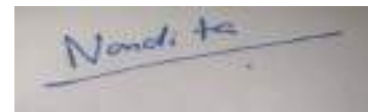


08.	Annexure P-5 True copy of the Mizoram State Action Plan on Climate Change	257-475
09.	Annexure P-6 True copy of the “Green Highways (Plantation, Transplantation, Beautification and Maintenance) Policy, 2015	476-492
10.	Annexure P-7 True copy of the Relevant portion of Uttarakhand State Action Plan on Climate Change	493-719
11.	Annexure P-8 True copy of the relevant chapter of the Disaster Mitigation and Management Centre Report	720-759
12.	Annexure P-9 True copy of the Geological Survey of India Report of Uttarkashi, 2014	760-767
13.	Annexure P-10 True copy of the Relevant part of Governance for Sustaining Himalayan Ecosystem Guidelines & Best Practices) issued by Ministry of Environment, Forest and Climate Change in association with G.B. Pant National Institute of Himalayan Environment & Sustainable Development	768-788
14.	Annexure P-11 True copy of the relevant part of ACTION PLAN FOR HIMALAYA issued by G.B. Pant National Institute of Himalayan Environment & Sustainable Development	789-854

15.	Annexure P-12 True copy of THE TRAINING MODULE ON COMPREHENSIVE LANDSLIDES RISK MANAGEMENT by National Institute of Disaster Management (NIDM)	855-1160
16.	Annexure P-13 True Copy of POLICIES TO MAINSTREAM ADAPTATION TO CLIMATE CHANGE AND FOR SUSTAINABLE DEVELOPMENT IN THE HIMALAYAS	1161-1171
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**BEFORE THE NATIONAL GREEN TRIBUNAL,
SITTING AT KOLKATA
ORIGINAL APPLICATION NO OF 2023**
(Under Section 14 of the National Green Tribunal Act, 2010)

IN THE MATTER OF:

PI VANRAMCHHUANGI

.....**APPLICANT**

VERSUS

UNION OF INDIA AND OTHERS

.....**RESPONDENTS**

SYNOPSIS CUM LIST OF DATES

That by way of the present application filed under section 14 r/w Section 15 and Section 18 (1) & (2) of the National Green Tribunal Act-2010 (hereinafter referred as NGT Act) by the aggrieved applicant being person interested in the protection of Biodiversity, Ecology, Environment of hills of Mizoram.

It is submitted that the present petition is being filed in public interest to ensure that the widening to 2 Lane of NH-54 between Km 431/00 to Km 562/00 in the State of Mizoram (hereinafter referred to as the 'NH-54 within Mizoram project') does not cause a man-made disaster, and affect the ecology as well as human lives in the state of Mizoram. It is also being filed to make certain that all necessary precautions are taken to avoid such a scenario.

It is respectfully submitted that recognizing the current inadequate transportation infrastructure facility in the State of Mizoram, Ministry of Roads Transport and Highway,

5

Government of INDIA has prioritized to take up for up gradation and improvement of NH54 from Km 431/00 to Km 562/00 to 2 lane NH standard in Mizoram.

That as per the Detailed Project Report for NH-54 from Km 431/00 to Km 562/00, the project Project Corridor takes off from Lunglei district near Tawipui North Village-2 at Km 431+00 and runs towards southern direction passes through a number of villages like Tawipui North-2, Tawipui North-1, Tawipui South , Thingfal , Thingka , AOC, Saika , Chawntlangpui , Sihtlangpui , Kawlchaw , Zero point , Maubawk , Theiva , Theihri , Tuipang village and Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.

That as per the Detailed Project Report for NH-54 from Km 431/00 to Km 562/00, the alignment of the project road passes through mountainous and steep terrain. It is also pertinent to mention here that as per the said Detailed Project Report the Geological and Geo technical investigation indicate that proposed road alignment is passing through hard rock area and as such to widen the road in these stretch control blasting is needed.

6

That applicant has also learnt from the detailed project report that about 43.2 million cum of spoil will be generated due to widening of this road. Only 5.00% of the spoil will be reused during construction of the road rest will be disposed off in an environmental friendly manner.

Further, as per the detailed project report the consultant has identified 62 disposal sites but which are not sufficient to accommodate the spoil. More sites need to be identified based on consultation with communities.

That as per the Detailed Project Report, process for obtaining forest clearance is in the hand of the concerned authority of Government of Mizoram which will be then submitted to the Ministry of Environment and Forests, Government of India shortly under clause 2.5 of forest clearance 1980.

It is also respectfully submitted that apart from the said project, applicant has learnt that State of Mizoram is also carrying similar types of road widening project at other parts of State of Mizoram also.

It is submitted that during construction of road under the said project, the debris/muck is being directly thrown along the slopes next to the road. The debris then slides down directly into the river. This process will be much faster with the onset of monsoons, thereby causing concerns of an impending disaster in the form of landslides and flooding. Indiscriminate muck dumping into the river also raises concerns about excessive pollution in the river and alteration of its course, hence the present Original Application.

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**BEFORE THE NATIONAL GREEN TRIBUNAL,
SITTING AT KOLKATA
ORIGINAL APPLICATION NO OF 2023**

(Under Section 14 of the National Green Tribunal Act, 2010)

IN THE MATTER OF:

PI VANRAMCHHUANGI

.....APPLICANT

VERSUS

UNION OF INDIA AND OTHERS

.....RESPONDENTS

MEMO OF PARTY

PI VANRAMCHHUANGI

Chaltlang Dawrkawn
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.....Applicant

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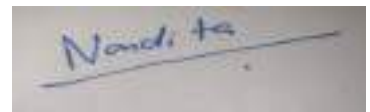
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protection of Biodiversity, Ecology, Environment of hills of Mizoram.

JURISDICTION OF NATIONAL GREEN TRIBUNAL

04. It is respectfully submitted that the, Applicant has filed the present Original Application seeking, inter alia, issuance of directions to Respondents to forthwith submit a time-bound muck disposal plan at the earliest and bar them from continuing with construction of road until proper disposal of muck already generated is undertaken.

05. It is respectfully submitted that this Hon'ble Court has the Jurisdiction to adjudicate the present Original Application as the following are the substantial questions relating to environment:

- i.** Whether or not it is the duty of the Respondents to act as per the recommendations of National Action Plan on Climate Change?
- ii.** Whether or not it is the duty of the Respondents to act in accordance with the recommendations of the Mizoram Action Plan on Climate Change?

- iii.** Whether or not it is the duty of the Respondents to act in accordance with the National Mission for Sustaining Himalayan Ecosystem?
- iv.** Whether or not there is a necessity of having proper and effective MUCK DISPOSAL FACILITY before starting excavation of hills for the purpose of Road Widening?
- v.** Whether or not Respondents are in violation of various provisions of The Environment (Protection) Act, 1986?
- vi.** Whether or not Respondents are in violation of the Construction and Demolition of Waste Management Rules 2016.

It is respectfully submitted that as per section 3 of The Environment (Protection) Act, 1986, Respondents are duty bound to protect and improve the quality of the environment, but in the present case Respondents while carrying out Road widening activities have failed to act according to the letter and spirit of section 03 of The Environment (Protection) Act, 1986.

Needless to mention here that The Environment (Protection) Act, 1986 is mentioned in Schedule I of the National Green Tribunal Act. Hence, it is clear from the above mentioned facts and circumstances that this Hon'ble Tribunal has the jurisdiction to entertain the present Original Application.

CASE SYNOPSIS

- 06.** It is submitted that the present petition is being filed in public interest to ensure that the widening to 2 Lane of NH-54 between Km 431/00 to Km 562/00 in the State of Mizoram (hereinafter referred to as the 'NH-54 within Mizoram project') does not cause a man-made disaster, and affect the ecology as well as human lives in the state of Mizoram. It is also being filed to make certain that all necessary precautions are taken to avoid such a scenario.
- 07.** It is respectfully submitted that recognizing the current inadequate transportation infrastructure facility in the State of Mizoram, Ministry of Roads Transport and Highway, Government of INDIA has prioritized to take up for

up gradation and improvement of NH54 from Km 431/00 to Km 562/00 to 2 lane NH standard in Mizoram.

08. That as per the Detailed Project Report for NH-54 from Km 431/00 to Km 562/00, the project Project Corridor takes off from Lunglei district near Tawipui North Village-2 at Km 431+00 and runs towards southern direction passes through a number of villages like Tawipui North-2, Tawipui North-1, Tawipui South , Thingfal , Thingka , AOC, Saika , Chawntlangpui , Sihtlangpui , Kawlchaw , Zero point , Maubawk , Theiva , Theihri , Tuipang village and Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.

09. That as per the Detailed Project Report for NH-54 from Km 431/00 to Km 562/00, the alignment of the project road passes through mountainous and steep terrain. It is also pertinent to mention here that as per the said Detailed Project Report the Geological and Geo technical investigation indicate that proposed road alignment is passing through hard rock area and as such to widen the road in these stretch control blasting is needed.

10. That applicant has also learnt from the detailed project report that about 43.2 million cum of spoil will be generated due to widening of this road. Only 5.00% of the spoil will be reused during construction of the road rest will be disposed off in an environmental friendly manner.

11. Further, as per the detailed project report the consultant has identified 62 disposal sites but which are not sufficient to accommodate the spoil. More sites need to be identified based on consultation with communities. This remaining earth shall be disposed off in an environmentally suitable manner. Certain guidelines for debris disposal are given below:

- a.** The debris generated shall be disposed of within designated areas only.
- b.** The filled up area shall be used for designated purposes such as: Play ground, Truck Lay-by, short relocation & realignment portion.

12. That as per the Detailed Project Report, process for obtaining forest clearance is in the hand of the concerned authority of Government of Mizoram which will be then submitted to the Ministry of Environment and Forests,

Government of India shortly under clause 2.5 of forest clearance 1980.

True copy of the Detailed Project Report for widening to 2-Lane of NH-54 between Km 431/00 to Km 562/00 in the State of Mizoram is annexed and marked hereto as Annexure P-1.

13. It is also respectfully submitted that apart from the said project, applicant has learnt that State of Mizoram is also carrying similar types of road widening project at the following places:

- Package II (51 Km) – Existing 65 Km-125 km – 16 spoil bank only
- Package III (40 Km) – Existing 125 Km-165 km – No spoil bank
- Package IV (43 Km) – Existing 165 Km-208 km – 24 spoil bank only
- Package V (34.5 Km) – Existing 208 Km-250 km – No spoil bank
- Package VI (48 Km) – Existing 250 Km-298 km – 25 spoil bank only
- Package VII (48 Km) – Existing 298 Km to 338 km – 09 spoil bank only

- Package VIII (41 Km) – Existing 339 Km to 380 km –
25 spoil bank only

14. It is submitted that during construction of road under the said project, the debris/muck is being directly thrown along the slopes next to the road. The debris then slides down directly into the river. This process will be much faster with the onset of monsoons, thereby causing concerns of an impending disaster in the form of landslides and flooding. Indiscriminate muck dumping into the river also raises concerns about excessive pollution in the river and alteration of its course.

Original photographs showing illegal and unscientific disposal of muck and excavated ballistic material are annexed hereto and marked as Annexure P-2.

15. It is further submitted that under the said project there is unnecessary and indiscriminate falling of trees in huge numbers, which is not accurately quantifiable since forest clearances have been applied for in segments.

16. That various scientific research papers, the Supreme Court expert body report and the National Institute of Disaster Management (henceforth NIDM) report have noted that

during the June 2013 disaster in Uttarakhand, a major factor triggering massive devastation was muck dumping into the river during the construction of Alaknanda hydropower project by GVK. Based on these findings, GVK builders, the project proponent, was fined Rs 9 crore for the devastating effects of illegal muck dumping. Despite numerous reports underlining the requirement of a muck disposal policy during road construction in a hilly terrain, and debris being held responsible for triggering landslides in various scientific reports, the respondent has failed to bring out a proper muck disposal policy. The respondent is also dumping the debris along the slopes and into river beds.

VIOLATIONS OF LEGAL REQUIREMENTS IN NH-54

PROJECT

- 17.** That applicant herein also wishes to point out that National Institute of Disaster Management in its report titled as “Uttarakhand Disaster 2013 Report” has also pointed out about the aspect of ECOLOGICAL DISTURBANCE due to CONSTRUCTION OF ROADS in HILLY TERRAIN. For the

sake of convenience of this Honble Court, relevant part of the said report is reproduced hereinbelow:

"Road Construction:

In the hilly terrain, the construction of roads is the main factor disturbing the ecological balance. It also causes serious damage to drainage pattern (both underground and surface), increases soil erosion, and leads to mass movement of the soil and rocks. The problem accelerates further, if the road construction is carried out without taking into consideration the geological, geomorphological, ecological aspects and drainage. The major destruction due to road construction is the result of ignoring all these important aspects. Road construction leads to excavation of steep and unstable slopes, felling of trees, dumping of debris down the slope resulting into damage to drainage system of the area. *Road construction is very damaging in hilly terrain, particularly in sensitive zones like Himalaya. Scientists have estimated the erosion from road sites to be ten times more than from agricultural fields, 200 times more than grass land*

and 2000 times more than forest cover: One kilometer length of road constructed on hilly terrain requires removal of approximately 60, 000 cubic m of debris from the site. Unfortunately, in Uttarakhand, most of the roads are constructed _without giving much consideration to such important issues resulting into increased instability and thus vulnerability to landslides."Emphasis supplied ...

True and correct copy of the relevant chapter of the National Institute of Disaster Management Report on the Uttarakhand Disaster 2013 is annexed herewith and marked as ANNEXURE P-3.

18.That it is respectfully submitted that as per the Detailed Project Report of “NH-54 within Mizoram” project, it has been estimated that about 43.2 million cum of spoil will be generated due to widening of the said road. As per the Detailed Project Report 62 disposal sites has been identified are not enough to accommodate the spoil, hence it is mentioned that remaining earth shall be disposed off in an environmentally suitable manner. Certain guidelines for debris disposal are given below:

- a.** The debris generated shall be disposed of within designated areas only.
- b.** The filled up area shall be used for designated purposes such as: Play ground, Truck Lay-by, short relocation & realignment portion.

19. It is submitted that according to the terms laid down by the Ministry of Environment, Forest and Climate Change, the respondents are bound to remove the muck excavated during the construction of the project as per the Muck Disposal Policy, under the watch of the Divisional Forest Officer. They are also bound not to dispose of the excavated muck at any other site apart from the allocated places. However, the respondent has been unable to make a muck disposal policy for the said project and illegal dumping of muck is being done in contravention of the terms of approval for diversion of forest land.

20. It is respectfully submitted that Central Government Rules for Management of Construction and Demolition Waste provide the following:

"(4) (3) Waste generators who generate more than 20 tons or more in one day or 300 tons per

project in a month shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar and *shall submit waste management plan and get appropriate approvals from the local authority* before starting construction or demolition or remodeling work and keep the concerned authorities informed regarding the relevant activities from the planning stage to the implementation stage and this should be on project to project basis."

Emphasis supplied

21. That the Hill Road Manual developed by The Indian Roads Congress provides details of the structures and protective works to be constructed during construction of roads in a hilly terrain. The specifications of retaining walls, breast walls, etc. are provided in the manual.

True and correct copy of the relevant chapter of the Hill Road Manual is annexed herewith and is marked as ANNEXURE P-4.

22. That in the year 2009, India prepared and released the National Action Plan on Climate Change. It is worth

mentioning here that the plan consists of the following eight national missions:

1. National Solar Mission
2. National Mission for Enhanced Energy Efficiency
3. National Mission on Sustainable Habitat
4. National Water Mission
5. National Mission for Sustaining the Himalayan Ecosystem
6. National Mission for a Green INDIA
7. National Mission for Sustainable Agriculture
8. National Mission on Strategic Knowledge for Climate Change

23. It is respectfully submitted that under the National Mission for Sustaining the Himalayan Ecosystem the Union of India as well as the State of Mizoram are duty-bound to protect the Himalayan ecosystem.

24. It is respectfully submitted that in order to protect the Himalayan ecosystem, the State of Mizoram released the Mizoram State Action Plan on Climate Change which is duly approved by the Ministry of Environment, Forest and Climate Change, Union of India.

25. It is respectfully submitted that the relevant part of the Mizoram State Action Plan on Climate Change is reproduced herein below:

- a.** Mizoram is a state of rolling hills with about 21 major hill features running through the state; streams, deep gorges evergreen forests form part of the climate sensitive Himalayan ecosystem. The region is also very vulnerable to the impacts of a changing climate and sometimes faces wrath of freak weather events.
- b.** Due to the steepness of the hillsides, underground water retention is minimal, causing perennial water sources to dry up during this period.
- c.** State of Mizoram is located in a highly seismic zone (Zone V) as per the seismic zoning atlas of India and is prone to frequent earthquake shocks and subsequent hazards. The state also lies in the ecologically sensitive region of the northeast India.
- d.** Mizoram is a fragment of Lower Himalayan range with altitude ranging

from 500 m. to 3000 m. The hills are steep and are separated by the rivers which create deep gorges between the hill ranges. There are 21 major hill ranges with average height of 1000 ft to 2000 ft spreading across the state. The average height of the hills is about 900 meters with highest forest cover in the eastern region.

