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EXECUTIVE SUMMARY

0.1 INTRODUCTION

Uttar Pradesh Expressways Industrial Development Authority (known by its acronym UPEIDA) was set up by the State Government under U.P. Industrial Areas Development Act 1976, in December 2007 for development of Expressways in Uttar Pradesh. This is a newly established Organization with lean and laborious employee base, on contract or on deputation basis from State Revenue Department/PWD, among them few are deployed on retainership basis or by service provider.

Govt. of Uttar Pradesh (GoUP) has successfully developed 165 km Noida to Agra 6 Lane Access Controlled Expressway (Yamuna Expressway). Rigid pavement has been constructed for the entire length of the expressway. The project was developed on Public Private Partnership (PPP) mode and is in operation since August 2012.

Fig. 0.1 - Yamuna Expressway

The work of linking this expressway with State Capital through another high speed six lane corridor namely "Agra to Lucknow Access Controlled Expressway (Green Field) Project" has also been successfully completed. It is India's largest 302 Km access controlled Greenfield expressway. The entire length of the project road is of flexible pavement type. This Expressway Project has been developed on EPC mode with Government funding.

Fig. 0.2 – Agra-Lucknow Expressway

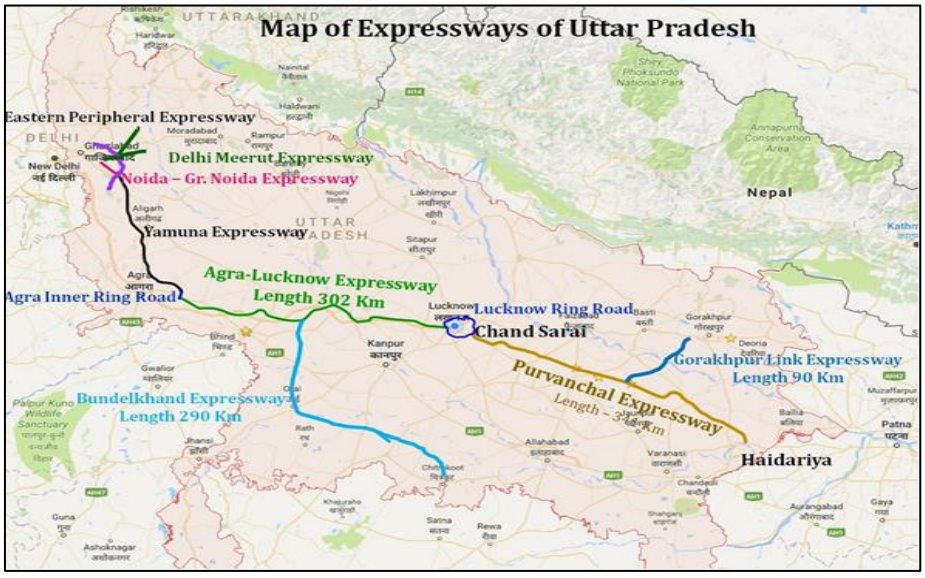
The Yamuna Expressway & Agra-Lucknow Expressway network starting from Noida area to Lucknow city provides seamless travel between State Capital and National Capital.

The Authority is developing another 6 Lane Access Controlled Green Field Expressway "The Purvanchal Expressway" in EPC Mode, which will connect to outer Ring Road in Lucknow which in turn will be connected to "Agra-Lucknow Access Controlled Expressway (Green Field) Project" at Lucknow. This Expressway project shall create immense opportunities to the people of eastern region of the State and over all development of the State by providing high speed connectivity between East & West borders of the State and with national capital.

The construction for 'Purvanchal Expressway', 'Bundelkand Expressway' & 'Gorakpur Link Expressway' projects are in progress & these Expressways are expected to be ready by 2020, 2022 & 2022 respectively.

Fig. 0.3 – Construction of Purvanchal Expressway

The Uttar Pradesh Government has decided to develop the "Ganga Expressway Project". UPEIDA is committed for the development of this expressway and has Entrusted M/s L N Malviya Infra Projects Pvt. Ltd., Highway Engineering Consultant and Intratech Civil Solutions (Consortium) to carry out the detailed project report to implement the project on EPC Mode and selection of developers through competitive bidding process.



The project will provide direct high speed connectivity from National Capital Region through proposed expressway to Meerut and then onwards to Prayagraj. It will facilitate construction of all-weather high speed access controlled expressway, which will decongest the increasing traffic on existing road network. The expressway will also decrease travel time substantially.

The Consultant has undertaken requisite surveys & studies for the project which includes costing to assess technical, environmental and social assessment studies, their analysis etc. As a part of the study to establish the viability, this Project Report has been prepared after carrying out engineering surveys and appropriate assessment of a preliminary design considering the engineering conditions, the present traffic and its growth, the environmental impact assessment as well as the social aspects along with cost assessment. This report among other aspects covers the details on finalization of alignment, grade separator interchanges and structures along the proposed Expressway, marking on the Khasra maps of ROW and marking of alignment on revenue maps, identification of Tourist spots, eco-friendly structures, water bodies etc. along the expressway.

The Project Report contains the following chapters:

- Executive Summary
- Chapter 1: Introduction
- Chapter 2: Project Description
- Chapter 3: Methodology and Design Standards
- Chapter 4: Traffic Studies
- Chapter 5: Highway Design & Proposed Typical Cross-Sections, Service Roads, Roadside Drains & Air Strip
- Chapter 6: Pavement Design & Proposals
- Chapter 7: Hydrological Studies & Drainage Design
- Chapter 8: Proposals for Structures & Interchanges
- Chapter 9: Project Facilities, Roadside Features & Road Safety
- Chapter 10: Social & Environmental Studies
- Chapter 11: Financial Analysis
- Chapter 12: Economic Analysis
- Chapter 13: Cost Estimate

0.2 APPROACH AND METHODOLOGY

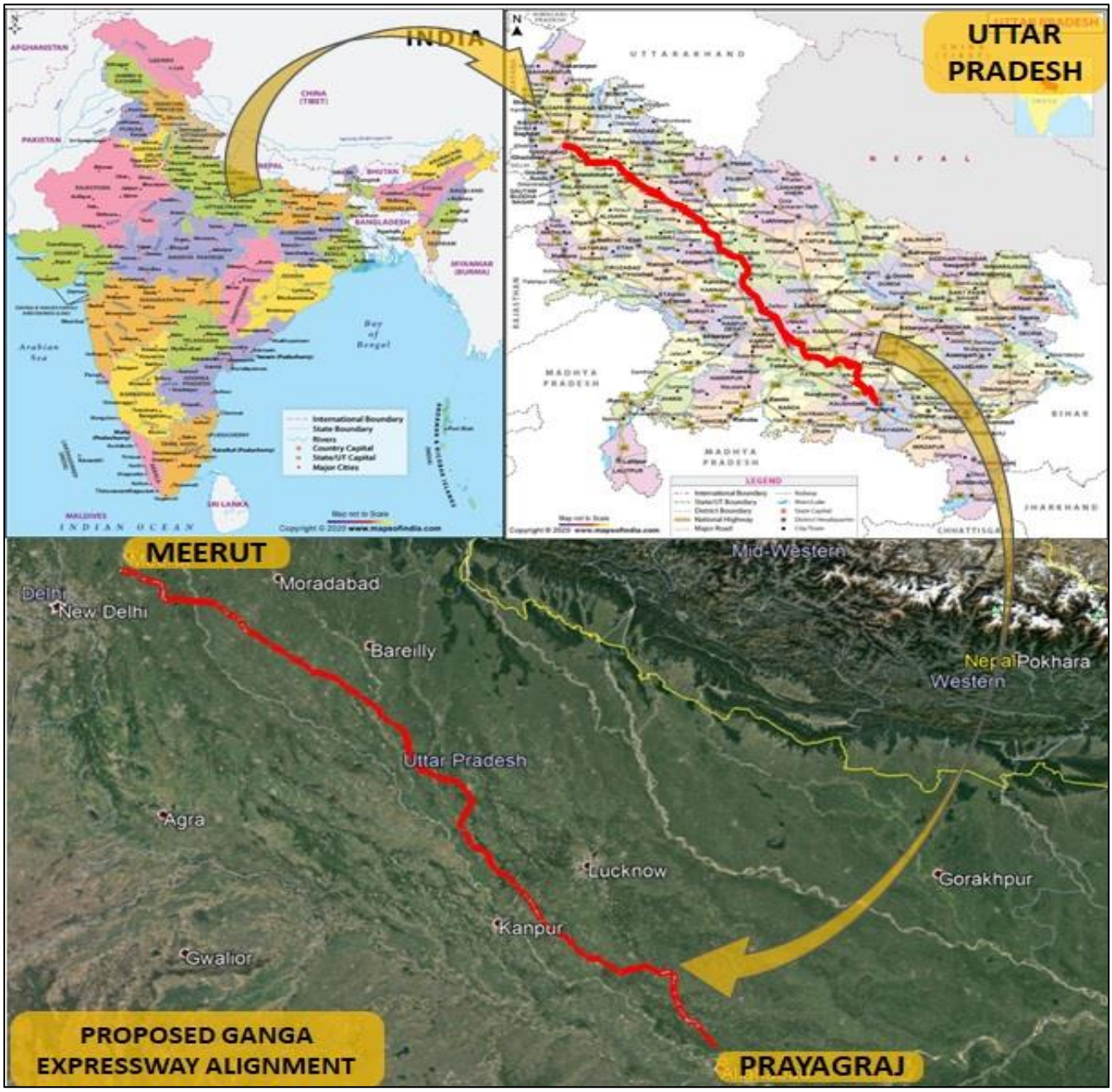
Methodology adopted for the study was initially presented in Inception Report. The methodology adopted for the project is based on initial studies, secondary data, traffic analysis, topographic survey, revenue calculations and Cost Estimates. The project area social screening/RAP and Environment Impact Assessment are also completed for the detailed Engineering stage (DPR). The government policies about Land acquisition is also covered in the detailed Engineering stage (DPR). The methodology adopted is in line with the requirements of the ToR. The methodology adopted to arrive at detailed Engineering stage is covered in chapter 3. Detailed Engineering and field studies such as soil investigations, Environment Impact Analysis and design works are completed for the most preferred alignment Option-1.

0.3 PROJECT ALIGNMENT DESCRIPTION

The proposed Ganga Expressway starts from **km 16+000** of Meerut-Bulandshahar (NH-334) near village Bijoli (Dist. Meerut) **(CH 7+900)** & terminates at Prayagraj Bypass on NH-19 near village Judapur Dando (Dist. Prayagraj) **(CH 601+847)**.

The length of the proposed expressway alignment is **593.947 km**.

The project Index Map is Shown below:



The proposed expressway has been divided into 12 packages. The chainage wise detail of the packages has been given in Table-0.1 below:

Table-0.1

Package No.	Section Details	Chainage (km)		Length
		From	To	
I	From Village Bijoli (Dist. Meerut) to Village-Chandner (Dist. Hapur)	7.900	56.900	49.000
II	From Village-Chandner (Dist. Hapur) to Village-Mirzapur Dugar (Dist. Amroha)	56.900	86.900	30.000
III	From Mirzapur Dugar (Dist. Amroha) to Village-Nagla Barah (Dist. Budaun)	86.900	137.600	50.700
IV	From Village-Nagla Barah (Dist. Budaun) to Village-Binawar (Dist. Budaun)	137.600	189.700	52.100
V	From Binawar (Dist.Budaun) to Girdharpur (Dist. Shahjahanpur)	189.700	236.400	46.700
VI	From Village- Girdharpur (Dist. Shahjahanpur) to Village-Ubariya Khurd (Dist. Hardoi)	236.400	289.300	52.900
VII	From Village-Ubariya Khurd (Dist. Hardoi) to Village- Pandra Lakhanpur (Dist. Hardoi)	289.300	341.700	52.400
VIII	From Village- Pandra Lakhanpur (Dist. Hardoi) to Village-Raiyamau(Dist. Unnao)	341.700	391.900	50.200
IX	From Village- Raiyamau (Dist. Unnao) to Village-Sarso (Dist. Unnao)	391.900	445.000	53.100
X	From Village- Sarso (Dist. Unnao) to Village-Terukha (Dist. Raebareli)	445.000	496.800	51.800
XI	From Village-Terukha (Dist. Raebareli) to Village-Arro (Dist. Pratapgarh)	496.800	548.800	52.000
XII	From Village- Arro (Dist. Pratapgarh) to Village-Judapur Dando (Dist. Prayagraj)	548.800	601.847	53.047
Total				**593.947**

The Expressway is access controlled with only entry/exit at Nodes (intersecting points of National Highway or State Highways or Major District Roads – crossing with the proposed Expressway Alignment), details of which has been described in Table-0.3.

0.3.1 Alignment & Structures

The expressway alignment is having 6 Lanes with Paved Shoulders Configuration with Service Roads, which is further expandable up to 8 Lanes. The alignment has been designed with the design speed of 120 km/h.

The key features of the project alignment are given in Table 0.2 below:

Table-0.2

S. No.	Particulars	Nos. / Length
1	Length (km)	593.947
2	Major Bridges	14
3	Minor Bridges	127
4	Culverts	929

S. No.	Particulars	Nos. / Length
5	ROB	7
6	VUP	50
7	LVUP	171
8	SVUP	154
9	Flyovers	28
10	Trumpet	2
11	Double Trumpet	7
12	Diamond Interchange	8
13	Way Side Amenities	9
14	Proposed Node Development	17

0.3.2 Node Development

The Expressway is access controlled with only entry/exit at Nodes (intersecting points of National Highway or State Highways or Major District Roads – crossing with the proposed Expressway Alignment). In view of the background and detailed discussions held with UPEIDA and other stake holders such as the Revenue Authorities, Eighteen locations were selected along the project corridor where Nodes would be developed and are lettered "A" to "R" as listed in Table-0.3 below:

Table-0.3

Toll Nodes	Chainage	Details of the Intersecting Roads	Road No.	Type of Interchange
A	0+100	Delhi - Meerut Expressway	Expressway	Dummy Node
B	8+920	Meerut – Hapur	NH-334	Trumpet
C	35+270	Hapur - Garhmukteshwar	NH-24	Diamond
D	54+640	Bulandshahr - Garhmukteshwar	SH-65	Diamond
E	74+181	Hasanpur-Anupshahar	MDR-162W	Diamond
F	102+427	Anupshahr - Moradabad	ODR	Diamond
G	123+288	Babrala - Chandausi	NH-509	Double Trumpet
H	173+454	Chandausi - Budaun	SH-125	Diamond
I	189+394	Budaun - Bareilly	SH-33	Double Trumpet
J	255+167	Farukkhabad - Shahjahanpur	SH-29	Double Trumpet
K	282+845	Farukkhabad - Shahbad	SH-138	Diamond
L	329+945	Kannauj– Hardoi	SH-21	Double Trumpet
M	378+136	Agra - Lucknow Expressway	Agra Lucknow Exp	Double Trumpet
N	420+932	Kanpur - Lucknow	NH-27	Diamond
O	487+285	Lalganj - Raebareli	NH-31	Double Trumpet
P	517+708	Raebareli–Unchahar	NH-30	Double Trumpet
Q	554+951	Manikpur - Bela Pratapgarh	MDR-102E	Diamond
R	600+457	Prayagraj Bypass	NH-19	Trumpet

Node A is revised and treated as Dummy Node in this Report, as the Start Point of the Ganga Expressway has been changed from Node A to Node B due to Engineering Design Constraints, with prior approval of UPEIDA.

0.4 RIGHT OF WAY

ROW has been taken as total 120 m for the proposed expressway except at Interchange Locations, Way Side Amenities (including Toilet Block), Toll Plaza locations and at locations for training on the course of nallah/drain and at airstrip, where the ROW varies.

0.5 ABUTTING LAND USE PATTERN

The land use pattern on the both sides of the expressway in maximum section is agricultural.

0.6 TERRAIN

The terrain of this stretch can be termed as plain and flat throughout.

0.7 FOREST

No forest land observed along the road. However, the alignment passes some stretches of Social Forestry.

0.8 ARCHEOLOGICAL/ANCIENT STRUCTURE

No such type of structure found along the project corridor.

0.9 TRAFFIC SURVEYS, ANALYSIS AND PROJECTIONS

The traffic surveys were mainly:

(a) Origin and destination surveys (which included willingness-to-pay "stated-preference" questions and, in one instance where this type of survey was possible, a "revealed-preference" survey – see below); and

(b) Classified Volume Count Surveys;

(c) Axle Load Surveys

All survey types were conducted in accordance with the guidelines specified in IRC 9-1972, IRC 102-1988 and IRC SP19-2001.

The surveys were conducted at points close to where the proposed Expressway would intersect with the National, State and other highways/district roads and other locations from which, traffic that may eventually use the Expressway either partly or entirely.

Table-0.5 Locations for Road-Side Origin and Destination (O-D) Surveys

OD. No.	Survey Location	Stretch & Road Name	Day & Date of O-D Survey
1	Siwaya Toll Booth	Muzaffarnagar - Meerut	Wednesday, 12thFebruary 2020
2	Nizampur	Meerut - Garhmukteshwar	Friday, 6th December 2019
3	Kurkawali	Hasanpur - Chandausi	Monday, 4th November 2019
5	Nagariya	Aligarh - Etah	Wednesday, 27th November 2019
6	Khankah e Niyaziya	Aliganj - Farrukhabad	Monday, 9th December 2019

OD. No.	Survey Location	Stretch & Road Name	Day & Date of O-D Survey
7	Samdhan	Farrukhabad - Kannauj	Wednesday, 27th November 2019
8	Bilhaur	Kannauj - Kanpur	Monday, 2nd December 2019
9	Katohan Toll Booth	Fatehpur - Prayagraj	Monday, 16th February 2020
10	Agwanpur	Bijnor - Moradabad	Friday, 29th November 2019
11	Faridpur Toll Booth	Bareilly - Shahjahanpur	Monday, 2nd December 2019
12	Nawada	Chandausi - Budaun	Thursday, 28th November 2019
13	Usawan	Budaun - Farrukhabad	Thursday, 5th December 2019
14	Shahabad	Shahjahanpur - Hardoi	Friday, 29th November 2019
15	Safipur	Bangarmau - Unnao	Wednesday, 4th December 2019
16	Semari	Unnao - Lalganj	Friday, 6th December 2019
17	Andiyari	Unchahar - Prayagraj	Tuesday, 10th December 2019

Seven-day count using video coverage was undertaken on National Highways/State Highways/Major District Roads where Road Side Origin-Destination Surveys were carried out – results **(Average Daily Traffic - ADT**) are shown on Tables 4.6 and detailed counts at each location are provided in Appendix.

Table-0.6 Average Daily Traffic (ADT) on Existing Alternate Roads

Vehicle Classification			PCU Factor	Muzaffarnagar – Meerut	Aligarh - Etah	Aliganj - Farrukhabad	Farrukhabad – Kannauj	Kannauj - Kanpur	Budaun – Farrukhabad	Meerut – Garhmukteshwar	Hasanpur - Chandausi	Chandausi - Budaun	Bijnor - Moradabad	Bareilly – Shahjahanpur	Shahjahanpur - Hardoi	Bangarmau - Unnao	Unnao - Lalganj	Unchahar - Prayagraj	Fatehpur - Prayagraj
Passenger Vehicles	Two Wheeler		0.5	5380	1750	2813	3569	2723	1776	3683	2285	3453	7080	9565	3514	6026	2838	6245	3162
	Three Wheeler		1.5	877	605	124	658	415	87	695	254	212	934	1749	347	362	74	586	300
	Car/Van/ Jeep		1.0	12525	736	679	1921	2444	964	4879	855	2027	5179	5976	2476	2163	1282	4632	3094
	Mini Bus		1.5	21	4	18	9	35	7	11	8	7	39	21	19	31	3	52	32
	Bus		3.0	1253	541	37	75	249	244	430	202	278	581	578	197	191	210	490	469
Govt. & Other Vehicles	Tempo/ LCV		1.5	1048	346	226	344	795	315	842	510	707	745	1794	783	742	618	956	1274
	Commercial Vehicles	2 Axle	3.0	484	1061	73	85	853	430	599	164	456	263	1509	231	280	493	448	1033
		3 Axle	3.0	325	1066	50	90	877	438	561	176	447	283	1453	392	491	501	656	1062
		M-Axle	4.5	665	826	138	146	972	454	481	152	509	143	2375	467	606	778	1171	2464
Agricultural Vehicles	Tractor		1.5	20	26	17	17	20	31	48	26	50	43	26	28	38	20	34	13
	Tractor with Trailer		4.5	71	82	139	99	103	151	250	250	282	325	206	243	111	37	356	89
Passenger Vehicles	Cycle		0.5	42	152	950	357	239	286	385	82	500	125	527	835	500	570	501	151
	Cycle Rickshaw		2.0	11	2	0	0	0	9	23	3	7	26	0	0	0	0	0	11
Goods Vehicles	Animal Drawn	Bullock Cart	8.0	0	2	13	10	1	24	50	0	6	14	84	30	16	17	47	0
		Horse	8.0	0	3	0	0	0	35	0	0	24	11	0	0	0	0	0	0
	Hand Cart		3.0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0
	Other (Pl. Specify)		2.0	24	10	0	3	6	17	28	7	14	42	29	31	1	9	3	16
Total Vehicles (Nos.)				**22749**	**7212**	**5277**	**7383**	**9733**	**5269**	**12966**	**4974**	**8980**	**15833**	**25892**	**9594**	**11558**	**7449**	**16178**	**13170**
Total Vehicles (PCUs)				**27761**	**15313**	**4975**	**7364**	**16617**	**9240**	**17867**	**6692**	**12859**	**17245**	**39371**	**12376**	**13428**	**11487**	**22484**	**26414**

0.10 PAVEMENT DESIGN

Flexible pavement has been adopted for new carriageways throughout the project length except at toll plaza/booth & Air strip locations. In the toll plaza/booth area & Air strip, rigid pavement has been adopted.

(a) New Flexible Pavement Design

The pavement design basically aims at determining the total thickness of the pavement structure as well as thickness of individual structural components. The following assumptions are considered for the preliminary pavement design. The basic assumptions considered while designing are as follows:

- Design life of 20 (after construction period) years has been considered for flexible pavement design.
- Sub grade CBR (for design) has been taken as 8%.
- Design life for Cement Concrete pavement has been assumed as 30 years.

Proposed Crust Composition for New Construction

Proposed Crust For Main Carriageway										
Package No.	Section		Length (m)	Adopted MSA (20 Years)	Design CBR	Crust Composition (in mm)				
	From	To				Subgrade	GSB	WMM	DBM	BC
I	7.900	56.9	49	89	8%	500	200	155	150	40
II	56.9	86.9	30	92	8%	500	200	150	155	40
III	86.90	137.60	50.70	99	8%	500	200	150	155	40
IV	137.60	189.70	52.10	98	8%	500	200	150	155	40
V	189.70	236.40	46.70	107	8%	500	200	150	160	40
VI	236.40	289.30	52.90	108	8%	500	200	150	160	40
VII	289.3	341.7	52.4	108	8%	500	200	150	150	40
VIII	341.70	391.90	50.20	98	8%	500	200	150	155	40
IX	391.90	445.00	53.10	98	8%	500	200	150	155	40
X	445.00	496.80	51.80	87	8%	500	200	150	150	40
XI	496.80	548.80	52.00	79	8%	500	200	155	145	40
XII	548.80	601.847	53.047	79	8%	500	200	155	145	40

(b) Service roads have been designed for 5 MSA with design CBR of 8%. The crust composition of service roads is given in Table below:

Proposed Crust For Service Road			
Package No.	Design MSA	Design CBR	Crust Composition (in mm)

			BC	DBM	WMM	GSB	Subgrade
I to XII	5	8%	30	50	150	150	500

0.11 ROAD SIDE DRAINS

Package wise lengths and types of Drains are given in table below:

Package No.	Length of Drain					Remarks
	Unlined Drain (LHS+RHS)	Lined Drain (LHS+RHS)	Median Drain	Covered Drain (LHS+RHS)	Chute Drain	
I	39774	55595	44103	2560	42750	
II	26465	32099	27856	-	43420	
III	28936	71719	48100	990	42120	
IV	38824	64507	49035	990	42260	
V	40973	51089	44608	-	42330	
VI	37623	62293	45716	990	48345	
VII	46896	56886	49921	990	41940	
VIII	29037	70411	46679	990	43820	
IX	42200	63188	51030	-	41920	
X	36613	66023	48991	990	42090	
XI	45876	56891	48753	990	43460	
XII	43851	60062	49858	2560	43160	
Total Length (m)	**457068**	**710761**	**554648**	**12050**	**511500**	
Total Length (km)	**457.07**	**710.76**	**554.65**	**12.05**	**511.50**	

0.12 SERVICE ROADS

Details of proposed Service Roads are as follows:

Package No.	3.75 m Service Road		7.0 m Service Road		10.0 m Service Road	
	LHS	RHS	LHS	RHS	LHS	RHS
I	36.77	14.31	5.33	1.82	0	0
II	23.81	8.93	0.80	0.00	0	0
III	45.25	26.41	0.40	0.40	0	0
IV	23.74	35.50	5.74	0.40	0	0
V	20.93	12.40	0.80	18.30	0	0

Package No.	3.75 m Service Road		7.0 m Service Road		10.0 m Service Road	
	LHS	RHS	LHS	RHS	LHS	RHS
VI	32.34	15.34	2.98	7.52	5.0	5.0
VII	21.55	35.16	0.40	0.80	0	0
VIII	26.15	33.22	8.41	3.58	0	0
IX	33.79	25.12	3.08	2.01	0	0
X	22.11	33.89	2.58	8.41	0	0
XI	18.53	28.32	3.87	7.40	0	0
XII	26.12	25.14	5.16	2.25	0	0
Total Length (km)	**331.09**	**293.74**	**39.55**	**52.89**	**5.0**	**5.0**

0.13 AIR STRIPS

The Air Strips may allow military aircraft to continue operating even if their regular air bases, some of the most vulnerable targets in any war, are degraded or destroyed.

Package wise details of Air Strips are given below:

Package No.	Component Start/ End		Chainage	Length	Remarks
6	**Start**	Clear Zone	242+500	0.750	
		Air Strip	243+250	3.500	Clear Zone End
	End	Air Strip	246+750		Clear Zone Start
		Clear Zone	247+500	0.750	

Proposals for the Air Strips have been made on selected locations. The Width of Carriageway at Airstrip locations has been kept 36.0 m with 15.0 m Earthen Shoulders on both sides. The type of Pavement proposed for Air Strip is Rigid Pavement.

0.14 GRADE SEPARATED STRUCTURES

Package wise count & details of Grade Separated structures are given in table below:

Package No.	ROB (Nos.)	VUP (Nos.)	LVUP (Nos.)	SVUP (Nos.)	Flyover (Nos.)	Trumpet (Nos.)	Double Trumpet (Nos.)	Diamond Interchange (Nos.)
Package-1	1	1	20	14	5	1	0	2
Package-2	0	3	8	6	1	0	0	1
Package-3	1	2	13	22	3	0	1	1
Package-4	1	6	12	22	3	0	1	1

Package No.	ROB (Nos.)	VUP (Nos.)	LVUP (Nos.)	SVUP (Nos.)	Flyover (Nos.)	Trumpet (Nos.)	Double Trumpet (Nos.)	Diamond Interchange (Nos.)
Package-5	0	1	12	16	1	0	0	0
Package-6	0	4	13	11	2	0	1	1
Package-7	0	6	16	15	2	0	1	0
Package-8	1	4	14	10	4	0	1	0
Package-9	1	7	12	8	1	0	0	1
Package-10	0	4	19	11	2	0	1	0
Package-11	2	7	14	7	2	0	1	0
Package-12	0	5	18	12	2	1	0	1
Total Structures (Nos.)	**7**	**50**	**171**	**154**	**28**	**2**	**7**	**8**

Table 0.12 (a) List of Road Over-bridge (ROB)

S. No.	Chainage	Type of Structure			Span Arrangement	Width of Structure (m)	Skew Angle, if any	Remarks
		Foundation	Sub Structure	Super Structure				
1	34+280	Pile	R.C.C.	Bowstring	1X15 x 64.090 + 1X 15	4X12.5	0	Package-1
2	123+100	Pile	R.C.C.	Bowstring	1X76.080 +2X15	4X12.5	16	Package-3
3	188+100	Pile	R.C.C.	Bowstring	1 X 15+ 1X45.484 + 1X15	4X12.5	0	Package-4
4	354+780	Pile	R.C.C.	Bowstring	1X15 + 1X45.48 +1X15	4X12.5	10	Package-8
5	420+100	Pile	R.C.C.	Bowstring	1X15+1X64.09+1X15	4X12.5	0	Package-9
6	503+025	Pile	R.C.C	Bowstring	1X15+1X51.4+1X15	4X12.5	0	Package-11
7	516+100	Pile	R.C.C	Bowstring	1X15+1X64.09+1X15	4X12.5	7	Package-11

Table 0.12 (b) List of Vehicular Underpass (VUP)

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Skew Angle, if any	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)			
1	12+438	ODR	Box	2X10	5.5	2x21.25	25	Package-1
2	69+842	ODR	Box	2X10	5.5	2x21.25	20	Package-2
3	72+700	WSA	Box	2X10	5.5	2x21.25	0	Package-2
4	83+182	ODR	Box	2X10	5.5	2x21.25	45	Package-2
5	124+051	Interchange	Box	2X10	5.5	2x21.25	0	Package-3
6	125+300	WSA	Box	2X10	5.5	2x21.25	0	Package-3
7	146+275	ODR	Box	2X10	5.5	2x21.25	45	Package-4

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Skew Angle, if any	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)			
8	152+328	ODR	Box	2X10	5.5	2x21.25	20	Package-4
9	166+966	ODR	Box	2X10	5.5	2x21.25	0	Package-4
10	175+000	WSA	Box	2X10	5.5	2x21.25	0	Package-4
11	180+276	MDR	Box	2X10	5.5	2x21.25	7	Package-4
12	188+445	Interchange	Box	2X10	5.5	2x21.25	0	Package-4
13	211+540	MDR	Box	2X10	5.5	2x21.25	30	Package-5
14	248+627	MDR	Box	2X10	5.5	2x21.25	20	Package-6
15	254+200	WSA	Box	2X10	5.5	2x21.25	0	Package-6
16	256+316	Interchange	Box	2X10	5.5	2x21.25	0	Package-6
17	281+928	ODR	Box	2X10	5.5	2x21.25	41	Package-6
18	292+637	ODR	Box	2X10	5.5	2x21.25	45	Package-7
19	303+602	MDR/SH	Box	2X10	5.5	2x21.25	10	Package-7
20	308+111	MDR/SH	Box	2X10	5.5	2x21.25	48	Package-7
21	324+663	MDR / SH	Box	2X10	5.5	2x21.25	35	Package-7
22	326+500	WSA	Box	2X10	5.5	2x21.25	0	Package-7
23	328+720	Interchange	Box	2X10	5.5	1x21.25+1x25.75	0	Package-7
24	345+739	ODR	Box	2X10	5.5	2x21.25	8	Package-8
25	351+311	ODR	Box	2X10	5.5	2x21.25	0	Package-8
26	376+111	Interchange	Box	2X10	5.5	2x21.25	12	Package-8
27	377+492	WSA	Box	2X10	5.5	2x21.25	0	Package-8
28	395+440	ODR	Box	2X10	5.5	2x21.25	10	Package-9
29	398+662	ODR	Box	2X10	5.5	2x21.25	15	Package-9
30	401+755	ODR	Box	2X10	5.5	2x21.25	20	Package-9
31	423+352	ODR	Box	2X10	5.5	2x21.25	15	Package-9
32	424+000	WSA	Box	2X10	5.5	2x21.25	0	Package-9
33	432+750	MDR	Box	2X10	5.5	2x21.25	48	Package-9
34	438+821	ODR	Box	2X10	5.5	2x21.25	45	Package-9
35	446+625	ODR	Box	2X10	5.5	2x21.25	0	Package-10
36	460+245	ODR	Box	2X10	5.5	2x21.25	45	Package-10
37	480+900	WSA	Box	2X10	5.5	2x21.25	0	Package-10
38	487+952	Interchange	Box	2X10	5.5	2x21.25	20	Package-10
39	511+764	ODR	Box	2X10	5.5	2x21.25	35	Package-11
40	520+595	Interchange	Box	2X10	5.5	2x21.25	32	Package-11
41	522+635	ODR	Box	2X10	5.5	2x21.25	3	Package-11

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Skew Angle, if any	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)			
42	533+020	ODR	Box	2X10	5.5	2x21.25	0	Package-11
43	540+905	ODR	Box	2X10	5.5	2x21.25	7	Package-11
44	541+645	WSA	Box	2X10	5.5	2x21.25	0	Package-11
45	546+286	ODR	Box	2X10	5.5	2x21.25	31	Package-11
46	549+206	ODR	Box	2X10	5.5	2x21.25	11	Package-12
47	556+420	ODR	Box	2X10	5.5	2x21.25	14	Package-12
48	576+587	ODR	Box	2X10	5.5	2x21.25	2	Package-12
49	592+516	ODR	Box	2X10	5.5	2x21.25	35	Package-12
50	599+008	ODR	Box	2X10	5.5	2x21.25	20	Package-12

Table 0.12 (c) List of Light Vehicular Underpass (LVUP)

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
1	10+333	VR	Box	12	4.5	2x21.25	Package-1
2	14+100	VR	Box	12	4.5	2x21.25	Package-1
3	14+800	VR	Box	12	4.5	2x21.25	Package-1
4	18+614	VR	Box	12	4.5	2x21.25	Package-1
5	22+200	VR	Box	12	4.5	2x21.25	Package-1
6	23+370	VR	Box	12	4.5	2x21.25	Package-1
7	25+670	VR	Box	12	4.5	2x21.25	Package-1
8	28+159	VR	Box	12	4.5	2x21.25	Package-1
9	29+967	VR	Box	12	4.5	2x21.25	Package-1
10	30+769	VR	Box	12	4.5	2x21.25	Package-1
11	32+826	VR	Box	12	4.5	2x21.25	Package-1
12	36+767	VR	Box	12	4.5	2x21.25	Package-1
13	37+840	VR	Box	12	4.5	2x21.25	Package-1
14	38+500	VR	Box	12	4.5	2x21.25	Package-1
15	41+405	VR	Box	12	4.5	2x21.25	Package-1
16	43+140	VR	Box	12	4.5	2x21.25	Package-1
17	45+210	VR	Box	12	4.5	2x21.25	Package-1
18	46+214	VR	Box	12	4.5	2x21.25	Package-1
19	47+195	VR	Box	12	4.5	2x21.25	Package-1
20	53+693	VR	Box	12	4.5	2x21.25	Package-1
21	58+318	VR	Box	12	4.5	2x21.25	Package-2

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
22	59+487	VR	Box	12	4.5	2x21.25	Package-2
23	62+694	VR	Box	12	4.5	2x21.25	Package-2
24	71+850	VR	Box	12	4.5	2x21.25	Package-2
25	75+915	VR	Box	12	4.5	2x21.25	Package-2
26	79+290	VR	Box	12	4.5	2x21.25	Package-2
27	80+648	VR	Box	12	4.5	2x21.25	Package-2
28	81+508	VR	Box	12	4.5	2x21.25	Package-2
29	90+150	VR	Box	12	4.5	2X21.25	Package-3
30	94+354	VR	Box	12	4.5	2X21.25	Package-3
31	97+300	VR	Box	12	4.5	2X21.25	Package-3
32	99+100	VR	Box	12	4.5	2X21.25	Package-3
33	105+647	VR	Box	12	4.5	2X21.25	Package-3
34	106+420	VR	Box	12	4.5	2X21.25	Package-3
35	109+041	Road	Box	12	4.5	2X21.25	Package-3
36	112+038	VR	Box	12	4.5	2X21.25	Package-3
37	121+885	VR	Box	12	4.5	2X21.25	Package-3
38	125+666	VR	Box	12	4.5	2X21.25	Package-3
39	129+855	VR	Box	12	4.5	2X21.25	Package-3
40	132+475	VR	Box	12	4.5	2X21.25	Package-3
41	134+930	VR	Box	12	4.5	2X21.25	Package-3
42	139+873	VR	Box	12	4.5	2x21.25	Package-4
43	140+650	VR	Box	12	4.5	2x21.25	Package-4
44	143+832	VR	Box	12	4.5	2x21.25	Package-4
45	144+864	VR	Box	12	4.5	2x21.25	Package-4
46	147+393	VR	Box	12	4.5	2x21.25	Package-4
47	149+094	VR	Box	12	4.5	2x21.25	Package-4
48	159+267	VR	Box	12	4.5	2x21.25	Package-4
49	161+205	VR	Box	12	4.5	2x21.25	Package-4
50	164+386	VR	Box	12	4.5	2x21.25	Package-4
51	170+075	VR	Box	12	4.5	2x21.25	Package-4
52	172+673	VR	Box	12	4.5	2x21.25	Package-4
53	187+523	VR	Box	12	4.5	2x21.25	Package-4
54	193+040	VR	Box	12	4.5	2X21.25	Package-5
55	194+585	VR	Box	12	4.5	2X21.25	Package-5
56	197+335	VR	Box	12	4.5	2X21.25	Package-5

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
57	201+195	VR	Box	12	4.5	2X21.25	Package-5
58	204+941	VR	Box	12	4.5	2X21.25	Package-5
59	210+428	VR	Box	12	4.5	2X21.25	Package-5
60	215+446	VR	Box	12	4.5	2X21.25	Package-5
61	221+780	VR	Box	12	4.5	2X21.25	Package-5
62	225+650	VR	Box	12	4.5	2X21.25	Package-5
63	229+795	VR	Box	12	4.5	2X21.25	Package-5
64	231+705	VR	Box	12	4.5	2X21.25	Package-5
65	234+520	VR	Box	12	4.5	2X21.25	Package-5
66	237+680	VR	Box	12	4.5	2X21.25	Package-6
67	239+488	VR	Box	12	4.5	2X21.25	Package-6
68	242+188	VR	Box	12	4.5	2X21.25	Package-6
69	247+530	VR	Box	12	4.5	2X21.25	Package-6
70	250+304	VR	Box	12	4.5	2X21.25	Package-6
71	260+080	VR	Box	12	4.5	2X21.25	Package-6
72	262+202	VR	Box	12	4.5	2X21.25	Package-6
73	266+035	VR	Box	12	4.5	2X21.25	Package-6
74	269+200	VR	Box	12	4.5	2X21.25	Package-6
75	271+063	VR	Box	12	4.5	2X21.25	Package-6
76	283+719	VR	Box	12	4.5	2X21.25	Package-6
77	286+000	VR	Box	12	4.5	2X21.25	Package-6
78	289+045	VR	Box	12	4.5	2X21.25	Package-6
79	289+994	VR	Box	12	4.5	2x21.25	Package-7
80	293+830	VR	Box	12	4.5	2x21.25	Package-7
81	298+015	VR	Box	12	4.5	2x21.25	Package-7
82	300+686	VR	Box	12	4.5	2x21.25	Package-7
83	304+430	VR	Box	12	4.5	2x21.25	Package-7
84	309+220	VR	Box	12	4.5	2x21.25	Package-7
85	313+490	VR	Box	12	4.5	2x21.25	Package-7
86	314+735	VR	Box	12	4.5	2x21.25	Package-7
87	317+061	VR	Box	12	4.5	2x21.25	Package-7
88	319+189	VR	Box	12	4.5	2x21.25	Package-7
89	320+564	VR	Box	12	4.5	2x21.25	Package-7
90	323+666	VR	Box	12	4.5	2x21.25	Package-7
91	332+486	VR	Box	12	4.5	2x21.25	Package-7

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
92	333+443	VR	Box	12	4.5	2x21.25	Package-7
93	336+120	VR	Box	12	4.5	2x21.25	Package-7
94	341+485	VR	Box	12	4.5	2x21.25	Package-7
95	342+901	VR	Box	12	4.5	2X21.25	Package-8
96	349+115	VR	Box	12	4.5	2X21.25	Package-8
97	352+856	VR	Box	12	4.5	2X21.25	Package-8
98	356+360	VR	Box	12	4.5	2X21.25	Package-8
99	358+435	VR	Box	12	4.5	2X21.25	Package-8
100	360+793	VR	Box	12	4.5	2X21.25	Package-8
101	362+775	Road	Box	12	4.5	2X21.25	Package-8
102	365+118	VR	Box	12	4.5	2X21.25	Package-8
103	366+766	VR	Box	12	4.5	2X21.25	Package-8
104	367+653	VR	Box	12	4.5	2X21.25	Package-8
105	373+657	VR	Box	12	4.5	2X21.25	Package-8
106	376+475	VR	Box	12	4.5	2X21.25	Package-8
107	379+159	VR	Box	12	4.5	2X21.25	Package-8
108	390+979	VR	Box	12	4.5	2X21.25	Package-8
109	393+700	VR	Box	12	4.5	2X21.25	Package-9
110	406+260	VR	Box	12	4.5	2X21.25	Package-9
111	407+810	VR	Box	12	4.5	2X21.25	Package-9
112	409+650	VR	Box	12	4.5	2X21.25	Package-9
113	417+790	VR	Box	12	4.5	2X21.25	Package-9
114	418+925	VR	Box	12	4.5	2X21.25	Package-9
115	424+832	Road	Box	12	4.5	2X21.25	Package-9
116	427+763	VR	Box	12	4.5	2X21.25	Package-9
117	429+990	VR	Box	12	4.5	2X21.25	Package-9
118	431+017	VR	Box	12	4.5	2X21.25	Package-9
119	440+340	VR	Box	12	4.5	2X21.25	Package-9
120	443+785	VR	Box	12	4.5	2X21.25	Package-9
121	447+980	VR	Box	12	4.5	2X21.25	Package-10
122	449+946	VR	Box	12	4.5	2X21.25	Package-10
123	453+974	VR	Box	12	4.5	2X21.25	Package-10
124	455+027	VR	Box	12	4.5	2X21.25	Package-10
125	462+628	VR	Box	12	4.5	2X21.25	Package-10
126	464+723	VR	Box	12	4.5	2X21.25	Package-10

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
127	465+400	VR	Box	12	4.5	2X21.25	Package-10
128	466+897	VR	Box	12	4.5	2X21.25	Package-10
129	470+510	VR	Box	12	4.5	2X21.25	Package-10
130	472+987	VR	Box	12	4.5	2X21.25	Package-10
131	474+299	VR	Box	12	4.5	2X21.25	Package-10
132	475+908	VR	Box	12	4.5	2X21.25	Package-10
133	479+790	VR	Box	12	4.5	2X21.25	Package-10
134	484+205	VR	Box	12	4.5	2X21.25	Package-10
135	486+073	VR	Box	12	4.5	2X21.25	Package-10
136	488+493	VR	Box	12	4.5	2X21.25	Package-10
137	489+675	VR	Box	12	4.5	2X21.25	Package-10
138	491+372	VR	Box	12	4.5	2X21.25	Package-10
139	494+161	VR	Box	12	4.5	2x21.25	Package-10
140	500+527	VR	Box	12	4.5	2X21.25	Package-11
141	502+804	VR	Box	12	4.5	2X21.25	Package-11
142	504+090	VR	Box	12	4.5	2X21.25	Package-11
143	507+228	VR	Box	12	4.5	2X21.25	Package-11
144	509+217	VR	Box	12	4.5	2X21.25	Package-11
145	510+475	VR	Box	12	4.5	2X21.25	Package-11
146	513+034	VR	Box	12	4.5	2X21.25	Package-11
147	514+380	VR	Box	12	4.5	2X21.25	Package-11
148	515+485	VR	Box	12	4.5	2X21.25	Package-11
149	520+108	VR	Box	12	4.5	2X21.25	Package-11
150	528+545	VR	Box	12	4.5	2X21.25	Package-11
151	534+136	VR	Box	12	4.5	2X21.25	Package-11
152	543+333	VR	Box	12	4.5	2X21.25	Package-11
153	544+852	VR	Box	12	4.5	2X21.25	Package-11
154	552+005	VR	Box	12	4.5	2x21.25	Package-12
155	553+993	VR	Box	12	4.5	2x21.25	Package-12
156	558+663	VR	Box	12	4.5	2x21.25	Package-12
157	563+010	VR	Box	12	4.5	2x21.25	Package-12
158	565+154	VR	Box	12	4.5	2x21.25	Package-12
159	565+913	VR	Box	12	4.5	2x21.25	Package-12
160	566+655	Road	Box	12	4.5	2x21.25	Package-12
161	567+885	VR	Box	12	4.5	2x21.25	Package-12

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
162	571+243	VR	Box	12	4.5	2x21.25	Package-12
163	580+590	VR	Box	12	4.5	2x21.25	Package-12
164	582+213	VR	Box	12	4.5	2x21.25	Package-12
165	584+582	VR	Box	12	4.5	2x21.25	Package-12
166	587+622	VR	Box	12	4.5	2x21.25	Package-12
167	588+690	VR	Box	12	4.5	2x21.25	Package-12
168	590+776	VR	Box	12	4.5	2x21.25	Package-12
169	595+500	VR	Box	12	4.5	2x21.25	Package-12
170	596+649	VR	Box	12	4.5	2x21.25	Package-12
171	597+711	VR	Box	12	4.5	2x21.25	Package-12

Table 0.12 (d) List of Smaller Vehicular Underpass (SVUP)

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
1	11+626	VR	BOX	7	4.0	2x21.25	Package-1
2	12+765	VR	BOX	7	4.0	2x21.25	Package-1
3	15+300	VR	BOX	7	4.0	2x21.25	Package-1
4	17+015	VR	BOX	7	4.0	2x21.25	Package-1
5	20+994	VR	BOX	7	4.0	2x21.25	Package-1
6	26+425	VR	BOX	7	4.0	2x21.25	Package-1
7	31+578	VR	BOX	7	4.0	2x21.25	Package-1
8	33+800	VR	BOX	7	4.0	2x21.25	Package-1
9	37+120	VR	BOX	7	4.0	2x21.25	Package-1
10	39+000	VR	BOX	7	4.0	2x21.25	Package-1
11	40+045	VR	BOX	7	4.0	2x21.25	Package-1
12	42+400	VR	BOX	7	4.0	2x21.25	Package-1
13	50+846	VR	BOX	7	4.0	2x21.25	Package-1
14	52+950	VR	BOX	7	4.0	2x21.25	Package-1
15	64+172	VR	Box	7	4.0	2x21.25	Package-2
16	65+645	VR	Box	7	4.0	2x21.25	Package-2
17	68+564	VR	Box	7	4.0	2x21.25	Package-2
18	70+744	VR	Box	7	4.0	2x21.25	Package-2
19	76+945	VR	Box	7	4.0	2x21.25	Package-2
20	85+885	VR	Box	7	4.0	2x21.25	Package-2
21	87+300	VR	Box	7	4.0	2X21.25	Package-3

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
22	88+540	VR	Box	7	4.0	2X21.25	Package-3
23	91+027	VR	Box	7	4.0	2X21.25	Package-3
24	92+382	VR	Box	7	4.0	2X21.25	Package-3
25	93+160	VR	Box	7	4.0	2X21.25	Package-3
26	95+548	VR	Box	7	4.0	2X21.25	Package-3
27	96+728	VR	Box	7	4.0	2X21.25	Package-3
28	100+740	VR	Box	7	4.0	2X21.25	Package-3
29	101+648	VR	Box	7	4.0	2X21.25	Package-3
30	103+454	VR	Box	7	4.0	2X21.25	Package-3
31	104+662	VR	Box	7	4.0	2X21.25	Package-3
32	107+262	VR	Box	7	4.0	2X21.25	Package-3
33	110+935	VR	Box	7	4.0	2X21.25	Package-3
34	114+595	VR	Box	7	4.0	2X21.25	Package-3
35	117+505	VR	Box	7	4.0	2X21.25	Package-3
36	119+611	VR	Box	7	4.0	2X21.25	Package-3
37	124+110	VR	Box	7	4.0	2X21.25	Package-3
38	127+166	VR	Box	7	4.0	2X21.25	Package-3
39	128+341	VR	Box	7	4.0	2X21.25	Package-3
40	131+323	VR	Box	7	4.0	2X21.25	Package-3
41	133+437	VR	Box	7	4.0	2X21.25	Package-3
42	136+700	VR	Box	7	4.0	2X21.25	Package-3
43	137+904	VR	Box	7	4.0	2x21.25	Package-4
44	141+982	VR	Box	7	4.0	2x21.25	Package-4
45	142+762	VR	Box	7	4.0	2x21.25	Package-4
46	148+212	VR	Box	7	4.0	2x21.25	Package-4
47	150+478	VR	Box	7	4.0	2x21.25	Package-4
48	151+465	VR	Box	7	4.0	2x21.25	Package-4
49	153+526	VR	Box	7	4.0	2x21.25	Package-4
50	155+387	VR	Box	7	4.0	2x21.25	Package-4
51	156+302	VR	Box	7	4.0	2x21.25	Package-4
52	160+208	VR	Box	7	4.0	2x21.25	Package-4
53	162+300	VR	Box	7	4.0	2x21.25	Package-4
54	165+400	VR	Box	7	4.0	2x21.25	Package-4
55	168+787	VR	Box	7	4.0	2x21.25	Package-4
56	171+255	VR	Box	7	4.0	2x21.25	Package-4

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
57	174+200	VR	Box	7	4.0	2x21.25	Package-4
58	176+185	VR	Box	7	4.0	2x21.25	Package-4
59	177+370	VR	Box	7	4.0	2x21.25	Package-4
60	178+955	VR	Box	7	4.0	2x21.25	Package-4
61	181+347	VR	Box	7	4.0	2x21.25	Package-4
62	183+436	VR	Box	7	4.0	2x21.25	Package-4
63	185+117	VR	Box	7	4.0	2x21.25	Package-4
64	186+500	VR	Box	7	4.0	2x21.25	Package-4
65	189+802	VR	Box	7	4.0	2X21.25	Package-5
66	190+829	VR	Box	7	4.0	2X21.25	Package-5
67	191+647	VR	Box	7	4.0	2X21.25	Package-5
68	195+680	VR	Box	7	4.0	2X21.25	Package-5
69	198+519	VR	Box	7	4.0	2X21.25	Package-5
70	202+750	VR	Box	7	4.0	2X21.25	Package-5
71	203+751	VR	Box	7	4.0	2X21.25	Package-5
72	208+893	VR	Box	7	4.0	2X21.25	Package-5
73	214+405	VR	Box	7	4.0	2X21.25	Package-5
74	217+105	VR	Box	7	4.0	2X21.25	Package-5
75	219+690	VR	Box	7	4.0	2X21.25	Package-5
76	222+900	VR	Box	7	4.0	2X21.25	Package-5
77	224+534	VR	Box	7	4.0	2X21.25	Package-5
78	226+947	VR	Box	7	4.0	2X21.25	Package-5
79	227+975	VR	Box	7	4.0	2X21.25	Package-5
80	233+558	VR	Box	7	4.0	2X21.25	Package-5
81	236+662	VR	Box	7	4.0	2X21.25	Package-6
82	240+623	VR	Box	7	4.0	2X21.25	Package-6
83	251+455	VR	Box	7	4.0	2x21.25	Package-6
84	260+913	VR	Box	7	4.0	2X21.25	Package-6
85	263+565	VR	Box	7	4.0	2x21.25	Package-6
86	276+196	VR	Box	7	4.0	2X21.25	Package-6
87	277+359	VR	Box	7	4.0	2X21.25	Package-6
88	279+167	VR	Box	7	4.0	2X21.25	Package-6
89	281+023	VR	Box	7	4.0	2X21.25	Package-6
90	284+940	VR	Box	7	4.0	2X21.25	Package-6
91	287+293	VR	Box	7	4.0	2X21.25	Package-6

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
92	291+788	VR	Box	7	4.0	2x21.25	Package-7
93	295+622	VR	Box	7	4.0	2x21.25	Package-7
94	296+489	VR	Box	7	4.0	2x21.25	Package-7
95	299+389	VR	Box	7	4.0	2x21.25	Package-7
96	302+613	VR	Box	7	4.0	2x21.25	Package-7
97	310+300	VR	Box	7	4.0	2x21.25	Package-7
98	311+571	VR	Box	7	4.0	2x21.25	Package-7
99	312+710	VR	Box	7	4.0	2x21.25	Package-7
100	316+300	VR	Box	7	4.0	2x21.25	Package-7
101	319+860	VR	Box	7	4.0	2x21.25	Package-7
102	321+408	VR	Box	7	4.0	2x21.25	Package-7
103	322+303	VR	Box	7	4.0	2x21.25	Package-7
104	327+340	VR	Box	7	4.0	2x21.25	Package-7
105	331+428	VR	Box	7	4.0	2x21.25	Package-7
106	338+926	VR	Box	7	4.0	2x21.25	Package-7
107	342+375	VR	Box	7	4.0	2X21.25	Package-8
108	347+698	VR	Box	7	4.0	2X21.25	Package-8
109	357+020	VR	Box	7	4.0	2X21.25	Package-8
110	363+682	VR	Box	7	4.0	2X21.25	Package-8
111	368+330	VR	Box	7	4.0	2X21.25	Package-8
112	369+025	VR	Box	7	4.0	2X21.25	Package-8
113	371+333	VR	Box	7	4.0	2X21.25	Package-8
114	380+400	VR	Box	7	4.0	2X21.25	Package-8
115	385+328	VR	Box	7	4.0	2X21.25	Package-8
116	388+685	VR	Box	7	4.0	2X21.25	Package-8
117	392+840	VR	Box	7	4.0	2X21.25	Package-9
118	396+302	VR	Box	7	4.0	2X21.25	Package-9
119	400+300	VR	Box	7	4.0	2X21.25	Package-9
120	404+741	VR	Box	7	4.0	2X21.25	Package-9
121	411+800	VR	Box	7	4.0	2X21.25	Package-9
122	413+212	VR	Box	7	4.0	2X21.25	Package-9
123	415+400	VR	Box	7	4.0	2X21.25	Package-9
124	442+785	VR	Box	7	4.0	2X21.25	Package-9
125	445+175	VR	Box	7	4.0	2X21.25	Package-10
126	448+400	VR	Box	7	4.0	2x21.25	Package-10

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
127	453+057	VR	Box	7	4.0	2x21.25	Package-10
128	456+786	VR	Box	7	4.0	2X21.25	Package-10
129	457+496	VR	Box	7	4.0	2X21.25	Package-10
130	459+110	VR	Box	7	4.0	2X21.25	Package-10
131	471+968	VR	Box	7	4.0	2X21.25	Package-10
132	477+340	VR	Box	7	4.0	2X21.25	Package-10
133	478+510	VR	Box	7	4.0	2X21.25	Package-10
134	492+846	VR	Box	7	4.0	2X21.25	Package-10
135	495+252	VR	Box	7	4.0	2X21.25	Package-10
136	497+585	VR	Box	7	4.0	2X21.25	Package-11
137	505+238	VR	Box	7	4.0	2x21.25	Package-11
138	524+464	VR	Box	7	4.0	2x21.25	Package-11
139	525+354	VR	Box	7	4.0	2X21.25	Package-11
140	526+767	VR	Box	7	4.0	2X21.25	Package-11
141	536+880	VR	Box	7	4.0	2X21.25	Package-11
142	539+551	VR	Box	7	4.0	2X21.25	Package-11
143	549+925	VR	Box	7	4.0	2x21.25	Package-12
144	552+858	VR	Box	7	4.0	2x21.25	Package-12
145	561+628	VR	Box	7	4.0	2x21.25	Package-12
146	564+450	VR	Box	7	4.0	2x21.25	Package-12
147	572+769	VR	Box	7	4.0	2x21.25	Package-12
148	574+555	VR	Box	7	4.0	2x21.25	Package-12
149	577+523	VR	Box	7	4.0	2x21.25	Package-12
150	578+473	VR	Box	7	4.0	2x21.25	Package-12
151	580+018	VR	Box	7	4.0	2x21.25	Package-12
152	583+758	VR	Box	7	4.0	2x21.25	Package-12
153	589+220	VR	Box	7	4.0	2x21.25	Package-12
154	600+092	VR	Box	7	4.0	2x21.25	Package-12

Table 0.12 (e) List of Flyovers

S. No.	Chainage	Type of Crossing	Structure Type			Span Arrangement	Width of Structure	Remarks
			Foundation	Sub Structure	Super Structure			
1	8+920	NH-334	Pile	R.C.C	PSC I Girder	2x30	2X21.25	Package-1
2	19+941	SH-118	Pile	R.C.C.	Steel Girder	2x30	2X21.25	Package-1
3	34+650	NH-24	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-1

S. No.	Chainage	Type of Crossing	Structure Type			Span Arrangement	Width of Structure	Remarks
			Foundation	Sub Structure	Super Structure			
4	35+270	NH-24 ((Bypass)	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-1
5	54+640	SH-65	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-1
6	74+181	MDR-162W	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-2
7	102+427	ODR-BT	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-3
8	115+751	SH-51	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-3
9	123+288	NH-509	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-3
10	154+200	SH-109	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-4
11	173+454	SH-125	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-4
12	189+394	SH-33	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package- 4
13	207+484	SH-26	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-5
14	255+167	SH-29	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-6
15	282+845	SH-138	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-6
16	329+945	Bilgram To Haibatpur (SH-21)	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-7
17	337+901	Dherhni Saraiya To Bilgram (SH-38)	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-7
18	353+998	SH-38	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-8
19	370+486	SH-137	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-8
20	378+136	Expressway	Pile	R.C.C.	PSC I Girder	2X25+2X30	2x21.25	Package-8
21	386+528	SH-40	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-8
22	420+932	NH-27	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-9
23	482+667	SH-13	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-10
24	487+285	NH-31	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-10
25	499+077	SH-13A	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package-11
26	517+708	NH-30	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package-11
27	554+950	MDR-102E	Pile	RCC	PSC I Girder	2x30	2X21.25	Package-12
28	600+457	NH-19	Pile	RCC	PSC I Girder	2X45	1X27.50	Package-12

Table 0.12 (f) List of Trumpets

S. No.	Chainage	Type of Crossing	Remarks
1	8+920	NH-334	Package-1
2	600+457	NH-19	Package-12

Table 0.12 (g) List of Double Trumpets

S. No.	Chainage	Type of Crossing	Remarks
1	123+288	NH-509	Package-3
2	189+394	SH-33	Package- 4
3	255+167	SH-29	Package-6
4	329+945	SH-21	Package-7
5	378+136	Agra-Lucknow Expressway	Package-8
6	487+285	NH-31	Package-10
7	517+708	NH-30	Package-11

Table 0.12 (h) List of Diamond Interchanges

S. No.	Chainage	Type of Crossing	Remarks
1	35+274	NH-24	Package-1
2	54+640	SH-65	Package-1
3	74+181	MDR-162W	Package-2
4	102+427	ODR-BT	Package-3
5	173+454	SH-125	Package-4
6	282+845	SH-138	Package-6
7	420+932	NH-27	Package-9
8	554+951	MDR-102E	Package-12

0.15 CROSS DRAINAGE STRUCTURES

Package wise count of Major Bridges, Minor Bridges & culverts is given in table below:

Package No.	Major Bridges (Nos.)	Minor Bridges (Nos.)	Culverts (Nos.)
Package-1	3	9	80
Package-2	2	5	47
Package-3	0	1	83
Package-4	1	1	86
Package-5	2	6	64

Package No.	Major Bridges (Nos.)	Minor Bridges (Nos.)	Culverts (Nos.)
Package-6	1	10	80
Package-7	1	7	79
Package-8	1	9	75
Package-9	1	14	79
Package-10	0	24	81
Package-11	1	23	93
Package-12	1	18	82
Total Structures (Nos.)	**14**	**127**	**929**

Table-0.13 (a) List of Major Bridges

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
1	17+727	Kali River	Well Foundation	R.C.C.	PSC BOX GIRDER	3X30	2x21.25	0	Package-1
2	35+978	Canal+Road	PILE	R.C.C.	PSC I GIRDER	4X37	2x21.25	12	Package-1
3	51+649	Canal+Road	PILE	R.C.C.	PSC BOX GIRDER	3 X 29	2x21.25	16	Package-1
4	60+140	River	Pile	R.C.C.	PSC Girder	2x30.5	2x21.25	27	Package-2
5	66+850	River	Well	R.C.C.	PSC I Girder	16X60	2x21.25	0	Package-2
6	157+356	River	Well	R.C.C.	PSC Box	3 X 35	2 x 21.25	0	Package -4
7	207+740	Aril River Stream	Well	R.C.C.	PSC Box Girder	3 X 30	2x21.25	0	Package-5
8	217+920	Ram Ganga	Well	R.C.C.	PSC Box Girder	12 X 60	2x21.25	0	Package-5
9	238+190	River	Well	R.C.C.	PSC I Girder	4 X 38	2x21.25	31	Package-6
10	317+923	River	Well	R.C.C.	Box Girder	4 X 60	2x21.25	0	Package-7
11	359+169	Canal+Road	Pile	R.C.C.	PSC I Girder	3X30	2x21.25	45	Package-8
12	422+002	Canal+Road	Well	R.C.C.	PSC Box Girder	3 X 20.033	2x21.25	45	Package-9
13	530+123	Canal+Road	Pile	R.C.C	PSC I Girder	4 X 32	2x21.25	30	Package-11
14	587+316	Canal + BT Road	Pile	R.C.C.	PSC I Girder	2 X 35	2x21.25	15	Package-12

Table-0.13 (b) List of Minor Bridges

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
1	24+179	ChoiaNala	Raft	Box Mnb	Box Mnb	4 X 10 X 5	2x21.25	30	Package-1

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
2	29+022	Canal+Road	Raft	Box Mnb	Box Mnb	1 x 12 + 1 x 10	2x21.25	15	Package-1
3	37+188	Canal+Road	Raft	Box Mnb	Box Mnb	1X8	2x21.25	15	Package-1
4	40+480	Canal+Road	Raft	Box Mnb	Box Mnb	1 X 8 + 1 X 10	2x21.25	35	Package-1
5	44+600	Canal+Road	Raft	Box Mnb	Box Mnb	2 X 10	2x21.25	46	Package-1
6	48+745	Canal+Road	Rafy	Box Mnb	Box Mnb	1x8+1x10	2x21.25	35	Package-1
7	49+869	Canal+Road	Raft	Box Mnb	Box Mnb	2x10	2x21.25	46	Package-1
8	51+060	Canal	Pile	R.C.C	PSC Girder	1x25	2x21.25	14	Package-1
9	56+515	Canal+Road	Raft	Box Mnb	Box Mnb	1x13	2x21.25	38	Package-1
10	59+565	Canal+Road	Raft	Box MNB	Box MNB	2X8	2x21.25	35	Package-2
11	61+327	Canal+Road	Pile	R.C.C	RCC Girder	1 x 20	2x21.25	56	Package-2
12	67+672	Stream/ Nallah	Pile	R.C.C	PSC Girder	2 X 20	2x21.25	0	Package-2
13	69+170	Stream/ Nallah	Pile	R.C.C	RCC Girder	1 X 20	2x21.25	40	Package-2
14	73+353	River	Pile	R.C.C	RCC Girder	1 X 30	2x21.25	0	Package-2
15	112+800	Canal+Road	Pile	R.C.C	RCC Girder	2X18	2x21.25	50	Package-3
16	166+070	Stream	Raft	Box MNB	Box MNB	1 x 8 x 4.5	2x21.25	15	Package-4
17	195+295	Stream/ Nallah	Raft	Box MNB	Box MNB	2 X 8 X 4.5	2x21.25		Package-5
18	195+749	Stream/ Nallah	Raft	Box MNB	Box MNB	2 X 10 X 5	2x21.25	15	Package-5
19	200+280	Canal+Road	Pile	Wall	RCC Girder	2 X 20	2x21.25	24	Package-5
20	213+609	Aril River	Raft	Box MNB	Box MNB	3 X 10 X 5	2x21.25	30	Package-5
21	224+230	Branch of Ram Ganga	Raft	Box MNB	Box MNB	2 X 10 X 5	2x21.25	18	Package-5
22	235+947	Andhoi River	Pile	Wall	RCC Girder	2 X 20	2x21.25	40	Package-5
23	242+125	Stream/ Nallah	Raft	Box MNB	Box MNB	2x8	2x21.25	0	Package-6
24	247+260	Canal	Raft	Box MNB	Box MNB	1x10	2x21.25	40	Package-6
25	249+320	Canal	Raft	Box MNB	Box MNB	2x8	2x21.25	0	Package-6
26	252+418	Canal+Road	Raft	Box MNB	Box MNB	2x10	2x21.25	30	Package-6
27	257+521	Canal+Road	Raft	Box MNB	Box MNB	2 x 8	2x21.25	45	Package-6
28	258+544	Canal+Road	Raft	Box MNB	Box MNB	2 x7	2x21.25	50	Package-6
29	261+324	Canal	Raft	Box MNB	Box MNB	1x8	2x21.25	42	Package-6
30	268+340	Canal	Raft	Box MNB	Box MNB	1x8	2x21.25	53	Package-6
31	274+000	Canal	Raft	Box MNB	Box MNB	1x10	2x21.25	0	Package-6
32	274+780	Canal+Road	Raft	Box MNB	Box MNB	2X7	2x21.25	0	Package-6
33	290+966	Canal+Road	Raft	Box MNB	Box MNB	1 X 12	2x21.25	24	Package-7
34	306+602	River	Pile	Wall	R.C.C Girder	2 X 25	2x21.25	30	Package-7
35	310+540	River	Pile	Wall	R.C.C Girder	2 X 30	2x21.25	30	Package-7
36	320+933	Stream/ Nallah	Raft	Box MNB	Box MNB	2X8X5.0	2x21.25	0	Package-7

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
37	329+037	Canal+Road	Pile	Wall	R.C.C Girder	1 X 22	2x21.25	54	Package-7
38	333+181	Canal+Road	Raft	Box MNB	Box MNB	2X7	2x21.25	43	Package-7
39	340+895	Stream/ Nallah	Pile	Wall	R.C.C Girder	1X25	2x21.25	0	Package-7
40	362+954	Canal	Raft	Box MNB	Box MNB	1X8	2x21.25	52	Package-8
41	364+902	Canal+Road	Raft	Box MNB	Box MNB	1X10	2x21.25	26	Package-8
42	367+322	Canal	Raft	Box MNB	Box MNB	1X8	2x21.25	27	Package-8
43	370+669	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10	2x21.25	40	Package-8
44	377+043	Canal+Road	Raft	Box MNB	Box MNB	2X7	2x21.25	16	Package-8
45	381+558	Canal+Road	Raft	Box MNB	Box MNB	2X8	2x21.25	22	Package-8
46	383+980	Canal+Road	Raft	Box MNB	Box MNB	1X10	2x21.25	59	Package-8
47	387+696	Canal+Road	Raft	Box MNB	Box MNB	1X8	2x21.25	10	Package-8
48	389+662	Canal+Road	Raft	Box MNB	MNB	2X20	2x21.25	8	Package-8
49	392+612	Canal	Raft	Box MNB	Box MNB	1X8	2x21.25	44	Package-9
50	394+132	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	9	Package-9
51	397+182	Canal+Road	Raft	Box MNB	Box MNB	2 x 7.5 x 7.5	2x21.25	49	Package-9
52	401+175	Stream/ Nallah	Raft	Box MNB	Box MNB	1X8X5	2x21.25	0	Package-9
53	402+750	Stream/ Nallah	Raft	MNB	MNB	1X25	2x21.25	0	Package-9
54	407+037	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	0	Package-9
55	408+332	Stream/ Nallah	Raft	MNB	MNB	1 X 20	2x21.25	45	Package-9
56	414+612	Canal+Road	Raft	Box MNB	Box MNB	1x13	2x21.25	24	Package-9
57	420+322	Stream/ Nallah	Raft	Box MNB	Box MNB	2X8X5	2x21.25	0	Package-9
58	428+544	Canal	Raft	Box MNB	Box MNB	1X8	2x21.25	0	Package-9
59	431+336	Stream/ Nallah	Raft	MNB	MNB	1X30	2x21.25	24	Package-9
60	433+605	Canal+Road	Raft	Box MNB	Box MNB	1x13	2x21.25	0	Package-9
61	436+039	Canal+Road	Raft	Box MNB	Box MNB	1X10	2x21.25	29	Package-9
62	440+437	Gas Pipe Line	Raft	MNB (Portal Frame)	MNB (Portal Frame)	1X9	2x21.25	56	Package-9
63	448+062	Loni River	Pile	Wall	RCC Girder	2X20	2x21.25	0	Package-10
64	450+724	Canal + VR	Pile	Wall	PSC Girder	1x15	2x21.25	59	Package-10
65	452+210	Canal + VR	Pile	Wall	RCC Girder	2X8	2x21.25	47	Package-10
66	452+775	Canal+Road	Raft	Box MNB	Box MNB	1X10	2x21.25	15	Package-10
67	457+091	Stream/ Nallah	Pile	Wall	PSC Girder	1X25	2x21.25	25	Package-10
68	458+945	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	0	Package-10
69	459+739	Canal	Raft	Box MNB	Box MNB	1X8	2x21.25	0	Package-10
70	463+570	Canal +VR	Pile	Wall	RCC Girder	2X8	2x21.25	18	Package-10
71	467+183	Canal	Raft	Box MNB	Box MNB	1X10	2x21.25	26	Package-10

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
72	467+535	Canal + VR	Raft	Box MNB	Box MNB	1X12	2x21.25	13	Package-10
73	469+212	Canal +Road	Pile	Wall	RCC Girder	2X8	2x21.25	5	Package-10
74	470+413	Canal +Road	Pile	Wall	PSC Girder	1x16	2x21.25	54	Package-10
75	474+857	Canal +Road	Pile	Wall	PSC Girder	1x12	2x21.25	37	Package-10
76	477+028	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	40	Package-10
77	477+921	Canal +Road	Pile	Wall	PSC Girder	1X10	2x21.25	8	Package-10
78	480+400	Canal + VR	Pile	Wall	RCC Girder	1X10	2x21.25	48	Package-10
79	482+305	Canal	Raft	Box MNB	Box MNB	1 X 10	2x21.25	33	Package-10
80	484+839	Canal	Pile	Wall	RCC Girder	3 X 17.33	2x21.25	75	Package-10
81	485+750	Canal+Road	Pile	Box MNB	Box MNB	2X8	2x21.25	10	Package-10
82	487+679	Canal+Road	Raft	Girder	MNB	1X8	2x21.25	58	Package-10
83	489+464	Canal	Raft	Girder	MNB	2X8	2x21.25	40	Package-10
84	492+466	Canal	Raft	Box MNB	Box MNB	2X8	2x21.25	0	Package-10
85	494+015	Canal	Raft	Box MNB	Box MNB	1X8	2x21.25	0	Package-10
86	496+350	Canal+Road	Pile	Girder	MNB	1 X 25	2x21.25	24	Package-10
87	497+189	Canal+Road	Raft	Box MNB	Box MNB	2 X7	2x21.25	61	Package-11
88	497+756	Canal	Raft	Box MNB	Box MNB	1 X10	2x21.25	6	Package-11
89	499+653	Canal+Road	Raft	Box MNB	Box MNB	2X10	2x21.25	38	Package-11
90	504+217	Canal	Raft	Box MNB	Box MNB	1X12	2x21.25	0	Package-11
91	505+840	Canal	Raft	Box MNB	Box MNB	1X8	2x21.25	8	Package-11
92	508+750	Canal	Raft	Box MNB	Box MNB	1X10	2x21.25	35	Package-11
93	511+600	Canal	Pile	Wall	RCC Girder	1X20	2x21.25	40	Package-11
94	512+280	Canal+Road	Raft	Box MNB	Box MNB	2 X 8	2x21.25	51	Package-11
95	518+354	Canal+Road	Raft	Box MNB	Box MNB	1x12	2x21.25	12	Package-11
96	518+675	Canal	Raft	Box MNB	Box MNB	1x7	2x21.25	0	Package-11
97	519+668	Canal+Road	Pile	Wall	RCC Girder	2x25	2x21.25	35	Package-11
98	524+108	Canal + Road	Raft	Box MNB	Box MNB	2 x 7	2x21.25	38	Package-11
99	526+863	Canal+Road	Raft	Box MNB	Box MNB	1 X 10	2x21.25	28	Package-11
100	527+682	Canal+Road	Pile	Wall	RCC Girder	2X25	2x21.25	19	Package-11
101	531+280	Canal+Road	Pile	Wall	RCC Girder	1x30	2x21.25	12	Package-11
102	533+037	Canal	Raft	Box MNB	Box MNB	1x7	2x21.25	12	Package-11
103	535+770	Canal+Road	Raft	Box MNB	Box MNB	1x4+1x6	2x21.25	70	Package-11
104	536+325	Canal	Raft	Box MNB	Box MNB	1X10	2x21.25	54	Package-11
105	538+310	Canal	Raft	Box MNB	Box MNB	2x7	2x21.25	44	Package-11
106	538+742	Canal+Road	Pile	Wall	RCC Girder	2X20	2x21.25	21	Package-11

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
107	542+543	Canal+Road	Raft	Box MNB	Box MNB	2 x 8	2x21.25	10	Package-11
108	546+060	Canal	Raft	Box MNB	Box MNB	1X7	2x21.25	28	Package-11
109	547+537	Canal	Raft	Box MNB	Box MNB	1X12	2x21.25	15	Package-11
110	550+855	Canal+Road	pile	MNB	MNB	1X25	2x21.25	39	Package-12
111	555+130	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	0	Package-12
112	558+425	Canal+Road	Raft	Box MNB	Box MNB	1X12	2x21.25	37	Package-12
113	559+295	Canal+Road	Raft	Box MNB	Box MNB	1X12	2x21.25	15	Package-12
114	560+034	Canal +road	Raft	Box MNB	Box MNB	1X12	2x21.25	44	Package-12
115	560+860	Canal+Road	pile	MNB	MNB	2X20	2x21.25	40	Package-12
116	568+940	Canal+Road	Raft	Box MNB	Box MNB	3 X 10	2x21.25	20	Package-12
117	569+553	Canal	Raft	Box MNB	Box MNB	2 X10	2x21.25	31	Package-12
118	575+380	Canal+Road	Raft	Box MNB	Box MNB	2 x 7	2x21.25	6	Package-12
119	578+860	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	0	Package-12
120	581+978	River	Pile	MNB	MNB	2X 20	2x21.25	45	Package-12
121	585+957	Canal+Road	Pile	Box MNB	Box MNB	1 X 10	2x21.25	40	Package-12
122	592+025	Canal+Road	Raft	MNB	MNB	1x21	2x21.25	37	Package-12
123	592+170	Canal	Raft	Box MNB	Box MNB	1x 12	2x21.25	15	Package-12
124	592+802	Canal+Road	Raft	Box MNB	Box MNB	1x10	2x21.25	41	Package-12
125	594+340	Canal+Road	Raft	Box MNB	Box MNB	2 X 7	2x21.25	17	Package-12
126	594+610	Canal	Raft	Box MNB	Box MNB	1 X 12	2x21.25	40	Package-12
127	596+404	Canal+Road	Raft	Box MNB	Box MNB	1X10	2x21.25	27	Package-12

Table-0.13 (c) List of Culverts

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
1	9+323	Culvert	3	3	2x21.25	Package-1
2	10+060	Culvert	3	3	2x21.25	Package-1
3	10+700	Culvert	2	2	2x21.25	Package-1
4	11+000	Culvert	3	3	2x21.25	Package-1
5	12+020	Culvert	2	2	2x21.25	Package-1
6	13+019	Culvert	3	3	2x21.25	Package-1
7	13+957	Culvert	2	2	2x21.25	Package-1
8	14+560	Culvert	2	2	2x21.25	Package-1
9	15+650	Culvert	2	2	2x21.25	Package-1
10	16+191	Culvert	3	3	2x21.25	Package-1

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
11	16+630	Culvert	2	2	2x21.25	Package-1
12	17+340	Culvert	2	2	2x21.25	Package-1
13	18+160	Culvert	2	2	2x21.25	Package-1
14	19+164	Culvert	2	2	2x21.25	Package-1
15	19+842	Culvert	3	3	2x21.25	Package-1
16	20+135	Culvert	3	3	2x21.25	Package-1
17	20+441	Culvert	2	2	2x21.25	Package-1
18	20+747	Culvert	3	3	2x21.25	Package-1
19	21+620	Culvert	3	3	2x21.25	Package-1
20	21+950	Culvert	2	2	2x21.25	Package-1
21	22+410	Culvert	2	2	2x21.25	Package-1
22	22+765	Culvert	3	3	2x21.25	Package-1
23	23+100	Culvert	2	2	2x21.25	Package-1
24	23+990	Culvert	3	3	2x21.25	Package-1
25	24+915	Culvert	6	3	2x21.25	Package-1
26	25+135	Culvert	3	3	2x21.25	Package-1
27	26+040	Culvert	2	2	2x21.25	Package-1
28	26+730	Culvert	2	2	2x21.25	Package-1
29	27+070	Culvert	2	2	2x21.25	Package-1
30	27+710	Culvert	2	2	2x21.25	Package-1
31	28+778	Culvert	3	3	2x21.25	Package-1
32	29+285	Culvert	5	2	2x21.25	Package-1
33	29+880	Culvert	4	2	2x21.25	Package-1
34	30+345	Culvert	3	3	2x21.25	Package-1
35	31+120	Culvert	2	2	2x21.25	Package-1
36	32+015	Culvert	2	2	2x21.25	Package-1
37	32+455	Culvert	3	3	2x21.25	Package-1
38	32+898	Culvert	6	2	2x21.25	Package-1
39	33+540	Culvert	2	2	2x21.25	Package-1
40	34+918	Culvert	2	2	2x21.25	Package-1
41	36+500	Culvert	2	2	2x21.25	Package-1
42	37+493	Culvert	3	3	2x21.25	Package-1
43	38+283	Culvert	2	2	2x21.25	Package-1
44	39+430	Culvert	2	2	2x21.25	Package-1
45	40+982	Culvert	3	3	2x21.25	Package-1

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
46	41+276	Culvert	2	2	2x21.25	Package-1
47	41+980	Culvert	2	2	2x21.25	Package-1
48	42+620	Culvert	2	2	2x21.25	Package-1
49	43+428	Culvert	3	3	2x21.25	Package-1
50	44+143	Culvert	3	3	2x21.25	Package-1
51	45+320	Culvert	2	2	2x21.25	Package-1
52	45+674	Culvert	3	3	2x21.25	Package-1
53	46+440	Culvert	2	2	2x21.25	Package-1
54	46+907	Culvert	5	2	2x21.25	Package-1
55	47+510	Culvert	2	2	2x21.25	Package-1
56	48+035	Culvert	3	3	2x21.25	Package-1
57	48+400	Culvert	3	3	2x21.25	Package-1
58	49+315	Culvert	6	2	2x21.25	Package-1
59	50+090	Culvert	2	2	2x21.25	Package-1
60	50+753	Culvert	2	2	2x21.25	Package-1
61	51+380	Culvert	3	3	2x21.25	Package-1
62	52+203	Culvert	3	3	2x21.25	Package-1
63	53+430	Culvert	2	2	2x21.25	Package-1
64	54+170	Culvert	2	2	2x21.25	Package-1
65	55+218	Culvert	3	3	2x21.25	Package-1
66	56+063	Culvert	3	3	2x21.25	Package-1
67	56+279	Culvert	2	2	2x21.25	Package-1
68	8+920	Culvert @ Trumpet	3	3	1 numbers	Package-1
69-72	8+920	HPC @ Trumpet	1X1200		4 numbers	Package-1
73-76	35+270	Culvert @ Diamond Interchange	3	3	4 numbers	Package-1
77-80	54+640	Culvert @ Diamond Interchange	3	3	4 numbers	Package-1
81	57+170	Culvert	3	3	2X21.25	Package-2
82	57+700	Culvert	3	3	2X21.25	Package-2
83	58+144	Culvert	2	2	2X21.25	Package-2
84	58+992	Culvert	2	2	2X21.25	Package-2
85	59+416	Culvert	2	2	2X21.25	Package-2
86	60+545	Culvert	2	2	2X21.25	Package-2
87	61+600	Culvert	3	3	2X21.25	Package-2
88	62+100	Culvert	3	3	2X21.25	Package-2
89	62+339	Culvert	3	3	2X21.25	Package-2

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
90	63+096	Culvert	3	3	2X21.25	Package-2
91	63+700	Culvert	2	2	2X21.25	Package-2
92	64+470	Culvert	2	2	2X21.25	Package-2
93	65+100	Culvert	3	3	2X21.25	Package-2
94	65+970	Culvert	2	2	2X21.25	Package-2
95	68+170	Culvert	2	2	2X21.25	Package-2
96	68+740	Culvert	2	2	2X21.25	Package-2
97	69+500	Culvert	2	2	2X21.25	Package-2
98	70+158	Culvert	2	2	2X21.25	Package-2
99	71+234	Culvert	2	2	2X21.25	Package-2
100	72+100	Culvert	2	2	2X21.25	Package-2
101	73+040	Culvert	2	2	2X21.25	Package-2
102	73+720	Culvert	3	3	2X21.25	Package-2
103	74+860	Culvert	3	3	2X21.25	Package-2
104	75+440	Culvert	2	2	2X21.25	Package-2
105	76+480	Culvert	2	2	2X21.25	Package-2
106	77+360	Culvert	2	2	2X21.25	Package-2
107	77+742	Culvert	2	2	2X21.25	Package-2
108	77+928	Culvert	3	3	2X21.25	Package-2
109	78+320	Culvert	3	3	2X21.25	Package-2
110	78+890	Culvert	2	2	2X21.25	Package-2
111	79+790	Culvert	2	2	2X21.25	Package-2
112	80+163	Culvert	3	3	2X21.25	Package-2
113	81+150	Culvert	2	2	2X21.25	Package-2
114	81+850	Culvert	3	3	2X21.25	Package-2
115	82+030	Culvert	2	2	2X21.25	Package-2
116	82+680	Culvert	2	2	2X21.25	Package-2
117	83+765	Culvert	3	3	2X21.25	Package-2
118	84+224	Culvert	2	2	2X21.25	Package-2
119	84+816	Culvert	3	3	2X21.25	Package-2
120	85+510	Culvert	2	2	2X21.25	Package-2
121	86+130	Culvert	2	2	2X21.25	Package-2
122-125	74+181	Culverts @ Diamond Interchange	3	3	4 numbers	Package-2
126	72+700	HPC @ WSA	1X1200		1 Culvert	Package-2

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
127	72+700	HPC @ WSA	1X1200		1 Culvert	Package-2
128	87+750	Culvert	2	2	2X21.25	Package-3
129	88+160	Culvert	2	2	2X21.25	Package-3
130	89+170	Culvert	2	2	2X21.25	Package-3
131	89+734	Culvert	2	2	2X21.25	Package-3
132	90+610	Culvert	2	2	2X21.25	Package-3
133	91+515	Culvert	2	2	2X21.25	Package-3
134	92+100	Culvert	2	2	2X21.25	Package-3
135	92+789	Culvert	2	2	2X21.25	Package-3
136	93+333	Culvert	2	2	2X21.25	Package-3
137	94+000	Culvert	2	2	2X21.25	Package-3
138	94+610	Culvert	2	2	2X21.25	Package-3
139	95+095	Culvert	3	3	2X21.25	Package-3
140	95+795	Culvert	2	2	2X21.25	Package-3
141	96+300	Culvert	2	2	2X21.25	Package-3
142	96+905	Culvert	2	2	2X21.25	Package-3
143	97+800	Culvert	3	3	2X21.25	Package-3
144	98+624	Culvert	3	3	2X21.25	Package-3
145	99+630	Culvert	2	2	2X21.25	Package-3
146	100+310	Culvert	2	2	2X21.25	Package-3
147	101+148	Culvert	3	3	2X21.25	Package-3
148	101+430	Culvert	2	2	2X21.25	Package-3
149	103+300	Culvert	2	2	2X21.25	Package-3
150	103+705	Culvert	3	3	2X21.25	Package-3
151	104+215	Culvert	3	3	2X21.25	Package-3
152	105+197	Culvert	2	2	2X21.25	Package-3
153	106+200	Culvert	2	2	2X21.25	Package-3
154	106+903	Culvert	3	3	2X21.25	Package-3
155	107+640	Culvert	3	3	2X21.25	Package-3
156	108+190	Culvert	2	2	2X21.25	Package-3
157	108+600	Culvert	2	2	2X21.25	Package-3
158	109+495	Culvert	2	2	2X21.25	Package-3
159	110+025	Culvert	2	2	2X21.25	Package-3
160	110+560	Culvert	2	2	2X21.25	Package-3
161	111+556	Culvert	3	3	2X21.25	Package-3

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
162	112+310	Culvert	2	2	2X21.25	Package-3
163	113+279	Culvert	3	3	2X21.25	Package-3
164	113+510	Culvert	2	2	2X21.25	Package-3
165	114+176	Culvert	2	2	2X21.25	Package-3
166	115+160	Culvert	2	2	2X21.25	Package-3
167	116+600	Culvert	2	2	2X21.25	Package-3
168	117+166	Culvert	2	2	2X21.25	Package-3
169	117+840	Culvert	2	2	2X21.25	Package-3
170	118+208	Culvert	3	3	2X21.25	Package-3
171	119+180	Culvert	2	2	2X21.25	Package-3
172	119+910	Culvert	2	2	2X21.25	Package-3
173	120+278	Culvert	3	3	2X21.25	Package-3
174	120+750	Culvert	2	2	2X21.25	Package-3
175	121+315	Culvert	2	2	2X21.25	Package-3
176	122+310	Culvert	2	2	2X21.25	Package-3
177	124+806	Culvert	2	2	2X21.25	Package-3
178	125+950	Culvert	2	2	2X21.25	Package-3
179	126+345	Culvert	3	3	2X21.25	Package-3
180	126+960	Culvert	2	2	2X21.25	Package-3
181	127+620	Culvert	2	2	2X21.25	Package-3
182	128+100	Culvert	2	2	2X21.25	Package-3
183	128+788	Culvert	3	3	2X21.25	Package-3
184	129+162	Culvert	2	2	2X21.25	Package-3
185	130+240	Culvert	2	2	2X21.25	Package-3
186	130+639	Culvert	3	3	2X21.25	Package-3
187	131+626	Culvert	3	3	2X21.25	Package-3
188	132+165	Culvert	3	3	2X21.25	Package-3
189	132+948	Culvert	3	3	2X21.25	Package-3
190	133+840	Culvert	3	3	2X21.25	Package-3
191	134+626	Culvert	2	2	2X21.25	Package-3
192	135+340	Culvert	2	2	2X21.25	Package-3
193	135+783	Culvert	2	2	2X21.25	Package-3
194	136+180	Culvert	2	2	2X21.25	Package-3
195	136+600	Culvert	2	2	2X21.25	Package-3
196	137+402	Culvert	2	2	2X21.25	Package-3

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
197-200	102+427	Culverts @ Diamond Interchange	3	3	4 numbers	Package-3
201-202	123+288	Culverts @ Double Trumpet	3	3	2 numbers	Package-3
203-208	123+288	HPC @ Double Trumpet	1x1200		6 numbers	Package-3
209	125+300	HPC @ Way Side Amenities	1X1200		1 number	Package-3
210	125+300	HPC @ Way Side Amenities	1X1200		1 number	Package-3
211	138+476	Culvert	2	2	2x21.25	Package-4
212	139+027	Culvert	2	2	2x21.25	Package-4
213	139+456	Culvert	2	2	2x21.25	Package-4
214	140+240	Culvert	2	2	2x21.25	Package-4
215	141+338	Culvert	2	2	2x21.25	Package-4
216	141+650	Culvert	2	2	2x21.25	Package-4
217	142+450	Culvert	2	2	2x21.25	Package-4
218	143+204	Culvert	3	3	2x21.25	Package-4
219	143+490	Culvert	2	2	2x21.25	Package-4
220	144+455	Culvert	2	2	2x21.25	Package-4
221	145+425	Culvert	3	3	2x21.25	Package-4
222	145+810	Culvert	2	2	2x21.25	Package-4
223	146+707	Culvert	3	3	2x21.25	Package-4
224	147+030	Culvert	2	2	2x21.25	Package-4
225	147+755	Culvert	2	2	2x21.25	Package-4
226	148+570	Culvert	2	2	2x21.25	Package-4
227	149+400	Culvert	2	2	2x21.25	Package-4
228	150+090	Culvert	2	2	2x21.25	Package-4
229	150+920	Culvert	2	2	2x21.25	Package-4
230	151+900	Culvert	2	2	2x21.25	Package-4
231	152+700	Culvert	2	2	2x21.25	Package-4
232	153+056	Culvert	3	3	2x21.25	Package-4
233	154+500	Culvert	3	3	2x21.25	Package-4
234	154+950	Culvert	3	3	2x21.25	Package-4
235	155+320	Culvert	2	2	2x21.25	Package-4

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
236	155+830	Culvert	2	2	2x21.25	Package-4
237	156+927	Culvert	3	3	2x21.25	Package-4
238	157+600	Culvert	3	3	2x21.25	Package-4
239	158+030	Culvert	2	2	2x21.25	Package-4
240	158+790	Culvert	3	3	2x21.25	Package-4
241	159+733	Culvert	2	2	2x21.25	Package-4
242	160+830	Culvert	2	2	2x21.25	Package-4
243	161+520	Culvert	2	2	2x21.25	Package-4
244	161+930	Culvert	2	2	2x21.25	Package-4
245	162+683	Culvert	2	2	2x21.25	Package-4
246	162+960	Culvert	3	3	2x21.25	Package-4
247	163+340	Culvert	2	2	2x21.25	Package-4
248	163+800	Culvert	3	3	2x21.25	Package-4
249	164+740	Culvert	2	2	2x21.25	Package-4
250	165+529	Culvert	6	2	2x21.25	Package-4
251	166+400	Culvert	3	3	2x21.25	Package-4
252	167+410	Culvert	2	2	2x21.25	Package-4
253	167+772	Culvert	3	3	2x21.25	Package-4
254	168+260	Culvert	3	3	2x21.25	Package-4
255	169+229	Culvert	3	3	2x21.25	Package-4
256	169+523	Culvert	3	3	2x21.25	Package-4
257	170+500	Culvert	2	2	2x21.25	Package-4
258	170+790	Culvert	2	2	2x21.25	Package-4
259	171+735	Culvert	2	2	2x21.25	Package-4
260	172+350	Culvert	2	2	2x21.25	Package-4
261	172+910	Culvert	6	2	2x21.25	Package-4
262	174+500	Culvert	2	2	2x21.25	Package-4
263	175+641	Culvert	3	3	2x21.25	Package-4
264	176+590	Culvert	2	2	2x21.25	Package-4
265	176+914	Culvert	2	2	2x21.25	Package-4
266	177+950	Culvert	3	3	2x21.25	Package-4
267	178+545	Culvert	2	2	2x21.25	Package-4
268	179+470	Culvert	3	3	2x21.25	Package-4
269	180+010	Culvert	2	2	2x21.25	Package-4
270	180+955	Culvert	2	2	2x21.25	Package-4

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
271	181+810	Culvert	2	2	2x21.25	Package-4
272	182+170	Culvert	3	3	2x21.25	Package-4
273	182+889	Culvert	3	3	2x21.25	Package-4
274	183+700	Culvert	2	2	2x21.25	Package-4
275	183+963	Culvert	3	3	2x21.25	Package-4
276	184+600	Culvert	2	2	2x21.25	Package-4
277	185+610	Culvert	2	2	2x21.25	Package-4
278	186+360	Culvert	2	2	2x21.25	Package-4
279	186+952	Culvert	3	3	2x21.25	Package-4
280	187+260	Culvert	2	2	2x21.25	Package-4
281-284	173+454	Culverts @ Diamond Interchange	3	3	4 Culverts	Package-4
285-286	189+394	Culverts @ Double Trumpet	3	3	2 Culverts	Package-4
287-294	189+394	HPC @ Double Trumpet	1x1200		8 Culverts	Package-4
295	175+000	HPC @ WSA	1X1200		1 Culvert	Package-4
296	175+000	HPC @ WSA	1X1200		1 Culvert	Package-4
297	190+080	Culvert	3	3	2X21.25	Package-5
298	190+440	Culvert	2	2	2X21.25	Package-5
299	191+250	Culvert	2	2	2X21.25	Package-5
300	192+170	Culvert	2	2	2X21.25	Package-5
301	192+660	Culvert	2	2	2X21.25	Package-5
302	193+210	Culvert	2	2	2X21.25	Package-5
303	193+941	Culvert	3	3	2X21.25	Package-5
304	194+940	Culvert	2	2	2X21.25	Package-5
305	195+101	Culvert	3	3	2X21.25	Package-5
306	196+160	Culvert	2	2	2X21.25	Package-5
307	196+590	Culvert	2	2	2X21.25	Package-5
308	197+450	Culvert	6	1.5	2X21.25	Package-5
309	198+040	Culvert	3	3	2X21.25	Package-5
310	198+950	Culvert	2	2	2X21.25	Package-5
311	199+310	Culvert	3	3	2X21.25	Package-5
312	199+860	Culvert	2	2	2X21.25	Package-5
313	200+830	Culvert	2	2	2X21.25	Package-5

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
314	201+610	Culvert	3	3	2X21.25	Package-5
315	202+052	Culvert	3	3	2X21.25	Package-5
316	202+380	Culvert	2	2	2X21.25	Package-5
317	203+095	Culvert	2	2	2X21.25	Package-5
318	203+470	Culvert	2	2	2X21.25	Package-5
319	204+230	Culvert	3	3	2X21.25	Package-5
320	205+317	Culvert	3	3	2X21.25	Package-5
321	205+790	Culvert	2	2	2X21.25	Package-5
322	206+210	Culvert	2	2	2X21.25	Package-5
323	206+805	Culvert	3	3	2X21.25	Package-5
324	207+927	Culvert	3	3	2X21.25	Package-5
325	208+180	Culvert	2	2	2X21.25	Package-5
326	209+590	Culvert	2	2	2X21.25	Package-5
327	210+080	Culvert	3	3	2X21.25	Package-5
328	210+740	Culvert	2	2	2X21.25	Package-5
329	211+080	Culvert	2	2	2X21.25	Package-5
330	212+200	Culvert	3	3	2X21.25	Package-5
331	212+810	Culvert	2	2	2X21.25	Package-5
332	213+242	Culvert	2	2	2X21.25	Package-5
333	213+920	Culvert	2	2	2X21.25	Package-5
334	214+985	Culvert	3	3	2X21.25	Package-5
335	215+880	Culvert	2	2	2X21.25	Package-5
336	216+530	Culvert	2	2	2X21.25	Package-5
337	218+810	Culvert	2	2	2X21.25	Package-5
338	219+260	Culvert	2	2	2X21.25	Package-5
339	220+130	Culvert	2	2	2X21.25	Package-5
340	220+520	Culvert	3	3	2X21.25	Package-5
341	221+575	Culvert	5	3	2X21.25	Package-5
342	222+130	Culvert	2	2	2X21.25	Package-5
343	222+650	Culvert	2	2	2X21.25	Package-5
344	223+456	Culvert	2	2	2X21.25	Package-5
345	223+976	Culvert	3	3	2X21.25	Package-5
346	224+790	Culvert	2	2	2X21.25	Package-5
347	225+120	Culvert	2	2	2X21.25	Package-5
348	226+160	Culvert	2	2	2X21.25	Package-5

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
349	227+305	Culvert	2	2	2X21.25	Package-5
350	228+150	Culvert	2	2	2X21.25	Package-5
351	228+835	Culvert	3	3	2X21.25	Package-5
352	229+210	Culvert	2	2	2X21.25	Package-5
353	230+325	Culvert	3	3	2X21.25	Package-5
354	231+000	Culvert	2	2	2X21.25	Package-5
355	231+360	Culvert	2	2	2X21.25	Package-5
356	232+080	Culvert	2	2	2X21.25	Package-5
357	232+750	Culvert	3	3	2X21.25	Package-5
358	233+410	Culvert	2	2	2X21.25	Package-5
359	234+056	Culvert	3	3	2X21.25	Package-5
360	235+100	Culvert	3	3	2X21.25	Package-5
361	237+071	Culvert	3	3	2X21.25	Package -6
362	238+932	Culvert	3	3	2X21.25	Package -6
363	239+200	Culvert	2	2	2X21.25	Package -6
364	240+055	Culvert	2	2	2X21.25	Package -6
365	240+910	Culvert	3	3	2X21.25	Package -6
366	241+580	Culvert	3	3	2X21.25	Package -6
367	244+210	Culvert	3	2	2X21.25	Package -6
368	247+900	Culvert	3	3	2X21.25	Package -6
369	248+990	Culvert	3	3	2X21.25	Package -6
370	249+710	Culvert	2	2	2X21.25	Package -6
371	250+000	Culvert	2	2	2X21.25	Package -6
372	250+950	Culvert	2	2	2X21.25	Package -6
373	251+742	Culvert	3	3	2X21.25	Package -6
374	252+110	Culvert	3	3	2X21.25	Package -6
375	253+232	Culvert	2	2	2X21.25	Package -6
376	254+657	Culvert	3	3	2X21.25	Package -6
377	255+370	Culvert	3	2	2X21.25	Package -6
378	255+910	Culvert	3	3	2X21.25	Package -6
379	257+220	Culvert	3	3	2X21.25	Package -6
380	258+050	Culvert	2	2	2X21.25	Package -6
381	258+960	Culvert	4	2	2X21.25	Package -6
382	259+456	Culvert	3	3	2X21.25	Package -6
383	260+657	Culvert	3	3	2X21.25	Package -6

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
384	261+646	Culvert	3	3	2X21.25	Package -6
385	262+530	Culvert	2	2	2X21.25	Package -6
386	263+185	Culvert	2	2	2X21.25	Package -6
387	263+900	Culvert	3	3	2X21.25	Package -6
388	264+280	Culvert	2	2	2X21.25	Package -6
389	264+950	Culvert	3	3	2X21.25	Package -6
390	265+700	Culvert	3	3	2X21.25	Package -6
391	266+618	Culvert	3	3	2X21.25	Package -6
392	267+170	Culvert	2	2	2X21.25	Package -6
393	267+510	Culvert	2	2	2X21.25	Package -6
394	268+900	Culvert	3	3	2X21.25	Package -6
395	269+915	Culvert	2	2	2X21.25	Package -6
396	270+295	Culvert	2	2	2X21.25	Package -6
397	270+831	Culvert	2	2	2X21.25	Package -6
398	271+657	Culvert	3	3	2X21.25	Package -6
399	272+100	Culvert	3	3	2X21.25	Package -6
400	272+950	Culvert	2	2	2X21.25	Package -6
401	273+500	Culvert	2	2	2X21.25	Package -6
402	274+365	Culvert	3	3	2X21.25	Package -6
403	275+576	Culvert	3	3	2X21.25	Package -6
404	276+600	Culvert	2	2	2X21.25	Package -6
405	277+700	Culvert	2	2	2X21.25	Package -6
406	278+059	Culvert	2	2	2X21.25	Package -6
407	278+575	Culvert	3	3	2X21.25	Package -6
408	279+950	Culvert	2	2	2X21.25	Package -6
409	280+450	Culvert	2	2	2X21.25	Package -6
410	281+535	Culvert	3	3	2X21.25	Package -6
411	281+982	Culvert	4	2	2X21.25	Package -6
412	282+300	Culvert	2	2	2X21.25	Package -6
413	283+405	Culvert	2	2	2X21.25	Package -6
414	284+280	Culvert	2	2	2X21.25	Package -6
415	285+438	Culvert	2	2	2X21.25	Package -6
416	286+171	Culvert	2	2	2X21.25	Package -6
417	286+971	Culvert	2	2	2X21.25	Package -6
418	287+935	Culvert	2	2	2X21.25	Package -6

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
419	288+700	Culvert	3	3	2X21.25	Package -6
420	242+710	HPC	2x1200			Package -6
421	243+610	HPC	2x1200			Package -6
422	245+550	HPC	2x1200			Package -6
423	246+520	HPC	2x1200			Package -6
424-426	255+167	Culverts @ Double Trumpet	3	3	3 culverts	Package-6
427-434	255+167	Culverts @ Double Trumpet	1x1200		8 culverts	Package-6
435-438	282+845	Culverts @ Diamond Interchange	3	3	4 culverts	Package-6
439	254+200	HPC @ Way Side Amenities	1x1200		1 culvert	Package-6
440	254+200	HPC @ Way Side Amenities	1x1200		1 culvert	Package-6
441	289+386	Culvert	2	2	2x21.25	Package -7
442	289+963	Culvert	3	3	2x21.25	Package -7
443	290+540	Culvert	2	2	2x21.25	Package -7
444	291+440	Culvert	2	2	2x21.25	Package -7
445	292+430	Culvert	2	2	2x21.25	Package -7
446	293+140	Culvert	2	2	2x21.25	Package -7
447	293+555	Culvert	3	3	2x21.25	Package -7
448	294+565	Culvert	2	2	2x21.25	Package -7
449	295+160	Culvert	3	3	2x21.25	Package -7
450	296+710	Culvert	2	2	2x21.25	Package -7
451	297+485	Culvert	3	3	2x21.25	Package -7
452	298+485	Culvert	3	3	2x21.25	Package -7
453	299+300	Culvert	6	2	2x21.25	Package -7
454	299+987	Culvert	2	2	2x21.25	Package -7
455	300+570	Culvert	2	2	2x21.25	Package -7
456	301+147	Culvert	2	2	2x21.25	Package -7
457	301+638	Culvert	3	3	2x21.25	Package -7
458	301+960	Culvert	3	3	2x21.25	Package -7
459	302+850	Culvert	2	2	2x21.25	Package -7
460	303+973	Culvert	2	2	2x21.25	Package -7
461	304+750	Culvert	2	2	2x21.25	Package -7
462	305+080	Culvert	3	3	2x21.25	Package -7
463	305+550	Culvert	2	2	2x21.25	Package -7
464	306+048	Culvert	2	2	2x21.25	Package -7

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
465	307+243	Culvert	2	2	2x21.25	Package -7
466	307+818	Culvert	3	3	2x21.25	Package -7
467	308+635	Culvert	2	2	2x21.25	Package -7
468	309+945	Culvert	2	2	2x21.25	Package -7
469	310+830	Culvert	2	2	2x21.25	Package -7
470	311+082	Culvert	2	2	2x21.25	Package -7
471	312+050	Culvert	2	2	2x21.25	Package -7
472	313+030	Culvert	2	2	2x21.25	Package -7
473	314+240	Culvert	3	3	2x21.25	Package -7
474	315+170	Culvert	2	2	2x21.25	Package -7
475	315+600	Culvert	3	3	2x21.25	Package -7
476	316+630	Culvert	2	2	2x21.25	Package -7
477	317+390	Culvert	2	2	2x21.25	Package -7
478	318+600	Culvert	2	2	2x21.25	Package -7
479	319+470	Culvert	2	2	2x21.25	Package -7
480	320+350	Culvert	2	2	2x21.25	Package -7
481	321+720	Culvert	2	2	2x21.25	Package -7
482	322+667	Culvert	2	2	2x21.25	Package -7
483	323+467	Culvert	2	2	2x21.25	Package -7
484	324+210	Culvert	2	2	2x21.25	Package -7
485	325+300	Culvert	3	3	2x21.25	Package -7
486	325+790	Culvert	2	2	2x21.25	Package -7
487	326+930	Culvert	3	3	2x21.25	Package -7
488	327+640	Culvert	3	3	2x21.25	Package -7
489	328+110	Culvert	2	2	2x21.25	Package -7
490	329+517	Culvert	2	2	2x21.25	Package -7
491	330+152	Culvert	3	2	2x21.25	Package -7
492	330+810	Culvert	2	2	2x21.25	Package -7
493	331+153	Culvert	2	2	2x21.25	Package -7
494	332+140	Culvert	2	2	2x21.25	Package -7
495	333+690	Culvert	2	2	2x21.25	Package -7
496	334+076	Culvert	2	2	2x21.25	Package -7
497	334+680	Culvert	2	2	2x21.25	Package -7
498	335+475	Culvert	3	3	2x21.25	Package -7
499	336+320	Culvert	2	2	2x21.25	Package -7

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
500	337+075	Culvert	3	2	2x21.25	Package -7
501	337+500	Culvert	2	2	2x21.25	Package -7
502	338+095	Culvert	4	2	2x21.25	Package -7
503	338+375	Culvert	3	3	2x21.25	Package -7
504	339+270	Culvert	2	2	2x21.25	Package -7
505	339+640	Culvert	2	2	2x21.25	Package -7
506	340+010	Culvert	2	2	2x21.25	Package -7
507	341+610	Culvert	2	2	2x21.25	Package -7
508-511	328+200	Culverts @ Double Trumpet	3	3	4 culverts	Package-7
512-517	328+200	HPC @ Double Trumpet	1x1200		6 culverts	Package-7
518	326+500	HPC @ Way Side Amenities	1x1200		1 culvert	Package-7
519	326+500	HPC @ Way Side Amenities	1x1200		1 culvert	Package-7
520	342+583	Culvert	2	2	2 x 21.25	Package-8
521	343+062	Culvert	3	3	2 x 21.25	Package-8
522	343+560	Culvert	3	3	2 x 21.25	Package-8
523	344+035	Culvert	3	3	2 x 21.25	Package-8
524	344+593	Culvert	3	3	2 x 21.25	Package-8
525	345+167	Culvert	6	3	2 x 21.25	Package-8
526	345+970	Culvert	2	2	2 x 21.25	Package-8
527	346+272	Culvert	3	3	2 x 21.25	Package-8
528	346+800	Culvert	2	2	2 x 21.25	Package-8
529	347+433	Culvert	3	3	2 x 21.25	Package-8
530	348+136	Culvert	3	3	2 x 21.25	Package-8
531	348+940	Culvert	2	2	2 x 21.25	Package-8
532	349+670	Culvert	3	3	2 x 21.25	Package-8
533	350+382	Culvert	3	3	2 x 21.25	Package-8
534	350+880	Culvert	3	3	2 x 21.25	Package-8
535	351+815	Culvert	3	3	2 x 21.25	Package-8
536	352+292	Culvert	3	3	2 x 21.25	Package-8
537	353+463	Culvert	3	3	2 x 21.25	Package-8
538	354+580	Culvert	3	3	2 x 21.25	Package-8
539	355+310	Culvert	2	2	2 x 21.25	Package-8
540	355+730	Culvert	3	3	2 x 21.25	Package-8

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
541	356+760	Culvert	2	2	2 x 21.25	Package-8
542	357+746	Culvert	2	2	2 x 21.25	Package-8
543	358+057	Culvert	3	3	2 x 21.25	Package-8
544	359+753	Culvert	2	2	2 x 21.25	Package-8
545	360+197	Culvert	3	2.5	2 x 21.25	Package-8
546	361+290	Culvert	2	2	2 x 21.25	Package-8
547	361+898	Culvert	2	2	2 x 21.25	Package-8
548	362+300	Culvert	2	2	2 x 21.25	Package-8
549	363+356	Culvert	2	2	2 x 21.25	Package-8
550	364+272	Culvert	3	3	2 x 21.25	Package-8
551	364+470	Culvert	2	2	2 x 21.25	Package-8
552	365+663	Culvert	3	3	2 x 21.25	Package-8
553	366+380	Culvert	2	2	2 x 21.25	Package-8
554	366+940	Culvert	3	3	2 x 21.25	Package-8
555	367+930	Culvert	2	2	2 x 21.25	Package-8
556	369+187	Culvert	3	3	2 x 21.25	Package-8
557	370+220	Culvert	2	2	2 x 21.25	Package-8
558	371+845	Culvert	2	2	2 x 21.25	Package-8
559	372+320	Culvert	2	2	2 x 21.25	Package-8
560	373+195	Culvert	2	2	2 x 21.25	Package-8
561	374+080	Culvert	2	2	2 x 21.25	Package-8
562	374+619	Culvert	3	3	2 x 21.25	Package-8
563	375+344	Culvert	2	2	2 x 21.25	Package-8
564	375+699	Culvert	3	3	2 x 21.25	Package-8
565	376+709	Culvert	2	2	2 x 21.25	Package-8
566	378+431	Culvert	3	3	2 x 21.25	Package-8
567	379+393	Culvert	2	2	2 x 21.25	Package-8
568	381+254	Culvert	2	2	2 x 21.25	Package-8
569	382+080	Culvert	2	2	2 x 21.25	Package-8
570	382+619	Culvert	3	2.5	2 x 21.25	Package-8
571	383+584	Culvert	3	3	2 x 21.25	Package-8
572	384+705	Culvert	2	2	2 x 21.25	Package-8
573	385+931	Culvert	3	3	2 x 21.25	Package-8
574	386+504	Culvert	3	3	2 x 21.25	Package-8
575	387+169	Culvert	2	2	2 x 21.25	Package-8

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
576	387+969	Culvert	3	3	2 x 21.25	Package-8
577	388+914	Culvert	3	3	2 x 21.25	Package-8
578	389+244	Culvert	2	2	2 x 21.25	Package-8
579	390+502	Culvert	2	2	2 x 21.25	Package-8
580	391+459	Culvert	3	3	2 x 21.25	Package-8
581-582	378+155	Culverts @ Double Trumpet	3	3	**2 Culverts**	Package-8
583	378+155	Culverts @ Double Trumpet	2	2	**1 Culvert**	Package-8
584	378+155	Culverts @ Double Trumpet	2	2	**1 Culvert**	Package-8
585-586	378+155	HPC @ Double Trumpet	6x1200		**2 Culverts**	Package-8
587-588	378+155	HPC @ Double Trumpet	3x1200		**2 Culverts**	Package-8
589-591	378+155	HPC @ Double Trumpet	1x1200		**3 Culverts**	Package-8
592	378+155	HPC @ Double Trumpet	2x1200		**1 Culvert**	Package-8
593	377+492	HPC @ Way Side Amenities	1X1200		**1 Culvert**	Package-8
594	377+492	HPC @ Way Side Amenities	1X1200		**1 Culvert**	Package-8
595	392+180	Culvert	2	2	2X21.25	Package-9
596	393+093	Culvert	2	2	2X21.25	Package-9
597	394+717	Culvert	2	2	2X21.25	Package-9
598	395+170	Culvert	2	2	2X21.25	Package-9
599	396+761	Culvert	2	2	2X21.25	Package-9
600	397+550	Culvert	2	2	2X21.25	Package-9
601	398+245	Culvert	3	3	2X21.25	Package-9
602	399+192	Culvert	3	3	2X21.25	Package-9
603	399+630	Culvert	2	2	2X21.25	Package-9
604	400+002	Culvert	3	3	2X21.25	Package-9
605	400+670	Culvert	2	2	2X21.25	Package-9
606	401+580	Culvert	2	2	2X21.25	Package-9
607	402+530	Culvert	2	2	2X21.25	Package-9
608	403+413	Culvert	2	2	2X21.25	Package-9
609	403+850	Culvert	3	3	2X21.25	Package-9
610	404+176	Culvert	3	3	2X21.25	Package-9
611	405+500	Culvert	2	2	2X21.25	Package-9
612	406+430	Culvert	2	2	2X21.25	Package-9
613	407+470	Culvert	3	3	2X21.25	Package-9
614	408+675	Culvert	2	2	2X21.25	Package-9

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
615	409+270	Culvert	3	3	2X21.25	Package-9
616	410+240	Culvert	2	2	2X21.25	Package-9
617	410+819	Culvert	2	2	2X21.25	Package-9
618	410+856	Culvert	2	2	2X21.25	Package-9
619	411+263	Culvert	2	2	2X21.25	Package-9
620	411+531	Culvert	2	2	2X21.25	Package-9
621	412+095	Culvert	2	2	2X21.25	Package-9
622	412+890	Culvert	2	2	2X21.25	Package-9
623	413+700	Culvert	2	2	2X21.25	Package-9
624	414+572	Culvert	2	2	2X21.25	Package-9
625	415+550	Culvert	2	2	2X21.25	Package-9
626	416+134	Culvert	2	2	2X21.25	Package-9
627	416+820	Culvert	2	2	2X21.25	Package-9
628	417+110	Culvert	3	3	2X21.25	Package-9
629	417+302	Culvert	4	3	2X21.25	Package-9
630	418+410	Culvert	3	3	2X21.25	Package-9
631	419+280	Culvert	2	2	2X21.25	Package-9
632	419+590	Culvert	3	3	2X21.25	Package-9
633	421+060	Culvert	5	3	2X21.25	Package-9
634	421+590	Culvert	3	3	2X21.25	Package-9
635	422+720	Culvert	3	3	2X21.25	Package-9
636	423+610	Culvert	2	2	2X21.25	Package-9
637	424+561	Culvert	2	2	2X21.25	Package-9
638	425+468	Culvert	2	2	2X21.25	Package-9
639	426+100	Culvert	3	3	2X21.25	Package-9
640	426+202	Culvert	3	3	2X21.25	Package-9
641	426+835	Culvert	3	2	2X21.25	Package-9
642	427+130	Culvert	2	2	2X21.25	Package-9
643	428+369	Culvert	3	3	2X21.25	Package-9
644	429+300	Culvert	2	2	2X21.25	Package-9
645	430+428	Culvert	3	3	2X21.25	Package-9
646	431+664	Culvert	2	2	2X21.25	Package-9
647	432+060	Culvert	3	3	2X21.25	Package-9
648	433+170	Culvert	2	2	2X21.25	Package-9
649	434+260	Culvert	2	2	2X21.25	Package-9

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
650	434+650	Culvert	2	2	2X21.25	Package-9
651	435+032	Culvert	2	2	2X21.25	Package-9
652	435+480	Culvert	2	2	2X21.25	Package-9
653	436+263	Culvert	3	3	2X21.25	Package-9
654	436+790	Culvert	2	2	2X21.25	Package-9
655	437+430	Culvert	2	2	2X21.25	Package-9
656	438+268	Culvert	3	3	2X21.25	Package-9
657	438+600	Culvert	6	3	2X21.25	Package-9
658	439+265	Culvert	3	3	2X21.25	Package-9
659	439+623	Culvert	3	2	2X21.25	Package-9
660	440+140	Culvert	2	2	2X21.25	Package-9
661	440+870	Culvert	2	2	2X21.25	Package-9
662	441+430	Culvert	3	3	2X21.25	Package-9
663	442+000	Culvert	2	2	2X21.25	Package-9
664	442+485	Culvert	2	2	2X21.25	Package-9
665	442+840	Culvert	2	2	2X21.25	Package-9
666	443+499	Culvert	2	2	2X21.25	Package-9
667	444+463	Culvert	2	2	2X21.25	Package-9
668-669	420+932	Culverts @ Diamond Interchange	2	2	2 Culverts	Package-9
670	420+932	Culverts @ Diamond Interchange	5	3	1 Culvert	Package-9
671	420+932	Culverts @ Diamond Interchange	5	3	1 Culvert	Package-9
672	423+844	HPC @ Way Side Amenities	1X1200		1 Culvert	Package-9
673	424+140	HPC @ Way Side Amenities	1X1200		1 Culvert	Package-9
674	445+300	Culvert	2	2	2 x 21.25	Package-10
675	445+680	Culvert	2	2	2 x 21.25	Package-10
676	446+243	Culvert	3	3	2 x 21.25	Package-10
677	446+765	Culvert	2	2	2 x 21.25	Package-10
678	446+939	Culvert	2	2	2 x 21.25	Package-10
679	447+700	Culvert	2	2	2 x 21.25	Package-10
680	448+581	Culvert	3	3	2 x 21.25	Package-10
681	448+780	Culvert	2	2	2 x 21.25	Package-10
682	449+265	Culvert	3	3	2 x 21.25	Package-10
683	450+420	Culvert	3	3	2 x 21.25	Package-10
684	451+363	Culvert	3	3	2 x 21.25	Package-10
685	452+536	Culvert	2	2	2 x 21.25	Package-10

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
686	453+621	Culvert	2	2	2 x 21.25	Package-10
687	454+332	Culvert	2	2	2 x 21.25	Package-10
688	455+250	Culvert	3	3	2 x 21.25	Package-10
689	455+892	Culvert	2	2	2 x 21.25	Package-10
690	456+345	Culvert	2	2	2 x 21.25	Package-10
691	457+680	Culvert	2	2	2 x 21.25	Package-10
692	458+175	Culvert	2	2	2 x 21.25	Package-10
693	459+190	Culvert	2	2	2 x 21.25	Package-10
694	460+896	Culvert	2	2	2 x 21.25	Package-10
695	461+370	Culvert	2	2	2 x 21.25	Package-10
696	461+805	Culvert	2	2	2 x 21.25	Package-10
697	462+380	Culvert	2	2	2 x 21.25	Package-10
698	463+033	Culvert	2	2	2 x 21.25	Package-10
699	464+180	Culvert	3	3	2 x 21.25	Package-10
700	464+826	Culvert	2	2	2 x 21.25	Package-10
701	465+796	Culvert	3	3	2 x 21.25	Package-10
702	466+490	Culvert	2	2	2 x 21.25	Package-10
703	467+826	Culvert	2	2	2 x 21.25	Package-10
704	468+215	Culvert	2	2	2 x 21.25	Package-10
705	468+400	Culvert	2	2	2 x 21.25	Package-10
706	469+720	Culvert	3	3	2 x 21.25	Package-10
707	470+210	Culvert	2	2	2 x 21.25	Package-10
708	471+288	Culvert	2	2	2 x 21.25	Package-10
709	472+062	Culvert	3	3	2 x 21.25	Package-10
710	472+735	Culvert	2	2	2 x 21.25	Package-10
711	473+524	Culvert	2	2	2 x 21.25	Package-10
712	473+930	Culvert	2	2	2 x 21.25	Package-10
713	474+480	Culvert	2	2	2 x 21.25	Package-10
714	475+345	Culvert	3	2.5	2 x 21.25	Package-10
715	476+240	Culvert	2	2	2 x 21.25	Package-10
716	476+635	Culvert	3	3	2 x 21.25	Package-10
717	478+758	Culvert	3	3	2 x 21.25	Package-10
718	479+306	Culvert	3	2	2 x 21.25	Package-10
719	480+150	Culvert	3	3	2 x 21.25	Package-10
720	481+700	Culvert	2	2	2 x 21.25	Package-10

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
721	482+000	Culvert	3	2	2 x 21.25	Package-10
722	482+923	Culvert	2	2	2 x 21.25	Package-10
723	483+230	Culvert	3	3	2 x 21.25	Package-10
724	484+000	Culvert	3	3	2 x 21.25	Package-10
725	484+400	Culvert	2	2	2 x 21.25	Package-10
726	485+365	Culvert	2	2	2 x 21.25	Package-10
727	486+270	Culvert	3	3	2 x 21.25	Package-10
728	488+380	Culvert	2	2	2 x 21.25	Package-10
729	488+567	Culvert	2	2	2 x 21.25	Package-10
730	489+780	Culvert	2	2	2 x 21.25	Package-10
731	490+220	Culvert	2	2	2 x 21.25	Package-10
732	490+700	Culvert	2	2	2 x 21.25	Package-10
733	491+051	Culvert	2	2	2 x 21.25	Package-10
734	491+920	Culvert	3	3	2 x 21.25	Package-10
735	492+160	Culvert	2	2	2 x 21.25	Package-10
736	493+247	Culvert	2	2	2 x 21.25	Package-10
737	494+760	Culvert	2	2	2 x 21.25	Package-10
738	495+532	Culvert	2	2	2 x 21.25	Package-10
739	496+550	Culvert	2	2	2 x 21.25	Package-10
740	487+285	Culverts @ Double Trumpet	2	2	1 Culvert	Package-10
741	487+285	Culverts @ Double Trumpet	2	2	1 Culvert	Package-10
742	487+285	HPC @ Double Trumpet	1x1200		1 Culvert	Package-10
743	487+285	HPC @ Double Trumpet	1x1200		1 Culvert	Package-10
744	487+285	HPC @ Double Trumpet	1x1200		1 Culvert	Package-10
745-750	487+285	HPC @ Double Trumpet	1x1200		6 Culverts	Package-10
751-752	487+285	HPC @ Double Trumpet	1x1200		2 Culverts	Package-10
753	480+900	HPC @ WSA	1X1200		1 Culvert	Package-10
754	481+000	HPC @ WSA	1X1200		1 Culvert	Package-10
755	498+308	Culvert	2	2	2X21.25	Package-11
756	499+520	Culvert	2	2	2X21.25	Package-11
757	500+240	Culvert	3	3	2X21.25	Package-11
758	501+255	Culvert	2	2	2X21.25	Package-11
759	501+762	Culvert	5	3	2X21.25	Package-11
760	502+561	Culvert	2	2	2X21.25	Package-11

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
761	503+200	Culvert	2	2	2X21.25	Package-11
762	503+860	Culvert	2	2	2X21.25	Package-11
763	504+146	Culvert	5	3	2X21.25	Package-11
764	504+680	Culvert	3	3	2X21.25	Package-11
765	505+560	Culvert	3	2	2X21.25	Package-11
766	506+018	Culvert	5	3	2X21.25	Package-11
767	506+690	Culvert	2	2	2X21.25	Package-11
768	507+700	Culvert	3	3	2X21.25	Package-11
769	508+383	Culvert	3	3	2X21.25	Package-11
770	509+850	Culvert	3	3	2X21.25	Package-11
771	510+875	Culvert	3	3	2X21.25	Package-11
772	511+279	Culvert	3	3	2X21.25	Package-11
773	511+934	Culvert	3	3	2X21.25	Package-11
774	512+640	Culvert	2	2	2X21.25	Package-11
775	513+300	Culvert	2	2	2X21.25	Package-11
776	513+633	Culvert	2	2	2X21.25	Package-11
777	514+472	Culvert	2	2	2X21.25	Package-11
778	514+845	Culvert	3	2	2X21.25	Package-11
779	515+280	Culvert	2	2	2X21.25	Package-11
780	516+786	Culvert	3	2	2X21.25	Package-11
781	517+020	Culvert	2	2	2X21.25	Package-11
782	518+920	Culvert	2	2	2X21.25	Package-11
783	519+480	Culvert	3	2	2X21.25	Package-11
784	520+377	Culvert	3	2	2X21.25	Package-11
785	520+906	Culvert	5	3	2X21.25	Package-11
786	521+608	Culvert	3	3	2X21.25	Package-11
787	522+200	Culvert	2	2	2X21.25	Package-11
788	522+779	Culvert	3	2	2X21.25	Package-11
789	523+185	Culvert	3	2	2X21.25	Package-11
790	523+864	Culvert	3	3	2X21.25	Package-11
791	524+900	Culvert	3	3	2X21.25	Package-11
792	525+105	Culvert	2	2	2X21.25	Package-11
793	525+583	Culvert	3	2	2X21.25	Package-11
794	526+040	Culvert	2	2	2X21.25	Package-11
795	526+540	Culvert	2	2	2X21.25	Package-11

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
796	527+288	Culvert	2	2	2X21.25	Package-11
797	527+941	Culvert	6	3	2X21.25	Package-11
798	528+000	Culvert	3	3	2X21.25	Package-11
799	528+300	Culvert	3	2	2X21.25	Package-11
800	529+450	Culvert	2	2	2X21.25	Package-11
801	530+620	Culvert	2	2	2X21.25	Package-11
802	531+580	Culvert	2	2	2X21.25	Package-11
803	532+450	Culvert	2	2	2X21.25	Package-11
804	532+780	Culvert	2	2	2X21.25	Package-11
805	533+400	Culvert	2	2	2X21.25	Package-11
806	533+815	Culvert	5	3	2X21.25	Package-11
807	534+159	Culvert	4	3	2X21.25	Package-11
808	535+400	Culvert	3	3	2X21.25	Package-11
809	536+665	Culvert	4	3	2X21.25	Package-11
810	537+352	Culvert	3	2	2X21.25	Package-11
811	537+835	Culvert	5	3	2X21.25	Package-11
812	538+080	Culvert	2	2	2X21.25	Package-11
813	539+200	Culvert	2	2	2X21.25	Package-11
814	540+330	Culvert	3	3	2X21.25	Package-11
815	540+815	Culvert	6	3	2X21.25	Package-11
816	541+110	Culvert	2	2	2X21.25	Package-11
817	541+860	Culvert	3	3	2X21.25	Package-11
818	542+494	Culvert	3	3	2X21.25	Package-11
819	543+000	Culvert	3	3	2X21.25	Package-11
820	543+732	Culvert	4	3	2X21.25	Package-11
821	544+100	Culvert	3	2	2X21.25	Package-11
822	544+258	Culvert	4	3	2X21.25	Package-11
823	544+563	Culvert	6	3	2X21.25	Package-11
824	545+460	Culvert	6	3	2X21.25	Package-11
825	546+710	Culvert	4	3	2X21.25	Package-11
826	547+395	Culvert	3	2	2X21.25	Package-11
827	547+915	Culvert	2	2	2X21.25	Package-11
828	548+121	Culvert	3	2	2X21.25	Package-11
829	517+439	Culverts @ Double Trumpet	3	2	1 culvert	Package-11
830	517+439	Culverts @ Double Trumpet	3	2	1 culvert	Package-11

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
831-832	517+439	Culverts @ Double Trumpet	2	2	2 culverts	Package-11
833-843	517+439	HPC @ Double Trumpet	1x1200		11 culverts	Package-11
844	522+635	CULVERT Beside VUP	3	2	1 culvert	Package-11
845	536+880	CULVERT Beside SVUP	4	2	1 culvert	Package-11
846	540+800	HPC @ Way Side Amenities	1x1200		1 culvert	Package-11
847	540+800	HPC @ Way Side Amenities	1x1200		1 culvert	Package-11
848	548+993	Culvert	3	2	2 x 21.25	Package-12
849	549+506	Culvert	3	2	2 x 21.25	Package-12
850	550+320	Culvert	3	3	2 x 21.25	Package-12
851	551+436	Culvert	4	3	2 x 21.25	Package-12
852	552+086	Culvert	3	3	2 x 21.25	Package-12
853	552+757	Culvert	6	3	2 x 21.25	Package-12
854	553+310	Culvert	2	2	2 x 21.25	Package-12
855	553+750	Culvert	4	3	2 x 21.25	Package-12
856	554+155	Culvert	2	2	2 x 21.25	Package-12
857	555+710	Culvert	3	3	2 x 21.25	Package-12
858	556+100	Culvert	3	3	2 x 21.25	Package-12
859	556+955	Culvert	2	2	2 x 21.25	Package-12
860	557+455	Culvert	2	2	2 x 21.25	Package-12
861	558+840	Culvert	6	3	2 x 21.25	Package-12
862	559+660	Culvert	6	3	2 x 21.25	Package-12
863	560+306	Culvert	2	2	2 x 21.25	Package-12
864	561+970	Culvert	2	2	2 x 21.25	Package-12
865	562+457	Culvert	3	3	2 x 21.25	Package-12
866	563+470	Culvert	2	2	2 x 21.25	Package-12
867	563+810	Culvert	2	2	2 x 21.25	Package-12
868	564+210	Culvert	2	2	2 x 21.25	Package-12
869	565+061	Culvert	5	3	2 x 21.25	Package-12
870	565+190	Culvert	6	3	2 x 21.25	Package-12
871	566+180	Culvert	4	3	2 x 21.25	Package-12
872	567+290	Culvert	5	3	2 x 21.25	Package-12
873	568+360	Culvert	2	2	2 x 21.25	Package-12
874	569+760	Culvert	2	2	2 x 21.25	Package-12
875	570+253	Culvert	3	3	2 x 21.25	Package-12

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
876	570+570	Culvert	2	2	2 x 21.25	Package-12
877	571+530	Culvert	2	2	2 x 21.25	Package-12
878	571+756	Culvert	3	2	2 x 21.25	Package-12
879	571+936	Culvert	3	2	2 x 21.25	Package-12
880	572+410	Culvert	2	2	2 x 21.25	Package-12
881	573+100	Culvert	2	2	2 x 21.25	Package-12
882	573+690	Culvert	2	2	2 x 21.25	Package-12
883	574+180	Culvert	2	2	2 x 21.25	Package-12
884	574+784	Culvert	4	3	2 x 21.25	Package-12
885	575+965	Culvert	3	3	2 x 21.25	Package-12
886	576+093	Culvert	2	2	2 x 21.25	Package-12
887	576+870	Culvert	2	2	2 x 21.25	Package-12
888	577+330	Culvert	2	2	2 x 21.25	Package-12
889	578+150	Culvert	2	2	2 x 21.25	Package-12
890	579+520	Culvert	2	2	2 x 21.25	Package-12
891	580+740	Culvert	2	2	2 x 21.25	Package-12
892	581+106	Culvert	3	3	2 x 21.25	Package-12
893	582+503	Culvert	2	2	2 x 21.25	Package-12
894	583+360	Culvert	2	2	2 x 21.25	Package-12
895	584+080	Culvert	2	2	2 x 21.25	Package-12
896	585+592	Culvert	3	2	2 x 21.25	Package-12
897	585+850	Culvert	2	2	2 x 21.25	Package-12
898	586+236	Culvert	2	2	2 x 21.25	Package-12
899	586+405	Culvert	3	3	2 x 21.25	Package-12
900	586+907	Culvert	4	3	2 x 21.25	Package-12
901	587+980	Culvert	3	3	2 x 21.25	Package-12
902	588+256	Culvert	3	3	2 x 21.25	Package-12
903	588+945	Culvert	2	2	2 x 21.25	Package-12
904	590+050	Culvert	6	1.5	2 x 21.25	Package-12
905	590+650	Culvert	2	2	2 x 21.25	Package-12
906	590+925	Culvert	6	3	2 x 21.25	Package-12
907	591+496	Culvert	2	2	2 x 21.25	Package-12
908	593+095	Culvert	3	3	2 x 21.25	Package-12
909	593+842	Culvert	5	3	2 x 21.25	Package-12
910	594+086	Culvert	3	3	2 x 21.25	Package-12

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
911	595+160	Culvert	2	2	2 x 21.25	Package-12
912	595+900	Culvert	2	2	2 x 21.25	Package-12
913	596+270	Culvert	4	3	2 x 21.25	Package-12
914	597+153	Culvert	2	2	2 x 21.25	Package-12
915	597+375	Culvert	3	3	2 x 21.25	Package-12
916	598+193	Culvert	3	2	2 x 21.25	Package-12
917	598+565	Culvert	2	2	2 x 21.25	Package-12
918	599+345	Culvert	2	2	2 x 21.25	Package-12
919	599+990	Culvert	2	2	2 x 21.25	Package-12
920-923	554+951	Culverts @ Diamond Interchange	3	3	4 culverts	Package-12
924-926	600+457	HPC @ Trumpet	1x1200		3 culverts	Package-12
927	601+280	Culverts @ Trumpet	2	2	1 culvert	Package-12
928	563+010	CULVERT Beside LVUP	3	2	1 culvert	Package-12
929	576+587	CULVERT Beside VUP	3	2	1 Culvert	Package-12

0.16 RAILWAY TRACKS/CROSSINGS

There are 7 locations where expressway corridor crosses railway lines. 7 Nos. of Rail Over Bridges (ROBs) have been proposed at these locations, list of which has already been attached above in in Table-0.12 (a).

0.17 TOLL PLAZAS & RAMP PLAZAS

2 Main Toll Plazas, 7 Toll Plazas (8 Lanes each) on Double Trumpet Interchanges & 32 Ramp Plazas (2 lanes on each leg) on Diamond Interchanges (at 16 Nodes) have been proposed along the project corridor. List of the Toll Plazas & Toll Booths is attached below:

S. No.	Location		Remarks
1	13+400	Meerut	Toll Plaza (16 lanes)
2	35+270	Hapur - Garhmukteshwar	Ramp Plaza
3	54+640	Bulandshahr - Garhmukteshwar	Ramp Plaza)
4	74+181	Hasanpur-Anupshahar	Ramp Plaza
5	102+427	Anupshahr - Moradabad	Ramp Plaza
6	123+288	Babrala - Chandausi	Double Trumpet (8 lanes)
7	173+454	Chandausi - Budaun	Ramp Plaza
8	189+394	Budaun - Bareilly	Double Trumpet (8 lanes)

S. No.	Location		Remarks
9	255+167	Farukkhabad - Shahjahanpur	Double Trumpet (8 lanes)
10	282+845	Farukkhabad - Shahbad	Ramp Plaza
11	329+945	Kannauj– Hardoi	Double Trumpet (8 lanes)
12	378+136	Agra - Lucknow Expressway	Double Trumpet (8 lanes)
13	420+932	Kanpur - Lucknow	Ramp Plaza
14	487+285	Lalganj - Raebareli	Double Trumpet (8 lanes)
15	517+708	Raebareli–Unchahar	Double Trumpet (8 lanes)
16	554+951	Manikpur - Bela Pratapgarh	Ramp Plaza
17	589+450	Before Prayagraj Bypass	Toll Plaza (16 Lanes)

0.18 WAY SIDE AMENITIES

Way Side Amenities have been proposed on 9 locations along the project corridor. All WSA's will be approachable from both side of MCW.

S. No.	Chainage	LHS/RHS	Distance between WSA (km)
1	72+700	LHS	
2	125+400	RHS	52.7
3	175+000	LHS	49.6
4	254+200	RHS	79.2
5	326+500	LHS	72.3
6	377+500	RHS	51.0
7	424+000	LHS	46.5
8	480+900	RHS	56.9
9	541+600	LHS	60.7

0.19 SOCIAL IMPACT ASSESSMENT (SIA) AND R&R POLICY

Social Impact Assessment will involve:

(i) Agricultural/Homestead/Commercial Land Impacts;

(ii) Loss of Structures (Residential/Commercial/Other);

(iii) Loss of livelihood due to loss of primary source of income;

(iv) Loss of community infrastructure/common property resources;

(v) Temporary Impacts on agricultural land due to plant site for contractor etc.;

(vi) Any unanticipated impacts due to the project will be documented and mitigated based on the spirit of the principle agreed upon in this policy framework.

R&R Policies:

The project being greenfield alignment will require acquisition of large area of agriculture/ private/ government land. However, it is kept in mind while finalizing the alignment that the impact to the structures is minimum.

The R&R policies for the impacts to the Land (agricultural/Private/Government), Structures, Persons, Livelihood & others will involve various kind of compensations involving financial assistance, compensation for land, land for land (if feasible), compensation for crops, rental accommodation etc., whichever applicable based on the policy norms.

