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0 PROJECT DESCRIPTION

0.1 INTRODUCTION

Government of India has decided to take up through National Highways Authority of India (NHAI) about 1000Kms of expressways under Phase VI of the National Highways Development Project (NHDP). NHAI has decided to take up the Bangalore-Chennai Expressway project to facilitate high speed travel in this corridor. The existing National Highway–4 which is running parallel to the proposed expressway carries one of the highest traffic carrying corridors in India. The proposed expressway facility is proposed to be developed as a fully access controlled facility on a new alignment.

The National Highways Authority of India (NHAI) has appointed M/s Egis-BCEOM International S.A. in association with M/s SECON Pvt. Ltd. as consultants to carryout Consultancy Services for Feasibility Study cum Preliminary Design Report for the Bangalore-Chennai Expressway under NHDP Phase-VI. The proposed eight lane expressway would be a fully access controlled high speed facility. Therefore all the entry, exits and crossings have to be planned suitably as grade separated facilities. Safety in design, construction, and operation is of paramount importance for the facility and needs to be integrated at the planning stage itself.

The Feasibility cum Preliminary Design Report thus prepared shall contain, inter-alia, the scheme and layout of the expressway and the project facility, preliminary design and costing. The report will form the basis on which a Financial Consultant and legal consultant will prepare an RFP document for inviting bids from private entrepreneurs to award on Hybrid Annuity (HAM) concession. The concession will be on Hybrid Annuity (HAM) pattern, wherein the concessionaire shall, in accordance with the model concession agreement approved by the Government, take full responsibility to carry out the detailed design, construction, maintenance and operation of the project expressway and the project facilities confirming to the standards specified in the concession agreement. Concessionaire will obtain all the finances required for the project, and eventually transfer the project to NHAI after expiry of the concession period in a state as specified in the concession agreement. The Feasibility cum Preliminary Design report would provide all the technical details, based on which realistic bids will be received from the prospective bidders.

0.2 NEED FOR THE PROJECT

Road projects are generally undertaken to improve the economic and social welfare of those using the road or served by it. Increased road capacity and improved pavements can reduce travel times and lower the costs of vehicle use. Benefits include increased access to markets, jobs, education and health services, and reduced transport costs for both freight and passengers, reduce fuel consumption and exhaust emissions from the vehicle plying on the road.

0.3 PROJECT OBJECTIVE

The main objective of the consultancy work is to establish the feasibility of an expressway corridor between Bangalore and Chennai on the basis of technical, economic and financial

viability of the project in the first stage and thereafter prepare the feasibility cum preliminary design report for the construction of the expressway along the selected alignment by the NHAI. Based on the feasibility cum preliminary design report, bidding documents will be prepared for award of project on Hybrid annuity (HAM) Pattern for the construction, operation and maintenance of the expressway.

The expressway is planned to be developed as a fully access controlled facility. Appropriate measures for mitigating the effects of property and community severance and circulation of the local and access traffic are to be suggested. Drainage pattern needs to be undisturbed. Natural environment, human habitation and heritage sites have to be fully protected.

Safety is of paramount importance for the project and needs to be incorporated at the planning stage itself. Infrastructure for user facilities, operation and maintenance, incident management and user information system will be an integral part of the study. Modern automatic toll collection systems with state of the art technologies will be proposed for the project.

0.4 PROJECT APPROACH FOR ENVIRONMENTAL STUDIES

The basic approach adopted for conducting the environmental study for the project will strongly pursue the prevailing institutional and legislative setup of the Government of India (GoI) and in conformity with NHAI policy on this subject. The main approaches are:

- Identification, appraisal and division between positive and negative impacts, direct and indirect impacts, and instant and long-term impacts likely to result from the proposed bypass;
- Identification of unavoidable or irreversible impacts;
- Explanation of the impacts quantitatively, in terms of environmental costs and benefits, if possible;
- Characterization of the extent and quality of available data;
- Identification of significant information deficiencies;
- Identification as well as estimation of any uncertainties associated with predictions of impacts;
- Identification of un-mitigated negative impacts;
- Exploration towards the opportunities for environmental enhancement; and
- Identification of feasible and cost effective mitigation measures to minimize negative impacts and enhance positive impacts by incorporating in the preliminary engineering design.

0.5 PROJECT LOCATION

0.5.1 Bangalore-Chennai Expressway

After a thorough and careful study of various alternate alignments, the Main alignment of Bangalore-Chennai Expressway was finalised keeping in view the engineering, environmental and social aspects. The final alignment considered for feasibility and preliminary study of BCE phase – III of 8 lane Bangalore Chennai Expressway starts from Km 156.000 near 190.Ramapuram Village, Gudipala mandal, Chittoor District in Andhra Pradesh and ends at Km 262.569 near Irungattukottai village, Sriperambudur Taluq, Kanchipuram District in Tamil Nadu. The total length of the proposed BCE project is 106.569 Km.

The Phase III of Bangalore-Chennai Expressway starts from Km 156+000 and ends at Km 262+569 and passes through 2 States: Andhra Pradesh and Tamil Nadu. The major land use of BCE in Andhra Pradesh is of cultivation land and rest includes waste land. Section of BCE in Tamil Nadu is mainly cultivation land and waste land with some forest and intermixed patches of grass lands. The details of the project road are given in Table 0.1 to Table 0.2.

Table 0. 1: Details of the Project in the State of Andhra Pradesh

Sl. No.	Section	Design Chainage (km)		Length (km)
		From	To	
1	From Km 156.000 near 190.Ramapuram Village,Gudipala mandal,Chittoor District in Andhra Pradesh to AP/TN Border	156+000	168+000	12.000
			Total	12.000

Table 0. 2: Details of the Project in the State of Tamil Nadu

Sl. No.	Section	Chainage		Length (km)
		From	To	
1	Near AP/TN Border to Km 262+569 of proposed BCE near Irungattukottai village, Sriperambudur Taluq, Kanchipuram District in Tamil Nadu at NH-4 (Sriperambadur road).	168+000	262+569	94.569
			Total	94.569

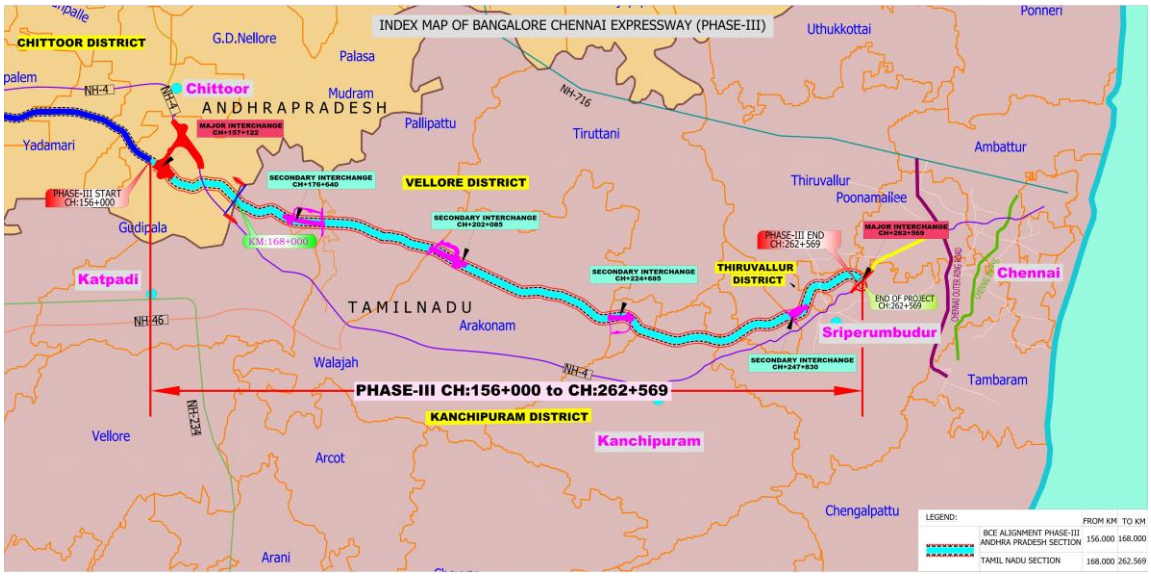


Figure 0.1: Key Plan

0.6 PROPOSED DEVELOPMENT

As stated earlier the proposed project is the part of National Highway Development project (NHDP) Phase-VI to facilitate high speed travel in this corridor, which carries one of the highest

volumes of traffic along the existing National Highway route serving the corridor. The project road under the proposal is from Km 156.000 near interchange at NH-4 and ends at Km 262+569 near interchange at NH-4 (Sriperambadur road). The total length of the proposed BCE project is 106.569 Km. the salient feature of the proposed project is summarized in **Table 0.3.**

The Project road shall be eight lane divided configuration with paved shoulder. The typical cross sections along the project highway are indicated in **Figure 0-2 (a)** to **Figure 0-2 (n)**.

Table 0.3: Salient Features of the Project

A. General Information:

S. No.	Project Components	Details
1.	Location of Project	8-lane of Bangalore Chennai Expressway in the states of Andhra Pradesh and Tamil Nadu
2.	Administrative locations	Districts: Chittoor, Vellore, Kanchipuram and Thiruvallur.
3.	State	Andhra Pradesh and Tamil Nadu
4.	Length of the Project road	106.569 Km
5.	Terrain	The project road is in plain/Rolling/Hilly terrain
6.	Major Settlement along the Project Stretch	Banavaram, Sriperambadur
7.	Rivers/Streams/Canals	The project mainly crosses rivers namely Ponnai and Kusas Thalai. Apart from these rivers, there are some natural streams/nallas crosses the project road.
8.	Ponds/Tanks	27 No Tanks are affected.
9.	Forest area	Reserved Forest (RF) is located in Mahimandalam Village in Vellore district Tamil Nadu.

B. Other features:

S. No.	Items	Proposed
1.	ROW	90 m
2.	Carriageway	The paved carriageway shall be 37.5 meters wide including edge strip.
3.	Design Speed	120 Kmph
4.	Major Bridge	34 Nos.
5.	Minor Bridge	22 Nos.
6.	ROB	3 Nos.
7.	No. of Culverts	125 Nos.
8.	Vehicular Underpass	13 Nos.
9.	Vehicular Overpass	1 No
10	Light Vehicular Underpass	35 Nos
11.	Elephant Underpass	-
12.	Flyovers	7 Nos
13.	Rest Area	4 Nos (Include Both Side)
14.	Toll Plaza	1 No
15.	Interchange with Toll plaza	5 Nos
16.	Street Light	See section 0.8.10
17.	High Mast Light	See section 0.8.10
18.	Estimated Cost of the Project	Rs. 5774.43 crores.

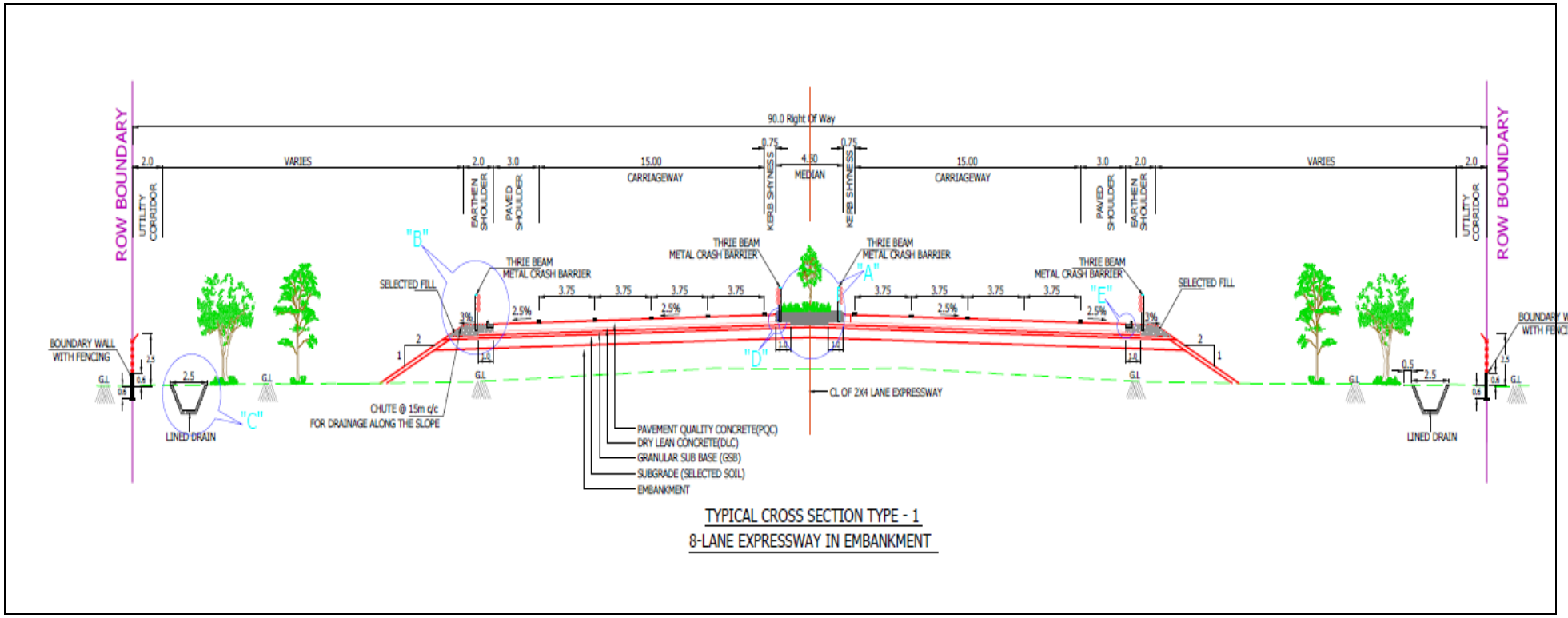


Figure 0-2 (a): The typical cross section along the project highway

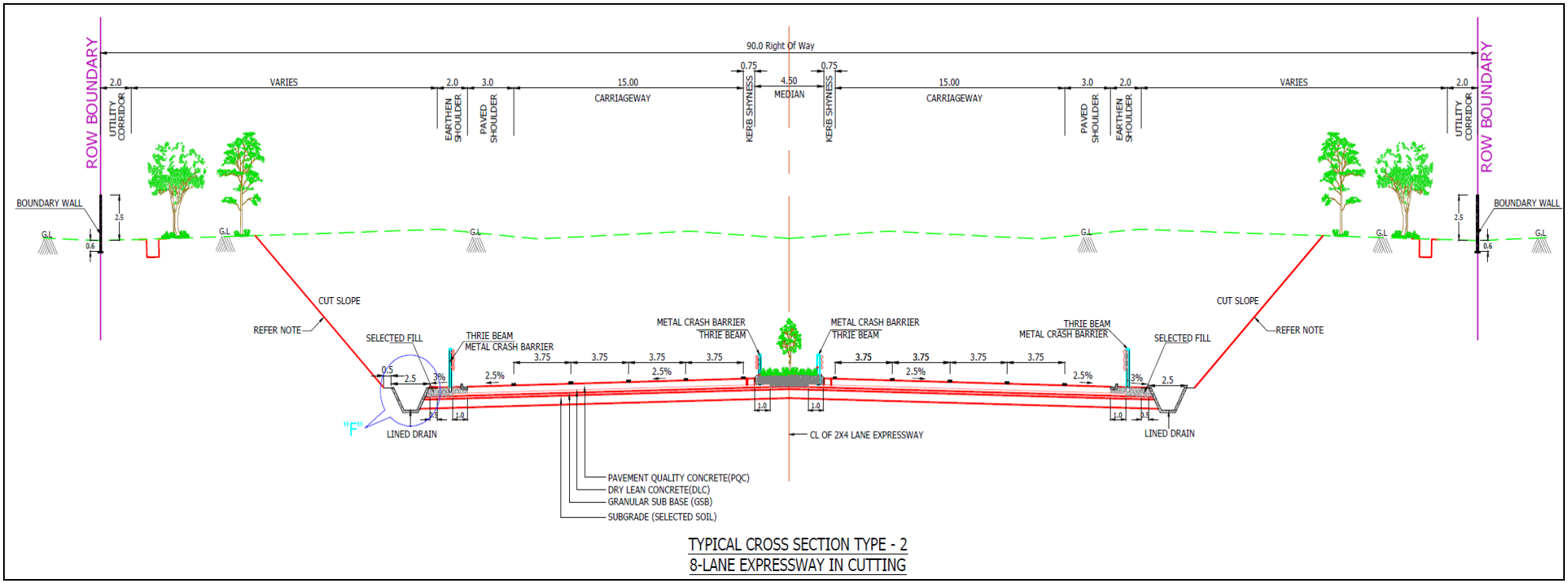
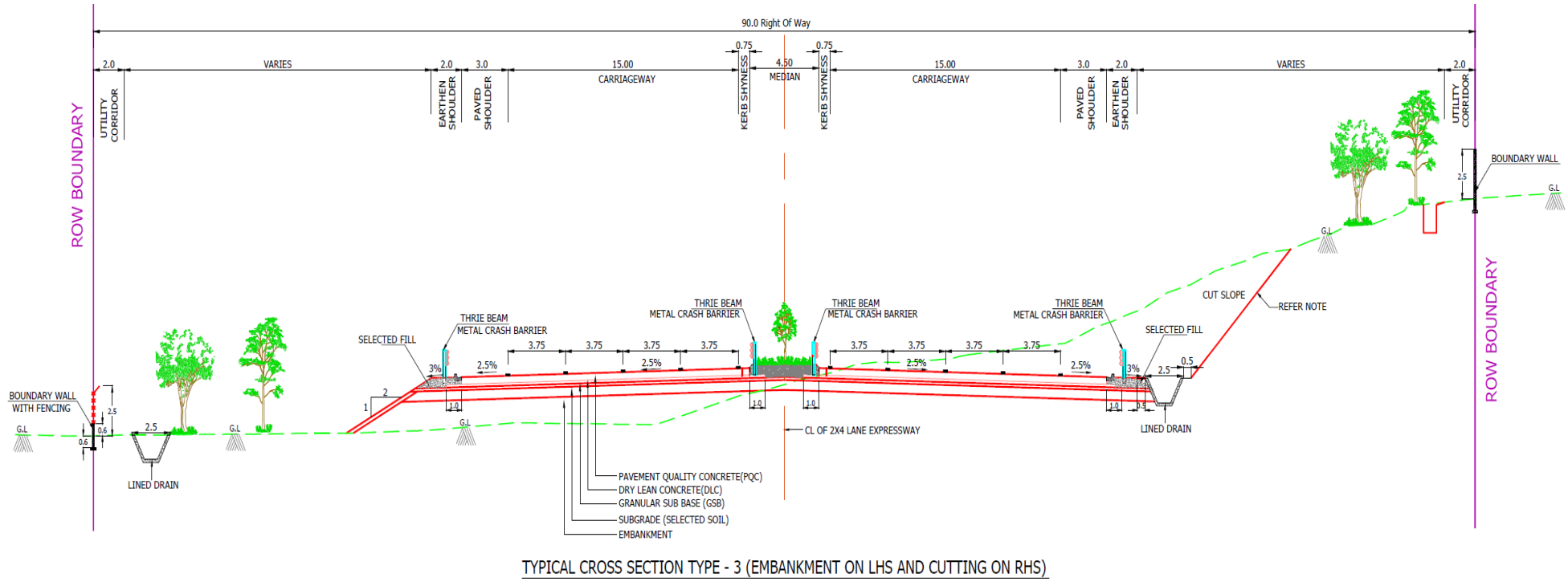