- e. Construction of Retaining Wall drains etc to prevent calamities, rehabilitate disaster victims as well as for restoration and repair works necessitated by natural disasters is required each year in the urban areas of Mizoram.

True copy of the Mizoram State Action Plan on Climate Change is annexed and marked hereto as Annexure P-5.

26. That applicant herein also wishes to appraise this Honble Court that as per the Mizoram State Action Plan on Climate

Change, under the Sustainable Habitat Mission, GREEN HIGHWAYS CONSTRUCTION is a key program.

27.It is respectfully submitted that Ministry of Road, Transport and Highways, Government of INDIA has issued a Policy titled as “Green Highways (Plantation, Transplantation, Beautification and Maintenance) Policy, 2015. That one of the objective of the said Policy is to arrest Soil Erosion at the embankments slopes.

True copy of the “Green Highways (Plantation, Transplantation, Beautification and Maintenance) Policy, 2015 is annexed and marked hereto as Annexure P-6.

28.That applicant herein also wishes to point out the Uttarakhand State Action Plan on Climate Change. It is respectfully submitted that the Uttarakhand Climate Change Action Plan also talks about the ecological problems associated with road construction in Hilly Areas. Relevant part of the same is reproduced herein below:

"Disturbance of geological strata

Operations such as blasting, excavation and chipping of mountain slopes to the desired accessibility are involved during road construction in hill areas. These operations often create geological disturbances in the mountains and set into motion dynamic forces causing the movements of slip zones, cracks, fissures and weak planes.

Hill face disturbance

Natural inclinations of hill faces are disturbed by road-cutting operations and downhill movement of landslide material and disposal of excavated mass from road construction degrades and defaces natural landscapes. The growth of vegetation is also affected by the loss of topsoil, which causes ecological imbalances.

Drainage pattern interruption:

The velocity of runoff downhill increases to a very large extent due to construction of bridges and culverts on the road as well as due to cutting for establishing proper communication systems. This leads to erosion of banks and is a threat to the existence of trees and vegetation on the hill slopes.

Sometimes lakes are formed by accumulation of debris from the excavated material and landslides. Such lakes that are formed divert the flow of water, causing significant destruction. In this way, natural drainage patterns are disturbed by road construction, which can result in devastating flash floods."

- 29.** It must be brought to the Hon'ble Court's attention that the Uttarakhand Action Plan on Climate Change specifically mentions that while proper muck disposal is a very important aspect of road construction, accumulation of debris from the excavation, as well as cutting of hills and disposal of muck into the water bodies, also cause siltation and pollution. Subsequently, there's significant impact on the flora and fauna of the surroundings.

True copy of the Relevant portion of Uttarakhand State Action Plan on Climate Change is annexed and marked hereto as Annexure P-7.

STUDIES THAT HIGHLIGHT THE URGENT NEED FOR ADOPTING PROPER ROAD CONSTRUCTION PRACTICES

- 30.** That debris disposal policy is an important aspect and the same should not be ignored. Applicant wishes to highlight

before this Honble Court that in its report titled as "Investigations in the areas around Okhimath in Rudraprayag district on the aftermath of landslide incidences of September, 2012 - A report," the Disaster Mitigation & Management Centre under the Department of Disaster Management, Government of Uttarakhand, has suggested the following on the issue of debris disposal:

"Debris disposal policy:

Unplanned and unscientific disposal of the excavated material along the hill slopes often initiates landslides besides causing loss of forest resources, agricultural land and water sources. *A clear cut policy for the disposal of excavated material is immediately required for the hills.* The cost of planned disposal of excavated material would then have to be made part of the routine budget of the developmental initiative. It might sound like additional financial burden but for larger good of the society provision for this would have to be made."

**True copy of the relevant chapter of the
Disaster Mitigation and Management Centre**

Report is annexed and marked hereto as Annexure P-8.

31. That Geological Survey of India Report of Uttarkashi, 2014, noted that slope failures have mainly occurred due to saturation of debris material after incessant rains. Some of the recommendations of the report were:

" ... c. Construction of breast wall/ retaining wall, along with adequate number of weep holes/ perforated pipes for draining out water thereby reducing the pore water pressure IS recommended.

d. For landslides caused due to toe cutting/erosion by the river, proper toe protection measures have to be adopted like constructing RCC/ retaining wall with deep foundation either on the sound bed rock or it should be lowered down below the scouring depth of river/ nala as per site geological or topographical conditions. Construction of gabion/ crate wall with deflectors for energy dissipation and to protect the structures from its impact.

As most of the damage occurred due to toe cutting of the structures located at or near river bed level (To-T1 level), it is advisable that such practices should be prohibited. *Construction of roads in such areas be planned carefully and excavation and stabilization work should be done concurrently, backfilling of the constructed wall should be done with proper compaction and providing lined toe drains, etc.* Drainage system improves life of structure because water is the main culprit as happened at Dharasu landslide and Kharadi landslide.

True copy of the Geological Survey of India Report of Uttarkashi, 2014 is annexed and marked hereto as Annexure P-9.

32. It is also important to mention here that in order to prevent further degradation of the Indian Himalayan Region and to enhance its Ecology and Biodiversity, the Ministry of Environment, Forest and Climate Change, in association with G.B. Pant National Institute of Himalayan Environment & Sustainable Development, has issued a Document namely Governance for Sustaining Himalayan

Ecosystem (Guidelines & Best Practices). The said document has recommended the following broad guidelines for the construction of roads in the Himalayan Region:

- "For construction of any road in the Himalayan region of more than 5 kms (including, extension/widening of existing roads) length where the same may not be tarred roads and environmental impact assessment is otherwise not required, environmental impact assessment should be carried out in accordance with the instructions to be issued for this purpose by the State Governments.
- Provision should be made in the design of the road for treatment of hill slope instabilities resulting from road cutting cross drainage works and culverts using bio-engineering and other appropriate techniques by including the cost of such measures in the cost estimate of the proposed road.

- Provisions should also be made for disposal of debris from construction sites in an appropriate manner at suitable and identified locations so as not to affect the ecology of the area adversely; further, the dumped material should be treated using bio-engineering and other appropriate techniques and the cost of such measures should be included in the cost estimate of the proposed road.
- Wherever hot mix plants are used, they should be set up at least 2 km away from settlements and a minimum area of 200 sq. m. surrounding the site should be devoid of vegetation.
- No stone quarrying should be carried out without proper management and treatment plan including rehabilitation plan and financial provision for rehabilitation of the site should be included in the cost of the management plan.

34

- All hill roads should be provided with adequate number of roadside drains and these drains shall be kept free from blockage for runoff disposal; in the event that this is not done and this fact leads to damages that could otherwise have been prevented, the persons responsible should be liable for prosecution/damages; further, the cross drains shall be treated suitably using bio-engineering and other appropriate technologies so as to minimise slope instability.
- The runoff from the roadside drains should be connected with the natural drainage system in the area.
- Fault zones and historically land slide prone zones should be avoided during alignment of a road, where for any reason it is not possible to do so, notice should be given providing full justification and the construction should be carried out only

after sufficient measures have been taken to minimize the associated risks.

- Notice should be given about all fault zones and landslide zones along the roads indicating the beginning and the end of such areas.
- Ridge alignment should be preferred to valley alignment.
- Alignment should be selected so as to minimise loss of vegetal cover.
- South or south-west alignment should be preferred to avoid moist areas.
- Appropriate design standards should be followed while designing the roads including mass balancing of cut and fill and avoidance of unnecessary cutting.
- Encouragement should be provided for use of debris material for local development."

True copy of the Relevant part of Governance for Sustaining Himalayan Ecosystem Guidelines & Best Practices) issued by Ministry of

Environment, Forest and Climate Change in association with G.B. Pant National Institute of Himalayan Environment & Sustainable Development is annexed hereto and marked as Annexure P-10.

- 33.** It is also important to mention here that in order to strengthen the mechanism of ecologically sound economic development of the Himalayas, the G.B. Pant National Institute of Himalayan Environment & Sustainable Development has prepared a comprehensive Document namely "ACTION PLAN FOR HIMALAYA".
- 34.** It is respectfully submitted that the said document has dedicated a full chapter on Transport and Communication, wherein the Institute has dealt with the pros and cons of road construction. As per the said documents, "Projects of expanding the road network should be carefully formulated. Road alignment should be worked out on the basis of geotechnical feasibility instead of the desire of the people, which is more often put forward and emphasized to serve political motives. Broadening and metalling of existing foot paths or bridle paths or cart road should be restricted.

Instead necessary changes in the design of vehicles for transport in the hills should be given priority".

True copy of the relevant part of ACTION PLAN FOR HIMALAYA is annexed issued by G.B. Pant National Institute of Himalayan Environment & Sustainable Development is annexed hereto and marked as Annexure P-11.

35. It is respectfully submitted that the Training Module on Comprehensive Landslides Risk Management prepared by NIDM that discusses the impacts of landslides on society and environment needs to be appreciated in this regard. It refers to the opinions of certain scholars on this subject:

" ... Bartarya and Valdiya, 1989 estimated that almost 50% of the landslides occur along the roads. Valdiya, (1987) reported that the incidences of landslides increase by 25 to 345 times due to road construction activities whereas Gupta (1990) estimated that each kilometer of road in hills require displacement of 40 to 80 thousand cubic meter debris ... "

In addition, the training module looks at examples from other countries to explain the role of debris in aggravating disasters:

"In Japan alone, an average of 90 lives are lost annually from debris flows (Takahashi, 1981). In 1970, a debris avalanche (a rapidly moving form of debris flow) triggered by an earthquake, completely destroyed the city of Yungay, Peru, killing an estimated 17,000 people and burying the whole city under 5m of mud and debris (Piafker and Erickson, 1978). Other countries with chronic losses from debris flows are USA, Indonesia, Tanzania, Norway, Sweden, Denmark, Costa Rica, China, Brazil, Ireland, Romania, Japan, Bangladesh, New Zealand, Russia etc."

The module also discusses various measures to mitigate the impact of landslides, ranging from simple vegetation to bio-technical processes. These measures can be undertaken specifically to ensure control, maintenance or/and removal of debris from the potential landslide risk zones.

**True copy of THE TRAINING MODULE ON
COMPREHENSIVE LANDSLIDES RISK
MANAGEMENT by National Institute of Disaster
Management (NIDM) is annexed hereto and marked
as Annexure P-12.**

36. It is also important to mention here that the Swiss Agency for Development and Cooperation (SOC), along with Indian Himalayas Climate Adaptation Programme (IHCAP), has published a book titled "Policies to Mainstream Adaptation to Climate Change and for Sustainable Development in the Himalayas". It is respectfully submitted that following is the finding of the said publication:

“ poorly-planned roads have often been held responsible for landslides that block the same roads, as well as for causing major damage to the ecosystem. Taking this into account, the NMSHE policy prescription is: Mandatory EIA for all roads longer than 5 km; align roads along ridges rather than river valleys; cost estimates for road construction to include mandatory treatment of hill slope instabilities resulting from road-cutting, cross

drainage works and culverts, disposal of debris at suitable and identified locations; norms for hot mix plant sites; all hill roads to provide adequate roadside drains and, wherever possible, be connected to the natural drainage system; alignment of proposed roads to avoid fault zones and landslide prone zones wherever possible; explore alternative forms of mass transport like railways and ropeways; enforce fuel quality standards and clean filters, especially for diesel vehicles

True copy of the publication titled POLICIES TO MAINSTREAM ADAPTATION TO CLIMATE CHANGE AND FOR SUSTAINABLE DEVELOPMENT IN THE HIMALAYAS is annexed hereto and marked as Annexure P-13.

37. That it is clear from the above mentioned facts and circumstances as well as from the annexed photographs that there is an urgent need to seriously take note of the magnitude and dimensions of the unscientific dumping of muck, including ballistic material.

38. That vide its Order dated 23rd July, 2015 passed in Original Application No. 498 of 2014, this Hon'ble Court has expressly observed that in case there is a specific violation of the National / State Action Plan on Climate Change, a case can be filed before this Hon'ble Court.

True copy of the Order dated 23rd July, 2015 passed in Original Application No. 498 of 2014 is annexed hereto as Annexure P-14.

39. That unscientific dumping of muck in the Himalayan region will lead to a huge number of problems, including soil erosion, landslides and other extreme climate events. This will also result in loss of habitats and biodiversity. Hence, there is an urgent need to assess the impact of loss of habitats and biodiversity due to unscientific dumping of muck.

40. That the balance of convenience is in favour of the applicant association and the ends of justice shall suffer if the relief as prayed is not granted.

41. That the applicant has not filed any other application or petition in any other court praying similar relief.

GROUND

- A.** Because unscientific dumping of muck and debris can lead to disaster of epic proportions, during or after the monsoons, similar to the tragic event of June 2013 in Uttarakhand.
- B.** Because in the construction of road under the said project the debris/muck is being thrown directly along the slopes next to the road. This is likely to slide down into the river during the monsoons, thereby increasing the possibility of flash floods and landslides.
- C.** Because this Hon'ble Court vide its Order dated 23rd July, 2015 passed' in Gaurav Kumar Bansal Versus Union of India and Others directed the State of Mizoram, among other States to comply with the directions issued by Ministry of Environment, Forest and Climate Change and to implement the same in accordance with their respective State Action Plan on Climate Change.
- D.** Because vide its Order dated 23rd July, 2015 passed in Original Application No. 498 of 2014, this Hon'ble Court has expressly observed that in case there is a specific violation of

the National *I* State Action Plan on Climate Change, a case can be filed before this Hon'ble Court.

E. Because the photos annexed with the present Original Application confirms that there is unnecessary and indiscriminate felling of trees in the road construction and widening process, causing irreversible damage to the ecology.

F. Because balance of convenience is in favour of the applicant association and the ends of justice shall suffer if the relief as prayed is not granted.

LIMITATION

It is respectfully submitted that the present Original Application is filed within Limitation as prescribed under section 14 of the National Green Tribunal Act-201. It is further respectfully submitted that the cause of action is still continuous as Respondents are disposing the Muck in the most unscientific and illegal manner, hence the present petition is filed within limitation.

PRAYERS

In view of the above mentioned facts and circumstances, this Hon'ble Court may graciously be pleased to


- a)** Set up an independent Commission of Experts, comprising reputed geologists, environmental rights activists, etc. to look into the issue and review the plan of muck disposal in the “NH-54 within Mizoram project”, as submitted by the Respondents.
- b)** Direct the respondents to establish that the road design conforms to the principle of mass balancing of cut and fill.
- c)** Bar the Respondents from undertaking any further widening work till the stability of the new slope is established.
- d)** Direct the Respondents to submit a time-bound muck disposal plan at the earliest and bar them from continuing with construction of road until proper disposal of muck already generated is undertaken as the same is not only effecting the biological diversity, ecology, flora fauna of the hills but is also affecting the riverine ecology.
- e)** Direct the Respondents to bring on record all the documents pertaining to diversion of forest land in the “NH-54 within Mizoram project” area, especially the total number of trees that will be cut, the hill slopes

expected to be cut, as well as the number of trees already cut.

- f)** Direct the State of Mizoram to restore the environmental damage in constructing the NHIDCL Project for widening and construction of the NH54.
- g)** Impose Environmental Compensation against State of Mizoram as per the polluter pays principle.
- h)** Pass any other Order or Direction as this Hon'ble Court may deem fit and proper.

**AND FOR THIS ACT OF KINDNESS THE APPLICANT AS
IN DUTY BOUND SHALL EVER PRAY.**

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GOVERNMENT OF MIZORAM PUBLIC WORKS DEPARTMENT



DETAILED PROJECT REPORT FOR WIDENING TO 2- LANE OF NH 54 BETWEEN KM 431/00 TO KM 562/00 IN THE STATE OF MIZORAM



DETAILED PROJECT REPORT

VOLUME - I: MAIN REPORT

OCTOBER - 2015



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MULTI MODAL PROJECT DIVISION-I

**GOVERNMENT OF MIZORAM
PUBLIC WORKS DEPARTMENT**

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**DETAILED PROJECT REPORT FOR WIDENING TO 2-LANE OF NH 54 BETWEEN
KM 431/00 TO KM 562/00 IN THE STATE OF MIZORAM**

Name of Road :NH-54 within Mizoram (KM 431+00 TO KM- 562+00)

Length of road : 122.636 Km

**VOLUME - I
MAIN REPORT
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EXECUTIVE SUMMARY

1. INTRODUCTION

Recognizing the current inadequate transportation infrastructure facility of the country and the vital role transportation sector plays in the accelerated economic growth of the country, the Government of India has placed a high priority in this sector's development to meet the current and future highway transportation needs.

