

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

O. A. No. 739/2023

IN THE MATTER OF:

Environment Protection Society ...Applicant
(Regd.) S.A.S. Nagar & Anr.

Versus

Ministry of Environment, ...Respondents
Forest and Climate Change &
Ors.

INDEX

S.No.	Particulars	Pg. No.
1.	Traffic Volume Study by Respondent No. 6 Greater Mohali Area Development Authority	1 - 25
2.	Proof of Service	26

Through



PRASHANT MANCHANDA
COUNSEL FOR RESPONDENT NO. 6
123, R.G. COMPLEX II PRASHANT VIHAR,
ROHINI DELHI-110085
PH. 9971879203
EMAIL ID – Prashant.manchanda05@gmail.com

Upgradation/Strengthening of Roads:

- 100 Feet wide Sector dividing road starting from Sector junction 69/70-61/62 (Kumbra Chowk) to Bawa White House (3.2 Km)
- 100 Feet wide Sector dividing road starting from Sector junction 52/53-60/61 (SSP residence) lights to Mohali village T-junction (2.2 Km)
- 100 Feet wide sector dividing road Sector 48/65 and 49/64 (1.6 Km)

Client: Divisional Engineer, (C-3) GMADA, SAS Nagar



Consultant:

Department of Civil Engineering
National Institute of Technical Teachers' Training and Research, (MHRD, GOI)
Chandigarh – 160019

December, 2022

Contents

1. 100 Feet Sector *dividing road* Sector 52/53-60/61(SSP Residence) to Mohali Vill.:

Description	Page No
• Introduction, Methodology, Condition Survey	1
• Characteristic Deflection	2
• Design Thickness of Widening Portion, Overlay	3
• Design Recommendations	4-7
• OMC, MDD, CBR and Grading	8
• IITPAVE Sheet	9

2. 100 Feet Sector *dividing road* Sector *dividing road* Sector 48/65 and 49/64:

Description	Page No
• Introduction, Methodology, Condition Survey	10
• Characteristic Deflection	10
• Design Thickness of Widening Portion, Overlay	11-12
• Design Recommendations	13-14
• OMC, MDD, CBR and Grading	15
• IITPAVE Sheet	16

3. 100 Feet Sector *dividing road* Sector *dividing road* from Sector Jn 69/70-61/62 (Kumbra Chowk) to Bawa white House:

Description	Page No
• Introduction, Methodology, Condition Survey	17
• Characteristic Deflection	17
• Design Thickness of Widening Portion, Overlay	18-19
• Design Recommendations	20-21
• OMC, MDD, CBR and Grading	22
• IITPAVE Sheet	23
	24

4. Condition survey	25-31
5. Benkelman Beam Data	32-35
6. Photographs	



Project : 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61 (SSP Residence) lights to Mohali Village T junction (2.2 km)

Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

1. Introduction :

It is required to evaluate the road and provide Design for strengthening of the said road . It is also intended to widen the road on both side to increase the number of lanes . Total length is 2.2 km (approx) . It is at present mainly 2 lane without central verge . However , after widening , it shall have divider (Central verge) .

The Evaluation of existing road has been done by Benkelman Beam method. For new road section (widening portion) it is required to prepare design on CBR data. The department has desired that the design be provided on the basis of the relevant test data.

2. Methodology :-

- (i) For Existing portion , Benkelman Beam test is carried out.
- (ii) For widening portion , the samples are taken from Sub-grade level and CBR is carried out corresponding to appropriate degree of compaction (98% of MDD) after determining optimum compaction parameters based on Proctor Heavy Compaction test.

The design of Overlay for existing portion is based on guidelines as laid down in IRC: 81 – 1997.

The design of Widening portion is based on guidelines as laid down in IRC: 37 – 2108 .

Finally the compatibility has been made between the two designs such that existing and widening portion behave as a single structure.

Benkelman Beam test was conducted in the following manner :

- (i) Existing road : covering both sides to obtain overall idea. Standard procedure was adopted.

3. Condition Survey :

The following is observed :

The road generally has normal deterioration as occurs with aging . Some portion of have been subject to Patching by Bituminous works which are in good condition. Most common defects are loss of fines . All these indicate that the road generally requires renewal . A condition Survey report is attached separately.



Project : 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61
(SSP Residence) lights to Mohali Village T junction (2.2 km)
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

4. Characteristics Deflection Data :-

The characteristic deflection has been determined as per deflection data (Table 3 to Table 4).The corrections for sub-grade moisture , temperature has been applied. The compiled data is given below . Design Values may be selected such that it represents the whole section

Road Segment	Characteristic Deflection, mm
RD 0 to RD 1000	0.764
RD 1100 to RD 2100	0.771

5. Traffic Data , Axle Load Survey and Calculation of total axle load (msa's)

The number of standard axles are determined as per section 4 of standard (IRC – 37-2018)

$$N_s = \frac{365 \times A [1+r]^x - 1}{r} \times F \times D$$

A – Initial traffic in terms of no. of commercial vehicles

r - Rate of annual growth,

X – Design life taken to be 10 years.