0.20 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The major objective of EIA study is to establish present environmental condition along the project corridor through available data / information supported by field studies to evaluate the impacts on relevant environmental attributes due to the construction & operation of the proposed project; to recommend adequate mitigation measures to minimize / reduce adverse impacts and to prepare an Environmental Management Plan (EMP) for timely implementation of the mitigation measures to make the project environmentally sound and sustainable. An Environmental Impact Assessment (EIA) study basically includes:

- Establishment of the present environmental scenario
- Study of the specific activities related to the project
- Evaluation of the probable environmental impacts
- Recommendations of necessary environmental control measures.
- Preparation of Environmental Management Plan

0.21 TCS SCHEDULE FOR THE PROJECT

The chainage wise list of Typical Cross-sections applicable along the project is attached below:

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
7.900	8.688	0.788	Nil	Nil	R	Package-1
8.688	8.920	0.232	Nil	Nil	C	Package-1
8.920	9.152	0.232	7.00	Nil	E	Package-1
9.152	9.440	0.288	7.00	Nil	T	Package-1
9.440	10.200	0.760	7.00	Nil	A1	Package-1
10.200	10.620	0.420	7.00	3.75	D	Package-1

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
10.620	12.438	1.818	7.00	Nil	A1	Package-1
12.438	12.630	0.192	7.00	3.75	D	Package-1
12.630	15.150	2.520	3.75	3.75	B3	Package-1
15.150	17.700	2.550	3.75	Nil	B1	Package-1
17.700	17.750	0.050	Nil	Nil	C	Package-1
17.750	23.370	5.620	3.75	Nil	B1	Package-1
23.370	24.000	0.630	3.75	3.75	B3	Package-1
24.000	24.110	0.110	3.75	Nil	B1	Package-1
24.110	24.510	0.400	7.00	Nil	A1	Package-1
24.510	25.135	0.625	3.75	Nil	B1	Package-1
25.135	28.160	3.025	3.75	3.75	B3	Package-1
28.160	28.950	0.790	3.75	Nil	B1	Package-1
28.950	29.350	0.400	7.00	Nil	A1	Package-1
29.350	33.850	4.500	3.75	Nil	B1	Package-1
33.850	34.650	0.800	Nil	Nil	C	Package-1
34.650	34.800	0.150	Nil	7.00	A2	Package-1
34.800	35.270	0.470	7.00	7.00	A3	Package-1
35.270	35.400	0.130	7.00	Nil	A1	Package-1
35.400	36.140	0.740	Nil	Nil	C	Package-1
36.140	40.045	3.905	3.75	Nil	B1	Package-1
40.045	41.500	1.455	3.75	3.75	B3	Package-1
41.500	43.170	1.670	3.75	Nil	B1	Package-1
43.170	43.445	0.275	3.75	3.75	B3	Package-1
43.445	45.200	1.755	3.75	Nil	B1	Package-1
45.200	46.240	1.040	3.75	3.75	B3	Package-1
46.240	48.545	2.305	Nil	3.75	B2	Package-1
48.545	48.560	0.015	Nil	7	A2	Package-1
48.560	48.780	0.220	7.00	7.00	A3	Package-1
48.780	48.945	0.165	Nil	7.00	A2	Package-1
48.945	49.669	0.724	Nil	3.75	B2	Package-1
49.669	49.825	0.156	Nil	7.00	A2	Package-1
49.825	50.069	0.244	3.75	7.00	D	Package-1
50.069	50.850	0.781	3.75	3.75	B3	Package-1
50.850	50.860	0.010	Nil	3.75	B2	Package-1
50.860	51.260	0.400	Nil	7.00	A2	Package-1

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
51.260	51.400	0.140	Nil	3.75	B2	Package-1
51.400	51.625	0.225	Nil	Nil	C	Package-1
51.625	52.911	1.286	3.75	Nil	B1	Package-1
52.911	53.700	0.789	3.75	3.75	B3	Package-1
53.700	56.900	3.200	3.75	Nil	B1	Package-1
56.900	59.495	2.595	3.75	Nil	B1	Package-2
59.495	60.140	0.645	Nil	Nil	C	Package-2
60.140	60.190	0.050	Nil	3.75	B2	Package-2
60.190	60.665	0.475	3.75	3.75	B3	Package-2
60.665	61.127	0.462	3.75	Nil	B1	Package-2
61.127	61.400	0.273	7.00	Nil	A1	Package-2
61.400	61.527	0.127	7.00	3.75	D	Package-2
61.527	62.700	1.173	3.75	3.75	B3	Package-2
62.700	65.690	2.990	3.75	Nil	B1	Package-2
65.690	67.610	1.920	Nil	Nil	C	Package-2
67.610	69.830	2.220	Nil	3.75	B2	Package-2
69.830	69.850	0.020	Nil	Nil	C	Package-2
69.850	71.830	1.980	3.75	Nil	B1	Package-2
71.830	72.500	0.670	3.75	3.75	B3	Package-2
72.500	73.153	0.653	3.75	Nil	B1	Package-2
73.153	73.553	0.400	7.00	Nil	A1	Package-2
73.553	73.600	0.047	3.75	Nil	B1	Package-2
73.600	74.190	0.590	3.75	3.75	B3	Package-2
74.190	74.630	0.440	Nil	3.75	B2	Package-2
74.630	77.930	3.300	3.75	Nil	B1	Package-2
77.930	79.300	1.370	3.75	3.75	B3	Package-2
79.300	80.615	1.315	3.75	Nil	B1	Package-2
80.615	82.130	1.515	3.75	3.75	B3	Package-2
82.130	86.600	4.470	3.75	Nil	B1	Package-2
86.600	86.800	0.200	3.75	3.75	B3	Package-2
86.800	86.900	0.100	Nil	3.75	B2	Package-2
86.900	87.300	0.400	3.75	3.75	B3	Package-3
87.300	88.100	0.800	3.75	Nil	B1	Package-3
88.100	88.540	0.440	3.75	3.75	B3	Package-3
88.540	95.540	7.000	3.75	Nil	B1	Package-3

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
95.540	96.010	0.470	3.75	3.75	B3	Package-3
96.010	97.300	1.290	3.75	Nil	B1	Package-3
97.300	97.810	0.510	3.75	3.75	B3	Package-3
97.810	99.100	1.290	3.75	Nil	B1	Package-3
99.100	99.355	0.255	3.75	3.75	B3	Package-3
99.355	101.150	1.795	3.75	Nil	B1	Package-3
101.150	102.427	1.277	3.75	3.75	B3	Package-3
102.427	102.948	0.521	Nil	3.75	B2	Package-3
102.948	104.215	1.267	3.75	3.75	B3	Package-3
104.215	105.715	1.500	3.75	Nil	B1	Package-3
105.715	105.900	0.185	3.75	3.75	B3	Package-3
105.900	107.262	1.362	Nil	3.75	B2	Package-3
107.262	107.790	0.528	3.75	3.75	B3	Package-3
107.790	109.041	1.251	Nil	3.75	B2	Package-3
109.041	112.600	3.559	3.75	3.75	B3	Package-3
112.600	113.000	0.400	7.00	7.00	A3	Package-3
113.000	114.595	1.595	3.75	3.75	B3	Package-3
114.595	115.550	0.955	3.75	Nil	B1	Package-3
115.550	115.810	0.260	3.75	3.75	B3	Package-3
115.810	117.505	1.695	3.75	Nil	B1	Package-3
117.505	118.200	0.695	3.75	3.75	B3	Package-3
118.200	119.611	1.411	3.75	Nil	B1	Package-3
119.611	120.290	0.679	3.75	3.75	B3	Package-3
120.290	121.550	1.260	3.75	Nil	B1	Package-3
121.550	122.146	0.596	3.75	3.75	B3	Package-3
122.146	123.135	0.989	Nil	Nil	C	Package-3
123.135	124.060	0.925	Nil	3.75	B2	Package-3
124.060	128.335	4.275	3.75	3.75	B3	Package-3
128.335	129.461	1.126	3.75	Nil	B1	Package-3
129.461	131.323	1.862	3.75	3.75	B3	Package-3
131.323	134.100	2.777	3.75	Nil	B2	Package-3
134.100	137.600	3.500	3.75	3.75	B3	Package-3
137.600	137.905	0.305	3.75	3.75	B3	Package-4
137.905	139.850	1.945	3.75	Nil	B1	Package-4
139.850	140.652	0.802	3.75	3.75	B3	Package-4

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
140.652	146.330	5.678	3.75	Nil	b1	Package-4
146.330	147.395	1.065	Nil	Nil	C	Package-4
147.395	150.475	3.080	Nil	3.75	B2	Package-4
150.475	151.450	0.975	3.75	3.75	B3	Package-4
151.450	152.160	0.710	Nil	3.75	B2	Package-4
152.160	152.330	0.170	7.00	3.75	D	Package-4
152.330	153.525	1.195	7.00	Nil	A1	Package-4
153.525	153.680	0.155	7.00	3.75	D	Package-4
153.680	153.800	0.120	7.00	Nil	A1	Package-4
153.800	154.310	0.510	7.00	3.75	D	Package-4
154.310	157.900	3.590	7.00	Nil	A1	Package-4
157.900	158.685	0.785	Nil	Nil	C	Package-4
158.685	158.800	0.115	3.75	Nil	B1	Package-4
158.800	159.270	0.470	3.75	3.75	B3	Package-4
159.270	160.205	0.935	Nil	3.75	B2	Package-4
160.205	164.395	4.190	3.75	3.75	B3	Package-4
164.395	165.390	0.995	Nil	3.75	B2	Package-4
165.390	165.985	0.595	3.75	3.75	B3	Package-4
165.985	166.963	0.978	Nil	3.75	B2	Package-4
166.963	167.774	0.811	3.75	3.75	B3	Package-4
167.774	169.520	1.746	Nil	3.75	B2	Package-4
169.520	170.087	0.567	3.75	3.75	B3	Package-4
170.087	171.255	1.168	Nil	3.75	B2	Package-4
171.255	171.500	0.245	3.75	3.75	B3	Package-4
171.500	171.900	0.400	3.75	7.00	D	Package-4
171.900	174.180	2.280	3.75	3.75	B3	Package-4
174.180	180.276	6.096	Nil	3.75	B2	Package-4
180.276	181.347	1.071	3.75	3.75	B3	Package-4
181.347	182.170	0.823	Nil	3.75	B2	Package-4
182.170	183.970	1.800	3.75	3.75	B3	Package-4
183.970	185.117	1.147	Nil	3.75	B2	Package-4
185.117	185.400	0.283	3.75	3.75	B3	Package-4
185.400	186.483	1.083	Nil	3.75	B2	Package-4
186.483	187.690	1.207	3.75	3.75	B3	Package-4
187.690	189.400	1.710	Nil	Nil	C	Package-4

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
189.400	189.700	0.300	Nil	3.75	B2	Package-4
189.700	189.800	0.100	Nil	7.00	A2	Package-5
189.800	190.100	0.300	3.75	7.00	D	Package-5
190.100	195.410	5.310	Nil	7.00	A2	Package-5
195.410	195.680	0.270	3.75	7.00	D	Package-5
195.680	198.400	2.720	Nil	7.00	A2	Package-5
198.400	199.942	1.542	3.75	7.00	D	Package-5
199.942	201.195	1.253	Nil	7.00	A2	Package-5
201.195	201.600	0.405	3.75	7.00	D	Package-5
201.600	204.940	3.340	Nil	7.00	A2	Package-5
204.940	205.320	0.380	3.75	7.00	D	Package-5
205.320	207.600	2.280	Nil	7.00	A2	Package-5
207.600	208.570	0.970	Nil	Nil	C	Package-5
208.570	211.500	2.930	Nil	3.75	B2	Package-5
211.500	212.200	0.700	3.75	3.75	B3	Package-5
212.200	213.409	1.209	Nil	3.75	B2	Package-5
213.409	213.809	0.400	Nil	7.00	A2	Package-5
213.809	217.105	3.296	Nil	3.75	B2	Package-5
217.105	218.265	1.160	Nil	Nil	C	Package-5
218.265	224.030	5.765	3.75	Nil	B1	Package-5
224.030	224.430	0.400	7.00	Nil	A1	Package-5
224.430	225.640	1.210	3.75	Nil	B1	Package-5
225.640	226.950	1.310	3.75	3.75	B3	Package-5
226.950	228.820	1.870	3.75	Nil	B1	Package-5
228.820	229.780	0.960	3.75	3.75	B3	Package-5
229.780	231.735	1.955	3.75	Nil	B1	Package-5
231.735	232.750	1.015	3.75	3.75	B3	Package-5
232.750	233.550	0.800	3.75	Nil	B1	Package-5
233.550	234.525	0.975	3.75	3.75	B3	Package-5
234.525	235.750	1.225	3.75	Nil	B1	Package-5
235.750	236.150	0.400	7.00	Nil	A1	Package-5
236.150	236.400	0.250	3.75	Nil	B1	Package-5
236.400	236.555	0.155	3.75	Nil	B1	Package-6
236.555	237.100	0.545	3.75	3.75	B3	Package-6
237.100	237.714	0.614	3.75	Nil	B1	Package-6

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
237.714	238.380	0.666	Nil	Nil	C	Package-6
238.380	240.910	2.530	3.75	3.75	B3	Package-6
240.910	241.925	1.015	3.75	Nil	B1	Package-6
241.925	242.500	0.575	7.00	Nil	A1	Package-6
242.500	247.500	5.000	10.00	10.00	F	Package-6
247.500	247.759	0.259	3.75	3.75	B3	Package-6
247.759	248.643	0.884	3.75	Nil	B1	Package-6
248.643	249.220	0.577	3.75	7.00	D	Package-6
249.220	250.304	1.084	Nil	7.00	A2	Package-6
250.304	250.747	0.443	3.75	7.00	D	Package-6
250.747	252.085	1.338	Nil	7.00	A2	Package-6
252.085	252.390	0.305	3.75	7.00	D	Package-6
252.390	253.642	1.252	Nil	7.00	A2	Package-6
253.642	254.245	0.603	3.75	7.00	D	Package-6
254.245	255.167	0.922	Nil	7.00	A2	Package-6
255.167	255.915	0.748	3.75	Nil	B1	Package-6
255.915	256.180	0.265	3.75	3.75	B3	Package-6
256.180	257.321	1.141	3.75	Nil	B1	Package-6
257.321	257.721	0.400	7.00	Nil	A1	Package-6
257.721	258.344	0.623	3.75	Nil	B1	Package-6
258.344	258.744	0.400	7.00	Nil	A1	Package-6
258.744	260.080	1.336	3.75	Nil	B1	Package-6
260.080	260.170	0.090	3.75	3.75	B3	Package-6
260.170	261.124	0.954	3.75	Nil	B1	Package-6
261.124	261.524	0.400	7.00	Nil	A1	Package-6
261.524	261.648	0.124	3.75	Nil	B1	Package-6
261.648	262.202	0.554	3.75	3.75	B3	Package-6
262.202	263.565	1.363	3.75	Nil	B1	Package-6
263.565	264.195	0.630	3.75	3.75	B3	Package-6
264.195	264.957	0.762	3.75	Nil	B1	Package-6
264.957	265.420	0.463	3.75	3.75	B3	Package-6
265.420	268.060	2.640	3.75	Nil	B1	Package-6
268.060	268.140	0.080	3.75	3.75	B3	Package-6
268.140	268.540	0.400	7.00	3.75	D	Package-6
268.540	269.200	0.660	3.75	3.75	B3	Package-6

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
269.200	271.063	1.863	3.75	Nil	B1	Package-6
271.063	271.660	0.597	3.75	3.75	B3	Package-6
271.660	273.800	2.140	3.75	Nil	B1	Package-6
273.800	274.200	0.400	7.00	Nil	A1	Package-6
274.200	274.580	0.380	3.75	Nil	B1	Package-6
274.580	274.980	0.400	7.00	Nil	A1	Package-6
274.980	277.355	2.375	3.75	Nil	B1	Package-6
277.355	279.167	1.812	3.75	3.75	B3	Package-6
279.167	281.850	2.683	3.75	Nil	B1	Package-6
281.850	281.980	0.130	3.75	7.00	D	Package-6
281.980	282.845	0.865	Nil	7.00	A2	Package-6
282.845	289.300	6.455	Nil	3.75	B2	Package-6
289.300	290.900	1.600	3.75	3.75	B3	Package-7
290.900	292.580	1.680	3.75	Nil	B1	Package-7
292.580	292.635	0.055	3.75	3.75	B3	Package-7
292.635	307.811	15.176	Nil	3.75	B2	Package-7
307.811	308.000	0.189	3.75	3.75	B3	Package-7
308.000	309.226	1.226	3.75	Nil	B1	Package-7
309.226	310.310	1.084	3.75	3.75	B3	Package-7
310.310	315.600	5.290	3.75	Nil	B1	Package-7
315.600	317.083	1.483	3.75	3.75	B3	Package-7
317.083	319.183	2.100	Nil	Nil	C	Package-7
319.183	320.731	1.548	3.75	Nil	B2	Package-7
320.731	321.131	0.400	7.00	Nil	A1	Package-7
321.131	321.370	0.239	3.75	Nil	B1	Package-7
321.370	322.300	0.930	3.75	3.75	B3	Package-7
322.300	323.650	1.350	3.75	Nil	B1	Package-7
323.650	324.730	1.080	3.75	3.75	B3	Package-7
324.730	327.340	2.610	3.75	Nil	B1	Package-7
327.340	327.655	0.315	3.75	3.75	B3	Package-7
327.655	329.745	2.090	Nil	3.75	B2	Package-7
329.745	329.945	0.200	Nil	7.00	A2	Package-7
329.945	330.145	0.200	3.75	7.00	D	Package-7
330.145	330.420	0.275	3.75	3.75	B3	Package-7
330.420	335.837	5.417	Nil	3.75	B2	Package-7

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
335.837	336.100	0.263	3.75	3.75	B3	Package-7
336.100	337.860	1.760	Nil	3.75	B2	Package-7
337.860	337.990	0.130	3.75	3.75	B3	Package-7
337.990	340.693	2.703	Nil	3.75	B2	Package-7
340.693	341.093	0.400	Nil	7.00	A2	Package-7
341.093	341.700	0.607	Nil	3.75	B2	Package-7
341.700	345.739	4.039	Nil	3.75	B2	Package-8
345.739	349.169	3.430	3.75	Nil	B1	Package-8
349.169	351.311	2.142	3.75	3.75	B3	Package-8
351.311	352.700	1.389	3.75	Nil	B1	Package-8
352.700	352.960	0.260	3.75	3.75	B3	Package-8
352.960	354.010	1.050	Nil	3.75	B2	Package-8
354.010	354.580	0.570	3.75	3.75	B3	Package-8
354.580	355.360	0.780	Nil	Nil	C	Package-8
355.360	355.710	0.350	3.75	Nil	B1	Package-8
355.710	356.360	0.650	3.75	3.75	B3	Package-8
356.360	358.065	1.705	Nil	3.75	B2	Package-8
358.065	358.435	0.370	3.75	3.75	B3	Package-8
358.435	358.520	0.085	Nil	3.75	B2	Package-8
358.520	359.151	0.631	Nil	Nil	C	Package-8
359.151	359.250	0.099	3.75	Nil	B1	Package-8
359.250	359.475	0.225	3.75	3.75	B3	Package-8
359.475	362.754	3.279	Nil	3.75	B2	Package-8
362.754	363.154	0.400	Nil	7.00	A2	Package-8
363.154	364.702	1.548	Nil	3.75	B2	Package-8
364.702	365.102	0.400	Nil	7.00	A2	Package-8
365.102	365.118	0.016	Nil	3.75	B2	Package-8
365.118	365.663	0.545	3.75	3.75	B3	Package-8
365.663	366.388	0.725	Nil	3.75	B2	Package-8
366.388	366.766	0.378	3.75	3.75	B3	Package-8
366.766	367.653	0.887	Nil	3.75	B2	Package-8
367.653	367.788	0.135	3.75	3.75	B3	Package-8
367.788	370.486	2.698	3.75	Nil	B1	Package-8
370.486	370.869	0.383	7.00	7.00	A3	Package-8
370.869	371.310	0.441	7.00	3.75	D	Package-8

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
371.310	373.090	1.780	7.00	Nil	A1	Package-8
373.090	378.095	5.005	7.00	3.75	D	Package-8
378.095	378.190	0.095	Nil	3.75	B2	Package-8
378.190	381.360	3.170	3.75	3.75	B3	Package-8
381.360	381.760	0.400	3.75	7.00	D	Package-8
381.760	383.780	2.020	3.75	3.75	B3	Package-8
383.780	384.180	0.400	3.75	7.00	D	Package-8
384.180	386.500	2.320	3.75	3.75	B3	Package-8
386.500	387.496	0.996	3.75	7.00	D	Package-8
387.496	387.896	0.400	7.00	7.00	A3	Package-8
387.896	389.460	1.564	3.75	3.75	B3	Package-8
389.460	389.660	0.200	7.00	7.00	A3	Package-8
389.660	389.860	0.200	7.00	Nil	A1	Package-8
389.860	391.900	2.040	3.75	Nil	B1	Package-8
391.900	392.410	0.510	3.75	Nil	B1	Package-9
392.410	392.810	0.400	7.00	Nil	A1	Package-9
392.810	393.240	0.430	3.75	Nil	B1	Package-9
393.240	393.700	0.460	3.75	3.75	B3	Package-9
393.700	393.940	0.240	3.75	Nil	B1	Package-9
393.940	394.340	0.400	7.00	Nil	A1	Package-9
394.340	396.990	2.650	3.75	Nil	B1	Package-9
396.990	397.050	0.060	7.00	Nil	A1	Package-9
397.050	397.120	0.070	7.00	3.75	D	Package-9
397.120	397.390	0.270	7.00	Nil	A1	Package-9
397.390	398.640	1.250	3.75	Nil	B1	Package-9
398.640	399.180	0.540	3.75	3.75	B3	Package-9
399.180	400.950	1.770	Nil	3.75	B2	Package-9
400.950	401.280	0.330	Nil	7.00	A2	Package-9
401.280	401.360	0.080	7.00	7.00	A3	Package-9
401.360	401.750	0.390	3.75	3.75	B3	Package-9
401.750	402.550	0.800	Nil	3.75	B2	Package-9
402.550	402.950	0.400	Nil	7.00	A2	Package-9
402.950	403.850	0.900	Nil	3.75	B2	Package-9
403.850	404.950	1.100	3.75	3.75	B3	Package-9
404.950	406.260	1.310	Nil	3.75	B2	Package-9

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
406.260	406.840	0.580	3.75	3.75	B3	Package-9
406.840	407.240	0.400	Nil	7.00	A2	Package-9
407.240	408.130	0.890	Nil	3.75	B2	Package-9
408.130	408.530	0.400	Nil	7.00	A2	Package-9
408.530	409.270	0.740	Nil	3.75	B2	Package-9
409.270	409.650	0.380	3.75	3.75	B3	Package-9
409.650	411.530	1.880	Nil	3.75	B2	Package-9
411.530	411.830	0.300	3.75	3.75	B3	Package-9
411.830	413.210	1.380	3.75	Nil	B1	Package-9
413.210	413.620	0.410	3.75	3.75	B3	Package-9
413.620	414.410	0.790	Nil	3.75	B2	Package-9
414.410	414.610	0.200	Nil	7.00	A2	Package-9
414.610	414.810	0.200	7.00	7.00	A3	Package-9
414.810	415.390	0.580	3.75	3.75	B3	Package-9
415.390	417.100	1.710	Nil	3.75	B2	Package-9
417.100	417.790	0.690	3.75	3.75	B3	Package-9
417.790	418.920	1.130	Nil	3.75	B2	Package-9
418.920	419.600	0.680	3.75	3.75	B3	Package-9
419.600	419.710	0.110	3.75	Nil	B1	Package-9
419.710	420.950	1.240	Nil	Nil	C	Package-9
420.950	422.032	1.082	3.75	Nil	A1	Package-9
422.032	422.640	0.608	Nil	Nil	C	Package-9
422.640	423.350	0.710	Nil	3.75	B2	Package-9
423.350	423.370	0.020	Nil	Nil	C	Package-9
423.370	428.350	4.980	3.75	Nil	B1	Package-9
428.350	428.750	0.400	7.00	Nil	A1	Package-9
428.750	429.120	0.370	3.75	Nil	B1	Package-9
429.120	430.000	0.880	3.75	3.75	B3	Package-9
430.000	431.017	1.017	3.75	Nil	B1	Package-9
431.017	431.140	0.123	3.75	3.75	B3	Package-9
431.140	431.540	0.400	7.00	3.75	D	Package-9
431.540	432.750	1.210	3.75	3.75	B3	Package-9
432.750	433.410	0.660	3.75	Nil	B1	Package-9
433.410	433.810	0.400	7.00	Nil	A1	Package-9
433.810	435.840	2.030	3.75	Nil	B1	Package-9

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
435.840	436.240	0.400	7.00	Nil	A1	Package-9
436.240	438.770	2.530	3.75	Nil	B1	Package-9
438.770	439.280	0.510	3.75	3.75	B3	Package-9
439.280	440.360	1.080	3.75	Nil	B1	Package-9
440.360	442.785	2.425	3.75	3.75	B3	Package-9
442.785	443.760	0.975	3.75	Nil	B1	Package-9
443.760	444.520	0.760	3.75	3.75	B3	Package-9
444.520	445.000	0.480	3.75	Nil	B1	Package-9
445.000	446.625	1.625	3.75	Nil	B1	Package-10
446.625	447.870	1.245	3.75	3.75	B3	Package-10
447.870	447.980	0.110	7.00	3.75	D	Package-10
447.980	448.270	0.290	7.00	7.00	A3	Package-10
448.270	448.360	0.090	3.75	7.00	D	Package-10
448.360	449.940	1.580	3.75	Nil	B1	Package-10
449.940	450.410	0.470	3.75	3.75	B3	Package-10
450.410	450.530	0.120	Nil	3.75	B2	Package-10
450.530	450.930	0.400	Nil	7.00	A2	Package-10
450.930	452.010	1.080	Nil	3.75	B2	Package-10
452.010	452.410	0.400	Nil	7.00	A2	Package-10
452.410	452.580	0.170	Nil	3.75	B2	Package-10
452.580	452.980	0.400	Nil	7.00	A2	Package-10
452.980	453.075	0.095	Nil	3.75	B2	Package-10
453.075	453.490	0.415	3.75	3.75	B3	Package-10
453.490	455.030	1.540	Nil	3.75	B2	Package-10
455.030	455.240	0.210	3.75	3.75	B3	Package-10
455.240	456.900	1.660	Nil	3.75	B2	Package-10
456.900	457.300	0.400	Nil	7.00	A2	Package-10
457.300	457.500	0.200	Nil	3.75	B2	Package-10
457.500	458.120	0.620	3.75	3.75	B3	Package-10
458.120	458.750	0.630	Nil	3.75	B2	Package-10
458.750	459.150	0.400	Nil	7.00	A2	Package-10
459.150	459.540	0.390	Nil	3.75	B2	Package-10
459.540	459.940	0.400	Nil	7.00	A2	Package-10
459.940	462.630	2.690	Nil	3.75	B2	Package-10
462.630	463.210	0.580	3.75	3.75	B3	Package-10

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
463.210	463.370	0.160	Nil	3.75	B2	Package-10
463.370	463.770	0.400	Nil	7.00	A2	Package-10
463.770	464.190	0.420	Nil	3.75	B2	Package-10
464.190	464.730	0.540	3.75	3.75	B3	Package-10
464.730	465.290	0.560	Nil	3.75	B2	Package-10
465.290	465.800	0.510	3.75	3.75	B3	Package-10
465.800	466.180	0.380	Nil	3.75	B2	Package-10
466.180	466.900	0.720	3.75	3.75	B3	Package-10
466.900	466.990	0.090	Nil	3.75	B2	Package-10
466.990	467.740	0.750	Nil	7.00	A2	Package-10
467.740	469.020	1.280	Nil	3.75	B2	Package-10
469.020	469.050	0.030	Nil	7.00	A2	Package-10
469.050	469.230	0.180	7.00	7.00	A3	Package-10
469.230	469.420	0.190	Nil	7.00	A2	Package-10
469.420	470.220	0.800	Nil	3.75	B2	Package-10
470.220	470.620	0.400	Nil	7.00	A2	Package-10
470.620	472.680	2.060	Nil	3.75	B2	Package-10
472.680	472.990	0.310	3.75	3.75	B3	Package-10
472.990	476.830	3.840	Nil	3.75	B2	Package-10
476.830	477.230	0.400	Nil	7.00	A2	Package-10
477.230	478.510	1.280	Nil	3.75	B2	Package-10
478.510	478.760	0.250	3.75	3.75	B3	Package-10
478.760	479.290	0.530	Nil	3.75	B2	Package-10
479.290	480.200	0.910	3.75	3.75	B3	Package-10
480.200	480.600	0.400	3.75	7.00	D	Package-10
480.600	480.700	0.100	3.75	3.75	B3	Package-10
480.700	482.110	1.410	Nil	3.75	B2	Package-10
482.110	482.510	0.400	Nil	7.00	A2	Package-10
482.510	482.670	0.160	Nil	3.75	B2	Package-10
482.670	482.690	0.020	Nil	7.00	A2	Package-10
482.690	483.230	0.540	3.75	7.00	D	Package-10
483.230	483.810	0.580	Nil	7.00	A2	Package-10
483.810	484.350	0.540	3.75	7.00	D	Package-10
484.350	486.073	1.723	3.75	Nil	B1	Package-10
486.073	487.479	1.406	3.75	3.75	B3	Package-10

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
487.479	487.879	0.400	7.00	7.00	A3	Package-10
487.879	489.264	1.385	3.75	3.75	B3	Package-10
489.264	489.664	0.400	7.00	7.00	A3	Package-10
489.664	491.900	2.236	3.75	3.75	B3	Package-10
491.900	492.266	0.366	3.75	Nil	B1	Package-10
492.266	492.666	0.400	7.00	Nil	A1	Package-10
492.666	492.840	0.174	3.75	Nil	B1	Package-10
492.840	493.170	0.330	3.75	3.75	B3	Package-10
493.170	493.815	0.645	3.75	Nil	B1	Package-10
493.815	494.215	0.400	7.00	Nil	A1	Package-10
494.215	496.150	1.935	3.75	Nil	B1	Package-10
496.150	496.550	0.400	7.00	Nil	A1	Package-10
496.550	496.800	0.250	3.75	Nil	B1	Package-10
496.800	496.987	0.187	3.75	Nil	B1	Package-11
496.987	497.387	0.400	7.00	Nil	A1	Package-11
497.387	497.558	0.171	3.75	Nil	B1	Package-11
497.558	497.958	0.400	7.00	Nil	A1	Package-11
497.958	499.452	1.494	3.75	Nil	B1	Package-11
499.452	499.653	0.201	7.00	Nil	B1	Package-11
499.653	499.852	0.199	7.00	3.75	D	Package-11
499.852	500.945	1.093	3.75	3.75	B3	Package-11
500.945	502.804	1.859	Nil	3.75	B2	Package-11
502.804	503.300	0.496	Nil	Nil	C	Package-11
503.300	503.960	0.660	3.75	3.75	B3	Package-11
503.960	504.090	0.130	3.75	7.00	D	Package-11
504.090	504.360	0.270	Nil	7.00	A2	Package-11
504.360	505.238	0.878	Nil	3.75	B1	Package-11
505.238	505.640	0.402	3.75	3.75	B3	Package-11
505.640	506.040	0.400	7.00	7.00	A3	Package-11
506.040	506.150	0.110	3.75	3.75	B3	Package-11
506.150	507.150	1.000	Nil	3.75	B2	Package-11
507.150	508.380	1.230	3.75	3.75	B3	Package-11
508.380	510.475	2.095	Nil	3.75	B2	Package-11
510.475	511.400	0.925	3.75	Nil	B1	Package-11
511.400	511.600	0.200	7.00	Nil	A1	Package-11

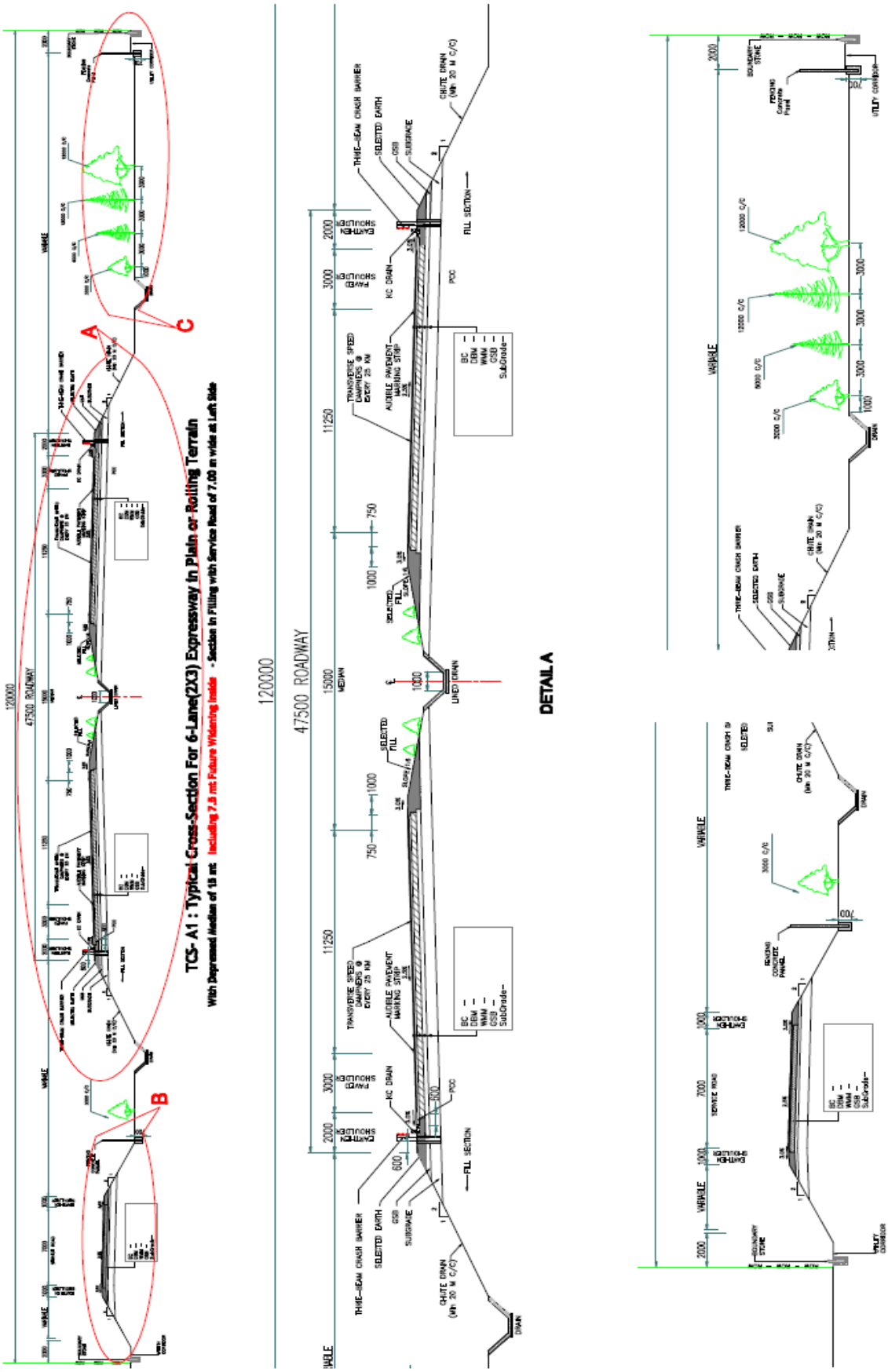
Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
511.600	511.800	0.200	7.00	3.75	D	Package-11
511.800	511.900	0.100	3.75	3.75	B3	Package-11
511.900	512.080	0.180	3.75	Nil	B1	Package-11
512.080	512.480	0.400	7.00	Nil	A1	Package-11
512.480	515.500	3.020	3.75	Nil	B1	Package-11
515.500	517.220	1.720	Nil	Nil	C	Package-11
517.220	517.590	0.370	3.75	Nil	B1	Package-11
517.590	517.708	0.118	3.75	3.75	B3	Package-11
517.708	518.154	0.446	3.75	Nil	B1	Package-11
518.154	518.827	0.673	7.00	Nil	A1	Package-11
518.827	519.417	0.590	3.75	Nil	B1	Package-11
519.417	519.817	0.400	7.00	Nil	A1	Package-11
519.817	520.100	0.283	3.75	Nil	B1	Package-11
520.100	520.280	0.180	3.75	3.75	B3	Package-11
520.280	522.640	2.360	3.75	Nil	B1	Package-11
522.640	523.165	0.525	3.75	3.75	B3	Package-11
523.165	523.908	0.743	Nil	3.75	B2	Package-11
523.908	524.308	0.400	Nil	7.00	A2	Package-11
524.308	526.663	2.355	Nil	3.75	B2	Package-11
526.663	527.063	0.400	Nil	7.00	A2	Package-11
527.063	527.482	0.419	Nil	3.75	B2	Package-11
527.482	527.700	0.218	Nil	7.00	A2	Package-11
527.700	527.882	0.182	3.75	7.00	D	Package-11
527.882	528.000	0.118	3.75	3.75	B3	Package-11
528.000	528.845	0.845	Nil	3.75	B2	Package-11
528.845	530.210	1.365	Nil	Nil	C	Package-11
530.210	533.237	3.027	Nil	7.00	A2	Package-11
533.237	534.130	0.893	Nil	3.75	B2	Package-11
534.130	534.445	0.315	3.75	3.75	B3	Package-11
534.445	535.400	0.955	Nil	3.75	B2	Package-11
535.400	536.125	0.725	3.75	3.75	B3	Package-11
536.125	536.525	0.400	7.00	7.00	A3	Package-11
536.525	536.880	0.355	3.75	3.75	B3	Package-11
536.880	538.170	1.290	Nil	3.75	B2	Package-11
538.170	538.942	0.772	Nil	7.00	A2	Package-11

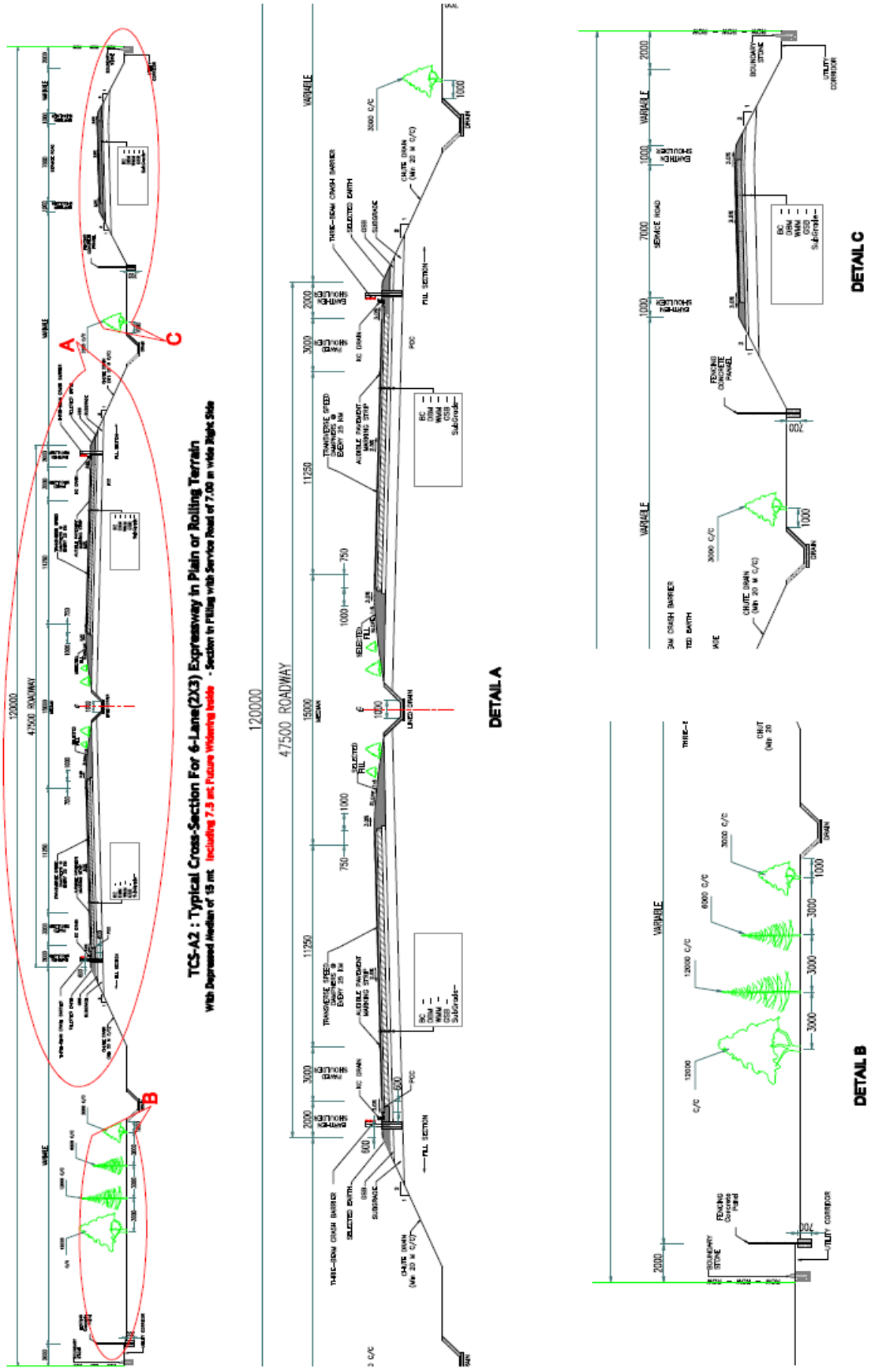
Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
538.942	539.545	0.603	Nil	3.75	B2	Package-11
539.545	540.365	0.820	3.75	3.75	B3	Package-11
540.365	540.905	0.540	Nil	3.75	B2	Package-11
540.905	542.015	1.110	3.75	3.75	B3	Package-11
542.015	542.342	0.327	Nil	3.75	B2	Package-11
542.342	542.742	0.400	Nil	7.00	A2	Package-11
542.742	543.000	0.258	Nil	3.75	B2	Package-11
543.000	543.333	0.333	3.75	3.75	B3	Package-11
543.333	545.860	2.527	Nil	3.75	B2	Package-11
545.860	546.260	0.400	Nil	7.00	A2	Package-11
546.260	547.500	1.240	Nil	3.75	B2	Package-11
547.500	547.900	0.400	Nil	7.00	A2	Package-11
547.900	548.800	0.900	Nil	3.75	B2	Package-11
548.800	550.655	1.855	Nil	3.75	B2	Package-12
550.655	550.865	0.210	7.00	7.00	A3	Package-12
550.865	551.055	0.190	Nil	7.00	A2	Package-12
551.055	552.500	1.445	Nil	3.75	B2	Package-12
552.500	552.858	0.358	3.75	3.75	B3	Package-12
552.858	554.951	2.093	Nil	3.75	B2	Package-12
554.951	555.332	0.381	7.00	3.75	D	Package-12
555.332	556.420	1.088	3.75	3.75	B3	Package-12
556.420	558.690	2.270	Nil	3.75	B2	Package-12
558.690	559.100	0.410	3.75	Nil	B1	Package-12
559.100	559.500	0.400	7.00	Nil	A1	Package-12
559.500	560.035	0.535	3.75	Nil	B1	Package-12
560.035	560.435	0.400	7.00	Nil	A1	Package-12
560.435	560.660	0.225	3.75	Nil	B1	Package-12
560.660	561.060	0.400	7.00	Nil	A1	Package-12
561.060	564.250	3.190	3.75	Nil	B1	Package-12
564.250	564.580	0.330	3.75	3.75	B3	Package-12
564.580	564.810	0.230	3.75	Nil	B1	Package-12
564.810	564.990	0.180	3.75	3.75	B3	Package-12
564.990	565.160	0.170	7.00	3.75	D	Package-12
565.160	565.390	0.230	7.00	Nil	A1	Package-12
565.390	568.750	3.360	3.75	Nil	B1	Package-12

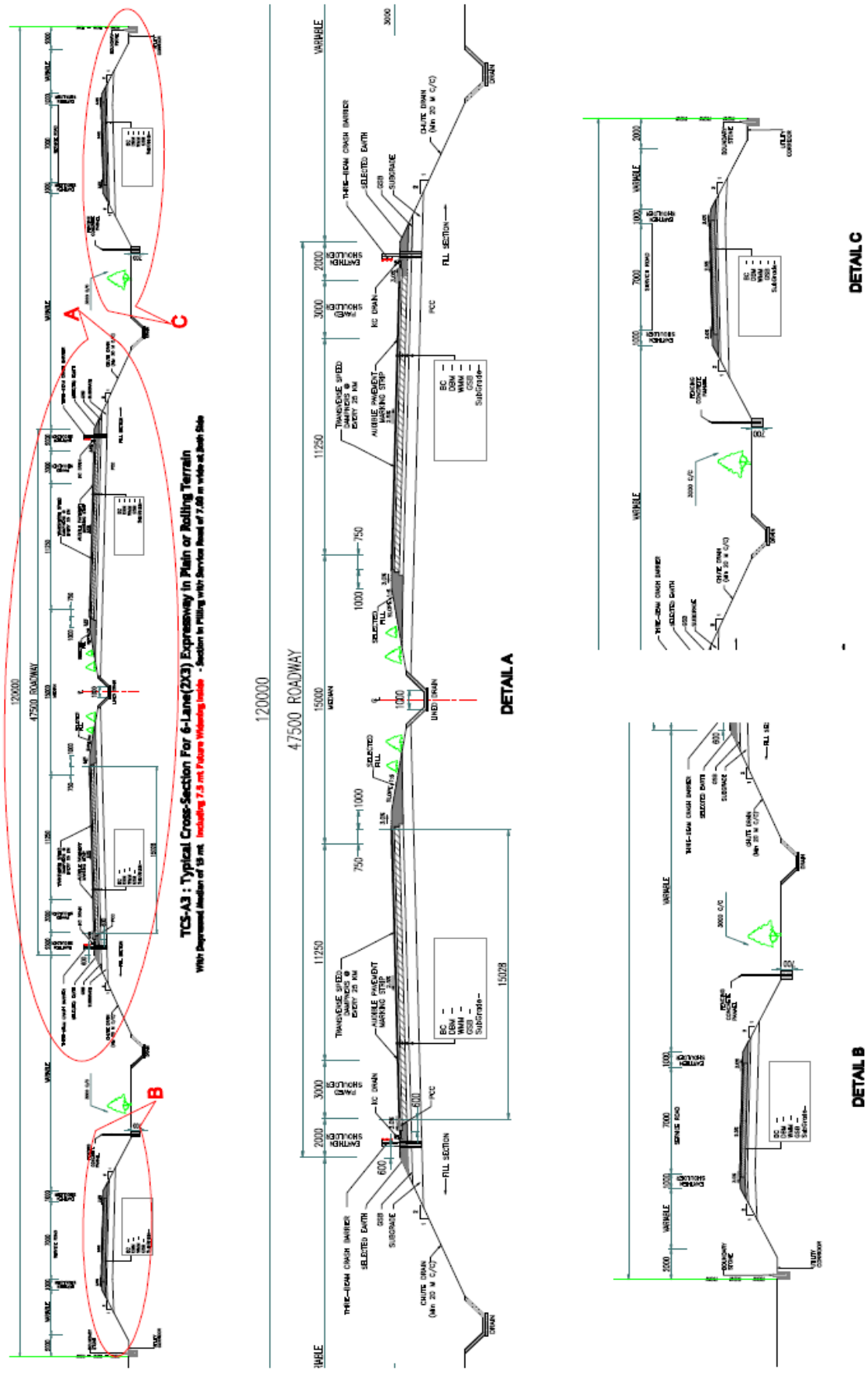
Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
568.750	568.900	0.150	7.00	Nil	A1	Package-12
568.900	568.950	0.050	7.00	7.00	A3	Package-12
568.950	569.150	0.200	Nil	7.00	A2	Package-12
569.150	569.352	0.202	Nil	3.75	B2	Package-12
569.352	569.752	0.400	Nil	7.00	A2	Package-12
569.752	575.181	5.429	Nil	3.75	B2	Package-12
575.181	575.370	0.189	Nil	7.00	A1	Package-12
575.370	575.581	0.211	7.00	7.00	A3	Package-12
575.581	575.992	0.411	3.75	3.75	B3	Package-12
575.992	578.947	2.955	Nil	3.75	B2	Package-12
578.947	579.347	0.400	Nil	7.00	A2	Package-12
579.347	580.440	1.093	Nil	3.75	B2	Package-12
580.440	580.590	0.150	3.75	3.75	B3	Package-12
580.590	581.778	1.188	3.75	Nil	B1	Package-12
581.778	582.178	0.400	7.00	Nil	A1	Package-12
582.178	584.580	2.402	3.75	Nil	B1	Package-12
584.580	585.485	0.905	3.75	3.75	B3	Package-12
585.485	586.400	0.915	Nil	3.75	B2	Package-12
586.400	587.280	0.880	3.75	3.75	B3	Package-12
587.280	587.310	0.030	3.75	Nil	B1	Package-12
587.310	587.615	0.305	Nil	Nil	C	Package-12
587.615	589.210	1.595	3.75	Nil	B1	Package-12
589.210	589.690	0.480	3.75	3.75	B3	Package-12
589.690	590.725	1.035	3.75	Nil	B1	Package-12
590.725	591.125	0.400	7.00	Nil	A1	Package-12
591.125	591.825	0.700	3.75	Nil	B1	Package-12
591.825	592.325	0.500	7.00	Nil	A1	Package-12
592.325	592.480	0.155	3.75	Nil	B1	Package-12
592.480	592.604	0.124	3.75	3.75	B3	Package-12
592.604	593.005	0.401	7.00	7.00	A3	Package-12
593.005	594.140	1.135	3.75	Nil	B1	Package-12
594.140	594.810	0.670	7.00	Nil	A1	Package-12
594.810	594.970	0.160	3.75	Nil	B1	Package-12
594.970	595.500	0.530	3.75	3.75	B3	Package-12
595.500	596.202	0.702	3.75	Nil	B1	Package-12

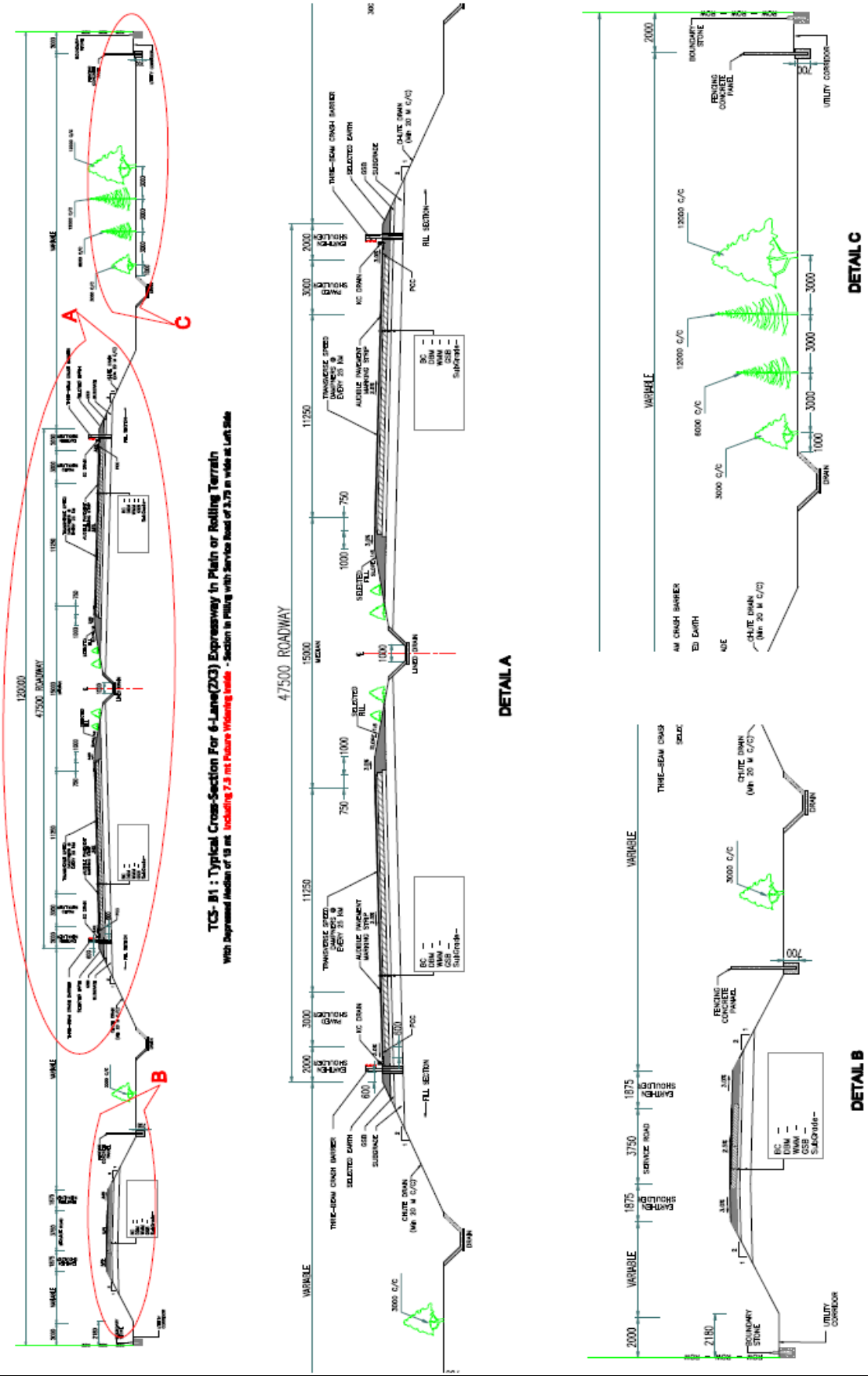
Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
596.202	596.602	0.400	7.00	Nil	A1	Package-12
596.602	596.650	0.048	3.75	Nil	B1	Package-12
596.650	597.045	0.395	3.75	3.75	B3	Package-12
597.045	599.000	1.955	3.75	Nil	B1	Package-12
599.000	599.100	0.100	3.75	3.75	B3	Package-12
599.100	599.700	0.600	3.75	Nil	B1	Package-12
599.700	600.100	0.400	3.75	3.75	B3	Package-12
600.100	600.233	0.133	3.75	Nil	B3	Package-12
600.233	601.847	1.614	Nil	Nil	R	Package-12

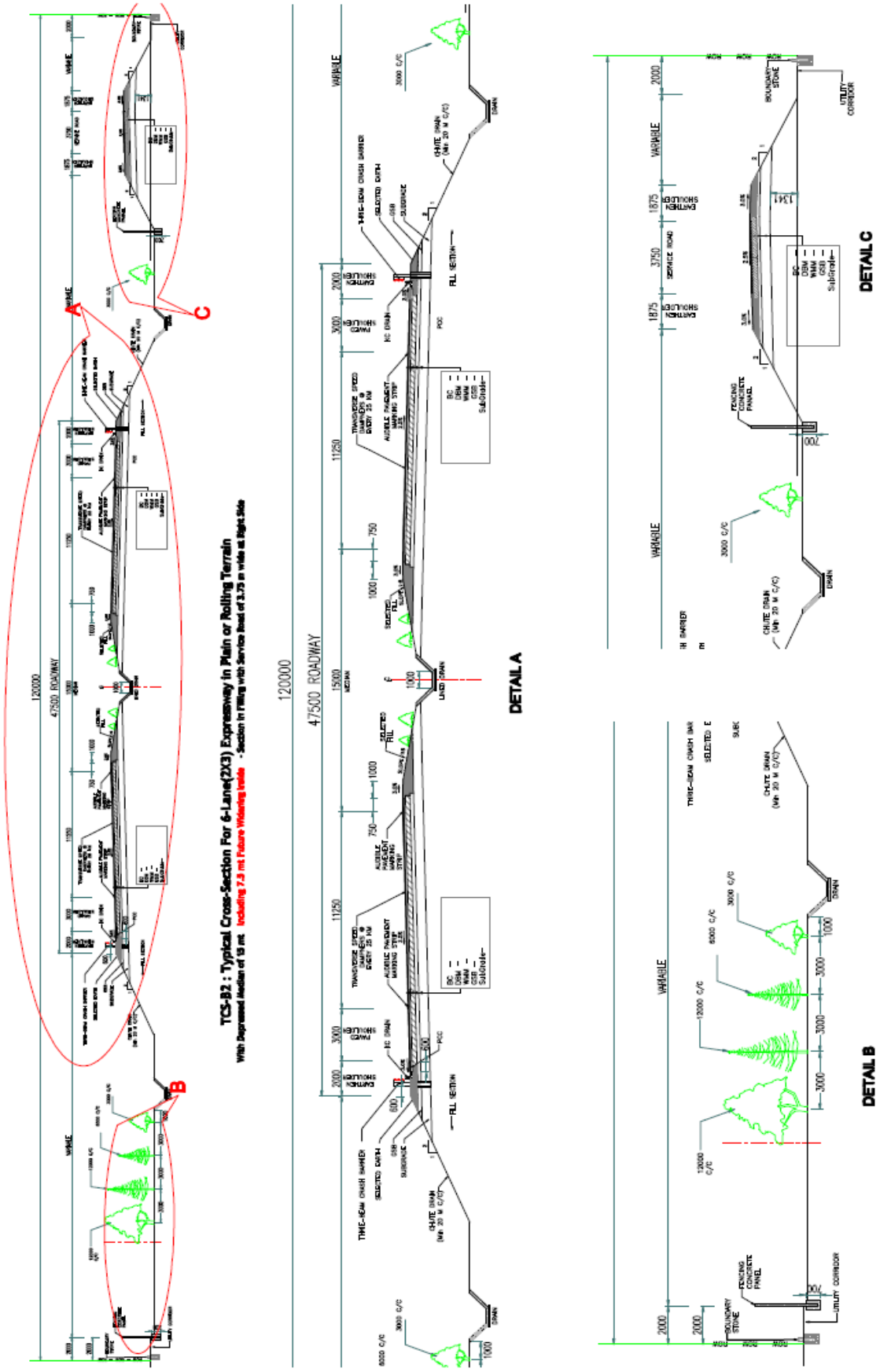
Typical cross-sections mentioned in the above table have been attached below:

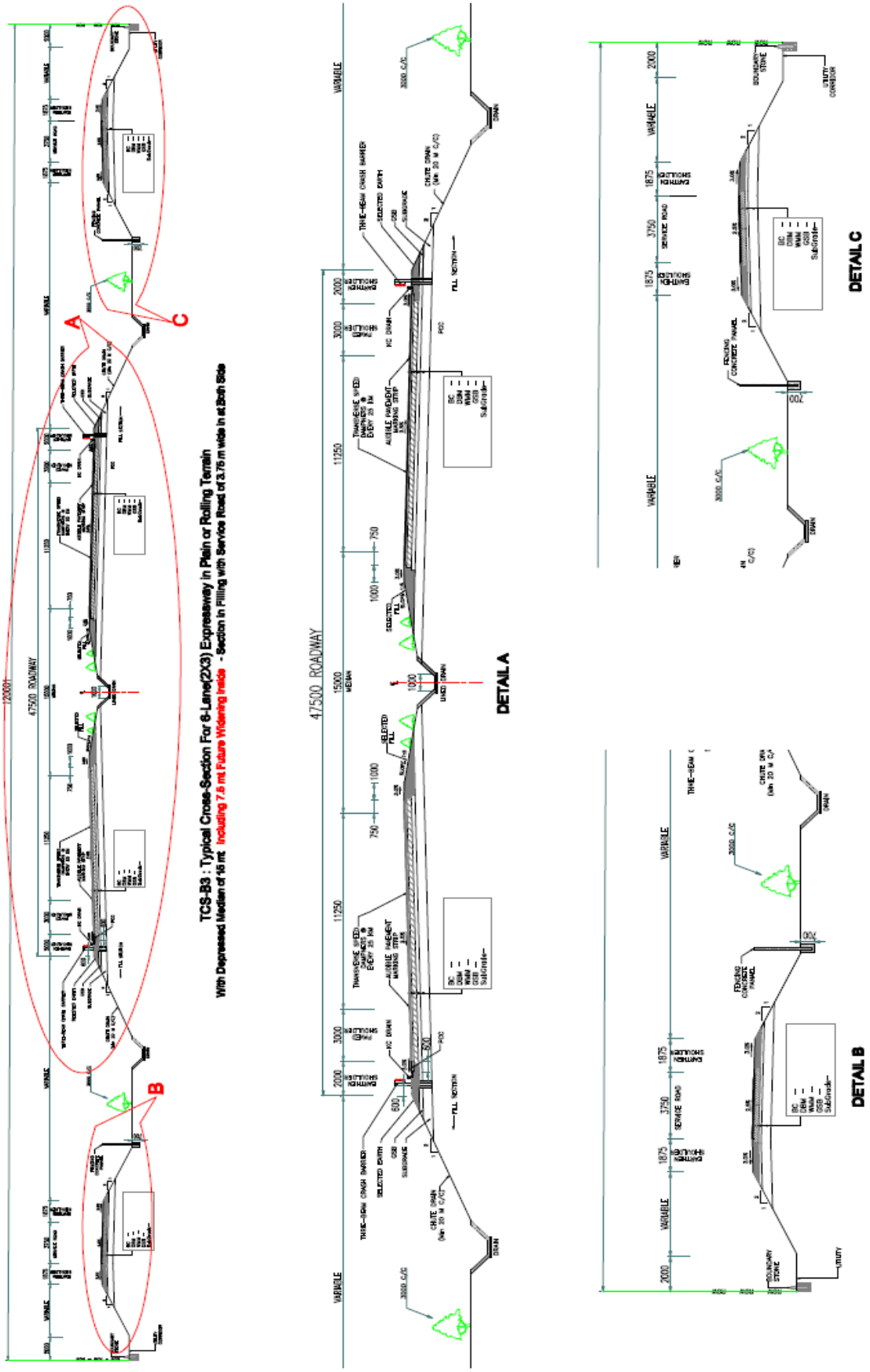

TCS- A1 : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
With Depressed Median of 15 mt Including 7.5 mt Future Widening Inside - Section in Filling with Service Road of 7.00 m wide at Left Side
47500 ROADWAY
120000
DETAIL A
A
B
C

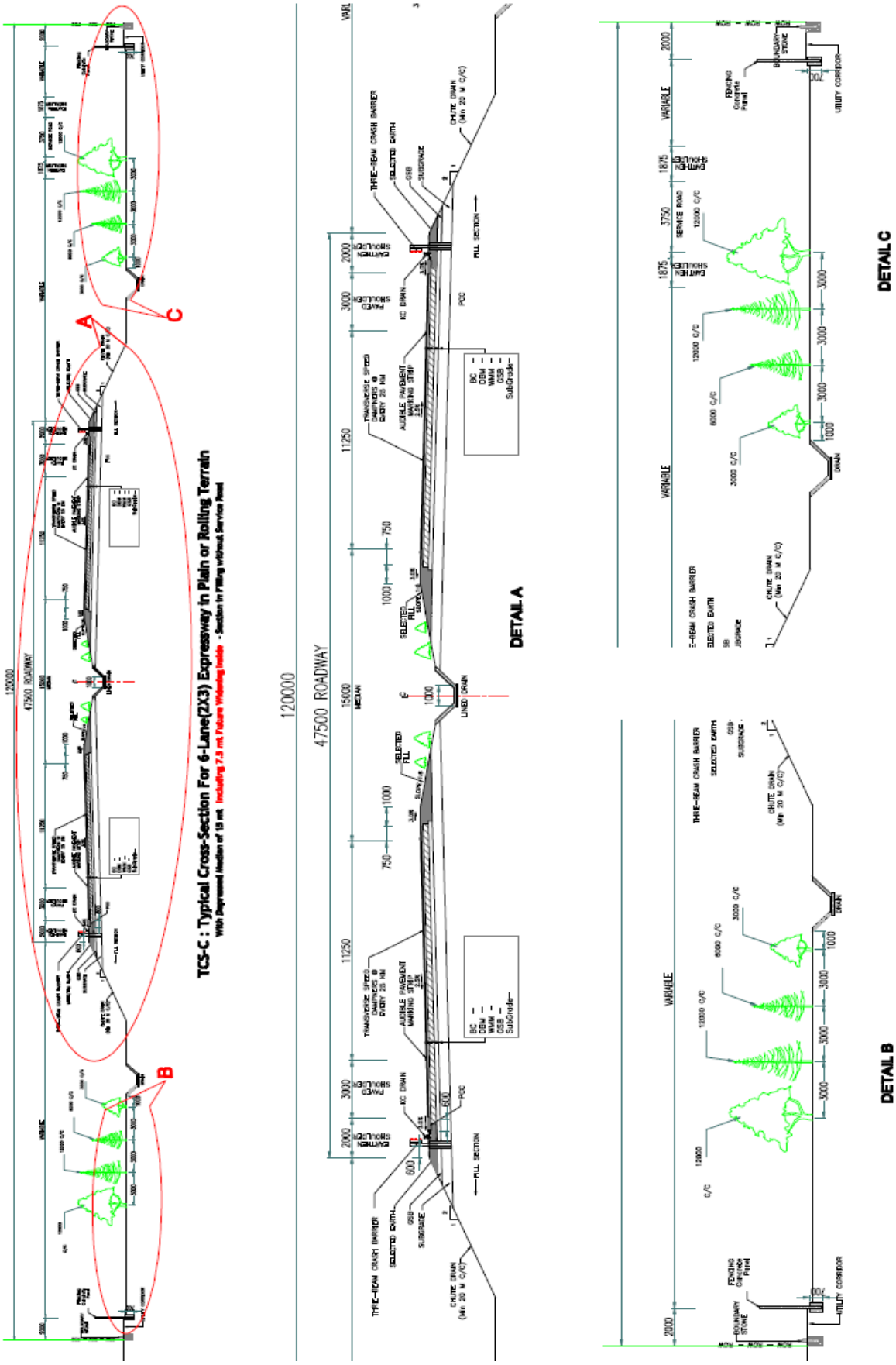

TCS-A2 : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
With Depressed Median of 15 mt Including 7.5 mt. Future Widening Inside - Section in Filling with Service Road of 7.00 m wide Right Side
120000
47500 ROADWAY
DETAIL A
DETAIL B
DETAIL C
A
B
C

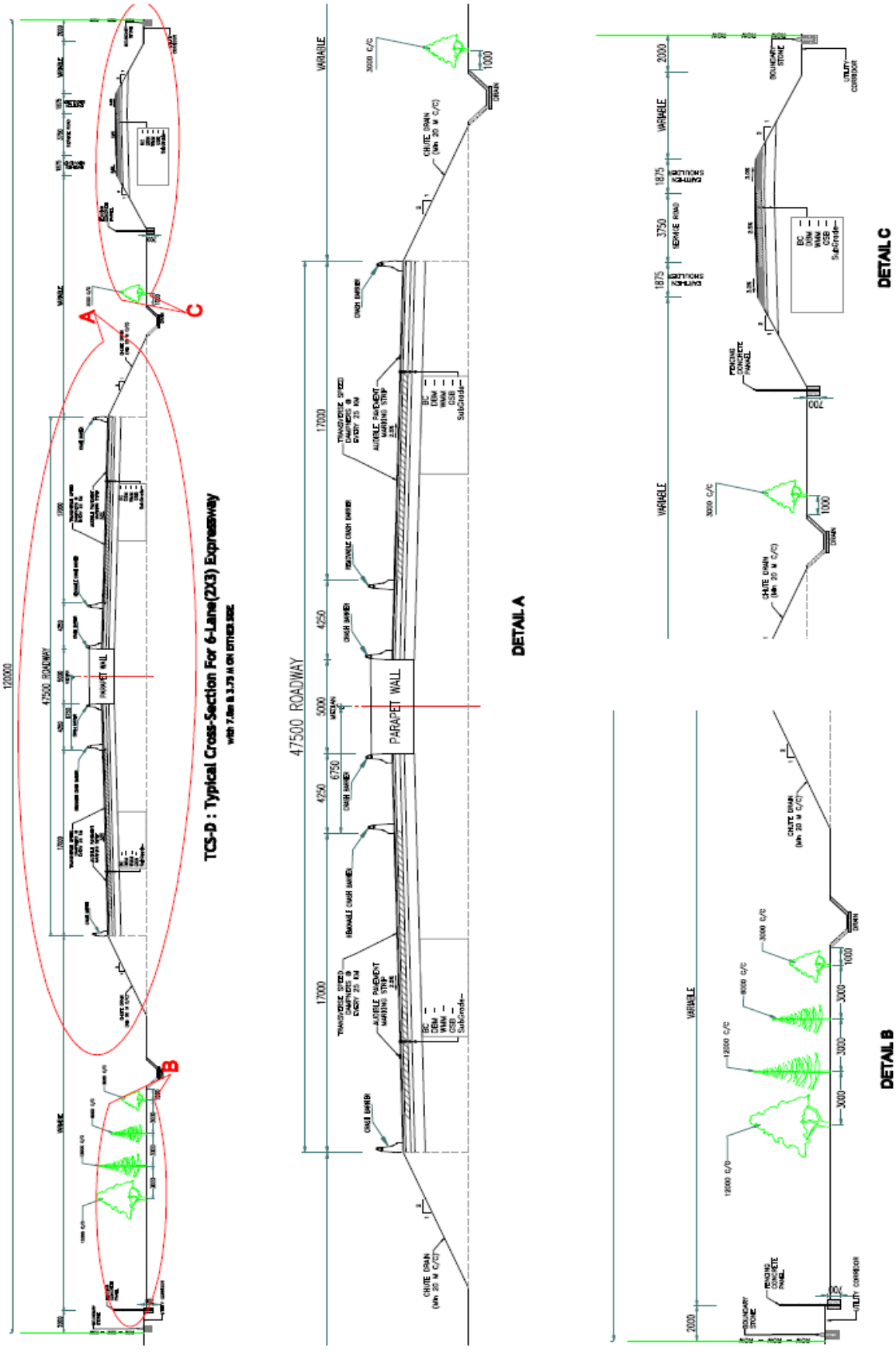

TCS-A3 : Typical Cross-Section For 6-Lane(2X3) Expressway In Plain or Rolling Terrain
47500 ROADWAY
120000
DETAIL A
DETAIL B
DETAIL C
A
B
C

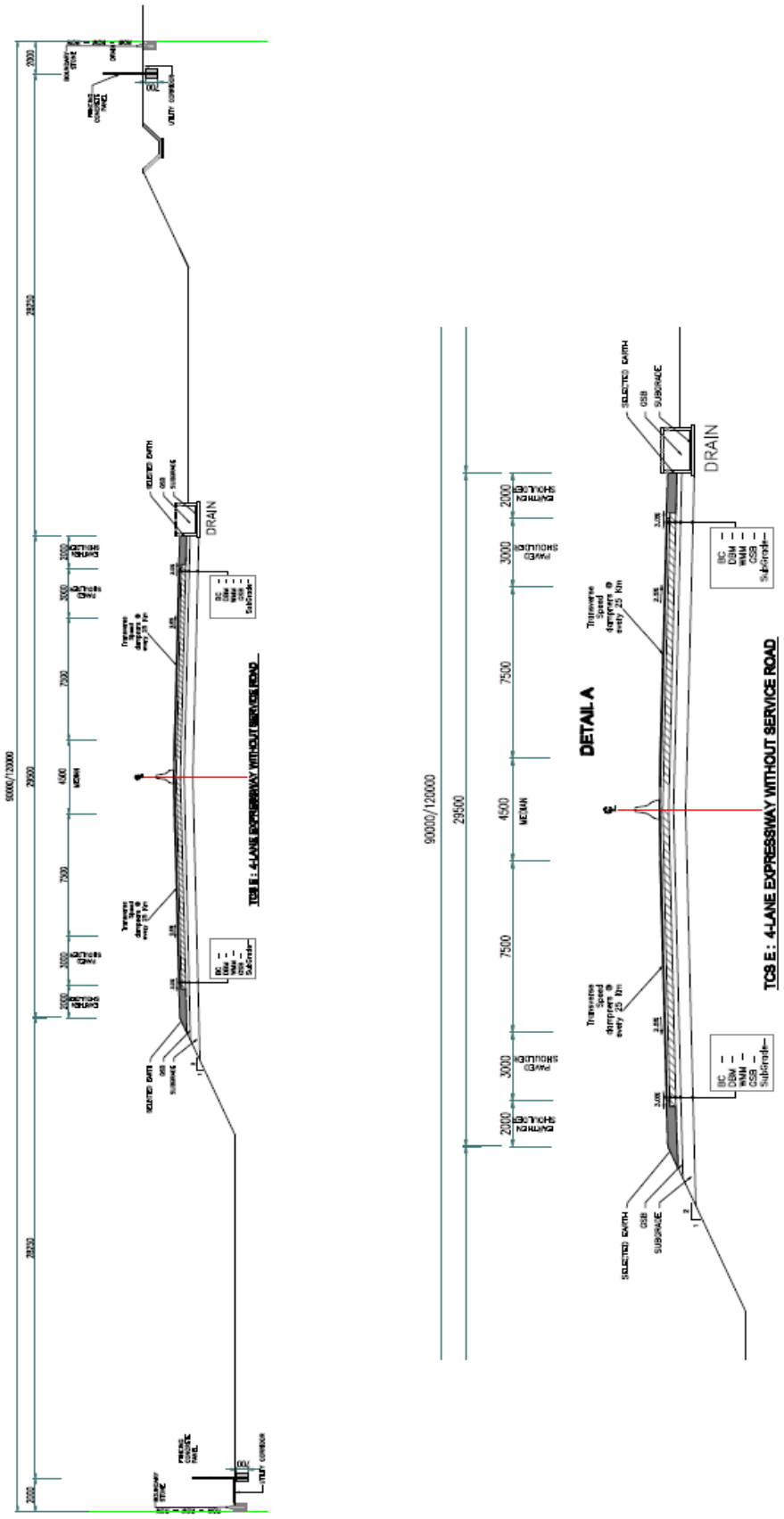

TCS- B1 : Typical Cross-Section For 6-Lane(203) Expressway in Plain or Rolling Terrain
With Depressed Median of 15 mt. including 7.5 mt Future Widening Inside - Section in Filling with Service Road of 3.75 m wide on Left Side
47500 ROADWAY
DETAIL A
DETAIL B
DETAIL C
A
B
C

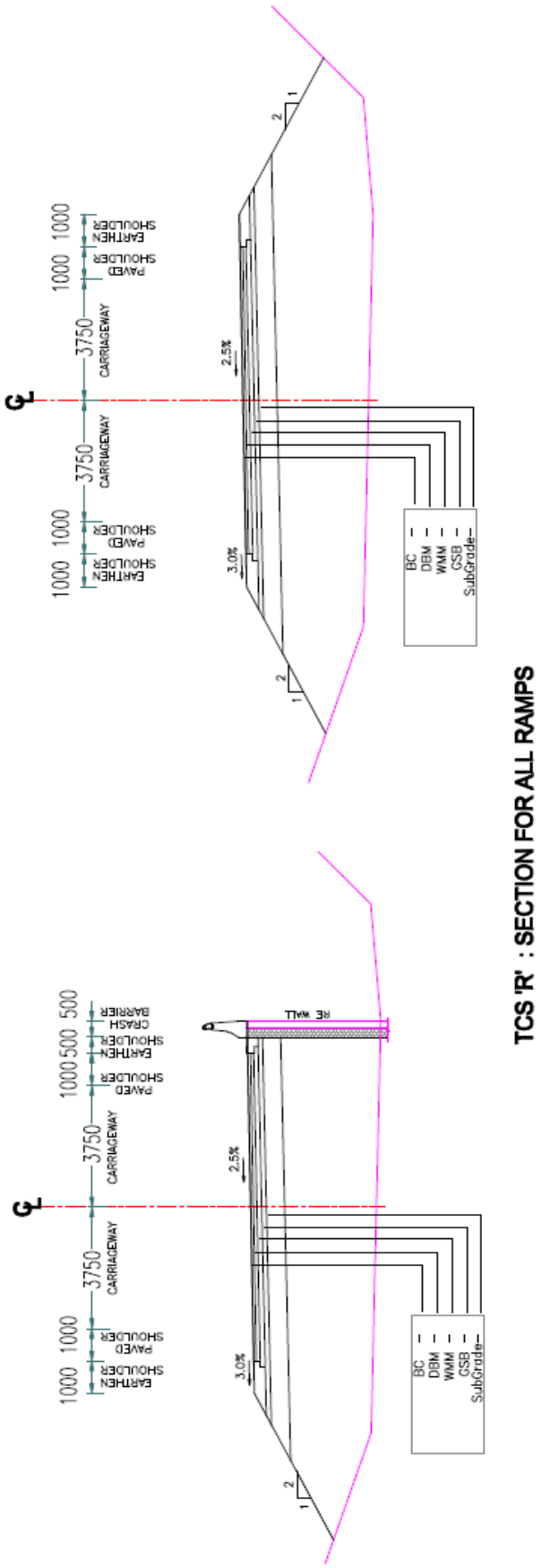

TCS-B2 : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
With Depressed Median of 15 mt. Including 7.3 mt Future Widening inside - Section in rolling with Service Road of 3.75 m wide at Right Side
120000
47500 ROADWAY
VARIABLE
DETAIL A
DETAIL B
DETAIL C
A
B
C


TCS-B3 : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
With Depressed Median of 15 mt Including 7.5 mt Future Widening Inside - Section in Filling with Service Road of 3.75 m wide in at Both Side
47500 ROADWAY
VARIABLE
DETAIL A
DETAIL B
DETAIL C
A
B
C

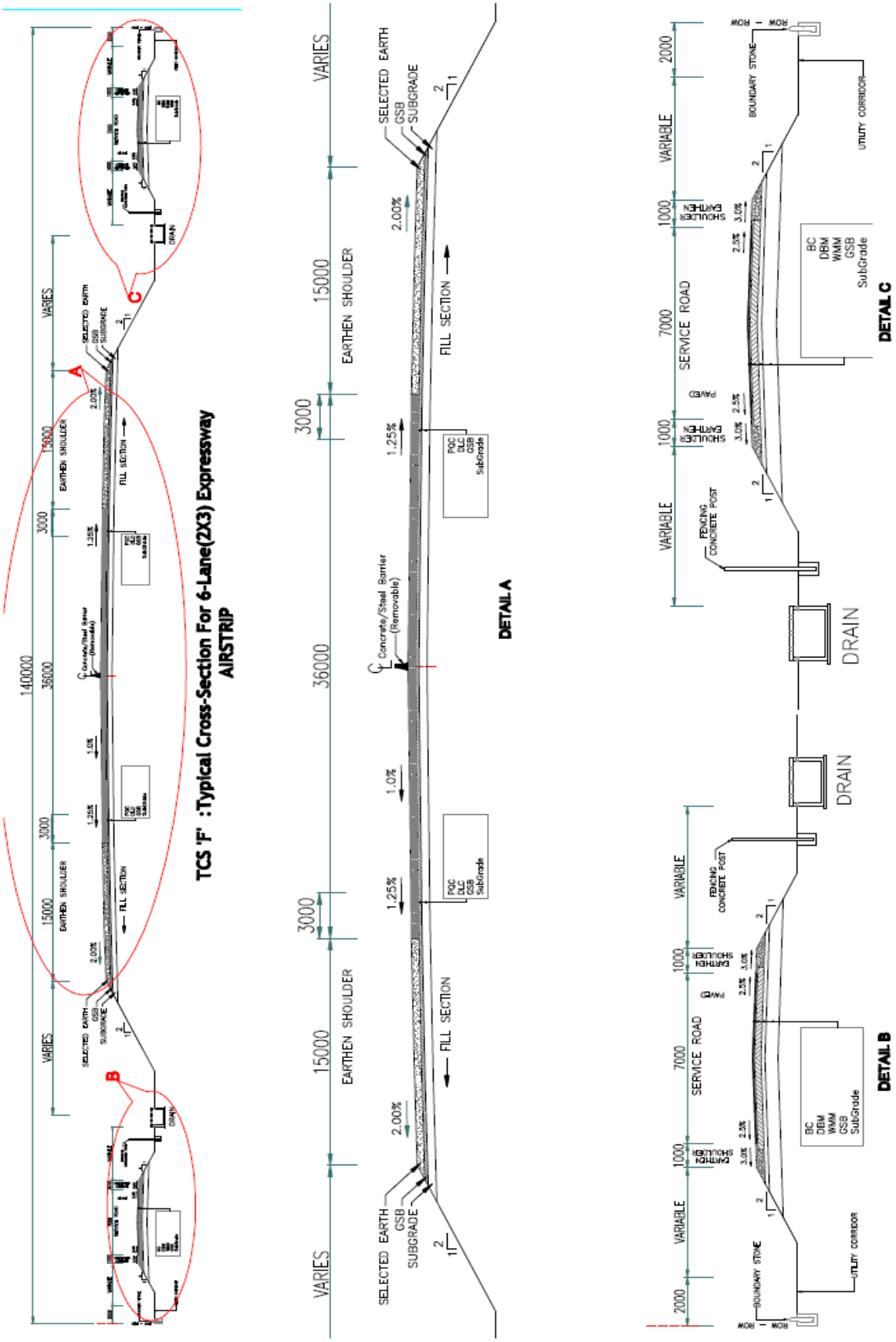

TCS-C : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
With Depressed Median of 19 mt Including 7.3 mt Future Widening Inside - Section in Filling without Service Road
120000
47500 ROADWAY
DETAIL A
DETAIL B
DETAIL C
A
B
C


TCS-D : Typical Cross-Section For 6-Lane(2X3) Expressway
47500 ROADWAY
PARAPET WALL
DETAIL A
DETAIL B
DETAIL C
VARIABLE
CHUTE DRAIN
FENCING CONCRETE PANEL
UTILITY CORRIDOR
BOUNDARY STONE
SERVICE ROAD
EARTH SHOULDER
BC
DBM
WMM
GSB
Subgrade


DRAIN
TCS E : 4-LANE EXPRESSWAY WITHOUT SERVICE ROAD
DETAIL A
90000/120000
29500
7500
4500
3000
2000
SELECTED EARTH
GSB
SUBGRADE



TCS 'R' : SECTION FOR ALL RAMPS


TCS 'F' :Typical Cross-Section For 6-Lane(2X3) Expressway
AIRSTRIP
DETAIL A
DETAIL B
DETAIL C
VARIES
EARTHEN SHOULDER
FILL SECTION
SELECTED EARTH
GSB
SUBGRADE
Concrete/Steel Barrier (Removable)
PQC
DLC
GSB
Subgrade
VARIABLE
SERVICE ROAD
DRAIN
FENCING CONCRETE POST
BOUNDARY STONE
UTILITY CORRIDOR
BC
DBM
WMM
GSB
SubGrade

0.22 TOLLING STRATEGY

- The closed tolling system needs to be adopted and implemented for the primary reason of amassing the maximum toll fee from the maximum number of commuters in order to adequately recover the project costs.
- Further, closed tolling system is also a transparent and authentic way of tolling as the commuter pays toll fee based on the distance travelled.
- Moreover, in a closed tolling system, the commuter has an advantage of commuting with minimum halts at only two locations namely, ingress and egress; whereas in the open tolling system, the commuter might have to stop at multiple locations.
- Additionally, a closed tolling system will reduce the fuel consumption of the vehicles by eliminating conventional deceleration and acceleration and cost of travel.

0.23 COST ESTIMATES & RATE ANALYSIS

This being a Project Report, cost estimate is carried out based on preliminary design. The project cost estimates have been prepared considering various items of works associated with the identified proposals. Package wise cost summary is given below:

Pkg. No.	Chainage (km)		Length	Cost		
	From	To		Civil Cost (Rs)	Civil Cost (Including 12% GST) (Rs)	Capital Cost (Rs)
I	7.9	56.9	49	₹ 16,929,753,704	₹ 18,961,324,148	₹ 38,979,027,289
II	56.9	86.9	30	₹ 12,770,047,611	₹ 14,302,453,325	₹ 22,75,65,45,374
III	86.9	137.6	50.7	₹ 15,529,406,218	₹ 17,392,934,964	₹ 30,203,705,174
IV	137.6	189.7	52.1	₹ 17,067,827,331	₹ 19,115,966,610	₹ 30,681,453,777
V	189.7	236.4	46.7	₹ 15,688,567,430	₹ 17,571,195,521	₹ 27,285,967,834
VI	236.4	289.3	52.9	₹ 17,564,234,099	₹ 19,671,942,190	₹ 30,811,919,833
VII	289.3	341.7	52.4	₹ 18,510,368,030	₹ 20,731,612,193	₹ 30,946,262,712
VIII	341.7	391.9	50.2	₹ 17,927,737,151	₹ 20,079,065,609	₹ 30,257,858,376
IX	391.9	445	53.1	₹ 15,445,750,470	₹ 17,299,240,526	₹ 27,551,565,374
X	445	496.8	51.8	₹ 16,585,292,104	₹ 18,575,527,157	₹ 29,345,599,143
XI	496.8	548.8	52	₹ 17,806,124,788	₹ 19,942,859,763	₹ 32,608,076,560
XII	548.8	601.847	53.047	₹ 15,844,814,925	₹ 17,746,192,716	₹ 32,616,027,055
Total			**593.947**	**₹ 197,669,923,861**	**₹ 221,390,314,772**	**₹ 341,287,463,127**

0.24 ECONOMIC & FINANCIAL ANALYSIS

Financial Viability Report & Economic Viability Report is attached separately as Volume-VII.

1. INTRODUCTION

1.1 GENERAL

During the last two decades India has witnessed significant improvements in road infrastructure. Highways can now facilitate higher speed and volume of transportation due to their increased capacity. Today road transport in India carries 65 per cent of freight and it has more than doubled over the last 20 years. This is despite about 45% lower freight cost of rail on per ton per km basis. In addition to freight, it also caters to 80% of passenger traffic.

Thus considering the trend of massive dependence of trade and commerce on roads, and the catalytic growth expected from the recent policies to boost manufacturing in India, the creation of increased high quality and efficient transport infrastructure system is extremely mandatory. Good roads bring about overall development in the region as it helps in the success of all developmental activities, be it in the sphere of movement of people or goods, development of agriculture, commerce, education, health and social welfare, or even maintenance of law and order and security.

The State of Uttar Pradesh (UP) is the most populous state in the country accounting for 16 per cent of the country's population. It is also the fourth largest state in geographical area covering 9.0 per cent of the country's geographical area, encompassing about 243 lakhs hectare land. Garlanded by the river Ganga and Yamuna, Uttar Pradesh is surrounded by Bihar in the East, Madhya Pradesh in the South, Rajasthan, Delhi, Himachal Pradesh and Haryana in the West and Uttarakhand in the North and Nepal touches the northern borders of Uttar Pradesh.

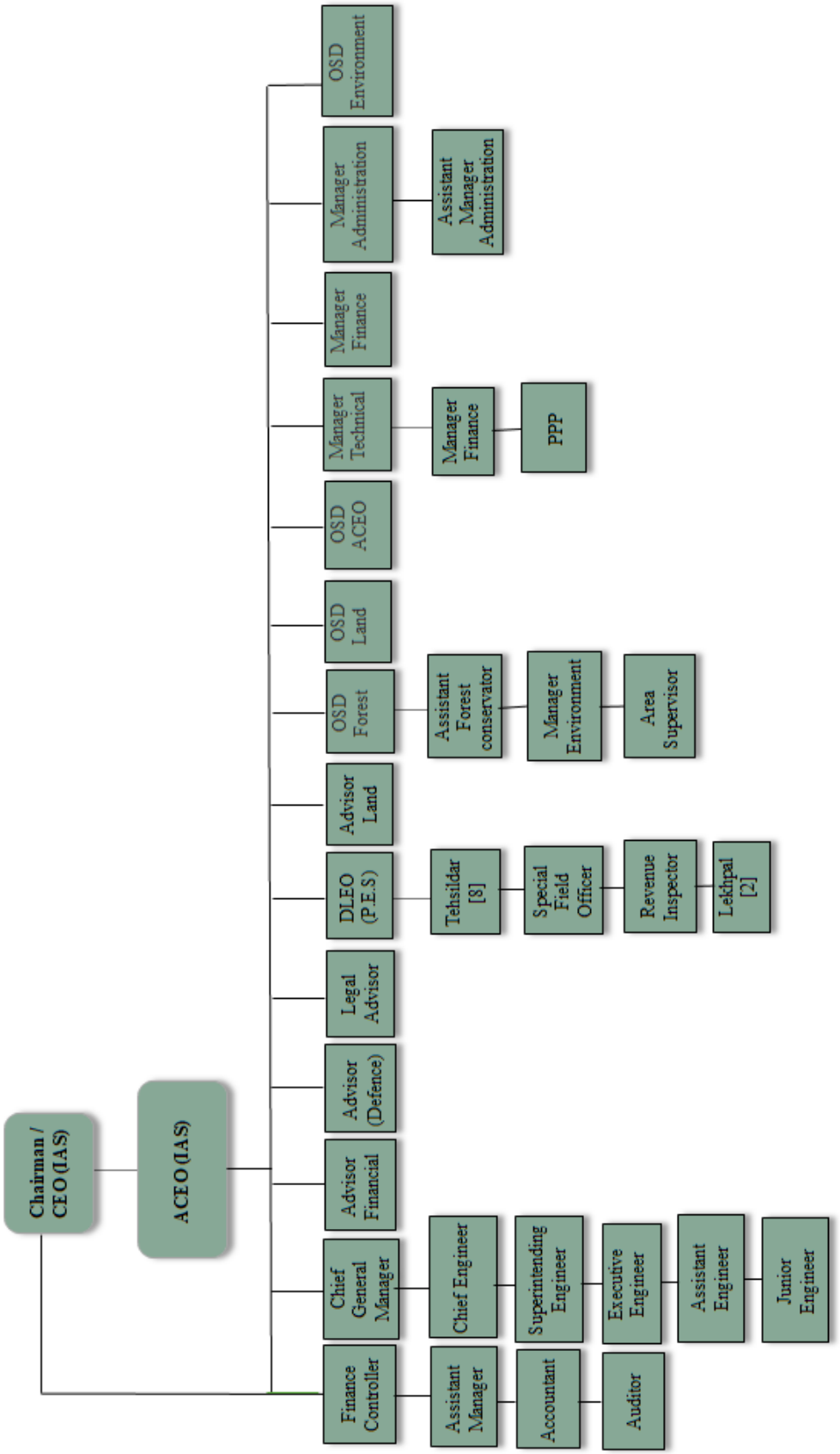
The Government of Uttar Pradesh has set up an Authority named "Uttar Pradesh Expressways Industrial Development Authority" (UPEIDA), under UP Industrial Area Development Act 1976, vide Notification Number 4246/77-4-07-94 Bha/07TC, dated December 27, 2007 issued by Industrial Area Development Department-4, Government of Uttar Pradesh.

1.2 ABOUT UPEIDA

Uttar Pradesh Expressways Industrial Development Authority (known by its acronym UPEIDA) was set up by the State Government under U.P. Industrial Areas Development Act 1976, in December 2007 for development of Expressways in Uttar Pradesh. This is a newly established Organisation with lean and laborious employee base, on contract or on deputation basis from State Revenue Department/PWD, among them few are deployed on retainership basis or by service provider.

1.2.1 UPEIDA Organisational Structure

An organizational structure is a system that outlines how certain activities are directed in order to achieve the goals of an organization. These activities can include rules, roles, and responsibilities. The organisational structure of UPEIDA is given below:


UPIEDA ORGANISATIONAL STRUCTURE
Chairman / CEO (IAS)
ACEO (IAS)
Finance Controller
Chief General Manager
Advisor Financial
Advisor (Defence)
Legal Advisor
DLEO (P.E.S)
Advisor Land
OSD Forest
OSD Land
OSD ACEO
Manager Technical
Manager Finance
Manager Administration
OSD Environment
Assistant Manager
Accountant
Auditor
Chief Engineer
Superintending Engineer
Executive Engineer
Assistant Engineer
Junior Engineer
Tehsildar [8]
Special Field Officer
Revenue Inspector
Lekhpal [2]
Assistant Forest conservator
Manager Environment
Area Supervisor
Manager Finance
PPP
Assistant Manager Administration

1.2.2 Expressway Projects by UPEIDA

Expressway Projects executed/ under execution by UPEIDA so far are as under:

(a) Agra-Lucknow Expressway

This Greenfield Expressway project is 302.22 km long, starts from Agra passes through Firozabad, Mainpuri, Etawah, Auraiya, Kannauj, Kanpur Nagar, Unnao, Hardoi and ends at Lucknow districts. The expected travel time from Agra to Lucknow shall be reduced to 4 hours. The width of the Expressway is 6 lanes (expandable up to 8 lanes with all structured as 8 lanes) with a design speed of 120 km per hour. Inauguration of this expressway has been done on 21.11.2016 and at present this Expressways is operational.


(b) Purvanchal Expressway

This Greenfield Expressway project is 340.824 KM long, starts from Lucknow passes through districts Barabanki, Ayodhya. Amethi, Sultanpur, Ambedkarnagar, Azamgarh, Mau and ends at Ghazipur. Purvanchal Expressway 6 lane (expandable to 8 lane with all structures as 8 lane) Access Controlled expressway project with design speed of 120 km/h. This Expressway is under construction and expected to be operational at the end of year 2020.

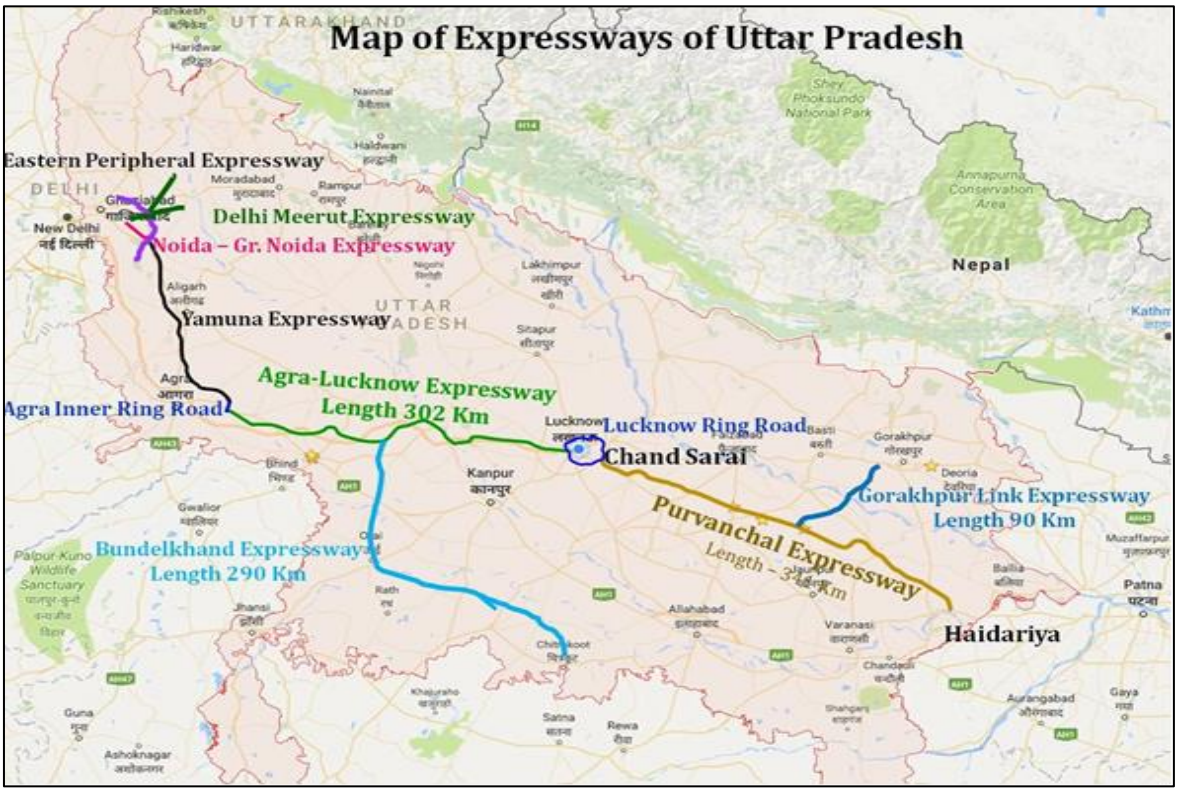
(c) Bundelkhand Expressway

This Greenfield Expressway project is 296.07 KM long, starts from Chitrakoot passes through districts Banda, Mahoba, Hamirpur, Jalaun, Auraiya and ends at Agra-Lucknow Expressway in

district Etawah. Bundelkhand Expressway is 4 lane (expandable to 6 lane with all structures as 6 lane) Access Controlled expressway project with design speed of 120 km/h. This Expressway is under construction and expected to be operational by the year 2022.

(d) Gorakhpur Link Expressway

This Greenfield Expressway project is 91.352 KM long, starts from Gorakhpur passes through districts Ambedkar nagar, Sant Kabir nagar and ends at Purvanchal Expressway in district Azamgarh. Gorakhpur Link Expressway is 4 lane (expandable to 6 lane with all structures as 6 lane) Access Controlled expressway project with design speed of 120 km/h. This Expressway is under construction and expected to be operational in the year 2022.

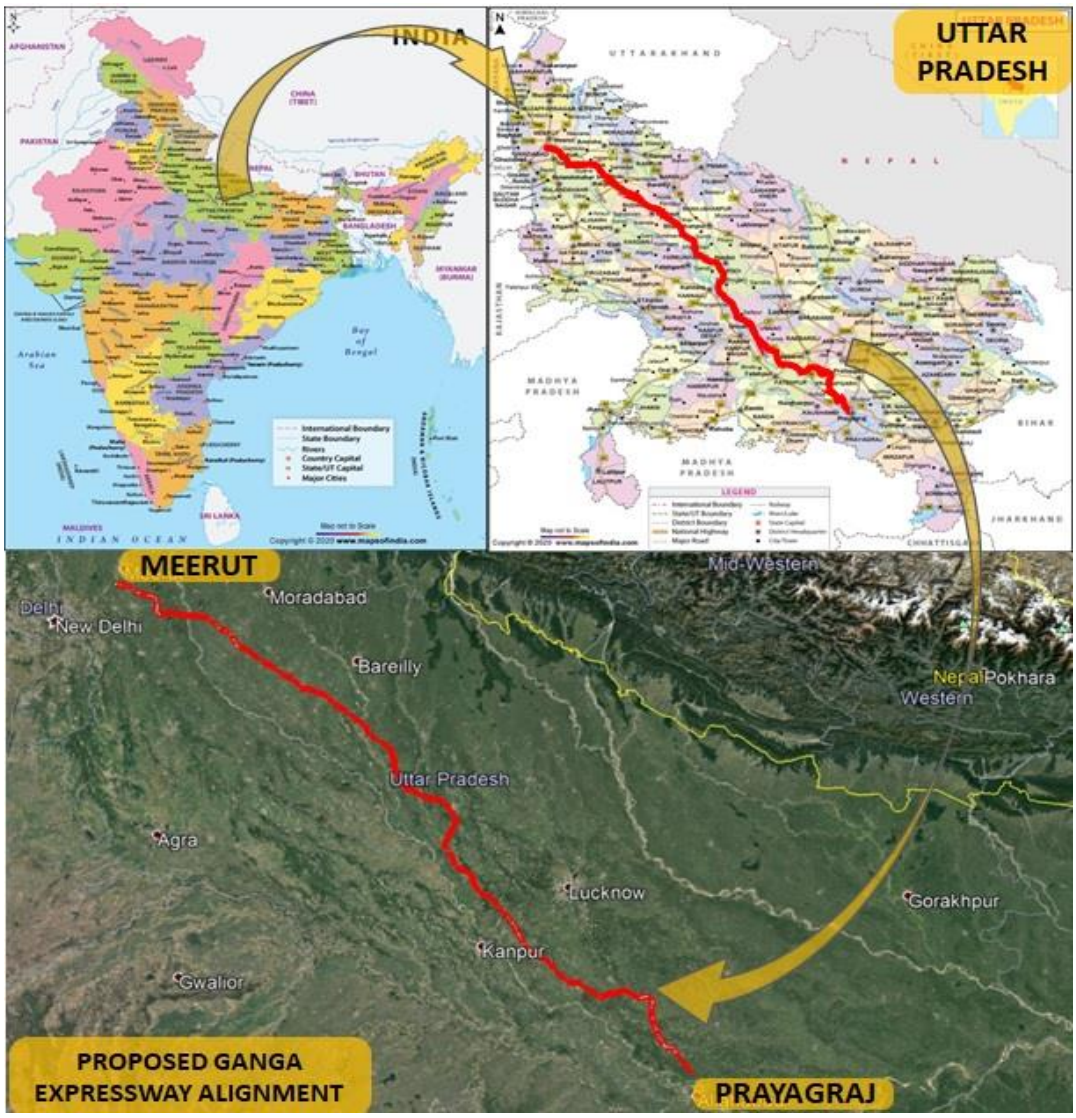


1.3 NEWLY PROPOSED GANGA EXPRESSWAY (THE PROJECT)

The proposed "Ganga Expressway" is Access Controlled Expressway (Green Field) Project which will connect Meerut to Prayagraj. This proposed Expressway project shall create immense opportunities to the people of Western & Central region of the State and over all development of the State by providing safer & faster connectivity from East to West borders of the State and with National Capital and NCR Region.

The project will provide direct high speed connectivity from National Capital Region through proposed expressway to Meerut and then onwards to Prayagraj. It will facilitate construction of all-weather high speed access controlled expressway, which will decongest the increasing traffic on existing road network. The expressway will also decrease travel time substantially.

Index Map showing proposed Ganga Expressway alignment is presented below:



Index map of Ganga Expressway

The Uttar Pradesh Government has decided to develop the "Ganga Expressway Project". UPEIDA is committed for the development of this expressway and has Entrusted M/s L N Malviya Infra Projects Pvt. Ltd., Highway Engineering Consultant and Intratech Civil Solutions (Consortium) to carry out the detailed project report to implement the project on an appropriate Mode and selection of developers through competitive bidding process.

The Consultant has undertaken requisite surveys & studies for the project which includes costing to assess technical, environmental and social assessment studies, their analysis etc. As a part of the study to establish the viability, this Project Report has been prepared after carrying out engineering surveys and appropriate assessment of a preliminary design considering the engineering conditions, the present traffic and its growth, the environmental impact assessment as well as the social aspects along with cost assessment. This report among other aspects covers the details on finalization of alignment, grade separator interchanges and structures along the proposed Expressway, marking on the Khasra maps of ROW and marking of alignment on

revenue maps, identification of Tourist spots, eco-friendly structures, water bodies etc. along the expressway.

1.4 OBJECTIVE

The objective of this consultancy (the "Objective") is to undertake feasibility study and prepare a 'Detailed Project Report' of the Project Expressway.

1.5 SCOPE OF CONSULTANCY SERVICES

(a) Preparation of feasibility report having different alignment options conforming to expressway Geometric Standards and also showing their merits & demerits so that most appropriate Alignment can be selected.

(b) Traffic surveys and demand assessment.

(c) Engineering surveys and investigations.

(d) Location and layout of toll plazas, truck lay byes, bus bays and bus shelters, public utilities, restaurant, workshops, PCO etc.

(e) Social and Environmental impact assessment including providing all assistance in obtaining necessary clearances including Forest, Wild-Life & Environment Clearance from GoUP/GoI.

(f) Designs of Road/Bridges/Structures/interchanges etc.

(g) Preparation of detailed cost estimates on the basis of designs & Bill of Quantities.

(h) Detailed cost of shifting and relocation of utilities (duly authenticated by the competent authority in the department owning the Utilities), land acquisition, removal of encroachments and rehabilitation etc.

(i) Evaluating the financial viability/economic analysis of the project.

(j) For SELECTED mode the consultant shall have to suggest the possible modes of financing of the project and help the Authority/ Government to arrange funds from external resources, if required. For PPP mode, the consultant shall have to assist the Authority in getting the VGF. For other modes, necessary assistance for the funding of the project shall have to be provided by the consultant.

(k) Preparation of bid documents for selection of prospective "Developer(s)/Contractor(s)" including all schedules of the Agreement.

(l) Finalization of Expressway Packages and evaluating their detailed costs separately and including measurements of different items, analysis of rates based on prevalent PWD rates, BOQ including Costing of Structures, Toll Plaza, utility areas etc. and for evaluation of the Financial viability of Project separately for each distinct package as well as the complete Project as a whole.

(m) The Project is to be bidded out in a way so that the Bidders may have an option of bidding for individual packages/ combination of packages/ Complete Project.

(n) Preparation of supporting information to assist bidders in preparation of their bids, and where relevant, creation of a data base and management access to the data base.

(o) Support to communication with the prospective bidders and interaction with them, including managing and responding to requests for clarification.

(p) Preparation of a bid evaluation plan, assistance in evaluation and preparation of evaluation reports.

(q) Assistance in negotiation with one or more parties prior to contract award, if required.

(r) Monitoring and advice on bidder performance against any conditions precedent to financial close; and

(s) Providing assistance in obtaining necessary clearances from the Forest Department which includes preparation of proposal for clearance under Forest Conservation Act., counting & marking of trees, joint inspection with Forest Department officials etc.

(t) Preparation of TOR, Bid Documents, Contract Agreement for selection of Authority's Engineer, Project Management Consultant (PMC) and Safety Engineer etc. as per requirement and facilitation of Authority in their selection and appointment.

1.6 CONSULTANT'S APPROACH

The Consultant's approach to the project is in accordance with the "Description of Services" given in the Contract Document, understanding of the project objectives and further discussions with the Client during progress of the project study. The main approach of this consultancy service comprise of the following:

(a) The Greenfield alignment is within the proposed Right of Way (ROW);

(b) The most economical but sound proposal is arrived at for the required roadwork and related bridge works;

(c) Engineering, economic, environmental and social feasibility studies of the proposed road improvements are carried out keeping in view of several important aspects of project execution.

(d) International "best practices" including use of "State of the art" and computer based survey and design techniques (e.g. GPS, Total Station Survey, LiDAR, Computer Aided Designs (MX/MOSS/Equivalent etc.) is incorporated for preparation of the technical proposal, development of designs, cost estimates, bid documents etc.;

(e) Preliminary designs of the agreed road and related bridge works is prepared, as a basis for completing Environmental Impact Assessment (EIA) shall be prepared;

(f) Reports and analysis shall be provided, suitable for meeting the standards and specifications laid down according to Ministry of Road Transport and Highways (MORTH), Government of India requirements on environmental and social assessment.

1.7 STRUCTURE OF DETAILED PROJECT REPORT

The Detailed Project Report has been divided in following volumes:

Volume-I: Main Report

Volume-II: Cost Estimates

Volume-III: Rate Analysis

Volume-IV: Design Report

Volume-V: Technical Specifications

Volume-VI: Investigation Reports

(a) Report on traffic survey and demand assessment

(b) Soil, geotechnical and drainage report

(c) Social Impact Assessment Report

(d) EIA Report and Environmental Management Plan

Volume-VII: Financial Analysis & Economic Analysis

Volume-VIII: Drawings (Highways, Structures & Miscellaneous)

Volume-IX: Land Acquisition Reports & LA Plans

Volume-X: Report on Project Clearances

2. PROJECT DESCRIPTION

2.1 GENERAL

Uttar Pradesh is a state in northern part of India. It was formed on 1 April 1937 as It was created on 1 April 1937 as the United Provinces of Agra and Oudh during British rule, and was renamed Uttar Pradesh (UP) in 1950. The state is divided into 18 divisions and 75 districts with the capital being Lucknow. On 9 November 2000, a new state, Uttarakhand, was carved out from the state's Himalayan hill region.

The two major rivers of the state, the Ganges and Yamuna, join at Allahabad and flow further east as Ganges. Other prominent rivers are Gomti and Varuna. Hindi is the most widely spoken language and is also the official language of the state, along with Urdu.

From population, political awareness, historical and cultural heritage and freedom movement points of view, Uttar Pradesh is a very important state of the country. As much as 16.17% of India's population lives in the state. Geographically, it acquires 5th position after Rajasthan, Madhya Pradesh, Maharashtra and Andhra Pradesh and covers 7.3% land area of India. Area wise it covers 240.928 square Kilo meters. For administrative convenience, it has 18 divisions, 75 districts, 915 urban bodies, 8135 Nyaya Panchayats. 13 Municipal corporations, 226 municipal boards, 59163 gram sabhas, 822 development blocks, 97941 populated villages 180000 post offices and 2885 telephone exchanges.

Uttar Pradesh sends 80 members to Lok Sabha, 31 members to Rajya Sabha and 404 members to its Legislative Assembly and 100 members to its Legislative council.

It is pertinent to mention that the strength of work force in the state is 23.7%, out of which 65.9% are farmers and 5.6% are industrial workers. Its per capita income is Rs. 13,262 as per existing rate.

Area	240928 square K.M.
No. of districts	75
Total population (year 2011)	199812341
Male	104480510
Female	95331831
Population growth during 2001-2011	33614420
Decline in population rate during 2001-2011	20.29%
Density of population (per sq. km)	829
Sex ratio	912:1000
percentage of children population in the age group of 0-6 years	
Total children	18.35%
Boys	18.18%
Girls	18.54%
Literacy among in the age group of 7 years and above (2011)	
Total	69.72%
Male	79.24%
Female	59.26%

2.2 PROJECT BACKGROUND

After Successful Preparation/ Execution of various Expressway Projects viz. Yamuna Expressway, Agra-Lucknow Expressway, Purvanchal Expressway & Bundelkhand Expressway, the Uttar Pradesh Government has decided to develop the "Ganga Expressway Project".

The project will provide direct high speed connectivity from National Capital Region through proposed expressway to Meerut and then onwards to Prayagraj. It will facilitate construction of all-weather high speed access controlled expressway, which will decongest the increasing traffic on existing road network. The expressway will also decrease travel time substantially.

UPEIDA is committed for the development of this expressway and has entrusted M/s L N Malviya Infra Projects Pvt. Ltd., Highway Engineering Consultant and Intratech Civil Solutions (Consortium) to carry out the detailed project report to implement the project on EPC Mode and selection of developers through competitive bidding process.

The Consultant has undertaken requisite surveys & studies for the project which includes costing to assess technical, environmental and social assessment studies, their analysis etc. As a part of the study to establish the viability, this Project Report has been prepared after carrying out engineering surveys and appropriate assessment of a preliminary design considering the engineering conditions, the present traffic and its growth, the environmental impact assessment as well as the social aspects along with cost assessment. This report among other aspects covers the details on finalization of alignment, grade separator interchanges and structures along the proposed Expressway, marking on the Khasra maps of ROW and marking of alignment on revenue maps, identification of Tourist spots, eco-friendly structures, water bodies etc. along the expressway.

2.3 PROJECT DESCRIPTION

The The proposed Ganga Expressway **(CH 7+900)** starts from km 16+000 of Meerut-Bulandshahar (NH-334) near village Bijoli in District Meerut & terminates at Prayagraj Bypass on NH-19 near village Judapur Dando (Dist. Prayagraj) **(CH 601+847)**.

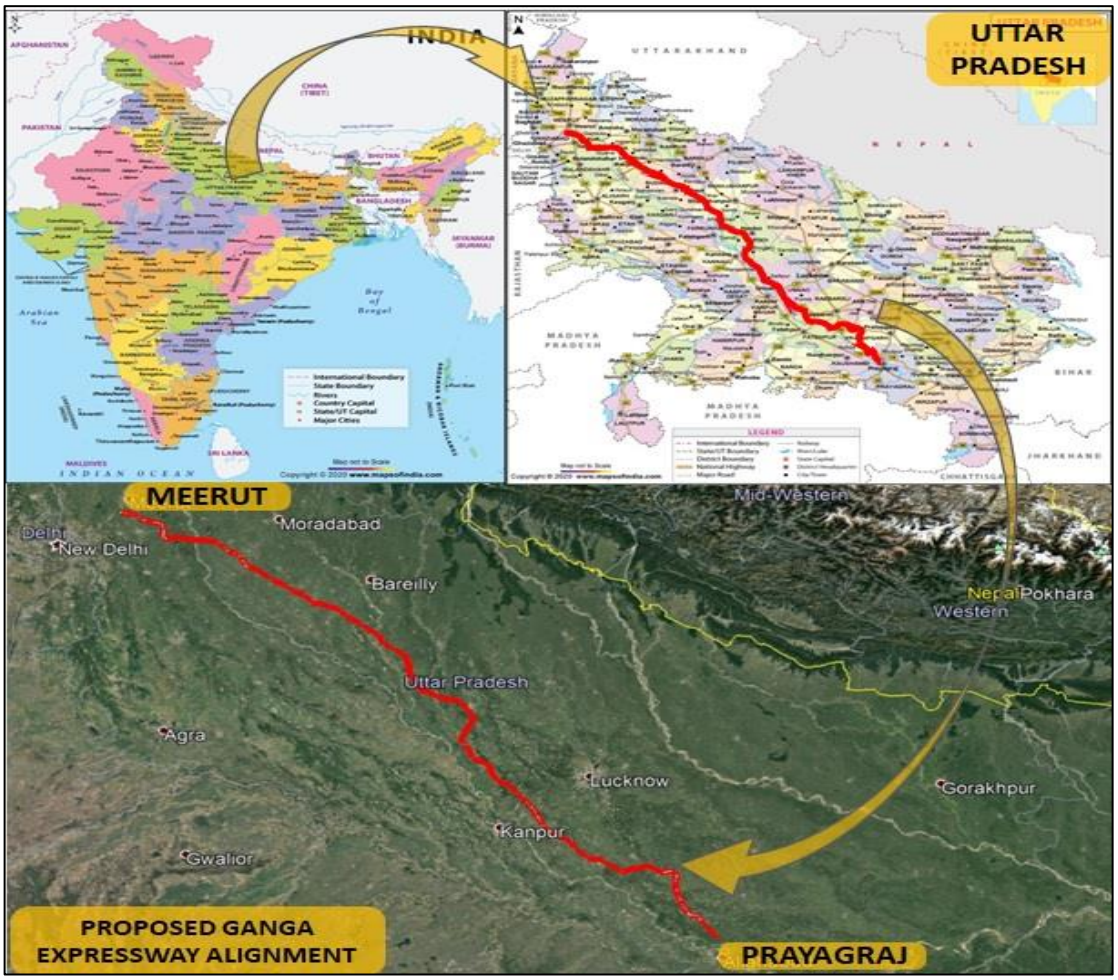
The length of the proposed expressway alignment is **593.947 km**.

The proposed expressway has been divided into 12 packages. The chainage wise details of the packages have been given below:

Package No.	Section Details	Chainage (km)		Length
		From	To	
I	From Village Bijoli (Dist. Meerut) to Village-Chandner (Dist. Hapur)	7.900	56.900	49.000
II	From Village-Chandner (Dist. Hapur) to Village-Mirzapur Dugar (Dist. Amroha)	56.900	86.900	30.000
III	From Mirzapur Dugar (Dist. Amroha) to Village-Nagla Barah (Dist. Budaun)	86.900	137.600	50.700
IV	From Village-Nagla Barah (Dist. Budaun) to Village-Binawar (Dist. Budaun)	137.600	189.700	52.100
V	From Binawar (Dist.Budaun) to Girdharpur (Dist. Shahjahanpur)	189.700	236.400	46.700

Package No.	Section Details	Chainage (km)		Length
		From	To	
VI	From Village- Girdharpur (Dist. Shahjahanpur) to Village-Ubariya Khurd (Dist. Hardoi)	236.400	289.300	52.900
VII	From Village-Ubariya Khurd (Dist. Hardoi) to Village- Pandra Lakhanpur (Dist. Hardoi)	289.300	341.700	52.400
VIII	From Village- Pandra Lakhanpur (Dist. Hardoi) to Village-Raiyamau(Dist. Unnao)	341.700	391.900	50.200
IX	From Village- Raiyamau (Dist. Unnao) to Village-Sarso (Dist. Unnao)	391.900	445.000	53.100
X	From Village- Sarso (Dist. Unnao) to Village-Terukha (Dist. Raebareli)	445.000	496.800	51.800
XI	From Village-Terukha (Dist. Raebareli) to Village-Arro (Dist. Pratapgarh)	496.800	548.800	52.000
XII	From Village- Arro (Dist. Pratapgarh) to Village-Judapur Dando (Dist. Prayagraj)	548.800	601.847	53.047
Total				**593.947**

The project Index Map is Shown below:



3. METHODOLOGY & DESIGN STANDARDS

3 General

All the services are carried out strictly as per ToR. The Guidelines for Expressway published by Ministry of Road Trans-port and Highways (MoRT&H) have been followed for preparing this Project Report. Specific Codes and Guidelines of the IRC and publications of the MoRT&H including circulars & general/special publications, technical Specifications & Standards have also been considered. All the field activities have been completed as discussed in detail with Authority.

For Topographic survey latest electronic instruments like Differential Global Positioning System (DGPS), RTK GPS and Total Station were used. Data was collected as per formats and procedures approved by the MoRT&H and analyzed using in-house developed software. MX Roads software for the highway designs and STADD-proV8i for the structure designs are used. For the pavement designs standard software/programs developed in-house have been used.

In depth consultation process with UPEIDA was held on a regular basis to enhance the progress of the work. As time and quality are the essence of the project, before any analysis and designs, all the parameters to be used were got approved by the Client during preparation of draft reports so there is minimum changes later on, i.e. minimum time requirement in the finalization of final reports without compromising quality.

The idea is to seek prior approval from client through meeting/discussion on Inception, alignment finalization, bid evaluation, pre-bid conference etc. Similarly, various traffic scenarios will be developed and presented to client for discussion and approval.

3.1 Design Basis

The broad methodology has been developed keeping standard practices / IRC guidelines, with certain additions and modifications as felt necessary.

3.2 Review of Earlier Reports

The Consultants have collected and reviewed the relative study reports to have a better understanding of the project & also for getting some inputs as a part of the services. The study reports thus considered for review are:

1. Concept Report for Development of Purvanchal Express-way (Green Field) Project.
2. Road development plan in the region by UPEIDA.
3. Any useful details relevant for the project available with the Client/ Other agencies have been collected. Other details are also collected and collated to form recommendations by considering the following inputs:
    - Material details
    - Soil Test results
    - Geo-technical investigation reports
    - Topographic survey details / Bench mark details and other survey information
    - Utility Services/Utility Relocation Plans
    - Traffic Studies

- Tree plantation records
- Hydrological and Hydraulic details
- Development Plans for major towns and areas along the project road
- Availability of construction materials and unit rates for work items
- Recent acquisition rates for different types of land/immovable properties
- Right of Way Details from Revenue maps

3.3 Socio-Economic Profile

Socio-economic profile of the influence area is prepared, after study of data on growth of population and density, human settlement pattern, land use, sub-profiles of agriculture and industries, economic base, trends in socio-economic indicators, development scenarios for various sectors, transport infrastructure and its uses such as use of waterways & rail transport etc.

The relevant data is collected from the following sources:

- State Statistical Abstracts
- State Year Books

Census Publications – Districts and State

- Hand Books of Statistics of Districts in the area of influence
- Economic Surveys of the State constituting the zone of influence
- The Bureau of Economics & Statistics of Uttar Pradesh

3.4 Traffic Survey, Analysis and Projections

Traffic surveys include (only those surveys would be carried out which are required for correctly forecasting the traffic along the proposed road):

- Classified Traffic Volume Counts
- Origin – Destination and commodity Movement Surveys

Standard procedures given in IRC Codes have been followed for carrying out Traffic Surveys. The data arrived from the Surveys has been analyzed to determine ADT of surrounding roads of the proposed project road and travel characteristics.

Growth of traffic in project road influence area and also on the project road is regarded as the most important aspect since the whole project design is based on this. To establish the realistic growth rates, road transport data, population growth rates and socio-economic parameters have been studied and analyzed. The growth rates for passenger vehicles have been worked out on the basis of annual growth rate of population and per capita income while the growth rates of freight vehicles have been based on the rate of growth in agricultural, industrial and tourism sectors and historical traffic data. These growth rates have been used to arrive at the traffic projections for the design period. After the development of project corridor to six lane standard configuration, greater amount of traffic is expected to be diverted from the peripheral road network. Appropriate traffic diversion models have been used for assessment of diverted traffic to this road. Details on traffic data & projections have been discussed in Chapter 4 of this Report.

3.5 Engineering Surveys and Investigations

3.5.1 Reconnaissance Survey of the Project Road

Reconnaissance survey has been carried out immediately before the kick off meeting to examine the general characteristics of the Project Corridor. Consultants have undertaken a site visit along with the experts in the field of Highway, Pavement and Bridge Engineering. This has helped in the detailed appreciation of the project corridor in terms of traffic and other engineering measures and judicious assessment of the following salient factors have generally been made:

- Topography of the area
- Terrain and soil conditions
- Climate and Rainfall
- Drainage Characteristics
- Traffic patterns and preliminary identification of traffic homogeneous sections of road.
- Railway lines and other critical utilities/services having impact on road alignment
- Land use (agricultural, build-up, forest land, etc.,)
- Environmental factors
- Availability of materials
- Any other useful information

The findings are described in the following paragraphs;

3.5.2 Topographic Surveys

Topographic survey has been carried out along the proposed alignment to know the topography, natural and manmade features present within the proposed ROW and to assess the existing geometric deficiencies along with land use plan. The survey has been carried out only after establishing horizontal and vertical control grids. Horizontal grid has been established through DGPS points and been erected at every 5 km interval. For vertical grid, bench mark has been erected at every 250m interval and connecting these to the nearest BM of Survey of India.

Selection of primary Control Points and Observations is as detailed below:

- These are located on the edge of the proposed right of way (ROW) at inter-visible locations at every 5 km.
- These are, as far as possible, on either side of 5 km stone so that it can be identified easily in the field and an arrow has been painted on the existing road indicating their location. They are recorded in separate field with their three dimensional locations.
- The stations selected are free from obstruction towards sky at an angle of 15° with horizontal plane.
- The horizontal control station is established on nail fixed in centre of RCC (M15) pillar of size 15 cm x 15 cm x 45 cm embedded in concrete M10 (5 cm all around) up to a depth of 30 cm and the balance 15 cm above the ground painted yellow.

- The Primary Control Stations are fixed using DGPS Trimble make instrument. The time of observations at Base Stations is observed for a minimum of 30 minutes and at Reference Stations for 20 minutes or longer if instrument signal is not indicating sufficient data received, to eliminate the possible projection and time errors in the signals received from various satellites being observed at respective locations in order to ensure high accuracy in the positioning of control stations within + 20 mm.
- Minimum of 6 satellites are available during observation to ensure high accuracy Secondary control stations are established at 2 km intervals using Total Station and through closed traverse distributed linearly running between two nearest Primary Control Stations ensuring accuracy in the order of $12\sqrt{K}$ in mm, where 'K' is the distance in kilometers between two primary control stations. Any errors within permissible limits are distributed in rational manner to establish the accurate and effective horizontal control grid. These are established on reference pillars having configuration similar to primary control station with an arrow painted on the surface of existing road indicating their location.

3.5.2.1 Pillar Construction

Benchmark pillars at every 1000m along the route within the ROW have been constructed. All these pillars will have to be furnished with X, Y, Z co-ordinates. The pillars are of size 150 x 150 x 600mm long. The pillar is concreted and embedded in a manner that 150mm is remain above ground. A steel rod has been fixed in the centre for punching the point and finally these are to be painted yellow.

3.5.2.2 Total Station Traverse

A closed traverse is run for a loop length of 5 km. While traversing, station is established 200 to 250mts apart. The pillars constructed along the route are connected. These points are further used for detailed survey. The minimum accuracy of this survey is 1:10,000.

3.5.2.3 Bench mark

These are located, as far as possible, along the proposed right of way (ROW) boundaries at an interval of 250 m with BM No. marked on it with red paint.

- Bench Mark pillar is of size 15 cm x 15 cm x 45 cm cast in RCC M15 with a nail fixed in the centre of the top surface and embedded in concrete M10 (5cm all around) up to a depth of 30 cm. The balance 15 cm above the ground is painted yellow.
- An arrow indicating the location of the BM is painted on the road with the permanent yellow paint and recorded in separate field books with its three dimensional location.

The Bench Mark is established using high accuracy Digital Level and Bar coded staff by way of double run leveling in small circuits of 3 km length ensuring an accuracy in the order of $12\sqrt{k}$ mm, where 'K' is the distance in Kilometers between two Bench Marks avail-able in the project area, and error, if any, within permissible limits is distributed in rational manner to establish the accurate and effective vertical control grid.

The topographic survey has been extending up to the proposed Right of Way (ROW). Wherever necessary, the survey corridor width is further increased to accommodate situations arising out of encroachments and any other contingencies. The survey areas at the locations of intersections cover up to a minimum of 500m on the either side of the centre-line and have sufficient width to accommodate improvement measures. Necessary surveys are

also carried out for determining the requirements of service roads for local traffic, where appropriate.

3.5.2.4 Detailed Survey

Using the horizontal and vertical control points established accurate data in the digital format in terms of Northing (Y). Easting (X) and Elevation (Z) co-ordinates for all breaks in terrain such as ridges and ditches are collected perpendicular to the centre line at 50m intervals in tangent sections and 20-25m in curve sections using Total Stations. Cross sections are taken for the specified corridor width of 110m; however this corridor width is increased to 150m on the inside of sharp curves to account for minor adjustments.

All natural and man-made features such as buildings, irrigation channels, drainage structures, temples, mosques, trees and utility installations etc. are captured during the survey. Spot level on the existing carriageway are captured at five points namely at centerline, mid points of both lanes of traffic movement and pavement edges at both ends to calculate the profile corrective courses more realistically. Trees with girth wise are captured with areas of plantation. Wherever there are groups of trees/plantations, they are picked with the areas of plantation. Boundaries of Agricultural Land area have been surveyed to demarcate the cultivation land limit.

Where existing major roads cross the alignment, the survey has been extended to a maximum of 500m on either side of the road centerline to allow improvements including grade separated intersections to be designed. Apart from this, the survey has covered a maxi-mum of 1000m and 500m on either side of centerline in cases of major and minor bridges respectively.

3.5.2.5 Data Processing

The field survey data are processed in the office to provide a digital output file for the de-sign engineers. The data is structured so that the existing vertical profile along the pro-posed alignment can be produced automatically. The format of the resulting data readily promotes the calculations of earthworks and other quantities required for the evaluation of cost estimates.

Roadway plans have been produced from the survey data, which identify the available Right of Way (ROW) along the existing road corridors. In addition, the plans identify all existing utilities /installations within the corridor/ROW that require re-location by the new road design. Action Plans for covering the relocation of these obstructing installations and public utilities are to be prepared on a km to km basis.

3.5.2.6 Material Investigations

The Material Investigation for road construction has been carried out to identify the potential sources of construction materials and to assess their general availability, mechanical properties and quantities. This is one of the most important factors for stable, economic and successful implementation of the road program within the stipulated time for improvement work as well as for new carriageway, the list of materials includes the following:

a) Granular material for lower sub-base works.

b) Crushed stone aggregates for upper sub-base, base, surfacing and cement concrete works.

c) Sand for filter material and cement, concrete works, sub-base and filling material.

d) Borrow material for embankment, sub-grade and filling.

e) Manufactured material like cement, steel, bitumen, geo-textiles etc. for other related works. The Information on material sources has been carried out with the following basic objectives:

Source location, indicating places, kilometer age, availability and the status whether in operation or new source.

- Access to source, indicating the direction and nature of the access road i.e. left / right of project road, approximate lead distance from the gravity centre and type of access road.
- Ownership of land / quarries, either government or private.
- Probable uses indicating the likely use of materials at various stages of construction work i.e. fill materials, sub-grade, sub-base, base and wearing course and cross drainage structures.

During the process of investigation, due consideration has been given to the locally available materials for reducing the cost of construction.

The samples have been collected as described below:

- From quarry sites for aggregate characteristics like, aggregate impact value, gradation, soundness, flakiness index and elongation, stripping value and water absorption etc.
- From random pits (farmland) along the proposed alignment for availability of suitable embankment and sub grade material, and identification of the borrow areas and tested in line with relevant IRC code.

3.5.2.7 Geotechnical Investigations

Sufficient information about the arrangement & behavior of the underlying materials and their physical properties for adopting and designing the structural foundation is essential. Soil exploration through field investigation and laboratory testing of the substrata are helpful in arriving at required parameters for designing of safe and economical foundations. The data obtained from these investigations has been analyzed for safe design of the foundation. In the geotechnical report's recommendations has been made for type of foundations and its safe bearing capacity/load carrying capacity required for the structure design.

3.5.2.8 Hydrological Investigations

Hydrological investigations have been carried out for the entire project. It has been ensured that majority of the cross drainage structures are hierologically adequate to carry the discharge of the river / streams.

3.6 Traffic Design

3.6.1 General

The capacity standards for expressway have been adopted as per the "Guidelines for Expressways". Capacity analysis is fundamental to the planning, design and operation of roads and provides, among other things, the basis for determining the carriageway width to be provided at any point in a road network with respect to the volume and composition of traffic. Moreover, it is a valuable tool for evaluation of the investments needed for future road constructions and improvements.

3.6.1.1 Equivalency Factors

The need of expressing capacity in passenger car units has triggered off many studies for establishing appropriate passenger car equivalency (PCE) values for different types of vehicles. Notable among the studies carried out in India are the road user cost studies (RUCS) by CRRI and the MoRT&H. It has been recognized that the PCE values vary under different traffic, roadway conditions and composition for any given type of vehicle.

Equivalency Factor is a factor to convert the mixed flow of traffic in to single unit to express the capacity of road. The unit generally employed is the passenger car unit (PCU). The equivalency factors for conversion of different types of vehicles in to equivalent passenger car units based on their relative interference value are given in Table 2.1 (as per IRC: 64 – 1990).

Table 2.1: PCU Factor for Various types of Vehicles on Rural Roads

S. No.	Vehicle Type	Equivalency Factors
Fast moving vehicles		
1	Motor cycle or scooter	0.50
2	Passenger car, pick up van or auto-rickshaw	1.00
3	Agricultural tractor, light commercial vehicle	1.50
4	Truck or bus	3.00
5	Truck – trailer, agricultural tractor – trailer	4.50
Slow moving vehicles		
1	Cycle	0.50
2	Cycle rickshaw	2.00
3	Hand cart	3.00
4	Horse drawn vehicle	4.00
5	Bullock cart	8.00

3.6.2 Capacity Analysis for 6-Lane Expressway

As per the Guidelines for Expressways Volume-I: Planning, the capacity of an expressway is sensitive to the traffic flow characteristics on divided highways.

3.6.2.1 Free Flow Speed

An important element of the speed – flow curves of the project roads is the free flow speed. It is the speed at which driver feel comfortable travelling under the physical, environmental and traffic control conditions on a non-congested section of a multi lane highway, - HCM (2000). All recent studies suggest that speed on project road is insensitive to flow over a broad range of flows. Thus free-flow speed can be established on an existing facility by measuring in the field, the average speed of vehicles when flow rates do not exceed 1300 passenger car per hour per lane (PCPHPL) (HCM 1994). In the absence of traffic flow speed data on highway in India, the free flow speed is required to be assumed.

3.6.2.2 Factors affecting the Free Flow Speed (FFS):

The FFS of an expressway depends on the traffic and roadway conditions described below:

- Lane width
- Lateral Clearance
- Number of Lanes
- Interchange Density
- Geometric design

The basic equation used to calculate the FFS is as given below:

$$FFS = BFFS - f_{LW} - f_{LC} - f_N - f_{ID} \quad \text{----Eq(1)}$$

Where,

BFFS=base free flow speed, kmph

f_{LW} = adjustment factor for lane width

f_{LC} = adjustment factor for right shoulder lateral clearance

f_N = adjustment factor for number of lanes

f_{ID} = adjustment factor for interchange density

Base Free Flow Speed BFFS is set at 120 kmph for rural facilities.

Adjustment factor for Lane width (f_{LW}) is given in Table 2.2.

Table 2.2: Adjustment Factor for Lane Width

Lane Width (m)	Reduction in FFS (kmph)
3.6	0.0
3.5	1.0
3.4	2.1
3.3	3.1
3.2	5.6
3.1	8.1
3.0	10.6

For the project road, the lane width considered is 3.75, hence, the reduction in FFS =0.0

Adjustment factor for left shoulder clearance (f_{LC}) is given in Table 2.3.

Table 2.3: Adjustment Factors for Left Shoulder Clearance.

Left Shoulder width(m)	Reduction in FFS (Kmph; fLC)			
	Number of Lanes in One Direction			
	2	3	4	>=5
>=1.8	0.0	0.0	0.0	0.0
1.5	1.0	0.6	0.3	0.2

1.2	2.0	1.3	0.6	0.3

For the project road, the left shoulder width is greater than 1.8, hence adjustment factor is 0.0.

Adjustment factor for Number of Lanes (fN):

For rural facilities f***N*** is set as 0.

Adjustment factor for Interchange density (fID)

Since the minimum interchange spacing more than 4 kms, the adjustment factor for interchange density is set as 0.

The using Equation (1) we get

FFS=120-0-0-0-0

FFS = 120kmph

Calculation of Base Capacity (Base Cap)

The base capacity (pcphpl) of an expressway facility is given by

Base Capacity = 1700+10FFS; for FFS<=112 ----------Eq(2)

Base Capacity = 2400; for FFS>112 ----------Eq(3)

Since, the FFS is (120kmph)>112kmph, base capacity =2400pcphpl

Determination of Peak Capacity (Peak Cap)

The peak capacity is given by,

Peak Cap = Base Cap*PHF*N*f_{HV}*f_P

Where,

Peak Capacity = Peak capacity, vehicles per hour (all lanes, one direction)

PHF = Peak Hour Factor; *0 .88 so as to maintain LOS B always on Expressway*

N = Number of lanes in one direction (3 for 6-lane); *3 for one direction flow on Expressway*

f_{HV} = Adjustment factor for heavy vehicles; *0.8253 for expressway as calculated below*

f_P = Adjustment factor for driver population; *0.975 for rural expressways*

Assign a final PHF is given in **Table 2.4.:**

Table 2.4: Peak Hour Factor

Area Type	V/C Ratio	PHF
Rural	<0.7744 0.7744<=v/c<=0.9025 >0.9025	0.88 Equation (4.04) 0.95
Urban	<0.8100 0.8100<=v/c<=0.9025 >0.9025	0.90 Equation (4.04) 0.95

For the project road the PHF of 0.88 has been considered.

Adjustment factor for Heavy Vehicles (fHV)

The adjustment factor for heavy vehicles is based on calculating passenger car equivalents for trucks and buses.

$f_{HV} = 1/(1+PT(ET-1))$

Where,

PT= Proportion of trucks and buses in the traffic stream; 42% as per traffic projections

ET=Passenger car Equivalents; 1.5 for rural expressways in level terrain.

The f_{HV} factor for the expressway using the above equation is 0.8253

Adjustment factor for Driver Population (f_P)

On rural expressways, the factor is set to 0.975 but has been considered as 1.0 for the project road.

Thus, the peak capacity for the 6-lane expressway

Peak Capacity = 2400*0.88*3*0.8253*.975

= 5089 pcphpl *(for 3-lane in one direction)*

= 5089*2/0.08 = 127225 PCUs per day *(for 6-lane carriageway with depressed median)*

The peak capacity of the Ganga Expressway shall be 127225 PCUs per day

3.6.2.3 Recommended Design Service Volume for Six Lane Expressway

Assuming a V/C ratio of 0.77 lesser than 0.7744 corresponding to PHF of 0.88 to maintain a Level of Service B, the Design Service Volume for 6-Lane Expressway with depressed median shall be 98000 PCU per day for peak hour flow of 8%

= 127225 * 0.77 = 97963, say 98000 PCUs per day

3.7 Engineering Design

3.7.1 Geometric Design of the Alignment

The Preliminary Design has been carried out on the selected alignment so as to have optimum Construction, Operation & maintenance cost and Vehicle Operation Cost; minimum Social Impacts and Social Costs and Environmental Impacts and Environmental Mitigation Costs.

The preferred alignment would definitely have minimum Rehabilitation and Resettlement i.e. it would utilize to the maximum possible barren / agriculture / government land to minimize Land Acquisition in villages / habited areas. A thorough consultation with stakeholders including industries, relevant government agencies, NGOs, project affected persons (including farmers & people having property) and other consultants working in the region will be made.

Geometric Design Control

The detailed design for geometric elements covers, but is not limited to the following major aspects:

- Horizontal alignment
- Longitudinal profile

- Cross-sectional elements
- Junctions, intersections and Interchanges
- Service road along the alignment

Different options for providing grade separated interchanges were examined and the geometric design of interchanges has taken into account the site conditions, turning movement characteristics, level of service, overall economy and operational safety.

Indicative Design Standards

The indicative design standards for geometric design of road are illustrated in Table 2.5 for main carriageway, geometric standards for Interchange elements and Length of speed change lanes. Ruling design speed is adopted for designing the Project Highway in conformity with the provisions of the Guidelines for Expressway Manual.

Table 2.5: Indicative Design Standards

S.No.	Descriptipn		Details of Project Road
1	Design speed		120 Kmph
2	Lane width		3.75 m
3	Depressed Median (including shyness)		15.0 m
4	Median side paved strip (Shy distance)		0.75 m
5	3-Lane carriageway		11.25m
6	Paved Shoulder		3.00m
7	Earthen Shoulder		2.00m
8	Camber/Cross-fall	C/W & PS	2.50%
		Earthen shoulder	3.00%
9	Width of Service Road		3.75 m/7.00m/10.00m
10	Utility Corridor		2.00m
11	Maximum	For below 1000m radius	7.00%
	Super-elevation	For above 1000m radius	5.00%
12	Safe Stopping Sight Distance (SSD)		250 m
13	Desirable Minimum Sight Distance (ISD)		500 m
14	K-Value for Sag-curve (minimum)		132
	K-Value for Hog-curve (minimum)		261
15	Desirable Minimum radius of horizontal curve		1000 m
16	Minimum radius of Horizontal curve without transition		4000 m
17	Minimum vertical Gradient		0.30%

S.No.	Descriptipn		Details of Project Road
18	Min. Longitudinal slope for Drain	Unlined	1%
		Lined	0.50%
19	Ruling/Limiting gradients		2.5% / 3%
20	Minimum grade change requiring vertical curve		0.50%
21	Minimum length of vertical curve		100m
21	Minimum Height of Embankment		Bottom of Sub-grade is at least 1.5 m above the High Flood Level/Water Table/Pond Level.
22	Vertical clearance for SVUP		4.0 m
	Vertical clearance for LVUP		4.5 m
	Vertical clearance for VUP		5.5 m
	Vertical clearance for Interchanges/Flyovers		6.5 m
	Vertical clearance for ROB		7.3 m
23	K-Value for Sag-curve (minimum)		132
24	K-Value for Hog-curve (minimum)		261

Design Speed

Design speed 120 Km/h is the basic parameter, which determines the geometric features of the road. The proposed design speeds for different terrain categories are as per "Guidelines for Expressway".

In general, the ruling design speed is adopted for geometric design of the highway. Only in exceptional circumstances, minimum design speed may be adopted where site conditions are extremely restrictive and adequate land width is not available.

3.7.2 Cross Sectional Elements

Right of Way (ROW)

As per Guidelines for Expressway the minimum right of way (ROW) for up to 6 lanes expressways is 90m for plain and rolling terrain in case of without service road. The minimum ROW of 120 m has been adopted for the proposed expressway in rural section (open areas i.e. green field section). The ROW at toll plaza locations, ROBs and flyovers/interchange sections may vary depending on their respective layout and requirement. A 2m wide utility corridor outside the boundary fencing has been taken into account within the proposed ROW width.

Table 2.6: Right of Way in Plain/Rolling Terrain

Section	Right Of Way Width* (ROW)
Rural Section	90 m – 120 m

Rural Section passing through semi-urban areas	120 m#

* The ROW width includes 2 m wide strip on either side reserved for placement of utilities outside fencing.

In case an elevated expressway on viaduct is proposed, the width of ROW may be reduced as per site conditions and availability of land

Lane Width

As per Guidelines for Expressway the width of a lane in Plain and Rolling terrains has been taken as 3.75 m. The kerb shyness of 0.75 m shyness on median side has been provided.

Median width of Carriageway

The median shall be depressed or flush. As a rule, depressed median shall be provided except in situations where the availability of ROW is a constraint. The width of median is the distance between inside edges of carriageways. The recommended width of median is given in Table 2.7 below:

Table 2.7: Median Width

Type of Median	Recommended Median Width (m)	
	Minimum	Desirable
Depressed	12	15
Flushed	4.5	4.5
Flush (to accommodate structure/pier on median)	8	8

The depressed median shall have suitably designed drainage system so that water does not stagnate in the median.

An edge strip of 0.75 m width of depressed median adjacent to carriageway in either direction shall be paved with same specifications as of the adjoining carriageway.

As far as possible, the median shall be of uniform width in a particular section of the Project Expressway. However, where changes are unavoidable, a transition of 1 in 50 shall be provided.

Paved Shoulder

Paved shoulders shall be designed as an integral part of the pavement for the main carriageway. Width of these shoulders has been taken as 3 m. This will provide for better traffic operation conditions, lower maintenance and facility of directly using these as part of carriageway when the road is subsequently widened on these sides.

The Composition and specification of the paved shoulder shall be as that of the main carriageway.

Earthen Shoulder

The earthen shoulder has been proposed with good borrowed earth having a width of 2m on the outer side.

Sight Distance

The Safe stopping sight distance and desirable minimum sight distance for divided carriageway for various design speed given in Table 2.8. The desirable values of the sight distance shall be adopted unless there are sight constraints. A minimum of Safe stopping sight distance shall be available throughout.

Table 2.8: Safe Sight Distance

Design Speed (km/h)	Safe Stopping Sight Distance (m)	Desirable minimum Sight Distance (m) (Intermediate Sight Distance)
120	250	500
100	180	360

At critical locations decision or decision points where changes in cross sections occurs such as Toll Plazas and Interchanges, the sight distance shall not be less than decision sight distance given in Table 2.9. The criteria for measuring sight distance are same as for the stopping sight distance.

Table 2.9: Decision of Sight Distance

Design Speed (km/h)	Decision Sight Distance (m)
120	360
100	315

Horizontal Alignment

The horizontal curves on the project road are designed for maximum radii (where feasible) as per Guidelines of Expressway manual and IRC:SP:99-2013, absolute minimum radius has been used at couple of locations.

The Alignment shall be fluent and blend with the topography. The horizontal curve shall be designed to have largest practical radius and shall consist of circular portion flanked by spiral transitions at both the ends.

Super – Elevation

Super-Elevation shall be limited to 7%, if radius of curve is less than desirable minimum radius. It shall be limited to 5% if radius is more than or equal to desirable minimum. Super elevation shall not be less than the minimum specified Cross fall.

The super elevation at curves is arrived at as per the following equation:

$(e + f) = v2/127R$

Where,

v = Vehicle speed in Km/h.

e = Super elevation ratio in meter per meter

f = Coefficient of side friction between vehicle tyre and pavement (0.1)

R = Radius in meters.

The super elevation is calculated keeping in view the horizontal radii and gradient at curves at different locations.

3.7.3 Method for attaining super-elevation

Dual – inner edge pivot of both carriageways at different chainage is used for attaining super-elevation. This method pivots the dual carriageway about the inner edge strings of both carriageways using different chainage, so that the central reservation levels are not changed. The application of super-elevation to the left and the right carriageways will start (or end) at different chainage, to ensure that the rate of change remains the same for both. The method is explained in Figure 2.1:

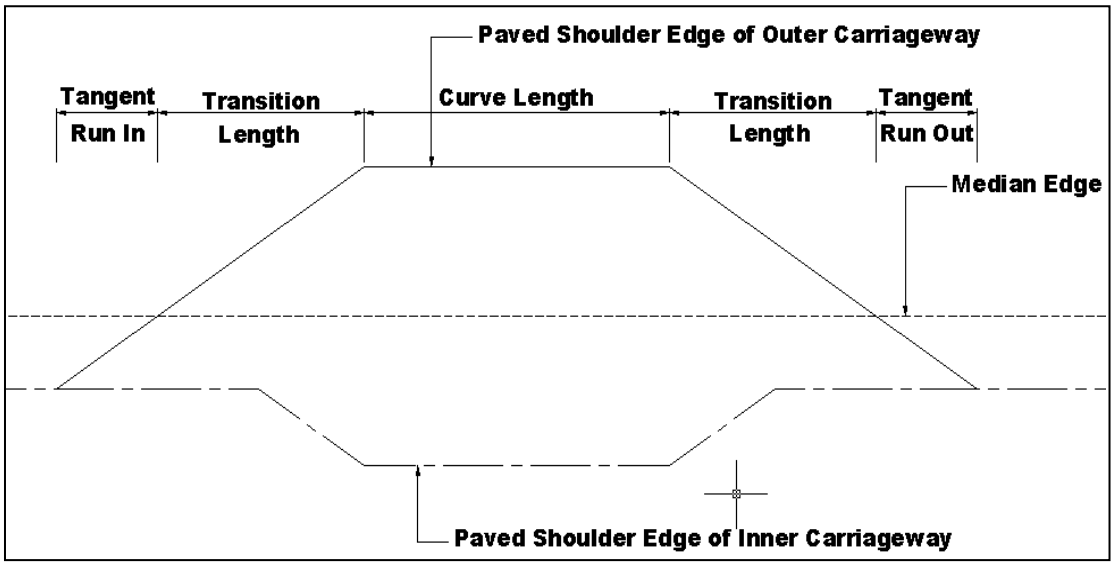


Figure 2.1: Method for attaining Super-Elevation

3.7.4 Transition Curves

The following three formulae are used for calculating the transition lengths and the maximum value is being adopted for design:

a) Rate of change of centrifugal acceleration

Ls = 0.0215 V3/ CR

Where,
R – Radius of curve in meters
V – Vehicle speed in Km / hour
Ls – Length of transition in meters
C – Rate of change of acceleration.
C = 80/(75+V)

Subject to maximum of 0.6 & minimum of 0.4

b) Rate of change of super elevation or runoff.

The rate of change of super elevation is being considered not steeper than 1 in 200 for roads in plain and rolling terrain and 1 in 150 for roads in Mountainous terrain.

c) Three seconds time for manipulating the steering. The minimum length of transition curves for this criterion is as in Table 2.10.

Table 2.10: Minimum Length of Transition Curve

Design Speed (km/h)	Minimum length of transition curve (m)
120	100
100	85

3.7.5 Vertical Alignment

General

The vertical alignment of the carriageway is generally compatible with the guidelines given in the Guidelines of Expressway manual as well as IRC: SP: 99-2013.

At locations of grade break of 0.5%, vertical curves are being provided.

- There shall be no change in grade within a distance of 150m
- The length of vertical curve will not be less than 0.6V (kmph)
- Number of vertical intersection point shall not be more than 4 per km.
- At locations of sight deficiency, at least stopping sight distance (SSD) is being provided.

The aspect of efficient drainage shall be kept into consideration while designing the vertical profile and cross sections of the Project Expressway as stipulated in IRC:SP:42 and IRC:SP:50.

The vertical alignment shall be coordinated with the horizontal alignment

Gradients

The ruling and limiting gradients are given in Table 2.11.

Table 2.11: Gradients

Terrain	Ruling Gradient	Limiting Gradient
Plain	2.5%	3.0%
Rolling	3.0%	4.0%

The ruling gradient shall be adopted as far as possible. Limiting gradient shall be adopted only in very difficult situation and for short lengths.

In cut sections, minimum gradient for drainage considerations is 0.5% (1 in 200) if the side drains are lined; and 1.0% (1 in 100) if these are unlined.

Vertical Curves

Long sweeping vertical curves shall be provided at all grade changes. Summit curves and valley curves shall be designed as square parabolas. The length of the vertical curves is controlled by sight distance requirements, but desirably curves with the longer length shall be provided from aesthetic considerations. The minimum grade changes requiring vertical curve and the minimum length of vertical curve shall be as given in Table 2.12. More liberal

values are adopted wherever this is economically feasible. Valley curves are designed for headlight sight distance.

Table 2.12: Minimum Length of Transition Curve

Design Speed (km/h)	Minimum Grade Change requiring Vertical curve	Minimum length of Vertical Curve(m)
120	0.5%	100
100	0.5%	85

Lateral and Vertical Clearance at Underpasses

Lateral Clearance

Minimum clearance at under passes shall be as follows:

i) For Vehicular Underpass, the lateral clearance shall not be less than 20 m

ii) For Light Vehicular Underpass, the lateral clearance shall not be less than 12 m including 1.5 m wide raised footpaths on either side.

iii) For Smaller Vehicular Underpass, the lateral clearance shall not be less than 7m.

iv) Crash barrier shall be provided for protection of vehicles from colliding with abutments and piers and the deck of the super structures.

Vertical Clearance

The vertical clearances at underpasses shall not be less than the values given in Table 2.13.

Table 2.13: Vertical Clearance

Rail Over Bridges	7.3 m
Interchange/Flyover	6.5 m
Vehicular Underpass	5.5 m
Light Vehicular Underpass	4.5 m
Smaller Vehicular Underpass	4.0 m

Lateral and Vertical Clearance at Overpasses

Lateral Clearance

Shall be provided as a full roadway width as specified in Schedule of Contract Agreement.

Vertical Clearance

A minimum of 5.5m Vertical Clearance shall be provided from all points of the Carriageway of the Project Expressway.

3.7.6 Cross-Fall

The cross-fall on each sections of the expressway carriageway shall be as given in Table 2.14. Each carriageway shall have unidirectional cross fall.

Table 2.14: Cross-fall on different surfaces

Cross-Sectional Element	Annual Rainfall	
Carriageway, Paved shoulders, Edge Strip, Flush Median.	**1000mm or more**	**Less than 1000mm**
	2.5 %	2.0 %

The cross-fall for earthen/granular shoulders on straight portions shall be at least 0.5% steeper than the values given in Table above. On Super Elevated sections, the earthen portion of the shoulder on the outer side of the curve would be provided with reverse crossfall so that the earth does not drain on the carriageway and the storm water drains out with minimum travel path.

3.8 Design OF Horizontal and Vertical Alignment

The general principles and design criteria laid down in MoRTH Guidelines for Expressways shall be followed except as otherwise indicated in this Manual.

Culverts

The culverts are proposed to be built to the full formation width of the road and have been designed accordingly.

Highway Signs and Marking

The road signs conforming to latest IRC: 67 have been proposed. Location of route marker signs are as per the latest IRC: 2; the provision for hectometer stones, 5th kilometer stone, Kilometer and 200 m stones are as per latest IRC: 8 and latest IRC: 26 respectively. The boundary stones are as per latest IRC: 25. Road Delineators are as per latest IRC: 79.

All road signs are considered as retro-reflective sheet of high intensity grade with encapsulated lens fixed over aluminium substratum and conforming to MoRT&H Specifications for road and bridge works. Provisions for Road markings have been considered as latest IRC: 35.

3.9 Access Control

Project Expressway shall be designed for fast motorized traffic with full control of access. Access to the Expressway shall be provided with grade separators at location of intersections. Parking/standing, loading/unloading of goods and passengers and pedestrians/animals shall not be permitted on the Expressway.

Location of interchange – The locations of individual interchanges are determined primarily to reduce detour considering regional network and nearness to places of importance. Location of interchange is guided by the following situations:

i) At crossing or nearest points of other Expressways, National Highways, State Highways and important arterial roads.
ii) At crossing or nearest points of major roads to important ports, airports, material transport facilities, commercial and industrial areas, and places of tourist interest.

The interchanges shall be provided at the locations specified in Schedule-B of the Concession Agreement.

3.10 Connecting roads

Connecting roads where required to maintain proper circulation of local traffic, continuity of travel and to facilitate crossing over to the other side of the Project Expressway through an under/overpass shall be constructed on the land acquired within the ROW of the Project Expressway. These shall be provided outside the fencing. The location, length, other details and specifications of connecting roads to be constructed shall be specified in Schedule-B of the Concession Agreement. The width of the connecting road shall be 7.0 m. The construction and maintenance of connecting roads shall be part of the Project Expressway

3.11 Pavement Design

Type of Pavement – The Authority may require provision of specific type (flexible/rigid) of pavement depending upon specific site conditions. Such requirements shall be as specified in Schedule-B of the Contract Agreement. Unless otherwise specified in Schedule-B, the may adopt any type (flexible/rigid) of pavement structure for new construction.