The Ministry of Roads Transport and Highway, Govt. of India has prioritized to take up for up gradation and improvement of NH 54 from Km 431/00 to Km 562/00 to 2-lane NH Standard in Mizoram. The existing road has steep gradient and sharp curves/zigs at various stretches. It is of single lane road with formation width of 6.00 m to 6.50 m without conforming any standard / specification. As a result, the heavily loaded trucks and large sized vehicles find it difficult to pass through these stretches safely.

The Project Corridor takes off from Lunglei district near Tawipui North Village-2 at Km 431+00 and runs towards southern direction passes through a number of villages like Tawipui North-2, Tawipui North-1, Tawipui South, Thingfal, Thingka, AOC, Saika, Chawntlangpui, Sihtlangpui, Kawlchaw, Zero point, Maubawk, Theiva, Theihri, Tuipang village and Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.

The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International Trade Road between India & Myanmar. NH 54 B is also branching from Km 519.200, which is serving as Saiha District connecting Highway and a number of villages which are located in the area adjoining to this road are also heavily dependent on this road for their social and economic development. Thus, the importance of this road and hence the role it plays for the upliftments of the region needs no more emphasis. And, its importance is further enhanced by the requirement of law and order maintenance as these areas are very remote where unlawful activities are of frequent occurrence. Over and above, being located in the fertile region, large quantities of fruits and vegetables are produced annually, which provides sustainable economy for many villagers. This is an important road and life line for the people of the Southern Districts of Mizoram. It is very essential for improvement & up-gradation of existing NH-54 conforming to National Highway Standards.

2. PROJECT BACKGROUND

The existing NH-54 was originally constructed as ODR Standard Road during the early part of seventies. It was constructed by the BRO. The road was constructed to provide connectivity to Southern Districts of Mizoram. The road was upgraded to the status of National Highway in the year 1980. No substantial improvement of the road other than normal renewal works have been carried out since the road was declared a National Highway. The pavement work and the permanent works of retaining wall and cross drainage structures were done at the time of construction as an ODR standard road and

the width of the cross drainage structures are also only 6.50 m. Most of the retaining wall /wing wall had been collapsed and the road formation width also breaches at many stretches.

3. PROJECT ROAD

The stretches of the road under this report is between 431/00 Km to 562/00 Km of NH 54 as per existing chainage required for up gradation & improvement to standard 2 lane. In this portion of proposed highway, about 25 % length of road passes through heavily built-up areas which involve costly Land Acquisition and serious resettlement problems in the existing road. The existing alignment also passes through steep terrains which are unstable and landslide prone area at many locations which could also posed serious problems in future.

The proposed realignment of the existing road from Km 535+070 to Km 539+330 at Theiva village to avoid the sharp zig of existing road and Lawngtlai Bye Pass from Km 473+300 to Km 478+400 as per existing chainage , which include 4.40 Km stretch of Multi Model Transit Route & 1.92 Km new alignment to avoid the movement of heavy vehicle traffic & traffic conjunction within the built-up portion of Lawngtlai city.

The proposed realignment take off points are very near due to which ,it will not effected and deprived the connectivity with villages and hence, the villagers would be the beneficiaries with the proposed alignment. Therefore, the proposed re-alignment does not passes through heavily built-up area and would involve much less Land Acquisition cost as well as resettlement problem as compared to the existing alignment. The re-alignment also passes through an area with a much better topographical as well as soil conditions. Hence, apart from the reduction in distance between Lunglei and Tuipang, which would greatly benefit both the neighbouring countries in terms of vehicle operating cost and travel time, the proposed re-alignment is technically far better and financially cost effective in the long run.

Land use

As per Right of way of proposed 2 land standard alignment 210.50 Ha land is required. About 78.50% length of the road passes through land owned/developed by individuals land holders under periodic patta and LSC pass , 11.50 % length of the road passes through forest & 10.00% length of the road passes through other . This land will not be available free of cost and also compensation for plantations, crops etc. within the required corridor is to be paid to each individuals. About 24.35% length passes through habited area.

OBJECTIVE OF THE PROJECT AND SCOPE

a) Objective of the project :

The stretches of the road under this report is between 431/00 Km to 562/00 Km of NH 54 as per existing chainage required for up gradation & improvement to 2 lane standard

In order to improve 131 km stretch of existing road to standard 2-lanes, some stretches of the road will have to be re-aligned whereas some existing stretches can be improved to conform to National Highway Specification in respect of its gradient, curves, super

elevations etc. Since the proposed Widening to 2-lane with geometric improvement and re-alignment of NH-54 is passing through steep terrain, gorges, nallah etc. Many number of Retaining wall, Breast Walls, Culverts etc have to be constructed.

b) The Scope of the Project

The scope of work includes:-

- I. Up-gradation of the existing road, having formation width of about 6.50m to a formation width of 12.0m.
- II. Geometric improvement of existing road by short relocation
- III. Realignment at the existing road from Km 535+070 to Km 539+330 at Theiva Village.
- IV. Lawngtlai Bye Pass 1.92 Km, Take of point at Km 4.40 of Multi Model Transit Route to Km 475+500 on NH 54 near BRO Camp.
- V. New construction, re-construction of cross-drainage works, protection works and side drains along the whole stretch.
- VI. New Construction of pavement on full stretch as flexible pavement (GSB+WMM+DBM+BC).
- VII. Road signs, stones, safety measures, etc along the whole stretch.

c) Detailed project report consisting of the following:

- Conduct surveys of the existing alignment and collect inventory data.
- Conduct detailed reconnaissance survey and collect relevant data as well as the remote sensing data.
- Conduct detailed topographical, geotechnical / geological, hydrological and environmental surveys on selected alignment.
- Carry out detailed survey for construction materials
- Preparation of detail alignment drawings and geometric designs and prepare cost estimates
- Analyse the traffic census collected by the Department and conduct economic evaluation of various alternatives
- Analyse various alternatives and recommend the most appropriate for detailed design.
- Prepare Detailed Project Reports covering the following :
 - Main Report
 - Design Report
 - Cost Estimate
 - DPR Drawing
 - Land Acquisition & Utility Shifting Details.

4. ENGINEERING SURVEYS AND INVESTIGATIONS

Detailed engineering surveys and investigation have been carried out along the selected alignment of the project road and major findings are as given below:

a) Terrain:

The alignment of the project road passes through mountainous and steep terrain exceeding 30 % ground slope across the alignment.

b) Rainfall:

The proposed road is in heavy rainfall area. Monsoon period is between May and September when construction work is practically impossible.

c) Topographical Survey:

The topographical survey was conducted with Total Station and Auto Level Bench Marks were established at every kilometer and cross-section levels were recorded at 20m intervals in straight portions in general and at closer intervals at curves and where required. The topo-survey information was then translated into digitized topographical map using suitable mapping software.

d) Alignment & Road Design:

The general alignment of the road under this project is as:

NH 54 Highway	from Km 431 /000 to 553/604	Km as per design Chainage
Existing alignment	:	120.026 Km
Re-alignment	:	2.610 Km
Total length of proposed road	:	122.604 Km
Lawngtlai Bye Pass	:	1.92 Km
Total Length of project road	:	

Road is designed for 2-Lane (12.00 m roadway with 7.00 m carriageway).

Gradient, being the most important parameter, has been the guiding factor. Ruling gradient less than 5.0% has been achieved in most point of the road and the maximum gradient being 7.0 % at few selected unavoidable stretch.

e) Realignment of existing road:

For improvement of existing road some stretches relocation and re-grading are proposed due to which traffic movement on existing road would be disturbed. Permanent diversion will be included in the design as to minimizing the structure damage, reducing cost of resettlement and easy and faster movement of vehicles. Details of re-alignment is as follows

Sr. No.	Name of Village	Design Chainage		Existing Chainage		Length in Km
		From	To	From	To	
1	Theiva village	530+470	533+080	535+070	539+330	2.610
Total						2.610

f) Bye Pass of Existing Road for Lawngtlai City:

The proposed Lawngtlai Bye pass take off from Km 470+50 of NH 54 and merging with NH 54 at Km 475+550 near BRO Camp. Lawngtlai Bye pass, which include 4.40 Km stretch of Multi Model Transit Route & 1.92 Km new alignment to avoid the movement of heavy vehicle traffic & traffic conjunction within the built-up portion of Lawngtlai city. Lawngtlai is the district headquarters of Lawngtlai district in the state of Mizoram . It is also the headquarters of Lai Autonomous District Council. Lawngtlai city spread is about 5.0 Km stretches length along the NH 54 both side. Within the city most of the stretches width of the existing road formation are varies from 9.0 m to 8.0 m. & nos of sub standard

curve .Entire lawngtlai city markets, prominent building, Church & residential builds are along the NH 54. Therefore within the city, improvement of road geometry for NH 2 lane standard is practically impossible because it will be raise up huge Compensation, rehabilitation & settlement issue. However with available formation width of existing road within city will be possible for minor improvement of existing road geometry & carriage way for 2 lane standard with cover drain. So that commercial passenger vehicle & Light vehicle will be smoothly plying within city, which will benefit for commercial & social development of Lai Autonomous District Council. The proposed Bye pass will be used for heavy vehicle traffic & through traffic and to traffic conjunction within city.

g) Soil:

The soil along the alignment of the project is fairly homogenous in nature and character. Soil types vary from silty clay to sandy clay of medium plasticity, plasticity index varying from 7 to 18. The soaked CBR value ranges from 6 to 8.

h) Construction Material and Stones:

The rock deposits are available along or the vicinity of the project road alignment. Besides, cobbles, pebbles and sand deposits are available in the rivers or streams crossing the main alignment. Construction materials for GSB, Cross drainage & Masonry R/Wall etc. works, will be available at local quarry within the project corridor and WMM, DBM & BC material from Tuipui River at Kawlchaw on NH 54 at Km 506 and Liapha on Multi Model Transit Route .Water Absorption and AIV of these quarries are within the limit of the Ministry's Specifications. Bitumen will have to be taken from Guwahati, steel and cement from Aizawl.

5. TRAFFIC SURVEY, ANALYSIS & FORECAST

This is to assess the capacity requirements, pavement design, identify present and likely future traffic conditions and to have provisions for future improvements.

From traffic volume counts the following observations are made,

Location	Average daily traffic intensity (PCU)	Average daily traffic intensity (CVD)	peak Hour Traffic Nos/PCU	Peak Hour Traffic ratio in %	Time of Peak Traffic
Lawngtlai	1166	312	462/569	7.31	09-10
Zero Point	813	228	367/451	8.47	09-10

- (i) There are large numbers of Cars and Auto Rickshaw using the road (42.00%).
- (ii) Traffic is dominated by the passenger vehicles (cars and two wheelers).
- (iii) The heavy vehicle traffic (19.88%) as compared to the passenger traffic (42.00%).

Capacity analysis is fundamental to the planning, design and operation of roads and provides among other things the basis for determining the carriageway width to be

provided at any point in a road network with respect to the volume and composition of traffic. It is also a valuable tool for evaluation of the investments needed for future road construction and improvements and for working out priorities between competing Projects. The NH road has been considered for two lanes.

- Therefore, No of commercial vehicles per day for design taking into consideration 7.5% per annum growth rate and a pavement life of 15 years
- After 15 years design life PCU per day : 4956
- Design road capacity (Service volume) for hill road for high curvature (above 200 degrees per Km) for 2 lane ,greater than 4500 PCU
- Hence existing road need to be upgrade for 2 lane standard

6. SALIENT FEATURES OF THE PROJECT

Salient Features

Salient features based on design are as below:

- Length of Project Road Sector 122.636Km
- The road has a ROW of 24.00 m at open area & 20.00 m at built up area
- The formation width is 12.0m
- The Highway is designed for 2-lane carriageway of 7.0 m width.
- The Highway is designed with flexible pavement
- Paved shoulders of 2.50 m are provided both sides.
- All structures are matching to 2 lane NH roadway standard.
- Route Alignment: The Project Corridor Takes off from Lunglei district near Tawipui North Village-2 at Km 431+00 then passes through the 13 Nos of villages & Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.
- Lawngtlai Bye Pass 1.92 Km, Take of point at Km 4.40 of Multi Model Transit Route to Km 475+550 on NH 54 near BRO Camp.
- Drains: Lined Drain.
- Landslide : 40 Nos.
- Junction - 45 Nos., Major Junction - 6 & Minor Junction - 39 Nos
- Bridges - 1 Nos. Existing PSC Bridge over Tuipui River at Kaulchaw
- Items for Road Safety, Roadside Amenities and Road Furniture are provided.

a) Cross Section Elements:

The design standards of relevant Indian Roads Congress for Roads and Bridges are adopted for cross section designs of the project road. The earlier items of construction may involve construction of the road formation, cross-drainage works including construction of major bridges for 2-lane standard and protection works. The later stage of the

construction will cover the construction of Pavement for double lane (7.00 m wide) NH standard. The proposed cross section element with dimensions is shown in table below:

Sl.No.	Design elements	Dimensions
1	Roadway width	
	At roads and culverts*	12.00 m & 10.80m
	At bridges**	10.50m
2	Carriageway width	7.00 m
3	Cross slopes/Camber at straight reaches	2.5%

*Roadway width is inclusive of side drain and parapet wall/crash barrier (IRC SP: 48)

**Roadway width is exclusive of kerbs

b) Road Geometry:

The project corridor passes through steep and mountainous terrain. The design speed adopted is 30km/hour (IRC SP: 48). Along the proposed alignment, there will be no hair-pin bend. However minimum design speed has been considered on technical grounds. The vertical and horizontal alignments of the proposed road can be summarized as shown in table below:

Project Road length	No. of Curves with Design Speed in km/h				No. of Curves with Radius (m)		
	<30	30-40	40-50	>50	<30	30-50	>50
122.636 km	308	904	215	72	27	716	756
1.92 km	5	12	2	2	0	10	11

Project road length	Length Distribution (km) and Gradient Class				
	<4%	4%-5%	5%-6%	6%-7%	7%-8%
122.636 km	77.376 Km	22.750 Km	13.170 Km	9.200 Km	0.140 Km
1.92 km	-	-	-	1.920 Km	-

c) Design of Embankment / Hill Cutting

Considering the physical features, particularly the terrain, soil classification and hill slope line, typical cross-section (Type 1F to Type 49F) have been developed for hill road cutting / embankment building.

Concept Plan of the design of the embankment / hill cutting (stretch-wise) has been developed with specific mention of the formation building methodology / type to be adopted.

There are 2 Nos. of ridge line in proposed alignment
Km 449+400 to Km 449+800 and Km 475+300 to Km 475+600

d) Land Slide Prone Area

Major land slide prone areas were not noticed during the field visit to the project stretch. However some minor land slide was noticed in following locations

Km 463+052 to Km 463+247, Km 507+800 to Km 507+870, Km 539+510 to Km 539+530 and Km 540+980 to Km 541+060

e) Hard Rock Area for Blasting

Geological and geo- technical investigation indicate that proposed road alignment is passing through hard rock area from Chainage 436580 to 436610 , 437130 to 437200 , 437640 to 437665 , 441070 to 441110 , 441420 to 441500 , 459300 to 460280 , 461160 to 461260 , 461540 to 461780 , 461920 to 462010 , 462200 to 462270 , 462800 to 463190 , 465550 to 465620 , 465830 to 465860 , 465950 to 466010 , 466120 to 466160, 466220 to 466310 , 467640 to 467700 , 468430 to 468490 , 469655 to 469760 , 474440 to 474470 , 476870 to 477090 , 477580 to 477650 , 478640 to 478710 , 484200 to 484230 , 484300 to 484360 , 484445 to 484525 , 484540 to 484580 , 485290 to 485325 , 487145 to 487400 , 487480 to 487560, 487720 to 487920 , 488000 to 488100 , 488665 to 488700 , 494430 to 494580 , 502360 to 502470 , 502660 to 502790 , 509010 to 509035 , 512730 to 512755 , 513020 to 513045 , 513115 to 513160 , 521400 to 521490 , 524670 to 525120 , 525170 to 525415 , 528340 to 528390 , 538870 to 538950 and 550885 to 550920. To widen the road in these stretch needs control blasting to avoid the damage of cultivated land on downhill side & nearby built area.

f) Dumping area identified on the Proposed Road

It has been estimated that about 43.2 million cum of spoil will be generated due to widening of this road. Only 5.00% of the spoil will be reused during construction of the road rest will be disposed off in an environmental friendly manner. Consultant has identified 62 disposal sites but which are not sufficient to accommodate the spoil. More sites need to be identified based on consultation with communities.

This remaining earth shall be disposed off in an environmentally suitable manner. Certain guidelines for debris disposal are given below.

- The debris generated shall be disposed of within designated areas only.
- The filled up area shall be used for designated purposes such as: Play ground, Truck Lay-by, short relocation & realignment portion.