F – vehicle damage factor, to be taken as per Table 4.2 of IRC 37 : 2018 or as per actual.

D = Lane Distribution Factor

N_s – Cumulative no. of standard axles.

No of msa's have been determined for a design life of 10 years (being case of Overlay) taking vdf values as determined from IRC Code .

A – 270 no. of commercial vehicles

r – 0.06 (6 %)

X – Design life taken to be 10 years.

F – 3.9

D = 0.5

Considering that after widening , the whole road section shall be Four Lane divided highway.

No of msa's in each direction : 2.53

No of msa's adopted for Design = 3



Project : 100 feet road Sector dividing road starting from Sector junction 52/53 - 60/61
(SSP Residence) lights to Mohali Village T junction (2.2 km)
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

6. Thickness of Overlay:-

For different road stretches, the over lay thickness are given in following table.

Characteristic Deflection, mm	Total overlay Thickness, mm (in terms of BM)	Equivalent thickness (DBM + BC)
0.77	Nil	-

Overlay thickness required in the table above is in terms of B.M

Even though , as per design chart , there is no requirement of Overlay for Strengthening purpose, there are requirements for the purpose of renewal and restoration of the riding quality.

7. Design Thickness of Widening portion :-

For design the guidelines of following code have been referred :
IRC-37-2018 (the design charts). Design is checked using IITPAVE Software as well

Design Life : For these roads , a design life of 20 years may be chosen .

Calculation of total axle load :

The number of standard axles are determined as per clause 4.6 of the standard (IRC - 37:2018)

$$N_s = \frac{365 \times [1+r]^n - 1}{r} \times A \times F \times D$$

For Design life = 20 years

N_s - Cumulative no. of standard axles.

Taking Lane distribution factor = 0.75 and directional distribution factor = 0.5

Substituting the values cumulative number of CVs for Internal Roads = 53001884

Say 5.30 msa or 5.5 msa

A value of 5.5 msa can be chosen for Design.

Project : 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61
(SSP Residence) lights to Mohali Village T junction (2.2 km)
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

8. Design for Widening Portion :

The design may be based on CBR Values . The existing soil shall be removed and re-compacted . The effective CBR has been taken as 6.5 % for design purpose.

Considering the following conditions :

Sub-grade CBR effective = 6 %

Granular layer thicknesses is taken as total 400 mm . Trial runs with various thickness of bituminous layers were made and the one meeting requirements is detailed below :

M_R Values :

1. Sub-Grade ; CBR = 6.0 % $M_R = 55.4 \text{ MPa} ; \mu = 0.35$
2. GSB (200 mm thick) $M_R = 173.17 \text{ MPa} ; \mu = 0.35$
3. WMM : (250 mm thick) ; (for granular layers GSB + WMM)
4. DBM Layer = 50 mm thick ; $M_R = 3000 \text{ MPa} ; \mu = 0.35$
5. BC Layer with VG- 30(35 mm thick) ; $M_R = 3000 \text{ MPa} ; \mu = 0.35$

Total Thickness of Bituminous Layer = 85 mm

Substituting thickness values and M_R Values in IITPAVE Software

$$\epsilon_t = 0.3183 \times 10^{-3}$$

$$\epsilon_v = 0.6593 \times 10^{-3}$$

Check for Performance Criteria :

(i) *Sub-grade Rutting* :

Degree of Reliability = 80 %

$$N_R = 4.1656 \times 10^{-8} [1/ \epsilon_v]^{4.5337}$$

Degree of Reliability = 90 %

$$N_R = 1.41 \times 10^{-8} [1/ \epsilon_v]^{4.5337}$$

Considering that the road is in City area ; for 80 % reliability

ϵ_v (permissible) for $m_{sa} = 5.5$; $= 7.680 \times 10^{-4}$

ϵ_v developed for present case ; i.e developed = 6.593×10^{-4}

Strain developed is less than permissible ; hence OK

IITPAVE Output Sheet enclosed.



Project : 100 feet road Sector dividing road starting from Sector junction 52/53 - 60/61
(SSP Residence) lights to Mohali Village T junction (2.2 km)
Client Executive Engineer (C-3) GMADA, SAS Nagar, Mohali

(ii) *Fatigue Cracking* :

Degree of Reliability = 90 %

$$N_f = 0.5161 \times C \times 10^{-4} [1/\epsilon_t]^{3.89} \times [1/M_{Rm}]^{0.854}$$

Degree of Reliability = 80 %

$$N_f = 1.6064 \times C \times 10^{-4} [1/\epsilon_t]^{3.89} \times [1/M_{Rm}]^{0.854}$$

$$C = 10^M \text{ where } M = 4.84 \left[\left\{ \frac{V_{be}}{(V_a + V_{be})} \right\} - 0.69 \right]$$

$$V_a = 4.0 \% ; V_{be} = 10.44 \% \text{ (For Binder Content} = 4.5 \% \text{)}$$

$$M = 0.15968 \text{ and } C = 10^M = 1.44$$

$$M_{Rm} = 3000 \text{ MPa (VG-40 grade being used)}$$

Substituting for $N_f = 5.5 \text{ msa}$

$$\text{Permissible Strain } \epsilon_t = 3.8009 \times 10^{-4}$$

Strain developed is 0.3183×10^{-3} or 3.183×10^{-4} which is lower than permissible value. Hence OK ; IITPAVE Output Sheet enclosed.