Flexible pavement is designed by using IRC: 37-2012 and rigid pavement is designed as per the provisions contained in latest IRC: 58. Besides the above, designs for service roads, toll plaza, parking bays have been carried out.

Design of flexible pavement – The pavement shall be designed to ensure the specified performance for the projected traffic needs, climate and type of soils in the given area. The Contractor is expected to use a design procedure that is appropriate to produce a cost-effective structure meeting the performance requirements and long term durability. The Contractor may use IRC:37 "Tentative Guidelines for the Design of Flexible Pavements" or it may use any internationally accepted design procedure that is based on past performance and research. It will be the Contractor's responsibility to provide a pavement structure that fully meets the prescribed performance requirements throughout the operation period.

Design of rigid pavement – Jointed rigid pavement shall be designed in accordance with the method prescribed in IRC:58 "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways". Continuously Reinforced Concrete Pavements (CRCP) shall be designed as per any recognized international guidelines which shall be subject to approval by the Independent Engineer.

Design Life

The bituminous pavement with design life of 20 years has been considered for the flexible pavement design. For rigid pavement a design life of 30 years has been considered.

Design Traffic

The Design traffic has been estimated in terms of cumulative number of standard axles (8160kgs) to be carried by the Pavement during the design period.

Any likely change in traffic due to proposed improvement of the facility and/or future development plans, land use, shall be duly considered in estimating the Design Traffic. The Growth rates mentioned in the Traffic Studies chapter has been considered while calculating the Million Standard Axle loads. The project road is a green field highway and there is no existing carriageway, therefore, the VDF has been calculated based on the Axle Load Surveys

conducted on alternate roads and the values of VDF has been presented in Section 3.3.3 of this report.

Rigid Pavement Design

Design of Concrete Slab

Once the parameters are decided, actual stresses developed in the concrete slab due to design wheel load is computed by the Westergaard's Equation modified by Teller and Sutherland. The maximum stress occurs in the corner and the minimum in the interior. The edge load condition gives an intermediate value.

Temperature stresses at the edge are calculated by using Bradbury's formula. The temperature stresses in the corner region is negligible as the corners are relatively free to wrap and may be ignored.

The design wheel load stress and the temperature stress at the edge are then added up together and this summation shall be less than 28 days flexural strength of concrete for the assumed thickness to be adequate from design point of view.

Once the assumed slab thickness is found adequate for the combined stresses developed due to temperature and design wheel load, its adequacy needs to be checked from the view point of its consumption of fatigue resistance. In this case also, edge stresses are computed as discussed earlier for various axle load classes. Then stress ratio (SR) is calculated as ratio of stress due to wheel load and the 28 days flexural strength of concrete for all axle load class. Consumption of fatigue resistance is computed for this stress ratio for each axle load class. Summation of this consumption of fatigue resistance should not exceed the allowable limit for the assumed thickness to be adequate from the view point of fatigue consideration.

Design of Joints

Once the concrete slab thickness is designed based on particular spacing and location of joints, the remaining job is the design of dowel bars and tie bars with the provision of adequate sealants.

Dowel Bars

The design of dowel bar at joints is carried out on the basis of its load transfer capacity. It is recommended that 40% of wheel load can be transferred through dowel bar system. It is observed that failure of dowel bar occurs due to the crushing of concrete below the dowel bar and hence bearing stress shall be considered for its design.

Generally, 500 mm long 32 mm diameter M.S. bar at a spacing of 250 – 300 mm is used as dowel bar for concrete slab of 200 -350 mm thick. No dowel bar is required for slab thickness less than 150 mm. However separate calculation has been made for present situation for dowel bar design.

Tie Bar

Tie bars are provided to prevent the adjoining slabs from separating. Longitudinal joints are provided with tie bars. It does not increase the structural capacity of the slab and are not designed as load transferred devices.

3.12 Hydrological Design

Design Standards

The hydrological & hydraulic design for cross drainage structure shall conform to the following codes and reports:

IRC: SP-13 – Guidelines for the design of small bridges and culverts

IRC: 5 – Code of practice for Road Bridges, Section I (General features of Design)

IRC: 78 – Code of Practice for Road Bridges, Section VII (Design of Foundation and Substructure)

IRC: SP-87 – Manual of Specifications and Standards for Six-Laning of Highways through Public Private Partnership

Design Approach

The hydrological & hydraulic design of bridges is an important aspect to determine the minimum required waterway; design highest flood level (HFL) and minimum scour levels of piers & abutments of the bridges proposed on the new alignments. The various design standards (latest) which have been adopted for the hydrological & hydraulic design of bridges are given below. Approach slabs shall be provided for all bridges and grade separated structures as per Clause 217 of IRC:6 and Section 2700 of MORTH Specifications.

Design Parameters –

Area of catchment & length of longest stream have been obtained from topographical sheets of Survey of India (SOI).

The Cross Section of stream at 500 m U/S and 500 m D/S depending upon catchment area along with longitudinal gradient has been obtained to evaluate design discharge .The various method such as area velocity , unit hydrograph Rankins method has been considered for obtaining of design discharge .

Scour Depth

Scour depth can be calculated as per Clause 703.2 of latest IRC: 78 and as explained in latest IRC: SP 13. The mean depth of scour, dsm below the highest flood level is given by the following equation:

dsm = 1.34 (Db2/Ksf)1/3

Where, Db = the design discharge for foundation in cumec per meter width. The value of Db shall be the total design discharge divided by the effective linear waterway width be-tween abutments.

"Silt Factor" (Ksf) have been assumed based on the silt factor values of the Agra to Etawah project. As per latest IRC: 78, for the design of piers and abutments located in a straight reach and having individual foundations without any floor protection works, the maximum depth of scour from the highest flood level is given by:

For piers: dmax = 2 x dsm

For abutments: dmax = 1.27 x dsm (having retained approach)

Minimum Founding Level: The foundation has been taken to a level to safeguard against scour. In case of bridges, where the mean scour depth dsm is calculated by using the equation given in Clause 703.2 of latest IRC-78, the depth of foundation has not been taken less than that of existing structures in the vicinity.

3.12.1

3.12.2 Drainage and Protection Works

The drainage requirements for the project road and adjoining areas are assessed through the DTM prepared from topographical survey data. Pavement internal and external drain-age is ensured by providing drainage layer and camber respectively. Longitudinal slopes in roadside ditches and central drain are generally equal to generate self-cleaning velocity at the time of storm.

Small catchment analysis with project specific unit hydrograph is undertaken for the hydraulic design of the drain channel. The shape of the channels is fixed to facilitate easy and economical construction and easy maintenance. Suitable drainage system is planned for the high embankment, super-elevated carriageway and other key areas, with a view to en sure easy collection and disposal of storm water. A network has been conceptualized from runoff till final disposal and its continuity is ensured at each critical point.

3.13 Structural Design

3.13.1 General

This section deals with the standards to be adopted in design of vis-à-vis ROBs, flyovers, bridges, underpasses and culverts. It also provides for the type of materials and their specifications that had been adopted for the above structures, the loads and forces to be considered. The project road is 6 lane and the structures are also designed for 6 lanes.

3.13.2 Cross-sectional Elements

a) Structural width for bridges / flyovers / road over rail bridges

The overall deck width for all bridges, underpasses has been kept as 21.25 m (including 0.5m crash barrier on either side) & 2X12.5 m for ROBs in each direction of traffic. Please refer for structure drawing and GADs of each major/minor structures.

b) Median width

A median width of 12.5 m is maintained between two outer faces of RCC crash barriers.

c) Reinforced Earth Retaining Structures –

The design and construction of reinforced earth structures shall conform to section 3100 of MORTH Specifications. Reinforced earth retaining structures shall not be provided near water bodies. Such structures should be given special attention in design, construction, ground improvement where necessary, maintenance and selection of System/System design. Local and global stability of the structure shall be ensured.

d) Road over bridge (road over railway line)

i) If the alignment of road at the existing railway crossing has skew angle more than 45°, the alignment of road or of pier/abutment shall be suitably designed to reduce skew angle up to 45°.

ii) Railways normally do not allow construction of solid embankment in their right of way. The horizontal and vertical clearances to be provided on the railway land shall be as per requirement of the Railway authorities.

iii) In case the Authority has obtained approval of General Arrangement Drawings, the same shall be appended with the Request for Proposal. The Contractor shall have option of adopting the same span arrangement or have his revised proposal for GAD approved from the Railways. In case the total length of stilt portion is not reduced, it will not be considered as change of scope. However, before submitting the revised proposal to the Railways, prior consent of the Authority shall be required.

iv) The Contractor shall be required to obtain approvals of all designs and drawings from the concerned Railway authorities.

v) The construction of ROB within the railway boundary shall be under the supervision of the Railway authorities.

vi) The approach gradient shall not be steeper than 1 in 40.

vii) Outside the railway boundary, one span of 12 m conforming to the requirements of Vehicular Underpass shall be provided on either side of ROB to cater for the local traffic, inspection, and pedestrian movement.

3.13.3 Specification for Material

a) **Concrete:** The grades of concrete are either equal to or higher than those pre-scribed in latest IRC: 112. Grade of concrete in various structural elements is for moderate conditions of exposure.

Superstructure

PSC Members : M 45

RCC T-Girder and Deck Slab : M 35

RCC Solid Slab : M 35

RCC Box cell : M 35

RCC Crash Barriers: M 40

Substructure

RCC substructures and foundations: M 35

All PCC structural members: M 20

All PCC non structural members: M 15

Pedestals for bearings

Pot/PTFE : M 40

Elastomeric: M 40

b) **Steel:** This conforms to the provisions given in IS: 1786, IS: 432 (Part I).

Reinforcement steel:

- High yield strength deformed bars conforming to Fe 500 / TMT.
- Mild steel not to be used.
- Pre-stressing steel

These conform to IS: 14268-1995

System : 19 K13 or 12 T13 low relaxation multiple strands system

Cables :19 K13 or 12 T13 systems with strands of 12.7 mm nominal diameters.

Sheathing : 90 mm / 75mm Corrugated HDPE sheathing duct.

c) Bearings

All bearings shall be easily accessible for inspection, maintenance and replacement. Suitable permanent arrangements shall be made for inspection of bearings from bridge deck. Design and specifications of bearings shall be as per IRC: 83 (Part I, II and III). Spherical bearings shall conform to the requirements of BS:5400 and materials of such bearings may conform to the relevant BIS codes nearest to the specifications given in BS:5400. The drawing of bearings shall include the layout plan showing exact location on top of pier and abutment cap and the type of bearings i.e. fixed/free/rotational at each location along with notes for proper installation. The bearing should cater for rotation and movement in both longitudinal and lateral direction. Elastomeric bearing has been provided under RCC T-beams and RCC solid slabs type superstructures as per latest IRC: 83 (Part II) and shall conform to clause 2005 of MoRT&H specification for Road and Bridge Works.

POT cum PTFE bearing has been provided for span more than 25m where we have to cater for large loads and conforming to latest IRC: 83 (Part III) and clause 2006 of MoRT&H specifications for Road & Bridge works.

d) Expansion Joints

All Structures shall have minimum number of expansion joints. This may be achieved by adopting longer spans, making the superstructure continuous or by adopting integrated structures. Expansion joints shall conform to IRC:SP:69. In any case, the number of expansion joints shall not be more than 1 for each 100 m length of the bridge or part thereof. For avoidance of doubt, the structures upto 100 m length shall have only one joint at one side abutment, the structures over 100 m and upto 200 m length may have two joints and structures over 200 m and upto 300 m length may have maximum 3 expansion joints. Elastomeric strip seal type expansion joints are provided on all the bridges and ROBs as per Clause No. 2607 of MoRT&H specification for road and bridge works and interim specifications for expansion joints issued subsequently vide MoRT&H letter no. RW/NH-34059/1/96-S&R dated 25.01.2001 and addendum there to circulated vide letter of even no; dated 30.11.2001. In case of bridges with smaller spans slab seal type expansion joints are provided.

3.13.4 Loads and Forces to be considered in Design

Vertical Loads

a) Dead Loads

Following unit weights are assumed in the design as per latest IRC Codes.

Pre-stressed Concrete: 2.5 t / m3

Reinforced Concrete: 2.5 t / m3

Plain Cement Concrete: 2.2 t / m3

Structural steel: 7.85 t / m3

Dry Density of Backfill Soil: 2.0 t / m3

Saturated Density of Backfill Soil: 2.0 t / m3

b) Superimposed Dead Loads

Wearing Coat: 65mm thick with 40mm bituminous concrete overlaid + 25mm thick bituminous mastic layer

Crash barriers: 1.0 t / m / side

c) Live Loads

Carriageway live loads: The following load combinations are considered in the analysis and whichever produces the worst effect is considered.

Five Lanes of IRC Class A

One Lane of 70R (wheeled) with Three lanes of IRC Class A.

Resultant live load stresses are reduced by 20% in case all the five lanes are loaded. Impact factor is as per latest IRC: 6 for the relevant load combinations. For simplicity in design, Impact factor for continuous structures is calculated for the smallest span of each module and used for all the spans of that module.

d) Horizontal Forces

(i) Longitudinal Forces due to live load

Following effects are considered in the design

- Braking forces as per the provision of latest IRC: 6
- Distribution of longitudinal forces due to horizontal deformation of bearings/frictional resistance offered to the movement of free bearings as per latest IRC: 6

(ii) Horizontal forces due to water currents

The portion of bridge, which may be submerged in running water, is designed to sustain safely the horizontal pressure due to force of water current as per the stipulations of latest IRC:6

(iii) Earth load

Earth forces are calculated as per the provisions of latest IRC:6 assuming the following soil properties:

a. Type of soil assumed for backfilling: As per latest IRC: 112

Angle of Internal Friction: Φ= 30O

Angle of Wall Friction: δ = 20O

Coefficient of Friction 'μ'at base : tan (2/3 Φ), while Φ is the angle of internal friction of substrata immediately under the foundations.

b. Live load surcharge is considered as per the provisions of latest IRC: 6.

e) Centrifugal forces

Centrifugal forces are calculated as per the provisions of latest IRC: 6 for a design speed applicable at horizontal curves.

f) Wind effect

Structures are designed for wind effects as stipulated in latest IRC: 6. The wind forces are considered in the following two ways and the one producing the worst effect shall govern design.

g) Seismic Effect

The road stretch is located in Seismic Zone-III as per the revised seismic map of India (IS: 1893-2002). The seismic forces will be coefficient method as suggested by the modified clause for the interim measures for seismic provisions in latest IRC: 6.

h) Other Forces / Effects

Temperature effects: The bridge structure / components i.e. bearings and expansion joints, are designed for a temperature variation of + 250 C considering extreme cli-mate. The superstructures are also designed for effects of distribution of temperature across the deck depth as given in latest IRC: 6, suitably modified for the surfacing thickness.

Temperature effects considered are as follows:

- Effects of non-linear profile of temperature combined with 50% live load and full value of 'E' is considered.
- Effects of global rise and fall of temperature combined with 100% live load and full value of 'E' is considered.

Differential shrinkage effects: A minimum reinforcement of 0.2% of cross sectional area in the longitudinal direction of the cast-in-situ slab is provided to cater for differential shrinkage stresses in superstructures with cast-in-situ slab over precast Girders as per Clause 605.2 of latest IRC: 22.

However, effects due to differential shrinkage and / or differential creep are duly accounted for in the design.

Construction stage loadings / effects: A uniformly distributed load of 3.6 KN /m2 of the form area is considered to account for construction stage loadings in the design of superstructure elements, wherever applicable, as per Cl. 4.2.2.2.2 of IRC: 87 – 1984.

Buoyancy: 100% buoyancy is considered while checking stability of foundations 135um-spective of their resting on soil/weathered rock / or hard rock.

i) Load Combinations to be considered in Design

All members are designed to sustain safely the most critical combination of various loads and forces that can coexist. Various load combinations as relevant with increase in permissible stresses considered in the design are as per latest IRC: 6.

In addition, the stability of bridge supporting two superstructures (with an expansion joint) is checked under one span dislodged condition also.

j) Exposure Condition

Moderate exposure conditions are considered while designing various components of the bridge.

k) Design Codes

The main design criteria adopted is to evolve design of a safe structure having good durability conforming to the various technical specifications and sound engineering practices.

l) Load combinations

The various load combinations considered are as per provisions of latest IRC: 6

ROB

The design of ROB will be based on the guidelines of Ministry of Railways. As per the latest Railways Guidelines, a vertical clearance of 7.3 m is being imposed for electrified track.

CD structures & HO/Grade separators

The GAD of CD structures is based on hydraulic and hydrological studies.

The GAD of flyovers/Grade separator is based on the traffic surveys and guidelines as contained in relevant IRC codes.

Codes and Publications

The following codes and publications (latest editions) shall be used for the design of approach road and bridge components:

- Specifications For Road and Bridge Works (4th Revision, 2000)
- IRC: 5-1998 For General Features of Design
- IRC: 6-2000 For Loads and Stresses
- IRC: 18-2000 For Pre-stressed Concrete Road Bridges
- IRC: 21-2000 For Reinforced Concrete Design
- IRC: 78-2000 For Substructure and Foundations
- IRC: 83-1999 (Part I) For Metallic Bearings
- IRC: 83-1987 (Part II) For Elastomeric Bearings
- IRC: 83-1987 (Part III) For Pot cum PTFE Bearings

3.14 Environmental and Social Screening

3.14.1 Environmental Screening

An Environmental screening study has been undertaken. The preliminary environmental study focused on identifying the key areas, the need for assessment of key impacts, issues, including information necessary for proposed development. The following issues were identified:

- The important environmental issues and concerns;
- The significant effects and factors; and
- The appropriate content and boundaries of an EIA study.

The programme included:

- Field surveys;
- Consultation exercises; identifying existing relevant baseline data;
- Identifying the scope of baseline surveys required;
- Identifying key issues to be addressed within the EIA; and
- Providing a technical brief for the EIA.

To identify any potential environmental conflicts arising out from the construction of the road, information was collected to arrive at the environmental constraints for the proposed scheme. The main issues included as appropriate, local settlements and communities, traffic, agriculture, ecology, land-use and soils, water, archaeological heritage, cultural and religious sites and planning issues.

This part of the study was undertaken in parallel with the economic and engineering analyses in order to determine any significant social or environmental issues, which require further detailed study. The approach and methodology to be adopted for environmental assessment conforms to the requirement of the Environmental Impact Assessment Notification, MoEF, 2006 & its amendment.

3.14.1.1 Secondary data collection

Secondary data collection including relevant maps for all the corridors was made available from various government agencies regarding:

(i) Flora and fauna

(ii) Critical natural habitats

(iii) Built-up areas

(iv) Water bodies

(v) Other critical environmental indicators

(vi) Policy, legal and administrative framework etc.

The available data has been used for environmental screening. The results of the preliminary screening lead to identification of the nature and extent of environmental issues needing more detailed examination, which may be dealt as a full EIA.

3.14.2 Social Screening

The overall objective of the study is to assess the likely impact on persons/families in the process of land acquisition needed in the process of construction of project road.

Social assessment would be conducted to broadly assess the extent of impacts due to the project on persons and properties within the corridor of impact. Both desk research and identification of major settlements within project area through field survey are conducted.

Social assessment study also aims at identifying the project affected people (PAP) and project affected families (PAF) analysing their socio-economic status, assessing losses due to project implementation. Remedial measures are proposed in the RAP to ensure that the income levels of PAPs, after the project implementation, are improved or at least restored to the pre-project level.

3.14.2.1 Secondary data collection

Available information is collected from various agencies that have worked in the state. The information includes constitutional provisions, status of social related legislation and policies of the central government and the state of Uttar Pradesh, guidelines for entitlement framework and community, social, ethnic and economic indicators of the population.

3.14.3 Social Impact Screening

During this preliminary screening stage, the consultants made an initial visit to the site in order to develop a clear understanding of the proposed road changes that may be undertaken and to identify the impact on housing, business and agricultural activities expected to arise out of the changes to be adopted. The social impact screening concentrated on the areas where there is likely to be the greatest impact on the population.

The data is analysed and screening is done initially, through a reconnaissance survey.

The various indicators considered are:

- Community life and economic activities
- Severance of community
- Encroachment on local community facilities
- Encroachment on local economic activities
- Encroachment on the access to and rights of resources
- Cultural heritage / property
- Social structure, institution and customs
- Cultural shock
- Road safety
- Public health
- Waste

Land acquisition and resettlement

- Expropriation of resources
- Involuntary resettlement
- Conflict between target population and host population
- Indigenous or traditional population

The results of the screening are plotted on maps and tabulated to identify any major conflicts and extent of conflicts.

3.15 Schemes for Development and Assessment

From the existing field data a few alternatives are evolved. This task made use of available data, site reconnaissance desk studies and preliminary findings. The standards, codes of practice and other relevant controlling documents are listed thereby establishing the procedures, design controls and general engineering practice required.

In the review of project alignment due considerations are given to the environmental implications, land acquisition and impact on project affected people, using information, provided in the discipline desk study reports undertaken earlier.

3.16 Preliminary Cost Estimates

The rates of materials adopted in the preliminary cost estimate are based on the SoR from respective districts of the Uttar Pradesh. The basis of rate analysis is the MoRT&H Stan-dard Data Book. For the working out of preliminary cost estimate, work items are split into the following sub-heads:

- Site clearance and Dismantling
- Earth Work
- Granular Sub Base Courses and Base Courses (Non- Bituminous)
- Bituminous Courses
- Box Culverts
- Minor Bridges
- Major Bridges
- VUP/LVUP/PUP
- ROB
- Flyover and NH & SH Crossing
- Interchange and Junctions
- Retaining Wall
- Drainage & Protective Works
- Traffic signs, Road markings and other road appurtenances
- Toll Plaza
- Approach to Wayside Amenities, Toilet block & Median Opening
- Environmental Cost (Civil Works)
- Miscellaneous Works
- ATMS for Access Controlled Expressway,

4. TRAFFIC STUDIES

4.1 Introduction

This Chapter examines the Traffic Studies for the present day traffic and traffic forecast besides "Toll Studies" which section contains the analyses of system options, makes recommendations regarding the level of toll to be applied to different vehicle categories.

The presently available routes for traffic between Meerut (Start Point of Expressway) & Prayagraj Bypass on NH-19 (old NH-2) (End Point of Expressway) are indicated on Figure 4.1.

The Expressway is access controlled with only entry/exit at Nodes (*intersecting points of National Highway or State Highways or Major District Roads – crossing with the proposed Expressway Alignment*) are lettered "A" to "R" as listed on Table 4.1:

Table 4.1: Details of Toll Nodes for entry / exit proposed on the Expressway

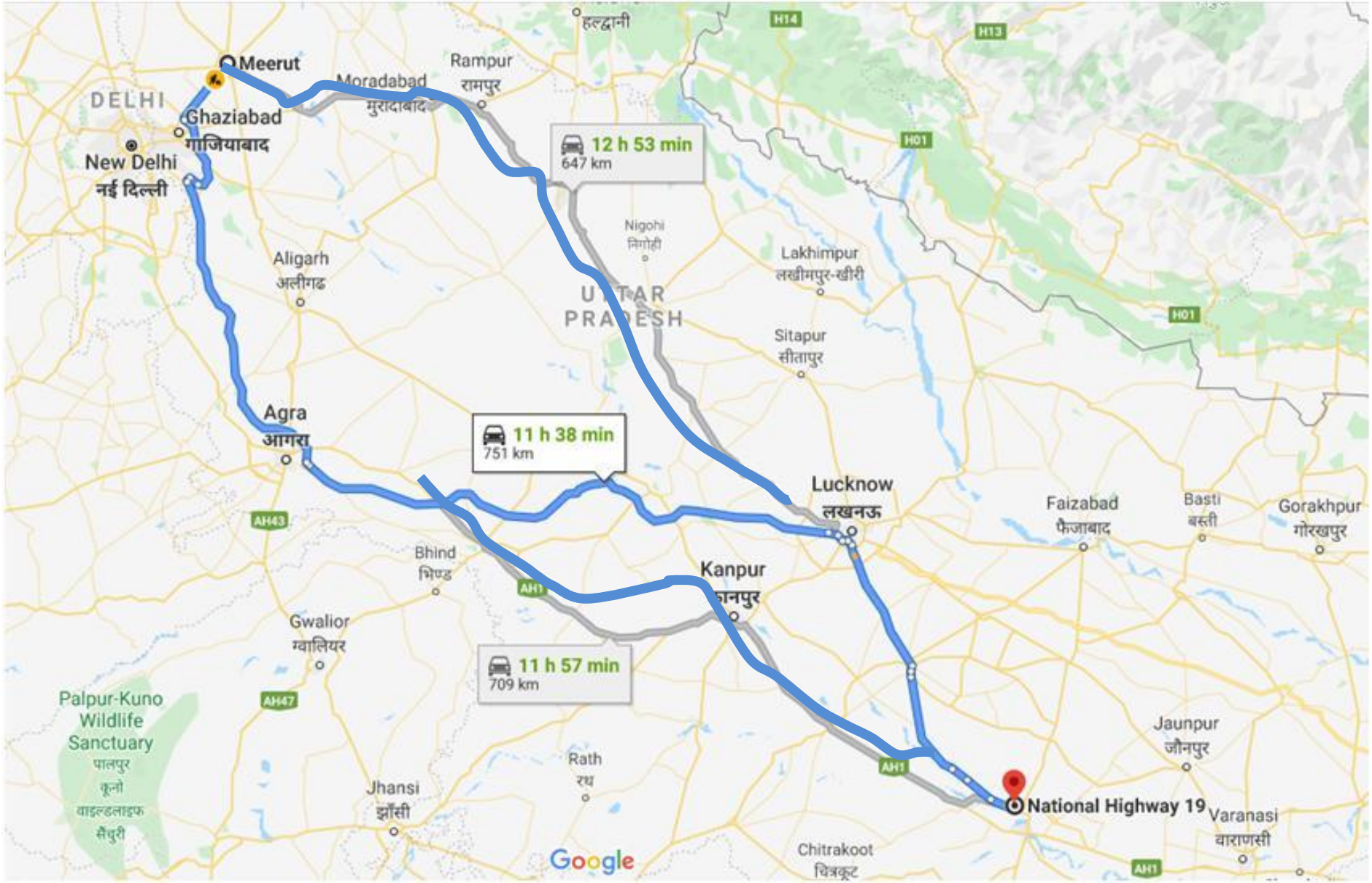
Toll Nodes	Chainage	Details of the Intersecting Roads	Road No.	Type of Intersection
A	0+100	Delhi - Meerut Expressway	Expressway	Dummy Node
B	8+920	Meerut – Hapur	NH-334	Trumpet
C	35+270	Hapur - Garhmukteshwar	NH-24	Diamond
D	54+640	Bulandshahr - Garhmukteshwar	SH-65	Diamond
E	74+181	Hasanpur-Anupshahar	MDR-162W	Diamond
F	102+427	Anupshahr - Moradabad	ODR	Diamond
G	123+288	Babrala - Chandausi	NH-509	Double Trumpet
H	173+454	Chandausi - Budaun	SH-125	Diamond
I	189+394	Budaun - Bareilly	SH-33	Double Trumpet
J	255+167	Farukkhabad - Shahjahanpur	SH-29	Double Trumpet
K	282+845	Farukkhabad - Shahbad	SH-138	Diamond
L	329+945	Kannauj– Hardoi	SH-21	Double Trumpet
M	378+136	Agra - Lucknow Expressway	Agra Lucknow Exp	Double Trumpet
N	420+932	Kanpur - Lucknow	NH-27	Diamond
O	487+285	Lalganj - Raebareli	NH-31	Double Trumpet
P	517+708	Raebareli–Unchahar	NH-30	Double Trumpet
Q	554+951	Manikpur - Bela Pratapgarh	MDR-102E	Diamond
R	600+457	Prayagraj Bypass	NH-19	Trumpet

Node A is revised and treated as Dummy Node in this Report, as the Start Point of the Ganga Expressway has been changed from Node A to Node B due to Engineering Design Constraints, with prior approval of UPEIDA. Table showing distances between various destinations from Ganga Expressway, that traffic which are likely to use the sections of Expressway between these lettered nodes "A"to "R" are provided as follows:

(a) on the presently available network of alternative routes – Table 4.2; and
(b) as estimated on the Proposed Expressway– Table 4.3.

Table 4.2 shows Traffic Zones from Expressway, the distances travelled by *"passenger cars"*. Distances travelled by truck are occasionally longer – these vehicles must use especially-designated truck routes.

Figure 4.1 Presently Available Routes for Through Traffic between Meerut and Prayagraj



National Highway NH 19 (old NH 2), Agra-Lucknow Expressway and NH 30 (Old NH24) are the alternate routes:

The present status of these alternate routes between Prayagraj and Meerut are as follows:

Alternate Route	Description of Route	Distance (Kms)	Travel Times (Hours : Minutes)	Journey Speed (Average) (Km/hr)
NH19 Route Prayagraj – Kanpur – Agra – Greater Noida – Dasna – Meerut	• Prayagraj - Kanpur (NH19, old NH2); • Kanpur – Bachhela/Bachheli – Agra (Agra Lucknow Expressway); • Agra – Greater Noida (Yamuna Expressway); • Greater Noida – Dasna (Easter Pheripheral Expressway); and • Dasna - Meerut (NH34, old NH58)	709	11h:57m *(includes lesser sections of other Expressways)*	59.33 (approx. 60 Km/hr)
Agra Lucknow Expressway Prayagraj – Lucknow – Agra – Greater Noida – Dasna – Meerut	• Prayagraj - Lucknow (NH 30); • Lucknow – Agra (Agra Lucknow Expressway); • Agra – Greater Noida (Yamuna Expressway); • Greater Noida – Dasna (Easter Pheripheral Expressway); and • Dasna - Meerut (NH34, old NH58)	751	11h:38m *(includes maximum sections of other Expressways)*	64.55 (approx. 65 Km/hr)
NH 30 Route (no sections of expressways) Prayagraj – Lucknow – Bareilly – Rampur – Moradabad – Garhmukteshwar – Meerut	• Prayagraj - Lucknow – Bareilly (NH 30); • Bareilly – Rampur (NH 530); • Rampur - Moradabad – Garhmukteshwar (NH9); and • Garhmukteshwar - Meerut (SH14)	647	12h:53m *(does not include any sections of other Expressways)*	50.21 (approx. 50 Km/hr)

Table 4.2: Distance (in Kms) to Destination Zones from Expressway

Name of District Centres	Origin Zones	Expressway Nodes (A to R)	Distance *(in Kms)*	Journey Speed *(Km/hr)*
Saharanpur	11	A	122.0	52
Muzaffarnagar	12	A	57.7	52
Bulandshahr	13	G	86.6	42
Ghaziabad	14	C	147.0	45
Meerut	15	B	11.0	-
Noida	16	C	74.3	49
Baghpat	17	B	60.9	44
Greater Noida	18	G	131.0	41
Shamli	19	A	75.2	51
Bijnor	20	E	86.4	39
Moradabad	21	G	61.6	43
Rampur	22	I	111.0	47
Jyotiba Phule Nagar	23	E	36.1	19
Kasganj	24	I	83.4	45
Bareilly	25	I	38.9	40
Pilibhit	26	J	129.0	43
Shahjahanpur	27	J	38.6	38
Ayodhya	28	M	217.0	55
Yusuf	29	-	-	-
Hardoi	30	L	26.7	38
Kheri	31	J	138.0	42
Lucknow	32	M	71.9	58
Raebareli	33	O	26.5	44
Sitapur	34	L	98.3	42
Unnao	35	N	9.0	54
Amethi	36	N	86.0	43
Hapur	37	C	17.1	45
Sambhal	38	F	7.0	53
Amroha	39	E	36.1	19
Bahraich	40	L	200.0	44
Barabanki	41	M	109.0	52
Faizabad	42	M	217.0	55
Gonda	43	M	199.0	51
Sultanpur	44	M	218.0	57
Ambedkar Nagar	45	M	283.0	63
Shrawasti	46	L	246.0	44
Balrampur	47	L	277.0	48
Budaun	48	I	13.2	36
Chitrakoot	49	R	129.0	43
Azamgarh	50	M	350.0	51
Basti	51	M	275.0	55
Deoria	52	M	399.0	54
Gorakhpur	53	M	351.0	55
Mau	54	M	395.0	60
Siddharth Nagar	55	M	351.0	53

Name of District Centres	Origin Zones	Expressway Nodes (A to R)	Distance *(in Kms)*	Journey Speed *(Km/hr)*
Mahrajganj	56	M	380.0	51
Padrauna	57	M	426.0	55
Sant Kabir Nagar	58	M	319.0	56
Hathras	59	M	304.0	68
Ballia	60	M	473.0	58
Ghazipur	61	M	422.0	58
Jaunpur	62	R	108.0	47
Mirzapur	63	R	120.0	41
Sonbhadra	64	R	213.0	43
Varanasi	65	R	134.0	44
Sant Ravidas Nagar	66	R	81.0	47
Chandauli	67	R	163.0	43
Kushinagar	68	M	426.0	55
Lakhimpur - Kheri	69	J	138.0	42
Prayagraj	70	R	10.0	60
Fatehpur	71	O	42.4	41
Pratapgarh	72	Q	41.9	44
Kaushambi	73	R	73.0	43
Kannauj	74	L	34.6	40
Etawah	75	M	149.0	68
Farrukhabad	76	J	50.5	39
Kanpur Dehat	77	N	89.6	42
Kanpur Nagar	78	N	21.6	26
Auraiya	79	M	125.0	50
Agra	80	M	260.0	76
Aligarh	81	M	362.0	69
Etah	82	I	101.0	44
Firozabad	83	M	219.0	67
Mainpuri	84	M	179.0	74
Mathura	85	M	320.0	76
Mahamaya Nagar	86	M	295.0	69
Kanshiram Nagar	87	I	70.1	45
Lalitpur	88	-	-	-
Mahoba	89	-	-	-
Banda	90	-	-	-
Hamirpur	91	-	-	-
Jalaun	92	-	-	-
Jhansi	93	-	-	-
Other Influence States Assam, Bihar, Chhattisgarh, Chandigarh, Gujarat, Himachal Pradesh, Haryana, Jharkhand, Karnataka, Maharashtra, Madhyapradesh, New Delhi, Nepal, Odisha, Punjab, Rajasthan, TamilNadu, Telangana, Uttarakhand, WestBengal	AS, BR, CG, CH, GJ, HP, HR, JH, KA, MH, MP, NDLS, Nepal, OR, PB, RJ, TN, TS, UK, WB	-	500+	-

Table 4.3: Distance Matrix between Toll Nodes (Nodes "A" to "R") of Expressway

(Distance in Kms)

Toll Nodes	A	B (NH 334)	C (NH 24)	D (SH 65)	E (MDR)	F (ODR)	G (NH 509)	H (SH 125)	I (SH 33)	J (SH 29)	K (SH 138)	L (SH 21)	M (EW)	N (NH 27)	O (NH 31)	P (NH 30)	Q (MDR 102E)	R (NH 19 Bypass)
A	0	8.92	35.27	54.64	74.18	102.43	123.29	173.45	189.39	255.17	282.85	329.95	378.14	420.93	487.29	517.71	554.95	600.46
B (NH 334)		0	26.35	45.72	65.26	93.51	114.37	164.53	180.47	246.25	273.93	321.03	369.22	412.01	478.37	508.79	546.03	591.54
C (NH 24)			0	19.37	38.91	67.16	88.02	138.18	154.12	219.90	247.58	294.68	342.87	385.66	452.02	482.44	519.68	565.19
D (SH 65)				0	19.54	47.79	68.65	118.81	134.75	200.53	228.21	275.31	323.50	366.29	432.65	463.07	500.31	545.82
E (MDR 162W)					0	28.25	49.11	99.27	115.21	180.99	208.66	255.76	303.96	346.75	413.10	443.53	480.77	526.28
F (ODR)						0	20.86	71.03	86.97	152.74	180.42	227.52	275.71	318.51	384.86	415.28	452.52	498.03
G (NH 509)							**0**	50.17	66.11	131.88	159.56	206.66	254.85	297.64	364.00	394.42	431.66	477.17
H (SH 125)								**0**	15.94	81.71	109.39	156.49	204.68	247.48	313.83	344.25	381.50	427.00
I (SH 33)									**0**	65.77	93.45	140.55	188.74	231.54	297.89	328.31	365.56	411.06
J (SH 29)										**0**	27.68	74.78	122.97	165.77	232.12	262.54	299.78	345.29
K (SH 138)											**0**	47.10	95.29	138.09	204.44	234.86	272.11	317.61
L (SH 21)												**0**	48.19	90.99	157.34	187.76	225.01	270.51
M (EW)													**0**	42.80	109.15	139.57	176.82	222.32
N (NH 27)														**0**	66.35	96.78	134.02	179.53
O (NH 31)															**0**	30.42	67.67	113.17
P (NH 30)																**0**	37.24	83.57
Q (MDR 102E)																	**0**	46.33
R (NH 19 Bypass)																		0

Note: Distance for reverse routes shall have same diagonal values

4.2 Traffic Surveys

4.2.1 Introduction

The traffic surveys were of three main types:

(a) origin and destination surveys (which included willingness-to-pay *"stated-preference"* questions and, in one instance where this type of survey was possible, a *"revealed-preference"* survey – see below); and
(b) classified count surveys;

All three survey types were conducted in accordance with the guidelines specified in IRC 9-1972, IRC 102-1988 and IRC SP19-2001.

4.2.2 Origin and Destination Surveys

The origin and destination surveys were the most important traffic surveys - as it is from these that the **Candidate Traffic** was derived. The surveys were conducted at points close to where the proposed Expressway would intersect with the National, State and other highways/district roads and other locations from which, traffic that may eventually use the Expressway either partly or entirely. The traffic survey locations are shown on Figure 4.2 and listed on Table 4.4.

Table 4.4: Locations for Road-Side Origin and Destination (O-D) Surveys

OD.No.	Survey Location	Stretch & Road Name	Day & Date of O-D Survey
1	Siwaya Toll Booth	Muzaffarnagar - Meerut	Wednesday, 12thFebruary 2020
2	Nizampur	Meerut - Garhmukteshwar	Friday, 6th December 2019
3	Kurkawali	Hasanpur - Chandausi	Monday, 4th November 2019
5	Nagariya	Aligarh - Etah	Wednesday, 27th November 2019
6	Khankah e Niyaziya	Aliganj - Farrukhabad	Monday, 9th December 2019
7	Samdhan	Farrukhabad - Kannauj	Wednesday, 27th November 2019
8	Bilhaur	Kannauj - Kanpur	Monday, 2nd December 2019
9	Katohan Toll Booth	Fatehpur - Prayagraj	Monday, 16th February 2020
10	Agwanpur	Bijnor - Moradabad	Friday, 29th November 2019
11	Faridpur Toll Booth	Bareilly - Shahjahanpur	Monday, 2nd December 2019
12	Nawada	Chandausi - Budaun	Thursday, 28th November 2019
13	Usawan	Budaun - Farrukhabad	Thursday, 5th December 2019
14	Shahabad	Shahjahanpur - Hardoi	Friday, 29th November 2019
15	Safipur	Bangarmau - Unnao	Wednesday, 4th December 2019
16	Semari	Unnao - Lalganj	Friday, 6th December 2019
17	Andiyari	Unchahar - Prayagraj	Tuesday, 10th December 2019

At all sites, the questions, besides *"origin"* and *"destination"*, ascertained trip purpose, type frequency, and for freight vehicles the nature of any loads and the tonnage carried.

For the purpose of analysing the data from origin and destination surveys,

(i) all of the areas on either sides of the proposed Expressway alignment were divided into 72 Zones, i.e. each on left side and right side of 18 nodes - A to R; and in order to arrive at the

candidate traffic and homogeneous traffic sections for the proposed alignment of Expressway, traffic with origin and destinations in this area are considered more likely to use certain sections of the Expressway and a percentage of it that may use the entire length of the Expressway.

(ii) The rest of the areas were divided into 83 (district) Zones lying within the State of Lucknow, and into 20 Zones for other States (project influence) of India.

These zones served principally to assess the proportion of traffic that travels even less than 25 Kms using existing roads that may divert to the Expressway (refer Table 4.5).

Figure 4.2 Traffic Survey Sites

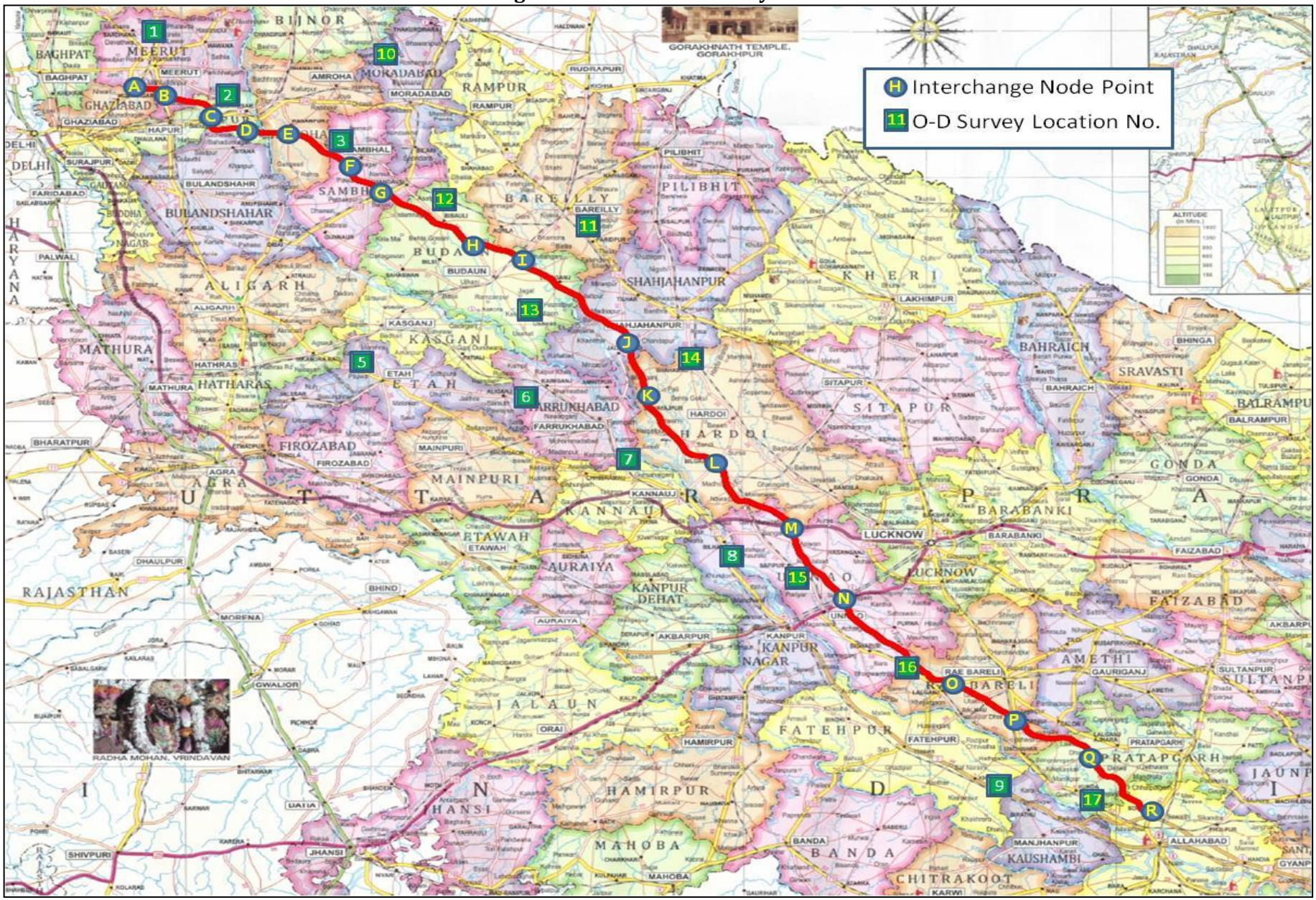


Table 4.5 Zoning Definitions

Sl. No.	Region / City / District / State	Zoning Code	Origin/Destination Villages/Places
1.	Saharanpur	11	Abdal Pur, Abdalpur, Abdalpur Up, Ananybad, Badhu, Bedhu, Bhaidpur, Bongarpur, Boral, Deoband, Deoband Up, Dhorshi, Gagoh, Gangohi, Gangohi Up, Hardakheda, Jaroda, Jaroda Up, Jharoda Up, Maqsoodpur, Marv, Punkaji, Sahanranpur, Saharanpur, Saharanpur, Saharanpur Up, Sedpur, Sharanpur, Sheikhpur, Shigna, Shiman Up, Sholda, Sholda Up, Shondi, Shopur, Sispodi, Sodkhand, Wajeerpur
2.	Muzaffarnagar	12	Baghra, Baghra Up, Bawrala, Chapar, Chaper, Chapur, Chhapar, Chhapar Up, Chittorganj, Jambalhera, Jhiyad, Johad, Khatoli, Khatoli Up, Kiranabad, Mansupur, Morna, Muzaffar Nagar, Muzaffar Nagar Up, Muzaffarnagar, Muzaffarnagar, Muzzafar Nagar, Purkaji, Sambalhera, Sambhalhera, Sapur, Shahpur, Shahpur Up, Shampur, Shapur, Sipoli, Sisholi, Sisoli Up, Sisona, Tigree
3.	Bulandshahr	13	Adainagar, Aurang, Aurangabad Up, Baharpur, Banche, Bejuee, Bhalt, Bilsuri, Binuvat, Borha, Bulandhahr, Bulandhshahr, Bulandshahr, Bulandshahr, Bulandshahr Up, Bulandshehar, Bundnio, Chawali, Dhatori, Dhaturi Up, Dibai, Dibai Up, Ganga, Ghort, Halpura, Halwani, Jahanpur, Jaharpur, Jamunanagar Up, Jehangirabad, Jehangirabad Up, Karada, Karliya, Kheja, Khurga, Khurja, Khurja Up, Kurzo, Lakhoti, Lakhoti Up, Nowganj, Noydd, Pahasu Up, Pahsu, Palsa, Plunger, Polwayi, Pousha, Really, Ridshi, Sarangpur, Shamal, Shamul, Shikapur, Shikarpur, Shikarpur Up, Sikandrabad, Vilashi, Village, Vilshi, Vilshi Up, Vinvat, Zahidpur
4.	Ghaziabad	14	Gajiyabad, Gaziabad, Gaziabad Up, Gaziyabad, Ghaziabad, Ghaziabad, Sabibabad Up, Sahibabad, Vishali
5.	Meerut	15	All, College, Daurala, Gedpur, Gorum, Has, Meerut, Meerut, Meerut Up
6.	Noida	16	Noida
7.	Baghpat	17	Baghpat
8.	Greater Noida	18	Bahtta, Bhatta, Buhtta, Greater Noida, Habibpur, Haldoni, Jhajhar, Junad, Noida, Noida Hr, Noida Up, Sambalpur, Sambhalpur
9.	Shamli	19	Shamli
10.	Bijnor	20	Akbarabad, Akbarpur Up, Akbrabad, Bangal Rawra, Bangarpul Up, Bangarpur, Berulu, Bhinor Up, Bijnor, Bijnor, Bijnore, Bijnour, Chandpur, Dhampur, Dhundhli, Dhundhlijhalu, Gurdaspur, Haldar, Jhalu, Kanth, Karabali, Kiratpur, Nagina, Najibabad, Noorpur, Qadarganj, Samshabad, Sarai, Seohara, Shadpur, Shamsabad, Shamshabad, Shashabad, Shikhora, Shungrmeda
11.	Moradabad	21	Agwanpur, Barkheda, Barkhera, Bilari, Gherat Up, Janmot, Kandarki, Karula, Karula Up, Karulabad, Kundarki, Moradabad, Moradabad, Moradabad , Muradabad, Pakwara, Palanpur, Umri Kalan, Umrikalan
12.	Rampur	22	Ali Nagar, Alinagar, Alinagar Up, Bahapur, Bikli, Bilaspur, Degarpur, Hajitpur, Kashipur, Khau, Milak, Milock, Rampur, Rampur
13.	Jyotiba Phule Nagar	23	Jyotiba Phule Nagar

Sl. No.	Region / City / District / State	Zoning Code	Origin/Destination Villages/Places
14.	Kasganj	24	Alipur, Amanpur, Badhonu, Badhun, Bahedia, Bahodia, Dariyaganj, Kasganj, Kasganj, Kashganj, Sahwar, Shahawar, Shahway
15.	Bareilly	25	Bachoom, Bachrom, Bahari, Bahedi, Baheri, Baliamirand, Baliatpur, Barali, Barapeli, Bareilly, Bareily, Bareily Up, Bareli, Bareli Up, Bareliey, Barely, Bariely, Barili, Biharipur, Billpur, Bilpur, Bilwa, Borali, Dakni, Devchara Up, Faridpur, Fatehganj Purbi, Folar, Ganj, Gatsol, Hafizganj, Izzatnagar, Jade, Jasdanpur, Kargaina, Kesarpur, Manpur, Mirganj, Mirgunj, Mokalganj, Nahoma, Nakitsy, Paiga, Parsakheda, Rafiabad, Rafiyabad, Rampura Ratan, Rampuraratan, Richha, Richola, Tajua, Tisua, Umarsia
16.	Pilibhit	26	Bebor, Bisalpur, Bishalpur, Changli, Pilibhit, Pilibhit, Pilibhit Up, Puranpur, Satipur, Shitarganj, Sitaraganj, Sitarganj, Vishalpur
17.	Shahjahanpur	27	Banisha, Banthra, Bathra, Feroz, Katra, Kattra, Khandelwal, Khutar, Khutar Up, Kurpur, Maanhila, Madnapur, Maikalganj, Mohanpur, Morena, Morewa, Nagashi, Nagasi, Nighoi, Nighroi, Nigohi, Patiana, Pedu, Rampura, Sahajanpur, Sahjanpur, Samdil, Sasanpur, Sashanpur, Shahajahnpur, Shahjahanpur, Shahjahanpur, Shahjahnpur, Shahjanpur, Shahjapur, Shahjehanpur, Tilhar, Tillor, Vashari, Vashri
18.	Ayodhya	28	Ayodhya
19.	Yusuf	29	Yusuf
20.	Hardoi	30	Atarli, Athroli, Atrali, Atroli, Bagholi, Balamau, Bharti, Gopamau, Hardoi, Hardoi, Hardoi Up, Jiman, Launi, Malechabad, Malehabad, Malihabad, Mandara, Naruganj, Pihani, Pihoni, Sahabad, Sandi, Sandila, Shabad, Shahabad, Shahbad, Shamshapur, Sondila, Tandila,
21.	Kheri	31	Kheri
22.	Lucknow	32	Agar, Atal Nagar, Behta, Bhagwaniya, Kalampur, Lucknow, Lucknow, Lucknow Up, Mohanlal Ganj, Nazirabad, Nizampur, Paliya, Samoshi, Transport Ngr, Ushmi
23.	Raebareli	33	Aihar, Bursganj, Burshaganj, Dedaur, Kondganj, Rae, Raebareily, Raebareli, Raebareli, Raebareli Up, Raibareily, Raibareli, Raibareli Up, Raibarely, Raibariely, Raibawali, Salon, Salon Up
24.	Sitapur	34	Ailiya, Aruwa, Bandya, Benaura, Bhawana Up, Biswa, Biswan, Dewaji, Dewayi, Dewyi, Dhanayi, Diryi, Diwai Up, Diwayi, Diyi, Guzra, Itina, Kamoli, Katiya, Khairabad, Khirbad P, Kutub Nagar, Laharpur, Local Up, Maholi, Maholi Up, Maigalganj, Misrikh, Mohali, Mohali Up, Neri, Sheswan, Sindhauli, Sindhauli Up, Sitapur, Sitapur, Sitapur P, Tandua, Titapur
25.	Unnao	35	Ajgain, Azgen, Bakram, Chimor, Ganjmurkhed, Hasanganj, Hindokheda, Hinduheda, Hindukheda, Indoptan, Lakhmi, Nawab Ganj, Nawabganj, Orash, Saraon, Shrodhi, Simri, Unnao, Unnao, Vgo,
26.	Amethi District	36	Amethi
27.	Hapur	37	Badgoo, Bajooda, Garh Mukteshwar, Garhmukteshwar, Garmukteshwar Up, Hapad, Hapud, Hapur, Hapur, Hapur Up
28.	Sambhal	38	Baboala, Babrala, Dhanry, Faizapur, Jargaon, Sambal, Sambhal, Sambhal, Sambhal Up

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29.	Amroha (J.P. Nagar)	39	Ampko, Amplio, Amro, Amroh, Amroha, Amroha (J.P. Nagar), Dhanora, Dharora, Didauli, Gangeshwari, Gangeshwari Up, Hashampur, Jalsurya, Jalwaray, Joya,Kalampur Up
30.	Bahraich	40	Bahraich, Bangal, Behraich, Bengal, Bichuna
31.	Barabanki	41	Bara Banki, Barabanki, Barabanki, Barabanki Up, Bheriya, Haidargarh, Haidargarh Up, Jaroli, Kotara, Mehmoodpur,
32.	Faizabad	42	Bachholi, Chirra, Faizabad, Faizabad, Faizabad Up, Kurbabad, Ranchi, Satna, Wazeerganj,
33.	Gonda	43	Gonda, Shidpur
34.	Sultanpur	44	Baranpur, Gauriganj, Goriganj, Katawabul, Nayoda, Nayrda, Rajuh, Shakhana, Sulanpur, Sultanpur, Sultanpur, Sultanpur Up, Sultanpuri, Uchhgaon
35.	Ambedkar Nagar	45	Akbarpur, Ambedkar Nagar, Ambedkar Nagar, Malipur, Ravi, Ravipur, Warora
36.	Shrawasti	46	Shrawasti
37.	Balrampur	47	Balrampur, Deonagar, Kamda, Vithar
38.	Budaun	48	Aapna, Adhapur, Alapu, Aldarmali, Allapur, Badaan, Badam, Badaun, Badayu, Badayun, Badhayun, Barahkalan, Bilhar, Bilhari, Bilhawad, Bilshi, Bilsi, Bisli, Budaun, Chiroli, Deputa, Diblai, Gaawan, Gaawana Up, Gauram, Gavan, Gawan, Gennor, Ginnor, Ginnor Up, Gonar, Guneer, Gunnoor, Hoista, Jharpur, Kakarala, Kakrala, Kokrala, Kurau, Mek, Mev, Miahu, Mithu, Myau, Narora, Narorda, Osawa, Palaw Sarai, Ramghat, Ramghat Up, Risrodi, Sahaswan, Sane, Sasman, Saswan, Seshwan, Shanpur, Shrugimo, Singhpur, Singpur, Thanugadi, Ughani, Ujhani, Usawa, Usawan, Usawat, Uset, Velopur, Workapur, Yenor
39.	Chitrakoot	49	Chitrakoot, Manikpur
40.	Azamgarh	50	Azamgarh, Azamgarh, Gopalpur, Kamhepur, Kasba, Madia, Newada, Pihargaon, Vidhyapur,
41.	Basti	51	Bahanpur, Basti, Budhiya, Karza, Khatiyar,
42.	Deoria	52	Bagra, Deoria, Deoria, Gohari, Gohri, Guhari, Madanpur,
43.	Gorakhpur	53	Gorakhpur, Gorakhpur, Gorakhpur Up, Mahu,
44.	Mau	54	Kasari, Kawala, Mau, Mau Up, Paligarh, Siura, Udarn,
45.	Siddharth Nagar	55	Banshi, Bansi, Bansy, Bhatal, Bhatul, Bhutal, Kesar, Kusawa, Santa, Siddharth Nagar,
46.	Mahrajganj	56	Dashrathpur, Farendu, Mahrajganj
47.	Padrauna	57	Padrauna
48.	Sant Kabir Nagar	58	Sant Kabir Nagar, Upraudh, Uprauth
49.	Hathras	59	Hasayan, Hasayan Up, Hathras, Hathras, Hathras Up, Khati, Murasa, Pashayan, Piprama
50.	Ballia	60	Azahar, Azhar, Baliya, Ballia, Balliya, Bori, Bouri, Khari, Ujair,
51.	Ghazipur	61	Badorose, Chhatarpur, Firozpur, Gazipur, Ghazipur, Kurshyaganj, Malikpur, Mohamadabad, Mohammadabad, Raipur, Saidpur, Sonwal, Tajpur,
52.	Jaunpur	62	Ambikapur, Bithar, Bithor, Faridabad, Jaunpur, Jaunpur, Jaunpur Up, Jhampur, Jhanpur, Jonpur, Kalapur, Kanhapur, Machhlishahar,

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53.	Mirzapur	63	Chunaar, Chunar, Dauhya, Daulatpur, Gopiganj, Gyanpur, Kanhaipur, Khalapur, Mirzapur, Mirzapur,
54.	Sonbhadra	64	Kewal, Renukoot, Robatsganj, Robitsganj, Sonbhadra, Sonpat,
55.	Varanasi	65	Badoh, Ballabhpuram, Banaras, Banaras Up, Behaura, Bhainsa, Gul, Gula, Gulab Bagh, Kash, Pahladpur, Ramnagar, Ramnau, Varanasi, Varanasi, Varanasi Up,
56.	Sant Ravidas Nagar	66	Bhadohi, Bhadoni, Darwaji, Darwashi, Darwayi, Dhavarsi, Dhawarasi Up, Dhawarsi, Dorwyi, Sant Ravidas Nagar,
57.	Chandauli	67	Besila, Candoli, Chandauli, Chandauli, Chandauli Up, Chandoli, Kamalpur, Kamalpur Up, Mugalsarai, Mughal Sarai, Mughalsarai, Pathhan,
58.	Kushinagar	68	Kushinagar
59.	Lakhimpur - Kheri	69	Bhuria, Darra, Gokarnath, Gorakhnath, Islamabad, Jangbahadur Ganj, Jangbahadurganj, Khiri, Khitai Up, Lakhimpur, Lakhimpur - Kheri, Lakhimpur Kheri, Lakhimpur P, Mahdi, Mailani, Mailani Up, Mirpur, Mohamadi, Nigasan, Pilia, Piliya, Pillya, Sarkhanpur
60.	Prayagraj	70	Allahabad, Allahabad, Allahabad Up, Allahapur, Allahpur, Andheridham, Basahi, Bhatoripura, Billhore, Chalapurgaon, Dhanupur, Fafaamor, Fulbattis, Handia, Handiya, Jeri, Jhusi, Kadhabool, Kareli, Katayali, Mahjapur, Meerganj, Mollawa, Naini, Phaphamau, Phoolpur, Phophamau, Prayagraj, Prayagraj Up, Sahjadpur, Sirsa, Soraon, Surabgaon
61.	Fatehpur	71	Ajhawa, Ajhuwa, Bahua, Bilanda, Bindhki, Bindki, Binki, Budwan, Fatehpur, Fatehpur, Fatehpur Up, Hardoan, Hardod, Haswa, Iskuri, Jakhmi, Katagham, Katogham, Khaga, Khajuha, Kodarpur, Kora Jahanabad, Kotagham, Maharajpur, Malwan, Malwan Up, Mannikheda, Pichhuli, Pilhi, Raiwardi, Rewari, Sauran, Tharian, Thariaon, Vidhki
62.	Pratapgarh	72	Aghiya, Ajhar, Ajhar Up, Basauli, Kashar, Kunda, Patava, Pati, Pratapgarh, Pratapgarh, Rakha, Rakri
63.	Kaushambi	73	Bariya, Bharwari, Chail, Daranagar, Devrand, Dolchi, Karari, Kasiya, Kaushambi, Mandook, Manoharganj, Moradpur, Saraibhajitamal, Sirathu, Sirothu, Sitahu
64.	Kannauj	74	Anash, Annajj, Arash, Bidai, Chhipra, Chhipramau, Chibramau, Garshayera, Gathoshi, Gatoshi, Ghosar, Gotashi, Gursaganj, Gursahaiganj, Gursaiganj, Gursarai, Gurusaiganj, Guthashi, Jaryapur, Kadhaganj, Kadhganj, Kahukawad, Kandganj, Kannauj, Kannauj, Kannauj Up, Kannoj, Kannoz, Khudaganj, Kodaganj, Kundaganj, Ladhar, Locla, Majhana, Makanpur, Makhanpur, Mushyna, Sahmadhan, Samdhan, Shadhan, Shamdhan, Shandhan, Sirdi, Sirli, Sudaganj, Sundhan, Talgram, Terara, Terru, Uncha
65.	Etawah	75	Aman, Aorema, Aroj, Aroz, Balarayi, Balragi, Balrai, Balrai Up, Balraji, Balrayi, Balruji, Balryi, Bedpur, Bedpura, Bharthana Up, Chithbhaon, Dhamua, Dhanua, Etawa, Etawa Up, Etawa Upq, Etawah, Etawah, Etawah Up, Jaswant Nagar, Jaswant Nagar Up, Jefayi, Karawani, Kewala, Nowali, Saifai, Saifai Up, Sarai Bhopat Up, Saryi Bhopat, Sefayi, Suryibhopat, Udhampur, Udrampur,
66.	Farrukhabad	76	Amritpur, Atena, Barshayaganj, Basili, Borili, Chiwarmau, Chiwramal, Daltun, Dursamganj, Farrukhabad, Farrukhabad, Farrukhabad Up, Fatehgarh, Geari, Geri, Gueri, Jarari, Kalan,

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			Kalantar, Kamalganj, Kamganj, Kayamganj, Kharsuiya, Kudaganj, Roshan, Roshanabad, Roshnabad, Sagar, Sagaria, Saraiadhhar, Saraighat, Sarraiadhar, Tathiya, Tatia
67.	Kanpur Dehat (Rural)	77	Anti, Bara, Bihari, Kakwan, Kanpur Dehat Rural), Kokwan, Rajpura, Ramiya, Rania, Raniya, Raniya Up, Rasulabad, Roniya, Sarayan, Sukhabad
68.	Kanpur Nagar	78	Amiliha, Amiliya, Araul, Atrapuri, Bakathi, Bakedi, Bakhuti, Bakodi, Bakothi, Barra, Barro, Bihaur, Bilhaur, Bilhore, Billore, Bilohre, Chobepur, Chorepur, Dalhai, Dehrampur, Ghimau, Gimau, Harshnagar, Hathipur, Kalyanpur, Kamri, Kanpur, Kanpur Nagar, Kanpur Up, Karachi Khana, Koriya, Korliya, Mandhana, Manthana, Manthna, Monthana, Naramau, Nison, Pilar, Pormi, Prempur, Ramaipur, Rawatpur, Roma, Rooma, Sarsaul, Shivrajpur, Shubhampur, Shuklapur, Suklaganj, Tatiyaganj, Tatyaganj, Udetpur, Udetpur Up,
69.	Auraiya	79	Amla, Aoraiya, Aoraiya Up, Aorya, Auraiya, Auraiya, Babarpur, Bidhuna Up, Bidona, Billawa, Bithona, Houriya, Oraiya, Oriya, Vidhana
70.	Agra	80	Agra, Agra, Agra Up, Amritpuri, Bamdha, Barham, Barhanshi, Beelpura, Bidhari, Bordi, Fatehabad, Fatehpur Sikri, Gajol, Sakganj, Shahganj, Sirauli, Siroli
71.	Aligarh	81	Aligarh, Aligarh, Aligarh Up, Barauli, Bharatpur, Bharatpur Up, Bhartpur, Bidhana, Dudpur, Ekri, Enkri, Harduaganj, Harduaganj P, Jalali Up, Jalalpur, Jatpur, Jatpura, Jidali, Jilali, Kankit, Kannore, Kasimpur, Khair, Khair Up, Lathgarh, Madrak, Madrak Up, Malhapur, Manai, Manai Up, Manesar, Purhan, Shiddha, Siddha, Siddhu, Singhar, Vishanpur
72.	Etah	82	Ahmadpur, Aliganj, Barigo, Barigo Up, Baringo, Barthar Up, Barther, Bather, Bathore, Borthor, Burigo, Dharra, Eta Up, Etah, Etah, Etha, Ganjdulware, Jaithara, Jaythara, Khatia, Khera, Kishangarh, Local, Malawan, Manjhana, Miyau, Myuni, Nagriya, Nogriya, Paringo, Patiyali, Patyali, Pilua, Pilua Up, Pilwa, Pinoa, Salali, Sarni, Saroni, Sidhpura, Sunashi, Sunshi, Yamuna
73.	Firozabad	83	Asfabad, Bilahna, Bilahna Up, Dabrai, Darayi, Darbai, Durbai, Fathgyi, Firojabad Up, Firozabad, Firozabad, Firozabad Up, Jaithgyi, Jashrama, Jasrana, Jasrana Up, Jathgyi, Nilhoma, Parham, Parham P, Paruji, Sargai, Satgai Up, Sathgyi, Sershaganj, Shatgay, Shekhoyabad, Shersaganj, Shikhobad, Shikhohabad, Shikohabad, Shikohabad Up, Sikohabad, Sirlaganj, Sirsaganj, Sirsaganj Up, Undani, Undani Up, Undashi
74.	Mainpuri	84	Andani, Barnahal, Barnal Up, Chandpura, Karahal Up, Karalia Up, Karhal, Kurawali Up, Kurwali, Mainpuri, Mainpuri, Muimpuri, Nayagaon, Pakhna, Udham, Udhan, Udhanaj
75.	Mathura	85	Badhon, Barshna, Dehgaon, Dolatpur, Mathura, Mathura, Mathura Up, Nagaria, Nagariya, Naroli, Naroli Up, Nawali, Palar, Sankit Up, Semari, Semri,
76.	Mahamaya Nagar	86	Mahamaya Nagar (Hathras)
77.	Kanshiram Nagar	87	Kanshiram Nagar (Kasganj)
78.	Lalitpur	88	Bhadramandi, Lalitpur, Nagda

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79.	Mahoba	89	Mahoba, Mahoba, Mahoba Up
80.	Banda	90	Banda, Manipur
81.	Hamirpur	91	Atra, Bebar, Beobar, Bewar, Bilga, Bilgaon, Hamirpur, Hamirpur, Orath, Sumerpur
82.	Jalaun	92	Bigapur, Bijapur, Bilua Up, Chandawali, Chandola, Chandwali, Chanuwali, Jalaun, Kalpi, Kosba, Kudhod, Orai, Orai Mp, Rewa
83.	Jhansi	93	Bijoli, Bukhara, Jhansi, Jhansi, Katera, Lalitpur, Launda, Sajjanpur
84.	Node A Left South	AL1	Johiri,
85.	Node A Left North	AL2	Kirwa, Modi Nagar, Modinagar, Mohannagar, Nabali, Nabli, Partapur, Sheyana Up, Simana Up, Siwai Up, Siyana, Siyana Up, Siyna
86.	Node A Right South	AR1	Ganela, Jaani, Jani, Jani Up, Khore, Khori,
87.	Node A Right North	AR2	Baralwad, Bodha, Budana, Budhana, Budhana Up, Budhna, Khiwai, Khiwai Up, Khiwaji, Khiwayi, Khiwyi, Lakhwa, Mator, Pohli, Samli, Shamoli
88.	Node B Left South	BL1	Bana, Bharala, Gokalpur, Gokulgaon, Gokulpur, Gokulpur Gaon, Nagli Sadharan
89.	Node B Left North	BL2	Dohrala, Dorala, Dordla, Dorla, Dortal, Dorula, Medpur Up, Murlipur, Murlipur Up, Rahsa, Ruhasa, Sakaveti, Sakoti, Sardhana, Sardhana Up, Sarthana Up, Sirdhana, Ukawa
90.	Node B Right South	BR1	Chatri
91.	Node C Left South	CL1	Baksar
92.	Node C Left North	CL2	Mukteshwar, Nanpur
93.	Node C Right South	CR1	Sikhera
94.	Node C Right North	CR2	Babugarh, Madhapur
95.	Node D Left South	DL1	Aali Nagar, Gaaran Up, Kheda
96.	Node D Left North	DL2	Bhaina Up, Dholpur, Hastinapur, Nagli, Nawana Up, Nigli, Salonda
97.	Node D Right South	DR1	Bagrasi, Bugrasi, Bugrasi Up
98.	Node D Right North	DR2	Shiyna
99.	Node E Left South	EL1	Hasanpur, Hasanpur Up, Hashanpur, Hashpur, Rajabpur, Rajabpur Up, Ujhari, Ujhari Up
100.	Node E Left North	EL2	Galshua, Gulsua, Naagli
101.	Node E Right South	ER1	Bhavarsi
102.	Node E Right North	ER2	Gagrola, Gajaraula, Gajrala, Gajratola, Gajraula, Gajrola, Gajrola Up, Garola, Gazota, Gazrolla, Gorula

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103.	Node F Left South	FL1	Saraitarin, Sirsha, Sirshi, Sirsi
104.	Node F Left North	FL2	Asmoli, Dehpa, Sujatpur, Syed Nagri
105.	Node G Left South	GL1	Baniyakhera, Chandausi, Chandausi Up, Chandoshi, Chandoshi Up, Chandosi, Chandroshi, Faizganj, Faizgaon, Nehta
106.	Node G Left North	GL2	Afzalpur, Afzalpur Up, Akroli, Narauli, Pawas, Pawsa, Pawsa Up, Sarthal
107.	Node G Right South	GR1	Bahjai, Bahjoi, Bahroi Up, Behjayi, Bejoi, Islam Nagar, Islamnagar, Islamnagar Up, Naroda, Naroda Up
108.	Node H Left North	HL2	Bisauli, Bisolee, Bisoli, Karanpur, Raheria, Raherial, Raheriya, Sureni, Urari, Vajirganj, Wajeerganj, Wazirganj
109.	Node I Left South	IL1	Binarar, Binawar Up, Dataganj, Dhakka, Kanshi, Narka Patta, Narkheda
110.	Node I Left North	IL2	Aonia, Aonla, Aowla
111.	Node I Right North	IR2	Kuthiya
112.	Node J Left North	JL2	Muzaffarpu,Muzaffarpur
113.	Node J Right South	JR1	Dahena, Dhena, Jalalabad
114.	Node J Right North	JR2	Dasiya, Sakhanu
115.	Node K Left South	KL1	Pali
116.	Node K Left North	KL2	Akri
117.	Node K Right South	KR1	Baron, Baroun
118.	Node K Right North	KR2	Allaganj, Allganj
119.	Node L Left South	LL1	Sanjalhera
120.	Node L Right South	LR1	Bilgram, Billgram
121.	Node L Right North	LR2	Panthora, Panthro,
122.	Node M Left South	ML1	Kulha,
123.	Node M Left North	ML2	Gosganj, Goshganj, Mallawa, Mallawan, Mallowa,
124.	Node M Right South	MR1	Bagarmau, Bagarmaw, Bangarmau, Bangarmuva, Darola, Ugo, Ugu,
125.	Node M Right North	MR2	Aazmen, Parmi, Raghpur
126.	Node N Left South	NL1	Katha

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127.	Node N Left North	NL2	Chagalwanshi, Jagdahpur, Jagdishpur
128.	Node N Right South	NR1	Achalganj,Acharganj, Anuppur, Badarka, Gandhinagar
129.	Node N Right North	NR2	Bethor, Safipur, Supipur
130.	Node O Left North	OL2	Fatehganj, Gonamau
131.	Node O Right South	OR1	Dalamun, Dalmau, Dolmau, Dolmoon, Domau, Kaammau, Korihara, Lalganj, Lalganj Up, Raithana
132.	Node O Right North	OR2	Akthi, Augadh, Bighapur, Bighpur, Bihar, Bihargaon, Kushela, Lakhyapuri, Lakshipur, Lalkua, Lalkuan, Pidua, Poova, Sareni, Takiya
133.	Node P Left South	PL1	Bhikh, Parhari, Unchahar
134.	Node P Left North	PL2	Bhena
135.	Node Q Right South	QR1	Barai, Bhulsa, Chakerhum, Intaura, Mangarh
136.	Node Q Right North	QR2	Pariyawaan, Pariyawan
137.	Node R Left North	RL2	Kharga, Kurga, Mendara, Raiya
138.	Node R Right South	RR1	Bajha
139.	Node R Right North	RR2	Anapur, Bedhan, Deeha, Dheemi, Dhophamau, Kasimpur Jharha, Kaurihar, Lalgopalganj, Lankapuri
140.	Assam	ZAS	Assam, Goahati, Guwahati, Guwahati Ms, Katoni, Sonali Bodar, Varywer
141.	Bihar	ZBR	Gaya, Patna, Patna Bihar, Patna Br, Purni, Purniya, Siwan, Aurangabad, Aurangabad , Aurangabad Br, Baliya Br, Bedhna, Bhagalpur Uk, Chandi, Gopalganj, Hatwa, Kewla, Kishanganj, Kishanganj Br, Kosiya, Lohni, Mourawan, Nalanda, Ramapur, Renukoot Br, Sarh, Sasaram, Vithoma
142.	Chattisgarh	ZCG	Bhilai Cg, Bilaspur Cg, Bilhama, Bilhma, Chhattisgarh, Danyo, Korba Cg, Merai, Pithora, Raipur Cg
143.	Chandigarh	ZCH	Chadigarh Up, Chandigarh, Chandigarh Ch, Chandigarh Cn, Chandigarh Pb
144.	Gujarat	ZGJ	Gujrat, Jamnagar, Kambola, Khangan
145.	Himachal Pradesh	ZHP	Baddi, Himachal, Kalka, Kulu Manali, Kunala, Manaji, Nalagarh Hp, Shimla, Shimla Hp, Simla, Solan Hp
146.	Haryana	ZHR	Ambala, Ambala Pb, Badrai, Banaas, Bidhuki, Bidhuwa, Damla, Dehya, Gurgaon, Gurgaon Hr, Gurugram, Gurugram Up, Haryana, Hisar Hr, Jatoli, Jhajjar, Jindi, Jondhan, Kaithla, Karnal, Karnal Hr, Kundal, Kurnal, Kurukshetra, Malram, Malran, Milkpur, Narayangarh Hr, Palwal Hr, Panipat, Panipat Hr, Punchkula, Rohtak, Sonipat, Tarolikheda, Yamuna Nagar, Yamuna Nagar Up, Yamunanagar, Yamunanagar Hr
147.	Jharkhand	ZJH	Bagodar, Bokaro, Chaibasa, Dhanabad, Dhanbad, Dhanbad Jh, Hazaribagh, Jamshedpur, Jharkhand, Kandi, Katbhori, Ranchi Jh

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148.	Karnataka	ZKA	Mangalore
149.	Maharashtra	ZMH	Daund, Jaywant Nagar, Nagpur, Porla, Pune Mh, Walwan, Mumbai Mh
150.	Madhya Pradesh	ZMP	Bhind, Bhind Mp, Bhojipura, Bhopal, Bhopal Mp, Bijawar, Chanderhi, Chhatarpur Mp, Dhyanpur, Dochara, Gwalior, Harda, Ichhapur, Jabalpur, Jabalpur Mp, Jaranpur, Kajroda, Kannod, Kannod Up, Kardiya, Kasrawad, Katni, Katni Mp, Khatiya, Khumar, Kudpur, Orchhi, Piyani, Piyon, Rewa Mp, Satna Mp, Shajapur, Shihuda, Shivpuri, Shivpuri Mp, Udabi, Udani, Udhani, Udhyani, Ujhawan, Urai Mp
151.	New Delhi	ZNDLS	Anand Vihar, Delhi, Delhi Dl, Kabil, Mangla Sahab, New Delhi, Polar
152.	Nepal	ZNEPAL	Amritganj, Znepal
153.	Orissa	ZOR	Bhuwaneshwar, Cuttack, Odisha, Penga, Pikla, Salipur
154.	Punjab	ZPB	Amritsar, Amritsar Pb, Hoshiarpur, Jalandhar, Jalandhar Pb, Ludhiana, Ludhiana Pb, Ludhiyana, Manyi, Pathan, Pathankot, Patiala, Patiali, Patiyala, Punjab
155.	Rajasthan	ZRJ	Ajmer, Bagroli, Bhavri, Bundi, Chittorgarh Rj, Dholpa Rj, Hathipura Rj, Jaipur, Jaipur Rj, Jakhoni, Karawali Up, Mandhawa, Mandhawan, Nareyli, Nayala, Puriya, Shekhawad, Sinhli Agir, Sinhli Jagir Up, Thakri
156.	Tamil Nadu	ZTN	Tamil Nadu
157.	Telangana	ZTS	Secunderabad
158.	Uttarakhand	ZUK	Aldwani, Almoda, Almora, Almora Uk, Aroli, Badrinath, Bharli, Budhan, Chamoli, Chamoli Uk, Champavat, Chan, Chayli, Deban Uk, Dehradoon, Dehradoon Uk, Dehradun, Dehradun Uk, Devprayag, Dewan Uk, Dhella, Dohalam, Dohra, Donda, Haldwani, Haldwani Uk, Ardiwar, Haridwar, Haridwar Uk, Hariyali, Hridwar, Joshi, Joshimath, Karbali, Kathiya, Kedarnath, Khandila, Khatar, Khoatar, Lalkuan Uk, Maneshwar, Masoori, Masoorie, Mosari Uk, Moshri Uk, Nagoli, Nagoria, Nainital, Nainital Uk, Nehu, Pilighoti, Piran Kaliya, Piran Aliyar, Pirankalihar, Pithoragarh, Pithoregarh, Purthi, Puthri Up, Rachna Up, Ranikhet, Ranikhet Uk, Ranikot Up, Rishikesh, Roorkee, Roorkie, Roorkie Uk, Roorkie Up, Rudrapr, Rudraprayag, Rudrapur, Rudrapur Uk, Sawa, Srinagar, Srinagar Uk, Tanakpura, Uttar Ashipur Uk, Uttarakhand, Uttarkashi, Uttarkashi Uk
159.	West Bengal	ZWB	Akharpur, Asansole, Darjelling, Doband, Kadarpur, Kharagpur Wb, Khibayi, Khirai, Kolkata, Kolkata (Wb), Kolkata Wb, Siligudi, Siligurhi, Siliguri, Unab

4.2.3 Classified Count Surveys

The principal purpose of the classified count surveys on Traffic Survey Locations (existing alternate roads to the proposed Expressway), was to establish Expansion Factors for the origin and destination data – thus permitting to establish average daily traffic flows.

4.2.3.1 Average Daily Traffic

Seven-day count using video coverage was undertaken on National Highways/State Highways/Major District Roads where Road Side Origin-Destination Surveys were carried out –

results **(Average Daily Traffic - ADT**) are shown on Tables 4.6 and detailed counts at each location are provided in Appendix.

The survey form, divided vehicles into the normal classifications for such surveys in India. The larger trucks were, however, further divided into following sub-categories:
(a) 2-axled truck;
(b) 3-axled truck;
(c) 4+ axled vehicles (Multi Axle Vehicle- MAV)

This latter category MAV, although frequently observed at present, can be expected to grow in importance once the Varanasi Port[1] becomes fully operational and it is possible to assess whether, or not, it would be appropriate to charge such vehicles a higher toll.

The classified counts were undertaken at the same locations as the origin and destination surveys and were for periods which incorporated the days in which the origin and destination surveys were undertaken. The classified count information, besides providing the above-referred to expansion factors, was used to indicate the hours of the week that might be categorised as:
(a) *"peak"*;
(b) *"shoulders"* to the peak; and
(c) *"off-peak"* periods.

These are important data, needed when calculating likely journey time-savings and vehicle operating cost savings. When congestion is less on Expressways comparatively, a smaller proportion of through-traffic will be prepared to pay tolls.

A summary of the variations in flow by direction is also shown on Table 4.7. There is very little difference in the pattern of in-bound and out-bound flows (to Fatehpur / to Prayagraj) and, for this reason, all further analyses are in terms of total two-directional flows. The division of the hours of the week into these 3 periods is shown on Table 4.8 and summarised below:

(a) *"Peak"* hours: 08:00 to 18:00 (70 hours total per week)
(average two-way flows on the NH19 (old NH2) near Katoghan Toll Plaza are **1515 vehicles/hour,** i.e. ***average peak hour factor of 5.74%*)**

(b) *"Shoulder"* hours: 07:00 to 08:00 & 18:00 to 01:00 (56 hours total per week)
(average two-way flows on the NH19 (old NH2) near Katoghan Toll Plaza are **959 vehicles/hour,** i.e. ***average shoulder factor of 3.63%*)**

(c) *"Off-Peak"* hours: 01:00 to 07:00 (42 hours total per week)
(average two-way flows on the NH19 (old NH2) near Katoghan Toll Plaza are **599 vehicles/hour** i.e. ***average off-peak hour factor of 2.27%***).

The time divisions are assumed to be the same for all sections of the proposed Expressway.

[1] **Varanasi Multi-Modal Terminal** or **Varanasi Port** is an Inland river port situated in the city of Varanasi, Uttar Pradesh. The port is located on the River Ganga. This port is built under the central government's **Jal Marg Vikas** project. The port has provided a direct link with the Port of Kolkata and Haldia Port

Table 4.6: Average Daily Traffic (ADT) on Existing Alternate Roads

Vehicle Classification			PCU Factor	Muzaffarnagar - Meerut	Aligarh - Etah	Aliganj - Farrukhabad	Farrukhabad - Kannauj	Kannauj - Kanpur	Budaun - Farrukhabad	Meerut - Garhmukteshwar	Hasanpur - Chandausi	Chandausi - Budaun	Bijnor - Moradabad	Bareilly - Shahjahanpur	Shahjahanpur - Hardoi	Bangarmau - Unnao	Unnao - Lalganj	Unchahar - Prayagraj	Fatehpur - Prayagraj
Passenger Vehicles	Two Wheeler		0.5	**5380**	1750	2813	3569	2723	1776	3683	2285	3453	7080	**9565**	3514	6026	2838	6245	3162
	Three Wheeler		1.5	**877**	605	124	658	415	87	695	254	212	934	**1749**	347	362	74	586	300
	Car/Van/ Jeep		1.0	**12525**	736	679	1921	2444	964	4879	855	2027	5179	**5976**	2476	2163	1282	4632	3094
	Mini Bus		1.5	**21**	4	18	9	35	7	11	8	7	39	**21**	19	31	3	52	32
	Bus		3.0	**1253**	541	37	75	249	244	430	202	278	581	**578**	197	191	210	490	469
Govt. & Others Vehicles	Tempo/ LCV		1.5	**1048**	346	226	344	795	315	842	510	707	745	**1794**	783	742	618	956	1274
	Commercial Vehicles	2 Axle	3.0	**484**	1061	73	85	853	430	599	164	456	263	**1509**	231	280	493	448	1033
		3 Axle	3.0	**325**	1066	50	90	877	438	561	176	447	283	**1453**	392	491	501	656	1062
		M-Axle	4.5	**665**	826	138	146	972	454	481	152	509	143	**2375**	467	606	778	1171	2464
Agricultural Vehicles	Tractor		1.5	**20**	26	17	17	20	31	48	26	50	43	**26**	28	38	20	34	13
	Tractor with Trailer		4.5	**71**	82	139	99	103	151	250	250	282	325	**206**	243	111	37	356	89
Passenger Vehicles	Cycle		0.5	**42**	152	950	357	239	286	385	82	500	125	**527**	835	500	570	501	151
	Cycle Rickshaw		2.0	**11**	2	0	0	0	9	23	3	7	26	**0**	0	0	0	0	11

Vehicle Classification			PCU Factor	Muzaffarnagar – Meerut	Aligarh - Etah	Aliganj – Farrukhabad	Farrukhabad - Kannauj	Kannauj – Kanpur	Budaun – Farrukhabad	Meerut - Garhmukteshwar	Hasanpur – Chandausi	Chandausi – Budaun	Bijnor – Moradabad	Bareilly - Shahjahanpur	Shahjahanpur – Hardoi	Bangarmau – Unnao	Unnao – Lalganj	Unchahar – Prayagraj	Fatehpur – Prayagraj
Goods Vehicles	Animal Drawn	Bullock Cart	8.0	**0**	2	13	10	1	24	50	0	6	14	**84**	30	16	17	47	0
		Horse	8.0	**0**	3	0	0	0	35	0	0	24	11	**0**	0	0	0	0	0
	Hand Cart		3.0	**0**	0	0	0	0	1	0	0	1	1	**0**	0	0	0	0	0
	Other (Pl. Specify)		2.0	**24**	10	0	3	6	17	28	7	14	42	**29**	31	1	9	3	16
Total Vehicles (Nos.)				**22749**	**7212**	**5277**	**7383**	**9733**	**5269**	**12966**	**4974**	**8980**	**15833**	**25892**	**9594**	**11558**	**7449**	**16178**	13170
Total Vehicles (PCUs)				**27761**	**15313**	**4975**	**7364**	**16617**	**9240**	**17867**	**6692**	**12859**	**17245**	**39371**	**12376**	**13428**	**11487**	**22484**	26414

Note: Data may not add up to the total due to rounding.

Table 4.7: Average Daily Traffic (ADT) Direction Flows on NH19 (old NH2) (near Katoghan Toll)

(7 day Average)

Vehicle Classification			PCU Factor	Prayagraj to Fatehpur	Fatehpur to Prayagraj	Both Directions
Passenger Vehicles	Two Wheeler		0.5	1686	1476	3162
	Three Wheeler		1.5	154	146	300
	Car/Van/ Jeep		1.0	1633	1461	3094
	Mini Bus		1.5	16	16	32
	Bus		3.0	233	236	469
Govt. & Others Vehicles	Tempo/ LCV		1.5	640	634	1274
	Commercial Vehicles	2 Axle	3.0	520	513	1033
		3 Axle	3.0	535	527	1062
		M-Axle	4.5	1239	1225	2464
Agricultural Vehicles	Tractor		1.5	8	5	13
	Tractor with Trailer		4.5	42	47	89
Passenger Vehicles	Cycle		0.5	85	67	151
	Cycle Rickshaw		2.0	5	6	11
Goods Vehicles	Animal Drawn	Bullock Cart	8.0	0	0	0
		Horse	8.0	0	0	0
	Hand Cart		3.0	0	0	0
	Other (Pl. Specify)		2.0	11	5	16
Total Vehicles (Nos.)				**6807**	**6364**	**13170**
Total Vehicles (PCUs)				**13406**	**13008**	**26414**

Note: Data may not add up to the total due to rounding.

Table 4.8 Hourly PCUs Variation over the Week on NH19 (old NH2) (near Katoghan Toll)

(Total No. of Vehicles per hour)

Date & Hour of Day	17-02-20	18-02-20	19-02-20	20-02-20	14-02-20	15-02-20	16-02-20	7 – Day Average
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	
00:00 - 01:00	722	802	876	698	839	924	790	807.3
01:00 - 02:00	*766*	*699*	*853*	*559*	*638*	*766*	*651*	*704.4*
02:00 - 03:00	*682*	*535*	*831*	*478*	*608*	*718*	*482*	*619.1*
03:00 - 04:00	*635*	*471*	*662*	*424*	*566*	*644*	*465*	*552.4*
04:00 - 05:00	*568*	*424*	*494*	*664*	*484*	*548*	*399*	*511.4*
05:00 - 06:00	*512*	*439*	*639*	*677*	*393*	*417*	*738*	*545.0*
06:00 - 07:00	*748*	*674*	*648*	*611*	*615*	*624*	*707*	*661.0*
07:00 - 08:00	946	889	848	841	784	886	868	866.0
08:00 - 09:00	**1427**	**1554**	**1428**	**1586**	**1600**	**1510**	**1513**	**1516.9**
09:00 - 10:00	**1382**	**1507**	**1428**	**1566**	**1466**	**1600**	**1451**	**1485.0**
10:00 - 11:00	**1475**	**1627**	**1543**	**1581**	**1569**	**1505**	**1485**	**1540.7**
11:00 - 12:00	**1354**	**1460**	**1327**	**1388**	**1339**	**1365**	**1318**	**1364.4**
12:00 - 13:00	**1486**	**1493**	**1610**	**1569**	**1607**	**1592**	**1524**	**1554.4**
13:00 - 14:00	**1377**	**1495**	**1427**	**1552**	**1549**	**1542**	**1561**	**1500.4**
14:00 - 15:00	**1499**	**1403**	**1445**	**1322**	**1418**	**1499**	**1380**	**1423.0**
15:00 - 16:00	**1557**	**1581**	**1591**	**1524**	**1622**	**1475**	**1591**	**1563.0**
16:00 - 17:00	**1474**	**1727**	**1307**	**1690**	**1843**	**1761**	**1750**	**1650.3**
17:00 - 18:00	**1305**	**1753**	**1676**	**1650**	**1645**	**1536**	**1313**	**1554.0**
18:00 - 19:00	1256	1273	1343	1086	972	1095	1186	1173.0
19:00 - 20:00	991	946	1019	1030	1085	1007	928	1000.9
20:00 - 21:00	911	1006	1048	1532	803	867	946	1016.1
21:00 - 22:00	1055	998	959	1180	1116	1081	912	1043.0
22:00 - 23:00	1057	804	1017	826	943	883	891	917.3
23:00 - 24:00	975	844	878	730	811	866	811	845.0
Total (24 hr PCUs)	**26,154**	**26,399**	**26,890**	**26,757**	**26,310**	**26,708**	**25,655**	**26,414**
Avg. Peak Hr. Traffic	1433	1560	1478	1543	1566	1538	1488	**1515**
Peak Hour Factor	5.48%	5.91%	5.50%	5.76%	5.95%	5.76%	5.80%	**5.74%**
Avg. Shoulder Traffic	989	945	998	990	919	951	916	959
Shoulder Hour Factor	3.78%	3.58%	3.71%	3.70%	3.49%	3.56%	3.57%	3.63%
Avg. Off-Peak Hr. Traffic	652	540	688	569	550	619	573	599
Off Peak Factor	2.49%	2.05%	2.56%	2.12%	2.09%	2.32%	2.24%	2.27%

Note: Data may not add up to the total due to rounding.

4.2.3.2 Past Traffic Data

Review of Literature: Past Traffic data has been collected from Toll Plaza at Sasaram on NH-19 (old NH2) and its vehicle wise data area shown on Table 4.9.

Table 4.9: Annual Average Daily Traffic on NH19 (old NH 2)
Vehicle Type: Car+Jeep+Van (CJV)

Month	2011	2012	2013	2014	2015	2016	2017
Jan	0	1971	2248	2204	2517	3092	2937
Feb	0	2319	3084	2718	3139	3589	2504
Mar	0	2293	2527	2590	2960	3486	2006
Apr	0	2626	2624	2389	3126	4021	3428
May	0	2113	3316	2947	3561	3107	3910
Jun	0	2520	2406	2880	3061	3026	3581
Jul	0	2226	2051	2226	2397	3177	2925
Aug	0	1848	1944	2089	2781	2897	2784
Sep	3459	1778	1933	2431	2426	3057	3550
Oct	3034	2400	2210	2514	2887	3163	3610
Nov	2823	2328	2504	2513	2985	2150	0
Dec	1854	2381	2293	2523	3142	2311	0
AADT	**2787**	**2238**	**2424**	**2500**	**2913**	**3096**	**3126**

Source: Toll Booth Operator at Sasaram

The **annual growth rate of Car traffic** on NH-19 (old NH2) over 5 year period between Year 2012 and Year 2017 is about **6.91%**

Vehicle Type: Bus

Month	2011	2012	2013	2014	2015	2016	2017
Jan		106	105	85	95	105	156
Feb		93	139	87	102	106	169
Mar		112	146	118	127	151	201
Apr		75	88	82	105	132	177
May		96	97	80	81	99	172
Jun		63	68	70	98	78	176
Jul		70	54	65	78	78	198
Aug		134	67	88	102	102	221
Sep	202	139	118	136	99	180	317
Oct	111	162	93	123	158	141	275
Nov	105	118	102	102	118	82	0
Dec	80	79	70	75	87	93	0
AADT	**2787**	**2238**	**2424**	**2500**	**2913**	**3096**	**3126**

Source: Toll Booth Operator at Sasaram

The **annual growth rate of Bus traffic** on NH19 (old NH2) over 5 year period between Year 2012 and Year 2017 is about **14.62%**

Vehicle Type: Mini Bus

Month	2011	2012	2013	2014	2015	2016	2017
Jan		238	232	228	229	260	290
Feb		269	291	276	273	290	252
Mar		244	269	177	253	276	133
Apr		286	276	128	278	293	283
May		266	303	272	311	280	336
Jun		268	265	269	270	271	297
Jul		261	249	241	223	278	273
Aug		263	226	221	258	280	278
Sep	288	233	231	234	198	281	287
Oct	392	244	238	232	169	275	246
Nov	96	252	253	251	252	170	0
Dec	204	251	235	231	245	225	0
AADT	**246**	**257**	**255**	**230**	**246**	**266**	**267**

Source: Toll Booth Operator at Sasaram

The **annual growth rate of Mini Bus** on NH19 (old NH2) over 5 year period between Year 2012 and Year 2017 is about **0.81%.**

Vehicle Type: Light Commercial Vehicle (LCV)

Month	2011	2012	2013	2014	2015	2016	2017
Jan		282	261	294	219	227	291
Feb		237	278	326	193	239	305
Mar		247	301	343	199	294	310
Apr		262	310	328	208	229	275
May		242	295	298	182	212	254
Jun		258	276	308	182	230	247
Jul		282	299	334	189	220	223
Aug		238	252	297	196	216	251
Sep	0	255	281	306	191	236	276
Oct	0	260	256	245	178	229	204
Nov	346	252	280	330	199	121	0
Dec	289	290	310	314	237	252	0
AADT	**159**	**260**	**283**	**310**	**198**	**226**	**263**

Source: Toll Booth Operator at Sasaram

The **annual growth rate of LCV traffic** on NH19 (old NH2) over 5 year period between Year 2012 and Year 2017 is about **0.27%**

Vehicle Type: 2-Axle Truck

Month	2011	2012	2013	2014	2015	2016	2017
Jan		651	485	434	525	642	733
Feb		692	522	456	623	706	835
Mar		642	524	469	598	700	808
Apr		616	533	447	575	670	831
May		690	531	462	542	717	804
Jun		623	480	493	558	724	759
Jul		514	441	415	538	683	668
Aug		498	415	408	508	697	759
Sep	565	476	467	482	573	766	804
Oct	665	509	436	397	562	759	597
Nov	634	479	411	437	575	396	0
Dec	623	511	463	445	700	681	0
AADT	**622**	**576**	**475**	**445**	**573**	**681**	**759**

Source: Toll Booth Operator at Sasaram

The **annual growth rate of 2-axle truck traffic** on NH19 (old NH2) over 5 year period between Year 2012 and Year 2017 is about **5.65%.**

Vehicle Type: Multi Axle Vehicle (MAV) Trucks

Month	2011	2012	2013	2014	2015	2016	2017
Jan		4866	5290	5032	4742	6920	6846
Feb		5439	5338	5601	6816	6372	8127
Mar		5794	5457	5558	6580	5926	8173
Apr		5523	4799	5596	6472	6806	7916
May		5826	4792	5645	6908	7095	9135
Jun		5650	4906	6305	6926	7011	8538
Jul		5065	4483	5387	5604	5272	5478
Aug		4685	4285	4798	5214	5279	5863
Sep	4327	4615	5232	5907	5419	5962	6253
Oct	4768	5180	5004	5610	5745	6870	5475
Nov	5102	5079	5510	6351	6371	4888	0
Dec	4812	5364	5597	5737	6373	6369	0
AADT	**4753**	**5271**	**5055**	**5623**	**6089**	**6248**	**7167**

Source: Toll Booth Operator at Sasaram

The **annual growth rate of MAV Truck** on NH19 (old NH2) over 5 year period between Year 2012 and Year 2017 is about **6.34%**

4.2.3.3 Annual Average Daily Traffic (AADT)

Factors for seasonal corrections were also derived from the sale of fuel (petrol for passenger vehicles like cars, two wheelers and diesel for commercial vehicles like light commercial vehicles, trucks and larger vehicles) at fuel pump stations available along the proposed alignment of Expressway. **Annual Average Daily Traffic (AADT)** is established considering the Seasonal Correction Factors of 1.003 for Passenger Vehicles and 1.063 for commercial vehicles – results (**Annual Average Daily Traffic - ADT**) are shown on Table 4.10.

Table 4.10: Annual Average Daily Traffic (AADT) on Existing Alternate Roads

Vehicle Classification			PCU Factor	Muzaffarnagar - Meerut	Aligarh - Etah	Aliganj - Farrukhabad	Farrukhabad - Kannauj	Kannauj - Kanpur	Budaun - Farrukhabad	Meerut - Garhmukteshwar	Hasanpur - Chandausi	Chandausi - Budaun	Bijnor - Moradabad	Bareilly - Shahjahanpur	Shahjahanpur - Hardoi	Bangarmau - Unnao	Unnao - Lalganj	Unchahar - Prayagraj	Fatehpur - Prayagraj
Passenger Vehicles	Two Wheeler		0.5	5396	1755	2821	3580	2731	1781	3694	2292	3463	7101	9594	3525	6044	2847	6264	3171
	Three Wheeler		1.5	880	607	124	660	416	87	697	255	213	937	1754	348	363	74	588	301
	Car/Van/ Jeep		1.0	12563	738	681	1927	2451	967	4894	858	2033	5195	5994	2483	2169	1286	4646	3103
	Mini Bus		1.5	22	4	19	10	37	7	12	9	7	41	22	20	33	3	55	34
	Bus		3.0	1332	575	39	80	265	259	457	215	296	618	614	209	203	223	521	499
Govt. & Others Vehicles	Tempo/ LCV		1.5	1114	368	240	366	845	335	895	542	752	792	1907	832	789	657	1016	1354
	Commercial Vehicles	2 Axle	3.0	514	1128	78	90	907	457	637	174	485	280	1604	246	298	524	476	1098
		3 Axle	3.0	345	1133	53	96	932	466	596	187	475	301	1545	417	522	533	697	1129
		M-Axle	4.5	707	878	147	155	1033	483	511	162	541	152	2525	496	644	827	1245	2619
Agricultural Vehicles	Tractor		1.5	21	28	18	18	21	33	51	28	53	46	28	30	40	21	36	14
	Tractor with Trailer		4.5	75	87	148	105	109	161	266	266	300	345	219	258	118	39	378	95
Passenger Vehicles	Cycle		0.5	42	152	950	357	239	286	385	82	500	125	527	835	500	570	501	151
	Cycle Rickshaw		2.0	11	2	0	0	0	9	23	3	7	26	0	0	0	0	0	11
Goods Vehicles	Animal Drawn	Bullock Cart	8.0	0	2	13	10	1	24	50	0	6	14	84	30	16	17	47	0
		Horse	8.0	0	3	0	0	0	35	0	0	24	11	0	0	0	0	0	0
	Hand Cart		3.0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0
	Other (Pl. Specify)		2.0	24	10	0	3	6	17	28	7	14	42	29	31	1	9	3	16
Total Vehicles (Nos.)				**23047**	**7470**	**5332**	**7456**	**9995**	**5408**	**13196**	**5078**	**9169**	**16026**	**26445**	**9761**	**11741**	**7630**	**16474**	**13595**
Total Vehicles (PCUs)				**28,504**	**16,117**	**5,109**	**7,530**	**17,389**	**9,661**	**18,485**	**6,965**	**13,387**	**17,703**	**40,986**	**12,822**	**13,907**	**12,020**	**23,341**	**27,762**

Note: Data may not add up to the total due to rounding.

4.2.4 Origin – Destination (O-D) Matrices

O-D matrices for Tollable Traffic (vehicle types as listed in Table 4.11) are generated from the information recorded during the Origin-Destination Surveys, and expanded by multiplying with corresponding Expansion Factors to arrive at the Expanded O-D Matrix (Vehicle Type, Existing Alternate Road) and results are annexed to Appendix.

4.2.4.1 Expansion Factors

Expansion Factors were derived from the percentage of tollable vehicles interviewed during the origin and destination surveys to that of the ADT arrived for respective roads. The values of expansion factors for tollable traffic type at each of the origin & destination survey locations are given shown on Table 4.11.

Table 4.11: Expansion Factors for O-D Matrices (Tollable Traffic)

Survey Location	Tollable Vehicles	Car	Bus	LCV	2-Axle Truck	3-Axle Truck	MAV (4 + axles)
On Muzaffarnagar - Meerut Stretch at Siwaya Toll Booth	% Interviewed	2.46%	5.49%	6.11%	9.12%	10.12%	9.19%
	Expansion Factor	40.65	18.22	16.38	10.96	9.88	10.88
On Fatehpur - Prayagraj Stretch at Katodhan Toll Booth	% Interviewed	7.58%	7.02%	6.87%	4.56%	3.81%	3.55%
	Expansion Factor	13.20	14.25	14.56	21.95	26.25	28.16
On Meerut - Garhmukteshwar Stretch at Nizampur	% Interviewed	6.19%	13.23%	5.14%	1.88%	1.68%	6.07%
	Expansion Factor	16.15	7.56	19.46	53.10	59.66	16.48
On Hasanpur - Chandausi Stretch at Kurkawali	% Interviewed	18.87%	8.90%	7.19%	11.47%	13.37%	18.52%
	Expansion Factor	5.30	11.23	13.90	8.72	7.48	5.40
On Chandausi - Budaun Stretch at Nawada	% Interviewed	11.17%	12.18%	5.46%	5.77%	3.37%	5.91%
	Expansion Factor	8.95	8.21	18.33	17.32	29.68	16.92
On Aligarh - Etah Stretch at Nagariya	% Interviewed	18.42%	11.42%	7.07%	6.57%	5.65%	6.95%
	Expansion Factor	5.43	8.76	14.14	15.23	17.70	14.39
On Aliganj - Farrukhabad Stretch at Khankah e Niyaziya	% Interviewed	24.81%	28.09%	18.76%	38.46%	44.84%	24.45%
	Expansion Factor	4.03	3.56	5.33	2.60	2.23	4.09
On Farrukhabad - Kannauj Stretch at Samdhan	% Interviewed	7.79%	13.85%	10.38%	26.46%	12.48%	20.66%
	Expansion Factor	12.84	7.22	9.63	3.78	8.01	4.84
On Kannauj - Kanpur Stretch at Bilhaur	% Interviewed	6.81%	8.32%	6.03%	3.31%	1.72%	4.55%
	Expansion Factor	14.68	12.02	16.58	30.21	58.26	21.99
On Budaun - Farrukhabad Stretch at Usawan	% Interviewed	18.02%	16.21%	17.33%	11.15%	7.73%	10.57%
	Expansion Factor	5.55	6.17	5.77	8.97	12.93	9.46
On Bijnor - Moradabad Stretch at Agwanpur	% Interviewed	3.75%	4.86%	6.94%	10.00%	7.64%	6.60%
	Expansion Factor	26.64	20.57	14.40	10.00	13.09	15.16
On Bareilly - Shahjahanpur Stretch at Faridpur Toll Booth	% Interviewed	3.95%	5.37%	2.94%	4.80%	5.18%	4.87%
	Expansion Factor	25.29	18.61	34.05	20.83	19.30	20.53
On Shahjahanpur - Hardoi Stretch at Shahabad	% Interviewed	5.44%	8.60%	4.57%	8.94%	4.79%	4.84%
	Expansion Factor	18.39	11.63	21.90	11.18	20.86	20.68
On Bangarmau - Unnao Stretch at Safipur	% Interviewed	8.16%	10.36%	5.68%	9.78%	5.64%	6.94%
	Expansion Factor	12.25	9.65	17.61	10.23	17.72	14.41
On Unnao - Lalganj Stretch at Semari	% Interviewed	11.21%	16.16%	5.26%	7.84%	5.07%	5.45%
	Expansion Factor	8.92	6.19	19.00	12.75	19.73	18.34
On Unchahar - Prayagraj Stretch at Andiyari	% Interviewed	3.59%	4.22%	5.70%	8.61%	7.03%	5.46%
	Expansion Factor	27.82	23.68	17.53	11.61	14.23	18.30

4.2.4.2 Candidate Traffic for Proposed Expressway (All trip lengths)

Candidate Traffic is that traffic on the alternate existing roads whose travel pattern (origin-destination) can be serviced by the proposed Expressway. Origin-Destination pairs that can be serviced by the proposed Expressway are extracted from the Expanded O-D Matrix, and thus form the Candidate Traffic for proposed Expressway.

Derived *"Candidate"* traffic are shown on Appendix

For cars and trucks, these volumes were obtained from:

(a) a careful examination of the origin and destination data and the elimination of trips that would not find travel by the proposed Expressway useful (mainly trips to and from Zones East/West perpendicularly to the proposed Expressway alignment); and

(b) by multiplying the above-derived numbers by the earlier-described Expansion Factors and applying the appropriate Seasonal Correction Factors.

For buses, these volumes were obtained from an examination of advertised origins and destinations. Only those services known to be on journeys to and from points beyond corresponding Interchange Nodes in (north direction) & (south direction) were considered.

4.2.4.3 Candidate Traffic for Proposed Expressway

However, the it is prudent not to restrict the Candidate Traffic of those traffic whose trip lengths would be even lesser than ~25 Kms (*approximate usage of any one package of the proposed alignment of expressway*), this is basically to reflect the users choice of intending to the Expressway for shorter trip lengths (shorter trip lengths may incur time savings/perceived cost savings/avoid congestion, i.e. does trigger route choice).

The Zones (Origins & Destinations) as shown on Table 4.5 served as base, with Trip Matrix for O-D pairs as shown in Table 4.12 were used to generate the Candidate Traffic between designated Toll Nodes (Nodes A to R) of the Proposed Expressway.

While movement "AE" shown in the matrix from Node A to Node E represents traffic that will use the Expressway from Node A to Node E and "EA" shown in the matrix from Zone E to Zone A represents traffic that will use the Expressway from Node E to Node A.

Trip Matrix was matched with Expanded OD Matrices to arrive the Candidate Traffic; Movement Matrix-Tollable Traffic results are shown on Tables 4.13 to Tables 4.18

Table 4.12: Trip Matrix for O-D Pairs (Trips within Districts of Uttar Pradesh)

Zones	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
11	-	-	-	-	-	-	-	-	-	-	-	-	AE	-	AH	AH	AJ	AM	-	AL	AJ	AM	AO	AK	AN	AO	-	AG	AE	-	AM	AM	AM	AM	AM	-	-	AH	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM	AJ	AR	AO	AQ	AR	AL	-	AK	AL	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	AE	-	AH	AH	AJ	AM	-	AL	AJ	AM	AO	AK	AN	AO	-	AG	AE	-	AM	AM	AM	AM	AM	-	-	AH	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM	AJ	AR	AO	AQ	AR	AL	-	AK	AL	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	GJ	GM	-	GL	GJ	GM	GO	GK	GN	GO	-	-	-	GJ	GM	GM	GM	GM	GM	GJ	GJ	-	GR	GM	GM	GM	GM	GM	GM	GM	GM	GM	-	GM	GM	GR	GR	GR	GR	GR	GR	GM	GJ	GR	GO	GQ	GR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	CE	-	CH	CH	CJ	CM	-	CJ	CJ	CM	CO	CK	CN	CO	-	CG	CE	CJ	CM	CM	CM	CM	CM	CJ	CJ	CH	CR	CM	CM	CM	CM	CM	CM	CM	CM	CM	-	CM	CM	CR	CR	CR	CR	CR	CR	CM	CJ	CR	CO	CQ	CR	-	-	CK	CL	CN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	BE	-	BH	BH	BJ	BM	-	BJ	BJ	BM	BO	BK	BN	BO	-	BG	BE	BJ	BM	BM	BM	BM	BM	BJ	BJ	BH	BR	BM	BM	BM	BM	BM	BM	BM	BM	BM	-	BM	BM	BR	BR	BR	BR	BR	BR	BM	BJ	BR	BO	BQ	BR	-	-	BK	BL	BN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	CE	-	CH	CH	CJ	CM	-	CJ	CJ	CM	CO	CK	CN	CO	-	CG	CE	CJ	CM	CM	CM	CM	CM	CJ	CJ	CH	CR	CM	CM	CM	CM	CM	CM	CM	CM	CM	-	CM	CM	CR	CR	CR	CR	CR	CR	CM	CJ	CR	CO	CQ	CR	-	-	CK	CL	CN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	BE	-	BH	BH	BJ	BM	-	BJ	BJ	BM	BO	BK	BN	BO	-	BG	BE	BJ	BM	BM	BM	BM	BM	BJ	BJ	BH	BR	BM	BM	BM	BM	BM	BM	BM	BM	BM	-	BM	BM	BR	BR	BR	BR	BR	BR	BM	BJ	BR	BO	BQ	BR	-	-	BK	BL	BN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	GJ	GM	-	GL	GJ	GM	GO	GK	GN	GO	-	-	-	GJ	GM	GM	GM	GM	GM	GJ	GJ	-	GR	GM	GM	GM	GM	GM	GM	GM	GM	GM	-	GM	GM	GR	GR	GR	GR	GR	GR	GM	GJ	GR	GO	GQ	GR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	AE	-	AH	AH	AJ	AM	-	AL	AJ	AM	AO	AK	AN	AO	-	AG	AE	-	AM	AM	AM	AM	AM	-	-	AH	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM	AJ	AR	AO	AQ	AR	AL	-	AK	AL	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	EJ	EM	-	EL	EJ	EM	EO	EK	EN	EO	-	-	-	EJ	EM	EM	EM	EM	EM	EJ	EJ	-	ER	EM	EM	EM	EM	EM	EM	EM	EM	EM	-	EM	EM	ER	ER	ER	ER	ER	ER	EM	EJ	ER	EO	EQ	ER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	GJ	GM	-	GL	GJ	GM	GO	GK	GN	GO	-	-	-	GJ	GM	GM	GM	GM	GM	GJ	GJ	-	GR	GM	GM	GM	GM	GM	GM	GM	GM	GM	-	GM	GM	GR	GR	GR	GR	GR	GR	GM	GJ	GR	GO	GQ	GR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	IM	-	IL	-	IM	IO	IK	IN	IO	-	-	-	-	IM	IM	IM	IM	IM	-	-	-	IR	IM	IM	IM	IM	IM	IM	IM	IM	IM	-	IM	IM	IR	IR	IR	IR	IR	IR	IM	-	IR	IO	IQ	IR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	EA	EA	-	EC	EB	EC	EB	-	EA	-	-	-	-	-	-	-	EJ	EM	-	EL	EJ	EM	EO	EK	EN	EO	-	-	-	EJ	EM	EM	EM	EM	EM	EJ	EJ	-	ER	EM	EM	EM	EM	EM	EM	EM	EM	EM	-	EM	EM	ER	ER	ER	ER	ER	ER	EM	EJ	ER	EO	EQ	ER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	IM	-	IL	-	IM	IO	IK	IN	IO	-	-	-	-	IM	IM	IM	IM	IM	-	-	-	IR	IM	IM	IM	IM	IM	IM	IM	IM	IM	-	IM	IM	IR	IR	IR	IR	IR	IR	IM	-	IR	IO	IQ	IR	-	-	-	IN	IN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	HA	HA	-	HC	HB	HC	HB	-	HA	-	-	-	-	-	-	-	-	IM	-	IL	-	IM	IO	IK	IN	IO	-	-	-	-	IM	IM	IM	IM	IM	-	-	-	IR	IM	IM	IM	IM	IM	IM	IM	IM	IM	-	IM	IM	IR	IR	IR	IR	IR	IR	IM	-	IR	IO	IQ	IR	-	-	-	IN	IN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	HA	HA	-	HC	HB	HC	HB	-	HA	-	-	-	-	-	-	-	-	JM	-	JL	-	JM	JO	-	JN	IO	-	-	-	-	JM	JM	JM	JM	JM	-	-	-	JR	JM	JM	JM	JM	JM	JM	JM	JM	JM	-	JM	JM	JR	JR	JR	JR	JR	JR	JM	-	JR	JO	JQ	JR	-	-	-	JN	JN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	JA	JA	JG	JC	JB	JC	JB	JG	JA	JE	JG	-	JE	-	-	-	-	JM	-	JL	-	JM	JO	-	JN	IO	-	-	-	-	JM	JM	JM	JM	JM	-	-	-	JR	JM	JM	JM	JM	JM	JM	JM	JM	JM	-	JM	JM	JR	JR	JR	JR	JR	JR	JM	-	JR	JO	JQ	JR	-	-	-	JN	JN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	-	-	-	-	-	-	-	MC	MG	-	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	LA	LA	LG	JC	JB	JC	JB	LG	LA	LE	LG	LI	LE	LI	LI	LJ	LJ	-	-	-	-	-	LO	-	LN	LO	LC	LG	LE	-	-	LM	-	LM	LM	-	-	-	LR	LM	LM	LM	LM	LM	LM	LM	LM	LM	-	LM	LM	LR	LR	LR	LR	LR	LR	LM	-	LR	LO	LQ	LR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	JA	JA	JG	JC	JB	JC	JB	JG	JA	JE	JG	-	JE	-	-	-	-	-	-	-	-	-	-	-	-	-	JC	JG	JE	-	-	-	-	-	-	-	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	-	-	-	-	-	-	-	MC	MG	ME	-	-	-	-	-	-	-	-	MI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	OA	OA	OG	OC	OB	OC	OB	OG	OA	OE	OG	OI	OE	OI	OI	OJ	OJ	-	-	OL	-	-	-	-	ON	-	OC	OG	OE	-	-	-	-	-	-	-	-	-	OR	-	-	-	-	-	-	-	-	-	-	-	OR	-	OR	OR	OR	OR	OR	-	-	OR	-	-	OR	OM	OM	OK	ON	ON	OM	OM	OM	OJ	OM	OM	OM	OM	OI	-	-	-	-	-	-
34	KA	KA	KG	KC	KB	KC	KB	KG	KA	KE	KG	KI	KE	KI	KI	-	-	-	-	-	-	-	-	-	-	-	LC	LG	LE	-	-	-	-	-	-	-	-	LI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	NA	NA	NG	NC	NB	NC	NB	NG	NA	NE	NG	NI	NE	NI	NI	NJ	NJ	-	-	NL	-	-	NO	-	-	-	NC	NG	NE	-	-	-	-	-	-	-	-	NI	NR	-	-	-	-	-	-	-	-	-	NM	-	NR	NR	NR	NR	NR	NR	NR	-	-	NR	-	-	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	OA	OA	OG	OC	OB	OC	OB	OG	OA	OE	OG	OI	OE	OI	OI	OI	OI	-	-	OL	-	-	-	-	-	-	NC	NG	NE	-	-	-	-	-	-	-	-	NI	NR	-	-	-	-	-	-	-	-	-	NM	-	NR	NR	NR	NR	NR	NR	NR	-	-	NR	-	-	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CM	-	CL	CJ	CM	CO	CL	CN	CN	-	CG	-	CJ	CM	-	CM	CM	CM	CJ	CJ	CH	CR	CM	CM	CM	CM	CM	CM	CM	CM	CM	-	CM	CM	CR	CR	CR	CR	CR	CR	CM	-	CR	CO	CQ	CR	-	-	CK	CL	CN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	GA	GA	-	GC	GB	GC	GB	-	GA	-	-	-	-	-	-	-	-	GM	-	GL	GJ	GM	GO	GL	GN	GN	GC	-	-	FJ	FM	-	FM	FM	FM	FJ	FJ	-	FR	FM	FM	FM	FM	FM	FM	FM	FM	FM	-	FM	FM	FR	FR	FR	FR	FR	FR	FM	-	FR	FO	FQ	FR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	EA	EA	-	EC	EB	EC	EB	-	EA	-	-	-	-	-	-	-	-	-	-	EL	EJ	EM	EO	EL	EN	EN	-	-	-	EJ	EM	-	EM	EM	EM	EJ	EJ	-	ER	EM	EM	EM	EM	EM	EM	EM	EM	EM	-	EM	EM	ER	ER	ER	ER	ER	ER	EM	-	ER	EO	EQ	ER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	-	-	JG	JC	JB	JC	JB	JG	-	JE	JG	-	JE	-	-	-	-	-	-	-	-	-	-	-	-	-	JC	JF	JE	-	-	-	-	-	-	-	-	LI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	-	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46	-	-	JG	JC	JB	JC	JB	JG	-	JE	JG	-	JE	-	-	-	-	-	-	-	-	-	-	-	-	-	JC	JF	JE	-	-	-	-	-	-	-	-	LI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	-	-	JG	JC	JB	JC	JB	JG	-	JE	JG	-	JE	-	-	-	-	-	-	-	-	-	-	-	-	-	JC	JF	JE	-	-	-	-	-	-	-	-	LI	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	HA	HA	-	HC	HB	HC	HB	-	HA	-	-	-	-	-	-	-	-	IM	-	-	-	IM	-	IL	IN	IN	HC	-	-	IL	IM	IM	IM	IM	IM	IL	IL	-	IR	IM	IM	IM	IM	IM	IM	IM	IM	IM	-	IM	IM	IR	IR	IR	IR	IR	IR	IM	-	IR	IO	IQ	IR	-	-	-	IN	IN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
49	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RP	-	-	RQ	-	RM	-	RK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	RO	-	RN	RN	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	-	-	-	-	RN	RN	RC	RF	RE	-	-	-	-	-	-	-	-	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RM	RM	RK	RN	RM	RM	RM	RM	RM	RM	RM	RM	RM	RM	-	-	-	-	-	-
63	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RM	RM	RK	RN	RM	RM	RM	RM	RM	RM	RM	RM	RM	RM	-	-	-	-	-	-
64	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RM	RM	RK	RN	RM	RM	RM	RM	RM	RM	RM	RM	RM	RM	-	-	-	-	-	-
65	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RM	RM	RK	RN	RM	RM	RM	RM	RM	RM	RM	RM	RM	RM	-	-	-	-	-	-
66	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RM	RM	RK	RN	RM	RM	RM	RM	RM	RM	RM	RM	RM	RM	-	-	-	-	-	-
67	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RM	RM	RK	RN	RM	RM	RM	RM	RM	RM	RM	RM	RM	RM	-	-	-	-	-	-
68	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	ML	-	-	-	-	-	-	MC	MF	ME	-	-	-	-	-	-	-	-	MI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	JA	JA	JG	JC	JB	JC	JB	JG	JA	JE	JG	-	JE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	-	-	PR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
70	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RP	-	-	-	-	RM	RM	RK	RN	RM	RM	RM	RM	RM	RM	RM	RM	RM	RM	-	-	-	-	-	-
71	OA	OA	OG	OC	OB	OC	OB	OG	OA	OE	OG	OI	OE	OI	OI	OJ	OJ	-	-	OL	-	-	-	-	-	-	OC	OF	OE	-	-	-	-	-	-	-	-	OI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OR	OM	OM	OK	ON	ON	OM	OM	OM	OJ	OM	OM	OM	OM	OI	-	-	-	-	-	-
72	QA	QA	QG	QC	QB	QC	QB	QG	QA	QE	QG	QI	QE	QI	QI	QJ	QJ	-	-	QL	-	-	-	-	-	-	QC	QF	QE	-	-	-	-	-	-	-	-	QI	QR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	QR	QM	QM	QK	QN	QN	QM	QM	QM	QJ	QM	QM	QM	QM	QI	-	-	-	-	-	-
73	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RP	-	RO	RQ	-	RM	RM	RK	RN	RM	RM	RM	RM	RM	RM	RM	RM	RM	RM	-	-	-	-	-	-
74	LA	LA	-	-	-	-	-	-	LA	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
76	KA	KA	-	KC	KB	KC	KB	-	KA	-	-	-	-	-	-	-	-	KM	-	-	-	-	KO	-	-	-	KC	-	-	-	-	-	-	-	-	-	-	-	KR	-	-	-	-	-	-	-	-	-	-	-	-	KR	KR	KR	KR	KR	KR	-	-	KR	KO	KQ	KR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	LA	LA	-	LC	LB	LC	LB	-	LA	-	-	-	-	NI	NI	NJ	NJ	-	-	-	-	-	NO	-	-	-	LC	-	-	-	-	-	-	-	-	-	-	NI	-	-	-	-	-	-	-	-	-	-	-	-	-	NR	NR	NR	NR	NR	NR	-	-	NR	NO	NQ	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
78	NA	NA	-	NC	NB	NC	NB	-	NA	-	-	-	-	NI	NI	NJ	NJ	-	-	-	-	-	NO	-	-	-	NC	-	-	-	-	-	-	-	-	-	-	NI	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	NO	NQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	JO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	JO	JQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	MO	MQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	IO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-	-	MR	IO	IQ	MR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Trip Matrix for O-D Pairs (Trips between Districts of Uttar Pradesh and Expressway Interchange Node Zones+Other States of India)

Zones	AL1	AL2	AR1	AR2	BL1	BL2	BR1	CL1	CL2	CR1	CR2	DL1	DL2	DR1	DR2	EL1	EL2	ER1	ER2	FL1	FL2	GL1	GL2	GR1	HL2	IL1	IL2	IR2	JL2	JR1	JR2	KL1	KL2	KR1	KR2	LL1	LR1	LR2	ML1	ML2	MR1	MR2	NL1	NL2	NR1	NR2	OL2	OR1	OR2	PL1	PL2	QR1	QR2	RL2	RR1	RR2	ZAS	ZBR	ZCG	ZCH	ZGJ	ZHP	ZHR	ZJH	ZKA	ZMH	ZMP	ZNDLS	ZNepal	ZOR	ZPB	ZRJ	ZTN	ZTS	ZUK	ZWB
11	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
12	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	GH	GI	GI	GI	GJ	GJ	GJ	GK	GK	GK	GK	GL	GL	GL	GM	GM	GM	GM	GN	GN	GN	GN	GO	GO	GO	GP	GP	GQ	GQ	GR	GR	GR	GR	GR	GR	-	-	-	-	GR	-	-	-	-	-	GR	-	-	-	-	-	GR
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CE	CE	CE	CE	CF	CF	CG	CG	CG	CH	CI	CI	CI	CJ	CJ	CJ	CK	CK	CK	CK	CL	CL	CL	CM	CM	CM	CM	CN	CN	CN	CN	CO	CO	CO	CP	CP	CQ	CQ	CR	CR	CR	CR	CR	CR	-	-	-	-	CR	-	-	-	-	-	CR	-	-	-	-	-	CR
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BE	BE	BE	BE	BF	BF	BG	BG	BG	BH	BI	BI	BI	BJ	BJ	BJ	BK	BK	BK	BK	BL	BL	BL	BM	BM	BM	BM	BN	BN	BN	BN	BO	BO	BO	BP	BP	BQ	BQ	BR	BR	BR	BR	BR	BR	-	-	-	-	BR	-	-	-	-	-	BR	-	-	-	-	-	BR
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CE	CE	CE	CE	CF	CF	CG	CG	CG	CH	CI	CI	CI	CJ	CJ	CJ	CK	CK	CK	CK	CL	CL	CL	CM	CM	CM	CM	CN	CN	CN	CN	CO	CO	CO	CP	CP	CQ	CQ	CR	CR	CR	CR	CR	CR	-	-	-	-	CR	-	-	-	-	-	CR	-	-	-	-	-	CR
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BE	BE	BE	BE	BF	BF	BG	BG	BG	BH	BI	BI	BI	BJ	BJ	BJ	BK	BK	BK	BK	BL	BL	BL	BM	BM	BM	BM	BN	BN	BN	BN	BO	BO	BO	BP	BP	BQ	BQ	BR	BR	BR	BR	BR	BR	-	-	-	-	BR	-	-	-	-	-	BR	-	-	-	-	-	BR
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	GH	GI	GI	GI	GJ	GJ	GJ	GK	GK	GK	GK	GL	GL	GL	GM	GM	GM	GM	GN	GN	GN	GN	GO	GO	GO	GP	GP	GQ	GQ	GR	GR	GR	GR	GR	GR	-	-	-	-	GR	-	-	-	-	-	GR	-	-	-	-	-	GR
19	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	EH	EI	EI	EI	EJ	EJ	EJ	EK	EK	EK	EK	EL	EL	EL	EM	EM	EM	EM	EN	EN	EN	EN	EO	EO	EO	EP	EP	EQ	EQ	ER	ER	ER	ER	ER	ER	-	-	-	-	ER	-	-	-	-	-	ER	-	-	-	-	-	ER
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	GJ	GJ	GJ	GK	GK	GK	GK	GL	GL	GL	GM	GM	GM	GM	GN	GN	GN	GN	GO	GO	GO	GP	GP	GQ	GQ	GR	GR	GR	GR	GR	GR	-	-	-	-	GR	-	-	-	-	-	GR	-	-	-	-	-	GR
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	-	-	-	-	IR	-	-	-	-	-	IR	-	-	-	-	-	IR
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	EF	EF	EG	EG	EG	EH	EI	EI	EI	EJ	EJ	EJ	EK	EK	EK	EK	EL	EL	EL	EM	EM	EM	EM	EN	EN	EN	EN	EO	EO	EO	EP	EP	EQ	EQ	ER	ER	ER	ER	ER	ER	-	-	-	-	ER	-	-	-	-	-	ER	-	-	-	-	-	ER
24	IA	IA	IA	IA	IB	IB	IB	IC	IC	IC	IC	ID	ID	ID	ID	IE	IE	IE	IE	-	-	-	-	-	-	-	-	-	-	-	-	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	-	-	-	-	IR	-	-	-	-	-	IR	-	-	-	-	-	IR
25	IA	IA	IA	IA	IB	IB	IB	IC	IC	IC	IC	ID	ID	ID	ID	IE	IE	IE	IE	-	-	-	-	-	-	-	-	-	-	-	-	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	-	-	-	-	IR	-	-	-	-	-	IR	-	-	-	-	-	IR
26	JA	JA	JA	JA	JB	JB	JB	JC	JC	JC	JC	JD	JD	JD	JD	JE	JE	JE	JE	JF	JF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	JL	JL	JL	JM	JM	JM	JM	JN	JN	JN	JN	JO	JO	JO	JP	JP	JQ	JQ	JR	JR	JR	JR	JR	JR	-	-	-	-	JR	-	-	-	-	-	JR	-	-	-	-	-	JR
27	JA	JA	JA	JA	JB	JB	JB	JC	JC	JC	JC	JD	JD	JD	JD	JE	JE	JE	JE	JF	JF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	JL	JL	JL	JM	JM	JM	JM	JN	JN	JN	JN	JO	JO	JO	JP	JP	JQ	JQ	JR	JR	JR	JR	JR	JR	-	-	-	-	JR	-	-	-	-	-	JR	-	-	-	-	-	JR
28	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	MA	-	-	MA	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	LA	LA	LA	LA	LB	LB	LB	LC	LC	LC	LC	LD	LD	LD	LD	LE	LE	LE	LE	LF	LF	LG	LG	LG	LH	LI	LI	LI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	LN	LN	LN	LN	LO	LO	LO	LP	LP	LQ	LQ	LP	LP	LP	LR	LR	LR	LA	-	LA	LA	LR	-	-	-	LA	-	LR	LA	-	-	-	-	LR
31	JA	JA	JA	JA	JB	JB	JB	JC	JC	JC	JC	JD	JD	JD	JD	JE	JE	JE	JE	JF	JF	JG	JG	JG	JH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	PR	JA	-	JA	JA	PR	-	-	-	JA	-	PR	-	-	-	-	-	PR
32	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PQ	PQ	PR	PR	PR	PR	PR	PR	MA	-	MA	MA	PR	-	-	-	MA	-	PR	MA	-	-	-	MA	PR
33	OA	OA	OA	OA	OB	OB	OB	OC	OC	OC	OC	OD	OD	OD	OD	OE	OE	OE	OE	OF	OF	OG	OG	OG	OH	OI	OI	OI	OJ	OJ	OJ	OK	OK	OK	OK	OL	OL	OL	OM	OM	OM	OM	ON	ON	ON	ON	-	-	-	OP	OP	OQ	OQ	OR	OR	OR	OR	OR	OR	OA	-	OA	OA	OR	-	-	-	OA	-	OR	OA	-	-	-	OA	PR
34	LA	LA	LA	LA	LB	LB	LB	LC	LC	LC	LC	LD	LD	LD	LD	LE	LE	LE	LE	LF	LF	LG	LG	LG	LH	LI	LI	LI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	PR	LA	-	LA	LA	PR	-	-	-	LA	-	PR	-	-	-	-	LA	PR
35	NA	NA	NA	NA	NB	NB	NB	NC	NC	NC	NC	ND	ND	ND	ND	NE	NE	NE	NE	NF	NF	NG	NG	NG	NH	NI	NI	NI	NJ	NJ	NJ	NK	NK	NK	NK	NL	NL	NL	-	-	-	-	NO	NO	NO	NO	-	-	-	NP	NP	NQ	NQ	NR	NR	NR	NR	NR	NR	NA	-	NA	NA	NR	-	-	-	NA	-	NR	NA	-	-	-	NA	NR
36	NA	NA	NA	NA	NB	NB	NB	NC	NC	NC	NC	ND	ND	ND	ND	NE	NE	NE	NE	NF	NF	NG	NG	NG	NH	NI	NI	NI	NJ	NJ	NJ	NK	NK	NK	NK	NL	NL	NL	-	-	-	-	NO	NO	NO	NO	-	-	-	NP	NP	NQ	NQ	NR	NR	NR	NR	NR	NR	NA	-	NA	NA	NR	-	-	-	NA	-	NR	NA	-	-	-	NA	NR
37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CE	CE	CE	CE	CF	CF	CG	CG	CG	CH	CI	CI	CI	CJ	CJ	CJ	CK	CK	CK	CK	CL	CL	CL	CM	CM	CM	CM	CN	CN	CN	CN	CO	CO	CO	CP	CP	CQ	CQ	CR	CR	CR	CR	CR	CR	-	-	-	-	CR	-	-	-	-	-	CR	-	-	-	-	-	CR
38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	FJ	FJ	FJ	FK	FK	FK	FK	FL	FL	FL	FM	FM	FM	FM	FN	FN	FN	FN	FO	FO	FO	FP	FP	FQ	FP	FR	FR	FR	FR	FR	FR	-	-	-	-	FR	-	-	-	-	-	FR	-	-	-	-	-	FR
39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	EJ	EJ	EJ	EK	EK	EK	EK	EL	EL	EL	EM	EM	EM	EM	EN	EN	EN	EN	EO	EO	EO	EP	EP	EQ	EP	ER	ER	ER	ER	ER	ER	-	-	-	-	ER	-	-	-	-	-	ER	-	-	-	-	-	ER
40	LA	LA	LA	LA	LB	LB	LB	LC	LC	LC	LC	LD	LD	LD	LD	LE	LE	LE	LE	LF	LF	LG	LG	LG	LH	LI	LI	LI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	PR	LA	-	LA	LA	PR	-	-	-	LA	-	PR	-	-	-	-	LA	PR
41	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PQ	PQ	PR	PR	PR	PR	PR	PR	MA	-	MA	MA	PR	-	-	-	MA	-	PR	MA	-	-	-	MA	PR
42	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PQ	PQ	PR	PR	PR	PR	PR	PR	MA	-	MA	MA	PR	-	-	-	MA	-	PR	MA	-	-	-	MA	PR
43	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PQ	PQ	PR	PR	PR	PR	PR	PR	MA	-	MA	MA	PR	-	-	-	MA	-	PR	MA	-	-	-	MA	PR
44	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PQ	PQ	PR	PR	PR	PR	PR	PR	MA	-	MA	MA	PR	-	-	-	MA	-	PR	MA	-	-	-	MA	PR
45	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PQ	PQ	PR	PR	PR	PR	PR	PR	MA	-	MA	MA	PR	-	-	-	MA	-	PR	MA	-	-	-	MA	PR
46	LA	LA	LA	LA	LB	LB	LB	LC	LC	LC	LC	LD	LD	LD	LD	LE	LE	LE	LE	LF	LF	LG	LG	LG	LH	LI	LI	LI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	PR	LA	-	LA	LA	PR	-	-	-	LA	-	PR	-	-	-	-	LA	PR
47	LA	LA	LA	LA	LB	LB	LB	LC	LC	LC	LC	LD	LD	LD	LD	LE	LE	LE	LE	LF	LF	LG	LG	LG	LH	LI	LI	LI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	PR	LA	-	LA	LA	PR	-	-	-	LA	-	PR	-	-	-	-	LA	PR
48	IA	IA	IA	IA	IB	IB	IB	IC	IC	IC	IC	ID	ID	ID	ID	IE	IE	IE	IE	-	-	-	-	-	-	-	-	-	-	-	-	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	-	-	-	-	IR	-	-	-	-	-	IR	-	-	-	-	-	IR
49	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
50	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
51	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
52	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
53	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
54	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
55	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
56	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
57	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
58	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
60	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
61	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
62	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	-	-	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
63	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	-	-	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
64	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	-	-	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
65	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	-	-	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
66	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	-	-	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
67	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	-	-	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
68	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MA	-	MA	MA	-	-	-	-	NA	-	-	MA	-	-	-	MA	-
69	JA	JA	JA	JA	JB	JB	JB	JC	JC	JC	JC	JD	JD	JD	JD	JE	JE	JE	JE	JF	JF	JG	JG	JG	JH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	PR	PR	PR	PR	PR	PR	JA	-	JA	JA	PR	-	-	-	JA	-	PR	-	-	-	-	-	PR
70	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	-	-	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
71	OA	OA	OA	OA	OB	OB	OB	OC	OC	OC	OC	OD	OD	OD	OD	OE	OE	OE	OE	OF	OF	OG	OG	OG	OH	OI	OI	OI	OJ	OJ	OJ	OK	OK	OK	OK	OL	OL	OL	OM	OM	OM	OM	ON	ON	ON	ON	-	-	-	OP	OP	OQ	OQ	OR	OR	OR	OR	OR	OR	OA	-	OA	OA	OR	-	-	-	OA	-	OR	OA	-	-	-	OA	PR
72	QA	QA	QA	QA	QB	QB	QB	QC	QC	QC	QC	QD	QD	QD	QD	QE	QE	QE	QE	QF	QF	QG	QG	QG	QH	QI	QI	QI	QJ	QJ	QJ	QK	QK	QK	QK	QL	QL	QL	QM	QM	QM	QM	QN	QN	QN	QN	QO	QO	QO	-	-	-	-	-	-	-	QR	QR	QR	QA	-	QA	QA	QR	-	-	-	QA	-	QR	QA	-	-	-	QA	QR
73	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	-	-	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
74	LA	LA	LA	LA	LB	LB	LB	LC	LC	LC	LC	LD	LD	LD	LD	LE	LE	LE	LE	LF	LF	LG	LG	LG	LH	LI	LI	LI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	LN	LN	LN	LN	LO	LO	LO	LP	LP	LQ	LQ	LP	LP	LP	LR	LR	LR	LA	-	LA	LA	LR	-	-	-	LA	-	LR	LA	-	-	-	-	LR
75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
76	JA	JA	JA	JA	JB	JB	JB	JC	JC	JC	JC	JD	JD	JD	JD	JE	JE	JE	JE	JF	JF	JG	JG	JG	JH	-	JI	JI	-	-	-	JK	JK	JK	JK	JL	JL	JL	JM	JM	JM	JM	JN	JN	JN	JN	JO	JO	JO	JP	JP	JQ	JQ	JR	JR	JR	JR	JR	JR	JA	-	JA	JA	JR	-	-	-	JA	-	JR	JA	-	-	-	JA	JR
77	NA	NA	NA	NA	NB	NB	NB	NC	NC	NC	NC	ND	ND	ND	ND	NE	NE	NE	NE	NF	NF	NG	NG	NG	NH	NI	NI	NI	NJ	NJ	NJ	NK	NK	NK	NK	NL	NL	NL	-	-	-	-	NO	NO	NO	NO	-	-	-	NP	NP	NQ	NQ	NR	NR	NR	NR	NR	NR	NA	-	NA	NA	NR	-	-	-	NA	-	NR	NA	-	-	-	NA	NR
78	NA	NA	NA	NA	NB	NB	NB	NC	NC	NC	NC	ND	ND	ND	ND	NE	NE	NE	NE	NF	NF	NG	NG	NG	NH	NI	NI	NI	NJ	NJ	NJ	NK	NK	NK	NK	NL	NL	NL	-	-	-	-	NO	NO	NO	NO	-	-	-	NP	NP	NQ	NQ	NR	NR	NR	NR	NR	NR	NA	-	NA	NA	NR	-	-	-	NA	-	NR	NA	-	-	-	NA	NR
79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
82	IA	IA	IA	IA	IB	IB	IB	IC	IC	IC	IC	ID	ID	ID	ID	IE	IE	IE	IE	-	-	-	-	-	-	-	-	-	-	-	-	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	-	-	-	-	IR	-	-	-	-	-	IR	-	-	-	-	-	IR
83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	-	-	-	-	MR	-	-	-	-	-	MR	-	-	-	-	-	MR
87	IA	IA	IA	IA	IB	IB	IB	IC	IC	IC	IC	ID	ID	ID	ID	IE	IE	IE	IE	-	-	-	-	-	-	-	-	-	-	-	-	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	-	-	-	-	IR	-	-	-	-	-	IR	-	-	-	-	-	IR
88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Trip Matrix for O-D Pairs (Trips between Expressway Interchange Node Zones + Other States of India and Districts of Uttar Pradesh)

Zones	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
AL1	-	-	-	-	-	-	-	-	-	-	-	-	-	AI	AI	AJ	AJ	AM	-	AL	AJ	AM	AO	AL	AN	AN	-	-	-
AL2	-	-	-	-	-	-	-	-	-	-	-	-	-	AI	AI	AJ	AJ	AM	-	AL	AJ	AM	AO	AL	AN	AN	-	-	-
AR1	-	-	-	-	-	-	-	-	-	-	-	-	-	AI	AI	AJ	AJ	AM	-	AL	AJ	AM	AO	AL	AN	AN	-	-	-
AR2	-	-	-	-	-	-	-	-	-	-	-	-	-	AI	AI	AJ	AJ	AM	-	AL	AJ	AM	AO	AL	AN	AN	-	-	-
BL1	BA	BA	-	-	-	-	-	-	BA	-	-	-	-	BI	BI	BJ	BJ	BM	-	BL	BJ	BM	BO	BL	BN	BN	-	-	-
BL2	BA	BA	-	-	-	-	-	-	BA	-	-	-	-	BI	BI	BJ	BJ	BM	-	BL	BJ	BM	BO	BL	BN	BN	-	-	-
BR1	BA	BA	-	-	-	-	-	-	BA	-	-	-	-	BI	BI	BJ	BJ	BM	-	BL	BJ	BM	BO	BL	BN	BN	-	-	-
CL1	CA	CA	-	-	-	-	-	-	CA	-	-	-	-	CI	CI	CJ	CJ	CM	-	CL	CJ	CM	CO	CL	CN	CN	-	-	-
CL2	CA	CA	-	-	-	-	-	-	CA	-	-	-	-	CI	CI	CJ	CJ	CM	-	CL	CJ	CM	CO	CL	CN	CN	-	-	-
CR1	CA	CA	-	-	-	-	-	-	CA	-	-	-	-	CI	CI	CJ	CJ	CM	-	CL	CJ	CM	CO	CL	CN	CN	-	-	-
CR2	CA	CA	-	-	-	-	-	-	CA	-	-	-	-	CI	CI	CJ	CJ	CM	-	CL	CJ	CM	CO	CL	CN	CN	-	-	-
DL1	DA	DA	-	-	-	-	-	-	DA	-	-	-	-	DI	DI	DJ	DJ	DM	-	DL	DJ	DM	DO	DL	DN	DN	-	-	-
DL2	DA	DA	-	-	-	-	-	-	DA	-	-	-	-	DI	DI	DJ	DJ	DM	-	DL	DJ	DM	DO	DL	DN	DN	-	-	-
DR1	DA	DA	-	-	-	-	-	-	DA	-	-	-	-	DI	DI	DJ	DJ	DM	-	DL	DJ	DM	DO	DL	DN	DN	-	-	-
DR2	DA	DA	-	-	-	-	-	-	DA	-	-	-	-	DI	DI	DJ	DJ	DM	-	DL	DJ	DM	DO	DL	DN	DN	-	-	-
EL1	EA	EA	-	EC	EB	EC	EB	-	EA	-	-	-	-	EI	EI	EJ	EJ	EM	-	EL	EJ	EM	EO	EL	EN	EN	EC	-	-
EL2	EA	EA	-	EC	EB	EC	EB	-	EA	-	-	-	-	EI	EI	EJ	EJ	EM	-	EL	EJ	EM	EO	EL	EN	EN	EC	-	-
ER1	EA	EA	-	EC	EB	EC	EB	-	EA	-	-	-	-	EI	EI	EJ	EJ	EM	-	EL	EJ	EM	EO	EL	EN	EN	EC	-	-
ER2	EA	EA	-	EC	EB	EC	EB	-	EA	-	-	-	-	EI	EI	EJ	EJ	EM	-	EL	EJ	EM	EO	EL	EN	EN	EC	-	-
FL1	FA	FA	-	FC	FB	FC	FB	-	FA	-	-	-	FE	-	-	FJ	FJ	FM	-	FL	FJ	FM	FO	FL	FN	FN	FC	-	-
FL2	FA	FA	-	FC	FB	FC	FB	-	FA	-	-	-	FE	-	-	FJ	FJ	FM	-	FL	FJ	FM	FO	FL	FN	FN	FC	-	-
GL1	GA	GA	-	GC	GB	GC	GB	-	GA	-	-	-	GE	-	-	-	-	GM	-	GL	GJ	GM	GO	GL	GN	GN	GC	-	-
GL2	GA	GA	-	GC	GB	GC	GB	-	GA	-	-	-	GE	-	-	-	-	GM	-	GL	GJ	GM	GO	GL	GN	GN	GC	-	-
GR1	GA	GA	-	GC	GB	GC	GB	-	GA	-	-	-	GE	-	-	-	-	GM	-	GL	GJ	GM	GO	GL	GN	GN	GC	-	-
HL2	HA	HA	HG	HC	HB	HC	HB	HG	HA	HE	-	-	HE	-	-	-	-	HM	-	HL	HJ	HM	HO	HL	HN	HN	HC	-	-
IL1	IA	IA	IG	IC	IB	IC	IB	IG	IA	IE	-	-	IE	-	-	-	-	IM	-	IL	-	IM	IO	IL	IN	IN	IC	-	-
IL2	IA	IA	IG	IC	IB	IC	IB	IG	IA	IE	-	-	IE	-	-	-	-	IM	-	IL	-	IM	IO	IL	IN	IN	IC	-	-
IR2	IA	IA	IG	IC	IB	IC	IB	IG	IA	IE	-	-	IE	-	-	-	-	IM	-	IL	-	IM	IO	IL	IN	IN	IC	-	-
JL2	JA	JA	JG	JC	JB	JC	JB	JG	JA	JE	JG	-	JE	-	-	-	-	JM	-	-	-	JM	JO	-	JN	JN	JC	JF	JE
JR1	JA	JA	JG	JC	JB	JC	JB	JG	JA	JE	JG	-	JE	-	-	-	-	JM	-	-	-	JM	JO	-	JN	JN	JC	JF	JE
JR2	JA	JA	JG	JC	JB	JC	JB	JG	JA	JE	JG	-	JE	-	-	-	-	JM	-	-	-	JM	JO	-	JN	JN	JC	JF	JE
KL1	KA	KA	KG	KC	KB	KC	KB	KG	KA	KE	KG	KI	KE	KI	KI	-	-	KM	-	-	-	-	KO	-	KN	KN	KC	KF	KE
KL2	KA	KA	KG	KC	KB	KC	KB	KG	KA	KE	KG	KI	KE	KI	KI	-	-	KM	-	-	-	-	KO	-	KN	KN	KC	KF	KE
KR1	KA	KA	KG	KC	KB	KC	KB	KG	KA	KE	KG	KI	KE	KI	KI	-	-	KM	-	-	-	-	KO	-	KN	KN	KC	KF	KE
KR2	KA	KA	KG	KC	KB	KC	KB	KG	KA	KE	KG	KI	KE	KI	KI	-	-	KM	-	-	-	-	KO	-	KN	KN	KC	KF	KE
LL1	LA	LA	LG	LC	LB	LC	LB	LG	LA	LE	LG	LI	LE	LI	LI	LJ	LJ	-	-	-	-	-	LO	-	LN	LN	LC	LF	LE
LR1	LA	LA	LG	LC	LB	LC	LB	LG	LA	LE	LG	LI	LE	LI	LI	LJ	LJ	-	-	-	-	-	LO	-	LN	LN	LC	LF	LE
LR2	LA	LA	LG	LC	LB	LC	LB	LG	LA	LE	LG	LI	LE	LI	LI	LJ	LJ	-	-	-	-	-	LO	-	LN	LN	LC	LF	LE
ML1	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	-	-	-	MO	-	-	-	MC	MF	ME
ML2	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	-	-	-	MO	-	-	-	MC	MF	ME
MR1	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	-	-	-	MO	-	-	-	MC	MF	ME
MR2	MA	MA	MG	MC	MB	MC	MB	MG	MA	ME	MG	MI	ME	MI	MI	MJ	MJ	-	-	-	-	-	MO	-	-	-	MC	MF	ME
NL1	NA	NA	NG	NC	NB	NC	NB	NG	NA	NE	NG	NI	NE	NI	NI	NJ	NJ	-	-	NL	-	-	NO	-	ON	ON	NC	NF	NE
NL2	NA	NA	NG	NC	NB	NC	NB	NG	NA	NE	NG	NI	NE	NI	NI	NJ	NJ	-	-	NL	-	-	NO	-	ON	ON	NC	NF	NE
NR1	NA	NA	NG	NC	NB	NC	NB	NG	NA	NE	NG	NI	NE	NI	NI	NJ	NJ	-	-	NL	-	-	NO	-	ON	ON	NC	NF	NE
NR2	NA	NA	NG	NC	NB	NC	NB	NG	NA	NE	NG	NI	NE	NI	NI	NJ	NJ	-	-	NL	-	-	NO	-	ON	ON	NC	NF	NE
OL2	OA	OA	OG	OC	OB	OC	OB	OG	OA	OE	OG	OI	OE	OI	OI	OJ	OJ	-	-	OL	-	-	-	-	-	-	OC	OF	OE
OR1	OA	OA	OG	OC	OB	OC	OB	OG	OA	OE	OG	OI	OE	OI	OI	OJ	OJ	-	-	OL	-	-	-	-	-	-	OC	OF	OE
OR2	OA	OA	OG	OC	OB	OC	OB	OG	OA	OE	OG	OI	OE	OI	OI	OJ	OJ	-	-	OL	-	-	-	-	-	-	OC	OF	OE
PL1	PA	PA	PG	PC	PB	PC	PB	PG	PA	PE	PG	PI	PE	PI	PI	PJ	PJ	-	-	PL	-	-	PO	-	PN	PN	PC	PF	PE
PL2	PA	PA	PG	PC	PB	PC	PB	PG	PA	PE	PG	PI	PE	PI	PI	PJ	PJ	-	-	PL	-	-	PO	-	PN	PN	PC	PF	PE
QR1	QA	QA	QG	QC	QB	QC	QB	QG	QA	QE	QG	QI	QE	QI	QI	QJ	QJ	-	-	QL	-	QP	QO	-	QN	QN	QC	QF	QE
QR2	QA	QA	QG	QC	QB	QC	QB	QG	QA	QE	QG	QI	QE	QI	QI	QJ	QJ	-	-	QL	-	QP	QO	-	QN	QN	QC	PF	PE
RL2	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	PL	RP	RP	RO	RP	RN	RN	RC	RF	RE
RR1	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	PL	RP	RP	RO	RP	RN	RN	RC	RF	RE
RR2	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	PL	RP	RP	RO	RP	RN	RN	RC	RF	RE
ZAS	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE
ZBR	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE
ZCG	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE
ZCH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AM	-	AL	AJ	AM	AO	AL	AN	AN	-	-	-
ZGJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZHP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AM	-	AL	AJ	AM	AO	AL	AN	AN	-	-	-
ZHR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AM	-	AL	AJ	AM	AO	AL	AN	AN	-	-	-
ZJH	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE
ZKA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZMH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZMP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZNDLS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AM	-	AL	AJ	AM	AO	AL	AN	AN	-	-	-
ZNepal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOR	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RO	RP	RN	RN	RC	RF	RE
ZPB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AM	-	AL	-	AM	AO	-	AN	AN	-	-	-
ZRJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZTN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZUK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AM	AO	AL	AN	AN	-	-	-
ZWB	RA	RA	RG	RC	RB	RC	RB	RG	RA	RE	RG	RI	RE	RI	RI	RJ	RJ	-	-	RL	RP	RP	RP	RP	RN	RN	RC	RF	RE