There are 62 No. of dumping areas on the Proposed Road

Sr. No.	Chainage	Side	Sr. No.	Chainage	Side	Sr. No.	Chainage	Side	Sr. No.	Chainage	Side
1	431890	RHS	17	462970	RHS	33	506770	LHS	49	530670	RHS
2	433060	RHS	18	466900	RHS	34	507500	LHS	50	533250	RHS
3	435850	RHS	19	476810	RHS	35	509330	LHS	51	534840	RHS
4	438950	RHS	20	477420	RHS	36	509580	LHS	52	535800	RHS
5	439320	RHS	21	479820	RHS	37	510600	LHS	53	536750	RHS
6	441300	RHS	22	482280	RHS	38	514080	LHS	54	540500	RHS
7	443380	RHS	23	484120	LHS	39	515860	LHS	55	542500	RHS
8	444230	RHS	24	486850	LHS	40	517710	LHS	56	543900	RHS
9	445270	LHS	25	488180	LHS	41	518090	LHS	57	544970	RHS
10	448360	LHS	26	491080	LHS	42	519830	LHS	58	546100	RHS
11	450650	LHS	27	492600	LHS	43	520830	LHS	59	547670	RHS
12	453310	LHS	28	494480	LHS	44	522660	LHS	60	549250	RHS
13	455000	LHS	29	495960	LHS	45	524600	RHS	61	550120	RHS
14	456780	LHS	30	499330	LHS	46	526400	RHS	62	551060	RHS
15	457330	LHS	31	500950	LHS	47	526830	RHS			
16	460150	RHS	32	502200	LHS	48	528740	RHS			

g) Pavement Design

It is based upon CVD-312, CBR-6%, Traffic msa -10, Design period – 15 years, VDF-1.5, Annual Growth of traffic rate 7.5% and Design speed 30.00 Km/h. However the proposed pavement composition is based on CBR-5% and msa -20.

Pavement composition is designed as under:

Proposed pavement.

BC	:	40 mm
DBM	:	100 mm
WMM in 2-layers	:	250mm
GSB in 2-layers	:	300 mm
Total	:	690 mm

h) Shoulder Design

The carriageway width of 7m and paved shoulder width of 1.5 m on each side shall have the same pavement as the carriageway. The remaining 1.0m on each side shall be used to accommodate side drain on hill side or parapet/soft shoulder on valley side. In the hill side, depending on the total width of side drain, there is a small width remaining between the wall of side drain and paved shoulder, therefore it is also paved to avoid erosion by surface water

i) Culverts:

The project road traverses through mountainous and steep terrains with several natural drainages such as deep gorges, depressions, etc., where perennial water and rain water runoff are collected. Sometimes the storm runoff is accompanied by large quantities of debris from upstream side of the nallahs. Cross-drainage structures/culverts are required at these locations. From the field survey and investigations and geometric design of alignment the requirement of culverts for the whole length of the project have been identified.

Sr. No.	Type of culvert	Description	Span X Depth	NH 54	Lawngtlai Bye Pass
1	Type -1	Pipe Culvert	1.2 D	59	1
2	Type - 2	Pipe Culvert	1.2 D	112	10
3	Type - 1	Box Culvert	2.0 X 2.0	467	
4	Type - 2	Box Culvert	3.0 x 3.0	11	
5	Type - 3	Box Culvert	4.0 x 4.0	7	
6	Type - 4	Box Culvert	6.0 x 4.0	2	
			Total	658	11

i) Slope Protection works:

Adequate Protective structures are proposed for retaining of cut/fill slopes to ensure stability of the road formation at locations where required. The proposed type and length of each structure are shown in the table below:

Sr. No.	Type of Structure	Unit	Quantity		Remarks
			NH 54	Lawngtlai Bye Pass	
1	Retaining Wall	Rm	19400.00	390.00	Height varying between 3.0m to 6.0 m
2	Breast Wall	Rm	720.00	100.00	Height varying between 2.0m to 3.0 m
3	Gabion Wall	Rm	2790.00		Height varying between 2.0m to 3.0 m
4	Toe Wall	Rm	13490.00	100.00	Height varying between 2.0m to 3.0 m
5	Reinforced Earth Wall	Rm	750.00		Height varying between 7.0 m to 10.0 m
6	Cut Slope Wall	Rm	70000.00		Height upto 3.0 m
7	Gabion Wall (1:0.3)	cum	10428.00		
8	Rock fall Prevention Wall (H=3m)	Rm	9647.50		
9	Rock fall Prevention Fence (H=2m)	Rm	2410.00		
10	Hydro seeding (t=5cm)	sqm	5377.00		
11	Seeding and Mulching (Soil Cut Slope)	sqm	448043.00		
12	Vegetation Mat (Steep Slope)	sqm	1237.00		
13	Crib Work (F300)	sqm	1756.16		
14	Crib Work (F500)	sqm	3510.00		
15	Earth Removal	cum	12970.00		
16	Groundwater Drainage Work	Rm	9924.00		
17	Anchor Work	Rm	3072.00		
18	Rock-bolt Work	Rm	702.00		
19	Bamboo crib wall	Rm	22320.00		Height 1.5 m at Embankment & disposal location.

k) Drainage Design

Pavement Drainage includes camber / cross fall of 2.50%.

Slope 3.5 % has been considered for drainage of shoulders.

Roadside drains are designed: Lined drains in case of soils

Sr.No.	Type	Length	Remarks
1	Type-1	97404.00	Ordinary Soil stretch Rocky & Steep Stretch & Catch water drain at box cutting portion
2	Type-2	29466.00	Built up area

Chutes of the culverts form part of the culvert structure to lead the discharge to the catch-pit or to natural drainage channel.

l) Road Sign, Markings and Furniture

The project design includes (a) Mandatory / Regulatory Signs, (b) Cautionary / Warning Signs and (c) Information Signs.

Route Marker Signs are provided.

KM Stones are included as per type design.

m) Street Furniture

Traffic Safety Posts and Parapet Walls are included.
Traffic Signs Marking & other Road Appurtenances

n) Roadside Amenities

The continuous long distance travel on highways at speed is liable to cause fatigue as also mental tension to the road users. Moreover, the monotony of driving over long sections in the rural areas with no likelihood of any cross traffic brings sense of complacency in many drivers and such distractions could result in serious accidents.

Sr.No.	Description	Nos.	Location
1	Public Toilet	15	Tawipui North -2,Tawipui North-1,Tawipui South
2	Bus Shed	30	,Thingfal ,Thingka ,AOC, Lawngtlai City, Saika,
3	Bazar Shed	15	Chawntlangpui ,Sihtlangpui ,Kawlchaw ,Zero point, Maubawk ,Theiva ,Theihri & Tuipang village

7. DIVERSION OF EXISTING ROAD DURING CONSTRUCTION

For improvement of existing road some stretches localized, relocation and re-grading are proposed. Due to which traffic movement on existing road will be hamper .Therefore temporary diversion of existing road is very much necessary during construction period.

8. MAINTENANCE OF EXISTING ROAD:

The existing road is the main route to provide connectivity between district headquarters and International boarder of Indo Myanmar for international trading but also for Southern part of Mizoram. The minimum construction time provided for completion of the project is 4(four) years during which maintenance by the PIU will be no longer convenient as the site possession is resorted to hand over to the contractor till completion of the project. Under this circumstance, it is inevitable to keep provision for yearly maintenance of the existing road during construction and hence a provision of Rs.78.60 lakhs per year is made to make the road playable for all type of vehicles without serious interruption of the traffic flow throughout the year.

Scope of Maintenance:

- 1) Maintenance of Earthen Shoulder (filling with fresh soil).
- 2) Filling Pot- holes and Patch Repairs with open - graded Premix surfacing, 20mm.
- 3) Hill Side Drain Clearance.
- 4) Land Slide Clearance in soil/ rock
- 5) Clearing Grass and Removal of Rubbish.
- 6) Maintenance/repair of culvert/Retaining wall.
- 7) Clearance of culvert before monsoon
- 8) Removal of land slide

9. ENVIRONMENTAL IMPACT ASSESSMENT

The proposed up-gradation of NH 54 from Km 431+00 to Km 553.60 in Mizoram will serve southern belt of Mizoram state. The preliminary Environmental Impact Assessment

does not envisage any Negative Impact. The preliminary study suggests numerous beneficial impacts on the environment.

As there is no new alignment that passes through forest areas, there are no endanger species both in plants and animals, the project will not attract the provision of Forest (Conservation) Act 1980 vide Govt. of India. Ministry of Environment & Forest No. 4-1/97-FC Dt. 18.2.1998.

Nevertheless, all possible measures will be taken to mitigate any adverse environmental impact the project may cause to the environment.

The air pollution due to emission/effluents from the construction machineries will also be negligible. The stream pollution due to spillage from the construction machineries will also be negligible. As the construction work involves widening of existing road formation, no adverse effect will occur on aquatic life system.

The alignment has been adjoined by private land and households, there will be damage to private crops and plantation, further private house will be affected, and hence relief and rehabilitation scheme shall be required and included in the project.

10. LAND ACQUISITION PLANS AND FOREST CLEARANCE

a) Land Acquisition Plans

The alignment passes through private lands, households, gardens and other properties. Up-gradation of this road by widening the formation width and diversion of the alignment, improving the geometry (including gradient) is going to occupy private properties, crops, plantation, houses, etc. Hence, compensation will be provided for the above properties, as well as relief and rehabilitation wherever the local populations are displaced due to dismantling of their houses. For this matter, required fund shall be required for compensation or relief & rehabilitation.

Notification had been issued by Government of Mizoram under Land Acquisition Act 1894 verification of land , building, crops etc likely to get damaged due to the proposed construction of the road will be verify by the Deputy Commissioner, Lunglei , Lawngtlai & Saiha District. Representative of Revenue Deptt. And representative of State PWD jointly carried out the assessment and based on the assessment carried out; acquisition estimate will be framed and submitted later on.

b) Forest Clearance

The Mizoram State Forest authorities conducted a detailed survey of the alignment and the following is the findings of that survey:

- 1) That the proposed road alignment does not form part of National Park, wild life sanctuary, biosphere reserve, tiger reserve, elephant corridor, etc.
- (2) No rare/endangered/unique species of flora and fauna are found in the area.
- (3) No protected archeological/heritage site /defense establishment or any other important monument is located in the area.
- (4) The requirement of forest land as proposed by the user agency is unavoidable and barest minimum for the project. No alternative for the project exists.
- (5) No work in violation of the Forest Act has been carried out.

The road passes through private holdings like pisciculture, horticulture and habitation. As per Right of way of proposed 2 land standard alignment 193.16 Ha land is required. About 78.50% length of the road passes through land owned/developed by individuals land holders under periodic patta and LSC pass , 11.50 % length of the road passes through forest & 10.00% length of the road passes through other . This land will not be available free of cost and also compensation for plantations, crops etc. within the required corridor is to be paid to each individuals. About 24.35% passes through habited area.

After due verification and assessment, the Estimate for Net Present Value and Compensatory Afforestation will be duly framed by the concerned Environment and Forest Department. Process for obtaining forest clearance is in the hand of the concerned authority of Government of Mizoram which will be then submitted to the Ministry of Environment and Forests, Government of India shortly under clause 2.5 of forest clearance 1980.

11. MATERIALS, LABOURS AND CONSTRUCTION EQUIPMENTS:

a) Materials:

The rock deposits are available along or the vicinity of the project road alignment. Besides, cobbles, pebbles and sand deposits are available in the rivers or streams crossing the main alignment. Construction materials for GSB, Cross drainage & Masonry R/Wall etc. works, will be available at local quarry within the project corridor and WMM, DBM & BC material from Tuipui River at Kawlchaw on NH 54 at Km 506 and Liapha on Multi Model Transit Route .Water Absorption and AIV of these quarries are within the limit of the Ministry's Specifications.

Major constructional materials such as Bitumen, Cement, Steel and POL etc., will be taken through NH-54 from outside the state mostly from Assam state.

Source of Quarry Material

Sr.No.	Name of Source	Type of Material	Location	Quantity
1	Kawlchaw (R.Kaladan)	Sand, GSB,WMM,DBM,BC & Stone aggregates	On NH 54 at Km 506+650	Plenty
2	Liapha (R.Kaladan)	Sand, GSB,WMM,DBM,BC & Stone aggregates	NH-54 at Km 473+300 on Multi Model Transit Route at 37 Km then 5 km earthen road	Plenty
3	Rulkual Quarry	Masonry Stone ,DBM,BC & Stone aggregates	NH-54 at Km 486+900 on NCV Road at 18 Km surface road	Plenty
4	Thingkah Quarry	Masonry Stone	On NH 54 at Km 469+700	Plenty
5	Paithar Quarry	Masonry Stone	NH-54 at Km 486+900 on NCV Road at 8 Km surface road	Plenty
6	Near Saika Village	Masonry Stone	On NH 54 at Km483+450	Plenty
7	Near Zero point	Masonry Stone	On NH 54 at Km 517+000	Plenty
8	Near Maubawk village	Masonry Stone	On NH 54 at Km 529+500	Plenty

b) Labour:

Local labourers skilled & unskilled are available in plenty. However, where required, imported labourers will also be engaged for road construction works. Since the area is malaria infested, medical assistance with qualified practitioners will be required during the execution of the project. Comparatively higher wages (from the National average) and incentives have to be paid to labourers for the work. It is envisaged that equipment / machine-intensive method would be adopted for proposed construction works.

c) Equipment:

Heavy Machineries like Bull dozers, Excavators, Loaders, Air compressors, Vibratory / Static Road Rollers, Wet-mix plants, Electric generator sets, Motor Graders, Tractor-Rotavators, Hot/batch-mix plants, Paver-finishers, etc. as required for the execution of the work will be arranged by the contractor executing the project.

12. UNIT RATES AND COST ESTIMATES:

The cost estimate for the proposed construction work has been based on the quantities worked out from the design drawings.

a) Unit Rate:

The unit rates for arriving at cost of different components of works are based on Mizoram PWD Schedule of Rates 2014 (for National Highways). For those items of works which are not available in the SOR, separate Analysis of Rates have been carried out and incorporated in this DPR.

b) Procurement / Implementation Strategies:

The general conditions of Contract will be as per Standard Bidding Document of Ministry of Shipping, Road Transport and Highways, Government of India, works.

c) Phasing of Construction:

The total cost of the _____ which covers costs for formation work, Slope protection and cross drainage works, construction of bridges and pavement works. Construction period of 42 months has been proposed, considering the quantum of activities to be performed including mobilization period needed and four intervening rainy seasons in between.

The project is proposed for commencement during the financial year 2016-2017 with target completion by the year end of 2019-2020. Since the project will be executed through a period of four years there will be cost escalation during the period of construction. Considering the rate of price escalation at an average rate of 5% per annum compounded annually after the initial year, the cost of construction and physical and financial phasing of the project is given in the table below:

Sr.No	Year	Cumulative Physical Target (%)
1	2016 -17	15
2	2017 -18	45
3	2018 -19	80
4	2019 - 20	100

12. TENDER DOCUMENTS:

a) General Conditions of Contract:

The general conditions of Contract will be as per Standard Bidding Document of Ministry of Shipping, Road Transport and Highways, Government of India, works.

b) Technical Specifications:

The Technical Specifications shall be the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" FIFTH REVISION 2013, of the Ministry of Road Transport and Highways, Government of India.

c) Project Drawings:

The Project Drawings as produced in Volume -IV of this Detailed Project Report.

Sub Divisional Officer, PWD
Multi Modal Project Sub Division - I,
Lawngtlai: Mizoram

Executive Engineer, PWD
Multi Modal Project Division - I,
Lawngtlai: Mizoram

Superintending Engineer, PWD
Multi Modal Project Circle,
Lawngtlai: Mizoram

Chief Engineer, PWD
Highway,
Aizawl: Mizoram

SECTION - 1

INTRODUCTION

1.1 INTRODUCTION

The Ministry of Roads Transport and Highway, Govt. of India has prioritized to take up for upgrading and improvement of NH 54 from Km 431/00 to Km 562/00 to 2-lane NH standard in Mizoram. The existing road has steep gradient and sharp curves/zigs at various stretches. It is of single lane road with formation width 6.00 m to 6.50 m without conforming any standard / specification. As a result, the heavily loaded trucks and large sized vehicles find it difficult to pass through these stretches safely.

The Project Corridor takes off from Lunglei district near Tawipui North Village-2 at Km 431+00 and runs towards southern direction passes through a number of villages like Tawipui North-1, Tawipui South, Thingfal, Thingka, AOC, Saika, Chawntlangpui, Sihtlangpui, Kawlchaw, Zero point, Maubawk, Theiva, Theihri, Tuipang village and Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.

The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar. NH 54 B is also branching from Km 519.200, which is serving as Saiha District connecting Highway and a number of villages which are located in the area adjoining to this road are also heavily depending on this road for their social and economic development. Thus, the importance of this road and hence the role it plays for the upliftments of the region needs no more emphasis. And, its importance is further enhanced by the requirement of law and other maintenance as these areas are very remote where unlawful activities are of frequent occurrence. Over and above, being located in the fertile region, large quantities of fruits and vegetables are produced annually, which provides sustainable economy for many villagers. This is an important road and life line for the people of the Southern Districts of Mizoram. It is very essential for improvement & up-gradation of existing NH-54 conforming to National Highway Standards.