9. Overall Design :-

Following Considerations are kept in mind while finalizing Overlay on existing portion and design for widening portion.:

- (i) Profile Correction may be needed as the central verge /Divider shall be provided.
- (ii) In existing portion , the Central Verge shall be constructed. Even though an Overlay of 30 mm may be adequate for *renewal* , it is recommended to provide 40 mm thick layer to accommodate profile correction.
- (iii) During Widening , there is loss of support to the existing structure as excavation is done and traffic movement is normal. This can lead to depression at the joint in long run. Suitable precautions may be done to avoid traffic movement close to edge.
- (iv) The BC layer shall be laid common to cover existing portion and widening portion



Project : 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61
(SSP Residence) lights to Mohali Village T junction (2.2 km)
Client Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

10. Recommendations :

For Existing Portion

Provide BC of thickness = 40 mm

For Widening portion :

GSB = 200 mm + WMM = 250 mm

DBM = 50 mm + BC = 40 mm

10.1 Details /Brief Specifications

(i) **GSB** : To be laid in 2 layers

Each Layer : Grading 1 or Grading 5 for top 100 mm thick

And Grading 3 or 4 for bottom 100 mm layer.

Use Vibratory Roller, GSB may be laid in 2 layers each of thickness

(ii) **WMM/WBM**:

Selection of WBM/WMM need to be made depending on availability of appropriate width to lay WMM . If sufficient width available WMM shall be preferred , For smaller widths WBM may also be adopted .

For **WBM** : To be laid in 3 layers 100 mm , 75 mm and 75 mm thickness

Bottom layer – 100 mm thick , Grading 1 material with screenings

Remaining Layers : Grading 2 , with screenings

For **WMM** :

WMM can also be laid in 2 layers with vibratory roller , approx. of equal thickness.

DBM : Minimum Bitumen Content 4.5 % . Actual Bitumen Content should be worked out Optimum as per Marshall Method.

A Tentative Value of 4.65 % may be taken for estimate and variation may be admissible in the tender clause. Use VG-30 grade binder .

B.C.: Minimum Bitumen Content 5.4 % . Actual Bitumen Content should be worked out Optimum as per Marshall Method.

A Tentative value of 5.5 % may be taken for estimate and variation may be admissible in the tender clause ; Use VG-30 grade binder

(i) Take *Tack Coat* , *Prime Coat* as per standard practice.

(ii) Tack Coat of VG-10 @ 3 Kg/10sqm

Project : 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61
(SSP Residence) lights to Mohali Village T junction (2.2 km)
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

11. Compatibility of existing portion and widening portion :

It is required that the widened portion levels are such executed that the top layers of BC 40 mm is laid common . The profile correction for the purpose of making Central Verge shall be done with BC. Accordingly a varied thickness may be laid as per Site conditions on existing portion.

Generally it is observed that a longitudinal depression get formed at the joint between existing portion and widening portion. This is due to loss of side support and possible loosening of granular materials during excavation for widening purpose. Further a continuity/bond between existing and new portion needs special attention. To overcome this , provide Glass-Grid of width 1.5 m covering the joint portion of widening and existing road. This shall be done at the level on existing surface of road and DBM of widening portion. . The Glas grid should meet the following requirements :

Tensile Strength Ultimate , = 100 x 200 kN/m (MD x CD)

(machine direction , cross direction)

Tensile Elongation = 2.5 % \pm 1% ; Melting Point \geq 250 ° C

Biaxial , Grid Size or aperture = 25 mm x 19 mm

The material is available in Roll lengths = 50 to 60 m .



(Er .Ajay K. Duggal)

Associate Prof., Civil Engg.



Project: Testing and crust design for widening and up-gradation of the roads.
Client: Divisional Engineer (C-3) GMADA, SAS Nagar
Ref. No. GMADA/DE(C-2)/2022/1644 dated 11/11/2022

1. Sector dividing road Sector 52/53-60/61(SSP Residence) to Mohali Vill.:

Determination of OMC & MDD (as per IS : 2720- Part 8) and CBR Values (As per IS: 2720- Part 16): Method of Compaction: Heavy (Modified Proctor Compaction Method). Samples prepared at 97% density corresponding to OMC-MDD.