Figure 0-2 (b): The typical cross section along the project highway



TYPICAL CROSS SECTION TYPE - 3 (EMBANKMENT ON LHS AND CUTTING ON RHS)

Figure 0-2 (c): The typical cross section along the project highway

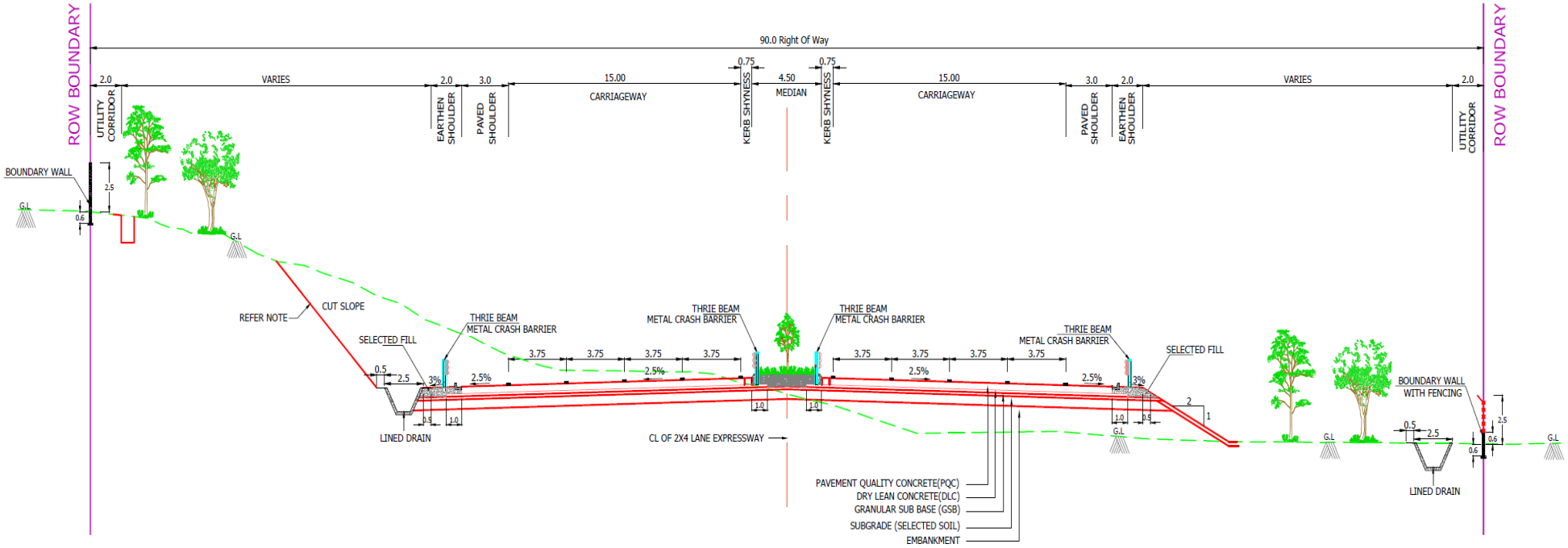


Figure 0-2 (d): The typical cross section along the project highway

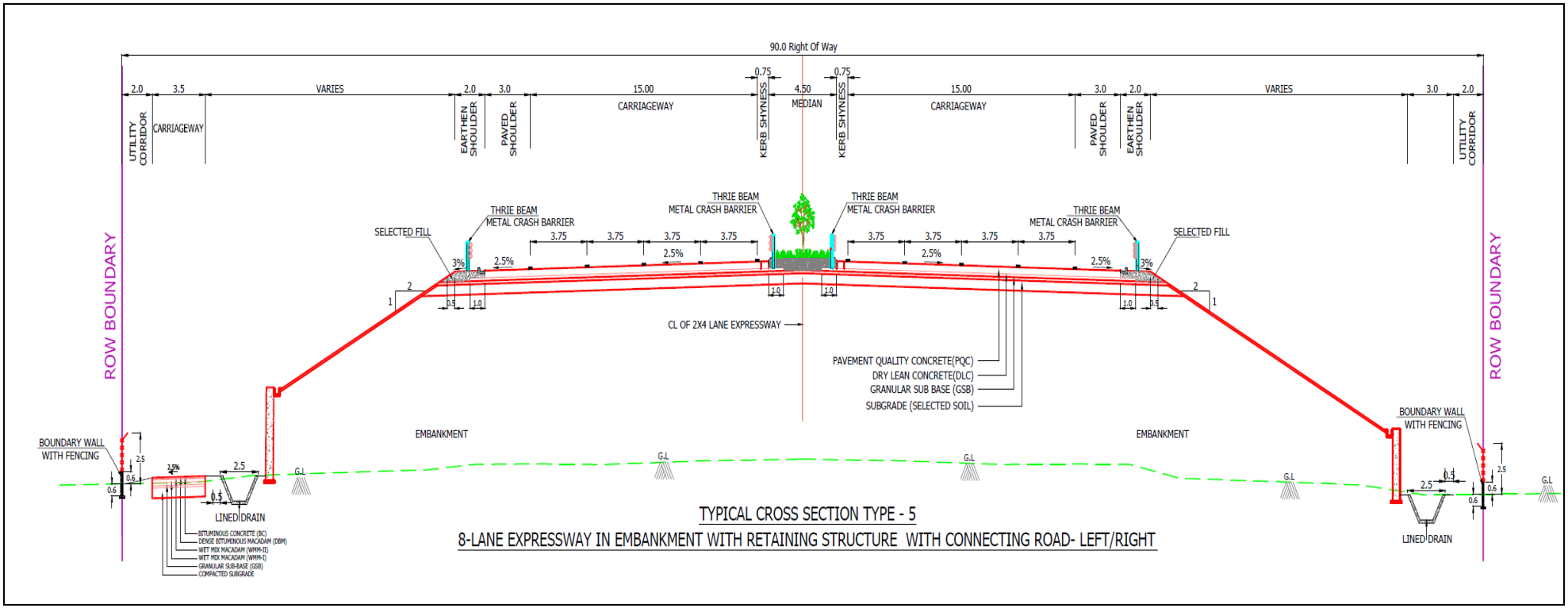


Figure 0-2 (e): The typical cross section along the project highway

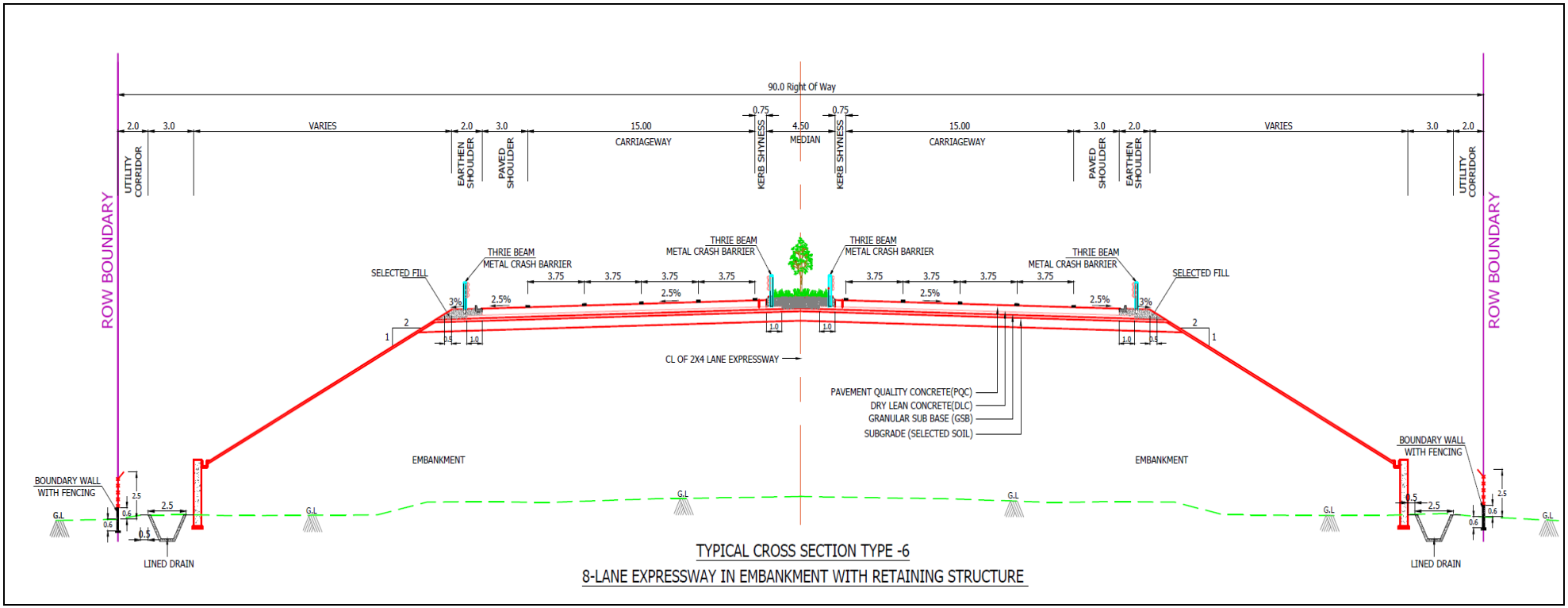


Figure 0-2 (f): The typical cross section along the project highway

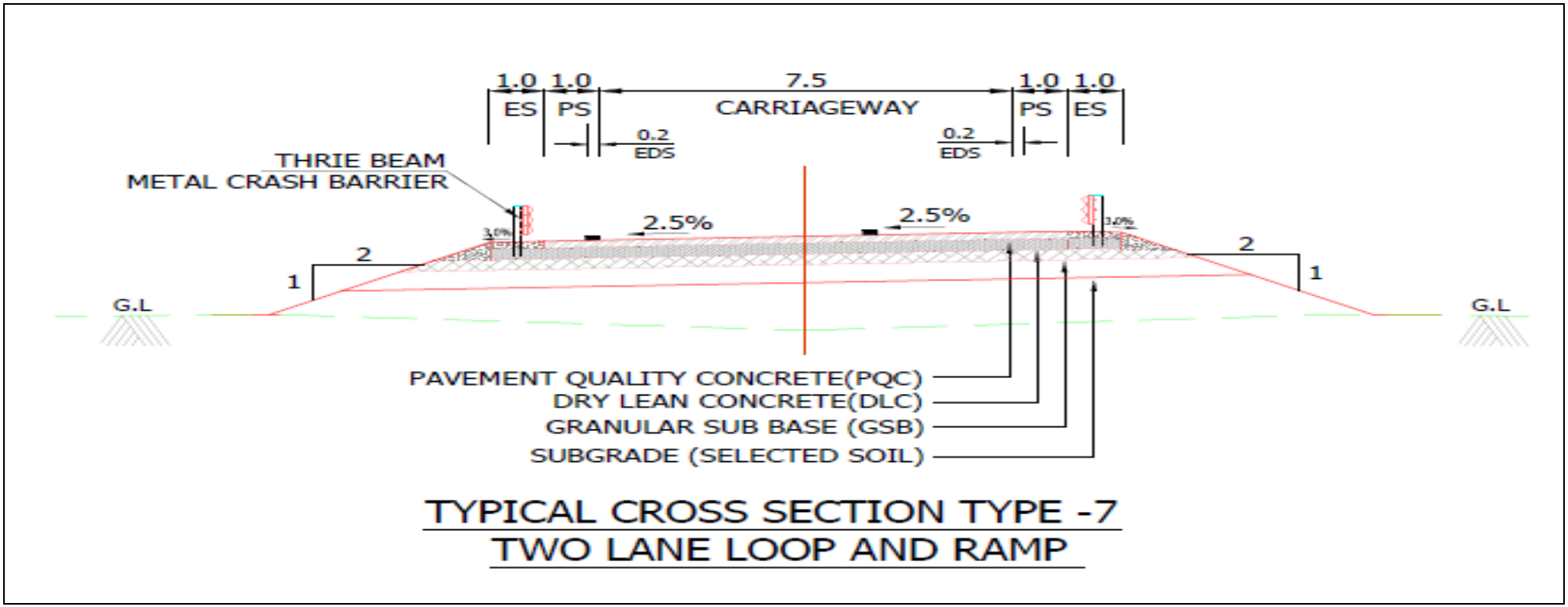


Figure 0-2 (g): The typical cross section along the project highway

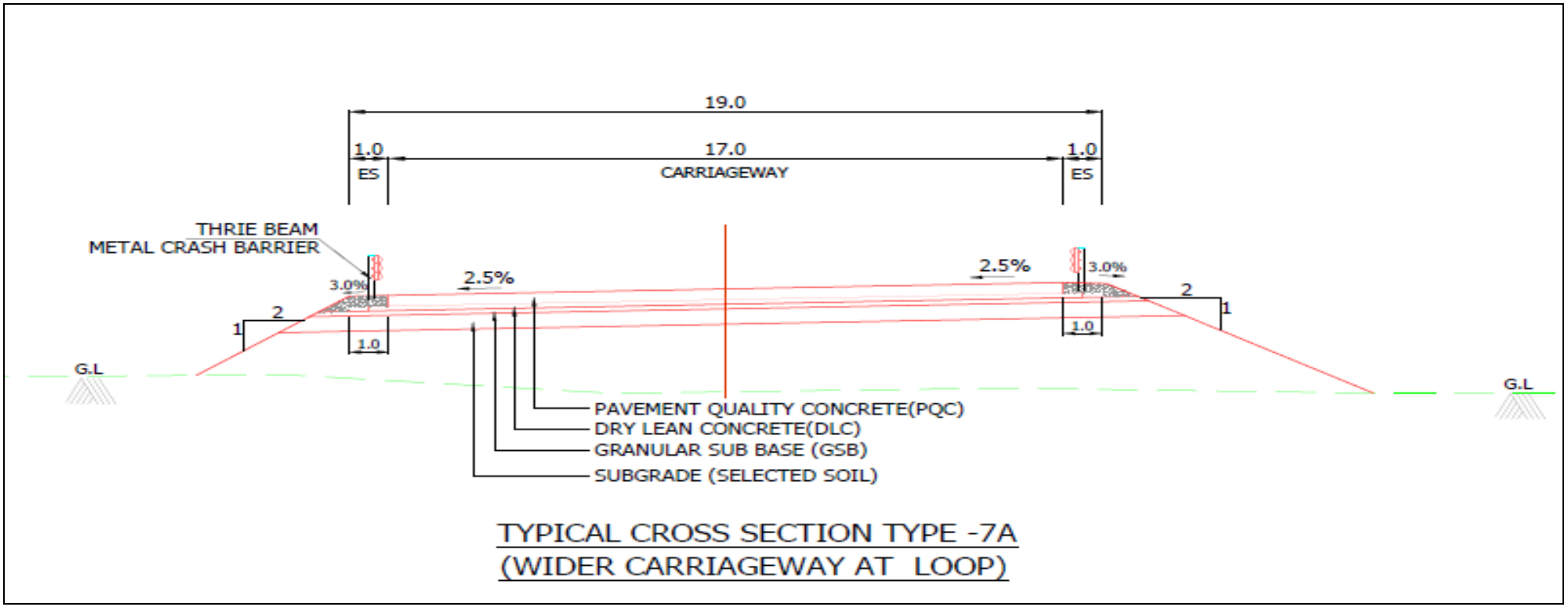


Figure 0-2 (h): The typical cross section along the project highway

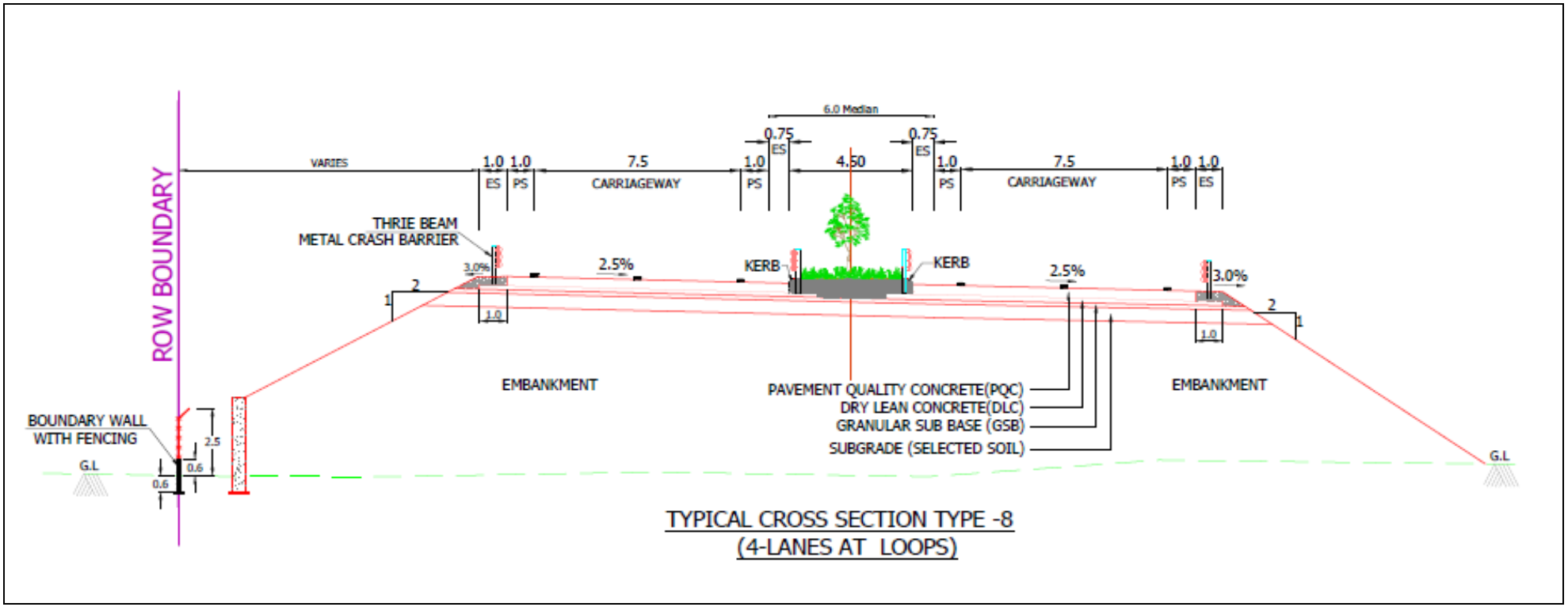


Figure 0-2 (i): The typical cross section along the project highway

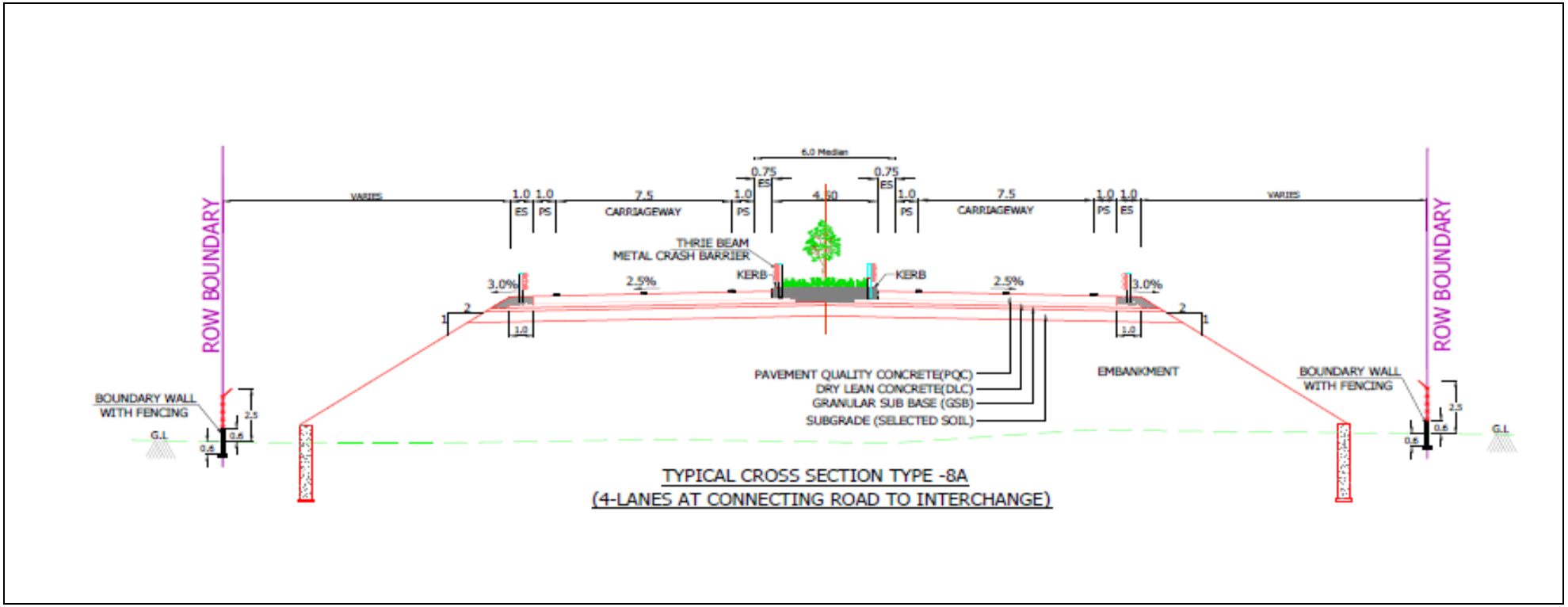


Figure 0-2 (j): The typical cross section along the project highway

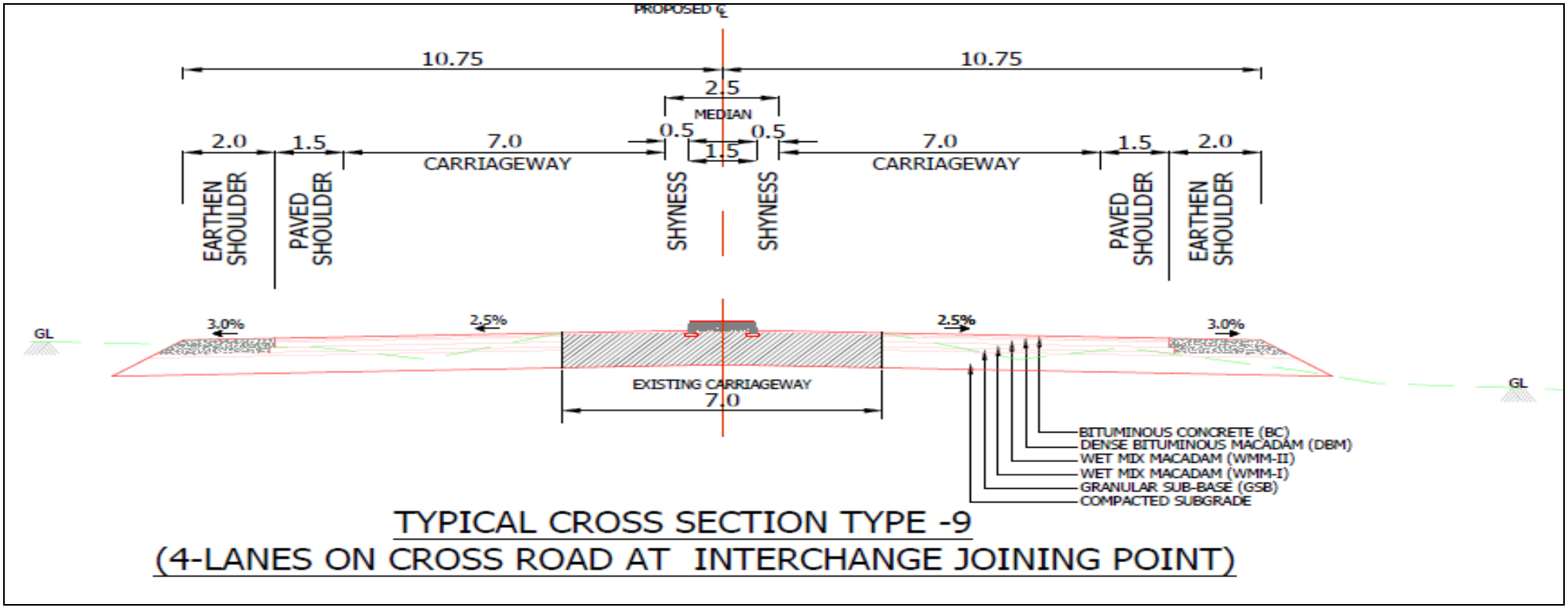


Figure 0-2 (k): The typical cross section along the project highway

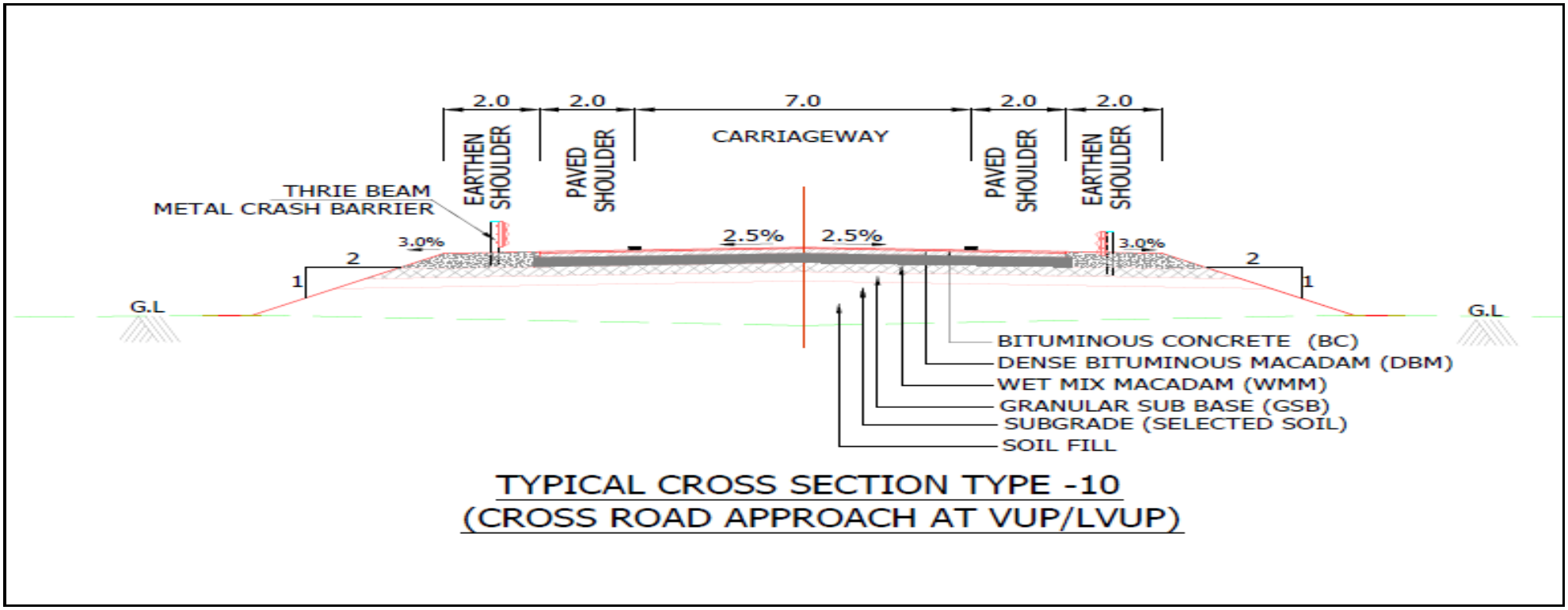


Figure 0-2 (I): The typical cross section along the project highway

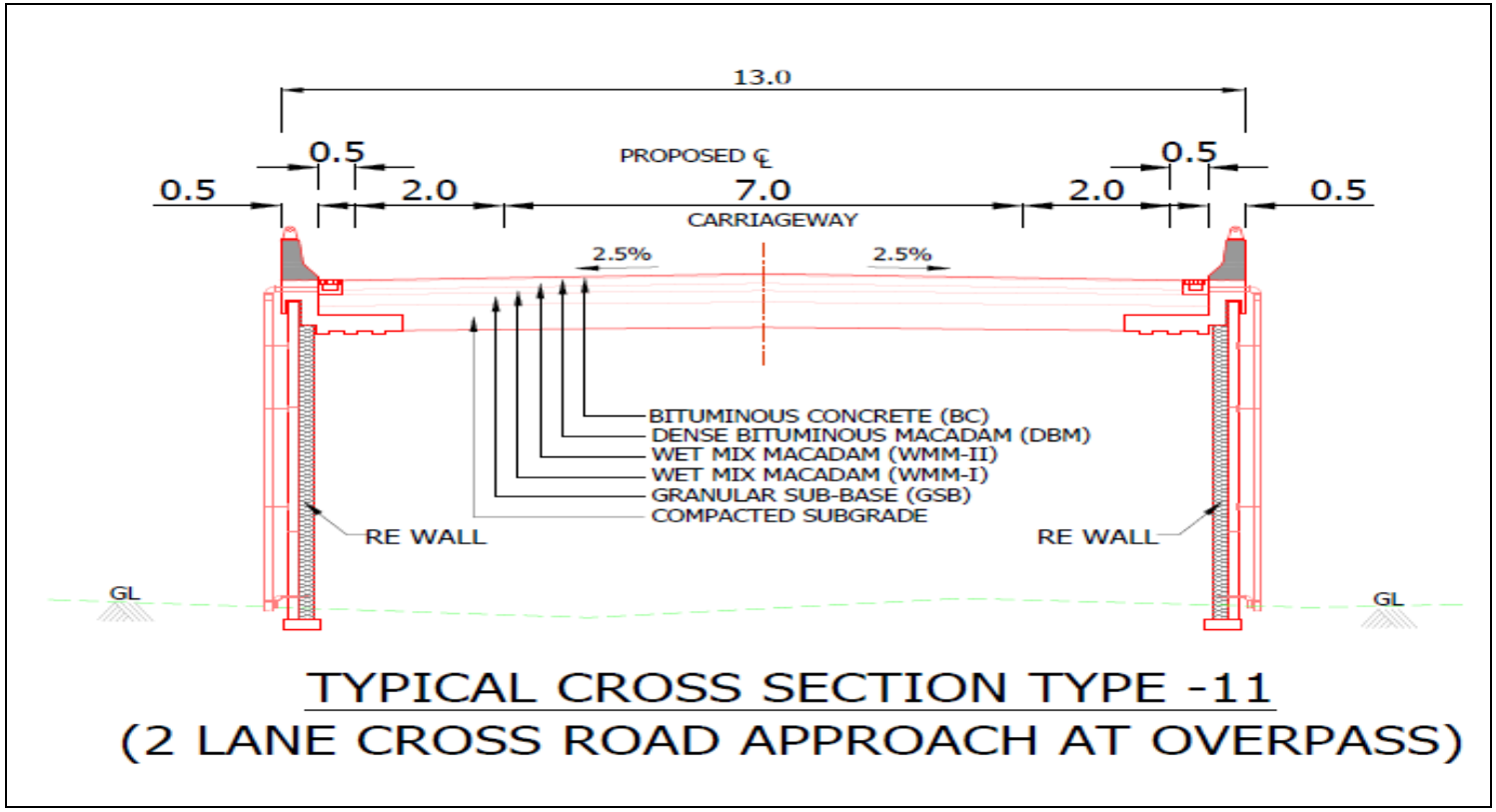


Figure 0-2 (m): The typical cross section along the project highway

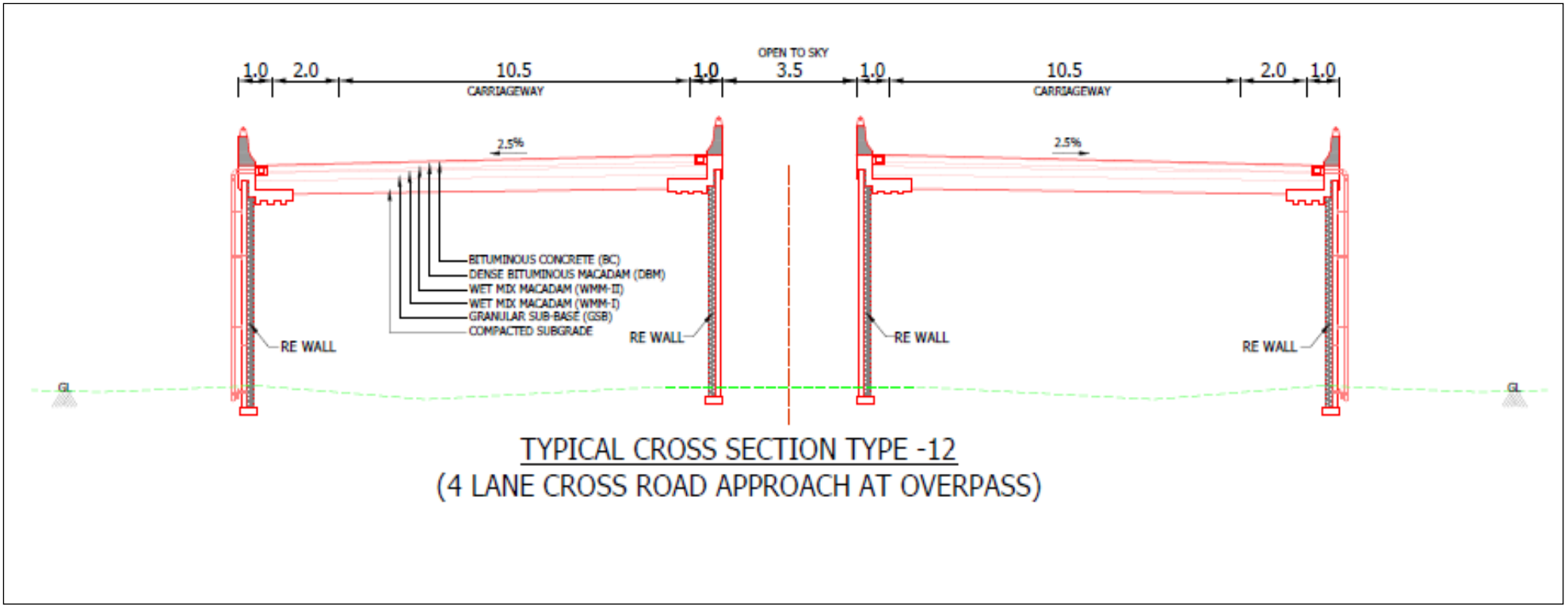


Figure 0-2 (n): The typical cross section along the project highway

0.7 PROPOSED PLAN FOR PROJECT

0.7.1 Right of Way (ROW)

The proposed Right of Way (ROW) of the Bangalore-Chennai expressway is 90m. Additional ROW will be required as per the followings:

- At toll plaza locations estimated minimum additional ROW of 30m x 140m will be required on main highway.
- At Rest Area estimated additional ROW of 460m x 320m will be required on either side of the expressway.
- For check post additional ROW of 370m x 37m will be required.

0.7.2 Land Requirement for Proposed Project

A total area of 1118.105 Ha of land will be required for acquisition to accommodate proposed ROW.

0.7.3 Vehicular/Light Vehicular/Elephant Underpasses

Provision of underpasses at strategic locations within the project stretch is an important consideration in highway development. The project road traverses through many villages. Safe crossing facilities should be provided as the project road is designed for 120 Kmph speed and is designed for access controlled.

The proposed Light Vehicular Underpasses, Vehicular Overpasses and Vehicular Underpasses are given in **Table 0.4-0.6** respectively.

Table 0. 4: Details of Light Vehicular Underpasses (LVUP)

S. No.	Chainage (km)	Type of crossing	Name of Village	Span Arrangement (no. x m)	Type of Structure	Minimum Vertical Clearance required (m)	Total width of structure*
1	156+360	Cart Road	Vasanthapuram	1 x 12.0	Box Type	4.0	2 x 21.25
2	157+790	VR	Pasumanda	1 x 12.0	Box Type	4.0	2 x 21.25
3	159+117	VR	-	1 x 12.0	Box Type	4.0	2 x 21.25
4	160+242	VR	Pasumanda	1 x 12.0	Box Type	4.0	2 x 21.25
5	162+746	VR	-	1 x 12.0	Box Type	4.0	2 x 21.25
6	163+912	Cart Road	Thimmaiah palle	1 x 12.0	Box Type	4.0	2 x 21.25
7	167+274	VR	Mahimandalam	1 x 12.0	Box Type	4.0	2 x 21.25
8	168+036	VR	Mahimandalam	1 x 12.0	Box Type	4.0	2 x 21.25
9	168+829	VR	Mahimandalam	1 x 12.0	Box Type	4.0	2 x 21.25
10	171+250	VR	Mahimandalam	1 x 12.0	Box Type	4.0	2 x 21.25
11	172+949	VR	Mahimandalam	1 x 12.0	Box Type	4.0	2 x 21.25
12	181+450	VR	Sengalnatham	1 x 12.0	Box Type	4.0	2 x 21.25
13	183+421	ODR	Sengalnatham	1 x 12.0	Box Type	4.0	2 x 21.25

S. No.	Chainage (km)	Type of crossing	Name of Village	Span Arrangement (no. x m)	Type of Structure	Minimum Vertical Clearance required (m)	Total width of structure*
14	187+573	VR	Jambukulam	1 x 12.0	Box Type	4.0	2 x 21.25
15	189+203	VR	Kesavanankuppam	1 x 12.0	Box Type	4.0	2 x 21.25
16	190+028	VR	Kesavanankuppam	1 x 12.0	Box Type	4.0	2 x 21.25
17	194+133	VR	Kadappanthangal	1 x 12.0	Box Type	4.0	2 x 21.25
18	195+163	VR	Kadappanthangal	1 x 12.0	Box Type	4.0	2 x 21.25
