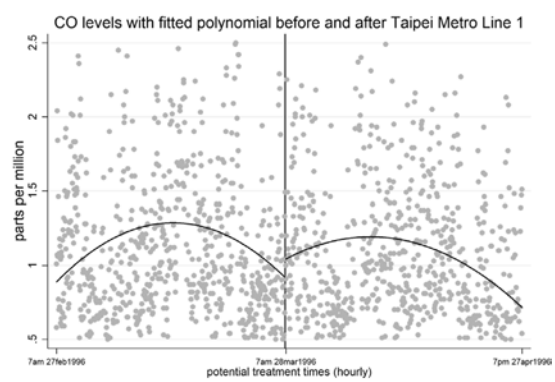
First-order Polynomial: 30 days before and after



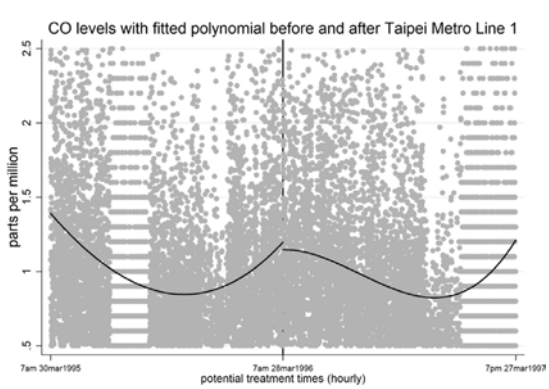
Second-order Polynomial: One year before and after



Second-order Polynomial: 30 days before and after



Third-order Polynomial: One year before and after



Third-order Polynomial: 30 days before and after

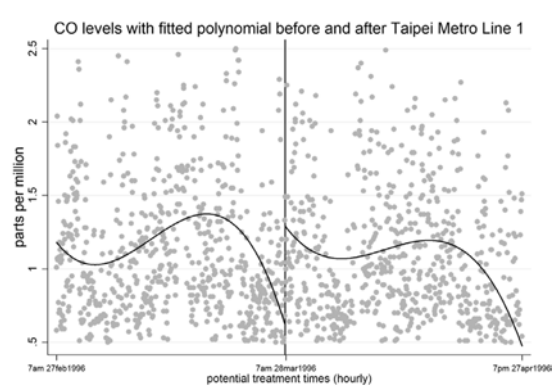
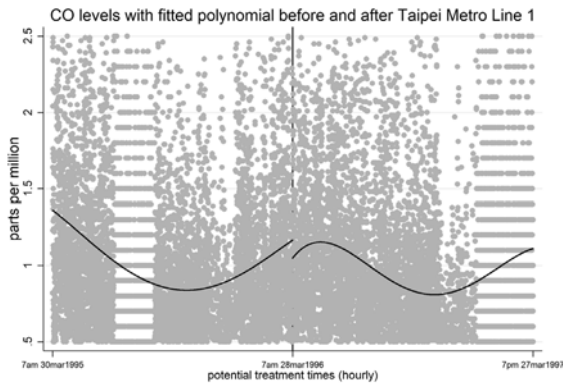
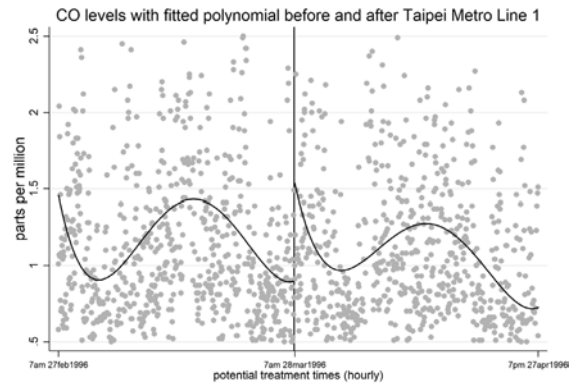


Fig. 3. Scatterplots of CO with varying polynomial trends and sample periods.
Note: These graphs show scatterplots of CO levels at 2 of the 5 monitoring stations that are classified as being near the Taipei Metro line in the dataset of Chen and Whalley (2012) for periods of 1 year (left panel) and 30 days (right panel) before and after the opening. Graph scale is restricted to emphasize the difference in the magnitude of the discontinuity on treatment date. Polynomial trends are fitted on raw data without controls.

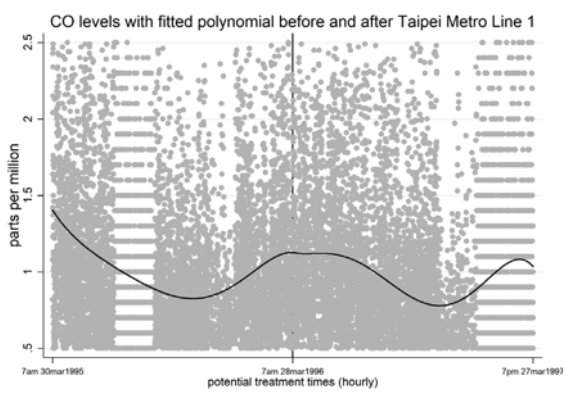
Fourth-order Polynomial: One year before and after



Fourth-order Polynomial: 30 days before and after



Fifth-order Polynomial: One year before and after



Fifth-order Polynomial: 30 days before and after

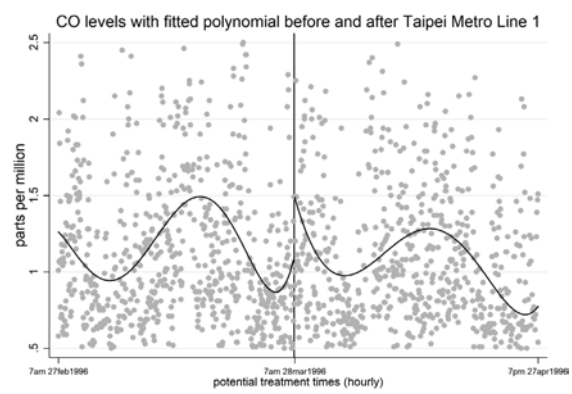


Fig. 3. (*continued*).

the date of Taipei Metro opening. Some researchers use spatial difference-in-differences to compare areas in the vicinity of a transport project to areas beyond the treatment areas before and after project implementation. For example, Li et al. (2019) compare monitors within 2 km of the Metro station with those that are farther than 20 km from it. Lee et al. (2023) also use difference-in-differences in a robustness check, comparing pollution levels along road segments affected by high-speed intercity rail and randomly selected segments of unaffected roads in the same geographical area.

The chosen comparison location in the DiD approach is assumed to mimic the pollution change in the treatment location in the absence of the policy (parallel trends assumption). That is, it is assumed that there would have been a constant difference in pollution levels between treatment and control locations in the absence of the transit project. This is an assumption that must be made by the researcher and is inherently untestable. It is problematic because transit projects are strategically placed to maximize use, and the locations that have them are inherently special. Therefore, researchers should carefully use pre-period data to test for possible violations of parallel trends and account for the magnitude of bias that may be present (Rambachan and Roth, 2023; Roth et al., 2023).

In the absence of any appropriate comparison locations, researchers can combine multiple locations to construct a synthetic comparison group. The change in pollution in the treatment location is computed relative to the change in pollution in the synthetic comparison location. One way to execute this is to use the synthetic DiD estimator in Arkhangelsky et al. (2021), which constructs the synthetic control group by weighting observations based on both cross-sectional and temporal similarity criteria.[15] A common issue with the DiD approach is the presence of spillovers from the treatment to the control group, leading to a violation of the Stable Unit Treatment Value Assumption (SUTVA), and incorrect estimates of the transit project impact. Li et al. (2019) deal with this possibility in the context of the Beijing Metro by making sure that the treatment and control location monitors are spatially separated by a buffer of at least 18 km. In the presence of spillovers, the synthetic DiD estimator reduces the severity of bias of the two-way fixed effects estimator used in the literature (Arkhangelsky et al., 2021).[16]

[15] Traditional approaches construct the synthetic control group based mainly on cross-sectional similarity.

[16] This is due to the inclusion of both unit and time weights. More weight is assigned to pre-treatment periods where control group outcomes more closely resemble post-treatment control group outcomes and more weight is assigned

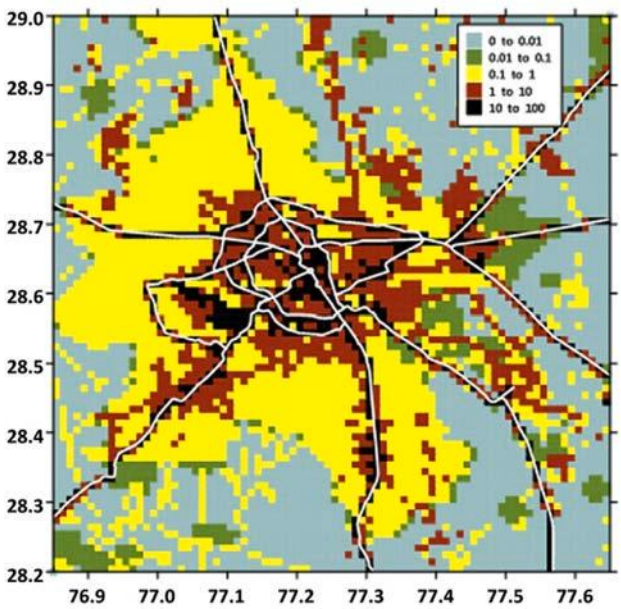


Fig. 4. Vehicle exhaust emissions of PM_{10} in tons/year/grid.
Note: This map shows the emissions of PM_{10} from vehicle exhaust at the 1 km grid level estimated by Guttikunda and Calori (2013).
Source: From Guttikunda and Calori (2013).

Summary: Quasi-experimental econometric methods can be used to estimate the causal impacts of transit projects on air quality, but face several challenges. First, researchers must select measurement locations that are most likely to capture emission changes from the transit policy in question. Second, measurements should be considered for the time period during which modal substitutions due to the transit project are most likely to affect air quality. Third, the influence of the polynomial order, sample period, and control variables on regression discontinuity estimates should be carefully analyzed and reported. Fourth, the selection of treatment and control locations should be carefully justified and sensitivity of results to the exact definitions explored.

Additionally, for the event study approaches outlined above to causally identify the impact of a transit project on pollution, it must be the case that no other policies affecting pollution occur simultaneously with the transit project. This is difficult to verify in practice, but most researchers attempt to use contextual information to investigate this possibility.[17] These challenges underscore why it is advisable, if possible, to compare econometric estimates with the magnitude of emissions reductions one might expect from modal shifts. We do this in the next section in analyzing the air quality impacts of the Delhi Metro.

4. An emissions/air quality modeling approach to estimating the impacts of a public transit project on air quality: The case of the Delhi Metro

To use an air quality modeling approach to evaluating the impacts of a Metro project requires parameterizing an air quality model at a fine spatial scale (e.g., 1 km × 1 km). This entails obtaining an emissions inventory – based on all sources of the criteria pollutants – at this scale, and appropriate meteorological inputs. After the model is run to obtain ambient concentrations of the pollutants, results (e.g., ambient concentrations of PM_{10}) are compared with monitoring readings to validate the emissions inventory.[18]

Guttikunda and Calori (2013) have developed an emissions inventory for Delhi for 2010 at a 1 km × 1 km scale. Their model covers the National Capital Territory and surrounding areas, a total area of 80 km × 80 km. Table 2 shows their estimates of emissions of $PM_{2.5}$, PM_{10}, SO_2, NO_x, CO and VOCs from the transport sector in 2010 and the percent of emissions of each pollutant contributed by transport. Transport accounts for over half of the emissions of NO_x and VOCs in Delhi, 18% of CO emissions, 13% of PM_{10} emissions and 17% of $PM_{2.5}$. Fig. 4 shows the spatial pattern of PM_{10} emissions from transport: Most emissions are concentrated along major roads. This represents all forms of road transport, including heavy duty and light duty goods vehicles. Indeed, over half of PM_{10} was estimated to come from goods vehicles rather than passenger vehicles (Goel and Guttikunda, 2015). The majority of NO_x emissions were also estimated to come from goods vehicles rather than passenger vehicles, although the reverse was true for CO emissions (Goel and Guttikunda, 2015).