Table 1.1: CBR Values

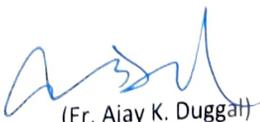
S. No.	RD	CBR (%)
1	250	6.8
2	1000	7.1
3	1500	9.9
4	2100	8.2

Table 1.2: Properties of Soil

RD	OMC (%)	MDD (g/cc)	L.L. (%)	P.L. (%)	P.I. (%)
250	10.4	1.96	28.7	21.9	6.8

Table 1.3: Grading of Soil Sample

IS Sieve Size ↓	RD →	250
4.75mm		100
2.00mm		100
1.18mm		100
600μ		93.8
425 μ		86.4
300 μ		85.1
150 μ		82.2
75 μ		79.8


(Er. Ajay K. Duggal)
Associate Prof., Civil Engg.

Project: 100 Feet wide Sector dividing road starting from Sector jn 52/53-60/61 (SSP residence) lights to Mohali Village T-Junction.

No. of layers 3
 E values (MPa) 3000.00 173.10 55.40
 Mu values 0.350.350.35
 thicknesses (mm) 85.00 450.00
 single wheel load (N) 20000.00
 tyre pressure (MPa) 0.56
 Dual wheel

Z	R	SigmaZ	SigmaT	SigmaR	TaoRZ	DispZ	epZ	epT	epR
85.00	0.00-0.	0.1916E+00	0.1238E+01	0.1001E+01-0.	0.1859E-01	0.5993E+00-0.	0.3251E-03	0.3183E-03	0.2115E-03
85.00L	0.00-0.	0.1916E+00-0.	0.2577E-01-0.	0.3945E-01-0.	0.1859E-01	0.5993E+00-0.	0.9748E-03	0.3183E-03	0.2115E-03
85.00	155.00-0.	0.1464E+00	0.8815E+00	0.9566E-01-0.	0.8204E-01	0.6087E+00-0.	0.1628E-03	0.2997E-03	0.5387E-04
85.00L	155.00-0.	0.1464E+00-0.	0.2342E-01-0.	0.6876E-01-0.	0.8204E-01	0.6087E+00-0.	0.6593E-03	0.2997E-03	0.5387E-04
485.00	0.00-0.	0.2906E-01	0.2793E-01	0.2299E-01-0.	0.7593E-02	0.4057E+00-0.	0.2709E-03	0.1736E-03	0.1351E-03
485.00	155.00-0.	0.3171E-01	0.2990E-01	0.2639E-01-0.	0.1162E-01	0.4191E+00-0.	0.2970E-03	0.1835E-03	0.1561E-03



Project : 100 feet road Sector dividing road from Sector junction 48/65 and 49/64 (1.6 km)

Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

1. Introduction :

It is required to evaluate the road and provide Design for strengthening of the said road . It is also intended to widen the road on both side to increase the number of lanes . Total length is 1.6 km (approx) . It is at present mainly 2 lane without central verge . However , after widening , it shall have divider (Central verge) .

The Evaluation of existing road has been done by Benkelman Beam method. For new road section (widening portion) it is required to prepare design on CBR data. The department has desired that the design be provided on the basis of the relevant test data.

2. Methodology :-

Same as on page 1 of report.

3. Condition Survey :

The following is observed :

The road generally has normal deterioration as occurs with aging . Some portion of have been subject to Patching by Bituminous works which are in good condition. Most common defects are loss of fines . All these indicate that the road generally requires renewal . In addition , there is low lying area on the Chandigarh border side that would require filling . This occurs in a length of about 300-400 m . A condition Survey report is attached separately.

4. Characteristics Deflection Data :-

The characteristic deflection has been determined as per deflection data (Table 3 to Table 4).The corrections for sub-grade moisture , temperature has been applied. The compiled data is given below . Design Values may be selected such that it represents the whole section

Road Segment	Characteristic Deflection, mm
RD 0 to RD 800	0.647
RD 800 to RD 1600	0.729



Project : 100 feet road Sector dividing road from Sector junction 48/65 and 49/64
(1.6 km)

Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

5. Traffic Data , Axle Load Survey and Calculation of total axle load (msa's)

The number of standard axles are determined as per section 4 of standard (IRC - 37-2018)

$$N_s = \frac{365 \times A [1+r]^x - 1}{r} \times F \times D$$

No of msa's have been determined for a design life of 10 years (being case of Overlay) taking vdf values as determined from IRC Code .

A - 243 no. of commercial vehicles

r - 0.06 (6 %)

X - Design life taken to be 10 years.

F - 3.9

D = 0.5

Considering that after widening , the whole road section shall be Four Lane divided highway.

No of msa's in each direction : 2.28

No of msa's adopted for Design = 3

6. Thickness of Overlay:-

For different road stretches, the over lay thickness are given in following table.