19	197+035	VR	Govindacheri kuppam	1 x 12.0	Box Type	4.0	2 x 21.25
20	197+792	VR	Govindacheri	1 x 12.0	Box Type	4.0	2 x 21.25
21	200+101	Cart Road	Banavaram	1 x 12.0	Box Type	4.0	2 x 21.25
22	209+807	MDR	Uliyanallur	1 x 12.0	Box Type	4.0	2 x 21.25
23	210+343	VR	Uliyanallur	1 x 12.0	Box Type	4.0	2 x 21.25
24	212+169	VR	Vepperi	1 x 12.0	Box Type	4.0	2 x 21.25
25	214+060	VR	punnai	1 x 12.0	Box Type	4.0	2 x 21.25
26	216+126	VR	Asanallikuppam	1 x 12.0	Box Type	4.0	2 x 21.25
27	217+283	VR	Asanallikuppam	1 x 12.0	Box Type	4.0	2 x 21.25
28	230+362	VR	Siruvallore	1 x 12.0	Box Type	4.0	2 x 21.25
29	238+954	VR	Sivankudal	1 x 12.0	Box Type	4.0	2 x 21.25
30	240+243	ODR	Ramanujapuram	1 x 12.0	Box Type	4.0	2 x 21.25
31	246+110	VR	Sogandi	1 x 12.0	Box Type	4.0	2 x 21.25
32	248+480	Cart Road	Thirumangaluru	1 x 12.0	Box Type	4.0	2 x 21.25
33	250+610	VR	-	1 x 12.0	Box Type	4.0	2 x 21.25
34	253+845	VR	Sri Perambadur	1 x 12.0	Box Type	4.0	2 x 21.25
35	255+760	VR	Ayakolathur	1 x 12.0	Box Type	4.0	2 x 21.25

Table 0. 5: Details of Vehicular Overpasses

S. No.	Chainage	Type of crossing	Names of Connecting Villages	Name of Village	Span Arrangement	Type of Structure	Minimum Vertical Clearance required	Total width of structure
1	171+890	VR	Mahimandalam	Mahimandalam	2 x 45	PSC I Girder	5.5	1 x 13.0

Table 0. 6: Details of Vehicular Underpasses

S. No.	Chainage	Type of crossing	Name of Connecting Villages	Name of Village	Span Arrangement	Type of Structure	Minimum Vertical Clearance required	Total width of structure*
1	161+806	ODR/ VR	Pasumanda-Thimmaiah palle	Thimmaiah palle	1 x 12.0	Box Type	5.5	2 x 21.25
2	163+386	VR	Venkatalakshmambapuram -	Thimmaiah palle	1 x 12.0	Box Type	5.5	2 x 21.25
3	165+300	VR	Thimmaiah palle-Mahimandalam	Mahimandalam	1 x 12.0	Box Type	5.5	2 x 21.25
4	165+969	VR	Thimmaiah palle-Mahimandalam	Mahimandalam	1 x 12.0	Box Type	5.5	2 x 21.25
5	175+430	VR	Mahimandalam-Melpadi	Melpadi	1 x 12.0	Box Type	5.5	2 x 21.25
6	179+800	SH-124A	Veppalai-Kondakuppam	Kondakuppam	1 x 30.0	PSC I girder	5.5	2 x 21.25
7	202+935	MDR	Kuthambakkam	Kuthambakkam	1 x 12.0	Box Type	5.5	2 x 21.25
8	206+670	VR	Karnavoor-Mahendrawadi	Mahendrawadi	1 x 12.0	Box Type	5.5	2 x 21.25
9	212+920	VR	Uliyanallur-Vepperi	Vepperi	1 x 12.0	Box Type	5.5	2 x 21.25
10	230+977	VR	Siruvallore-Podavur	Podavur	1 x 12.0	Box Type	5.5	2 x 21.25
11	235+117	MDR	Thodur-Thandalam	Thandalam	1 x 12.0	Box Type	5.5	2 x 21.25
12	241+565	VR	Keeranallur-Podavur	Podavur	1 x 12.0	Box Type	5.5	2 x 21.25
13	258+815	ODR	Nemili-Irungattukottai	Irungattukottai	1 x 12.0	Box Type	5.5	2 x 21.25

0.7.4 Interchange Structures

Five interchange locations has been proposed, the detail are given in **Table 0.7**.

Table 0. 7: Details of Interchange Structures

S. No.	Chainage	Type of crossing/ Connecting to	Name of Location of Crossing	Span Arrangement	Type of Structure	Total length of structure	Minimum Vertical Clearance required	Total width of structure
1	157+118	Over NH4	Vasanthapuram	1x24+1x35	PSC Box Girder	59	5.5	2x21.25
2	176+525	SH-124	Melpadi	1X24+1X35	PSC I Girder	60	5.5	2x21.25
3	202+086	SH-128	Banavaram	1X24+1X35	PSC I Girder	60	5.5	2x21.25
4	224+685	SH95	Govindavadi	1X35+1X24	PSC I Girder	60	5.5	2x21.25
5	247+832	NH219	Molasur	1X26+1X38	PSC I Girder	64	5.5	2x21.25
6	262+450	SH-508	Irungattukottai	1x15	RCC I Girder	15	5.5	2x21.25
	262+558	SH-508	Irungattukottai	1X18+1X30	PSC I Girder	48	5.5	2x21.25

0.7.5 Bridges

There are 34 nos. of major bridges and 22 nos. of minor bridges are proposed along the project road. The proposed major and minor bridges are given in **Table 0.8 and Table 0.9** respectively

Table 0. 8: Details of Major Bridges

S. No.	Chainage	Type of crossing	Name of Village	Span Arrangement	Type of Structure	Total length of structure	Total width of structure
1	157+070	Tank	Ramapuram	7 x 30	PSC I-Girder	210	2 x 21.25
2	158+620	Tank	Kothapalle	11 x 30	PSC I-Girder	330	2 x 21.25
3	159+780	Tank	9.Ko-thapalle	12 x 30	PSC I-Girder	360	2 x 21.25