1.2 PROJECT BACKGROUND

The existing NH-54 was originally constructed as ODR Standard road during the early part of seventies. It was constructed by the BRO. The road was constructed to provide connectivity Southern Districts of Mizoram. The road was upgraded to the status of National Highway in the year 1980. No substantial improvement of the road other than normal renewal works have been carried out since the road was declared a National Highway. The pavement work and the permanent works of retaining wall and cross drainage structures were done at the time of construction as an ODR standard road and the width of the cross drainage structures are also only 6.50 m. Most of the retaining wall / wing wall had been collapsed and the road formation width also breaches at many stretches.

1.3 SCOPE OF THE PROJECT

Up-gradation of the existing road, having formation width of about 6.50m, to a formation width of 12.0m, construction of pavement work for the entire length, culverts and permanent works at essential places, widening and improvement of blind curve portion, realignments at the portions where steep gradients have to be avoided, construction of pucca side drains at needy stretches, and installation of traffic/informatory sign and Kilometre.

1.4 PROJECT ROAD

The stretches of the road under this report is between 431/00 Kmp to 562/00 Kmp of NH 54 as per existing chainage required for up gradation & improvement to standard 2 lane. In this portion of proposed highway about 25 % length of road passes through heavily built-up areas which involve costly of Land Acquisition and serious resettlement problems in the existing road. The existing alignment also passes through steep terrains which are unstable and landslide prone area at many locations which could also posed serious problems in future.

The proposed realignment of the existing road from Km 535+070 to Km 539+330 at Theiva village to avoid the sharp zig of existing road and Lawngtlai Bye Pass from Km 473+300 to Km 478+400 as per existing chainage , which include 4.40 Km stretch of Multi Model Transit Route & 1.92 Km new alignment to avoid the movement of heavy vehicle traffic & traffic conjunction within the built-up portion of Lawngtlai city.

The proposed realignment take off points are very near due to which ,it will not effected and deprived the connectivity with villages and hence, the villagers would be the beneficiaries with the proposed alignment. Therefore, the proposed re-alignment does not passes through heavily built-up area and would involve much less L.A cost as well as resettlement problem as compared to the existing alignment. The re-alignment also passes through an area with a much better topographical as well as soil conditions. Hence, apart from the reduction in distance between Lunglei and Tuipang, which would greatly benefit both the neighbouring countries in terms of vehicle operating cost and travel time, the proposed re-alignment is technically far better and financially cost effective in the long run.

The topographical area of the road under this report i.e. from Km431+00 to Km553.604 is divided into seven segments depended upon terrain condition of hill.

Table: Project road segment

Sr.No.	Design Chainage		Name of River along / across	Location	Type of Terrain
	From	To			
1	431000	445980	Mengpui Lui	Tawipui North -2 ,Tawipui North -1 & Tawipui South Village	Mountainous to Steep
2	445980	459350	Kamhuai Lui & Ngengrual Lui	Thingfal village	Mountainous & Saddle from 449+400 to 449+800
3	459350	470220	Servapui Lui	Thingka village & Aoc village	Steep
4	470220	475700	Sahri Lui & Chengkawl Lui	Lawngtlai city	Mountainous
5	475700	483730	Tuiphal Lui	Saika village	Steep
6	483730	523070	River Tuipui	Chawntlangpui,Sihtlangpui ,Kawlchaw , Zero point & Maubawk village	Mountainous to Rolling near Tuipui river.
7	523070	553604	Kawlchaw Chava	Theiva ,Theihri & Tuipang village	Mountainous to Steep

Segment	Remarks	Drainage System
Segment-I	In this segment the general topography are Mountainous to Steep terrain .Most of the stretches in this segment are built up. Catchment area is very high. Most of the stretch sandstone types & numbers of small quarry are available at road site. Few stretches are exposed weathered disintegrated rock Therefore to obtain the formation width blasting will be required to widen the existing road.	Mengpui Lui
Segment-II	In this segment the general topography are Mountainous terrain. Most of the stretch siltstone & shale types. Few stretches are exposed weathered disintegrated rock .From Km 449+400 to Km 449+800 proposed road passing through the ridge line. Catchment area is very small because almost entire road passing through small hill lock or hill top / ridge line.	Kamhuai Lui & Ngengrual Lui
Segment-III	In this segment the general topography is Steep terrain. Catchment area is medium because almost entire road passing through high structure hill. Most of the stretch soil types are mixed soil boulder with sandstone & two nos small quarry is available at road site	Servapui Lui
Segment-IV	In this segment the general topography are Mountainous terrain. Almost entire road passing through medium structure hill. Most of the stretch siltstone & shale types. Most of the stretches in this segment are built up. Few stretches are sinking within Lawngtlai City.	Sahri Lui & Chengkawl Lui

Segment-V	In this segment the general topography is that the Steep terrain & most of the stretches passing through the soil mixed boulder & highly weathered sandstone. Catchment area is very high because almost entire road passing through high structure hill.	Tuiphal Lui
Segment-VI	In this segment the general topography is that the Mountainous to rolling terrain to Tuipui River flood plain & most of the stretches passing through the cultivated land. Most of the stretch soil types are mixed soil boulder, siltstone & shale types. Proposed road passing through the high hill structure. Catchment area is very high.	River Tuipui
Segment-VII	In this segment the general topography is that the Mountainous terrain to steep terrain & most of the stretches passing through the cultivated land. Most of the stretch soil types are mixed soil boulder & siltstone & shale types. Proposed road passing through the medium hill structure. Catchment area is very high.	Kawlchaw Chava

All above drainage systems are distributory of Tuipui River. The altitude of the road at various locations varies from 585 m near Tawipui North Village-2 to 1335.0 m near Tuipang Village above mean sea level (MSL). Lowest MSL along the project is at Kawlchaw River Bridge 140.00 m.

1.5 THE NAME OF VILLAGE ALONG PROJECT ROAD:

The name of the villages, located nearby the project road corridor, which will be directly influenced by the project road are listed below -

Sr.No	Existing Chainage		Village Name	District
	From	To		
1	432800	434750	Tawipui North village-2	Lunglei
2	435250	438150	Tawipui North village-1	Lunglei
3	444100	447250	Tawipui South village	Lunglei
4	459700	461100	Thingfal village	Lunglei
5	469550	470700	Thingka village	Lawngtlai
6	471550	473400	AOC village	Lawngtlai
7	473400	478900	Lawngtlai city	Lawngtlai
8	486800	487100	Saika village	Lawngtlai
9	498300	499000	Chawntlangpui village	Lawngtlai
10	501050	502550	Sihtlangpui village	Lawngtlai
11	506250	509350	Kawlchaw village	Saiha
12	518800	519900	Zero point	Saiha
13	525200	526850	Maubawk village	Saiha
14	536000	538000	Theiva village	Saiha
15	544950	546000	Theihri village	Saiha
16	558600	561200	Tuipang village	Saiha

1.6 REPORT STRUCTURE

The Detail Project Report is presented in the following format

VOLUME I - MAIN REPORT

		Executive Summary
Section 1	:	Introduction
Section 2	:	Socio-Economic Profile
Section 3	:	Engineering Surveys and Investigations
Section 4	:	Design Standards and Specifications
Section 5	:	Engineering Designs and Construction Proposals
Section 6	:	Environmental Impact Assessment
Section 7	:	Materials, Labours and Equipments
	:	
Section 9	:	Implementation Programme.
Section 10	:	Maintenance of Existing Road

VOLUME II - DESIGN REPORT

Section -1	:	Design of Road Features, Pavement Composition, Cross Drainage Structures and Slope Protection Works.
Section 2	:	Hydrology and Drainage Study
Section 3	:	Soil Investigation Report
Section 4	:	Traffic Study and Survey
Section 5	:	Inventory Survey

VOLUME IV - PROJECT DRAWINGS

VOLUME V - LAND ACQUISITION AND UTILITY RELOCATION DETAILED

SECTION - 2

SOCIO ECONOMIC PROFILE

Project Road

The proposed widening to 2-lane, re-alignment and geometric improvement of NH 54 under this report is from Km 431+00 to Km 562+000 of existing chainage in Mizoram. This road will serve as connectivity between two Southern District Headquarter. The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar for economic and culture transformation . The project road corridor runs through Lunglei , Lawngtlai & Saiha District.The area is mountainous and steep. Existing road is single lane road with formation width about 6.5 m without conforming any standard / specification.

Project Location:

- Country : India
- State : Mizoram
- District : Lunglei - Lawngtlai-Saiha District
- Road Name : The Project Corridor Takes off from Lunglei district near Tawipui North - 2 at Km 431+00 and runs toward southern direction passes through Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+00 at Tuipang Village within Saiha District.
- Project Road Length : 122.604 Km.

Project Country: India

India occupies a strategic position in Asia, looking across the seas to Arabia and Africa on the west and Burma, Malaysia and the Indonesian Archipelago on the east. Geographically, the Himalayan ranges keep India apart from the rest of Asia.

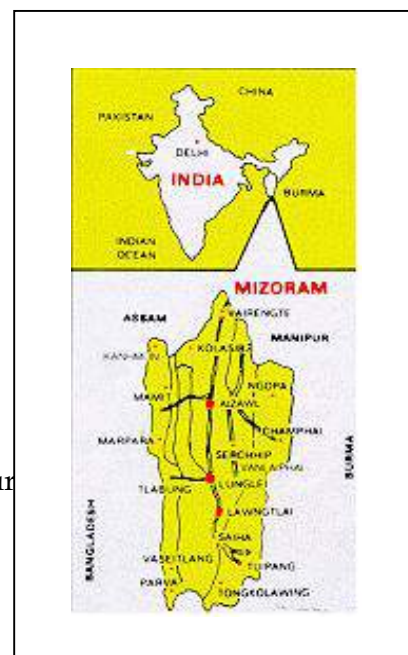
Project State: Mizoram

Mizoram State is bordering Myanmar in the east & south and Bangladesh in the West.

The Location Map of Project road:

Mizoram at a glance

- Name of the State : Mizoram
- State Capital : Aizawl
- Area : 21,087 Sq.km
 - (a) North South : 277 kms
 - (b) East-West : 121 kms
- Inter State Border : Assam, Tripura and Manipur (284 Km)
- International Border : Myanmar and Bangladesh (722 Km)
- No. of Districts : 8



No. of Autonomous Dist Councils : 3

No. of Sub Divisions : 23

No. of R.D Blocks : 26

Means of communication

By Air : Lengpui Airport

By Road : Via Silchar

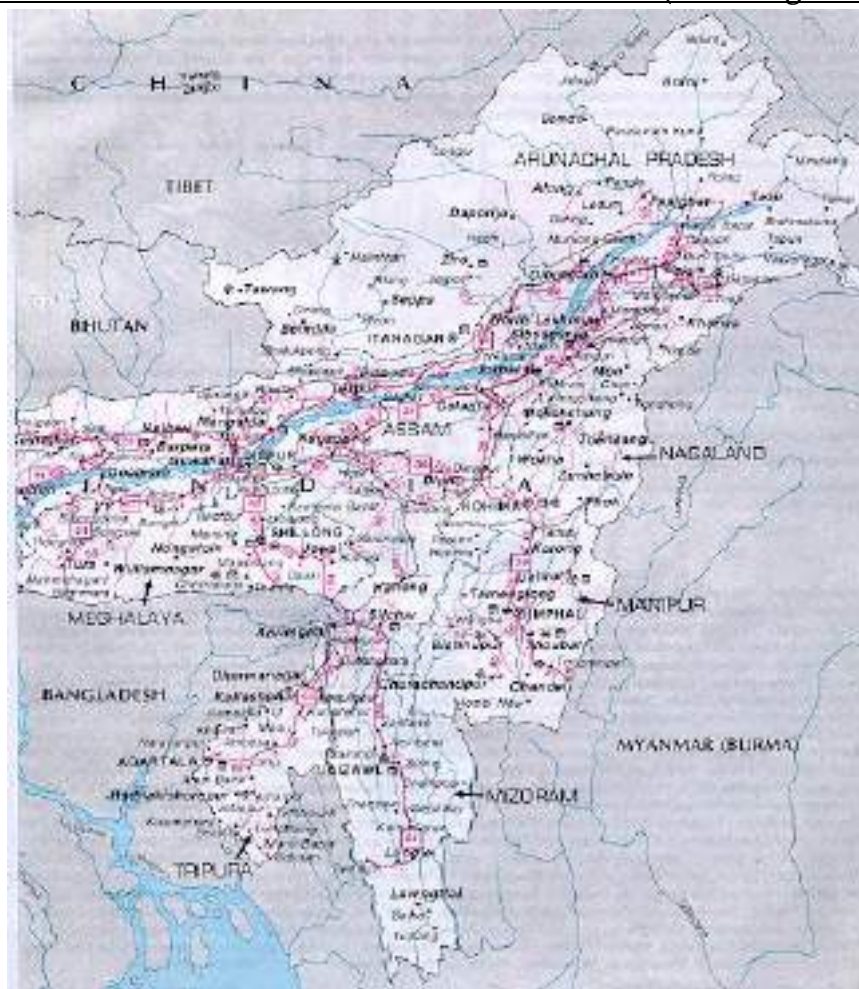
Major Festivals : Chapchar Kut, Pawl Kut, Mim Kut, Christmas & New Year

Major Dances : Cheraw, Khuallam, Parlam, Sarlamkai, Chailam, Rallulam, Chheihlam

Other Statistics

- Population (2011) 10,97,206
- Languages Mizo
- Literacy (2011) 91.33%
- Per Capita income Rs 54,689 during 2011-12
- Roads length 7437 Km

LOCATION MAP OF NORTH-EASTERN STATES (including Mizoram)



Land: Mizoram is a mountainous region, which became the 23rd State of the Indian Union in February 1987. It was one of the districts of Assam till 1972 when it became a Union Territory. Sandwiched between Myanmar (Burma) in the east and south and Bangladesh in the west, Mizoram occupies an area of great strategic importance in the northeastern corner of India. It has a total of 630 miles boundary with Myanmar (Burma) and Bangladesh.

Terrain: Mizoram has the most variegated hilly terrain in eastern part of India. The hills are steep and are separated by rivers, which flow either to the north or south creating deep gorges between the hill ranges. The average height of the hills is about 900 m. The highest peak in Mizoram is the Blue Mountain (Phawngpui) with a height of 2210 m.



Mizoram: Road in Hilly Terrain

Climate: Mizoram has a pleasant climate. It is generally cool in summer and not very cold in winter. During winter, the temperature varies from 8° C to 21°C and in the summer it varies between 20°C and 35°C. The entire area is under the direct influence of the monsoon. It rains heavily from May to September and the average rainfall is 2540 mm. per annum. The average rainfall in Aizawl is 2080 mm and Lunglei in Southern Mizoram has 3500 mm. Winter in Mizoram is rain-free and is very pleasant; the skies are wonderfully blue, and in the morning the mist formed between the hills gives an enchanting view of wide stretches of a vast lake of cloud.

Flora and Fauna: Mizoram has great natural beauty and an endless variety of landscape and is very rich in flora and fauna. Almost all kinds of tropical trees and plants thrive in Mizoram. The hills are marvelously green. Some of the common trees and shrubs grown in the forest of the project area are Teak, Putli, Khair, Shingle Tree, Red Wood, Goat Weed, Australian Wattle etc. The state has a wide forest resource and it is also exported to various parts of the country for various purposes.

People: The word, Mizo is a generic term and is used to mean hillmen or highlanders. The Mizos are a distinct community and the social unit was the village. Around it revolved the life of a Mizo. In olden days, Mizo village is usually set on top of a hill with the chief's house at the centre and the bachelor's dormitory called Zawlbuk, prominently located in a central place.

In a way the focal point in the village was the Zawlbuk where all young bachelors of the village slept. Zawlbuk was the training ground, and indeed, the cradle wherein the Mizo youth was shaped into a responsible adult member of the society.

Social Life: The fabric of social life in the Mizo society has undergone tremendous changes over the years. Before the British moved into the hills, for all practical purposes the village and the clan formed units of Mizo society. The Mizo code of ethics or Dharma moved round "Tlawmngaihna" an untranslatable term meaning on the part of everyone to be hospitable, kind, unselfish and helpful to others. 'Tlawmngaihna' to a Mizo stands for that compelling moral force which finds expression in self-sacrifice for the service of others. Mizos are a close-knit society with no class distinction and no discrimination on grounds of sex. 80% of them are cultivators and the village exists like a big family. Birth of a child, marriage in the village and death of a person in the village or a community feast arranged by a member of the village are important occasions in which the whole village is involved.

Administration: The Capital of Mizoram is Aizawl. Mizoram is divided into 8 districts -Aizawl District with headquarters at Aizawl, Lunglei District with headquarters at Lunglei and Saiha District with headquarters at Saiha, Lawngtlai District with headquarters at Lawngtlai, Serchhip District with headquarters at Serchhip, Mamit District with headquarters at Mamit, Champhai District with headquarters at Champhai, Kolasib District with headquarters at Kolasib.