Zones	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
AL1	AL	AM	AM	AM	AM	AM	AL	AL	AI	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
AL2	AL	AM	AM	AM	AM	AM	AL	AL	AI	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
AR1	AL	AM	AM	AM	AM	AM	AL	AL	AI	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
AR2	AL	AM	AM	AM	AM	AM	AL	AL	AI	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
BL1	BL	BM	BM	BM	BM	BM	BL	BL	BI	BR	BM	BM	BM	BM	BM	BM	BM	BM	BM	-	BM	BM	BR	BR	BR	BR	BR	BR	BM
BL2	BL	BM	BM	BM	BM	BM	BL	BL	BI	BR	BM	BM	BM	BM	BM	BM	BM	BM	BM	-	BM	BM	BR	BR	BR	BR	BR	BR	BM
BR1	BL	BM	BM	BM	BM	BM	BL	BL	BI	BR	BM	BM	BM	BM	BM	BM	BM	BM	BM	-	BM	BM	BR	BR	BR	BR	BR	BR	BM
CL1	CL	CM	CM	CM	CM	CM	CL	CL	CI	CR	CM	CM	CM	CM	CM	CM	CM	CM	CM	-	CM	CM	CR	CR	CR	CR	CR	CR	CM
CL2	CL	CM	CM	CM	CM	CM	CL	CL	CI	CR	CM	CM	CM	CM	CM	CM	CM	CM	CM	-	CM	CM	CR	CR	CR	CR	CR	CR	CM
CR1	CL	CM	CM	CM	CM	CM	CL	CL	CI	CR	CM	CM	CM	CM	CM	CM	CM	CM	CM	-	CM	CM	CR	CR	CR	CR	CR	CR	CM
CR2	CL	CM	CM	CM	CM	CM	CL	CL	CI	CR	CM	CM	CM	CM	CM	CM	CM	CM	CM	-	CM	CM	CR	CR	CR	CR	CR	CR	CM
DL1	DL	DM	DM	DM	DM	DM	DL	DL	DI	DR	DM	DM	DM	DM	DM	DM	DM	DM	DM	-	DM	DM	DR	DR	DR	DR	DR	DR	DM
DL2	DL	DM	DM	DM	DM	DM	DL	DL	DI	DR	DM	DM	DM	DM	DM	DM	DM	DM	DM	-	DM	DM	DR	DR	DR	DR	DR	DR	DM
DR1	DL	DM	DM	DM	DM	DM	DL	DL	DI	DR	DM	DM	DM	DM	DM	DM	DM	DM	DM	-	DM	DM	DR	DR	DR	DR	DR	DR	DM
DR2	DL	DM	DM	DM	DM	DM	DL	DL	DI	DR	DM	DM	DM	DM	DM	DM	DM	DM	DM	-	DM	DM	DR	DR	DR	DR	DR	DR	DM
EL1	EL	EM	EM	EM	EM	EM	EL	EL	EI	ER	EM	EM	EM	EM	EM	EM	EM	EM	EM	-	EM	EM	ER	ER	ER	ER	ER	ER	EM
EL2	EL	EM	EM	EM	EM	EM	EL	EL	EI	ER	EM	EM	EM	EM	EM	EM	EM	EM	EM	-	EM	EM	ER	ER	ER	ER	ER	ER	EM
ER1	EL	EM	EM	EM	EM	EM	EL	EL	EI	ER	EM	EM	EM	EM	EM	EM	EM	EM	EM	-	EM	EM	ER	ER	ER	ER	ER	ER	EM
ER2	EL	EM	EM	EM	EM	EM	EL	EL	EI	ER	EM	EM	EM	EM	EM	EM	EM	EM	EM	-	EM	EM	ER	ER	ER	ER	ER	ER	EM
FL1	FL	FM	FM	FM	FM	FM	FL	FL	-	FR	FM	FM	FM	FM	FM	FM	FM	FM	FM	-	FM	FM	FR	FR	FR	FR	FR	FR	FM
FL2	FL	FM	FM	FM	FM	FM	FL	FL	-	FR	FM	FM	FM	FM	FM	FM	FM	FM	FM	-	FM	FM	FR	FR	FR	FR	FR	FR	FM
GL1	GL	GM	GM	GM	GM	GM	GL	GL	-	GR	GM	GM	GM	GM	GM	GM	GM	GM	GM	-	GM	GM	GR	GR	GR	GR	GR	GR	GM
GL2	GL	GM	GM	GM	GM	GM	GL	GL	-	GR	GM	GM	GM	GM	GM	GM	GM	GM	GM	-	GM	GM	GR	GR	GR	GR	GR	GR	GM
GR1	GL	GM	GM	GM	GM	GM	GL	GL	-	GR	GM	GM	GM	GM	GM	GM	GM	GM	GM	-	GM	GM	GR	GR	GR	GR	GR	GR	GM
HL2	HL	HM	HM	HM	HM	HM	HL	HL	-	HR	HM	HM	HM	HM	HM	HM	HM	HM	HM	-	HM	HM	HR	HR	HR	HR	HR	HR	HM
IL1	IL	IM	IM	IM	IM	IM	IL	IL	-	IR	IM	IM	IM	IM	IM	IM	IM	IM	IM	-	IM	IM	IR	IR	IR	IR	IR	IR	IM
IL2	IL	IM	IM	IM	IM	IM	IL	IL	-	IR	IM	IM	IM	IM	IM	IM	IM	IM	IM	-	IM	IM	IR	IR	IR	IR	IR	IR	IM
IR2	IL	IM	IM	IM	IM	IM	IL	IL	-	IR	IM	IM	IM	IM	IM	IM	IM	IM	IM	-	IM	IM	IR	IR	IR	IR	IR	IR	IM
JL2	-	JM	JM	JM	JM	JM	-	-	-	JR	JM	JM	JM	JM	JM	JM	JM	JM	JM	-	JM	JM	JR	JR	JR	JR	JR	JR	JM
JR1	-	JM	JM	JM	JM	JM	-	-	-	JR	JM	JM	JM	JM	JM	JM	JM	JM	JM	-	JM	JM	JR	JR	JR	JR	JR	JR	JM
JR2	-	JM	JM	JM	JM	JM	-	-	-	JR	JM	JM	JM	JM	JM	JM	JM	JM	JM	-	JM	JM	JR	JR	JR	JR	JR	JR	JM
KL1	-	-	-	-	-	-	-	-	KI	KR	KM	KM	KM	KM	KM	KM	KM	KM	KM	-	KM	KM	KR	KR	KR	KR	KR	KR	KM
KL2	-	-	-	-	-	-	-	-	KI	KR	KM	KM	KM	KM	KM	KM	KM	KM	KM	-	KM	KM	KR	KR	KR	KR	KR	KR	KM
KR1	-	-	-	-	-	-	-	-	KI	KR	KM	KM	KM	KM	KM	KM	KM	KM	KM	-	KM	KM	KR	KR	KR	KR	KR	KR	KM
KR2	-	-	-	-	-	-	-	-	KI	KR	KM	KM	KM	KM	KM	KM	KM	KM	KM	-	KM	KM	KR	KR	KR	KR	KR	KR	KM
LL1	-	-	-	-	-	-	-	-	LI	LR	LM	LM	LM	LM	LM	LM	LM	LM	LM	-	LM	LM	LR	LR	LR	LR	LR	LR	LM
LR1	-	-	-	-	-	-	-	-	LI	LR	LM	LM	LM	LM	LM	LM	LM	LM	LM	-	LM	LM	LR	LR	LR	LR	LR	LR	LM
LR2	-	-	-	-	-	-	-	-	LI	LR	LM	LM	LM	LM	LM	LM	LM	LM	LM	-	LM	LM	LR	LR	LR	LR	LR	LR	LM
ML1	-	-	-	-	-	-	-	-	MI	MR	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-
ML2	-	-	-	-	-	-	-	-	MI	MR	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-
MR1	-	-	-	-	-	-	-	-	MI	MR	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-
MR2	-	-	-	-	-	-	-	-	MI	MR	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	MR	MR	MR	MR	-
NL1	-	-	-	-	-	-	-	-	NI	NR	-	-	-	-	-	-	-	-	-	NM	-	-	NR	NR	NR	NR	NR	NR	-
NL2	-	-	-	-	-	-	-	-	NI	NR	-	-	-	-	-	-	-	-	-	NM	-	-	NR	NR	NR	NR	NR	NR	-
NR1	-	-	-	-	-	-	-	-	NI	NR	-	-	-	-	-	-	-	-	-	NM	-	-	NR	NR	NR	NR	NR	NR	-
NR2	-	-	-	-	-	-	-	-	NI	NR	-	-	-	-	-	-	-	-	-	NM	-	-	NR	NR	NR	NR	NR	NR	-
OL2	-	-	-	-	-	-	-	-	OI	OR	-	-	-	-	-	-	-	-	-	OM	-	-	OR	OR	OR	OR	OR	OR	-
OR1	-	-	-	-	-	-	-	-	OI	OR	-	-	-	-	-	-	-	-	-	OM	-	-	OR	OR	OR	OR	OR	OR	-
OR2	-	-	-	-	-	-	-	-	OI	OR	-	-	-	-	-	-	-	-	-	OM	-	-	OR	OR	OR	OR	OR	OR	-
PL1	-	-	-	-	-	-	-	-	PI	PR	-	-	-	-	-	-	-	-	-	PM	-	-	PR	PR	PR	PR	PR	PR	-
PL2	-	-	-	-	-	-	-	-	PI	PR	-	-	-	-	-	-	-	-	-	PM	-	-	PR	PR	PR	PR	PR	PR	-
QR1	-	QP	QP	QP	QP	QP	-	-	QI	QR	-	-	-	-	-	-	-	-	-	QM	-	-	-	-	-	-	-	-	-
QR2	-	QP	QP	QP	QP	QP	-	-	QI	QR	-	-	-	-	-	-	-	-	-	QM	-	-	-	-	-	-	-	-	-
RL2	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-
RR1	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-
RR2	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-
ZAS	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-
ZBR	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-
ZCG	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-
ZCH	AL	AM	AM	AM	AM	AM	AL	AL	-	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
ZGJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZHP	AL	AM	AM	AM	AM	AM	AL	AL	-	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
ZHR	AL	AM	AM	AM	AM	AM	AL	AL	-	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
ZJH	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-
ZKA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZMH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZMP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZNDLS	AL	AM	AM	AM	AM	AM	AL	AL	-	AR	AN	AN	AN	AN	AN	AN	AN	AN	AN	-	AN	AN	AR	AR	AR	AR	AR	AR	AN
ZNepal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOR	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-
ZPB	-	AM	AM	AM	AM	AM	-	-	-	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
ZRJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZTN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZUK	AL	AM	AM	AM	AM	AM	AL	AL	-	AR	AM	AM	AM	AM	AM	AM	AM	AM	AM	-	AM	AM	AR	AR	AR	AR	AR	AR	AM
ZWB	RP	RP	RP	RP	RP	RP	RP	RP	RI	-	-	-	-	-	-	-	-	-	-	RM	-	-	-	-	-	-	-	-	-

Zones	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
AL1	AJ	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	AI	-	-	-	-	AI	-	-	-	-	-	-
AL2	AJ	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	AI	-	-	-	-	AI	-	-	-	-	-	-
AR1	AJ	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	AI	-	-	-	-	AI	-	-	-	-	-	-
AR2	AJ	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	AI	-	-	-	-	AI	-	-	-	-	-	-
BL1	BJ	BR	BO	BQ	BR	BL	-	BJ	BN	BN	-	-	-	BI	-	-	-	-	BI	-	-	-	-	-	-
BL2	BJ	BR	BO	BQ	BR	BL	-	BJ	BN	BN	-	-	-	BI	-	-	-	-	BI	-	-	-	-	-	-
BR1	BJ	BR	BO	BQ	BR	BL	-	BJ	BN	BN	-	-	-	BI	-	-	-	-	BI	-	-	-	-	-	-
CL1	CJ	CR	CO	CQ	CR	CL	-	CJ	CN	CN	-	-	-	CI	-	-	-	-	CI	-	-	-	-	-	-
CL2	CJ	CR	CO	CQ	CR	CL	-	CJ	CN	CN	-	-	-	CI	-	-	-	-	CI	-	-	-	-	-	-
CR1	CJ	CR	CO	CQ	CR	CL	-	CJ	CN	CN	-	-	-	CI	-	-	-	-	CI	-	-	-	-	-	-
CR2	CJ	CR	CO	CQ	CR	CL	-	CJ	CN	CN	-	-	-	CI	-	-	-	-	CI	-	-	-	-	-	-
DL1	DJ	DR	DO	DQ	DR	DL	-	DJ	DN	DN	-	-	-	DI	-	-	-	-	DI	-	-	-	-	-	-
DL2	DJ	DR	DO	DQ	DR	DL	-	DJ	DN	DN	-	-	-	DI	-	-	-	-	DI	-	-	-	-	-	-
DR1	DJ	DR	DO	DQ	DR	DL	-	DJ	DN	DN	-	-	-	DI	-	-	-	-	DI	-	-	-	-	-	-
DR2	DJ	DR	DO	DQ	DR	DL	-	DJ	DN	DN	-	-	-	DI	-	-	-	-	DI	-	-	-	-	-	-
EL1	EJ	ER	EO	EQ	ER	EL	-	EJ	EN	EN	-	-	-	EI	-	-	-	-	EI	-	-	-	-	-	-
EL2	EJ	ER	EO	EQ	ER	EL	-	EJ	EN	EN	-	-	-	EI	-	-	-	-	EI	-	-	-	-	-	-
ER1	EJ	ER	EO	EQ	ER	EL	-	EJ	EN	EN	-	-	-	EI	-	-	-	-	EI	-	-	-	-	-	-
ER2	EJ	ER	EO	EQ	ER	EL	-	EJ	EN	EN	-	-	-	EI	-	-	-	-	EI	-	-	-	-	-	-
FL1	FJ	FR	FO	FQ	FR	FL	-	FJ	FN	FN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FL2	FJ	FR	FO	FQ	FR	FL	-	FJ	FN	FN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GL1	GJ	GR	GO	GQ	GR	GL	-	GJ	GN	GN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GL2	GJ	GR	GO	GQ	GR	GL	-	GJ	GN	GN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GR1	GJ	GR	GO	GQ	GR	GL	-	GJ	GN	GN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HL2	HJ	HR	HO	HQ	HR	HL	-	HJ	HN	HN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IL1	-	IR	IO	IQ	IR	IL	-	-	IN	IN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IL2	-	IR	IO	IQ	IR	IL	-	IJ	IN	IN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IR2	-	IR	IO	IQ	IR	IL	-	IJ	IN	IN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JL2	-	JR	JO	JQ	JR	-	-	-	JN	JN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JR1	-	JR	JO	JQ	JR	-	-	-	JN	JN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JR2	-	JR	JO	JQ	JR	-	-	-	JN	JN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KL1	-	KR	KO	KQ	KR	-	-	KJ	KN	KN	-	-	-	KI	-	-	-	-	KI	-	-	-	-	-	-
KL2	-	KR	KO	KQ	KR	-	-	KJ	KN	KN	-	-	-	KI	-	-	-	-	KI	-	-	-	-	-	-
KR1	-	KR	KO	KQ	KR	-	-	KJ	KN	KN	-	-	-	KI	-	-	-	-	KI	-	-	-	-	-	-
KR2	-	KR	KO	KQ	KR	-	-	KJ	KN	KN	-	-	-	KI	-	-	-	-	KI	-	-	-	-	-	-
LL1	-	LR	LO	LQ	LR	-	-	LJ	LN	LN	-	-	-	LI	-	-	-	-	LI	-	-	-	-	-	-
LR1	-	LR	LO	LQ	LR	-	-	LJ	LN	LN	-	-	-	LI	-	-	-	-	LI	-	-	-	-	-	-
LR2	-	LR	LO	LQ	LR	-	-	LJ	LN	LN	-	-	-	LI	-	-	-	-	LI	-	-	-	-	-	-
ML1	-	MR	MO	MQ	MR	-	-	MJ	-	-	-	-	-	MI	-	-	-	-	MI	-	-	-	-	-	-
ML2	-	MR	MO	MQ	MR	-	-	MJ	-	-	-	-	-	MI	-	-	-	-	MI	-	-	-	-	-	-
MR1	-	MR	MO	MQ	MR	-	-	MJ	-	-	-	-	-	MI	-	-	-	-	MI	-	-	-	-	-	-
MR2	-	MR	MO	MQ	MR	-	-	MJ	-	-	-	-	-	MI	-	-	-	-	MI	-	-	-	-	-	-
NL1	-	NR	NO	NQ	NR	NL	NM	NJ	ON	ON	NM	NM	NM	NI	NM	NM	NM	NM	NI	-	-	-	-	-	-
NL2	-	NR	NO	NQ	NR	NL	NM	NJ	ON	ON	NM	NM	NM	NI	NM	NM	NM	NM	NI	-	-	-	-	-	-
NR1	-	NR	NO	NQ	NR	NL	NM	NJ	ON	ON	NM	NM	NM	NI	NM	NM	NM	NM	NI	-	-	-	-	-	-
NR2	-	NR	NO	NQ	NR	NL	NM	NJ	ON	ON	NM	NM	NM	NI	NM	NM	NM	NM	NI	-	-	-	-	-	-
OL2	-	OR	-	OQ	OR	OL	OM	OJ	-	-	OM	OM	OM	OI	OM	OM	OM	OM	OI	-	-	-	-	-	-
OR1	-	OR	-	OQ	OR	OL	OM	OJ	-	-	OM	OM	OM	OI	OM	OM	OM	OM	OI	-	-	-	-	-	-
OR2	-	OR	-	OQ	OR	OL	OM	OJ	-	-	OM	OM	OM	OI	OM	OM	OM	OM	OI	-	-	-	-	-	-
PL1	-	PR	PO	-	PR	PL	PM	PJ	PN	PN	PM	PM	PM	PI	PM	PM	PM	PM	PI	-	-	-	-	-	-
PL2	-	PR	PO	-	PR	PL	PM	PJ	PN	PN	PM	PM	PM	PI	PM	PM	PM	PM	PI	-	-	-	-	-	-
QR1	-	-	QO	-	-	QL	QM	QJ	QN	QN	QM	QM	QM	QI	QM	QM	QM	QM	QI	-	-	-	-	-	-
QR2	-	-	QO	-	-	QL	QM	QJ	QN	QN	QM	QM	QM	QI	QM	QM	QM	QM	QI	-	-	-	-	-	-
RL2	RP	-	RO	-	-	PL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-
RR1	RP	-	RO	-	-	PL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-
RR2	RP	-	RO	-	-	PL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-
ZAS	RP	-	RO	RQ	-	RL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-
ZBR	RP	-	RO	RQ	-	RL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-
ZCG	RP	-	RO	RQ	-	RL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-
ZCH	AJ	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZGJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZHP	AJ	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZHR	AJ	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZJH	RP	-	RO	RQ	-	RL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-
ZKA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZMH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZMP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZNDLS	AJ	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZNepal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOR	RP	-	RO	RQ	-	RL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-
ZPB	-	AR	AO	AQ	AR	AL	-	AJ	AN	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZRJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZTN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZUK	-	AR	AO	AQ	AR	-	-	AJ	AN	AN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZWB	RP	-	RP	RQ	-	RL	RM	RJ	RN	RN	RM	RM	RM	RI	RM	RM	RM	RM	RI	-	-	-	-	-	-

Trip Matrix for O-D Pairs (Trips between Interchange Node Zones and Other States of India)

Zones	AL1	AL2	AR1	AR2	BL1	BL2	BR1	CL1	CL2	CR1	CR2	DL1	DL2	DR1	DR2	EL1	EL2	ER1	ER2	FL1	FL2	GL1	GL2	GR1	HL2	IL1	IL2	IR2	JL2	JR1	JR2	KL1	KL2	KR1	KR2	LL1	LR1	LR2	ML1	ML2	MR1	MR2	NL1	NL2	NR1	NR2	OL2	OR1	OR2	PL1	PL2	QR1	QR2	RL2	RR1	RR2	ZAS	ZBR	ZCG	ZCH	ZGJ	ZHP	ZHR	ZJH	ZKA	ZMH	ZMP	ZNDLS	ZNepal	ZOR	ZPB	ZRJ	ZTN	ZTS	ZUK	ZWB
AL1	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
AL2	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
AR1	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
AR2	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
BL1	BA	BA	BA	BA	-	-	-	BC	BC	BC	BC	BD	BD	BD	BD	BE	BE	BE	BE	BF	BF	BG	BG	BG	BH	BI	BI	BI	BJ	BJ	BJ	BK	BK	BK	BK	BL	BL	BL	BM	BM	BM	BM	BN	BN	BN	BN	BO	BO	BO	BP	BP	BQ	BQ	BR	BR	BR	BR	BR	BR	BA	-	BA	BA	BR	-	-	-	BA	-	BR	BA	-	-	-	BA	BR
BL2	BA	BA	BA	BA	-	-	-	BC	BC	BC	BC	BD	BD	BD	BD	BE	BE	BE	BE	BF	BF	BG	BG	BG	BH	BI	BI	BI	BJ	BJ	BJ	BK	BK	BK	BK	BL	BL	BL	BM	BM	BM	BM	BN	BN	BN	BN	BO	BO	BO	BP	BP	BQ	BQ	BR	BR	BR	BR	BR	BR	BA	-	BA	BA	BR	-	-	-	BA	-	BR	BA	-	-	-	BA	BR
BR1	BA	BA	BA	BA	-	-	-	BC	BC	BC	BC	BD	BD	BD	BD	BE	BE	BE	BE	BF	BF	BG	BG	BG	BH	BI	BI	BI	BJ	BJ	BJ	BK	BK	BK	BK	BL	BL	BL	BM	BM	BM	BM	BN	BN	BN	BN	BO	BO	BO	BP	BP	BQ	BQ	BR	BR	BR	BR	BR	BR	BA	-	BA	BA	BR	-	-	-	BA	-	BR	BA	-	-	-	BA	BR
CL1	CA	CA	CA	CA	CB	CB	CB	-	-	-	-	CD	CD	CD	CD	CE	CE	CE	CE	CF	CF	CG	CG	CG	CH	CI	CI	CI	CJ	CJ	CJ	CK	CK	CK	CK	CL	CL	CL	CM	CM	CM	CM	CN	CN	CN	CN	CO	CO	CO	CP	CP	CQ	CQ	CR	CR	CR	CR	CR	CR	CA	-	CA	CA	CR	-	-	-	CA	-	CR	CA	-	-	-	CA	CR
CL2	CA	CA	CA	CA	CB	CB	CB	-	-	-	-	CD	CD	CD	CD	CE	CE	CE	CE	CF	CF	CG	CG	CG	CH	CI	CI	CI	CJ	CJ	CJ	CK	CK	CK	CK	CL	CL	CL	CM	CM	CM	CM	CN	CN	CN	CN	CO	CO	CO	CP	CP	CQ	CQ	CR	CR	CR	CR	CR	CR	CA	-	CA	CA	CR	-	-	-	CA	-	CR	CA	-	-	-	CA	CR
CR1	CA	CA	CA	CA	CB	CB	CB	-	-	-	-	CD	CD	CD	CD	CE	CE	CE	CE	CF	CF	CG	CG	CG	CH	CI	CI	CI	CJ	CJ	CJ	CK	CK	CK	CK	CL	CL	CL	CM	CM	CM	CM	CN	CN	CN	CN	CO	CO	CO	CP	CP	CQ	CQ	CR	CR	CR	CR	CR	CR	CA	-	CA	CA	CR	-	-	-	CA	-	CR	CA	-	-	-	CA	CR
CR2	CA	CA	CA	CA	CB	CB	CB	-	-	-	-	CD	CD	CD	CD	CE	CE	CE	CE	CF	CF	CG	CG	CG	CH	CI	CI	CI	CJ	CJ	CJ	CK	CK	CK	CK	CL	CL	CL	CM	CM	CM	CM	CN	CN	CN	CN	CO	CO	CO	CP	CP	CQ	CQ	CR	CR	CR	CR	CR	CR	CA	-	CA	CA	CR	-	-	-	CA	-	CR	CA	-	-	-	CA	CR
DL1	DA	DA	DA	DA	DB	DB	DB	DC	DC	DC	DC	-	-	-	-	DE	DE	DE	DE	DF	DF	DG	DG	DG	DH	DI	DI	DI	DJ	DJ	DJ	DK	DK	DK	DK	DL	DL	DL	DM	DM	DM	DM	DN	DN	DN	DN	DO	DO	DO	DP	DP	DQ	DQ	DR	DR	DR	DR	DR	DR	DA	-	DA	DA	DR	-	-	-	DA	-	DR	DA	-	-	-	DA	DR
DL2	DA	DA	DA	DA	DB	DB	DB	DC	DC	DC	DC	-	-	-	-	DE	DE	DE	DE	DF	DF	DG	DG	DG	DH	DI	DI	DI	DJ	DJ	DJ	DK	DK	DK	DK	DL	DL	DL	DM	DM	DM	DM	DN	DN	DN	DN	DO	DO	DO	DP	DP	DQ	DQ	DR	DR	DR	DR	DR	DR	DA	-	DA	DA	DR	-	-	-	DA	-	DR	DA	-	-	-	DA	DR
DR1	DA	DA	DA	DA	DB	DB	DB	DC	DC	DC	DC	-	-	-	-	DE	DE	DE	DE	DF	DF	DG	DG	DG	DH	DI	DI	DI	DJ	DJ	DJ	DK	DK	DK	DK	DL	DL	DL	DM	DM	DM	DM	DN	DN	DN	DN	DO	DO	DO	DP	DP	DQ	DQ	DR	DR	DR	DR	DR	DR	DA	-	DA	DA	DR	-	-	-	DA	-	DR	DA	-	-	-	DA	DR
DR2	DA	DA	DA	DA	DB	DB	DB	DC	DC	DC	DC	-	-	-	-	DE	DE	DE	DE	DF	DF	DG	DG	DG	DH	DI	DI	DI	DJ	DJ	DJ	DK	DK	DK	DK	DL	DL	DL	DM	DM	DM	DM	DN	DN	DN	DN	DO	DO	DO	DP	DP	DQ	DQ	DR	DR	DR	DR	DR	DR	DA	-	DA	DA	DR	-	-	-	DA	-	DR	DA	-	-	-	DA	DR
EL1	EA	EA	EA	EA	EB	EB	EB	EC	EC	EC	EC	ED	ED	ED	ED	-	-	-	-	EF	EF	EG	EG	EG	EH	EI	EI	EI	EJ	EJ	EJ	EK	EK	EK	EK	EL	EL	EL	EM	EM	EM	EM	EN	EN	EN	EN	EO	EO	EO	EP	EP	EQ	EQ	ER	ER	ER	ER	ER	ER	EA	-	EA	EA	ER	-	-	-	EA	-	ER	EA	-	-	-	EA	ER
EL2	EA	EA	EA	EA	EB	EB	EB	EC	EC	EC	EC	ED	ED	ED	ED	-	-	-	-	EF	EF	EG	EG	EG	EH	EI	EI	EI	EJ	EJ	EJ	EK	EK	EK	EK	EL	EL	EL	EM	EM	EM	EM	EN	EN	EN	EN	EO	EO	EO	EP	EP	EQ	EQ	ER	ER	ER	ER	ER	ER	EA	-	EA	EA	ER	-	-	-	EA	-	ER	EA	-	-	-	EA	ER
ER1	EA	EA	EA	EA	EB	EB	EB	EC	EC	EC	EC	ED	ED	ED	ED	-	-	-	-	EF	EF	EG	EG	EG	EH	EI	EI	EI	EJ	EJ	EJ	EK	EK	EK	EK	EL	EL	EL	EM	EM	EM	EM	EN	EN	EN	EN	EO	EO	EO	EP	EP	EQ	EQ	ER	ER	ER	ER	ER	ER	EA	-	EA	EA	ER	-	-	-	EA	-	ER	EA	-	-	-	EA	ER
ER2	EA	EA	EA	EA	EB	EB	EB	EC	EC	EC	EC	ED	ED	ED	ED	-	-	-	-	EF	EF	EG	EG	EG	EH	EI	EI	EI	EJ	EJ	EJ	EK	EK	EK	EK	EL	EL	EL	EM	EM	EM	EM	EN	EN	EN	EN	EO	EO	EO	EP	EP	EQ	EQ	ER	ER	ER	ER	ER	ER	EA	-	EA	EA	ER	-	-	-	EA	-	ER	EA	-	-	-	EA	ER
FL1	FA	FA	FA	FA	FB	FB	FB	FC	FC	FC	FC	FD	FD	FD	FD	FE	FE	FE	FE	-	-	FG	FG	FG	FH	FI	FI	FI	FJ	FJ	FJ	FK	FK	FK	FK	FL	FL	FL	FM	FM	FM	FM	FN	FN	FN	FN	FO	FO	FO	FP	FP	FQ	FQ	FR	FR	FR	FR	FR	FR	FA	-	FA	FA	FR	-	-	-	FA	-	FR	FA	-	-	-	FA	FR
FL2	FA	FA	FA	FA	FB	FB	FB	FC	FC	FC	FC	FD	FD	FD	FD	FE	FE	FE	FE	-	-	FG	FG	FG	FH	FI	FI	FI	FJ	FJ	FJ	FK	FK	FK	FK	FL	FL	FL	FM	FM	FM	FM	FN	FN	FN	FN	FO	FO	FO	FP	FP	FQ	FQ	FR	FR	FR	FR	FR	FR	FA	-	FA	FA	FR	-	-	-	FA	-	FR	FA	-	-	-	FA	FR
GL1	GA	GA	GA	GA	GB	GB	GB	GC	GC	GC	GC	GD	GD	GD	GD	GE	GE	GE	GE	GF	GF	-	-	-	GH	GI	GI	GI	GJ	GJ	GJ	GK	GK	GK	GK	GL	GL	GL	GM	GM	GM	GM	GN	GN	GN	GN	GO	GO	GO	GP	GP	GQ	GQ	GR	GR	GR	GR	GR	GR	GA	-	GA	GA	GR	-	-	-	GA	-	GR	GA	-	-	-	GA	GR
GL2	GA	GA	GA	GA	GB	GB	GB	GC	GC	GC	GC	GD	GD	GD	GD	GE	GE	GE	GE	GF	GF	-	-	-	GH	GI	GI	GI	GJ	GJ	GJ	GK	GK	GK	GK	GL	GL	GL	GM	GM	GM	GM	GN	GN	GN	GN	GO	GO	GO	GP	GP	GQ	GQ	GR	GR	GR	GR	GR	GR	GA	-	GA	GA	GR	-	-	-	GA	-	GR	GA	-	-	-	GA	GR
GR1	GA	GA	GA	GA	GB	GB	GB	GC	GC	GC	GC	GD	GD	GD	GD	GE	GE	GE	GE	GF	GF	-	-	-	GH	GI	GI	GI	GJ	GJ	GJ	GK	GK	GK	GK	GL	GL	GL	GM	GM	GM	GM	GN	GN	GN	GN	GO	GO	GO	GP	GP	GQ	GQ	GR	GR	GR	GR	GR	GR	GA	-	GA	GA	GR	-	-	-	GA	-	GR	GA	-	-	-	GA	GR
HL2	HA	HA	HA	HA	HB	HB	HB	HC	HC	HC	HC	HD	HD	HD	HD	HE	HE	HE	HE	HF	HF	HG	HG	HG	-	HI	HI	HI	HJ	HJ	HJ	HK	HK	HK	HK	HL	HL	HL	HM	HM	HM	HM	HN	HN	HN	HN	HO	HO	HO	HP	HP	HQ	HQ	HR	HR	HR	HR	HR	HR	HA	-	HA	HA	HR	-	-	-	HA	-	HR	HA	-	-	-	HA	HR
IL1	IA	IA	IA	IA	IB	IB	IB	IC	IC	IC	IC	ID	ID	ID	ID	IE	IE	IE	IE	IF	IF	IG	IG	IG	IH	-	-	-	IJ	IJ	IJ	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	IA	-	IA	IA	IR	-	-	-	IA	-	IR	IA	-	-	-	IA	IR
IL2	IA	IA	IA	IA	IB	IB	IB	IC	IC	IC	IC	ID	ID	ID	ID	IE	IE	IE	IE	IF	IF	IG	IG	IG	IH	-	-	-	IJ	IJ	IJ	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	IA	-	IA	IA	IR	-	-	-	IA	-	IR	IA	-	-	-	IA	IR
IR2	IA	IA	IA	IA	IB	IB	IB	IC	IC	IC	IC	ID	ID	ID	ID	IE	IE	IE	IE	IF	IF	IG	IG	IG	IH	-	-	-	IJ	IJ	IJ	IK	IK	IK	IK	IL	IL	IL	IM	IM	IM	IM	IN	IN	IN	IN	IO	IO	IO	IP	IP	IQ	IQ	IR	IR	IR	IR	IR	IR	IA	-	IA	IA	IR	-	-	-	IA	-	IR	IA	-	-	-	IA	IR
JL2	JA	JA	JA	JA	JB	JB	JB	JC	JC	JC	JC	JD	JD	JD	JD	JE	JE	JE	JE	JF	JF	JG	JG	JG	JH	JI	JI	JI	-	-	-	JK	JK	JK	JK	JL	JL	JL	JM	JM	JM	JM	JN	JN	JN	JN	JO	JO	JO	JP	JP	JQ	JQ	JR	JR	JR	JR	JR	JR	JA	-	JA	JA	JR	-	-	-	JA	-	JR	JA	-	-	-	JA	JR
JR1	JA	JA	JA	JA	JB	JB	JB	JC	JC	JC	JC	JD	JD	JD	JD	JE	JE	JE	JE	JF	JF	JG	JG	JG	JH	JI	JI	JI	-	-	-	JK	JK	JK	JK	JL	JL	JL	JM	JM	JM	JM	JN	JN	JN	JN	JO	JO	JO	JP	JP	JQ	JQ	JR	JR	JR	JR	JR	JR	JA	-	JA	JA	JR	-	-	-	JA	-	JR	JA	-	-	-	JA	JR
JR2	JA	JA	JA	JA	JB	JB	JB	JC	JC	JC	JC	JD	JD	JD	JD	JE	JE	JE	JE	JF	JF	JG	JG	JG	JH	JI	JI	JI	-	-	-	JK	JK	JK	JK	JL	JL	JL	JM	JM	JM	JM	JN	JN	JN	JN	JO	JO	JO	JP	JP	JQ	JQ	JR	JR	JR	JR	JR	JR	JA	-	JA	JA	JR	-	-	-	JA	-	JR	JA	-	-	-	JA	JR
KL1	KA	KA	KA	KA	KB	KB	KB	KC	KC	KC	KC	KD	KD	KD	KD	KE	KE	KE	KE	KF	KF	KG	KG	KG	KH	KI	KI	KI	KJ	KJ	KJ	-	-	-	-	KL	KL	KL	KM	KM	KM	KM	KN	KN	KN	KN	KO	KO	KO	KP	KP	KQ	KQ	KR	KR	KR	KR	KR	KR	KA	-	KA	KA	KR	-	-	-	KA	-	KR	KA	-	-	-	KA	KR
KL2	KA	KA	KA	KA	KB	KB	KB	KC	KC	KC	KC	KD	KD	KD	KD	KE	KE	KE	KE	KF	KF	KG	KG	KG	KH	KI	KI	KI	KJ	KJ	KJ	-	-	-	-	KL	KL	KL	KM	KM	KM	KM	KN	KN	KN	KN	KO	KO	KO	KP	KP	KQ	KQ	KR	KR	KR	KR	KR	KR	KA	-	KA	KA	KR	-	-	-	KA	-	KR	KA	-	-	-	KA	KR
KR1	KA	KA	KA	KA	KB	KB	KB	KC	KC	KC	KC	KD	KD	KD	KD	KE	KE	KE	KE	KF	KF	KG	KG	KG	KH	KI	KI	KI	KJ	KJ	KJ	-	-	-	-	KL	KL	KL	KM	KM	KM	KM	KN	KN	KN	KN	KO	KO	KO	KP	KP	KQ	KQ	KR	KR	KR	KR	KR	KR	KA	-	KA	KA	KR	-	-	-	KA	-	KR	KA	-	-	-	KA	KR
KR2	KA	KA	KA	KA	KB	KB	KB	KC	KC	KC	KC	KD	KD	KD	KD	KE	KE	KE	KE	KF	KF	KG	KG	KG	KH	KI	KI	KI	KJ	KJ	KJ	-	-	-	-	KL	KL	KL	KM	KM	KM	KM	KN	KN	KN	KN	KO	KO	KO	KP	KP	KQ	KQ	KR	KR	KR	KR	KR	KR	KA	-	KA	KA	KR	-	-	-	KA	-	KR	KA	-	-	-	KA	KR
LL1	LA	LA	LA	LA	LB	LB	LB	LC	LC	LC	LC	LD	LD	LD	LD	LE	LE	LE	LE	LF	LF	LG	LG	LG	LH	LI	LI	LI	LJ	LJ	LJ	LK	LK	LK	LK	-	-	-	LM	LM	LM	LM	LN	LN	LN	LN	LO	LO	LO	LP	LP	LQ	LQ	LR	LR	LR	LR	LR	LR	LA	-	LA	LA	LR	-	-	-	LA	-	LR	LA	-	-	-	LA	LR
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LR2	LA	LA	LA	LA	LB	LB	LB	LC	LC	LC	LC	LD	LD	LD	LD	LE	LE	LE	LE	LF	LF	LG	LG	LG	LH	LI	LI	LI	LJ	LJ	LJ	LK	LK	LK	LK	-	-	-	LM	LM	LM	LM	LN	LN	LN	LN	LO	LO	LO	LP	LP	LQ	LQ	LR	LR	LR	LR	LR	LR	LA	-	LA	LA	LR	-	-	-	LA	-	LR	LA	-	-	-	LA	LR
ML1	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	MA	-	MA	MA	MR	-	-	-	MA	-	MR	MA	-	-	-	MA	MR
ML2	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	MA	-	MA	MA	MR	-	-	-	MA	-	MR	MA	-	-	-	MA	MR
MR1	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	MA	-	MA	MA	MR	-	-	-	MA	-	MR	MA	-	-	-	MA	MR
MR2	MA	MA	MA	MA	MB	MB	MB	MC	MC	MC	MC	MD	MD	MD	MD	ME	ME	ME	ME	MF	MF	MG	MG	MG	MH	MI	MI	MI	MJ	MJ	MJ	MK	MK	MK	MK	ML	ML	ML	-	-	-	-	MN	MN	MN	MN	MO	MO	MO	MP	MP	MQ	MQ	MR	MR	MR	MR	MR	MR	MA	-	MA	MA	MR	-	-	-	MA	-	MR	MA	-	-	-	MA	MR
NL1	NA	NA	NA	NA	NB	NB	NB	NC	NC	NC	NC	ND	ND	ND	ND	NE	NE	NE	NE	NF	NF	NG	NG	NG	NH	NI	NI	NI	NJ	NJ	NJ	NK	NK	NK	NK	NL	NL	NL	NM	NM	NM	NM	-	-	-	-	NO	NO	NO	NP	NP	NQ	NQ	NR	NR	NR	NR	NR	NR	NA	-	NA	NA	NR	-	-	-	NA	-	NR	NA	-	-	-	NA	NR
NL2	NA	NA	NA	NA	NB	NB	NB	NC	NC	NC	NC	ND	ND	ND	ND	NE	NE	NE	NE	NF	NF	NG	NG	NG	NH	NI	NI	NI	NJ	NJ	NJ	NK	NK	NK	NK	NL	NL	NL	NM	NM	NM	NM	-	-	-	-	NO	NO	NO	NP	NP	NQ	NQ	NR	NR	NR	NR	NR	NR	NA	-	NA	NA	NR	-	-	-	NA	-	NR	NA	-	-	-	NA	NR
NR1	NA	NA	NA	NA	NB	NB	NB	NC	NC	NC	NC	ND	ND	ND	ND	NE	NE	NE	NE	NF	NF	NG	NG	NG	NH	NI	NI	NI	NJ	NJ	NJ	NK	NK	NK	NK	NL	NL	NL	NM	NM	NM	NM	-	-	-	-	NO	NO	NO	NP	NP	NQ	NQ	NR	NR	NR	NR	NR	NR	NA	-	NA	NA	NR	-	-	-	NA	-	NR	NA	-	-	-	NA	NR
NR2	NA	NA	NA	NA	NB	NB	NB	NC	NC	NC	NC	ND	ND	ND	ND	NE	NE	NE	NE	NF	NF	NG	NG	NG	NH	NI	NI	NI	NJ	NJ	NJ	NK	NK	NK	NK	NL	NL	NL	NM	NM	NM	NM	-	-	-	-	NO	NO	NO	NP	NP	NQ	NQ	NR	NR	NR	NR	NR	NR	NA	-	NA	NA	NR	-	-	-	NA	-	NR	NA	-	-	-	NA	NR
OL2	OA	OA	OA	OA	OB	OB	OB	OC	OC	OC	OC	OD	OD	OD	OD	OE	OE	OE	OE	OF	OF	OG	OG	OG	OH	OI	OI	OI	OJ	OJ	OJ	OK	OK	OK	OK	OL	OL	OL	OM	OM	OM	OM	ON	ON	ON	ON	-	-	-	OP	OP	OQ	OQ	OR	OR	OR	OR	OR	OR	OA	-	OA	OA	OR	-	-	-	OA	-	OR	OA	-	-	-	OA	OR
OR1	OA	OA	OA	OA	OB	OB	OB	OC	OC	OC	OC	OD	OD	OD	OD	OE	OE	OE	OE	OF	OF	OG	OG	OG	OH	OI	OI	OI	OJ	OJ	OJ	OK	OK	OK	OK	OL	OL	OL	OM	OM	OM	OM	ON	ON	ON	ON	-	-	-	OP	OP	OQ	OQ	OR	OR	OR	OR	OR	OR	OA	-	OA	OA	OR	-	-	-	OA	-	OR	OA	-	-	-	OA	OR
OR2	OA	OA	OA	OA	OB	OB	OB	OC	OC	OC	OC	OD	OD	OD	OD	OE	OE	OE	OE	OF	OF	OG	OG	OG	OH	OI	OI	OI	OJ	OJ	OJ	OK	OK	OK	OK	OL	OL	OL	OM	OM	OM	OM	ON	ON	ON	ON	-	-	-	OP	OP	OQ	OQ	OR	OR	OR	OR	OR	OR	OA	-	OA	OA	OR	-	-	-	OA	-	OR	OA	-	-	-	OA	OR
PL1	PA	PA	PA	PA	PB	PB	PB	PC	PC	PC	PC	PD	PD	PD	PD	PE	PE	PE	PE	PF	PF	PG	PG	PG	PH	PI	PI	PI	PJ	PJ	PJ	PK	PK	PK	PK	PL	PL	PL	PM	PM	PM	PM	PN	PN	PN	PN	PO	PO	PO	-	-	PQ	PQ	PR	PR	PR	PR	PR	PR	PA	-	PA	PA	PR	-	-	-	PA	-	PR	PA	-	-	-	PA	PR
PL2	PA	PA	PA	PA	PB	PB	PB	PC	PC	PC	PC	PD	PD	PD	PD	PE	PE	PE	PE	PF	PF	PG	PG	PG	PH	PI	PI	PI	PJ	PJ	PJ	PK	PK	PK	PK	PL	PL	PL	PM	PM	PM	PM	PN	PN	PN	PN	PO	PO	PO	-	-	PQ	PQ	PR	PR	PR	PR	PR	PR	PA	-	PA	PA	PR	-	-	-	PA	-	PR	PA	-	-	-	PA	PR
QR1	QA	QA	QA	QA	QB	QB	QB	QC	QC	QC	QC	QD	QD	QD	QD	QE	QE	QE	QE	QF	QF	QG	QG	QG	QH	QI	QI	QI	QJ	QJ	QJ	QK	QK	QK	QK	QL	QL	QL	QM	QM	QM	QM	QN	QN	QN	QN	QO	QO	QO	QP	QP	-	-	QR	QR	QR	QR	QR	QR	QA	-	QA	QA	QR	-	-	-	QA	-	QR	QA	-	-	-	QA	QR
QR2	QA	QA	QA	QA	QB	QB	QB	QC	QC	QC	QC	QD	QD	QD	QD	QE	QE	QE	QE	QF	QF	QG	QG	QG	QH	QI	QI	QI	QJ	QJ	QJ	QK	QK	QK	QK	QL	QL	QL	QM	QM	QM	QM	QN	QN	QN	QN	QO	QO	QO	QP	QP	-	-	QR	QR	QR	QR	QR	QR	QA	-	QA	QA	QR	-	-	-	QA	-	QR	QA	-	-	-	QA	QR
RL2	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
RR1	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
RR2	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
ZAS	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	RA	-	-	RA	-
ZBR	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	RA	-	-	RA	-
ZCG	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	RA	-	-	RA	-	-	-	RA	-
ZCH	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
ZGJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AR	-	-	-	-	-	-	-	-	-	-	-	AR
ZHP	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	-	-	-	-	-	-	AR	-	-	-	-	-	AR
ZHR	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
ZJH	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	RA	-	RA	-	-	-	-	RA	-	-	RA	RA	-	-	RA	-
ZKA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RA	-	-	-	-	-	RA	-
ZMH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RA	-	-	-	-	-	RA	-
ZMP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RA	-	-	-	-	-	RA	-
ZNDLS	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	-	-	-	-	-	-	AR
ZNepal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AR	AR	AR	-	-	-	-	-	-	-	-	AR
ZOR	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	-	RA	RA	-	-	-	-	-	-	-	RA	-	-	-	RA	-
ZPB	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	-	-	-	-	-	AR	-	-	-	-	-	AR
ZRJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AR	AR	-	-	-	-	-	AR	-	-	-	-	-	-	-	-	-	-	-	AR
ZTN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RA	-
ZTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RA	-
ZUK	-	-	-	-	AB	AB	AB	AC	AC	AC	AC	AD	AD	AD	AD	AE	AE	AE	AE	AF	AF	AG	AG	AG	AH	AI	AI	AI	AJ	AJ	AJ	AK	AK	AK	AK	AL	AL	AL	AM	AM	AM	AM	AN	AN	AN	AN	AO	AO	AO	AP	AP	AQ	AQ	AR	AR	AR	AR	AR	AR	-	-	-	-	AR	AR	AR	AR	-	-	AR	-	-	AR	AR	-	AR
ZWB	RA	RA	RA	RA	RB	RB	RB	RC	RC	RC	RC	RD	RD	RD	RD	RE	RE	RE	RE	RF	RF	RG	RG	RG	RH	RI	RI	RI	RJ	RJ	RJ	RK	RK	RK	RK	RL	RL	RL	RM	RM	RM	RM	RN	RN	RN	RN	RO	RO	RO	RP	RP	RQ	RQ	-	-	-	-	-	-	RA	RA	RA	RA	-	-	-	-	RA	RA	-	RA	RA	-	-	RA	-

Table 4.13: Movement Matrix – Car

Nodes	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Total
A	0	90	20	111	209	0	66	72	12	37	0	35	48	45	22	9	43	83	**901**
B	163	0	20	5	48	0	34	8	11	0	0	0	0	8	8	0	11	5	**323**
C	0	0	0	0	0	4	24	5	0	0	1	0	0	0	2	0	0	20	**55**
D	22	5	0	0	0	0	5	0	0	2	0	0	5	0	0	0	0	0	**39**
E	81	32	0	0	0	0	7	11	34	50	0	19	21	17	5	0	0	20	**297**
F	0	4	2	0	2	0	0	6	0	4	0	0	0	0	26	0	0	12	**56**
G	76	52	7	0	4	4	0	33	0	12	1	8	14	3	5	0	0	47	**265**
H	84	36	4	0	2	3	18	0	0	4	0	1	4	0	0	0	0	0	**156**
I	25	11	0	2	60	0	3	0	0	2	36	87	93	62	26	0	0	62	**469**
J	22	0	0	0	91	3	23	1	4	0	0	129	33	16	0	0	1	25	**347**
K	3	3	1	0	0	0	8	0	53	0	0	0	0	6	7	0	0	3	**84**
L	35	3	1	6	48	3	33	1	92	104	0	0	7	48	77	0	0	43	**501**
M	34	22	9	5	9	12	16	0	56	30	0	8	0	6	37	3	9	150	**406**
N	38	7	0	0	20	0	4	0	32	3	0	97	0	0	66	3	18	96	**384**
O	66	0	1	0	3	20	23	0	52	15	8	96	93	23	0	0	0	424	**824**
P	36	11	0	0	0	0	9	0	0	9	0	3	5	9	0	0	0	231	**314**
Q	0	0	0	0	0	3	0	0	0	0	0	9	3	13	0	0	0	9	**38**
R	150	23	41	0	52	7	40	0	61	22	7	27	210	91	315	240	0	0	**1285**
Total	**834**	**299**	**106**	**129**	**546**	**57**	**313**	**137**	**408**	**295**	**53**	**520**	**535**	**347**	**598**	**255**	**81**	**1230**	

Note: Data may not add up to the total due to rounding.

Table 4.14: Movement Matrix – Bus

Nodes	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Total
A	0	0	0	9	10	0	23	9	0	19	0	1	1	42	0	8	0	20	**143**
B	0	0	0	0	3	0	6	3	0	4	0	0	0	4	0	0	0	0	**19**
C	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	5	**9**
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
E	0	5	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	11	**20**
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	**14**
G	13	23	4	0	0	4	0	0	0	0	0	2	0	0	0	0	0	11	**55**
H	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**
I	0	0	0	0	0	0	0	0	0	0	0	10	6	4	0	0	0	7	**27**
J	12	0	0	0	0	0	0	0	0	0	0	16	0	0	7	0	0	0	**34**
K	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
L	2	0	0	0	0	0	0	0	0	12	0	0	0	24	2	0	0	0	**39**
M	6	3	0	0	0	0	3	0	6	4	0	0	0	0	11	0	0	28	**61**
N	6	17	0	0	0	0	0	0	4	0	0	6	0	0	6	0	0	10	**49**
O	7	0	2	0	0	0	0	0	0	0	0	0	9	8	0	0	0	16	**42**
P	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	32	**34**
Q	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	**10**
R	15	0	9	0	7	7	4	0	1	0	7	0	17	16	24	32	0	0	**139**
Total	**60**	**51**	**16**	**9**	**20**	**11**	**39**	**12**	**11**	**38**	**9**	**35**	**33**	**110**	**51**	**39**	**0**	**153**	

Note: Data may not add up to the total due to rounding.

Table 4.15: Movement Matrix – LCV

Nodes	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Total
A	0	0	0	0	49	0	27	56	6	9	7	15	11	29	12	6	6	57	**291**
B	0	0	0	6	6	0	6	21	6	0	0	0	8	11	0	0	0	0	**66**
C	0	0	0	0	0	0	9	5	0	29	0	12	1	0	0	0	0	0	**56**
D	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**
E	42	0	0	0	0	0	0	0	27	24	0	14	5	6	0	0	1	6	**125**
F	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	**7**
G	16	5	0	0	5	0	0	0	0	26	0	1	12	4	0	0	0	0	**68**
H	49	26	5	0	0	0	0	0	0	5	0	2	0	2	0	0	0	0	**88**
I	0	0	0	0	31	0	0	0	0	2	79	71	12	35	0	0	0	13	**244**
J	6	0	21	0	12	8	25	5	1	0	0	84	7	9	38	0	0	13	**230**
K	0	0	0	0	0	0	11	0	24	0	0	0	0	0	7	0	0	18	**60**
L	32	0	12	0	18	0	1	2	62	41	0	0	0	18	22	3	0	40	**251**
M	22	0	11	0	0	0	6	0	22	19	0	0	0	0	3	0	0	99	**183**
N	30	8	0	0	0	0	5	2	23	16	0	12	0	0	0	0	6	155	**256**
O	6	0	3	0	0	0	3	0	0	18	7	25	13	10	0	0	0	50	**134**
P	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	**34**
Q	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6**
R	52	8	0	0	0	0	5	0	14	25	16	33	105	194	57	35	0	0	**545**
Total	**268**	**53**	**52**	**6**	**121**	**8**	**99**	**90**	**187**	**221**	**110**	**269**	**175**	**317**	**139**	**45**	**14**	**478**	

Note: Data may not add up to the total due to rounding.

Table 4.16: Movement Matrix – 2 Axle Truck

Nodes	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Total
A	0	0	0	0	18	0	3	15	0	5	52	52	60	38	20	0	0	70	**333**
B	0	0	0	0	0	0	18	0	0	3	6	0	26	28	1	0	0	0	**81**
C	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	8	**15**
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
E	0	0	0	0	0	0	3	0	0	14	7	0	18	4	7	0	0	8	**60**
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
G	6	0	0	0	0	0	0	0	0	0	14	7	41	7	3	0	0	18	**96**
H	14	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**43**
I	0	0	0	0	0	0	0	0	0	0	7	0	48	38	11	0	0	21	**126**
J	23	3	7	0	7	0	4	0	0	0	0	7	0	11	0	0	0	7	**69**
K	12	9	3	0	7	0	14	0	7	0	0	0	0	0	0	0	0	55	**106**
L	50	0	2	0	0	0	7	2	9	11	0	0	0	0	0	0	0	22	**102**
M	44	15	4	0	4	0	29	0	26	7	0	0	0	0	17	0	0	164	**309**
N	77	7	9	0	3	0	7	0	12	7	0	0	3	0	0	0	0	27	**154**
O	43	6	0	0	0	0	1	0	0	3	6	0	9	4	0	0	0	4	**76**
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	**22**
Q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
R	56	18	6	0	11	0	18	0	47	8	98	11	152	31	4	22	0	0	**481**
Total	**324**	**85**	**31**	**0**	**50**	**0**	**103**	**17**	**101**	**66**	**189**	**77**	**358**	**162**	**63**	**22**	**0**	**425**	

Note: Data may not add up to the total due to rounding.

Table 4.17 Movement Matrix – 3 Axle Truck

Nodes	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Total
A	0	4	0	0	0	0	7	4	0	4	23	45	148	175	71	0	0	180	**661**
B	0	0	0	0	0	0	0	0	0	0	10	6	26	20	20	0	0	35	**117**
C	0	0	0	0	0	0	0	0	0	0	0	0	8	7	0	0	0	61	**76**
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
E	0	0	0	0	0	0	0	0	0	0	0	0	18	0	10	0	0	16	**44**
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
G	7	0	2	0	2	0	0	0	0	0	0	0	7	6	19	0	0	26	**69**
H	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**
I	0	0	0	0	0	0	0	0	0	0	6	7	13	6	0	0	0	89	**122**
J	8	0	0	0	0	0	0	0	0	0	0	21	7	7	12	0	0	24	**79**
K	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**11**
L	35	0	0	0	0	0	0	0	0	14	0	0	0	0	7	0	0	0	**56**
M	73	25	9	0	20	0	13	0	25	0	0	0	0	3	0	0	0	149	**316**
N	119	7	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	24	**157**
O	88	28	4	0	0	0	7	0	0	0	4	0	0	2	0	0	0	5	**137**
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
R	183	34	44	0	9	0	42	0	72	21	0	0	175	31	11	0	0	0	**623**
Total	**522**	**102**	**62**	**0**	**32**	**0**	**69**	**4**	**97**	**38**	**43**	**79**	**401**	**256**	**149**	**7**	**0**	**609**	

Table 4.18: Movement Matrix – Multi Axle Truck

Nodes	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Total
A	0	0	7	0	0	0	0	0	0	9	2	29	192	154	65	0	0	755	**1212**
B	0	0	0	0	0	0	0	0	0	0	0	0	25	5	6	0	0	38	**74**
C	0	0	0	0	0	0	0	0	0	0	0	0	10	0	2	0	0	38	**50**
D	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**
E	0	5	0	0	0	0	0	0	0	0	0	0	14	2	0	0	0	34	**55**
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
G	11	0	0	0	0	0	0	0	2	0	0	0	14	5	0	0	0	83	**114**
H	0	2	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	**8**
I	5	0	0	0	0	0	0	0	0	0	0	7	9	4	31	0	0	42	**98**
J	14	0	13	0	0	0	0	0	0	0	0	7	0	1	12	0	0	19	**65**
K	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**13**
L	27	0	2	0	0	0	0	0	7	0	0	0	0	0	0	0	0	15	**51**
M	182	16	9	0	11	0	30	0	27	0	0	0	0	0	5	0	0	146	**425**
N	102	5	3	0	0	0	8	0	2	1	0	0	0	0	0	0	0	12	**133**
O	58	7	3	0	0	0	0	0	0	0	6	0	5	0	0	0	0	20	**99**
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	**7**
Q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
R	882	71	18	0	14	0	71	0	77	18	0	24	114	12	6	5	0	0	**1313**
Total	**1299**	**108**	**54**	**0**	**25**	**0**	**114**	**0**	**114**	**28**	**8**	**66**	**383**	**182**	**126**	**5**	**0**	**1209**	

Note: Data may not add up to the total due to rounding.

From the above tables; the Candidate Traffic i.e. the sectional traffic loads on each section of the proposed Expressway i.e. between Node "A" to Node "R" is shown in Table 4.19

Table 4.19: Candidate Traffic/Day for Proposed Expressway

Section	A-B	B-C	C-D	D-E	E-F	F-G	G-H	H-I	I-J	J-K	K-L	L-M	M-N	N-O	O-P	P-Q	Q-R
Car	1735	1852	1932	1816	1917	2009	2032	1762	2324	2456	2379	2189	2279	2187	2242	2615	2515
Bus	203	273	298	288	293	318	262	246	284	288	292	282	317	263	249	302	292
LCV	559	679	787	787	838	854	884	740	1029	1120	1033	817	901	1057	997	1043	1023
2 Axle Truck	657	823	869	870	945	945	1086	1030	1256	1245	1266	1152	1176	986	863	906	906
3 Axle Truck	1183	1394	1532	1532	1607	1607	1708	1700	1918	2012	1964	1843	1779	1493	1239	1232	1232
Multi Axle Truck	2511	2693	2783	2780	2849	2849	3055	3048	3246	3269	3258	3219	2950	2683	2511	2522	2522
Total Vehicles (Nos.)	**6849**	**7713**	**8201**	**8073**	**8450**	**8582**	**9027**	**8525**	**10058**	**10391**	**10193**	**9501**	**9402**	**8668**	**8100**	**8621**	**8491**
Total Vehicles (PCUs)	**20,004**	**22,456**	**23,733**	**23,577**	**24,529**	**24,720**	**26,273**	**25,513**	**28,852**	**29,483**	**29,157**	**27,729**	**26,719**	**24,071**	**22,085**	**22,852**	**22,691**

Note: Data may not add up to the total due to rounding.

4.2.5 Other Traffic Survey Data

Analyses of other data derived from the Origin and Destination Surveys (and used mainly in the financial and economic appraisals) for Passenger & Goods Statistics are provided on Chapters 1 to 5 of Appendix. For passengers, these data relate to the average occupancy of vehicles, trip purpose and the origin and destination of trips that are from/to Interchange Nodes and the immediate areas. For freight, these data refer to commodities carried, axle loads and the origins and destination of trips that are from/to Interchange Nodes and the immediate areas.

4.2.6 Speed-Time Surveys

Travel times have been estimated using passenger car for *"peak"* travel times and for those portions of each trip on 2/4/6 lane roads, with free access from sides and urban sections on these roads. It can be seen that, during peak periods, the full length journeys are:

(a) ***for 2-lane configuration in rural areas with free access to road from either sides**:* requiring 45 minutes to complete the average 34.1 km between Meerut outer point and Garhmukteshwar outer point – implying an average speed of about **45.46 km/hour**.

(b) ***for 4-lane configuration toll roads**:* requiring 66 minutes to complete the 71.1 km between Moradabad and Bareilly on National Highway NH530 (old NH24)– implying a spot speed of about **64.63 km/hour;** however, the **journey speeds** observed on alternate route *(journey combines 4-lane National Highway & 2-lane State Highways, Hasanpur – Chandausi – Budaun sections)* in the project influence areas, the average journey speed falls to about **35.0 Km/hour**

(c) ***for 6-lane/4-lane configuration in rural areas with heavily built up areas**:* requiring average of 11 hours 38 minutes to complete the approx. 751 km (maximum sections of access controlled Expressway) – implying an average speed of about **64.55 km/hour**.

4.3 Traffic Assignments

Traffic assignments of Candidate Traffic has been done using diversion curve method, wherein a logit model computes expected diversion % based on the ratio of perceived cost on the existing alternate roads and proposed Expressway. The perceived cost is the financial vehicle operating cost and the vehicle operating time saving cost including toll charges (if any).

The estimated *"generalised"* costs for travel between Node A and Node R on the proposed Expressway and between outer origins & outer destinations while in two comparing circumstances:

(a) when using the presently available alternate through route NH19 (old NH2) (4/6-lane dual carriageway without service roads or with service roads on either/one side at few urban stretches with traffic signals causing travel time delays); and
(b) when using the proposed Expressway (6-lane dual carriageway access controlled facility with 2 lane services road on either/one side).

These *"generalised"* costs are:

(a) *for buses and trucks:* the **financial costs of travel (including passenger and other time costs)** plus any tolls;
(b) *for cars:* the **perceived costs of travel** (a term applied mainly to private users who are known to make route and modal choice decisions not on total, or even marginal costs, but on the costs of only a few specific items – normally fuel, tyres and time)

Vehicle Operating Costs (VOC) and Vehicle Operating Time (VOT) Costs have been estimated using the relationships presented in IRC Special Publication SP-30 2009, Manual on Economic Evaluation of Highway Projects in India, Indian Road Congress 2009. Perceived cost (VOC + VOT

+Toll charges) in Rs/Km computed for presently available alternate route NH 19 (existing condition) vis a vis proposed Expressway (6-lane dual carriageway) is shown on Appendix.

According to logit model a vehicle user will shift if the perceived cost on the proposed Expressway is lower in comparison to existing alternate road NH19 (old NH2). The diversion equations for carrying out traffic assignment have been adopted from Study on Expressway System Planning, March 1991 done by Wilbur Smith Associates for Ministry of Surface Transport, Govt. of India.

Diversion percentages using Cost Ratio relationships as explained below, were estimated for alternate route NH 19 (old NH 2) versus proposed Expressway (Refer Table 4.20)

Table 4.20: Diversion Formulae (Logit Model)

Vehicle	Cost Ratio (CR)	Relationship
Car	CR < 0.634	% Div = 98.75 – ((CR/0.634)*8.125
	0.634 <= CR < 1.465	% Div = 90.625 – ((CR – 0.634)/0.831)*84.375
	1.465 <= CR <=2.00	% Div = 6.25 – ((CR – 1.465)/0.535))*5.25
Bus & Truck	CR < 0.75	% Div = 100 – ((CR/0.75)*5)
	0.75 <= CR < 1.25	% Div = 95 – ((CR-0.75)/0.5)*90
	1.25 <= CR <= 2.00	% Div = ((2-CR)/0.75)*5

Thus the perceived cost (VOC + VOT +Toll charges) in Rs/Km for different alternate routes (a combination of four/six lane dual carriageway with free access - *in future*) vis a vis proposed Expressway (6-lane dual carriageway) with restricted access will determine the route choice of the user; the link characteristics as shown on Table 4.21 adopted here represents better Level of Service of roads under tolling scenario, for calculation of Vehicle Operating Costs – results (VOC & VOT) are shown on Table 4.22

All the alternate routes NH19 (old NH2) are either toll operated 4/6 Lane dual carriageway (*a combination of NH19 (old NH2), Agra-Lucknow Expressway, Lucknow–Moradabad, Moradabad–Garhmukteshwar, Garhmukteshwar-Meerut*) or under various stages of widening i.e. from existing two lane to four lane standards or from existing four lane to six lane; for instance, the stretch from Meerut to Garhmukteshwar is presently two lane, proposed for four laning in near future and instance of six laning of National Highway NH19 at various sections from Prayagraj to Agra. Similarly National Highways/State Highways/Major District Roads which intersect with the proposed Expressway are under various stages of improvement including 2/4/6-laning by Central/State Agencies.

Toll charges (Rs/km) is likely to be charged on the proposed Expressway is per UPEIDA Toll Rules, similarly the Agra to Prayagraj (under widening scheme by NHAI/MoRTH) will also be tolled as per NH Toll Rules; However, the Expressway is expected to have higher toll rates due to the fact that Expressway will have more structures like Bridges, ROBs, and Viaducts at some interchanges/crossings.

Table 4.21 Link Characteristics for VOC Calculations

Description	Expressway	Alternate Road (NH 19)
Lane Configuration	6 lane Dual Carriageway	4/6 lane dual carriageway
Access Control	Restricted Access	Free Access
Traffic 2020 (PCUs)	21173	27762
Car Speed (Km/hr)	89.81	81.10
Roughness (mm/km)	Between 1800 and 2500	Between 2500 and 3000
Rise & Fall (m)	1	3

Diversion percentage between Proposed Expressway and alternate 4/6 lane toll road NH19 (AR) as per Cost Ratios – results (diversion percentages) are shown in Table **4.22**

Table 4.22: Diversion of Traffic

Perceived Cost	Car		Bus		LCV		2-Axle Truck		3-Axle Truck		MAV(4+Axles)	
Roads	**PR**	**AR**	**PR**	**PR**	**PR**	**AR**	**PR**	**AR**	**PR**	**AR**	**PR**	**AR**
VOC (Rs./km)	5.51	5.57	14.04	16.57	12.57	14.78	13.91	16.67	24.86	30.61	26.49	32.79
VOT (Rs./km)	2.81	3.57	1.35	1.93	38.13	49.45	4.38	6.56	6.09	10.78	8.25	14.60
Toll (Rs./km)	1.95	0.86	3.10	1.41	6.23	2.90	6.23	3.21	9.58	3.21	9.58	5.56
Total Cost (Rs./km)	10.26	10.00	18.49	19.91	56.94	67.12	24.53	26.44	40.54	44.60	44.33	52.95
Cost Ratio (PR/AR)	**1.042**		**0.976**		**0.891**		**0.997**		**0.951**		**0.876**	
% Diversion	**49.20%**		**54.34%**		**69.69%**		**50.49%**		**58.80%**		**72.38%**	

Diversion percentages were applied to the Candidate Traffic as shown in Table 4.19 to arrive at the Tollable Traffic on each section of the proposed Expressway, i.e. sectional traffic between Node 'A' and Node 'R' is shown on Table 4.23.

Table 4.23: Tollable Traffic/Day for Proposed Expressway

Section	A-B	B-C	C-D	D-E	E-F	F-G	G-H	H-I	I-J	J-K	K-L	L-M	M-N	N-O	O-P	P-Q	Q-R
Car	854	911	950	893	943	988	999	866	1143	1208	1170	1077	1121	1076	1103	1287	1237
Bus	141	190	207	201	204	221	182	171	198	201	203	197	221	183	173	211	203
LCV	304	369	428	421	449	457	474	395	552	602	562	444	490	574	542	567	556
2 Axle Truck	332	416	439	439	476	476	547	519	633	628	639	582	594	498	436	458	458
3 Axle Truck	696	819	901	901	945	945	1004	999	1128	1183	1155	1084	1046	878	728	724	724
Multi Axle Truck	1817	1949	2015	2011	2060	2060	2210	2204	2348	2365	2358	2330	2135	1942	1817	1826	1826
Total Vehicles (Nos.)	**4144**	**4654**	**4939**	**4864**	**5077**	**5148**	**5417**	**5156**	**6003**	**6186**	**6088**	**5712**	**5606**	**5151**	**4799**	**5072**	**5004**
Total Vehicles (PCUs)	**12,995**	**14,510**	**15,298**	**15,193**	**15,764**	**15,874**	**16,856**	**16,449**	**18,416**	**18,787**	**18,617**	**17,811**	**17,044**	**15,352**	**14,104**	**14,530**	**14,442**

Note: Data may not add up to the total due to rounding.

4.4 Diverted and Generated Traffic

4.4.1 Diverted Traffic

In this Study, the term "diverted" traffic refers to traffic which has diverted from other modes. Traffic diverting from other roads was, of course, considered above.

Although rail freight traffic is growing, the modal-share of surface transport that the railways enjoy has fallen, nationally, from about 78.45% in 1955 to 26% in 2001. The railways although reporting operating revenues in excess of operating expenditures are, also, not recovering sufficient revenue for needed capital investments and, when these items are taken into account, it is estimated that the users are being subsidised by the equivalent of about 20% of current tariffs. Also, the growth of Rail Freight and Road Freight in terms of Billion Tonnes Kilo Meters (BTKM) is 4% and 9% respectively from 1950-51 to 2000-01 (five decades).

As the nascent access controlled expressway system in India (esp. Uttar Pradesh) grows and, as the quality-of-service offered by road transport companies grows in-line, it is likely that there will be further shifts away from rail and towards road. This has been the experience of other countries. Additional shifts towards road transport will also occur if the railways are required to recover their full capital expenditures from users. The share of road transport will also continue to increase given the highly competitive nature of road transport, convenience and flexibility in tariffs, and the capability of road to handle smaller loads vis a vis rail transport.

While the general trend away from rail will undoubtedly continue, it can be seen that almost all rail freight movements along the proposed truck route are bulk in nature and that, as such, these are not cargoes likely soon (or ever) to shift to the proposed Expressway.

It is, moreover, noted that, except for occasional bulk raw material deliveries, agro processing, food processing, textiles, leather based industry, handloom and handicrafts, sports goods, bio-technology, mineral based industry, tourism and IT and ITeS industries, including software, captive business process outsourcing (BPO) and electronics industries now dominating the Uttar Pradesh economy, have high-value inputs and outputs, generally unsuited to rail transport.

It is worth noting that Indian Railways operate two trains only which directly connect Meerut City Junction station and Prayagraj Junction station, and travel times of these trains are somewhere between 10 hours 45 minutes and 13 hours 35 minutes costing about Rs. 360 per one way trip, but has passenger load factor of more than 1 all round the year, primarily is linked to patrons/matrons of law from Meerut attending the Judicial Complex at Prayagraj on a regular basis. This waitlisted passenger may shift to the Expressway, on either as bus/mini bus trips, car pool trips or private trips, as the travel times between Meerut and Prayagraj shall reduce by 3 hours.

For the purposes of this Study, it is assumed no immediate shift from rail to road. Any long term trend in the shift from rail to road will, of course, shall be accounted for in the described forecasts for natural growth later in this report.

The share of inland waterways and pipelines, which are both energy efficient modes of transport have relatively lower chances of being operative in the next few decades and hence not being projected and its impact in this report.

4.4.2 Generated Traffic

The project road, which will comprise various elements of an Expressway from Meerut (District Meerut) to Prayagraj Bypass (District Prayagraj) and which will have restricted access, is of itself unlikely to cause the generation of much locally-based traffic. There are, however, two elements of generated traffic that should be considered:

(a) *increase in traffic will occur from Expressway development purposely located close to interchanges* – such developments, while possibly substantial, are, however, notoriously difficult to predict – the best approach has therefore been to test the effect on Economic Internal Rate of Return (EIRRs) of the assumption that the growth in traffic (***will be proportionate to growth of the population/migration in the Interchange Node areas***) during the first five years of the Project, increases by an additional 1% per year (*factored over the development period*) as a direct result of the Project and that this additional traffic, on average, will use any section of the proposed Expressway to access its destination.

(b) *Varanasi Multi Modal Terminal or Varanasi Port* - One very important generator of traffic, that also needs special mention will be the Varanasi Port[2] towards (about 120 Kms away from Prayagraj) on the Southern End of the proposed Expressway. The timing of this project, featuring prominently on the centre's development plans, accentuates need of an access controlled highway (*probably phase 2 of the Ganga Expressway*) connecting the proposed Expressway to the Varanasi port. Noting that inland waterways offer significant economic advantages compared to overland logistics in India, with average cost of moving one ton of cargo by ship/waterways estimated at Rs. 1.10 per km versus Rs. 1.41 per km by Train/railways and Rs. 2.28 per km by Truck. Nonetheless, it can be stated that:

(i) when *Phase 2 of Ganga Expressway* is constructed by the State or Centre/MoRTH, the Varanasi Port will be a direct generator (and, from the land side development (*about 150 ha. of land parcel-sweetner under the port based special economic zone (SEZ development*) induced to locate around the Varanasi Port site, also an indirect generator of large volumes of road traffic – though the extent of such generation remains unknown; and

(ii) most of the traffic generated will be out of the Meerut/Prayagraj and, thus, large volumes that have origins and destinations far outside the Meerut/Prayagraj might be induced to use the Expressway as it is presently conceived (in this regard, **a direct Expressway from Meerut to Prayagraj Bypass and to the Varanasi Port** would carry more port related traffic – such a Expressway, more usefully, serving destinations on the outskirts of the Uttar Pradesh State as well).

In/Out Bound Heavy Vehicle Traffic of Varanasi Port: The cargo handling capacity of the Varanasi port or multi modal terminal is estimated to be 1.2 million metric tons per year (MTPA), i.e. about 3287 TEUS (Twenty Foot Equivalent Unit) or roughly about 150 Trucks per day would be handled at Varanasi Port; most of which will access NH 19 (old NH2) from the northern direction, as the Varanasi Port traffic on southern side would be through waterways to reach Kolkata Port/Haldia Port. About 50% of these may use the proposed Expressway (from Node M to Node R).

It should finally be noted that the Centre/MoRTH is only ever prepared to invest funds in such capital intensive projects, to take into account revenues about which they are absolutely certain – i.e. deriving from either existing traffic or from land parcels/developments that are: clearly committed; for which financing has already been arranged; and/or for which construction is about to commence or under construction. It has, therefore, deemed appropriate to include the benefit from the development of Varanasi Port in both the economic or financial analyses.

[2] **Varanasi Multi-Modal Terminal** or **Varanasi Port** is an Inland river port situated in the city of Varanasi, Uttar Pradesh. The port is located on the River Ganga. This port is built under the central government's **Jal Marg Vikas** project. The port has provided a direct link with the Port of Kolkata and Haldia Port

4.4.3 Base Estimates of Tollable Traffic (2020) Section-by-Section for Proposed Expressway

The base year (2020) estimates of total traffic on each section of the Expressway are shown on Table 4.24.

Table 4.24: Base Estimates of Tollable Traffic (2020) Section including Varanasi Port bound Traffic

Section	A-B	B-C	C-D	D-E	E-F	F-G	G-H	H-I	I-J	J-K	K-L	L-M	M-N	N-O	O-P	P-Q	Q-R
Car	854	911	950	893	943	988	999	866	1143	1208	1170	1077	1121	1076	1103	1287	1237
Bus	141	190	207	201	204	221	182	171	198	201	203	197	221	183	173	211	203
LCV	304	369	428	421	449	457	474	395	552	602	562	444	490	574	542	567	556
2 Axle Truck	332	416	439	439	476	476	547	519	633	628	639	582	594	498	436	458	458
3 Axle Truck	696	819	901	901	945	945	1004	999	1128	1183	1155	1084	***1121***	***953***	***803***	***799***	***799***
Multi Axle Truck	1817	1949	2015	2011	2060	2060	2210	2204	2348	2365	2358	2330	2135	1942	1817	1826	1826
Total Vehicles (Nos.)	**4144**	**4654**	**4939**	**4864**	**5077**	**5148**	**5417**	**5156**	**6003**	**6186**	**6088**	**5712**	5681	5226	4874	5147	5079
Total Vehicles (PCUs)	**12,995**	**14,510**	**15,298**	**15,193**	**15,764**	**15,874**	**16,856**	**16,449**	**18,416**	**18,787**	**18,617**	**17,811**	**17,269**	**15,577**	**14,329**	**14,755**	**14,667**

Note: Data may not add up to the total due to rounding.

50% of all commercial vehicles (3-Axle Truck) assumed to handle Port bound traffic at Varanasi may use stretch between Node R (Prayagraj Bypass) and Node M (Agra Lucknow Expressway)

4.4.4 Capacity Constraints

The Indian recommended design service volumes (DSV) of expressways for Level of Service B (LoS-B) and peak hour traffic in the range of 6% (actual peak hour traffic on the project highway is likely to be lower – no more than 6%) for plain terrain shall be 1300 PCU/hr/lane are shown below (source: IRC SP: 99-2013), viz Table 4.25:

Table 4.25: Design Service Volume (DSV) in PCUs per day for Level of Service (LOS) B

Peak Hour	4-Lane	6-Lane	8-Lane
6%	86,000	1,30,000	1,73,000
8%	65,000	98,000	1,30,000

It can be seen from Table 4.26 that the lane requirement for the Base Estimates of Traffic (2020) for all sections is two lane configurations.

Table 4.26: Lane Requirement at DSV for LOS B for Proposed Expressway (2020)

Sections	Base Traffic (PCUs)	Peak Hour (6%)	Peak Hour (8%)
A-B	12,995	780	1040
B-C	14,510	871	1161
C-D	15,298	918	1224
D-E	15,193	912	1215
E-F	15,764	946	1261
F-G	15,874	952	1270
G-H	16,856	1011	1348
H-I	16,449	987	1316
I-J	18,416	1105	1473
J-K	18,787	1127	1503
K-L	18,617	1117	1489
L-M	17,811	1069	1425
M-N	17,269	1036	1382
N-O	15,577	935	1246
O-P	14,329	860	1146
P-Q	14,755	885	1180
Q-R	14,667	880	1173

Note: DSV of 1300 PCU/h/lane has been considered

For the purposes of Development Proposal of Expressway, the lane configuration requirement shall be carried for a forecasted traffic for a 25 Year period from year 2024 (*year of start of traffic operations on the Expressway*), i.e. 3 year (36 months) construction period and 20 year operations period (for 20 year design)

4.5 Traffic Growth

4.5.1 Vehicular Registration

Data showing growth in numbers of registered vehicles throughout Uttar Pradesh is provided on Table 4.27. It can be seen that the decadal and recent annual growth in:

(a) the *"all-vehicle"* fleet has been:
- 11.61% per year from 2000 to 2015;
- 11.53% per year from 2005 to 2015; and
- 10.65% per year from 2010 to 2015

(b) the truck fleet (goods vehicles) has been:
- 12.93% per year from 2000 to 2015;
- 11.83% per year from 2005 to 2015; and
- 7.21% per year from 2010 to 2015

(c) the motor-car fleet (passenger vehicles) has been:
- 9.23% per year from 2000 to 2015;
- 11.88% per year from 2005 to 2015; and
- 6.62% per year from 2010 to 2015,

it may be noted that the annual growth last year of motor-car fleet has been about 13.5%;

(d) the two-wheeler fleet has been:
- 12.71% per year from 2000 to 2015;
- 11.54% per year from 2005 to 2015; and
- 12.10% per year from 2010 to 2015

Table 4.27: Vehicle Registration Data in Uttar Pradesh

Year	Motor Cycle	Motor Car	Bus	Mini Bus	Truck	Wheel Delivery	Tractor	Tempo / Auto Rickshaw	Others	Total
1	2	3	4	5	6	7	8	9	10	11
1980-81	41401	3810	1242	-	5591	-	14146	-	5112	71302
1981-82	-	-	-	-	-	-	-	-	-	0
1982-83	57393	4019	1587	-	5222	-	12216	-	4311	84748
1983-84	71136	3625	1862	250	2776	529	13364	1714	3209	98465
1984-85	85004	4256	2194	117	3634	433	13835	2792	4095	116360
1985-86	92711	6111	1187	116	4396	370	15222	2601	4257	126971
1986-87	140014	8081	1747	157	4117	455	18644	2474	4657	180346
1987-88	160370	12123	1640	238	5324	532	19435	3295	2024	204981
1988-89	149013	9768	1611	208	5648	571	25586	5023	1858	199286
1989-90	179676	10358	1574	264	6994	974	27176	6692	6141	239849
1990-91	187436	11104	1209	633	8056	1314	35933	7337	2922	255944
1991-92	173703	10009	1198	367	6411	1472	36289	6847	2722	239018
1992-93	128816	6973	1521	1104	3706	709	27506	3974	4102	178411
1993-94	152398	11687	1213	889	3713	911	28175	4179	3848	207013
1994-95	167258	12200	1493	1092	5953	1156	30467	4811	3468	227898
1995-96	168676	13978	1400	763	7310	2093	28450	5083	6686	234439
1996-97	230933	27309	1146	588	10581	3659	34718	10796	11162	330892
1997-98	254225	28985	1813	730	9593	3112	39311	10145	8439	356353
1998-99	325793	33197	1244	814	9282	3837	52650	10698	12882	450397
1999-00	329633	42766	1575	1031	8312	3921	51286	10934	10897	460355
2000-01	406216	39840	1450	1439	7202	4817	84141	11933	7625	564663
2001-02	364839	64241	730	745	3619	2325	38750	6927	16550	498726
2002-03	552378	43827	1452	1005	7051	3531	40715	9546	9912	669417
2003-04	585013	47189	1182	910	13259	3766	39421	11302	8773	710815
2004-05	665589	52311	1223	942	16827	4260	42714	9691	9130	802687
2005-06	769183	60090	1570	1209	17825	5216	52705	12627	14364	934789
2006-07	773478	71213	1565	1206	22895	4909	45173	20235	16189	956863
2007-08	748731	81158	1402	1080	24590	5282	41338	14078	21894	939553
2008-09	831946	92423	1910	1471	23529	5789	46219	21404	24928	1049619
2009-10	1120748	116706	2628	2024	36353	6620	80123	34034	42809	1442045
2010-11	1269550	127116	3097	2385	43474	7112	83287	34480	42814	1613315
2011-12	1368524	134580	2753	2120	50178	7766	73513	38374	50068	1727876
2012-13	1455867	140549	3594	2768	61370	5712	77972	38254	68556	1854642
2013-14	1713375	141646	3709	2858	53105	6099	87315	32062	58829	2098998
2014-15	1653456	134004	2804	2161	42905	4306	78991	26359	47814	1992800
Total(Lakhs)	**173.75**	**16.07**	**.59**	**0.33**	**5.40**	**1.04**	**14.36**	**4.21**	**5.43**	**221.20**
Population	215609813									
Ownership%	**8.06**	**0.75**	**0.03**	**0.02**	**0.25**	**0.05**	**0.67**	**0.20**	**0.25**	**10.26**

Source: Annual Report of Transport Department, Govt. of Uttar Pradesh

4.5.2 Regional Influences on Traffic Growth

The findings from the economic profile of the project influence areas and the data contained herein are highly relevant to forecasts for future traffic growth, viz:

(a) *freight:* the majority of *"candidate"* road freight is agricultural (often perishable) goods and goods destined for the secondary, manufacturing and construction sectors; and goods for the non-agricultural primary sector (mining and quarrying) etc. and bulk products for the secondary sector travel mainly by rail (see below) – and goods for the tertiary sector (mainly service industries) are light and while, no doubt most are travelling by road, these do not contribute significantly to total *"candidate"* road freight traffic (see Appendix for the commodity distribution by freight traffic)

(b) *passenger:* most *"candidate"* passenger travel is by persons with incomes much higher than the average (even when those persons are travelling by bus) – the average income of car passengers is half the national average and the average income of bus passengers about a quarter of the national average; in Uttar Pradesh total vehicle ownership is only 10.26 per 100 head of population; and car ownership is only 0.75 per 100 head of population (see Table 4.27) – which data implies that there is much scope for growth in this sector.

Consequently, it better to believe that future growth in:

(a) *candidate freight traffic:* might reasonably be linked to growth in the *"NSDP"* of those regional and State economies which are presently contributing candidate traffic; and

(b) *candidate passenger traffic*: might reasonably be linked to two factors in combination:

- growth in the *"populations"* (P) of those regional and State economies which are presently contributing *"candidate"* traffic; and

- growth in the *"average per capita incomes"* (I) of those regional and State economies which are presently contributing *"candidate"* traffic.

Recent growth in three indices for the above and for each of regions and States that contribute *"trip-ends"* for *"candidate"* traffic are shown on Tables 4.28.

Table 4.28: Zonal Influence Factors (%)

State Name	Car	Bus	LCV	2-Axle Truck	3-Axle Truck	Multi-Axle Truck
Uttar Pradesh	94.36 %	84.20%	94.08%	84.95%	74.55%	56.82%
Assam	0.08%	-	0.13%	0.23%	0.05%	0.06%
Bihar	0.51%	-	1.16%	0.94%	3.02%	5.94%
Chandigarh	0.04%	-	0.18%	0.00%	0.43%	0.19%
Chattisgarh	-	0.19%	0.28%	0.47%	0.87%	4.84%
Himachal Pradesh	0.06%	-	0.23%	0.28%	0.36%	1.08%
Haryana	0.43%	0.47%	0.63%	3.08%	3.91%	6.42%
Jharkhand	0.35%	-	-	0.17%	0.11%	1.81%
Maharashtra	-	-	-	-	0.24%	0.41%
Madhya Pradesh	0.03%	-	-	0.57%	0.87%	0.35%
New Delhi	1.60%	7.94%	1.65%	3.34%	2.85%	3.42%
Orissa	0.07%	-	0.00%	0.10%	0.41%	0.32%
Punjab	0.25%	-	0.68%	1.19%	4.85%	10.84%
Rajasthan	-	-	-	-	-	0.08%
Telangana	0.12%	-	-	-	-	-
Uttarakhand	1.99%	6.80%	0.84%	3.76%	6.24%	6.27%
West Bengal	0.12%	0.40%	0.13%	0.90%	1.25%	1.15%

From the zonal influence factors, it is clear that the growth rate of passenger car and bus (public transport) shall be regressed with growth of per capita income and growth of population of states of Uttar Pradesh and its neighbouring states respectively – results are shown on Table 4.29 and Table 4.30

On the Table 4.29 and 4.30, a weighted average for each of these indices has been derived and in the case of passenger traffic, the *"growth in car traffic"* was correlated against the *"growth in relevant per capita incomes"* and for bus traffic *multiplied by the growth in relevant populations"*.

In the case of freight, the *"growth in freight traffic"* correlated against the weighted average for *"NSDP"* as shown on Table 4.31.

Table 4.29: Regression Co-efficient of Car Growth with Per Capital Income of Project Influence Areas

State / Union Territory	Regression Variables	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	Growth Rate (2012-19)	Regression Co-efficient (Elasticity Value)	R Square	t-stat	Factored Growth	Zone Influence Factors	Weighted Growth Rate
Assam	Cars	318627	366884	445177	539920	578122	582024	676337	734778	**12.68%**	1.87	0.86	6.06	9.78%	0.08%	**0.01%**
	PCI	41142	41609	43002	44809	50642	53745	57099	58833	**5.24%**						
Bihar	Cars	256346	297507	346120	390770	434258	482962	526792	572163	**12.15%**	2.13	0.85	5.75	10.66%	0.51%	**0.05%**
	PCI	21750	22201	22776	23223	24064	25825	28101	30617	**5.01%**						
Haryana	Cars	988958	1134514	1293065	1454182	1609544	1764448	1920484	2076589	**11.18%**	1.55	0.98	16.10	10.52%	0.43%	**0.05%**
	PCI	106085	111780	119791	125032	137748	148193	157649	168209	**6.81%**						
Himachal Pradesh	Cars	162723	209116	234788	265384	297514	332505	364808	397514	**13.61%**	1.86	0.97	13.79	12.18%	0.06%	**0.01%**
	PCI	87721	92672	98816	105241	112723	122208	128840	136881	**6.56%**						
Jharkhand	Cars	557932	627945	563713	248949	282929	332671	332671	332671	**7.52%**	0.79	0.35	1.26	3.19%	0.35%	**0.01%**
	PCI	41254	44176	43779	48781	44524	48826	54246	57157	**4.04%**						
Madhya Pradesh	Cars	526970	598810	686456	767032	871334	925644	1018526	1101141	**11.10%**	1.66	0.95	10.86	10.30%	0.03%	**0.00%**
	PCI	38551	41287	42778	44336	47763	53253	55677	58706	**6.19%**						
Odisha	Cars	247575	287183	328836	367217	412257	460486	498408	540641	**11.80%**	1.66	0.93	8.72	10.71%	0.07%	**0.01%**
	PCI	48370	50714	54109	54210	57592	66240	69864	74927	**6.45%**						
Punjab	Cars	554699	583850	605714	627577	649441	671304	695597	718502	**3.77%**	0.82	0.99	21.21	3.66%	0.25%	**0.01%**
	PCI	85577	88915	93238	95807	100141	105848	110834	116222	**4.47%**						
Telangana	Cars	0	0	797546	885318	976312	1145108	1234491	1347859	**11.07%**	1.28	0.98	16.17	11.00%	0.12%	**0.01%**
	PCI	91121	92732	96039	101424	112267	121568	132380	145082	**8.60%**						
Uttar Pradesh	Cars	1208699	1367795	1523603	1779146	2161533	2435390	2623049	2873626	**13.17%**	2.90	0.96	11.37	12.59%	94.36%	**11.88%**
	PCI	32002	32908	34044	34583	36923	38965	41082	43102	**4.35%**						
Uttara khand	Cars	177363	223329	267432	304674	340644	345318	399356	434469	**13.65%**	1.85	0.93	8.96	11.90%	1.99%	**0.24%**
	PCI	100305	106318	112803	118788	126952	138286	147204	155151	**6.43%**						
West Bengal	Cars	572466	2573013	991981	1063592	1137056	1187057	1237058	1287059	**12.27%**	0.63	0.03	0.46	3.24%	0.12%	**0.00%**
	PCI	51543	53157	53811	54520	57255	60618	65497	73202	**5.14%**						
Chandigarh	Cars	268410	290075	313792	248187	265660	291356	277168	276479	**0.42%**	0.01	0.00	0.04	0.05%	0.04%	**0.00%**
	PCI	159116	169492	180779	183029	195595	210405	232116	235167	**5.74%**						
Delhi	Cars	2258434	2303052	2547877	2691282	2859620	3009234	3168294	3327354	**5.69%**	0.95	0.98	18.73	5.73%	1.60%	**0.09%**
	PCI	185361	193175	202216	215726	235737	247255	262682	279601	**6.05%**						
														Car Traffic Growth Rate for FY 2020		**12.37%**

Source: Transport Research Wing Ministry of Surface Transport & National Statistical Office (NSO)
Note: PCI - Per Capita Income (in Rs.) are at 2011-12 Constant Prices as Independent Variable & Cars (no. of registered vehicles) as Dependent Variable

Table 4.30: Regression Co-efficient of Bus Growth with Population of Project Influence Areas

State / Union Territory	Regression Variables	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	Growth Rate (2012-19)	Regression Co-efficient (Elasticity Value)	R Square	t-stat	Factored Growth	Zone Influence Factors	Weighted Growth Rate
Chhattisgarh	Bus	8596	12049	13071	48501	52783	58026	72649	84214	**12.40%**	28.01	0.89	7.04	35.41%	0.19%	**0.07%**
	Population	24258	24585	24909	25232	25555	25879	26186	26488	**3.76%**						
Haryana	Bus	35646	39153	42800	45893	50207	53348	56984	60549	**11.18%**	5.04	1.00	48.32	7.60%	0.47%	**0.04%**
	Population	25439	25854	26266	26675	27079	27477	27868	28253	**6.81%**						
Uttar Pradesh	Bus	31922	34428	40501	45607	51866	57939	62461	67818	**13.17%**	6.97	0.99	29.10	11.36%	84.20%	**9.56%**
	Population	200764	204250	207739	211217	214671	218088	221469	224829	**4.35%**						
Uttarakhand	Bus	8066	8504	8997	9962	10716	7736	9592	9762	**13.65%**	1.46	0.17	1.11	1.90%	6.80%	**0.13%**
	Population	9943	10084	10224	10362	10499	10632	10761	10887	**6.43%**						
West Bengal	Bus	34184	35603	51660	53899	56878	44771	58066	61466	**12.27%**	8.47	0.65	3.30	7.39%	0.40%	**0.03%**
	Population	89499	90320	91122	91920	92725	93550	94334	95109	**5.14%**						
Delhi	Bus	45757	20142	19912	19590	19695	43723	43615	50768	**5.69%**	2.91	0.20	1.24	8.42%	7.94%	**0.67%**
	Population	8596	12049	13071	48501	52783	58026	72649	84214	**6.05%**						
														Bus Traffic Growth Rate for FY 2020		**10.49%**

Source: Transport Research Wing Ministry of Surface Transport & National Statistical Office (NSO)
Note: Population (in 000') as Independent Variable & Buses (no. of registered vehicles) as Dependent Variable

Table 4.31: Regression Co-efficient of Multi-Axle Truck Growth with NSDP of Project Influence Areas

State / Union Territory	Regression Variables	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	Growth Rate (2012-18)	Regression Co-efficient (Elasticity Value)	R Square	t-stat	Factored Growth	Zone Influence Factors	Weighted Growth Rate
Assam	Goods Vehicle	171878	191479	69342	226612	243409	254929	265773	**7.53%**	1.85	0.33	1.58	11.73%	0.06%	**0.01%**
	NSDP	129354	132518	138725	146425	167629	175745	186992	**6.33%**						
Bihar	Goods Vehicle	73472	83191	103211	109010	123744	141242	152276	**12.91%**	1.96	0.89	6.47	12.29%	5.94%	**0.73%**
	NSDP	228497	236933	246915	255739	268333	294890	328824	**6.25%**						
Chhattisgarh	Goods Vehicle	127610	141441	155981	171840	186960	204692	218537	**9.38%**	1.52	0.97	13.41	9.27%	4.84%	**0.45%**
	NSDP	142273	148760	163494	165418	175362	190841	203174	**6.12%**						
Haryana	Goods Vehicle	389546	417632	445020	479951	516633	550506	580221	**6.87%**	0.91	0.99	27.37	6.98%	6.42%	**0.45%**
	NSDP	271152	289414	314224	331413	361231	392729	422969	**7.69%**						
Himachal Pradesh	Goods Vehicle	99294	96855	128017	136760	143008	144977	162380	**8.54%**	1.22	0.89	6.32	8.69%	1.08%	**0.09%**
	NSDP	60536	64519	69398	74553	80563	86186	91593	**7.15%**						
Jharkhand	Goods Vehicle	35330	39389	41242	105786	117759	158508	174557	**30.51%**	6.03	0.86	5.48	31.03%	1.81%	**0.56%**
	NSDP	137383	149526	150609	170568	158231	177622	185623	**5.14%**						
Madhya Pradesh	Goods Vehicle	195627	217618	242811	263039	297188	374592	380522	**11.73%**	1.56	0.99	23.37	12.16%	0.35%	**0.04%**
	NSDP	282371	306853	322598	339247	369929	417903	443183	**7.80%**						
Maha rashtra	Goods Vehicle	973788	1067825	1142091	1273256	1360214	1396713	1514610	**7.64%**	1.01	0.95	10.28	7.29%	0.41%	**0.03%**
	NSDP	1126595	1189711	1267538	1345388	1454411	1598422	1712905	**7.23%**						
Odisha	Goods Vehicle	219691	239749	267615	285887	303035	324105	346367	**7.88%**	1.12	0.95	9.95	7.61%	0.32%	**0.02%**
	NSDP	204226	216301	233122	235935	255713	282775	302909	**6.79%**						
Punjab	Goods Vehicle	169553	201758	201758	201758	201758	352427	312939	**10.75%**	1.97	0.74	3.77	11.07%	10.84%	**1.20%**
	NSDP	239227	251813	267515	278485	294895	314402	332072	**5.62%**						
Rajasthan	Goods Vehicle	385796	431537	478379	467758	564152	617367	645339	**8.95%**	1.34	0.95	9.67	8.60%	0.08%	**0.01%**
	NSDP	395331	409802	434292	465599	498138	535208	573628	**6.40%**						
Uttar Pradesh	Goods Vehicle	307058	338977	400061	467786	511631	562503	617627	**12.35%**	2.07	0.95	9.50	11.89%	56.82%	**6.75%**
	NSDP	645132	673552	707469	729686	790993	846834	901353	**5.73%**						
Uttara khand	Goods Vehicle	39169	50456	52098	58232	62789	84657	84957	**13.77%**	1.84	0.94	8.78	12.98%	6.27%	**0.81%**
	NSDP	101960	109529	117777	125702	136144	143975	153601	**7.07%**						
West Bengal	Goods Vehicle	248776	281995	436839	468719	495790	407229	536444	**13.66%**	1.92	0.51	2.29	10.09%	1.15%	**0.12%**
	NSDP	473205	492901	503952	515702	546988	590958	642999	**5.24%**						

State / Union Territory	Regression Variables	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	Growth Rate (2012-18)	Regression Co-efficient (Elasticity Value)	R Square	t-stat	Factored Growth	Zone Influence Factors	Weighted Growth Rate
Chandigarh	Goods Vehicle	24331	25704	27077	29416	30031	30668	34572	**6.03%**	0.81	0.95	9.42	5.62%	0.19%	**0.01%**
	NSDP	16930	18305	19813	20353	22296	23681	25331	**6.95%**						
Delhi	Goods Vehicle	242331	129339	131715	142203	153406	281159	207708	**9.94%**	0.64	0.13	0.86	5.26%	3.42%	**0.18%**
	NSDP	314650	334193	356528	388183	429149	465770	503507	**8.54%**						
													Multi Axle Truck Traffic Growth Rate for FY 2020		**11.47%**

Source: Transport Research Wing Ministry of Surface Transport & National Statistical Office (NSO)
Note: NSDP– Net State Domestic Product (in Crores) are at 2011-12 Constant Prices as Independent Variable & Goods Vehicle (no. of registered vehicles) as Dependent Variable.

Elasticities were then derived. In the case of freight, the weighted average elasticity of MAVs is 1.94 and, in the case of passengers the average elasticity is 2.80, in case of bus the average elasticity is 6.31 – implying that:

(a) growth in freight travel is growing faster than growth in the *"NDSP"* of the regional and State economies which presently contribute candidate traffic; and

(b) growth in passenger travel is growing faster than growth in the *"per capita incomes"* of the regional and State economies which presently contribute candidate traffic.

(c) growth in bus travel is growing faster than growth in the *"populations"* of the regional and State which presently contribute candidate traffic.

The weighted average elasticites changes for LCVs, 2-Axle Trucks and 3-Axle Trucks change marginally from weighted average elasticies of 1.94 obtained for MAVs because of change in project influence area factors, as 2.03, 1.98 and 1.98 respectively

This is, as expected, and typical of developing economies that, like Uttar Pradesh and the rest of India, are experiencing a surge in economic growth. The elasticity can however be expected to fall with time. The *"best estimate"* forecasts for traffic, which assume continued growth in the *"NSDP"* sectors and in *"per capita incomes"* at projected rates and a convincing increase in average loads caused by the use of greater numbers of larger trucks, and an improvement in load factors, refer Appendix for year wise projections for *"NSDP"* and *"per capita incomes"*.

The growth in multi-axle vehicles (which are mainly articulated MAVs) is assumed to be 0.25% per annum higher than those of LCVs. There is relatively higher number of multi-axle vehicles amongst the candidate vehicles. The experience of almost all other developing countries at a similar stage of development has been for a major growth in these vehicles types – particularly when nascent expressway systems across the country are being developed.

During the last few years growth in real incomes started raising above growth in per capita GDP – it is expected that over the next decade that trend should continue. Also during the last few years growth in population is falling behind growth – it is expected that over the next few decade that trend should reduce)

These growth rates may initially seem high (*additional 1% per year factored for induced traffic as a direct result of the Project*) and, over the next twenty five years, are consistent with: a 7.5 fold increase in *"candidate"* freight traffic; a 12.4 fold increase in car traffic (*implying car ownership of still only about 0.75 per 100 head of population*) and a 6.0 fold increase in bus passengers. These are not unreasonable expectations.

Summary of annual growth rate for vehicles during the development period of the expressway and further 25 year Horizon is shown in Table 4.32.

Table 4.32: Annual Growth Rates for Vehicles Development Period & further 25 Year Horizon

Year	Cars	All Buses	LCV	2-Axle Trucks	3-Axle Trucks	MAV (4+ axles)
FY 2021	12.31%	10.24%	11.66%	11.49%	11.41%	11.41%
FY 2022	12.24%	9.99%	11.37%	11.20%	11.13%	11.13%
FY 2023	12.17%	9.75%	11.07%	10.92%	10.85%	10.85%
FY 2024	12.08%	9.51%	10.79%	10.65%	10.58%	10.57%
FY 2025	11.98%	9.26%	10.50%	10.38%	10.31%	10.30%
FY 2026	11.87%	9.02%	10.22%	10.11%	10.05%	10.04%
FY 2027	11.76%	8.79%	9.95%	9.85%	9.79%	9.78%
FY 2028	11.63%	8.55%	9.68%	9.59%	9.54%	9.52%
FY 2029	11.49%	8.31%	9.41%	9.33%	9.29%	9.27%
FY 2030	11.35%	8.08%	9.15%	9.08%	9.04%	9.02%
FY 2031	11.19%	7.85%	8.89%	8.83%	8.80%	8.78%
FY 2032	11.03%	7.62%	8.63%	8.59%	8.55%	8.54%
FY 2033	10.86%	7.40%	8.38%	8.34%	8.32%	8.30%
FY 2034	10.67%	7.17%	8.13%	8.11%	8.08%	8.07%
FY 2035	10.48%	6.95%	7.88%	7.87%	7.85%	7.83%
FY 2036	10.28%	6.73%	7.63%	7.63%	7.62%	7.60%
FY 2037	10.07%	6.51%	7.39%	7.40%	7.39%	7.38%
FY 2038	9.84%	6.29%	7.15%	7.17%	7.17%	7.15%
FY 2039	9.61%	6.07%	6.91%	6.95%	6.95%	6.93%
FY 2040	9.37%	5.86%	6.68%	6.72%	6.73%	6.71%
FY 2041	9.12%	5.65%	6.44%	6.50%	6.51%	6.50%
FY 2042	8.86%	5.44%	6.21%	6.28%	6.29%	6.28%
FY 2043	8.59%	5.23%	5.98%	6.06%	6.08%	6.07%
FY 2044	8.31%	5.02%	5.75%	5.84%	5.87%	5.86%
FY 2045	8.02%	4.82%	5.53%	5.62%	5.66%	5.65%

Given the uncertain nature of traffic forecasting, for financial analysis sensitivity purposes, assumptions are:

(a) low or pessimistic growth rates of 0.9 times these values; and

(b) high or optimistic growth rates of 1.1 times these values.

This is in line with normal practice in such situations.

4.5.3 Traffic Projections

Base Estimates of Tollable Traffic (2020) section by section of proposed Expressway as shown in Table 4.24 have been projected by assigning the above annual growth rates for the corresponding periods – results are shown in Tables 4.33 to 4.35

Table 4.33: Traffic Forecast (FY 2025) Section by Section of Proposed Expressway

Sections	Cars	All Buses	All LCVs	2-Axle Trucks	3-Axle Trucks	MAV (4-6axles)	Total Traffic Nos.	Total Traffic PCUs.
A-B	1515	225	514	558	1165	3042	**7018**	**21816**
B-C	1617	303	624	698	1372	3262	**7875**	**24349**
C-D	1687	330	723	737	1508	3372	**8357**	**25670**
D-E	1584	320	712	737	1508	3366	**8226**	**25490**
E-F	1673	325	759	800	1582	3449	**8588**	**26452**
F-G	1753	353	773	800	1582	3449	**8710**	**26637**
G-H	1773	290	801	919	1681	3699	**9164**	**28293**
H-I	1538	273	669	872	1673	3690	**8714**	**27598**
I-J	2028	316	934	1064	1888	3931	**10160**	**30918**
J-K	2143	320	1018	1054	1980	3958	**10474**	**31546**
K-L	2077	324	950	1073	1933	3948	**10305**	**31257**
L-M	1911	313	750	977	1814	3900	**9665**	**29896**
M-N	1990	352	828	997	1876	3574	**9616**	**28988**
N-O	1909	292	971	836	1595	3250	**8853**	**26161**
O-P	1957	276	916	731	1345	3042	**8267**	**24075**
P-Q	2283	335	959	769	1338	3056	**8740**	**24798**
Q-R	2196	324	940	769	1338	3056	**8622**	**24648**

Note: Data may not add up to the total due to rounding.

Table 4.34: Traffic Forecast (FY 2035) Section by Section of Proposed Expressway

Sections	Cars	All Buses	All LCVs	2-Axle Trucks	3-Axle Trucks	MAV (4-6axles)	Total Traffic Nos.	Total Traffic PCUs.
A-B	4392	484	1219	1316	2739	7145	**17296**	**51992**
B-C	4688	652	1481	1647	3226	7662	**19356**	**57963**
C-D	4890	711	1717	1738	3546	7920	**20523**	**61093**
D-E	4593	689	1689	1738	3546	7905	**20161**	**60619**
E-F	4851	699	1801	1889	3720	8100	**21061**	**62929**
F-G	5083	759	1836	1889	3720	8100	**21387**	**63393**
G-H	5141	625	1902	2169	3954	8688	**22479**	**67336**
H-I	4459	588	1587	2058	3934	8667	**21292**	**65578**
I-J	5880	680	2217	2511	4440	9232	**24959**	**73639**
J-K	6215	688	2416	2488	4657	9297	**25762**	**75178**
K-L	6023	697	2254	2533	4547	9272	**25325**	**74457**
L-M	5542	674	1781	2305	4266	9159	**23727**	**71164**
M-N	5770	757	1966	2353	4412	8393	**23652**	**69056**
N-O	5536	628	2305	1973	3750	7634	**21828**	**62405**
O-P	5675	595	2174	1726	3162	7144	**20477**	**57534**
P-Q	6621	722	2275	1814	3147	7177	**21756**	**59380**
Q-R	6367	697	2231	1814	3147	7177	**21434**	**58986**

Note: Data may not add up to the total due to rounding.

Table 4.35: Traffic Forecast (FY 2045) Section by Section of Proposed Expressway

Sections	Cars	All Buses	All LCVs	2-Axle Trucks	3-Axle Trucks	MAV (4-6axles)	Total Traffic Nos.	Total Traffic PCUs.
A-B	10596	848	2303	2497	5202	13554	**35000**	**100683**
B-C	11310	1141	2797	3126	6127	14533	**39035**	**112088**
C-D	11797	1245	3244	3299	6734	15024	**41343**	**118104**
D-E	11081	1207	3191	3299	6734	14994	**40506**	**117061**
E-F	11703	1224	3403	3583	7066	15366	**42345**	**121572**
F-G	12263	1329	3467	3583	7066	15366	**43075**	**122545**
G-H	12401	1094	3592	4116	7510	16481	**45195**	**130114**
H-I	10756	1029	2998	3904	7471	16440	**42599**	**126448**
I-J	14186	1190	4187	4764	8432	17512	**50271**	**142428**
J-K	14993	1205	4564	4721	8845	17636	**51965**	**145516**
K-L	14529	1220	4257	4806	8636	17587	**51037**	**144047**
L-M	13369	1180	3364	4374	8101	17374	**47763**	**137565**
M-N	13919	1325	3714	4465	8380	15921	**47725**	**133647**
N-O	13355	1100	4354	3745	7123	14482	**44158**	**120957**
O-P	13691	1041	4107	3276	6006	13551	**41672**	**111801**
P-Q	15972	1264	4298	3443	5977	13614	**44567**	**115732**
Q-R	15359	1220	4214	3443	5977	13614	**43828**	**114865**

Note: Data may not add up to the total due to rounding.

4.5.4 Capacity Constraints and Proposed Intervention

The 25 year horizon traffic forecasts (FY 2045) on all sections from Node A to R of the proposed expressway exceeds 86,000[3] PCUs per day, i.e. the requirement is 6-lane requirement and on 5 sections viz. G-H, I-J, J-K, K-L, L-M and M-N, the traffic forecasts (year 2045) exceeds 1,30,000[4] PCUs per day, i.e the requirement is 8-lane requirement.

The projected traffic warrants the following the lane requirement for each section to maintain a design service volume for Level of Service B on the proposed expressway at the years mentioned in Table 4.50

Table 4.50: Lane Requirement to maintain Level of Service B on the Expressway

Sections	4-Lane requirement (threshold 40,000 PCUs)	6-Lane requirement (threshold 86,000 PCUs)	8-Lane requirement (threshold 130,000 PCUs)
A-B	FY 2032	FY 2043	After FY 2045
B-C	FY 2031	FY 2041	After FY 2045
C-D	FY 2030	FY 2040	After FY 2045
D-E	FY 2030	FY 2040	After FY 2045
E-F	FY 2030	FY 2040	After FY 2045
F-G	FY 2030	FY 2040	After FY 2045
G-H	FY 2029	FY 2039	After FY 2045
H-I	FY 2029	FY 2039	FY 2045
I-J	FY 2028	FY 2038	FY 2044
J-K	FY 2028	FY 2037	FY 2044
K-L	FY 2028	FY 2037	FY 2044
L-M	FY 2029	FY 2038	FY 2045
M-N	FY 2029	FY 2039	FY 2045
N-O	FY 2030	FY 2040	After FY 2045
O-P	FY 2031	FY 2041	After FY 2045
P-Q	FY 2031	FY 2041	After FY 2045
Q-R	FY 2031	FY 2041	After FY 2045

Note: DSV of 1300 PCU/h/lane has been considered

[3] the DSV for LOS B on 4-lane (refer Table 4.39)
[4] the DSV for LOS B on 6-lane configuration(refer Table 4.39)

It can be seen that a 6-lane configuration can cater to the forecasted traffic till FY 2043, i.e. (20 year design period/operations period) from start of operations of the Expressway; beyond which, widening of few sections of the Expressway to 8-lane configuration becomes necessary.

Thus, the development proposal for expressway shall be a 6-lane dual carriageway configuration with Structures (Culvets, Underpassess, Flyovers, ROBs) of 8-lane configuration so that road widening (median side) is possible as and when warranted by traffic. Thus the life cycle cost of development of the Expressway is justified.

5. HIGHWAY DESIGN, PROPOSED TYPICAL CROSS-SECTIONS, SERVICE ROADS, ROADSIDE DRAINS & AIR STRIPS

5.1 GEOMETRIC DESIGN

The proposed expressway would be of 6 lanes (expandable to 8 Lanes) and fenced to prevent unauthorized access. The expressway will be fully access controlled and designed for a closed toll system, so except at the ends of the expressway [where it ties or connects back via grade separated interchanges back to existing road networks] the intermediate connectivity/ access will be through grade-separated facilities i.e. interchanges with toll booths. Interchanges will generally be of the "trumpet" and "diamond" shape; in fact, significant connections to the existing network will sometimes require double trumpet layouts (or a trumpet on expressway plus another grade separated interchange of some type on road connected to) where the connection to a National Highway [from the expressway via an interchange on the expressway] itself also has to be grade separated.

5.1.1 Carriageway, Shoulder & Median Width

Carriageway: The expressway will be 6-lane wide. Lane width for each carriageway will be 3.75m width (therefore 3 lanes in each direction = 11.25 m width).

Paved Shoulder: Width of Paved shoulder on outer (left) edge of carriageway will be 3.0 m.

Edge Strip: A paved shoulder [called a right median side edge strip] of 0.75m will be provided on median side [adjacent to inner 3.75m wide carriageway].

Unpaved Shoulder: Width of unpaved shoulder on outer side of paved shoulder will be 2.0 m & towards median, it will be 1.0 m.

Width of median: As a rule 15.0 m wide depressed median will be provided, which includes 0.75m edge strip on both sides.

Typical Cross-Sections have been depicted in **Section 5.3** of this chapter.

5.1.2 Other Geometrical Features

Cross fall/Camber: Unidirectional Cross fall on all bituminous surfaces [such as paved shoulder, carriageways, and median side edge strip] shall be 2.5%. The cross fall for earth shoulders shall be 3.0%.

On horizontal curves, the shoulder on the high side of the supper elevated portion may be with reverse slope from the super-elevated carriageway portion, but ensuring the rate of change between pavement cross slope and outside shoulder is not exceeded by 7%.

Super Elevation: For the upper side, the cross fall variation would be calculated by using a linear function between the non-super-elevated cross fall -2.5% (for the minimum radius without transition curve: R=4000m for a 120kph design speed) and the maximum super-elevation 5% (R=1000m for a 120kph design speed). For the lower side, Cross fall is maintained at 2.5% until the opposite side has reached this cross fall. The change is then applied at the same rate as the opposite side.

Spirals (also known as Clothoid) will be used in the horizontal alignment plan design of Transition curves.

Minimum Radius of Horizontal Curve: The minimum radius of horizontal curve used for the 120 km/h expressway alignment design is 1000m. The minimum radius of horizontal curve where super elevation is not required is 4000m.

Visibility Criteria: The minimum ISD requirements can affect the overall expressway geometry locally on horizontal curves for instance where the outside barrier [both on expressway and bridges] and the median barrier [both on expressway and on bridges] are located relative to the carriageways.

Maximum Longitudinal Grade: Maximum longitudinal grade on the expressway will be 2.5%. Minimum longitudinal grade shall be 0.3% except in exceptional circumstances.

Emergency Crossover: Emergency crossovers [also called median openings in the Guidelines for Expressways] in the expressway median are necessary. These are designed fully paved areas in the median, with demountable median barriers that can only be removed and later replaced by the Operation Company.

They are used for instance during periods of emergency [accident fully blocking one direction and traffic must be temporarily moved to the other direction] and also sometimes for controlled heavy maintenance every few years [like pavement resurfacing or strengthening] when some traffic lanes on the expressway is temporarily switched to the opposite direction carriageway under a controlled traffic management operation (albeit when traffic is moving at any speed the opening widths designed for emergency crossovers are not large enough to easily transfer more than 1 to 2 lanes across due to the horizontal alignment characteristics of the S curve needed).

Spacing of the emergency crossovers adopted in general is 5 km along the mainline with provision on either side of mainline Expressway Interchanges. Crossovers are best located on straight sections where visibility is high. Length of emergency crossovers shall benot less than 20 m (for emergency and for repair/maintenance works). Detachable guard barrier shall be provided at every crossover.

It is necessary to close the full infrastructure of the expressway including the interchanges by fencing; this is necessary for safety reasons. There has to be no cross access to the expressway except via designed crossings as uncontrolled cross access will be extremely dangerous on such a high speed expressway and as the expressway will be a closed toll system facility (so no access apart from through controlled interchanges is to be allowed).

Grade Separation: All Intersections/Junctions will be provided as grade-separated with project expressway.

5.1.3 Proposed Right of Way

It has been proposed to acquire 120 m land for the ROW. Additional land shall be required at the location of interchanges, toll plazas, project facilities etc. as per design and same will be acquired.

5.2 CONSTRUCTION PACKAGING

The development proposal consists of new construction of 6-lane divided carriageway with paved shoulder (Expandable to 8 lanes) on both sides. The project corridor is divided into 12 construction packages as per the details given below in **Table-5.1**:

Table-5.1 – Construction Package Details of Ganga Expressway

Package No.	Section Details	Chainage (km)		Length
		From	To	
I	From Village Bijoli (Dist. Meerut) to Village-Chandner (Dist. Hapur)	7.900	56.900	49.000
II	From Village-Chandner (Dist. Hapur) to Village-Mirzapur Dugar (Dist. Amroha)	56.900	86.900	30.000
III	From Mirzapur Dugar (Dist. Amroha) to Village-Nagla Barah (Dist. Budaun)	86.900	137.600	50.700
IV	From Village-Nagla Barah (Dist. Budaun) to Village-Binawar (Dist. Budaun)	137.600	189.700	52.100
V	From Binawar (Dist. Budaun) to Girdharpur (Dist. Shahjahanpur)	189.700	236.400	46.700
VI	From Village- Girdharpur (Dist. Shahjahanpur) to Village-Ubariya Khurd (Dist. Hardoi)	236.400	289.300	52.900
VII	From Village-Ubariya Khurd (Dist. Hardoi) to Village-Pandra Lakhanpur (Dist. Hardoi)	289.300	341.700	52.400
VIII	From Village-Pandra Lakhanpur (Dist. Hardoi) to Village-Raiyamau(Dist. Unnao)	341.700	391.900	50.200
IX	From Village- Raiyamau (Dist. Unnao) to Village-Sarso (Dist. Unnao)	391.900	445.000	53.100
X	From Village- Sarso (Dist. Unnao) to Village-Terukha (Dist. Raebareli)	445.000	496.800	51.800
XI	From Village-Terukha (Dist. Raebareli) to Village-Arro (Dist. Pratapgarh)	496.800	548.800	52.000
XII	From Village- Arro (Dist. Pratapgarh) to Village-Judapur Dando (Dist. Prayagraj)	548.800	601.847	53.047
Total				**593.947**

5.3 TYPICAL CROSS_SECTIONS

The chainage wise list of Typical Cross-sections applicable along the project is attached below in **Table-5.2** which is further followed by Typical Cross-Section Figures.

Table-5.2 Typical Cross-Sections along the Project

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
7.900	8.688	0.788	Nil	Nil	R	Package-1
8.688	8.920	0.232	Nil	Nil	C	Package-1
8.920	9.152	0.232	7.00	Nil	E	Package-1
9.152	9.440	0.288	7.00	Nil	T	Package-1
9.440	10.200	0.760	7.00	Nil	A1	Package-1
10.200	10.620	0.420	7.00	3.75	D	Package-1
10.620	12.438	1.818	7.00	Nil	A1	Package-1
12.438	12.630	0.192	7.00	3.75	D	Package-1

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
12.630	15.150	2.520	3.75	3.75	B3	Package-1
15.150	17.700	2.550	3.75	Nil	B1	Package-1
17.700	17.750	0.050	Nil	Nil	C	Package-1
17.750	23.370	5.620	3.75	Nil	B1	Package-1
23.370	24.000	0.630	3.75	3.75	B3	Package-1
24.000	24.110	0.110	3.75	Nil	B1	Package-1
24.110	24.510	0.400	7.00	Nil	A1	Package-1
24.510	25.135	0.625	3.75	Nil	B1	Package-1
25.135	28.160	3.025	3.75	3.75	B3	Package-1
28.160	28.950	0.790	3.75	Nil	B1	Package-1
28.950	29.350	0.400	7.00	Nil	A1	Package-1
29.350	33.850	4.500	3.75	Nil	B1	Package-1
33.850	34.650	0.800	Nil	Nil	C	Package-1
34.650	34.800	0.150	Nil	7.00	A2	Package-1
34.800	35.270	0.470	7.00	7.00	A3	Package-1
35.270	35.400	0.130	7.00	Nil	A1	Package-1
35.400	36.140	0.740	Nil	Nil	C	Package-1
36.140	40.045	3.905	3.75	Nil	B1	Package-1
40.045	41.500	1.455	3.75	3.75	B3	Package-1
41.500	43.170	1.670	3.75	Nil	B1	Package-1
43.170	43.445	0.275	3.75	3.75	B3	Package-1
43.445	45.200	1.755	3.75	Nil	B1	Package-1
45.200	46.240	1.040	3.75	3.75	B3	Package-1
46.240	48.545	2.305	Nil	3.75	B2	Package-1
48.545	48.560	0.015	Nil	7	A2	Package-1
48.560	48.780	0.220	7.00	7.00	A3	Package-1
48.780	48.945	0.165	Nil	7.00	A2	Package-1
48.945	49.669	0.724	Nil	3.75	B2	Package-1
49.669	49.825	0.156	Nil	7.00	A2	Package-1
49.825	50.069	0.244	3.75	7.00	D	Package-1
50.069	50.850	0.781	3.75	3.75	B3	Package-1
50.850	50.860	0.010	Nil	3.75	B2	Package-1
50.860	51.260	0.400	Nil	7.00	A2	Package-1
51.260	51.400	0.140	Nil	3.75	B2	Package-1
51.400	51.625	0.225	Nil	Nil	C	Package-1
51.625	52.911	1.286	3.75	Nil	B1	Package-1

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
52.911	53.700	0.789	3.75	3.75	B3	Package-1
53.700	56.900	3.200	3.75	Nil	B1	Package-1
56.900	59.495	2.595	3.75	Nil	B1	Package-2
59.495	60.140	0.645	Nil	Nil	C	Package-2
60.140	60.190	0.050	Nil	3.75	B2	Package-2
60.190	60.665	0.475	3.75	3.75	B3	Package-2
60.665	61.127	0.462	3.75	Nil	B1	Package-2
61.127	61.400	0.273	7.00	Nil	A1	Package-2
61.400	61.527	0.127	7.00	3.75	D	Package-2
61.527	62.700	1.173	3.75	3.75	B3	Package-2
62.700	65.690	2.990	3.75	Nil	B1	Package-2
65.690	67.610	1.920	Nil	Nil	C	Package-2
67.610	69.830	2.220	Nil	3.75	B2	Package-2
69.830	69.850	0.020	Nil	Nil	C	Package-2
69.850	71.830	1.980	3.75	Nil	B1	Package-2
71.830	72.500	0.670	3.75	3.75	B3	Package-2
72.500	73.153	0.653	3.75	Nil	B1	Package-2
73.153	73.553	0.400	7.00	Nil	A1	Package-2
73.553	73.600	0.047	3.75	Nil	B1	Package-2
73.600	74.190	0.590	3.75	3.75	B3	Package-2
74.190	74.630	0.440	Nil	3.75	B2	Package-2
74.630	77.930	3.300	3.75	Nil	B1	Package-2
77.930	79.300	1.370	3.75	3.75	B3	Package-2
79.300	80.615	1.315	3.75	Nil	B1	Package-2
80.615	82.130	1.515	3.75	3.75	B3	Package-2
82.130	86.600	4.470	3.75	Nil	B1	Package-2
86.600	86.800	0.200	3.75	3.75	B3	Package-2
86.800	86.900	0.100	Nil	3.75	B2	Package-2
86.900	87.300	0.400	3.75	3.75	B3	Package-3
87.300	88.100	0.800	3.75	Nil	B1	Package-3
88.100	88.540	0.440	3.75	3.75	B3	Package-3
88.540	95.540	7.000	3.75	Nil	B1	Package-3
95.540	96.010	0.470	3.75	3.75	B3	Package-3
96.010	97.300	1.290	3.75	Nil	B1	Package-3
97.300	97.810	0.510	3.75	3.75	B3	Package-3
97.810	99.100	1.290	3.75	Nil	B1	Package-3

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
99.100	99.355	0.255	3.75	3.75	B3	Package-3
99.355	101.150	1.795	3.75	Nil	B1	Package-3
101.150	102.427	1.277	3.75	3.75	B3	Package-3
102.427	102.948	0.521	Nil	3.75	B2	Package-3
102.948	104.215	1.267	3.75	3.75	B3	Package-3
104.215	105.715	1.500	3.75	Nil	B1	Package-3
105.715	105.900	0.185	3.75	3.75	B3	Package-3
105.900	107.262	1.362	Nil	3.75	B2	Package-3
107.262	107.790	0.528	3.75	3.75	B3	Package-3
107.790	109.041	1.251	Nil	3.75	B2	Package-3
109.041	112.600	3.559	3.75	3.75	B3	Package-3
112.600	113.000	0.400	7.00	7.00	A3	Package-3
113.000	114.595	1.595	3.75	3.75	B3	Package-3
114.595	115.550	0.955	3.75	Nil	B1	Package-3
115.550	115.810	0.260	3.75	3.75	B3	Package-3
115.810	117.505	1.695	3.75	Nil	B1	Package-3
117.505	118.200	0.695	3.75	3.75	B3	Package-3
118.200	119.611	1.411	3.75	Nil	B1	Package-3
119.611	120.290	0.679	3.75	3.75	B3	Package-3
120.290	121.550	1.260	3.75	Nil	B1	Package-3
121.550	122.146	0.596	3.75	3.75	B3	Package-3
122.146	123.135	0.989	Nil	Nil	C	Package-3
123.135	124.060	0.925	Nil	3.75	B2	Package-3
124.060	128.335	4.275	3.75	3.75	B3	Package-3
128.335	129.461	1.126	3.75	Nil	B1	Package-3
129.461	131.323	1.862	3.75	3.75	B3	Package-3
131.323	134.100	2.777	3.75	Nil	B2	Package-3
134.100	137.600	3.500	3.75	3.75	B3	Package-3
137.600	137.905	0.305	3.75	3.75	B3	Package-4
137.905	139.850	1.945	3.75	Nil	B1	Package-4
139.850	140.652	0.802	3.75	3.75	B3	Package-4
140.652	146.330	5.678	3.75	Nil	b1	Package-4
146.330	147.395	1.065	Nil	Nil	C	Package-4
147.395	150.475	3.080	Nil	3.75	B2	Package-4
150.475	151.450	0.975	3.75	3.75	B3	Package-4
151.450	152.160	0.710	Nil	3.75	B2	Package-4

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
152.160	152.330	0.170	7.00	3.75	D	Package-4
152.330	153.525	1.195	7.00	Nil	A1	Package-4
153.525	153.680	0.155	7.00	3.75	D	Package-4
153.680	153.800	0.120	7.00	Nil	A1	Package-4
153.800	154.310	0.510	7.00	3.75	D	Package-4
154.310	157.900	3.590	7.00	Nil	A1	Package-4
157.900	158.685	0.785	Nil	Nil	C	Package-4
158.685	158.800	0.115	3.75	Nil	B1	Package-4
158.800	159.270	0.470	3.75	3.75	B3	Package-4
159.270	160.205	0.935	Nil	3.75	B2	Package-4
160.205	164.395	4.190	3.75	3.75	B3	Package-4
164.395	165.390	0.995	Nil	3.75	B2	Package-4
165.390	165.985	0.595	3.75	3.75	B3	Package-4
165.985	166.963	0.978	Nil	3.75	B2	Package-4
166.963	167.774	0.811	3.75	3.75	B3	Package-4
167.774	169.520	1.746	Nil	3.75	B2	Package-4
169.520	170.087	0.567	3.75	3.75	B3	Package-4
170.087	171.255	1.168	Nil	3.75	B2	Package-4
171.255	171.500	0.245	3.75	3.75	B3	Package-4
171.500	171.900	0.400	3.75	7.00	D	Package-4
171.900	174.180	2.280	3.75	3.75	B3	Package-4
174.180	180.276	6.096	Nil	3.75	B2	Package-4
180.276	181.347	1.071	3.75	3.75	B3	Package-4
181.347	182.170	0.823	Nil	3.75	B2	Package-4
182.170	183.970	1.800	3.75	3.75	B3	Package-4
183.970	185.117	1.147	Nil	3.75	B2	Package-4
185.117	185.400	0.283	3.75	3.75	B3	Package-4
185.400	186.483	1.083	Nil	3.75	B2	Package-4
186.483	187.690	1.207	3.75	3.75	B3	Package-4
187.690	189.400	1.710	Nil	Nil	C	Package-4
189.400	189.700	0.300	Nil	3.75	B2	Package-4
189.700	189.800	0.100	Nil	7.00	A2	Package-5
189.800	190.100	0.300	3.75	7.00	D	Package-5
190.100	195.410	5.310	Nil	7.00	A2	Package-5
195.410	195.680	0.270	3.75	7.00	D	Package-5
195.680	198.400	2.720	Nil	7.00	A2	Package-5

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
198.400	199.942	1.542	3.75	7.00	D	Package-5
199.942	201.195	1.253	Nil	7.00	A2	Package-5
201.195	201.600	0.405	3.75	7.00	D	Package-5
201.600	204.940	3.340	Nil	7.00	A2	Package-5
204.940	205.320	0.380	3.75	7.00	D	Package-5
205.320	207.600	2.280	Nil	7.00	A2	Package-5
207.600	208.570	0.970	Nil	Nil	C	Package-5
208.570	211.500	2.930	Nil	3.75	B2	Package-5
211.500	212.200	0.700	3.75	3.75	B3	Package-5
212.200	213.409	1.209	Nil	3.75	B2	Package-5
213.409	213.809	0.400	Nil	7.00	A2	Package-5
213.809	217.105	3.296	Nil	3.75	B2	Package-5
217.105	218.265	1.160	Nil	Nil	C	Package-5
218.265	224.030	5.765	3.75	Nil	B1	Package-5
224.030	224.430	0.400	7.00	Nil	A1	Package-5
224.430	225.640	1.210	3.75	Nil	B1	Package-5
225.640	226.950	1.310	3.75	3.75	B3	Package-5
226.950	228.820	1.870	3.75	Nil	B1	Package-5
228.820	229.780	0.960	3.75	3.75	B3	Package-5
229.780	231.735	1.955	3.75	Nil	B1	Package-5
231.735	232.750	1.015	3.75	3.75	B3	Package-5
232.750	233.550	0.800	3.75	Nil	B1	Package-5
233.550	234.525	0.975	3.75	3.75	B3	Package-5
234.525	235.750	1.225	3.75	Nil	B1	Package-5
235.750	236.150	0.400	7.00	Nil	A1	Package-5
236.150	236.400	0.250	3.75	Nil	B1	Package-5
236.400	236.555	0.155	3.75	Nil	B1	Package-6
236.555	237.100	0.545	3.75	3.75	B3	Package-6
237.100	237.714	0.614	3.75	Nil	B1	Package-6
237.714	238.380	0.666	Nil	Nil	C	Package-6
238.380	240.910	2.530	3.75	3.75	B3	Package-6
240.910	241.925	1.015	3.75	Nil	B1	Package-6
241.925	242.500	0.575	7.00	Nil	A1	Package-6
242.500	247.500	5.000	10.00	10.00	F	Package-6
247.500	247.759	0.259	3.75	3.75	B3	Package-6
247.759	248.643	0.884	3.75	Nil	B1	Package-6

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
248.643	249.220	0.577	3.75	7.00	D	Package-6
249.220	250.304	1.084	Nil	7.00	A2	Package-6
250.304	250.747	0.443	3.75	7.00	D	Package-6
250.747	252.085	1.338	Nil	7.00	A2	Package-6
252.085	252.390	0.305	3.75	7.00	D	Package-6
252.390	253.642	1.252	Nil	7.00	A2	Package-6
253.642	254.245	0.603	3.75	7.00	D	Package-6
254.245	255.167	0.922	Nil	7.00	A2	Package-6
255.167	255.915	0.748	3.75	Nil	B1	Package-6
255.915	256.180	0.265	3.75	3.75	B3	Package-6
256.180	257.321	1.141	3.75	Nil	B1	Package-6
257.321	257.721	0.400	7.00	Nil	A1	Package-6
257.721	258.344	0.623	3.75	Nil	B1	Package-6
258.344	258.744	0.400	7.00	Nil	A1	Package-6
258.744	260.080	1.336	3.75	Nil	B1	Package-6
260.080	260.170	0.090	3.75	3.75	B3	Package-6
260.170	261.124	0.954	3.75	Nil	B1	Package-6
261.124	261.524	0.400	7.00	Nil	A1	Package-6
261.524	261.648	0.124	3.75	Nil	B1	Package-6
261.648	262.202	0.554	3.75	3.75	B3	Package-6
262.202	263.565	1.363	3.75	Nil	B1	Package-6
263.565	264.195	0.630	3.75	3.75	B3	Package-6
264.195	264.957	0.762	3.75	Nil	B1	Package-6
264.957	265.420	0.463	3.75	3.75	B3	Package-6
265.420	268.060	2.640	3.75	Nil	B1	Package-6
268.060	268.140	0.080	3.75	3.75	B3	Package-6
268.140	268.540	0.400	7.00	3.75	D	Package-6
268.540	269.200	0.660	3.75	3.75	B3	Package-6
269.200	271.063	1.863	3.75	Nil	B1	Package-6
271.063	271.660	0.597	3.75	3.75	B3	Package-6
271.660	273.800	2.140	3.75	Nil	B1	Package-6
273.800	274.200	0.400	7.00	Nil	A1	Package-6
274.200	274.580	0.380	3.75	Nil	B1	Package-6
274.580	274.980	0.400	7.00	Nil	A1	Package-6
274.980	277.355	2.375	3.75	Nil	B1	Package-6
277.355	279.167	1.812	3.75	3.75	B3	Package-6

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
279.167	281.850	2.683	3.75	Nil	B1	Package-6
281.850	281.980	0.130	3.75	7.00	D	Package-6
281.980	282.845	0.865	Nil	7.00	A2	Package-6
282.845	289.300	6.455	Nil	3.75	B2	Package-6
289.300	290.900	1.600	3.75	3.75	B3	Package-7
290.900	292.580	1.680	3.75	Nil	B1	Package-7
292.580	292.635	0.055	3.75	3.75	B3	Package-7
292.635	307.811	15.176	Nil	3.75	B2	Package-7
307.811	308.000	0.189	3.75	3.75	B3	Package-7
308.000	309.226	1.226	3.75	Nil	B1	Package-7
309.226	310.310	1.084	3.75	3.75	B3	Package-7
310.310	315.600	5.290	3.75	Nil	B1	Package-7
315.600	317.083	1.483	3.75	3.75	B3	Package-7
317.083	319.183	2.100	Nil	Nil	C	Package-7
319.183	320.731	1.548	3.75	Nil	B2	Package-7
320.731	321.131	0.400	7.00	Nil	A1	Package-7
321.131	321.370	0.239	3.75	Nil	B1	Package-7
321.370	322.300	0.930	3.75	3.75	B3	Package-7
322.300	323.650	1.350	3.75	Nil	B1	Package-7
323.650	324.730	1.080	3.75	3.75	B3	Package-7
324.730	327.340	2.610	3.75	Nil	B1	Package-7
327.340	327.655	0.315	3.75	3.75	B3	Package-7
327.655	329.745	2.090	Nil	3.75	B2	Package-7
329.745	329.945	0.200	Nil	7.00	A2	Package-7
329.945	330.145	0.200	3.75	7.00	D	Package-7
330.145	330.420	0.275	3.75	3.75	B3	Package-7
330.420	335.837	5.417	Nil	3.75	B2	Package-7
335.837	336.100	0.263	3.75	3.75	B3	Package-7
336.100	337.860	1.760	Nil	3.75	B2	Package-7
337.860	337.990	0.130	3.75	3.75	B3	Package-7
337.990	340.693	2.703	Nil	3.75	B2	Package-7
340.693	341.093	0.400	Nil	7.00	A2	Package-7
341.093	341.700	0.607	Nil	3.75	B2	Package-7
341.700	345.739	4.039	Nil	3.75	B2	Package-8
345.739	349.169	3.430	3.75	Nil	B1	Package-8
349.169	351.311	2.142	3.75	3.75	B3	Package-8

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
351.311	352.700	1.389	3.75	Nil	B1	Package-8
352.700	352.960	0.260	3.75	3.75	B3	Package-8
352.960	354.010	1.050	Nil	3.75	B2	Package-8
354.010	354.580	0.570	3.75	3.75	B3	Package-8
354.580	355.360	0.780	Nil	Nil	C	Package-8
355.360	355.710	0.350	3.75	Nil	B1	Package-8
355.710	356.360	0.650	3.75	3.75	B3	Package-8
356.360	358.065	1.705	Nil	3.75	B2	Package-8
358.065	358.435	0.370	3.75	3.75	B3	Package-8
358.435	358.520	0.085	Nil	3.75	B2	Package-8
358.520	359.151	0.631	Nil	Nil	C	Package-8
359.151	359.250	0.099	3.75	Nil	B1	Package-8
359.250	359.475	0.225	3.75	3.75	B3	Package-8
359.475	362.754	3.279	Nil	3.75	B2	Package-8
362.754	363.154	0.400	Nil	7.00	A2	Package-8
363.154	364.702	1.548	Nil	3.75	B2	Package-8
364.702	365.102	0.400	Nil	7.00	A2	Package-8
365.102	365.118	0.016	Nil	3.75	B2	Package-8
365.118	365.663	0.545	3.75	3.75	B3	Package-8
365.663	366.388	0.725	Nil	3.75	B2	Package-8
366.388	366.766	0.378	3.75	3.75	B3	Package-8
366.766	367.653	0.887	Nil	3.75	B2	Package-8
367.653	367.788	0.135	3.75	3.75	B3	Package-8
367.788	370.486	2.698	3.75	Nil	B1	Package-8
370.486	370.869	0.383	7.00	7.00	A3	Package-8
370.869	371.310	0.441	7.00	3.75	D	Package-8
371.310	373.090	1.780	7.00	Nil	A1	Package-8
373.090	378.095	5.005	7.00	3.75	D	Package-8
378.095	378.190	0.095	Nil	3.75	B2	Package-8
378.190	381.360	3.170	3.75	3.75	B3	Package-8
381.360	381.760	0.400	3.75	7.00	D	Package-8
381.760	383.780	2.020	3.75	3.75	B3	Package-8
383.780	384.180	0.400	3.75	7.00	D	Package-8
384.180	386.500	2.320	3.75	3.75	B3	Package-8
386.500	387.496	0.996	3.75	7.00	D	Package-8
387.496	387.896	0.400	7.00	7.00	A3	Package-8

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
387.896	389.460	1.564	3.75	3.75	B3	Package-8
389.460	389.660	0.200	7.00	7.00	A3	Package-8
389.660	389.860	0.200	7.00	Nil	A1	Package-8
389.860	391.900	2.040	3.75	Nil	B1	Package-8
391.900	392.410	0.510	3.75	Nil	B1	Package-9
392.410	392.810	0.400	7.00	Nil	A1	Package-9
392.810	393.240	0.430	3.75	Nil	B1	Package-9
393.240	393.700	0.460	3.75	3.75	B3	Package-9
393.700	393.940	0.240	3.75	Nil	B1	Package-9
393.940	394.340	0.400	7.00	Nil	A1	Package-9
394.340	396.990	2.650	3.75	Nil	B1	Package-9
396.990	397.050	0.060	7.00	Nil	A1	Package-9
397.050	397.120	0.070	7.00	3.75	D	Package-9
397.120	397.390	0.270	7.00	Nil	A1	Package-9
397.390	398.640	1.250	3.75	Nil	B1	Package-9
398.640	399.180	0.540	3.75	3.75	B3	Package-9
399.180	400.950	1.770	Nil	3.75	B2	Package-9
400.950	401.280	0.330	Nil	7.00	A2	Package-9
401.280	401.360	0.080	7.00	7.00	A3	Package-9
401.360	401.750	0.390	3.75	3.75	B3	Package-9
401.750	402.550	0.800	Nil	3.75	B2	Package-9
402.550	402.950	0.400	Nil	7.00	A2	Package-9
402.950	403.850	0.900	Nil	3.75	B2	Package-9
403.850	404.950	1.100	3.75	3.75	B3	Package-9
404.950	406.260	1.310	Nil	3.75	B2	Package-9
406.260	406.840	0.580	3.75	3.75	B3	Package-9
406.840	407.240	0.400	Nil	7.00	A2	Package-9
407.240	408.130	0.890	Nil	3.75	B2	Package-9
408.130	408.530	0.400	Nil	7.00	A2	Package-9
408.530	409.270	0.740	Nil	3.75	B2	Package-9
409.270	409.650	0.380	3.75	3.75	B3	Package-9
409.650	411.530	1.880	Nil	3.75	B2	Package-9
411.530	411.830	0.300	3.75	3.75	B3	Package-9
411.830	413.210	1.380	3.75	Nil	B1	Package-9
413.210	413.620	0.410	3.75	3.75	B3	Package-9
413.620	414.410	0.790	Nil	3.75	B2	Package-9