4	161+365	Tank	Basavapalli	8 x 30	PSC I-Girder	240	2 x 21.25
5	164+450	Tank	Vasanthapuram	12 x 30	PSC I-Girder	360	2 x 21.25
6	166+410	Tank	K.T.Palle	10 x 30	PSC I-Girder	300	2 x 21.25
7	170+015	Tank	Mahimandalam	4 x 30	PSC I-Girder	120	2 x 21.25

S. No.	Chainage	Type of crossing	Name of Village	Span Arrangement	Type of Structure	Total length of structure	Total width of structure
8	177+200 179+440	Tank -	Veeranthangal	10 x 30 15 x 30	PSC I-Girder PSC I-Girder	300 450	2 x 21.25 2 x 21.25
9			Melpadi				
10	180+515	Tank	Kummananthangal	18 x 30	PSC I-Girder	540	2 x 21.25
11	182+080	Tank	Thagarakuppam	7 x 30	PSC I-Girder	210	2 x 21.25
12	184+877	-	-	4 x 30	PSC I-Girder	120	2 x 21.25
13	185+520	Tank	Sekkadikuppam	9 x 30	PSC I-Girder	270	2 x 21.25
14	200+630	Tank	Banavaram	5 x 30	PSC I-Girder	150	2 x 21.25
15	205+070	Tank	Karnavoor	10 x 30	PSC I-Girder	300	2 x 21.25
16	206+110	Tank	Mahendravadi	17 x 30	PSC I-Girder	510	2 x 21.25
17	215+825	Tank	Asanallikuppam	9 x 30	RCC I-Girder	270	2 x 21.25
18	220+876	Tank	Thirumalpur	3 x 20	RCC I-Girder	60	2 x 21.25
19	223+390	Tank	Govindavadi Agaram	22 x 30	PSC I-Girder	660	2 x 21.25
20	225+595	Tank	Putheri	5 x 30	PSC I-Girder	150	2 x 21.25
21	229+375	Tank	Parandur	30 x 30	PSC I-Girder	900	2 x 21.25
22	231+500	Tank	Podavur	17 x 30	PSC I-Girder	510	2 x 21.25
23	232+700	Tank	Podavur	13 x 30	PSC I-Girder	390	2 x 21.25
24	233+800	Tank	Madapuram	30 x 30	PSC I-Girder	900	2 x 21.25
25	234+800	Tank	Thodur	10 x 30	PSC I-Girder	300	2 x 21.25
26	236+030	Tank	Thandalam	15 x 30	PSC I-Girder	450	2 x 21.25
27	237+000	Tank	Sivankoodal	19 x 30	PSC I-Girder	570	2 x 21.25

S. No.	Chainage	Type of crossing	Name of Village	Span Arrangement	Type of Structure	Total length of structure	Total width of structure
28	242+700	Tank	Keeranallur	4 x 30	PSC I-Girder	120	2 x 21.25
29	247+285	Tank	Molasur	8 x 30	PSC I-Girder	240	2 x 21.25
30	250+340	Quarry	Vadamangalam	3 x 30	PSC I-Girder	90	2 x 21.25
31	251+280	Tank		8 x 30	PSC I-Girder	240	2 x 21.25
32	251+880	Drain/Nallah	Sriperambudur	5 x 30	PSC I-Girder	150	2 x 21.25
33	252+170	Tank	Ayankolathur	3 x 30	PSC I-Girder	90	2 x 21.25
34	261+725	Tank	Irungattukottai	25 x 30	PSC I-Girder	750	2 x 21.25

Table 0. 9: Details of Minor Bridges

S. No.	Chainage	Type of crossing	Village Name	Span Arrangement	Type of Structure	Total length of structure
1	167+215	Drain/Nallah	Mahimandalam	1 x 15	RCC I-Girder	2 x 21.25
2	170+610	Nallah/VR	Mahimandalam	1 x 10	RCC Box	2 x 21.25
3	178+430	Drain/Nallah	Veppalai	1 x 15	RCC I-Girder	2 x 21.25
4	181+200	Nallah	Thagarakuppam	1 x 15	RCC I-Girder	2 x 21.25
5	181+300	Drain/Nallah	Thagarakuppam	1 x 15	RCC I-Girder	2 x 21.25
6	183+827	Drain/Nallah	Sengalnatham	2 x 15	RCC I-Girder	2 x 21.25
7	187+044	Drain/Nallah	Jambukulam	2 x 20	RCC I-Girder	2 x 21.25
8	193+185	Drain/Nallah	Kadappanthangal	2 x 15	RCC I-Girder	2 x 21.25
9	201+840	Drain/Nallah	Banavaram	2 x 20	RCC I-Girder	2 x 21.25
10	203+460	Nallah/VR	Kuthambakkam	3 x 3	RCC Box	2 x 21.25
11	228+510	Drain/Nallah	Parandur	2 x 15	RCC I-Girder	2 x 21.25
12	230+098	Drain/Nallah	Parandur	2 x 20	RCC I-Girder	2 x 21.25
13	239+190	Drain/Nallah	Ramanujapuram	1 x 15	RCC I-Girder	2 x 21.25

S. No.	Chainage	Type of crossing	Village Name	Span Arrangement	Type of Structure	Total length of structure
14	239+625	Drain/Nallah	Ramanujapuram	1 x 15	RCC I-Girder	2 x 21.25
15	239+950	Drain/Nallah	Ramanujapuram	1 x 15	RCC I-Girder	2 x 21.25
16	240+768	Drain/Nallah	Keeranallur	1 x 15	RCC I-Girder	2 x 21.25
17	241+620	Drain/Nallah	Podavur	1 x 15	RCC I-Girder	2 x 21.25
18	241+945	Drain/Nallah	Podavur	1 x 15	RCC I-Girder	2 x 21.25
19	243+900	Drain/Nallah	Podavur	2 x 27	PSC I-Girder	2 x 21.25
20	252+450	Drain/Nallah	Sri Perambadur	2 x 15	RCC I-Girder	2 x 21.25
21	252+755	Drain/Nallah	Sri Perambadur	3 x 15	RCC I-Girder	2 x 21.25
22	253+075	Drain/Nallah	Sri Perambadur	2 x 15	RCC I-Girder	2 x 21.25

0.7.6 Rail Over Bridge (ROB)

Three ROB's has been proposed, the detail of ROB is given in **Table 0.10**.