Characteristic Deflection, mm	Total overlay Thickness, mm (in terms of BM)	Equivalent thickness (DBM + BC)
0.73	Nil	-

Overlay thickness required in the table above is in terms of B.M

Even though , as per design chart , there is no requirement of Overlay for Strengthening purpose, there are requirements for the purpose of renewal and restoration of the riding quality.

7. Design Thickness of Widening portion :-

For design the guidelines of following code have been referred :
IRC-37-2018 (the design charts). Design is checked using IITPAVE Software as well

Design Life : For these roads , a design life of 20 years may be chosen .



Project : 100 feet road Sector dividing road from Sector junction 48/65 and 49/64 (1.6 km)
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

Calculation of total axle load :

It is determined for a Design life = 20 years as before
 N_S - Cumulative no. of standard axles.

Taking Lane distribution factor = 0.75 and directional distribution factor = 0.5
Substituting the values cumulative number of CVs for Internal Roads = 47701696
Say 4.7 msa or 5.0 msa
A value of 5.0 msa can be chosen for Design.

8. Design for Widening Portion :

The design may be based on CBR Values . The existing soil shall be removed and re-compacted . The effective CBR has been taken as 5.0 % for design purpose. The CBR in the length near RD 100 is found to be 4.2 . This is soaked value of CBR . This soil may be used for filling purpose and Soil of Soaked CBR = 5.5 may be used here to form sub-grade of compacted thickness of 500 mm .

Considering the following conditions :

Sub-grade CBR effective = 5 %

Granular layer thicknesses is taken as total 400 mm . Trial runs with various thickness of bituminous layers were made and the one meeting requirements is detailed below :

M_R Values :

- 1. Sub-Grade ; CBR = 5.0 % $M_R = 50.0 \text{ MPa} ; \mu = 0.35$
- 2. GSB (200 mm thick) $M_R = 156.3 \text{ MPa} ; \mu = 0.35$
- 3. WMM : (250 mm thick) ; (for granular layers GSB + WMM)
- 4. DBM Layer = 50 mm thick ; $M_R = 3000 \text{ MPa} ; \mu = 0.35$
- 5. BC Layer with VG- 30(35 mm thick) ; $M_R = 3000 \text{ MPa} ; \mu = 0.35$

Total Thickness of Bituminous Layer = 85 mm (for analysis purpose only)

Substituting thickness values and M_R Values in IITPAVE Software

$$\epsilon_t = 0.3363 \times 10^{-3}$$

$$\epsilon_v = 0.3246 \times 10^{-3}$$

Check for Performance Criteria :

(i) Sub-grade Rutting :

Degree of Reliability = 80 %

$$N_R = 4.1656 \times 10^{-8} [1 / \epsilon_v]^{4.5337}$$

Degree of Reliability = 90 %

$$N_R = 1.41 \times 10^{-8} [1 / \epsilon_v]^{4.5337}$$

Project : 100 feet road Sector dividing road from Sector junction 48/65 and 49/64 1.6 km
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

Considering that the road is in City area ; for 80 % reliability

ϵ_v (permissible) for $m_{sa} = 5.0$; $= 7.8437 \times 10^{-4}$

ϵ_v developed for present case , i.e developed $= 3.246 \times 10^{-4}$

Strain developed is less than permissible ; hence OK

IITPAVE Output Sheet enclosed.

(ii) *Fatigue Cracking* :

Degree of Reliability = 90 %

$$N_f = 0.5161 \times C \times 10^{-4} [1/\epsilon_t]^{3.89} \times [1/M_{Rm}]^{0.854}$$

Degree of Reliability = 80 %

$$N_f = 1.6064 \times C \times 10^{-4} [1/\epsilon_t]^{3.89} \times [1/M_{Rm}]^{0.854}$$

$$C = 10^M \text{ where } M = 4.84 \left[\left\{ \frac{V_{be}}{V_a + V_{be}} \right\} - 0.69 \right]$$

$$V_a = 4.0 \% ; V_{be} = 10.44 \% \text{ (For Binder Content} = 4.5 \% \text{)}$$

$$M = 0.15968 \text{ and } C = 10^M = 1.44$$

$$M_{Rm} = 3000 \text{ MPa (VG - 30 grade being used)}$$

Substituting for $N_f = 5.0 \text{ msa}$

$$\text{Permissible Strain } \epsilon_t = 3.8009 \times 10^{-4}$$

Strain developed is 0.3363×10^{-3} or 3.363×10^{-4} which is lower than permissible value. Hence OK ; IITPAVE Output Sheet enclosed.