Connectivity: Aizawl, the Capital of Mizoram is 180 Kms. from Silchar, which is the nearest railhead. The bus journey from Silchar to Aizawl usually takes about 6 hours. Mizoram State Transport Buses ply between Aizawl and Silchar daily. There is daily Air Service between Calcutta and Aizawl and between Guwahati and Aizawl.

Logistic - Road Distance: The road distance of important places in N.E. Region from Aizawl are as given below:

Place	Distance in Kms
Shillong	423
Agartala	440
Dibrugarh	751
Dhuburi	808
Diphu	372
Dispur	523
Haflong	260
Imphal	307
Jorhat	591
Jowai	370
Kohima	430
Nagaon	443
Silchar	180

Mizoram Road Network : It consists of 7437.128 kms (2011) with road categories mentioned below:

Road Category	Length (kms)
National Highway	886.03
State highways	699.64

Major District roads	935.65
Other District Roads	1384.90
City Road	355.487
Town & Satellite Town Road	591.645
Village Road	1108.981
Others Road	1474.795
Total	7437.128
No of district	8 Nos

As per the economic survey 2011 -2012, the increase in the population of vehicles has been 11.68%, the transport has observed tremendous increase. The heavy traffic pressures on the deficient roads are rendering the quality of pavement very poor.

Important roads in the State of Mizoram are given below:

Sn	Name of Some Important Road Sectors	Length in Km
01	Aizawl-Thenzawl-Lunglei	163.60
02	Kawnpui-Aizawl via Lungdai	44.290
03	Bairabi-Zamuang	28.00
04	Lawngtlai-Saiha Feeder road	25.00
05	Seling-champhai	150.300
06	Seling-tipaimukh	140.00
07	Sairang-Tuipuibari	154.00
08	Champhai-N. Vanlaiphai-Keitum	155.00
09	Kawlkulh-Ngopa-Tuivai	96.00
10	Serchhip - thenzawl - Bungmun	126.00
11	Hnahthial-South Vanlaiphai-sangau-Saiha	142.750
12	Lunglei-Tlabung	91.00
13	Kanhmun-Zamuang-Tuilutkawn	96.00
14	Tut-Mamit-Tuidam-R. Langkaih	78.00
15	Serkhan-Bhaga Bazar	117.00
16	W. Phaileng-Phuldungsei-Marpara	80.00
17	Tuipuibari-W. Kawnpui	18.00
18	Lawngtlai-Diltlang	269.130
19	Lawngtlai-Nalkawn-Chamdur valley (NCV)	60.00
20	Marpara-Tlabung	41.400
21	Demagiri-Borapansury-Parva	120.00
22	Vairente-Phainuam-Saiphai	24.00
23	Bilkhawthlir-Saiphai-Saipum	35.00
24.	Vairengte-Phaisen-Buchangphai	20.00
25	Bilkhawthlir-Buhchangphai-Kolasib	35.00
26	Kawlkulh-Lungpho-serchhip	110.00
27	Champhai-Sasaiphai-Vaphai-Farkawn-Khawbung	140.00
28	Haulawng-Chhipphir-Pangzawl	60.00
29	Muallungthu-Khumtung	35.00
30	Keitum-N. Vanlaiphai-Thingsai-Bualpui-S. Vanlaiphai	140.00
31	Leite-Mualthuam-Thingfal	110.00
32	Lungsen-Chawngte	48.00

Sn	Name of Some Important Road Sectors	Length in Km
33	Bairabi-Mamit	36.00
34	Rawpuichhip-Buarpui	89.000
35	Buarpui-Lunglei	75.00
36	Chawngte-Borapansury	32.00
37	Aibawk-Darlung	33.00
38	Aizawl-Tlawng-Reiek-W.Lungdar	37.00
39	Hnathial-Thingsai Road	57.720
40	Saiha-Chhualung-Siata-Tuipang	122.00
41	Kawlchaw-Phura-tawngkolong-Berami-Khopai-Zawngling	160.00
42	Chawngte-Diltlang	32.00
43	Zobawk-Haulawng	35.00
44	Kawnpui-Hortoki	20.00
45	Khawzawl-Rabung-Lamzawl-Ngopa	64.00
46	Saitual-Phullen-E.Phaileng	135.00
47	Phairuang-Bunghmun	69.00
48	Kawlchaw-serkawr-Phura	44.00
49	Thenzawl-Chhipphir	22.500
50	Lunglei-Nghasih	10.00
51	Aizawl-Samtlang-Lungleng	20.00
52	Khawzawl-Biate	60.00
53	Chekkawn-Artahkawn	9.00
54	Champhai-Hnahlan-Mimbung	120.00
55	E. Phaileng - Suangpuilawn - Phullen	80.00
56	New vervek - Sakawrdai - Tuivai	20.00
57	Sakawrdai - Zohmun	14.00
58	Ratu - Suangpuilawn	40.00
59	Chhingchhip - Hmuntha	27.461
60	Khawzawl - Phaisen	10.00
61	Champhai - Hmunhmeltha - N. Khawbung	30.00
62	Ngopa-Mimbung	52.500
63	Kolasib-N. Hlimen	40.00
64	Road within Towns	82.00

The map showing road network of Mizoram is shown below.



Project Road: NH 54 from 431/000 KM to 553/604 KM

- The proposed widening to 2-lane, re-location and geometric improvement of NH -54 in Mizoram. This road will serve as connectivity between two Southern District Headquarter. The Multi Model transit route is branching from Km 473.30 of NH-54, which is going to serve the International trade road between India & Myanmar for economic and culture transformation.
- Altitude of alignment varies from 585.0 m at take off point and 1335.0 m at end point above the MSL
- The list of the habitations along the road Tawipui North-2, Tawipui North-1, Tawipui South, Thingfal, Thingka, AOC, Saika, Chawntlangpui, Sihtlangpui, Kawlchaw, Zero point, Maubawk, Theiva, Theihri, Tuipang village and Lawngtlai City from Km 472+00 to Km 480+00 and Terminate at km 562+000 at Tuipang Village within Saiha District.

General Project Area

The alignment of the project passes through Lunglei –Lawngtlai-Saiha District in Southern direction. The whole length of the project will be partly fresh cutting of mountainous to steep terrain with broken contours as well as widening of the existing road. The alignment of the project road is habited area.

Man power needed for the project implementation will be taken from the area nearby the project. However, skilled labour will have to be taken from other towns and cities. Moreover, the working season for road project work is clash with the harvesting season of the people in the area more man power may also be needed depending upon the quantum of the requirement. The project road is also a highly malaria infested area; proper medical facilities will be required.

Problems and Challenge Areas

Based on the ground study, reconnaissance & survey and the data collected from BRO & other dept. Mizoram have gained appreciation of the technical and project management problems and have insight of the challenge areas of the project. The general appreciation of the thrust areas are described in the following paragraph.

Accessibility:

To visualize the problems that may be encountered in the development of road network inside, it is necessary to understand the topographical features of the State with particular reference to its location in the Indian sub-continent. The State is flanked by Myanmar on the south & East and Bangladesh on the West, thereby having deprived of the advantage of nearness to the Indian Sister States. At present NH-54 is the only main road which linked with Assam and through this road most of commodities are transported in the state.

Seismic Effect: The entire state of Mizoram is earthquake prone and falls under seismic Zone V with reference to IRC-6. All structures need to be designed with seismic effect as per stipulations in IRC-6.

Land Slide: There is no major potential land slide in the Project road ,however 40 minor slide location .

Plantation: There is thick growth of Bamboo vegetation along the Project road

Stone for Road Construction: Stone for construction work other than BC work will be available locally.

Water: In general, water available in the area has been found suitable for use in the road construction work. However, water is not available at all places and has to be transported from the local water points to the construction sites.

Work Force: Mostly local people are agriculturists. Road construction requires tradesmen of sorts, skilled labourers and unskilled labourers. Manpower may need to be brought from other part of the country. It requires planning and organization for recruitment, training, induction and maintenance including provision of campage, food supplies, medical, welfare activities, etc. Independent facilities are necessitated to cater for the increased workforce.

Contractors: Though small supply Contractors are available in this part of Mizoram, the bulk of the requirement is initially to be augmented from outside. The stone crushers have to be installed for meeting the project requirements.

SECTION - 3

ENGINEERING SURVEYS AND INVESTIGATIONS

3.0 ENGINEERING SURVEYS AND INVESTIGATIONS

3.1 TOPOGRAPHICAL SURVEY

a) General

Topographical survey was performed in order to set up a digital terrain model of the area. The survey covered a strip of 30-40 m width with cross sections taken at 20 m intervals.

Topographical surveys included the following:

- Control Point Survey
- Traversing
- Cross-section Survey
- Establishing Bench Mark

b) Methodology for Topographical Survey

Topographical survey was carried out with Total Station, Auto level and checked with GPS, state-of-the art instruments. The survey methodology involved the following sequential steps:

Control Points: Establishing control points in the form of temporary bench marks (TBM) at 1 km intervals (approx.) on ground and running traverse along tentative alignment using Total Stations. Reference Pillars consisting cement concrete pillars with central nail point; have been fixed at every 200m to 250m intervals depending upon safe site location.

Traversing: Connecting all control points with one or more Benchmarks using precision Auto Level and Total Station.

Cross-section: Taking detailed cross sections at 20 m interval using Total Station. The main features captured in the cross-sections were:

- all natural ground break-point within the Right-of-Way (ROW)
- Property lines within ROW.

Cross-sections were also taken along intersecting roads to a distance of 200 m for major roads and 50 m for minor roads. 3-point cross-sectional data 100 m upstream and downstream of waterways were also gathered.

The data for each survey point were recorded in terms of Northing and Easting and Elevation to an accuracy of 1 mm.

Establishing Bench Mark: Due to non-availability of Survey of India reference bench mark, bench mark elevation was carried from Lengpui Airport BM pillar. Based on this reference BM, TBMs were established along the proposed road alignment, using auto levels and double leveling method.

In addition, all TS stations were also leveled. Permanent cement concrete pillars were established at 1 km interval.

Chainage Marking : The project road has been marked with chainages on center of pavement at 50 m apart in straight and at 10 m in curve portions. The chainage marking on the road enabled proper inventory of all the items required for design and act as reference points for cross sections.

c) Topographical Survey

Based on the Control / traverse station fixed along the stretch for horizontal and vertical control, surveys using total station were carried out to collect co-ordinate data (Northing and Easting) of all topographical points. The details covered included:

- Road centerline of regrading stretch and trace-cut centerline of re-alignment stretches.
- Left and right edges of existing road pavements
- Connecting roads
- Ground points on both sides of Road centerline and trace-cut centerline for exact computation of quantity.
- Trace-cut in hard rock area is for reference as the alignment points were not approachable due to vertical rock formation.

All man-made features have been surveyed including:

- Water sources including hand pumps, wells, etc.
- CD structures including culverts, bridges, etc
- Slope protection structures such as Retaining wall and Breast walls
- Buildings, huts, boundary walls, etc
- Electric pole, telephone poles , mobile tower etc.

All natural topographical features have been surveyed both in regrading and realignment stretches:

- Streams, channels and water sources
- Ponds and water bodies

Survey for Cross Sections

In order to provide proper design and quantity estimation, cross section survey has been carried out. The cross section survey included collection of elevation and other relevant heights in the corridor width. It contained the topographical survey which is utilized to create a proper Digital Terrain Model (DTM) so as to enable design of road geometrics, plan and profile, cross sections and quantity computations for various items including earth work, sub-grade and pavement.

Plan and Profile

The plan shows the recommended centerline of the regrading and realignment stretches, existing and proposed carriageway structures, drainage courses, intersections, electric and telephone poles, control traverse stations, proposed location of CD works in regrading and realignment stretches. Hill valley sides along with all the villages and habitats coming in proposed route.

The longitudinal section shows the average existing ground level (left and right), the existing centerline levels, the proposed road level, the gradient, details of horizontal alignment and location of cross drainage structures along with cross roads, etc.

3.2 TRAFFIC SURVEYS

In order to establish the traffic characteristics of the project roadway the following traffic surveys were carried out:

- i) Classified Traffic Volume Count
- ii) Intersection Turning Movement Count Survey
- iii) Origin-destination Survey

The methodology of traffic surveys and analysis of results have been presented in "Traffic Surveys and Analyses" in Volume II.

3.3 GEOTECHNICAL INVESTIGATION

Investigation was undertaken to characterise the soil forming the sub-grade by collecting samples by digging pits along the proposed road. Information regarding the top soil strata along the new proposed alignment was also collected.

Laboratory investigations were performed on collected soil samples, according to relevant Indian Standards to determine the engineering properties, namely:

- i) Particle size distribution
- ii) Atterberg limits
- iii) Field density
- iv) Field moisture content
- v) Compaction characteristics
- vi) 4-day soaked CBR

Soil investigation results and analyses have been presented in detail in "Design Report" section.

3.4 MATERIALS INVESTIGATION

Material survey of the area around the project road was conducted to identify the sources of suitable materials which can be used for construction. Samples collected from various sources were tested for their engineering properties and assessed for their suitability to be used in new construction.

Field investigations were performed to gather following information:

- i) Identification of suitable sources of granular material for base course.
- ii) Testing of physical properties of collected material for granular materials.
- iii) Testing of engineering properties for stone aggregates for use in WMM, DBM, BC and cement concrete.

3.5 HYDROLOGICAL INVESTIGATION

Hydrological investigations were carried out for economical design of cross drain structures. These investigations included performance of existing structures, assessment of discharge, HFL and other data as required for design.

Local enquiries were also made regarding HFL and watermarks were observed. For detailed study, site conditions, survey data, meteorological data were studied. Survey for taking cross sections, long sections of existing rivers and drains were carried out as per IRC code requirements.

3.6 ROAD -SIDE GEOTECHNICAL INVESTIGATION

Trial pits were excavated at 5 km intervals in a staggered manner to carry out investigation of field density and moisture content, in-situ CBR, laboratory CBR under control condition and sub grade soil properties.

3.7 ALIGNMENT OPTIONS

3.7.1 Introduction

The objective of the Route alignment study is to determine various alternative alignment options and to identify relative acceptable and preferable alignment. With a view to appreciate the feasibility and relative strength, weakness of the alternative proposals marked on the topo-sheets, and site evaluation of the same have been carried out. This was manifested through identifying the problems, shortcomings along with probable route.

The Project Road from Km 431.0 to Km 562.0 has road geometrics is not upto NH Standards. For the up-gradation of the road to the National Highway Standards, the existing gradients & radius have to be improved for safe and smooth flow of traffic. However, in many stretches, the gradients are very steep and the road has to be realigned. Based on the reconnaissance and other surveys, it is identified that more or less the complete road has to be reshaped. In this effort, there are two situations for improvement of the road geometric:

- Realignment Sections
- Regrading Sections

Re-alignment Sections

The existing road geometric in certain stretches cannot be brought within the permissible level of the road geometric of the National Highway Standards due to several considerations. In view of that, the realignment has been resorted to. We have studied a number of options before finalizing the realignment sections.

Re-grading Sections

The balance portion of the road after realignment is to be regraded in order to remove kinks, undulations, unevenness and fast changing gradients so as to bring the geometrics to the parameters of the National Highway Standards. Efforts have been made to adopt the existing road level in stretches. However, it is to bring it within the parameters of the

prescribed geometric standards. In view of that the existing road is to be adopted by cutting, filling and widening as well as by relocation more or less in the same area.

3.7.2 Critical Factors in Alignment Selection

The critical factors to be considered in the selection of the alignment are as follows:

The alignment should meet the geometric standards, particularly the gradients and curvature.

It should avoid acquisition of commercial and residential establishments.

It should avoid costly land acquisition.

It should be as directional as possible, i.e. least distance.

It should facilitate smooth traffic dispersal.

It should be environment friendly.

It should have minimum provision of structures.

During the detailed topographical survey, the existing road centre line has been marked on the ground and details surveys have been obtained on the existing road. However, in hard rock and hazardous areas the trace-cut is serving as reference line only.

3.7.3 METHODOLOGY

The Methodology Adopted Is Described As Follows :

Step - 1: Contour Map Study

Contour sheets are very important for fixing the alignment of the road and to design the road geometric, particularly in the hill road. Based on the contours, approximate alignment options have been studied taking into account the level difference between take-off and the terminal points. This exercise was done with a view to have an approximate understanding of the alignment options. The alignment marked on the contour sheets are planned to achieve the required length

Step-2: Satellite Image Study

Satellite image is very useful for fixing of the new alignment. Satellite image gives three dimension picture of the project area. Based on the contours, clear view of water channel & terrain condition, approximate alignment option has been studied. This exercise was done with a view to have a better understanding of the alignment option.

Step-3: Fly Level Survey

After the detailed study of the contour sheets and the available data, fly level survey of the entire road was carried out by using Auto Levels and the support instruments in order to generate the road profile. The gradients of various alignment options were generated in the shape of strip plan showing gradient of proposed road

SECTION - 4

DESIGN STANDARDS AND SPECIFICATIONS

DESIGN PHILISOPHY

Up-gradation of the existing road, having formation width of about 6.50m, to a formation width of 12.0m, construction of pavement work for the entire length, construction of culverts and permanent works at essential places, widening and improvement of blind curve portion, realignments at the portions where steep gradients have to be avoided, construction of pucca side drains at needy stretches, and installation of traffic/informatory sign and Kilometer stones.