Table 0. 10: Details of Proposed ROBs/RUBs

S. No.	Chainage	Type of crossing	Span Arrangement	Type of Structure	Total length of structure	Total width of structure*
1	165+585	Railway Track/ Road	1 x 45+ 1 x 55+ 1 x 45	Steel+PSC	145	2 x 21.25
2	199+685	Railway Track/ Road	1 x 25+1x 37.2+ 1 x 25	Steel+PSC	87.2	2 x 21.25
3	223+760	Railway Track	1 x 25+1x 31.2+ 1 x 25	Steel+PSC	81.2	2 x 21.25

0.7.7 Culverts

There are 125 nos. of culverts along the project road are proposed and the details of the mentioned **Table 0.11.**

Table 0. 11: Details of Proposed Culverts

S. No	Chainage	Span Arrangement	Type of Water Body	Name of Village	Type of structure	Formation width of structure
1	156+216	1 x 2 x 2.5	Stream/Nallah	Vasanthapuram	Box	As per TCS

S. No	Chainage	Span Arrangement	Type of Water Body	Name of Village	Type of structure	Formation width of structure
					Culvert	
2	157+420	1 x 2 x 2.5	Stream/Nallah	Vasanthapuram	Box Culvert	As per TCS
3	157+696	1 x 2 x 2.5	Stream/Nallah	Vasanthapuram	Box Culvert	As per TCS
4	159+230	1 x 2 x 2.5	Stream/Nallah	Pasumanda	Box culvert	As per TCS
5	159+440	1 x 2 x 2.5	Stream/Nallah	Pasumanda	Box culvert	As per TCS
6	160+020	1 x 2 x 2.5	Stream/Nallah	Pasumanda	Box culvert	As per TCS
7	160+820	1 x 2 x 2.5	Stream/Nallah	Basavapalli	Box culvert	As per TCS
8	162+613	1 x 2 x 2.5	Stream/Nallah	197-Ramapuram	Box culvert	As per TCS
9	163+723	1 x 2 x 2.5	Stream/Nallah	Thimmaiah palle	Box culvert	As per TCS
10	163+886	1 x 2 x 2.5	Stream/Nallah	Thimmaiah palle	Box culvert	As per TCS
11	164+040	1 x 2 x 2.5	Stream/Nallah	Thimmaiah palle	Box culvert	As per TCS
12	164+978	2 x 2 x 2.5	Stream/Nallah	Thimmaiah palle	Box culvert	As per TCS
13	165+080	1 x 2 x 2.5	Stream/Nallah	Thimmaiah palle	Box culvert	As per TCS
14	166+966	1 x 2 x 2.5	Stream/Nallah	Thimmaiah palle	Box culvert	As per TCS
15	167+980	1 x 2 x 2.5	Stream/Nallah	Thimmaiah palle	Box culvert	As per TCS
16	168+530	1 x 2 x 2.5	Stream/Nallah	Mahimandalam	Box culvert	As per TCS
17	168+640	1 x 2 x 2.5	Stream/Nallah	Mahimandalam	Box culvert	As per TCS
18	169+420	2 x 2 x 2.5	Stream/Nallah	Mahimandalam	Box culvert	As per TCS
19	171+020	1 x 2 x 2.5	Stream/Nallah	Mahimandalam	Box culvert	As per TCS
20	172+508	1 x 2 x 2.5	Stream/Nallah	Mahimandalam	Box culvert	As per TCS

S. No	Chainage	Span Arrangement	Type of Water Body	Name of Village	Type of structure	Formation width of structure
21	172+900	1 x 2 x 2.5	Stream/Nallah	Mahimandalam	Box culvert	As per TCS
22	173+085	1 x 2 x 2.5	Stream/Nallah	Mahimandalam	Box culvert	As per TCS
23	173+420	1 x 2 x 2.5	Stream/Nallah	Melpadi	Box culvert	As per TCS
24	174+649	1x 3 x 2.5	Stream/Nallah	Melpadi	Box culvert	As per TCS
25	175+460	1 x 2 x 2.5	Stream/Nallah	Melpadi	Box culvert	As per TCS
26	181+760	1 x 2 x 2.5	Stream/Nallah	Thagarakuppam	Box culvert	As per TCS
27	182+440	1 x 2 x 2.5	Stream/Nallah	Thagarakuppam	Box culvert	As per TCS
28	182+844	1 x 2 x 2.5	Stream/Nallah	Thagarakuppam	Box culvert	As per TCS
29	183+190	1 x 2 x 2.5	Stream/Nallah	Sengalnatham	Box culvert	As per TCS
30	184+280	1 x 2 x 2.5	Stream/Nallah	Sengalnatham	Box culvert	As per TCS
31	186+000	1 x 2 x 2.5	Stream/Nallah	Sengalnatham	Box culvert	As per TCS
32	186+330	1 x 2 x 2.5	Stream/Nallah	Sengalnatham	Box culvert	As per TCS
33	186+720	1 x 2 x 2.5	Stream/Nallah	Sekkadikuppam	Box culvert	As per TCS
34	187+420	1 x 2 x 2.5	Stream/Nallah	Jambukulam	Box culvert	As per TCS
35	187+680	1 x 2 x 2.5	Stream/Nallah	Jambukulam	Box culvert	As per TCS
36	188+140	1 x 2 x 2.5	Stream/Nallah	Jambukulam	Box culvert	As per TCS
37	191+275	1 x 2 x 2.5	Stream/Nallah	Venkatapuram	Box culvert	As per TCS
38	191+420	1 x 2 x 2.5	Stream/Nallah	Venkatapuram	Box culvert	As per TCS
39	192+120	1 x 2 x 2.5	Stream/Nallah	Venkatapuram	Box culvert	As per TCS

S. No	Chainage	Span Arrangement	Type of Water Body	Name of Village	Type of structure	Formation width of structure
40	192+880	1 x 2 x 2.5	Stream/Nallah	Kodakkal	Box culvert	As per TCS
41	195+900	1 x 2 x 2.5	Stream/Nallah	Govindacheri kuppam	Box culvert	As per TCS
42	196+110	1 x 2 x 2.5	Stream/Nallah	Govindacheri kuppam	Box culvert	As per TCS
43	196+620	1 x 2 x 2.5	Stream/Nallah	Govindacheri kuppam	Box culvert	As per TCS
44	196+940	1 x 2 x 2.5	Stream/Nallah	Govindacheri kuppam	Box culvert	As per TCS
45	197+356	1 x 2 x 2.5	Stream/Nallah	Govindacheri	Box culvert	As per TCS
46	197+960	1 x 2 x 2.5	Stream/Nallah	Govindacheri	Box culvert	As per TCS
47	199+495	1 x 2 x 2.5	Stream/Nallah	Banavaram	Box culvert	As per TCS
48	199+740	1 x 2 x 2.5	Stream/Nallah	Banavaram	Box culvert	As per TCS
49	199+875	1 x 2 x 2.5	Stream/Nallah	Banavaram	Box culvert	As per TCS
50	201+320	1 x 2 x 2.5	Stream/Nallah	Banavaram	Box culvert	As per TCS
51	202+280	1 x 2 x 2.5	Stream/Nallah	Banavaram	Box culvert	As per TCS
52	202+750	1 x 3 x 2.5	Stream/Nallah	Kuthambakkam	Box culvert	As per TCS
53	203+350	2 x 3 x 3.0	Stream/Nallah	Kuthambakkam	Box culvert	As per TCS
54	207+280	1 x 2 x 2.5	Stream/Nallah	Mahendrawadi	Box culvert	As per TCS
55	207+858	1 x 2 x 2.5	Stream/Nallah	Mahendrawadi	Box culvert	As per TCS
56	208+153	1 x 2 x 2.5	Stream/Nallah	Mahendrawadi	Box culvert	As per TCS
57	208+580	1 x 3 x 2.5	Stream/Nallah	Perapperi	Box culvert	As per TCS
58	209+459	1 x 2 x 2.5	Stream/Nallah	Perapperi	Box culvert	As per TCS

S. No	Chainage	Span Arrangement	Type of Water Body	Name of Village	Type of structure	Formation width of structure
59	209+620	1 x 2 x 2.5	Stream/Nallah	Uliyanallur	Box culvert	As per TCS
60	210+260	1 x 2 x 2.5	Stream/Nallah	Uliyanallur	Box culvert	As per TCS
61	210+470	1 x 2 x 2.5	Stream/Nallah	Uliyanallur	Box culvert	As per TCS
62	210+760	1 x 2 x 2.5	Stream/Nallah	Uliyanallur	Box culvert	As per TCS
63	211+180	1 x 2 x 2.5	Stream/Nallah	Uliyanallur	Box culvert	As per TCS
64	212+580	1 x 2 x 2.5	Stream/Nallah	Vepperi	Box culvert	As per TCS
65	212+700	1 x 2 x 2.5	Stream/Nallah	Vepperi	Box culvert	As per TCS
66	213+215	1 x 2 x 2.5	Stream/Nallah	Vepperi	Box culvert	As per TCS
67	213+476	1 x 2 x 2.5	Stream/Nallah	Vepperi	Box culvert	As per TCS
68	213+768	1 x 2 x 2.5	Stream/Nallah	Vepperi	Box culvert	As per TCS
69	214+350	1 x 2 x 2.5	Stream/Nallah	Vepperi	Box culvert	As per TCS
70	214+420	1 x 2 x 2.5	Stream/Nallah	Punnai	Box culvert	As per TCS
71	214+962	1 x 2 x 2.5	Stream/Nallah	Punnai	Box culvert	As per TCS
72	216+530	1 x 2 x 2.5	Stream/Nallah	Asanallikuppam	Box culvert	As per TCS
73	217+140	1 x 2 x 2.5	Stream/Nallah	Asanallikuppam	Box culvert	As per TCS
74	218+240	1 x 2 x 2.5	Stream/Nallah	Asanallikuppam	Box culvert	As per TCS
75	218+320	1 x 2 x 2.5	Stream/Nallah	Asanallikuppam	Box culvert	As per TCS
76	218+480	1 x 2 x 2.5	Stream/Nallah	Asanallikuppam	Box culvert	As per TCS
77	219+460	1 x 2 x 2.5	Stream/Nallah	Nelvoy	Box culvert	As per TCS

S. No	Chainage	Span Arrangement	Type of Water Body	Name of Village	Type of structure	Formation width of structure
78	220+180	1 x 2 x 2.5	Stream/Nallah	Nelvoy	Box culvert	As per TCS
79	221+295	1 x 2 x 2.5	Stream/Nallah	Thirumalpur	Box culvert	As per TCS
80	221+560	1 x 2 x 2.5	Stream/Nallah	Thirumalpur	Box culvert	As per TCS
81	222+780	1 x 2 x 2.5	Stream/Nallah	Govindavadi	Box culvert	As per TCS
82	224+150	1 x 2 x 2.5	Stream/Nallah	Govindavadi	Box culvert	As per TCS
83	224+920	1 x 2 x 2.5	Stream/Nallah	Govindavadi	Box culvert	As per TCS
84	226+420	1 x 2 x 2.5	Stream/Nallah	Putheri	Box culvert	As per TCS
85	226+560	1 x 2 x 2.5	Stream/Nallah	Putheri	Box culvert	As per TCS
86	226+898	1 x 2 x 2.5	Stream/Nallah	Putheri	Box culvert	As per TCS
87	227+240	1 x 2 x 2.5	Stream/Nallah	Putheri	Box culvert	As per TCS
88	230+190	1 x 2 x 2.5	Stream/Nallah	Parandur	Box culvert	As per TCS
89	230+715	1 x 2 x 2.5	Stream/Nallah	Siruvallore	Box culvert	As per TCS
90	232+140	1 x 2 x 2.5	Stream/Nallah	Podavur	Box culvert	As per TCS
91	234+320	1 x 2 x 2.5	Stream/Nallah	Thodur	Box culvert	As per TCS
92	238+255	1 x 2 x 2.5	Stream/Nallah	Thodur	Box culvert	As per TCS
93	238+980	1 x 2 x 2.5	Stream/Nallah	Sivankudal	Box culvert	As per TCS
94	239+900	1 x 2 x 2.5	Stream/Nallah	Ramanujapuram	Box culvert	As per TCS
95	240+780	1 x 2 x 2.5	Stream/Nallah	Keeranallur	Box culvert	As per TCS
96	245+020	1 x 2 x 2.5	Stream/Nallah	Sogandi	Box culvert	As per TCS

S. No	Chainage	Span Arrangement	Type of Water Body	Name of Village	Type of structure	Formation width of structure
97	245+900	1 x 2 x 2.5	Stream/Nallah	Sogandi	Box culvert	As per TCS
98	246+475	1 x 2 x 2.5	Stream/Nallah	Molasur	Box culvert	As per TCS
99	248+070	1 x 2 x 2.5	Stream/Nallah	Thirumangalam	Box culvert	As per TCS
100	248+220	1 x 2 x 2.5	Stream/Nallah	Thirumangalam	Box culvert	As per TCS
101	249+117	1 x 2 x 2.5	Stream/Nallah	Vadamangalam	Box culvert	As per TCS
102	249+495	1 x 2 x 2.5	Stream/Nallah	Vadamangalam	Box culvert	As per TCS
103	249+666	1 x 2 x 2.5	Stream/Nallah	Vadamangalam	Box culvert	As per TCS
104	250+945	1 x 2 x 2.5	Stream/Nallah	Vadamangalam	Box culvert	As per TCS
105	251+030	1 x 2 x 2.5	Stream/Nallah	Vadamangalam	Box culvert	As per TCS
106	251+500	1 x 2 x 2.5	Stream/Nallah	Vadamangalam	Box culvert	As per TCS
107	254+190	1 x 2 x 2.5	Stream/Nallah	Sri Perambadur	Box culvert	As per TCS
108	254+455	1 x 3 x 2.5	Stream/Nallah	Sri Perambadur	Box culvert	As per TCS
109	254+576	1 x 2 x 2.5	Stream/Nallah	Sri Perambadur	Box culvert	As per TCS
110	254+750	1 x 2 x 2.5	Stream/Nallah	Sri Perambadur	Box culvert	As per TCS
111	255+020	1 x 2 x 2.5	Stream/Nallah	Ayakolathur	Box culvert	As per TCS
112	255+603	1 x 2 x 2.5	Stream/Nallah	Ayakolathur	Box culvert	As per TCS
113	256+075	1 x 2 x 2.5	Stream/Nallah	Ayakolathur	Box culvert	As per TCS
114	256+383	1 x 2 x 2.5	Stream/Nallah	Ayakolathur	Box culvert	As per TCS
115	257+103	1 x 2 x 2.5	Stream/Nallah	Ayakolathur	Box culvert	As per TCS

S. No	Chainage	Span Arrangement	Type of Water Body	Name of Village	Type of structure	Formation width of structure
116	257+123	1 x 2 x 2.5	Stream/Nallah	Nemili	Box culvert	As per TCS
117	257+653	1 x 2 x 2.5	Stream/Nallah	Nemili	Box culvert	As per TCS
118	258+463	1 x 2 x 2.5	Stream/Nallah	Nemili	Box culvert	As per TCS
119	259+403	1 x 2 x 2.5	Stream/Nallah	Nemili	Box culvert	As per TCS
120	260+343	1 x 2 x 2.5	Stream/Nallah	Nemili	Box culvert	As per TCS
121	260+603	1 x 2 x 2.5	Stream/Nallah	Irungattukottai	Box culvert	As per TCS
122	261+063	1 x 2 x 2.5	Stream/Nallah	Irungattukottai	Box culvert	As per TCS
123	261+403	1 x 2 x 2.5	Stream/Nallah	Irungattukottai	Box culvert	As per TCS
124	262+423	1 x 2 x 2.5	Stream/Nallah	Irungattukottai	Box culvert	As per TCS
125	156+216	1 x 2 x 2.5	Stream/Nallah	Vasanthapuram	Box Culvert	As per TCS

0.7.8 Flyovers

Seven flyovers have been proposed along project expressway. The details are provided in **Table 0.12**.