9. Overall Design :-

Following Considerations are kept in mind while finalizing Overlay on existing portion and design for widening portion.:

- (i) Profile Correction may be needed as the central verge /Divider shall be provided.
- (ii) In existing portion , the Central Verge shall be constructed. Even though an Overlay of 30- 35 mm may be adequate for *renewal* , it is recommended to provide 40 mm thick layer to accommodate profile correction.
- (iii) During Widening , there is loss of support to the existing structure as excavation is done and traffic movement is normal. This can lead to depression at the joint in long run. Suitable precautions may be done to avoid traffic movement close to edge.
- (iv) The BC layer shall be laid common to cover existing portion and widening portion





Project : 100 feet road Sector dividing road from Sector junction 48/65 and 49/64 (1.6 km)
Client : Executive Engineer (C-3) GMADA, SAS Nagar, Mohali

10. Recommendations :

For Existing Portion

Provide BC of thickness = 40 mm

For Widening portion :

GSB = 200 mm + WMM = 250 mm

DBM = 50 mm + BC = 40 mm

10.1 Details /Brief Specifications

As provided for 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61 (SSP Residence) lights to Mohali Village T junction (2.2 km)

11. Compatibility of existing portion and widening portion :

As per reasoning provided for 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61 (SSP Residence) lights to Mohali Village T junction provide Glass-Grid of width 1.5 m covering the joint portion of widening and existing road.

(Er. Ajay K. Duggal)
Associate Prof., Civil Engg.



Project: Testing and crust design for widening and up-gradation of the roads.

Client: Divisional Engineer (C-3) GMADA, SAS Nagar

Ref. No. GMADA/DE(C-2)/2022/1644 dated 11/11/2022

2. Sector dividing road Sector 48/65 and 49/64:

Determination of OMC & MDD (as per IS : 2720- Part 8) and CBR Values (As per IS: 2720- Part 16): Method of Compaction: Heavy (Modified Proctor Compaction Method). Samples prepared at 97% density corresponding to OMC-MDD.

Table 2.1: CBR Values

S. No.	RD	CBR (%)
1	100	4.2
2	650	5.3
3	1050	6.1
4	1350	7.8

Table 2.2: Properties of Soil

RD	OMC (%)	MDD (g/cc)	L.L. (%)	P.L. (%)	P.I. (%)
650	9.8	1.92	33.4	24.9	8.5

Table 2.3: Grading of Soil Sample

IS Sieve Size ↓	RD →	650
4.75mm		100
2.36mm		100
1.18mm		100
600μ		94.6
425 μ		88.1
300 μ		84.3
150 μ		80.0
75 μ		77.4

(Er. Ajay K. Duggal)
Associate Prof., Civil Engg.



Project : 100 feet wide Sector dividing road starting from Sector junction 69/70 - 61/62 (Kumbra Chowk to Bawa White house)

Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

1. Introduction :

It is required to evaluate the road and provide Design for strengthening of the said road . It is also intended to widen the road on both side to increase the number of lanes . Total length is 3.2 km (approx) . It is at present mainly 2 lane without central verge . However , after widening , it shall have divider (Central verge) .

The road has recently been re-done for a larger width following the damage that occurred due to laying of Sewer line.

The Evaluation of existing road has been done by Benkelman Beam method. For new road section (widening portion) it is required to prepare design on CBR data. The department has desired that the design be provided on the basis of the relevant test data.

2. Methodology :-

Same as on page 1 of report.

3. Condition Survey :

The following is observed :

The road has recently been constructed by MC Mohali under project grant (AMRUT) A large portion (width) has been reconstructed from Sub-grade . The balance width has been provided with BC layer . The BC layer is done mostly and is under completion stage at the time of observation.

4. Characteristics Deflection Data :-

The characteristic deflection has been determined as per deflection data attached. The corrections for sub-grade moisture , temperature has been applied. The compiled data is given below . Design Values may be selected such that it represents the whole section .

Starting RD = Near Kumbra Chowk

Road Segment	Characteristic Deflection, mm
RD 0 to RD 1000	0.395
RD 1000 to RD 2000	0.488
RD 2000 to RD 3000	0.562

Project : 100 feet wide Sector dividing road starting from Sector junction 69/70 - 61/62
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

5. Traffic Data , Axle Load Survey and Calculation of total axle load (msa's)

The number of standard axles are determined as per section 4 of standard (IRC - 37-2018)

$$N_s = \frac{365 \times A [1+r]^x - 1}{r} \times F \times D$$

No of msa's have been determined for a design life of 10 years (being case of Overlay) taking vdf values as determined from IRC Code .

A - 274 no. of commercial vehicles

r - 0.06 (6 %)

X - Design life taken to be 10 years.

F - 3.9

D = 0.5

Considering that after widening , the whole road section shall be Four Lane divided highway.

No of msa's in each direction : 2.57

No of msa's adopted for Design = 3

6. Thickness of Overlay:-

For different road stretches, the over lay thickness are given in following table.

Characteristic Deflection, mm	Total overlay Thickness, mm (in terms of BM)	Equivalent thickness (DBM + BC)
0.56	Nil	-

Overlay thickness required in the table above is in terms of B.M

There is no requirement of Overlay for Strengthening or Renewal purpose, as it has been recently laid.