The Delhi Metro first opened in 2002. By November of 2006, Phase I of the Metro, consisting of 59 stations and 65 km of track had been completed (see Fig. 5). By September of 2011, Phase II, consisting of 123 km of track had opened, yielding the network pictured in Fig. 6. The area occupied by the network in 2011 covered 1100 km^2–most of the National Capital Territory of Delhi.

Evaluating the impact of the Delhi Metro using air quality modeling begins with an evaluation of the georeferenced reduction in emissions that is likely to result from the project. Ignoring the local pollutants generated by the electricity which powers the Delhi Metro, the sum of reductions in pollutant i from passengers who shift to the Metro from mode m can be calculated as:

$$\text{Emissions reduced}_i = \sum_m \text{Passengers shifted from mode m} * e_{im} * l_m \tag{3}$$

where e_{im} is grams of pollutant i emitted per passenger km traveled (pkt) on mode m and l_m is average trip length on mode m in km/day.

After a transit project opens, modal shifts can be estimated by surveying users to find out the modes of transport previously used. In the case of the Delhi Metro, Sharma et al. (2014) estimate that in 2011, 55% of the 2 million daily Metro riders had previously used the bus, 20% had traveled by two-wheeler, 20% by car and 5% by three-wheeler. Doll and Balaban (2013) estimate that 44% of Metro riders shifted to Metro from bus, 25% from two-wheelers, 22% from car, 4% from taxis and 5% from three-wheelers.[19]

to control units where the growth in pre-period outcomes is similar to that of treated units.

[17] For example, dummy variables may be included in an RD equation to record the timing of relevant policies. This has been done to capture the introduction of gas content regulations in Taipei (Chen and Whalley, 2012), the opening of different Metro routes in Delhi (Goel and Gupta, 2017), and the imposition of driving restrictions in Beijing (Li et al., 2019). Some studies estimate the impact of such events on pollution as a placebo test, for example, in Cropper and Suri (2022), the opening of the first two phases of Eastern Freeway in Mumbai are placebo events for the opening of Metro Line 1.

[18] Note that for this purpose, models are usually run at a fine (e.g., 1 h) time scale. Emissions inventories also vary by hour of the day, day of the week and month of the year.

[19] Together with occupancy rates, these data can be used to calculate the number of vehicles removed from the road for purposes of calculating congestion impacts. If 400,000 passengers on the Delhi Metro would have ridden two-wheelers, and the occupancy factor is 1.5 passengers per two-wheeler, 266,667 two-wheelers have been removed from the road—at least near Metro lines. Sharma et al. (2014) estimated that in 2011, the Delhi Metro removed over 500,000 vehicles from the roads: 27,800 buses, 267,000 two-wheelers, 167,000 cars and 40,000 three-wheelers–approximately 1.5% of the vehicle fleet.

Table 2
Delhi transport emissions inventory in 2010 and estimated reductions due to the Delhi Metro (tons/year).

Pollutant	$PM_{2.5}$	PM_{10}	SO_2	NO_x	CO	Study
Transport Emissions	10,900	14,600	700	198,900	256,200	Guttikunda and Calori (2013)
Percent of Total	17%	13%	2%	53%	18%	
Reduced by 2011 Metro		107		1,320	3,882	Sharma et al. (2014)
Reduced by 2011 Metro		163		1,443	6,545	Doll and Balaban (2013)
Reduced by 2006 Metro		23		299	1,097	Sharma et al. (2014)

Estimates of transport emissions by pollutant are from (Guttikunda and Calori, 2013) and pertain to the NCT and surrounding areas, an area of 80 km × 80 km. The percent of total emissions of each pollutant attributable to transport (row 2) also pertain to this area. Estimates of emissions reduced by the Delhi Metro, as of 2011, are bottom-up estimates, provided by Sharma et al. (2014) and Doll and Balaban (2013). They reflect the authors' estimates of changes in modal shares, average km driven, by mode, emissions factors for different classes of vehicles and vehicle occupancy rates.

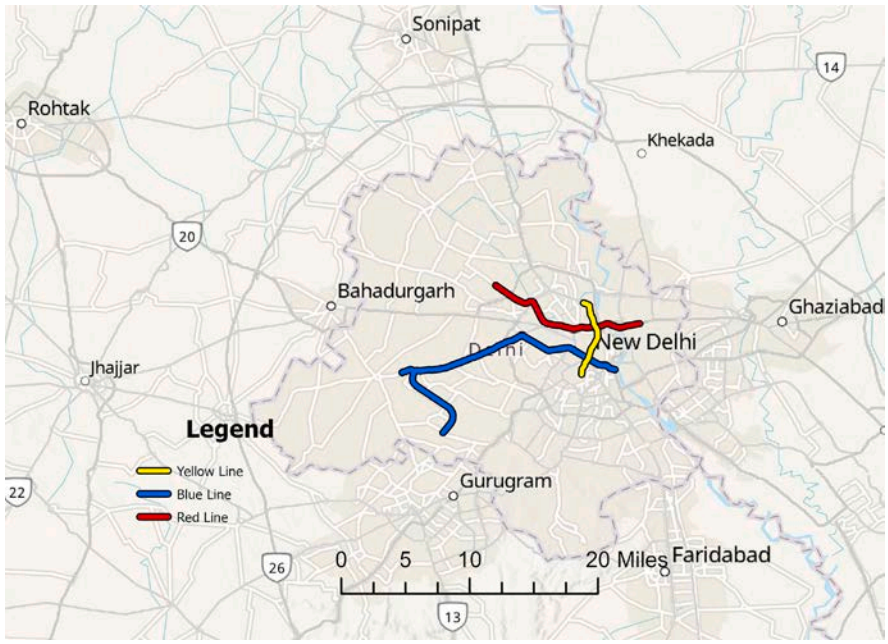


Fig. 5. Delhi Metro 2006.

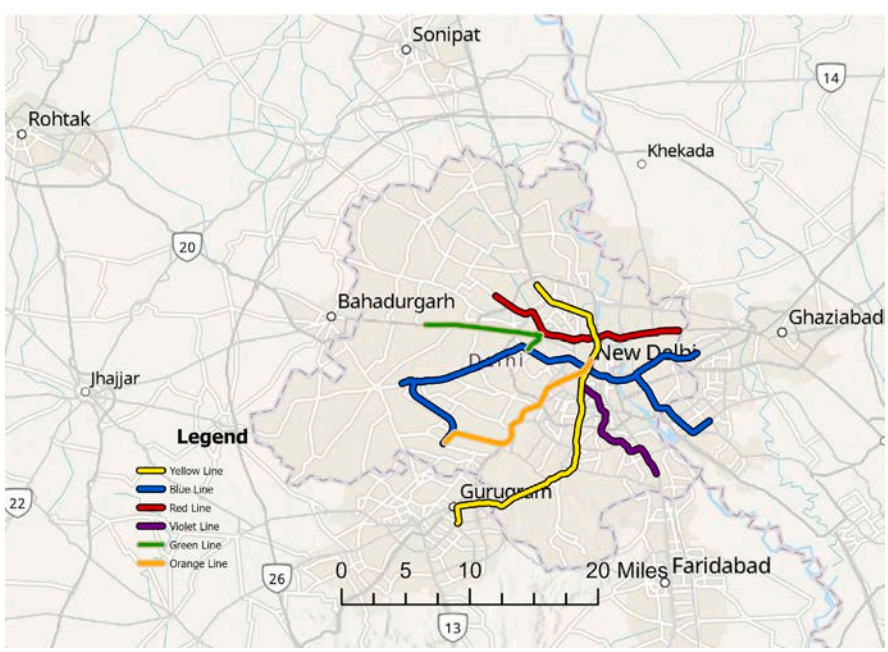


Fig. 6. Delhi Metro 2011.

To calculate emissions per pkt requires estimates of emissions in g/km, for each mode and pollutant, as well as vehicle occupancy rates. Emission factors per km depend on the type of fuel burned (diesel, petrol, CNG), vehicle fuel economy, and use of pollution control equipment. Because these factors vary by vintage of vehicle, calculating emissions reductions requires information, by mode, on the vintage of vehicle fleet. Emissions in g/km may be based on emissions testing information (and adjusted for deterioration factors) or information on emissions in real-world situations (Raparthi et al., 2021). Together with average occupancy factors, g/pkt can be calculated.

Table 2 presents estimates of the annual tons of PM_{10}, NO_x, CO and VOCs emissions reduced by the Delhi Metro in 2011. Estimates by Sharma et al. (2014) are very similar to those of Doll and Balaban (2013) for PM_{10}, NO_x and VOCs, but differ for CO. This is due in part to the higher share of riders estimated by Doll and Balaban (2013) to come from two-and four-wheelers. Estimates of tons of emissions reduced by Phase I of the Metro in 2006 (Sharma et al., 2014), when daily ridership was approximately 451,000 per day, are also in Table 2.

To use atmospheric chemistry to estimate the impact of the reductions in emissions associated with the Metro requires that an atmospheric chemistry model be run with and without the emissions reductions in Table 2, both georeferenced. This has not been done for Delhi; however, the information in Table 2 can be used to place bounds on the magnitude of the air quality improvements associated with the Delhi Metro.

The air quality monitoring station at the Income Tax Office (ITO) in central Delhi has been the focus of air quality analyses for many years (Guttikunda and Calori, 2013; Nagpure and Gurjar, 2012) given its location at a major traffic intersection. The ITO is also located near the intersection of Yellow and Blue lines of the Delhi Metro (see Figs. 5 and 6). As noted in Section 3, Goel and Gupta (2017) have used a regression discontinuity design to examine the impact of the extension of the Yellow line in July of 2005 on air quality at the ITO monitoring station. They find that this extension reduced CO at the ITO by 34% between 2004 and 2006. A 34% reduction in CO concentrations at the ITO would require a 34% reduction in CO emissions near the ITO monitor. Nagpure and Gurjar (2012) estimate only a 4% reduction in CO emissions within a km^2 of the ITO between 2004 and 2006 based on traffic counts and estimates of CO emissions by type of vehicle. The information in Table 2 also suggests that a 34% reduction is highly unlikely. Sharma et al. (2014) estimate total reductions in CO associated with the Delhi Metro to be 1027 tons/year in 2006. Even if the 256,200 tons/year of CO transport emissions were evenly distributed over the NCT, virtually all of the estimated CO reduction due to the Metro would have to occur in the vicinity of the air quality monitor (i.e. within a 2.5 km radius of the ITO monitor) to equal the 34% reduction in ambient CO documented in Goel and Gupta (2017).[20]

Modeling the air quality impacts of the estimated changes in pollutants in Table 2, including the formation of secondary pollutants, requires running a model with full atmospheric chemistry. To our knowledge, this has not been done for Delhi. Guttikunda and Calori (2013) do, however, run a Lagrangian plume model to identify the share of transport emissions in ambient $PM_{2.5}$ in six areas of Delhi in 2010. In South Delhi, a residential area which encompasses Delhi's two ring roads, the authors estimate that 42% of ambient $PM_{2.5}$ in 2010 was due to transport emissions. The Metro was extended to South Delhi in 2018. No study has yet been conducted of the impact of this Metro extension on ambient $PM_{2.5}$ using an air quality model. In the interim, it is important to ground truth econometric estimates by determining (a) what proportion of transport emissions are due to passenger transport; (b) calculating the reduction in emissions from passenger vehicles associated with the Metro.