The project road will have two-lane carriageway facility. The design philosophy that will be followed embodies the following:

- The facility should be of National Highway Standards
- The facility must meet the needs for development activities in the region.
- Travel should be safe, with in-built engineering features
- The facility should be aesthetically pleasing and should not be visually intrusive
- The facility should meet the environmental conditions

Design Standards for the highway requirements have been framed for providing the desirable level of service and safety. For this Project it is proposed to follow Design Standards given in IRC Standards, Codes, Guidelines and Special Publications besides MORT & H circulars and specifications as applicable to National Highways.

GEOMETRIC DESIGN STANDARDS

For this Highway Project, Geometric Design Standards shall be as per the following:

- IRC: 73-1980 shall be generally followed.
- IRC: SP: 19-2001: Manual for survey, investigations and preparation of road projects.
- IRC: 52: Recommendations about the Alignment survey and Geometric Design of Hill Roads (Second Revision).
- IRC-SP-48-1998: Hill Road Manual

Altitude of the road

Altitude of the Project Road lies between 585.0 m to 1335.0 m above the MSL

- **Terrain Classification:**

Terrain as pertinent to the road structure is classified as given in the following table:

Terrain	Cross Slope (%)
Plain	0 - 10
Rolling	> 10 upto 25
Mountainous	> 25 upto 60
Steep	> 60

This Road Corridor is generally in mountainous terrain.

Design Speed:

Sr/No	Mountainous Terrain		Steep Terrain	
	Ruling	Minimum	Ruling	Minimum
1.	50	40	40	30

The ruling design speed should generally be the criterion for correlation of the various design features.

Minimum design speed may be adopted in sections where site conditions or economic do not permit a design based on the ruling design speed. The adopted design speed is 30 Km/hr.

Cross Section Elements:

- **Right of Way (ROW)**

IRC: 73-1980 Table recommends the following land width for National Highways:

ROW Width

Sn	Road Classification	Mountainous and Steep Terrain	
		Open areas	Built-up areas
		Normal	Normal
1	National & State Highways	24	20

The existing ROW along the project road is not uniform. . The width of ROW 24 m and 20 m have been adjusted to accommodated the public concerser provided. However there are stretches where the ROW has been temporarily encroached. However, for improvement of junctions, relocation, etc, design will be as per functional requirement. Additional land acquisition shall be kept to the minimum for these areas

➤ Roadway Details

- **Total Road Width**

Total roadway width shall be 12.00 m.

- **Carriageway Width**

The National Highway shall be designed as a 2- lane carriageway. The width of two lane shall be 7.0 m.

- **Shoulder**

By the side of the carriageway on both sides, there shall be a paved shoulder of 2.5m.

- **Cross-Slope**

Each carriageway shall have cross slope of 2.50 per cent
The shoulder shall have a slope of 3.5 per cent.

- **Stopping Sight Distance:**

Sufficient stopping distance is made available for drivers to stop their vehicles when faced with an unexpected obstruction in the carriageway. The safe stopping sight distance, overtaking sight distance as recommended in the manual is as below:

Minimum Recommended Sight Distances

Speed (Km/h)	Safe Stopping Sight Distance (m)	Intermediate Sight Distance (m)
20	20	40
25	25	50
30	30	60
35	40	80
40	45	90
50	60	120

Horizontal Alignment:

- **Superelevation**

No super elevation is proposed when its value obtained is less than the road camber e.g. radii beyond which super elevation is not proposed are as mentioned below:

Radius Beyond Which Superelevation Not Required

Design Speed (km/hr)	Radii (Meters) For Camber of					
		4%	3%	2.5%	2%	1.7%
20	Proposed as per IRC: SP: 48-1998	50	60	70	90	100
25		70	90	110	140	150
30		100	130	160	200	240
35		140	180	220	270	320
40		180	240	280	350	420
50		280	370	450	550	650

- **Radius**

Radii for horizontal curves corresponding to ruling minimum and absolute minimum design speeds are as given below:

Minimum Radius for National Highways
(As per IRC: SP: 48-1998)

Mountainous Terrain		Steep Terrain	
Ruling Min Radius (m)	Absolute Minimum Radius (m)	Ruling Min Radius (m)	Absolute Minimum Radius (m)
80	50	50	30

There will be corresponding speed limit in case the radii are less than the above due to hill physical features and economic consideration.

Widening of Pavement at Curves

At sharp horizontal curves, it is necessary to widen the carriageway to facilitate safe passers of vehicle. Extra width to be provided on horizontal curve is given below (refer clause 6.8.5 of IRC: SP: 48: 1998).

Radius of Curve (m)	Upto 20°	20° to 40°	41° to 60°	61° to 100°
Extra width (m) 2 Lane	1.5	1.5	1.2	0.90

Wherever the radius is less than the specified minimum design speed, the transition curve, superelevation and pavement widening will be introduced. This will minimize the intrusion of vehicles on to adjacent lanes, tend to encourage uniformity of speed and increase vehicle speed at the curves.

- **Transition Length**

Transition length is given in Table below:

Transition Length of Curve
(As per IRC: SP: 48-1998)

Curve Radius (m)	Design Speed Km/h				
	50	40	30	25	20
15				NA	30
20				35	20
25			NA	25	20
30			30	25	15
40		NA	25	20	15
50		40	20	15	15
55		40	20	15	15
70	NA	30	15	15	15
80	55	25	15	15	NR
90	45	25	15	15	
100	45	20	15	15	
125	35	15	15	NR	
150	30	15	15		
170	25	15	NR		
200	20	15			
300	15	NR			
400	15				
500	NR				

NA-Not Applicable and NR- Transition not required

Vertical Alignment:

- **Codal Provisions**

The gradients to be maintained in the design are as per following guidelines:

Codal Reference	Clause No.
IRC : SP-48 - 1998, Hill Road Manual	12.2.1
IRC : SP-52-2001, Recommendations about Alignment Survey and Geometric Design of Hill Roads	6.9.1.3

- **Gradients for Different Terrain**

SL. No	Terrain	Ruling Gradient	Limited Gradient	Exceptional Gradient
1	Steep terrain up to 3,000 m height above mean sea level	6 % (1 in 16.7)	7 % (1 in 14.3)	8 % (1 in 12.5)

- Gradients upto the ruling gradient may be used as a matter of course in design (Ref. Clause No. 6.9.1.4 of IRC-SP: 48 - 1998).
- The limiting gradients may be used where the topography of a place compels this course or where the adoption of gentler gradients would add enormously to the cost. In such cases, the length of continuous grade steeper than the ruling gradient should be as short as possible. (Ref. Clause No. 6.9.1.5 of IRC-SP:48 - 1998).
- Exceptional gradients are meant to be adopted only in very difficult situations and for short lengths not exceeding 100 m at a stretch. Successive stretches of exceptional gradients must be separated by a minimum length of 100 m having gentler / flatter gradient (Ref. Clause No. 6.9.1.6 of IRC-SP:48 - 1998).

- **Vertical Curves**

Minimum length of Vertical Curve (As per IRC: SP: 48-1998)

Design speed km/h	Maximum Grade Change (Percent) Not Requiring A Vertical Curve	Minimum Length Of Vertical Curve (m)
35	1.5	15
40	1.2	20
50	1.0	30

The actual length for the vertical curve shall however be provided as per IRC: 73-1980

GEOTECHNICAL DESIGN**Earth Embankment**

- The fill material, compaction and other requirements shall conform to IRC: 36-1970. Where these specifications are in variance with the MORT&H specifications, the later shall govern and accordingly followed.

- ii) Side slope of 2:1 is provided

Side Slopes Formation in Cutting

The following values are adopted as per IRC: SP: 48:1998 Clause 7.4.

Side Slope in Cutting

<i>Sl.No.</i>	<i>Item</i>	<i>Slopes of Cutting</i>
1	Ordinary Soil / Heavy Soils	1 : 2
2	Ordinary / Soft Rock	1 : 4
3	Hard rock	80° to 90°

(Explanation: The slope 1: 2 signifies 1 in the horizontal direction and 2 in the vertical)

4.4 ROAD FURNITURES

Km Stones :

Km Stones, 200m stones and 5th km stones shall be provided as per Codal provisions.

Road Signs:

All signs shall be placed on the valley side of the road. Where extra emphasis is warranted, they may be duplicated on the right hand side as well as per IRC: 67-1977. The extreme edge of the sign shall be not less than 2 m from the edge of the carriageway.

Road Marking:

Provisions shall be made for center line marking with ready mixed road marking paint conforming to IS: 164

Safety Barriers:

Guardrails shall be provided on approaches to bridges.

4.5 PAVEMENT DESIGN

Design for flexible pavement has been carried out in accordance with the latest version of IRC: 37-2001.

Drainage

- An effective drainage system for drainage of road shall be designed as per stipulations of IRC SP: 42-1994.

- The road side channel will be trapezoidal and V shape of adequate capacity to carry 100% surface runoff of drainage area of highway ROW. It will be drained to the nearest available natural water course. We propose to adopt semi trapezoidal section as space is a not a constraint and it is more efficient and economical. This will be lined drain to drain out in the open field or to the defined outfall points. Semi trapezoidal shaped lined drain will also be adopted in the hard rock hill sections.
- The superstructure of bridges shall be drained with suitable drainage spouts.

Traffic Safety Measures

The design layout and materials chosen for the safety barrier shall suitably blend with the surrounding and shall further conform to MORT&H circulars and shall be finalized in consultation with and approved by PWD.

Culverts

- All Cross- Drainage structures shall be classified as culverts, minor bridges & major bridges depending on the length of the structure as per IRC standards. Structures up to 6m length fall into the category of culverts, more than 6m but up to 60m in length as minor bridges and beyond 60m length as major bridges.
- The deck width is required to be kept the same as that of the roadway for 2-lanes
- The bridge components shall be designed at least carry one lane of Class 70R for every two lanes with one lane of Class A for the remaining lanes, if any, or one lane of Class A for each lane.
- Entire project area falls under Zone-V of seismic zone as provided in IRC: 6-2000 Clause 222
- The list of IRC codes given below but not limiting to shall be referred during formulation of the design and drawings of bridges.

List of IRC Codes

IRC: 5-1998	Standard Specification & Code of practice for Road Bridges. Section - I General Features of Design (Seventh Revision)
IRC: 6-2010	Standard Specification & Code of practice for Road Bridges. Section - II Loads & Stresses (Fourth Revision)
IRC: 18-2000	Design Criteria for Pre-stressed Concrete Road Bridges (Post- Tensioned Concrete) (Third Revision)
IRC: 21-1997	Standard Specification & Code of practice for Road Bridges. Section - III Cement Concrete Plain & Reinforced (Second Revision)

IRC: 22-1986	Standard Specification & Code of practice for Road Bridges. Section - VI Composite Construction (First Revision)
IRC: 24-2001	Standard Specification & Code of practice for Road Bridges. Section - V Steel Road Bridges (Second Revision)
IRC: 45-1972	Recommendations for Estimating the Resistance of soil below the maximum Scour Level in the Design of Well Foundations of Bridges.
IRC: 73-1980	Geometric Design standards for Rural (Non-Urban) Highways.
IRC: 78-1983	Standard Specification & Code of practice for Road Bridges. Section - VII Foundation & Substructure (First Revision)
IRC: 83-1987	Standard Specification & Code of practice for Road Bridges. Section - IX Bearings, Part-II Elastomeric Bearings
IRC: 83-1987	Standard Specification & Code of practice for Road Bridges. Section - IX Bearings, Part-II POT,POT CUM PTFE, PIN Bearing
IRC: 89-1997	Guidelines for Design & Construction of River training & control works for road bridges.
IRC:SP:33-1989	Guidelines on supplemental Measures for Design, Detailing & Durability of Important Bridge Structures.

Design loads

- **Dead Loads:**

Apart from all the actual dead loads, irrespective of the type of wearing coat and crash barrier proposed, the structure shall be designed to allow for

- Wearing coat load = 2 kN/m².
- RCC Railing as per Standard Drawing

- **Live Loads:**

The bridge shall be designed to carry one lane of Class 70R for every two lanes with one lane of Class A for the remaining lanes, if any, or one lane of Class A for each lane.

- **Seismic Effects:**

- Basic horizontal seismic co-efficient - As per zone V
(Table 5 & fig 11 of IRC: 6-2000)
- Importance Factor - 1.5
Reinforcement detailing of structures shall conform to the provisions of IS 13920

Loading due to RCC Railing: **As per Standard Drawing**

- **Temperature Effect:**

- (i) Temperature stresses to be worked out as per Clause 218 of IRC: 6 - 2000.

For design of structure the temperature range to account for temperature effect shall be:

In the present case $t = +/- 25^{\circ} C$

- (ii) The superstructures shall also be designed for effects of distribution of temperature across the deck depth. For calculation of thermal forces effect of 'E' value of concrete should be taken as 50% of the instantaneous value as to account for effects of creep on thermal strains.

- **Differential Settlement:** 6 mm with instantaneous E value of concrete. This will be deemed to cover lifting of superstructure also.

TECHNICAL SPECIFICATIONS

The work will be executed as per MORT&H Specifications for Road & Bridge Works 5th Revision 2013

SECTION - 5

ENGINEERING DESIGN AND CONSTRUCTION PROPOSALS

5.1 GENERAL

This chapter deals with detailed design of various elements of project road, based on the findings of survey and investigations and design standards in the preceding chapters. The proposals include provision for the major items as given in Table.

Project Proposals - Major Items

Sl No.	Item
1	Site Clearance
2	Earthwork
3	Pavement Works
4	Slope Protection Works
5	Culverts
6	Miscellaneous Works
7	Facilities for Engineers
8	Provision for land Acquisition & Forest Clearance

5.2 CROSS SECTION ELEMENTS & ALIGNMENT

a) Cross Section Elements

Hill road cross-section has the usual components of carriageway, shoulder and longitudinal drain and parapet/railing requirements. The carriageway and shoulder widths are governed by the traffic volume expected on the road. Other components are functions of traffic safety and surface run-off requirements. Roadway, however, is defined as the total width of carriageway and shoulder.

Design Standards for Cross-section Elements

Sl. No.	Design Elements	Dimension in m
1.	Roadway width (including culverts)*	12.00 & 10.8
2	Roadway width at Bridges **	12.90
3	Carriageway width	7.00
4	Cross-slopes / camber (%)	2.5

* Roadway width are including width of side drain and parapet wall

** Roadway width is Overall Width between outermost faces of the railing.

b) Geometric Design

The general alignment of the road under this project is as:

NH 54 Highway	from Km 431 /000 to 553/604	Km as per design Chainage
Existing alignment	:	120.026 Km
Re-alignment	:	2.610 Km
Total length of proposed road	:	122.636 Km
Lawngtlai Bye Pass	:	1.92 Km
Total Length of project road	:	

Road is designed for 2-Lane (12.00 m roadway with 7.00 m carriageway).

Gradient, being the most important parameter, has been the guiding factor. Ruling gradient (less than 5.0%) has been achieved the maximum gradient being 7.0 % at few selected stretch.

c) Realignment of existing road:

For improvement of existing road some stretches, relocation and re-grading are proposed due to which traffic movement on existing road would be disturbed. Permanent diversion will be included in the design as to minimizing the structure damage, reducing cost of resettlement and easy and faster movement of vehicles.

For improvement of existing road some stretches relocation and re-grading are proposed due to which traffic movement on existing road would be disturbed. Permanent diversion will be included in the design as to minimizing the structure damage, reducing cost of resettlement and easy and faster movement of vehicles.

Sr. No.	Name of Village	Design Chainage		Existing Chainage		Length in Km
		From	To	From	To	
1	Theiva village	530+470	533+080	535+070	539+330	2.610
Total						2.610

d) Bye Pass Of Existing Road For Lawngtlai City:

The proposed Lawngtlai Bye pass take off from Km 470+50 of NH 54 and merging with NH 54 at Km 475+550 near BRO Camp. Lawngtlai Bye pass, which include 4.40 Km stretch of Multi Model Transit Route & 1.92 Km new alignment to avoid the movement of heavy vehicle traffic & traffic conjunction within the built-up portion of Lawngtlai city. Lawngtlai is the district headquarters of Lawngtlai district in the state of Mizoram . It is also the headquarters of Lai Autonomous District Council. Lawngtlai city spread is about 5.0 Km stretches length along the NH 54 both side. Within the city most of the stretches width of the existing road formation are varies from 9.0 m to 8.0 m. & nos of sub standard curve .Entire lawngtlai city markets, prominent building, Church & residential builds was along the NH 54. Therefore within the city improvement of road geometry for NH 2 lane standard is practically impossible because it will be raise up huge Compensation, rehabilitation & settlement issue up. However with available formation width of existing road within city will be possible for minor improvement of existing road geometry & carriage way for 2 lane standard with cover drain. So that commercial passenger vehicle & Light vehicle will be smoothly plying within city, which will benefit for commercial & social development of Lai Autonomous District Council. The proposed Bye pass will be used for heavy vehicle traffic & through traffic and to traffic conjunction within city.

e) Horizontal Alignment

The project corridor passes through steep and mountainous terrain. The design speed adopted is 30km/hour (IRC SP: 48). Along the proposed alignment, there will be no hair-pin bend. However minimum design speed has been considered on technical grounds. The vertical and horizontal alignments of the proposed road can be summarized as shown in table below:

Project Road length	No. of Curves with Design Speed in km/h				No. of Curves with Radius (m)		
	<30	30-40	40-50	>50	<30	30-50	>50
122.636 km	308	904	215	72	27	716	756
1.92 km	5	12	2	2	0	10	11

f) Vertical Alignment/Gradient

Gradient, being the most important parameter, has been the guiding factor. Ruling gradient (less than 5.0%) has been achieved, the maximum gradient being 7.0% at few selected stretch.