7. Design Thickness of Widening portion :-

For design the guidelines of following code have been referred :

IRC-37-2018 (the design charts). Design is checked using IITPAVE Software as well

Design Life : For these roads , a design life of 20 years may be chosen .

A



Project : 100 feet wide Sector dividing road starting from Sector junction 69/70 - 61/62
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

Calculation of total axle load :

The number of standard axles are determined as per clause 4.6 of the standard (IRC - 37:2018)

$$N_S = \frac{365 \times [1+r]^n - 1}{r} \times A \times F \times D$$

For Design life = 20 years

N_S - Cumulative no. of standard axles.

Taking Lane distribution factor = 0.75 and directional distribution factor = 0.5

Substituting the values cumulative number of CVs for Internal Roads = 53787097

Say 5.4 msa or 5.5 msa

A value of 5.5 msa can be chosen for Design.

12. Design for Widening Portion :

The design may be based on CBR Values . The existing soil shall be removed and re-compacted . The effective CBR has been taken as 5.0 % for design purpose.

Considering the following conditions :

Sub-grade CBR effective = 5 %

Granular layer thicknesses is taken as total 400 mm . Trial runs with various thickness of bituminous layers were made and the one meeting requirements is detailed below :

M_R Values :

- | | |
|---|--|
| 6. Sub-Grade ; CBR = 5.0 % | $M_R = 50.0 \text{ MPa} ; \mu = 0.35$ |
| 7. GSB (200 mm thick) | $M_R = 156.3 \text{ MPa} ; \mu = 0.35$ |
| 8. WMM : (250 mm thick) ; | (for granular layers GSB + WMM) |
| 9. DBM Layer = 50 mm thick ; | $M_R = 3000 \text{ MPa} ; \mu = 0.35$ |
| 10. BC Layer with VG- 30(35 mm thick) ; | $M_R = 3000 \text{ MPa} ; \mu = 0.35$ |

Total Thickness of Bituminous Layer = 85 mm (for analysis purpose only)

Substituting thickness values and M_R Values in IITPAVE Software

$$\epsilon_t = 0.3363 \times 10^{-3}$$

$$\epsilon_v = 0.3246 \times 10^{-3}$$

Check for Performance Criteria :

(iii) Sub-grade Rutting :

Degree of Reliability = 80 %

$$N_R = 4.1656 \times 10^{-8} [1/ \epsilon_v]^{4.5337}$$

Degree of Reliability = 90 %

$$N_R = 1.41 \times 10^{-8} [1/ \epsilon_v]^{4.5337}$$

Project : 100 feet wide Sector dividing road starting from Sector junction 69/70 - 61/62
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

Considering that the road is in City area ; for 80 % reliability

ϵ_v (permissible) for $m_{sa} = 5.5$; $= 6.048 \times 10^{-4}$

ϵ_v developed for present case, i.e developed $= 3.246 \times 10^{-4}$

Strain developed is less than permissible ; hence OK

IITPAVE Output Sheet enclosed.

(iv) *Fatigue Cracking* :

Degree of Reliability = 90 %

$$N_f = 0.5161 \times C \times 10^{-4} [1/\epsilon_t]^{3.89} \times [1/M_{Rm}]^{0.854}$$

Degree of Reliability = 80 %

$$N_f = 1.6064 \times C \times 10^{-4} [1/\epsilon_t]^{3.89} \times [1/M_{Rm}]^{0.854}$$

$$C = 10^M \text{ where } M = 4.84 \left[\left\{ \frac{V_{bc}}{V_a + V_{bc}} \right\} - 0.69 \right]$$

$$V_a = 4.0 \% ; V_{bc} = 10.44 \% \quad (\text{For Binder Content} = 4.5 \%)$$

$$M = 0.15968 \text{ and } C = 10^M = 1.44$$

$$M_{Rm} = 3000 \text{ MPa (VG - 30 grade being used)}$$

Substituting for $N_f = 5.5$ msa

$$\text{Permissible Strain } \epsilon_t = 3.7089 \times 10^{-4}$$

Strain developed is 0.3363×10^{-3} or 3.363×10^{-4} which is lower than permissible value. Hence OK ; IITPAVE Output Sheet enclosed.

13. Overall Design :-

Following Considerations are kept in mind while finalizing Overlay on existing portion and design for widening portion.:

(v) Profile Correction may be needed as the central verge /Divider shall be provided.

(vi) In existing portion , the Central Verge shall be constructed. No Overlay required except that it may be required for slope correction/ due to damage on account of machinery operations . Provision may be kept of 30 mm thick layer to accommodate such correction.

(vii) During Widening , there is loss of support to the existing structure as excavation is done and traffic movement is normal. This can lead to depression at the joint in long run. Suitable precautions may be done to avoid traffic movement close to edge.

(viii) The BC layer of widening portion shall match existing portion .