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
414.410	414.610	0.200	Nil	7.00	A2	Package-9
414.610	414.810	0.200	7.00	7.00	A3	Package-9
414.810	415.390	0.580	3.75	3.75	B3	Package-9
415.390	417.100	1.710	Nil	3.75	B2	Package-9
417.100	417.790	0.690	3.75	3.75	B3	Package-9
417.790	418.920	1.130	Nil	3.75	B2	Package-9
418.920	419.600	0.680	3.75	3.75	B3	Package-9
419.600	419.710	0.110	3.75	Nil	B1	Package-9
419.710	420.950	1.240	Nil	Nil	C	Package-9
420.950	422.032	1.082	3.75	Nil	A1	Package-9
422.032	422.640	0.608	Nil	Nil	C	Package-9
422.640	423.350	0.710	Nil	3.75	B2	Package-9
423.350	423.370	0.020	Nil	Nil	C	Package-9
423.370	428.350	4.980	3.75	Nil	B1	Package-9
428.350	428.750	0.400	7.00	Nil	A1	Package-9
428.750	429.120	0.370	3.75	Nil	B1	Package-9
429.120	430.000	0.880	3.75	3.75	B3	Package-9
430.000	431.017	1.017	3.75	Nil	B1	Package-9
431.017	431.140	0.123	3.75	3.75	B3	Package-9
431.140	431.540	0.400	7.00	3.75	D	Package-9
431.540	432.750	1.210	3.75	3.75	B3	Package-9
432.750	433.410	0.660	3.75	Nil	B1	Package-9
433.410	433.810	0.400	7.00	Nil	A1	Package-9
433.810	435.840	2.030	3.75	Nil	B1	Package-9
435.840	436.240	0.400	7.00	Nil	A1	Package-9
436.240	438.770	2.530	3.75	Nil	B1	Package-9
438.770	439.280	0.510	3.75	3.75	B3	Package-9
439.280	440.360	1.080	3.75	Nil	B1	Package-9
440.360	442.785	2.425	3.75	3.75	B3	Package-9
442.785	443.760	0.975	3.75	Nil	B1	Package-9
443.760	444.520	0.760	3.75	3.75	B3	Package-9
444.520	445.000	0.480	3.75	Nil	B1	Package-9
445.000	446.625	1.625	3.75	Nil	B1	Package-10
446.625	447.870	1.245	3.75	3.75	B3	Package-10
447.870	447.980	0.110	7.00	3.75	D	Package-10
447.980	448.270	0.290	7.00	7.00	A3	Package-10

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
448.270	448.360	0.090	3.75	7.00	D	Package-10
448.360	449.940	1.580	3.75	Nil	B1	Package-10
449.940	450.410	0.470	3.75	3.75	B3	Package-10
450.410	450.530	0.120	Nil	3.75	B2	Package-10
450.530	450.930	0.400	Nil	7.00	A2	Package-10
450.930	452.010	1.080	Nil	3.75	B2	Package-10
452.010	452.410	0.400	Nil	7.00	A2	Package-10
452.410	452.580	0.170	Nil	3.75	B2	Package-10
452.580	452.980	0.400	Nil	7.00	A2	Package-10
452.980	453.075	0.095	Nil	3.75	B2	Package-10
453.075	453.490	0.415	3.75	3.75	B3	Package-10
453.490	455.030	1.540	Nil	3.75	B2	Package-10
455.030	455.240	0.210	3.75	3.75	B3	Package-10
455.240	456.900	1.660	Nil	3.75	B2	Package-10
456.900	457.300	0.400	Nil	7.00	A2	Package-10
457.300	457.500	0.200	Nil	3.75	B2	Package-10
457.500	458.120	0.620	3.75	3.75	B3	Package-10
458.120	458.750	0.630	Nil	3.75	B2	Package-10
458.750	459.150	0.400	Nil	7.00	A2	Package-10
459.150	459.540	0.390	Nil	3.75	B2	Package-10
459.540	459.940	0.400	Nil	7.00	A2	Package-10
459.940	462.630	2.690	Nil	3.75	B2	Package-10
462.630	463.210	0.580	3.75	3.75	B3	Package-10
463.210	463.370	0.160	Nil	3.75	B2	Package-10
463.370	463.770	0.400	Nil	7.00	A2	Package-10
463.770	464.190	0.420	Nil	3.75	B2	Package-10
464.190	464.730	0.540	3.75	3.75	B3	Package-10
464.730	465.290	0.560	Nil	3.75	B2	Package-10
465.290	465.800	0.510	3.75	3.75	B3	Package-10
465.800	466.180	0.380	Nil	3.75	B2	Package-10
466.180	466.900	0.720	3.75	3.75	B3	Package-10
466.900	466.990	0.090	Nil	3.75	B2	Package-10
466.990	467.740	0.750	Nil	7.00	A2	Package-10
467.740	469.020	1.280	Nil	3.75	B2	Package-10
469.020	469.050	0.030	Nil	7.00	A2	Package-10
469.050	469.230	0.180	7.00	7.00	A3	Package-10

Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
469.230	469.420	0.190	Nil	7.00	A2	Package-10
469.420	470.220	0.800	Nil	3.75	B2	Package-10
470.220	470.620	0.400	Nil	7.00	A2	Package-10
470.620	472.680	2.060	Nil	3.75	B2	Package-10
472.680	472.990	0.310	3.75	3.75	B3	Package-10
472.990	476.830	3.840	Nil	3.75	B2	Package-10
476.830	477.230	0.400	Nil	7.00	A2	Package-10
477.230	478.510	1.280	Nil	3.75	B2	Package-10
478.510	478.760	0.250	3.75	3.75	B3	Package-10
478.760	479.290	0.530	Nil	3.75	B2	Package-10
479.290	480.200	0.910	3.75	3.75	B3	Package-10
480.200	480.600	0.400	3.75	7.00	D	Package-10
480.600	480.700	0.100	3.75	3.75	B3	Package-10
480.700	482.110	1.410	Nil	3.75	B2	Package-10
482.110	482.510	0.400	Nil	7.00	A2	Package-10
482.510	482.670	0.160	Nil	3.75	B2	Package-10
482.670	482.690	0.020	Nil	7.00	A2	Package-10
482.690	483.230	0.540	3.75	7.00	D	Package-10
483.230	483.810	0.580	Nil	7.00	A2	Package-10
483.810	484.350	0.540	3.75	7.00	D	Package-10
484.350	486.073	1.723	3.75	Nil	B1	Package-10
486.073	487.479	1.406	3.75	3.75	B3	Package-10
487.479	487.879	0.400	7.00	7.00	A3	Package-10
487.879	489.264	1.385	3.75	3.75	B3	Package-10
489.264	489.664	0.400	7.00	7.00	A3	Package-10
489.664	491.900	2.236	3.75	3.75	B3	Package-10
491.900	492.266	0.366	3.75	Nil	B1	Package-10
492.266	492.666	0.400	7.00	Nil	A1	Package-10
492.666	492.840	0.174	3.75	Nil	B1	Package-10
492.840	493.170	0.330	3.75	3.75	B3	Package-10
493.170	493.815	0.645	3.75	Nil	B1	Package-10
493.815	494.215	0.400	7.00	Nil	A1	Package-10
494.215	496.150	1.935	3.75	Nil	B1	Package-10
496.150	496.550	0.400	7.00	Nil	A1	Package-10
496.550	496.800	0.250	3.75	Nil	B1	Package-10
496.800	496.987	0.187	3.75	Nil	B1	Package-11

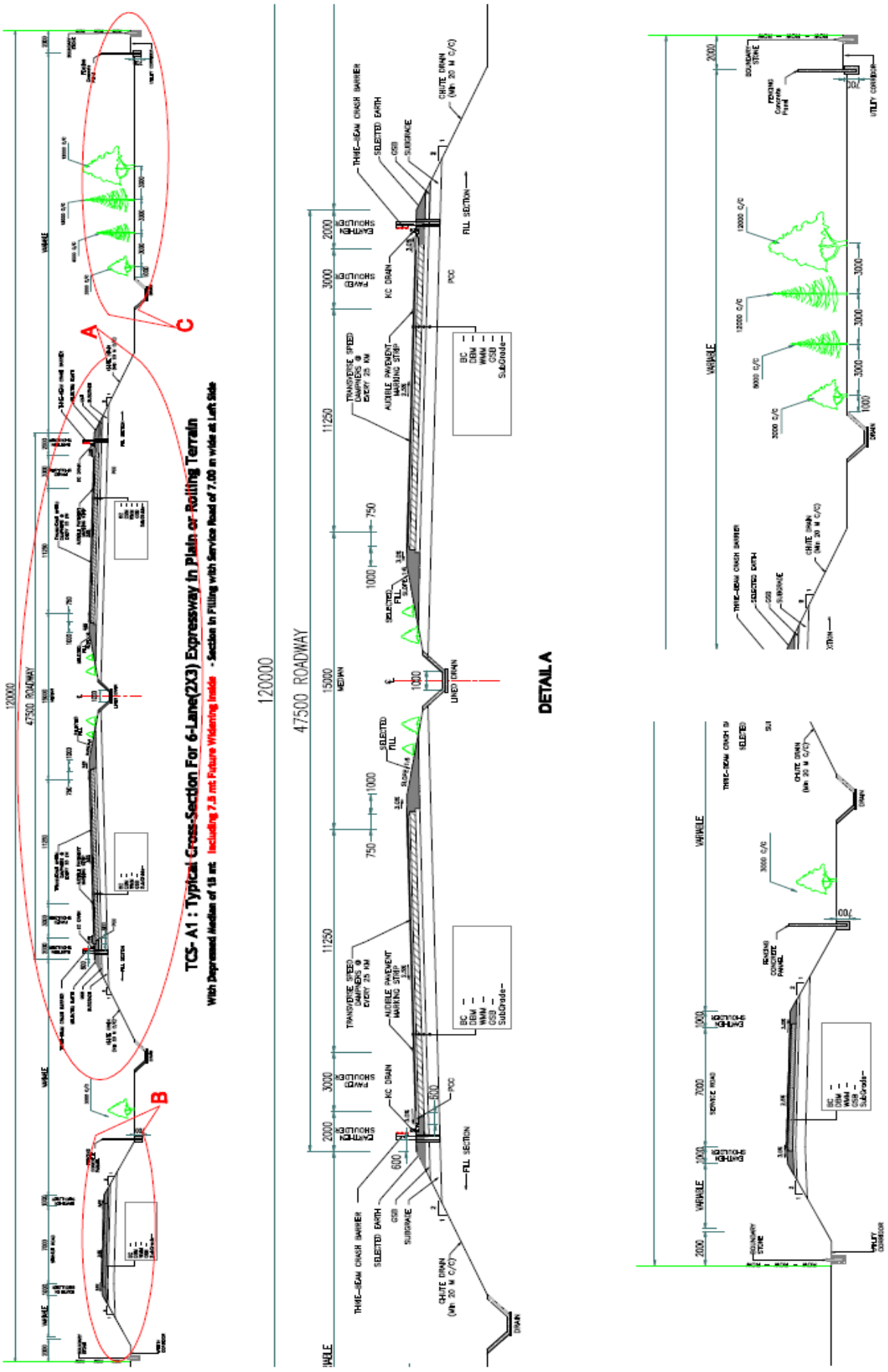
Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
496.987	497.387	0.400	7.00	Nil	A1	Package-11
497.387	497.558	0.171	3.75	Nil	B1	Package-11
497.558	497.958	0.400	7.00	Nil	A1	Package-11
497.958	499.452	1.494	3.75	Nil	B1	Package-11
499.452	499.653	0.201	7.00	Nil	B1	Package-11
499.653	499.852	0.199	7.00	3.75	D	Package-11
499.852	500.945	1.093	3.75	3.75	B3	Package-11
500.945	502.804	1.859	Nil	3.75	B2	Package-11
502.804	503.300	0.496	Nil	Nil	C	Package-11
503.300	503.960	0.660	3.75	3.75	B3	Package-11
503.960	504.090	0.130	3.75	7.00	D	Package-11
504.090	504.360	0.270	Nil	7.00	A2	Package-11
504.360	505.238	0.878	Nil	3.75	B1	Package-11
505.238	505.640	0.402	3.75	3.75	B3	Package-11
505.640	506.040	0.400	7.00	7.00	A3	Package-11
506.040	506.150	0.110	3.75	3.75	B3	Package-11
506.150	507.150	1.000	Nil	3.75	B2	Package-11
507.150	508.380	1.230	3.75	3.75	B3	Package-11
508.380	510.475	2.095	Nil	3.75	B2	Package-11
510.475	511.400	0.925	3.75	Nil	B1	Package-11
511.400	511.600	0.200	7.00	Nil	A1	Package-11
511.600	511.800	0.200	7.00	3.75	D	Package-11
511.800	511.900	0.100	3.75	3.75	B3	Package-11
511.900	512.080	0.180	3.75	Nil	B1	Package-11
512.080	512.480	0.400	7.00	Nil	A1	Package-11
512.480	515.500	3.020	3.75	Nil	B1	Package-11
515.500	517.220	1.720	Nil	Nil	C	Package-11
517.220	517.590	0.370	3.75	Nil	B1	Package-11
517.590	517.708	0.118	3.75	3.75	B3	Package-11
517.708	518.154	0.446	3.75	Nil	B1	Package-11
518.154	518.827	0.673	7.00	Nil	A1	Package-11
518.827	519.417	0.590	3.75	Nil	B1	Package-11
519.417	519.817	0.400	7.00	Nil	A1	Package-11
519.817	520.100	0.283	3.75	Nil	B1	Package-11
520.100	520.280	0.180	3.75	3.75	B3	Package-11
520.280	522.640	2.360	3.75	Nil	B1	Package-11

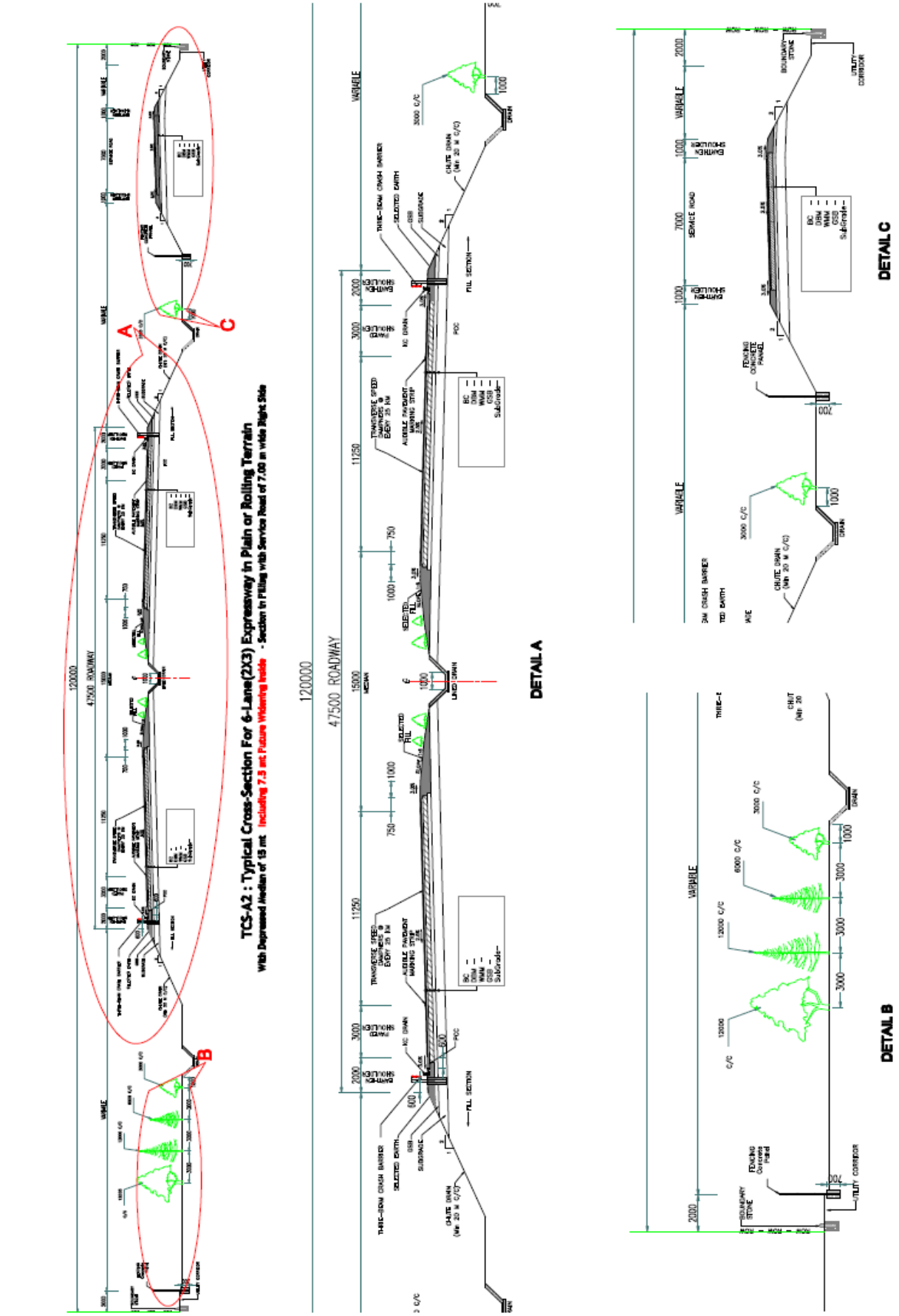
Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
522.640	523.165	0.525	3.75	3.75	B3	Package-11
523.165	523.908	0.743	Nil	3.75	B2	Package-11
523.908	524.308	0.400	Nil	7.00	A2	Package-11
524.308	526.663	2.355	Nil	3.75	B2	Package-11
526.663	527.063	0.400	Nil	7.00	A2	Package-11
527.063	527.482	0.419	Nil	3.75	B2	Package-11
527.482	527.700	0.218	Nil	7.00	A2	Package-11
527.700	527.882	0.182	3.75	7.00	D	Package-11
527.882	528.000	0.118	3.75	3.75	B3	Package-11
528.000	528.845	0.845	Nil	3.75	B2	Package-11
528.845	530.210	1.365	Nil	Nil	C	Package-11
530.210	533.237	3.027	Nil	7.00	A2	Package-11
533.237	534.130	0.893	Nil	3.75	B2	Package-11
534.130	534.445	0.315	3.75	3.75	B3	Package-11
534.445	535.400	0.955	Nil	3.75	B2	Package-11
535.400	536.125	0.725	3.75	3.75	B3	Package-11
536.125	536.525	0.400	7.00	7.00	A3	Package-11
536.525	536.880	0.355	3.75	3.75	B3	Package-11
536.880	538.170	1.290	Nil	3.75	B2	Package-11
538.170	538.942	0.772	Nil	7.00	A2	Package-11
538.942	539.545	0.603	Nil	3.75	B2	Package-11
539.545	540.365	0.820	3.75	3.75	B3	Package-11
540.365	540.905	0.540	Nil	3.75	B2	Package-11
540.905	542.015	1.110	3.75	3.75	B3	Package-11
542.015	542.342	0.327	Nil	3.75	B2	Package-11
542.342	542.742	0.400	Nil	7.00	A2	Package-11
542.742	543.000	0.258	Nil	3.75	B2	Package-11
543.000	543.333	0.333	3.75	3.75	B3	Package-11
543.333	545.860	2.527	Nil	3.75	B2	Package-11
545.860	546.260	0.400	Nil	7.00	A2	Package-11
546.260	547.500	1.240	Nil	3.75	B2	Package-11
547.500	547.900	0.400	Nil	7.00	A2	Package-11
547.900	548.800	0.900	Nil	3.75	B2	Package-11
548.800	550.655	1.855	Nil	3.75	B2	Package-12
550.655	550.865	0.210	7.00	7.00	A3	Package-12
550.865	551.055	0.190	Nil	7.00	A2	Package-12

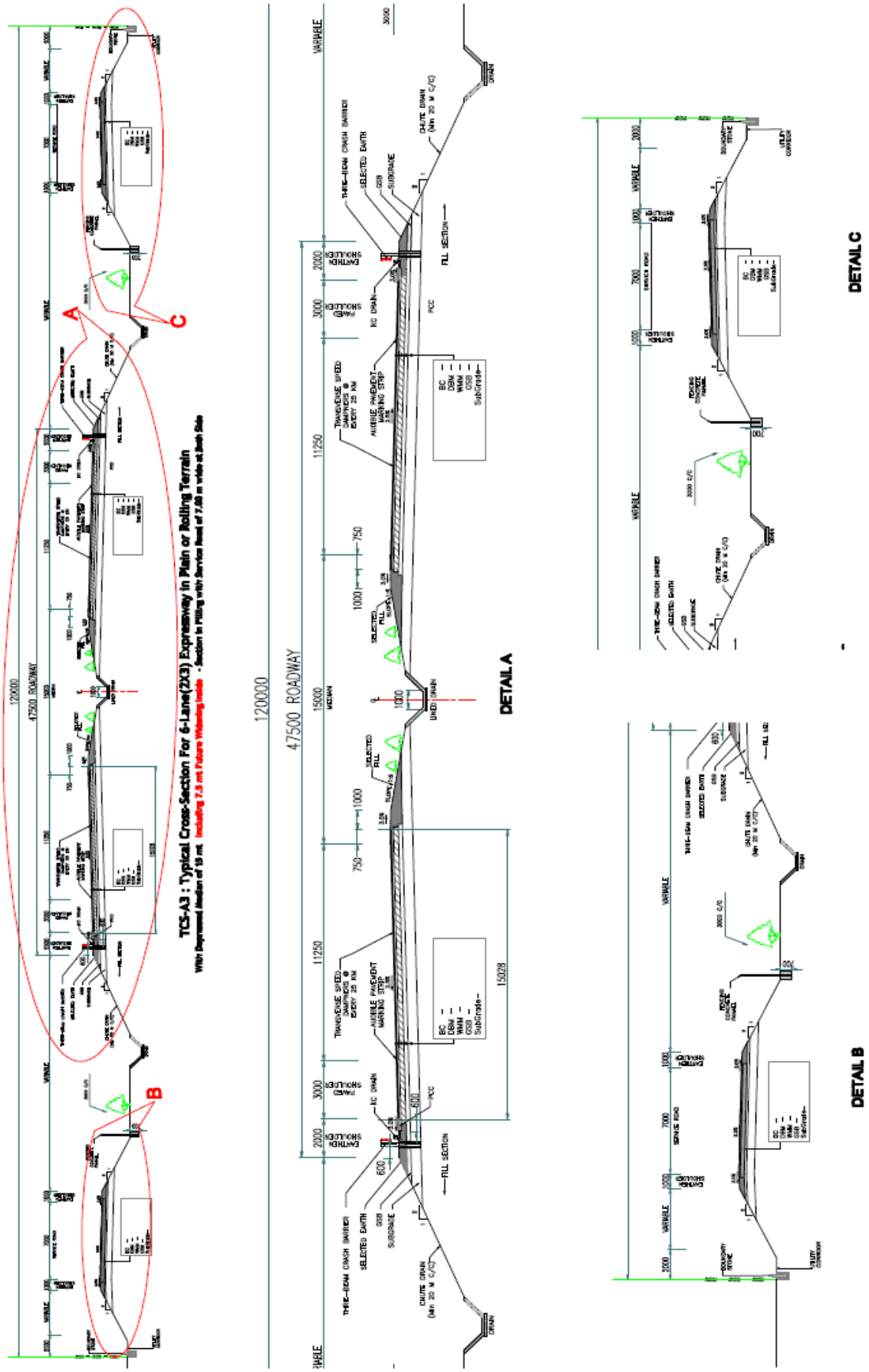
Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
551.055	552.500	1.445	Nil	3.75	B2	Package-12
552.500	552.858	0.358	3.75	3.75	B3	Package-12
552.858	554.951	2.093	Nil	3.75	B2	Package-12
554.951	555.332	0.381	7.00	3.75	D	Package-12
555.332	556.420	1.088	3.75	3.75	B3	Package-12
556.420	558.690	2.270	Nil	3.75	B2	Package-12
558.690	559.100	0.410	3.75	Nil	B1	Package-12
559.100	559.500	0.400	7.00	Nil	A1	Package-12
559.500	560.035	0.535	3.75	Nil	B1	Package-12
560.035	560.435	0.400	7.00	Nil	A1	Package-12
560.435	560.660	0.225	3.75	Nil	B1	Package-12
560.660	561.060	0.400	7.00	Nil	A1	Package-12
561.060	564.250	3.190	3.75	Nil	B1	Package-12
564.250	564.580	0.330	3.75	3.75	B3	Package-12
564.580	564.810	0.230	3.75	Nil	B1	Package-12
564.810	564.990	0.180	3.75	3.75	B3	Package-12
564.990	565.160	0.170	7.00	3.75	D	Package-12
565.160	565.390	0.230	7.00	Nil	A1	Package-12
565.390	568.750	3.360	3.75	Nil	B1	Package-12
568.750	568.900	0.150	7.00	Nil	A1	Package-12
568.900	568.950	0.050	7.00	7.00	A3	Package-12
568.950	569.150	0.200	Nil	7.00	A2	Package-12
569.150	569.352	0.202	Nil	3.75	B2	Package-12
569.352	569.752	0.400	Nil	7.00	A2	Package-12
569.752	575.181	5.429	Nil	3.75	B2	Package-12
575.181	575.370	0.189	Nil	7.00	A1	Package-12
575.370	575.581	0.211	7.00	7.00	A3	Package-12
575.581	575.992	0.411	3.75	3.75	B3	Package-12
575.992	578.947	2.955	Nil	3.75	B2	Package-12
578.947	579.347	0.400	Nil	7.00	A2	Package-12
579.347	580.440	1.093	Nil	3.75	B2	Package-12
580.440	580.590	0.150	3.75	3.75	B3	Package-12
580.590	581.778	1.188	3.75	Nil	B1	Package-12
581.778	582.178	0.400	7.00	Nil	A1	Package-12
582.178	584.580	2.402	3.75	Nil	B1	Package-12
584.580	585.485	0.905	3.75	3.75	B3	Package-12

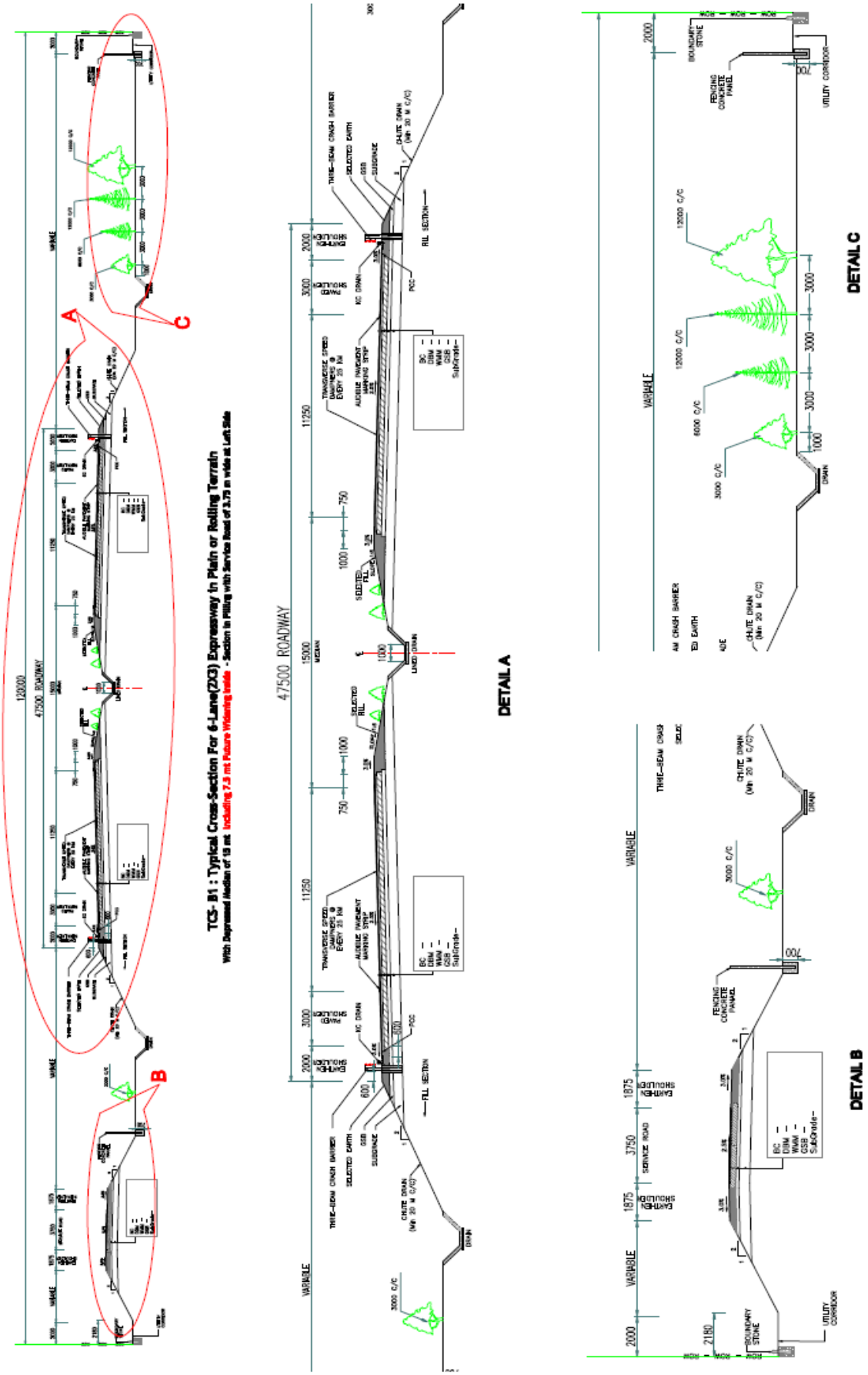
Chainage		Length (Km)	Service Road Width (Km)		Type of C/S	Package No.
From	To		LHS	RHS		
585.485	586.400	0.915	Nil	3.75	B2	Package-12
586.400	587.280	0.880	3.75	3.75	B3	Package-12
587.280	587.310	0.030	3.75	Nil	B1	Package-12
587.310	587.615	0.305	Nil	Nil	C	Package-12
587.615	589.210	1.595	3.75	Nil	B1	Package-12
589.210	589.690	0.480	3.75	3.75	B3	Package-12
589.690	590.725	1.035	3.75	Nil	B1	Package-12
590.725	591.125	0.400	7.00	Nil	A1	Package-12
591.125	591.825	0.700	3.75	Nil	B1	Package-12
591.825	592.325	0.500	7.00	Nil	A1	Package-12
592.325	592.480	0.155	3.75	Nil	B1	Package-12
592.480	592.604	0.124	3.75	3.75	B3	Package-12
592.604	593.005	0.401	7.00	7.00	A3	Package-12
593.005	594.140	1.135	3.75	Nil	B1	Package-12
594.140	594.810	0.670	7.00	Nil	A1	Package-12
594.810	594.970	0.160	3.75	Nil	B1	Package-12
594.970	595.500	0.530	3.75	3.75	B3	Package-12
595.500	596.202	0.702	3.75	Nil	B1	Package-12
596.202	596.602	0.400	7.00	Nil	A1	Package-12
596.602	596.650	0.048	3.75	Nil	B1	Package-12
596.650	597.045	0.395	3.75	3.75	B3	Package-12
597.045	599.000	1.955	3.75	Nil	B1	Package-12
599.000	599.100	0.100	3.75	3.75	B3	Package-12
599.100	599.700	0.600	3.75	Nil	B1	Package-12
599.700	600.100	0.400	3.75	3.75	B3	Package-12
600.100	600.233	0.133	3.75	Nil	B3	Package-12
600.233	601.847	1.614	Nil	Nil	R	Package-12

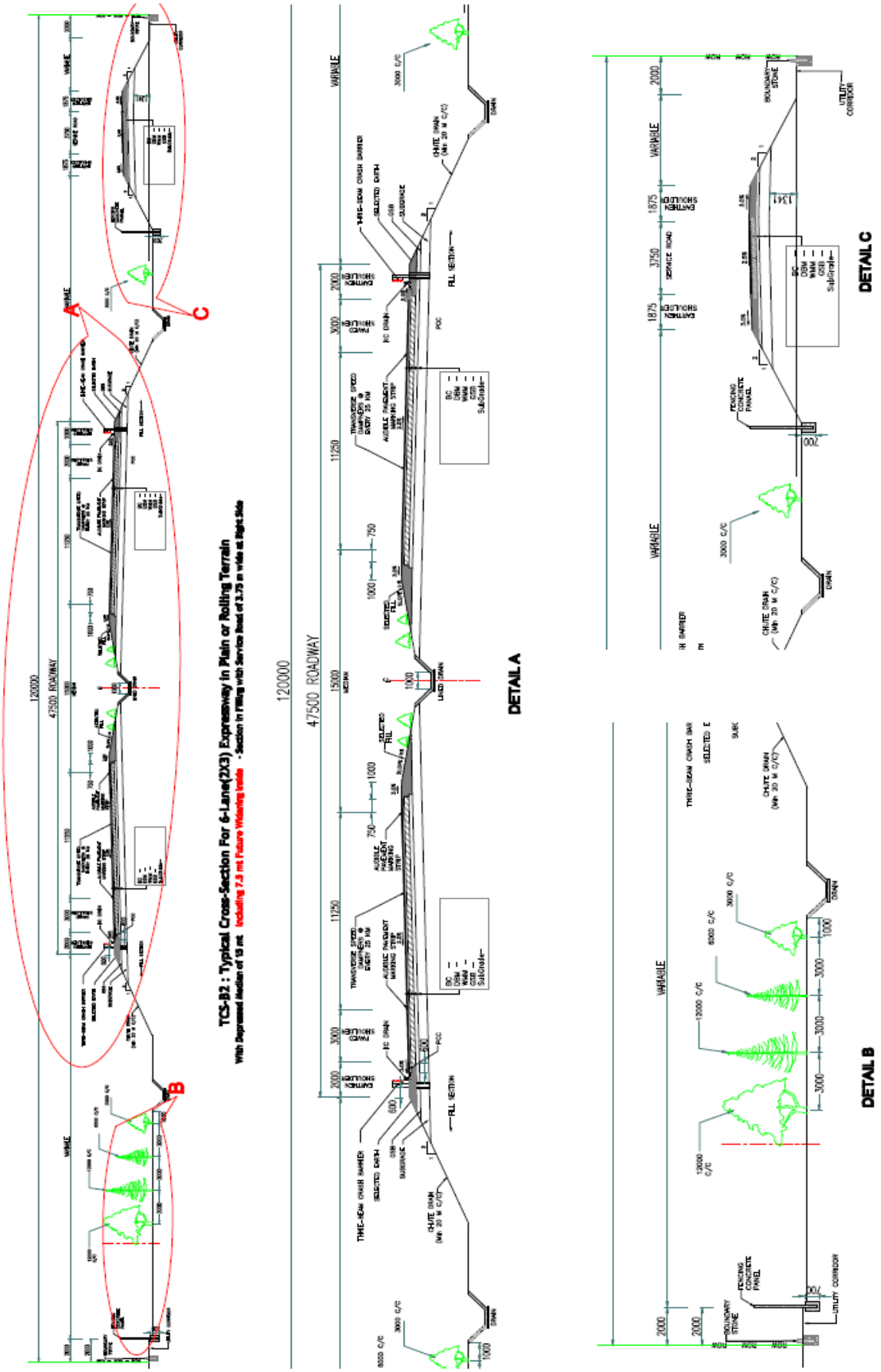
Typical cross-sections mentioned in the above table have been attached below:

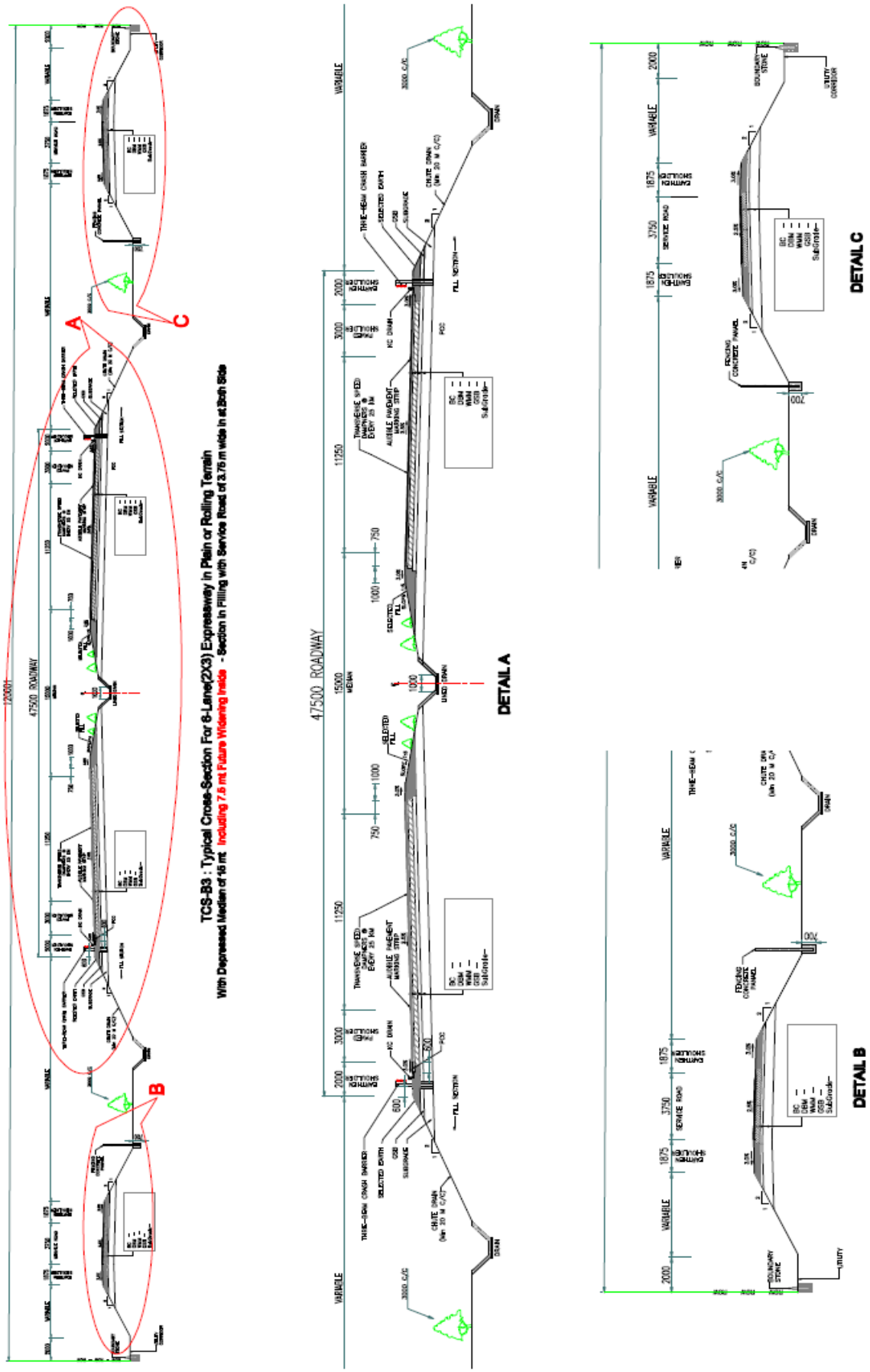

TCS- A1 : Typical Cross-Section For 6-Lane(2X3) Expressway In Plain or Rolling Terrain
With Depressed Median of 18 mt Including 7.5 mt Future Widening Inside - Section In Filling with Service Road of 7.00 m wide at Left Side
120000
47500 ROADWAY
A
B
C
DETAIL A
FILL SECTION
CHUTE DRAIN
THRIE-BEAM CRASH BARRIER
SELECTED EARTH
GSB
SUBGRADE
PAVED SHOULDER
EARTHEN SHOULDER
MEDIAN
UNDIVIDED
VARIABLE
SERVICE ROAD
BOUNDARY STONE
UTILITY CORRIDOR

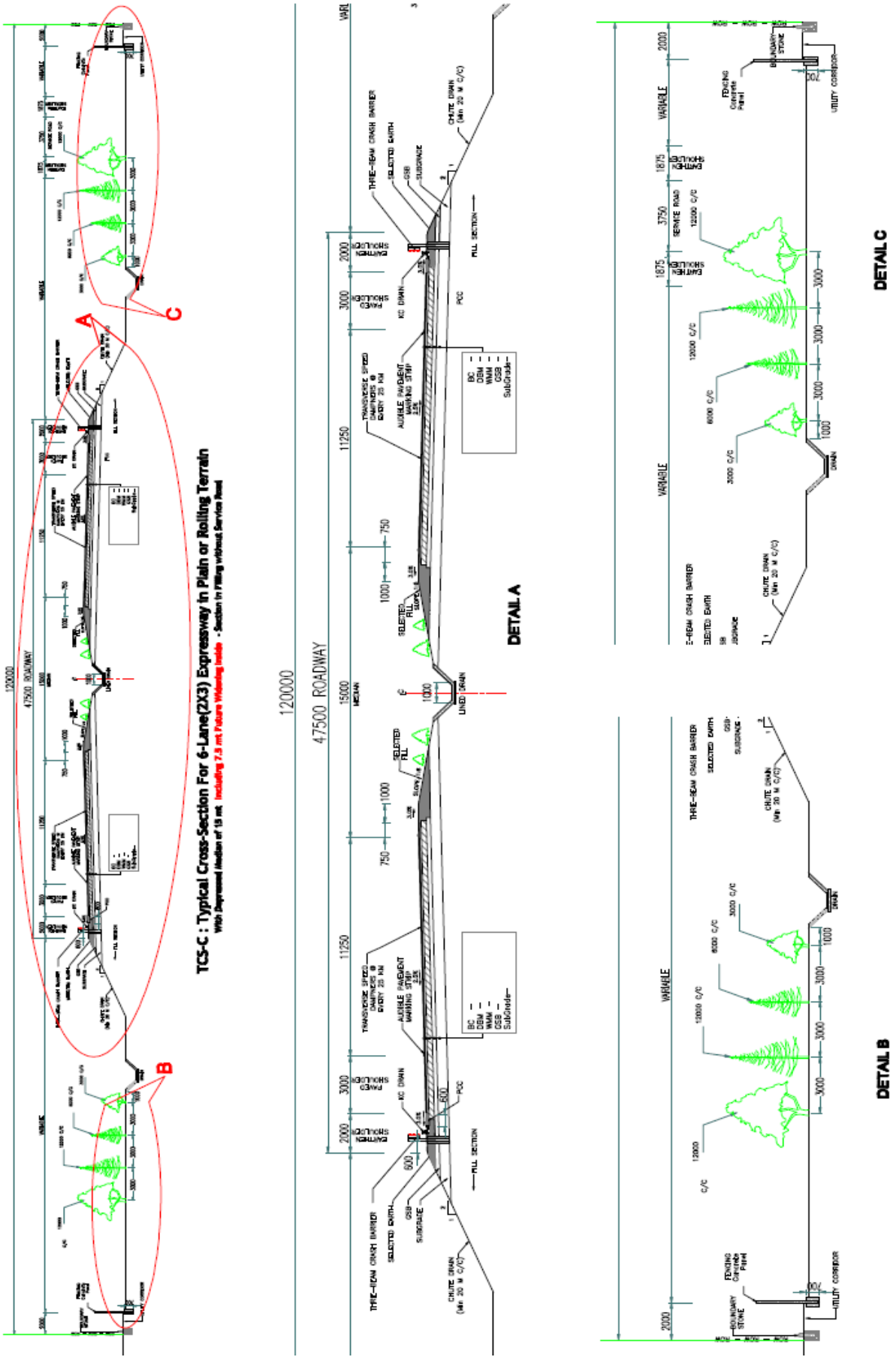

TCS-A2 : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
With Depressed Median of 15 mt Including 7.5 mt Future Widening Inside - Section in Filling with Service Road of 7.00 m wide Right Side
120000
47500 ROADWAY
VARIABLE
A
B
C
DETAIL A
DETAIL B
DETAIL C

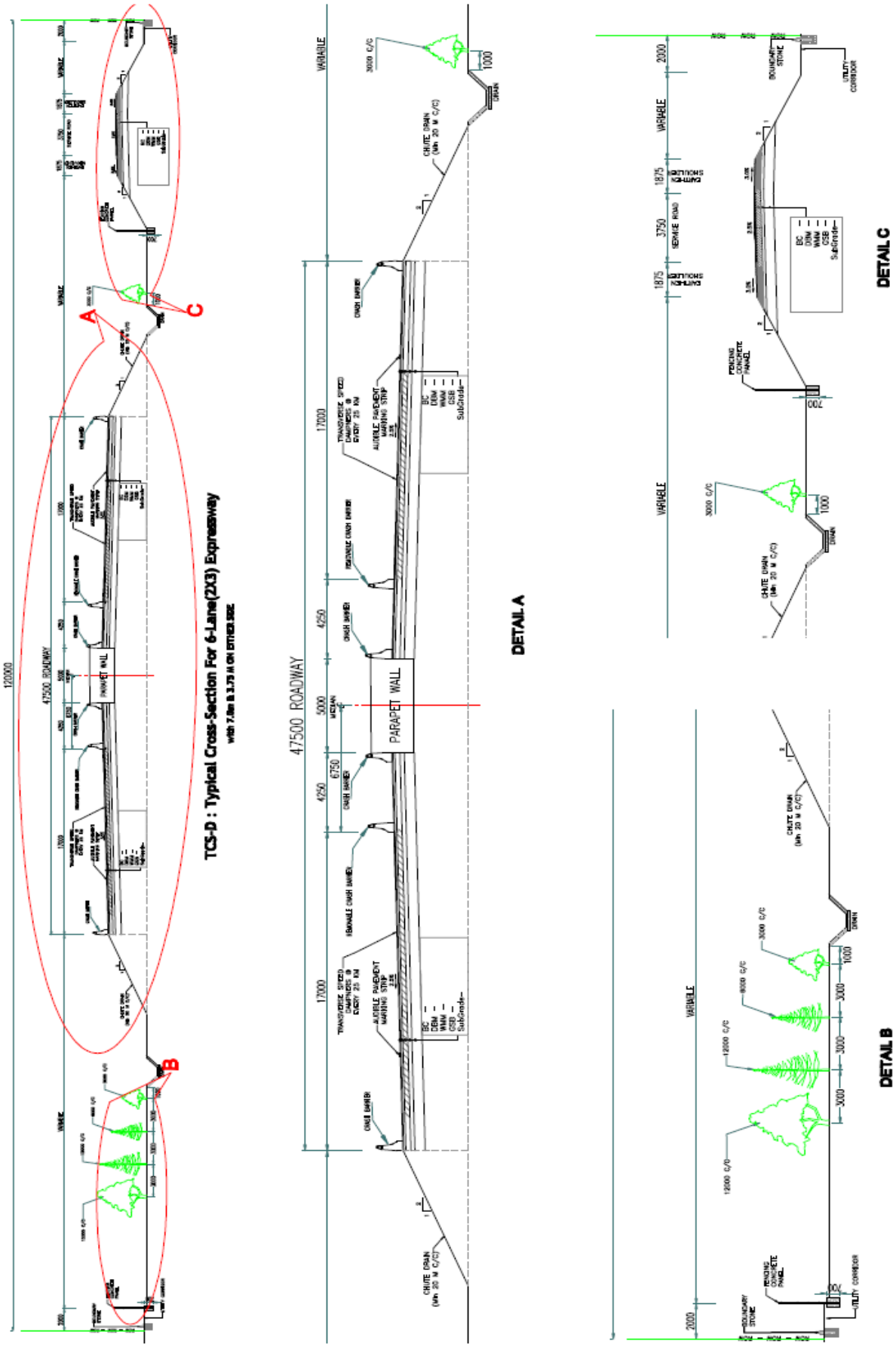

TCS-A3 : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
47500 ROADWAY
120000
DETAIL A
DETAIL B
DETAIL C
A
B
C

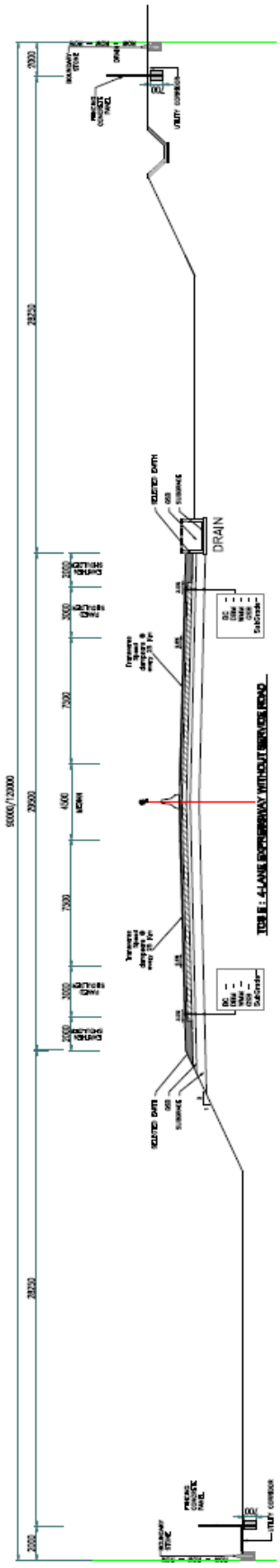

TCS- B1 : Typical Cross-Section For 6-Lane(ZX3) Expressway In Plain or Rolling Terrain
With Depressed Median of 18 mt. Including 7.5 mt. Future Widening Width - Section in Filling with Service Road of 3.75 m wide at Left Side
47500 ROADWAY
12000
DETAIL A
DETAIL B
DETAIL C
VARIABLE
SERVICE ROAD
EARTHEN SHOULDER
FENCING CONCRETE PANEL
UTILITY CORRIDOR
BOUNDARY STONE
CHUTE DRAIN
RIL SECTION
FILL SECTION

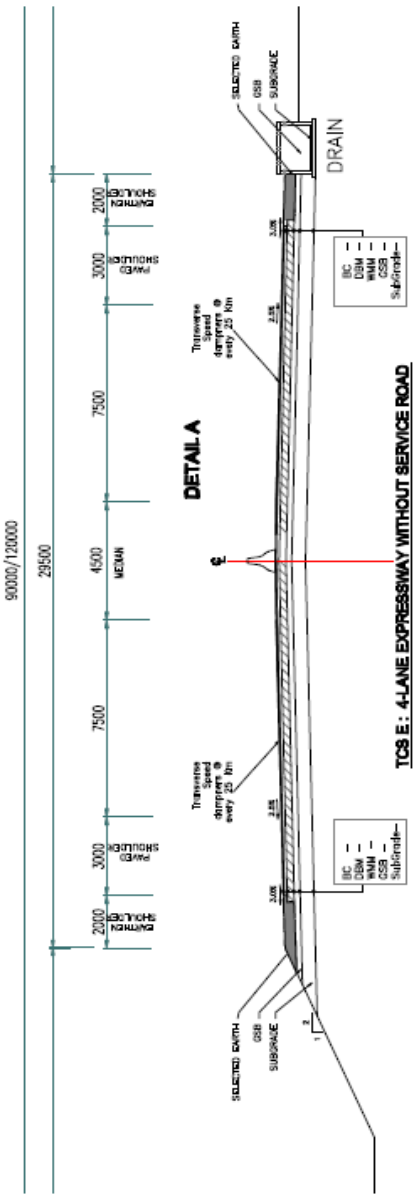

TCS-B2 : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
With Depressed Median of 13 mt Including 7.5 mt Future Widening Inside - Section in Filling with Service Road of 3.75 m wide at Right Side
120000
47500 ROADWAY
VARIABLE
A
B
C
DETAIL A
DETAIL B
DETAIL C
CHUTE DRAIN
SELECTED FILL
PCC
BC
DBM
WMM
GSB
Subbase

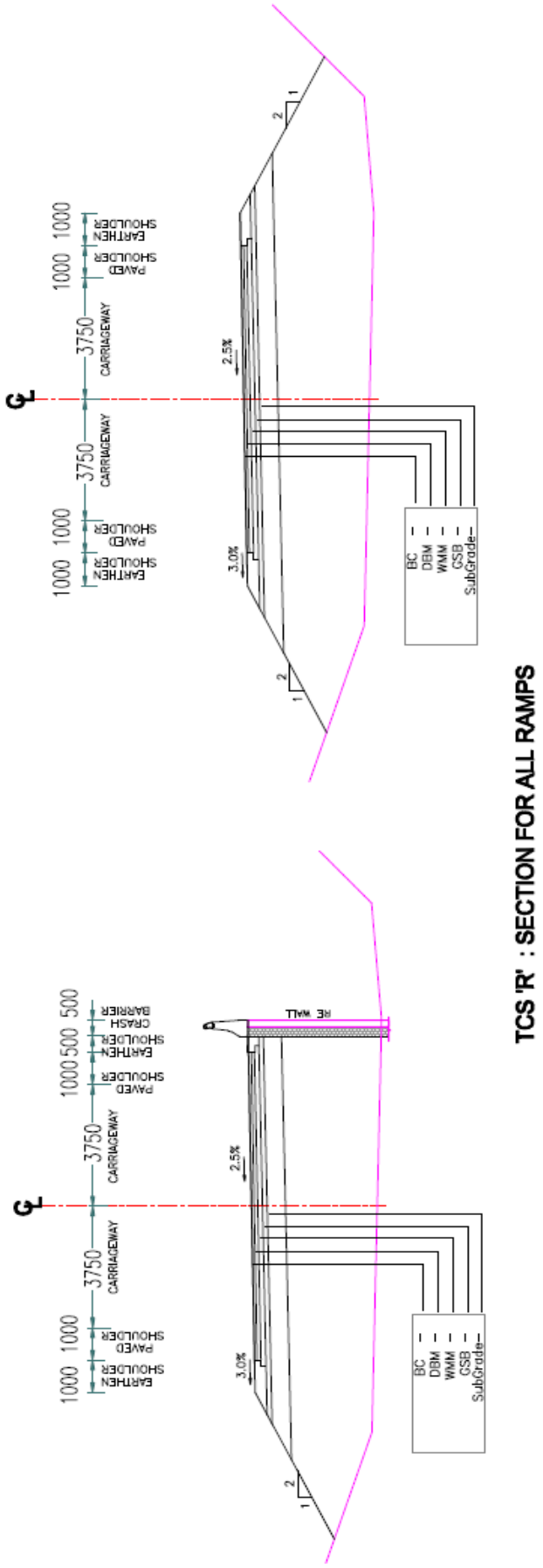

TCS-B3 : Typical Cross-Section For 6-Lane(2X3) Expressway in Plain or Rolling Terrain
With Depressed Median of 16 mt. Including 7.5 mt Future Widening Inside - Section in Filling with Service Road of 3.75 m wide in at Both Side
47500 ROADWAY
DETAIL A
DETAIL B
DETAIL C


TCS-C : Typical Cross-Section For 6-Lane(2X3) Expressway In Plain or Rolling Terrain
With Depressed Median of 19 mt. Including 7.5 mt Future Widening Inside - Section In Filling without Service Road
120000
47500 ROADWAY
DETAIL A
DETAIL B
DETAIL C
A
B
C

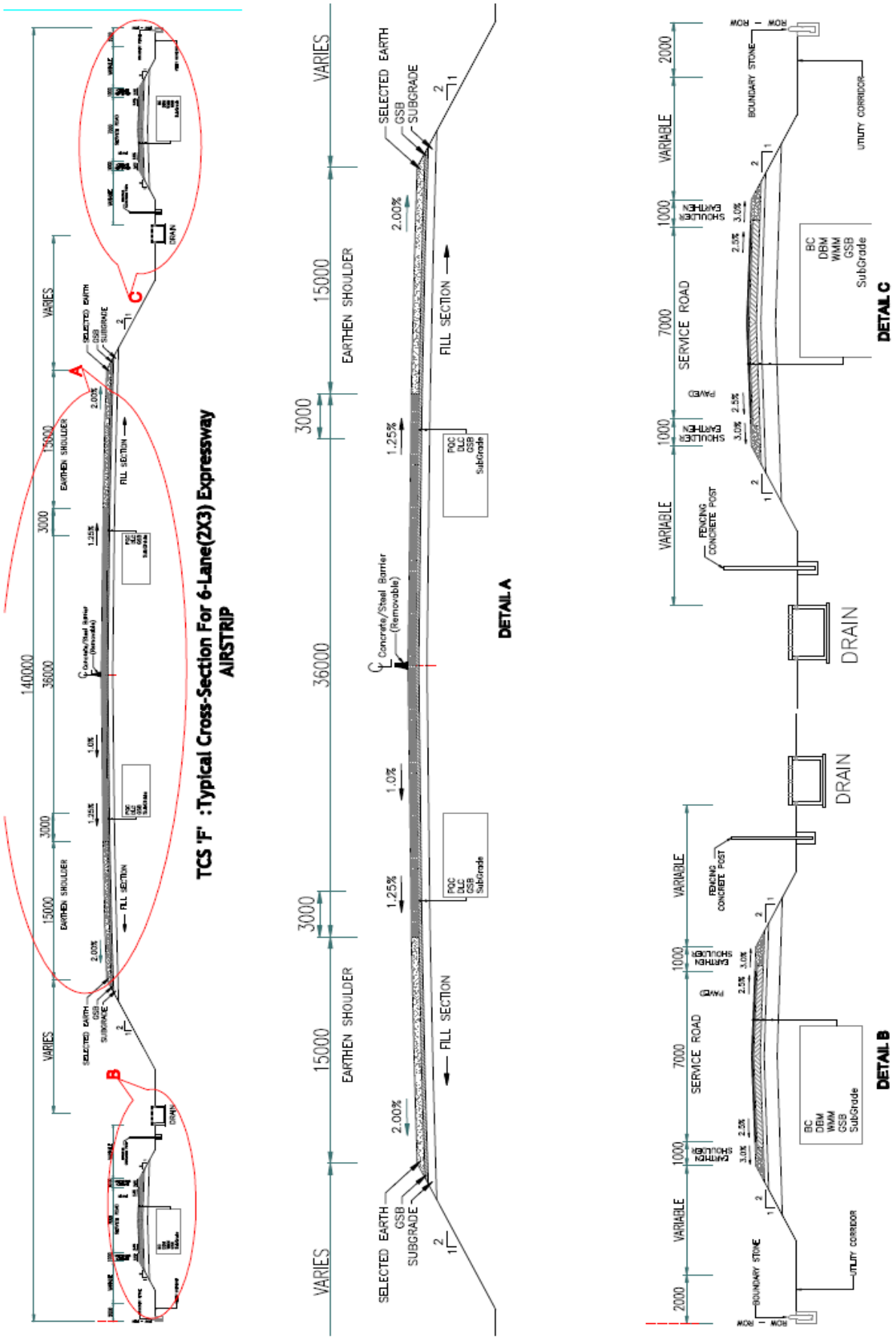

TCS-D : Typical Cross-Section For 6-Lane(2X3) Expressway
47500 ROADWAY
PARAPET WALL
DETAIL A
DETAIL B
DETAIL C
A
B
C


DRAIN
TCS E : 4-LANE EXPRESSWAY WITHOUT SERVICE ROAD


DETAIL A
DRAIN
TCS E : 4-LANE EXPRESSWAY WITHOUT SERVICE ROAD



TCS 'R' : SECTION FOR ALL RAMPS


TCS 'F' :Typical Cross-Section For 6-Lane(2X3) Expressway
AIRSTRIP
1400000
VARIES
15000
EARTHEN SHOULDER
3000
36000
FILL SECTION
SELECTED EARTH
GSB
SUBGRADE
DETAIL A
DETAIL B
DETAIL C
VARIABLE
SERVICE ROAD
DRAIN
BOUNDARY STONE
UTILITY CORRIDOR
FENCING CONCRETE POST
BC
DBM
WMM
GSB
SubGrade

5.4 HORIZONTAL DESIGN & VERTICAL DESIGN

The proposed expressway passes mainly through plain terrain. The design standard for plain terrain is adopted for entire expressway. The minimum radius of horizontal curve adopted for the expressway is desirable minimum radius (1000m). Wherever possible, higher radii have been adopted. Horizontal alignment is designed as such to avoid all constraints and have curvilinear alignment to the maximum extend. The horizontal curves with radius of curvature < 4000 m, transition curves are provided on both ends of circular curve. Package wise details of horizontal curves are presented in **Tables-5.3.1 to 5.3.12** below:

Table-5.3.1 Horizontal Curve Report (Package-1)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Superelevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
1	328	52	14.3	Arc	8885.387	12317.845	3432.458	99 23 41.1	Right	120	5000	2.50%
1	328	52	14.3	Straight	12317.845	13367.838	1049.993	138 43 40.1	Right	120		2.50%
2	350	36	20	Arc	13367.838	17714.316	4346.478	138 43 40.1	Left	120	-8000	2.50%
2	350	36	20	Straight	17714.316	21306.689	3592.373	107 35 54.4	Left	120		2.50%
3	64	1	13.1	Arc	21306.689	22618.401	1311.712	107 35 54.4	Left	120	-8000	2.50%
3	64	1	13.1	Straight	22618.401	27547.137	4928.736	98 12 14.4	Left	120		2.50%
4	351	7	15.2	Arc	27547.137	33133.962	5586.825	98 12 14.4	Right	120	5000	2.50%
4	351	7	15.2	Straight	33133.962	34454.452	1320.490	162 13 27.5	Right	120		2.50%
5	40	21	20.5	Arc	34454.452	35074.332	619.880	162 13 27.5	Left	120	-4000	2.50%
5	40	21	20.5	Straight	35074.332	36243.018	1168.686	153 20 42.7	Left	120		2.50%
6	44	17	46	Transition	36243.018	36493.018	250.000	153 20 42.7	Left	120		2.50%
6	356	13	28.4	Arc	36493.018	37651.698	1158.680	93 24 7.8	Right	120	2000	2.50%
6	356	13	28.4	Transition	37651.698	37901.698	250.000	144 14 58.3	Right	120		2.50%
7	13	28	38.9	Straight	37901.698	38605.266	703.568	193 42 3.2	Right	120		2.50%
7	249	13	18	Arc	38605.266	39593.672	988.406	193 42 3.2	Left	120	-15000	2.50%
7	249	13	18	Straight	39593.672	41076.476	1482.804	189 55 31.7	Left	120		2.50%
7				Transition	41076.476	41296.476	220.000	189 55 31.7				
8	0	0	0	Arc	41296.476	45330.058	4033.582		Left		-2200	
8	0	0	0	Transition	45330.058	45550.058	220.000		Left			
8				Straight	45550.058	47115.342	1565.284	79 8 49.7				
9	328	52	14.3	Start	47115.34	47183.637	68.297	99 23 41.1	Right	120		2.50%
9	5	9	16.9	Arc	47183.637	47903.369	719.732	138 43 40.1	Right	120	8000	2.500%
9	5			Straight	47903.369	49487.507	1584.138	84 18 6.6				
10	356	48	42.8	Arc	49487.507	50322.156	834.649		Left	120	-15000	2.50%

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Superelevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
10	356			Straight	50322.156	52198.763	1876.607	81 6 49.3				
11	21	0	5.4	Arc	52198.763	55131.127	2932.364		Right	120	8000	2.500%
11	21			Straight	55131.127	57015.147	1884.020	102 6 54.8				
					57015.147						10000	

Table-5.3.2 Horizontal Curve Report (Package-2)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Superelevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
1	339	18	8.6	Arc	57015.147	58455.473	1440.326		Right	120	10000	2.50%
1	356	35	31.3	Straight	58455.473	61403.513	2948.040	110 22 3.6	Left	120		2.50%
2	2	41	58.8	Arc	61403.513	64293.446	2889.933	137 38 2.9	Left	120	-8000	2.50%
2	29	56	31.3	Straight	64293.446	67806.353	3512.907	89 40 12.2	Right	120		2.50%
3	355	59	43.3	Arc	67806.353	68277.534	471.181	167 34 34.2	Right	120	10000	2.50%
3	330	44	36	Straight	68277.534	69055.484	777.950	92 22 11	Left	120		2.50%
4	22	51	38.2	Arc	69055.484	69754.425	698.941	138 19 10.2	Left	120	-10000	2.50%
4	358	23	43.3	Straight	69754.425	71017.137	1262.712	88 21 54.3	Left	120		2.50%
5	342	10	35.3	Arc	71017.137	73411.094	2393.957	136 42 53.4	Right	120	6000	2.50%
5	5	0	2.1	Straight	73411.094	75033.879	1622.785	111 13 32.5	Right	120		2.50%
6	44	17	46	Arc	75033.879	76278.197	1244.318	141 42 55.5	Left	120	-4000	2.50%
6	2	32	2.8	Straight	76278.197	78161.575	1883.378	93 24 7.8	Right	120		2.50%
7	0	0	0	Arc	78161.575	84346.480	6184.905	144 14 58.3	Right	120	8000	2.50%
7	13	28	38.9	Straight	84346.48	86900.000	2553.520	137 41 53.8	Right	120		2.50%
7	300	16	22.2	Straight	86900	315735.740	2025.223	157 43 37.2	Left	120	INFINITY	2.50%

Table-5.3.3 Horizontal Curve Report (Package-3)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	84346.481	87319.979	2973.498					
1	4	29	35.8	Arc	87319.979	88496.313	1176.334		Right	120	15000	2.50%
				Straight	88496.313	90824.127	2327.814	142 11 29.6				
2	329	1	18.5	Arc	90824.127	92986.813	2162.686		Left	120	-4000	2.50%
				Straight	92986.813	96120.295	3133.482	111 12 48.1				
3	20	38	5.6	Arc	96120.295	99001.470	2881.175		Right	120	8000	2.50%
				Straight	99001.47	102501.409	3499.939	131 50 53.7				
4	33	16	44.1	Arc	102501.41	104824.715	2323.306		Right	120	4000	2.50%
				Straight	104824.72	105987.168	1162.453	165 7 37.8				
5	347	48	13.7	Arc	105987.17	107690.077	1702.909		Left	120	-8000	2.50%
				Straight	107690.08	109919.608	2229.531	152 55 51.5				
6	314	24	53.6	Arc	109919.61	113897.659	3978.051		Left	120	-5000	2.50%
				Straight	113897.66	116325.115	2427.456	107 20 45.1				
7	23	56	52.1	Arc	116325.12	120922.763	4597.648		Right	120	11000	2.50%
				Straight	120922.76	123997.891	3075.128	131 17 37.2				
8	349	19	58.8	Arc	123997.89	125673.458	1675.567		Left	120	-9000	2.50%
				Straight	125673.46	127469.991	1796.533	120 37 36.1				
9	18	37	19.6	Arc	127469.99	130070.129	2600.138		Right	120	8000	2.50%
				Straight	130070.13	131903.586	1833.457	139 14 55.7				
10	330	1	46.4	Arc	131903.59	136088.248	4184.662		Left	120	-8000	2.50%
				Straight	136088.25	137859.550	1771.302	109 16 42.1				
					137859.55						INFINITY	

Table-5.3.4 Horizontal Curve Report (Package-4)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	136900	137859.550	959.550					
1	16	32	13.4	Arc	137859.55	141900.317	4040.767		Right	120	14000	2.50%
				Straight	141900.32	144943.285	3042.968	125 48 55.5				
2	15	55	3.1	Arc	144943.29	147165.793	2222.508		Right	120	8000	2.50%
				Straight	147165.79	149969.206	2803.413	141 43 58.7				
3	326	30	45.2	Arc	149969.21	152307.070	2337.864		Left	120	-4000	2.50%
				Straight	152307.07	154648.257	2341.187	108 14 43.9				
4	357	27	10.3	Arc	154648.26	155315.094	666.837		Left	120	-15000	2.50%
				Straight	155315.09	157897.091	2581.997	105 41 54.2				
5	40	41	12.8	Arc	157897.09	160737.571	2840.480		Right	120	4000	2.50%
				Straight	160737.57	163627.043	2889.472	146 23 7				
6	358	29	14.2	Arc	163627.04	164023.072	396.029		Left	120	-15000	2.50%
				Straight	164023.07	166994.112	2971.040	144 52 21.2				
7	305	54	41.4	Arc	166994.11	170770.202	3776.090		Left	120	-4000	2.50%
				Straight	170770.2	173178.930	2408.728	90 47 2.6				
8	24	50	56.9	Arc	173178.93	176648.525	3469.595		Right	120	8000	2.50%
				Straight	176648.53	180073.076	3424.551	115 37 59.5				
9	346	17	28.5	Arc	180073.08	182465.704	2392.628		Left	120	-10000	2.50%
				Straight	182465.7	185115.905	2650.201	101 55 28				
10	23	13	5.8	Arc	185115.91	186736.845	1620.940		Right	120	4000	2.50%
				Straight	186736.85	189522.035	2785.190	125 8 33.8				
				Transition	189522.04	189722.035	200.000					
11	27	5	31.5	Arc	189722.04	190704.150	982.115		Right	120	2500	4.54%
				Transition	190704.15	190904.150	200.000					
				Straight	190904.15	192500.000	1595.850	152 14 5.2				
					192500						INFINITY	

Table-5.3.5 Horizontal Curve Report (Package-5)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	186736.845	189522.035	2785.190					
1	15	2	53.4	Transition	189522.035	189722.035	200.000		Right	120		
1	27	5	31.5	Arc	189722.035	190704.149	982.114	138 50 46.3	Right	120	2500	2.50%
2	355	38	38.3	Transition	190704.149	190904.149	200.000		Left	120		
				Straight	190904.149	194291.817	3387.668	152 14 5.2				
2	320	59	4.9	Arc	194291.817	198377.490	4085.673		Left	120	-6000	2.50%
				Straight	198377.49	200515.340	2137.850	113 13 10.1				
3	6	26	30.7	Arc	200515.34	201639.659	1124.319		Right	120	10000	2.50%
				Straight	201639.659	204653.673	3014.014	119 39 40.9				
4	7	46	36.6	Arc	204653.673	205875.255	1221.582		Right	120	9000	2.50%
				Straight	205875.255	207535.629	1660.374	127 26 17.5				
5	21	15	21.6	Arc	207535.629	210503.527	2967.898		Right	120	8000	2.50%
6	41	21	14.2	Straight	210503.527	211777.687	1274.160	148 41 39.1	Right	120		
6	328	55	36.3	Arc	211777.687	213947.009	2169.322		Left	120	-4000	2.50%
				Straight	213947.009	215308.860	1361.851	117 37 15.4				
7	4	12	12.1	Arc	215308.86	216776.106	1467.246		Right	120	20000	2.50%
				Straight	216776.106	219494.047	2717.941	121 49 27.5				
8	358	53	6.1	Arc	219494.047	219883.246	389.199		Left	120	-20000	2.50%
				Straight	219883.246	222196.593	2313.347	120 42 33.6				
9	46	51	22.6	Arc	222196.593	225467.777	3271.184		Right	120	4000	2.50%
				Straight	225467.777	226940.241	1472.464	167 33 56.1				
10	347	22	1	Arc	226940.241	228704.147	1763.906		Left	120	-8000	2.50%
				Straight	228704.147	230727.033	2022.886	154 55 57.2				
11	322	45	32.8	Arc	230727.033	233976.913	3249.880		Left	120	-5000	2.50%
				Straight	233976.913	235859.344	1882.431	117 41 30				
12	357	58	19.8	Arc	235859.344	236567.191	707.847		Left	120	-20000	2.50%
				Straight	236567.191	238542.260	1975.069	115 39 49.8				
13	309	35	23.2	Arc	238542.26	479796.349	3519.298		Left	120	INFINITY	
				Straight		483892.319	4095.970	93 16 27.4				

Table-5.3.6 Horizontal Curve Report (Package-6)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	235700	235859.344	159.344					
1	357	58	19.8	Arc	235859.344	236567.191	707.847		Left	120	-20000	2.50%
				Straight	236567.191	238542.260	1975.069	115 39 49.8				
2	20	34	57.8	Arc	238542.26	239979.205	1436.945		Right	120	4000	2.50%
2	27	28	56.4	Straight	239979.205	241405.340	1426.135	136 14 47.6	Right	120		2.50%
3	342	24	59.8	Arc	241405.34	242632.892	1227.552		Left	120	-4000	2.50%
				Straight	242632.892	248243.825	5610.933	118 39 47.4				
4	52	9	28.9	Arc	248243.825	251885.142	3641.317		Right	120	4000	2.50%
4	293	59	20.7	Straight	251885.142	253337.642	1452.500	170 49 16.3	Left	120		2.50%
5	348	56	10.4	Arc	253337.642	254110.040	772.398		Left	120	-4000	2.50%
				Straight	254110.04	256540.576	2430.536	159 45 26.6				
6	15	25	27	Arc	256540.576	258155.792	1615.216		Right	120	6000	2.50%
5	36	50	12.5	Straight	258155.792	260726.629	2570.837	175 10 53.6	Right	120		2.50%
7	2	17	35.2	Arc	260726.629	261326.966	600.337		Right	120	15000	2.50%
7	300	16	22.2	Straight	261326.966	263441.479	2114.513	177 28 28.9	Left	120		2.50%
8	340	20	39.4	Arc	263441.479	265156.764	1715.285		Left	120	-5000	2.50%
7	325	33	22.4	Straight	265156.764	268007.940	2851.176	157 49 8.3	Left	120		2.50%
9	349	35	38.9	Arc	268007.94	269824.107	1816.167		Left	120	-10000	2.50%
				Straight	269824.107	271670.107	1846.000	147 24 47.1				
10	21	22	40.6	Arc	271670.107	274655.029	2984.922		Right	120	8000	2.50%
8	74	31	56.2	Straight	274655.029	276376.979	1721.950	168 47 27.7	Right	120		2.50%
11	3	36	48.3	Arc	276376.979	277322.968	945.989		Right	120	15000	2.50%
				Straight	277322.968	280976.492	3653.524	172 24 16				
12	15	19	18.9	Arc	280976.492	282313.583	1337.091		Right	120	5000	2.50%
11	291	42	41	Straight	282313.583	283711.378	1397.795	187 43 34.9	Left	120		2.50%
13	336	54	22	Arc	283711.378	285323.635	1612.257		Left	120	-4000	2.50%
				Straight	285323.635	287021.890	1698.255	164 37 56.9				
14	336	24	34.6	Arc	287021.89	288874.675	1852.785		Left	120	-4500	2.50%
11	316	26	9.6	Straight	288874.675	289300.000	425.325	141 2 31.6	Left	120		2.50%
13	349	26	50.6	Transition	289300	590922.908	220.000		Left	120	INFINITY	2.50%
15	41	14	15.3	Arc		592142.372	1219.464	126 5 47.6	Right	120		2.50%

Table-5.3.7 Horizontal Curve Report (Package-7)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Superelevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	289300	291005.755	1705.755					
1	356	35	31.3	Arc	291005.755	291897.960	892.205		Left	120	-15000	2.50%
				Straight	291897.96	294720.419	2822.459	137 38 2.9				
2	29	56	31.3	Arc	294720.419	297333.354	2612.935		Right	120	5000	2.50%
2	27	28	56.4	Straight	297333.354	299217.460	1884.106	167 34 34.2	Right	120		2.50%
3	330	44	36	Arc	299217.46	301770.586	2553.126		Left	120	-5000	2.50%
				Straight	301770.586	304189.339	2418.753	138 19 10.2				
4	358	23	43.3	Arc	304189.339	304609.435	420.096		Left	120	-15000	2.50%
4	293	59	20.7	Straight	304609.435	306977.348	2367.913	136 42 53.4	Left	120		2.50%
5	5	0	2.1	Arc	306977.348	307850.116	872.768		Right	120	10000	2.50%
				Straight	307850.116	310044.892	2194.776	141 42 55.5				
6	2	32	2.8	Arc	310044.892	310487.178	442.286		Right	120	10000	2.50%
5	36	50	12.5	Straight	310487.178	312534.386	2047.208	144 14 58.3	Right	120		2.50%
7	13	28	38.9	Arc	312534.386	313710.517	1176.131		Right	120	5000	2.50%
7	300	16	22.2	Straight	313710.517	315735.740	2025.223	157 43 37.2	Left	120		2.50%
8	329	0	25.3	Arc	315735.74	317899.458	2163.718		Left	120	-4000	2.50%
7	325	33	22.4	Straight	317899.458	319138.757	1239.299	126 44 2.5	Left	120		2.50%
9	327	37	34.2	Arc	319138.757	321398.876	2260.119		Left	120	-4000	2.50%
				Straight	321398.876	323698.792	2299.916	94 21 36.7				
10	22	5	6.4	Arc	323698.792	326011.541	2312.749		Right	120	6000	2.50%
8	74	31	56.2	Straight	326011.541	330036.450	4024.909	116 26 43.2	Right	120		2.50%
11	45	4	59.4	Arc	330036.45	333183.848	3147.398		Right	120	4000	2.50%
				Straight	333183.848	334310.593	1126.745	161 31 42.5				
12	356	55	52.2	Arc	334310.593	334846.205	535.612		Left	120	-10000	2.50%
11	291	42	41	Straight	334846.205	336833.171	1986.966	158 27 34.7	Left	120		2.50%
13	12	40	2.1	Arc	336833.171	337938.596	1105.425		Right	120	5000	2.50%
				Straight	337938.596	340966.441	3027.845	171 7 36.8				
14	356	10	48.8	Arc	340966.441	341499.783	533.342		Left	120	-8000	2.50%
11	316	26	9.6	Straight	341499.783	341700.000	200.217	167 18 25.6	Left	120		2.50%
13	349	26	50.6	Transition	341700	590922.908	220.000		Left	120	INFINITY	2.50%

Table-5.3.8 Horizontal Curve Report (Package-8)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	341700	343692.369	1992.369					
1	340	57	37.7	Arc	343692.37	345021.579	1329.210		Left	120	-4000	-2.500%
				Straight	345021.58	346512.864	1491.285	148 16 3.2				
2	2	47	2.7	Arc	346512.86	346998.778	485.914		Right	120	10000	-2.500%
				Straight	346998.78	349584.393	2585.615	151 3 5.9				
3	357	51	59.2	Arc	349584.39	349956.770	372.377		Left	120	-10000	-2.500%
				Straight	349956.77	351508.431	1551.661	148 55 5.1				
				Transition	351508.43	351728.431	220.000					
4	293	59	20.7	Arc	351728.43	353812.647	2084.216		Left	120	-2000	-2.500%
				Transition	353812.65	354032.647	220.000					
				Straight	354032.65	355243.903	1211.256	82 54 25.8				
				Transition	355243.9	355463.903	220.000					
5	36	50	12.5	Arc	355463.9	356658.335	1194.432		Right	120	2200	-2.500%
				Transition	356658.34	356878.335	220.000					
				Straight	356878.34	360469.277	3590.942	119 44 38.2				
6	351	14	13.8	Arc	360469.28	361310.449	841.172		Left	120	-5500	-2.500%
				Straight	361310.45	365429.196	4118.747	110 58 52				
7	17	34	2.6	Arc	365429.2	368495.283	3066.087		Right	120	10000	-2.500%
				Straight	368495.28	371379.572	2884.289	128 32 54.6				
8	8	36	6.4	Arc	371379.57	372580.607	1201.035		Right	120	8000	-2.500%
				Straight	372580.61	374744.190	2163.583	137 9 1				
9	20	41	46.7	Arc	374744.19	377633.937	2889.747		Right	120	8000	-2.500%
				Straight	377633.94	379161.033	1527.096	157 50 47.7				
10	354	1	4.9	Arc	379161.03	379787.464	626.431		Left	120	-6000	-2.500%
				Straight	379787.46	381341.231	1553.767	151 51 52.6				
11	20	58	49.8	Arc	381341.23	382805.946	1464.715		Right	120	4000	-2.500%
				Straight	382805.95	384863.243	2057.297	172 50 42.3				
12	357	33	22.2	Arc	384863.24	385503.035	639.792		Left	120	-15000	-2.500%
				Straight	385503.04	387241.025	1737.990	170 24 4.6				
13	349	26	50.6	Arc	387241.03	389082.803	1841.778		Left	120	-10000	-2.500%
				Straight	389082.8	390595.288	1512.485	159 50 55.2				
14	5	22	21	Arc	390595.29	390970.359	375.071		Right	120	4000	-2.500%
				Straight	390970.36	391900.000	929.641	165 13 16.2				
					391900						INFINITY	

Table-5.3.9 Horizontal Curve Report (Package-9)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	341700	343692.369	1992.369					
1	340	57	37.7	Arc	343692.37	345021.579	1329.210		Left	120	-4000	-2.500%
				Straight	345021.58	346512.864	1491.285	148 16 3.2				
2	2	47	2.7	Arc	346512.86	346998.778	485.914		Right	120	10000	-2.500%
				Straight	346998.78	349584.393	2585.615	151 3 5.9				
3	357	51	59.2	Arc	349584.39	349956.770	372.377		Left	120	-10000	-2.500%
				Straight	349956.77	351508.431	1551.661	148 55 5.1				
				Transition	351508.43	351728.431	220.000					
4	293	59	20.7	Arc	351728.43	353812.647	2084.216		Left	120	-2000	-2.500%
				Transition	353812.65	354032.647	220.000					
				Straight	354032.65	355243.903	1211.256	82 54 25.8				
				Transition	355243.9	355463.903	220.000					
5	36	50	12.5	Arc	355463.9	356658.335	1194.432		Right	120	2200	-2.500%
				Transition	356658.34	356878.335	220.000					
				Straight	356878.34	360469.277	3590.942	119 44 38.2				
6	351	14	13.8	Arc	360469.28	361310.449	841.172		Left	120	-5500	-2.500%
				Straight	361310.45	365429.196	4118.747	110 58 52				
7	17	34	2.6	Arc	365429.2	368495.283	3066.087		Right	120	10000	-2.500%
				Straight	368495.28	371379.572	2884.289	128 32 54.6				
8	8	36	6.4	Arc	371379.57	372580.607	1201.035		Right	120	8000	-2.500%
				Straight	372580.61	374744.190	2163.583	137 9 1				
9	20	41	46.7	Arc	374744.19	377633.937	2889.747		Right	120	8000	-2.500%
				Straight	377633.94	379161.033	1527.096	157 50 47.7				
10	354	1	4.9	Arc	379161.03	379787.464	626.431		Left	120	-6000	-2.500%
				Straight	379787.46	381341.231	1553.767	151 51 52.6				
11	20	58	49.8	Arc	381341.23	382805.946	1464.715		Right	120	4000	-2.500%
				Straight	382805.95	384863.243	2057.297	172 50 42.3				
12	357	33	22.2	Arc	384863.24	385503.035	639.792		Left	120	-15000	-2.500%
				Straight	385503.04	387241.025	1737.990	170 24 4.6				
13	349	26	50.6	Arc	387241.03	389082.803	1841.778		Left	120	-10000	-2.500%
				Straight	389082.8	390595.288	1512.485	159 50 55.2				
14	5	22	21	Arc	390595.29	390970.359	375.071		Right	120	4000	-2.500%
				Straight	390970.36	391900.000	929.641	165 13 16.2				
					391900						INFINITY	

Table-5.3.10 Horizontal Curve Report (Package-10)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super Elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	443700	443755.765	55.765					
1	15	2	53.4	Arc	443755.765	444806.326	1050.561		Right	120	4000	
				Straight	444806.326	446278.981	1472.655	138 50 46.3				
2	355	38	38.3	Arc	446278.981	447039.253	760.272		Left	120	-10000	
				Straight	447039.253	449248.630	2209.377	134 29 24.6				
3	343	12	57.7	Arc	449248.63	450420.373	1171.743		Left	120	-4000	
				Straight	450420.373	453579.461	3159.088	117 42 22.2				
4	12	3	12.2	Arc	453579.461	454420.945	841.484		Right	120	4000	
				Straight	454420.945	456973.550	2552.605	129 45 34.4				
5	351	51	50.4	Arc	456973.55	457541.550	568.000		Left	120	-4000	
				Straight	457541.55	459060.295	1518.745	121 37 24.8				
6	7	18	10.5	Transition	459060.295	459280.295	220.000		Right	120		
6	41	21	14.2	Arc	459280.295	460503.820	1223.525	143 31 30.7	Right	120	2000	
7	25	38	8.1	Transition	460503.82	460723.820	220.000		Right	120		
				Straight	460723.82	462686.063	1962.243	162 58 39				
7	330	14	17	Arc	462686.063	464763.839	2077.776		Left	120	-4000	
				Straight	464763.839	466094.609	1330.770	133 12 56				
8	1	11	22.8	Arc	466094.609	466406.065	311.456		Right	120	15000	
				Straight	466406.065	469067.124	2661.059	134 24 18.8				
9	3	17	33.9	Arc	469067.124	469526.879	459.755		Right	120	8000	
				Straight	469526.879	470569.696	1042.817	137 41 52.7				
10	356	57	57.1	Arc	470569.696	470993.340	423.644		Left	120	-8000	
				Straight	470993.34	471869.844	876.504	134 39 49.9				
11	346	29	38.3	Arc	471869.844	472812.743	942.899		Left	120	-4000	
				Straight	472812.743	473396.150	583.407	121 9 28.2				
12	22	31	36.1	Arc	473396.15	474968.810	1572.660		Right	120	4000	
				Straight	474968.81	476277.051	1308.241	143 41 4.3				
13	309	35	23.2	Arc	476277.051	479796.349	3519.298		Left	120	-4000	

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super Elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Straight	479796.349	483892.319	4095.970	93 16 27.4				
14	16	28	10.3	Arc	483892.319	485128.343	1236.024		Right	120	4300	
				Straight	485128.343	487519.142	2390.799	109 44 37.7				
				Transition	487519.142	487719.142	200.000					
15	40	38	54.4	Arc	487719.142	489292.765	1573.623		Right	120	2500	
				Transition	489292.765	489492.765	200.000					
				Straight	489492.765	490107.604	614.839	150 23 32.1				
				Transition	490107.604	490307.604	200.000					
16	330	23	9.8	Arc	490307.604	491399.756	1092.152		Left	120	-2500	
				Transition	491399.756	491599.756	200.000					
				Straight	491599.756	492892.226	1292.470	120 46 41.9				
17	2	19	15.1	Arc	492892.226	493297.291	405.065		Right	120	10000	
				Straight	493297.291	494887.199	1589.908	123 5 57				
18	1	56	36	Arc	494887.199	495226.373	339.174		Right	120	10000	
				Straight	495226.373	497000.000	1773.627	125 2 32.9				
					497000						INFINITY	

Table-5.3.11 Horizontal Curve Report (Package-11)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length(m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius(m)	Superelevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	496800	498818.431	2018.431					
1	349	1	18.9	Arc	498818.431	500351.261	1532.830		Left	120	-8000	2.50%
				Straight	500351.261	501258.000	906.739	114 3 51.8				
2	329	1	18.5	Transition	501258	501428.000	170.000		Left	120		2.50%
2	27	28	56.4	Arc	501428	502696.971	1268.971	111 12 48.1	Right	120	3000	2.50%
3	20	38	5.6	Transition	502696.971	502866.971	170.000		Right	120		2.50%
				Straight	502866.971	503700.484	833.513	141 32 48.2				
3	346	30	48.7	Arc	503700.484	505112.785	1412.301		Left	120	-6000	2.50%
4	293	59	20.7	Straight	505112.785	506704.836	1592.051	128 3 36.9	Left	120		2.50%
4	3	22	4.1	Arc	506704.836	507410.187	705.351		Right	120	12000	2.50%
				Straight	507410.187	508930.132	1519.945	131 25 41				
5	7	53	46.7	Arc	508930.132	509894.847	964.715		Right	120	7000	2.50%
5	36	50	12.5	Straight	509894.847	510432.356	537.509	139 19 27.6	Right	120		2.50%
6	342	17	14.7	Arc	510432.356	511978.072	1545.716		Left	120	-5000	2.50%
7	300	16	22.2	Straight	511978.072	514351.228	2373.156	121 36 42.3	Left	120		2.50%
8	349	19	58.8	Transition	514351.228	514571.228	220.000		Left	120		2.50%
7	325	33	22.4	Arc	514571.228	515553.543	982.315	120 37 36.1	Left	120	-2000	2.50%
9	18	37	19.6	Transition	515553.543	515773.543	220.000		Right	120		2.50%
				Straight	515773.543	517108.945	1335.402	87 10 4.6				
10	330	1	46.4	Transition	517108.945	517328.945	220.000		Left	120		2.50%
8	74	31	56.2	Arc	517328.945	519450.445	2121.500	109 16 42.1	Right	120	1800	2.50%
11	3	36	48.3	Transition	519450.445	519670.445	220.000		Right	120		2.50%
				Straight	519670.445	520418.863	748.418	161 42 0.8				
9	336	18	38.4	Arc	520418.863	522072.689	1653.826		Left	120	-4000	2.50%
				Straight	522072.689	522877.975	805.286	138 0 39.3				
10	31	38	58.8	Arc	522877.975	525087.538	2209.563		Right	120	4000	2.50%
				Straight	525087.538	525749.624	662.086	169 39 38				
				Transition	525749.624	525929.624	180.000					
11	316	26	9.6	Arc	525929.624	527878.563	1948.939		Left	120	-2800	2.50%

HIP / Curve No.	Deflection Angle			Element	Start	End	Length(m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius(m)	Superelevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Transition	527878.563	528058.563	180.000					
				Straight	528058.563	530708.708	2650.145	126 5 47.6				
12	11	6	44.6	Arc	530708.708	531484.499	775.791		Right	120	4000	2.50%
				Straight	531484.499	532159.358	674.859	137 12 32.2				
				Transition	532159.358	532359.358	200.000					
13	297	5	8.4	Arc	532359.358	534904.514	2545.156		Left	120	-2500	2.50%
				Transition	534904.514	535104.514	200.000					
				Straight	535104.514	536647.539	1543.025	74 17 40.6				
14	17	58	20.5	Arc	536647.539	537902.245	1254.706		Right	120	4000	2.50%
				Straight	537902.245	538725.474	823.229	92 16 1				
15	353	56	40.3	Arc	538725.474	539782.351	1056.877		Left	120	-10000	2.50%
				Straight	539782.351	542768.531	2986.180	86 12 41.4				
16	42	27	20.6	Arc	542768.531	547214.484	4445.953		Right	120	6000	
				Straight	547214.484	548800.000	1585.516	128 40 2				
					548800						INFINITY	

Table-5.3.12 Horizontal Curve Report (Package-12)

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Start	548800	548999.272	199.272					
1	342	36	20	Arc	548999.272	550820.815	1821.543		Left	120	-6000	2.50%
				Straight	550820.815	551781.533	960.718	111 16 21.9				
2	57	28	11.6	Arc	551781.533	555793.687	4012.154		Right	120	4000	2.50%
2	27	28	56.4	Straight	555793.687	558537.076	2743.389	168 44 33.5	Right	120		2.50%
3	337	22	56.4	Arc	558537.076	560116.087	1579.011		Left	120	-4000	2.50%
				Straight	560116.087	562461.641	2345.554	146 7 29.9				
4	10	21	3.5	Arc	562461.641	563906.909	1445.268		Right	120	8000	2.50%
4	293	59	20.7	Straight	563906.909	564558.335	651.426	156 28 33.4	Left	120		2.50%
5	347	3	15.4	Arc	564558.335	565462.117	903.782		Left	120	-4000	2.50%
				Straight	565462.117	567069.442	1607.325	143 31 48.8				
6	12	47	25.7	Arc	567069.442	567962.386	892.944		Right	120	4000	2.50%
5	36	50	12.5	Straight	567962.386	568411.297	448.911	156 19 14.6	Right	120		2.50%
6	342	17	14.7	Transition	568411.297	568631.297	220.000		Left	120		2.50%
7	300	16	22.2	Arc	568631.297	571017.386	2386.089	121 36 42.3	Left	120	-2500	2.50%
6	351	14	13.8	Transition	571017.386	571237.386	220.000		Left	120		2.50%
7	325	33	22.4	Straight	571237.386	572952.965	1715.579	96 35 36.7	Left	120		2.50%
8	38	27	34	Arc	572952.965	575637.940	2684.975		Right	120	4000	2.50%
				Straight	575637.94	576658.208	1020.268	135 3 10.7				
9	26	45	11.9	Arc	576658.208	578525.941	1867.733		Right	120	4000	2.50%
8	74	31	56.2	Straight	578525.941	579606.092	1080.151	161 48 22.6	Right	120		2.50%
10	31	21	59.8	Arc	579606.092	581795.894	2189.802		Right	120	4000	2.50%
				Straight	584912.336	588183.835	3271.499	124 53 3.4				
12	353	59	36.7	Arc	588183.835	588603.165	419.330		Left	120	-4000	2.50%
11	316	26	9.6	Straight	588603.165	590702.908	2099.743	118 52 40.1	Left	120		2.50%
13	349	26	50.6	Transition	590702.908	590922.908	220.000		Left	120		2.50%
13	41	14	15.3	Arc	590922.908	592142.372	1219.464	126 5 47.6	Right	120	2000	2.50%
12	11	6	44.6	Transition	592142.372	592362.372	220.000		Right	120		2.50%
				Straight	592362.372	594495.703	2133.331	160 6 55.4				

HIP / Curve No.	Deflection Angle			Element	Start	End	Length (m)	Bearing (dd mm ss)	Hand of Arc	Design Speed (KM/H)	Radius (m)	Super elevation (%)
	Deg	Min	Sec		Chainage (m)	Chainage (m)						
				Transition	594495.703	594715.703	220.000					
14	331	17	25.9	Arc	594715.703	595397.638	681.935		Left	120	-1800	2.50%
				Transition	595397.638	595617.638	220.000					
				Straight	595617.638	596372.370	754.732	131 24 21.3				
15	8	23	52.3	Arc	596372.37	596958.651	586.281		Right	120	4000	2.50%
				Straight	596958.651	599507.007	2548.356	139 48 13.6				
16	356	30	41.5	Arc	599507.007	599994.089	487.082		Left	120	-8000	2.50%
				Straight	599994.089	600467.087	472.998	136 18 55.1				
17	42	27	20.6	Arc	600467.087	547214.484	4445.953		Right	120	INFINITY	2.50%
				Straight		548800.000	1585.516	128 40 2				
					548800						INFINITY	

Package wise details of vertical curves are presented in **Tables-5.4.1 to 5.4.12** below:

Table-5.4.1 Vertical Alignment Report (Package-1)

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1	9112.822	232.334	-1.303	Hog Curve	9112.822	232.334	9783.431	223.594		-23018	-0.434	230.176	670.609
2	9783.431	223.594	2.296	Sag Curve	9783.431	223.594	10333.323	229.054		13500	0.741	135.000	549.892
3	10333.323	229.054	-2.034	Hog Curve	10333.323	229.054	10901.007	223.144		-27040	-0.370	270.395	567.684
4	10901.007	223.144	1.498	Sag Curve	10901.007	223.144	11571.275	226.203		13355	0.749	133.554	670.268
5	11571.275	226.203	-0.889	Hog Curve	11571.275	226.203	11903.213	224.768		-27003	-0.370	270.029	331.938
6	11903.213	224.768	1.179	Sag Curve	11903.213	224.768	12550.726	229.600		16970	0.589	169.701	647.513
7	12550.726	229.600	-1.759	Hog Curve	12550.726	229.600	13100.522	224.033		-26154	-0.382	261.540	549.796
8	13100.522	224.033	1.330	Sag Curve	13100.522	224.033	13500.000	225.300		18801	0.532	188.005	399.478
9	13500.000	225.300	-0.649	Hog Curve	13500.000	225.300	13727.425	224.545		-30809	-0.325	308.090	227.425
10	13727.425	224.545	1.125	Sag Curve	13727.425	224.545	14100.000	227.500		13332	0.750	133.321	372.575
11	14100.000	227.500	-1.838	Hog Curve	14100.000	227.500	14484.932	223.478		-26099	-0.383	260.994	384.932
12	14484.932	223.478	1.805	Sag Curve	14484.932	223.478	15081.476	228.015		13304	0.752	133.044	596.544
13	15081.476	228.015	-1.723	Hog Curve	15081.476	228.015	15656.253	222.486		-26702	-0.375	267.023	574.777
14	15656.253	222.486	1.262	Sag Curve	15656.253	222.486	16111.472	223.851		14262	0.701	142.621	455.219
15	16111.472	223.851	-0.661	Hog Curve	16111.472	223.851	16667.519	221.844		-30257	-0.331	302.572	556.047
16	16667.519	221.844	0.868	Sag Curve	16667.519	221.844	16903.885	223.042		17280	0.579	172.795	236.366
17	16903.885	223.042	-0.818	Hog Curve	16903.885	223.042	17317.718	221.755		-29333	-0.341	293.333	413.833
18	17317.718	221.755	1.042	Sag Curve	17317.718	221.755	17571.031	223.607		14392	0.695	143.924	253.313
19	17571.031	223.607	-0.731	Hog Curve	17571.031	223.607	17853.786	223.607		-28723	-0.348	287.233	282.755
20	17853.786	223.607	-0.594	Hog Curve	17853.786	223.607	18090.562	222.200		-26920	-0.371	269.201	236.776
21	18090.562	222.200	1.604	Sag Curve	18090.562	222.200	18649.000	227.838		13716	0.729	137.161	558.438
22	18649.000	227.838	-2.017	Hog Curve	18649.000	227.838	19215.106	222.137		-26282	-0.381	262.812	566.106
23	19215.106	222.137	2.089	Sag Curve	19215.106	222.137	19941.000	229.990		14363	0.696	143.629	725.894
24	19941.000	229.990	-2.142	Hog Curve	19941.000	229.990	20559.946	223.428		-26844	-0.373	268.435	618.946
25	20559.946	223.428	0.463	Sag Curve	20559.946	223.428	21597.216	217.238		21575	0.463	215.754	1037.270
26	21597.216	217.238	1.608	Sag Curve	21597.216	217.238	22163.215	222.964		13678	0.731	136.782	565.999
27	22163.215	222.964	-1.540	Hog Curve	22163.215	222.964	22830.837	219.439		-27278	-0.367	272.777	667.622

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
28	22830.837	219.439	1.477	Sag Curve	22830.837	219.439	23370.000	224.554		13543	0.738	135.426	539.163
29	23370.000	224.554	-1.990	Hog Curve	23370.000	224.554	24019.676	217.790		-26382	-0.379	263.824	649.676
30	24019.676	217.790	1.041	Sag Curve	24019.676	217.790	24347.477	217.790		14407	0.694	144.065	327.801
31	24347.477	217.790	0.310	Sag Curve	24347.477	217.790	25168.213	220.336		64475	0.155	644.745	820.736
32	25168.213	220.336	0.494	Sag Curve	25168.213	220.336	26047.500	227.406		20251	0.494	202.507	879.287
33	26047.500	227.406	-1.940	Hog Curve	26047.500	227.406	26860.079	218.179		-41247	-0.242	412.473	812.579
34	26860.079	218.179	1.629	Sag Curve	26860.079	218.179	28129.546	224.445		15345	0.652	153.452	1269.467
35	28129.546	224.445	-1.258	Hog Curve	28129.546	224.445	28592.283	220.909		-20097	-0.498	200.973	462.737
36	28592.283	220.909	1.510	Sag Curve	28592.283	220.909	29019.000	224.093		15664	0.638	156.642	426.717
37	29019.000	224.093	-1.669	Hog Curve	29019.000	224.093	29488.884	219.757		-26964	-0.371	269.636	469.884
38	29488.884	219.757	1.901	Sag Curve	29488.884	219.757	29966.000	224.422		14043	0.712	140.426	477.116
39	29966.000	224.422	-1.704	Hog Curve	29966.000	224.422	30408.181	221.212		-27429	-0.365	274.288	442.181
40	30408.181	221.212	1.191	Sag Curve	30408.181	221.212	30838.588	223.215		14399	0.695	143.988	430.407
41	30838.588	223.215	-1.465	Hog Curve	30838.588	223.215	31197.434	219.627		-27296	-0.366	272.963	358.846
42	31197.434	219.627	1.655	Sag Curve	31197.434	219.627	31578.000	222.121		13290	0.752	132.896	380.566
43	31578.000	222.121	-1.763	Hog Curve	31578.000	222.121	32094.101	216.405		-26660	-0.375	266.596	516.101
44	32094.101	216.405	1.800	Sag Curve	32094.101	216.405	32799.000	221.285		15002	0.667	150.020	704.899
45	32799.000	221.285	-1.545	Hog Curve	32799.000	221.285	33372.045	216.398		-29127	-0.343	291.273	573.045
46	33372.045	216.398	2.081	Sag Curve	33372.045	216.398	34059.366	224.840		20184	0.495	201.837	687.321
47	34059.366	224.840	-1.228	Hog Curve	34059.366	224.840	34384.182	224.840		-27683	-0.361	276.824	324.816
48	34384.182	224.840	-0.405	Hog Curve	34384.182	224.840	34563.930	224.113		-27192	-0.368	271.916	179.748
49	34563.930	224.113	0.405	Sag Curve	34563.930	224.113	34748.325	224.113		24715	0.405	247.152	184.395
50	34748.325	224.113	-0.492	Hog Curve	34748.325	224.113	34937.065	223.184		-26407	-0.379	264.075	188.740
51	34937.065	223.184	0.823	Sag Curve	34937.065	223.184	35174.076	223.968		13366	0.748	133.658	237.011
52	35174.076	223.968	-0.331	Hog Curve	35174.076	223.968	35361.465	223.968		-30231	-0.331	302.307	187.389
53	35361.465	223.968	-0.390	Hog Curve	35361.465	223.968	35504.134	223.412		-28213	-0.354	282.135	142.669
54	35504.134	223.412	1.100	Sag Curve	35504.134	223.412	35706.509	224.848		13642	0.733	136.416	202.375
55	35706.509	224.848	-0.710	Hog Curve	35706.509	224.848	36377.504	224.848		-27054	-0.370	270.541	670.995
56	36377.504	224.848	-0.951	Hog Curve	36377.504	224.848	37200.846	217.019		-27448	-0.364	274.484	823.342
57	37200.846	217.019	1.251	Sag Curve	37200.846	217.019	37780.000	218.756		13591	0.736	135.912	579.154

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
58	37780.000	218.756	-0.600	Hog Curve	37780.000	218.756	38378.725	216.960		-33338	-0.300	333.378	598.725
59	38378.725	216.960	0.809	Sag Curve	38378.725	216.960	38755.972	218.881		21004	0.476	210.035	377.247
60	38755.972	218.881	-1.122	Hog Curve	38755.972	218.881	39360.385	215.179		-44562	-0.224	445.613	604.413
61	39360.385	215.179	1.091	Sag Curve	39360.385	215.179	40098.752	218.708		18337	0.545	183.375	738.367
62	40098.752	218.708	-0.062	Sag Curve	40098.752	218.708	40480.000	220.294					381.248
63	40480.000	220.294	-1.500	Hog Curve	40480.000	220.294	40881.910	215.937		-26667	-0.375	266.667	401.910
64	40881.910	215.937	1.779	Sag Curve	40881.910	215.937	41515.959	220.342		12930	0.773	129.303	634.049
65	41515.959	220.342	-1.593	Hog Curve	41515.959	220.342	42027.128	215.752		-26996	-0.370	269.964	511.169
66	42027.128	215.752	1.583	Sag Curve	42027.128	215.752	42400.000	218.307		13580	0.736	135.796	372.872
67	42400.000	218.307	-1.473	Hog Curve	42400.000	218.307	42741.771	215.616		-27163	-0.368	271.628	341.771
68	42741.771	215.616	1.536	Sag Curve	42741.771	215.616	43140.000	218.598		13996	0.715	139.958	398.229
69	43140.000	218.598	-1.793	Hog Curve	43140.000	218.598	43926.535	210.385		-28443	-0.352	284.430	786.535
70	43926.535	210.385	2.276	Sag Curve	43926.535	210.385	44657.292	219.385		26363	0.379	263.630	730.757
71	44657.292	219.385	-1.731	Hog Curve	44657.292	219.385	45234.880	216.500		-27148	-0.368	271.481	577.588
72	45234.880	216.500	-0.097	Hog Curve	45234.880	216.500	45787.012	213.206		-103037	-0.097	1030.397	552.132
73	45787.012	213.206	1.656	Sag Curve	45787.012	213.206	46214.000	217.728		13289	0.753	132.889	426.988
74	46214.000	217.728	-1.960	Hog Curve	46214.000	217.728	46573.443	214.488		-26527	-0.377	265.273	359.443
75	46573.443	214.488	1.436	Sag Curve	46573.443	214.488	47115.342	217.387		13228	0.756	132.282	541.899
76	47115.342	217.387	0.000	Sag Curve	47115.342	217.387	29732.326	222.137					-17383.016
77	47115.342	217.387	0.000	Hog Curve	29732.326	222.137	30199.674	222.726		-27429	-0.365	274.288	467.348
78				Grade	30199.674	222.726	30322.405	221.835	-0.726				122.731
79	47115.342	217.387	0.000	Sag Curve	30322.405	221.835	30493.958	221.611		14399	0.695	143.988	171.553
80				Grade	30493.958	221.611	30638.588	222.284	0.465				144.630
81	47115.342	217.387	0.000	Hog Curve	30638.588	222.284	31038.588	221.215		-27296	-0.366	272.963	400.000
82				Grade	31038.588	221.215	31087.434	220.727	-1.000				48.846
83	47115.342	217.387	0.000	Sag Curve	31087.434	220.727	31307.434	220.347		13290	0.752	132.896	220.000
84				Grade	31307.434	220.347	31343.000	220.581	0.655				35.566
85	47115.342	217.387	0.000	Hog Curve	31343.000	220.581	31813.000	219.518		-26660	-0.375	266.596	470.000
86				Grade	31813.000	219.518	31959.101	217.900	-1.108				146.101
87	47115.342	217.387	0.000	Sag Curve	31959.101	217.900	32229.101	217.340		15002	0.667	150.020	270.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
88				Grade	32229.101	217.340	32574.000	219.727	0.692				344.899
89	47115.342	217.387	0.000	Hog Curve	32574.000	219.727	33024.000	219.366		-29127	-0.343	291.273	450.000
90				Grade	33024.000	219.366	33162.045	218.189	-0.853				138.045
91	47115.342	217.387	0.000	Sag Curve	33162.045	218.189	33582.045	218.978		20184	0.495	201.837	420.000
92				Grade	33582.045	218.978	33889.365	222.752	1.228				307.320
93	47115.342	217.387	0.000	Hog Curve	33889.365	222.752	34229.365	224.840		-27683	-0.361	276.824	340.000
94				Grade	34229.365	224.840	34329.182	224.840	0.000				99.817
95	47115.342	217.387	0.000	Hog Curve	34329.182	224.840	34439.182	224.618		-27192	-0.368	271.916	110.000
96				Grade	34439.182	224.618	34513.930	224.315	-0.405				74.748
97	47115.342	217.387	0.000	Sag Curve	34513.930	224.315	34613.930	224.113		24715	0.405	247.152	100.000
98				Grade	34613.930	224.113	34683.325	224.113	0.000				69.395
99	47115.342	217.387	0.000	Hog Curve	34683.325	224.113	34813.325	223.793		-26407	-0.379	264.075	130.000
100				Grade	34813.325	223.793	34882.065	223.455	-0.492				68.740
101	47115.342	217.387	0.000	Sag Curve	34882.065	223.455	34992.065	223.366		13366	0.748	133.658	110.000
102				Grade	34992.065	223.366	35124.076	223.803	0.331				132.011
103	47115.342	217.387	0.000	Hog Curve	35124.076	223.803	35224.076	223.968		-30231	-0.331	302.307	100.000
104	47115.340	217.387	0.000	Sag Curve	47115.340	217.387	47397.509	218.897					282.169
105	47397.509	218.897	-1.421	Hog Curve	47397.509	218.897	48096.129	212.708		-26742	-0.374	267.415	698.620
106	48096.129	212.708	2.037	Sag Curve	48096.129	212.708	48745.000	220.180		13498	0.741	134.978	648.871
107	48745.000	220.180	-2.254	Hog Curve	48745.000	220.180	49238.911	214.737		-26181	-0.382	261.808	493.911
108	49238.911	214.737	2.252	Sag Curve	49238.911	214.737	49869.000	221.983		13321	0.751	133.214	630.089
109	49869.000	221.983	-2.300	Hog Curve	49869.000	221.983	50429.436	215.538		-26087	-0.383	260.872	560.436
110	50429.436	215.538	2.150	Sag Curve	50429.436	215.538	50846.000	219.704		13954	0.717	139.536	416.564
111	50846.000	219.704	-1.700	Hog Curve	50846.000	219.704	51194.922	217.261		-26176	-0.382	261.760	348.922
112	51194.922	217.261	1.350	Sag Curve	51194.922	217.261	51517.049	219.355		13332	0.750	133.323	322.127
113	51517.049	219.355	-0.650	Hog Curve	51517.049	219.355	51855.044	219.355		-26152	-0.382	261.520	337.995
114	51855.044	219.355	-1.176	Hog Curve	51855.044	219.355	52374.643	213.246		-26367	-0.379	263.671	519.599
115	52374.643	213.246	2.075	Sag Curve	52374.643	213.246	52883.242	217.819		13013	0.768	130.132	508.599
116	52883.242	217.819	-0.593	Hog Curve	52883.242	217.819	53693.000	220.300		-53993	-0.185	539.928	809.758
117	53693.000	220.300	-1.006	Hog Curve	53693.000	220.300	54126.256	217.267		-26330	-0.380	263.296	433.256

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
118	54126.256	217.267	1.682	Sag Curve	54126.256	217.267	54475.098	220.691		13678	0.731	136.776	348.842
119	54475.098	220.691	-0.982	Hog Curve	54475.098	220.691	54843.000	220.691		-26489	-0.378	264.894	367.902
120	54843.000	220.691	-1.301	Hog Curve	54843.000	220.691	55473.304	212.493		-26140	-0.383	261.397	630.304
121	55473.304	212.493	0.985	Sag Curve	55473.304	212.493	55974.264	210.909		15236	0.656	152.360	500.960
122	55974.264	210.909	1.374	Sag Curve	55974.264	210.909	56534.848	216.841		15279	0.655	152.788	560.584

Table-5.4.2 Vertical Alignment Report (Package-2)

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	56791.316	215.414	57412.036	211.959	-0.557				620.720
2	58272.132	216.010	-1.138	Sag Curve	57412.036	211.959	57662.036	212.071		20794	0.481	207.939	250.000
3				Grade	57662.036	212.071	58092.132	214.847	0.646				430.096
4	58950.859	212.667	1.586	Hog Curve	58092.132	214.847	58452.132	215.123		-31630	-0.316	316.296	360.000
5				Grade	58452.132	215.123	58818.359	213.319	-0.493				366.227
6	59542.140	219.135	-1.564	Sag Curve	58818.359	213.319	59083.359	214.116		16704	0.599	167.040	265.000
7				Grade	59083.359	214.116	59337.140	216.892	1.094				253.781
8	59833.151	217.767	1.217	Hog Curve	59337.140	216.892	59747.140	218.171		-26217	-0.381	262.171	410.000
9				Grade	59747.140	218.171	59752.651	218.145	-0.470				5.511
10	60018.100	219.149	-0.747	Sag Curve	59752.651	218.145	59913.651	218.369		13227	0.756	132.273	161.000
11				Grade	59913.651	218.369	59920.600	218.420	0.747				6.949
12	60332.064	219.149	-1.213	Hog Curve	59920.600	218.420	60115.600	219.149		-26097	-0.383	260.967	195.000
13				Grade	60115.600	219.149	60173.064	219.149	0.000				57.464
14	60637.684	215.442	1.950	Hog Curve	60173.064	219.149	60491.064	217.221		-26219	-0.381	262.192	318.000
15				Grade	60491.064	217.221	60507.684	217.019	-1.213				16.620
16	61182.688	219.457	-1.521	Sag Curve	60507.684	217.019	60767.684	216.400		13336	0.750	133.362	260.000
17				Grade	60767.684	216.400	60982.688	217.984	0.737				215.004
18	62127.119	212.047	1.610	Hog Curve	60982.688	217.984	61382.688	217.888		-26293	-0.380	262.930	400.000
19				Grade	61382.688	217.888	61952.120	213.420	-0.785				569.432
20	62693.867	216.723	-1.736	Sag Curve	61952.120	213.420	62302.120	213.491		21745	0.460	217.453	350.000
21				Grade	62302.120	213.491	62458.867	214.784	0.825				156.747
22	63289.758	211.296	1.507	Hog Curve	62458.867	214.784	62928.867	214.582		-27078	-0.369	270.783	470.000
23				Grade	62928.867	214.582	63164.758	212.434	-0.911				235.891
24	64079.259	216.002	-1.337	Sag Curve	63164.758	212.434	63414.758	212.041		16590	0.603	165.901	250.000
25				Grade	63414.758	212.041	63889.259	214.869	0.596				474.501
26	64629.337	211.926	1.146	Hog Curve	63889.259	214.869	64269.259	214.594		-28420	-0.352	284.196	380.000
27				Grade	64269.259	214.594	64529.337	212.667	-0.741				260.078
28	65345.750	214.830	-1.199	Sag Curve	64529.337	212.667	64729.337	212.332		17447	0.573	174.474	200.000
29				Grade	64729.337	212.332	65185.750	214.182	0.405				456.413

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	65689.126	212.105	-0.740	Hog Curve	65185.750	214.182	65505.750	213.560		-26685	-0.375	266.852	320.000
31				Grade	65505.750	213.560	65589.126	212.898	-0.794				83.376
32	66021.884	207.000	1.534	Hog Curve	65589.126	212.898	65789.126	210.571		-27019	-0.370	270.197	200.000
33				Grade	65789.126	210.571	65871.884	209.301	-1.534				82.758
34	67383.403	207.000	-0.591	Sag Curve	65871.884	209.301	66171.884	207.000		19556	0.511	195.565	300.000
35				Grade	66171.884	207.000	67233.402	207.000	0.000				1061.518
36	68388.025	201.060	1.377	Hog Curve	67233.402	207.000	67533.402	206.113		-50735	-0.197	507.357	300.000
37				Grade	67533.402	206.113	68293.025	201.621	-0.591				759.623
38	69259.976	207.913	-1.565	Sag Curve	68293.025	201.621	68483.025	201.806		13795	0.725	137.952	190.000
39				Grade	68483.025	201.806	69049.976	206.262	0.786				566.951
40	69628.670	205.042	1.087	Hog Curve	69049.976	206.262	69469.976	206.278		-26844	-0.373	268.442	420.000
41				Grade	69469.976	206.278	69548.670	205.665	-0.779				78.694
42	70188.400	206.766	-1.168	Sag Curve	69548.670	205.665	69708.670	205.289		14725	0.679	147.252	160.000
43				Grade	69708.670	205.289	70013.400	206.227	0.308				304.730
44	71273.331	197.439	1.860	Hog Curve	70013.400	206.227	70363.400	205.262		-29973	-0.334	299.724	350.000
45				Grade	70363.400	205.262	71148.331	198.513	-0.860				784.931
46	71858.838	203.294	-1.702	Sag Curve	71148.331	198.513	71398.331	198.689		13443	0.744	134.427	250.000
47				Grade	71398.331	198.689	71568.838	200.394	1.000				170.507
48	72715.662	197.283	1.691	Hog Curve	71568.838	200.394	72148.838	201.259		-34087	-0.293	340.866	580.000
49				Grade	72148.838	201.259	72590.662	198.160	-0.702				441.824
50	73213.713	202.213	-0.990	Sag Curve	72590.662	198.160	72840.662	198.520		14780	0.677	147.802	250.000
51				Grade	72840.662	198.520	73083.713	200.926	0.990				243.051
52	73545.693	202.213	0.864	Hog Curve	73083.713	200.926	73343.713	202.213		-26265	-0.381	262.646	260.000
53				Grade	73343.713	202.213	73445.693	202.213	0.000				101.980
54	73926.064	205.501	-0.864	Sag Curve	73445.693	202.213	73645.693	203.077		23139	0.432	231.396	200.000
55				Grade	73645.693	203.077	73776.064	204.204	0.864				130.371
56	74349.763	205.501	-0.544	Hog Curve	73776.064	204.204	74076.064	205.501		-34709	-0.288	347.090	300.000
57				Grade	74076.064	205.501	74224.763	205.501	0.000				148.699
58	75534.121	199.057	1.366	Hog Curve	74224.763	205.501	74474.763	204.821		-45952	-0.218	459.517	250.000
59				Grade	74474.763	204.821	75434.121	199.601	-0.544				959.358

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
60	75915.058	202.187	-1.347	Sag Curve	75434.121	199.601	75634.121	199.879		14645	0.683	146.447	200.000
61				Grade	75634.121	199.879	75715.058	200.544	0.822				80.937
62	76426.688	199.497	0.946	Hog Curve	75715.058	200.544	76115.058	201.136		-29686	-0.337	296.859	400.000
63				Grade	76115.058	201.136	76326.688	200.023	-0.526				211.630
64	77030.185	202.032	-1.629	Sag Curve	76326.688	200.023	76526.688	199.917		21144	0.473	211.443	200.000
65				Grade	76526.688	199.917	76805.185	201.087	0.420				278.497
66	77528.984	196.004	2.263	Hog Curve	76805.185	201.087	77255.185	199.313		-27630	-0.362	276.304	450.000
67				Grade	77255.185	199.313	77378.984	197.817	-1.209				123.799
68	78377.172	204.945	-1.681	Sag Curve	77378.984	197.817	77678.984	197.585		13258	0.754	132.584	300.000
69				Grade	77678.984	197.585	78152.172	202.573	1.054				473.188
70	78822.861	202.150	1.780	Hog Curve	78152.172	202.573	78602.172	203.534		-26764	-0.374	267.637	450.000
71				Grade	78602.172	203.534	78697.861	202.934	-0.627				95.689
72	79292.409	207.565	-1.900	Sag Curve	78697.861	202.934	78947.861	203.591		14041	0.712	140.414	250.000
73				Grade	78947.861	203.591	79027.408	204.509	1.153				79.547
74	79896.038	203.060	1.713	Hog Curve	79027.408	204.509	79557.408	205.587		-27902	-0.358	279.018	530.000
75				Grade	79557.408	205.587	79756.038	204.105	-0.746				198.630
76	80498.016	208.880	-1.757	Sag Curve	79756.038	204.105	80036.038	204.413		16345	0.612	163.452	280.000
77				Grade	80036.038	204.413	80258.016	206.560	0.967				221.978
78	81067.864	204.377	1.790	Hog Curve	80258.016	206.560	80738.016	206.983		-27320	-0.366	273.202	480.000
79				Grade	80738.016	206.983	80942.864	205.365	-0.790				204.848
80	81507.818	208.776	-2.000	Sag Curve	80942.864	205.365	81192.864	205.627		13965	0.716	139.653	250.000
81				Grade	81192.864	205.627	81242.818	206.126	1.000				49.954
82	82158.714	202.267	1.300	Hog Curve	81242.818	206.126	81772.818	206.126		-26501	-0.377	265.006	530.000
83				Grade	81772.818	206.126	82058.714	203.267	-1.000				285.896
84	82488.827	203.258	0.700	Sag Curve	82058.714	203.267	82258.714	202.567		15385	0.650	153.846	200.000
85				Grade	82258.714	202.567	82388.827	202.958	0.300				130.113
86	83182.122	210.191	-2.000	Sag Curve	82388.827	202.958	82588.827	204.258		28572	0.350	285.714	200.000
87				Grade	82588.827	204.258	82917.122	207.541	1.000				328.295
88	83649.874	205.513	1.301	Hog Curve	82917.122	207.541	83447.122	207.541		-26500	-0.377	264.999	530.000
89				Grade	83447.122	207.541	83544.153	206.570	-1.000				97.031

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
90	84061.075	206.753	-1.289	Sag Curve	83544.153	206.570	83755.595	205.832		16247	0.616	162.467	211.442
91				Grade	83755.595	205.832	83880.897	206.209	0.301				125.302
92	84446.520	202.947	1.293	Hog Curve	83880.897	206.209	84241.252	204.974		-27961	-0.358	279.611	360.355
93				Grade	84241.252	204.974	84340.457	203.994	-0.987				99.205
94	84827.702	204.112	-0.605	Sag Curve	84340.457	203.994	84552.582	203.271		16407	0.609	164.074	212.125
95				Grade	84552.582	203.271	84727.702	203.806	0.306				175.120
96	85388.355	202.430	1.186	Hog Curve	84727.702	203.806	84927.702	203.812		-33032	-0.303	330.327	200.000
97				Grade	84927.702	203.812	85288.355	202.730	-0.300				360.653
98	85885.798	206.838	-1.885	Sag Curve	85288.355	202.730	85488.355	203.316		16863	0.593	168.626	200.000
99				Grade	85488.355	203.316	85635.798	204.623	0.886				147.443
100	86313.641	202.566	1.485	Hog Curve	85635.798	204.623	86135.798	204.341		-26530	-0.377	265.301	500.000
101				Grade	86135.798	204.341	86206.141	203.639	-0.999				70.343
102	86900.000	205.418	0.000	Sag Curve	86206.141	203.639	86421.141	203.089		14478	0.691	144.781	215.000
103				Grade	86421.141	203.089	86900.000	205.418	0.486				478.859

Table-5.4.3 Vertical Alignment Report (Package-3)

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	84346.481	203.441	84390.000	203.310	-0.301				43.519
2	84490.000	203.009	0.606	Sag Curve	84390.000	203.310	84590.000	203.315		32991	0.303	329.913	200.000
3				Grade	84590.000	203.315	84727.545	203.735	0.305				137.545
4	84827.545	204.040	-0.605	Hog Curve	84727.545	203.735	84927.545	203.740		-33045	-0.303	330.447	200.000
5				Grade	84927.545	203.740	85263.800	202.732	-0.300				336.255
6	85363.800	202.432	1.186	Sag Curve	85263.800	202.732	85463.800	203.318		16864	0.593	168.640	200.000
7				Grade	85463.800	203.318	85630.517	204.795	0.886				166.717
8	85885.517	207.055	-1.885	Hog Curve	85630.517	204.795	86140.517	204.509		-27061	-0.370	270.607	510.000
9				Grade	86140.517	204.509	86220.580	203.709	-0.999				80.063
10	86328.080	202.636	1.485	Sag Curve	86220.580	203.709	86435.580	203.159		14478	0.691	144.781	215.000
11				Grade	86435.580	203.159	86998.018	205.895	0.486				562.438
12	87188.018	206.819	-1.368	Hog Curve	86998.018	205.895	87378.018	205.144		-27771	-0.360	277.708	380.000
13				Grade	87378.018	205.144	87587.048	203.300	-0.882				209.030
14	87677.048	202.507	1.249	Sag Curve	87587.048	203.300	87767.048	202.837		14416	0.694	144.157	180.000
15				Grade	87767.048	202.837	88528.770	205.631	0.367				761.722
16	88718.770	206.328	-1.332	Hog Curve	88528.770	205.631	88908.770	204.494		-28525	-0.351	285.258	380.000
17				Grade	88908.770	204.494	89071.602	202.922	-0.965				162.832
18	89121.602	202.439	0.638	Sag Curve	89071.602	202.922	89171.602	202.275		15672	0.638	156.723	100.000
19				Grade	89171.602	202.275	89390.793	201.558	-0.327				219.191
20	89540.793	201.067	1.327	Sag Curve	89390.793	201.558	89690.793	202.567		22603	0.442	226.024	300.000
21				Grade	89690.793	202.567	89890.000	204.559	1.000				199.207
22	90155.000	207.209	-2.000	Hog Curve	89890.000	204.559	90420.000	204.559		-26500	-0.377	264.999	530.000
23				Grade	90420.000	204.559	90478.792	203.971	-1.000				58.792
24	90588.792	202.871	1.604	Sag Curve	90478.792	203.971	90698.792	203.536		13714	0.729	137.135	220.000
25				Grade	90698.792	203.536	90830.515	204.332	0.604				131.723
26	91063.015	205.737	-1.770	Hog Curve	90830.515	204.332	91295.515	203.026		-26267	-0.381	262.674	465.000
27				Grade	91295.515	203.026	91316.110	202.786	-1.166				20.595
28	91376.110	202.086	0.867	Sag Curve	91316.110	202.786	91436.110	201.907		13839	0.723	138.385	120.000
29				Grade	91436.110	201.907	91804.491	200.806	-0.299				368.381

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	91894.491	200.537	1.299	Sag Curve	91804.491	200.806	91984.491	201.437		13858	0.722	138.581	180.000
31				Grade	91984.491	201.437	92115.945	202.751	1.000				131.454
32	92355.945	205.151	-1.760	Hog Curve	92115.945	202.751	92595.945	203.328		-27277	-0.367	272.769	480.000
33				Grade	92595.945	203.328	92710.265	202.459	-0.760				114.320
34	92835.265	201.510	1.867	Sag Curve	92710.265	202.459	92960.265	202.894		13390	0.747	133.896	250.000
35				Grade	92960.265	202.894	92993.403	203.261	1.107				33.138
36	93268.403	206.306	-2.116	Hog Curve	92993.403	203.261	93543.403	203.532		-25988	-0.385	259.882	550.000
37				Grade	93543.403	203.532	93717.893	201.771	-1.009				174.490
38	93847.893	200.459	2.009	Sag Curve	93717.893	201.771	93977.893	201.759		12942	0.773	129.421	260.000
39				Grade	93977.893	201.759	94123.048	203.211	1.000				145.155
40	94388.048	205.861	-2.000	Hog Curve	94123.048	203.211	94653.048	203.211		-26500	-0.377	264.999	530.000
41				Grade	94653.048	203.211	94737.598	202.366	-1.000				84.550
42	94887.598	200.866	1.800	Sag Curve	94737.598	202.366	95037.598	202.065		16667	0.600	166.667	300.000
43				Grade	95037.598	202.065	95312.979	204.269	0.800				275.381
44	95547.979	206.149	-1.800	Hog Curve	95312.979	204.269	95782.979	203.799		-26112	-0.383	261.117	470.000
45				Grade	95782.979	203.799	95882.440	202.804	-1.000				99.461
46	95957.440	202.054	0.697	Sag Curve	95882.440	202.804	96032.440	201.827		21522	0.465	215.216	150.000
47				Grade	96032.440	201.827	96220.694	201.257	-0.303				188.254
48	96320.694	200.954	1.355	Sag Curve	96220.694	201.257	96420.694	202.006		14756	0.678	147.558	200.000
49				Grade	96420.694	202.006	96508.872	202.934	1.052				88.178
50	96688.872	204.828	-1.371	Hog Curve	96508.872	202.934	96868.872	204.255		-26261	-0.381	262.612	360.000
51				Grade	96868.872	204.255	96966.213	203.945	-0.318				97.341
52	97041.213	203.707	0.787	Sag Curve	96966.213	203.945	97116.213	204.058		19052	0.525	190.516	150.000
53				Grade	97116.213	204.058	97183.306	204.373	0.469				67.093
54	97448.306	205.615	-1.469	Hog Curve	97183.306	204.373	97713.306	202.965		-36081	-0.277	360.815	530.000
55				Grade	97713.306	202.965	97832.237	201.776	-1.000				118.931
56	97932.237	200.776	1.301	Sag Curve	97832.237	201.776	98032.237	201.077		15373	0.650	153.730	200.000
57				Grade	98032.237	201.077	98798.498	203.383	0.301				766.261
58	98848.498	203.534	0.266	Sag Curve	98798.498	203.383	98898.498	203.817		37571	0.266	375.714	100.000
59				Grade	98898.498	203.817	99016.488	204.487	0.567				117.990

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
60	99181.488	205.422	-1.235	Hog Curve	99016.488	204.487	99346.488	204.320		-26716	-0.374	267.165	330.000
61				Grade	99346.488	204.320	99875.134	200.788	-0.668				528.646
62	100100.134	199.285	1.668	Sag Curve	99875.134	200.788	100325.134	201.535		26978	0.371	269.782	450.000
63				Grade	100325.134	201.535	100475.140	203.035	1.000				150.006
64	100740.140	205.685	-2.000	Hog Curve	100475.140	203.035	101005.140	203.035		-26500	-0.377	265.006	530.000
65				Grade	101005.140	203.035	101128.124	201.805	-1.000				122.984
66	101253.124	200.555	1.862	Sag Curve	101128.124	201.805	101378.124	201.632		13429	0.745	134.289	250.000
67				Grade	101378.124	201.632	101975.805	206.782	0.862				597.681
68	102150.805	208.290	-0.862	Hog Curve	101975.805	206.782	102325.805	208.290		-40620	-0.246	406.190	350.000
69				Grade	102325.805	208.290	102529.521	208.290	0.000				203.716
70	102679.521	208.290	-0.881	Hog Curve	102529.521	208.290	102829.521	206.969		-34059	-0.294	340.599	300.000
71				Grade	102829.521	206.969	102954.948	205.864	-0.881				125.427
72	103029.948	205.204	0.531	Sag Curve	102954.948	205.864	103104.948	204.941		28254	0.354	282.542	150.000
73				Grade	103104.948	204.941	103354.143	204.069	-0.350				249.195
74	103454.143	203.719	-0.650	Hog Curve	103354.143	204.069	103554.143	202.719		-30769	-0.325	307.692	200.000
75				Grade	103554.143	202.719	103731.277	200.948	-1.000				177.134
76	103881.277	199.448	1.821	Sag Curve	103731.277	200.948	104031.277	200.680		16474	0.607	164.742	300.000
77				Grade	104031.277	200.680	104265.344	202.602	0.821				234.067
78	104450.344	204.121	-1.331	Hog Curve	104265.344	202.602	104635.344	203.179		-27808	-0.360	278.079	370.000
79				Grade	104635.344	203.179	105108.679	200.767	-0.509				473.335
80	105208.679	200.258	1.509	Sag Curve	105108.679	200.767	105308.679	201.258		13250	0.755	132.501	200.000
81				Grade	105308.679	201.258	105397.057	202.142	1.000				88.378
82	105662.057	204.792	-2.000	Hog Curve	105397.057	202.142	105927.057	202.142		-26500	-0.377	264.999	530.000
83				Grade	105927.057	202.142	106005.137	201.361	-1.000				78.080
84	106055.137	200.861	0.693	Sag Curve	106005.137	201.361	106105.137	200.707		14435	0.693	144.350	100.000
85				Grade	106105.137	200.707	106674.762	198.957	-0.307				569.625
86	106774.762	198.650	1.278	Sag Curve	106674.762	198.957	106874.762	199.621		15648	0.639	156.477	200.000
87				Grade	106874.762	199.621	107013.705	200.970	0.971				138.943
88	107278.706	203.543	-1.971	Hog Curve	107013.705	200.970	107543.705	200.893		-26891	-0.372	268.911	530.000
89				Grade	107543.705	200.893	107693.858	199.391	-1.000				150.153

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
90	107793.858	198.391	1.311	Sag Curve	107693.858	199.391	107893.858	198.702		15254	0.656	152.541	200.000
91				Grade	107893.858	198.702	108015.848	199.082	0.311				121.990
92	108115.848	199.393	-0.622	Hog Curve	108015.848	199.082	108215.848	199.083		-32176	-0.311	321.761	200.000
93				Grade	108215.848	199.083	108377.400	198.581	-0.310				161.552
94	108492.400	198.224	1.310	Sag Curve	108377.400	198.581	108607.400	199.374		17551	0.570	175.512	230.000
95				Grade	108607.400	199.374	108776.000	201.060	1.000				168.600
96	109041.000	203.710	-2.000	Hog Curve	108776.000	201.060	109306.000	201.060		-26500	-0.377	264.999	530.000
97				Grade	109306.000	201.060	109477.310	199.347	-1.000				171.310
98	109567.310	198.447	1.300	Sag Curve	109477.310	199.347	109657.310	198.717		13846	0.722	138.464	180.000
99				Grade	109657.310	198.717	109939.186	199.562	0.300				281.876
100	110089.186	200.012	-0.606	Hog Curve	109939.186	199.562	110239.186	199.553		-49469	-0.202	494.682	300.000
101				Grade	110239.186	199.553	110333.798	199.263	-0.306				94.612
102	110433.798	198.956	0.946	Sag Curve	110333.798	199.263	110533.798	199.596		21131	0.473	211.314	200.000
103				Grade	110533.798	199.596	110736.632	200.894	0.640				202.834
104	110936.632	202.174	-1.533	Hog Curve	110736.632	200.894	111136.632	200.388		-26088	-0.383	260.879	400.000
105				Grade	111136.632	200.388	111303.512	198.897	-0.893				166.880
106	111403.512	198.004	1.403	Sag Curve	111303.512	198.897	111503.512	198.514		14253	0.702	142.533	200.000
107				Grade	111503.512	198.514	111964.882	200.866	0.510				461.370
108	112014.882	201.121	-0.152	Hog Curve	111964.882	200.866	112064.882	201.300		-65694	-0.152	656.944	100.000
109				Grade	112064.882	201.300	112665.907	203.450	0.358				601.025
110	112790.907	203.897	-0.808	Hog Curve	112665.907	203.450	112915.907	203.334		-30957	-0.323	309.569	250.000
111				Grade	112915.907	203.334	113045.811	202.750	-0.450				129.904
112	113185.811	202.120	-1.090	Hog Curve	113045.811	202.750	113325.811	199.964		-25687	-0.389	256.871	280.000
113				Grade	113325.811	199.964	113449.342	198.062	-1.540				123.531
114	113599.342	195.752	1.853	Sag Curve	113449.342	198.062	113749.342	196.222		16187	0.618	161.867	300.000
115				Grade	113749.342	196.222	114317.858	198.004	0.313				568.516
116	114367.858	198.160	0.396	Sag Curve	114317.858	198.004	114417.858	198.515		25237	0.396	252.372	100.000
117				Grade	114417.858	198.515	114441.767	198.685	0.710				23.909
118	114591.767	199.749	-1.006	Hog Curve	114441.767	198.685	114741.767	199.305		-29813	-0.335	298.125	300.000
119				Grade	114741.767	199.305	114812.527	199.095	-0.297				70.760

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
120	114937.527	198.724	1.297	Sag Curve	114812.527	199.095	115062.527	199.974		19281	0.519	192.808	250.000
121				Grade	115062.527	199.974	115448.659	203.835	1.000				386.132
122	115583.659	205.185	-1.000	Hog Curve	115448.659	203.835	115718.659	205.185		-27000	-0.370	270.000	270.000
123				Grade	115718.659	205.185	115785.269	205.185	0.000				66.610
124	115955.269	205.185	-1.278	Hog Curve	115785.269	205.185	116125.269	203.012		-26598	-0.376	265.979	340.000
125				Grade	116125.269	203.012	116566.084	197.377	-1.278				440.815
126	116766.084	194.820	1.981	Sag Curve	116566.084	197.377	116966.084	196.226		20193	0.495	201.930	400.000
127				Grade	116966.084	196.226	117280.560	198.435	0.703				314.476
128	117505.560	200.016	-1.707	Hog Curve	117280.560	198.435	117730.560	197.757		-26368	-0.379	263.685	450.000
129				Grade	117730.560	197.757	117874.556	196.311	-1.004				143.996
130	117989.556	195.156	1.351	Sag Curve	117874.556	196.311	118104.556	195.556		17022	0.587	170.216	230.000
131				Grade	118104.556	195.556	118287.545	196.191	0.347				182.989
132	118412.545	196.625	-0.704	Hog Curve	118287.545	196.191	118537.545	196.179		-35534	-0.281	355.341	250.000
133				Grade	118537.545	196.179	119066.963	194.293	-0.356				529.418
134	119166.963	193.936	1.356	Sag Curve	119066.963	194.293	119266.963	194.936		14745	0.678	147.453	200.000
135				Grade	119266.963	194.936	119344.954	195.716	1.000				77.991
136	119609.954	198.366	-2.000	Hog Curve	119344.954	195.716	119874.954	195.716		-26500	-0.377	264.999	530.000
137				Grade	119874.954	195.716	119971.463	194.751	-1.000				96.509
138	120061.463	193.851	1.313	Sag Curve	119971.463	194.751	120151.463	194.132		13714	0.729	137.137	180.000
139				Grade	120151.463	194.132	120229.731	194.377	0.313				78.268
140	120319.731	194.658	-0.623	Hog Curve	120229.731	194.377	120409.731	194.379		-28907	-0.346	289.067	180.000
141				Grade	120409.731	194.379	120728.398	193.391	-0.310				318.667
142	120803.398	193.158	0.610	Sag Curve	120728.398	193.391	120878.398	193.383		24585	0.407	245.851	150.000
143				Grade	120878.398	193.383	121013.523	193.789	0.300				135.125
144	121113.524	194.089	-0.610	Hog Curve	121013.523	193.789	121213.523	193.779		-32780	-0.305	327.804	200.000
145				Grade	121213.523	193.779	121264.916	193.619	-0.310				51.393
146	121354.916	193.340	1.310	Sag Curve	121264.916	193.619	121444.916	194.240		13739	0.728	137.391	180.000
147				Grade	121444.916	194.240	121684.638	196.637	1.000				239.722
148	121884.639	198.637	-1.500	Hog Curve	121684.638	196.637	122084.638	197.637		-26665	-0.375	266.652	400.000
149				Grade	122084.638	197.637	122212.706	196.997	-0.500				128.068

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
150	122312.706	196.497	1.500	Sag Curve	122212.706	196.997	122412.706	197.497		13332	0.750	133.321	200.000
151				Grade	122412.706	197.497	122775.000	201.120	1.000				362.294
152	122910.000	202.470	-1.000	Hog Curve	122775.000	201.120	123045.000	202.470		-26998	-0.370	269.986	270.000
153				Grade	123045.000	202.470	123155.000	202.470	0.000				110.000
154	123320.000	202.470	-1.250	Hog Curve	123155.000	202.470	123485.000	200.408		-26401	-0.379	264.005	330.000
155				Grade	123485.000	200.408	123686.394	197.890	-1.250				201.394
156	123796.394	196.515	1.562	Sag Curve	123686.394	197.890	123906.394	196.858		14086	0.710	140.859	220.000
157				Grade	123906.394	196.858	124000.874	197.153	0.312				94.480
158	124170.874	197.683	-1.230	Hog Curve	124000.874	197.153	124340.874	196.123		-27653	-0.362	276.533	340.000
159				Grade	124340.874	196.123	124653.255	193.257	-0.918				312.381
160	124778.255	192.109	1.927	Sag Curve	124653.255	193.257	124903.255	193.371		12974	0.771	129.740	250.000
161				Grade	124903.255	193.371	125091.313	195.269	1.009				188.058
162	125326.313	197.641	-1.778	Hog Curve	125091.313	195.269	125561.313	195.834		-26432	-0.378	264.326	470.000
163				Grade	125561.313	195.834	126033.107	192.207	-0.769				471.794
164	126133.107	191.438	1.069	Sag Curve	126033.107	192.207	126233.107	191.738		18712	0.534	187.119	200.000
165				Grade	126233.107	191.738	127028.135	194.123	0.300				795.028
166	127203.135	194.648	-0.969	Hog Curve	127028.135	194.123	127378.135	193.478		-36136	-0.277	361.363	350.000
167				Grade	127378.135	193.478	127762.534	190.908	-0.669				384.399
168	127862.534	190.239	1.669	Sag Curve	127762.534	190.908	127962.534	191.239		11986	0.834	119.864	200.000
169				Grade	127962.534	191.239	128076.000	192.374	1.000				113.466
170	128341.000	195.024	-2.000	Hog Curve	128076.000	192.374	128606.000	192.374		-26500	-0.377	265.006	530.000
171				Grade	128606.000	192.374	128772.993	190.704	-1.000				166.993
172	128872.993	189.704	1.309	Sag Curve	128772.993	190.704	128972.993	190.014		15274	0.655	152.737	200.000
173				Grade	128972.993	190.014	129287.550	190.987	0.309				314.557
174	129337.550	191.142	0.596	Sag Curve	129287.550	190.987	129387.550	191.595		16769	0.596	167.695	100.000
175				Grade	129387.550	191.595	129536.661	192.946	0.906				149.111
176	129801.660	195.346	-1.961	Hog Curve	129536.661	192.946	130066.661	192.549		-27026	-0.370	270.256	530.000
177				Grade	130066.661	192.549	130195.951	191.185	-1.055				129.290
178	130295.951	190.130	1.421	Sag Curve	130195.951	191.185	130395.951	190.496		14071	0.711	140.708	200.000
179				Grade	130395.951	190.496	130478.393	190.797	0.366				82.442

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
180	130568.393	191.127	-0.675	Hog Curve	130478.393	190.797	130658.393	190.849		-26667	-0.375	266.674	180.000
181				Grade	130658.393	190.849	130720.316	190.658	-0.309				61.923
182	130795.316	190.426	1.027	Sag Curve	130720.316	190.658	130870.316	190.964		14612	0.684	146.116	150.000
183				Grade	130870.316	190.964	131093.000	192.562	0.718				222.684
184	131323.000	194.213	-1.658	Hog Curve	131093.000	192.562	131553.000	192.050		-27741	-0.360	277.416	460.000
185				Grade	131553.000	192.050	131677.133	190.882	-0.941				124.133
186	131787.133	189.848	1.541	Sag Curve	131677.133	190.882	131897.133	190.508		14281	0.700	142.808	220.000
187				Grade	131897.133	190.508	132269.477	192.742	0.600				372.344
188	132469.477	193.942	-1.500	Hog Curve	132269.477	192.742	132669.477	192.142		-26667	-0.375	266.667	400.000
189				Grade	132669.477	192.142	132872.550	190.314	-0.900				203.073
190	133000.050	189.167	1.800	Sag Curve	132872.550	190.314	133127.550	190.314		14167	0.706	141.667	255.000
191				Grade	133127.550	190.314	133199.140	190.958	0.900				71.590
192	133434.140	193.073	-1.800	Hog Curve	133199.140	190.958	133669.140	190.958		-26111	-0.383	261.110	470.000
193				Grade	133669.140	190.958	133956.982	188.368	-0.900				287.842
194	134056.982	187.468	1.213	Sag Curve	133956.982	188.368	134156.982	187.780		16494	0.606	164.938	200.000
195				Grade	134156.982	187.780	134341.615	188.357	0.313				184.633
196	134391.615	188.514	0.687	Sag Curve	134341.615	188.357	134441.615	189.014		14547	0.687	145.469	100.000
197				Grade	134441.615	189.014	134675.461	191.352	1.000				233.846
198	134940.461	194.002	-2.000	Hog Curve	134675.461	191.352	135205.461	191.352		-26500	-0.377	264.999	530.000
199				Grade	135205.461	191.352	135358.060	189.826	-1.000				152.599
200	135458.060	188.826	0.657	Sag Curve	135358.060	189.826	135558.060	188.484		30421	0.329	304.210	200.000
201				Grade	135558.060	188.484	135971.555	187.067	-0.343				413.495
202	136021.555	186.896	0.657	Sag Curve	135971.555	187.067	136071.555	187.053		15213	0.657	152.133	100.000
203				Grade	136071.555	187.053	136247.395	187.607	0.315				175.840
204	136297.395	187.764	0.689	Sag Curve	136247.395	187.607	136347.395	188.266		14509	0.689	145.087	100.000
205				Grade	136347.395	188.266	136434.897	189.145	1.004				87.502
206	136699.897	191.805	-2.004	Hog Curve	136434.897	189.145	136964.897	189.155		-26447	-0.378	264.473	530.000
207				Grade	136964.897	189.155	137058.740	188.217	-1.000				93.843
208	137158.740	187.217	1.502	Sag Curve	137058.740	188.217	137258.740	187.719		13318	0.751	133.181	200.000
209				Grade	137258.740	187.719	137859.550	190.733	0.502				600.810