[20] If the CO emissions due to transport in Table 2 were evenly distributed over the area of the NCT (approx. 1500 km^2), there would be approximately 3358 tons emitted within a 2.5 km radius of the ITO. For a 34% reduction in CO to occur at the ITO, *all* of the 1027 tons of CO reduced due to the Metro would have to occur within a 2.5 km radius of the ITO.

5. Conclusion

The economics literature on the local air quality impacts of public transport projects is growing rapidly. In this paper we have summarized the econometric methods used to estimate these effects. We have also discussed the approach used by engineers and air quality modelers to estimate the emissions reductions associated with public transport projects, and the likely impact of these emissions reductions on ambient air quality. There are two key insights.

Atmospheric chemistry has important implications for estimating the impact of a transport project, such as Metro rail, on ambient air quality. Reductions in primary pollutants from private or other forms of public transport occur along the road network, as people shift to riding the Metro. The rapid decay of primary pollutants with distance from roads implies that air quality monitors may not capture all the impacts of pollution reductions due to Metro rail (Zhou and Levy, 2007; Karner et al., 2010). This also implies that, for primary pollutants, monitors far from a transit project should be analyzed separately or used for robustness checks but should not be averaged with the readings of monitors near the project. This does not apply to secondary pollutants such as $PM_{2.5}$ or ozone, which travel long distances. This guidance has been applied in the econometric literature to some extent.

It is also important to calculate the likely reduction in emissions resulting from the shift to Metro from other forms of transportation, and to determine in a particular area what percent of total emissions this reduction constitutes. For primary pollutants, a rough rule is that the percentage reduction in emissions in a given area results in an equivalent percentage reduction in ambient concentrations. This should be used as a rough check on whether econometric results of reductions in pollution concentration are reasonable.

CRediT authorship contribution statement

Maureen Cropper: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Palak Suri:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

We declare that we have no potential financial or non-financial conflicts of interest to report.

Data availability

Data will be made available on request.

Appendix

See Table A.1.

Table A.1
Additional published studies on the importance of public transit for air quality using econometric methods (Economics or Transportation Journals).

Study	Context	Empirical approach	Pollutants examined	Results
Bel and Holst (2018)	Introduction of Line 1 of BRT Metrobus in Mexico City in 2005	DiD (main) and RD in time (robustness)	Daily averages of CO, NO_x, PM_{10}, SO_2	Decline in CO and NO_x by 6%–7% and in PM_{10} by 8%–9% within 2.5 and 5 km of the BRT corridor compared to 10–30 km away; no effect on SO_2; more rapid decline in CO with distance relative to NO_x and PM_{10}; larger and noisier RD estimates
Gallego et al. (2013)	Transantiago bus routing and scheduling system reform in Santiago, Chile in 2007	Dynamic event study and RD in time	Hourly CO	No immediate effect but a substantial increase in 7 months, likely due to the documented increases in inconvenience under the new system
Bauernschuster et al. (2017)	Strikes affecting Germany's five largest cities' local suburban train connections and the subway-tram-bus network from 2002–11	DiD comparing outcomes in affected and non-affected cities before, during, and after strike episodes	SO_2, CO (examined in a previous version of the paper), PM_{10}, NO_2	Increase in NO_2 by 4.3% of the strike-free level and in PM_{10} by 13.3–14.8%; no effects on SO_2 or CO
Lalive et al. (2018)	Service improvement of regional rail in Germany between 1994 and 2004	Procurement mode (competitiveness) as an instrumental variable for service growth	Annual means of CO, NO_x (estimated by averaging NO and NO_2), SO_2, O_3	10% increase in frequency leads to a weakly significant reduction of 1.9% in NO_x, insignificant reduction in CO, and no effect on SO_2 and O_3
Fageda (2021)	Light rail, tram extensions and introductions in about 98 mid-size European cities across 13 countries between 2008–2016	DiD continuous and binary treatments, rail length and policy indicators respectively	Estimated annual mean PM2.5 from AOD data combined with GEOS-Chem AQM	0.5% decrease in annual estimated $PM_{2.5}$ due to 1% increase in rail coverage; 3% decline in $PM_{2.5}$ in cities due to new rail relative to cities with no rail
Rivers et al. (2020)	Transit strikes in 18 Canadian cities between 1974 and 2011 lasting between 1 to 87 days (average 19)	Event study	Daily and hourly NO_x, CO, $PM_{2.5}$	10% decline in NO_x and no effect on $PM_{2.5}$ and CO due to strikes; likely due to higher NO_x emissions from transit than passenger vehicles
González et al. (2021)	Barcelona Public Transit strikes during 2008–16	Event study	Hourly CO, NO_x, O_3, PM_{10}, and SO_2	Bus strikes lead to higher CO, but no effect on other pollutants, Metro strikes lead to an increase in all pollutants except O_3; regional rail services strikes have ambiguous effects

Note: Main empirical approach is described unless otherwise noted.

References

Arkhangelsky, D., Athey, S., Hirshberg, D.A., Imbens, G.W., Wager, S., 2021. Synthetic difference-in-differences. Amer. Econ. Rev. 111 (12), 4088–4118.
Bauernschuster, S., Hener, T., Rainer, H., 2017. When labor disputes bring cities to a standstill: The impact of public transit strikes on traffic, accidents, air pollution, and health. Am. Econ. J.: Econ. Policy 9 (1), 1–37.
Bel, G., Holst, M., 2018. Evaluation of the impact of bus rapid transit on air pollution in Mexico City. Transp. Policy 63, 209–220, Elsevier.
Brunekreef, B., Beelen, R., Hoek, G., Schouten, L., Bausch-Goldbohm, S., Fischer, P., Armstrong, B., Hughes, E., Jerrett, M., et al., 2009. Effects of long-term exposure to traffic-related air pollution on respiratory and cardiovascular mortality in the Netherlands: The NLCS-AIR study. Res. Rep. (Health Effects Institute) (139), 5–71.
Calonico, S., Cattaneo, M.D., Farrell, M.H., Titiunik, R., 2017. rdrobust: Software for regression-discontinuity designs. Stata J. 17 (2), 372–404.
Cameron, A.C., Gelbach, J.B., Miller, D.L., 2011. Robust inference with multiway clustering. J. Bus. Econom. Statist. 29 (2), 238–249.
Cattaneo, M.D., Titiunik, R., 2022. Regression discontinuity designs. Annu. Rev. Econ. 14, 821–851.
Chen, Y., Whalley, A., 2012. Green infrastructure: The effects of urban rail transit on air quality. Am. Econ. J.: Econ. Policy 4 (1), 58–97.
Cropper, M., Suri, P., 2022. Air Quality Impacts of Metro Rail in Mumbai. In: The Benefits of Metro Rail in Mumbai: Reduced Form and Structural Approaches (Ph.D. Thesis). University of Maryland, College Park.
Doll, C.N., Balaban, O., 2013. A methodology for evaluating environmental co-benefits in the transport sector: Application to the Delhi metro. J. Clean. Prod. 58, 61–73.
EPA, 2023. Fast Facts on Transportation Greenhouse Gas Emissions. United States Environmental Protection Agency, URL https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions.
European Parliament, 2022. Emissions from Planes and Ships: Facts and Figures (Infographic). European Parliament (June 15, 2022), URL https://www.europarl.europa.eu/news/en/headlines/society/20191129STO67756/emissions-from-planes-and-ships-facts-and-figures-infographic.
Fageda, X., 2021. Do light rail systems reduce traffic externalities? Empirical evidence from mid-size European cities. Transp. Res. Part D: Transp. Environ. 92, 102731.
Gallego, F., Montero, J.-P., Salas, C., 2013. The effect of transport policies on car use: Evidence from Latin American cities. J. Public Econ. 107, 47–62.
Gendron-Carrier, N., Gonzalez-Navarro, M., Polloni, S., Turner, M.A., 2022. Subways and urban air pollution. Am. Econ. J.: Appl. Econ. 14 (1), 164–196.
Goel, D., Gupta, S., 2017. The effect of metro expansions on air pollution in Delhi. World Bank Econ. Rev. 31 (1), 271–294, Oxford University Press.
Goel, R., Guttikunda, S.K., 2015. Evolution of on-road vehicle exhaust emissions in Delhi. Atmos. Environ. 105, 78–90.
González, L., Perdiguero, J., Sanz, A., 2021. Impact of public transport strikes on traffic and pollution in the city of Barcelona. Transp. Res. Part D: Transp. Environ. 98, 102952.
Guo, S., Chen, L., 2019. Can urban rail transit systems alleviate air pollution? Empirical evidence from Beijing. Growth Change 50 (1), 130–144, Wiley Online Library.
Guo, X., Sun, W., Yao, S., Zheng, S., 2020. Does high-speed railway reduce air pollution along highways?——Evidence from China. Transp. Res. Part D: Transp. Environ. 89, 102607.
Guttikunda, S.K., Calori, G., 2013. A GIS based emissions inventory at 1 km× 1 km spatial resolution for air pollution analysis in Delhi, India. Atmos. Environ. 67, 101–111.
Hausman, C., Rapson, D.S., 2018. Regression discontinuity in time: Considerations for empirical applications. Ann. Rev. Resourc. Econ. 10, 533–552.
HEI, 2010. Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects. HEI Special Report 17. Technical Report, HEI Boston, MA, Health Effects Institute Panel on the Health Effects of Traffic-Related Air Pollution.
IEA, 2019. CO_2 Emissions From Fuel Combustion 2019 Edition (Database Document). Technical Report, International Energy Agency, URL https://iea.blob.core.windows.net/assets/abf78b7f-29dc-4cb9-bb9c-1a875486d09a/Worldco2_Documentation.pdf.
Karner, A.A., Eisinger, D.S., Niemeier, D.A., 2010. Near-roadway air quality: Synthesizing the findings from real-world data. Environ. Sci. Technol. 44 (14), 5334–5344. http://dx.doi.org/10.1021/es100008x.
Lalive, R., Luechinger, S., Schmutzler, A., 2018. Does expanding regional train service reduce air pollution? J. Environ. Econ. Manag. 92, 744–764.
Lee, D.S., Lemieux, T., 2010. Regression discontinuity designs in economics. J. Econ. Literature 48 (2), 281–355.
Lee, W.-S., Tran, T.M., Yu, L.B., 2023. Green infrastructure and air pollution: Evidence from highways connecting two megacities in China. J. Environ. Econ. Manag. 122, 102884.

Li, S., Liu, Y., Purevjav, A.-O., Yang, L., 2019. Does subway expansion improve air quality? J. Environ. Econ. Manag. 96, 213–235, Elsevier.

Li, S., Xing, J., Yang, L., Zhang, F., 2020. Transportation and the environment in developing countries. Ann. Rev. Resourc. Econ. 12, 389–409.

Nagpure, A.S., Gurjar, B.R., 2012. Development and evaluation of vehicular air pollution inventory model. Atmos. Environ. 59, 160–169.

NRC, 2010. Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use. National Research Council, National Academies Press.

Rambachan, A., Roth, J., 2023. A more credible approach to parallel trends. Rev. Econom. Stud. rdad018.

Raparthi, N., Debbarma, S., Phuleria, H.C., 2021. Development of real-world emission factors for on-road vehicles from motorway tunnel measurements. Atmos. Environ.: X 10, 100113.

Rivers, N., Saberian, S., Schaufele, B., 2020. Public transit and air pollution: Evidence from Canadian transit strikes. Canad. J. Econ./Rev. Canadienne D'économique 53 (2), 496–525.

Roth, J., Sant'Anna, P.H., Bilinski, A., Poe, J., 2023. What's trending in difference-in-differences? A synthesis of the recent econometrics literature. J. Econometrics.

Sharma, N., Singh, A., Dhyani, R., Gaur, S., 2014. Emission reduction from MRTS projects–A case study of Delhi metro. Atmos. Pollut. Res. 5 (4), 721–728.