Project : 100 feet wide Sector dividing road starting from Sector junction 69/70 - 61/62
Client : Executive Engineer (C-3) GMADA , SAS Nagar , Mohali

14. Recommendations :

For Existing Portion

Keep Provision for BC of thickness = 30 mm to be executed need based.

For Widening portion :

GSB = 200 mm + WMM = 250 mm

DBM = 50 mm + BC = 35 mm

14.1 Details /Brief Specifications

As provided for 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61 (SSP Residence) lights to Mohali Village T junction (2.2 km)

15. Compatibility of existing portion and widening portion :

As per reasoning provided for 100 feet road Sector dividing road starting from Sector junction 52/53 – 60/61 (SSP Residence) lights to Mohali Village T junction provide Glass-Grid of width 1.5 m covering the joint portion of widening and existing road.

(Er. Ajay K. Duggal)
Associate Prof., Civil Engg.

Project: Testing and crust design for widening and up-gradation of the roads.

Client: Divisional Engineer (C-3) GMADA, SAS Nagar

Ref. No. GMADA/DE(C-2)/2022/1644 dated 11/11/2022

3. Sector dividing road from Sector Jn 69/70-61/62 (Kumbra Chowk) to Bawa white House:

Determination of OMC & MDD (as per IS : 2720- Part 8) and CBR Values (As per IS: 2720- Part 16): Method of Compaction: Heavy (Modified Proctor Compaction Method). Samples prepared at 97% density corresponding to OMC-MDD.

Table 3.1: CBR Values

S. No.	RD	CBR (%)
1	350	7.3
2	900	5.8
3	1350	4.9
4	1800	7.4
5	2500	8.1
6	3150	7.3

Table 3.2: Properties of Soil Sample

RD	OMC (%)	MDD (g/cc)	L.L. (%)	P.L. (%)	P.I. (%)
900	9.0	1.83	24.6	20.4	4.2
2500	10.8	1.81	-	-	-

Table 3.3: Grading of Soil Sample

IS Sieve Size ↓	RD →	2500
4.75mm		100
2.00mm		100
1.18mm		100
600μ		92.9
425 μ		86.3
300 μ		84.8
150 μ		81.7
75 μ		79.4


(Er. Ajay K. Duggal)
Associate Prof., Civil Engg.

Project:100 Feet Sector dividing road Sector 69/70-61/62.

No. of layers 3
 E values (MPa) 3000.00 156.30 50.00
 Mu values 0.350.350.35
 thicknesses (mm) 85.00 450.00
 single wheel load (N) 20000.00
 tyre pressure (MPa) 0.56
 Dual Wheel

Z	R	SigmaZ	SigmaT	SigmaR	TaorZ	DispZ	epZ	epT	epR
85.00	0.00-0.	1838E+00	0.1317E+01	0.1064E+01	-0.1841E-01	0.6550E+00	-0.3390E-03	0.3363E-03	0.2224E-03
85.00L	0.00-0.	1838E+00	-0.2521E-01	-0.3839E-01	-0.1841E-01	0.6550E+00	-0.1034E-02	0.3363E-03	0.2224E-03
85.00	155.00-0.	1435E+00	0.9575E+00	0.1463E+00	-0.7800E-01	0.6669E+00	-0.1766E-03	0.3188E-03	-0.4622E-04
85.00L	155.00-0.	1435E+00	-0.2333E-01	-0.6560E-01	-0.7800E-01	0.6669E+00	-0.7186E-03	0.3188E-03	-0.4622E-04
485.00	0.00-0.	2871E-01	0.2762E-01	0.2286E-01	-0.7443E-02	0.4465E+00	-0.2967E-03	0.1898E-03	0.1487E-03
485.00	155.00-0.	3124E-01	0.2956E-01	0.2614E-01	-0.1124E-01	0.4611E+00	-0.3246E-03	0.2005E-03	0.1710E-03

340



ashwani kaushik <kaushikashwani278@gmail.com>

OA 739/2023, Environment Protection Society(Regd.) S.A.S Nagar and Anr Versus Ministry of Environment, Forest and Climate Change and ors.

1 message

ashwani kaushik <kaushikashwani278@gmail.com>

Mon, Apr 28, 2025 at 10:38 AM

To: environmentprotection.regd@gmail.com, advskrattan@yahoo.com

Dear Sir,

Please find attached the Traffic Volume Study by Respondent No. 6 Greater Mohali Area Development Authority in the captioned matter.

Kindly treat this as an advance service and acknowledge the receipt of the same

This is for your kind information

Best Regards

Ashwani Kaushik

on behalf of

Prashant Manchanda

Counsel for Respondent No. 6

9971879203



Traffic Volume Study by Respondent No. 6 Greater Mohali Area Development Authority in OA 739 of 2023 Environment Protection Society regd VS Ministry of Environment Forest And Climate Change.pdf
7580K