Table 0. 12: Location of Proposed Flyovers

S. No.	Chainage	Span Arrangement	Type of Structure	Total length of structure	Minimum Vertical Clearance required	Total width of structure*	Remarks
1	177+665	1 x 25	PSC I girder	25	5.5	2 x 21.25	SH-124-PANNAI-THIRUVALAM-ROAD
2	191+445	1 x 25	PSC I girder	25	5.5	2 x 21.25	SH-61
3	201+057	1 x 25	PSC I girder	25	5.5	2 x 21.25	SH-128
4	215+515	1 x 25	PSC I-Girder	25	5.5	2 x 21.25	SH-126

5	221+029	1 x 25	PSC I-Girder	25	5.5	2 x 21.25	MDR-792
6	246+720	1 x 25	PSC I-Girder	25	5.5	2 x 21.25	SH-120
7	256+460	1 x 25	PSC I-Girder	25	5.5	2 x 21.25	SH-57

0.7.9 Toll Plazas

Toll plazas are proposed on all the interchange locations along the project stretch. The locations are provided in **Table 0.13**.

Table 0. 13: Location of Toll Plazas

S. No.	Chainage	Type of crossing/ Connecting to	Village Name
1	157+118	NH-4	Vasanthapuram
2	176+640	SH-124	Melpadi
3	202+085	SH-128	Banavaram
4	224+685	SH95	Govindavadi
5	247+830	NH219	Molasur
6	253+200	SH-508	Near Sriperumbudur

0.7.10 Facilities and Services to the Users

Street Lighting

At present no street lights are there on the highways section in this stretch. The street light has been proposed for locations at LVUP, VUP, Interchange, Check Post, Rest Area and Toll Plaza Locations.

Highway Lighting

The High mast lighting has been proposed along the project highway locations in interchange locations, Rest area, Toll plaza locations and check post locations.

Rest Area

The Rest area is provided at four locations along the project stretch. The location of rest area is given in **Table 0.14**.

Table 0. 14: Proposed Locations of Rest Area

S. No.	Chainage	Remarks
1	188+200	Left Side of Expressway

S. No.	Chainage	Remarks
2	188+200	Right Side of Expressway
3	227+500	Left Side of Expressway
4	227+500	Right Side of Expressway

State Border Check Posts

The state border check post are provided to enable the state Authorities to exercise checks as per applicable laws:

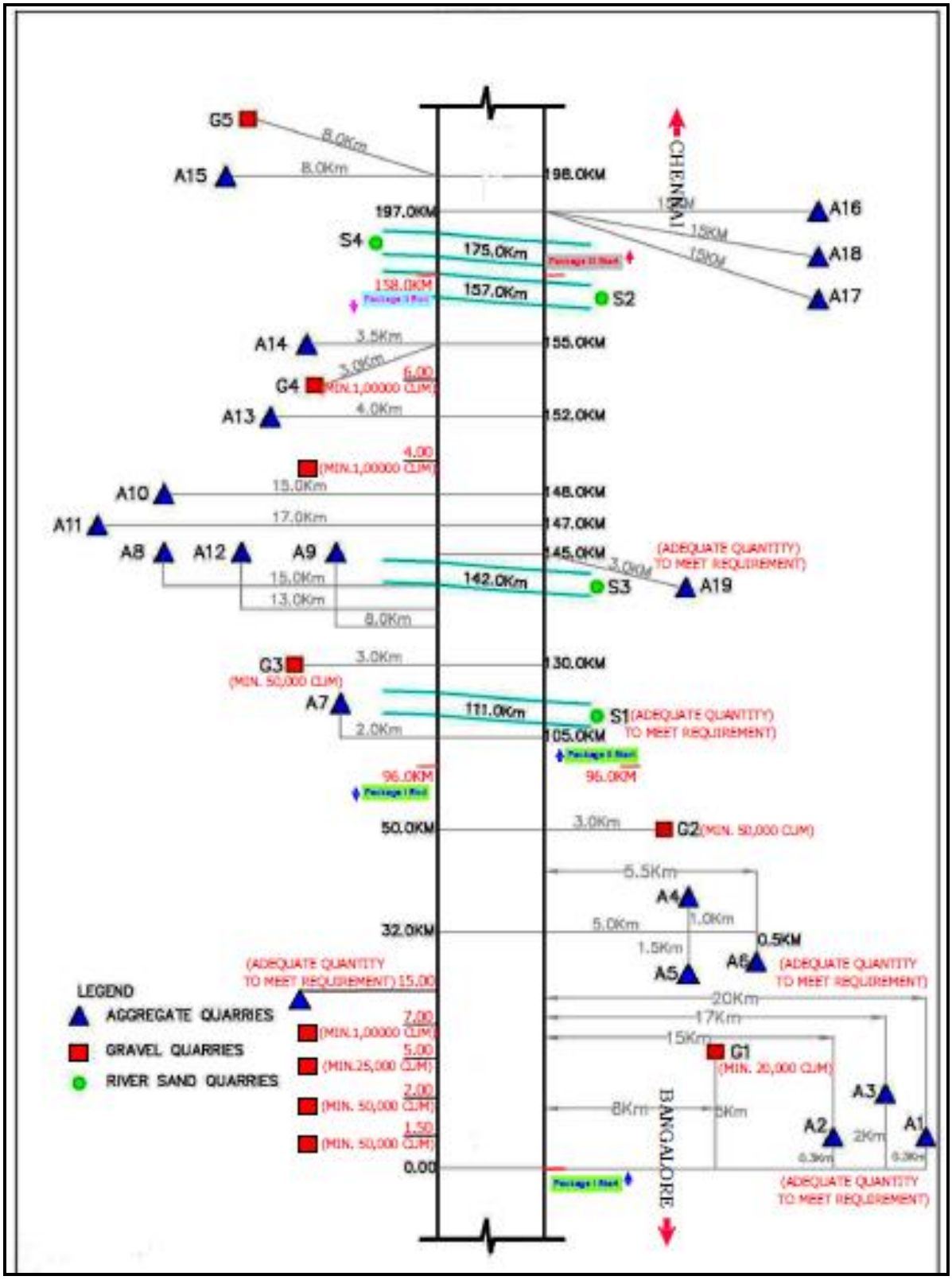
Check Post		Village Name
Chainage	Side	
167+715	RHS	Ramapuram
169+215	LHS	

Truck Lay byes

In addition to Rest areas Truck lay byes proposed approximately half way between Rest areas. The locations are as below:

Truck Lay Bay		Village Name
Chainage	Side	
174+137	RHS	Melpadi
204+155	Both Sides	Karnavoor

0.8 BORROW AREAS



0.8.1 Quarry Areas

A reconnaissance survey was carried out along the project stretch. Quarry maps collected from State Government authority in Karnataka & Tamilnadu was used as guidance for inspection of various quarries. Stone metal quarries have been identified and the salient features of the quarries are given in table below:

Sl.No.	Name of the Quarry / Address / Location	Ownership of the land and area (Acres)	No. of Crushers available and Output per day	Parties to whom supplied and other details
1.	A1 - M/s.Varalaxmi Stone Crushers, Bellur (via), Narsapur (Post), Kolar Dt. Name of the Owner: Mr. Pintu Shet Mob.No.98451 91492/ 98441 80169. Situated at 20 km from Ch.0+000 on right side towards Chennai. Land mark: IOCL Petrol Bunk	Own Land 10 Acres	02 Nos. & 750 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
2.	A2 - M/s. Gayatri Stone Crushers, Byrasandra village, Narsapur (Post), Kolar (District). Name of the Owner: Mr.Mukesh Patel Mob.No.98451 76649 Situated at 20 km from Ch.0+000 on right side towards Chennai. Land mark: IOCL Petrol Bunk	Own Land 35 Acres	03 Nos. & 1000 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
3.	A3 - M/s. Divya Bala Yesu Stone Crushers, Bendapalli village, Hoskote (Taluk), Bangalore (District) Name of the Owner: Mr. P Sunil Kumar	Own Land 08 Acres	01 No. & 450 cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works

Sl.No.	Name of the Quarry / Address / Location	Ownership of the land and area (Acres)	No. of Crushers available and Output per day	Parties to whom supplied and other details
	Mob.No. 94801 11812/ 94842 41466 Situated at 20 km from Ch.0+000 on right side towards Chennai. Land mark: Near Confident Amon Resorts			and other maintenance works, etc.,
4.	A4 - M/s. Katariya Stone Crushers, Takal village, Malur (Taluk), Kolar (District). Name of the Owner: Mr. Shoukat Ali Khan Mob.No.91649 97717/ 97439 98989 Situated at 06 km from Ch.32+000 on right side towards Chennai	Land from Tekal Mandal Panchayat 03 Acres	01 No. & 150 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
5.	A5 - M/s. Goundar Stone Crushers, Takal village, Malur (Taluk), Kolar (District). Name of the Owner: Mr. Ramesh Gowda Mob.No.94481 39062/ 94408 11795 Situated at 6.5 km from Ch.32+000 on right side towards Chennai	Own Land 05 Acres	02 No. & 450 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
6.	A6 - M/s. Ranganath Stone Crushers, Takal village, Malur (Taluk), Kolar (District). Name of the Owner: Mr. Bala Chandar	Own Land 07 Acres	02 No. & 250 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for

Sl.No.	Name of the Quarry / Address / Location	Ownership of the land and area (Acres)	No. of Crushers available and Output per day	Parties to whom supplied and other details
	Mob.No.94480 44191 Situated at 6.5 km from Ch.32+000 on right side towards Chennai			road works, building works and other maintenance works, etc.,
7.	A7 - M/s. Sri Venkateswara Stone Crushers, Madiga Banda village, Palamner (Mandal), Chittoor (District). Name of the Owner: Mr. G Keshava Naidu Mob.No.94409 58312/ 90522 66386 Situated at 2.0 km from Ch.105+000 on left side towards Chennai	Own Land 05 Acres	02 No. & 250 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
8.	A8 - M/s. Pooja Stone Crushers, Mittapalli village, Bangarupalem (Mandal), Chittoor (District). Name of the Owner: Mr. M Bharath Kumar Reddy Mob.No.98664 23298 Situated at 15 km from Ch.145+000 on left side towards Chennai	Own Land 06 Acres	02 No. & 300 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
9.	A9 - M/s. Poojitha Stone Crushers, K G Satram village, Bangarupalem (Mandal), Chittoor (District). Name of the Owner: Mr. Sharat Kumar Reddy Mob.No.90008 08059/ 90526 61689	Own Land 16 Acres	02 No. & 450 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other

Sl.No.	Name of the Quarry / Address / Location	Ownership of the land and area (Acres)	No. of Crushers available and Output per day	Parties to whom supplied and other details
	Situated at 08 km from Ch.145+000 on left side towards Chennai			maintenance works, etc.,
10.	A10 - M/s. Nagarjuna Stone Crushers, Ramabadra puram village, Yadamarri (Mandal), Chittoor (District). Name of the Owner: Mr. Junid Mob.No.97049 94938/ 81213 11824 Situated at 15 km from Ch.148+000 on left side towards Chennai	Own Land 04 Acres	01 No. & 150 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
11.	A11 - M/s. Sri Sai Stone Crushers, Tenabanda village, Chittoor (Mandal & District). Name of the Owner: Mr. V G Babu Mob.No.98494 06623 / 99665 65849 Situated at 17 km from Ch.147+000 on left side towards Chennai	Own Land 07 Acres	02 No. & 450 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
12.	A12 - M/s. Devi Stone Crushers, Laxmaiahkandriga village, Yadamari (Mandal) & Chittoor (District). Name of the Owner: Mr. Bala Mob.No.94402 46751 / 97048 02776 Situated at 13 km from	Own Land 05 Acres	01 No. & 150 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,

Sl.No.	Name of the Quarry / Address / Location	Ownership of the land and area (Acres)	No. of Crushers available and Output per day	Parties to whom supplied and other details
	Ch.145+000 on left side towards Chennai			
13.	A13 - M/s. Srinivasa Stone Crushers, Nargipalli village, Chittoor (Mandal & District). Name of the Owner: Mr. Govindu Mob.No.94409 07148/94402 71359 Situated at 03 km from Ch.152+000 on left side towards Chennai	Own Land 05 Acres	01 No. & 150 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
14.	A14 - M/s. Rangamma Stone Crushers, Gopalapuram village, Chittoor (Mandal & District). Name of the Owner: Ms.Parvathamma / Mr. S Jagannathan Mob.No.97044 38929/ 98859 64535 Situated at 3.5 km from Ch.155+000 on left side towards Chennai	Own Land 03 Acres	01 No. & 100 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
15.	A15 - M/s. A V C Blue Metals, Krishnapuram village, Walajapet (Taluk) & Vellore (District). Name of the Owner: Mr. K V Chidambaram Mob.No.97878 13100 /97513 71605 Situated at 08 km from	Own Land 08 Acres	02 No. & 250 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,

Sl.No.	Name of the Quarry / Address / Location	Ownership of the land and area (Acres)	No. of Crushers available and Output per day	Parties to whom supplied and other details
	Ch.198+000 on left side towards Chennai			
16.	A16 - M/s. Chakra Blue Metals, Chengadu Mottur village, Walajapet (Taluk) & Vellore (District). Name of the Owner: Mr. Umapathi Mob.No.87544 26691 Situated at 15 km from Ch.197+000 on right side towards Chennai	Own Land 05 Acres	01 No. & 150 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
17.	A17 - M/s. Gopi Blue Metals, Musiri village, Walajapet (Taluk) & Vellore (District). Name of the Owner: Mr. S M Sukumaran Mob.No.94432 27552/ 99655 85970 Situated at 15 km from Ch.197+000 on right side towards Chennai	Own Land 10 Acres	02 No. & 250 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
18.	A18 - M/s. Banari Crushers, Musiri village, Walajapet (Taluk) & Vellore (District). Name of the Owner: Mr. Senthil kumar Mob.No.98840 90085/ 91483 41534 Situated at 15 km from Ch.197+000 on right side towards Chennai	Own Land 02 Acres	01 No. & 75 Cum/day	Metal sizes available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,
19.	A19 - M/s. Sri Devi Blue	Own Land	01 No. & 150	Metal sizes

Sl.No.	Name of the Quarry / Address / Location	Ownership of the land and area (Acres)	No. of Crushers available and Output per day	Parties to whom supplied and other details
	Metals, Markabanda village, Kasarala (Post), Yadameri (Mandal), Chittoor (District) Name of the Owner: Mr. N C Barath Kumar Mob.No.99595 93937/ 94920 76831 Situated at 3 km from Ch.145+000 on right side towards Chennai	06 Acres	Cum/day	available are 40 mm, 20 mm, 12 mm, 6 mm and Stone dust. Supplying for road works, building works and other maintenance works, etc.,

0.8.2 Gravel Material for Granular Sub-base

SL NO	Quarry No, Name & Address	Ownership & Acres	Lead from Chainage (Km)	Remarks
1	G1 - Divya Bala Yesu Diggers, 21/22, Dodda Basavanapura Extn, Battarahalli, K R Puram, Bangalore. Contact person: Mr.Augustine, 98456 95862/98454 49841	Pvt Land, 200 Acres	15 Km from Ch.0+000, right side towards Chennai	The quarry is located in Hoskote Village, Shidlaghatta Road, Near Nandini Milk Dairy
2	G2 - Doddur- Karpanahalli Panchayat Quarry	Govt. Land 05 Acres	03 Km from Ch.50+000, right side towards Chennai	The quarry is located in Karpanahalli to BEML road.
3	G3 - Mogilivenkatagiri Panchayat Quarry	Govt. Land, 10 Acres	01 Km from Ch.130+000, left side towards Chennai	The quarry is located in Mogilivenkatagiri village, Bangarupalem (Mandal), Chittoor (District)
4	G4 - Rangamma Quarry, Contact person: Mr.Jagannathan, 97044 38929	Pvt. Land, 04 Acres	03 Km from Ch.155+000, left side towards	The quarry is located near Rangamma Stone Crushers, Gopalapuram (Mandal), Chittoor (District).