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
210				Grade	137859.550	190.733	0.000	0.000	0.502				-137859.550

Table-5.4.4 Vertical Alignment Report (Package-4)

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	136900.000	189.804	137058.693	188.217	-1.000				158.693
2	137158.693	187.217	1.502	Sag Curve	137058.693	188.217	137258.693	187.719		13318	0.751	133.184	200.000
3				Grade	137258.693	187.719	137799.330	190.431	0.502				540.637
4	137949.330	191.184	-1.143	Hog Curve	137799.330	190.431	138099.330	190.221		-26242	-0.381	262.419	300.000
5				Grade	138099.330	190.221	138447.935	187.985	-0.642				348.605
6	138517.935	187.536	0.937	Sag Curve	138447.935	187.985	138587.935	187.743		14947	0.669	149.470	140.000
7				Grade	138587.935	187.743	138775.018	188.295	0.295				187.083
8	138870.018	188.575	-0.625	Hog Curve	138775.018	188.295	138965.018	188.262		-30402	-0.329	304.016	190.000
9				Grade	138965.018	188.262	139352.743	186.983	-0.330				387.725
10	139452.744	186.653	1.330	Sag Curve	139352.743	186.983	139552.743	187.653		15039	0.665	150.390	200.000
11				Grade	139552.743	187.653	139638.000	188.505	1.000				85.257
12	139873.000	190.856	-1.800	Hog Curve	139638.000	188.505	140108.000	188.976		-26111	-0.383	261.110	470.000
13				Grade	140108.000	188.976	140167.063	188.503	-0.800				59.063
14	140277.063	187.623	1.600	Sag Curve	140167.063	188.503	140387.063	188.503		13750	0.727	137.501	220.000
15				Grade	140387.063	188.503	140480.000	189.246	0.800				92.937
16	140650.000	190.606	-1.300	Hog Curve	140480.000	189.246	140820.000	189.756		-26153	-0.382	261.527	340.000
17				Grade	140820.000	189.756	141059.455	188.559	-0.500				239.455
18	141109.455	188.309	-0.106	Hog Curve	141059.455	188.559	141159.455	188.006		-93911	-0.106	939.144	100.000
19				Grade	141159.455	188.006	141353.301	186.830	-0.607				193.846
20	141453.301	186.223	1.210	Sag Curve	141353.301	186.830	141553.301	186.827		16533	0.605	165.330	200.000
21				Grade	141553.301	186.827	141925.669	189.073	0.603				372.368
22	142085.669	190.038	-1.203	Hog Curve	141925.669	189.073	142245.669	189.078		-26599	-0.376	265.993	320.000
23				Grade	142245.669	189.078	142341.050	188.506	-0.600				95.381
24	142431.050	187.966	1.226	Sag Curve	142341.050	188.506	142521.050	188.529		14682	0.681	146.823	180.000
25				Grade	142521.050	188.529	142538.118	188.636	0.626				17.068
26	142763.118	190.045	-1.700	Hog Curve	142538.118	188.636	142988.118	187.629		-26476	-0.378	264.760	450.000
27				Grade	142988.118	187.629	143009.198	187.403	-1.074				21.080
28	143129.198	186.115	1.774	Sag Curve	143009.198	187.403	143249.198	186.955		13532	0.739	135.320	240.000
29				Grade	143249.198	186.955	143607.000	189.459	0.700				357.802

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	143832.000	191.034	-1.700	Hog Curve	143607.000	189.459	144057.000	188.784		-26471	-0.378	264.711	450.000
31				Grade	144057.000	188.784	144260.242	186.752	-1.000				203.242
32	144372.742	185.627	1.693	Sag Curve	144260.242	186.752	144485.242	186.406		13292	0.752	132.915	225.000
33				Grade	144485.242	186.406	144557.326	186.906	0.693				72.084
34	144742.325	188.188	-1.283	Hog Curve	144557.326	186.906	144927.326	187.096		-28839	-0.347	288.392	370.000
35				Grade	144927.326	187.096	145480.547	183.831	-0.590				553.221
36	145590.547	183.182	1.590	Sag Curve	145480.547	183.831	145700.547	184.282		13835	0.723	138.353	220.000
37				Grade	145700.547	184.282	146012.500	187.402	1.000				311.953
38	146275.000	190.027	-2.000	Hog Curve	146012.500	187.402	146537.500	187.402		-26250	-0.381	262.502	525.000
39				Grade	146537.500	187.402	146743.550	185.341	-1.000				206.050
40	146868.549	184.091	1.820	Sag Curve	146743.550	185.341	146993.550	185.116		13736	0.728	137.363	250.000
41				Grade	146993.550	185.116	147178.000	186.629	0.820				184.450
42	147393.000	188.391	-1.640	Hog Curve	147178.000	186.629	147608.000	186.628		-26219	-0.381	262.192	430.000
43				Grade	147608.000	186.628	147701.558	185.861	-0.820				93.558
44	147801.558	185.041	1.432	Sag Curve	147701.558	185.861	147901.558	185.653		13968	0.716	139.684	200.000
45				Grade	147901.558	185.653	147955.883	185.985	0.612				54.325
46	148165.883	187.270	-1.579	Hog Curve	147955.883	185.985	148375.883	185.239		-26598	-0.376	265.979	420.000
47				Grade	148375.883	185.239	148421.220	184.800	-0.967				45.337
48	148553.720	183.518	1.967	Sag Curve	148421.220	184.800	148686.220	184.843		13470	0.742	134.702	265.000
49				Grade	148686.220	184.843	148822.000	186.201	1.000				135.780
50	149087.000	188.851	-2.000	Hog Curve	148822.000	186.201	149352.000	186.201		-26500	-0.377	264.999	530.000
51				Grade	149352.000	186.201	149616.928	183.552	-1.000				264.928
52	149716.928	182.552	1.296	Sag Curve	149616.928	183.552	149816.928	182.848		15431	0.648	154.311	200.000
53				Grade	149816.928	182.848	150039.363	183.507	0.296				222.435
54	150089.363	183.655	0.704	Sag Curve	150039.363	183.507	150139.363	184.155		14206	0.704	142.062	100.000
55				Grade	150139.363	184.155	150213.000	184.891	1.000				73.637
56	150478.000	187.541	-2.000	Hog Curve	150213.000	184.891	150743.000	184.891		-26500	-0.377	264.999	530.000
57				Grade	150743.000	184.891	150933.900	182.982	-1.000				190.900
58	151068.900	181.632	2.000	Sag Curve	150933.900	182.982	151203.900	182.982		13500	0.741	135.000	270.000
59				Grade	151203.900	182.982	151265.000	183.593	1.000				61.100

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
60	151465.000	185.593	-1.500	Hog Curve	151265.000	183.593	151665.000	184.593		-26665	-0.375	266.652	400.000
61				Grade	151665.000	184.593	151780.547	184.015	-0.500				115.547
62	151860.547	183.615	1.145	Sag Curve	151780.547	184.015	151940.547	184.131		13973	0.716	139.727	160.000
63				Grade	151940.547	184.131	152314.695	186.544	0.645				374.148
64	152524.695	187.899	-1.536	Hog Curve	152314.695	186.544	152734.695	186.028		-27349	-0.366	273.493	420.000
65				Grade	152734.695	186.028	153143.091	182.391	-0.891				408.396
66	153283.091	181.144	1.952	Sag Curve	153143.091	182.391	153423.091	182.630		14344	0.697	143.443	280.000
67				Grade	153423.091	182.630	153766.000	186.269	1.061				342.909
68	153966.000	188.392	-1.061	Hog Curve	153766.000	186.269	154166.000	188.392		-37689	-0.265	376.889	400.000
69				Grade	154166.000	188.392	154235.000	188.392	0.000				69.000
70	154435.000	188.392	-1.500	Hog Curve	154235.000	188.392	154635.000	185.392		-26667	-0.375	266.667	400.000
71				Grade	154635.000	185.392	154722.926	184.073	-1.500				87.926
72	154857.926	182.048	1.926	Sag Curve	154722.926	184.073	154992.926	182.623		14021	0.713	140.205	270.000
73				Grade	154992.926	182.623	155371.797	184.236	0.426				378.871
74	155561.797	185.045	-1.422	Hog Curve	155371.797	184.236	155751.797	183.152		-26718	-0.374	267.187	380.000
75				Grade	155751.797	183.152	155795.478	182.716	-0.996				43.681
76	155905.478	181.620	1.641	Sag Curve	155795.478	182.716	156015.478	182.329		13409	0.746	134.088	220.000
77				Grade	156015.478	182.329	156126.285	183.043	0.644				110.807
78	156341.285	184.428	-1.644	Hog Curve	156126.285	183.043	156556.285	182.278		-26151	-0.382	261.513	430.000
79				Grade	156556.285	182.278	156897.980	178.860	-1.000				341.695
80	156987.980	177.960	1.300	Sag Curve	156897.980	178.860	157077.980	178.230		13844	0.722	138.441	180.000
81				Grade	157077.980	178.230	157203.738	178.608	0.300				125.758
82	157253.738	178.758	-0.300	Hog Curve	157203.738	178.608	157303.738	178.758		-33317	-0.300	333.167	100.000
83				Grade	157303.738	178.758	157410.872	178.758	0.000				107.134
84	157460.872	178.758	-0.300	Hog Curve	157410.872	178.758	157510.872	178.608		-33333	-0.300	333.333	100.000
85				Grade	157510.872	178.608	157913.629	177.400	-0.300				402.757
86	158013.629	177.100	1.248	Sag Curve	157913.629	177.400	158113.629	178.047		16031	0.624	160.308	200.000
87				Grade	158113.629	178.047	158296.593	179.781	0.948				182.964
88	158466.593	181.392	-1.248	Hog Curve	158296.593	179.781	158636.593	180.882		-27251	-0.367	272.509	340.000
89				Grade	158636.593	180.882	158692.393	180.714	-0.300				55.800

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
90	158779.893	180.452	1.300	Sag Curve	158692.393	180.714	158867.393	181.327		13461	0.743	134.609	175.000
91				Grade	158867.393	181.327	159002.000	182.673	1.000				134.607
92	159267.000	185.323	-2.000	Hog Curve	159002.000	182.673	159532.000	182.673		-26500	-0.377	264.999	530.000
93				Grade	159532.000	182.673	159572.264	182.270	-1.000				40.264
94	159697.264	181.020	1.890	Sag Curve	159572.264	182.270	159822.264	182.133		13229	0.756	132.293	250.000
95				Grade	159822.264	182.133	159907.622	182.892	0.890				85.358
96	160147.622	185.027	-1.820	Hog Curve	159907.622	182.892	160387.622	182.795		-26377	-0.379	263.769	480.000
97				Grade	160387.622	182.795	160529.665	181.474	-0.930				142.043
98	160634.665	180.498	1.579	Sag Curve	160529.665	181.474	160739.665	181.179		13303	0.752	133.034	210.000
99				Grade	160739.665	181.179	160956.424	182.585	0.649				216.759
100	161226.424	184.336	-1.649	Hog Curve	160956.424	182.585	161496.424	181.636		-32756	-0.305	327.557	540.000
101				Grade	161496.424	181.636	161666.600	179.934	-1.000				170.176
102	161799.100	178.609	2.000	Sag Curve	161666.600	179.934	161931.600	179.934		13250	0.755	132.499	265.000
103				Grade	161931.600	179.934	162035.000	180.968	1.000				103.400
104	162300.000	183.618	-2.000	Hog Curve	162035.000	180.968	162565.000	180.968		-26499	-0.377	264.992	530.000
105				Grade	162565.000	180.968	162705.325	179.565	-1.000				140.325
106	162755.325	179.064	0.682	Sag Curve	162705.325	179.565	162805.325	178.905		14669	0.682	146.690	100.000
107				Grade	162805.325	178.905	163057.999	178.101	-0.318				252.674
108	163182.999	177.703	0.637	Sag Curve	163057.999	178.101	163307.999	178.101		39273	0.255	392.727	250.000
109				Grade	163307.999	178.101	163910.102	180.017	0.318				602.103
110	163960.102	180.176	0.382	Sag Curve	163910.102	180.017	164010.102	180.526		26193	0.382	261.931	100.000
111				Grade	164010.102	180.526	164161.000	181.582	0.700				150.898
112	164386.000	183.157	-1.700	Hog Curve	164161.000	181.582	164611.000	180.907		-26472	-0.378	264.718	450.000
113				Grade	164611.000	180.907	164847.882	178.539	-1.000				236.882
114	164967.882	177.339	1.800	Sag Curve	164847.882	178.539	165087.882	178.299		13335	0.750	133.348	240.000
115				Grade	165087.882	178.299	165165.000	178.916	0.800				77.118
116	165400.000	180.796	-1.800	Hog Curve	165165.000	178.916	165635.000	178.446		-26113	-0.383	261.131	470.000
117				Grade	165635.000	178.446	165750.297	177.293	-1.000				115.297
118	165925.297	175.543	1.706	Sag Curve	165750.297	177.293	166100.297	176.778		20521	0.487	205.208	350.000
119				Grade	166100.297	176.778	166235.148	177.729	0.706				134.851

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
120	166285.148	178.082	-0.031	Hog Curve	166235.148	177.729	166335.148	178.419		-320062	-0.031	3201.024	100.000
121				Grade	166335.148	178.419	166685.000	180.779	0.674				349.852
122	166820.000	181.689	-0.674	Hog Curve	166685.000	180.779	166955.000	181.689		-40036	-0.250	400.368	270.000
123				Grade	166955.000	181.689	166997.464	181.689	0.000				42.464
124	167082.464	181.689	-0.586	Hog Curve	166997.464	181.689	167167.464	181.191		-29002	-0.345	290.023	170.000
125				Grade	167167.464	181.191	167991.885	176.358	-0.586				824.421
126	168191.885	175.186	1.586	Sag Curve	167991.885	176.358	168391.885	177.186		25219	0.397	252.188	400.000
127				Grade	168391.885	177.186	168522.000	178.487	1.000				130.115
128	168787.000	181.137	-2.000	Hog Curve	168522.000	178.487	169052.000	178.487		-26500	-0.377	265.006	530.000
129				Grade	169052.000	178.487	169110.000	177.907	-1.000				58.000
130	169200.000	177.007	1.321	Sag Curve	169110.000	177.907	169290.000	177.295		13631	0.734	136.307	180.000
131				Grade	169290.000	177.295	169557.114	178.152	0.321				267.114
132	169607.114	178.312	0.179	Sag Curve	169557.114	178.152	169657.114	178.562		55754	0.179	557.538	100.000
133				Grade	169657.114	178.562	169875.000	179.651	0.500				217.886
134	170075.000	180.651	-1.500	Hog Curve	169875.000	179.651	170275.000	178.651		-26668	-0.375	266.681	400.000
135				Grade	170275.000	178.651	170474.028	176.661	-1.000				199.028
136	170601.528	175.386	1.800	Sag Curve	170474.028	176.661	170729.028	176.406		14167	0.706	141.667	255.000
137				Grade	170729.028	176.406	171020.000	178.733	0.800				290.972
138	171255.000	180.613	-1.800	Hog Curve	171020.000	178.733	171490.000	178.264		-26111	-0.383	261.110	470.000
139				Grade	171490.000	178.264	171609.497	177.069	-1.000				119.497
140	171699.497	176.169	1.309	Sag Curve	171609.497	177.069	171789.497	176.447		13749	0.727	137.487	180.000
141				Grade	171789.497	176.447	171914.191	176.832	0.309				124.694
142	172014.191	177.142	-0.616	Hog Curve	171914.191	176.832	172114.191	176.834		-32445	-0.308	324.444	200.000
143				Grade	172114.191	176.834	172198.781	176.574	-0.307				84.590
144	172273.781	176.344	1.031	Sag Curve	172198.781	176.574	172348.781	176.887		14548	0.687	145.476	150.000
145				Grade	172348.781	176.887	173179.477	182.900	0.724				830.696
146	173304.477	183.805	-0.724	Hog Curve	173179.477	182.900	173429.477	183.805		-34536	-0.290	345.363	250.000
147				Grade	173429.477	183.805	173486.000	183.805	0.000				56.523
148	173621.000	183.805	-0.918	Hog Curve	173486.000	183.805	173756.000	182.566		-29416	-0.340	294.161	270.000
149				Grade	173756.000	182.566	173921.919	181.043	-0.918				165.919

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
150	173971.919	180.584	0.334	Sag Curve	173921.919	181.043	174021.919	180.292		29935	0.334	299.347	100.000
151				Grade	174021.919	180.292	174432.300	177.896	-0.584				410.381
152	174542.300	177.254	1.484	Sag Curve	174432.300	177.896	174652.300	178.244		14826	0.674	148.262	220.000
153				Grade	174652.300	178.244	174750.000	179.123	0.900				97.700
154	175000.000	181.374	-1.900	Hog Curve	174750.000	179.123	175250.000	178.873		-26314	-0.380	263.137	500.000
155				Grade	175250.000	178.873	175381.845	177.555	-1.000				131.845
156	175491.845	176.455	1.447	Sag Curve	175381.845	177.555	175601.845	176.946		15201	0.658	152.013	220.000
157				Grade	175601.845	176.946	175985.000	178.660	0.447				383.155
158	176185.000	179.554	-1.444	Hog Curve	175985.000	178.660	176385.000	177.561		-27708	-0.361	277.077	400.000
159				Grade	176385.000	177.561	176528.212	176.134	-0.996				143.212
160	176578.212	175.636	0.644	Sag Curve	176528.212	176.134	176628.212	175.459		15528	0.644	155.284	100.000
161				Grade	176628.212	175.459	176749.860	175.031	-0.353				121.648
162	176849.860	174.678	1.353	Sag Curve	176749.860	175.031	176949.860	175.678		14786	0.676	147.863	200.000
163				Grade	176949.860	175.678	177107.500	177.255	1.000				157.640
164	177370.000	179.880	-2.000	Hog Curve	177107.500	177.255	177632.500	177.255		-26247	-0.381	262.474	525.000
165				Grade	177632.500	177.255	177726.791	176.312	-1.000				94.291
166	177776.791	175.812	0.690	Sag Curve	177726.791	176.312	177826.791	175.657		14488	0.690	144.875	100.000
167				Grade	177826.791	175.657	178144.895	174.671	-0.310				318.104
168	178194.895	174.516	0.621	Sag Curve	178144.895	174.671	178244.895	174.672		16095	0.621	160.950	100.000
169				Grade	178244.895	174.672	178580.011	175.715	0.311				335.116
170	178630.011	175.871	0.689	Sag Curve	178580.011	175.715	178680.011	176.371		14523	0.689	145.231	100.000
171				Grade	178680.011	176.371	178745.000	177.021	1.000				64.989
172	178955.000	179.121	-1.600	Hog Curve	178745.000	177.021	179165.000	177.861		-26251	-0.381	262.509	420.000
173				Grade	179165.000	177.861	179466.556	176.052	-0.600				301.556
174	179581.556	175.362	1.350	Sag Curve	179466.556	176.052	179696.556	176.224		17038	0.587	170.384	230.000
175				Grade	179696.556	176.224	180076.000	179.070	0.750				379.444
176	180276.000	180.570	-1.500	Hog Curve	180076.000	179.070	180476.000	179.070		-26669	-0.375	266.688	400.000
177				Grade	180476.000	179.070	180729.643	177.168	-0.750				253.643
178	180819.643	176.493	1.050	Sag Curve	180729.643	177.168	180909.643	176.763		17145	0.583	171.447	180.000
179				Grade	180909.643	176.763	181172.000	177.550	0.300				262.357

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
180	181347.000	178.075	-1.300	Hog Curve	181172.000	177.550	181522.000	176.325		-26924	-0.371	269.244	350.000
181				Grade	181522.000	176.325	181665.000	174.895	-1.000				143.000
182	181765.000	173.895	1.330	Sag Curve	181665.000	174.895	181865.000	174.225		15036	0.665	150.362	200.000
183				Grade	181865.000	174.225	182117.168	175.057	0.330				252.168
184	182267.168	175.553	-0.640	Hog Curve	182117.168	175.057	182417.168	175.088		-46897	-0.213	468.977	300.000
185				Grade	182417.168	175.088	182865.731	173.700	-0.310				448.563
186	182965.731	173.390	1.110	Sag Curve	182865.731	173.700	183065.731	174.190		18024	0.555	180.239	200.000
187				Grade	183065.731	174.190	183201.000	175.272	0.800				135.269
188	183436.000	177.152	-1.800	Hog Curve	183201.000	175.272	183671.000	174.803		-26110	-0.383	261.103	470.000
189				Grade	183671.000	174.803	183710.520	174.407	-1.000				39.520
190	183760.520	173.907	0.693	Sag Curve	183710.520	174.407	183810.520	173.754		14435	0.693	144.354	100.000
191				Grade	183810.520	173.754	184371.348	172.030	-0.307				560.828
192	184421.348	171.877	0.616	Sag Curve	184371.348	172.030	184471.348	172.031		16242	0.616	162.425	100.000
193				Grade	184471.348	172.031	184680.711	172.677	0.308				209.363
194	184730.711	172.831	0.282	Sag Curve	184680.711	172.677	184780.711	173.126		35506	0.282	355.051	100.000
195				Grade	184780.711	173.126	185133.443	175.207	0.590				352.732
196	185333.443	176.388	-1.487	Hog Curve	185133.443	175.207	185533.443	174.594		-26906	-0.372	269.063	400.000
197				Grade	185533.443	174.594	185771.238	172.462	-0.897				237.795
198	185881.238	171.476	1.597	Sag Curve	185771.238	172.462	185991.238	172.246		13779	0.726	137.794	220.000
199				Grade	185991.238	172.246	186275.000	174.232	0.700				283.762
200	186500.000	175.807	-1.368	Hog Curve	186275.000	174.232	186725.000	174.305		-32900	-0.304	329.001	450.000
201				Grade	186725.000	174.305	186967.818	172.683	-0.668				242.818
202	187087.818	171.882	1.453	Sag Curve	186967.818	172.683	187207.818	172.824		16520	0.605	165.202	240.000
203				Grade	187207.818	172.824	187773.000	177.260	0.785				565.182
204	187908.000	178.320	-0.785	Hog Curve	187773.000	177.260	188043.000	178.320		-34396	-0.291	343.962	270.000
205				Grade	188043.000	178.320	188122.000	178.320	0.000				79.000
206	188257.000	178.320	-1.000	Hog Curve	188122.000	178.320	188392.000	176.971		-27011	-0.370	270.110	270.000
207				Grade	188392.000	176.971	188592.197	174.969	-1.000				200.197
208	188727.197	173.620	1.739	Sag Curve	188592.197	174.969	188862.197	174.619		15524	0.644	155.239	270.000
209				Grade	188862.197	174.619	189092.000	176.318	0.740				229.803

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
210	189227.000	177.317	-0.740	Hog Curve	189092.000	176.318	189362.000	177.317		-36502	-0.274	365.017	270.000
211				Grade	189362.000	177.317	189425.934	177.317	0.000				63.934
212	189625.934	177.317	-1.500	Hog Curve	189425.934	177.317	189825.934	174.317		-26667	-0.375	266.667	400.000

Table-5.4.5 Vertical Alignment Report (Package-5)

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	186736.845	171.992	187008.969	172.478	0.179				272.124
2	187095.000	172.632	0.554	Sag Curve	187008.969	172.478	187181.031	173.263		31040	0.322	310.395	172.062
3				Grade	187181.031	173.263	187378.864	174.713	0.733				197.833
4	187453.864	175.263	-0.060	Hog Curve	187378.864	174.713	187528.864	175.767		-250950	-0.040	2509.410	150.000
5				Grade	187528.864	175.767	187773.000	177.411	0.673				244.136
6	187908.000	178.320	-0.673	Hog Curve	187773.000	177.411	188043.000	178.320		-40104	-0.249	401.043	270.000
7				Grade	188043.000	178.320	188122.000	178.320	0.000				79.000
8	188257.000	178.320	-1.000	Hog Curve	188122.000	178.320	188392.000	176.971		-27011	-0.370	270.110	270.000
9				Grade	188392.000	176.971	188592.197	174.969	-1.000				200.197
10	188727.197	173.620	1.739	Sag Curve	188592.197	174.969	188862.197	174.619		15524	0.644	155.239	270.000
11				Grade	188862.197	174.619	189092.000	176.318	0.740				229.803
12	189227.000	177.317	-0.740	Hog Curve	189092.000	176.318	189362.000	177.317		-36502	-0.274	365.017	270.000
13				Grade	189362.000	177.317	189425.934	177.317	0.000				63.934
14	189625.934	177.317	-1.500	Hog Curve	189425.934	177.317	189825.934	174.317		-26667	-0.375	266.667	400.000
15				Grade	189825.934	174.317	190343.104	166.559	-1.500				517.170
16	190473.104	164.609	1.824	Sag Curve	190343.104	166.559	190603.104	165.030		14255	0.701	142.554	260.000
17				Grade	190603.104	165.030	190731.236	165.445	0.324				128.132
18	190811.236	165.704	-0.637	Hog Curve	190731.236	165.445	190891.236	165.454		-25106	-0.398	251.061	160.000
19				Grade	190891.236	165.454	190922.184	165.357	-0.313				30.948
20	190972.184	165.200	-0.369	Hog Curve	190922.184	165.357	191022.184	164.859		-27073	-0.369	270.724	100.000
21				Grade	191022.184	164.859	191139.607	164.057	-0.683				117.423
22	191239.607	163.374	1.383	Sag Curve	191139.607	164.057	191339.607	164.074		14462	0.691	144.619	200.000
23				Grade	191339.607	164.074	191422.000	164.651	0.700				82.393
24	191647.000	166.226	-1.700	Hog Curve	191422.000	164.651	191872.000	163.976		-26470	-0.378	264.697	450.000
25				Grade	191872.000	163.976	192043.265	162.264	-1.000				171.265
26	192155.765	161.139	1.650	Sag Curve	192043.265	162.264	192268.265	161.870		13637	0.733	136.374	225.000
27				Grade	192268.265	161.870	192795.000	165.294	0.650				526.735
28	193040.000	166.886	-1.850	Hog Curve	192795.000	165.294	193285.000	163.946		-26487	-0.378	264.873	490.000
29				Grade	193285.000	163.946	193382.700	162.774	-1.200				97.700

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	193582.700	160.374	1.821	Sag Curve	193382.700	162.774	193782.700	161.616		21961	0.455	219.616	400.000
31				Grade	193782.700	161.616	193985.800	162.878	0.621				203.100
32	193985.800	162.878	-0.171	Sag Curve	193985.800	162.878	194370.000	164.607					384.200
33	194585.000	165.575	-1.650	Hog Curve	194370.000	164.607	194800.000	162.995		-26062	-0.384	260.613	430.000
34				Grade	194800.000	162.995	194877.427	162.066	-1.200				77.427
35	194997.427	160.626	1.799	Sag Curve	194877.427	162.066	195117.427	161.345		13339	0.750	133.388	240.000
36				Grade	195117.427	161.345	195411.897	163.110	0.599				294.470
37	195611.897	164.309	-1.498	Hog Curve	195411.897	163.110	195811.897	162.511		-26701	-0.375	267.016	400.000
38				Grade	195811.897	162.511	196046.239	160.405	-0.899				234.342
39	196146.239	159.506	1.511	Sag Curve	196046.239	160.405	196246.239	160.119		13233	0.756	132.326	200.000
40				Grade	196246.239	160.119	196377.533	160.923	0.613				131.294
41	196510.033	161.735	-0.975	Hog Curve	196377.533	160.923	196642.533	161.255		-27174	-0.368	271.747	265.000
42				Grade	196642.533	161.255	196750.462	160.863	-0.363				107.929
43	196845.462	160.519	1.362	Sag Curve	196750.462	160.863	196940.462	161.469		13946	0.717	139.454	190.000
44				Grade	196940.462	161.469	197072.500	162.789	1.000				132.038
45	197335.000	165.414	-2.000	Hog Curve	197072.500	162.789	197597.500	162.789		-26251	-0.381	262.509	525.000
46				Grade	197597.500	162.789	197759.328	161.171	-1.000				161.828
47	197884.328	159.921	1.569	Sag Curve	197759.328	161.171	198009.328	160.632		15933	0.628	159.332	250.000
48				Grade	198009.328	160.632	198405.502	162.886	0.569				396.174
49	198555.502	163.740	-1.015	Hog Curve	198405.502	162.886	198705.502	163.071		-29549	-0.338	295.491	300.000
50				Grade	198705.502	163.071	198977.720	161.856	-0.446				272.218
51	199027.720	161.633	0.123	Sag Curve	198977.720	161.856	199077.720	161.471		81595	0.123	815.927	100.000
52				Grade	199077.720	161.471	199404.895	160.412	-0.324				327.175
53	199494.895	160.121	1.284	Sag Curve	199404.895	160.412	199584.895	160.985		14024	0.713	140.237	180.000
54				Grade	199584.895	160.985	200055.000	165.497	0.960				470.105
55	200280.000	167.657	-1.660	Hog Curve	200055.000	165.497	200505.000	166.082		-27109	-0.369	271.091	450.000
56				Grade	200505.000	166.082	200801.995	164.003	-0.700				296.995
57	200876.995	163.478	1.010	Sag Curve	200801.995	164.003	200951.995	163.710		14855	0.673	148.551	150.000
58				Grade	200951.995	163.710	201045.000	163.998	0.310				93.005
59	201195.000	164.463	-1.030	Hog Curve	201045.000	163.998	201345.000	163.382		-29116	-0.343	291.163	300.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
60				Grade	201345.000	163.382	201438.300	162.710	-0.721				93.300
61	201488.300	162.349	0.407	Sag Curve	201438.300	162.710	201538.300	162.192		24596	0.407	245.960	100.000
62				Grade	201538.300	162.192	202210.000	160.083	-0.314				671.700
63	202300.000	159.800	1.314	Sag Curve	202210.000	160.083	202390.000	160.700		13698	0.730	136.979	180.000
64				Grade	202390.000	160.700	202487.500	161.675	1.000				97.500
65	202750.000	164.300	-2.000	Hog Curve	202487.500	161.675	203012.500	161.675		-26251	-0.381	262.509	525.000
66				Grade	203012.500	161.675	203141.993	160.380	-1.000				129.493
67	203276.993	159.030	2.000	Sag Curve	203141.993	160.380	203411.993	160.380		13500	0.741	135.004	270.000
68				Grade	203411.993	160.380	203516.000	161.420	1.000				104.007
69	203751.000	163.771	-1.800	Hog Curve	203516.000	161.420	203986.000	161.891		-26111	-0.383	261.110	470.000
70				Grade	203986.000	161.891	204246.444	159.807	-0.800				260.444
71	204371.444	158.807	1.800	Sag Curve	204246.444	159.807	204496.444	160.057		13889	0.720	138.891	250.000
72				Grade	204496.444	160.057	204678.500	161.878	1.000				182.056
73	204941.000	164.502	-2.000	Hog Curve	204678.500	161.878	205203.500	161.878		-26251	-0.381	262.509	525.000
74				Grade	205203.500	161.878	205418.168	159.731	-1.000				214.668
75	205568.168	158.231	1.295	Sag Curve	205418.168	159.731	205718.168	158.674		23165	0.432	231.648	300.000
76				Grade	205718.168	158.674	206862.709	162.051	0.295				1144.541
77	206912.709	162.199	0.705	Sag Curve	206862.709	162.051	206962.709	162.699		14187	0.705	141.866	100.000
78				Grade	206962.709	162.699	207177.192	164.844	1.000				214.483
79	207312.192	166.194	-1.000	Hog Curve	207177.192	164.844	207447.192	166.194		-27000	-0.370	270.000	270.000
80				Grade	207447.192	166.194	207542.615	166.194	0.000				95.423
81	207677.615	166.194	-1.001	Hog Curve	207542.615	166.194	207812.615	164.842		-26972	-0.371	269.724	270.000
82				Grade	207812.615	164.842	208202.156	160.943	-1.001				389.541
83	208292.156	160.042	1.301	Sag Curve	208202.156	160.943	208382.156	160.312		13835	0.723	138.353	180.000
84				Grade	208382.156	160.312	208723.000	161.335	0.300				340.844
85	208893.000	161.844	-1.300	Hog Curve	208723.000	161.335	209063.000	160.144		-26154	-0.382	261.540	340.000
86				Grade	209063.000	160.144	209169.700	159.078	-1.000				106.700
87	209257.200	158.203	1.309	Sag Curve	209169.700	159.078	209344.700	158.473		13369	0.748	133.688	175.000
88				Grade	209344.700	158.473	209538.765	159.073	0.309				194.065
89	209588.765	159.227	0.182	Sag Curve	209538.765	159.073	209638.765	159.473		54814	0.182	548.125	100.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
90				Grade	209638.765	159.473	210172.370	162.095	0.491				533.605
91	210322.370	162.832	-1.077	Hog Curve	210172.370	162.095	210472.370	161.954		-27852	-0.359	278.520	300.000
92				Grade	210472.370	161.954	210839.492	159.804	-0.586				367.122
93	210939.492	159.218	1.336	Sag Curve	210839.492	159.804	211039.492	159.968		14974	0.668	149.739	200.000
94				Grade	211039.492	159.968	211340.000	162.222	0.750				300.508
95	211540.000	163.722	-1.500	Hog Curve	211340.000	162.222	211740.000	162.222		-26667	-0.375	266.667	400.000
96				Grade	211740.000	162.222	212007.967	160.212	-0.750				267.967
97	212057.967	159.837	0.130	Sag Curve	212007.967	160.212	212107.967	159.527		77095	0.130	770.951	100.000
98				Grade	212107.967	159.527	212507.116	157.051	-0.620				399.149
99	212607.116	156.431	0.926	Sag Curve	212507.116	157.051	212707.116	156.737		21601	0.463	216.011	200.000
100				Grade	212707.116	156.737	212812.178	157.058	0.306				105.062
101	212927.178	157.409	-0.828	Hog Curve	212812.178	157.058	213042.178	156.808		-27765	-0.360	277.654	230.000
102				Grade	213042.178	156.808	213145.131	156.270	-0.523				102.953
103	213205.131	155.956	0.823	Sag Curve	213145.131	156.270	213265.131	156.136		14585	0.686	145.845	120.000
104				Grade	213265.131	156.136	213524.000	156.912	0.300				258.869
105	213609.000	157.168	-0.600	Hog Curve	213524.000	156.912	213694.000	156.913		-28340	-0.353	283.407	170.000
106				Grade	213694.000	156.913	213790.625	156.623	-0.300				96.625
107	213860.625	156.413	1.000	Sag Curve	213790.625	156.623	213930.625	156.903		14003	0.714	140.031	140.000
108				Grade	213930.625	156.903	214180.000	158.648	0.700				249.375
109	214405.000	160.223	-1.700	Hog Curve	214180.000	158.648	214630.000	157.973		-26470	-0.378	264.704	450.000
110				Grade	214630.000	157.973	214686.892	157.404	-1.000				56.892
111	214786.892	156.404	1.500	Sag Curve	214686.892	157.404	214886.892	156.904		13332	0.750	133.321	200.000
112				Grade	214886.892	156.904	215321.000	159.075	0.500				434.108
113	215446.000	159.700	-0.950	Hog Curve	215321.000	159.075	215571.000	159.137		-26314	-0.380	263.137	250.000
114				Grade	215571.000	159.137	216366.353	155.558	-0.450				795.353
115	216436.353	155.243	0.754	Sag Curve	216366.353	155.558	216506.353	155.456		18562	0.539	185.622	140.000
116				Grade	216506.353	155.456	216627.000	155.823	0.304				120.647
117	216700.000	156.045	0.469	Sag Curve	216627.000	155.823	216773.000	156.609		31138	0.321	311.381	146.000
118				Grade	216773.000	156.609	217284.314	160.562	0.773				511.314
119	217419.314	161.606	-0.773	Hog Curve	217284.314	160.562	217554.314	161.606		-34926	-0.286	349.260	270.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
120				Grade	217554.314	161.606	218284.565	161.606	0.000				730.251
121	218419.565	161.606	-1.000	Hog Curve	218284.565	161.606	218554.565	160.256		-27000	-0.370	270.000	270.000
122				Grade	218554.565	160.256	218896.078	156.841	-1.000				341.513
123	219011.078	155.691	1.550	Sag Curve	218896.078	156.841	219126.078	156.323		14839	0.674	148.388	230.000
124				Grade	219126.078	156.323	219545.000	158.627	0.550				418.922
125	219690.000	159.425	-1.100	Hog Curve	219545.000	158.627	219835.000	158.627		-26364	-0.379	263.637	290.000
126				Grade	219835.000	158.627	220114.484	157.090	-0.550				279.484
127	220164.484	156.815	-0.284	Hog Curve	220114.484	157.090	220214.484	156.398		-35220	-0.284	352.199	100.000
128				Grade	220214.484	156.398	220277.999	155.868	-0.834				63.515
129	220352.999	155.243	1.136	Sag Curve	220277.999	155.868	220427.999	155.470		13203	0.757	132.032	150.000
130				Grade	220427.999	155.470	220749.536	156.441	0.302				321.537
131	220834.536	156.698	-0.610	Hog Curve	220749.536	156.441	220919.536	156.436		-27867	-0.359	278.668	170.000
132				Grade	220919.536	156.436	221139.839	155.758	-0.308				220.303
133	221229.839	155.481	1.308	Sag Curve	221139.839	155.758	221319.839	156.381		13763	0.727	137.625	180.000
134				Grade	221319.839	156.381	221517.500	158.357	1.000				197.661
135	221780.000	160.983	-2.000	Hog Curve	221517.500	158.357	222042.500	158.358		-26251	-0.381	262.509	525.000
136				Grade	222042.500	158.358	222245.587	156.327	-1.000				203.087
137	222345.587	155.327	1.405	Sag Curve	222245.587	156.327	222445.587	155.732		14230	0.703	142.304	200.000
138				Grade	222445.587	155.732	222790.000	157.129	0.405				344.413
139	222990.000	157.940	-0.894	Hog Curve	222790.000	157.129	223190.000	156.963		-44747	-0.223	447.467	400.000
140				Grade	223190.000	156.963	223622.458	154.851	-0.488				432.458
141	223722.458	154.363	0.789	Sag Curve	223622.458	154.851	223822.458	154.663		25341	0.395	253.408	200.000
142				Grade	223822.458	154.663	224098.894	155.495	0.301				276.436
143	224148.894	155.645	0.699	Sag Curve	224098.894	155.495	224198.894	156.145		14303	0.699	143.027	100.000
144				Grade	224198.894	156.145	224284.000	156.996	1.000				85.106
145	224534.000	159.497	-1.900	Hog Curve	224284.000	156.996	224784.000	157.246		-26316	-0.380	263.158	500.000
146				Grade	224784.000	157.246	224923.934	155.987	-0.900				139.934
147	225033.934	154.997	1.532	Sag Curve	224923.934	155.987	225143.934	155.692		14358	0.696	143.581	220.000
148				Grade	225143.934	155.692	225518.460	158.060	0.632				374.526
149	225688.460	159.135	-1.212	Hog Curve	225518.460	158.060	225858.460	158.149		-28052	-0.356	280.521	340.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
150				Grade	225858.460	158.149	226283.922	155.682	-0.580				425.462
151	226368.921	155.190	1.035	Sag Curve	226283.922	155.682	226453.922	155.576		16427	0.609	164.268	170.000
152				Grade	226453.922	155.576	226942.381	157.799	0.455				488.459
153	227092.381	158.482	-1.126	Hog Curve	226942.381	157.799	227242.381	157.476		-26649	-0.375	266.489	300.000
154				Grade	227242.381	157.476	227479.653	155.884	-0.671				237.272
155	227572.153	155.264	1.371	Sag Curve	227479.653	155.884	227664.653	155.912		13496	0.741	134.960	185.000
156				Grade	227664.653	155.912	227750.000	156.509	0.700				85.347
157	227975.000	158.084	-1.700	Hog Curve	227750.000	156.509	228200.000	155.834		-26468	-0.378	264.683	450.000
158				Grade	228200.000	155.834	228260.000	155.234	-1.000				60.000
159	228360.000	154.234	1.310	Sag Curve	228260.000	155.234	228460.000	154.544		15263	0.655	152.625	200.000
160				Grade	228460.000	154.544	228708.235	155.315	0.310				248.235
161	228818.235	155.656	-0.785	Hog Curve	228708.235	155.315	228928.235	155.134		-28030	-0.357	280.293	220.000
162				Grade	228928.235	155.134	229111.335	154.265	-0.475				183.100
163	229201.335	153.838	1.175	Sag Curve	229111.335	154.265	229291.335	154.468		15325	0.653	153.252	180.000
164				Grade	229291.335	154.468	229610.000	156.699	0.700				318.665
165	229795.000	157.994	-1.400	Hog Curve	229610.000	156.699	229980.000	156.698		-26429	-0.378	264.292	370.000
166				Grade	229980.000	156.698	230447.960	153.423	-0.700				467.960
167	230557.960	152.653	1.029	Sag Curve	230447.960	153.423	230667.960	153.015		21374	0.468	213.744	220.000
168				Grade	230667.960	153.015	230751.849	153.291	0.329				83.889
169	230846.849	153.604	-0.641	Hog Curve	230751.849	153.291	230941.849	153.307		-29621	-0.338	296.209	190.000
170				Grade	230941.849	153.307	231081.123	152.873	-0.312				139.274
171	231171.123	152.592	1.312	Sag Curve	231081.123	152.873	231261.123	153.492		13718	0.729	137.178	180.000
172				Grade	231261.123	153.492	231470.000	155.581	1.000				208.877
173	231705.000	157.931	-1.800	Hog Curve	231470.000	155.581	231940.000	156.051		-26112	-0.383	261.124	470.000
174				Grade	231940.000	156.051	232139.952	154.451	-0.800				199.952
175	232389.952	152.451	1.150	Sag Curve	232139.952	154.451	232639.952	153.326		43481	0.230	434.802	500.000
176				Grade	232639.952	153.326	233418.000	156.049	0.350				778.048
177	233558.000	156.539	-1.050	Hog Curve	233418.000	156.049	233698.000	155.559		-26665	-0.375	266.652	280.000
178				Grade	233698.000	155.559	234006.750	153.398	-0.700				308.750
179	234096.750	152.768	1.300	Sag Curve	234006.750	153.398	234186.750	153.308		13845	0.722	138.450	180.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
180				Grade	234186.750	153.308	234375.000	154.438	0.600				188.250
181	234520.000	155.308	-1.100	Hog Curve	234375.000	154.438	234665.000	154.583		-26362	-0.379	263.623	290.000
182				Grade	234665.000	154.583	234778.963	154.013	-0.500				113.963
183	234828.963	153.763	0.188	Sag Curve	234778.963	154.013	234878.963	153.607		53239	0.188	532.396	100.000
184				Grade	234878.963	153.607	235297.416	152.301	-0.312				418.453
185	235347.416	152.144	0.622	Sag Curve	235297.416	152.301	235397.416	152.299		16087	0.622	160.867	100.000
186				Grade	235397.416	152.299	235867.000	153.752	0.309				469.584
187	235947.000	154.000	-0.616	Hog Curve	235867.000	153.752	236027.000	153.755		-25968	-0.385	259.680	160.000
188				Grade	236027.000	153.755	236115.358	153.484	-0.307				88.358
189	236170.358	153.315	0.745	Sag Curve	236115.358	153.484	236225.358	153.556		14767	0.677	147.667	110.000
190				Grade	236225.358	153.556	236592.171	155.164	0.438				366.813
191	236792.171	156.040	-1.310	Hog Curve	236592.171	155.164	236992.171	154.297		-30540	-0.327	305.399	400.000
192				Grade	236992.171	154.297	237066.869	153.646	-0.872				74.698
193	237174.369	152.709	1.609	Sag Curve	237066.869	153.646	237281.869	153.501		13366	0.748	133.658	215.000
194				Grade	237281.869	153.501	237468.292	154.875	0.737				186.423
195	237678.292	156.423	-1.580	Hog Curve	237468.292	154.875	237888.292	154.653		-26583	-0.376	265.830	420.000
196				Grade	237888.292	154.653	237965.336	154.004	-0.843				77.044
197	238025.336	153.498	0.843	Sag Curve	237965.336	154.004	238085.336	153.498		14237	0.702	142.367	120.000
198				Grade	238085.336	153.498	238278.600	153.498	0.000				193.264
199	238378.600	153.498	1.167	Sag Curve	238278.600	153.498	238478.600	154.665		17137	0.584	171.371	200.000
200				Grade	238478.600	154.665	238542.260	155.408	1.167				63.660

Table-5.4.6 Vertical Alignment Report (Package-6)

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	235700.000	153.359	235824.520	153.745	0.309				124.520
2	235904.520	153.992	-0.614	Hog Curve	235824.520	153.745	235984.520	153.749		-26054	-0.384	260.539	160.000
3				Grade	235984.520	153.749	236063.916	153.507	-0.305				79.396
4	236128.915	153.309	0.743	Sag Curve	236063.916	153.507	236193.916	153.594		17499	0.571	174.990	130.000
5				Grade	236193.916	153.594	236566.292	155.225	0.438				372.376
6	236741.292	155.992	-1.254	Hog Curve	236566.292	155.225	236916.292	154.564		-27907	-0.358	279.072	350.000
7				Grade	236916.292	154.564	237029.271	153.643	-0.816				112.979
8	237139.271	152.745	1.553	Sag Curve	237029.271	153.643	237249.271	153.556		14166	0.706	141.663	220.000
9				Grade	237249.271	153.556	237439.644	154.959	0.737				190.373
10	237649.644	156.507	-1.580	Hog Curve	237439.644	154.959	237859.644	154.737		-26583	-0.376	265.830	420.000
11				Grade	237859.644	154.737	237946.616	154.004	-0.843				86.972
12	238006.616	153.498	0.843	Sag Curve	237946.616	154.004	238066.616	153.498		14237	0.702	142.367	120.000
13				Grade	238066.616	153.498	238278.600	153.498	0.000				211.984
14	238378.600	153.498	-0.711	Hog Curve	238278.600	153.498	238478.600	152.787		-28146	-0.355	281.452	200.000
15				Grade	238478.600	152.787	238636.855	151.663	-0.711				158.255
16	238761.855	150.775	1.711	Sag Curve	238636.855	151.663	238886.855	152.025		14615	0.684	146.148	250.000
17				Grade	238886.855	152.025	239225.500	155.411	1.000				338.645
18	239488.000	158.036	-2.000	Hog Curve	239225.500	155.411	239750.500	155.411		-26250	-0.381	262.495	525.000
19				Grade	239750.500	155.411	240019.600	152.720	-1.000				269.100
20	240154.600	151.370	2.000	Sag Curve	240019.600	152.720	240289.600	152.720		13500	0.741	134.996	270.000
21				Grade	240289.600	152.720	240358.000	153.404	1.000				68.400
22	240623.000	156.054	-2.000	Hog Curve	240358.000	153.404	240888.000	153.404		-26500	-0.377	265.006	530.000
23				Grade	240888.000	153.404	240895.159	153.333	-1.000				7.159
24	240990.159	152.383	1.300	Sag Curve	240895.159	153.333	241085.159	152.668		14616	0.684	146.160	190.000
25				Grade	241085.159	152.668	241203.840	153.024	0.300				118.681
26	241293.840	153.294	-0.600	Hog Curve	241203.840	153.024	241383.840	153.024		-30000	-0.333	300.003	180.000
27				Grade	241383.840	153.024	241725.027	152.000	-0.300				341.187
28	241820.027	151.715	1.263	Sag Curve	241725.027	152.000	241915.027	152.630		15044	0.665	150.435	190.000
29				Grade	241915.027	152.630	242018.000	153.622	0.963				102.973

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	242188.000	155.259	-1.263	Hog Curve	242018.000	153.622	242358.000	154.749		-26920	-0.371	269.201	340.000
31				Grade	242358.000	154.749	242448.288	154.478	-0.300				90.288
32	242498.288	154.328	0.600	Sag Curve	242448.288	154.478	242548.288	154.478		16666	0.600	166.661	100.000
33				Grade	242548.288	154.478	242775.023	155.158	0.300				226.735
34	243175.023	156.358	-0.600	Hog Curve	242775.023	155.158	243575.023	155.158		-133320	-0.075	1333.156	800.000
35				Grade	243575.023	155.158	243955.486	154.017	-0.300				380.463
36	244080.486	153.642	0.600	Sag Curve	243955.486	154.017	244205.486	154.017		41663	0.240	416.632	250.000
37				Grade	244205.486	154.017	244606.040	155.218	0.300				400.554
38	245056.040	156.568	-0.667	Hog Curve	244606.040	155.218	245506.040	154.919		-135008	-0.074	1350.074	900.000
39				Grade	245506.040	154.919	246435.114	151.513	-0.367				929.074
40	246515.114	151.219	1.129	Sag Curve	246435.114	151.513	246595.114	151.830		14167	0.706	141.669	160.000
41				Grade	246595.114	151.830	247294.058	157.161	0.763				698.944
42	247516.558	158.858	-1.668	Hog Curve	247294.058	157.161	247739.058	156.843		-26671	-0.375	266.709	445.000
43				Grade	247739.058	156.843	247833.069	155.992	-0.906				94.011
44	247968.068	154.769	2.007	Sag Curve	247833.069	155.992	248103.069	156.255		13456	0.743	134.562	270.000
45				Grade	248103.069	156.255	248296.974	158.390	1.101				193.905
46	248626.974	162.022	-2.450	Hog Curve	248296.974	158.390	248956.974	157.571		-26941	-0.371	269.404	660.000
47				Grade	248956.974	157.571	249214.248	154.100	-1.349				257.274
48	249349.248	152.279	2.032	Sag Curve	249214.248	154.100	249484.248	153.201		13289	0.753	132.890	270.000
49				Grade	249484.248	153.201	250038.891	156.988	0.683				554.643
50	250303.891	158.797	-1.983	Hog Curve	250038.891	156.988	250568.891	155.352		-26729	-0.374	267.294	530.000
51				Grade	250568.891	155.352	250688.522	153.796	-1.300				119.631
52	250838.522	151.846	2.041	Sag Curve	250688.522	153.796	250988.522	152.958		14697	0.680	146.970	300.000
53				Grade	250988.522	152.958	251310.106	155.341	0.741				321.584
54	251455.106	156.416	-1.041	Hog Curve	251310.106	155.341	251600.106	155.981		-27855	-0.359	278.552	290.000
55				Grade	251600.106	155.981	251629.716	155.892	-0.300				29.610
56	251689.716	155.712	0.866	Sag Curve	251629.716	155.892	251749.716	156.052		13854	0.722	138.544	120.000
57				Grade	251749.716	156.052	252192.141	158.557	0.566				442.425
58	252417.141	159.831	-1.613	Hog Curve	252192.141	158.557	252642.141	157.476		-27900	-0.358	278.995	450.000
59				Grade	252642.141	157.476	253072.341	152.973	-1.047				430.200
60	253172.341	151.926	1.363	Sag Curve	253072.341	152.973	253272.341	152.243		14669	0.682	146.694	200.000

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
61				Grade	253272.341	152.243	253457.956	152.830	0.317				185.615
62	253507.956	152.989	0.383	Sag Curve	253457.956	152.830	253557.956	153.339		26086	0.383	260.858	100.000
63				Grade	253557.956	153.339	254111.625	157.214	0.700				553.669
64	254244.126	158.142	-1.000	Hog Curve	254111.625	157.214	254376.625	157.744		-26500	-0.377	264.999	265.000
65				Grade	254376.625	157.744	254575.778	157.147	-0.300				199.153
66	254665.778	156.877	1.300	Sag Curve	254575.778	157.147	254755.778	157.777		13847	0.722	138.466	180.000
67				Grade	254755.778	157.777	254870.000	158.919	1.000				114.222
68	255000.000	160.219	-1.000	Hog Curve	254870.000	158.919	255130.000	160.219		-26001	-0.385	260.010	260.000
69				Grade	255130.000	160.219	255251.700	160.219	0.000				121.700
70	255386.700	160.219	-1.000	Hog Curve	255251.700	160.219	255521.700	158.869		-27000	-0.370	270.000	270.000
71				Grade	255521.700	158.869	255762.681	156.459	-1.000				240.981
72	255877.681	155.309	1.680	Sag Curve	255762.681	156.459	255992.681	156.091		13690	0.730	136.904	230.000
73				Grade	255992.681	156.091	256095.373	156.789	0.680				102.692
74	256315.373	158.285	-1.680	Hog Curve	256095.373	156.789	256535.373	156.085		-26189	-0.382	261.890	440.000
75				Grade	256535.373	156.085	256689.140	154.548	-1.000				153.767
76	256824.140	153.197	1.820	Sag Curve	256689.140	154.548	256959.140	154.304		14837	0.674	148.368	270.000
77				Grade	256959.140	154.304	257284.903	156.974	0.820				325.763
78	257522.403	158.921	-1.820	Hog Curve	257284.903	156.974	257759.903	156.546		-26102	-0.383	261.015	475.000
79				Grade	257759.903	156.546	257873.127	155.414	-1.000				113.224
80	257988.127	154.264	1.544	Sag Curve	257873.127	155.414	258103.127	154.889		14895	0.671	148.951	230.000
81				Grade	258103.127	154.889	258318.844	156.063	0.544				215.717
82	258543.843	157.287	-1.544	Hog Curve	258318.844	156.063	258768.844	155.037		-29145	-0.343	291.443	450.000
83				Grade	258768.844	155.037	259097.769	151.748	-1.000				328.925
84	259212.769	150.598	1.625	Sag Curve	259097.769	151.748	259327.769	151.316		14157	0.706	141.573	230.000
85				Grade	259327.769	151.316	259816.415	154.369	0.625				488.646
86	260071.415	155.962	-1.625	Hog Curve	259816.415	154.369	260326.415	153.412		-31391	-0.319	313.913	510.000
87				Grade	260326.415	153.412	260373.631	152.939	-1.000				47.216
88	260478.631	151.889	1.528	Sag Curve	260373.631	152.939	260583.631	152.443		13746	0.727	137.459	210.000
89				Grade	260583.631	152.443	260738.547	153.261	0.528				154.916
90	260988.547	154.580	-1.393	Hog Curve	260738.547	153.261	261238.547	152.417		-35894	-0.279	358.938	500.000
91				Grade	261238.547	152.417	261370.724	151.273	-0.865				132.177

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
92	261470.724	150.408	1.326	Sag Curve	261370.724	151.273	261570.724	150.868		15088	0.663	150.877	200.000
93				Grade	261570.724	150.868	261848.104	152.145	0.460				277.380
94	262096.150	153.287	-1.460	Hog Curve	261848.104	152.145	262344.197	150.806		-33973	-0.294	339.732	496.093
95				Grade	262344.197	150.806	262613.761	148.111	-1.000				269.564
96	262888.761	145.361	1.661	Sag Curve	262613.761	148.111	263163.761	147.178		33116	0.302	331.159	550.000
97				Grade	263163.761	147.178	263459.136	149.130	0.661				295.375
98	263659.137	150.452	-1.429	Hog Curve	263459.136	149.130	263859.137	148.916		-27993	-0.357	279.932	400.001
99				Grade	263859.137	148.916	263958.567	148.152	-0.768				99.430
100	264050.952	147.443	1.191	Sag Curve	263958.567	148.152	264143.336	147.834		15510	0.645	155.099	184.769
101				Grade	264143.336	147.834	264673.663	150.078	0.423				530.327
102	264884.499	150.971	-0.774	Hog Curve	264673.663	150.078	265095.335	150.231		-54469	-0.184	544.692	421.672
103				Grade	265095.335	150.231	265338.222	149.379	-0.351				242.887
104	265442.769	149.012	1.051	Sag Curve	265338.222	149.379	265547.316	149.744		19898	0.503	198.977	209.094
105				Grade	265547.316	149.744	265660.682	150.537	0.700				113.366
106	266010.682	152.987	-1.728	Hog Curve	265660.682	150.537	266360.682	149.387		-40499	-0.247	404.989	700.000
107				Grade	266360.682	149.387	266618.558	146.735	-1.028				257.876
108	266709.857	145.796	1.326	Sag Curve	266618.558	146.735	266801.157	146.068		13772	0.726	137.716	182.599
109				Grade	266801.157	146.068	267024.613	146.732	0.297				223.456
110	267174.613	147.178	-0.595	Hog Curve	267024.613	146.732	267324.613	146.732		-50443	-0.198	504.414	300.000
111				Grade	267324.613	146.732	267877.941	145.087	-0.297				553.328
112	267927.942	144.939	0.699	Sag Curve	267877.941	145.087	267977.941	145.140		14309	0.699	143.086	100.000
113				Grade	267977.941	145.140	268139.432	145.788	0.402				161.491
114	268339.432	146.591	-0.835	Hog Curve	268139.432	145.788	268539.432	145.724		-47882	-0.209	478.813	400.000
115				Grade	268539.432	145.724	268541.872	145.713	-0.434				2.440
116	268656.872	145.214	1.652	Sag Curve	268541.872	145.713	268771.872	146.615		13924	0.718	139.239	230.000
117				Grade	268771.872	146.615	268900.461	148.181	1.218				128.589
118	269200.461	151.835	-2.218	Hog Curve	268900.461	148.181	269500.461	148.835		-27051	-0.370	270.512	600.000
119				Grade	269500.461	148.835	269594.649	147.893	-1.000				94.188
120	269694.649	146.893	1.304	Sag Curve	269594.649	147.893	269794.649	147.197		15339	0.652	153.393	200.000
121				Grade	269794.649	147.197	270216.934	148.480	0.304				422.285
122	270316.934	148.784	-0.612	Hog Curve	270216.934	148.480	270416.934	148.475		-32674	-0.306	326.744	200.000

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
123				Grade	270416.934	148.475	270503.291	148.209	-0.308				86.357
124	270593.291	147.932	1.308	Sag Curve	270503.291	148.209	270683.291	148.832		13759	0.727	137.588	180.000
125				Grade	270683.291	148.832	270798.093	149.980	1.000				114.802
126	271063.093	152.630	-1.953	Hog Curve	270798.093	149.980	271328.093	150.104		-27138	-0.368	271.378	530.000
127				Grade	271328.093	150.104	271715.289	146.414	-0.953				387.196
128	271802.789	145.580	1.253	Sag Curve	271715.289	146.414	271890.289	145.843		13967	0.716	139.673	175.000
129				Grade	271890.289	145.843	271913.150	145.911	0.300				22.861
130	272013.150	146.211	-0.614	Hog Curve	271913.150	145.911	272113.150	145.897		-32568	-0.307	325.680	200.000
131				Grade	272113.150	145.897	272642.066	144.235	-0.314				528.916
132	272742.066	143.921	0.626	Sag Curve	272642.066	144.235	272842.066	144.233		31954	0.313	319.540	200.000
133				Grade	272842.066	144.233	273076.737	144.964	0.312				234.671
134	273176.737	145.276	-0.620	Hog Curve	273076.737	144.964	273276.737	144.968		-32274	-0.310	322.737	200.000
135				Grade	273276.737	144.968	273698.161	143.670	-0.308				421.424
136	273798.161	143.362	0.652	Sag Curve	273698.161	143.670	273898.161	143.706		30675	0.326	306.748	200.000
137				Grade	273898.161	143.706	274113.928	144.448	0.344				215.767
138	274198.928	144.741	0.664	Sag Curve	274113.928	144.448	274283.928	145.598		25590	0.391	255.898	170.000
139				Grade	274283.928	145.598	274457.758	147.350	1.008				173.830
140	274532.758	148.107	-0.335	Hog Curve	274457.758	147.350	274607.758	148.611		-44758	-0.223	447.567	150.000
141				Grade	274607.758	148.611	274667.791	149.016	0.673				60.033
142	274866.216	150.351	-1.521	Hog Curve	274667.791	149.016	275064.641	148.669		-26089	-0.383	260.885	396.850
143				Grade	275064.641	148.669	275504.872	144.936	-0.848				440.231
144	275614.872	144.003	1.506	Sag Curve	275504.872	144.936	275724.872	144.727		14604	0.685	146.039	220.000
145				Grade	275724.872	144.727	275966.469	146.318	0.658				241.597
146	276164.926	147.625	-1.492	Hog Curve	275966.469	146.318	276363.384	145.970		-26595	-0.376	265.950	396.915
147				Grade	276363.384	145.970	276588.158	144.095	-0.834				224.774
148	276678.158	143.345	1.284	Sag Curve	276588.158	144.095	276768.158	143.750		14019	0.713	140.192	180.000
149				Grade	276768.158	143.750	277359.274	146.410	0.450				591.116
150	277489.274	146.995	-0.959	Hog Curve	277359.274	146.410	277619.274	146.333		-27118	-0.369	271.179	260.000
151				Grade	277619.274	146.333	278289.897	142.921	-0.509				670.623
152	278414.897	142.285	1.213	Sag Curve	278289.897	142.921	278539.897	143.165		20612	0.485	206.126	250.000
153				Grade	278539.897	143.165	278851.987	145.363	0.704				312.090

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
154	279166.987	147.581	-1.704	Hog Curve	278851.987	145.363	279481.987	144.430		-36969	-0.271	369.686	630.000
155				Grade	279481.987	144.430	279650.465	142.746	-1.000				168.478
156	279750.465	141.746	1.305	Sag Curve	279650.465	142.746	279850.465	142.050		15328	0.652	153.278	200.000
157				Grade	279850.465	142.050	280980.726	145.495	0.305				1130.261
158	281100.726	145.861	-0.827	Hog Curve	280980.726	145.495	281220.726	145.233		-29004	-0.345	290.040	240.000
159				Grade	281220.726	145.233	281404.994	144.270	-0.523				184.268
160	281519.994	143.669	1.648	Sag Curve	281404.994	144.270	281634.994	144.963		13961	0.716	139.606	230.000
161				Grade	281634.994	144.963	281819.423	147.037	1.125				184.429
162	282019.423	149.287	-1.427	Hog Curve	281819.423	147.037	282219.423	148.683		-28038	-0.357	280.379	400.000
163				Grade	282219.423	148.683	282363.426	148.248	-0.302				144.003
164	282449.426	147.989	1.301	Sag Curve	282363.426	148.248	282535.426	148.848		13217	0.757	132.167	172.000
165				Grade	282535.426	148.848	282551.266	149.007	1.000				15.840
166	282681.766	150.311	-1.000	Hog Curve	282551.266	149.007	282812.266	150.311		-26112	-0.383	261.117	261.000
167				Grade	282812.266	150.311	282879.992	150.311	0.000				67.726
168	283014.992	150.311	-0.957	Hog Curve	282879.992	150.311	283149.992	149.019		-28199	-0.355	281.992	270.000
169				Grade	283149.992	149.019	283436.177	146.278	-0.957				286.185
170	283486.177	145.800	0.657	Sag Curve	283436.177	146.278	283536.177	145.650		15212	0.657	152.119	100.000
171				Grade	283536.177	145.650	283813.718	144.817	-0.300				277.541
172	283903.718	144.547	-0.597	Hog Curve	283813.718	144.817	283993.718	143.740		-30169	-0.331	301.686	180.000
173				Grade	283993.718	143.740	284157.571	142.270	-0.897				163.853
174	284272.571	141.239	1.722	Sag Curve	284157.571	142.270	284387.571	142.188		13354	0.749	133.540	230.000
175				Grade	284387.571	142.188	284579.025	143.769	0.826				191.454
176	284739.025	145.090	-1.126	Hog Curve	284579.025	143.769	284899.025	144.610		-28430	-0.352	284.293	320.000
177				Grade	284899.025	144.610	285476.045	142.879	-0.300				577.020
178	285551.045	142.654	0.898	Sag Curve	285476.045	142.879	285626.045	143.102		16706	0.599	167.062	150.000
179				Grade	285626.045	143.102	285633.771	143.148	0.598				7.726
180	285898.771	144.733	-1.291	Hog Curve	285633.771	143.148	286163.771	142.897		-41068	-0.244	410.678	530.000
181				Grade	286163.771	142.897	286481.876	140.694	-0.693				318.105
182	286571.876	140.070	1.007	Sag Curve	286481.876	140.694	286661.876	140.353		17874	0.559	178.737	180.000
183				Grade	286661.876	140.353	286894.842	141.086	0.314				232.966
184	286964.842	141.306	0.486	Sag Curve	286894.842	141.086	287034.842	141.866		28833	0.347	288.326	140.000

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
185				Grade	287034.842	141.866	287053.000	142.011	0.800				18.158
186	287293.000	143.931	-1.800	Hog Curve	287053.000	142.011	287533.000	141.531		-26667	-0.375	266.674	480.000
187				Grade	287533.000	141.531	287647.496	140.386	-1.000				114.496
188	287747.496	139.386	1.401	Sag Curve	287647.496	140.386	287847.496	139.787		14272	0.701	142.723	200.000
189				Grade	287847.496	139.787	288002.830	140.411	0.401				155.334
190	288102.830	140.812	-0.733	Hog Curve	288002.830	140.411	288202.830	140.480		-27281	-0.367	272.807	200.000
191				Grade	288202.830	140.480	288308.931	140.128	-0.332				106.101
192	288398.931	139.830	1.334	Sag Curve	288308.931	140.128	288488.931	140.732		13491	0.741	134.907	180.000
193				Grade	288488.931	140.732	288618.515	142.031	1.002				129.584
194	288740.810	143.257	-0.401	Hog Curve	288618.515	142.031	288863.105	143.992		-61017	-0.164	610.165	244.590
195				Grade	288863.105	143.992	288899.360	144.210	0.602				36.255
196	289096.860	145.399	-1.501	Hog Curve	288899.360	144.210	289294.360	143.623		-26323	-0.380	263.234	395.000
197				Grade	289294.360	143.623	289300.000	143.572	-0.899				5.640

Table-5.4.7 Vertical Alignment Report (Package-7)

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	289300.000	143.572	289455.702	142.172	-0.899				155.702
2	289568.223	141.161	1.520	Sag Curve	289455.702	142.172	289680.743	141.860		14801	0.676	148.014	225.041
3				Grade	289680.743	141.860	289702.104	141.993	0.622				21.361
4	289868.866	143.029	-1.156	Hog Curve	289702.104	141.993	290035.627	142.138		-28855	-0.347	288.550	333.523
5				Grade	290035.627	142.138	290157.818	141.485	-0.534				122.191
6	290299.467	140.729	1.423	Sag Curve	290157.818	141.485	290441.116	141.987		19912	0.502	199.120	283.298
7				Grade	290441.116	141.987	290576.811	143.192	0.888				135.695
8	290872.398	145.818	-2.122	Hog Curve	290576.811	143.192	291167.985	142.171		-27854	-0.359	278.544	591.174
9				Grade	291167.985	142.171	291235.000	141.344	-1.234				67.015
10	291360.000	139.802	1.691	Sag Curve	291235.000	141.344	291485.000	140.373		14784	0.676	147.837	250.000
11				Grade	291485.000	140.373	292336.365	144.264	0.457				851.365
12	292501.819	145.020	-1.265	Hog Curve	292336.365	144.264	292667.272	143.684		-26164	-0.382	261.636	330.907
13				Grade	292667.272	143.684	293139.283	139.872	-0.808				472.011
14	293264.185	138.863	1.855	Sag Curve	293139.283	139.872	293389.087	140.171		13468	0.743	134.678	249.804
15				Grade	293389.087	140.171	293553.672	141.894	1.047				164.585
16	293830.177	144.790	-2.087	Hog Curve	293553.672	141.894	294106.682	141.915		-26500	-0.377	264.999	553.010
17				Grade	294106.682	141.915	294419.377	138.664	-1.040				312.695
18	294512.118	137.700	1.343	Sag Curve	294419.377	138.664	294604.858	137.981		13814	0.724	138.143	185.481
19				Grade	294604.858	137.981	294998.656	139.174	0.303				393.798
20	295098.656	139.477	0.210	Sag Curve	294998.656	139.174	295198.656	139.990		95252	0.105	952.562	200.000
21				Grade	295198.656	139.990	295434.619	141.200	0.513				235.963
22	295624.023	142.172	-1.055	Hog Curve	295434.619	141.200	295813.427	141.145		-35892	-0.279	358.925	378.808
23				Grade	295813.427	141.145	296063.828	139.786	-0.542				250.401
24	296153.828	139.298	1.186	Sag Curve	296063.828	139.786	296243.828	139.877		15176	0.659	151.754	180.000
25				Grade	296243.828	139.877	296326.640	140.411	0.644				82.812
26	296525.883	141.693	-1.494	Hog Curve	296326.640	140.411	296725.127	139.998		-26668	-0.375	266.674	398.487
27				Grade	296725.127	139.998	296869.484	138.770	-0.851				144.357
28	297015.471	137.529	1.232	Sag Curve	296869.484	138.770	297161.458	138.086		23693	0.422	236.933	291.974
29				Grade	297161.458	138.086	297531.632	139.499	0.382				370.174

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	297594.688	139.740	0.362	Sag Curve	297531.632	139.499	297657.745	140.209		34800	0.287	348.008	126.113
31				Grade	297657.745	140.209	297776.163	141.090	0.744				118.418
32	298017.810	142.888	-1.577	Hog Curve	297776.163	141.090	298259.458	140.876		-30648	-0.326	306.476	483.295
33				Grade	298259.458	140.876	298374.931	139.914	-0.833				115.473
34	298493.060	138.930	0.443	Sag Curve	298374.931	139.914	298611.188	138.470		53344	0.187	533.447	236.257
35				Grade	298611.188	138.470	298847.393	137.549	-0.390				236.205
36	298922.393	137.256	1.136	Sag Curve	298847.393	137.549	298997.393	137.816		13204	0.757	132.041	150.000
37				Grade	298997.393	137.816	299249.292	139.695	0.746				251.899
38	299502.897	141.587	-1.939	Hog Curve	299249.292	139.695	299756.501	138.561		-26155	-0.382	261.547	507.209
39				Grade	299756.501	138.561	299877.274	137.120	-1.193				120.773
40	299954.607	136.198	1.174	Sag Curve	299877.274	137.120	300031.941	136.183		13172	0.759	131.723	154.667
41				Grade	300031.941	136.183	300161.644	136.158	-0.019				129.703
42	300250.000	136.142	1.020	Sag Curve	300161.644	136.158	300338.356	137.026		17321	0.577	173.211	176.712
43				Grade	300338.356	137.026	300435.580	138.000	1.001				97.224
44	300689.478	140.542	-1.916	Hog Curve	300435.580	138.000	300943.377	138.218		-26499	-0.377	264.992	507.797
45				Grade	300943.377	138.218	301204.032	135.833	-0.915				260.655
46	301297.519	134.978	1.399	Sag Curve	301204.032	135.833	301391.006	135.430		13368	0.748	133.679	186.974
47				Grade	301391.006	135.430	301505.407	135.983	0.484				114.401
48	301630.407	136.588	-0.488	Hog Curve	301505.407	135.983	301755.407	136.583		-51265	-0.195	512.636	250.000
49				Grade	301755.407	136.583	302007.817	136.573	-0.004				252.410
50	302099.858	136.569	0.496	Sag Curve	302007.817	136.573	302191.898	137.022		37079	0.270	370.796	184.081
51				Grade	302191.898	137.022	302376.231	137.930	0.492				184.333
52	302555.565	138.813	-0.833	Hog Curve	302376.231	137.930	302734.898	138.202		-43062	-0.232	430.626	358.667
53				Grade	302734.898	138.202	302942.814	137.494	-0.340				207.916
54	303035.931	137.177	1.197	Sag Curve	302942.814	137.494	303129.047	137.974		15563	0.643	155.632	186.233
55				Grade	303129.047	137.974	303379.008	140.114	0.856				249.961
56	303607.505	142.071	-1.724	Hog Curve	303379.008	140.114	303836.001	140.087		-26501	-0.377	265.006	456.993
57				Grade	303836.001	140.087	303962.281	138.990	-0.868				126.280
58	304061.597	138.128	1.403	Sag Curve	303962.281	138.990	304160.913	138.658		14161	0.706	141.615	198.632
59				Grade	304160.913	138.658	304266.190	139.221	0.534				105.277
60	304456.190	140.236	-1.177	Hog Curve	304266.190	139.221	304646.190	139.015		-32283	-0.310	322.831	380.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
61				Grade	304646.190	139.015	304977.971	136.882	-0.643				331.781
62	305046.591	136.441	0.334	Sag Curve	304977.971	136.882	305115.211	136.229		41068	0.244	410.678	137.240
63				Grade	305115.211	136.229	305567.538	134.833	-0.309				452.327
64	305660.842	134.545	0.609	Sag Curve	305567.538	134.833	305754.146	134.825		30662	0.326	306.617	186.608
65				Grade	305754.146	134.825	306332.706	136.561	0.300				578.560
66	306465.258	136.959	-0.405	Hog Curve	306332.706	136.561	306597.810	136.819		-65394	-0.153	653.937	265.104
67				Grade	306597.810	136.819	306663.794	136.749	-0.105				65.984
68	306715.559	136.695	-0.282	Hog Curve	306663.794	136.749	306767.323	136.494		-36689	-0.273	366.892	103.529
69				Grade	306767.323	136.494	307004.376	135.575	-0.388				237.053
70	307091.923	135.236	0.964	Sag Curve	307004.376	135.575	307179.470	135.741		18155	0.551	181.554	175.094
71				Grade	307179.470	135.741	307914.585	139.982	0.577				735.115
72	308164.585	141.424	-1.683	Hog Curve	307914.585	139.982	308414.585	138.657		-29703	-0.337	297.027	500.000
73				Grade	308414.585	138.657	308626.796	136.309	-1.107				212.211
74	308776.795	134.650	1.980	Sag Curve	308626.796	136.309	308926.796	135.960		15149	0.660	151.494	300.000
75				Grade	308926.796	135.960	309045.549	136.998	0.874				118.753
76	309266.735	138.930	-1.576	Hog Curve	309045.549	136.998	309487.922	137.378		-28077	-0.356	280.765	442.373
77				Grade	309487.922	137.378	309745.143	135.573	-0.702				257.221
78	309853.035	134.816	1.613	Sag Curve	309745.143	135.573	309960.928	135.799		13376	0.748	133.765	215.785
79				Grade	309960.928	135.799	310060.691	136.708	0.911				99.763
80	310243.260	138.372	-1.373	Hog Curve	310060.691	136.708	310425.830	137.529		-26592	-0.376	265.922	365.139
81				Grade	310425.830	137.529	310932.073	135.191	-0.462				506.243
82	311086.162	134.480	1.148	Sag Curve	310932.073	135.191	311240.250	135.537		26854	0.372	268.536	308.177
83				Grade	311240.250	135.537	311312.685	136.034	0.686				72.435
84	311577.685	137.851	-1.183	Hog Curve	311312.685	136.034	311842.685	136.533		-44788	-0.223	447.888	530.000
85				Grade	311842.685	136.533	312090.169	135.302	-0.497				247.484
86	312190.169	134.804	0.880	Sag Curve	312090.169	135.302	312290.169	135.186		22737	0.440	227.366	200.000
87				Grade	312290.169	135.186	312540.310	136.142	0.382				250.141
88	312688.447	136.708	-0.915	Hog Curve	312540.310	136.142	312836.585	135.919		-32387	-0.309	323.866	296.275
89				Grade	312836.585	135.919	313012.469	134.982	-0.533				175.884
90	313115.000	134.436	1.490	Sag Curve	313012.469	134.982	313217.531	135.418		13762	0.727	137.624	205.062
91				Grade	313217.531	135.418	313250.266	135.731	0.957				32.735

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
92	313482.995	137.959	-1.649	Hog Curve	313250.266	135.731	313715.724	136.350		-28232	-0.354	282.318	465.458
93				Grade	313715.724	136.350	313991.714	134.442	-0.691				275.990
94	314139.506	133.420	1.686	Sag Curve	313991.714	134.442	314287.299	134.890		17533	0.570	175.328	295.585
95				Grade	314287.299	134.890	314416.443	136.175	0.995				129.144
96	314737.916	139.372	-2.072	Hog Curve	314416.443	136.175	315059.389	135.907		-31024	-0.322	310.241	642.946
97				Grade	315059.389	135.907	315172.144	134.691	-1.078				112.755
98	315345.000	132.828	1.585	Sag Curve	315172.144	134.691	315517.856	133.704		21814	0.458	218.141	345.712
99				Grade	315517.856	133.704	315965.266	135.972	0.507				447.410
100	316090.266	136.606	-0.887	Hog Curve	315965.266	135.972	316215.266	136.130		-28174	-0.355	281.746	250.000
101				Grade	316215.266	136.130	316558.371	134.825	-0.380				343.105
102	316721.109	134.206	1.353	Sag Curve	316558.371	134.825	316883.847	135.789		24059	0.416	240.593	325.476
103				Grade	316883.847	135.789	316951.789	136.449	0.972				67.942
104	317061.640	137.518	-0.592	Hog Curve	316951.789	136.449	317171.491	137.935		-37103	-0.270	371.030	219.702
105				Grade	317171.491	137.935	317591.727	139.533	0.380				420.236
106	317659.579	139.791	-0.380	Hog Curve	317591.727	139.533	317727.431	139.791		-35688	-0.280	356.875	135.704
107				Grade	317727.431	139.791	318081.934	139.791	0.000				354.503
108	318243.805	139.791	-1.239	Hog Curve	318081.934	139.791	318405.676	137.786		-26134	-0.383	261.342	323.742
109				Grade	318405.676	137.786	318502.892	136.582	-1.239				97.216
110	318620.964	135.119	1.648	Sag Curve	318502.892	136.582	318739.036	135.603		14325	0.698	143.252	236.144
111				Grade	318739.036	135.603	319157.567	137.317	0.410				418.531
112	319316.844	137.970	-1.177	Hog Curve	319157.567	137.317	319476.120	136.748		-27063	-0.370	270.629	318.553
113				Grade	319476.120	136.748	319482.299	136.700	-0.767				6.179
114	319564.703	136.068	1.165	Sag Curve	319482.299	136.700	319647.107	136.396		14144	0.707	141.437	164.808
115				Grade	319647.107	136.396	319677.360	136.516	0.398				30.253
116	319877.360	137.312	-1.509	Hog Curve	319677.360	136.516	320077.360	135.089		-26506	-0.377	265.062	400.000
117				Grade	320077.360	135.089	320096.449	134.877	-1.111				19.089
118	320238.949	133.294	2.137	Sag Curve	320096.449	134.877	320381.449	134.755		13339	0.750	133.388	285.000
119				Grade	320381.449	134.755	320407.372	135.020	1.025				25.923
120	320623.353	137.235	-1.517	Hog Curve	320407.372	135.020	320839.334	136.174		-28478	-0.351	284.779	431.962
121				Grade	320839.334	136.174	320943.841	135.660	-0.491				104.507
122	321043.875	135.168	0.836	Sag Curve	320943.841	135.660	321143.910	135.513		23919	0.418	239.194	200.069

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
123				Grade	321143.910	135.513	321427.664	136.492	0.345				283.754
124	321597.956	137.080	-1.294	Hog Curve	321427.664	136.492	321768.247	135.464		-26326	-0.380	263.262	340.583
125				Grade	321768.247	135.464	321820.577	134.968	-0.949				52.330
126	321936.019	133.872	1.391	Sag Curve	321820.577	134.968	322051.462	134.383		16593	0.603	165.928	230.885
127				Grade	322051.462	134.383	322167.601	134.898	0.443				116.139
128	322311.581	135.535	-1.087	Hog Curve	322167.601	134.898	322455.562	134.608		-26500	-0.377	264.999	287.961
129				Grade	322455.562	134.608	322847.713	132.083	-0.644				392.151
130	322964.324	131.332	1.516	Sag Curve	322847.713	132.083	323080.936	132.349		15385	0.650	153.846	233.223
131				Grade	323080.936	132.349	323724.533	137.961	0.872				643.597
132	323899.533	139.487	-1.324	Hog Curve	323724.533	137.961	324074.533	138.697		-26439	-0.378	264.389	350.000
133				Grade	324074.533	138.697	324168.683	138.271	-0.452				94.150
134	324257.212	137.872	1.190	Sag Curve	324168.683	138.271	324345.741	138.525		14875	0.672	148.752	177.058
135				Grade	324345.741	138.525	324510.837	139.745	0.739				165.096
136	324699.623	141.139	-1.425	Hog Curve	324510.837	139.745	324888.408	139.843		-26500	-0.377	264.999	377.571
137				Grade	324888.408	139.843	325103.179	138.369	-0.686				214.771
138	325213.102	137.615	1.429	Sag Curve	325103.179	138.369	325323.025	138.431		15386	0.650	153.860	219.846
139				Grade	325323.025	138.431	325712.643	141.325	0.743				389.618
140	325792.334	141.917	0.281	Sag Curve	325712.643	141.325	325872.025	142.732		56817	0.176	568.182	159.382
141				Grade	325872.025	142.732	326226.568	146.359	1.023				354.543
142	326504.895	149.207	-2.106	Hog Curve	326226.568	146.359	326783.222	146.194		-26436	-0.378	264.361	556.654
143				Grade	326783.222	146.194	326904.725	144.879	-1.083				121.503
144	327041.832	143.394	1.887	Sag Curve	326904.725	144.879	327178.938	144.497		14533	0.688	145.334	274.213
145				Grade	327178.938	144.497	327228.775	144.898	0.804				49.837
146	327435.281	146.559	-1.556	Hog Curve	327228.775	144.898	327641.788	145.006		-26537	-0.377	265.365	413.013
147				Grade	327641.788	145.006	327688.634	144.653	-0.752				46.846
148	327820.627	143.660	1.905	Sag Curve	327688.634	144.653	327952.619	145.183		13854	0.722	138.543	263.985
149				Grade	327952.619	145.183	328009.669	145.841	1.153				57.050
150	328226.194	148.338	-1.524	Hog Curve	328009.669	145.841	328442.720	147.536		-28421	-0.352	284.212	433.051
151				Grade	328442.720	147.536	328521.047	147.246	-0.370				78.327
152	328617.635	146.888	1.349	Sag Curve	328521.047	147.246	328714.223	147.833		14318	0.698	143.176	193.176
153				Grade	328714.223	147.833	328789.490	148.570	0.979				75.267

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
154	329038.504	151.008	-1.732	Hog Curve	328789.490	148.570	329287.519	149.132		-28754	-0.348	287.546	498.029
155				Grade	329287.519	149.132	329391.764	148.347	-0.753				104.245
156	329493.993	147.577	1.405	Sag Curve	329391.764	148.347	329596.222	148.243		14554	0.687	145.537	204.458
157				Grade	329596.222	148.243	329732.746	149.133	0.652				136.524
158	329820.327	149.704	-0.652	Hog Curve	329732.746	149.133	329907.908	149.704		-26878	-0.372	268.781	175.162
159				Grade	329907.908	149.704	330006.882	149.704	0.000				98.974
160	330186.305	149.704	-1.241	Hog Curve	330006.882	149.704	330365.727	147.476		-28906	-0.346	289.059	358.845
161				Grade	330365.727	147.476	330549.593	145.194	-1.241				183.866
162	330594.839	144.632	-0.189	Hog Curve	330549.593	145.194	330640.085	143.985		-47906	-0.209	479.065	90.492
163				Grade	330640.085	143.985	330771.404	142.107	-1.430				131.319
164	330930.000	139.838	2.316	Sag Curve	330771.404	142.107	331088.596	141.242		13698	0.730	136.981	317.192
165				Grade	331088.596	141.242	331203.441	142.259	0.885				114.845
166	331431.745	144.280	-1.688	Hog Curve	331203.441	142.259	331660.049	142.447		-27046	-0.370	270.460	456.608
167				Grade	331660.049	142.447	331775.341	141.521	-0.803				115.292
168	331902.837	140.497	1.795	Sag Curve	331775.341	141.521	332030.334	141.762		14206	0.704	142.058	254.993
169				Grade	332030.334	141.762	332307.645	144.513	0.992				277.311
170	332487.774	146.300	-1.344	Hog Curve	332307.645	144.513	332667.902	145.665		-26797	-0.373	267.967	360.257
171				Grade	332667.902	145.665	332834.861	145.077	-0.352				166.959
172	332931.211	144.737	0.857	Sag Curve	332834.861	145.077	333027.562	145.224		22473	0.445	224.729	192.701
173				Grade	333027.562	145.224	333178.992	145.989	0.505				151.430
174	333388.992	147.049	-1.587	Hog Curve	333178.992	145.989	333598.992	144.777		-26461	-0.378	264.613	420.000
175				Grade	333598.992	144.777	333841.471	142.153	-1.082				242.479
176	333941.471	141.071	1.382	Sag Curve	333841.471	142.153	334041.471	141.371		14470	0.691	144.705	200.000
177				Grade	334041.471	141.371	334085.585	141.503	0.300				44.114
178	334165.585	141.743	-0.600	Hog Curve	334085.585	141.503	334245.585	141.503		-26667	-0.375	266.667	160.000
179				Grade	334245.585	141.503	334478.616	140.804	-0.300				233.031
180	334628.616	140.354	0.600	Sag Curve	334478.616	140.804	334778.616	140.804		50000	0.200	500.000	300.000
181				Grade	334778.616	140.804	334885.239	141.124	0.300				106.623
182	334970.239	141.379	-0.600	Hog Curve	334885.239	141.124	335055.239	141.124		-28333	-0.353	283.334	170.000
183				Grade	335055.239	141.124	335184.666	140.736	-0.300				129.427
184	335271.131	140.476	1.124	Sag Curve	335184.666	140.736	335357.595	141.189		15385	0.650	153.846	172.929

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
185				Grade	335357.595	141.189	335695.648	143.974	0.824				338.053
186	335985.779	146.365	-2.190	Hog Curve	335695.648	143.974	336275.910	142.403		-26500	-0.377	264.999	580.262
187				Grade	336275.910	142.403	336329.284	141.674	-1.366				53.374
188	336521.295	139.052	1.671	Sag Curve	336329.284	141.674	336713.305	139.639		22979	0.435	229.795	384.021
189				Grade	336713.305	139.639	336966.001	140.411	0.306				252.696
190	337033.194	140.616	0.473	Sag Curve	336966.001	140.411	337100.387	141.139		28409	0.352	284.091	134.386
191				Grade	337100.387	141.139	337658.175	145.482	0.779				557.788
192	337760.922	146.282	-0.779	Hog Curve	337658.175	145.482	337863.668	146.282		-26394	-0.379	263.936	205.493
193				Grade	337863.668	146.282	337936.505	146.282	0.000				72.837
194	338097.896	146.282	-1.223	Hog Curve	337936.505	146.282	338259.286	144.309		-26400	-0.379	263.999	322.781
195				Grade	338259.286	144.309	338495.993	141.414	-1.223				236.707
196	338618.125	139.921	1.526	Sag Curve	338495.993	141.414	338740.257	140.292		16003	0.625	160.026	244.264
197				Grade	338740.257	140.292	338909.439	140.806	0.304				169.182
198	339040.311	141.204	-0.837	Hog Curve	338909.439	140.806	339171.184	140.505		-31261	-0.320	312.617	261.745
199				Grade	339171.184	140.505	339515.177	138.670	-0.534				343.993
200	339638.040	138.014	0.873	Sag Curve	339515.177	138.670	339760.902	138.432		28143	0.355	281.429	245.725
201				Grade	339760.902	138.432	339856.625	138.757	0.340				95.723
202	339956.630	139.096	-0.673	Hog Curve	339856.625	138.757	340056.634	138.763		-29736	-0.336	297.362	200.009
203				Grade	340056.634	138.763	340632.223	136.846	-0.333				575.589
204	340781.905	136.348	2.083	Sag Curve	340632.223	136.846	340931.587	138.967		14372	0.696	143.724	299.364
205				Grade	340931.587	138.967	341020.144	140.517	1.750				88.557
206	341127.042	142.388	-0.819	Hog Curve	341020.144	140.517	341233.940	143.383		-26100	-0.383	261.001	213.796
207				Grade	341233.940	143.383	341278.060	143.793	0.931				44.120
208	341457.191	145.460	-1.361	Hog Curve	341278.060	143.793	341636.322	144.690		-26331	-0.380	263.310	358.262
209				Grade	341636.322	144.690	341700.000	144.417	-0.430				63.678

Table-5.4.8 Vertical Alignment Report (Package-8)

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	341700.000	144.400	342010.000	142.247	-0.695				310.000
2	342060.000	141.899	0.367	Sag Curve	342010.000	142.247	342110.000	141.735		27284	0.367	272.836	100.000
3				Grade	342110.000	141.735	342356.273	140.927	-0.328				246.273
4	342901.000	143.113	-1.300	Sag Curve	342356.273	140.927	342486.273	141.039		15700	0.637	156.996	130.000
5				Grade	342486.273	141.039	342726.000	142.238	0.500				239.727
6	344190.995	140.898	-0.629	Hog Curve	342726.000	142.238	343076.000	141.713		-26924	-0.371	269.237	350.000
7				Grade	343076.000	141.713	343368.009	139.377	-0.800				292.009
8	345739.000	144.275	-2.000	Sag Curve	343368.009	139.377	343568.009	138.898		17841	0.561	178.409	200.000
9				Grade	343568.009	138.898	343840.995	139.774	0.321				272.986
10	346586.994	137.696	0.616	Hog Curve	343840.995	139.774	344540.995	139.821		-111360	-0.090	1113.586	700.000
11				Grade	344540.995	139.821	345029.077	138.320	-0.308				488.082
12	347371.874	137.104	0.809	Sag Curve	345029.077	138.320	345204.077	138.926		13384	0.747	133.837	175.000
13				Grade	345204.077	138.926	345474.000	141.625	1.000				269.923
14	348181.650	135.349	1.118	Hog Curve	345474.000	141.625	346004.000	141.625		-26500	-0.377	264.999	530.000
15				Grade	346004.000	141.625	346236.343	139.302	-1.000				232.343
16	349115.000	139.581	-0.988	Sag Curve	346236.343	139.302	346386.343	138.319		21755	0.460	217.547	150.000
17				Grade	346386.343	138.319	346536.991	137.851	-0.310				150.648
18	350242.358	138.855	-0.618	Sag Curve	346536.991	137.851	346636.996	137.849		16227	0.616	162.267	100.005
19				Grade	346636.996	137.849	346785.000	138.301	0.306				148.004
20	351203.847	143.119	-1.852	Hog Curve	346785.000	138.301	346985.000	138.298		-32550	-0.307	325.500	200.000
21				Grade	346985.000	138.298	347316.874	137.274	-0.309				331.874
22	352856.000	142.614	-1.700	Sag Curve	347316.874	137.274	347426.874	137.379		13603	0.735	136.032	110.000
23				Grade	347426.874	137.379	347533.000	137.910	0.500				106.126
24	353671.286	142.697	-0.652	Hog Curve	347533.000	137.910	347863.000	137.580		-27498	-0.364	274.982	330.000
25				Grade	347863.000	137.580	348096.650	135.944	-0.700				233.650
26	354137.755	143.569	0.651	Sag Curve	348096.650	135.944	348266.650	135.704		15209	0.658	152.089	170.000
27				Grade	348266.650	135.704	348709.173	137.552	0.418				442.523
28	355021.565	146.663	-1.356	Sag Curve	348709.173	137.552	348980.000	138.906					270.827

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
29	355705.175	137.392	2.356	Hog Curve	348980.000	138.906	349250.000	138.923		-27334	-0.366	273.336	270.000
30				Grade	349250.000	138.923	349587.090	137.279	-0.488				337.090
31	356820.348	139.337	0.664	Sag Curve	349587.090	137.279	349697.090	137.179		13836	0.723	138.355	110.000
32				Grade	349697.090	137.179	350042.358	138.240	0.307				345.268
33	358293.400	137.380	1.552	Hog Curve	350042.358	138.240	350442.358	138.233		-64721	-0.155	647.207	400.000
34				Grade	350442.358	138.233	350560.054	137.868	-0.311				117.696
35	359430.558	148.192	-1.370	Sag Curve	350560.054	137.868	350760.054	138.580		14997	0.667	149.975	200.000
36				Grade	350760.054	138.580	350953.847	140.562	1.023				193.793
37	360793.000	142.561	-2.000	Hog Curve	350953.847	140.562	351453.847	141.046		-26999	-0.370	269.993	500.000
38				Grade	351453.847	141.046	351984.708	136.645	-0.829				530.861
39	361867.737	137.743	-0.621	Sag Curve	351984.708	136.645	352284.708	136.901		16402	0.610	164.015	300.000
40				Grade	352284.708	136.901	352631.000	140.364	1.000				346.292
41	362775.000	142.178	-2.000	Hog Curve	352631.000	140.364	353081.000	141.039		-26471	-0.378	264.704	450.000
42				Grade	353081.000	141.039	353208.111	140.149	-0.700				127.111
43	363903.761	139.592	-0.773	Sag Curve	353208.111	140.149	353458.111	140.540		14602	0.685	146.024	250.000
44				Grade	353458.111	140.540	353571.286	141.685	1.012				113.175
45	364902.000	143.485	-2.100	Hog Curve	353571.286	141.685	353771.286	143.057		-30678	-0.326	306.786	200.000
46				Grade	353771.286	143.057	353863.421	143.389	0.360				92.135
47	366249.828	135.971	1.306	Hog Curve	353863.421	143.389	353963.421	143.569		-27768	-0.360	277.678	100.000
48				Grade	353963.421	143.569	354037.755	143.569	0.000				74.334
49	367255.687	136.236	2.045	Sag Curve	354037.755	143.569	354237.755	144.220		30712	0.326	307.116	200.000
50				Grade	354237.755	144.220	354512.863	146.012	0.651				275.108
51	368280.000	136.853	0.698	Hog Curve	354512.863	146.012	354712.863	146.663		-30712	-0.326	307.116	200.000
52				Grade	354712.863	146.663	354841.565	146.663	0.000				128.702
53	369025.000	140.592	-1.880	Hog Curve	354841.565	146.663	355201.565	144.222		-26545	-0.377	265.449	360.000
54				Grade	355201.565	144.222	355495.175	140.240	-1.356				293.610
55	370284.000	141.134	-1.300	Sag Curve	355495.175	140.240	355915.175	139.492		17826	0.561	178.256	420.000
56				Grade	355915.175	139.492	356095.000	141.290	1.000				179.825
57	371205.531	133.827	1.825	Hog Curve	356095.000	141.290	356625.000	141.290		-26501	-0.377	265.006	530.000
58				Grade	356625.000	141.290	356770.348	139.837	-1.000				145.348

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
59	373138.854	133.900	1.307	Sag Curve	356770.348	139.837	356870.348	139.168		15062	0.664	150.618	100.000
60				Grade	356870.348	139.168	357846.633	135.887	-0.336				976.285
61	374082.882	134.888	1.203	Sag Curve	357846.633	135.887	357976.633	135.960		16579	0.603	165.785	130.000
62				Grade	357976.633	135.960	358168.400	136.819	0.448				191.767
63	375090.594	134.308	0.623	Sag Curve	358168.400	136.819	358418.400	139.880		16109	0.621	161.090	250.000
64				Grade	358418.400	139.880	358564.021	142.792	2.000				145.621
65	376092.000	139.754	-1.198	Hog Curve	358564.021	142.792	359104.021	148.192		-27000	-0.370	270.000	540.000
66				Grade	359104.021	148.192	359225.558	148.192	0.000				121.537
67	376819.789	139.204	-0.683	Hog Curve	359225.558	148.192	359635.558	145.383		-29926	-0.334	299.267	410.000
68				Grade	359635.558	145.383	360068.023	139.459	-1.370				432.465
69	377880.000	143.794	-1.340	Sag Curve	360068.023	139.459	360418.023	138.811		14767	0.677	147.676	350.000
70				Grade	360418.023	138.811	360528.000	139.911	1.000				109.977
71	378863.785	137.137	0.971	Hog Curve	360528.000	139.911	361058.000	139.911		-26499	-0.377	264.992	530.000
72				Grade	361058.000	139.911	361314.743	137.344	-1.000				256.743
73	379674.799	131.667	1.485	Sag Curve	361314.743	137.344	361514.743	136.653		15280	0.654	152.798	200.000
74				Grade	361514.743	136.653	361717.737	137.280	0.309				202.994
75	380862.000	130.654	1.700	Hog Curve	361717.737	137.280	362017.737	137.275		-48290	-0.207	482.905	300.000
76				Grade	362017.737	137.275	362121.128	136.952	-0.312				103.391
77	382615.000	132.182	1.036	Sag Curve	362121.128	136.952	362321.128	137.639		15240	0.656	152.402	200.000
78				Grade	362321.128	137.639	362510.000	139.528	1.000				188.872
79	383980.000	140.083	-2.000	Hog Curve	362510.000	139.528	363040.000	139.528		-26500	-0.377	264.999	530.000
80				Grade	363040.000	139.528	363165.561	138.272	-1.000				125.561
81	385762.880	135.725	0.691	Sag Curve	363165.561	138.272	363365.561	137.636		14669	0.682	146.686	200.000
82				Grade	363365.561	137.636	363703.761	138.865	0.363				338.200
83	386695.000	141.706	-1.000	Hog Curve	363703.761	138.865	364103.761	138.772		-51722	-0.193	517.224	400.000
84				Grade	364103.761	138.772	364305.946	137.943	-0.410				202.185
85	387397.480	136.076	1.206	Sag Curve	364305.946	137.943	364535.946	138.909		13856	0.722	138.566	230.000
86				Grade	364535.946	138.909	364622.000	139.985	1.250				86.054
87	388741.312	132.212	1.793	Hog Curve	364622.000	139.985	365182.000	141.105		-26667	-0.375	266.674	560.000
88				Grade	365182.000	141.105	365475.195	138.613	-0.850				293.195

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
89	390456.229	133.477	1.461	Sag Curve	365475.195	138.613	365575.195	138.035		18380	0.544	183.803	100.000
90				Grade	365575.195	138.035	366099.828	136.430	-0.306				524.633
91	391734.822	132.272	0.609	Sag Curve	366099.828	136.430	366399.828	137.471		22972	0.435	229.727	300.000
92				Grade	366399.828	137.471	366501.000	138.483	1.000				101.172
93	391900.000	131.761	0.000	Hog Curve	366501.000	138.483	367031.000	138.483		-26500	-0.377	264.999	530.000
94				Grade	367031.000	138.483	367118.187	137.611	-1.000				87.187
95	391900.000	131.761	0.000	Sag Curve	367118.187	137.611	367393.187	137.673		13445	0.744	134.447	275.000
96				Grade	367393.187	137.673	367507.716	138.871	1.045				114.529
97	391900.000	131.761	0.000	Hog Curve	367507.716	138.871	368072.716	138.957		-27424	-0.365	274.236	565.000
98				Grade	368072.716	138.957	368194.987	137.716	-1.015				122.271
99	391900.000	131.761	0.000	Sag Curve	368194.987	137.716	368365.013	136.584		24361	0.410	243.611	170.026
100				Grade	368365.013	136.584	368497.558	136.164	-0.317				132.545
101	391900.000	131.761	0.000	Sag Curve	368497.558	136.164	368697.558	136.957		14015	0.714	140.154	200.000
102				Grade	368697.558	136.957	368775.000	137.817	1.110				77.442
103	391900.000	131.761	0.000	Hog Curve	368775.000	137.817	369275.000	138.667		-26594	-0.376	265.943	500.000
104				Grade	369275.000	138.667	369589.493	136.245	-0.770				314.493
105	391900.000	131.761	0.000	Sag Curve	369589.493	136.245	369989.493	137.305		19324	0.518	193.237	400.000
106				Grade	369989.493	137.305	370114.000	138.924	1.300				124.507
107	391900.000	131.761	0.000	Hog Curve	370114.000	138.924	370454.000	141.134		-26154	-0.382	261.540	340.000
108				Grade	370454.000	141.134	370518.374	141.134	0.000				64.374
109	391900.000	131.761	0.000	Hog Curve	370518.374	141.134	370918.374	138.134		-26667	-0.375	266.667	400.000
110				Grade	370918.374	138.134	371080.531	135.702	-1.500				162.157
111	391900.000	131.761	0.000	Sag Curve	371080.531	135.702	371330.531	134.233		13696	0.730	136.958	250.000
112				Grade	371330.531	134.233	372005.636	136.430	0.325				675.105
113	391900.000	131.761	0.000	Hog Curve	372005.636	136.430	372305.636	136.458		-47445	-0.211	474.451	300.000
114				Grade	372305.636	136.458	373038.854	134.207	-0.307				733.218
115	391900.000	131.761	0.000	Sag Curve	373038.854	134.207	373238.854	134.900		15303	0.653	153.029	200.000
116				Grade	373238.854	134.900	373388.000	136.391	1.000				149.146
117	391900.000	131.761	0.000	Hog Curve	373388.000	136.391	373888.000	136.642		-26316	-0.380	263.158	500.000
118				Grade	373888.000	136.642	373982.882	135.788	-0.900				94.882

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
119	391900.000	131.761	0.000	Sag Curve	373982.882	135.788	374182.882	135.191		16619	0.602	166.185	200.000
120				Grade	374182.882	135.191	374423.622	135.922	0.303				240.740
121	391900.000	131.761	0.000	Hog Curve	374423.622	135.922	374583.622	135.911		-25818	-0.387	258.184	160.000
122				Grade	374583.622	135.911	374990.594	134.624	-0.316				406.972
123	391900.000	131.761	0.000	Sag Curve	374990.594	134.624	375190.594	134.615		32092	0.312	320.924	200.000
124				Grade	375190.594	134.615	375406.073	135.277	0.307				215.479
125	391900.000	131.761	0.000	Sag Curve	375406.073	135.277	375506.073	135.770		26810	0.373	268.104	100.000
126				Grade	375506.073	135.770	375932.000	138.666	0.680				425.927
127	391900.000	131.761	0.000	Hog Curve	375932.000	138.666	376252.000	138.925		-26711	-0.374	267.108	320.000
128				Grade	376252.000	138.925	376395.848	138.180	-0.518				143.848
129	391900.000	131.761	0.000	Sag Curve	376395.848	138.180	376515.848	138.089		13561	0.737	135.610	120.000
130				Grade	376515.848	138.089	376644.789	138.562	0.367				128.941
131	391900.000	131.761	0.000	Hog Curve	376644.789	138.562	376994.789	138.651		-51260	-0.195	512.584	350.000
132				Grade	376994.789	138.651	377280.519	137.748	-0.316				285.730
133	391900.000	131.761	0.000	Sag Curve	377280.519	137.748	377520.519	138.977		14493	0.690	144.930	240.000
134				Grade	377520.519	138.977	377680.000	141.114	1.340				159.481
135	391900.000	131.761	0.000	Hog Curve	377680.000	141.114	378080.000	143.794		-29851	-0.335	298.507	400.000
136				Grade	378080.000	143.794	378192.000	143.794	0.000				112.000
137	391900.000	131.761	0.000	Hog Curve	378192.000	143.794	378542.000	141.449		-26119	-0.383	261.192	350.000
138				Grade	378542.000	141.449	378788.785	138.142	-1.340				246.785
139	391900.000	131.761	0.000	Sag Curve	378788.785	138.142	378938.785	136.860		15445	0.647	154.445	150.000
140				Grade	378938.785	136.860	379174.932	135.989	-0.369				236.147
141	391900.000	131.761	0.000	Hog Curve	379174.932	135.989	379384.932	134.556		-33445	-0.299	334.448	210.000
142				Grade	379384.932	134.556	379574.799	132.663	-0.997				189.867
143	391900.000	131.761	0.000	Sag Curve	379574.799	132.663	379774.799	132.155		13469	0.742	134.689	200.000
144				Grade	379774.799	132.155	380079.216	133.641	0.488				304.417
145	391900.000	131.761	0.000	Hog Curve	380079.216	133.641	380379.234	133.492		-27882	-0.359	278.823	300.018
146				Grade	380379.234	133.492	380562.000	132.417	-0.588				182.766
147	391900.000	131.761	0.000	Sag Curve	380562.000	132.417	381162.000	133.990		35296	0.283	352.958	600.000
148				Grade	381162.000	133.990	381349.047	136.070	1.112				187.047

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
149	391900.000	131.761	0.000	Hog Curve	381349.047	136.070	381919.047	137.189		-31120	-0.321	311.197	570.000
150				Grade	381919.047	137.189	382515.000	132.901	-0.720				595.953
151	391900.000	131.761	0.000	Sag Curve	382515.000	132.901	382715.000	132.498		19310	0.518	193.099	200.000
152				Grade	382715.000	132.498	383380.727	134.603	0.316				665.727
153	391900.000	131.761	0.000	Sag Curve	383380.727	134.603	383530.727	135.590		21937	0.456	219.366	150.000
154				Grade	383530.727	135.590	383715.000	137.433	1.000				184.273
155	391900.000	131.761	0.000	Hog Curve	383715.000	137.433	384245.000	137.433		-26501	-0.377	265.006	530.000
156				Grade	384245.000	137.433	384633.930	133.544	-1.000				388.930
157	391900.000	131.761	0.000	Sag Curve	384633.930	133.544	384833.930	132.853		15279	0.655	152.786	200.000
158				Grade	384833.930	132.853	385712.880	135.570	0.309				878.950
159	391900.000	131.761	0.000	Sag Curve	385712.880	135.570	385812.880	136.225		14473	0.691	144.726	100.000
160				Grade	385812.880	136.225	386226.000	140.356	1.000				413.120
161	391900.000	131.761	0.000	Hog Curve	386226.000	140.356	386496.000	141.706		-26999	-0.370	269.986	270.000
162				Grade	386496.000	141.706	386560.000	141.706	0.000				64.000
163	391900.000	131.761	0.000	Hog Curve	386560.000	141.706	386830.000	140.356		-27001	-0.370	270.008	270.000
164				Grade	386830.000	140.356	387066.281	137.993	-1.000				236.281
165	391900.000	131.761	0.000	Sag Curve	387066.281	137.993	387166.281	137.241		20163	0.496	201.629	100.000
166				Grade	387166.281	137.241	387297.480	136.580	-0.504				131.199
167	391900.000	131.761	0.000	Sag Curve	387297.480	136.580	387497.480	136.778		16589	0.603	165.890	200.000
168				Grade	387497.480	136.778	387651.935	137.861	0.702				154.455
169	391900.000	131.761	0.000	Hog Curve	387651.935	137.861	388051.935	137.679		-26764	-0.374	267.637	400.000
170				Grade	388051.935	137.679	388531.312	133.877	-0.793				479.377
171	391900.000	131.761	0.000	Sag Curve	388531.312	133.877	388951.312	134.312		23425	0.427	234.252	420.000
172				Grade	388951.312	134.312	389401.000	138.809	1.000				449.688
173	391900.000	131.761	0.000	Hog Curve	389401.000	138.809	389923.000	138.809		-26100	-0.383	261.001	522.000
174				Grade	389923.000	138.809	390331.229	134.727	-1.000				408.229
175	391900.000	131.761	0.000	Sag Curve	390331.229	134.727	390581.229	134.053		17109	0.584	171.089	250.000
176				Grade	390581.229	134.053	390975.186	135.870	0.461				393.957
177	391900.000	131.761	0.000	Hog Curve	390975.186	135.870	391465.186	134.750		-35510	-0.282	355.101	490.000
178				Grade	391465.186	134.750	391664.822	132.916	-0.919				199.636

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	% Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
179	391900.000	131.761	0.000	Sag Curve	391664.822	132.916	391804.822	132.056		22988	0.435	229.880	140.000
180				Grade	391804.822	132.056	391900.000	131.761	-0.310				95.178
181				Grade	391900.000	131.761	0.000	0.000	-0.310				-391900.000

Table-5.4.9 Vertical Alignment Report (Package-9)

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	390970.359	135.846	390975.186	135.868	0.462				4.827
2	391220.186	137.000	-1.381	Hog Curve	390975.186	135.868	391465.186	134.750		-35489	-0.282	354.887	490.000
3				Grade	391465.186	134.750	391664.822	132.916	-0.919				199.636
4	392258.085	130.652	0.649	Sag Curve	391664.822	132.916	391804.822	132.056		22989	0.435	229.896	140.000
5				Grade	391804.822	132.056	392008.085	131.426	-0.310				203.263
6	393107.391	131.244	1.200	Sag Curve	392008.085	131.426	392508.085	131.500		77075	0.130	770.772	500.000
7				Grade	392508.085	131.500	392649.513	131.979	0.339				141.428
8	394405.856	130.895	1.112	Hog Curve	392649.513	131.979	392849.513	132.018		-31291	-0.320	312.911	200.000
9				Grade	392849.513	132.018	392972.391	131.649	-0.300				122.878
10	395446.738	137.981	-2.000	Sag Curve	392972.391	131.649	393242.391	132.459		22497	0.445	224.972	270.000
11				Grade	393242.391	132.459	393475.000	134.553	0.900				232.609
12	396465.818	130.952	1.300	Hog Curve	393475.000	134.553	393925.000	134.766		-26392	-0.379	263.915	450.000
13				Grade	393925.000	134.766	394315.856	131.620	-0.805				390.856
14	397987.297	130.060	2.000	Sag Curve	394315.856	131.620	394495.856	131.172		16180	0.618	161.799	180.000
15				Grade	394495.856	131.172	394785.562	132.062	0.307				289.706
16	399296.251	130.465	0.686	Sag Curve	394785.562	132.062	394985.562	133.370		28879	0.346	288.784	200.000
17				Grade	394985.562	133.370	395181.738	135.331	1.000				196.176
18	400299.997	133.506	-2.002	Hog Curve	395181.738	135.331	395711.738	135.331		-26500	-0.377	264.999	530.000
19				Grade	395711.738	135.331	395914.192	133.307	-1.000				202.454
20	401104.455	127.031	1.429	Sag Curve	395914.192	133.307	396114.192	132.006		28569	0.350	285.690	200.000
21				Grade	396114.192	132.006	396365.818	131.252	-0.300				251.626
22	402576.031	125.318	1.348	Sag Curve	396365.818	131.252	396565.818	131.952		15385	0.650	153.853	200.000
23				Grade	396565.818	131.952	396917.000	135.463	1.000				351.182
24	403159.683	125.526	0.625	Hog Curve	396917.000	135.463	397447.000	135.463		-26500	-0.377	264.999	530.000
25				Grade	397447.000	135.463	397852.297	131.410	-1.000				405.297
26	404261.675	126.286	1.275	Sag Curve	397852.297	131.410	398122.297	131.410		13499	0.741	134.991	270.000
27				Grade	398122.297	131.410	398397.000	134.157	1.000				274.703

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
28	405483.600	125.062	1.811	Hog Curve	398397.000	134.157	398927.000	134.157		-26500	-0.377	264.999	530.000
29				Grade	398927.000	134.157	399221.251	131.215	-1.000				294.251
30	407070.196	124.724	2.300	Sag Curve	399221.251	131.215	399371.251	130.230		21858	0.457	218.584	150.000
31				Grade	399371.251	130.230	399729.372	129.106	-0.314				358.121
32	408401.918	126.680	0.988	Sag Curve	399729.372	129.106	399929.372	129.794		15205	0.658	152.050	200.000
33				Grade	399929.372	129.794	400034.997	130.852	1.002				105.625
34	409123.435	127.381	0.690	Hog Curve	400034.997	130.852	400564.997	130.857		-26479	-0.378	264.795	530.000
35				Grade	400564.997	130.857	400754.723	128.959	-1.000				189.726
36	410147.173	127.675	1.306	Sag Curve	400754.723	128.959	400904.723	127.888		26262	0.381	262.626	150.000
37				Grade	400904.723	127.888	400979.455	127.567	-0.429				74.732
38	411308.591	127.728	1.217	Sag Curve	400979.455	127.567	401229.455	128.282		17497	0.572	174.972	250.000
39				Grade	401229.455	128.282	401489.551	130.883	1.000				260.096
40	412339.137	127.394	1.195	Hog Curve	401489.551	130.883	402019.551	130.883		-26500	-0.377	264.999	530.000
41				Grade	402019.551	130.883	402476.031	126.318	-1.000				456.480
42	413362.302	131.765	-1.509	Sag Curve	402476.031	126.318	402676.031	125.666		14836	0.674	148.355	200.000
43				Grade	402676.031	125.666	402795.789	126.083	0.348				119.758
44	414595.024	133.907	-1.907	Hog Curve	402795.789	126.083	402965.789	126.119		-25995	-0.385	259.943	170.000
45				Grade	402965.789	126.119	403009.683	125.985	-0.306				43.894
46	415398.906	130.034	-0.837	Sag Curve	403009.683	125.985	403309.683	126.005		48008	0.208	480.077	300.000
47				Grade	403309.683	126.005	403725.480	127.331	0.319				415.797
48	417443.075	128.793	0.460	Hog Curve	403725.480	127.331	403925.480	127.338		-31660	-0.316	316.596	200.000
49				Grade	403925.480	127.338	404171.675	126.568	-0.313				246.195
50	418403.569	126.611	2.061	Sag Curve	404171.675	126.568	404351.675	127.152		14120	0.708	141.197	180.000
51				Grade	404351.675	127.152	404476.500	128.353	0.962				124.825
52	419369.272	128.193	2.042	Hog Curve	404476.500	128.353	405026.500	128.769		-31019	-0.322	310.193	550.000
53				Grade	405026.500	128.769	405358.600	126.076	-0.811				332.100
54	420211.240	134.580	-0.487	Sag Curve	405358.600	126.076	405608.600	126.312		13805	0.724	138.051	250.000
55				Grade	405608.600	126.312	405995.000	130.176	1.000				386.400

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
56	420797.160	135.000	-0.625	Hog Curve	405995.000	130.176	406525.000	130.176		-26501	-0.377	265.013	530.000
57				Grade	406525.000	130.176	406915.196	126.274	-1.000				390.196
58	421525.011	131.422	1.591	Sag Curve	406915.196	126.274	407225.196	126.739		13479	0.742	134.789	310.000
59				Grade	407225.196	126.739	407445.000	129.596	1.300				219.804
60	422083.964	134.078	-0.369	Hog Curve	407445.000	129.596	408175.000	129.617		-28139	-0.355	281.389	730.000
61				Grade	408175.000	129.617	408326.918	127.650	-1.294				151.918
62	422775.586	128.349	2.007	Sag Curve	408326.918	127.650	408476.918	126.450		15176	0.659	151.757	150.000
63				Grade	408476.918	126.450	408575.778	126.148	-0.306				98.860
64	424044.306	127.144	0.729	Sag Curve	408575.778	126.148	408725.778	126.150		24372	0.410	243.718	150.000
65				Grade	408725.778	126.150	409048.435	127.149	0.310				322.657
66	424832.000	131.065	-2.000	Sag Curve	409048.435	127.149	409198.435	128.131		21728	0.460	217.278	150.000
67				Grade	409198.435	128.131	409385.000	129.997	1.000				186.565
68	425886.986	127.083	-0.600	Hog Curve	409385.000	129.997	409915.000	129.997		-26502	-0.377	265.020	530.000
69				Grade	409915.000	129.997	410047.173	128.675	-1.000				132.173
70	427338.464	127.172	0.692	Sag Curve	410047.173	128.675	410247.173	127.981		15311	0.653	153.111	200.000
71				Grade	410247.173	127.981	410638.221	129.179	0.306				391.048
72	428359.079	125.755	0.643	Hog Curve	410638.221	129.179	410838.221	129.177		-32547	-0.307	325.468	200.000
73				Grade	410838.221	129.177	411218.591	128.005	-0.308				380.370
74	429540.161	126.612	0.492	Sag Curve	411218.591	128.005	411398.591	128.546		14792	0.676	147.925	180.000
75				Grade	411398.591	128.546	411562.893	130.039	0.909				164.302
76	430534.540	124.178	2.093	Hog Curve	411562.893	130.039	412032.893	130.099		-26232	-0.381	262.316	470.000
77				Grade	412032.893	130.099	412249.137	128.189	-0.883				216.244
78	431357.871	127.193	-0.470	Sag Curve	412249.137	128.189	412429.137	127.675		15063	0.664	150.630	180.000
79				Grade	412429.137	127.675	413004.190	129.469	0.312				575.053
80	432264.550	126.395	0.692	Sag Curve	413004.190	129.469	413104.190	129.972		26113	0.383	261.131	100.000
81				Grade	413104.190	129.972	413152.302	130.306	0.695				48.112
82	433165.753	125.972	1.700	Hog Curve	413152.302	130.306	413572.302	130.057		-27841	-0.359	278.412	420.000
83				Grade	413572.302	130.057	413798.865	128.213	-0.814				226.563

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
84	434257.558	123.827	1.106	Sag Curve	413798.865	128.213	414048.865	128.446		13784	0.725	137.844	250.000
85				Grade	414048.865	128.446	414345.024	131.407	1.000				296.159
86	434996.187	123.488	0.623	Hog Curve	414345.024	131.407	414845.024	131.640		-26223	-0.381	262.226	500.000
87				Grade	414845.024	131.640	415036.265	129.906	-0.907				191.241
88	436039.000	130.862	-2.000	Sag Curve	415036.265	129.906	415216.265	129.402		14367	0.696	143.670	180.000
89				Grade	415216.265	129.402	415263.906	129.566	0.346				47.641
90	437148.288	125.739	-0.600	Hog Curve	415263.906	129.566	415533.906	129.372		-32276	-0.310	322.768	270.000
91				Grade	415533.906	129.372	416081.043	126.688	-0.490				547.137
92	438255.278	125.038	0.685	Sag Curve	416081.043	126.688	416581.043	126.211		63292	0.158	632.911	500.000
93				Grade	416581.043	126.211	417368.075	128.568	0.300				787.032
94	439577.770	123.126	1.346	Sag Curve	417368.075	128.568	417518.075	129.363		32575	0.307	325.754	150.000
95				Grade	417518.075	129.363	417640.503	130.294	0.760				122.428
96	440352.938	128.753	-2.000	Hog Curve	417640.503	130.294	418125.503	129.563		-26627	-0.376	266.262	485.000
97				Grade	418125.503	129.563	418267.069	128.060	-1.061				141.566
98	441515.556	124.696	-0.607	Sag Curve	418267.069	128.060	418540.069	127.976		13243	0.755	132.429	273.000
99				Grade	418540.069	127.976	418685.650	129.432	1.000				145.581
100	442829.876	126.582	-1.113	Hog Curve	418685.650	129.432	419155.650	129.902		-26112	-0.383	261.117	470.000
101				Grade	419155.650	129.902	419234.272	129.273	-0.800				78.622
102	443960.628	127.068	-1.389	Sag Curve	419234.272	129.273	419504.272	129.869		13225	0.756	132.249	270.000
103				Grade	419504.272	129.869	419721.172	132.562	1.242				216.900
104	445175.000	125.750	-1.841	Hog Curve	419721.172	132.562	420046.172	134.580		-26175	-0.382	261.753	325.000
105				Grade	420046.172	134.580	420146.240	134.580	0.000				100.068
106	446089.066	122.761	0.692	Hog Curve	420146.240	134.580	420276.240	134.264		-26713	-0.374	267.137	130.000
107				Grade	420276.240	134.264	420422.999	133.549	-0.487				146.759
108	446200.000	123.871	0.000	Sag Curve	420422.999	133.549	420582.999	133.661		14387	0.695	143.872	160.000
109				Grade	420582.999	133.661	420697.160	134.375	0.625				114.161
110	446200.000	123.871	0.000	Hog Curve	420697.160	134.375	420897.160	135.000		-31977	-0.313	319.765	200.000

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
111				Grade	420897.160	135.000	420972.738	135.000	0.000				75.578
112	446200.000	123.871	0.000	Hog Curve	420972.738	135.000	421182.738	134.160		-26251	-0.381	262.515	210.000
113				Grade	421182.738	134.160	421410.011	132.342	-0.800				227.273
114	446200.000	123.871	0.000	Sag Curve	421410.011	132.342	421640.011	132.332		14452	0.692	144.521	230.000
115				Grade	421640.011	132.332	421755.574	133.247	0.792				115.563
116	446200.000	123.871	0.000	Hog Curve	421755.574	133.247	421965.574	134.078		-26532	-0.377	265.315	210.000
117				Grade	421965.574	134.078	422033.964	134.078	0.000				68.390
118	446200.000	123.871	0.000	Hog Curve	422033.964	134.078	422133.964	133.894		-27110	-0.369	271.098	100.000
119				Grade	422133.964	133.894	422164.748	133.780	-0.369				30.784
120	446200.000	123.871	0.000	Hog Curve	422164.748	133.780	422324.748	132.711		-26729	-0.374	267.294	160.000
121				Grade	422324.748	132.711	422635.586	129.704	-0.967				310.838
122	446200.000	123.871	0.000	Sag Curve	422635.586	129.704	422915.586	129.805		13948	0.717	139.480	280.000
123				Grade	422915.586	129.805	423079.500	131.510	1.040				163.914
124	446200.000	123.871	0.000	Hog Curve	423079.500	131.510	423624.500	131.510		-26202	-0.382	262.020	545.000
125				Grade	423624.500	131.510	423994.306	127.664	-1.040				369.806
126	446200.000	123.871	0.000	Sag Curve	423994.306	127.664	424094.306	126.989		13718	0.729	137.178	100.000
127				Grade	424094.306	126.989	424246.074	126.516	-0.311				151.768
128	446200.000	123.871	0.000	Sag Curve	424246.074	126.516	424446.074	127.205		15255	0.656	152.553	200.000
129				Grade	424446.074	127.205	424567.000	128.415	1.000				120.926
130	446200.000	123.871	0.000	Hog Curve	424567.000	128.415	425097.000	128.415		-26500	-0.377	264.999	530.000
131				Grade	425097.000	128.415	425281.713	126.567	-1.000				184.713
132	446200.000	123.871	0.000	Sag Curve	425281.713	126.567	425481.713	125.867		15383	0.650	153.834	200.000
133				Grade	425481.713	125.867	425586.986	126.183	0.300				105.273
134	446200.000	123.871	0.000	Hog Curve	425586.986	126.183	426186.986	126.183		-99988	-0.100	999.900	600.000
135				Grade	426186.986	126.183	426357.097	125.673	-0.300				170.111
136	446200.000	123.871	0.000	Sag Curve	426357.097	125.673	426857.097	125.692		82299	0.122	822.978	500.000
137				Grade	426857.097	125.692	427288.464	127.018	0.308				431.367

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
138	446200.000	123.871	0.000	Sag Curve	427288.464	127.018	427388.464	127.672		14441	0.692	144.411	100.000
139				Grade	427388.464	127.672	427503.000	128.818	1.000				114.536
140	446200.000	123.871	0.000	Hog Curve	427503.000	128.818	428023.000	128.948		-26667	-0.375	266.667	520.000
141				Grade	428023.000	128.948	428294.079	126.372	-0.950				271.079
142	446200.000	123.871	0.000	Sag Curve	428294.079	126.372	428424.079	125.555		20216	0.495	202.159	130.000
143				Grade	428424.079	125.555	428562.840	125.129	-0.307				138.761
144	446200.000	123.871	0.000	Sag Curve	428562.840	125.129	429062.840	125.135		81135	0.123	811.359	500.000
145				Grade	429062.840	125.135	429490.161	126.457	0.309				427.321
146	446200.000	123.871	0.000	Sag Curve	429490.161	126.457	429590.161	127.012		20327	0.492	203.264	100.000
147				Grade	429590.161	127.012	429693.726	127.842	0.801				103.565
148	446200.000	123.871	0.000	Hog Curve	429693.726	127.842	430283.726	126.948		-30960	-0.323	309.598	590.000
149				Grade	430283.726	126.948	430394.540	125.724	-1.104				110.814
150	446200.000	123.871	0.000	Sag Curve	430394.540	125.724	430674.540	125.561		13381	0.747	133.806	280.000
151				Grade	430674.540	125.561	430813.284	126.932	0.988				138.744
152	446200.000	123.871	0.000	Hog Curve	430813.284	126.932	431203.284	127.930		-26624	-0.376	266.248	390.000
153				Grade	431203.284	127.930	431292.871	127.503	-0.477				89.587
154	446200.000	123.871	0.000	Hog Curve	431292.871	127.503	431422.871	126.578		-27673	-0.361	276.732	130.000
155				Grade	431422.871	126.578	431544.100	125.431	-0.946				121.229
156	446200.000	123.871	0.000	Sag Curve	431544.100	125.431	431744.100	124.792		15944	0.627	159.439	200.000
157				Grade	431744.100	124.792	432189.550	126.164	0.308				445.450
158	446200.000	123.871	0.000	Sag Curve	432189.550	126.164	432339.550	127.145		21674	0.461	216.736	150.000
159				Grade	432339.550	127.145	432429.000	128.040	1.000				89.450
160	446200.000	123.871	0.000	Hog Curve	432429.000	128.040	432959.000	128.040		-26499	-0.377	264.992	530.000
161				Grade	432959.000	128.040	433053.253	127.097	-1.000				94.253
162	446200.000	123.871	0.000	Sag Curve	433053.253	127.097	433278.253	126.760		13235	0.756	132.354	225.000
163				Grade	433278.253	126.760	433405.000	127.647	0.700				126.747
164	446200.000	123.871	0.000	Hog Curve	433405.000	127.647	433805.000	127.447		-26668	-0.375	266.681	400.000
165				Grade	433805.000	127.447	434177.558	124.467	-0.800				372.558

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
166	446200.000	123.871	0.000	Sag Curve	434177.558	124.467	434337.558	124.071		14471	0.691	144.714	160.000
167				Grade	434337.558	124.071	434497.266	124.560	0.306				159.708
168	446200.000	123.871	0.000	Hog Curve	434497.266	124.560	434657.266	124.553		-25811	-0.387	258.104	160.000
169				Grade	434657.266	124.553	434921.187	123.724	-0.314				263.921
170	446200.000	123.871	0.000	Sag Curve	434921.187	123.724	435071.187	123.719		24091	0.415	240.912	150.000
171				Grade	435071.187	123.719	435362.827	124.619	0.308				291.640
172	446200.000	123.871	0.000	Sag Curve	435362.827	124.619	435512.827	125.600		21689	0.461	216.892	150.000
173				Grade	435512.827	125.600	435774.000	128.212	1.000				261.173
174	446200.000	123.871	0.000	Hog Curve	435774.000	128.212	436304.000	128.212		-26500	-0.377	265.006	530.000
175				Grade	436304.000	128.212	436589.063	125.362	-1.000				285.063
176	446200.000	123.871	0.000	Sag Curve	436589.063	125.362	436789.063	124.662		15385	0.650	153.851	200.000
177				Grade	436789.063	124.662	437048.288	125.439	0.300				259.225
178	446200.000	123.871	0.000	Hog Curve	437048.288	125.439	437248.288	125.439		-33329	-0.300	333.289	200.000
179				Grade	437248.288	125.439	437629.220	124.296	-0.300				380.932
180	446200.000	123.871	0.000	Sag Curve	437629.220	124.296	438029.220	124.326		65024	0.154	650.237	400.000
181				Grade	438029.220	124.326	438180.278	124.802	0.315				151.058
182	446200.000	123.871	0.000	Sag Curve	438180.278	124.802	438330.278	125.789		21898	0.457	218.986	150.000
183				Grade	438330.278	125.789	438555.890	128.045	1.000				225.612
184	446200.000	123.871	0.000	Hog Curve	438555.890	128.045	439085.890	128.045		-26499	-0.377	264.985	530.000
185				Grade	439085.890	128.045	439477.770	124.126	-1.000				391.880
186	446200.000	123.871	0.000	Sag Curve	439477.770	124.126	439677.770	123.472		14858	0.673	148.580	200.000
187				Grade	439677.770	123.472	439827.615	123.990	0.346				149.845
188	446200.000	123.871	0.000	Sag Curve	439827.615	123.990	439977.615	125.000		22937	0.436	229.368	150.000
189				Grade	439977.615	125.000	440087.938	126.103	1.000				110.323
190	446200.000	123.871	0.000	Hog Curve	440087.938	126.103	440617.938	126.103		-26501	-0.377	265.006	530.000
191				Grade	440617.938	126.103	440786.536	124.418	-1.000				168.598
192	446200.000	123.871	0.000	Sag Curve	440786.536	124.418	441086.536	123.378		22951	0.436	229.516	300.000
193				Grade	441086.536	123.378	441415.556	124.389	0.307				329.020

S.No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
194	446200.000	123.871	0.000	Hog Curve	441415.556	124.389	441615.556	124.396		-32937	-0.304	329.370	200.000
195				Grade	441615.556	124.396	441853.270	123.683	-0.300				237.714
196	446200.000	123.871	0.000	Sag Curve	441853.270	123.683	442053.270	123.748		30077	0.332	300.770	200.000
197				Grade	442053.270	123.748	442679.876	126.035	0.365				626.606
198	446200.000	123.871	0.000	Hog Curve	442679.876	126.035	442979.876	125.459		-26944	-0.371	269.440	300.000
199				Grade	442979.876	125.459	443128.849	124.344	-0.748				148.973
200	446200.000	123.871	0.000	Sag Curve	443128.849	124.344	443378.849	124.056		19742	0.507	197.426	250.000
201				Grade	443378.849	124.056	443760.628	126.033	0.518				381.779
202	446200.000	123.871	0.000	Hog Curve	443760.628	126.033	444160.628	125.325		-28792	-0.347	287.919	400.000
203				Grade	444160.628	125.325	444468.998	122.638	-0.871				308.370
204	446200.000	123.871	0.000	Sag Curve	444468.998	122.638	444798.998	122.588		19271	0.519	192.704	330.000
205				Grade	444798.998	122.588	444930.000	123.690	0.841				131.002
206	446200.000	123.871	0.000	Hog Curve	444930.000	123.690	445420.000	123.300		-26616	-0.376	266.163	490.000
207				Grade	445420.000	123.300	445518.676	122.313	-1.000				98.676
208	446200.000	123.871	0.000	Sag Curve	445518.676	122.313	445718.676	121.621		15293	0.654	152.931	200.000
209				Grade	445718.676	121.621	446034.066	122.592	0.308				315.390
210	446200.000	123.871	0.000	Sag Curve	446034.066	122.592	446144.066	123.311		15885	0.630	158.854	110.000
211				Grade	446144.066	123.311	446200.000	123.871	1.000				55.934
212				Grade	446200.000	123.871	0.000	0.000	1.000				-446200.000

Table-5.4.10 Vertical Alignment Report (Package-10)

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	443700.000	125.719	443760.628	126.033	0.518				60.628
2	443960.628	127.068	-1.389	Hog Curve	443760.628	126.033	444160.628	125.325		-28794	-0.347	287.944	400.000
3				Grade	444160.628	125.325	444468.998	122.638	-0.871				308.370
4	445175.000	125.473	-1.727	Sag Curve	444468.998	122.638	444798.998	122.503		19865	0.503	198.653	330.000
5				Grade	444798.998	122.503	444930.000	123.538	0.790				131.002
6	446089.066	122.761	0.684	Hog Curve	444930.000	123.538	445420.000	123.176		-28369	-0.353	283.688	490.000
7				Grade	445420.000	123.176	445518.676	122.251	-0.937				98.676
8	447292.335	121.401	0.469	Sag Curve	445518.676	122.251	445718.676	121.621		16061	0.623	160.606	200.000
9				Grade	445718.676	121.621	446034.066	122.592	0.308				315.390
10	448194.111	125.424	-2.005	Sag Curve	446034.066	122.592	446144.066	123.306		16092	0.621	160.919	110.000
11				Grade	446144.066	123.306	446360.000	125.447	0.991				215.934
12	449083.661	121.127	-0.664	Hog Curve	446360.000	125.447	446890.000	125.424		-26615	-0.376	266.149	530.000
13				Grade	446890.000	125.424	447217.335	122.151	-1.000				327.335
14	449946.000	125.729	-1.300	Sag Curve	447217.335	122.151	447367.335	121.002		31991	0.313	319.908	150.000
15				Grade	447367.335	121.002	447499.544	120.300	-0.531				132.209
16	450724.000	128.172	-1.850	Sag Curve	447499.544	120.300	447699.544	120.720		13493	0.741	134.931	200.000
17				Grade	447699.544	120.720	447929.111	122.904	0.951				229.567
18	451852.310	122.536	0.594	Hog Curve	447929.111	122.904	448459.111	122.631		-26432	-0.378	264.326	530.000
19				Grade	448459.111	122.631	448616.635	120.971	-1.054				157.524
20	452518.587	124.213	0.800	Sag Curve	448616.635	120.971	448816.635	120.246		14453	0.692	144.532	200.000
21				Grade	448816.635	120.246	448983.661	120.797	0.330				167.026
22	453034.843	123.683	-0.665	Hog Curve	448983.661	120.797	449183.661	120.792		-30100	-0.332	300.996	200.000
23				Grade	449183.661	120.792	449295.000	120.420	-0.335				111.339
24	454009.783	121.181	-0.629	Sag Curve	449295.000	120.420	449475.000	121.019		13486	0.741	134.865	180.000
25				Grade	449475.000	121.019	449776.000	124.029	1.000				301.000
26	455027.000	124.554	-2.000	Hog Curve	449776.000	124.029	450116.000	125.219		-26154	-0.382	261.540	340.000
27				Grade	450116.000	125.219	450228.554	124.881	-0.300				112.554
28	455841.171	120.318	-0.630	Sag Curve	450228.554	124.881	450388.554	125.321		13913	0.719	139.130	160.000
29				Grade	450388.554	125.321	450479.000	126.090	0.850				90.446

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	456532.687	122.001	-0.483	Hog Curve	450479.000	126.090	450969.000	125.722		-26487	-0.378	264.866	490.000
31				Grade	450969.000	125.722	451330.032	122.112	-1.000				361.032
32	457077.160	121.774	1.099	Sag Curve	451330.032	122.112	451510.032	121.488		13780	0.726	137.798	180.000
33				Grade	451510.032	121.488	451802.310	122.383	0.306				292.278
34	457941.257	120.840	0.162	Sag Curve	451802.310	122.383	451902.310	122.986		16841	0.594	168.407	100.000
35				Grade	451902.310	122.986	452025.000	124.090	0.900				122.690
36	458930.355	124.838	-1.963	Hog Curve	452025.000	124.090	452395.000	124.831		-26430	-0.378	264.299	370.000
37				Grade	452395.000	124.831	452463.587	124.488	-0.500				68.587
38	460245.000	127.343	-2.000	Sag Curve	452463.587	124.488	452573.587	124.378		13754	0.727	137.540	110.000
39				Grade	452573.587	124.378	452670.000	124.667	0.300				96.413
40	462301.767	121.832	0.285	Hog Curve	452670.000	124.667	452880.000	124.457		-26256	-0.381	262.557	210.000
41				Grade	452880.000	124.457	452959.843	124.058	-0.500				79.843
42	463047.168	121.658	1.329	Hog Curve	452959.843	124.058	453109.843	122.809		-22547	-0.444	225.464	150.000
43				Grade	453109.843	122.809	453279.260	120.835	-1.165				169.417
44	464175.000	120.836	1.630	Sag Curve	453279.260	120.835	453549.260	119.697		18152	0.551	181.515	270.000
45				Grade	453549.260	119.697	453859.783	120.698	0.322				310.523
46	465011.445	122.227	1.101	Hog Curve	453859.783	120.698	454159.783	120.721		-47673	-0.210	476.735	300.000
47				Grade	454159.783	120.721	454440.000	119.860	-0.307				280.217
48	465907.650	119.831	1.358	Sag Curve	454440.000	119.860	454620.000	120.484		13772	0.726	137.718	180.000
49				Grade	454620.000	120.484	454762.000	121.904	1.000				142.000
50	466897.000	124.558	-1.076	Hog Curve	454762.000	121.904	455292.000	121.904		-26500	-0.377	264.999	530.000
51				Grade	455292.000	121.904	455454.544	120.279	-1.000				162.544
52	467535.000	125.194	-1.500	Sag Curve	455454.544	120.279	455630.044	119.670		13431	0.745	134.306	175.500
53				Grade	455630.044	119.670	455741.171	120.011	0.307				111.127
54	468512.897	120.945	0.146	Hog Curve	455741.171	120.011	455941.171	119.995		-31751	-0.315	317.511	200.000
55				Grade	455941.171	119.995	456154.028	119.307	-0.323				212.857
56	469732.036	121.380	1.818	Sag Curve	456154.028	119.307	456354.028	120.066		14224	0.703	142.241	200.000
57				Grade	456354.028	120.066	456477.687	121.405	1.083				123.659
58	470740.814	123.586	-0.471	Hog Curve	456477.687	121.405	456587.687	122.331		-22783	-0.439	227.827	110.000
59				Grade	456587.687	122.331	456626.000	122.561	0.600				38.313
60	471384.586	118.154	0.907	Hog Curve	456626.000	122.561	456946.000	122.561		-26666	-0.375	266.660	320.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
61				Grade	456946.000	122.561	457002.160	122.224	-0.600				56.160
62	472486.856	118.242	1.903	Sag Curve	457002.160	122.224	457152.160	122.148		13650	0.733	136.496	150.000
63				Grade	457152.160	122.148	457265.933	122.716	0.499				113.773
64	473768.765	118.805	1.640	Hog Curve	457265.933	122.716	457535.933	122.752		-27813	-0.360	278.133	270.000
65				Grade	457535.933	122.752	457891.257	121.076	-0.472				355.324
66	474643.260	122.386	0.950	Sag Curve	457891.257	121.076	457991.257	120.685		61834	0.162	618.353	100.000
67				Grade	457991.257	120.685	458289.162	119.761	-0.310				297.905
68	475104.954	122.603	-0.693	Sag Curve	458289.162	119.761	458489.162	120.446		15320	0.653	153.198	200.000
69				Grade	458489.162	120.446	458665.355	122.200	0.995				176.193
70	475908.000	123.359	-2.000	Hog Curve	458665.355	122.200	459195.355	122.273		-26996	-0.370	269.957	530.000
71				Grade	459195.355	122.273	459336.119	120.911	-0.968				140.764
72	477340.000	120.361	-1.432	Sag Curve	459336.119	120.911	459606.119	120.954		13720	0.729	137.201	270.000
73				Grade	459606.119	120.954	459980.000	124.693	1.000				373.881
74	478510.000	120.916	-1.900	Hog Curve	459980.000	124.693	460510.000	124.693		-26500	-0.377	264.999	530.000
75				Grade	460510.000	124.693	460854.131	121.252	-1.000				344.131
76	479636.339	120.615	-1.000	Sag Curve	460854.131	121.252	461454.131	119.187		45734	0.219	457.352	600.000
77				Grade	461454.131	119.187	462251.767	121.676	0.312				797.636
78	480198.719	118.213	0.534	Sag Curve	462251.767	121.676	462351.767	122.130		35058	0.285	350.582	100.000
79				Grade	462351.767	122.130	462413.040	122.496	0.597				61.273
80	480900.000	122.806	-2.072	Hog Curve	462413.040	122.496	462683.040	122.857		-29137	-0.343	291.375	270.000
81				Grade	462683.040	122.857	462947.168	121.987	-0.329				264.128
82	481862.373	117.338	0.829	Sag Curve	462947.168	121.987	463147.168	122.658		15044	0.665	150.435	200.000
83				Grade	463147.168	122.658	463305.000	124.236	1.000				157.832
84	482896.553	124.386	-1.373	Hog Curve	463305.000	124.236	463835.000	124.236		-26500	-0.377	264.999	530.000
85				Grade	463835.000	124.236	464065.000	121.936	-1.000				230.000
86	484205.000	122.320	-1.300	Sag Curve	464065.000	121.936	464285.000	121.529		13498	0.741	134.982	220.000
87				Grade	464285.000	121.529	464481.163	122.764	0.630				196.163
88	484699.775	123.515	-0.850	Hog Curve	464481.163	122.764	464751.163	123.141		-27526	-0.363	275.262	270.000
89				Grade	464751.163	123.141	464936.445	122.490	-0.351				185.282
90	485342.919	120.049	1.672	Sag Curve	464936.445	122.490	465086.445	122.790		13622	0.734	136.223	150.000
91				Grade	465086.445	122.790	465165.000	123.379	0.750				78.555

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
92	486604.008	119.725	1.355	Hog Curve	465165.000	123.379	465635.000	122.683		-26168	-0.382	261.677	470.000
93				Grade	465635.000	122.683	465807.650	120.877	-1.046				172.650
94	487418.305	124.820	-0.753	Sag Curve	465807.650	120.877	466007.650	120.143		14731	0.679	147.306	200.000
95				Grade	466007.650	120.143	466261.393	120.934	0.312				253.743
96	488101.319	119.731	1.339	Sag Curve	466261.393	120.934	466361.393	121.386		35641	0.281	356.405	100.000
97				Grade	466361.393	121.386	466747.000	123.670	0.592				385.607
98	489079.959	113.864	2.157	Hog Curve	466747.000	123.670	467047.000	123.833		-27884	-0.359	278.839	300.000
99				Grade	467047.000	123.833	467086.710	123.641	-0.484				39.710
100	490227.457	114.680	1.062	Sag Curve	467086.710	123.641	467226.710	123.653		14233	0.703	142.335	140.000
101				Grade	467226.710	123.653	467335.000	124.194	0.500				108.290
102	491372.000	121.228	-1.720	Hog Curve	467335.000	124.194	467735.000	123.194		-26667	-0.375	266.667	400.000
103				Grade	467735.000	123.194	468011.312	120.431	-1.000				276.312
104	492712.173	119.310	-1.332	Sag Curve	468011.312	120.431	468261.312	119.766		17025	0.587	170.248	250.000
105				Grade	468261.312	119.766	468462.897	120.711	0.468				201.585
106	494161.000	121.849	-2.000	Sag Curve	468462.897	120.711	468562.897	121.252		68492	0.146	684.932	100.000
107				Grade	468562.897	121.252	469081.864	124.441	0.614				518.967
108	495370.336	119.771	-0.994	Hog Curve	469081.864	124.441	469501.864	123.655		-26201	-0.382	262.006	420.000
109				Grade	469501.864	123.655	469607.036	122.616	-0.989				105.172
110	496350.000	123.959	-1.300	Sag Curve	469607.036	122.616	469857.036	122.417		13751	0.727	137.508	250.000
111				Grade	469857.036	122.417	470144.042	124.798	0.830				287.006

Table-5.4.11 Vertical Alignment Report (Package-11)