Summary of Proposed Vertical Alignment

Project road length	Length Distribution (km) and Gradient Class				
	<4%	4%-5%	5%-6%	6%-7%	7%-8%
122.636 km	77.376 Km	22.750 Km	13.170 Km	9.200 Km	0.140 Km
1.92 km	-	-	-	1.920 Km	-

5.3 Traffic Design Capacity

The width of a pavement is decided on the basis of the traffic volume it can efficiently carry. Traffic studies have been carried out in the vicinity of the project road and produced in this report. As the project road is going to serve as trade route between Tripura & Mizoram and later on with Bangladesh, the road is proposed to be of double-lane NH standard.

5.4 Design of Embankment / Hill Cutting

Considering the physical features, particularly the terrain, soil classification and hill slope line, typical cross-section (Type 1F to Type 49F) have been developed for hill road cutting / embankment building.

Concept Plan of the design of the embankment / hill cutting (stretch-wise) has been developed with specific mention of the formation building methodology / type to be adopted.

Compaction of disposal material

Spreading & Compaction of Roadway cutting and excavation from drain and foundation of other structures surplus material in layers not exceeding 300mm thickness at selected disposal location by Dozer at least four passes including construction of approach road to dumping site.

5.5 Pavement Proposal

The provision for pavement includes different layers of sub-base, base, and surfacing course as appropriate throughout the whole stretch of the road.

Granular Sub-base (GSB): 300mm thick sub-base layer of crushed stone aggregate has been proposed. The sub-base course has been extended up to full width of the formation.

Extra quantities for widening at curves, major and minor junction locations are calculated separately and final quantities are worked out.

#Wet Mix Macadam Base (WMM): 250mm thick base layer of Wet Mix Macadam is proposed for 7.0m width.

#Dense Bituminous Macadam of 100 mm thick and 40mm thick of Bituminous Concrete as surfacing course has been proposed.

5.6 Pavement Design

It is based upon CVD-312, CBR-6%, Traffic msa -10, Design period - 15 years, VDF-1.5, Annual Growth of traffic rate 7.5% and Design speed 30.00 Km/h. However the proposed pavement composition is based on CBR-5% and msa -20.

Pavement composition is designed as under:

Proposed pavement.

BC	:	40 mm
DBM	:	100 mm
WMM in 2-layers	:	250mm
GSB in 2-layers	:	300 mm
Total	:	690 mm

Shoulder Design

The carriageway width of 7m and paved shoulder width of 1.5 m on each side shall have the same pavement as the carriageway. The remaining 1.0m on each side shall be used to accommodate side drain on hill side or parapet/soft shoulder on valley side. In the hill side, depending on the total width of side drain, there is a small width remaining between the wall of side drain and paved shoulder, therefore it is also paved to avoid erosion by surface water

5.7 Culverts:

The project road traverses through mountainous and steep terrains with several natural drainages such as deep gorges, depressions, etc., where perennial water and rain water runoff are collected. Sometimes the storm runoff is accompanied by large quantities of debris from upstream side of the nallahs. Cross-drainage structures/culverts are required at these locations. From the field survey and investigations and geometric design of alignment the requirement of culverts for the whole length of the project have been identified.

Sr. No.	Type of culvert	Description	Span X Depth	NH 54	Lawngtlai Bye Pass
1	Type -1	Pipe Culvert	1.2 D	59	1
2	Type - 2	Pipe Culvert	1.2 D	112	10
3	Type - 1	Box Culvert	2.0 X 2.0	467	
4	Type - 2	Box Culvert	3.0 x 3.0	11	
5	Type - 3	Box Culvert	4.0 x 4.0	7	
6	Type - 4	Box Culvert	6.0 x 4.0	2	
			Total	658	11

5.8 Slope Protection works:

Adequate Protective structures are proposed for retaining of cut/fill slopes to ensure stability of the road formation at locations where required. The proposed type and length of each structure are shown in the table below:

Sr. No.	Type of Structure	Unit	Quantity		Remarks
			NH 54	Lawngtlai Bye Pass	
1	Retaining Wall	Rm	19400.00	390.00	Height varying between 3.0m to 6.0 m
2	Breast Wall	Rm	720.00	100.00	Height varying between 2.0m to 3.0 m
3	Gabion Wall	Rm	2790.00		Height varying between 2.0m to 3.0 m
4	Toe Wall	Rm	13490.00	100.00	Height varying between 2.0m to 3.0 m
5	Reinforced Earth Wall	Rm	750.00		Height varying between 7.0 m to 10.0 m
6	Cut Slope Wall	Rm	70000.00		Height upto 3.0 m
7	Gabion Wall (1:0.3)	cum	10428.00		
8	Rock fall Prevention Wall (H=3m)	Rm	9647.50		
9	Rock fall Prevention Fence (H=2m)	Rm	2410.00		
10	Hydro seeding (t=5cm)	sqm	5377.00		
11	Seeding and Mulching (Soil Cut Slope)	sqm	448043.00		
12	Vegetation Mat (Steep Slope)	sqm	1237.00		
13	Crib Work (F300)	sqm	1756.16		
14	Crib Work (F500)	sqm	3510.00		
15	Earth Removal	cum	12970.00		
16	Groundwater Drainage Work	Rm	9924.00		
17	Anchor Work	Rm	3072.00		
18	Rock-bolt Work	Rm	702.00		
19	Bamboo crib wall	Rm	22320.00		Height 1.5 m at Embankment & disposal location.

5.9 DRAINAGE DESIGN

Pavement Drainage includes camber / cross fall of 2.50%.

Slope 3.5 % has been considered for drainage of shoulders.

Roadside drains are designed as Lined drains

Length of drain					
Sr.No.	Chainage in m		Length	Type	Remarks
	From	To			
1	431000	432700	1700.0	Type-1	Soil Mixed Boulder
2	432700	434600	1900.0	Type-2	Village portion
3	434600	435100	500.0	Type-1	Soil Mixed Boulder
4	435100	437900	2800.0	Type-2	Village portion
5	437900	443400	5500.0	Type-1	Soil Mixed Boulder
6	443400	446400	3000.0	Type-2	Village portion

7	446400	457850	11450.0	Type-1	Soil Mixed Boulder
8	457850	459250	1400.0	Type-2	Village portion
9	459250	467000	7750.0	Type-1	Soil Mixed Boulder
10	467000	468100	1100.0	Type-2	Village portion
11	468100	468900	800.0	Type-1	Soil Mixed Boulder
12	468900	470600	1700.0	Type-2	Village portion
13	470600	476000	5400.0	Type-2	Village portion
14	476000	483750	7750.0	Type-1	Soil Mixed Boulder
15	483750	484050	300.0	Type-2	Village portion
16	484050	494750	10700.0	Type-1	Soil Mixed Boulder
17	494750	495450	700.0	Type-2	Village portion
18	495450	497400	1950.0	Type-1	Soil Mixed Boulder
19	497400	498900	1500.0	Type-2	Village portion
20	498900	502600	3700.0	Type-1	Soil Mixed Boulder
21	502600	505600	3000.0	Type-2	Village portion
22	505600	514800	9200.0	Type-1	Soil Mixed Boulder
23	514800	515900	1100.0	Type-2	Village portion
24	515900	520900	5000.0	Type-1	Soil Mixed Boulder
25	520900	522400	1500.0	Type-2	Village portion
26	522400	531300	8900.0	Type-1	Soil Mixed Boulder
27	531300	532030	730.0	Type-2	Village portion
28	532030	538600	6570.0	Type-1	Soil Mixed Boulder
29	538600	539400	800.0	Type-2	Village portion
30	539400	551100	11700.0	Type-1	Soil Mixed Boulder
31	551100	553636	2536.0	Type-2	Village portion
LAWNGTLAI BYE PASS ROAD					
32	0	1920	1920.0	Type-1	Soil Mixed Boulder
		Total	124524.00		
Summary					Length of drain in m
Length of drain on Hill side					= 124524.0
Length of drain on Valley side at Box Cutting portion					= 13260.0
Length of bridge					= 300.0
Catch water drain					= 2450.0
Culvert catchpit opening					= 1862.8
Net length of line drain					= 138071
	Type-1	108637	Type-2	29434	

Sr.No.	Type	Length	Remarks
1	Type-1	97404.00	Ordinary Soil stretch Rocky & Steep Stretch & Catch water drain at box cutting portion
2	Type-2	29466.00	Built up area

Chutes of the culverts form part of the culvert structure to lead the discharge to the catch-pit or to natural drainage channel.

5.10 ROAD SIGN AND MARKINGS

The project design includes (a) Mandatory / Regulatory Signs, (b) Cautionary / Warning Signs and (c) Information Signs , Route Marker Signs are provided .KM Stones are included as per type design.

5.11 STREET FURNITURE

Traffic Safety Posts and Parapet Walls are included.
Traffic Signs Marking & other Road Appurtenances

5.12 DIVERSION OF EXISTING ROAD DURING CONSTRUCTION

For improvement of existing road some stretches localized, relocation and re-grading are proposed. Due to which traffic movement on existing road will be hamper .Therefore temporary diversion of existing is very much necessary during construction period.

5.13 MAINTENANCE OF EXISTING ROAD:

The existing road is the main route to provide connectivity between district headquarters and International boarder of Indo Myanmar for international trading but also for Southern part of Mizoram. The minimum construction time provided for completion of the project is 4(four) years during which maintenance by the PIU will be no longer convenient as the site possession is resorted to hand over to the contractor till completion of the project. Under this circumstance, it is inevitable to keep provision for yearly maintenance of the existing road during construction and hence a provision of Rs.78.60 lakhs per year is kept to make the road payable for all type of vehicles without serious interruption of the traffic flow throughout the year.

Scope of maintenance:

- 1) Maintenance of Earthen Shoulder (filling with fresh soil).
- 2) Filling Pot- holes and Patch Repairs with open - graded Premix surfacing, 20mm.
- 3) Hill Side Drain Clearance.
- 4) Land Slide Clearance in soil/ rock
- 5) Clearing Grass and Removal of Rubbish.
- 6) Maintenance/repair of culvert/Retaining wall.
- 7) Clearance of culvert before monsoon
- 8) Removal of land slide

5.14 ROADSIDE AMENITIES

The continuous long distance travel on highways at speed is liable to cause fatigue as also mental tension to the road users. Moreover, the monotony of driving over long sections in the rural areas with no likelihood of any cross traffic brings sense of complacency in many drivers. and such distractions could result in serious accidents.

Sr.No.	Description	Nos.	Location
1	Public Toilet	15	Tawipui North -2,Tawipui North-1,Tawipui South
3	Bus Shed	30	,Thingfal ,Thingka ,AOC, Lawngtlai City, Saika,
4	Bazar Shed	15	Chawntlangpui ,Sihtlangpui ,Kawlchaw ,Zero point, Maubawk ,Theiva ,Theihri & Tuipang village

5.15 DESIGN OF INTERSECTION/JUNCTIONS

Based on the survey there are junctions/ intersections as mentioned below:

Road Junction.

Provisions have been made for the improvement of road junctions along the project road. Based on the survey there are 45 junctions/ intersections as mentioned below:-

S/N	CHAINAGE	SIDE	SHAPE	DESCRIPTION	LOCATION	TYPE
1	433340	LHS	Y	Village Link Road	Tawipui North -2	Minor
2	433500	LHS	Y	Village Link Road	Tawipui North -2	Minor
3	433525	RHS	X	Village Link Road	Tawipui North -2	Minor
4	433865	LHS	Y	Village Link Road	Tawipui North -2	Minor
5	433895	LHS	Y	Village Link Road	Tawipui North -2	Minor
6	434230	LHS	Y	Village Link Road	Tawipui North -2	Minor
7	435950	LHS	Y	Village Link Road	Tawipui North -1	Minor
8	440200	RHS	Y	Agricultural Link Road		Minor
9	440670	LHS	Y	Agricultural Link Road		Minor
10	445000	RHS	Y	Village Link Road	Tawipui South	Minor
11	445290	RHS	Y	Village Link Road	Tawipui South	Minor
12	450990	RHS	Y	BPL COMPANY		Minor
13	459150	LHS	Y	Village Link Road	Thingfal	Minor
14	467280	LHS	Y	Village Link Road	Thingka	Minor
15	467360	LHS	Y	Village Link Road	Thingka	Minor
16	470550	RHS	Y	Multi Model Road	Lawngtlai city	Major
17	472360	LHS	Y	Bungtlanga Road	Lawngtlai city	Major
18	472850	RHS	Y	City Link Road	Lawngtlai city	Minor
19	473060	LHS	Y	City Link Road	Lawngtlai city	Minor
20	473070	RHS	Y	City Link Road	Lawngtlai city	Minor
21	473450	RHS	Y	City Link Road	Lawngtlai city	Minor
22	474200	RHS	Y	City Link Road	Lawngtlai city	Minor
23	474770	RHS	Y	City Link Road	Lawngtlai city	Minor
24	475000	RHS	Y	City Link Road	Lawngtlai city	Minor
25	475500	RHS	Y	Multi Model Road	Link road	Major
26	475610	LHS	Y	PWD Complex Link Road	Lawngtlai city	Minor
27	478130	LHS	Y	Village Link Road		Minor
28	483800	RHS	Y	Village Link Road	Saika	Major
29	490650	RHS	Y	Village Link Road	Kawlchaw	Minor
30	503430	RHS	Y	Village Link Road	Kawlchaw	Minor
31	503720	LHS	Y	Village Link Road	Kawlchaw	Minor
32	503850	LHS	Y	Village Link Road	Kawlchaw	Minor
33	515170	LHS	Y	NH 54 B takeoff point	Zero Point	Major

34	523050	RHS	Y	Agricultural Link Road		Minor
35	530470	LHS	Y	Diversion start	Theiva	Minor
36	531480	RHS	Y	Village Link Road	Theiva	Minor
37	532020	RHS	Y	Village Link Road	Theiva	Minor
38	533080	RHS	Y	Diversion end	Theiva	Minor
39	536440	RHS	Y	Agricultural Link Road		Minor
40	538700	LHS	Y	Village Link Road	Theihri	Minor
41	539040	LHS	Y	Village Link Road	Theihri	Minor
42	552410	RHS	Y	Village Link Road	Tuipang	Minor
43	552830	RHS	Y	Village Link Road	Tuipang	Minor
44	553604		X	Village Link Road	Tuipang	Minor
45	Lawngtlai Bye Pass		Y	MM Road Junction	Lawngtlai City	Major

These Junctions needed major improvement as compared

Sr. No.	Chainage in m	Design
1	470+550	Junction with Multi Model Transit Route Take off
2	472+360	Junction with Bungtlanga BRO Road
3	475+500	Merging of Lawngtlai Bye Pass with existing NH-54
4	483+800	Junction with NCV road
5	515+170	Junction with NH- 54 B serves as Approach road Saiha District
6	0+00	Take of point of Lawngtlai Bye Pass from Multi Model Transit Route at Km 4.40.
7		Other link road need to be improved by proper grading, widening & black topping.

1.0 Junction at Ch. 470+550

Location : Junction with Multi Model Transit Route Take off
 Shape : Y-Shape
 Design : This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is considered suitable.

2.0 Junction at Ch. 472+360

Location : Junction with Bungtlanga BRO Road
 Shape : Y-Shape
 Design : This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is not considered suitable.

3.0 Junction at Ch. 475+500

Location	:	Merging of Lawngtlai Bye Pass with existing NH-54
Shape	:	Y -Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is not considered suitable.

4.0 Junction at Ch. 483+800

Location	:	Junction with NCV road
Shape	:	Y -Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is considered suitable.

5.0 Junction at Ch. 515+170

Location	:	Junction with NH- 54 B serves as Approach road Saiha District
Shape	:	Y-Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is not considered suitable.

6.0 Junction at Ch. 0+00

Location	:	Take of point of Lawngtlai Bye Pass from Multi Model Transit Route at Km 4.40.
Shape	:	Y-Shape
Design	:	This junction is designed as a simple meeting point with open space for the traffic. Regulation by rotary or traffic island is not considered suitable.

7.0 Other Junction

Location	:	Other link road , Junctions to be improved
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