Singh, N., Mishra, T., Banerjee, R., 2022. Emission inventory for road transport in India in 2020: Framework and post facto policy impact assessment. Environ. Sci. Pollut. Res. 29 (14), 20844–20863.

Small, K.A., Kazimi, C., 1995. On the costs of air pollution from motor vehicles. J. Transp. Econ. Policy 7–32.

WHO, 2013. Review of Evidence on Health Aspects of Air Pollution: REVIHAAP Project: Technical Report. Technical Report, World Health Organization. Regional Office for Europe.

Zheng, S., Zhang, X., Sun, W., Wang, J., 2019. The effect of a new subway line on local air quality: A case study in Changsha. Transp. Res. Part D: Transp. Environ. 68, 26–38.

Zhou, Y., Levy, J.I., 2007. Factors influencing the spatial extent of mobile source air pollution impacts: A meta-analysis. BMC Public Health 7 (1), 1–11.

NIH Public Access
Author Manuscript
Sci Total Environ. Author manuscript; available in PMC 2014 November 25.

Published in final edited form as:
Sci Total Environ. 2013 April 15; 0: 307–316. doi:10.1016/j.scitotenv.2013.01.074.

Air pollution and health risks due to vehicle traffic

Kai Zhang[a] and **Stuart Batterman**[b,*]

[a]Division of Epidemiology, Human Genetics and Environmental Sciences, University of Texas School of Public Health, Houston, TX 77030, USA

[b]Dept. of Environmental Health Sciences, University of Michigan, Ann Arbor, MI 48109-2029, USA

Abstract

Traffic congestion increases vehicle emissions and degrades ambient air quality, and recent studies have shown excess morbidity and mortality for drivers, commuters and individuals living near major roadways. Presently, our understanding of the air pollution impacts from congestion on roads is very limited. This study demonstrates an approach to characterize risks of traffic for on- and near-road populations. Simulation modeling was used to estimate on- and near-road NO_2 concentrations and health risks for freeway and arterial scenarios attributable to traffic for different traffic volumes during rush hour periods. The modeling used emission factors from two different models (Comprehensive Modal Emissions Model and Motor Vehicle Emissions Factor Model version 6.2), an empirical traffic speed–volume relationship, the California Line Source Dispersion Model, an empirical NO_2–NO_x relationship, estimated travel time changes during congestion, and concentration–response relationships from the literature, which give emergency doctor visits, hospital admissions and mortality attributed to NO_2 exposure. An incremental analysis, which expresses the change in health risks for small increases in traffic volume, showed non-linear effects. For a freeway, "U" shaped trends of incremental risks were predicted for on-road populations, and incremental risks are flat at low traffic volumes for near-road populations. For an arterial road, incremental risks increased sharply for both on- and near-road populations as traffic increased. These patterns result from changes in emission factors, the NO_2–NO_x relationship, the travel delay for the on-road population, and the extended duration of rush hour for the near-road population. This study suggests that health risks from congestion are potentially significant, and that additional traffic can significantly increase risks, depending on the type of road and other factors. Further, evaluations of risk associated with congestion must consider travel time, the duration of rush-hour, congestion-specific emission estimates, and uncertainties.

Keywords

Congestion; Morbidity; Mortality; NO_2; Risk assessment; Traffic-related air pollution

© 2013 Elsevier B.V. All rights reserved.

*Corresponding author. Tel.: +1 734 763 8095. stuartb@umich.edu (S. Batterman).

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

1. Introduction

Traffic on roads has significantly increased in the U.S. and elsewhere over the past 20 years (Schrank and Lomax, 2007). In many areas, vehicle emissions have become the dominant source of air pollutants, including carbon monoxide (CO), carbon dioxide (CO_2), volatile organic compounds (VOCs) or hydrocarbons (HCs), nitrogen oxides (NO_x), and particulate matter (PM) (Transportation Research Board (TRB), 2002). The increasing severity and duration of traffic congestion have the potential to greatly increase pollutant emissions and to degrade air quality, particularly near large roadways. These emissions contribute to risks of morbidity and mortality for drivers, commuters and individuals living near roadways, as shown by epidemiological studies, evaluations of proposed vehicle emission standards, and environmental impact assessments for specific road projects (World Health Organization (WHO), 2005; Health Effects Institute (HEI), 2010).

It is useful to separate traffic-associated pollutant impacts and risks into two categories. First, “congestion-free” impacts refer to impacts of traffic at volumes below the level that produces significant congestion. In this case, each additional vehicle added to the road does not substantially alter traffic patterns, e.g., the speed and travel time of other vehicles are unaffected, and thus vehicle emission factors do not depend on traffic volume. As a result, the marginal impact of an additional vehicle is equal to the average impact of the vehicle fleet. This is not necessarily true during congestion, the second category considered. While there are many definitions, congestion is often defined as periods when traffic volume exceeds road capacity. (Other definitions use a speed threshold, a percentage of free-flow speed of a roadway, or other indicator.) The present study focuses on what might be called “recurring congestion,” specifically, congestion caused by high traffic volumes during weekday peak “rush hour” periods. However, traffic volume is treated as a continuous variable, and strict definitions of congestion are not needed.

In the present analysis, “congestion-related” impacts incorporate multiple interactions that occur with congestion. First, congestion lowers the average speed, which increases travel time and exposure on a per vehicle basis. This effect can be considerable, e.g., the average annual travel delay for a traveler making rush hour trips in the U.S. was 38 h in 2005, based on 437 urban areas (Schrank and Lomax, 2007). Second, congestion diminishes dispersion of vehicle-related pollutants since vehicle-induced turbulence depends on vehicle speed (Benson, 1989). Thus, lower vehicle speeds can increase pollutant concentrations from roadway sources. Third, congestion can change driving patterns, resulting in an increased number of speedups, slowdowns, stops and starts, which increase emissions compared to “cruise” conditions, especially with high power acceleration. For example, Sjodin et al. (1998) showed up to 4-, 3- and 2-fold increases in CO, HC and NO_x emissions, respectively, with congestion (average speed of 13 miles per hour, mph; 1 mph=1.61 km per hour) compared to uncongested conditions (average speed, 38–44 mph). Thus, it is important to separate congestion-free and congestion-related impacts since emissions, impacts and risks can differ greatly, and because such analyses can better inform decisions related to traffic and air quality management, as well as impact and risk assessments.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Few evaluations of congestion-related impacts have been undertaken, and available studies have essentially combined congestion and non-congestion related impacts. Tonne et al. (2008) predicted that the congestion charging zone in London, where drivers must pay fees when their vehicles enter this area, would gain 183 years-of-life per 100,000 population in the congestion charging zone itself and a total of 1,888 years-of-life in the greater London area. Eliasson et al. (2009) estimated that a similar zone in Stockholm would avoid 20–25 deaths annually due to traffic-related air pollution in the inner city, and 25–30 deaths annually in the metropolitan area, which contains 1.4 million inhabitants. Both studies indicate that congestion pricing is beneficial in reducing traffic-related health impacts, but congestion-free and congestion-related impacts were not separated. These European studies focused on congestion charging zones, which are uncommon in the U.S., and the vehicle mix and fleet emission characteristics may differ substantially from those in the U.S. Using a different approach that examined shifts in time activity patterns (TAPs: the amount of time spent at various locations and related activities) due to travel delays along with literature values of exposure concentrations in relevant microenvironments, we estimated that a 30 min day^{-1} travel delay accounted for 21±12% of the exposure to benzene and 14±8% of $PM_{2.5}$ for a typical working adult on weekdays (Zhang and Batterman, 2009). Levy et al. (2010) estimated that the estimated public health cost of mortality attributable to congestion in 83 U.S. cities in 2000 was $31 billion (2007 dollars). This study used a macro-level approach to estimate traffic volume, which was then linked to the Motor Vehicle Emissions Factor Model 6.2 (MOBILE6.2) (EPA, 2003), thus providing a snapshot of congestion. However, congestion is dynamic and varies with time, space, weather and other factors (Downs, 2004). Overall, these studies suggest that congestion represents a substantial share of exposure to drivers and commuters, with potentially significant risks and impacts on health.

This study investigates the magnitude of air pollution impacts and health risks to on- and near-road populations that might occur due to recurring congestion, such as Monday through Friday rush hour traffic. Recurring congestion can result in repeated and chronic exposures, and an increase in long term health risks. “Incident congestion,” such as that caused by an accident or disabled vehicle, is not addressed, although such events may also be important for certain acute health outcomes, e.g., asthma exacerbation. This study utilizes predictive risk assessment techniques, namely, simulation models for traffic, emissions, pollutant dispersion and risk, and an incremental analysis that evaluates congestion-free and congestion-related impacts. After describing the approach, two case studies are used to analyze air pollution impacts and risks. A limited sensitivity analysis is conducted to examine impacts of key parameters on the estimated incremental risk. The merits of the various approaches that might be used to estimate congestion impacts conclude the analysis.

2. Methods

2.1. Approach

Risk assessment methods, depicted in Fig. 1, are used to estimate health risks due to traffic for two scenarios. In brief, vehicle emissions are used as an input to a dispersion model to estimate concentrations, which are then multiplied by exposure time and a risk factor

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

representing the concentration–response relationship. While some exposure and risk assessments utilize time activity patterns (TAPs) or human activity patterns, for simplicity we consider only exposure durations in traffic micro-environments, which include the delays due to traffic congestion. An incremental analysis is used to estimate the marginal impacts of increases in traffic volume. Such analyses are widely used in economic models to examine effects of small changes of an input on outcomes of interest; they also represent one of the classical "sensitivity analysis" techniques used to identify key variables in modeling systems (Trueman, 2007). One difference here, however, is that a wide range of traffic flows is examined over which relationships are expected to vary considerably.

2.2. Case studies

Two case studies or scenarios were developed to examine associations between traffic volume, exposures and health risks. The first, a freeway scenario, models an 8 km long segment of interstate I-94 in Ann Arbor, MI (Fig. S1), which was selected for a field study in which instantaneous emission rates were modeled. This segment had a permanent traffic recorder (PTR) operated by the Michigan Department of Transportation (MDOT). The portion of the segment west of US-23 had two lanes in each direction; the segment to the east had three lanes in each direction. The annual average daily traffic (AADT) volumes for these segments were 78,300 and 91,300 vehicles day^{-1} in west and east directions, respectively (MDOT, 2008). During the field study described in Zhang et al. (2011), traffic volumes were 3099 and 4040 vehicles per hour (vph) in morning and afternoon rush hour periods, respectively. The vehicle mix (8% heavy duty trucks and 92% light duty vehicles) during rush hour was based on PTR records from October, 2007 (Southeast Michigan Council of Governments (SEMCOG), 2006), and was assumed to be constant. The southeast Michigan vehicle age distribution was assumed to represent the fleet. The traffic volume in the incremental analysis was allowed to vary from 1000 to 10,000 vph. Given that design capacity is 2000 vehicles h^{-1} lane^{-1} for a freeway (SEMCOG, 2004), the upper volume represents about 120% of road capacity. In addition to the freeway scenario with an incremental analysis, a scenario using observed volumes on I-94 during rush hour was modeled to demonstrate the spatial and temporal patterns of predicted pollutant levels.

An arterial scenario was also modeled. This used a segment along Grand River Boulevard (M-5) in Detroit, which is 8.5 km long and includes two lanes per direction and a central turning lane (Fig. S2). The AADT volumes for the segment west of M-39 and east of M-39 were 23,800 and 19,200 vehicles day^{-1}, respectively (MDOT, 2009). The regional vehicle mix and age distribution described above were used. Traffic volumes ranged from 1000 to 4000 vph (about 120% of road capacity; design capacity is 825 vehicles h^{-1} lane^{-1} for an arterial road; SEMCOG, 2004).