SL NO	Quarry No, Name & Address	Ownership & Acres	Lead from Chainage (Km)	Remarks
			Chennai	
5	G5 – KVC Blue Metals (Quarry & Gravel), Contact person: Mr.K V Chidambaram, 97875 13100 /97513 71605	Pvt. Land, 05 Acres	07 Km from Ch.198+000, left side towards Chennai	Located in Krishnapuram Village, Walaja Taluk & Vellore District

0.8.3 Sand Quarry

Sand is available in the following four rivers and already quarrying activity is undertaken:

(i) Kaundinya River (S1)

(ii) Niva River @ Ch.157 Km (S2)

(iii) Niva River @ CH.145 Km (S3)

(iv) Ponnai River (S4)

0.9 IRC SPECIFICATIONS TO BE FOLLOWED

The project will be executed under Hybrid Annuity model in which the Concessionaire will design in accordance with the proposed improvement, Built, and operate the project till concession period. The IRC specification and guidelines will be followed during design and construction. The IRC/MORTH Codes and guidelines are given in **Table 0.17**, which will be applicable in the project.

Table 0. 15: Details of IRC/MORTH Codes and guidelines

S. No.	Particular	Relevant IRC Guidelines (Name/ Number)	Remarks
1	Project Highway Design	**IRC: SP: 99-2013** Manual of Specifications and Standards for Expressway	The project highway has been designed for the design speed of 120 kmph as per IRC: SP: 99:2013 requirements.
2	Provisions of Underpasses (Vehicular and Pedestrian)		Vehicular Underpasses: 13 nos. proposed vehicular underpasses has been proposed in entire road section. Pedestrian/Cattle/Elephant Underpasses: 35 nos proposed pedestrian/cattle underpasses has been proposed in entire road section. These underpasses are provided as per site requirement considering the safe movement.
3	Design of Bridges and culverts		Major bridges: 34 Nos. Minor bridges: 22 Nos. Culverts: 125 Nos. ROB: 3 No. Cross drainage structures are proposed based on hydraulic study.
4	Traffic Safety provisions such as crash barriers, railings		Crash barriers/Guard Stones: At locations where embankment height is more than 3m and at sharp curves crash barrier has been proposed as per IRC: SP: 99-2013

S. No.	Particular	Relevant IRC Guidelines (Name/ Number)	Remarks
	etc		requirements. Crash barriers/Railings: At all structures Others safety devices have been provided as per IRC: SP: 99-2013 requirements
5	Provisions of Flyovers, RUB, ROB, Grade Separators		ROB/ Flyovers has been provided as per IRC codes
6	Road Safety Audit details		The VUP/PUP has been proposed for safe movement of vehicles and pedestrian. The crash barrier and guard rail has been proposed as per IRC guidelines.

With respect to above, following additional IRC Codes/Guidelines to be used, which are included in IRC:SP:99-2013

S. No.	IRC Codes/Guidelines	Title of the Publication	Information
1	IRC:5-1998	Standard Specifications and Code of Practice for Road Bridges, Section I- General Features of Design (Seventh Revision)	Type design for crash barrier
2	IRC:6-2017	Standard Specifications and Code of Practice for Road Bridges, Section II- Loads and Stresses (Fourth Revision)	Design loads and stresses of structures
3	IRC:8-1990	Type design for Highway Kilometre stone (Second Revision)	Design for Highway Kilometre
4	IRC:9-1972	Traffic Census on non-urban roads (First Revision)	Traffic Census
5	IRC:25-1967	Type Design for boundary Stone	Design for boundary Stone
6	IRC:26-1967	Type Design for 200-meters Stones	Design for 200-mteres Stones
7	IRC:35-1997	Code practice for Road markings (First Revision)	Road markings
8	IRC:37-2012	Guidelines for the design of Flexible Pavements (Second Revision)	Design of Flexible Pavements
9	IRC: 58-2015	Guidelines for the Design of Plain Jointed Rigid Pavements (Second Revision)	Design of Rigid Pavements
10	IRC:67-2010	Code of Practice for Road Signs (First Revision)	Road Signs
11	IRC:78-2000	Standard Specifications and Code of Practice for Road Bridges. Section VII-Foundations and Substructure (Second Revision)	Bridges
12	IRC:81-1997	Guidelines for Strengthening of Flexible Road Pavement using Benkelman Beam Deflection Technique (First Revision)	Pavement Condition survey and evaluation
13	IRC:89-1997	Guidelines for Design and Construction of River Training and Control Woks for road bridges (First Revision)	River Training and Protective works
14	IRC:104-1998	Guidelines for Environmental Impact Assessment	Carrying out Environmental Impact Assessment for the proposed project road
15	IRC:108-1996	Guidelines for Traffic prediction on Rural Highways	Traffic projection
16	IRC:SP:19-2001	Manual for Survey, Investigation and Preparation for road project (Second Revision)	Soil test and Investigation
17	IRC:SP:21-2009	Guidelines on Landscaping and Tree Plantation (First Revision)	Landscaping and Avenue plantation for the proposed project road

S. No.	IRC Codes/Guidelines	Title of the Publication	Information
18	IRC:SP:42-1994	Guidelines on Road Drainage	Drainage System

0.9.1 Traffic Surveys

Two National Highways viz. NH-4 & NH-46 are presently connecting the Bangalore and Chennai Cities. The NH-4 (length 325 km) is passing through hilly region with steep gradients and hence is not preferred by motorists. NH-46 is having gentle gradients. Majority of the traffic is plying on this highway presently even though it is having longer length (about 360 km).

Project Proposal

NHAI initiated a feasibility study to develop an Expressway between these two cities. The Consultants have identified the alignment in such a way that, it is gentle and shorter in length with higher speeds and expressway standards. This alignment will reduce the travel time between these two cities to approximately 3 hours which otherwise takes 5 hours 30 min.

Homogeneous sections

To assess the diverted traffic on the proposed BCE, the total alignment is divided into 5 homogeneous sections. The details of the homogeneous sections assumed are presented below table;

Table 0. 16: Homogeneous Sections

Sections	Homogenous Sections	From Chainage	To Chainage	Length
Hoskote to Kolar	HS-I	0.00	52.10	42.00
Kolar to Palamaner (NH-219)	HS-II	52.10	94.10	16.30
Palamaner to Chittoor (NH-4)	HS-III	94.10	157.720	63.62
Chittoor to Kanchipuram (NH-4)	HS-IV	157.720	224.18	66.46
Kanchipuram (NH-4) to Sripeuembadur	HS-V	224.18	262.45	38.27

Reconnaissance Survey

The proposed Expressway is a new alignment. The proposed alignment is finalized by NHAI after reviewing five alternative alignments suggested by the Consultants. There are two National Highways running parallel to the proposed expressway and the travel pattern on the same needs to be understood before planning the new expressway. The consultants have done reconnaissance survey of the proposed project expressway alignment. The site visit was intended to identify and understand the following:

- Identify
  - Important traffic generators
  - Homogeneous sections of the expressway
  - Alternative diversion routes available
- Travel pattern of the study region

- Existing and proposed Land use pattern along the proposed expressway alignment
- Sensitive & special areas requiring special attention

To understand the existing travel pattern, it is necessary to collect the data through primary data collection i.e. through traffic surveys. The traffic survey locations are initially identified based on the map study of the existing network.

Presently National Highway NH 4 connects the two cities Bangalore and Chennai. NH 4 is existing throughout the length between the two cities where as NH 46 joins NH 4 near Ranipet, and joins NH 7 near Krishnagiri. NH 7 connects Bangalore with Krishnagiri.

It is proposed to travel along the existing major network to identify the proposed traffic survey locations on the network and finalize the same. Modification of the locations based on the site conditions and travel pattern is also made. Additional locations were also identified based on the travel pattern observed at site.

The following traffic surveys were planned to obtain the existing travel and traffic information:

1. Origin-Destination Survey
2. Willingness To Pay Survey for Toll Charges
3. Mid block 7 days Classified Traffic Volume Count Survey
4. Mid block 3 days Classified Traffic Volume Count Survey
5. Junction Count Survey
6. Vehicle speed distribution and journey time survey
7. Speed flow relationship and the existing level of service
8. Axle Load survey along the existing route
9.

The traffic survey locations identified and finalized are given in Table 0.2. These traffic surveys were conducted as per IRC guidelines during the months of November-December, 2009 as per the schedule provided in **Table 0.2.** Trained enumerators and supervisors are deployed to conduct the traffic surveys and these are supervised by Transportation Engineers.

Table 0. 17: Traffic Survey Location details

S.No.	Section	Time	Chainage	Location
I	**Mid block 7 day Classified Traffic Volume Count Survey**			
1	Dobbaspet-Doddaballapura	7 day TVC	Km 120	Dabbaspet
2	Dodballapur - Devenhalli	7 day TVC	Km 95	Dodballapur
3	Devanahalli - Hoskote	7 day TVC	Km 70	Devenhalli
4	Hoskote-Kolar section	7 day TVC	Km 285	Kolar
5	Palamner-Chittoor	7 day TVC	Km 184/100	Mogli
6	Kanchipuram-Sriperambadur	7 day TVC	Km 55/200	Senthamangalam
7	Krishnagiri - Vellore	7 day TVC	Km 32/000	Munthapalem
8	Hosur-Krishnagiri	7 day TVC	Km 87	Krishnagiri
II	**Mid block 3 day Classified Traffic Volume Count Survey**			
1	Kolar – Palamner	3 day TVC	Km 221/000	Nangli
2	Chittoor-Ranipet	3 day TVC	Km 139/600	Panatore
3	Arcot-Kanchipuram	3 day TVC	Km 96/000	Kaveripakkam
4	Vellore-Arcot	3 day TVC	Km 132/000	Ratnagiri

The analysis of the directional classified traffic volume counts observed at various count stations has been carried out to work out the following traffic characteristics:

- Average Daily Traffic (ADT) including toll exempted vehicles
- Hourly Variation
- Daily Variation in Traffic Volume
- Directional Distribution
- Composition of ADT
- Annual Average Daily Traffic (AADT)

The various vehicle types having different sizes and characteristics were converted into Equivalent Passenger Car Units. The Passenger Car Unit (PCU) factors recommended by Indian Road Congress in "Guidelines for Capacity of Roads in Rural Areas" (IRC-64-1990) have been used for conversion, and are presented in **Table 0.3**.

Table 0. 18: PCU Factors Adopted for Study

Fast Vehicles	PCU	Slow Vehicles	PCU
Car	1.0		
Mini Bus	1.5		
Standard Bus	3.0		
LCV/LGV	1.5	Agricultural Tractor	1.5
2-Axle Truck	3.0	Agricultural Tractor & Trailer	4.5
3 Axle Truck	3.0	Animal/Hand Cart	8.0
MAV	4.5	Cycle	0.5
Two Wheeler	0.5	Cycle Rickshaw	3.0
Auto Rickshaw	1.0		
Van/Tempo	1.0		

Source: IRC: 64-1990

Average Daily Traffic

Classified Traffic Volume Count (CTVC) surveys have been conducted along the NH-4, NH-46, NH-7 & NH-219. The traffic volume count surveys were also conducted along the NH-207 also. The Classified Traffic Volume Count surveys were conducted for 7 continuous days at most of the location and for 3 continuous days at some locations. The details of the survey locations are given below in **Table 0.8**.

For the location where 7 day TVC has been done, the data have been averaged to get the Average Daily Traffic (ADT) and for the locations where 3 day TVC has been done, the data has been averaged and scaled with the nearest 7 day TVC data to get the ADT. **Table 0.9** presents the ADT data for the above locations.

Table 0. 19: ADT for the 7 day Classified Traffic Volume Count survey locations

Vehicle Type	Dabbaspet	Dod Ballapur	Devenhalli	Kolar	Mogili	Sentha mangalam	Muntha palem	Krishnagiri
Two Wheeler	1,292	2,409	2,516	2,086	1,887	3,054	2,121	6,197
Three Wheeler	60	57	72	360	283	433	211	641
Car/Van/Jeep/Tempo	611	952	784	3,828	2,776	6,911	3,856	5,729

Vehicle Type		Dabbaspet	Dod Ballapur	Devenhalli	Kolar	Mogili	Sentha mangalam	Muntha palem	Krishnagiri
Taxi		-	-	-	-	-	-	-	162
Mini Bus		15	28	8	44	94	326	227	26
Private Bus		6	20	9	17	14	1,213	38	44
Govt Bus		110	101	151	1,275	1,207	1,989	829	2,634
LCV		340	426	456	1,341	1,367	1,440	1,277	2,658
2 Axle Truck		401	401	361	1,250	1,198	3,673	1,032	1,972
3 Axle Truck		362	342	322	1,230	1,088	2,460	1,387	3,796
MAV		33	24	18	308	323	709	340	533
MAV >6A		2	2	1	-	23	83	4	13
HCE/EME		4	6	4	7	7	7	2	5
Agricultural Tractor		7	11	6	18	88	52	8	8
Agricultural Tractor & Trailor		38	33	43	51	123	25	24	30
Non Motorised Vehicels	Animal & Hand drawn	5	8	4	1	17	7	-	4
	Cycle	81	165	22	20	359	102	78	130
	Cycle Rickshaw	1	3	-	-	7	12	-	2
	Others	-	-	-	-	1	6	-	-
Toll Exempted Vehicles	Car/Van/Jeep	6	5	2	4	39	59	21	37
	Ambulance	-	-	-	21	21	50	19	37
	Bus/Truck	-	-	-	-	7	9	2	4
Vehicles	Motorised	3,287	4,817	4,753	11,840	10,545	22,493	11,398	24,526
	Non Motorised	87	176	26	21	384	127	78	136
	Total	**3,374**	**4,993**	**4,779**	**11,861**	**10,929**	**22,620**	**11,476**	**24,662**
PCU	Motorised	4,856	5,810	5,653	20,345	19,091	43,483	18,977	41,733
	Non Motorised	84	156	43	18	340	161	39	103
	Total	**4,940**	**5,966**	**5,696**	**20,363**	**19,431**	**43,644**	**19,016**	**41,836**

Table 0. 20: ADT for the 3 day Classified Traffic Volume Count survey locations

Vehicle Type	Nagili	Penator	Kaveripakkam	Ratnagiri
Two Wheeler	1,393	962	3,697	6,941
Three Wheeler	157	40	160	637
Car/Van/Jeep/Tempo	1,498	671	7,220	7,611

Vehicle Type		Nagili	Penator	Kaveripakkam	Ratnagiri
Taxi		-	-	-	-
Mini Bus		25	16	336	375
Private Bus		7	6	64	66
Govt Bus		861	165	1,912	1,990
LCV		860	511	3,098	2,559
2 Axle Truck		914	914	3,014	1,801
3 Axle Truck		784	1,057	2,815	1,662
MAV		202	107	598	481
MAV >6A		24	1	14	9
HCE/EME		11	1	6	6
Agricultural Tractor		10	3	23	9
Agricultural Tractor & Trailor		74	12	55	71
Non Motorised Vehicles	Animal & Hand drawn	5	4	9	1
	Cycle	184	83	188	279
	Cycle Rickshaw	6	-	1	5
	Others	1	-	-	-
Toll Exempted Vehicles	Car/Van/Jeep	10	2	33	37
	Ambulance	5	2	46	45
	Bus/Truck	3	1	11	5
Vehicles	Motorised	6,837	4,470	23,102	24,308
	Non Motorised	196	87	198	285
	Total	**7,034**	**4,557**	**23,301**	**24,593**
PCU	Motorised	12,831	8,963	41,004	35,375
	Non Motorised	152	74	172	160
	Total	**12,983**	**9,037**	**41,176**	**35,535**

The Average Daily Traffic (ADT) on the project road sections varied between – to – with the highest traffic observed between -- and --. The obtained Average Daily Traffic (ADT) will have to be adjusted to account for the seasonal variation to obtain the Annual Average Daily Traffic (AADT).