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	496800.000	122.609	496986.558	122.049	-0.300				186.558
2	497076.355	121.780	-0.645	Hog Curve	496986.558	122.049	497166.153	120.931		-27833	-0.359	278.334	179.595
3				Grade	497166.153	120.931	497304.262	119.626	-0.945				138.109
4	497388.448	118.830	1.264	Sag Curve	497304.262	119.626	497472.635	119.098		13324	0.751	133.236	168.373
5				Grade	497472.635	119.098	497493.526	119.165	0.318				20.891
6	497631.026	119.602	-1.047	Hog Curve	497493.526	119.165	497768.526	118.601		-26272	-0.381	262.715	275.000
7				Grade	497768.526	118.601	497969.656	117.136	-0.728				201.130
8	498079.656	116.335	1.521	Sag Curve	497969.656	117.136	498189.656	117.207		14467	0.691	144.670	220.000
9				Grade	498189.656	117.207	498831.260	122.291	0.792				641.604
10	498936.260	123.123	-0.792	Hog Curve	498831.260	122.291	499041.260	123.123		-26501	-0.377	265.013	210.000
11				Grade	499041.260	123.123	499112.103	123.123	0.000				70.843
12	499204.603	123.123	-0.643	Hog Curve	499112.103	123.123	499297.103	122.528		-28767	-0.348	287.670	185.000
13				Grade	499297.103	122.528	499637.397	120.340	-0.643				340.294
14	499717.397	119.825	-0.579	Hog Curve	499637.397	120.340	499797.397	118.848		-27638	-0.362	276.381	160.000
15				Grade	499797.397	118.848	499916.636	117.391	-1.222				119.239
16	500041.636	115.863	1.862	Sag Curve	499916.636	117.391	500166.636	116.663		13427	0.745	134.264	250.000
17				Grade	500166.636	116.663	500352.000	117.849	0.640				185.364
18	500527.000	118.969	-1.340	Hog Curve	500352.000	117.849	500702.000	117.744		-26117	-0.383	261.172	350.000
19				Grade	500702.000	117.744	500747.410	117.426	-0.700				45.410
20	500817.410	116.936	-0.523	Hog Curve	500747.410	117.426	500887.410	116.080		-26756	-0.374	267.566	140.000
21				Grade	500887.410	116.080	500951.817	115.292	-1.223				64.407
22	501061.817	113.946	1.557	Sag Curve	500951.817	115.292	501171.817	114.313		14129	0.708	141.293	220.000
23				Grade	501171.817	114.313	501479.045	115.338	0.334				307.228
24	501579.045	115.672	-0.665	Hog Curve	501479.045	115.338	501679.045	115.340		-30063	-0.333	300.634	200.000
25				Grade	501679.045	115.340	502002.541	114.268	-0.332				323.496
26	502130.041	113.845	1.777	Sag Curve	502002.541	114.268	502257.541	115.688		14351	0.697	143.513	255.000
27				Grade	502257.541	115.688	502562.394	120.093	1.445				304.853
28	502702.394	122.117	-1.060	Hog Curve	502562.394	120.093	502842.394	122.656		-26418	-0.379	264.180	280.000
29				Grade	502842.394	122.656	502872.767	122.773	0.385				30.373

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	502927.767	122.985	-0.385	Hog Curve	502872.767	122.773	502982.767	122.985		-28536	-0.350	285.356	110.000
31				Grade	502982.767	122.985	503070.121	122.985	0.000				87.354
32	503187.621	122.985	-0.892	Hog Curve	503070.121	122.985	503305.121	121.936		-26331	-0.380	263.310	235.000
33				Grade	503305.121	121.936	503721.590	118.219	-0.893				416.469
34	503819.090	117.348	1.465	Sag Curve	503721.590	118.219	503916.590	117.906		13314	0.751	133.135	195.000
35				Grade	503916.590	117.906	503964.430	118.180	0.572				47.840
36	504139.430	119.181	-1.266	Hog Curve	503964.430	118.180	504314.430	117.967		-27647	-0.362	276.465	350.000
37				Grade	504314.430	117.967	504690.812	115.355	-0.694				376.382
38	504790.812	114.661	1.018	Sag Curve	504690.812	115.355	504890.812	114.985		19650	0.509	196.502	200.000
39				Grade	504890.812	114.985	505132.681	115.768	0.324				241.869
40	505367.680	116.529	-1.494	Hog Curve	505132.681	115.768	505602.680	113.779		-31451	-0.318	314.505	469.999
41				Grade	505602.680	113.779	505664.710	113.053	-1.171				62.030
42	505774.710	111.765	1.527	Sag Curve	505664.710	113.053	505884.710	112.158		14403	0.694	144.032	220.000
43				Grade	505884.710	112.158	507048.000	116.310	0.357				1163.290
44	507228.000	116.952	-1.366	Hog Curve	507048.000	116.310	507408.000	115.136		-26358	-0.379	263.581	360.000
45				Grade	507408.000	115.136	507544.372	113.760	-1.009				136.372
46	507652.736	112.667	1.429	Sag Curve	507544.372	113.760	507761.100	113.123		15161	0.660	151.612	216.728
47				Grade	507761.100	113.123	508020.660	114.214	0.421				259.560
48	508221.208	115.058	-1.395	Hog Curve	508020.660	114.214	508421.756	113.105		-28761	-0.348	287.613	401.096
49				Grade	508421.756	113.105	508495.231	112.389	-0.974				73.475
50	508686.923	110.522	2.244	Sag Curve	508495.231	112.389	508878.615	112.956		17085	0.585	170.850	383.384
51				Grade	508878.615	112.956	508958.334	113.969	1.270				79.719
52	509217.000	117.254	-1.952	Hog Curve	508958.334	113.969	509475.666	115.489		-26499	-0.377	264.992	517.332
53				Grade	509475.666	115.489	509917.602	112.474	-0.682				441.936
54	510044.907	111.606	1.627	Sag Curve	509917.602	112.474	510172.211	112.808		15653	0.639	156.534	254.609
55				Grade	510172.211	112.808	510443.393	115.368	0.944				271.182
56	510636.780	117.195	-1.478	Hog Curve	510443.393	115.368	510830.167	116.163		-26177	-0.382	261.766	386.774
57				Grade	510830.167	116.163	511179.576	114.300	-0.533				349.409
58	511279.576	113.767	1.272	Sag Curve	511179.576	114.300	511379.576	114.506		15725	0.636	157.248	200.000
59				Grade	511379.576	114.506	511578.712	115.977	0.739				199.136
60	511753.718	117.269	-1.066	Hog Curve	511578.712	115.977	511928.724	116.697		-32845	-0.304	328.450	350.012

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
61				Grade	511928.724	116.697	511975.692	116.543	-0.327				46.968
62	512050.247	116.300	1.022	Sag Curve	511975.692	116.543	512124.802	116.818		14593	0.685	145.930	149.110
63				Grade	512124.802	116.818	512204.712	117.373	0.695				79.910
64	512343.922	118.340	-1.056	Hog Curve	512204.712	117.373	512483.132	117.837		-26355	-0.379	263.546	278.420
65				Grade	512483.132	117.837	512864.000	116.459	-0.362				380.868
66	513034.000	115.844	-0.575	Hog Curve	512864.000	116.459	513204.000	114.252		-59133	-0.169	591.331	340.000
67				Grade	513204.000	114.252	513363.517	112.758	-0.937				159.517
68	513448.517	111.962	1.243	Sag Curve	513363.517	112.758	513533.517	112.222		13677	0.731	136.767	170.000
69				Grade	513533.517	112.222	513630.374	112.519	0.306				96.857
70	513690.374	112.703	0.832	Sag Curve	513630.374	112.519	513750.374	113.386		14420	0.693	144.200	120.000
71				Grade	513750.374	113.386	513870.406	114.753	1.139				120.032
72	514109.679	117.477	-1.827	Hog Curve	513870.406	114.753	514348.951	115.831		-26200	-0.382	262.000	478.545
73				Grade	514348.951	115.831	514609.126	114.041	-0.688				260.175
74	514705.465	113.378	1.180	Sag Curve	514609.126	114.041	514801.804	113.853		16322	0.613	163.217	192.678
75				Grade	514801.804	113.853	515889.295	119.209	0.493				1087.491
76	515970.274	119.608	-0.493	Hog Curve	515889.295	119.209	516051.254	119.608		-32882	-0.304	328.818	161.959
77				Grade	516051.254	119.608	516152.397	119.608	0.000				101.143
78	516284.897	119.608	-1.000	Hog Curve	516152.397	119.608	516417.397	118.283		-26501	-0.377	265.013	265.000
79				Grade	516417.397	118.283	516743.628	115.021	-1.000				326.231
80	516878.628	113.671	1.991	Sag Curve	516743.628	115.021	517013.628	115.009		13560	0.737	135.604	270.000
81				Grade	517013.628	115.009	517396.208	118.801	0.991				382.580
82	517531.208	120.139	-0.991	Hog Curve	517396.208	118.801	517666.208	120.139		-27241	-0.367	272.413	270.000
83				Grade	517666.208	120.139	517773.043	120.139	0.000				106.835
84	517873.043	120.139	-0.535	Hog Curve	517773.043	120.139	517973.043	119.604		-37349	-0.268	373.483	200.000
85				Grade	517973.043	119.604	518829.219	115.019	-0.535				856.176
86	518949.996	114.372	1.673	Sag Curve	518829.219	115.019	519070.773	115.746		14435	0.693	144.354	241.554
87				Grade	519070.773	115.746	519288.812	118.227	1.138				218.039
88	519438.812	119.934	-1.138	Hog Curve	519288.812	118.227	519588.812	119.934		-26365	-0.379	263.657	300.000
89				Grade	519588.812	119.934	519714.155	119.934	0.000				125.343
90	519904.155	119.934	-1.280	Hog Curve	519714.155	119.934	520094.155	117.502		-29693	-0.337	296.930	380.000
91				Grade	520094.155	117.502	520149.389	116.796	-1.280				55.234

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
92	520255.394	115.439	1.580	Sag Curve	520149.389	116.796	520361.399	115.757		13421	0.745	134.212	212.010
93				Grade	520361.399	115.757	520445.000	116.008	0.300				83.601
94	520595.000	116.458	-1.140	Hog Curve	520445.000	116.008	520745.000	115.197		-26317	-0.380	263.172	300.000
95				Grade	520745.000	115.197	521052.769	112.612	-0.840				307.769
96	521142.769	111.856	1.319	Sag Curve	521052.769	112.612	521232.769	112.287		13642	0.733	136.418	180.000
97				Grade	521232.769	112.287	521352.858	112.863	0.479				120.089
98	521492.858	113.534	-0.992	Hog Curve	521352.858	112.863	521632.858	112.817		-28226	-0.354	282.255	280.000
99				Grade	521632.858	112.817	521845.077	111.729	-0.513				212.219
100	521940.077	111.242	1.373	Sag Curve	521845.077	111.729	522035.077	112.059		13842	0.722	138.422	190.000
101				Grade	522035.077	112.059	522410.000	115.283	0.860				374.923
102	522635.000	117.219	-1.720	Hog Curve	522410.000	115.283	522860.000	115.284		-26163	-0.382	261.636	450.000
103				Grade	522860.000	115.284	523191.837	112.430	-0.860				331.837
104	523326.837	111.269	1.860	Sag Curve	523191.837	112.430	523461.837	112.619		14516	0.689	145.163	270.000
105				Grade	523461.837	112.619	523790.000	115.901	1.000				328.163
106	524100.000	119.001	-1.874	Hog Curve	523790.000	115.901	524410.000	116.291		-33082	-0.302	330.830	620.000
107				Grade	524410.000	116.291	524790.000	112.970	-0.874				380.000
108	524895.000	112.052	1.528	Sag Curve	524790.000	112.970	525000.000	112.739		13740	0.728	137.397	210.000
109				Grade	525000.000	112.739	525204.879	114.080	0.654				204.879
110	525354.879	115.061	-1.105	Hog Curve	525204.879	114.080	525504.879	114.385		-27144	-0.368	271.437	300.000
111				Grade	525504.879	114.385	526092.683	111.735	-0.451				587.804
112	526201.555	111.244	1.374	Sag Curve	526092.683	111.735	526310.427	112.249		15849	0.631	158.486	217.744
113				Grade	526310.427	112.249	526492.708	113.931	0.923				182.281
114	526865.620	117.374	-1.299	Hog Curve	526492.708	113.931	527238.531	115.973		-57427	-0.174	574.284	745.823
115				Grade	527238.531	115.973	527239.836	115.968	-0.376				1.305
116	527330.133	115.628	1.272	Sag Curve	527239.836	115.968	527420.429	116.438		14199	0.704	141.993	180.593
117				Grade	527420.429	116.438	527431.595	116.538	0.896				11.166
118	527551.367	117.611	-0.896	Hog Curve	527431.595	116.538	527671.140	117.611		-26730	-0.374	267.301	239.545
119				Grade	527671.140	117.611	527711.234	117.611	0.000				40.094
120	527836.234	117.611	-0.956	Hog Curve	527711.234	117.611	527961.234	116.416		-26156	-0.382	261.561	250.000
121				Grade	527961.234	116.416	528087.952	115.205	-0.956				126.718
122	528182.952	114.297	1.378	Sag Curve	528087.952	115.205	528277.952	114.698		13793	0.725	137.929	190.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
123				Grade	528277.952	114.698	528291.486	114.755	0.422				13.534
124	528556.486	115.872	-1.501	Hog Curve	528291.486	114.755	528821.486	113.011		-35302	-0.283	353.020	530.000
125				Grade	528821.486	113.011	528904.434	112.116	-1.080				82.948
126	529049.434	110.551	2.137	Sag Curve	528904.434	112.116	529194.434	112.083		13573	0.737	135.726	290.000
127				Grade	529194.434	112.083	529775.231	118.223	1.057				580.797
128	529915.231	119.703	-1.057	Hog Curve	529775.231	118.223	530055.231	119.703		-26488	-0.378	264.887	280.000
129				Grade	530055.231	119.703	530231.819	119.703	0.000				176.588
130	530331.645	119.703	-0.751	Hog Curve	530231.819	119.703	530431.471	118.953		-26602	-0.376	266.021	199.652
131				Grade	530431.471	118.953	530745.037	116.600	-0.751				313.566
132	530845.037	115.850	1.354	Sag Curve	530745.037	116.600	530945.037	116.453		14769	0.677	147.689	200.000
133				Grade	530945.037	116.453	531054.384	117.113	0.604				109.347
134	531289.894	118.535	-1.597	Hog Curve	531054.384	117.113	531525.403	116.197		-29503	-0.339	295.029	471.019
135				Grade	531525.403	116.197	531892.889	112.548	-0.993				367.486
136	532017.889	111.307	1.644	Sag Curve	531892.889	112.548	532142.889	112.121		15208	0.658	152.077	250.000
137				Grade	532142.889	112.121	532735.000	115.976	0.651				592.111
138	533020.000	117.832	-1.571	Hog Curve	532735.000	115.976	533305.000	115.210		-36281	-0.276	362.805	570.000
139				Grade	533305.000	115.210	533678.597	111.773	-0.920				373.597
140	533823.597	110.439	2.182	Sag Curve	533678.597	111.773	533968.597	112.269		13291	0.752	132.912	290.000
141				Grade	533968.597	112.269	534221.793	115.464	1.262				253.196
142	534461.793	118.492	-1.834	Hog Curve	534221.793	115.464	534701.793	117.119		-26168	-0.382	261.677	480.000
143				Grade	534701.793	117.119	535116.367	114.746	-0.572				414.574
144	535204.367	114.242	1.038	Sag Curve	535116.367	114.746	535292.367	114.652		16953	0.590	169.529	176.000
145				Grade	535292.367	114.652	535607.070	116.117	0.466				314.703
146	535772.070	116.886	-1.126	Hog Curve	535607.070	116.117	535937.070	115.797		-29320	-0.341	293.204	330.000
147				Grade	535937.070	115.797	536098.821	114.730	-0.660				161.751
148	536163.821	114.301	0.353	Sag Curve	536098.821	114.730	536228.821	114.102		36799	0.272	367.985	130.000
149				Grade	536228.821	114.102	536716.049	112.609	-0.306				487.228
150	536886.049	112.088	-0.529	Hog Curve	536716.049	112.609	537056.049	110.668		-64315	-0.155	643.170	340.000
151				Grade	537056.049	110.668	537186.137	109.582	-0.835				130.088
152	537271.137	108.872	1.145	Sag Curve	537186.137	109.582	537356.137	109.135		14850	0.673	148.498	170.000
153				Grade	537356.137	109.135	538090.110	111.408	0.310				733.973

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
154	538140.110	111.563	0.657	Sag Curve	538090.110	111.408	538190.110	112.046		15215	0.657	152.154	100.000
155				Grade	538190.110	112.046	538447.240	114.533	0.967				257.130
156	538582.240	115.838	-0.967	Hog Curve	538447.240	114.533	538717.240	115.838		-27924	-0.358	279.244	270.000
157				Grade	538717.240	115.838	538764.427	115.838	0.000				47.187
158	538899.427	115.838	-0.989	Hog Curve	538764.427	115.838	539034.427	114.503		-27302	-0.366	273.015	270.000
159				Grade	539034.427	114.503	539148.024	113.379	-0.989				113.597
160	539234.024	112.529	1.289	Sag Curve	539148.024	113.379	539320.024	112.787		13346	0.749	133.456	172.000
161				Grade	539320.024	112.787	539381.000	112.970	0.300				60.976
162	539551.000	113.480	-1.300	Hog Curve	539381.000	112.970	539721.000	111.780		-26157	-0.382	261.575	340.000
163				Grade	539721.000	111.780	539832.725	110.662	-1.000				111.725
164	540032.725	108.662	1.741	Sag Curve	539832.725	110.662	540232.725	110.144		22980	0.435	229.795	400.000
165				Grade	540232.725	110.144	540720.000	113.753	0.741				487.275
166	540905.000	115.123	-1.341	Hog Curve	540720.000	113.753	541090.000	114.013		-27595	-0.362	275.953	370.000
167				Grade	541090.000	114.013	541271.182	112.926	-0.600				181.182
168	541346.182	112.476	1.100	Sag Curve	541271.182	112.926	541421.182	112.851		13634	0.733	136.335	150.000
169				Grade	541421.182	112.851	541510.000	113.295	0.500				88.818
170	541645.000	113.971	-1.000	Hog Curve	541510.000	113.295	541780.000	113.295		-26996	-0.370	269.957	270.000
171				Grade	541780.000	113.295	541997.681	112.207	-0.500				217.681
172	542072.681	111.832	1.100	Sag Curve	541997.681	112.207	542147.681	112.282		13636	0.733	136.359	150.000
173				Grade	542147.681	112.282	542332.998	113.394	0.600				185.317
174	542542.998	114.654	-1.600	Hog Curve	542332.998	113.394	542752.998	112.554		-26249	-0.381	262.488	420.000
175				Grade	542752.998	112.554	542858.374	111.500	-1.000				105.376
176	542965.874	110.425	1.600	Sag Curve	542858.374	111.500	543073.374	111.070		13436	0.744	134.365	215.000
177				Grade	543073.374	111.070	543123.000	111.368	0.600				49.626
178	543333.000	112.628	-1.600	Hog Curve	543123.000	111.368	543543.000	110.528		-26249	-0.381	262.488	420.000
179				Grade	543543.000	110.528	543624.406	109.714	-1.000				81.406
180	543824.406	107.714	1.297	Sag Curve	543624.406	109.714	544024.406	108.308		30836	0.324	308.356	400.000
181				Grade	544024.406	108.308	544391.489	109.399	0.297				367.083
182	544441.489	109.548	0.703	Sag Curve	544391.489	109.399	544491.489	110.048		14227	0.703	142.270	100.000
183				Grade	544491.489	110.048	544589.500	111.028	1.000				98.011
184	544852.000	113.653	-2.000	Hog Curve	544589.500	111.028	545114.500	111.028		-26248	-0.381	262.481	525.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
185				Grade	545114.500	111.028	545373.100	108.442	-1.000				258.600
186	545508.100	107.092	2.000	Sag Curve	545373.100	108.442	545643.100	108.442		13499	0.741	134.991	270.000
187				Grade	545643.100	108.442	546023.500	112.246	1.000				380.400
188	546286.000	114.872	-2.000	Hog Curve	546023.500	112.246	546548.500	112.247		-26249	-0.381	262.495	525.000
189				Grade	546548.500	112.247	546898.035	108.751	-1.000				349.535
190	547032.575	107.406	1.354	Sag Curve	546898.035	108.751	547167.115	107.882		19874	0.503	198.740	269.080
191				Grade	547167.115	107.882	547289.299	108.315	0.354				122.184
192	547387.456	108.662	-0.745	Hog Curve	547289.299	108.315	547485.613	108.278		-26355	-0.379	263.546	196.314
193				Grade	547485.613	108.278	547702.513	107.430	-0.391				216.900
194	547763.202	107.193	0.920	Sag Curve	547702.513	107.430	547823.891	107.514		13200	0.758	131.999	121.378
195				Grade	547823.891	107.514	548027.509	108.590	0.529				203.618
196	548152.509	109.251	-0.845	Hog Curve	548027.509	108.590	548277.509	108.855		-29571	-0.338	295.709	250.000
197				Grade	548277.509	108.855	548452.671	108.300	-0.317				175.162
198	548518.774	108.090	1.002	Sag Curve	548452.671	108.300	548584.877	108.543		13200	0.758	131.999	132.206
199				Grade	548584.877	108.543	548800.000	110.016	0.685				215.123

Table-5.4.12 Vertical Alignment Report (Package-12)

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
1				Grade	548800.000	110.016	548820.129	110.153	0.682				20.129
2	548870.129	110.494	0.439	Sag Curve	548820.129	110.153	548920.129	111.055		22757	0.439	227.568	100.000
3				Grade	548920.129	111.055	549005.604	112.013	1.121				85.475
4	549205.604	114.256	-1.521	Hog Curve	549005.604	112.013	549405.604	113.456		-26292	-0.380	262.923	400.000
5				Grade	549405.604	113.456	549463.215	113.225	-0.400				57.611
6	549578.215	112.765	-0.875	Hog Curve	549463.215	113.225	549693.215	111.299		-26275	-0.381	262.743	230.000
7				Grade	549693.215	111.299	549834.945	109.491	-1.275				141.730
8	549987.445	107.546	2.275	Sag Curve	549834.945	109.491	550139.945	109.071		13404	0.746	134.043	305.000
9				Grade	550139.945	109.071	550546.864	113.140	1.000				406.919
10	550681.864	114.490	-1.000	Hog Curve	550546.864	113.140	550816.864	114.490		-27001	-0.370	270.008	270.000
11				Grade	550816.864	114.490	550875.717	114.490	0.000				58.853
12	551010.717	114.490	-1.000	Hog Curve	550875.717	114.490	551145.717	113.140		-27000	-0.370	270.000	270.000
13				Grade	551145.717	113.140	551534.511	109.252	-1.000				388.794
14	551634.511	108.252	1.688	Sag Curve	551534.511	109.252	551734.511	108.940		11849	0.844	118.493	200.000
15				Grade	551734.511	108.940	551979.785	110.627	0.688				245.274
16	552114.785	111.556	-1.188	Hog Curve	551979.785	110.627	552249.785	110.881		-22731	-0.440	227.309	270.000
17				Grade	552249.785	110.881	552468.964	109.785	-0.500				219.179
18	552543.964	109.410	1.000	Sag Curve	552468.964	109.785	552618.964	109.785		15001	0.667	150.006	150.000
19				Grade	552618.964	109.785	552658.000	109.980	0.500				39.036
20	552858.000	110.980	-1.500	Hog Curve	552658.000	109.980	553058.000	108.980		-26667	-0.375	266.667	400.000
21				Grade	553058.000	108.980	553232.453	107.235	-1.000				174.453
22	553322.453	106.335	1.296	Sag Curve	553232.453	107.235	553412.453	106.602		13893	0.720	138.929	180.000
23				Grade	553412.453	106.602	553577.076	107.088	0.296				164.623
24	553627.076	107.236	0.704	Sag Curve	553577.076	107.088	553677.076	107.736		14198	0.704	141.983	100.000
25				Grade	553677.076	107.736	553793.000	108.895	1.000				115.924
26	553993.000	110.895	-1.500	Hog Curve	553793.000	108.895	554193.000	109.895		-26668	-0.375	266.681	400.000
27				Grade	554193.000	109.895	554279.924	109.460	-0.500				86.924
28	554379.924	108.960	1.504	Sag Curve	554279.924	109.460	554479.924	109.964		13297	0.752	132.975	200.000
29				Grade	554479.924	109.964	554642.079	111.593	1.004				162.155

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
30	554777.079	112.948	-1.004	Hog Curve	554642.079	111.593	554912.079	112.948		-26891	-0.372	268.911	270.000
31				Grade	554912.079	112.948	554991.188	112.948	0.000				79.109
32	555126.188	112.948	-1.000	Hog Curve	554991.188	112.948	555261.188	111.598		-27000	-0.370	270.000	270.000
33				Grade	555261.188	111.598	555620.797	108.002	-1.000				359.609
34	555670.797	107.502	0.686	Sag Curve	555620.797	108.002	555720.797	107.345		14583	0.686	145.830	100.000
35				Grade	555720.797	107.345	555814.966	107.049	-0.314				94.169
36	555904.966	106.766	1.314	Sag Curve	555814.966	107.049	555994.966	107.666		13695	0.730	136.945	180.000
37				Grade	555994.966	107.666	556155.000	109.267	1.000				160.034
38	556420.000	111.917	-2.000	Hog Curve	556155.000	109.267	556685.000	109.267		-26498	-0.377	264.985	530.000
39				Grade	556685.000	109.267	556962.579	106.491	-1.000				277.579
40	557047.579	105.641	1.306	Sag Curve	556962.579	106.491	557132.579	105.901		13020	0.768	130.205	170.000
41				Grade	557132.579	105.901	557705.000	107.651	0.306				572.421
42	557755.000	107.803	0.497	Sag Curve	557705.000	107.651	557805.000	108.204		20140	0.497	201.402	100.000
43				Grade	557805.000	108.204	558123.202	110.757	0.802				318.202
44	558323.202	112.361	-1.383	Hog Curve	558123.202	110.757	558523.202	111.199		-28914	-0.346	289.143	400.000
45				Grade	558523.202	111.199	558755.430	109.849	-0.581				232.228
46	558840.430	109.355	1.281	Sag Curve	558755.430	109.849	558925.430	109.950		13269	0.754	132.686	170.000
47				Grade	558925.430	109.950	559095.000	111.137	0.700				169.570
48	559295.000	112.537	-1.500	Hog Curve	559095.000	111.137	559495.000	110.937		-26668	-0.375	266.681	400.000
49				Grade	559495.000	110.937	559571.909	110.322	-0.800				76.909
50	559661.909	109.602	1.353	Sag Curve	559571.909	110.322	559751.909	110.100		13302	0.752	133.025	180.000
51				Grade	559751.909	110.100	559816.232	110.456	0.553				64.323
52	559961.232	111.258	-0.957	Hog Curve	559816.232	110.456	560106.232	110.673		-30318	-0.330	303.186	290.000
53				Grade	560106.232	110.673	560305.868	109.868	-0.403				199.636
54	560395.868	109.505	1.204	Sag Curve	560305.868	109.868	560485.868	110.226		14945	0.669	149.454	180.000
55				Grade	560485.868	110.226	560660.000	111.621	0.801				174.132
56	560860.000	113.223	-1.513	Hog Curve	560660.000	111.621	561060.000	111.799		-26435	-0.378	264.354	400.000
57				Grade	561060.000	111.799	561765.000	106.779	-0.712				705.000
58	561865.000	106.067	1.010	Sag Curve	561765.000	106.779	561965.000	106.365		19793	0.505	197.926	200.000
59				Grade	561965.000	106.365	562240.832	107.189	0.298				275.832
60	562345.832	107.502	-0.790	Hog Curve	562240.832	107.189	562450.832	106.986		-26586	-0.376	265.858	210.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
61				Grade	562450.832	106.986	562505.041	106.719	-0.491				54.209
62	562605.041	106.228	1.491	Sag Curve	562505.041	106.719	562705.041	107.228		13410	0.746	134.099	200.000
63				Grade	562705.041	107.228	562747.500	107.653	1.000				42.459
64	563010.000	110.278	-2.000	Hog Curve	562747.500	107.653	563272.500	107.653		-26250	-0.381	262.502	525.000
65				Grade	563272.500	107.653	563437.521	106.002	-1.000				165.021
66	563547.521	104.902	1.312	Sag Curve	563437.521	106.002	563657.521	105.245		16771	0.596	167.712	220.000
67				Grade	563657.521	105.245	564253.035	107.102	0.312				595.514
68	564333.035	107.351	-0.612	Hog Curve	564253.035	107.102	564413.035	107.111		-26153	-0.382	261.534	160.000
69				Grade	564413.035	107.111	564562.490	106.663	-0.300				149.455
70	564652.490	106.393	1.300	Sag Curve	564562.490	106.663	564742.490	107.293		13846	0.722	138.462	180.000
71				Grade	564742.490	107.293	564891.520	108.783	1.000				149.030
72	565154.020	111.408	-2.000	Hog Curve	564891.520	108.783	565416.520	108.783		-26251	-0.381	262.509	525.000
73				Grade	565416.520	108.783	565688.351	106.065	-1.000				271.831
74	565813.351	104.815	1.306	Sag Curve	565688.351	106.065	565938.351	105.198		19147	0.522	191.472	250.000
75				Grade	565938.351	105.198	566213.368	106.038	0.306				275.017
76	566263.368	106.191	0.694	Sag Curve	566213.368	106.038	566313.368	106.691		14404	0.694	144.036	100.000
77				Grade	566313.368	106.691	566420.000	107.758	1.000				106.632
78	566655.000	110.108	-1.800	Hog Curve	566420.000	107.758	566890.000	108.228		-26112	-0.383	261.124	470.000
79				Grade	566890.000	108.228	567078.104	106.723	-0.800				188.104
80	567168.104	106.003	1.353	Sag Curve	567078.104	106.723	567258.104	106.501		13301	0.752	133.014	180.000
81				Grade	567258.104	106.501	567594.881	108.364	0.553				336.777
82	567771.381	109.341	-1.347	Hog Curve	567594.881	108.364	567947.881	107.941		-26212	-0.382	262.116	353.000
83				Grade	567947.881	107.941	568223.212	105.756	-0.793				275.331
84	568343.212	104.804	1.794	Sag Curve	568223.212	105.756	568463.212	106.005		13375	0.748	133.751	240.000
85				Grade	568463.212	106.005	568677.500	108.150	1.001				214.288
86	568940.000	110.778	-2.001	Hog Curve	568677.500	108.150	569202.500	108.153		-26237	-0.381	262.378	525.000
87				Grade	569202.500	108.153	569637.699	103.801	-1.000				435.199
88	569727.699	102.901	1.323	Sag Curve	569637.699	103.801	569817.699	103.191		13605	0.735	136.054	180.000
89				Grade	569817.699	103.191	571243.380	107.796	0.323				1425.681
90	571453.380	108.475	-1.593	Hog Curve	571243.380	107.796	571663.380	105.808		-26365	-0.379	263.651	420.000
91				Grade	571663.380	105.808	571778.700	104.343	-1.270				115.320

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
92	571898.700	102.819	1.690	Sag Curve	571778.700	104.343	572018.700	103.323		14201	0.704	142.011	240.000
93				Grade	572018.700	103.323	572594.000	105.739	0.420				575.300
94	572769.000	106.474	-1.340	Hog Curve	572594.000	105.739	572944.000	104.864		-26119	-0.383	261.192	350.000
95				Grade	572944.000	104.864	573145.495	103.010	-0.920				201.495
96	573235.495	102.182	1.220	Sag Curve	573145.495	103.010	573325.495	102.453		14754	0.678	147.536	180.000
97				Grade	573325.495	102.453	573442.927	102.805	0.300				117.432
98	573692.927	103.555	-0.600	Hog Curve	573442.927	102.805	573942.927	102.805		-83311	-0.120	833.125	500.000
99				Grade	573942.927	102.805	574067.740	102.430	-0.300				124.813
100	574162.740	102.145	1.420	Sag Curve	574067.740	102.430	574257.740	103.209		13378	0.748	133.776	190.000
101				Grade	574257.740	103.209	574355.000	104.299	1.120				97.260
102	574555.000	106.539	-1.421	Hog Curve	574355.000	104.299	574755.000	105.938		-28156	-0.355	281.563	400.000
103				Grade	574755.000	105.938	574904.872	105.488	-0.300				149.872
104	574989.872	105.232	1.250	Sag Curve	574904.872	105.488	575074.872	106.040		13595	0.736	135.947	170.000
105				Grade	575074.872	106.040	575130.000	106.564	0.950				55.128
106	575380.000	108.938	-1.900	Hog Curve	575130.000	106.564	575630.000	106.564		-26316	-0.380	263.165	500.000
107				Grade	575630.000	106.564	575856.715	104.410	-0.950				226.715
108	575986.715	103.175	1.950	Sag Curve	575856.715	104.410	576116.715	104.475		13334	0.750	133.340	260.000
109				Grade	576116.715	104.475	576304.445	106.352	1.000				187.730
110	576439.445	107.702	-1.000	Hog Curve	576304.445	106.352	576574.445	107.702		-27002	-0.370	270.015	270.000
111				Grade	576574.445	107.702	576659.815	107.702	0.000				85.370
112	576794.815	107.702	-1.000	Hog Curve	576659.815	107.702	576929.815	106.352		-27000	-0.370	270.000	270.000
113				Grade	576929.815	106.352	577355.499	102.095	-1.000				425.684
114	577445.499	101.195	1.309	Sag Curve	577355.499	102.095	577535.499	101.473		13753	0.727	137.527	180.000
115				Grade	577535.499	101.473	578094.345	103.199	0.309				558.846
116	578094.345	103.199	0.191	Sag Curve	578094.345	103.199	578200.888	103.732					106.543
117	578350.888	104.482	-1.131	Hog Curve	578200.888	103.732	578500.888	103.536		-26532	-0.377	265.322	300.000
118				Grade	578500.888	103.536	578543.579	103.267	-0.631				42.691
119	578593.579	102.952	-0.173	Hog Curve	578543.579	103.267	578643.579	102.550		-57681	-0.173	576.801	100.000
120				Grade	578643.579	102.550	578690.919	102.169	-0.804				47.340
121	578778.419	101.466	1.304	Sag Curve	578690.919	102.169	578865.919	101.904		13421	0.745	134.214	175.000
122				Grade	578865.919	101.904	578946.000	102.304	0.500				80.081

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
123	579146.000	103.304	-1.500	Hog Curve	578946.000	102.304	579346.000	101.304		-26667	-0.375	266.667	400.000
124				Grade	579346.000	101.304	579381.338	100.951	-1.000				35.338
125	579476.338	100.001	1.315	Sag Curve	579381.338	100.951	579571.338	100.300		14445	0.692	144.450	190.000
126				Grade	579571.338	100.300	580087.099	101.926	0.315				515.761
127	580162.099	102.163	0.685	Sag Curve	580087.099	101.926	580237.099	102.913		21908	0.456	219.082	150.000
128				Grade	580237.099	102.913	580390.000	104.442	1.000				152.901
129	580590.000	106.442	-1.490	Hog Curve	580390.000	104.442	580790.000	105.463		-26851	-0.372	268.507	400.000
130				Grade	580790.000	105.463	581191.770	103.495	-0.490				401.770
131	581281.770	103.054	0.796	Sag Curve	581191.770	103.495	581371.770	103.330		22621	0.442	226.214	180.000
132				Grade	581371.770	103.330	582320.512	106.233	0.306				948.742
133	582470.512	106.692	-1.106	Hog Curve	582320.512	106.233	582620.512	105.492		-27127	-0.369	271.267	300.000
134				Grade	582620.512	105.492	582887.502	103.356	-0.800				266.990
135	583002.502	102.436	1.143	Sag Curve	582887.502	103.356	583117.502	102.831		20121	0.497	201.207	230.000
136				Grade	583117.502	102.831	583497.032	104.133	0.343				379.530
137	583622.032	104.562	-0.864	Hog Curve	583497.032	104.133	583747.032	103.911		-28939	-0.346	289.385	250.000
138				Grade	583747.032	103.911	583922.561	102.997	-0.521				175.529
139	584047.561	102.346	1.521	Sag Curve	583922.561	102.997	584172.561	103.596		16439	0.608	164.393	250.000
140				Grade	584172.561	103.596	584319.500	105.066	1.000				146.939
141	584582.000	107.691	-2.000	Hog Curve	584319.500	105.066	584844.500	105.065		-26249	-0.381	262.495	525.000
142				Grade	584844.500	105.065	585058.722	102.923	-1.000				214.222
143	585178.722	101.723	1.800	Sag Curve	585058.722	102.923	585298.722	102.683		13333	0.750	133.326	240.000
144				Grade	585298.722	102.683	585630.000	105.333	0.800				331.278
145	585800.000	106.693	-1.300	Hog Curve	585630.000	105.333	585970.000	105.843		-26153	-0.382	261.527	340.000
146				Grade	585970.000	105.843	586224.089	104.573	-0.500				254.089
147	586329.089	104.048	1.516	Sag Curve	586224.089	104.573	586434.089	105.114		13855	0.722	138.550	210.000
148				Grade	586434.089	105.114	587006.445	110.928	1.016				572.356
149	587141.445	112.299	-1.016	Hog Curve	587006.445	110.928	587276.445	112.299		-26583	-0.376	265.830	270.000
150				Grade	587276.445	112.299	587356.445	112.299	0.000				80.000
151	587491.445	112.299	-1.018	Hog Curve	587356.445	112.299	587626.445	110.925		-26520	-0.377	265.196	270.000
152				Grade	587626.445	110.925	588019.968	106.918	-1.018				393.523
153	588069.968	106.409	0.333	Sag Curve	588019.968	106.918	588119.968	106.066		30055	0.333	300.553	100.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
154				Grade	588119.968	106.066	588288.113	104.914	-0.685				168.145
155	588378.113	104.297	1.176	Sag Curve	588288.113	104.914	588468.113	104.739		15301	0.654	153.010	180.000
156				Grade	588468.113	104.739	588606.276	105.417	0.491				138.163
157	588741.276	106.080	-0.991	Hog Curve	588606.276	105.417	588876.276	105.405		-27245	-0.367	272.457	270.000
158				Grade	588876.276	105.405	589012.332	104.725	-0.500				136.056
159	589087.332	104.350	-0.500	Hog Curve	589012.332	104.725	589162.332	103.600		-30006	-0.333	300.057	150.000
160				Grade	589162.332	103.600	589346.350	101.760	-1.000				184.018
161	589456.350	100.660	1.652	Sag Curve	589346.350	101.760	589566.350	101.377		13317	0.751	133.170	220.000
162				Grade	589566.350	101.377	589743.605	102.533	0.652				177.255
163	589876.105	103.397	-0.961	Hog Curve	589743.605	102.533	590008.605	102.988		-27580	-0.363	275.801	265.000
164				Grade	590008.605	102.988	590055.000	102.845	-0.309				46.395
165	590155.000	102.536	0.716	Sag Curve	590055.000	102.845	590255.000	102.944		27921	0.358	279.205	200.000
166				Grade	590255.000	102.944	590722.862	104.851	0.408				467.862
167	590897.862	105.564	-1.318	Hog Curve	590722.862	104.851	591072.862	103.972		-26562	-0.376	265.618	350.000
168				Grade	591072.862	103.972	591183.573	102.964	-0.910				110.711
169	591318.573	101.736	1.910	Sag Curve	591183.573	102.964	591453.573	103.086		14136	0.707	141.357	270.000
170				Grade	591453.573	103.086	591825.000	106.800	1.000				371.427
171	592025.000	108.800	-1.472	Hog Curve	591825.000	106.800	592225.000	107.856		-27177	-0.368	271.769	400.000
172				Grade	592225.000	107.856	592526.000	106.436	-0.472				301.000
173	592526.000	106.436	-0.085	Sag Curve	592526.000	106.436	593482.022	101.112					956.022
174	593592.022	100.499	1.272	Sag Curve	593482.022	101.112	593702.022	101.286		17295	0.578	172.948	220.000
175				Grade	593702.022	101.286	594074.611	103.950	0.715				372.589
176	594274.611	105.380	-1.408	Hog Curve	594074.611	103.950	594474.611	103.995		-28413	-0.352	284.131	400.000
177				Grade	594474.611	103.995	594858.791	101.334	-0.693				384.180
178	594983.791	100.468	1.687	Sag Curve	594858.791	101.334	595108.791	101.711		14816	0.675	148.157	250.000
179				Grade	595108.791	101.711	595186.922	102.489	0.995				78.131
180	595371.922	104.329	-1.419	Hog Curve	595186.922	102.489	595556.922	103.543		-26067	-0.384	260.675	370.000
181				Grade	595556.922	103.543	595747.076	102.736	-0.425				190.154
182	595847.076	102.311	0.834	Sag Curve	595747.076	102.736	595947.076	102.720		23990	0.417	239.894	200.000
183				Grade	595947.076	102.720	596389.182	104.528	0.409				442.106
184	596571.682	105.275	-1.374	Hog Curve	596389.182	104.528	596754.182	103.513		-26563	-0.376	265.625	365.000

S. No.	Vertical Intersection Points			Element	Vertical Tangent Points					Radius	M Value	K Value	Length of Element
	Chainage	Level	%Grade Diff.		Start Chainage	Level	End Chainage	Level	Grade (%)				
185				Grade	596754.182	103.513	597089.019	100.282	-0.965				334.837
186	597229.019	98.931	1.965	Sag Curve	597089.019	100.282	597369.019	100.331		14249	0.702	142.487	280.000
187				Grade	597369.019	100.331	597448.500	101.126	1.000				79.481
188	597711.000	103.750	-2.000	Hog Curve	597448.500	101.126	597973.500	101.126		-26250	-0.381	262.502	525.000
189				Grade	597973.500	101.126	598150.550	99.355	-1.000				177.050
190	598300.550	97.855	2.000	Sag Curve	598150.550	99.355	598450.550	99.355		15000	0.667	149.999	300.000
191				Grade	598450.550	99.355	598758.000	102.429	1.000				307.450
192	599008.000	104.929	-1.900	Hog Curve	598758.000	102.429	599258.000	102.679		-26315	-0.380	263.151	500.000
193				Grade	599258.000	102.679	599407.352	101.335	-0.900				149.352
194	599532.352	100.210	1.823	Sag Curve	599407.352	101.335	599657.352	101.364		13710	0.729	137.101	250.000
195				Grade	599657.352	101.364	600141.445	105.834	0.923				484.093
196	600276.445	107.081	-0.923	Hog Curve	600141.445	105.834	600411.445	107.081		-29240	-0.342	292.398	270.000
197				Grade	600411.445	107.081	600467.087	107.081	0.000				55.642
198				Grade	600467.087	107.081	0.000	0.000	0.000				-600467.087

5.5 SERVICE ROAD

Package wise width of Service Roads of different widths viz. 3.75 m, 7.0 m, 10 m is given below in **Table-5.4**:

Table-5.4 Package wise Length & Width of Service Roads

Package No.	3.75 m Service Road		7.0 m Service Road		10.0 m Service Road	
	LHS	RHS	LHS	RHS	LHS	RHS
I	36.77	14.31	5.33	1.82	0	0
II	23.81	8.93	0.80	0.00	0	0
III	45.25	26.41	0.40	0.40	0	0
IV	23.74	35.50	5.74	0.40	0	0
V	20.93	12.40	0.80	18.30	0	0
VI	32.34	15.34	2.98	7.52	5.0	5.0
VII	21.55	35.16	0.40	0.80	0	0
VIII	26.15	33.22	8.41	3.58	0	0
IX	33.79	25.12	3.08	2.01	0	0
X	22.11	33.89	2.58	8.41	0	0
XI	18.53	28.32	3.87	7.40	0	0
XII	26.12	25.14	5.16	2.25	0	0
Total Length (km)	**331.09**	**293.74**	**39.55**	**52.89**	**5.0**	**5.0**

5.6 ROADSIDE DRAIN

Package wise lengths and types of Drains is given in table below in **Table-5.5**:

Table-5.5 Package wise Length & Type of Roads Side Drain

Package No.	Length of Drain (m)					Remarks
	Unlined Drain (LHS+RHS)	Lined Drain (LHS+RHS)	Median Drain	Covered Drain (LHS+RHS)	Chute Drain	
I	39774	55595	44103	2560	42750	
II	26465	32099	27856	-	43420	
III	28936	71719	48100	990	42120	
IV	38824	64507	49035	990	42260	
V	40973	51089	44608	-	42330	
VI	37623	62293	45716	990	48345	

Package No.	Length of Drain (m)					Remarks
	Unlined Drain (LHS+RHS)	Lined Drain (LHS+RHS)	Median Drain	Covered Drain (LHS+RHS)	Chute Drain	
VII	46896	56886	49921	990	41940	
VIII	29037	70411	46679	990	43820	
IX	42200	63188	51030	-	41920	
X	36613	66023	48991	990	42090	
XI	45876	56891	48753	990	43460	
XII	43851	60062	49858	2560	43160	
Total Length (m)	**457068**	**710761**	**554648**	**12050**	**511500**	
Total Length (km)	**457.07**	**710.76**	**554.65**	**12.05**	**511.50**	

5.7 AIR STRIP

Highway strip/airstrip is the concept of using part of a road as an airstrip during exigencies. These airstrips are of extreme importance for rescue operations at times of war, natural calamities, and critical accidents. These Air Strips may result to be very useful for emergency landing of combat jets of the Indian Air Force.

The Air Strips may allow military aircraft to continue operating even if their regular air bases, some of the most vulnerable targets in any war, are degraded or destroyed.

Package wise details of Air Strips are given below:

Package No.	Component Start/ End		Chainage	Length	Remarks
6	**Start**	Clear Zone	242+500	0.750	
		Air Strip	243+250	3.500	Clear Zone End
	End	Air Strip	246+750		Clear Zone Start
		Clear Zone	247+500	0.750	

Proposals for the Air Strips have been made on selected locations. The Width of Carriageway at Airstrip locations has been kept 36.0 m with 15.0 m Earthen Shoulders on both sides. The type of Pavement proposed for Air Strip is Rigid Pavement.

6. PAVEMENT DESIGN & PAVEMENT PROPOSALS

6.1 PAVEMENT INVESTIGATIONS

In conformity with the provision of the TOR and various standards, the following investigations have been broadly carried during planning and designing stage.

- Axle Load Survey
- Material Investigations

6.1.1 Axle Load Surveys

Several factors such as gross load, tyre pressure, number of wheels and type of wheel configuration, number of repetitions, sub grade soil properties, climatic conditions and type of materials used in pavement, etc. affect the structural design and performance of pavements.

For the design of pavement for the Ganga Greenfield Expressway, the quantum of traffic wheel loads that will be diverted on the project corridor need to be established. For this, the behaviour of axle loading & VDF of commercial vehicles using the project corridor are necessary in determination of realistic pavement design.

To arrive axle loads on to the project corridor, Axle Load surveys have been carried out on primary roads in the Project Influence Area (PIA). Identified Roads in PIA are listed below:

Table- 6.1 Locations of Axle Load Survey

S. No.	Survey Location	Stretch & Road Name	Day & Date of O-D Survey
1	Siwaya Toll Booth	Muzaffarnagar - Meerut	Wednesday, 12thFebruary 2020
2	Nizampur	Meerut - Garhmukteshwar	Friday, 6th December 2019
3	Kurkawali	Hasanpur - Chandausi	Monday, 4th November 2019
5	Nagariya	Aligarh - Etah	Wednesday, 27th November 2019
6	Khankah e Niyaziya	Aliganj - Farrukhabad	Monday, 9th December 2019
7	Samdhan	Farrukhabad - Kannauj	Wednesday, 27th November 2019
8	Bilhaur	Kannauj - Kanpur	Monday, 2nd December 2019
9	Katohan Toll Booth	Fatehpur - Prayagraj	Monday, 16th February 2020
10	Agwanpur	Bijnor - Moradabad	Friday, 29th November 2019
11	Faridpur Toll Booth	Bareilly - Shahjahanpur	Monday, 2nd December 2019
12	Nawada	Chandausi - Budaun	Thursday, 28th November 2019
13	Usawan	Budaun - Farrukhabad	Thursday, 5th December 2019
14	Shahabad	Shahjahanpur - Hardoi	Friday, 29th November 2019
15	Safipur	Bangarmau - Unnao	Wednesday, 4th December 2019
16	Semari	Unnao - Lalganj	Friday, 6th December 2019
17	Andiyari	Unchahar - Prayagraj	Tuesday, 10th December 2019

The vehicles were selected randomly to ensure that the sample collected represents the overall-loading pattern plying on the project expressway. As the pavement design is governed by loading configuration of commercial vehicles, axle load data was collected only for commercial vehicles, which generally cause damage to the pavement. Special care has been taken to avoid any variation in the wheel loads due to camber. The procedure adopted using the weigh pad is as follows:

- A suitable safe site was selected for the diversion of vehicles to avoid traffic congestion and utilization of the equipment.
- The weigh pads were placed on firm ground adjacent to the carriageway, at a spacing to match with the wheel paths of trucks and buses. Each pad is provided with ramps to facilitate vehicle movement onto the pad.
- The driver of the vehicle was directed to position the front wheel(s) on the centre of the pad(s). After waiting for 30 seconds to stabilize the reading, axle load was noted from the inbuilt display unit along with vehicle code to represent type of vehicle.
- Similarly, the rear axle was also positioned and reading noted.

The enumerators recorded the type of the vehicles in the form of vehicle codes, and commodity being carried apart from the load recordings. The raw data and analysis for each of the survey location will be submitted separately.

6.1.2 Material Investigations

6.1.2.1 Objective & Scope of Work

Basic objective of material investigations is to identify the potential sources of construction materials, the borrow areas and their suitability by testing them to establish their physical and engineering- properties of the collected samples from the identified sources as per prevailing codes of practice along the project stretches with reasonable leads, to yield adequate quantity and quality of materials which are suitable for various pavement layers viz. embankment, sub grade, sub base, base and structures etc. The investigations have been done by studying the available information or by local enquiry of people, contractors and material suppliers in the PIA adjacent to roads. The objectives may broadly be defined as below.

- Identification of potential sources of borrow pit soils indicating places and the status of quarries whether in operation or new sources along with identification of naturally available granular material (GSB) if any
- Potential sources of stone quarries
- Sources of water for construction
- Availability of sand
- Availability of steel, cement and bitumen

The investigations of the materials were mainly concentrated on the above guidelines and were initially restricted along the respective road alignments and nearby sources adjoining road sections. When suitable information was not available, the reconnaissance extended towards

further more kilometers where potential sources were found and where access was not a major constraint.

6.1.2.2 Survey Methodology

In particular soils and materials like aggregates, sand surveys are required for following purpose:

- To determine the quantity and physical characteristics of soil for design of embankment and sub grade for pavement.
- To locate sources for aggregates required for pavement and structures and to ascertain their availability and suitability for use.

The field investigations at each section of the project corridor broadly includes:

- Study of available information
- Demarcate the possible borrow areas
- Site inspection and assessment of quantity of potential materials
- Sampling of representative materials and preparation of lead chart with the name and location of borrow area /quarry
- Estimation of approximate potential reserves and other necessary details.

A team of engineers under guidance of Material Engineer have visited site, carried out reconnaissance the area and identified number of quarries for stone, sand, gravel and borrow areas. From the reconnaissance and investigations, it has been observed that sufficient borrow areas are available along the roadside within reasonable lead. The collected samples from the respective source were tested in the laboratory for various physical/engineering properties of the materials as per the relevant Indian standard codes for their suitability in road construction.

6.1.2.3 Various Tests and Test Standards

The following tests were performed on soils, aggregates, sand as per relevant Indian standard codes as presented in the **Table 6.2** below.

Table 6.2: Type of Tests and Test Methods

Sl. No.	Name of the Test	Test Method
Soil		
1	Moisture Content at field	IS 2720, Part-2
2	Grain Size Analysis	IS 2720, Part-4
3	Atterberg Limits	IS 2720, Part-5
4	MDD & OMC Modified Proctor Compaction (Heavy Compaction)	IS 2720, Part-8
5	California Bearing Ratio Test (CBR)	IS 2720, Part-16

Sl. No.	Name of the Test	Test Method
6	Free Swelling Index(FSI)	IS 2720, Part-40
Aggregates		
1	Flakiness Index and Elongation Index	IS 2386, Part-1
2	Specific Gravity and Water Absorption	IS 2386, Part-3
3	Aggregate Impact Value	IS 2386, Part-4 or IS:5640
4	Stripping Value	IS : 6241 or AASHTO T:182
5	Soundness in Sodium Sulphate and Magnesium Sulphate	IS:2386 ,Part-5 or IS:383
Sand		
1	Gradation	IS: 383
2	Fineness Modulus	IS: 383

6.1.2.4 Subgrade Investigations

Pavement sub-grade soil investigations comprise of digging of test pits and collection of material sampling and testing. Physical and mechanical properties of roadway materials and sub-grade soil forms the basis for the design of pavement layers and preparation of most appropriate subgrade proposals for the new alignment (greenfield). For this purpose, various engineering surveys have been carried out as per the relevant MORTH/IRC Codes. This section covers the detailed pavement investigations procedures along with brief summary of field and laboratory test results.

The main objective of pavement investigations for new alignment is to evaluate the strength, condition of the sub-grade for the native/subgrade soil for the greenfield expressway. These characteristics are intended for designing overlay for the intended MSA, and for designing new pavement on Ganga Greenfield Expressway with enhanced durability benefits.

The following field investigations were carried out along with field and laboratory testing for assessment of various engineering properties.

- Sub-grade Investigations through Pavement Test Pits
- Laboratory Testing of Sub-Grade Soils

After the collection of representative samples, various laboratory tests as given in Table-6.3 were conducted for their assessment and suitability in construction.

Table 6.3

Sl. No.	Name of the Test	Test Method
1	Moisture Content at Field	IS 2720, Part-2
2	Grain Size Analysis	IS 2720, Part-4
3	Atterberg Limits	IS 2720, Part-5

Sl. No.	Name of the Test	Test Method
4	MDD & OMC Modified Proctor Compaction (Heavy Compaction)	IS 2720, Part-8
5	California Bearing Ratio Test (CBR)	IS 2720, Part-16
6	Free Swelling Index (FSI)	IS 2720, Part-40

Some photographs of test pits are given below which was collected from subgrade along the alignment.

More photos of the sampling have been attached in Material Report.

The results of Soil Test along the project alignment have been attached below in **Table-6.4** below:

Table-6.4 Summary of Lab Test Report of Soil along the alignment

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
1	10 + 000	LHS	10.45	33.28	56.27	37	19.76	17.24	1.95	12.77	25	8.51	CI
2	15 + 000	RHS	9.11	30.76	60.13	38	18.23	19.77	1.93	13.09	26.5	8.07	CI
3	20 + 000	LHS	10.72	39.87	49.41	32	22.76	9.24	1.97	10.87	23	9.56	CL
4	25 + 000	RHS	12.54	42.09	45.37	27	19.54	7.46	1.99	10.05	21	10.86	CL
5	30 + 000	LHS	9.87	37.87	52.26	33	23.94	9.06	1.96	11.43	24.5	8.88	CL
6	35 + 000	RHS	8.77	36.58	54.65	34	21.56	12.44	1.95	11.05	25	8.75	CL
7	40 + 000	LHS	10.09	39.54	50.37	29	20.76	8.24	1.97	10.24	23.5	9.74	CL
8	45 + 000	RHS	9.11	34.65	56.24	36	21.09	14.91	1.95	12.04	23	8.51	MI
9	50 + 000	LHS	9.76	43.54	46.7	32	23.76	8.24	1.98	10.37	23.5	10.04	CL
10	55 + 000	RHS	11.98	43.98	44.04	26	18.45	7.55	1.99	10.19	22	11.06	CL
11	60 + 000	LHS	9.04	32.77	58.19	35	21.78	13.22	1.96	11.76	24	9.03	CL
12	65 + 000	RHS	9.61	34.98	55.41	37	18.98	18.02	1.95	12.47	25	8.6	CI
13	70 + 000	LHS	8.33	32.76	58.91	39	19.76	19.24	1.93	13.24	26.5	7.78	CI
14	75 + 000	RHS	7.97	43.76	48.27	31	21.95	9.05	1.98	10.88	22.5	10.12	CL
15	80 + 000	LHS	10.05	35.76	54.19	33	20.76	12.24	1.96	11.58	24.5	9.18	CL
16	85 + 000	RHS	9.54	36.76	53.7	34	23.67	10.33	1.97	10.89	20.5	9.48	CL
17	90 + 000	LHS	8.12	32.77	59.11	37	21.39	15.61	1.94	12.66	26	8.65	MI
18	95 + 000	RHS	8.27	37.83	53.9	30	20.67	9.33	1.95	11.98	24	8.75	CL
19	100 + 000	LHS	8.32	39.54	52.14	34	21.98	12.02	1.96	12.79	24	8.58	CL
20	105 + 000	RHS	8.98	34.76	56.26	38	24.65	13.35	1.95	12.43	24.25	8.31	MI
21	110 + 000	LHS	10.54	41.78	47.68	30	23.86	6.14	1.99	10.27	21.5	11.08	CL
22	115 + 000	RHS	7.45	37.76	54.79	36	18.77	17.23	1.96	11.82	24	9.16	CI
23	120 + 000	LHS	9.08	39.12	51.8	34	21.48	12.52	1.97	10.43	23.5	9.69	CL
24	125 + 000	RHS	8.76	43.78	47.46	29	20.65	8.35	1.98	10.28	22.5	9.97	CL
25	130 + 000	LHS	7.99	31.67	60.34	39	20.57	18.43	1.94	12.67	25	8.07	CI
26	135 + 000	RHS	10.43	35.85	53.72	35	23.98	11.02	1.97	11.56	24	9.39	CL
27	140 + 000	LHS	9.34	44.98	45.68	27	18.76	8.24	1.98	10.45	22	10.42	CL
28	343 + 300	RHS	9.75	29.89	60.36	40.26	22.59	17.67	1.93	12.16	26.25	8.61	CI
29	145 + 000	RHS	8.35	32.18	59.47	36	19.65	16.35	1.95	12.05	25	8.64	CI
30	150 + 000	LHS	7.47	37.09	55.44	37	22.79	14.21	1.94	12.57	25.5	8.17	MI
31	155 + 000	RHS	9.54	40.76	49.7	27	18.65	8.35	1.97	11.09	24	9.85	CL
32	160 + 000	LHS	8.43	41.59	49.98	29	17.99	11.01	1.98	10.28	23.5	10.63	CL
33	165 + 000	RHS	10.56	37.48	51.96	33	19.77	13.23	1.95	11.78	24.5	8.72	CL
34	170 + 000	LHS	8.11	42.76	49.13	36	21.73	14.27	1.96	12.34	26	8.96	MI
35	173 + 000	RHS	9.56	34.78	55.66	32	19.06	12.94	1.94	12.57	26.5	8.16	CL

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
36	174 + 450	RHS	9.46	30.22	60.32	36	18.01	17.99	1.96	11.08	17.66	8.36	CI
37	179 + 450	LHS	4.24	33.42	62.34	38	26.09	11.91	1.92	11.83	19.63	7.63	MI
38	184 + 450	RHS	6.33	35.24	58.43	34	18.98	15.02	1.93	11.64	23.33	7.82	CL
39	189 + 450	LHS	3.68	30.88	65.44	37	18.89	18.11	1.92	12.24	22.39	7.45	CI
40	194 + 450	RHS	10.67	39.46	49.87	33	19.56	13.44	1.98	10.81	18.28	9.81	CL
41	199 + 450	LHS	15.44	52.13	32.43	29	18.45	10.55	2.01	8.98	12.44	11.45	CL
42	204 + 450	RHS	9.02	33.86	57.12	34	18.31	15.69	1.95	12.54	21.5	9.45	CL
43	209 + 450	LHS	5.79	32.66	61.55	37	18.74	18.26	1.94	11.76	18.47	8.18	CI
44	214 + 450	RHS	7.12	36.4	56.48	31	19.38	11.62	1.97	11.39	20.42	8.72	CL
45	219 + 450	LHS	21.35	45.98	32.67	30	20.01	9.99	2.02	10.21	14.47	13.09	CL
46	224 + 450	RHS	5.21	46.81	47.98	32	21.56	10.44	1.98	10.98	22.41	9.81	CL
47	229 + 450	LHS	7.44	28.22	64.34	39	18.66	20.34	1.92	13.34	22.14	7.82	CI
48	234 + 450	RHS	5.44	35.47	59.09	36	22.61	13.39	1.95	12.98	28.22	8.18	MI
49	239 + 450	LHS	6.22	32.8	60.98	37	26.87	10.13	1.96	11.87	26.75	8.72	MI
50	244 + 450	RHS	7.66	48.89	43.45	32	17.61	14.39	1.99	11.27	23.32	9.81	CL
51	249 + 450	LHS	5.33	39.24	55.43	34	17.54	16.46	1.94	11.64	31.48	7.82	CL
52	254 + 450	RHS	5.79	31.45	62.76	38	18.39	19.61	1.91	11.98	25.56	7.45	CI
53	259 + 450	LHS	7.3	33.81	58.89	37	24.43	12.57	1.92	12.08	23.17	7.63	MI
54	264 + 450	RHS	11.1	46.12	42.78	31	19.54	11.46	1.99	11.7	19.98	10.54	CL
55	269 + 450	LHS	4.77	49.34	45.89	33	20.11	12.89	1.96	12.43	23.88	8.72	CL
56	274 + 450	RHS	11.02	32.2	56.78	36	24.68	11.32	1.92	11.51	18.58	7.63	MI
57	279 + 450	LHS	9.57	45.45	44.98	32	22.78	9.22	1.98	11.76	20.32	9.45	CL
58	284 + 450	RHS	5.44	43	51.56	34	23.65	10.35	1.95	12.49	23.81	8.18	CL
59	289 + 000	LHS	9.22	34	56.78	36	17.91	18.09	1.92	13.09	24.63	7.45	CI
60	294 + 000	RHS	9.46	45.76	44.78	37	23.89	13.11	1.97	11.21	20.76	9.45	MI
61	299 + 000	LHS	7.67	49.66	42.67	33	20.87	12.13	1.98	11.09	19.58	9.81	CL
62	304 + 120	RHS	11.57	47.54	40.89	30	19.82	10.18	1.99	10.98	23.44	10	CL
63	309+500	LHS	12.76	52.26	34.98	29	20.76	8.24	2	9.53	22.96	10.54	CL
64	314+200	RHS	8.55	45.67	45.78	34	22.89	11.11	1.98	10.65	16.01	10.18	CL
65	319+000	LHS	7.33	36.8	55.87	36	22.76	13.24	1.95	12.62	19.2	8.72	MI
66	324+200	RHS	11.35	39.89	48.76	33	23.76	9.24	1.98	12.54	20.72	9.81	CL
67	329+100	LHS	8.24	40.31	51.45	34	19.87	14.13	1.96	11.59	23.95	8.72	CL
68	334+000	RHS	7.91	38.64	53.45	37	24.65	12.35	1.93	11.06	23.88	8.18	MI
69	338 + 300	LHS	8.59	42.56	48.85	41.23	20.71	20.52	1.95	10.23	24.5	9.56	CI
70	348 + 300	LHS	12.65	37.98	49.37	31	22.65	8.35	1.99	11.98	24.75	10.68	CL
71	353 + 300	RHS	9.87	31.45	58.68	34	22.54	11.46	1.97	12.4	25	9.87	CL
72	358 + 300	LHS	11.97	33.78	54.25	33	23.09	9.91	1.98	11.62	23.75	10.21	CL
73	363 + 300	RHS	8.52	42.31	49.17	25.46	15.78	9.68	1.96	10.19	28.75	9.89	CL
74	368 + 300	LHS	9.65	34.76	55.59	40.26	22.35	17.91	1.94	12.32	26.5	8.23	CI
75	373 + 300	RHS	7.59	39.85	52.56	28.23	20.72	7.51	1.98	10.46	27.75	9.52	CL

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
76	383 + 300	LHS	8.56	40.56	50.88	26.47	19.87	6.6	1.97	10.89	25.5	9.47	CL
77	388 + 300	RHS	9.76	34.56	55.68	39.89	22.76	17.13	1.94	12.22	22.25	8.59	CI
78	393 + 300	LHS	5.67	32.58	61.75	41	21.98	19.02	1.94	13.09	25.75	8.1	CI
79	398 + 300	RHS	7.56	39.87	52.57	26.47	17.76	8.71	1.98	10.23	24.5	8.59	CL
80	403 + 300	LHS	9.99	26.58	63.43	34	21.95	12.05	1.96	12.67	26.25	8.43	CL
81	408 + 300	RHS	9.67	31.56	58.77	36	24.69	11.31	1.97	12.56	26.5	8.52	MI
82	413 + 300	LHS	7.52	30.26	62.22	43.21	25.46	17.75	1.89	13.38	26	7.43	CI
83	418 + 300	RHS	7.69	34.78	57.53	39	20.67	18.33	1.95	12.89	25.25	8.82	CI
84	423 + 300	LHS	10.45	37.89	51.66	40.26	20.59	19.67	1.97	12.18	24	9.43	CI
85	428 + 300	RHS	9.56	34.54	55.9	35.98	21.41	14.57	1.96	12.45	26.5	8.64	MI
86	433 + 300	LHS	9.76	29.78	60.46	37.89	21.56	16.33	1.93	12.14	27.25	8.01	CI
87	438 + 300	RHS	9.64	29.58	60.78	38.59	21.46	17.13	1.92	12.46	24.5	7.98	CI
88	443 + 300	LHS	9.54	31.06	59.4	39.52	21.47	18.05	1.91	12.89	23.25	7.89	CI
89	448 + 300	RHS	8.59	32.46	58.95	36.56	21.48	15.08	1.94	12.09	20.5	8.58	MI
90	453 + 300	LHS	9.7	34.52	55.78	34.26	22.71	11.55	1.98	11.69	21.25	9.86	CL
91	458 + 300	RHS	7.59	39.42	52.99	32.56	20.71	11.85	1.97	11.19	23.75	9.56	CL
92	463 + 300	LHS	8.65	40.75	50.6	30.25	19.87	10.38	1.97	10.98	24.75	9.51	CL
93	468 + 300	RHS	9.45	40.26	50.29	34.71	17.89	16.82	1.96	11.14	26.25	8.93	CL
94	473 + 000	LHS	8.23	28.79	62.98	35.69	21.48	14.21	1.96	11.34	25.5	8.69	MI
95	478 + 300	RHS	7.56	39.85	52.59	26.52	19.58	6.94	1.98	11.02	24	9.56	CL
96	483 + 300	LHS	8.46	40.18	51.36	21.59	15.85	5.74	1.98	10.89	23.5	9.85	CL
97	488 + 300	RHS	8.34	28.69	62.97	35.6	21.48	14.12	1.97	11.05	24.5	9.24	MI
98	493 + 300	LHS	7.46	42.59	49.95	21.32	15.67	5.65	1.98	10.35	24.75	10.12	CL
99	498 + 800	RHS	8.32	39.78	51.9	26.98	19.71	7.27	1.97	11.37	26	9.89	CL
100	503 + 300	LHS	5.64	42.59	51.77	22.8	17.89	4.91	1.96	11.14	24.5	8.4	CL
101	508 + 300	RHS	9.12	39	51.88	27	20.72	6.28	1.96	10.64	24	8.12	CL
102	513 + 300	LHS	8.34	34.79	56.87	40.26	22.35	17.91	1.95	11.56	24.75	9.24	CI
103	518 + 300	RHS	9.68	36.58	53.74	22.42	14.56	7.86	1.98	11.68	23.5	10.89	CL
104	523 + 300	LHS	8.56	39.87	51.57	26.47	20.74	5.73	1.97	11.14	24	9.62	CL
105	528 + 300	RHS	7.52	36.27	56.21	36	20.71	15.29	1.95	12.17	23	9.4	CI
106	533 + 300	LHS	8.49	39.85	51.66	28.23	20.78	7.45	1.96	10.62	21.75	8.6	CL
107	538 + 200	RHS	8.54	32.67	58.79	37	19.87	17.13	1.9	12.89	24.25	7.87	CI
108	543 + 300	LHS	9.56	39.87	50.57	26.99	20.71	6.28	1.92	10.59	22.5	8.59	CL
109	548 + 300	LHS	7.65	40.56	51.79	26.48	19.87	6.61	1.95	11.78	23.5	8.26	CL
110	553 + 300	RHS	8.46	39.74	51.8	26.45	20.65	5.8	1.98	11.49	22	10.11	CL
111	558 + 300	LHS	7.59	39.12	53.29	27.01	20.56	6.45	1.96	11.56	23.5	9.56	CL
112	563 + 300	RHS	9.21	40.32	50.47	26.49	19.88	6.61	1.92	11.35	22.5	9.89	CL
113	568 + 300	LHS	8.46	34.78	56.76	22.46	14.62	7.84	1.98	11.67	24	10.01	CL
114	573 + 300	RHS	7.89	34.76	57.35	39	21.22	17.78	1.94	13.08	26	8.32	CI
115	578 + 300	LHS	7.45	32.56	59.99	41	22.56	18.44	1.93	12.36	24.25	7.51	CI

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
116	583 + 300	RHS	8.34	34.99	56.67	35.62	21.49	14.13	1.97	11.23	25	9.11	**MI**
117	588 + 300	LHS	7.59	38.97	53.44	27.04	20.97	6.07	1.96	10.98	23.75	9.87	**CL**
118	593 + 300	RHS	8.34	32.56	59.1	40.21	22.31	17.9	1.96	11.56	26.25	9.21	**CL**
119	598 + 300	LHS	9.63	35.69	54.68	26.59	19.78	6.81	1.98	10.67	22.5	10.02	**CL**

6.1.2.5 Borrow Area

Works Department and local people have been contacted. Based on the information received and field surveys carried out, the consultants identified the borrow areas which are new ones /existing ones belonging to the government or public. and include certain useful information such as, distance from the project road, location, village name etc. Borrowing soil from these areas would require prior approval of the local authorities' negotiations with private people. Soil samples from these borrow sources have been collected in bulk quantities by excavating test pits down up to 1.0 m to 1.5 m depth from the existing ground surface. The top organic soil layer of approximately 100 mm thickness has been removed before sampling. Representative sample of soil has been collected in bulk, in gunny bags, from major and minor test pits for laboratory testing. Representative samples of Borrow Area soils were collected from the test pits sent to Laboratory for various laboratory tests listed below

The tests performed are:

- Grain size distribution test for each sample.
- Atterberg limits for each sample
- Moisture v/s density relationship (Heavy Compaction) for each sample.
- Four days soaked CBR at three energy levels on each homogeneous group of soils. Soaked CBR at field dry density and 97% of maximum dry density is to be determined from the graphs plotted for CBR verses density at three energy levels. The grouping is established based on similar soil index properties, grain size distribution.

Some photographs of test pits are given below of borrow area sampling along the alignment shown below.

Summary of Laboratory Test Results of Borrow Area Soil Samples is attached below in Table-6.5:

Table-6.5 Laboratory Test Results of Borrow Area Soil

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
1	12+ 500	RHS	9.09	39.58	51.33	33	20.47	12.53	1.96	10.87	23.5	9.18	CL
2	21 + 200	LHS	12.34	41.67	45.99	26	18.57	7.43	1.99	10.32	21	11.37	CL
3	34+ 100	RHS	8.64	34.82	56.54	36	18.04	17.96	1.94	12.89	26	8.24	CI
4	38+ 900	LHS	7.49	32.28	60.23	40	21.69	18.31	1.93	12.76	26.5	7.97	CI
5	47 + 100	RHS	9.87	40.77	49.36	30	20.89	9.11	1.98	10.57	22	10.72	CL
6	58 + 500	LHS	10.48	39.26	50.26	32	21.82	10.18	1.97	10.33	23	9.55	CL
7	65 + 600	RHS	11.38	43.09	45.53	27	19.48	7.52	1.99	10.09	21.5	11.05	CL
8	71 +100	LHS	7.94	38.54	53.52	36	20.78	15.22	1.97	11.43	23.5	9.34	MI
9	82 + 600	RHS	8.68	32.09	59.23	38	20.11	17.89	1.95	12.67	24	8.35	CI
10	88 + 700	LHS	10.48	39.76	49.76	32	23.32	8.68	1.98	10.87	22.5	10.21	CL
11	94 + 200	RHS	8.74	42.38	48.88	33	22.17	10.83	2	10.18	20	12.03	CL

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
12	104 + 100	LHS	10.69	38.65	50.66	30	21.45	8.55	1.97	11.58	23	9.98	CL
13	119 + 200	RHS	8.44	36.38	55.18	38	24.39	13.61	1.94	12.93	25	8.22	MI
14	128 + 400	LHS	5.67	33.28	61.05	41	22.78	18.22	1.93	13.08	26.5	7.92	CI
15	142+ 500	RHS	8.05	38.79	53.16	32	22.23	9.77	1.97	10.94	22	10	CL
16	151 + 700	LHS	6.54	34.87	58.59	39	21.96	17.04	1.95	11.45	25.5	8.79	CI
17	162 + 300	RHS	8.79	37.56	53.65	36	22.85	13.15	1.96	10.97	23	9.22	MI
18	170 + 500	LHS	10.48	38.98	50.54	29	20.95	8.05	1.97	11.23	22	9.8	CL
19	175+500	LHS	9.46	26.11	64.43	37	16.11	20.89	1.95	11.87	23.45	8.72	CI
20	179+200	RHS	12.24	33.33	54.43	33	15.84	17.16	1.96	11.23	19.98	8.91	CL
21	187+100	LHS	12.66	24.89	62.45	36	22.76	13.24	1.94	12.03	25.56	8.36	MI
22	195+000	RHS	10.46	22.09	67.45	38	17.8	20.2	1.93	12.43	29.32	8	CI
23	206+300	LHS	10.67	31.68	57.65	34	17.07	16.93	1.95	11.65	25	8.54	CL
24	209+000	RHS	17.33	22.8	59.87	33	21.67	11.33	1.94	12.62	27.23	8.18	CL
25	217+200	LHS	10.46	39.42	50.12	39	20.17	18.83	1.92	12.93	30.92	8	CI
26	224+400	RHS	9.57	25.54	64.89	37	22.65	14.35	1.93	13.57	29.93	8.18	MI
27	232+300	LHS	9.02	23.09	67.89	40	27.04	12.96	1.9	14.7	24.02	7.82	MI
28	241+500	RHS	5.79	28.12	66.09	39	15.25	23.75	1.93	13.07	22.41	8.36	CI
29	244+600	LHS	7.12	25.45	67.43	36	14.2	21.8	1.92	14.05	20.42	8.18	CI
30	249+200	RHS	21.35	38.78	39.87	31	18.98	12.02	1.999	10.98	14.47	13.09	CL
31	254+000	LHS	9.68	26.43	63.89	33	17.61	15.39	1.97	11.78	22.54	8.91	CL
32	260+600	RHS	7.35	31.56	61.09	32	21.66	10.34	1.98	12.76	22.76	9.09	CL
33	266+000	LHS	14.68	27.34	57.98	33	20.87	12.13	1.965	11.2	22.14	10	CL
34	272+100	RHS	8.13	32.11	59.76	34	18.9	15.1	1.99	11.09	17.73	10.72	CL
35	278+500	LHS	28.24	44	27.76	32	19.42	12.58	2.105	9.89	14.81	15.99	CL
36	283+000	RHS	12.02	26.31	61.67	38	18.83	19.17	1.94	12.76	22.76	8.18	CI
37	290+300	LHS	10.91	25.31	63.78	40	17.76	22.24	1.92	13.04	24.51	8	CI
38	294+500	LHS	14.77	22.69	62.54	39	19.87	19.13	1.93	11.54	23.43	8.18	CI
39	300+000	RHS	17.13	41	41.87	33	21.54	11.46	2.02	9.89	18.94	12.72	CL
40	303+600	LHS	12.35	34.2	53.45	34	21.59	12.41	2	10.54	22.7	10.36	CL
41	314+200	RHS	11.68	39.67	48.65	32	21.99	10.01	1.99	11.67	26.11	10.72	CL
42	322+300	LHS	10.91	35.53	53.56	33	21.67	11.33	1.98	12.32	25.56	10.18	CL
43	326+000	RHS	22.88	40.58	36.54	32	22.3	9.7	2.07	9.02	17.35	13.45	CL
44	337+400	LHS	10.13	40	49.87	36	23.76	12.24	1.97	13.44	27.03	9.09	MI
45	348+100	RHS	10.91	29.2	59.89	40	24.76	15.24	1.93	12.45	26.11	8.36	CI
46	357+200	LHS	7.82	37.86	54.32	39	26.76	12.24	1.95	12.09	28.83	8.72	MI
47	360+000	RHS	6.44	36.13	57.43	38	23.78	14.22	1.91	14.22	30.44	8.36	MI
48	371+400	LHS	28.91	42.33	28.76	31	22.56	8.44	2.09	8.98	14.43	14.54	CL
49	377+500	RHS	17.11	44.13	38.76	33	21.71	11.29	2.04	10.11	18.9	13.99	CL
50	383+000	LHS	6.35	37.87	55.78	36	17.87	18.13	1.94	13.47	26.28	8.18	CI

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
51	394+100	RHS	10.68	37.43	51.89	37	22.88	14.12	1.95	12.9	27.64	9.09	MI
52	398+300	LHS	25.67	37.35	36.98	32	20.43	11.57	2.05	9.91	19.28	13.63	CL
53	406+500	RHS	6.35	43.78	49.87	33	20.65	12.35	1.96	12.89	26.74	10.18	CL
54	412+300	LHS	8.28	35.76	55.96	39.23	24.34	14.89	1.95	12.06	23.5	9.52	MI
55	416+600	RHS	5.79	40.52	53.69	36.62	22.54	14.08	1.91	11.8	26	7.49	MI
56	417+500	LHS	7.32	39.88	52.8	37.14	20.24	16.9	1.96	11.56	23	9.23	CI
57	419+000	RHS	9.73	38.3	51.97	33	22.95	10.05	1.99	11.26	21	10.27	CL
58	421+800	LHS	12.15	39.27	48.58	29	20.47	8.53	2	10.15	20	14.29	CL
59	423+100	LHS	6.63	35.97	57.4	39.41	18.18	21.23	1.95	12.4	24.5	9.68	CI
60	423+600	RHS	6.58	33.18	60.24	40	21.94	18.06	1.94	12.65	25	8.56	CI
61	425+300	LHS	7.85	33.79	58.36	41.17	21.2	19.97	1.94	11.67	25.5	9.45	CI
62	425+600	LHS	5.18	32.88	61.94	41	23.73	17.27	1.93	12.99	26	7.89	CI
63	426+100	RHS	11.34	40.29	48.37	32	18.33	13.67	1.98	10.24	22	12.11	CL
64	426+000	RHS	9.68	42.45	47.87	28	20.68	7.32	1.99	10.32	22	10.95	CL
65	436+900	RHS	9.81	37.54	52.65	35.24	24.47	10.77	1.97	11.17	23	10.05	MI
66	445+100	RHS	5.49	39.37	55.14	40.87	21.88	18.99	1.93	11.46	26.5	8.63	CI
67	445+800	LHS	12.43	44.98	42.59	25	17.97	7.03	2	10.21	21	11.86	CL
68	445+900	RHS	11.04	39.66	49.3	31	21.29	9.71	2.01	10.05	20	12.25	CL
69	448+200	LHS	7.13	39.47	53.4	39.34	25.11	14.23	1.95	10.63	24	11.01	MI
70	451+900	LHS	6.91	41.15	51.94	36.01	25.62	10.39	1.99	10.36	22	11.68	MI
71	456+800	LHS	4.15	37	58.85	31.03	20.74	10.29	1.95	10.85	23.5	8.63	CL
72	456+700	LHS	7.58	36.54	55.88	37	22.21	14.79	1.95	12.67	24.5	8.72	MI
73	457+700	RHS	9.05	37.65	53.3	36	22.91	13.09	1.97	11.76	23.5	9.39	MI
74	459+300	RHS	7.2	46.65	46.15	29.14	18.66	10.48	2.01	10.32	20.5	12.28	CL
75	466+700	RHS	10.61	38.82	50.57	33.35	16.27	17.08	1.97	12.04	23.25	11.23	CL
76	468 + 300	LHS	12.45	39.89	47.66	25.46	19.87	5.59	2	10.57	20.75	10.89	CL
77	468 + 600	RHS	8.59	40.84	50.57	34.56	23.45	11.11	1.97	11.78	24.5	8.59	CL
78	468+200	RHS	5.69	41.03	53.28	36.47	25.66	10.81	1.99	11.86	22	12.13	MI
79	468+300	RHS	7.74	34.72	57.54	37.21	23.02	14.19	1.98	10.35	22.5	12.35	MI
80	473 + 000	LHS	9.46	41.23	49.31	33	22.61	10.39	1.98	10.69	22.25	10.43	CL
81	475 + 300	RHS	8.26	42.56	49.18	35.5	21.48	14.02	1.96	11.09	24.75	8.69	MI
82	483 + 200	LHS	7.59	40.56	51.85	34	19.87	14.13	1.94	11.29	23.25	7.45	CL
83	483 + 500	RHS	8.98	43.98	47.04	31.46	19.56	11.9	1.98	10.27	23.75	10.02	CL
84	487 + 900	LHS	7.69	42.59	49.72	32.02	17.67	14.35	1.96	11.34	22.5	8.12	CL
85	488 + 300	RHS	8.34	40.23	51.43	34.56	21.48	13.08	1.97	10.78	24	9.09	CL
86	489 + 100	LHS	12.45	41.56	45.99	33.24	22.56	10.68	1.99	10.32	22	11.03	CL
87	492 + 700	RHS	7.59	40.78	51.63	34.56	18.79	15.77	1.97	10.75	24.5	9.32	CL
88	492 + 800	LHS	7.62	41.56	50.82	31.26	19.78	11.48	1.96	10.89	24	8.45	CL
89	498 + 800	RHS	9.65	40.49	49.86	31.45	21.54	9.91	1.98	10.03	22.25	10.04	CL

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
90	499 + 800	LHS	8.29	43.89	47.82	36.59	20.47	16.12	1.97	11.89	24.25	9.98	CI
91	500 + 000	RHS	8.54	37.89	53.57	38.95	19.89	19.06	1.93	10.78	25.25	7.53	CI
92	509 + 100	LHS	9.78	40.23	49.99	33.56	24.09	9.47	1.98	10.45	23.25	9.43	CL
93	509 + 800	RHS	8.59	41.57	49.84	32.41	19.58	12.83	1.97	10.1	22.5	9.21	CL
94	514 + 100	LHS	8.32	42.13	49.55	36.78	18.53	18.25	1.97	11.82	24.5	8.04	CI
95	514 + 200	RHS	8.23	34.78	56.99	35.69	21.48	14.21	1.96	11.89	20.5	8.69	MI
96	515 + 500	LHS	8.02	42.56	49.42	37	19.54	17.46	1.94	12.09	22.25	7.54	C1
97	522 + 000	RHS	10.89	40.81	48.3	31.45	22.67	8.78	1.98	10.68	24.25	9.86	CL
98	524 + 700	LHS	8.59	47.58	43.83	30.12	19.87	10.25	1.97	10.81	24.5	9.05	CL
99	531 + 700	RHS	9.87	41.23	48.9	36.47	20.58	15.89	1.98	11.86	26	9.74	MI
100	535 + 700	LHS	9.58	40.26	50.16	30.26	18.79	11.47	1.95	10.78	25.25	8.94	CL
101	537 + 600	RHS	8.31	42.3	49.39	36.74	17.31	19.43	1.97	11.89	24.5	8.45	CI
102	538 + 200	LHS	7.59	42.59	49.82	31.2	24.89	6.31	1.98	10.75	23.5	10.27	CL
103	539 + 000	RHS	8.44	41.52	50.04	35.46	19.82	15.64	1.95	10.98	24.75	8.46	MI
104	540 + 000	LHS	7.89	42.39	49.72	32.05	17.62	14.43	1.96	10.89	22.25	9.42	CL
105	541 + 000	RHS	8.65	42.43	48.92	31	24.25	6.75	1.99	10.48	21.75	10.03	CL
106	541 +200	LHS	7.48	41.87	50.65	31.26	19.56	11.7	1.97	10.76	24.5	9.48	CL
107	544 + 200	RHS	8.52	42.56	48.92	31.2	18.97	12.23	1.95	10.84	24.25	9.65	CL
108	545 + 000	LHS	7.69	48.59	43.72	32.59	18.95	13.64	1.94	11.08	25	8.47	CL
109	549+400	RHS	5.44	40.05	54.51	33.01	19.3	13.71	1.97	11.67	23	10.12	CL
110	551+400	LHS	8.43	33.59	57.98	39	21.46	17.54	1.95	12.68	25.5	8.49	CI
111	552+000	RHS	6.47	35.46	58.07	28.41	18.04	10.37	1.91	12.1	26	7.59	CL
112	553+800	LHS	6.58	32.33	61.09	38	19.69	18.31	1.94	12.93	26	8.34	CI
113	556+500	RHS	7.24	40.53	52.23	29.68	22.64	7.04	1.98	10.97	22	9.37	CL
114	557+000	LHS	9.06	41.45	49.49	27.51	18.01	9.5	1.99	10.36	21	9.47	CL
115	558+000	RHS	5.81	42.97	51.22	35.47	19.26	16.21	1.88	13.83	27	7.14	CI
116	559+000	LHS	7.41	43.96	48.63	22.62	12.32	10.3	1.98	11.42	22.5	10.64	CL
117	562+000	RHS	7.77	40.39	51.84	24.14	13.1	11.04	1.97	10.86	24.5	9.82	CL
118	583+900	LHS	2.73	43.23	54.04	35.23	21.26	13.97	1.93	11.46	25.5	8.34	MI
119	583+500	RHS	7.28	37.89	54.83	35	23.08	11.92	1.96	11.47	24	9.25	CL
120	584+500	LHS	10.58	39.77	49.65	31	21.05	9.95	1.98	10.62	22	10.63	CL
121	585+000	RHS	5.19	44.79	50.02	34.02	23.48	10.54	1.95	12	24	10.34	CL
122	585+400	LHS	8.34	36.54	55.12	37	22.63	14.37	1.95	12.38	24.5	8.74	MI
123	586+300	RHS	5.78	45.31	48.91	33.91	26.33	7.58	1.88	14.23	26	7.59	CL
124	586+500	LHS	6.44	42.41	51.15	40.11	27	13.11	1.98	11.36	22	10.56	MI
125	586+400	RHS	11.73	41.78	46.49	27	17.63	9.37	1.99	10.78	21.5	11.52	CL
126	586+600	LHS	7.67	37.8	54.53	34	23.43	10.57	1.97	11.21	23	9.71	CL
127	587+900	RHS	6.46	39.84	53.7	42.03	31.14	10.89	1.96	11.26	23	10.42	MI
128	588+300	LHS	10.76	38.97	50.27	33.85	20.77	13.08	1.99	10.76	21	11.38	CL

Sr. No.	Existing Chainage in km.	Side	Grain Size Analysis Test (%) As Per IS 2720 (Part-4)			Atterberg Limits (%) IS 2720 (Part-5)			Proctor Density AS Per IS 2720 (Part-8)		F.S.I % AS Per IS 2720 (Part -40)	CBR Value (%) AS Per 2720 (Part-16)	TYPE OF SOIL
			Gravel %	Sand %	Silt & Clay %	LL	PL	PI	MDD gm/cc	OMC %			
129	589+300	RHS	9.8	44	46.2	34.34	27.17	7.17	2	10.3	21.5	11.64	CL
130	589+100	LHS	5.49	36.54	57.97	37	23.71	13.29	1.94	12.58	26.5	8.32	MI
131	591+600	RHS	6.74	46.37	46.89	31.62	19.14	12.48	1.98	11.04	22.5	11.31	CL
132	591+400	LHS	9.39	41.77	48.84	29	20.73	8.27	1.99	10.73	21	11.64	CL
133	591+800	RHS	10.05	39.98	49.97	28	18.37	9.63	1.98	10.53	22	10.69	CL
134	592+700	RHS	5.53	38.98	55.49	40	23.98	16.02	1.95	12.4	23.5	10.34	CI
135	593+000	LHS	7.68	37.65	54.67	34	23.94	10.06	1.95	11.99	25.5	8.7	CL
136	594+000	RHS	4.92	42.79	52.29	38.22	20	18.22	1.96	11.75	24.5	10.79	CI
137	596+200	LHS	9.87	40.98	49.15	31	23.02	7.98	1.98	10.85	21.5	9.96	CL
138	597+400	RHS	11.25	39.63	49.12	26.31	18.17	8.14	2	10.68	20.5	12.2	CL
139	597+000	LHS	9.87	39.36	50.77	33	22.23	10.77	1.97	10.48	22.5	9.83	CL
140	598+500	RHS	7.44	40.65	51.91	25.45	16.52	8.93	1.99	10.56	22.5	11.46	CL
141	598+900	LHS	9.78	41.54	48.68	26.31	16.33	9.98	1.98	10.86	22	11.23	CL
142	598+400	LHS	6.43	38.23	55.34	35	22.98	12.02	1.95	11.67	25.5	8.8	CL

6.1.2.6 Coarse Aggregate

The objective of this investigation is to identify, inspect and evaluate the aggregate sources, which would supply for the pavement and concrete, quality aggregate for the road construction. During the site visit, aggregate quarries are observed along the alignment. Existing and known quarries/crushing plants and other potential extraction sources of quarry areas in the project vicinity have been inspected. Quarry details of Stone Aggregates & Boulders are attached below in **Table-6.6**.

Table-6.6 Quarry Details of Stone Aggregate and Boulders

Package	Type of material	Stone Aggregate & Boulder						Districts
	Source Point	Kabrai - Granite quarry	Shankargarh - Stone quarry	Meja Quarry	km 93 of Bareilly & Bageshwar road	Bharat Kup-Stone Quarry	Jwalapur/ Haridwar	District HQ
	Proposed Camp Location (km & Village)							
1	24.435 - Village – Dhanawali/Atav	555	665	683	200	627	137	Meerut, Hapur, Bulandshahar
2	71.900 - Village – Shakrauli/Rukhalu	506	610	649	165	575	159	Hapur, Amroha, Sambhal
3	112.3 - Village -Kirari	463	517	628	148	518	177	Sambhal Budaun
4	163.65 - Village - Khurrampur Bhamauri	420	466	575	157	461	235	Budaun
5	213.05 - Village - Keshaunpur Kalan,Dataganj Budaun	369	429	496	138	422	281	Budaun, Shahjahanpur

Package	Type of material	Stone Aggregate & Boulder						Districts
	Source Point	Kabrai - Granite quarry	Shankargarh - Stone quarry	Meja Quarry	km 93 of Bareilly & Bageshwar road	Bharat Kup-Stone Quarry	Jwalapur/ Haridwar	District HQ
	Proposed Camp Location (km & Village)							
6	262.85 - Village -Chauki Ajampur	322	373	442	179	366	330	Shahjahanpur, Hardoi
7	315.5 - Village - Chandsaura	252	308	374	241	296	392	Hardoi
8	366.8 - Village -Maholia	217	267	342	297	260	439	Hardoi, Unnao
9	418.45 - Village - Algangarh	161	209	276	361	205	507	Unnao
10	470.9 - Village -Chakpher shah	156	141	207	431	149	571	Unnao, Raebareli
11	522.4 - Village - Itaura Buzurg	176	94	164	450	137	590	Raebareli, Pratapgarh
12	574.05 - Village - Umarapatti	204	70	106	504	130	645	Pratapgarh, Prayagraj

Summary & Test Result details of Coarse Aggregates is attached in Table-6.7 below:

Table-6.7 Test Result details of Coarse Aggregates

Sr. No.	Location (km/Village)	Coarse Aggregate	Gradation	LAV (%)	AIV (%)	FI & EI (%)	Specific Gravity	Water Absorption (%)
1	24.435 - Village – Dhanawali/Atav	Kabrai - Granite quarry	OK	18.28	14.05	27.48	2.69	0.67
2		km 93 of Bareilly & Bageshwar road	OK	17.03	15.29	28.83	2.71	0.7
4		Jwalapur/Haridwar	OK	17.91	14.82	27.96	2.7	0.72
5	71.900 - Village – Shakrauli/Rukhalu	km 93 of Bareilly & Bageshwar road	OK	17.55	15.27	28.13	2.71	0.69
7		Jwalapur/Haridwar	OK	18.9	14.82	26.45	2.7	0.74
8		Meja Stone Quarry	OK	18.07	15.15	25.73	2.68	0.67
9	112.3 - Village - Kirari	Kabrai - Granite quarry	OK	17.29	15.36	28.29	2.7	0.68
10		km 93 of Bareilly & Bageshwar road	OK	16.69	14.73	26.72	2.69	0.7
12		Jwalapur/Haridwar	OK	16.79	15.29	29.35	2.7	0.72
13	163.65 - Village - Khurrampur Bhamauri	Kabrai - Granite quarry	OK	17.89	15.04	26.23	2.71	0.69
14		km 93 of Bareilly & Bageshwar road	OK	17.61	14.68	27.86	2.69	0.71
16		Jwalapur/Haridwar	OK	17.56	13.98	26.04	2.68	0.66
17	213.05 - Village - Keshaunpur Kalan,Dataganj Budaun	Kabrai - Granite quarry	OK	17.58	13.99	25.96	2.7	0.67
18		km 93 of Bareilly & Bageshwar road	OK	18.19	14.6	26.66	2.71	0.67
20		Jwalapur/Haridwar	OK	18.27	14.91	28.65	2.71	0.72

Sr. No.	Location (km/Village)	Coarse Aggregate	Gradation	LAV (%)	AIV (%)	FI & EI (%)	Specific Gravity	Water Absorption (%)
21	262.85 - Village - Chauki Ajampur	km 93 of Bareilly & Bageshwar road	OK	17.43	13.97	27.12	2.7	0.67
23		Bharat Kup-Stone Quarry	OK	19.28	15.19	26.58	2.71	0.69
24		Jwalapur/Haridwar	OK	18.15	14.86	27.19	2.68	0.68
25	315.5 - Village - Chandsaura	Kabrai - Granite quarry	OK	18.11	14.39	26.7	2.69	0.68
26		km 93 of Bareilly & Bageshwar road	OK	17.45	13.98	28.05	2.68	0.69
28		Bharat Kup-Stone Quarry	OK	18.83	13.6	27.11	2.67	0.73
29	366.8 - Village - Maholia	Kabrai - Granite quarry	OK	16.86	15.03	26.4	2.72	0.72
30		Shankargarh-Jasra Stone Quarry	OK	17.15	14.34	27.9	2.65	0.69
32		km 93 of Bareilly & Bageshwar road	OK	17.97	13.93	26.55	2.69	0.67
33	418.45 - Village - Algangarh	Kabrai - Granite quarry	OK	18.11	15.25	26.61	2.67	0.72
35		Shankargarh-Jasra Stone Quarry	OK	18.18	14.82	26.77	2.69	0.72
36		km 93 of Bareilly & Bageshwar road	OK	17.83	15.2	28	2.7	0.71
37	470.9 - Village - Chakpher shah	Kabrai - Granite quarry	OK	17.31	15.12	26.3	2.67	0.69
38		Shankargarh-Jasra Stone Quarry	OK	18.45	15.48	25.76	2.69	0.7
39		km 93 of Bareilly & Bageshwar road	OK	18.26	14.85	26.72	2.71	0.74
40		Bharat Kup-Stone Quarry	OK	19.05	15.25	28.46	2.69	0.66
41	522.4 - Village - Itaura Buzurg	Shankargarh - Stone quarry	OK	16.78	15.1	26.95	2.7	0.66
42		km 93 of Bareilly & Bageshwar road	OK	18.26	15.61	28.05	2.69	0.68
43		Bharat Kup-Stone Quarry	OK	17.05	13.96	25.77	2.71	0.69
44		Meja Stone Quarry	OK	17.43	14.89	26.73	2.69	0.75
45	574.05 - Village - Umarapatti	km 93 of Bareilly & Bageshwar road	OK	18.44	13.98	29.21	2.67	0.65
46		Shankargarh-Jasra Stone Quarry	OK	17.92	15.48	25.66	2.69	0.71
48		Bharat Kup-Stone Quarry	OK	19.04	15.08	27.76	2.71	0.73

6.1.2.7 Fine Aggregate

For masonry work, sand shall conform to the requirements of IS: 2116.

For plain and reinforced cement concrete (PCC and RCC) or pre stressed concrete (PSC) works, fine aggregate shall consist of clean, hard, strong and durable pieces of crushed stone, crushed gravel, or a suitable combination of natural sand, crushed stone or gravel. They shall not contain

dust, lumps, soft or flaky, materials, mica or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attach the embedded steel. Motorized sand washing machines should be used to remove impurities from sand. Fine aggregate having positive alkali-silica reaction shall not be used. All fine aggregates shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386 (Parts I to VIII). The contractor shall submit to the Engineer the entire information indicated in Appendix A of IS: 383. The fineness modulus of fine aggregate shall neither be less than 2.0 nor greater than 3.5.

Sand/fine aggregate for structural concrete shall conform to the following grading requirements grading requirements as per MORTH Table – 1000-2.

Table 6.8 below shows the location of these sand quarries along with lead to the Project Road.

Table-6.8 Sand Quarry Details

Package	Type of material	Coarse Sand				Districts
	Source Point	Hamirpur	Banda – Ken river	Allahabad-Mahewa ghat quarry	Lal kuan - Gola (UK)	District HQ
	Proposed Camp Location (km & Village)					
1	24.435 - Village –Dhanawali/Atav	504	585	652	197	Meerut,Hapur, Bulandshahar
2	71.900 - Village – Shakrauli/Rukhalu	441	522	585	162	Hapur, Amroha, Sambhal
3	112.3 - Village -Kirari	387	453	498	146	Sambhal Budaun
4	163.65 - Village -Khurrampur Bhamauri	344	420	453	154	Budaun
5	213.05 - Village -Keshaunpur Kalan,Dataganj Budaun	309	372	418	135	Budaun, Shahjahanpur
6	262.85 - Village -Chauki Ajampur	250	318	357	183	Shahjahanpur, Hardoi
7	315.5 - Village -Chandsaura	182	250	289	245	Hardoi
8	366.8 - Village -Maholia	145	212	251	298	Hardoi, Unnao
9	418.45 - Village -Algangarh	96.2	151	190	360	Unnao
10	470.9 - Village -Chakpher shah	108	121	131	406	Unnao, Raebareli
11	522.4 - Village - Itaura Buzurg	143	144	82.4	446	Raebareli, Pratapgarh
12	574.05 - Village -Umarapatti	195	178	76.9	500	Pratapgarh, Prayagraj

The representative Sand samples were collected from mines. Sand sources are generally suitable for fine aggregate materials in bituminous works and Concrete works but would require the removal of deleterious materials and Clay /Silt contents. From the test results it is observed that from all source, sand is as we require as per is 383. However, gradation may vary from location to locations at different bed level. Though there are certain frequency of tests &

type of test may be conducted during construction test results shows that sand samples from all sources are falling in zone 2 also bulk density ranging from 2 to 3.5 and hence also suitable for RCC / Masonry work.

Table-6.9 Summary & details of Fine Aggregate test results

Sr. No.	Location (km/Village)	Fine Aggregate	Gradation	Bulking of Sand (%)	Silt of Sand (%)	Specific Gravity
1	24.435 - Village – Dhanawali/Atav	Hamirpur	OK	10.4	2.13	2.58
2		Lalkuan/Uttarakhand	OK	10	1.87	2.61
3	71.900 - Village – Shakrauli/Rukhalu	Hamirpur	OK	9.13	1.73	2.6
4		Lalkuan/Uttarakhand	OK	10.4	2.27	2.61
5	112.3 - Village -Kirari	Hamirpur	OK	9.2	1.47	2.62
6		Lalkuan/Uttarakhand	OK	9.87	1.73	2.59
7	163.65 - Village - Khurrampur Bhamauri	Hamirpur	OK	9.47	2	2.63
8		Lalkuan/Uttarakhand	OK	8.4	1.33	2.62
9	213.05 - Village - Keshaunpur Kalan,Dataganj Budaun	Hamirpur	OK	10.53	2.13	2.58
10		Lalkuan/Uttarakhand	OK	9.87	1.73	2.61
11	262.85 - Village - Chauki Ajampur	Hamirpur	OK	10.13	2.27	2.6
12		Lalkuan/Uttarakhand	OK	9.53	1.6	2.61
13	315.5 - Village - Chandsaura	Hamirpur	OK	9.67	1.87	2.62
14		Lalkuan/Uttarakhand	OK	10.2	2.27	2.59
15	366.8 - Village - Maholia	Hamirpur	OK	9.6	1.6	2.6
16		Banda	OK	10	2.13	2.61
17	418.45 - Village - Algangarh	Hamirpur	OK	10.6	2.27	2.6
18		Banda	OK	10	1.73	2.58
19	470.9 - Village - Chakpher shah	Hamirpur	OK	9.47	2.13	2.6
20		Allahabad-Mahewa ghat quarry	OK	8.93	1.33	2.61
21	522.4 - Village -	Allahabad-Mahewa ghat quarry	OK	9.07	1.87	2.6
22	Itaura Buzurg	Banda	OK	9.47	1.47	2.56
23	574.05 - Village - Umarapatti	Allahabad-Mahewa ghat quarry	OK	9.33	1.73	2.58
24		Banda	OK	9.27	1.47	2.62

6.1.2.8 Manufactured Material

The bitumen, cement, steel, etc. are factory manufactured materials used in road projects. Reputed manufacturers are spread at different locations in the vicinity and materials are recommended to be procured directly from them.

6.1.2.9 Water Sources

Detailed survey for potential water sources for use in construction of cement concrete works and other works have been carried out in the vicinity of the project corridor at certain intervals. Water is available from underground water mainly through tube wells and mainly as surface water from major rivers.

6.1.2.10 Fly Ash

Fly Ash and bottom ash are the by-products of combustion of pulverized coal in thermal power plants. Fly Ash is the fine grained dusty material collected from the flue gases using suitable electrostatic precipitators. Bottom ash is the slag which accumulates on the heat absorbing surfaces of the furnace and subsequently falls through the furnace bottom to the ash hopper below. At the ash hopper it is then removed and hydraulically transported to the storage area.

Pond ash refers to the ash collected and stored in the ash ponds by the hydraulic fill method. It is obtained as the mixture of bottom ash and fly ash. Coarser variety of ash in the pond is usually obtained at the inflow point where the slurry from the pipeline is discharged. Finer variety at the out flow point where clean water is decanted.

As per the circular issued by MoEF&CC, The Gazatte of India dated 25th January 2016, pond ash shall be collected within 300km periphery of the project area.

6.2 PAVEMENT DESIGN

6.2.1 Introduction

Pavement design basically aims at determining the total thickness of the pavement structure as well as the thickness of the individual structural components for carrying the estimated traffic loading(MSA) under the prevailing traffic and environmental conditions. Many design methods, from purely empirical to rigorous analytical ones are available, and these are practiced in different parts of the world. The design practices followed in other countries May not be applicable to the Indian traffic and climatic conditions. Latest IRC 37:2018 provisions has been adopted for project pavement design considering the prevailing and horizon year traffic loading the subgrade soils are modified using stabilization technique.

6.2.2 Design Methodology

Pavement design involves 593.947km of Ganga Expressway. The design is based on the parameters as evaluated from field and laboratory investigations, with the objective to ascertain optimal pavement structure. While designing the pavement crust thickness and individual layers for the expressway, requirements of traffic loading and the provisions of the latest codes and UPEIDA guidelines are given consideration. The structural requirements of the pavement for both the roads are governed by:

(i) The total thickness of the pavement and the thickness of individual layers should be designed in such a way that they are not subjected to distress, exceeding those admissible limits in view of the material characteristics and performance factors,

(ii) The pavement layers should be able to withstand repeated applications of wheel loads of different magnitudes under the actual site conditions of sub grade, climate, drainage, and other environmental factors during its design life without causing:

a. excessive permanent deformation (settlement) in the form of rutting and undulations;
b. cracking of bituminous layers; and
c. other structural and functional deficiencies such as potholes, raveling etc.

(iii) Ensure structural and functional performance under varied conditions and factors affecting the performance of the road i.e. soil type, traffic, environment, etc.

6.2.2.1 Pavement Proposals & Design

(a) Based on adopted design methodology, Design Life of 20 years, calculated CBR value of Subgrade, Design Traffic, VDF & MSA values; Package wise total crust provided for main carriageway is tabulated below in **Table 6.10**:

Table-6.10 Package wise Crust Details for Main Carriageway

Proposed Crust For Main Carriageway										
Package No.	Section		Length (m)	Adopted MSA (20 Years)	Design CBR	Crust Composition (in mm)				
	From	To				Subgrade	GSB	WMM	DBM	BC
I	7.9	56.9	49	89	8%	500	200	155	150	40
II	56.9	86.9	30	92	8%	500	200	150	155	40
III	86.90	137.60	50.70	99	8%	500	200	150	155	40
IV	137.60	189.70	52.10	98	8%	500	200	150	155	40
V	189.70	236.40	46.70	107	8%	500	200	150	160	40
VI	236.40	289.30	52.90	108	8%	500	200	150	160	40
VII	289.3	341.7	52.4	108	8%	500	200	150	150	40
VIII	341.70	391.90	50.20	98	8%	500	200	150	155	40
IX	391.90	445.00	53.10	98	8%	500	200	150	155	40
X	445.00	496.80	51.80	87	8%	500	200	150	150	40
XI	496.80	548.80	52.00	79	8%	500	200	155	145	40
XII	548.80	601.847	53.05	79	8%	500	200	155	145	40

a. Service roads have been designed for 5 MSA with design CBR of 8%. The crust composition of service roads is given in Table below:**Table-6.11 Crust Details for Service Road**

Proposed Crust For Service Road							
Package No.	Design MSA	Design CBR	Crust Composition (in mm)				
			BC	DBM	WMM	GSB	Subgrade
I to XII	5	8%	30	50	150	150	500

Package wise Pavement Design of above proposed crust for main carriageway is attached below:

Pavement Design- Package-1

Ganga Expressway - Package - I							
Stress Table - 2018							
		Va		3.5	Vb	11.5	
Option -1		20 Years - design				Thickness Adopted	
		MSA			89.00	BC	40
S No	Strain	Alllowable Strain	Computed Strain		Remarks	DBM	150	190
1	€t at BT	1.536E-04	1.53E-04		OK	WMM	155	
2	€v at top of sub grade	3.273E-04	3.04E-04		OK	GSB	200	355


```
No. of layers                 3
E values (MPa)          3000.00  187.12   66.60
Mu values                  0.350.350.35
thicknesses (mm)         190.00  355.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
  Z         R       SigmaZ       SigmaT       SigmaR       TaoRZ       DispZ       epZ         epT         epR
190.00     0.00-0.6737E-01 0.5874E+00 0.4782E+00-0.1142E-01 0.3684E+00-0.1468E-03 0.1479E-03 0.9873E-04
190.00L    0.00-0.6737E-01 0.2624E-02-0.4188E-02-0.1142E-01 0.3684E+00-0.3571E-03 0.1479E-03 0.9873E-04
190.00   155.00-0.6488E-01 0.5667E+00 0.3705E+00-0.2950E-01 0.3787E+00-0.1310E-03 0.1532E-03 0.6496E-04
190.00L  155.00-0.6488E-01 0.2594E-02-0.9644E-02-0.2950E-01 0.3787E+00-0.3335E-03 0.1532E-03 0.6496E-04
545.00     0.00-0.1849E-01 0.2152E-01 0.1891E-01-0.2734E-02 0.2901E+00-0.1744E-03 0.1142E-03 0.9536E-04
545.00L    0.00-0.1847E-01 0.1254E-02 0.3120E-03-0.2734E-02 0.2901E+00-0.2856E-03 0.1143E-03 0.9517E-04
545.00   155.00-0.1957E-01 0.2277E-01 0.2105E-01-0.3632E-02 0.2965E+00-0.1865E-03 0.1189E-03 0.1065E-03
545.00L  155.00-0.1957E-01 0.1327E-02 0.6980E-03-0.3543E-02 0.2965E+00-0.3044E-03 0.1191E-03 0.1063E-03
```

Pavement Design- Package-2

Ganga Expressway - Package - 2								
Stress Table - 2018								
		Va		3.5	Vb	11.5		
Option -1		20 Years - design				Thickness Adopted		
		MSA			92.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain		Remarks	DBM	155	195
1	€t at BT	1.523E-04	1.49E-04		OK	WMM	150	
2	€v at top of sub grade	3.249E-04	2.99E-04		OK	GSB	200	350

VIEW RESULTS

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No. of layers                 3
E values (MPa)          3000.00  185.93   66.60
Mu values                  0.350.350.35
thicknesses (mm)         195.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
   Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
195.00     0.00-0.6439E-01 0.5725E+00 0.4659E+00-0.1105E-01 0.3637E+00-0.1426E-03 0.1440E-03 0.9603E-04
195.00L    0.00-0.6439E-01 0.2957E-02-0.3648E-02-0.1105E-01 0.3637E+00-0.3450E-03 0.1440E-03 0.9603E-04
195.00   155.00-0.6235E-01 0.5559E+00 0.3704E+00-0.2812E-01 0.3738E+00-0.1289E-03 0.1494E-03 0.6587E-04
195.00L  155.00-0.6235E-01 0.2962E-02-0.8537E-02-0.2812E-01 0.3738E+00-0.3248E-03 0.1494E-03 0.6587E-04
545.00     0.00-0.1823E-01 0.2091E-01 0.1840E-01-0.2673E-02 0.2882E+00-0.1721E-03 0.1122E-03 0.9393E-04
545.00L    0.00-0.1819E-01 0.1203E-02 0.2818E-03-0.2673E-02 0.2882E+00-0.2809E-03 0.1122E-03 0.9351E-04
545.00   155.00-0.1926E-01 0.2215E-01 0.2043E-01-0.3458E-02 0.2945E+00-0.1837E-03 0.1169E-03 0.1044E-03
545.00L  155.00-0.1926E-01 0.1276E-02 0.6633E-03-0.3459E-02 0.2945E+00-0.2994E-03 0.1169E-03 0.1045E-03
```

Pavement Design- Package-3

Ganga Expressway - Package - 3							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -1		20 Years - design			Thickness Adopted		
		MSA		99.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	155	195
1	€t at BT	1.494E-04	1.49E-04	OK	WMM	150	
2	€v at top of sub grade	3.197E-04	2.99E-04	OK	GSB	200	350

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```
No. of layers                 3
E values (MPa)          3000.00  185.93   66.60
Mu values                  0.350.350.35
thicknesses (mm)         195.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
   Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
195.00     0.00-0.6439E-01 0.5725E+00 0.4659E+00-0.1105E-01 0.3637E+00-0.1426E-03 0.1440E-03 0.9603E-04
195.00L    0.00-0.6439E-01 0.2957E-02-0.3648E-02-0.1105E-01 0.3637E+00-0.3450E-03 0.1440E-03 0.9603E-04
195.00   155.00-0.6235E-01 0.5559E+00 0.3704E+00-0.2812E-01 0.3738E+00-0.1289E-03 0.1494E-03 0.6587E-04
195.00L 155.00-0.6235E-01 0.2962E-02-0.8537E-02-0.2812E-01 0.3738E+00-0.3248E-03 0.1494E-03 0.6587E-04
545.00     0.00-0.1823E-01 0.2091E-01 0.1840E-01-0.2673E-02 0.2882E+00-0.1721E-03 0.1122E-03 0.9393E-04
545.00L    0.00-0.1819E-01 0.1203E-02 0.2818E-03-0.2673E-02 0.2882E+00-0.2809E-03 0.1122E-03 0.9351E-04
545.00   155.00-0.1926E-01 0.2215E-01 0.2043E-01-0.3458E-02 0.2945E+00-0.1837E-03 0.1169E-03 0.1044E-03
545.00L 155.00-0.1926E-01 0.1276E-02 0.6633E-03-0.3459E-02 0.2945E+00-0.2994E-03 0.1169E-03 0.1045E-03
```

Pavement Design- Package-4

Ganga Expressway - Package - 4							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -1		20 Years - design			Thickness Adopted		
		MSA		98.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	155	195
1	€t at BT	1.498E-04	1.49E-04	OK	WMM	150	
2	€v at top of sub grade	3.204E-04	2.99E-04	OK	GSB	200	350

VIEW RESULTS

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```
No. of layers                3
E values (MPa)          3000.00  185.93   66.60
Mu values                  0.350.350.35
thicknesses (mm)         195.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
  Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
195.00     0.00-0.6439E-01 0.5725E+00 0.4659E+00-0.1105E-01 0.3637E+00-0.1426E-03 0.1440E-03 0.9603E-04
195.00L    0.00-0.6439E-01 0.2957E-02-0.3648E-02-0.1105E-01 0.3637E+00-0.3450E-03 0.1440E-03 0.9603E-04
195.00   155.00-0.6235E-01 0.5559E+00 0.3704E+00-0.2812E-01 0.3738E+00-0.1289E-03 0.1494E-03 0.6587E-04
195.00L  155.00-0.6235E-01 0.2962E-02-0.8537E-02-0.2812E-01 0.3738E+00-0.3248E-03 0.1494E-03 0.6587E-04
545.00     0.00-0.1823E-01 0.2091E-01 0.1840E-01-0.2673E-02 0.2882E+00-0.1721E-03 0.1122E-03 0.9393E-04
545.00L    0.00-0.1819E-01 0.1203E-02 0.2818E-03-0.2673E-02 0.2882E+00-0.2809E-03 0.1122E-03 0.9351E-04
545.00   155.00-0.1926E-01 0.2215E-01 0.2043E-01-0.3458E-02 0.2945E+00-0.1837E-03 0.1169E-03 0.1044E-03
545.00L  155.00-0.1926E-01 0.1276E-02 0.6633E-03-0.3459E-02 0.2945E+00-0.2994E-03 0.1169E-03 0.1045E-03
```

Pavement Design- Package-5

Ganga Expressway - Package - 5							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -3		20 Years - design			Thickness Adopted		
		MSA		107.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	160	200
1	€t at BT	1.465E-04	1.45E-04	OK	WMM	150	
2	€v at top of sub grade	3.143E-04	2.91E-04	OK	GSB	200	350

VIEW RESULTS

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```
No. of layers                 3
E values (MPa)          3000.00  185.93   66.60
Mu values                  0.350.350.35
thicknesses (mm)         200.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
   Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
200.00     0.00-0.6191E-01 0.5555E+00 0.4531E+00-0.1073E-01 0.3578E+00-0.1383E-03 0.1395E-03 0.9344E-04
200.00L    0.00-0.6191E-01 0.3160E-02-0.3188E-02-0.1073E-01 0.3578E+00-0.3329E-03 0.1395E-03 0.9344E-04
200.00   155.00-0.6024E-01 0.5427E+00 0.3671E+00-0.2691E-01 0.3676E+00-0.1262E-03 0.1451E-03 0.6609E-04
200.00L 155.00-0.6024E-01 0.3207E-02-0.7675E-02-0.2691E-01 0.3676E+00-0.3156E-03 0.1451E-03 0.6609E-04
550.00     0.00-0.1771E-01 0.2030E-01 0.1780E-01-0.2579E-02 0.2845E+00-0.1670E-03 0.1090E-03 0.9084E-04
550.00L    0.00-0.1771E-01 0.1162E-02 0.2770E-03-0.2579E-02 0.2845E+00-0.2735E-03 0.1091E-03 0.9113E-04
550.00   155.00-0.1874E-01 0.2153E-01 0.1988E-01-0.3305E-02 0.2906E+00-0.1788E-03 0.1136E-03 0.1017E-03
550.00L 155.00-0.1874E-01 0.1231E-02 0.6438E-03-0.3328E-02 0.2906E+00-0.2913E-03 0.1136E-03 0.1017E-03
```

Pavement Design- Package-6

Ganga Expressway - Package - 6							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -3		20 Years - design			Thickness Adopted		
		MSA		108.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	160	200
1	€t at BT	1.461E-04	1.45E-04	OK	WMM	150	
2	€v at top of sub grade	3.136E-04	2.91E-04	OK	GSB	200	350

VIEW RESULTS

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```
No. of layers                3
E values (MPa)          3000.00  185.93   66.60
Mu values                  0.350.350.35
thicknesses (mm)         200.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
  Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
200.00     0.00-0.6191E-01 0.5555E+00 0.4531E+00-0.1073E-01 0.3578E+00-0.1383E-03 0.1395E-03 0.9344E-04
200.00L    0.00-0.6191E-01 0.3160E-02-0.3188E-02-0.1073E-01 0.3578E+00-0.3329E-03 0.1395E-03 0.9344E-04
200.00   155.00-0.6024E-01 0.5427E+00 0.3671E+00-0.2691E-01 0.3676E+00-0.1262E-03 0.1451E-03 0.6609E-04
200.00L  155.00-0.6024E-01 0.3207E-02-0.7675E-02-0.2691E-01 0.3676E+00-0.3156E-03 0.1451E-03 0.6609E-04
550.00     0.00-0.1771E-01 0.2030E-01 0.1780E-01-0.2579E-02 0.2845E+00-0.1670E-03 0.1090E-03 0.9084E-04
550.00L    0.00-0.1771E-01 0.1162E-02 0.2770E-03-0.2579E-02 0.2845E+00-0.2735E-03 0.1091E-03 0.9113E-04
550.00   155.00-0.1874E-01 0.2153E-01 0.1988E-01-0.3305E-02 0.2906E+00-0.1788E-03 0.1136E-03 0.1017E-03
550.00L  155.00-0.1874E-01 0.1231E-02 0.6438E-03-0.3328E-02 0.2906E+00-0.2913E-03 0.1136E-03 0.1017E-03
```

Pavement Design- Package-7

Ganga Expressway - Package - 7							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -3		20 Years - design			Thickness Adopted		
		MSA		108.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	160	200
1	€t at BT	1.461E-04	1.45E-04	OK	WMM	150	
2	€v at top of sub grade	3.136E-04	2.91E-04	OK	GSB	200	350

VIEW RESULTS

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```
No. of layers                3
E values (MPa)          3000.00  185.93   66.60
Mu values                  0.350.350.35
thicknesses (mm)         200.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
  Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
200.00     0.00-0.6191E-01 0.5555E+00 0.4531E+00-0.1073E-01 0.3578E+00-0.1383E-03 0.1395E-03 0.9344E-04
200.00L    0.00-0.6191E-01 0.3160E-02-0.3188E-02-0.1073E-01 0.3578E+00-0.3329E-03 0.1395E-03 0.9344E-04
200.00  155.00-0.6024E-01 0.5427E+00 0.3671E+00-0.2691E-01 0.3676E+00-0.1262E-03 0.1451E-03 0.6609E-04
200.00L 155.00-0.6024E-01 0.3207E-02-0.7675E-02-0.2691E-01 0.3676E+00-0.3156E-03 0.1451E-03 0.6609E-04
550.00     0.00-0.1771E-01 0.2030E-01 0.1780E-01-0.2579E-02 0.2845E+00-0.1670E-03 0.1090E-03 0.9084E-04
550.00L    0.00-0.1771E-01 0.1162E-02 0.2770E-03-0.2579E-02 0.2845E+00-0.2735E-03 0.1091E-03 0.9113E-04
550.00  155.00-0.1874E-01 0.2153E-01 0.1988E-01-0.3305E-02 0.2906E+00-0.1788E-03 0.1136E-03 0.1017E-03
550.00L 155.00-0.1874E-01 0.1231E-02 0.6438E-03-0.3328E-02 0.2906E+00-0.2913E-03 0.1136E-03 0.1017E-03
```

Pavement Design- Package-8

Ganga Expressway - Package - 8							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -3		20 Years - design			Thickness Adopted		
		MSA		98.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	155	195
1	€t at BT	1.498E-04	1.49E-04	OK	WMM	150	
2	€v at top of sub grade	3.204E-04	2.99E-04	OK	GSB	200	350

VIEW RESULTS

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```
No. of layers                3
E values (MPa)         3000.00  185.93   66.60
Mu values                 0.350.350.35
thicknesses (mm)         195.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
  Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
195.00     0.00-0.6439E-01 0.5725E+00 0.4659E+00-0.1105E-01 0.3637E+00-0.1426E-03 0.1440E-03 0.9603E-04
195.00L    0.00-0.6439E-01 0.2957E-02-0.3648E-02-0.1105E-01 0.3637E+00-0.3450E-03 0.1440E-03 0.9603E-04
195.00   155.00-0.6235E-01 0.5559E+00 0.3704E+00-0.2812E-01 0.3738E+00-0.1289E-03 0.1494E-03 0.6587E-04
195.00L  155.00-0.6235E-01 0.2962E-02-0.8537E-02-0.2812E-01 0.3738E+00-0.3248E-03 0.1494E-03 0.6587E-04
545.00     0.00-0.1823E-01 0.2091E-01 0.1840E-01-0.2673E-02 0.2882E+00-0.1721E-03 0.1122E-03 0.9393E-04
545.00L    0.00-0.1819E-01 0.1203E-02 0.2818E-03-0.2673E-02 0.2882E+00-0.2809E-03 0.1122E-03 0.9351E-04
545.00   155.00-0.1926E-01 0.2215E-01 0.2043E-01-0.3458E-02 0.2945E+00-0.1837E-03 0.1169E-03 0.1044E-03
545.00L  155.00-0.1926E-01 0.1276E-02 0.6633E-03-0.3459E-02 0.2945E+00-0.2994E-03 0.1169E-03 0.1045E-03
```

Pavement Design- Package-9

Ganga Expressway - Package - 9							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -3		20 Years - design			Thickness Adopted		
		MSA		98.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	155	195
1	€t at BT	1.498E-04	1.49E-04	OK	WMM	150	
2	€v at top of sub grade	3.204E-04	2.99E-04	OK	GSB	200	350

VIEW RESULTS

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```
No. of layers                3
E values (MPa)          3000.00  185.93   66.60
Mu values                  0.350.350.35
thicknesses (mm)         195.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
  Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
195.00     0.00-0.6439E-01 0.5725E+00 0.4659E+00-0.1105E-01 0.3637E+00-0.1426E-03 0.1440E-03 0.9603E-04
195.00L    0.00-0.6439E-01 0.2957E-02-0.3648E-02-0.1105E-01 0.3637E+00-0.3450E-03 0.1440E-03 0.9603E-04
195.00   155.00-0.6235E-01 0.5559E+00 0.3704E+00-0.2812E-01 0.3738E+00-0.1289E-03 0.1494E-03 0.6587E-04
195.00L  155.00-0.6235E-01 0.2962E-02-0.8537E-02-0.2812E-01 0.3738E+00-0.3248E-03 0.1494E-03 0.6587E-04
545.00     0.00-0.1823E-01 0.2091E-01 0.1840E-01-0.2673E-02 0.2882E+00-0.1721E-03 0.1122E-03 0.9393E-04
545.00L    0.00-0.1819E-01 0.1203E-02 0.2818E-03-0.2673E-02 0.2882E+00-0.2809E-03 0.1122E-03 0.9351E-04
545.00   155.00-0.1926E-01 0.2215E-01 0.2043E-01-0.3458E-02 0.2945E+00-0.1837E-03 0.1169E-03 0.1044E-03
545.00L  155.00-0.1926E-01 0.1276E-02 0.6633E-03-0.3459E-02 0.2945E+00-0.2994E-03 0.1169E-03 0.1045E-03
```

Pavement Design- Package-10

Ganga Expressway - Package - 10							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -3		20 Years - design			Thickness Adopted		
		MSA		87.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	150	190
1	€t at BT	1.545E-04	1.54E-04	OK	WMM	150	
2	€v at top of sub grade	3.289E-04	3.08E-04	OK	GSB	200	350

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```
No. of layers                 3
E values (MPa)          3000.00  185.93   66.60
Mu values                  0.350.350.35
thicknesses (mm)         190.00  350.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
  Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
190.00     0.00-0.6708E-01 0.5899E+00 0.4805E+00-0.1139E-01 0.3699E+00-0.1472E-03 0.1484E-03 0.9915E-04
190.00L    0.00-0.6708E-01 0.2682E-02-0.4103E-02-0.1139E-01 0.3699E+00-0.3581E-03 0.1484E-03 0.9915E-04
190.00   155.00-0.6456E-01 0.5693E+00 0.3729E+00-0.2939E-01 0.3803E+00-0.1314E-03 0.1538E-03 0.6540E-04
190.00L  155.00-0.6455E-01 0.2682E-02-0.9494E-02-0.2939E-01 0.3803E+00-0.3343E-03 0.1538E-03 0.6540E-04
540.00     0.00-0.1870E-01 0.2149E-01 0.1878E-01-0.2772E-02 0.2920E+00-0.1764E-03 0.1154E-03 0.9577E-04
540.00L    0.00-0.1867E-01 0.1246E-02 0.2600E-03-0.2772E-02 0.2920E+00-0.2882E-03 0.1154E-03 0.9545E-04
540.00   155.00-0.1980E-01 0.2281E-01 0.2100E-01-0.3597E-02 0.2985E+00-0.1889E-03 0.1204E-03 0.1073E-03
540.00L  155.00-0.1980E-01 0.1329E-02 0.6785E-03-0.3609E-02 0.2985E+00-0.3078E-03 0.1204E-03 0.1073E-03
```

Pavement Design- Package-11

Ganga Expressway - Package - 11							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -3		20 Years - design			Thickness Adopted		
		MSA		79.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	145	185
1	€t at BT	1.584E-04	1.58E-04	OK	WMM	155	
2	€v at top of sub grade	3.360E-04	3.13E-04	OK	GSB	200	355

VIEW RESULTS

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```
No. of layers                 3
E values (MPa)          3000.00  187.12   66.60
Mu values                 0.350.350.35
thicknesses (mm)         185.00  355.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
   Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
185.00     0.00-0.7023E-01 0.6061E+00 0.4929E+00-0.1177E-01 0.3747E+00-0.1516E-03 0.1527E-03 0.1018E-03
185.00L    0.00-0.7023E-01 0.2347E-02-0.4715E-02-0.1177E-01 0.3747E+00-0.3709E-03 0.1527E-03 0.1018E-03
185.00   155.00-0.6720E-01 0.5805E+00 0.3729E+00-0.3085E-01 0.3853E+00-0.1336E-03 0.1578E-03 0.6442E-04
185.00L 155.00-0.6719E-01 0.2284E-02-0.1066E-01-0.3085E-01 0.3853E+00-0.3434E-03 0.1578E-03 0.6442E-04
540.00     0.00-0.1896E-01 0.2214E-01 0.1935E-01-0.2836E-02 0.2939E+00-0.1789E-03 0.1176E-03 0.9748E-04
540.00L    0.00-0.1896E-01 0.1307E-02 0.3221E-03-0.2836E-02 0.2939E+00-0.2933E-03 0.1176E-03 0.9761E-04
540.00   155.00-0.2012E-01 0.2347E-01 0.2162E-01-0.3720E-02 0.3006E+00-0.1919E-03 0.1226E-03 0.1093E-03
540.00L 155.00-0.2012E-01 0.1378E-02 0.7186E-03-0.3687E-02 0.3006E+00-0.3131E-03 0.1226E-03 0.1093E-03
```

Pavement Design- Package-12

Ganga Expressway - Package - 12							
Stress Table - 2018							
		Va	3.5	Vb	11.5		
Option -3		20 Years - design			Thickness Adopted		
		MSA		79.00	BC	40	
S No	Strain	Alllowable Strain	Computed Strain	Remarks	DBM	145	185
1	€t at BT	1.584E-04	1.58E-04	OK	WMM	155	
2	€v at top of sub grade	3.360E-04	3.13E-04	OK	GSB	200	355