Exposures of drivers and commuters were estimated using several assumptions about their behavior, traffic, and in-vehicle concentrations. A driver or commuter was assumed to travel on the segments under a constant traffic volume in both morning and afternoon rush hours every weekday throughout the year. The in-vehicle concentration was assumed to be equal to predicted on-road concentrations.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Exposures of near-road residents were derived as follows. A uniform population density along both sides of the road was assumed. The (non-commuting) residents were assumed to stay at home, which was assumed to be located 100 m from the road, during rush hour every weekday. Obviously, time activity patterns and actual distances can vary considerably, although an estimated 11% of the US households are located within 100 m of a four lane highway (Brugge et al., 2007). The average concentrations at upwind and downwind receptors (each at 100 m distance) were used, given the assumption of a uniform population density. Since indoor NO_2 concentrations (in homes without indoor sources) are about 50% of outdoor concentrations (HEI, 2010), the indoor exposure concentration was assumed to be half that of predicted outdoor concentrations at the 100 m receptors.

2.3. Emission modeling

Emission factors for a vehicle fleet traveling at different speeds were estimated using the Comprehensive Modal Emissions Model (CMEM) and MOBILE6.2. In this study, emissions were estimated for NO_x since traffic is its major source, and both models can predict NO_x while adjusting for speed effects. There are other important traffic-related pollutants, e.g., $PM_{2.5}$; however, CMEM does not estimate $PM_{2.5}$, and MOBILE6.2 does not account for vehicle speed effects on $PM_{2.5}$.

CMEM is a power-demand instantaneous model that can predict fuel consumption and emissions of CO, HC, NO_x and CO_2 on a fine time scale, e.g., a second-by-second basis (Scora and Barth, 2006; Zhang and Batterman, 2011). CMEM was used only in the freeway scenario because driving patterns were collected at this frequency only for this freeway segment. The CMEM estimates from Zhang and Batterman (2011), which were based on the east-bound I-94 segment, were assumed to apply to both directions.

MOBILE6.2 is a widely used regulatory emission model (Pierce et al., 2008) that estimates emissions of HC, CO, NO_x, PM and air toxics like benzene on the basis of chassis dynamometer measurements and driving cycles designed for four road types: freeway, arterial, ramp and local road (Environmental Protection Agency (EPA), 2003; Pierce et al., 2008). Emission factors in summer and winter were estimated using MOBILE6.2 and the fleet mix, vehicle age distribution, and typical daily temperatures for different vehicle speeds. Annual average emission factors were approximated as the average of summer and winter predictions.

For both emission models, emission factors are a function of fleet speed, and speed is a function of traffic volume. Speeds corresponding to given traffic volumes were derived using the Bureau of Public Road (BPR) formula (Dowling, 1997):

$$s = s_f / \left[1 + a(v/c)^b\right] \quad (1)$$

where s=predicted mean speed; s_f =free-flow speed; v= volume per hour; c=practical capacity, estimated locally as 2000 vehicles h^{-1} $lane^{-1}$ for freeways, and 825 vehicles h^{-1} $lane^{-1}$ for urban arterials (SEMCOG, 2004); a=scalar coefficient ranging from 0.05 to 1; and b=power coefficient ranging from 4 to 11. The latter two coefficients were obtained from a Detroit case study, which estimated a=0.1226 for the freeway, a=1.00 for the arterial, and

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

b=4.688 (Batterman et al., 2010). The posted speed limits are 70 and 35 mph for freeway and arterial segments, respectively, in the two case studies.

2.4. Dispersion modeling

Dispersion model predictions of NO_x concentrations attributable to traffic emissions were given by the California Line Source Dispersion Model version 4 (CALINE4). This model uses a Gaussian-plume model for a line source of finite length, and a mixing zone to characterize thermal and mechanical turbulence (e.g., vehicle wake effects), which is defined as the region over the roadway (traffic lanes, not shoulders) plus 3 m on each side (Benson, 1989). Both emissions and turbulence in the mixing zone are assumed to be uniformly distributed, while the decay of concentrations at more distant locations follows an empirical Gaussian line source equation (Benson, 1989). Because CALINE4 was not designed to process hourly data for a full year, a simplified modeling approach was used (Zhang and Batterman, 2010). In brief, the annual average concentration at a receptor was estimated as the sum of CALINE predictions for 16 wind sectors (each spanning 22.5°) and 15 wind speed classes (1 m s^{-1} for each bin, e.g., 0.5 to 1.5, 1.5 to 2.5, …), weighted by the joint probability of each wind sector/wind speed category during morning and afternoon rush hour periods, based on (hourly) meteorology from 2005. Model inputs included emission factors, traffic flows, receptor locations, and surface meteorological data for morning and afternoon rush hours (7–9 am and 4–6 pm) in 2005, measured at Detroit Metropolitan Airport (located 24 and 18 km from the freeway and arterial segments, respectively). Receptors were placed 0, 25, 50, 75, 100 and 150 m from both sides of a transect perpendicular to the center of the studied road segments.

Predicted NO_x concentrations were converted into NO_2 levels in order to utilize NO_2-based concentration–health response relationships. Nitric oxide (NO) emissions, which usually account for 90–95% of NO_x emissions in traffic (WHO, 2005), are rapidly converted into NO_2 by reaction with ozone and OH^- radicals. Ambient concentrations of NO and NO_2 vary with distance from traffic and other factors, e.g., background ozone and NO_2 concentrations, sunlight and dispersion conditions (HEI, 2010). In this study, NO_2 concentrations were predicted using an empirical model recommended by the UK Department for Environment, Food and Rural Affairs (2003):

$$NO_{2(road)} = \left(\left(-0.068 \times \ln\left(NO_{x(road)} + NO_{x(background)}\right)\right) + 0.53\right) \times NO_{x(road)}, \quad (2)$$

where $NO_{2(road)}$ =annual mean NO_2 concentration attributable to the road; $NO_{x(road)}$ =annual mean NO_x concentration attributable to the road; and $NO_{x(background)}$ =annual mean background NO_x concentration. Eq. (2) gives NO_2:NO_x ratios from 0.25 at low NO_x levels to 0.12 at high NO_x concentrations. Although developed for long-term NO_2:NO_x ratios, Eq. (2) was assumed to hold for short term relationships. The $NO_{x(road)}$ concentration was taken from CALINE4 predictions, and the $NO_{x(background)}$ concentration was set to 28.7 μg m^{-3}, the 2004 average background level at a Detroit area monitor (East 7 Mile, northeast Detroit) (Brown et al., 2007).

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

2.5. Exposure assessment

Daily and annual NO_2 exposures of on-road population were calculated as follows

$$E_d = C_{on-road} \times T \times 1/24 \quad (3)$$

$$E_a = E_d \times 255/365 \quad (4)$$

where E_d =adjusted daily exposures to NO_2 (μg m^{-3} day^{-1}); E_a = adjusted annual exposures to NO_2 (μg m^{-3} $year^{-1}$); $C_{on-road}$ = predicted on-road concentrations (μg m^{-3}); T=travel time (h), calculated by dividing the segment length over vehicle speed; 1/24=daily adjusted coefficient (h^{-1} day^{-1}), a reciprocal of 24 h per day, which distributes in-vehicle exposures during travel over the day in order to be compatible with daily-average-based concentration–response relationships; and 255/365=annual adjusted coefficient given 255=weekdays per year and 365=days per year, thus distributing short-term exposures over a year, again to be comparable with the concentration–response relationships.

Exposures for near-road population were derived similarly to that just described, but with the following changes. In Eqs. (3) and (4), on-road concentrations were replaced by one half of the near-road concentrations, and travel time was replaced by the rush hour duration, defined in Eq. (5):

$$T_{rush-hour} = T_{free-flow} \times [1 + 0.5 \times (s_f/s - 1)] \quad (5)$$

where $T_{rush-hour}$ =actual duration of rush hour; $T_{free-flow}$ =baseline duration of free-flow conditions (0.5 h); 0.5=a scale factor, which is used to account for some of road network dynamics (e.g., vehicles enter and leave a network at anytime during a rush hour); s_f =free-flow speed (70 and 35 mph for freeway and arterial road, respectively); s= speed (mph). The rush hour duration is extended due to increased traffic volume. Residents were assumed to be at home during rush hours every weekday.

2.6. Risk characterization

Health risks were calculated by linking estimated exposures to the relevant concentration–response relationships from the literature. These relationships were assumed to hold for traffic-related air pollutants as indicated by NO_2, and for both congestion and congestion-free conditions, which can be justified if the pollutant mixtures associated with these conditions are similar. Health outcomes of interest and available in the literature include short term morbidity, which represents emergency doctor visits and hospital admissions (EDA), and long term mortality. Both short- and long-term endpoints were selected, based on the strongest concentrations–response relationships in the literature as given by US Environmental Projection Agency (EPA) (2008). Specifically, risks were estimated using exposures and the concentration–response intervals of 0.5–5.3% and 0–14.8% per 10 μg m^{-3} NO_2 concentration increase for EDA and all-cause mortality, respectively. These intervals represent the ranges of the mean estimates from different studies, and not statistical confidence intervals from a meta-analysis. EPA (2008) states that confidence intervals

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

cannot be established since the underlying studies used different models, e.g., single and multi-pollutant models, different covariates, different cohorts, some studies only consider one age group, and other differences.

The incremental risks of increases in traffic volume were derived by dividing the differences of the risks corresponding to nearby traffic volumes by the differences of these traffic volumes. They represent the change (e.g., increase) in risk for an individual per each additional vehicle at a specific traffic volume. Thus, the incremental risk is the marginal risk for an individual given changes in traffic volume. The analysis addressed risks for individuals in traffic-related microenvironments, e.g., in vehicles and near major roads. Incremental risks might also change for populations in other environments due to emissions of primary pollutants, e.g., carbon monoxide and NO_2, as well as the formation of secondary pollutants, e.g., ozone promoted by NO_2 emissions.

2.7. Sensitivity analysis

A limited sensitivity analysis examined impacts of key factors on predicted incremental risk, including speed, emission factors, and the NO_2/NO_x ratio. This analysis predicted incremental mortality risks for the on-road population during the morning rush hour using the freeway scenario under different conditions, speeds of 50, 55, 60, 65 and 70 mph with the constant emission factor (2.7 g mi^{-1}) and NO_2/NO_x ratio (0.16), emission rates of 1.9, 2.1, 2.3, 2.5 and 2.7 g mi^{-1} at constant speed (70 mph) and NO_2/NO_x ratio (0.16), and NO_2/NO_x ratios of 0.12, 0.15, 0.18, 0.22 and 0.25 at constant emission factor (2.7 g mi^{-1}) and speed (70 mph). Emission estimates were derived from MOBILE6.2.

3. Results

3.1. Spatial–temporal patterns of predicted NO_2 levels

Fig. S3 shows how quickly predicted NO_2 levels decrease with distance from the highway, consistent with previous studies (WHO, 2005). Although the afternoon rush hour traffic volume was 30% higher than that in the morning, morning and afternoon concentrations were similar, mainly due to poorer dispersion conditions in morning, specifically more frequent occurrences of low speed winds.

3.2. Air pollution impacts

Fig. 2 shows associations between traffic volume, speed and NO_x emission factors for the freeway and arterial scenarios. For the freeway, speeds were constant up to volume of approximately 4400 vph, at which point speeds began to decrease. Emission factors from both CMEM and MOBILE6.2 were also constant at low volumes. At high volumes, CMEM's predictions slightly increased while MOBILE6.2's slightly decreased. For the arterial case, speed was constant at low traffic volumes, and dropped quickly after around 2000 vph (Fig. 2A). Emission factors were nearly constant at low volumes, and increased after 2500 vph when vehicle speeds are low (Fig. 2B).