Table 0. 21: AADT for the 7 day Classified Traffic Volume Count survey locations

Vehicle Type	Dabbaspet	Dod ballapur	Devenhalli	Kolar	Mogili	Senthamangalam	Munthapalem	Krishnagiri
Two Wheeler	1,357	2,529	2,642	2,107	1,962	3,176	2,121	6,383
Three Wheeler	63	60	76	364	294	450	211	660
Car/Van/Jeep/Tempo	642	1,000	823	3,866	2,887	7,187	3,856	5,901
Taxi	-	-	-	-	-	-	-	167

Vehicle Type		Dabbaspet	Dod ballapur	Devenhalli	Kolar	Mogili	Sentha mangalam	Muntha palem	Krishnagiri
Mini Bus		16	31	9	48	100	346	216	28
Company Bus		7	22	10	18	15	1,286	36	47
Bus		120	110	165	1,377	1,279	2,108	788	2,818
LCV		371	464	497	1,448	1,449	1,526	1,213	2,844
2 Axle Truck		437	437	393	1,350	1,270	3,893	980	2,110
3 Axle Truck		395	373	351	1,328	1,153	2,608	1,318	4,062
MAV		36	26	20	333	342	752	323	570
MAV >6A		2	2	1	-	24	88	4	14
HCE/EME		4	7	4	8	7	7	2	5
Agricultural Tractor		8	12	7	19	93	55	8	9
Agricultural Tractor & Trailor		41	36	47	55	130	27	23	32
Non Motorised Vehicles	Animal & Hand drawn	5	8	4	1	17	7	-	4
	Cycle	81	165	22	20	359	102	78	130
	Cycle Rickshaw	1	3	-	-	7	12	-	2
	Others	-	-	-	-	1	6	-	-
Toll Exempted Vehicles	Car/Van/Jeep	6	5	2	4	41	61	21	38
	Ambulance	-	-	-	23	22	53	18	40
	Bus/Truck	-	-	-	-	7	10	2	4
Vehicles	Motorised	3,504	5,114	5,046	12,348	11,078	23,633	11,139	25,732
	Non Motorised	87	176	26	21	384	127	78	136
	Total	**3,591**	**5,290**	**5,072**	**12,369**	**11,462**	**23,760**	**11,217**	**25,868**
PCU	Motorised	5,240	6,244	6,077	21,606	20,156	45,913	18,286	44,268
	Non Motorised	84	156	43	18	340	161	39	103
	Total	**5,324**	**6,400**	**6,120**	**21,624**	**20,496**	**46,074**	**18,325**	**44,371**

Table 0. 22: AADT for the 3 day Classified Traffic Volume Count Survey locations

Vehicle Type	Nagili	Penator	Kaveripakkam	Ratnagiri
Two Wheeler	1,434	991	3,808	7,149

Vehicle Type		Nagili	Penator	Kaveripakkam	Ratnagiri
Three Wheeler		162	42	165	657
Car/Van/Jeep/Tempo		1,544	690	7,437	7,839
Taxi		-	-	-	-
Mini Bus		26	17	352	394
Company Bus		7	6	66	69
Bus		903	173	2,008	2,090
LCV		903	537	3,253	2,687
2 Axle Truck		960	960	3,166	1,891
3 Axle Truck		823	1,109	2,957	1,745
MAV		212	112	628	505
MAV >6A		25	-	15	9
HCE/EME		12	1	6	6
Agricultural Tractor		10	3	23	8
Agricultural Tractor & Trailor		74	12	55	71
Non Motorised Vehicles	Animal & Hand drawn	5	4	10	-
	Cycle	184	83	188	279
	Cycle Rickshaw	7	-	1	5
	Others	1	-	-	-
Toll Exempted Vehicles	Car/Van/Jeep	10	2	34	38
	Ambulance	5	2	48	47
	Bus/Truck	3	-	13	5
Vehicles	Motorised	7,113	4,657	24,032	25,212
	Non Motorised	197	87	199	284
	Total	**7,310**	**4,744**	**24,231**	**25,496**
PCU	Motorised	13,409	9,378	42,857	36,886
	Non Motorised	156	74	177	155
	Total	**13,565**	**9,452**	**43,034**	**37,041**

The salient features are:

- 2/3 wheelers are consistently higher at more than 40% at locations Dabbaspet, Dodballapur, and Devenhalli sections. This shows high usage of personalized modes and IPT modes on this section.
- 2/3 wheelers percentages are similar at Kolar, Nangli and Mogili sections at about 20-21 %. MAV percentage is similar at Kolar and Mogili (13-14%) where as at Nangli it is higher at 25%. 2axle, LCV and buses have similar composition at these three locations.
- Cars are similar at Kaveripakkam and Senthamangalam sections. Buses are higher at Senthamangalam due to presence of SEZs and operation of many company bus services at this location. This effect gets reduced in Kaveripakkam section.
- About 40 % of the trips are commercial trips at Krishnagiri and Munthapalem sections. This gets reduced to 30 % at Ratnagiri section.
- Slow moving vehicles are consistently low as these are National Highway locations.

0.9.2 Traffic Forecast model

Methodology

The traffic levels on any proposed transport level facility decides the revenue stream for the project and hence key to the financial viability of the project. To estimate the traffic levels on the proposed Expressway, the methodology adopted is described in various tasks outlined in the following paragraphs. The influence region is expected to be influence area due to the development of the new expressway. This will include assessment of traffic expected to be diverted from the existing network to the proposed expressway and also the induced traffic due to the new developments in the influence region as a result of better connectivity, and accessibility provided by the expressway. Another important component in the estimation of traffic and its revenue is toll. With the introduction of tolling what percentage of traffic is expected to get diverted from the existing network to the proposed expressway will also be studied.

The proposed expressway passes through three states viz., Karnataka, Andhra Pradesh and Tamilnadu. The study area comprises of an area 50 km on either side of the proposed expressway. Influence area of the parallel National Highways NH 4 & NH 46 will also be considered. The output from the study will be link loads in terms of traffic on the proposed expressway sections.

The normal procedure for estimation of traffic on the new expressway will involve estimation of traffic growth based on estimation and application of elasticity approach. Growths based on the socio-economic parameters will also be used in the analysis. Assignment of both passenger and freight traffic to various alternative routes based on the travel costs will be made. Generalized cost function will be used in estimation of total costs. The traffic forecast will be made for the different horizon years and for different modes.

The alternative approach will involve the matrix estimation method based on the observed link counts. This estimation will be for different modes. This method is a statistically valid and is an accepted estimation procedure. Consultants used the second method for estimation of the base year traffic. Elasticity method will be used to arrive at the growth of the traffic for the future years. The traffic forecast will be made for the different horizon years and for different modes. The breakup of the traffic will include diverted, generated/induced/developmental traffic. The estimation of the developmental traffic will be based on the proposed developments in the Project Influence Area.

Travel Demand Model

Earlier, Travel demand model for the proposed Bangalore – Chennai Expressway has been developed in Trans CAD software in the year 2009-10. As suggested by client during the review meeting on 4th January 2017, the base matrix and model is updated with latest traffic data. The model has been calibrated with the updated traffic data for the base year (2017) and validated for the use to forecast traffic for the future years.

Trip Generation

The base year origin-destination survey data is used to prepare the base year O-D matrix. This becomes the seed matrix for the base year. From the calibrated base matrix the trip productions and attractions are estimated. And for future years the growth rates established through the elasticity analysis are adopted.

Trip Distribution

Trip distribution is the process of establishing the trip production and attractions among various O-D zone pairs. Based on this estimated matrix the parameter of the trip distribution model is calibrated. Gravity formulation is used in the calibration procedure.

Generalized cost is used as impedance in the gravity calibration. Generalized cost is the combination of all types of costs that a vehicle incurs to travel on a road network. Generalized cost components include distance, travel time based vehicle operating costs. Thus both the vehicle operating costs and time based costs get built into the generalized cost as a measure of deterrence. Further, toll costs are also included into the generalized cost.

Traffic Assignment Model

The traffic assignment model allocates the forecasted travel demand on the available road network. User Equilibrium assignment technique is used for traffic assignment in the present study.

The output of this model is the link volume counts. These volume counts are compared with the observed volume counts. Also the trip length curve is compared with the base year data.

Calibration

The travel demand model needs to be calibrated to the base year. The output of the ODME procedure is to estimate the trip distribution matrix. The estimated matrix should resemble the seed matrix supplied to the model. To check this, the trip length distribution of the seed matrix and the estimated matrix of the model are compared. Once these two are in reasonable agreement with each other, the model is said to be calibrated. The following figures present the calibration of the model.

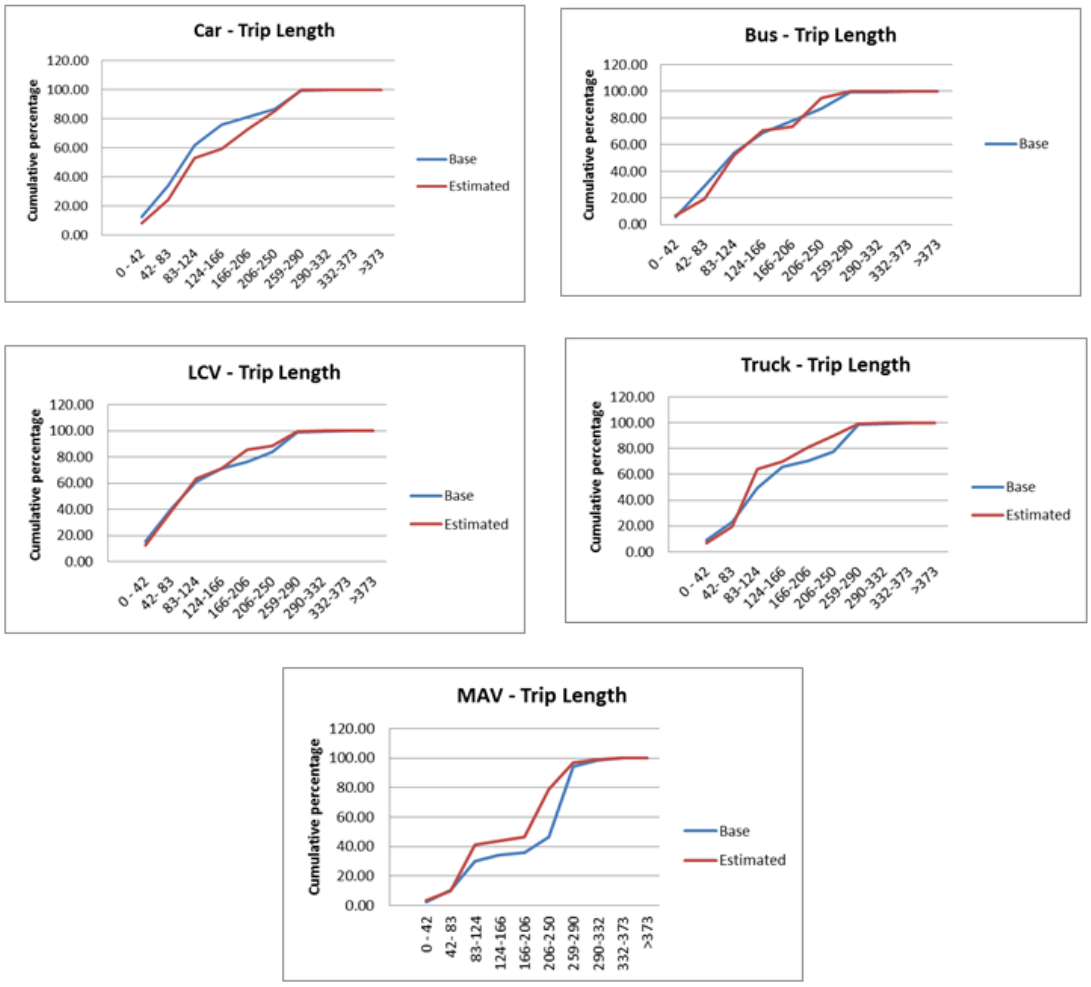


Figure: Trip Length Distribution (TLD) Base vs Estimated for all Modes

Both the trip length distribution curves for the base data and estimated data is in close agreement. Hence the model is considered to be calibrated and ready to be used for the estimation of future years.

Traffic Forecast

With the above growth rates the traffic is projected on the Expressway. The mode wise yearly projected traffic for different horizon years is provided in **Annexure A**.

Capacity Assessment for Phase-3

The Guidelines for Expressways issued by IRC is used in assessing the capacity of the Expressway. As per the guidelines the design service volume for Expressway (IRC:SP:99-2013) is given below.

Table 2.12 Design Service Volume for Expressways in Plain and Rolling Terrain (in PCUs/per day) for LOS B

Design Service Volume in PCUs per day for LOS B		
4-Lane	**6-Lane**	**8- lane**
86,000 for Peak hour flow (6%) 65,000 for Peak hour flow (8%)	1,30,000 for Peak hour flow (6%) 98,000 for Peak hour flow (8%)	1,73,000 for Peak hour flow (6%) 1,30,000 for Peak hour flow (8%)

From 2009 Traffic survey analysis 8% Peak hour flow is obtained for the study network. So this 8% Peak Hour flow Design Service Volume was used for the Capacity assessment and the same is adopted for the present analysis also.

The Section wise and Year wise Capacity analysis is done and summary is presented bellow and the cells highlighted in green colour are qualifying for **6-lanes** as per the expressway capacity analysis.

Year	HS-IV	HS-V
2021	48644	51453
2022	52080	55088
2023	55759	58979
2024	59697	63145
2025	63914	67606
2026	**67790**	**70297**
2027	71932	73015
2028	76326	75838
2029	80990	78770
2030	85937	81815
2031	**91188**	**84978**
2032	95953	88173
2033	100967	91488
2034	106243	94928
2035	111795	98498
2036	117637	102201
2037	125113	108359
2038	133064	114887
2039	141520	121809
2040	150513	129147
2041	160078	136928

Year	HS-IV	HS-V
2042	171988	147430
2043	184784	158737
2044	198531	170911
2045	213302	184019
2046	229171	198133
2047	244082	211675
2048	259964	226142
2049	276879	241598
2050	294894	258111
2051	314082	275752

Conclusion

From the capacity analysis, it can be seen that the Expressway requires 4-lane configuration in the opening year (2021) and needs up-gradation to 6-lane configurations in the year 2025 for section HS-V, if we can allow the Level of Service (LOS) to little more comfortable (i.e., LoS-A to LoS-B). The 6-lane configuration is required for all the sections in the year 2029.

Considering the project award to concessionaire in the year 2018 and three years construction time, the expressway is requiring 6-lanes after 8 years. Hence, recommended to go for 6-lanes in the year 2021.

Annexure A

Section wise Traffic Forecast on proposed Expressway for different horizon years with latest traffic data

2021	Sections	CJV	Bus	LCV	Trucks	MAV	Diverted PCU's	Induced PCU's	Generated PCU'S	Total PCU'S
	HS-IV	15658	4972	4158	3164	520	48644	1946	2000	**52589**
	HS-V	14160	5279	3651	4469	572	51453	2058	2000	**55511**

2026	Sections	CJV	Bus	LCV	Trucks	MAV	Diverted PCU's	Induced PCU's	Generated PCU'S	Total PCU'S
	HS-IV	20067	6452	5524	3935	726	62779	2511	2500	**67790**
	HS-V	18920	6490	5125	5188	788	65189	2608	2500	**70297**

2031	Sections	CJV	Bus	LCV	Trucks	MAV	Diverted PCU's	Induced PCU's	Generated PCU'S	Total PCU'S
	HS-IV	27472	8833	7693	4973	970	84796	3392	3000	**91188**
	HS-V	24024	7824	6866	5599	941	78825	3153	3000	**84978**

2036	Sections	CJV	Bus	LCV	Trucks	MAV	Diverted PCU's	Induced PCU's	Generated PCU'S	Total PCU'S
	HS-IV	35793	11559	9900	6175	1204	109266	4371	4000	**117637**
	HS-V	29561	9384	8317	6429	1099	94424	3777	4000	**102201**

2041	Sections	CJV	Bus	LCV	Trucks	MAV	Diverted PCU's	Induced PCU's	Generated PCU'S	Total PCU'S
	HS-IV	49470	15919	13622	8223	1615	149595	5984	4500	**160078**
	HS-V	40224	12636.06	11327.89	8571.604	1443.442	127335	5093	4500	**136928**

2046	Sections	CJV	Bus	LCV	Trucks	MAV	Diverted PCU's	Induced PCU's	Generated PCU'S	Total PCU'S
	HS-IV	70581	23720	19033	11688	2372	216030	8641	4500	**229171**
	HS-V	57805	18682	16293	12631	2223	186185	7447	4500	**198133**

2051	Sections	CJV	Bus	LCV	Trucks	MAV	Diverted PCU's	Induced PCU's	Generated PCU'S	Total PCU'S
	HS-IV	97668	32732	26190	15918	3282	297675	11907	4500	**314082**
	HS-V	81466	25953	22612	17841	3124	260819	10433	4500	**275752**