Figs. 3A–B show NO_2 concentrations predicted for various emission estimates, traffic volume and rush hour periods in the freeway scenario. Concentrations based on CMEM

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

estimates were nearly linearly associated with traffic volume (Figs. 3A–B); those based on MOBILE6.2 increased exponentially with traffic volume to 7000 vph, and then gradually leveled off (Fig. 3A–B). Figs. 3C–D show predicted NO_2 concentrations in the arterial scenario. NO_2 levels increased nearly linearly to about 3000 vph, and then increased sharply. These predictions included emissions from the road segment only, i.e., background levels of NO_2 attributable to other emissions were not included.

3.3. Health risks

Predicted short- and long-term health risks for the freeway scenario with traffic volumes from 1000 to 10,000 vph using CMEM and MOBILE6.2 emission estimates are shown in Tables 1 and 2, respectively. Predicted total health risks increased with increased traffic volume, regardless of health outcome, road type and emission models. At the same traffic volume, traffic during the morning rush hour increased risks by 20 to 40% compared to afternoon rush hour, mainly due to the poorer dispersion conditions mentioned. Differences between results in Tables 1 and 2 were mainly determined by the differences from two emission estimates and the empirical NO_2–NO_x relationship.

Table 3 shows predicted health risks for the arterial scenario. Like the freeway results, the arterial scenario had higher risks during the morning rush hour.

3.4. Incremental health risk analysis

Fig. 4 shows incremental risks (increased risk for an individual per an additional vehicle) for the upper bound mortality outcomes in the freeway scenario. (Figs. S4–S5 show incremental risks for EDA using CMEM and MOBILE6.2 emission estimates, which are proportional to the mortality risk.) The incremental risks for the on-road population in the morning rush hour period were 20 to 45% higher than those in the afternoon rush hour.

For the arterial scenario, incremental risks greatly increased at high traffic volumes (Fig. 5). (Fig. S6 shows incremental risks for EDA using MOBILE6.2 emission estimates, and again, incremental risks for EDA and mortality are proportional.) In the arterial scenario, speeds decreased substantially (from 35 to 10 mph) and emission factors increased markedly (from 1.7 to 2.3 g mi^{-1}).

3.5. Sensitivity analysis

Fig. S7 shows effects of speed, emission factors and the NO_2/NO_x ratio on incremental mortality risks. Generally, incremental risks decreased as speed increased (or traffic volume decreased), and risks increased with higher emission factors and higher NO_2/NO_x ratios. The NO_2/NO_x ratio had the largest impact on incremental risks; its relative sensitivity was an order of magnitude higher than that for emission factors, and two orders higher than speed's.

4. Discussion

This study demonstrates a methodology for analyzing the health risks attributable to traffic, specifically using a marginal analysis that shows the effect of incremental increases in traffic volume. To our knowledge, this appears to be the first study examining health risks

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

attributable to congestion-related air pollution using this approach. Although the methodology employs several models that incorporate simplifying assumptions, the incremental analysis shows the effect of each additional vehicle. It highlights the key factors affecting risks due to congestion, which include traffic volume, speed, road type, emission factor and meteorology.

The key factors determining NO_2 concentration predictions include the emission model (MOBILE6.2 vs. CMEM), receptor location (on-road vs. near road), and road type (freeway vs. arterial road). In the freeway scenario, NO_2 concentration trends were determined by mainly traffic volume, emission factors and the empirical NO_2–NO_x relationship. MOBILE6.2 has slightly lower emission factors at lower speeds (high traffic volumes), thus NO_2 concentrations increase slowly at high volumes compared to a sharp increase at low volumes. Additionally, with the same traffic volume, concentrations predicted for the morning rush hour are 30 to 50% higher than those in afternoon rush hour period, which is mainly attributable to meteorological factors (more frequent lower winds and poor dispersion conditions). In the arterial road scenario, the predicted NO_2 trends can be explained by emission factors that are approximately constant at low volumes and thus traffics volume dominates the trend, while at high volumes, increasing emission factors make NO_2 levels rise more sharply (Fig. 2).

The predicted incremental risk per vehicle in the freeway scenario suggests a U-shape pattern for the on-road population, and constant incremental risks at low traffic volume for near-road populations. This indicates that incremental risks may be variable, dependent on driving patterns and parameters that pertain to that specific road segment and population. These patterns can be explained by travel time (for the on-road population), emission estimates, and the empirical NO_2–NO_x relationship. The incremental risks derived using CMEM are used to explain the interactions of these factors. The on-road risks show U-shaped curves with traffic volume, as depicted in Fig. 4A and B: from 1000 to 4000 vph, trends are determined by the NO_2/NO_x empirical relationship because speed and emission factors are constant, while the proportion of NO_2 to NO_x slightly decreases from 0.3 to 0.22 with higher volumes; from 5000 to 7000 vph, emission factors remain constant but speed decreases, resulting in longer travel times, and the NO_2 to NO_x ratio slightly decreases (from 0.21 to 0.19), which together slightly increase incremental risks; and lastly, for volumes exceeding 8000 vph, incremental risks increase due to longer travel delays, higher emission factors, and slightly decreased NO_2/NO_x ratio. The near-road risks show smaller changes, but the pattern is similar. The variation in results around 7000 to 10,000 vph, a result of step changes in the underlying models, might be addressed by smoothing.

The dramatic changes in incremental risks in the arterial scenario suggest that congestion could pose risks to commuters on and residents near arterial roads that are greater than congestion risks associated with freeways, possibly because lower speeds might be associated with more acceleration/deceleration events than higher speeds and, to a lesser degree, because low speeds reduce vehicle-induced dispersion (Benson, 1989).

In summary, the case studies indicated that incremental risks depend primarily on emission rates, empirical NO_2–NO_x relationships, and travel delay (for the on-road population). At

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

the high traffic volumes often associated with congestion, emission rates dominate the factors affecting risk trends. The divergence between the two emission models further suggests the importance of the emission estimates, especially for congested conditions. Many other factors can influence risk results, as described below.

4.1. Relevance of the case studies

The case studies used two simplified and somewhat hypothetical scenarios. The volumes assumed for the study segments may be unrealistic, e.g., the observed freeway traffic volume was only 4040 vph in the afternoon rush hour, less than half of the highest volume (10,000 vph) simulated. The results of incremental risks are expected to vary with roads with different orientations, topography, meteorology, and population density. Further, only NO_2 was considered. It would be helpful to examine other traffic-related pollutants, such as diesel exhaust and $PM_{2.5}$, given its health significance and differences in emission trends from NO_x.

4.2. Emission uncertainties

The MOBILE6.2 and CMEM models yield different trends of emission factors against traffic volume, and the former model's predictions are systematically higher. These models have many differences. CMEM simulates segment-specific driving behaviors using segment-specific second-by-second speed/acceleration profiles, while MOBILE6.2 assumes a generic driving pattern. Differences and uncertainties also occur due to the different approaches used to represent driving patterns, smoothing of speed and acceleration data used by CMEM, vehicle fleet assumptions, and difference in driving cycles and calibration database, among other reasons (Zhang and Batterman, 2011). Smit (2006, 2008) suggests that emission models based on average speeds, such as MOBILE6.2, do not explicitly account for congestion since input parameters representing congestion levels are not incorporated. MOBILE6.2 implicitly accounts for congestion because some urban driving patterns used in the model are associated with congestion. In contrast, driving pattern-based emission models, such as CMEM, predict emissions in congestion using instantaneous speed and acceleration/deceleration profiles as model inputs. However, predictions for congestion periods have not been fully validated (Smit, 2006). Therefore, our scenarios used the default congestion levels in MOBILE6.2's development and calibration.

There are many other sources of uncertainty in the emission models. For CMEM, key uncertainties result from the speed-profile smoothing and the car-floating technique used to develop these profiles. This approach likely reduced differences between congestion and free-flow predictions since actual acceleration/deceleration is underestimated. Additional uncertainties result from mapping CMEM to vehicle categories, and assuming that CMEM predictions applied to both road directions. For MOBILE6.2, a key uncertainty is whether the embedded driving cycles and speed adjustments reflect the actual driving patterns. As discussed, MOBILE6.2's ability to predict congestion-related emissions for a specific road is limited. Other uncertainties include the lack of segment-specific vehicle mix and age distributions, and the performance of the BPR model that relates traffic flow and speed. Finally, both CMEM and MOBILE6.2 are deterministic models that do not represent uncertainties in both the structures and parameters of the models.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Roadway emissions can be estimated in other ways. The new EPA Motor Vehicle Emission Simulator (MOVES; EPA, 2009) has been calibrated using a larger database than CMEM, can consider user-specified driving patterns (EPA, 2009), and provides (varying) $PM_{2.5}$ estimates. Emissions might also be determined using on-board monitoring or near-road emission/concentration measurements. While expensive, onboard monitoring links transient emissions to transient speed, acceleration and deceleration parameters, and thus can capture emissions that typify stop-and-go congestion. Because such relationships can vary dramatically among vehicles, generalizations to the whole fleet may be problematic. Near-road monitoring can be difficult to couple to transient driving parameter given instrumental limitations and changes in meteorological conditions and dispersion, among other reasons, although such measurements might provide the best estimate of congestion's contribution to pollutant levels.

4.3. Dispersion modeling

The concentration predictions involved several uncertainties and limitations, the largest of which might arise from the use of the empirical NO_2–NO_x relationship. This relationship was derived from a UK study, whereas the case studies used US-based traffic compositions, vehicle technologies, and emission models. Actual NO_2–NO_x relationships depend on many factors, e.g., background levels of NO, NO_2 and O_3, and meteorology (Stedman et al., 2001). The empirical relationship was derived for long-term relationships. Here it was used for short-term concentrations. The background NO_x level used might not reflect levels around the studied roads. Meteorological information driving the dispersion model was obtained at an open (unsheltered) (airport) site, while conditions near roads might be affected by buildings, trees and other factors (Greco et al., 2007) that can reduce wind speed and increase turbulence. Because concentrations rapidly decrease at distances exceeding 150 m from the road, only near-road receptors were considered. This does not account for background concentrations that can be attributed to traffic. The dispersion model predictions are deterministic, and do not consider model uncertainty. Other limitations of CALINE4, e.g., its poor performance at low wind speeds, have been discussed elsewhere (Zhang and Batterman, 2010).

4.4. Exposure assessment limitations

The scenarios demonstrate key factors affecting risk trends, which do not necessarily apply to actual commuting populations. For example, commuters usually travel for longer trips than the studied segments: US commuters spent an average of 81 min day^{-1} in vehicles in 2001 (HEI, 2010). Such trips might include both congestion-free and congestion periods, and both freeway and arterial roads. Exposures for only two populations were examined (in-vehicle cabins for the on-road population, and in-homes for the near-road population). Dynamic adjustments to time activity patterns associated with travel delay were not considered (Zhang and Batterman, 2009). Concentrations in vehicle cabins, which can be affected by opening car windows, the air intake location, air conditioning system operation, and other factors, may differ from on-road concentrations. Similar considerations apply to indoor concentrations for near-road residents.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

4.5. Risk characterization

This study provides an analysis of the incremental risks of traffic-related air pollutants in on-road and near-road environments, e.g., in vehicle cabins and locations near roads. There are several related risks or risk trade-offs that fall beyond the scope of our analysis. For example, additional time in traffic will decrease the time spent in other microenvironments, most notably at home, which can represent a risk trade-off as analyzed previously by Zhang and Batterman (2009). Second, changes in the emissions of traffic related air pollutants can promote the formation of secondary air pollutants, e.g., ozone and organic aerosols, that potentially affect a broader population, not just the near-road population. Finally, we did not evaluate risks related to “upstream” or process emissions (e.g., refining), climate change pollutants (e.g., associated with CO_2 emissions), or accidents.

Several issues in the risk characterization are worth pointing out. First, congestion-specific concentration–response relationships are unavailable. The literature data may inadequately represent risks related to congestion, which typically involve shorter exposure periods (typically less than several hours) than the daily or annual periods used in most studies. It is unclear how averaging to the annual level in the present study affects true risks. Still, the NO_2 concentration–response relationship used can be supported since congestion does not generate new pollutants, but simply changes concentrations of traffic-related pollutants. Also, NO_2 was used as a surrogate for congestion impacts, thus representing effects of NO_2 as well as other traffic-related pollutants, such as $PM_{2.5}$. This might be justified given the high correlation between NO_2 and several co-pollutants (EPA, 2008; Tonne et al., 2008).

Risks were calculated for individuals that were on-road and at a distance of 100 m, which incompletely accounts for the diversity of population exposures. An improved spatial analysis of traffic-related air pollutants is possible using actual population densities. Other potentially affected persons would include indoor and outdoor workers near roads.

4.6. Other approaches for estimating congestion-related health risks

Health risks from congestion might be estimated using epidemio-logical studies that include indicators for congestion. Such studies might provide tailored dose–response relationships that could be used in risk assessments. For example, congestion indicators such as time spent in congestion might be linked to health outcomes directly. This could help avoid the use of complicated and uncertain models.

4.7. Recommendations

Further research is needed to characterize exposures and risks attributable to traffic congestion. Concentration–response relationships using direct indicators of congestion are needed since previous epidemiological studies used only aggregate (and not congestion) indicators, e.g., daily traffic volume or traffic density within a buffer. Second, there is a need for emission models that directly account for congestion. The application of the new MOVES model would be useful in this context; this also requires the development of representative driving patterns portraying congestion. Third, populations living and working near roads must be known at finer resolution given that pollutant concentrations associated with traffic rapidly decrease with distance.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

5. Conclusions

This study used an incremental analysis to estimate pollution impacts and characterize health risks caused by congestion, which appears to be the first of its type in the literature. Congestion can increase risks for individuals driving on freeways and arterial roads, and for individuals living or working near roads. The modeling analysis suggests that incremental risks have a "U" shaped pattern with increased traffic volume for on-road populations in the freeway case study, and a different pattern, dramatic increases at high traffic volumes, for the arterial road. Risk levels depend on many factors, including traffic volume, vehicle mix, road type and meteorology. While risks from congestion can be predicted and are potentially significant, uncertainties are also high, and thus additional information is required to confirm predictions. This study suggests that the marginal risks of additional vehicles vary, and that key risk determinants include emission factors in congestion, the NO_2–NO_x relationship, travel time changes, road type, and exposure location. Overall, the findings that marginal risks are not constant should be used to inform policy making related to traffic and air quality management.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Portions of this research were funded through the support of the National Science Foundation's Materials Use: Science, Engineering, and Society Biocomplexity Program Grant (CMS-0329416) and the University of Michigan Risk Science Center through the support of a fellowship.

References

Batterman S, Zhang K, Kononowech R. Prediction and analysis of near-road concentrations using a reduced-form emission/dispersion model. Environ Health. 2010; 9:29. [PubMed: 20579353]

Benson, P. FHWA-CA-TL-84-15. Sacramento, CA: California Department of Transportation; 1989. CALINE4 — a dispersion model for prediction air pollutant concentrations near roadways.

Brown, SG.; Wade, KS.; Hafner, HR. [Accessed April 2, 2010] Summary of recent ambient air quality and accountability analyses in the Detroit area. 2007. http://www.epa.gov/airtrends/specialstudies/2007detroit_summary_report.pdf

Brugge D, Durant JL, Rioux C. Near-highway pollutants in motor vehicle exhaust: a review of epidemiologic evidence of cardiac and pulmonary health risks. Environ Health. 2007; 6:23. [PubMed: 17688699]

Department for Environment, Food and Rural Affairs. [Accessed April 2, 2010] Part IV of the Environment Act 1995, Local Air Quality Management Technical Guidance. 2003. p. 6-33.http://www.ni-environment.gov.uk/technical_guidance.pdf

Dowling, R. National Cooperative Highway Research planning report. Vol. 387. Washington DC: National Research Council; 1997. Planning techniques to estimate speeds and service volumes for planning.

Downs, A. Still stuck in traffic: coping with peak-hour traffic congestion. Washington, DC: Brookings Institution Press; 2004.

Eliasson J, Hultkrantz L, Nerhagen L, Rosqvist LS. The Stockholm congestion — charging trial 2006: overview of effects. Transp Res A Policy Pract. 2009; 43(3):240–50.

EPA. User's guide to MOBILE6.1 and MOBILE6.2. 2003.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

EPA. [Accessed November 20, 2009] Risk and exposure assessment to support the review of the NO_2 primary National Ambient Air Quality Standard. 2008. http://www.epa.gov/ttn/naaqs/standards/nox/data/20081121_NO2_REA_final.pdf

EPA. [Accessed February 27, 2010] MOVES2010 policy guidance. 2009. http://www.epa.gov/otaq/models/moves/420b09046.pdf

Greco SL, Wilson AM, Hanna SR, Levy JI. Factors influencing mobile source particulate matter emissions-to-exposure relationships in the Boston urban area. Environ Sci Technol. 2007; 41:7675–82. [PubMed: 18075073]

Health effects institute. [Accessed on March 10, 2009] Traffic-related air pollution: a critical review of the literature on emissions, exposure, and health effects. http://pubs.healtheffects.org/getfile.php?u=5532010

Levy JI, Buonocore JJ, von Stackelberg K. Evaluation of the public health impacts of traffic congestion: a health risk assessment. Environ Health. 2010; 9:65. [PubMed: 20979626]

Michigan Department of Transportation. [Accessed April 28, 2009] Ann Arbor 2008 annual average daily traffic map. 2008. http://www.michigan.gov/documents/annarbor_19544_7.pdf & http://mdotwas1.mdot.state.mi.us/public/maps_adtmaparchive/2007cadt/Ann%20Arbor.pdf

Michigan Department of Transportation. [Accessed April 1, 2010] Detroit 2008 annual average daily traffic map. 2009. http://www.michigan.gov/documents/detmetro_19640_7.pdf

Pierce, T.; Isakov, V.; Haneke, B.; Paumier, J. [Accessed June 26, 2009] Emission and air quality modeling tools for near-roadway applications. 2008. http://www.epa.gov/airscience/pdf/Pierceetal_EPA2008.pdf

Schrank, D.; Lomax, T. [Accessed March 22, 2008] The 2007 urban mobility report. 2007. http://financecommission.dot.gov/Documents/Background%20Documents/mobility_report_2007_wappx.pdf

Scora, G.; Barth, M. Comprehensive Modal Emission Model (CMEM) Version 3.01 User's Guide. Riverside, California: University of California; 2006.

Sjodin A, Persson K, Andreasson K, Arlander B, Galle B. On-road emission factors derived from measurements in a traffic tunnel. Int J Veh Des. 1998; 20(1–4):147–58.

Smit, R. Doctoral dissertation: An examination of congestion in road traffic emission models and their application to urban road networks. Griffith University; Queensland, Australia: 2006. p. 12

Southeast Michigan Council of Governments (SEMCOG). [Accessed March 29, 2010] Sensitivity analysis of EPA's new mobile model. 2004. http://library.semcog.org/InmagicGenie/DocumentFolder/SensitivityAnalysisEPAmodel.pdf

Southeast Michigan Council of Governments (SEMCOG). Ozone and carbon monoxide conformity analysis for the proposed amendment of the 2030 regional transportation plan for southeast Michigan draft; Detroit, Michigan. 2006.

Stedman JR, Goodwin JWL, King K, Murrells TP, Bush TI. An empirical model for predicting urban roadside nitrogen dioxide concentrations in the UK. Atmos Environ. 2001; 35:1451–63.

Tonne C, Beevers S, Armstrong B, Kelly F, Wilkinson P. Air pollution and mortality benefits of the London Congestion Charge: spatial and socioeconomic inequalities. Occup Environ Med 2008. 2008; 65(9):620–7.

Transportation Research Board. Special Report. Washington, DC: Transportation Research Board, National Research Council; 2002. The Congestion Mitigation and Air Quality Improvement Program, assessing 10 years of experience; p. 60-4.

Trueman RE. Incremental (marginal) analysis of basic inventory models. Decis Sci. 2007; 2(3):341–55.

World Health Organization. Health effects of transport-related air pollution. Copenhagen: WHO Regional Office for Europe; 2005. p. 125-65.

Zhang K, Batterman S. Time allocation shifts and pollutant exposure due to traffic congestion: an analysis using the national human activity pattern survey. Sci Total Environ. 2009; 407:5493–500. [PubMed: 19683333]

Zhang K, Batterman S. Near-road air pollutant concentrations of CO and $PM_{2.5}$: a comparison of MOBILE6. 2/CALINE4 and generalized additive models. Atmos Environ. 2010; 44:1740–8.

Zhang K, Batterman S, Dion F. Vehicle emissions in congestion: comparison of work zone, rush hour and free-flow conditions. Atmos Environ. 2011; 45:1929–39.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.scitotenv.2013.01.074.

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

HIGHLIGHTS

- Congestion and additional traffic can significantly increase exposures and risks.
- Risks and exposures are not proportional to traffic volumes.
- Incremental risks depend on site-specific factors including road type.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

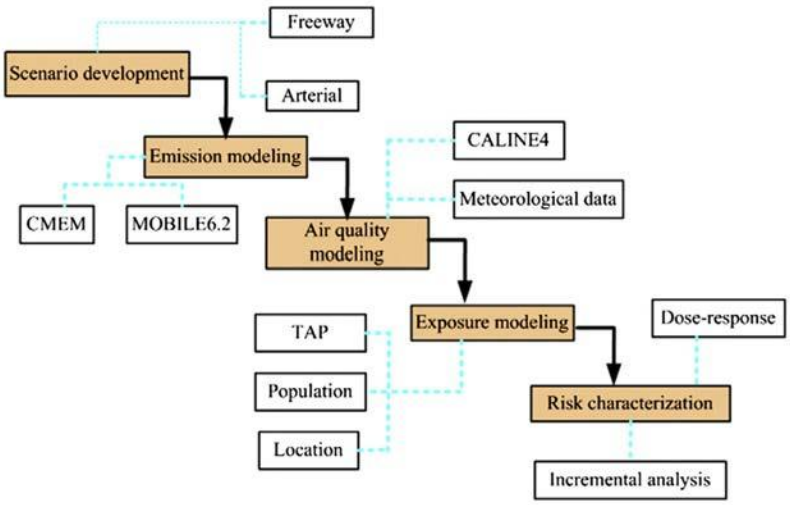


Fig. 1.

Diagram for modeling health risks due to traffic and congestion (CALINE4, the California Line Source Dispersion Model version 4 CMEM, the Comprehensive Modal Emissions Model; MOBILE6.2, the Motor Vehicle Emissions Factor Model version 6.2; TAP, time activity pattern).

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

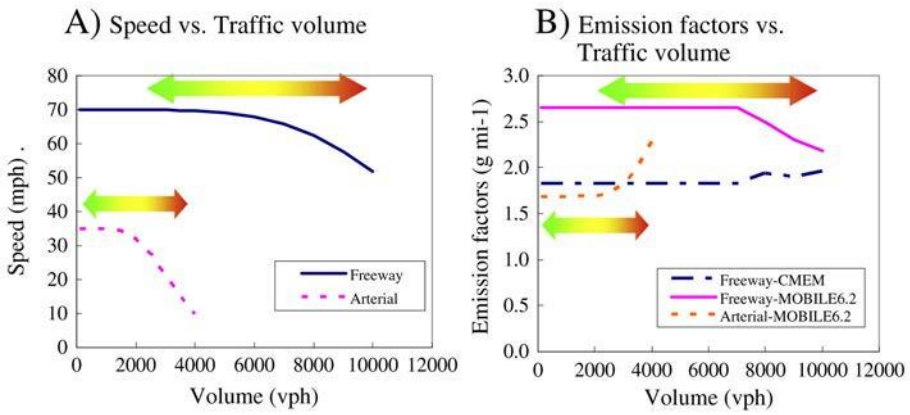


Fig. 2.

Predicted speed and NO_x emission factors versus traffic volumes for the freeway and arterial scenarios (green to red denotes free flow conditions to congestion).

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

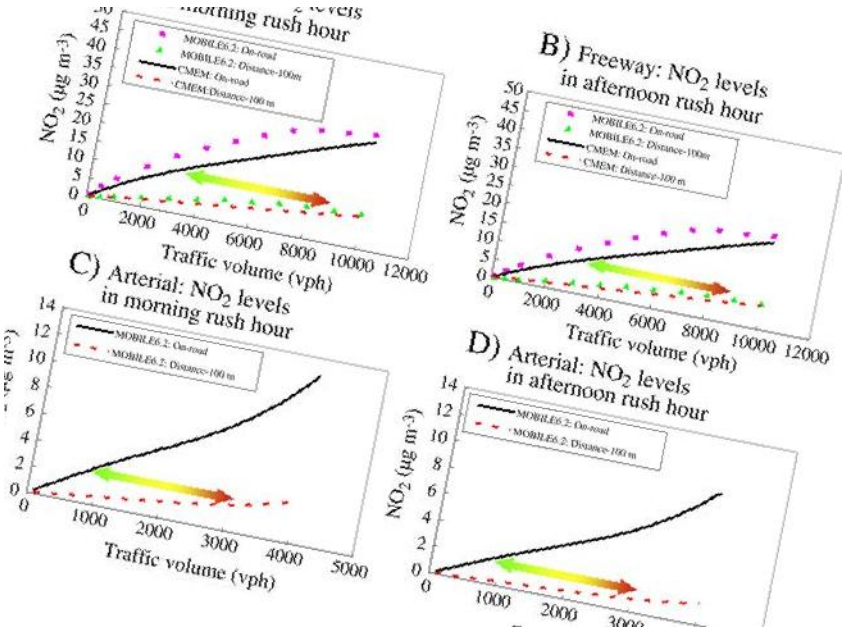


Fig. 3.

Predicted NO_2 concentrations versus traffic volume in the freeway and arterial scenarios (green to red, free flow conditions to congestion).

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

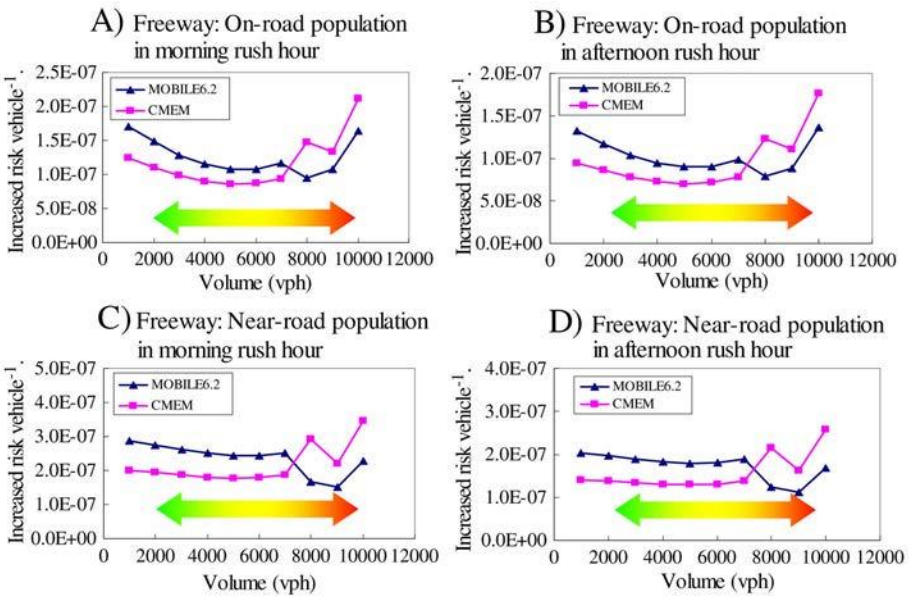


Fig. 4.

Predicted incremental risks per vehicle versus traffic volume for upper bound mortality in the freeway scenario (CMEM, estimated based on CMEM estimates; MOBILE6.2, estimated based on MOBILE6.2 estimates; near-road representing individuals living at 100 m to a highway; green to red, free flow conditions to congestion).

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

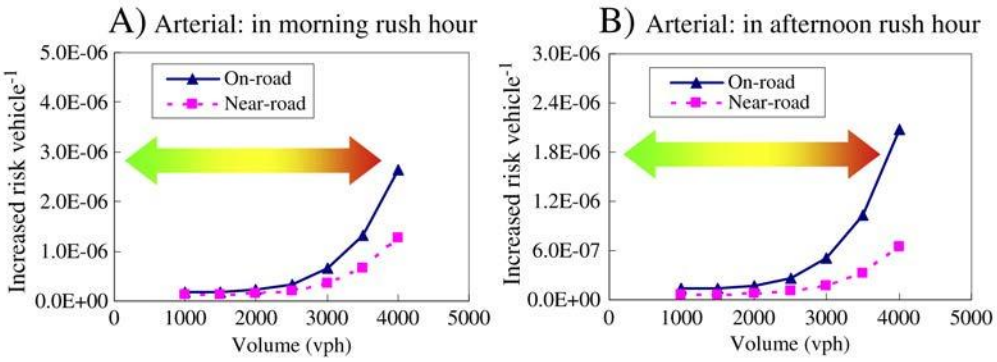


Fig. 5.

Predicted incremental risks per vehicle versus traffic volume for upper bound mortality in the arterial scenario.

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Table 1

Predicted short- and long-term health risks for selected receptors in the freeway scenario for different traffic volumes using CMEM emission estimates (EDA, emergency doctor visit or hospital admissions; unit: probability×10^{-6} day^{-1} $person^{-1}$ for EDA and probability×10^{-6} $year^{-1}$ $person^{-1}$ for mortality.).

Volume	On-road population				Near-road population[a]			
	Morning rush hours		Afternoon rush hours		Morning rush hours		Afternoon rush hours	
	EDA[b]	Mortality	EDA	Mortality	EDA	Mortality	EDA	Mortality
1000	6–67	0–130	5–50	0–98	10–104	0–203	7–73	0–142
2000	12–123	0–241	9–95	0–184	19–203	0–397	13–143	0–279
3000	16–174	0–339	13–135	0–262	28–299	0–583	20–211	0–412
4000	21–220	0–429	16–172	0–335	37–392	0–764	26–278	0–542
5000	25–264	0–515	20–208	0–405	46–483	0–942	32–344	0–672
6000	29–308	0–602	23–244	0–477	54–575	0–1121	39–411	0–803
7000	34–357	0–696	27–284	0–554	63–670	0–1307	45–482	0–940
8000	41–433	0–844	33–347	0–678	77–820	0–1599	56–592	0–1155
9000	47–501	0–977	38–404	0–788	88–932	0–1818	64–675	0–1318
10,000	57–609	0–1189	47–494	0–965	105–1110	0–2165	76–807	0–1575

[a] Near-road population represents individuals living at 100 m to freeways here.

[b] Emergency doctor visit or hospital admissions.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Table 2

Predicted short- and long-term health risks for selected receptors in the freeway scenario using MOBILE6.2 emission estimates (unit: probability×10^{-6} day^{-1} $person^{-1}$ for EDA and probability×10^{-6} $year^{-1}$ $person^{-1}$ for mortality.).

Volume	On-road population				Near-road population[a]			
	Morning rush hours		Afternoon rush hours		Morning rush hours		Afternoon rush hours	
	EDA[b]	Mortality	EDA	Mortality	EDA	Mortality	EDA	Mortality
1000	9–94	0–183	7–71	0–139	14–150	0–293	10–105	0–205
2000	16–170	0–331	12–131	0–256	28–292	0–569	19–206	0–401
3000	22–235	0–459	17–184	0–360	40–425	0–830	29–302	0–590
4000	28–294	0–574	22–233	0–455	52–553	0–1080	37–396	0–773
5000	33–350	0–682	26–279	0–545	64–678	0–1323	46–488	0–952
6000	38–405	0–790	31–326	0–635	76–803	0–1566	55–581	0–1133
7000	44–465	0–906	35–376	0–734	88–932	0–1819	64–677	0–1321
8000	48–513	0–1001	39–416	0–813	96–1017	0–1985	70–741	0–1445
9000	54–568	0–1108	44–462	0–901	103–1095	0–2136	75–798	0–1557
10,000	62–652	0–1273	50–532	0–1038	114–1212	0–2364	83–885	0–1726

[a]Near-road population represents individuals living at 100 m to freeways here.

[b]Emergency doctor visit or hospital admissions.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Table 3

Predicted short- and long-term health risks for selected receptors in the arterial scenario using MOBILE6.2 emission estimates (unit: probability×10^{-6} day^{-1} $person^{-1}$ for EDA and probability×10^{-6} $year^{-1}$ $person^{-1}$ for mortality.).

Volume	On-road population				Near-road population[a]			
	Morning rush hours		Afternoon rush hours		Morning rush hours		Afternoon rush hours	
	EDA[b]	Mortality	EDA	Mortality	EDA	Mortality	EDA	Mortality
1000	9–96	0–187	7–73	0–142	6–68	0–133	3–33	0–65
1500	13–143	0–278	10–109	0–212	10–102	0–200	5–51	0–99
2000	19–198	0–387	14–152	0–296	13–141	0–274	7–70	0–136
2500	27–284	0–554	21–219	0–427	18–192	0–374	9–95	0–186
3000	43–451	0–880	33–350	0–682	27–281	0–548	13–140	0–274
3500	74–787	0–1536	58–614	0–1198	42–448	0–874	21–225	0–439
4000	138–1461	0–2851	108–1148	0–2240	73–772	0–1507	37–391	0–763

[a]Near-road population represents individuals living at 100 m to freeways here.

[b]Emergency doctor visit or hospital admissions.

Advance Service of Reply to OA 227 of 2025 | Naveen Solanki & Anr. vs Rail Land Development Authority & Ors. - Hon'ble National Green Tribunal, Principal Bench, New Delhi

From Abhishek Bhatra <abhishek.bhatra@zeus.firm.in>
Date Thu 7/3/2025 9:12 PM
To ankursoodoffice@gmail.com <ankursoodoffice@gmail.com>; JMA Law Offices <jmalawoffices@gmail.com>
Cc Sunil Tyagi <sunil.tyagi@zeus.firm.in>; Yeshi Rinchhen <yeshi.rinchhen@zeus.firm.in>; Juvas Rawal <juvas.rawal@zeus.firm.in>

Dear Ma'am/Sir,

We represent the Respondent No.1 i.e., Rail Land Development Authority, in the captioned matter. Please find attached herewith the copy of Reply to be filed by the Respondent No.1 before the Hon'ble National Green Tribunal, Principal Bench - New Delhi.

Reply (R-1) to OA 227 of 2025.pdf

The contents of the "Reply" are self-explanatory. Kindly consider the present email alongwith its attachment as an advance service upon you.

Regards,

Abhishek Bhatra
Associate

Zeus Law

Contact: 2 Palam Marg, Vasant Vihar, New Delhi - 110057, India.
Phone: +91 11 4173 3090 Fax: +91 11 4173 3094
Website: www.zeus.firm.in

IMPORTANT: This document enjoys Attorney Client Privilege. The information in this message is confidential and legally privileged. It is intended solely for the addresses. Access to this message by any other person is illegal and not permitted. If you are not intended recipient of this message, any disclosure, copying, distribution or any action taken or omitted in reliance hereof is prohibited and may be unlawful. If you are not the intended recipient, please notify us immediately by telephone at +91-11-41733090 and delete this email transmission as soon as possible.

GO GREEN - Print only if necessary