VIEW RESULTS

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```
No. of layers                3
E values (MPa)          3000.00  187.12   66.60
Mu values                  0.350.350.35
thicknesses (mm)         185.00  355.00
single wheel load (N) 20000.00
tyre pressure (MPa)        0.56
Dual  Wheel
   Z         R       SigmaZ       SigmaT      SigmaR      TaoRZ       DispZ       epZ         epT         epR
185.00     0.00-0.7023E-01 0.6061E+00 0.4929E+00-0.1177E-01 0.3747E+00-0.1516E-03 0.1527E-03 0.1018E-03
185.00L    0.00-0.7023E-01 0.2347E-02-0.4715E-02-0.1177E-01 0.3747E+00-0.3709E-03 0.1527E-03 0.1018E-03
185.00   155.00-0.6720E-01 0.5805E+00 0.3729E+00-0.3085E-01 0.3853E+00-0.1336E-03 0.1578E-03 0.6442E-04
185.00L  155.00-0.6719E-01 0.2284E-02-0.1066E-01-0.3085E-01 0.3853E+00-0.3434E-03 0.1578E-03 0.6442E-04
540.00     0.00-0.1896E-01 0.2214E-01 0.1935E-01-0.2836E-02 0.2939E+00-0.1789E-03 0.1176E-03 0.9748E-04
540.00L    0.00-0.1896E-01 0.1307E-02 0.3221E-03-0.2836E-02 0.2939E+00-0.2933E-03 0.1176E-03 0.9761E-04
540.00   155.00-0.2012E-01 0.2347E-01 0.2162E-01-0.3720E-02 0.3006E+00-0.1919E-03 0.1226E-03 0.1093E-03
540.00L  155.00-0.2012E-01 0.1378E-02 0.7186E-03-0.3687E-02 0.3006E+00-0.3131E-03 0.1226E-03 0.1093E-03
```

7. Hydrological Studies & Drainage Design

7.1 HYDROLOGY FOR BRIDGES

7.1.1 Main Objective

The main objective of the hydrological and hydraulic study is to determine the required size of drainage structures to allow the estimated design flow of the streams to cross the road safely, and to check whether waterways of existing structures are sufficient to transmit the flow without risk so that appropriate decisions could be taken concerning their dimensions.

The hydrological and hydraulic study for the project has been based on:

- Topographic survey data of cross drainage structures.
- Topographic data and maps of streams, upstream and downstream.
- HFL from local enquiries and telltale marks and hydraulic conditions at the existing drainage structures and data provided by C.W.C.

7.1.2 General Description of the Project Site

The project alignment starts from **km 16+000** of Meerut-Bulandshahar (NH-334) near village Bijoli (Dist. Meerut) **(CH 7+900)** & terminates at Prayagraj Bypass on NH-19 near village Judapur Dando (Dist. Prayagraj) **(CH 601+847)**. The length of the proposed expressway alignment is 593.947 km.

There are a numerous rivers & streams like River KALI, Ganga, SOT, ARIL, RAMGANGA, BAGHUL GARRA crossing the alignment, which are generally flowing from left to right in the direction of increasing chainages.

The elevation of the project road varies from 90 m to 225 m. The normal annual rainfall varies from 933 mm to 980 mm. The monsoon is spread from June to September and the monsoon seasonal rainfall is about 85-90% of the annual rainfall. The mean annual temperature near the sites ranges between 24.7^{0}C to 26.3^{0}C.

7.1.3 Data Collection & Data Analysis

Requirements for Hydrological and Hydraulic Design

The hydrological study aims at estimating the peak discharge of the flood generated by the run-off of rainfall within the catchment area. The hydrological study requires:

- Knowledge of the characteristics of peak rainfall in the regions.
- Knowledge of the characteristics of the catchment areas.
- Topographic data about the stream, upstream and downstream.
- Survey of India toposheets maps to a scale of 1:50,000 and 1:250000 for identification of catchment area and its characteristics.

Data Collection

Topographical surveys have been done at river crossings with a view to obtain the cross sections of the rivers at the centre line of the road and up to a reasonable distance at upstream and downstream. The High Flood Levels (HFL) have been obtained from existing flood marks or ascertained from enquiry with local knowledgeable persons.

The characteristics of the catchment areas have been ascertained from Survey of India toposheets having a scale of 1:50,000 and 1:2,50,000 from which catchment area at the proposed bridge site, length of the stream and fall in elevation from originating point to the point of crossing, could be determined. Slope of the stream has been determined from the contours on the toposheets.

For rivers/streams having catchment area more than 25 sq. km, CWC Report on Flood Estimation Report for Middle Ganga Plain Subzone and Upper Indo-Ganga Plain Subzone has been used for calculating design discharge. This Report has been referred for determining the characteristics of peak rainfall regimes. The report has been jointly prepared by CWC, MOST, Ministry of Railways and IMD and contains all the rainfall data required for estimation of design discharge of 25, 50- and 100-year returns periods by applying the Synthetic Unit Hydrograph approach, the parameters of which have been indicated in the above report.

Return Period and Rainfall

As per IRC: 5 – 2015 (Standard Specifications and Code of Practice for Road Bridges, Section – 1, General Features of Design) the bridges are designed for a return period of 100 years.

The 100-year, 24-hour rainfall for the zone under consideration varies from 280 mm to 320 mm. (Ref: Report on Flood Estimation Report for Middle Ganga Plain Subzone and Upper Indo-Ganga Plain Subzone published by CWC.)

7.1.4 Hydrological Study for Major & Minor Bridges

Design engineers essentially need the design flood of a specific return period for fixing the waterway vis-a-vis the design HFL of bridges depending upon their size and importance to ensure safety as well as economy. IRC: 5-2015, Section – I General Features of Design specify that the waterway of a bridge is to be designed for a maximum flood discharge of 100 years return period.
The following methods have been used to estimate the peak discharge for bridge site:

- Rational Method
- Synthetic Unit Hydrograph Method
- Area Velocity Method
- Method of Transposition using Catchment Area Proportion method

The following method has been used to estimate the design high flood level corresponding to the design flood:

- HEC – RAS Computations

These methods have been discussed in detail as indicated below in subhead of Hydrological Aspect.

7.1.4.1 Hydrological & Hydraulic Design Aspect

a) Estimation of Input Data for Hydrological Analysis

Catchment Area, length of critical point to the structure and slope of fall in river from critical point to structure along with rainfall data is required for estimation design discharge.

On survey of India Topographic map, catchment area is plotted for each bridge and measured. Length of critical point to structure and slope of fall in river from critical point is also measured. 24 hr rainfall for 100 yr return period is also taken from CWC Report No. SB/8/1984 - Flood Estimation Report for sub zone 1(c).

b) Rational Method

$$Q = 0.028 \times P \times f \times A \times I_C$$

Where,

Q	=	Maximum runoff in cumecs
A	=	Catchment area in hectares
Ic	=	Critical intensity of rainfall in cm/ hr.
P	=	Coefficient of run-off for the given catchment characteristics.
f	=	Spread factor for converting point rainfall into area mean rainfall.
Ic	=	$(F/T)*(T+1) / (T_c+1)$
F	=	Total Rainfall of T hours duration (24 hrs.) in cm, corresponding to 100 yrs return period.
T	=	Duration of total rainfall (F) in hours= 24 hrs.
Tc	=	Time of concentration in hour.

Time of Concentration

Times of concentrations (T_C) are determined on the basis of stream lengths (L_C) and shape of catchment as well as from terrain slope and cover conditions from the toposheets as well as hydrological survey data of stream. The values are found both by Dicken's (Empirical) formulae as well as from time of travel from furthest point of catchment as follows:

Dicken's Formula

$$T_c = [0.87(L^3/H)]^{0.385}$$

Where L is the length of catchment in km and H is the elevation difference in meter in length L.

c) Synthetic Unit Hydrograph (SUH) Approach (Ref. Flood Estimation Report on Middle Ganga Plain Subzone and Upper Indo-Ganga Plain Subzone

This method has been used for those bridges, which cater for more than 25 sq. km of catchment area.

In this method 1 hour, 2 hour and 6-hour Synthetic Unit Hydrograph is determined for an ungauged catchment. Following steps have been followed as suggested in CWC report for determination of discharge by this method.

(i) Physiographic parameters of the ungauged catchment have been determined from toposheets.

Parameter	Definition	Unit
L	Length of longest main stream along the river course	km
Lc	Length of longest main stream from a point opposite to centroid of the catchment area to dam	km
A	Catchment Area of River	Km^2
S	Equivalent Stream Slope	m/ km

(ii) SUH parameters have been computed using the following equations:

(a) For Upper Indo-Ganga Plain Subzone

Parameter	Definition	Formula	Unit
q_p	Peak discharge of unit hydrograph per unit area per sq.km. in cumecs	2.030/(L/S^0.5)^649	m^3/km^2
t_p	Time lag from centre of unit rainfall duration to Peak of unit hydrograph in hrs.	1.858/(qp)^1.038	hrs
W_{50}	Width of UH at 50% of peak discharge (Qp) in hrs	2.217(qp)-.990	hrs
W_{75}	Width of UH at 75% of peak discharge (Qp) in hrs.	1.477(qp) -.876	hrs
W_{R50}	Width of UH at 50% of Qp bet. Raising limb and Qp ordinate in hrs.	0.812(qp)-.907	hrs
W_{R75}	Width of UH at 75% of Qp bet. Raising limb and Qp ordinate in hrs.	.606(qp)-.791	hrs
T_B	Base Period of UH in hrs.	7.744(tp)0.779	hrs
T_M	Time from start of raising limb to peak of UH in hrs.	tp + tr/2	hrs
Q_P	Peak discharge of unit hydrograph in hrs.	qp x A	hrs

(b) For Middle Ganga Plain Subzone

Parameter	Definition	Formula	Unit
q_p	Peak discharge of unit hydrograph per unit area per sq.km. in cumecs	0.409/(L/S^0.5)^.456	m^3/km^2
tp	Time lag from centre of unit rainfall duration to Peak of unit hydrograph in hrs.	1.217/(qp)^1.034	hrs
W50	Width of UH at 50% of peak discharge (Qp) in hrs.	1.743(qp)-1.104	hrs
W75	Width of UH at 75% of peak discharge (Qp) in hrs	.902(qp) -1.108	hrs
WR50	Width of UH at 50% of Qp bet. Raising limb and Qp ordinate in hrs.	1.743(qp)-1.104	hrs
WR75	Width of UH at 75% of Qp bet. Raising limb and Qp ordinate in hrs.	.478(qp)-.902	hrs
TB	Base Period of UH in hrs.	16.432(tp)0.646	hrs
TM	Time from start of raising limb to peak of UH in hrs.	tp + tr/2	hrs
QP	Peak discharge of unit hydrograph in hrs.	qp x A	hrs

(iii) The estimated parameters of unit hydrograph in (b) have been plotted and the plotted points were joined to draw synthetic unit hydrograph. The discharge ordinates of SUH at interval of unit hour duration were found out from the equation of the plotted graph. The obtained value of the ordinates is adjusted in order to get proper unit hydrograph shape and area under the unit hydrograph. The unit hydrograph ordinates are summed up and multiplied by the unit hour duration and compared with the volume of 1 cm direct runoff depth over catchment computed by the formula as given below:

$$Q = (A \times d) / (tr \times 0.36)$$

(iv) The design storm duration has been taken as equal to base period of unit graph (TB =1.1* tp).

(v) Point rainfall is read from the given plate in CWC report for 100 year 24 hr rainfall and has been converted to areal rainfall of 100 years and design storm duration.

(vi) The areal rainfall of design storm duration is split into 1-hour rainfall increments using time distribution coefficients.

(vii) Estimation of effective rainfall excess unit has been done after considering design loss rate.

(viii) Base flow has been estimated based upon the catchment area.

(ix) Finally, for 100 year peak discharge, the effective rainfall excess after removing the losses from rainfall increments are arranged against unit hydrograph ordinates such that the maximum of effective rainfall is placed against the maximum UG ordinate, next lower value of effective rainfall against next lower value of UG ordinate and so on. Sum of the product of the above two added together with base flow gives peak discharge.

d) Area Velocity Method/ Slope Area Method

This method has been utilized to calculate the discharge from the stream cross section and stream slope/bed slope at the proposed bridge sites, for bridges. After plotting the cross section of the river, and marking the observed HFL, the cross sectional area (A) and wetted perimeter (P) have been computed. In the absence of the flood slope of the stream, the bed slope of the river has been estimated along its length.

The velocity and Discharge have been calculated using the Manning's formula:

$$V = 1/n * R^{2/3} * S^{1/2}$$

$$Q = A \times V$$

Where,
V = Velocity in m/sec;
R = Hydraulic mean depth in m S = Flood slope/bed slope
n = Co-efficient of rugosity
Q = Peak Discharge
A = Area of cross section

The value of 'n' has been adopted as per soil criteria and river bed characteristics, observed at site and are based on Table 3 in IRC SP-13 which has been tabulated below.

Surface	Perfect	Good	Fair	Bad
Natural Streams				
1. Clean, straight bank, full stage, no rifts or deep pools	0.025	0.0275	0.030	0.033
2. Same as (I), but some weeds and stones	0.030	0.033	0.035	0.040
3. Winding, some pools and shoals, clean	0.035	0.040	0.045	0.050
4. Same as (3), lower stages, more ineffective slope and sections	0.040	0.045	0.050	0.055
5. Same as (3) some weeds and stones	0.033	0.035	0.040	0.045
6. Same as (4), stony sections	0.045	0.050	0.055	0.060
7. Sluggish river reaches, rather weedy or with very deep pools	0.050	0.060	0.070	0.080
8. Very weedy reaches	0.075	0.100	0.125	0.150

The discharge obtained using Slope area method has been used to determine the design HFL including the afflux.

e) Method of Transposition using Catchment Area Proportion Method

The CWC maintains records for the Gauge and Discharge relation for every major river. For such rivers, the other methods such as Rational and Synthetic Unit Hydrograph method does not hold valid. For such cases, the information on the maximum observed flood shall be collected from CWC or other relevant sources, which fall, in vicinity to the proposed bridges on the same river. The annual maximum observed flood is then transposed from the observatory site to the bridge site under consideration using Catchment area proportion method. This transposed discharge at bridge site is then used to determine the high flood level and the relevant hydraulic parameters.

7.1.4.2 Afflux Calculation

Since some of the bridges in the alignment have less clear waterway as compared to natural stream width and also velocities at bridge sites are high due to steep bed slopes, this combined effect causes afflux at bridge sites during flood. Afflux for the bridges has been calculated using Weir and Orifice formulae as described in IRC 5-2015.

As per IRC:5-2015, Cl. 06.6.2 Molesworth formula is given by

$$h = \{V^2/17.88 + 0.01524\} \times \{(A/a)^2 - 1\}$$

h = afflux in meters
V = is the mean velocity to normal HFL of flow in the river prior to bridge construction i.e. corresponding
A = Area of flow section at normal HFL in the approach river section.
a = Area of flow section under the bridge.

7.1.4.3 Development of Stage-Discharge Curve Using HEC – RAS Software

The stage – discharge curve for the bridge sections were determined by HEC-RAS analyses. HEC- RAS is a mathematical model developed by Hydrologic Engineering Centre USA and widely used for River Analyses System. The X-sectional and L-sectional data observed from the field survey at the bridge sites were used as input data for finding the rating curve of the bridge section. The manning's roughness coefficient is an important input data for the HEC-RAS analyses and proper values of 0.035 to 0.04 were provided for the channel and flood plain of the river sections based on the river bed and the river channel. These data were taken from the literatures of open channel hydraulics. The results obtained from the HEC-RAS analyses and water level records have been annexed.

7.1.5 Scour Depth

Various hydraulic parameters e.g. HFL, normal waterway, normal depth of scour under bridges, Maximum scour level at bridge piers and abutments, Froude's number of flow (for scoured waterway under bridges), fluming ratio, afflux etc., are given in detailed sheet attached with **hydrological report**.

Scour Depth

Lacey's equation is adopted for estimating normal scour depth as per IRC: 5

$$R = 1.34\,(q^2/f)^{1/3}$$

Where R is the Lacey's regime scour depth, measured below HFL, q is the design discharge intensity under bridge in cumecs per meter and f is silt factor given by the equation

$$f = 1.76 (d_{50})^{1/2}$$

Where d50 is the mean sediment size in mm. Normal scour depth based on Lacey's equation and the actual observed depth (equal to the difference between HFL and LBL)/1.27 are compared as per code. Higher of the two values is adopted for design. Silt factor 'f' is found from Lacey's equation corresponding to d50 size of bed materials. Maximum scour level for pier and abutment are calculated using a factor of safety of 2 and 1.27, respectively as per IRC: Code-5. For computing scour depth, design discharge is enhanced by 30% to provide for adequate margin of safety as per provision of IRC: 78 - 2000. The scour depth calculations based upon the silt factor as per surface bed material, are given in hydrological report separately.

7.1.6 Summary & Recommendation

The design discharge has been calculated for 100-year return period flood by the following methods:

- For catchment area greater than 25 sq. km by Synthetic Unit Hydrograph as per CWC Flood Estimation Report
- Area-Velocity Method.
- Rational Method as per IRC:SP-13:2004

The catchment area has been calculated on Survey of India Map on scale of 1:50,000 and 1:1,25,000.

HFL has been established by:

- Local enquiry and Observed Flood Marks, where available.
- HEC – RAS software developed by U.S. Army Corps of Engineers.

The linear waterway calculations have been calculated by Lacey's Perimeter and as per CWC guidelines.

When a new bridge is to be constructed, a designer has all the freedom to provide waterway as required. As per IRC-5:2015 clause 106, waterway (W) should be equal to Lacey's regime waterway (P) given by the equation:

$$P = W = C (Q^{1/2})$$

Where,
Q = design flood discharge in m3/s P = Wetted perimeter in meters
W = Linear waterway in meters (for wide river W is almost equal to P)

C = a constant usually taken as 4.8 for regime channels but it may vary from 4.5 to 6.3 according to local conditions.

The code also stipulates that the waterway so found should also be compared with linear waterway at HFL corresponding to design flood discharge and the minimum of the two should be adopted as the clear waterway under the bridge.

7.1.7 Results of the Hydrological Studies

The detailed hydrological and hydraulic calculations have been carried out for all the major and minor bridges. The hydrological analysis for the major and important bridges has been presented in **hydrological report** separately.

7.2 DRAINAGE DESIGN

7.2.1 Introduction

The construction of the expressway embankment will unavoidably obstruct the natural overland flow and flow through the local channels. Suitable bridge / culvert openings have therefore been proposed across natural drainage channels with a view to pass the discharges with minimal disturbances caused to the natural flow regime.

In addition to these bridges / culverts, localized drainage arrangements consisting of longitudinal drains and additional culverts are required to be developed to divert the overland flow (which would otherwise meet the natural stream at some downstream point) intercepted by the expressway embankment into the nearest natural drainage channel. Moreover, these local drainage arrangements have been designed to carry the runoff from the surface of the proposed expressway, too.

As such, development of a drainage system on micro area basis and integration of the same with the overall natural drainage network of the area shall ensure effective drainage of the whole area upstream of the proposed embankment and the expressway as well.

In developing the localized drainage systems, the issues which have been addressed are as follows:

a) Identification of local depressions / channels crossings the proposed alignment and naturally attracting overland flow towards them
b) Assessment of flow direction at those localized areas
c) Identification of local ridges - natural or manmade canals etc.
d) Distances between local depressions and nearest local ridges and corresponding land slope
e) Identification of natural storage areas like ponds, lakes etc.

7.2.2 Components of Road Drainage System and Design Methodology

The road drainage system shall consist of the following:

7.2.2.1 Drainage of Embankment

It is mandatory to design a system to carry runoff from top of embankment safely into the carrier channel. The system shall ensure safe disposal of surface runoff without erosion of earthen shoulder / slope / embankment toe. Considering the project of expressway standards, kerb and chute system for surface water disposal is proposed.

The basic design principles for avoiding accumulation of water on the road surface are:

a) Provision of suitable longitudinal slope

b) Provision of suitable cross slope (both-sides or unidirectional as applicable for the road stretch under consideration i.e. straight, curved, super elevated etc.
c) Provision of GSB layer with sufficient permeability extending up to embankment slope for all sections and provision of horizontal cut-off in waterlogged areas depending on the duration and extent of waterlogging.
d) Provision of shoulder drain (along the edge of shoulder in high embankments) which will empty into chute drains
e) Provision of Median drains for sections where medians wider than 5m. Also wherever the expressway section is in super-elevation in raised median, median drain would be required.
f) Provision of pipe drains to carry accumulated water from catch pits on medians up to the carrier channels / chutes.
g) Provision of chute drains with energy dissipation arrangement in high embankments to safely discharge runoff from embankment top into toe channels. The longitudinal spacing of the chute drains shall be kept at 20 m.
h) Provision of turfing with native vegetation / stone pitching / geotextile for protecting embankment slope from formation of gullies by rain wash.
i) Provision of lined drain between main carriageway and service road. Energy dissipation basin to be interconnected through lined drain. Wherever service road are not present, unlined drain to be provided.

7.2.2.2 Roadside Toe Drains

Roadside toe drains shall be provided to receive discharge from embankment surface and ROW of the embankment and carry it safely to the nearest outfall point ensuring safety to the embankment toe, which is the area most vulnerable to erosion / failure.

Roadside drains shall generally be provided on both sides of the embankment to safely carry the discharge from the embankment without jeopardizing the safety of the toe. For limited stretches, particularly near the approaches to rivers where the existing ground slope is steep enough to carry the upstream discharge up to the rivers, roadside drains shall be discontinued. Otherwise, these drains shall be carried on both sides of the widened embankment.

The alignment of the drains shall depend on the topography of the area and the type of drain selected. For stretches, where the natural ground slope is towards the embankment toe, the drain shall be provided at the toe point and lined suitably. For stretches, where the ground slope is away from the embankment toe, the drains may be provided at the edge of ROW and these drains may not be lined. IRC: SP-42: 2014 permits construction of unlined drains beyond a point where an imaginary line drawn from the shoulder edge at a slope of 4(H): 1(V) intersects the natural ground. However, maintenance of unlined drains is difficult. Unlined Drains are, therefore, not considered for recommendation.

The shape and size of the roadside drains shall be decided on the basis of length of embankment being served by the drain up to the nearest outfall point.

For stretches passing through urban areas, rectangular covered drains shall be recommended for safety reasons.

For rural areas, the drains shall be open and trapezoidal with 1:1 side slope. As the topography in general is quite flat, optimization of the length of drain, bed width and depth of flow shall be necessary to reduce the top width of the drain (land width required for construction of drain). To reduce the length of drain up to nearest outfall and consequently the section, intermediate balancing culverts shall be provided at suitable locations. These drains may also terminate at local roadside ponds, if feasible. The minimum bed width and depth of flow at starting section shall be 500 mm and 300 mm respectively. The sections shall be gradually increased in terms of bed width and depth of flow up to the outfall point.

7.2.2.3 Median Drains

For raised medians in super-elevated sections, concrete drains have been provided in the median. These shall be provided on the entire length of the horizontal curve. These shall facilitate drainage of the surface runoff from the outer carriageway.

Typical cross sections of the proposed road provide the typical arrangement of these drains.

7.2.2.4 Methodology for Design of Drains

The design discharge (25 Year Return Period) for the shoulder drains at high embankment sections and the roadside drains has been estimated on the basis of Rational Formula while the hydraulic design has been done with the help of Manning's Formula.

Steps involved for design of shoulder drains and roadside drains are as follows:

a) Computation of the Average coefficient of runoff (P_{av}) for composite surfaces.

$$P_{av} = (P1*A1+P2*A2)/ (A1+A2)$$

Where, P1, A1 and P2, A2 are the respective runoff coefficients and contributing areas applicable for paved road portion and adjacent built up / agricultural areas.

b) Computation of the Time of Concentration (Tc) has been done taking extreme boundary of the ROW as the remotest point.

Tc = Inlet time (from adjacent land) + Flow time in the drain.

c) Computation of the Catchment area (At) contributing flow to the drain.
At = (width of paved surface + width of adjacent land) * length of road under consideration.

d) Rainfall analysis – 25 year, 24-hr point rainfall has been taken from the Isopluvial Map of the area, as given in CWC Report on Flood Estimation Report for Middle Ganga Plain Subzone and Upper Indo-Ganga Plain Subzone.

e) Based on the above data, drainage discharge is found by using Rational method

$$Q = 0.028\ P\ X\ f\ X\ I_C\ X\ A$$

Where Q= the design discharge in m3/sec, f is the spread factor, taken as 1.0 (for small catchment), P is the mean run-off coefficient, Ic is the design rainfall intensity in cm/hr corresponding to time of concentration (tc) in hour and A is the catchment area in hectares.

8. PROPOSALS FOR STRUCTURES & INTERCHANGES

8.1 GENERAL

The proposed Ganga Expressway is Virgin/Greenfield alignment; hence there is not any existing structure on the alignment. There is not any improvement proposal required hence proposals for only new Major Bridges, Minor Bridges, ROBs, VUPs, LVUPs, SVUPs, PUPs/CUPs, Flyovers, Elevated structures & other Interchanges have been made at required locations with 8 Lane Expressway configuration.

8.2 PROPOSALS FOR MAJOR BRIDGES

There are total 14 numbers of Major bridges proposed on the alignment. The details of the proposed Major bridges are given in the **Table 8.1**.

Service roads shall be discontinued at major bridge locations.

Deck Width - Overall deck width of is 21.25 m. proposed structures are for dual carriageway with 2 decks separated by open to sky median.

Table -8.1 List of Major Bridges

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
1	17+727	Kali River	Well Foundation	R.C.C.	PSC BOX GIRDER	3X30	2x21.25	0	Package-1
2	35+978	Canal+Road	PILE	R.C.C.	PSC I GIRDER	4X37	2x21.25	12	Package-1
3	51+649	Canal+Road	PILE	R.C.C.	PSC BOX GIRDER	3 X 29	2x21.25	16	Package-1
4	60+140	River	Pile	R.C.C.	PSC Girder	2x30.5	2x21.25	27	Package-2
5	66+850	River	Well	R.C.C.	PSC I Girder	16X60	2x21.25	0	Package-2
6	157+356	River	Well	R.C.C.	PSC Box	3 X 35	2 x 21.25	0	Package -4
7	207+740	Aril River Stream	Well	R.C.C.	PSC Box Girder	3 X 30	2x21.25	0	Package-5
8	217+920	Ram Ganga	Well	R.C.C.	PSC Box Girder	12 X 60	2x21.25	0	Package-5
9	238+190	River	Well	R.C.C.	PSC I Girder	4 X 38	2x21.25	31	Package-6
10	317+923	River	Well	R.C.C.	Box Girder	4 X 60	2x21.25	0	Package-7
11	359+169	Canal+Road	Pile	R.C.C.	PSC I Girder	3X30	2x21.25	45	Package-8
12	422+002	Canal+Road	Well	R.C.C.	PSC Box Girder	3 X 20.033	2x21.25	45	Package-9
13	530+123	Canal+Road	Pile	R.C.C	PSC I Girder	4 X 32	2x21.25	30	Package-11
14	587+316	Canal + BT Road	Pile	R.C.C.	PSC I Girder	2 X 35	2x21.25	15	Package-12

8.3 PROPOSALS FOR MINOR BRIDGES

There are total 127 numbers of Minor bridges proposed on the alignment. The details of the proposed Minor bridges are given in the **Table 8.2**.

All structures that are proposed will have new 8-lane configurations with dual carriageway separated with median. The structures have been designed to cater 8 lanes vehicular traffic.

Table- 8.2 List of Minor Bridges

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
1	24+179	ChoiaNala	Raft	Box Mnb	Box Mnb	4 X 10 X 5	2x21.25	30	Package-1
2	29+022	Canal+Road	Raft	Box Mnb	Box Mnb	1 x 12 + 1 x 10	2x21.25	15	Package-1
3	37+188	Canal+Road	Raft	Box Mnb	Box Mnb	1X8	2x21.25	15	Package-1
4	40+480	Canal+Road	Raft	Box Mnb	Box Mnb	1 X 8 + 1 X 10	2x21.25	35	Package-1
5	44+600	Canal+Road	Raft	Box Mnb	Box Mnb	2 X 10	2x21.25	46	Package-1
6	48+745	Canal+Road	Rafy	Box Mnb	Box Mnb	1x8+1x10	2x21.25	35	Package-1
7	49+869	Canal+Road	Raft	Box Mnb	Box Mnb	2x10	2x21.25	46	Package-1
8	51+060	Canal	Pile	R.C.C	PSC Girder	1x25	2x21.25	14	Package-1
9	56+515	Canal+Road	Raft	Box Mnb	Box Mnb	1x13	2x21.25	38	Package-1
10	59+565	Canal+Road	Raft	Box MNB	Box MNB	2X8	2x21.25	35	Package-2
11	61+327	Canal+Road	Pile	R.C.C	RCC Girder	1 x 20	2x21.25	56	Package-2
12	67+672	Stream/ Nallah	Pile	R.C.C	PSC Girder	2 X 20	2x21.25	0	Package-2
13	69+170	Stream/ Nallah	Pile	R.C.C	RCC Girder	1 X 20	2x21.25	40	Package-2
14	73+353	River	Pile	R.C.C	RCC Girder	1 X 30	2x21.25	0	Package-2
15	112+800	Canal+Road	Pile	R.C.C	RCC Girder	2X18	2X21.25	50	Package-3
16	166+070	Stream	Raft	Box MNB	Box MNB	1 x 8 x 4.5	2x21.25	15	Package-4
17	195+295	Stream/ Nallah	Raft	Box MNB	Box MNB	2 X 8 X 4.5	2X21.25		Package-5
18	195+749	Stream/ Nallah	Raft	Box MNB	Box MNB	2 X 10 X 5	2X21.25	15	Package-5
19	200+280	Canal+Road	Pile	Wall	RCC Girder	2 X 20	2X21.25	24	Package-5
20	213+609	Aril River	Raft	Box MNB	Box MNB	3 X 10 X 5	2X21.25	30	Package-5
21	224+230	Branch of Ram Ganga	Raft	Box MNB	Box MNB	2 X 10 X 5	2X21.25	18	Package-5
22	235+947	Andhoi River	Pile	Wall	RCC Girder	2 X 20	2X21.25	40	Package-5
23	242+125	Stream/ Nallah	Raft	Box MNB	Box MNB	2x8	2X21.25	0	Package-6
24	247+260	Canal	Raft	Box MNB	Box MNB	1x10	2X21.25	40	Package-6
25	249+320	Canal	Raft	Box MNB	Box MNB	2x8	2X21.25	0	Package-6
26	252+418	Canal+Road	Raft	Box MNB	Box MNB	2x10	2X21.25	30	Package-6
27	257+521	Canal+Road	Raft	Box MNB	Box MNB	2 x 8	2X21.25	45	Package-6
28	258+544	Canal+Road	Raft	Box MNB	Box MNB	2 x7	2X21.25	50	Package-6
29	261+324	Canal	Raft	Box MNB	Box MNB	1x8	2X21.25	42	Package-6
30	268+340	Canal	Raft	Box MNB	Box MNB	1x8	2X21.25	53	Package-6
31	274+000	Canal	Raft	Box MNB	Box MNB	1x10	2X21.25	0	Package-6
32	274+780	Canal+Road	Raft	Box MNB	Box MNB	2X7	2X21.25	0	Package-6

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
33	290+966	Canal+Road	Raft	Box MNB	Box MNB	1 X 12	2x21.25	24	Package-7
34	306+602	River	Pile	Wall	R.C.C Girder	2 X 25	2x21.25	30	Package-7
35	310+540	River	Pile	Wall	R.C.C Girder	2 X 30	2x21.25	30	Package-7
36	320+933	Stream/ Nallah	Raft	Box MNB	Box MNB	2X8X5.0	2x21.25	0	Package-7
37	329+037	Canal+Road	Pile	Wall	R.C.C Girder	1 X 22	2x21.25	54	Package-7
38	333+181	Canal+Road	Raft	Box MNB	Box MNB	2X7	2x21.25	43	Package-7
39	340+895	Stream/ Nallah	Pile	Wall	R.C.C Girder	1X25	2x21.25	0	Package-7
40	362+954	Canal	Raft	Box MNB	Box MNB	1X8	2 x 21.25	52	Package-8
41	364+902	Canal+Road	Raft	Box MNB	Box MNB	1X10	2 x 21.25	26	Package-8
42	367+322	Canal	Raft	Box MNB	Box MNB	1X8	2 x 21.25	27	Package-8
43	370+669	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10	2 x 21.25	40	Package-8
44	377+043	Canal+Road	Raft	Box MNB	Box MNB	2X7	2 x 21.25	16	Package-8
45	381+558	Canal+Road	Raft	Box MNB	Box MNB	2X8	2 x 21.25	22	Package-8
46	383+980	Canal+Road	Raft	Box MNB	Box MNB	1X10	2 x 21.25	59	Package-8
47	387+696	Canal+Road	Raft	Box MNB	Box MNB	1X8	2 x 21.25	10	Package-8
48	389+662	Canal+Road	Raft	Box MNB	MNB	2X20	2 x 21.25	8	Package-8
49	392+612	Canal	Raft	Box MNB	Box MNB	1X8	2X21.25	44	Package-9
50	394+132	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2X21.25	9	Package-9
51	397+182	Canal+Road	Raft	Box MNB	Box MNB	2 x 7.5 x 7.5	2X21.25	49	Package-9
52	401+175	Stream/ Nallah	Raft	Box MNB	Box MNB	1X8X5	2X21.25	0	Package-9
53	402+750	Stream/ Nallah	Raft	MNB	MNB	1X25	2X21.25	0	Package-9
54	407+037	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2X21.25	0	Package-9
55	408+332	Stream/ Nallah	Raft	MNB	MNB	1 X 20	2X21.25	45	Package-9
56	414+612	Canal+Road	Raft	Box MNB	Box MNB	1x13	2X21.25	24	Package-9
57	420+322	Stream/ Nallah	Raft	Box MNB	Box MNB	2X8X5	2X21.25	0	Package-9
58	428+544	Canal	Raft	Box MNB	Box MNB	1X8	2X21.25	0	Package-9
59	431+336	Stream/ Nallah	Raft	MNB	MNB	1X30	2X21.25	24	Package-9
60	433+605	Canal+Road	Raft	Box MNB	Box MNB	1x13	2X21.25	0	Package-9
61	436+039	Canal+Road	Raft	Box MNB	Box MNB	1X10	2X21.25	29	Package-9
62	440+437	Gas Pipe Line	Raft	MNB (Portal Frame)	MNB (Portal Frame)	1X9	2X21.25	56	Package-9
63	448+062	Loni River	Pile	Wall	RCC Girder	2X20	2X21.25		Package-10
64	450+724	Canal + VR	Pile	Wall	PSC Girder	1x15	2X21.25	59	Package-10
65	452+210	Canal + VR	Pile	Wall	RCC Girder	2X8	2X21.25	47	Package-10
66	452+775	Canal+Road	Raft	Box MNB	Box MNB	1X10	2X21.25	15	Package-10
67	457+091	Stream/ Nallah	Pile	Wall	PSC Girder	1X25	2X21.25	25	Package-10

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
68	458+945	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2X21.25		Package-10
69	459+739	Canal	Raft	Box MNB	Box MNB	1X8	2X21.25		Package-10
70	463+570	Canal +VR	Pile	Wall	RCC Girder	2X8	2X21.25	18	Package-10
71	467+183	Canal	Raft	Box MNB	Box MNB	1X10	2X21.25	26	Package-10
72	467+535	Canal + VR	Raft	Box MNB	Box MNB	1X12	2X21.25	13	Package-10
73	469+212	Canal +Road	Pile	Wall	RCC Girder	2X8	2X21.25	5	Package-10
74	470+413	Canal +Road	Pile	Wall	PSC Girder	1x16	2X21.25	54	Package-10
75	474+857	Canal +Road	Pile	Wall	PSC Girder	1x12	2x21.25	37	Package-10
76	477+028	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	40	Package-10
77	477+921	Canal +Road	Pile	Wall	PSC Girder	1X10	2x21.25	8	Package-10
78	480+400	Canal + VR	Pile	Wall	RCC Girder	1X10	2X21.25	48	Package-10
79	482+305	Canal	Raft	Box MNB	Box MNB	1 X 10	2X21.25	33	Package-10
80	484+839	Canal	Pile	Wall	RCC Girder	3 X 17.33	2X21.25	75	Package-10
81	485+750	Canal+Road	Pile	Box MNB	Box MNB	2X8	2 x 21.25	10	Package-10
82	487+679	Canal+Road	Raft	Girder	MNB	1X8	2 x 21.25	58	Package-10
83	489+464	Canal	Raft	Girder	MNB	2X8	2 x 21.25	40	Package-10
84	492+466	Canal	Raft	Box MNB	Box MNB	2X8	2 x 21.25	0	Package-10
85	494+015	Canal	Raft	Box MNB	Box MNB	1X8	2 x 21.25	0	Package-10
86	496+350	Canal+Road	Pile	Girder	MNB	1 X 25	2 x 21.25	24	Package-10
87	497+189	Canal+Road	Raft	Box MNB	Box MNB	2 X7	2X21.25	61	Package-11
88	497+756	Canal	Raft	Box MNB	Box MNB	1 X10	2X21.25	6	Package-11
89	499+653	Canal+Road	Raft	Box MNB	Box MNB	2X10	2X21.25	38	Package-11
90	504+217	Canal	Raft	Box MNB	Box MNB	1X12	2X21.25	0	Package-11
91	505+840	Canal	Raft	Box MNB	Box MNB	1X8	2X21.25	8	Package-11
92	508+750	Canal	Raft	Box MNB	Box MNB	1X10	2X21.25	35	Package-11
93	511+600	Canal	Pile	Wall	RCC Girder	1X20	2X21.25	40	Package-11
94	512+280	Canal+Road	Raft	Box MNB	Box MNB	2 X 8	2X21.25	51	Package-11
95	518+354	Canal+Road	Raft	Box MNB	Box MNB	1x12	2X21.25	12	Package-11
96	518+675	Canal	Raft	Box MNB	Box MNB	1x7	2X21.25	0	Package-11
97	519+668	Canal+Road	Pile	Wall	RCC Girder	2x25	2X21.25	35	Package-11
98	524+108	Canal + Road	Raft	Box MNB	Box MNB	2 x 7	2X21.25	38	Package-11
99	526+863	Canal+Road	Raft	Box MNB	Box MNB	1 X 10	2x21.25	28	Package-11
100	527+682	Canal+Road	Pile	Wall	RCC Girder	2X25	2x21.25	19	Package-11
101	531+280	Canal+Road	Pile	Wall	RCC Girder	1x30	2x21.25	12	Package-11
102	533+037	Canal	Raft	Box MNB	Box MNB	1x7	2X21.25	12	Package-11

S. No.	Chainage	Type of Crossing	Type of Structure			Span Arrangement	Width of Structure	Skew Angle, if any	Remarks
			Found-ation	Sub Structure	Super Structure				
103	535+770	Canal+Road	Raft	Box MNB	Box MNB	1x4+1x6	2X21.25	70	Package-11
104	536+325	Canal	Raft	Box MNB	Box MNB	1X10	2X21.25	54	Package-11
105	538+310	Canal	Raft	Box MNB	Box MNB	2x7	2X21.25	44	Package-11
106	538+742	Canal+Road	Pile	Wall	RCC Girder	2X20	2X21.25	21	Package-11
107	542+543	Canal+Road	Raft	Box MNB	Box MNB	2 x 8	2X21.25	10	Package-11
108	546+060	Canal	Raft	Box MNB	Box MNB	1X7	2X21.25	28	Package-11
109	547+537	Canal	Raft	Box MNB	Box MNB	1X12	2X21.25	15	Package-11
110	550+855	Canal+Road	pile	MNB	MNB	1X25	2x21.25	39	Package-12
111	555+130	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	0	Package-12
112	558+425	Canal+Road	Raft	Box MNB	Box MNB	1X12	2x21.25	37	Package-12
113	559+295	Canal+Road	Raft	Box MNB	Box MNB	1X12	2x21.25	15	Package-12
114	560+034	Canal +road	Raft	Box MNB	Box MNB	1X12	2x21.25	44	Package-12
115	560+860	Canal+Road	pile	MNB	MNB	2X20	2x21.25	40	Package-12
116	568+940	Canal+Road	Raft	Box MNB	Box MNB	3 X 10	2x21.25	20	Package-12
117	569+553	Canal	Raft	Box MNB	Box MNB	2 X10	2x21.25	31	Package-12
118	575+380	Canal+Road	Raft	Box MNB	Box MNB	2 x 7	2x21.25	6	Package-12
119	578+860	Stream/ Nallah	Raft	Box MNB	Box MNB	1X10X5	2x21.25	0	Package-12
120	581+978	River	Pile	MNB	MNB	2X 20	2x21.25	45	Package-12
121	585+957	Canal+Road	Pile	Box MNB	Box MNB	1 X 10	2x21.25	40	Package-12
122	592+025	Canal+Road	Raft	MNB	MNB	1x21	2x21.25	37	Package-12
123	592+170	Canal	Raft	Box MNB	Box MNB	1x 12	2x21.25	15	Package-12
124	592+802	Canal+Road	Raft	Box MNB	Box MNB	1x10	2x21.25	41	Package-12
125	594+340	Canal+Road	Raft	Box MNB	Box MNB	2 X 7	2x21.25	17	Package-12
126	594+610	Canal	Raft	Box MNB	Box MNB	1 X 12	2x21.25	40	Package-12
127	596+404	Canal+Road	Raft	Box MNB	Box MNB	1X10	2x21.25	27	Package-12

8.4 PROPOSALS FOR CULVERTS

Total 929 Balancing Culverts have been proposed on the project expressway. List of culverts is attached below in **Table-8.3**.

Table-8.3 List of Culverts

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
1	9+323	Culvert	3	3	2x21.25	Package-1
2	10+060	Culvert	3	3	2x21.25	Package-1

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
3	10+700	Culvert	2	2	2x21.25	Package-1
4	11+000	Culvert	3	3	2x21.25	Package-1
5	12+020	Culvert	2	2	2x21.25	Package-1
6	13+019	Culvert	3	3	2x21.25	Package-1
7	13+957	Culvert	2	2	2x21.25	Package-1
8	14+560	Culvert	2	2	2x21.25	Package-1
9	15+650	Culvert	2	2	2x21.25	Package-1
10	16+191	Culvert	3	3	2x21.25	Package-1
11	16+630	Culvert	2	2	2x21.25	Package-1
12	17+340	Culvert	2	2	2x21.25	Package-1
13	18+160	Culvert	2	2	2x21.25	Package-1
14	19+164	Culvert	2	2	2x21.25	Package-1
15	19+842	Culvert	3	3	2x21.25	Package-1
16	20+135	Culvert	3	3	2x21.25	Package-1
17	20+441	Culvert	2	2	2x21.25	Package-1
18	20+747	Culvert	3	3	2x21.25	Package-1
19	21+620	Culvert	3	3	2x21.25	Package-1
20	21+950	Culvert	2	2	2x21.25	Package-1
21	22+410	Culvert	2	2	2x21.25	Package-1
22	22+765	Culvert	3	3	2x21.25	Package-1
23	23+100	Culvert	2	2	2x21.25	Package-1
24	23+990	Culvert	3	3	2x21.25	Package-1
25	24+915	Culvert	6	3	2x21.25	Package-1
26	25+135	Culvert	3	3	2x21.25	Package-1
27	26+040	Culvert	2	2	2x21.25	Package-1
28	26+730	Culvert	2	2	2x21.25	Package-1
29	27+070	Culvert	2	2	2x21.25	Package-1
30	27+710	Culvert	2	2	2x21.25	Package-1
31	28+778	Culvert	3	3	2x21.25	Package-1
32	29+285	Culvert	5	2	2x21.25	Package-1
33	29+880	Culvert	4	2	2x21.25	Package-1
34	30+345	Culvert	3	3	2x21.25	Package-1
35	31+120	Culvert	2	2	2x21.25	Package-1
36	32+015	Culvert	2	2	2x21.25	Package-1
37	32+455	Culvert	3	3	2x21.25	Package-1

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
38	32+898	Culvert	6	2	2x21.25	Package-1
39	33+540	Culvert	2	2	2x21.25	Package-1
40	34+918	Culvert	2	2	2x21.25	Package-1
41	36+500	Culvert	2	2	2x21.25	Package-1
42	37+493	Culvert	3	3	2x21.25	Package-1
43	38+283	Culvert	2	2	2x21.25	Package-1
44	39+430	Culvert	2	2	2x21.25	Package-1
45	40+982	Culvert	3	3	2x21.25	Package-1
46	41+276	Culvert	2	2	2x21.25	Package-1
47	41+980	Culvert	2	2	2x21.25	Package-1
48	42+620	Culvert	2	2	2x21.25	Package-1
49	43+428	Culvert	3	3	2x21.25	Package-1
50	44+143	Culvert	3	3	2x21.25	Package-1
51	45+320	Culvert	2	2	2x21.25	Package-1
52	45+674	Culvert	3	3	2x21.25	Package-1
53	46+440	Culvert	2	2	2x21.25	Package-1
54	46+907	Culvert	5	2	2x21.25	Package-1
55	47+510	Culvert	2	2	2x21.25	Package-1
56	48+035	Culvert	3	3	2x21.25	Package-1
57	48+400	Culvert	3	3	2x21.25	Package-1
58	49+315	Culvert	6	2	2x21.25	Package-1
59	50+090	Culvert	2	2	2x21.25	Package-1
60	50+753	Culvert	2	2	2x21.25	Package-1
61	51+380	Culvert	3	3	2x21.25	Package-1
62	52+203	Culvert	3	3	2x21.25	Package-1
63	53+430	Culvert	2	2	2x21.25	Package-1
64	54+170	Culvert	2	2	2x21.25	Package-1
65	55+218	Culvert	3	3	2x21.25	Package-1
66	56+063	Culvert	3	3	2x21.25	Package-1
67	56+279	Culvert	2	2	2x21.25	Package-1
68	8+920	Culvert @ Trumpet	3	3	1 numbers	Package-1
69-72	8+920	HPC @ Trumpet	1X1200		4 numbers	Package-1
73-76	35+270	Culvert @ Diamond Interchange	3	3	4 numbers	Package-1
77-80	54+640	Culvert @ Diamond Interchange	3	3	4 numbers	Package-1
81	57+170	Culvert	3	3	2X21.25	Package-2

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
82	57+700	Culvert	3	3	2X21.25	Package-2
83	58+144	Culvert	2	2	2X21.25	Package-2
84	58+992	Culvert	2	2	2X21.25	Package-2
85	59+416	Culvert	2	2	2X21.25	Package-2
86	60+545	Culvert	2	2	2X21.25	Package-2
87	61+600	Culvert	3	3	2X21.25	Package-2
88	62+100	Culvert	3	3	2X21.25	Package-2
89	62+339	Culvert	3	3	2X21.25	Package-2
90	63+096	Culvert	3	3	2X21.25	Package-2
91	63+700	Culvert	2	2	2X21.25	Package-2
92	64+470	Culvert	2	2	2X21.25	Package-2
93	65+100	Culvert	3	3	2X21.25	Package-2
94	65+970	Culvert	2	2	2X21.25	Package-2
95	68+170	Culvert	2	2	2X21.25	Package-2
96	68+740	Culvert	2	2	2X21.25	Package-2
97	69+500	Culvert	2	2	2X21.25	Package-2
98	70+158	Culvert	2	2	2X21.25	Package-2
99	71+234	Culvert	2	2	2X21.25	Package-2
100	72+100	Culvert	2	2	2X21.25	Package-2
101	73+040	Culvert	2	2	2X21.25	Package-2
102	73+720	Culvert	3	3	2X21.25	Package-2
103	74+860	Culvert	3	3	2X21.25	Package-2
104	75+440	Culvert	2	2	2X21.25	Package-2
105	76+480	Culvert	2	2	2X21.25	Package-2
106	77+360	Culvert	2	2	2X21.25	Package-2
107	77+742	Culvert	2	2	2X21.25	Package-2
108	77+928	Culvert	3	3	2X21.25	Package-2
109	78+320	Culvert	3	3	2X21.25	Package-2
110	78+890	Culvert	2	2	2X21.25	Package-2
111	79+790	Culvert	2	2	2X21.25	Package-2
112	80+163	Culvert	3	3	2X21.25	Package-2
113	81+150	Culvert	2	2	2X21.25	Package-2
114	81+850	Culvert	3	3	2X21.25	Package-2
115	82+030	Culvert	2	2	2X21.25	Package-2
116	82+680	Culvert	2	2	2X21.25	Package-2

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
117	83+765	Culvert	3	3	2X21.25	Package-2
118	84+224	Culvert	2	2	2X21.25	Package-2
119	84+816	Culvert	3	3	2X21.25	Package-2
120	85+510	Culvert	2	2	2X21.25	Package-2
121	86+130	Culvert	2	2	2X21.25	Package-2
122-125	74+181	Culverts @	3	3	4 numbers	Package-2
128	90+610	Diamond Interchange	2	2	2X21.25	Package-3
126	72+700	HPC @ WSA	1X1200		1 Culvert	Package-2
127	72+700	HPC @ WSA	1X1200		1 Culvert	Package-2
128	87+750	Culvert	2	2	2X21.25	Package-3
129	88+160	Culvert	2	2	2X21.25	Package-3
130	89+170	Culvert	2	2	2X21.25	Package-3
131	89+734	Culvert	2	2	2X21.25	Package-3
132	90+610	Culvert	2	2	2X21.25	Package-3
133	91+515	Culvert	2	2	2X21.25	Package-3
134	92+100	Culvert	2	2	2X21.25	Package-3
135	92+789	Culvert	2	2	2X21.25	Package-3
136	93+333	Culvert	2	2	2X21.25	Package-3
137	94+000	Culvert	2	2	2X21.25	Package-3
138	94+610	Culvert	2	2	2X21.25	Package-3
139	95+095	Culvert	3	3	2X21.25	Package-3
140	95+795	Culvert	2	2	2X21.25	Package-3
141	96+300	Culvert	2	2	2X21.25	Package-3
142	96+905	Culvert	2	2	2X21.25	Package-3
143	97+800	Culvert	3	3	2X21.25	Package-3
144	98+624	Culvert	3	3	2X21.25	Package-3
145	99+630	Culvert	2	2	2X21.25	Package-3
146	100+310	Culvert	2	2	2X21.25	Package-3
147	101+148	Culvert	3	3	2X21.25	Package-3
148	101+430	Culvert	2	2	2X21.25	Package-3
149	103+300	Culvert	2	2	2X21.25	Package-3
150	103+705	Culvert	3	3	2X21.25	Package-3
151	104+215	Culvert	3	3	2X21.25	Package-3
152	105+197	Culvert	2	2	2X21.25	Package-3
153	106+200	Culvert	2	2	2X21.25	Package-3

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
154	106+903	Culvert	3	3	2X21.25	Package-3
155	107+640	Culvert	3	3	2X21.25	Package-3
156	108+190	Culvert	2	2	2X21.25	Package-3
157	108+600	Culvert	2	2	2X21.25	Package-3
158	109+495	Culvert	2	2	2X21.25	Package-3
159	110+025	Culvert	2	2	2X21.25	Package-3
160	110+560	Culvert	2	2	2X21.25	Package-3
161	111+556	Culvert	3	3	2X21.25	Package-3
162	112+310	Culvert	2	2	2X21.25	Package-3
163	113+279	Culvert	3	3	2X21.25	Package-3
164	113+510	Culvert	2	2	2X21.25	Package-3
165	114+176	Culvert	2	2	2X21.25	Package-3
166	115+160	Culvert	2	2	2X21.25	Package-3
167	116+600	Culvert	2	2	2X21.25	Package-3
168	117+166	Culvert	2	2	2X21.25	Package-3
169	117+840	Culvert	2	2	2X21.25	Package-3
170	118+208	Culvert	3	3	2X21.25	Package-3
171	119+180	Culvert	2	2	2X21.25	Package-3
172	119+910	Culvert	2	2	2X21.25	Package-3
173	120+278	Culvert	3	3	2X21.25	Package-3
174	120+750	Culvert	2	2	2X21.25	Package-3
175	121+315	Culvert	2	2	2X21.25	Package-3
176	122+310	Culvert	2	2	2X21.25	Package-3
177	124+806	Culvert	2	2	2X21.25	Package-3
178	125+950	Culvert	2	2	2X21.25	Package-3
179	126+345	Culvert	3	3	2X21.25	Package-3
180	126+960	Culvert	2	2	2X21.25	Package-3
181	127+620	Culvert	2	2	2X21.25	Package-3
182	128+100	Culvert	2	2	2X21.25	Package-3
183	128+788	Culvert	3	3	2X21.25	Package-3
184	129+162	Culvert	2	2	2X21.25	Package-3
185	130+240	Culvert	2	2	2X21.25	Package-3
186	130+639	Culvert	3	3	2X21.25	Package-3
187	131+626	Culvert	3	3	2X21.25	Package-3
188	132+165	Culvert	3	3	2X21.25	Package-3

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
189	132+948	Culvert	3	3	2X21.25	Package-3
190	133+840	Culvert	3	3	2X21.25	Package-3
191	134+626	Culvert	2	2	2X21.25	Package-3
192	135+340	Culvert	2	2	2X21.25	Package-3
193	135+783	Culvert	2	2	2X21.25	Package-3
194	136+180	Culvert	2	2	2X21.25	Package-3
195	136+600	Culvert	2	2	2X21.25	Package-3
196	137+402	Culvert	2	2	2X21.25	Package-3
197-200	102+427	Culverts @	3	3	4 numbers	Package-3
215	150+920	Diamond Interchange	2	2	2x21.25	Package-4
201-202	123+288	Culverts	3	3	2 numbers	Package-3
217	152+700	@ Double Trumpet	2	2	2x21.25	Package-4
203-208	123+288	HPC	1x1200	6 numbers	Package-3	Package-4
219	154+500	@ Double Trumpet	3	3	2x21.25	Package-4
209	125+300	HPC	1X1200	1 number	Package-3	Package-4
221	155+320	@ Way Side Amenities	2	2	2x21.25	Package-4
210	125+300	HPC	1X1200	1 number	Package-3	Package-4
223	157+600	@ Way Side Amenities	3	3	2x21.25	Package-4
211	138+476	Culvert	2	2	2x21.25	Package-4
212	139+027	Culvert	2	2	2x21.25	Package-4
213	139+456	Culvert	2	2	2x21.25	Package-4
214	140+240	Culvert	2	2	2x21.25	Package-4
215	141+338	Culvert	2	2	2x21.25	Package-4
216	141+650	Culvert	2	2	2x21.25	Package-4
217	142+450	Culvert	2	2	2x21.25	Package-4
218	143+204	Culvert	3	3	2x21.25	Package-4
219	143+490	Culvert	2	2	2x21.25	Package-4
220	144+455	Culvert	2	2	2x21.25	Package-4
221	145+425	Culvert	3	3	2x21.25	Package-4
222	145+810	Culvert	2	2	2x21.25	Package-4
223	146+707	Culvert	3	3	2x21.25	Package-4
224	147+030	Culvert	2	2	2x21.25	Package-4
225	147+755	Culvert	2	2	2x21.25	Package-4
226	148+570	Culvert	2	2	2x21.25	Package-4

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
227	149+400	Culvert	2	2	2x21.25	Package-4
228	150+090	Culvert	2	2	2x21.25	Package-4
229	150+920	Culvert	2	2	2x21.25	Package-4
230	151+900	Culvert	2	2	2x21.25	Package-4
231	152+700	Culvert	2	2	2x21.25	Package-4
232	153+056	Culvert	3	3	2x21.25	Package-4
233	154+500	Culvert	3	3	2x21.25	Package-4
234	154+950	Culvert	3	3	2x21.25	Package-4
235	155+320	Culvert	2	2	2x21.25	Package-4
236	155+830	Culvert	2	2	2x21.25	Package-4
237	156+927	Culvert	3	3	2x21.25	Package-4
238	157+600	Culvert	3	3	2x21.25	Package-4
239	158+030	Culvert	2	2	2x21.25	Package-4
240	158+790	Culvert	3	3	2x21.25	Package-4
241	159+733	Culvert	2	2	2x21.25	Package-4
242	160+830	Culvert	2	2	2x21.25	Package-4
243	161+520	Culvert	2	2	2x21.25	Package-4
244	161+930	Culvert	2	2	2x21.25	Package-4
245	162+683	Culvert	2	2	2x21.25	Package-4
246	162+960	Culvert	3	3	2x21.25	Package-4
247	163+340	Culvert	2	2	2x21.25	Package-4
248	163+800	Culvert	3	3	2x21.25	Package-4
249	164+740	Culvert	2	2	2x21.25	Package-4
250	165+529	Culvert	6	2	2x21.25	Package-4
251	166+400	Culvert	3	3	2x21.25	Package-4
252	167+410	Culvert	2	2	2x21.25	Package-4
253	167+772	Culvert	3	3	2x21.25	Package-4
254	168+260	Culvert	3	3	2x21.25	Package-4
255	169+229	Culvert	3	3	2x21.25	Package-4
256	169+523	Culvert	3	3	2x21.25	Package-4
257	170+500	Culvert	2	2	2x21.25	Package-4
258	170+790	Culvert	2	2	2x21.25	Package-4
259	171+735	Culvert	2	2	2x21.25	Package-4
260	172+350	Culvert	2	2	2x21.25	Package-4
261	172+910	Culvert	6	2	2x21.25	Package-4

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
262	174+500	Culvert	2	2	2x21.25	Package-4
263	175+641	Culvert	3	3	2x21.25	Package-4
264	176+590	Culvert	2	2	2x21.25	Package-4
265	176+914	Culvert	2	2	2x21.25	Package-4
266	177+950	Culvert	3	3	2x21.25	Package-4
267	178+545	Culvert	2	2	2x21.25	Package-4
268	179+470	Culvert	3	3	2x21.25	Package-4
269	180+010	Culvert	2	2	2x21.25	Package-4
270	180+955	Culvert	2	2	2x21.25	Package-4
271	181+810	Culvert	2	2	2x21.25	Package-4
272	182+170	Culvert	3	3	2x21.25	Package-4
273	182+889	Culvert	3	3	2x21.25	Package-4
274	183+700	Culvert	2	2	2x21.25	Package-4
275	183+963	Culvert	3	3	2x21.25	Package-4
276	184+600	Culvert	2	2	2x21.25	Package-4
277	185+610	Culvert	2	2	2x21.25	Package-4
278	186+360	Culvert	2	2	2x21.25	Package-4
279	186+952	Culvert	3	3	2x21.25	Package-4
280	187+260	Culvert	2	2	2x21.25	Package-4
281-284	173+454	Culverts @	3	3	4 Culverts	Package-4
311	221+575	Diamond Interchange	5	3	2X21.25	Package-5
285-286	189+394	Culverts @	3	3	2 Culverts	Package-4
313	223+456	Double Trumpet	2	2	2X21.25	Package-5
287-294	189+394	HPC @	1x1200	8 Culverts	Package-4	Package-5
315	224+790	Double Trumpet	2	2	2X21.25	Package-5
295	175+000	HPC @ WSA	1X1200		1 Culvert	Package-4
296	175+000	HPC @ WSA	1X1200		1 Culvert	Package-4
297	190+080	Culvert	3	3	2X21.25	Package-5
298	190+440	Culvert	2	2	2X21.25	Package-5
299	191+250	Culvert	2	2	2X21.25	Package-5
300	192+170	Culvert	2	2	2X21.25	Package-5
301	192+660	Culvert	2	2	2X21.25	Package-5
302	193+210	Culvert	2	2	2X21.25	Package-5
303	193+941	Culvert	3	3	2X21.25	Package-5

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
304	194+940	Culvert	2	2	2X21.25	Package-5
305	195+101	Culvert	3	3	2X21.25	Package-5
306	196+160	Culvert	2	2	2X21.25	Package-5
307	196+590	Culvert	2	2	2X21.25	Package-5
308	197+450	Culvert	6	1.5	2X21.25	Package-5
309	198+040	Culvert	3	3	2X21.25	Package-5
310	198+950	Culvert	2	2	2X21.25	Package-5
311	199+310	Culvert	3	3	2X21.25	Package-5
312	199+860	Culvert	2	2	2X21.25	Package-5
313	200+830	Culvert	2	2	2X21.25	Package-5
314	201+610	Culvert	3	3	2X21.25	Package-5
315	202+052	Culvert	3	3	2X21.25	Package-5
316	202+380	Culvert	2	2	2X21.25	Package-5
317	203+095	Culvert	2	2	2X21.25	Package-5
318	203+470	Culvert	2	2	2X21.25	Package-5
319	204+230	Culvert	3	3	2X21.25	Package-5
320	205+317	Culvert	3	3	2X21.25	Package-5
321	205+790	Culvert	2	2	2X21.25	Package-5
322	206+210	Culvert	2	2	2X21.25	Package-5
323	206+805	Culvert	3	3	2X21.25	Package-5
324	207+927	Culvert	3	3	2X21.25	Package-5
325	208+180	Culvert	2	2	2X21.25	Package-5
326	209+590	Culvert	2	2	2X21.25	Package-5
327	210+080	Culvert	3	3	2X21.25	Package-5
328	210+740	Culvert	2	2	2X21.25	Package-5
329	211+080	Culvert	2	2	2X21.25	Package-5
330	212+200	Culvert	3	3	2X21.25	Package-5
331	212+810	Culvert	2	2	2X21.25	Package-5
332	213+242	Culvert	2	2	2X21.25	Package-5
333	213+920	Culvert	2	2	2X21.25	Package-5
334	214+985	Culvert	3	3	2X21.25	Package-5
335	215+880	Culvert	2	2	2X21.25	Package-5
336	216+530	Culvert	2	2	2X21.25	Package-5
337	218+810	Culvert	2	2	2X21.25	Package-5
338	219+260	Culvert	2	2	2X21.25	Package-5

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
339	220+130	Culvert	2	2	2X21.25	Package-5
340	220+520	Culvert	3	3	2X21.25	Package-5
341	221+575	Culvert	5	3	2X21.25	Package-5
342	222+130	Culvert	2	2	2X21.25	Package-5
343	222+650	Culvert	2	2	2X21.25	Package-5
344	223+456	Culvert	2	2	2X21.25	Package-5
345	223+976	Culvert	3	3	2X21.25	Package-5
346	224+790	Culvert	2	2	2X21.25	Package-5
347	225+120	Culvert	2	2	2X21.25	Package-5
348	226+160	Culvert	2	2	2X21.25	Package-5
349	227+305	Culvert	2	2	2X21.25	Package-5
350	228+150	Culvert	2	2	2X21.25	Package-5
351	228+835	Culvert	3	3	2X21.25	Package-5
352	229+210	Culvert	2	2	2X21.25	Package-5
353	230+325	Culvert	3	3	2X21.25	Package-5
354	231+000	Culvert	2	2	2X21.25	Package-5
355	231+360	Culvert	2	2	2X21.25	Package-5
356	232+080	Culvert	2	2	2X21.25	Package-5
357	232+750	Culvert	3	3	2X21.25	Package-5
358	233+410	Culvert	2	2	2X21.25	Package-5
359	234+056	Culvert	3	3	2X21.25	Package-5
360	235+100	Culvert	3	3	2X21.25	Package-5
361	237+071	Culvert	3	3	2X21.25	Package -6
362	238+932	Culvert	3	3	2X21.25	Package -6
363	239+200	Culvert	2	2	2X21.25	Package -6
364	240+055	Culvert	2	2	2X21.25	Package -6
365	240+910	Culvert	3	3	2X21.25	Package -6
366	241+580	Culvert	3	3	2X21.25	Package -6
367	244+210	Culvert	3	2	2X21.25	Package -6
368	247+900	Culvert	3	3	2X21.25	Package -6
369	248+990	Culvert	3	3	2X21.25	Package -6
370	249+710	Culvert	2	2	2X21.25	Package -6
371	250+000	Culvert	2	2	2X21.25	Package -6
372	250+950	Culvert	2	2	2X21.25	Package -6
373	251+742	Culvert	3	3	2X21.25	Package -6

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
374	252+110	Culvert	3	3	2X21.25	Package -6
375	253+232	Culvert	2	2	2X21.25	Package -6
376	254+657	Culvert	3	3	2X21.25	Package -6
377	255+370	Culvert	3	2	2X21.25	Package -6
378	255+910	Culvert	3	3	2X21.25	Package -6
379	257+220	Culvert	3	3	2X21.25	Package -6
380	258+050	Culvert	2	2	2X21.25	Package -6
381	258+960	Culvert	4	2	2X21.25	Package -6
382	259+456	Culvert	3	3	2X21.25	Package -6
383	260+657	Culvert	3	3	2X21.25	Package -6
384	261+646	Culvert	3	3	2X21.25	Package -6
385	262+530	Culvert	2	2	2X21.25	Package -6
386	263+185	Culvert	2	2	2X21.25	Package -6
387	263+900	Culvert	3	3	2X21.25	Package -6
388	264+280	Culvert	2	2	2X21.25	Package -6
389	264+950	Culvert	3	3	2X21.25	Package -6
390	265+700	Culvert	3	3	2X21.25	Package -6
391	266+618	Culvert	3	3	2X21.25	Package -6
392	267+170	Culvert	2	2	2X21.25	Package -6
393	267+510	Culvert	2	2	2X21.25	Package -6
394	268+900	Culvert	3	3	2X21.25	Package -6
395	269+915	Culvert	2	2	2X21.25	Package -6
396	270+295	Culvert	2	2	2X21.25	Package -6
397	270+831	Culvert	2	2	2X21.25	Package -6
398	271+657	Culvert	3	3	2X21.25	Package -6
399	272+100	Culvert	3	3	2X21.25	Package -6
400	272+950	Culvert	2	2	2X21.25	Package -6
401	273+500	Culvert	2	2	2X21.25	Package -6
402	274+365	Culvert	3	3	2X21.25	Package -6
403	275+576	Culvert	3	3	2X21.25	Package -6
404	276+600	Culvert	2	2	2X21.25	Package -6
405	277+700	Culvert	2	2	2X21.25	Package -6
406	278+059	Culvert	2	2	2X21.25	Package -6
407	278+575	Culvert	3	3	2X21.25	Package -6
408	279+950	Culvert	2	2	2X21.25	Package -6

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
409	280+450	Culvert	2	2	2X21.25	Package -6
410	281+535	Culvert	3	3	2X21.25	Package -6
411	281+982	Culvert	4	2	2X21.25	Package -6
412	282+300	Culvert	2	2	2X21.25	Package -6
413	283+405	Culvert	2	2	2X21.25	Package -6
414	284+280	Culvert	2	2	2X21.25	Package -6
415	285+438	Culvert	2	2	2X21.25	Package -6
416	286+171	Culvert	2	2	2X21.25	Package -6
417	286+971	Culvert	2	2	2X21.25	Package -6
418	287+935	Culvert	2	2	2X21.25	Package -6
419	288+700	Culvert	3	3	2X21.25	Package -6
420	242+710	HPC	2x1200	Package -6	2x21.25	Package -7
421	243+610	HPC	2x1200	Package -6	2x21.25	Package -7
422	245+550	HPC	2x1200	Package -6	2x21.25	Package -7
423	246+520	HPC	2x1200	Package -6	2x21.25	Package -7
424-426	255+167	Culverts @ Double Trumpet	3	3	3 culverts	Package-6
427-434	255+167	Culverts @ Double Trumpet	1x1200	8 culverts	Package-6	Package-8
435-438	282+845	Culverts @ Diamond Interchange	3	3	4 culvert	Package-6
439	254+200	HPC @ Way Side Amenities	1x1200	1 culvert	Package-6	Package-8
440	254+200	HPC @ Way Side Amenities	1x1200	1 culvert	Package-6	Package-8
441	289+386	Culvert	2	2	2x21.25	Package -7
442	289+963	Culvert	3	3	2x21.25	Package -7
443	290+540	Culvert	2	2	2x21.25	Package -7
444	291+440	Culvert	2	2	2x21.25	Package -7
445	292+430	Culvert	2	2	2x21.25	Package -7
446	293+140	Culvert	2	2	2x21.25	Package -7
447	293+555	Culvert	3	3	2x21.25	Package -7
448	294+565	Culvert	2	2	2x21.25	Package -7
449	295+160	Culvert	3	3	2x21.25	Package -7
450	296+710	Culvert	2	2	2x21.25	Package -7
451	297+485	Culvert	3	3	2x21.25	Package -7
452	298+485	Culvert	3	3	2x21.25	Package -7
453	299+300	Culvert	6	2	2x21.25	Package -7
454	299+987	Culvert	2	2	2x21.25	Package -7

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
455	300+570	Culvert	2	2	2x21.25	Package -7
456	301+147	Culvert	2	2	2x21.25	Package -7
457	301+638	Culvert	3	3	2x21.25	Package -7
458	301+960	Culvert	3	3	2x21.25	Package -7
459	302+850	Culvert	2	2	2x21.25	Package -7
460	303+973	Culvert	2	2	2x21.25	Package -7
461	304+750	Culvert	2	2	2x21.25	Package -7
462	305+080	Culvert	3	3	2x21.25	Package -7
463	305+550	Culvert	2	2	2x21.25	Package -7
464	306+048	Culvert	2	2	2x21.25	Package -7
465	307+243	Culvert	2	2	2x21.25	Package -7
466	307+818	Culvert	3	3	2x21.25	Package -7
467	308+635	Culvert	2	2	2x21.25	Package -7
468	309+945	Culvert	2	2	2x21.25	Package -7
469	310+830	Culvert	2	2	2x21.25	Package -7
470	311+082	Culvert	2	2	2x21.25	Package -7
471	312+050	Culvert	2	2	2x21.25	Package -7
472	313+030	Culvert	2	2	2x21.25	Package -7
473	314+240	Culvert	3	3	2x21.25	Package -7
474	315+170	Culvert	2	2	2x21.25	Package -7
475	315+600	Culvert	3	3	2x21.25	Package -7
476	316+630	Culvert	2	2	2x21.25	Package -7
477	317+390	Culvert	2	2	2x21.25	Package -7
478	318+600	Culvert	2	2	2x21.25	Package -7
479	319+470	Culvert	2	2	2x21.25	Package -7
480	320+350	Culvert	2	2	2x21.25	Package -7
481	321+720	Culvert	2	2	2x21.25	Package -7
482	322+667	Culvert	2	2	2x21.25	Package -7
483	323+467	Culvert	2	2	2x21.25	Package -7
484	324+210	Culvert	2	2	2x21.25	Package -7
485	325+300	Culvert	3	3	2x21.25	Package -7
486	325+790	Culvert	2	2	2x21.25	Package -7
487	326+930	Culvert	3	3	2x21.25	Package -7
488	327+640	Culvert	3	3	2x21.25	Package -7
489	328+110	Culvert	2	2	2x21.25	Package -7

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
490	329+517	Culvert	2	2	2x21.25	Package -7
491	330+152	Culvert	3	2	2x21.25	Package -7
492	330+810	Culvert	2	2	2x21.25	Package -7
493	331+153	Culvert	2	2	2x21.25	Package -7
494	332+140	Culvert	2	2	2x21.25	Package -7
495	333+690	Culvert	2	2	2x21.25	Package -7
496	334+076	Culvert	2	2	2x21.25	Package -7
497	334+680	Culvert	2	2	2x21.25	Package -7
498	335+475	Culvert	3	3	2x21.25	Package -7
499	336+320	Culvert	2	2	2x21.25	Package -7
500	337+075	Culvert	3	2	2x21.25	Package -7
501	337+500	Culvert	2	2	2x21.25	Package -7
502	338+095	Culvert	4	2	2x21.25	Package -7
503	338+375	Culvert	3	3	2x21.25	Package -7
504	339+270	Culvert	2	2	2x21.25	Package -7
505	339+640	Culvert	2	2	2x21.25	Package -7
506	340+010	Culvert	2	2	2x21.25	Package -7
507	341+610	Culvert	2	2	2x21.25	Package -7
508-511	328+200	Culverts @ Double Trumpet	3	3	4 culverts	Package-7
512-517	328+200	HPC @ Double Trumpet	1x1200		6 culverts	Package-7
518	326+500	HPC @ Way Side Amenities	1x1200		1 culvert	Package-7
519	326+500	HPC @ Way Side Amenities	1x1200		1 culvert	Package-7
520	342+583	Culvert	2	2	2 x 21.25	Package-8
521	343+062	Culvert	3	3	2 x 21.25	Package-8
522	343+560	Culvert	3	3	2 x 21.25	Package-8
523	344+035	Culvert	3	3	2 x 21.25	Package-8
524	344+593	Culvert	3	3	2 x 21.25	Package-8
525	345+167	Culvert	6	3	2 x 21.25	Package-8
526	345+970	Culvert	2	2	2 x 21.25	Package-8
527	346+272	Culvert	3	3	2 x 21.25	Package-8
528	346+800	Culvert	2	2	2 x 21.25	Package-8
529	347+433	Culvert	3	3	2 x 21.25	Package-8
530	348+136	Culvert	3	3	2 x 21.25	Package-8
531	348+940	Culvert	2	2	2 x 21.25	Package-8

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
532	349+670	Culvert	3	3	2 x 21.25	Package-8
533	350+382	Culvert	3	3	2 x 21.25	Package-8
534	350+880	Culvert	3	3	2 x 21.25	Package-8
535	351+815	Culvert	3	3	2 x 21.25	Package-8
536	352+292	Culvert	3	3	2 x 21.25	Package-8
537	353+463	Culvert	3	3	2 x 21.25	Package-8
538	354+580	Culvert	3	3	2 x 21.25	Package-8
539	355+310	Culvert	2	2	2 x 21.25	Package-8
540	355+730	Culvert	3	3	2 x 21.25	Package-8
541	356+760	Culvert	2	2	2 x 21.25	Package-8
542	357+746	Culvert	2	2	2 x 21.25	Package-8
543	358+057	Culvert	3	3	2 x 21.25	Package-8
544	359+753	Culvert	2	2	2 x 21.25	Package-8
545	360+197	Culvert	3	2.5	2 x 21.25	Package-8
546	361+290	Culvert	2	2	2 x 21.25	Package-8
547	361+898	Culvert	2	2	2 x 21.25	Package-8
548	362+300	Culvert	2	2	2 x 21.25	Package-8
549	363+356	Culvert	2	2	2 x 21.25	Package-8
550	364+272	Culvert	3	3	2 x 21.25	Package-8
551	364+470	Culvert	2	2	2 x 21.25	Package-8
552	365+663	Culvert	3	3	2 x 21.25	Package-8
553	366+380	Culvert	2	2	2 x 21.25	Package-8
554	366+940	Culvert	3	3	2 x 21.25	Package-8
555	367+930	Culvert	2	2	2 x 21.25	Package-8
556	369+187	Culvert	3	3	2 x 21.25	Package-8
557	370+220	Culvert	2	2	2 x 21.25	Package-8
558	371+845	Culvert	2	2	2 x 21.25	Package-8
559	372+320	Culvert	2	2	2 x 21.25	Package-8
560	373+195	Culvert	2	2	2 x 21.25	Package-8
561	374+080	Culvert	2	2	2 x 21.25	Package-8
562	374+619	Culvert	3	3	2 x 21.25	Package-8
563	375+344	Culvert	2	2	2 x 21.25	Package-8
564	375+699	Culvert	3	3	2 x 21.25	Package-8
565	376+709	Culvert	2	2	2 x 21.25	Package-8
566	378+431	Culvert	3	3	2 x 21.25	Package-8

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
567	379+393	Culvert	2	2	2 x 21.25	Package-8
568	381+254	Culvert	2	2	2 x 21.25	Package-8
569	382+080	Culvert	2	2	2 x 21.25	Package-8
570	382+619	Culvert	3	2.5	2 x 21.25	Package-8
571	383+584	Culvert	3	3	2 x 21.25	Package-8
572	384+705	Culvert	2	2	2 x 21.25	Package-8
573	385+931	Culvert	3	3	2 x 21.25	Package-8
574	386+504	Culvert	3	3	2 x 21.25	Package-8
575	387+169	Culvert	2	2	2 x 21.25	Package-8
576	387+969	Culvert	3	3	2 x 21.25	Package-8
577	388+914	Culvert	3	3	2 x 21.25	Package-8
578	389+244	Culvert	2	2	2 x 21.25	Package-8
579	390+502	Culvert	2	2	2 x 21.25	Package-8
580	391+459	Culvert	3	3	2 x 21.25	Package-8
581-582	378+155	Culverts @ Double Trumpet	3	3	**2 Culverts**	Package-8
583	378+155	Culverts @ Double Trumpet	2	2	**1 Culvert**	Package-8
584	378+155	Culverts @ Double Trumpet	2	2	**1 Culvert**	Package-8
585-586	378+155	HPC @ Double Trumpet	6x1200	**2 Culverts**	Package-8	
587-588	378+155	HPC @ Double Trumpet	3x1200	**2 Culverts**	Package-8	
589-591	378+155	HPC @ Double Trumpet	1x1200	**3 Culverts**	Package-8	
592	378+155	HPC @ Double Trumpet	2x1200	**1 Culvert**	Package-8	
593	377+492	HPC @ Way Side Amenities	1X1200	**1 Culvert**	Package-8	
594	377+492	HPC @ Way Side Amenities	1X1200	**1 Culvert**	Package-8	
595	392+180	Culvert	2	2	2X21.25	Package-9
596	393+093	Culvert	2	2	2X21.25	Package-9
597	394+717	Culvert	2	2	2X21.25	Package-9
598	395+170	Culvert	2	2	2X21.25	Package-9
599	396+761	Culvert	2	2	2X21.25	Package-9
600	397+550	Culvert	2	2	2X21.25	Package-9
601	398+245	Culvert	3	3	2X21.25	Package-9
602	399+192	Culvert	3	3	2X21.25	Package-9
603	399+630	Culvert	2	2	2X21.25	Package-9
604	400+002	Culvert	3	3	2X21.25	Package-9
605	400+670	Culvert	2	2	2X21.25	Package-9

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
606	401+580	Culvert	2	2	2X21.25	Package-9
607	402+530	Culvert	2	2	2X21.25	Package-9
608	403+413	Culvert	2	2	2X21.25	Package-9
609	403+850	Culvert	3	3	2X21.25	Package-9
610	404+176	Culvert	3	3	2X21.25	Package-9
611	405+500	Culvert	2	2	2X21.25	Package-9
612	406+430	Culvert	2	2	2X21.25	Package-9
613	407+470	Culvert	3	3	2X21.25	Package-9
614	408+675	Culvert	2	2	2X21.25	Package-9
615	409+270	Culvert	3	3	2X21.25	Package-9
616	410+240	Culvert	2	2	2X21.25	Package-9
617	410+819	Culvert	2	2	2X21.25	Package-9
618	410+856	Culvert	2	2	2X21.25	Package-9
619	411+263	Culvert	2	2	2X21.25	Package-9
620	411+531	Culvert	2	2	2X21.25	Package-9
621	412+095	Culvert	2	2	2X21.25	Package-9
622	412+890	Culvert	2	2	2X21.25	Package-9
623	413+700	Culvert	2	2	2X21.25	Package-9
624	414+572	Culvert	2	2	2X21.25	Package-9
625	415+550	Culvert	2	2	2X21.25	Package-9
626	416+134	Culvert	2	2	2X21.25	Package-9
627	416+820	Culvert	2	2	2X21.25	Package-9
628	417+110	Culvert	3	3	2X21.25	Package-9
629	417+302	Culvert	4	3	2X21.25	Package-9
630	418+410	Culvert	3	3	2X21.25	Package-9
631	419+280	Culvert	2	2	2X21.25	Package-9
632	419+590	Culvert	3	3	2X21.25	Package-9
633	421+060	Culvert	5	3	2X21.25	Package-9
634	421+590	Culvert	3	3	2X21.25	Package-9
635	422+720	Culvert	3	3	2X21.25	Package-9
636	423+610	Culvert	2	2	2X21.25	Package-9
637	424+561	Culvert	2	2	2X21.25	Package-9
638	425+468	Culvert	2	2	2X21.25	Package-9
639	426+100	Culvert	3	3	2X21.25	Package-9
640	426+202	Culvert	3	3	2X21.25	Package-9

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
641	426+835	Culvert	3	2	2X21.25	Package-9
642	427+130	Culvert	2	2	2X21.25	Package-9
643	428+369	Culvert	3	3	2X21.25	Package-9
644	429+300	Culvert	2	2	2X21.25	Package-9
645	430+428	Culvert	3	3	2X21.25	Package-9
646	431+664	Culvert	2	2	2X21.25	Package-9
647	432+060	Culvert	3	3	2X21.25	Package-9
648	433+170	Culvert	2	2	2X21.25	Package-9
649	434+260	Culvert	2	2	2X21.25	Package-9
650	434+650	Culvert	2	2	2X21.25	Package-9
651	435+032	Culvert	2	2	2X21.25	Package-9
652	435+480	Culvert	2	2	2X21.25	Package-9
653	436+263	Culvert	3	3	2X21.25	Package-9
654	436+790	Culvert	2	2	2X21.25	Package-9
655	437+430	Culvert	2	2	2X21.25	Package-9
656	438+268	Culvert	3	3	2X21.25	Package-9
657	438+600	Culvert	6	3	2X21.25	Package-9
658	439+265	Culvert	3	3	2X21.25	Package-9
659	439+623	Culvert	3	2	2X21.25	Package-9
660	440+140	Culvert	2	2	2X21.25	Package-9
661	440+870	Culvert	2	2	2X21.25	Package-9
662	441+430	Culvert	3	3	2X21.25	Package-9
663	442+000	Culvert	2	2	2X21.25	Package-9
664	442+485	Culvert	2	2	2X21.25	Package-9
665	442+840	Culvert	2	2	2X21.25	Package-9
666	443+499	Culvert	2	2	2X21.25	Package-9
667	444+463	Culvert	2	2	2X21.25	Package-9
668-669	420+932	Culverts @ Diamond Interchange	2	2	2 Culverts	Package-9
670	420+932	Culverts @ Diamond Interchange	5	3	1 Culvert	Package-9
671	420+932	Culverts @ Diamond Interchange	5	3	1 Culvert	Package-9
672	423+844	HPC @ Way Side Amenities	1X1200	1 Culvert	Package-9	Package-11
673	424+140	HPC @ Way Side Amenities	1X1200	1 Culvert	Package-9	Package-11
674	445+300	Culvert	2	2	2 x 21.25	Package-10
675	445+680	Culvert	2	2	2 x 21.25	Package-10
676	446+243	Culvert	3	3	2 x 21.25	Package-10

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
677	446+765	Culvert	2	2	2 x 21.25	Package-10
678	446+939	Culvert	2	2	2 x 21.25	Package-10
679	447+700	Culvert	2	2	2 x 21.25	Package-10
680	448+581	Culvert	3	3	2 x 21.25	Package-10
681	448+780	Culvert	2	2	2 x 21.25	Package-10
682	449+265	Culvert	3	3	2 x 21.25	Package-10
683	450+420	Culvert	3	3	2 x 21.25	Package-10
684	451+363	Culvert	3	3	2 x 21.25	Package-10
685	452+536	Culvert	2	2	2 x 21.25	Package-10
686	453+621	Culvert	2	2	2 x 21.25	Package-10
687	454+332	Culvert	2	2	2 x 21.25	Package-10
688	455+250	Culvert	3	3	2 x 21.25	Package-10
689	455+892	Culvert	2	2	2 x 21.25	Package-10
690	456+345	Culvert	2	2	2 x 21.25	Package-10
691	457+680	Culvert	2	2	2 x 21.25	Package-10
692	458+175	Culvert	2	2	2 x 21.25	Package-10
693	459+190	Culvert	2	2	2 x 21.25	Package-10
694	460+896	Culvert	2	2	2 x 21.25	Package-10
695	461+370	Culvert	2	2	2 x 21.25	Package-10
696	461+805	Culvert	2	2	2 x 21.25	Package-10
697	462+380	Culvert	2	2	2 x 21.25	Package-10
698	463+033	Culvert	2	2	2 x 21.25	Package-10
699	464+180	Culvert	3	3	2 x 21.25	Package-10
700	464+826	Culvert	2	2	2 x 21.25	Package-10
701	465+796	Culvert	3	3	2 x 21.25	Package-10
702	466+490	Culvert	2	2	2 x 21.25	Package-10
703	467+826	Culvert	2	2	2 x 21.25	Package-10
704	468+215	Culvert	2	2	2 x 21.25	Package-10
705	468+400	Culvert	2	2	2 x 21.25	Package-10
706	469+720	Culvert	3	3	2 x 21.25	Package-10
707	470+210	Culvert	2	2	2 x 21.25	Package-10
708	471+288	Culvert	2	2	2 x 21.25	Package-10
709	472+062	Culvert	3	3	2 x 21.25	Package-10
710	472+735	Culvert	2	2	2 x 21.25	Package-10
711	473+524	Culvert	2	2	2 x 21.25	Package-10

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
712	473+930	Culvert	2	2	2 x 21.25	Package-10
713	474+480	Culvert	2	2	2 x 21.25	Package-10
714	475+345	Culvert	3	2.5	2 x 21.25	Package-10
715	476+240	Culvert	2	2	2 x 21.25	Package-10
716	476+635	Culvert	3	3	2 x 21.25	Package-10
717	478+758	Culvert	3	3	2 x 21.25	Package-10
718	479+306	Culvert	3	2	2 x 21.25	Package-10
719	480+150	Culvert	3	3	2 x 21.25	Package-10
720	481+700	Culvert	2	2	2 x 21.25	Package-10
721	482+000	Culvert	3	2	2 x 21.25	Package-10
722	482+923	Culvert	2	2	2 x 21.25	Package-10
723	483+230	Culvert	3	3	2 x 21.25	Package-10
724	484+000	Culvert	3	3	2 x 21.25	Package-10
725	484+400	Culvert	2	2	2 x 21.25	Package-10
726	485+365	Culvert	2	2	2 x 21.25	Package-10
727	486+270	Culvert	3	3	2 x 21.25	Package-10
728	488+380	Culvert	2	2	2 x 21.25	Package-10
729	488+567	Culvert	2	2	2 x 21.25	Package-10
730	489+780	Culvert	2	2	2 x 21.25	Package-10
731	490+220	Culvert	2	2	2 x 21.25	Package-10
732	490+700	Culvert	2	2	2 x 21.25	Package-10
733	491+051	Culvert	2	2	2 x 21.25	Package-10
734	491+920	Culvert	3	3	2 x 21.25	Package-10
735	492+160	Culvert	2	2	2 x 21.25	Package-10
736	493+247	Culvert	2	2	2 x 21.25	Package-10
737	494+760	Culvert	2	2	2 x 21.25	Package-10
738	495+532	Culvert	2	2	2 x 21.25	Package-10
739	496+550	Culvert	2	2	2 x 21.25	Package-10
740	487+285	Culverts @ Double Trumpet	2	2	1 Culvert	Package-10
741	487+285	Culverts @ Double Trumpet	2	2	1 Culvert	Package-10
742	487+285	HPC @ Double Trumpet	1x1200	1 Culvert	Package-10	Package-12
743	487+285	HPC @ Double Trumpet	1x1200	1 Culvert	Package-10	Package-12
744	487+285	HPC @ Double Trumpet	1x1200	1 Culvert	Package-10	Package-12
745-750	487+285	HPC @ Double Trumpet	1x1200	6 Culverts	Package-10	Package-12
751-	487+285	HPC @ Double Trumpet	1x1200	2 Culverts	Package-10	Package-12

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
752						
753	480+900	HPC @ WSA	1X1200	1 Culvert	Package-10	Package-12
754	481+000	HPC @ WSA	1X1200	1 Culvert	Package-10	Package-12
755	498+308	Culvert	2	2	2X21.25	Package-11
756	499+520	Culvert	2	2	2X21.25	Package-11
757	500+240	Culvert	3	3	2X21.25	Package-11
758	501+255	Culvert	2	2	2X21.25	Package-11
759	501+762	Culvert	5	3	2X21.25	Package-11
760	502+561	Culvert	2	2	2X21.25	Package-11
761	503+200	Culvert	2	2	2X21.25	Package-11
762	503+860	Culvert	2	2	2X21.25	Package-11
763	504+146	Culvert	5	3	2X21.25	Package-11
764	504+680	Culvert	3	3	2X21.25	Package-11
765	505+560	Culvert	3	2	2X21.25	Package-11
766	506+018	Culvert	5	3	2X21.25	Package-11
767	506+690	Culvert	2	2	2X21.25	Package-11
768	507+700	Culvert	3	3	2X21.25	Package-11
769	508+383	Culvert	3	3	2X21.25	Package-11
770	509+850	Culvert	3	3	2X21.25	Package-11
771	510+875	Culvert	3	3	2X21.25	Package-11
772	511+279	Culvert	3	3	2X21.25	Package-11
773	511+934	Culvert	3	3	2X21.25	Package-11
774	512+640	Culvert	2	2	2X21.25	Package-11
775	513+300	Culvert	2	2	2X21.25	Package-11
776	513+633	Culvert	2	2	2X21.25	Package-11
777	514+472	Culvert	2	2	2X21.25	Package-11
778	514+845	Culvert	3	2	2X21.25	Package-11
779	515+280	Culvert	2	2	2X21.25	Package-11
780	516+786	Culvert	3	2	2X21.25	Package-11
781	517+020	Culvert	2	2	2X21.25	Package-11
782	518+920	Culvert	2	2	2X21.25	Package-11
783	519+480	Culvert	3	2	2X21.25	Package-11
784	520+377	Culvert	3	2	2X21.25	Package-11
785	520+906	Culvert	5	3	2X21.25	Package-11
786	521+608	Culvert	3	3	2X21.25	Package-11

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
787	522+200	Culvert	2	2	2X21.25	Package-11
788	522+779	Culvert	3	2	2X21.25	Package-11
789	523+185	Culvert	3	2	2X21.25	Package-11
790	523+864	Culvert	3	3	2X21.25	Package-11
791	524+900	Culvert	3	3	2X21.25	Package-11
792	525+105	Culvert	2	2	2X21.25	Package-11
793	525+583	Culvert	3	2	2X21.25	Package-11
794	526+040	Culvert	2	2	2X21.25	Package-11
795	526+540	Culvert	2	2	2X21.25	Package-11
796	527+288	Culvert	2	2	2X21.25	Package-11
797	527+941	Culvert	6	3	2X21.25	Package-11
798	528+000	Culvert	3	3	2X21.25	Package-11
799	528+300	Culvert	3	2	2X21.25	Package-11
800	529+450	Culvert	2	2	2X21.25	Package-11
801	530+620	Culvert	2	2	2X21.25	Package-11
802	531+580	Culvert	2	2	2X21.25	Package-11
803	532+450	Culvert	2	2	2X21.25	Package-11
804	532+780	Culvert	2	2	2X21.25	Package-11
805	533+400	Culvert	2	2	2X21.25	Package-11
806	533+815	Culvert	5	3	2X21.25	Package-11
807	534+159	Culvert	4	3	2X21.25	Package-11
808	535+400	Culvert	3	3	2X21.25	Package-11
809	536+665	Culvert	4	3	2X21.25	Package-11
810	537+352	Culvert	3	2	2X21.25	Package-11
811	537+835	Culvert	5	3	2X21.25	Package-11
812	538+080	Culvert	2	2	2X21.25	Package-11
813	539+200	Culvert	2	2	2X21.25	Package-11
814	540+330	Culvert	3	3	2X21.25	Package-11
815	540+815	Culvert	6	3	2X21.25	Package-11
816	541+110	Culvert	2	2	2X21.25	Package-11
817	541+860	Culvert	3	3	2X21.25	Package-11
818	542+494	Culvert	3	3	2X21.25	Package-11
819	543+000	Culvert	3	3	2X21.25	Package-11
820	543+732	Culvert	4	3	2X21.25	Package-11
821	544+100	Culvert	3	2	2X21.25	Package-11

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
822	544+258	Culvert	4	3	2X21.25	Package-11
823	544+563	Culvert	6	3	2X21.25	Package-11
824	545+460	Culvert	6	3	2X21.25	Package-11
825	546+710	Culvert	4	3	2X21.25	Package-11
826	547+395	Culvert	3	2	2X21.25	Package-11
827	547+915	Culvert	2	2	2X21.25	Package-11
828	548+121	Culvert	3	2	2X21.25	Package-11
829	517+439	Culverts @ Double Trumpet	3	2	1 culvert	Package-11
830	517+439	Culverts @ Double Trumpet	3	2	1 culvert	Package-11
831-832	517+439	Culverts @ Double Trumpet	2	2	2 culverts	Package-11
833-843	517+439	HPC @ Double Trumpet	1x1200	11 culverts	Package-11	
844	522+635	CULVERT Beside VUP	3	2	1 culvert	Package-11
845	536+880	CULVERT Beside SVUP	4	2	1 culvert	Package-11
846	540+800	HPC @ Way Side Amenities	1x1200	1 culvert	Package-11	
847	540+800	HPC @ Way Side Amenities	1x1200	1 culvert	Package-11	
848	548+993	Culvert	3	2	2 x 21.25	Package-12
849	549+506	Culvert	3	2	2 x 21.25	Package-12
850	550+320	Culvert	3	3	2 x 21.25	Package-12
851	551+436	Culvert	4	3	2 x 21.25	Package-12
852	552+086	Culvert	3	3	2 x 21.25	Package-12
853	552+757	Culvert	6	3	2 x 21.25	Package-12
854	553+310	Culvert	2	2	2 x 21.25	Package-12
855	553+750	Culvert	4	3	2 x 21.25	Package-12
856	554+155	Culvert	2	2	2 x 21.25	Package-12
857	555+710	Culvert	3	3	2 x 21.25	Package-12
858	556+100	Culvert	3	3	2 x 21.25	Package-12
859	556+955	Culvert	2	2	2 x 21.25	Package-12
860	557+455	Culvert	2	2	2 x 21.25	Package-12
861	558+840	Culvert	6	3	2 x 21.25	Package-12
862	559+660	Culvert	6	3	2 x 21.25	Package-12
863	560+306	Culvert	2	2	2 x 21.25	Package-12
864	561+970	Culvert	2	2	2 x 21.25	Package-12
865	562+457	Culvert	3	3	2 x 21.25	Package-12
866	563+470	Culvert	2	2	2 x 21.25	Package-12

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
867	563+810	Culvert	2	2	2 x 21.25	Package-12
868	564+210	Culvert	2	2	2 x 21.25	Package-12
869	565+061	Culvert	5	3	2 x 21.25	Package-12
870	565+190	Culvert	6	3	2 x 21.25	Package-12
871	566+180	Culvert	4	3	2 x 21.25	Package-12
872	567+290	Culvert	5	3	2 x 21.25	Package-12
873	568+360	Culvert	2	2	2 x 21.25	Package-12
874	569+760	Culvert	2	2	2 x 21.25	Package-12
875	570+253	Culvert	3	3	2 x 21.25	Package-12
876	570+570	Culvert	2	2	2 x 21.25	Package-12
877	571+530	Culvert	2	2	2 x 21.25	Package-12
878	571+756	Culvert	3	2	2 x 21.25	Package-12
879	571+936	Culvert	3	2	2 x 21.25	Package-12
880	572+410	Culvert	2	2	2 x 21.25	Package-12
881	573+100	Culvert	2	2	2 x 21.25	Package-12
882	573+690	Culvert	2	2	2 x 21.25	Package-12
883	574+180	Culvert	2	2	2 x 21.25	Package-12
884	574+784	Culvert	4	3	2 x 21.25	Package-12
885	575+965	Culvert	3	3	2 x 21.25	Package-12
886	576+093	Culvert	2	2	2 x 21.25	Package-12
887	576+870	Culvert	2	2	2 x 21.25	Package-12
888	577+330	Culvert	2	2	2 x 21.25	Package-12
889	578+150	Culvert	2	2	2 x 21.25	Package-12
890	579+520	Culvert	2	2	2 x 21.25	Package-12
891	580+740	Culvert	2	2	2 x 21.25	Package-12
892	581+106	Culvert	3	3	2 x 21.25	Package-12
893	582+503	Culvert	2	2	2 x 21.25	Package-12
894	583+360	Culvert	2	2	2 x 21.25	Package-12
895	584+080	Culvert	2	2	2 x 21.25	Package-12
896	585+592	Culvert	3	2	2 x 21.25	Package-12
897	585+850	Culvert	2	2	2 x 21.25	Package-12
898	586+236	Culvert	2	2	2 x 21.25	Package-12
899	586+405	Culvert	3	3	2 x 21.25	Package-12
900	586+907	Culvert	4	3	2 x 21.25	Package-12
901	587+980	Culvert	3	3	2 x 21.25	Package-12

S. No.	Chainage	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
			Lateral Clearance (m)	Vertical Clearance (m)		
902	588+256	Culvert	3	3	2 x 21.25	Package-12
903	588+945	Culvert	2	2	2 x 21.25	Package-12
904	590+050	Culvert	6	1.5	2 x 21.25	Package-12
905	590+650	Culvert	2	2	2 x 21.25	Package-12
906	590+925	Culvert	6	3	2 x 21.25	Package-12
907	591+496	Culvert	2	2	2 x 21.25	Package-12
908	593+095	Culvert	3	3	2 x 21.25	Package-12
909	593+842	Culvert	5	3	2 x 21.25	Package-12
910	594+086	Culvert	3	3	2 x 21.25	Package-12
911	595+160	Culvert	2	2	2 x 21.25	Package-12
912	595+900	Culvert	2	2	2 x 21.25	Package-12
913	596+270	Culvert	4	3	2 x 21.25	Package-12
914	597+153	Culvert	2	2	2 x 21.25	Package-12
915	597+375	Culvert	3	3	2 x 21.25	Package-12
916	598+193	Culvert	3	2	2 x 21.25	Package-12
917	598+565	Culvert	2	2	2 x 21.25	Package-12
918	599+345	Culvert	2	2	2 x 21.25	Package-12
919	599+990	Culvert	2	2	2 x 21.25	Package-12
920-923	554+951	Culverts @ Diamond Interchange	3	3	4 culverts	Package-12
924-926	600+457	HPC @ Trumpet	1x1200	3 culverts	Package-12	
927	601+280	Culverts @ Trumpet	2	2	1 culvert	Package-12
928	563+010	CULVERT Beside LVUP	3	2	1 culvert	Package-12
929	576+587	CULVERT Beside VUP	3	2	1 Culvert	Package-12

8.5 PROPOSALS FOR ROBs

Total 7 nos. of ROBs have been proposed as listed in **Table-8.4** below:

Table-8.4 List of ROBs

S. No.	Chainage	Type of Structure			Span Arrangement	Width of Structure (m)	Skew Angle, if any	Remarks
		Foundation	Sub Structure	Super Structure				
1	35+270	PILE	R.C.C.	Bowstring	1X15 x 64.090 + 1X 15	4X12.5	0	Package-1
2	123+100	Pile	R.C.C.	Bowstring	1X76.080 +2X15	4X12.5	16	Package-3
3	188+100	Pile	R.C.C.	Bowstring	1 X 15+ 1X 45.484 + 1X15	4X12.5	0	Package-4
4	354+778	Pile	R.C.C.	Bowstring	1X15 + 1X45.48 +1X15	4X12.5	10	Package-8

S. No.	Chainage	Type of Structure			Span Arrangement	Width of Structure (m)	Skew Angle, if any	Remarks
		Foundation	Sub Structure	Super Structure				
5	420+100	Pile	R.C.C.	Bowstring	1X15+1X64.09+1X15	4X12.5	0	Package-9
6	503+025	Pile	R.C.C	Bowstring	1X15+1X51.4+1X15	4X12.5	0	Package-11
7	516+100	Pile	R.C.C	Bowstring	1X15+1X64.09+1X15	4X12.5	7	Package-11

8.6 PROPOSALS FOR VUPs

Total 50 nos. of VUPs have been proposed as listed in **Table-8.5** below:

Table-8.5 List of VUPs

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Skew Angle, if any	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)			
1	12+438	ODR	Box	1X12	5.5	2x21.25	25	Package-1
2	69+842	ODR	Box	2X10	5.5	2x21.25	20	Package-2
3	74+900	WSA	Box	2X10	5.5	2x21.25	0	Package-2
4	83+182	ODR	Box	2X10	5.5	2x21.25	0	Package-2
5	124+051	Interchange	Box	2X10	5.5	2X21.25	0	Package-3
6	125+300	WSA	Box	2X10	5.5	2X21.25	0	Package-3
7	146+275	ODR	Box	2X10	5.5	2 x 21.25	45	Package-4
8	152+328	ODR	Box	2X10	5.5	2 x 21.25	20	Package-4
9	166+966	ODR	Box	2X10	5.5	2 x 21.25	0	Package-4
10	175+000	WSA	Box	2X10	5.5	2 x 21.25	0	Package-4
11	180+276	MDR	Box	2X10	5.5	2 x 21.25	7	Package-4
12	188+445	Interchange	Box	2X10	5.5	2 x 21.25	0	Package-4
13	211+540	MDR	Box	2X10	5.5	2X21.25	30	Package-5
14	248+627	MDR	Box	2X10	5.5	2X21.25	20	Package-6
15	254+200	WSA	Box	2X10	5.5	2X21.25	0	Package-6
16	256+316	Interchange	Box	2X10	5.5	2X21.25	0	Package-6
17	281+928	ODR	Box	2X10	5.5	2x21.25	55	Package-6
18	292+637	ODR	Box	2X10	5.5	2x21.25	45	Package-7
19	303+602	MDR/SH	Box	2X10	5.5	2x21.25	10	Package-7
20	308+111	MDR/SH	Box	2X10	5.5	2x21.25	48	Package-7
21	324+663	MDR / SH	Box	2X10	5.5	2x21.25	35	Package-7
22	326+500	WSA	Box	2X10	5.5	2x21.25	0	Package-7
23	328+720	Interchange	Box	2X10	5.5	1x21.25+1x25.75	0	Package-7
24	345+739	ODR	Box	2X10	5.5	2X21.25	8	Package-8

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Skew Angle, if any	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)			
25	351+311	ODR	Box	2X10	5.5	2X21.25	0	Package-8
26	376+111	Interchange	Box	2X10	5.5	2X21.25	12	Package-8
27	377+473	WSA	Box	2X10	5.5	2X21.25	0	Package-8
28	395+440	ODR	Box	2X10	5.5	2X21.25	10	Package-9
29	398+662	ODR	Box	2X10	5.5	2X21.25	15	Package-9
30	401+755	ODR	Box	2X10	5.5	2X21.25	20	Package-9
31	423+352	ODR	Box	2X10	5.5	2X21.25	15	Package-9
32	424+000	WSA	Box	2X10	5.5	2X21.25	0	Package-9
33	432+750	MDR	Box	2X10	5.5	2X21.25	48	Package-9
34	438+821	ODR	Box	2X10	5.5	2X21.25	45	Package-9
35	446+625	ODR	Box	2X10	5.5	2X21.25	0	Package-10
36	460+245	ODR	Box	2X10	5.5	2X21.25	45	Package-10
37	480+900	WSA	Box	2X10	5.5	2X21.25	0	Package-10
38	487+952	Interchange	Box	2X10	5.5	2x21.25	20	Package-10
39	511+764	ODR	Box	2X10	5.5	2X21.25	0	Package-11
40	520+595	Interchange	Box	2X10	5.5	2X21.25	45	Package-11
41	522+635	ODR	Box	2X10	5.5	2X21.25	0	Package-11
42	533+020	ODR	Box	2X10	5.5	2x21.25	20	Package-11
43	540+905	ODR	Box	2X10	5.5	2x21.25	7	Package-11
44	541+645	WSA	Box	2X10	5.5	2x21.25	0	Package-11
45	546+286	ODR	Box	2X10	5.5	2x21.25	31	Package-11
46	549+206	ODR	Box	2X10	5.5	2x21.25	11	Package-12
47	556+420	ODR	Box	2X10	5.5	2x21.25	14	Package-12
48	576+587	ODR	Box	2X10	5.5	2x21.25	2	Package-12
49	592+516	ODR	Box	2X10	5.5	2x21.25	35	Package-12
50	599+008	ODR	Box	2X10	5.5	2x21.25	20	Package-12

8.7 PROPOSALS FOR LVUPs

Total 171 nos. of LVUPs have been proposed as listed in **Table 8.6** below:

Table-8.6 List of LVUPs

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
1	10+333	VR	Box	12	4.5	2x21.25	Package-1

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
2	14+100	VR	Box	12	4.5	2x21.25	Package-1
3	14+800	VR	Box	12	4.5	2x21.25	Package-1
4	18+614	VR	Box	12	4.5	2x21.25	Package-1
5	22+200	VR	Box	12	4.5	2x21.25	Package-1
6	23+370	VR	Box	12	4.5	2x21.25	Package-1
7	25+670	VR	Box	12	4.5	2x21.25	Package-1
8	28+159	VR	Box	12	4.5	2x21.25	Package-1
9	29+967	VR	Box	12	4.5	2x21.25	Package-1
10	30+769	VR	Box	12	4.5	2x21.25	Package-1
11	32+826	VR	Box	12	4.5	2x21.25	Package-1
12	36+767	VR	Box	12	4.5	2x21.25	Package-1
13	37+840	VR	Box	12	4.5	2x21.25	Package-1
14	38+500	VR	Box	12	4.5	2x21.25	Package-1
15	41+405	VR	Box	12	4.5	2x21.25	Package-1
16	43+140	VR	Box	12	4.5	2x21.25	Package-1
17	45+210	VR	Box	12	4.5	2x21.25	Package-1
18	46+214	VR	Box	12	4.5	2x21.25	Package-1
19	47+195	VR	Box	12	4.5	2x21.25	Package-1
20	53+693	VR	Box	12	4.5	2x21.25	Package-1
21	58+318	VR	Box	12	4.5	2x21.25	Package-2
22	59+487	VR	Box	12	4.5	2x21.25	Package-2
23	62+694	VR	Box	12	4.5	2x21.25	Package-2
24	71+850	VR	Box	12	4.5	2x21.25	Package-2
25	75+915	VR	Box	12	4.5	2x21.25	Package-2
26	79+290	VR	Box	12	4.5	2x21.25	Package-2
27	80+648	VR	Box	12	4.5	2x21.25	Package-2
28	81+508	VR	Box	12	4.5	2x21.25	Package-2
29	90+150	VR	Box	12	4.5	2X21.25	Package-3
30	94+354	VR	Box	12	4.5	2X21.25	Package-3
31	97+300	VR	Box	12	4.5	2X21.25	Package-3
32	99+100	VR	Box	12	4.5	2X21.25	Package-3
33	105+647	VR	Box	12	4.5	2X21.25	Package-3
34	106+420	VR	Box	12	4.5	2X21.25	Package-3
35	109+041	Road	Box	12	4.5	2X21.25	Package-3
36	112+038	VR	Box	12	4.5	2X21.25	Package-3

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
37	121+885	VR	Box	12	4.5	2X21.25	Package-3
38	125+666	VR	Box	12	4.5	2X21.25	Package-3
39	129+855	VR	Box	12	4.5	2X21.25	Package-3
40	132+475	VR	Box	12	4.5	2X21.25	Package-3
41	134+930	VR	Box	12	4.5	2X21.25	Package-3
42	139+873	VR	Box	12	4.5	2x21.25	Package-4
43	140+650	VR	Box	12	4.5	2x21.25	Package-4
44	143+832	VR	Box	12	4.5	2x21.25	Package-4
45	144+864	VR	Box	12	4.5	2x21.25	Package-4
46	147+393	VR	Box	12	4.5	2x21.25	Package-4
47	149+094	VR	Box	12	4.5	2x21.25	Package-4
48	159+267	VR	Box	12	4.5	2x21.25	Package-4
49	161+205	VR	Box	12	4.5	2x21.25	Package-4
50	164+386	VR	Box	12	4.5	2x21.25	Package-4
51	170+075	VR	Box	12	4.5	2x21.25	Package-4
52	172+673	VR	Box	12	4.5	2x21.25	Package-4
53	187+523	VR	Box	12	4.5	2x21.25	Package-4
54	193+040	VR	Box	12	4.5	2X21.25	Package-5
55	194+585	VR	Box	12	4.5	2X21.25	Package-5
56	197+335	VR	Box	12	4.5	2X21.25	Package-5
57	201+195	VR	Box	12	4.5	2X21.25	Package-5
58	204+941	VR	Box	12	4.5	2X21.25	Package-5
59	210+428	VR	Box	12	4.5	2X21.25	Package-5
60	215+446	VR	Box	12	4.5	2X21.25	Package-5
61	221+780	VR	Box	12	4.5	2X21.25	Package-5
62	225+650	VR	Box	12	4.5	2X21.25	Package-5
63	229+795	VR	Box	12	4.5	2X21.25	Package-5
64	231+705	VR	Box	12	4.5	2X21.25	Package-5
65	234+520	VR	Box	12	4.5	2X21.25	Package-5
66	237+680	VR	Box	12	4.5	2X21.25	Package-6
67	239+488	VR	Box	12	4.5	2X21.25	Package-6
68	242+188	VR	Box	12	4.5	2X21.25	Package-6
69	247+530	VR	Box	12	4.5	2X21.25	Package-6
70	250+304	VR	Box	12	4.5	2X21.25	Package-6
71	260+080	VR	Box	12	4.5	2X21.25	Package-6

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
72	262+202	VR	Box	12	4.5	2X21.25	Package-6
73	266+035	VR	Box	12	4.5	2X21.25	Package-6
74	269+200	VR	Box	12	4.5	2X21.25	Package-6
75	271+063	VR	Box	12	4.5	2X21.25	Package-6
76	283+719	VR	Box	12	4.5	2X21.25	Package-6
77	286+000	VR	Box	12	4.5	2X21.25	Package-6
78	289+045	VR	Box	12	4.5	2X21.25	Package-6
79	289+994	VR	Box	12	4.5	2x21.25	Package-7
80	293+830	VR	Box	12	4.5	2x21.25	Package-7
81	298+015	VR	Box	12	4.5	2x21.25	Package-7
82	300+686	VR	Box	12	4.5	2x21.25	Package-7
83	304+430	VR	Box	12	4.5	2x21.25	Package-7
84	309+220	VR	Box	12	4.5	2x21.25	Package-7
85	313+490	VR	Box	12	4.5	2x21.25	Package-7
86	314+735	VR	Box	12	4.5	2x21.25	Package-7
87	317+061	VR	Box	12	4.5	2x21.25	Package-7
88	319+189	VR	Box	12	4.5	2x21.25	Package-7
89	320+564	VR	Box	12	4.5	2x21.25	Package-7
90	323+666	VR	Box	12	4.5	2x21.25	Package-7
91	332+486	VR	Box	12	4.5	2x21.25	Package-7
92	333+443	VR	Box	12	4.5	2x21.25	Package-7
93	336+120	VR	Box	12	4.5	2x21.25	Package-7
94	341+485	VR	Box	12	4.5	2x21.25	Package-7
95	342+901	VR	Box	12	4.5	2X21.25	Package-8
96	349+115	VR	Box	12	4.5	2X21.25	Package-8
97	352+856	VR	Box	12	4.5	2X21.25	Package-8
98	356+360	VR	Box	12	4.5	2X21.25	Package-8
99	358+435	VR	Box	12	4.5	2X21.25	Package-8
100	360+793	VR	Box	12	4.5	2X21.25	Package-8
101	362+775	Road	Box	12	4.5	2X21.25	Package-8
102	365+118	VR	Box	12	4.5	2X21.25	Package-8
103	366+766	VR	Box	12	4.5	2X21.25	Package-8
104	367+653	VR	Box	12	4.5	2X21.25	Package-8
105	373+657	VR	Box	12	4.5	2X21.25	Package-8
106	376+475	VR	Box	12	4.5	2X21.25	Package-8

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
107	379+159	VR	Box	12	4.5	2X21.25	Package-8
108	390+979	VR	Box	12	4.5	2X21.25	Package-8
109	393+700	VR	Box	12	4.5	2X21.25	Package-9
110	406+260	VR	Box	12	4.5	2X21.25	Package-9
111	407+810	VR	Box	12	4.5	2X21.25	Package-9
112	409+650	VR	Box	12	4.5	2X21.25	Package-9
113	417+790	VR	Box	12	4.5	2X21.25	Package-9
114	418+925	VR	Box	12	4.5	2X21.25	Package-9
115	424+832	Road	Box	12	4.5	2X21.25	Package-9
116	427+763	VR	Box	12	4.5	2X21.25	Package-9
117	429+990	VR	Box	12	4.5	2X21.25	Package-9
118	431+017	VR	Box	12	4.5	2X21.25	Package-9
119	440+340	VR	Box	12	4.5	2X21.25	Package-9
120	443+785	VR	Box	12	4.5	2X21.25	Package-9
121	447+980	VR	Box	12	4.5	2X21.25	Package-10
122	449+946	VR	Box	12	4.5	2X21.25	Package-10
123	453+974	VR	Box	12	4.5	2X21.25	Package-10
124	455+027	VR	Box	12	4.5	2X21.25	Package-10
125	462+628	VR	Box	12	4.5	2X21.25	Package-10
126	464+723	VR	Box	12	4.5	2X21.25	Package-10
127	465+400	VR	Box	12	4.5	2X21.25	Package-10
128	466+897	VR	Box	12	4.5	2X21.25	Package-10
129	470+510	VR	Box	12	4.5	2X21.25	Package-10
130	472+987	VR	Box	12	4.5	2X21.25	Package-10
131	474+299	VR	Box	12	4.5	2X21.25	Package-10
132	475+908	VR	Box	12	4.5	2X21.25	Package-10
133	479+790	VR	Box	12	4.5	2X21.25	Package-10
134	484+205	VR	Box	12	4.5	2X21.25	Package-10
135	486+073	VR	Box	12	4.5	2X21.25	Package-10
136	488+493	VR	Box	12	4.5	2X21.25	Package-10
137	489+675	VR	Box	12	4.5	2X21.25	Package-10
138	491+372	VR	Box	12	4.5	2X21.25	Package-10
139	494+161	VR	Box	12	4.5	2x21.25	Package-10
140	500+527	VR	Box	12	4.5	2X21.25	Package-11
141	502+804	VR	Box	12	4.5	2X21.25	Package-11

S. No.	Chainage	Type of Crossing	Structure Type	Span Arrangement		Width of Structure (m)	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
142	504+090	VR	Box	12	4.5	2X21.25	Package-11
143	507+228	VR	Box	12	4.5	2X21.25	Package-11
144	509+217	VR	Box	12	4.5	2X21.25	Package-11
145	510+475	VR	Box	12	4.5	2X21.25	Package-11
146	513+034	VR	Box	12	4.5	2X21.25	Package-11
147	514+380	VR	Box	12	4.5	2X21.25	Package-11
148	515+485	VR	Box	12	4.5	2X21.25	Package-11
149	520+108	VR	Box	12	4.5	2X21.25	Package-11
150	528+545	VR	Box	12	4.5	2X21.25	Package-11
151	534+136	VR	Box	12	4.5	2X21.25	Package-11
152	543+333	VR	Box	12	4.5	2X21.25	Package-11
153	544+852	VR	Box	12	4.5	2X21.25	Package-11
154	552+005	VR	Box	12	4.5	2x21.25	Package-12
155	553+993	VR	Box	12	4.5	2x21.25	Package-12
156	558+663	VR	Box	12	4.5	2x21.25	Package-12
157	563+010	VR	Box	12	4.5	2x21.25	Package-12
158	565+154	VR	Box	12	4.5	2x21.25	Package-12
159	565+913	VR	Box	12	4.5	2x21.25	Package-12
160	566+655	Road	Box	12	4.5	2x21.25	Package-12
161	567+885	VR	Box	12	4.5	2x21.25	Package-12
162	571+243	VR	Box	12	4.5	2x21.25	Package-12
163	580+590	VR	Box	12	4.5	2x21.25	Package-12
164	582+213	VR	Box	12	4.5	2x21.25	Package-12
165	584+582	VR	Box	12	4.5	2x21.25	Package-12
166	587+622	VR	Box	12	4.5	2x21.25	Package-12
167	588+690	VR	Box	12	4.5	2x21.25	Package-12
168	590+776	VR	Box	12	4.5	2x21.25	Package-12
169	595+500	VR	Box	12	4.5	2x21.25	Package-12
170	596+649	VR	Box	12	4.5	2x21.25	Package-12
171	597+711	VR	Box	12	4.5	2x21.25	Package-12

8.8 PROPOSALS FOR SVUPs

Total 154 nos. of SVUPs have been proposed as listed in **Table-8.7** below:

Table-8.7 List of SVUPs

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
1	11+626	VR	BOX	7	4.0	2x21.25	Package-1
2	12+765	VR	BOX	7	4.0	2x21.25	Package-1
3	15+300	VR	BOX	7	4.0	2x21.25	Package-1
4	17+015	VR	BOX	7	4.0	2x21.25	Package-1
5	20+994	VR	BOX	7	4.0	2x21.25	Package-1
6	26+425	VR	BOX	7	4.0	2x21.25	Package-1
7	31+578	VR	BOX	7	4.0	2x21.25	Package-1
8	33+800	VR	BOX	7	4.0	2x21.25	Package-1
9	37+120	VR	BOX	7	4.0	2x21.25	Package-1
10	39+000	VR	BOX	7	4.0	2x21.25	Package-1
11	40+045	VR	BOX	7	4.0	2x21.25	Package-1
12	42+400	VR	BOX	7	4.0	2x21.25	Package-1
13	50+846	VR	BOX	7	4.0	2x21.25	Package-1
14	52+950	VR	BOX	7	4.0	2x21.25	Package-1
15	64+172	VR	Box	7	4.0	2x21.25	Package-2
16	65+645	VR	Box	7	4.0	2x21.25	Package-2
17	68+564	VR	Box	7	4.0	2x21.25	Package-2
18	70+744	VR	Box	7	4.0	2x21.25	Package-2
19	76+945	VR	Box	7	4.0	2x21.25	Package-2
20	85+885	VR	Box	7	4.0	2x21.25	Package-2
21	87+300	VR	Box	7	4.0	2X21.25	Package-3
22	88+540	VR	Box	7	4.0	2X21.25	Package-3
23	91+027	VR	Box	7	4.0	2X21.25	Package-3
24	92+382	VR	Box	7	4.0	2X21.25	Package-3
25	93+160	VR	Box	7	4.0	2X21.25	Package-3
26	95+548	VR	Box	7	4.0	2X21.25	Package-3
27	96+728	VR	Box	7	4.0	2X21.25	Package-3
28	100+740	VR	Box	7	4.0	2X21.25	Package-3
29	101+648	VR	Box	7	4.0	2X21.25	Package-3
30	103+454	VR	Box	7	4.0	2X21.25	Package-3
31	104+662	VR	Box	7	4.0	2X21.25	Package-3
32	107+262	VR	Box	7	4.0	2X21.25	Package-3
33	110+935	VR	Box	7	4.0	2X21.25	Package-3
34	114+595	VR	Box	7	4.0	2X21.25	Package-3

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
35	117+505	VR	Box	7	4.0	2X21.25	Package-3
36	119+611	VR	Box	7	4.0	2X21.25	Package-3
37	124+110	VR	Box	7	4.0	2X21.25	Package-3
38	127+166	VR	Box	7	4.0	2X21.25	Package-3
39	128+341	VR	Box	7	4.0	2X21.25	Package-3
40	131+323	VR	Box	7	4.0	2X21.25	Package-3
41	133+437	VR	Box	7	4.0	2X21.25	Package-3
42	136+700	VR	Box	7	4.0	2X21.25	Package-3
43	137+904	VR	Box	7	4.0	2x21.25	Package-4
44	141+982	VR	Box	7	4.0	2x21.25	Package-4
45	142+762	VR	Box	7	4.0	2x21.25	Package-4
46	148+212	VR	Box	7	4.0	2x21.25	Package-4
47	150+478	VR	Box	7	4.0	2x21.25	Package-4
48	151+465	VR	Box	7	4.0	2x21.25	Package-4
49	153+526	VR	Box	7	4.0	2x21.25	Package-4
50	155+387	VR	Box	7	4.0	2x21.25	Package-4
51	156+302	VR	Box	7	4.0	2x21.25	Package-4
52	160+208	VR	Box	7	4.0	2x21.25	Package-4
53	162+300	VR	Box	7	4.0	2x21.25	Package-4
54	165+400	VR	Box	7	4.0	2x21.25	Package-4
55	168+787	VR	Box	7	4.0	2x21.25	Package-4
56	171+255	VR	Box	7	4.0	2x21.25	Package-4
57	174+200	VR	Box	7	4.0	2x21.25	Package-4
58	176+185	VR	Box	7	4.0	2x21.25	Package-4
59	177+370	VR	Box	7	4.0	2x21.25	Package-4
60	178+955	VR	Box	7	4.0	2x21.25	Package-4
61	181+347	VR	Box	7	4.0	2x21.25	Package-4
62	183+436	VR	Box	7	4.0	2x21.25	Package-4
63	185+117	VR	Box	7	4.0	2x21.25	Package-4
64	186+500	VR	Box	7	4.0	2x21.25	Package-4
65	189+802	VR	Box	7	4.0	2X21.25	Package-5
66	190+829	VR	Box	7	4.0	2X21.25	Package-5
67	191+647	VR	Box	7	4.0	2X21.25	Package-5
68	195+680	VR	Box	7	4.0	2X21.25	Package-5
69	198+519	VR	Box	7	4.0	2X21.25	Package-5

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
70	202+750	VR	Box	7	4.0	2X21.25	Package-5
71	203+751	VR	Box	7	4.0	2X21.25	Package-5
72	208+893	VR	Box	7	4.0	2X21.25	Package-5
73	214+405	VR	Box	7	4.0	2X21.25	Package-5
74	217+105	VR	Box	7	4.0	2X21.25	Package-5
75	219+690	VR	Box	7	4.0	2X21.25	Package-5
76	222+900	VR	Box	7	4.0	2X21.25	Package-5
77	224+534	VR	Box	7	4.0	2X21.25	Package-5
78	226+947	VR	Box	7	4.0	2X21.25	Package-5
79	227+975	VR	Box	7	4.0	2X21.25	Package-5
80	233+558	VR	Box	7	4.0	2X21.25	Package-5
81	236+662	VR	Box	7	4.0	2X21.25	Package-6
82	240+623	VR	Box	7	4.0	2X21.25	Package-6
83	251+455	VR	Box	7	4.0	2x21.25	Package-6
84	260+913	VR	Box	7	4.0	2X21.25	Package-6
85	263+565	VR	Box	7	4.0	2x21.25	Package-6
86	276+196	VR	Box	7	4.0	2X21.25	Package-6
87	277+359	VR	Box	7	4.0	2X21.25	Package-6
88	279+167	VR	Box	7	4.0	2X21.25	Package-6
89	281+023	VR	Box	7	4.0	2X21.25	Package-6
90	284+940	VR	Box	7	4.0	2X21.25	Package-6
91	287+293	VR	Box	7	4.0	2X21.25	Package-6
92	291+788	VR	Box	7	4.0	2x21.25	Package-7
93	295+622	VR	Box	7	4.0	2x21.25	Package-7
94	296+489	VR	Box	7	4.0	2x21.25	Package-7
95	299+389	VR	Box	7	4.0	2x21.25	Package-7
96	302+613	VR	Box	7	4.0	2x21.25	Package-7
97	310+300	VR	Box	7	4.0	2x21.25	Package-7
98	311+571	VR	Box	7	4.0	2x21.25	Package-7
99	312+710	VR	Box	7	4.0	2x21.25	Package-7
100	316+300	VR	Box	7	4.0	2x21.25	Package-7
101	319+860	VR	Box	7	4.0	2x21.25	Package-7
102	321+408	VR	Box	7	4.0	2x21.25	Package-7
103	322+303	VR	Box	7	4.0	2x21.25	Package-7
104	327+340	VR	Box	7	4.0	2x21.25	Package-7

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
105	331+428	VR	Box	7	4.0	2x21.25	Package-7
106	338+926	VR	Box	7	4.0	2x21.25	Package-7
107	342+375	VR	Box	7	4.0	2X21.25	Package-8
108	347+698	VR	Box	7	4.0	2X21.25	Package-8
109	357+020	VR	Box	7	4.0	2X21.25	Package-8
110	363+682	VR	Box	7	4.0	2X21.25	Package-8
111	368+330	VR	Box	7	4.0	2X21.25	Package-8
112	369+025	VR	Box	7	4.0	2X21.25	Package-8
113	371+333	VR	Box	7	4.0	2X21.25	Package-8
114	380+400	VR	Box	7	4.0	2X21.25	Package-8
115	385+328	VR	Box	7	4.0	2X21.25	Package-8
116	388+685	VR	Box	7	4.0	2X21.25	Package-8
117	392+840	VR	Box	7	4.0	2X21.25	Package-9
118	396+302	VR	Box	7	4.0	2X21.25	Package-9
119	400+300	VR	Box	7	4.0	2X21.25	Package-9
120	404+741	VR	Box	7	4.0	2X21.25	Package-9
121	411+800	VR	Box	7	4.0	2X21.25	Package-9
122	413+212	VR	Box	7	4.0	2X21.25	Package-9
123	415+400	VR	Box	7	4.0	2X21.25	Package-9
124	442+785	VR	Box	7	4.0	2X21.25	Package-9
125	445+175	VR	Box	7	4.0	2X21.25	Package-10
126	448+400	VR	Box	7	4.0	2x21.25	Package-10
127	453+057	VR	Box	7	4.0	2x21.25	Package-10
128	456+786	VR	Box	7	4.0	2X21.25	Package-10
129	457+496	VR	Box	7	4.0	2X21.25	Package-10
130	459+110	VR	Box	7	4.0	2X21.25	Package-10
131	471+968	VR	Box	7	4.0	2X21.25	Package-10
132	477+340	VR	Box	7	4.0	2X21.25	Package-10
133	478+510	VR	Box	7	4.0	2X21.25	Package-10
134	492+846	VR	Box	7	4.0	2X21.25	Package-10
135	495+252	VR	Box	7	4.0	2X21.25	Package-10
136	497+585	VR	Box	7	4.0	2X21.25	Package-11
137	505+238	VR	Box	7	4.0	2x21.25	Package-11
138	524+464	VR	Box	7	4.0	2x21.25	Package-11
139	525+354	VR	Box	7	4.0	2X21.25	Package-11

S. No.	Chainage	Type of Crossing	Type of Structure	Span Arrangement		Width of Structure	Remarks
				Lateral Clearance (m)	Vertical Clearance (m)		
140	526+767	VR	Box	7	4.0	2X21.25	Package-11
141	536+880	VR	Box	7	4.0	2X21.25	Package-11
142	539+551	VR	Box	7	4.0	2X21.25	Package-11
143	549+925	VR	Box	7	4.0	2x21.25	Package-12
144	552+858	VR	Box	7	4.0	2x21.25	Package-12
145	561+628	VR	Box	7	4.0	2x21.25	Package-12
146	564+450	VR	Box	7	4.0	2x21.25	Package-12
147	572+769	VR	Box	7	4.0	2x21.25	Package-12
148	574+555	VR	Box	7	4.0	2x21.25	Package-12
149	577+523	VR	Box	7	4.0	2x21.25	Package-12
150	578+473	VR	Box	7	4.0	2x21.25	Package-12
151	580+018	VR	Box	7	4.0	2x21.25	Package-12
152	583+758	VR	Box	7	4.0	2x21.25	Package-12
153	589+220	VR	Box	7	4.0	2x21.25	Package-12
154	600+092	VR	Box	7	4.0	2x21.25	Package-12

8.9 PROPOSALS FOR FLYOVERS

Total 28 nos. of Flyovers have been proposed. Details of the same are attached below in **Table-8.8**:

Table-8.8 List of Flyovers

S. No.	Chainage	Type of Crossing	Structure Type			Span Arrangement	Width of Structure	Remarks
			Foundation	Sub Structure	Super Structure			
1	8+920	NH-334	Pile	R.C.C	PSC I Girder	2x30	2X21.25	Package-1
2	19+941	SH-118	Pile	R.C.C.	Steel Girder	2x30	2X21.25	Package-1
3	34+650	NH-24	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-1
4	35+270	NH-24 ((Bypass)	Pile	R.C.C.	PSC I Girder	2x40	2X21.25	Package-1
5	54+640	SH-65	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-1
6	74+181	MDR-162W	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-2
7	102+427	ODR-BT	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-3
8	115+751	SH-51	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-3
9	123+288	NH-509	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-3
10	154+200	SH-109	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package-4
11	173+454	SH-125	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-4
12	189+394	SH-33	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package- 4

S. No.	Chainage	Type of Crossing	Structure Type			Span Arrangement	Width of Structure	Remarks
			Foundation	Sub Structure	Super Structure			
13	207+484	SH-26	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-5
14	255+167	SH-29	Pile	R.C.C.	PSC I Girder	2x30	2X21.25	Package-6
15	282+845	SH-138	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-6
16	329+945	Bilgram To Haibatpur (SH-21)	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-7
17	337+901	Dherhni Saraiya To Bilgram (SH-38)	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-7
18	353+998	SH-38	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package-8
19	370+486	SH-137	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package-8
20	378+136	Expressway	Pile	R.C.C.	PSC I Girder	2X25+2X30	2x21.25	Package-8
21	386+528	SH-40	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package-8
22	420+932	NH-27	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-9
23	482+667	SH-13	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-10
24	487+285	NH-31	Pile	R.C.C.	PSC I Girder	2x30	2x21.25	Package-10
25	499+077	SH-13A	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package-11
26	517+708	NH-30	Pile	R.C.C.	PSC I GIRDER	2x30	2x21.25	Package-11
27	554+950	MDR-102E	Pile	RCC	PSC I Girder	2x30	2X21.25	Package-12
28	600+457	NH-19	Pile	RCC	PSC I Girder	2X36	1X27.50	Package-12

8.10 PROPOSALS FOR TRUMPETS

Total 2 nos. of Trumpets have been proposed. Details of trumpets are as listed below in **Table-8.9**:

Table-8.9 List of Trumpets

S. No.	Chainage	Type of Crossing	Remarks
1	8+920	NH-334	Package-1
2	600+457	NH-19	Package-12

8.11 PROPOSALS FOR DOUBLE TRUMPETS

Total 7 nos. of Double Trumpets have been proposed. Details are as given below in **Table-7.10**:

Table-8.10 List of Double Trumpets

S. No.	Chainage	Type of Crossing	Remarks

1	123+288	NH-509	Package-3
2	189+394	SH-33	Package- 4
3	255+167	SH-29	Package-6
4	329+945	SH-21	Package-7
5	378+136	Agra-Lucknow Expressway	Package-8
6	487+285	NH-31	Package-10
7	517+708	NH-30	Package-11

8.12 PROPOSALS FOR DIAMOND INTERCHANGES

Total 8 nos. of Diamond Interchanges have been proposed. Details of Diamond Interchanges are given in **Table-8.11**:

Table-8.11 List of Diamond Interchanges

S. No.	Chainage	Type of Crossing	Remarks
1	35+270	NH-9	Package-1
2	54+640	SH-65	Package-1
3	74+181	MDR-162W	Package-2
4	102+427	ODR-BT	Package-3
5	173+454	SH-125	Package-4
6	282+845	SH-138	Package-6
7	420+932	NH-27	Package-9
8	554+951	MDR-102E	Package-12

9. PROJECT FACILITIES, ROADSIDE FEATURES & ROAD SAFETY

9.1 PROJECT FACILITIES

The Project Facilities proposed on the expressway shall include:

(a) Toll plazas & Ramp plazas;

(b) Traffic Control Devices, Road Safety Devices and Roadside Furniture;

(c) Lighting / illumination;

(d) Pedestrian facilities;

(e) Landscaping & tree plantation;

(f) Traffic and medical aid posts;

(g) Telecom System

(h) Intelligent Traffic Management System (ATMS/ ITMS);

(i) Wayside Amenities

(j) Toilet Block

Further details are given in the following sec tions:

9.1.1 Toll Plazas & Ramp Plazas

2 Main Toll Plazas, 7 Toll Plazas (8 Lanes each) on Double Trumpet Interchanges & 32 Ramp Plazas (2 lanes on each leg) on Diamond Interchanges (at 16 Nodes) have been proposed along the project corridor. List of the Toll Plazas & Toll Booths is attached below:

S. No.	Location		Remarks
1	13+400	Meerut	Toll Plaza (16 lanes)
2	35+270	Hapur - Garhmukteshwar	Ramp Plaza
3	54+640	Bulandshahr - Garhmukteshwar	Ramp Plaza)
4	74+181	Hasanpur-Anupshahar	Ramp Plaza
5	102+427	Anupshahr - Moradabad	Ramp Plaza
6	123+288	Babrala - Chandausi	Double Trumpet (8 lanes)
7	173+454	Chandausi - Budaun	Ramp Plaza
8	189+394	Budaun - Bareilly	Double Trumpet (8 lanes)
9	255+167	Farukkhabad - Shahjahanpur	Double Trumpet (8 lanes)
10	282+845	Farukkhabad - Shahbad	Ramp Plaza
11	329+945	Kannauj– Hardoi	Double Trumpet (8 lanes)
12	378+136	Agra - Lucknow Expressway	Double Trumpet (8 lanes)
13	420+932	Kanpur - Lucknow	Ramp Plaza

S. No.	Location		Remarks
14	487+285	Lalganj - Raebareli	Double Trumpet (8 lanes)
15	517+708	Raebareli–Unchahar	Double Trumpet (8 lanes)
16	554+951	Manikpur - Bela Pratapgarh	Ramp Plaza
17	589+450	Before Prayagraj Bypass	Toll Plaza (16 Lanes)

9.1.2 Traffic Control Devices, Road Safety Devices and Roadside Furniture

Traffic Control Devices, Road Safety Devices and roadside furniture shall be provided as per Section-10 and 12 of IRC:SP:99-2013. The details are as follows:

9.1.2.1 Road Signs

Road Signs include roadside signs; chevron signs; overhead signs and kerb mounted signs along the entire Project Expressway and service road.

All road signs shall be of Prismatic Grade Sheeting corresponding to Class 'C' Sheeting described in IRC: 67-2012 and any of the types VIII; IX or XI as per ASTM D-4956-09. The road signs and overhead signs erected on the Project Expressway and service road with regard to requirement of number of signs, type and size of sign, size of letter, color of sign, layout of sign; etc. including signs installations shall conform to Section-10 and Section-12 of "Manual" and IRC: 67-2012. Code of Practice for Road Signs and where the said codes are silent, other codes in the same order of preference shall be used. Chevron signs shall be installed on curves and interchange loops/ramps. In addition to signs prescribed in "Manual" other signs such as signs showing safety slogans, toll free numbers, nearby hospital and police station facilities, lane discipline signs on gantry etc. will also be provided as directed by Authority's Engineer.

The overhead signs shall be placed on a structurally sound gantry or cantilever structure made of tubular structure or steel structure. The final locations shall be finalized in consultation with the Authority's Engineer. The height, lateral clearance and installation of the sign structures shall be as per the MoRT&H/IRC guidelines.

Overhead Signs: Cantilever Type shall be provided at Interchanges as advance direction and exit signs on all arms of interchange.

Additionally, Overhead Gantry Type (4-lane width) is also proposed on each side of main carriageway.

Design and location of route marker signs for Project Expressway shall be as per the IRC: 67-2012.

On cross roads where interchange/slip roads have been provided, necessary information signboards on cross roads on both sides shall also be fixed suitable for the category of cross road.

9.1.2.2 Pavement Marking

Pavement markings shall cover the entire Project Expressway and service roads (on 7.0m wide portions) and shall be as per Section-10 of the "Expressway Manual" and IRC: 35-2015. These markings shall be applied to road carriageway lane; edge lines; continuity line; stop lines; give-way lines; diagonal/chevron markings; zebra crossing and at parking areas, toll booths etc. by

means of an approved self-propelled machine which has a satisfactory cut-off valve capable of applying broken lines automatically.

Road markings other than on main carriageway edges (both shoulder and median side) shall be of hot applied thermoplastic materials with glass reflectorizing beads as per relevant sub clauses of MoRT&H specifications;

Raised profile edge lines as per Clause 7.7 of IRC 35 shall be provided on main carriageway edges (both shoulder and median side right lane).

Acrylic water based road marking paint shall be used for kerb, concrete barrier painting, and to display details of structure number; span arrangement etc. on all culverts and bridges with required description as per MoRT&H guidelines.

9.1.2.3 Boundary Stones

These shall be provided for the entire Project Expressway at an interval of 100m c/c as per clause 10.8 of the "Expressway Manual".

9.1.2.4 Hectometer & Kilometer Distance Marker

The arrangement for fixing and placement on expressway for kilometer distance marker shall be as per relevant IRC Codes.

9.1.2.5 Crash Barrier

This shall be provided as per clause 10.7 of section-10 of IRC:SP:99-2013 & Relevant IRC Codes. Retro-reflective (same material as of road signs and Fluorescent yellow / white colour) Stickers (150mm width) shall be provided on alternative vertical posts of W beam barrier throughout.

9.1.2.6 Fencing

As the Expressway is completely access-controlled facility; fencing is its integral part to help enforcement of the acquired access rights. Access control extends to the limits of legal access control on the ramps i.e.; along the ramps to the beginning of the taper on the local road. Precast Pre-tensioned RCC 300 mm wide & 50 mm thick (M30) panels shall be fixed in RCC (M25) posts of minimum size 150mm x 150mm (with 7 Nos. 4mmØ HT wires). RCC posts shall be embedded in M15 grade concrete to a depth of 650 mm below ground having size of 450mm x 450mm. The height of fencing shall be 1.5 m above ground. Chain line fencing of 1.5m height is provided across the road from fencing to embankment at all the VUP/PUP locations so that no cattle can go towards expressway.

On the side where service road is being provided, fence will be placed in between expressway and service road. On the side where service road is not being provided the fence will be placed at ROW edge.

9.1.2.7 Reflective Pavement Markers, Solar Studs and Delineators

Raised pavement markers shall be provided as per Clause 7 of IRC 35 2015 on both should edges and median sides. Relaxation pavement markers and solar studs shall be as per Clause 10.5 and Table 10.4 of manual.

Delineators shall be provided as per clause 10.4 of "Manual". At merging/diverging areas; service areas; ramps of interchanges; bridges and their approaches; the spacing shall be reduced to 30m. The design; location and materials to be used for road delineators shall be as per IRC: 79- 1981.

9.1.2.8 Blinker Lights

Yellow flashing lights using solar power with full alternative power back-up shall be provided to alert the drivers about oncoming interchange; major bridge and toll plazas.

9.1.2.9 Glare Reduction

The devices shall be provided as per clause 10.11 of the "Expressway Manual".

9.1.3 Lighting/Illumination

External and Internal Lighting will be as per Section-15 of the "Expressway Manual" shall be provided. Street Lighting shall be provided at the locations of toll / ramp plaza, interchanges/slip roads and lighting on structures such as major bridges, ROB's, Flyovers, Minor Bridges and Underpasses including high mast at toll plaza, interchange/slip roads. A power connection of appropriate load shall be taken from state electricity department at above locations including all expenses. The use of solar power is optional in lieu of a regular power connection for isolated locations such as Bridges, ROBs, underpasses and flyovers. Provision of adequate capacity Diesel Generator sets as standby arrangement shall be made at Toll / Ramp Plaza, Interchange and Slip road.

9.1.4 Pedestrian Facilities

There is no separate pedestrian facility like FOB etc. SVUPs/LVUPs may be used for pedestrian to cross expressway.

9.1.5 Landscaping & Tree Plantation

Landscaping of road shall be as per IRC SP-21. Four rows of tree on the side where service road is not provided and 2 row of tree on the side of service road shall be provided. Compensatory afforestation shall be undertaken within ROW as prescribed in environment and forest clearances. Landscape treatment shall be provided in the entire open areas near major bridges, at interchanges, toll / ramp plaza, and O & M areas.
Planting along the Project Expressway shall follow a variety of schemes depending upon location requirement as per the IRC: SP: 21-2009. The choice of trees to be planted shall also be made as per IRC:SP:21-2009; "Manual of Landscaping". Local, indigenous species that grow in that area shall be preferred.

On medians and island: planting of dust and gaseous substance-absorbing shrubs shall be provided. The treatment of the highway embankment slopes shall be as per the recommendations of IRC: 56; depending upon the soil type involved and the provisions mentioned elsewhere in this document.

Visibility of any signs; signals or any other devices erected for traffic control, traffic guidance and/or information shall not be obstructed by plantation.
The central island of trumpet and loop area of interchanges has space for attractive landscaping which provide scope for both soft and hard landscape. Special attention will be given that each interchange has a distinct and unique landscape based on some theme. The theme and design of landscaping of each interchange will blend with the local surroundings. Careful selection of plant species will be done in order to match the climatic conditions to merge with the surrounding area. Rainwater/ ground water recharging system should also be integrated with landscaping in order to provide proper drainage to avoid ponding of water. The plantation will

be inter-mixed with evergreen species and seasonal flowers. Plantation of flowering species will be done in such a way that each area has different colour pattern. The outer margins of the central islands in the loops of interchange must have low ground covers to avoid any vision obstruction of the drivers to ensure visibility. The central portions of these islands will be provided with objects of any art; creation of pleasing/ attractive land pattern including plantation of trees keeping the aspect of vision in view. Designer lights along the periphery of the islands and central lighting in the form of high masts will be suitably provided for ensuring proper illumination of the area. Different types of water fountains may also be erected at the interchanges. No private advertisements; commercial information; hoardings etc. shall be permitted inside the interchange area. The scheme of landscape for each interchange has to be approved by the Authority's Engineer and the Authority.

9.1.6 Traffic & Medical Aid Post

Provisions as per the codal provisions have been made.

9.1.7 Telecom System

All necessary hardware, equipment, software, optical fiber cable etc. required for Communication System to interconnect Toll Plaza and Ramp Plaza /Toll Booths etc. are proposed and to be provided by the Contractor.

9.1.8 ATMS/ITMS

Implementation of latest Advanced/Intelligent Traffic Management System (ITMS), Highway Incident Control System, Facility Management System (FMS) for the 601.360 km long Ganga Expressway Project has been proposed.

By adopting the ITMS, Authority shall be able to enhance, the efficiency of Enforcement Management, Incident Management, Monitoring & Maintenance Control, Smoothing of Road Traffic Movement, Efficient Information sharing, processing and dissemination with the stakeholders.

9.1.9 Wayside Amenities

Way Side Amenities have been proposed on 9 locations along the project corridor.

S. No.	Chainage	LHS/RHS	Distance between WSA (km)
1	72+700	LHS	
2	125+400	RHS	52.7
3	175+000	LHS	49.6
4	254+200	RHS	79.2
5	326+500	LHS	72.3
6	377+500	RHS	51.0
7	424+000	LHS	46.5
8	480+900	RHS	56.9
9	541+600	LHS	60.7

9.1.10 Toilet Block

Separate Toilet Blocks with full facilities for public use shall be provided within the toll plaza for public access. The provisions listed below are

a) 4 Nos. urinals (Ladies) along with wash basin

b) 4 Nos. urinals (Gents) along with wash basin

c) 2 Nos WC in each washroom

d) Drinking Water facilities shall also be provided.

e) Water Supply/Electrical fixtures shall also be provided.

f) Landscaping along with parking space shall also be provided.

10. SOCIAL & ENVIRONMENTAL STUDIES

10.1 SOCIAL IMPACT ASSESSMENT AND R&R STUDIES

10.1.1 Methodology

The action plan is based on the primary and secondary data sources. Secondary data source includes Gazetteer of project districts, maps and Primary Census Abstract (PCA), 2011. A questionnaire was used to conduct census and socio-economic survey.

This Resettlement Action Plan (RAP) report has been prepared as per the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act-2013 (LA and R&R Act – 2013) and is based on data collected from field survey. The primary purpose for preparing Resettlement Action Plan (RAP) is to assess the socio-economic condition of the Project Affected Persons (PAPs) in order to minimize and provide mitigative measures. Since the displacement is indispensable, rehabilitation shall be done in such a manner so that the standard of living of PAPs is restored. Special attention will be paid to the vulnerable groups. RAP has provisions to ensure that PAPs are compensated at replacement value for the assets lost and to enable them to regain or improve their socio-economic status enjoyed prior to the project. The RAP is a live document and will be updated as and when necessary. Implementation of the RAP will be done on data so modified.

10.1.2 Objective of The Study

The objective of social screening is to create a baseline database containing the features and populace in the immediate vicinity of proposed project road as well as the structures likely to be affected by the road widening/Improvement process. Social screening during the feasibility stage helps to avoid, reduce or mitigate likely negative impacts of project action and enhance positive impacts, sustainability and development benefits. The report aims to highlight the social problems and suggests general and typical mitigation measures to alleviate social problems that the project- affected people may face such as loss of livelihood, displacement and loss of access to community facilities through construction of service roads, underpasses and other facilities.

10.1.3 Scope of the study

- Carry out Structure Verification Survey of the structures likely to be affected and Socio-Economic Survey of the Project Affected Persons (PAPs) to get the base line information about the level of impact and to get the base line socio economic status of the PAPs.
- Preparation of Strip Plan showing existing structures likely to be affected along the project roads.
- Conducting Social Impact Assessment including Rehabilitation and Resettlement (R&R) studies.
- Preparation of detailed Land Acquisition (LA) Plans with the help of Village Revenue Maps (RVMs) to undertake the land acquisition along the proposed project corridors.
- Preparation of Land Plan Schedules (LPS) of ownership thereof and costs as per revenue authorities and also based on realistic rates.

- Preparation of Social Impact Assessment (SIA) report and Resettlement Action Plan (RAP) for the Project road.

10.1.4 Social & Rehabilitation Issues

Most of the infrastructure improvements planned for the Urban/Rural areas take place within the existing Right of Way (RoW) except at some of the congested settlements and densely builtup areas where bypasses/change in alignment/grade separation are proposed and at locations where minor improvements are required for accommodating road safety measures. As the proposed project road is entirely a green field alignment except some entry/exit points near the proposed interchanges connecting existing State Highways and National Highways, social screening surveys need to be conducted in the DPR stage. These issues may compound leading to delay of project and escalation of project cost. Hence, in order to face or overcome these consequences, a preliminary idea of Social and Rehabilitation issues need to be acquired and should be considered while selection of corridors. The key social issues considered would be as below.

- Loss of fertile agricultural land;
- Loss of structures used for residential, commercial and other purposes and associated loss of livelihood i.e., loss of livelihood due to impacts on sources of earning;
- Loss of other properties and assets such as boundary walls, hand pumps, bore wells, dug wells, pump houses, ponds etc.;
- Disruption of livelihood due to clearing of RoW particularly, petty shop owners and agriculturists;
- Loss of common property resources such as religious places, Samadhi, graveyard, cremation places, water resources, passenger shelters, etc.

10.1.5 Land Use along the Project Road

The preliminary social assessment was carried out, considering 120m. all along the project road except at the proposed facilities such as Junctions, RoBs, Bridges etc. Most of the land use categories along this section is mainly agriculture land and at some locations it is either Residential. The settlements at the entry/exit point near proposed major/minor interchanges connecting existing State Highways and National Highways through which the proposed alignment is passing where some pucca, semi pucca and kutcha structures are found in very large number along the proposed alignment. These settlements are like as private, government and community assets. The major portion is predominantly either agricultural land or barren land. In general, the inhabitants occupying lands for different activities along the proposed road have land titles. This has implications on the design of the Entitlement Matrix and mitigative measures. Common Property Resources along the sections of the project road include some religious structures, community/village bushy land, grazing lands, water resources, etc.

10.1.6 Negative Social Impact

As the proposed project road is an expressway and passes through total 529 villages, some of these settlements may consist of impact on many pucca, semi pucca and kutcha structures along the proposed alignment (a total length of 593.947 km). However, it is kept in mind while fixing the alignment that minimum structures are affected. Acquisition would be required for the

proposed 8-lane expressway all along the proposed road. As per the preliminary assessment and base line verification survey, many structures are either partially or completely affected. In addition, other assets such as Bore Wells, Wells, Hand Pumps, Pump Houses etc. may also be affected. The land required by the project for the construction of proposed project roads falls under two classifications.

(1) Public land owned by the State Government and administered by other departments such as Revenue Department etc; and (2) Private Land.

10.1.7 Preparation of Land Acquisition Report/ Plan

As part of preparation of Land Acquisition (LA) Report/Plan, firstly after identifying the villages along the entire proposed project road, latest available Village maps were collected from the respective District Survey offices/Village Offices. There after reference points were identified along the project roads at common identifiable locations (both On Village revenue Maps as well as on ground).

The Village Revenue Maps were scanned and superimposed on the topographical data and based on the common reference points collected all along the project road.

As part of the preparation of Land Plan Schedules (LPS), Survey Numbers were identified for which the addition land is to be acquired for proposed improvements. For each survey number details such as type of land, nature of land and other relevant data was collected from the respective Village offices

10.1.8 Issues during preparation of Land Acquisition Plan/Report

Some revenue maps are not in proper shape.

10.1.9 Impact Assessment

Impact Assessment will involve:

(i) Agricultural/Homestead/Commercial Land Impacts;

(ii) Loss of Structures (Residential/Commercial/Other);

(iii) Loss of livelihood due to loss of primary source of income;

(iv) Loss of community infrastructure/common property resources;

(v) Temporary Impacts on agricultural land due to plant site for contractor etc.;

Any unanticipated impacts due to the project will be documented and mitigated based on the spirit of the principle agreed upon in this policy framework.

10.2 ENVIRONMENTAL IMPACT ASSESSMENT, MITIGATION PLANNING, MANAGEMENT PLAN & CLEARANCES

The environmental assessment preparation led to identification of potential environmental hazards and their feasible remedial measures, based on which the environmental mitigation measures have been prepared. The purpose of this report is to identify the legal requirement or otherwise for an Environmental Impact Assessment for the project. The project under assessment is detailed in the accompanying engineers' report.

10.2.1 Objectives of the study

The major objective of this study is to establish present environmental condition along the project corridor through available data / information supported by field studies to evaluate the impacts on relevant environmental attributes due to the construction & operation of the proposed project; to recommend adequate mitigation measures to minimize / reduce adverse impacts and to prepare an Environmental Management Plan (EMP) for timely implementation of the mitigation measures to make the project environmentally sound and sustainable. An Environmental Impact Assessment (EIA) study basically includes:

- Establishment of the present environmental scenario
- Study of the specific activities related to the project
- Evaluation of the probable environmental impacts
- Recommendations of necessary environmental control measures.
- Preparation of Environmental Management Plan

10.2.2 Scope of work for Environmental Screening

The general approach to be adopted for Environment Screening (ES) includes the following:

- Preliminary reconnaissance surveys to identify environmentally sensitive issues relating to road alignment and influence area and baseline conditions, including regionally and nationally recognized environmental resources and features of the environment and common property resources are such as forests, large water bodies and major physical cultural properties.
- Assessment of the potential impacts of the project on the baseline conditions.
- Recommended migratory measures to offset the identified adverse impacts.
- Stakeholder assessment and consultations along the alignment.
- Identification of the Valued Environmental Components (VECs) considering the baseline information (collected from both secondary and primary sources), the preliminary understanding of the activities proposed in the project and from stakeholder consultations and their requirements.
- Preliminary analysis of impacts identified on the projected site, surroundings and influence area and formulation of management measures/ options/ operations.
- Preparation of scoping for project Environmental Assessment (EA), which will be a direct outcome of the above-mentioned ES, and shall define the boundaries of the project like EA.
- Documentation of the above-mentioned ES in the form of Environmental Screening Report.

10.2.3 Environmental Policies and legislation

Environment policies of the Government of India include legislations related to environment. In the Directive Principles of State Policy, Article 48 says "the state shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country"; Article 51-A states that "it shall be the duty of every citizen of India to protect and improve the natural

environment including forests, lakes, rivers and wildlife and to have compassion for living creatures."

Present table shows various Environmental Regulations and legislations relevant to this project, which are the responsibility of a number of government agencies.

Table 8.1: Summary of Relevant Environmental Legislations

Act/Rule/Notification/Policy	Year	Objectives	Responsible Agency
Constitution of India, Article 48,51-A	1950	Article 48A of the directive Principles of State Policy provides for the State's commitment to protect and Article 51A(g) states that to protect and improve the natural environment shall be the fundamental duty of the citizen of India	MoEF&CC; GoI; Department of Forest, GoUP; UPPCB
The Environment (Protection) Act The Environment (Protection) Rules	1986 1986	To protect and improve the overall environment by ensuring that appropriate measures taken to conserve and protect the environment before commencement operations.	MoEF&CC; GoI; Department of Forest, GoUP; UPPCB
Environment Impact Assessment Notification and amendments made thereafter.	2006	To provide environmental clearance to new development activities following environmental impact assessment and Environmental Management Plan	MoEF&CC; GoI; UPPCB
Indian Forest Act Forest (Conservation) Act Forest (Conservation) Rules Forest Conservation Rules (Notification)	1927 1980 1981 2003	To Consolidate the laws related to forest, the transit of forest produce and the duty liveable on timber and other forest produce. Conservation of Forests, Judicious use of forestland for non-forestry purposes; and To replenish the loss of forest cover by Compensatory Afforestation on degraded Forestland and non-forest land. Procedure for submission of the proposals seeking approval for Central Government for diversion of forestland to non-forest purpose	MoEF&CC; Department of Forest, State Govt.
Wild Life (Protection)Act The Wild Life	1972 2002	To Protect wildlife in general and National parks and Sanctuaries in particulars. To protect wild animals, birds and	Chief Conservator of Wildlife Wing, Forest Department, State Govt. National/ State Board for Wildlife

Act/Rule/Notification/Policy	Year	Objectives	Responsible Agency
(Protection)Amendment Act		plants with a view to ensure the ecological and environmental security of the country.	
The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights)Act	2006	Grants legal recognition to the rights of traditional forest dwelling communities, partially correcting the injustice caused by the forest laws. Makes a beginning towards giving communities and the public a voice in forest and wildlife conservation	Ministry of Tribal Affaires, GOI and Department of Tribal Welfare, GoUP
National Forest Policy National Forest Policy(Revised)	1952 1988	To maintain ecological stability through preservation and restoration of biological diversity	Forest Department, GoI and States Govt.
The Water (Prevention and Control of Pollution)Act	1974	To control water pollution by controlling discharge of pollutants as per prescribed standards	CPCB;UPPCB
The air(Prevention and control of Pollution)Act	1981	To control air pollution by controlling emission of air pollutants as per prescribed standards	CPCB;UPPCB Transport Department; State Govt.
Noise Pollution (Regulation and Control) Rules The Noise Pollution (Regulation ad Control)Amendment Rules	2000 2006	To Regulate and Control noise producing and generating sources with the objective of maintaining the ambient air quality standard in respect of noise.	CPCB;UPPCB Transport Department; State Govt.
Biodiversity Act	2002	To provide for conservation of biodiversity, sustainable use of resources fair and equitable sharing of the benefits from use of resources	National Biodiversity Authority/State Authorities
Fly Ash Notification	2011 2016	Mandate use of fly ash in road construction within a radius of 100km.	MoEF&CC
Solid Waste Management Rules (SWM)	2016	For Management and handling of solid waste during construction	UPPCB
Hazardous and Other Wastes (Management & Trans boundary movement)Rules	2016	Protection to the general public against improper handling and disposal of hazardous wastes	UPPCB
Construction and Demolition Waste Management Rules	2016	To provide responsibility of the waste generators for the collection, segregation and other activities involved with the debris management generated during construction	PIU-UPEIDA,UPPCB

Act/Rule/Notification/Policy	Year	Objectives	Responsible Agency
Batteries (Management & Handling) Amendment Rules	2010	Management and handling of used lead batteries i.e. safe disposal of batteries used during construction	UPPCB
E-Waste (Management) Rules	2016	Effective mechanism to regulate generation, collection, storage, transport, import, export, recycling, treatment and disposal of e-wastes	UPPCB
National Environmental Tribunal	1995	To provide for strict liability for damages arising out of any accident occurring while handling any hazardous substance	National Environmental Tribunal
The Motor Vehicle Act Central Motor Vehicle Rules	1988 1989	To consolidate and amend the laws related to motor vehicles. Licensing of driving of motor vehicles, registration of motor vehicles, with emphasis on road safety standards and pollution control measures, standards for transportation of hazardous and explosive materials To check vehicular air and noise pollution.	RTO Office, GoUP, Govt. of Uttar Pradesh
The Ancient Monuments and Archaeological Sites and Remain (Amendment and Validation) Act	1958 2010	To provide for the preservation of ancient and historical monuments and archeological sites and remains of national importance and protection sculptures, carvings and other like objects.	Archaeological Department, GoI; Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH)
The Explosives Act & Rules Explosives Rules	1884 2008	An Act to regulate the manufacture, possession, use, sale, transport, import and export of Explosive (For transporting and storing diesel, bitumen etc.)	Petroleum & Explosives Safety Organization (PESO)
Mines and Minerals (Development and Regulation), Amendment Act UP Minor Mineral Concession Rules	2015 1963	The Mining act has been notified for safe and sound mining activity. For Opening New Quarries for minor minerals like stone, sand ,river sand etc.	District Magistrate, Government of Uttar Pradesh
National Policy of Resettlement and Rehabilitation	2007	For payment of compensation and assistance, different entitlements payment of compensation and assistance, resettlement and rehabilitation of project affected population due to acquisition of lands and structures.	PIU UPEIDA, Competent Authority (Revenue Department)

Act/Rule/Notification/Policy	Year	Objectives	Responsible Agency
Sec 135 and schedule VII of Companies Act Companies (Corporate Social Responsibility Policy) Rules	2013 2014	To provide 2% of the average Net Profits of the Company made during the three immediately preceding financial years.	CSR Committee, UPEIDA
Corporate Environment Responsibility vide MoEF&CC F.No. 22-65/2017-IA.III dated 01.05.2018	2018	Establishing a guideline for compliance with the provisions of Regulations to dedicate a percentage of Company's profits for social projects and Creating opportunities for employees to participate in socially responsible initiatives	SEAC, SEIAA, MoEF&CC
Right to fair compensation and transparency in land acquisition, Rehabilitation and Resettlement Act	2013	Fair compensation for acquisition of immovable assets; Resettlement of displaced population due to LA and economic rehabilitation of all those who are affected due to land acquisition.	Revenue Department. Govt. of U.P.
Uttar Pradesh Policy on direct purchase of land of through mutual agreement	2015	To ensure speedy land purchase in agreement with land owner thus protecting the rights of land owner Land to be purchased in mutual agreement with land owner so that land owner gets the fair compensation for the land and rehabilitation assistance in shortest possible time.	Revenue Department, Govt. of Uttar Pradesh

10.2.4 Environmental Impact Assessment

The Environmental Impact Assessment is a systematic investigation of both positive and negative impacts on the physical, biological socioeconomic environment, which would be caused or induced due to a proposed project. EIA provides a plan to reduce the negative environmental effect of proposed development project through alternative approaches, design modification and remedial measures. Highway construction is a major activity of economic development countries. Road development is major source of damage to the environment, including ecological destabilization, habitat disturbance and damage to flora and fauna. After analysing different parameters and discussing the probable impact suggestion are made regarding the mitigation measures that can be taken at different stages in order to reduce the environmental impacts.

10.2.4.1 Purpose of EIA

The purpose of this Environmental Impact Assessment (EIA) study is to provide information on the nature and extent of environmental impacts arising from the development of the proposed project and related activities with a view to define an Environmental Management Plan (EMP) to minimize adverse environmental impacts.

M/s L N Malviya Infra Projects Pvt. Ltd., Highway Engineering Consultant and Intratech Civil Solutions (Consortium) have been appointed as EIA Consultants to carry out the Environmental Impact Assessment (EIA) study for the proposed project site incorporating baseline data for various Environmental Components, viz, air, water, noise, land and biological along with the parameters of human interest and to prepare Environmental Management Plan (EMP) for mitigation adverse impacts.

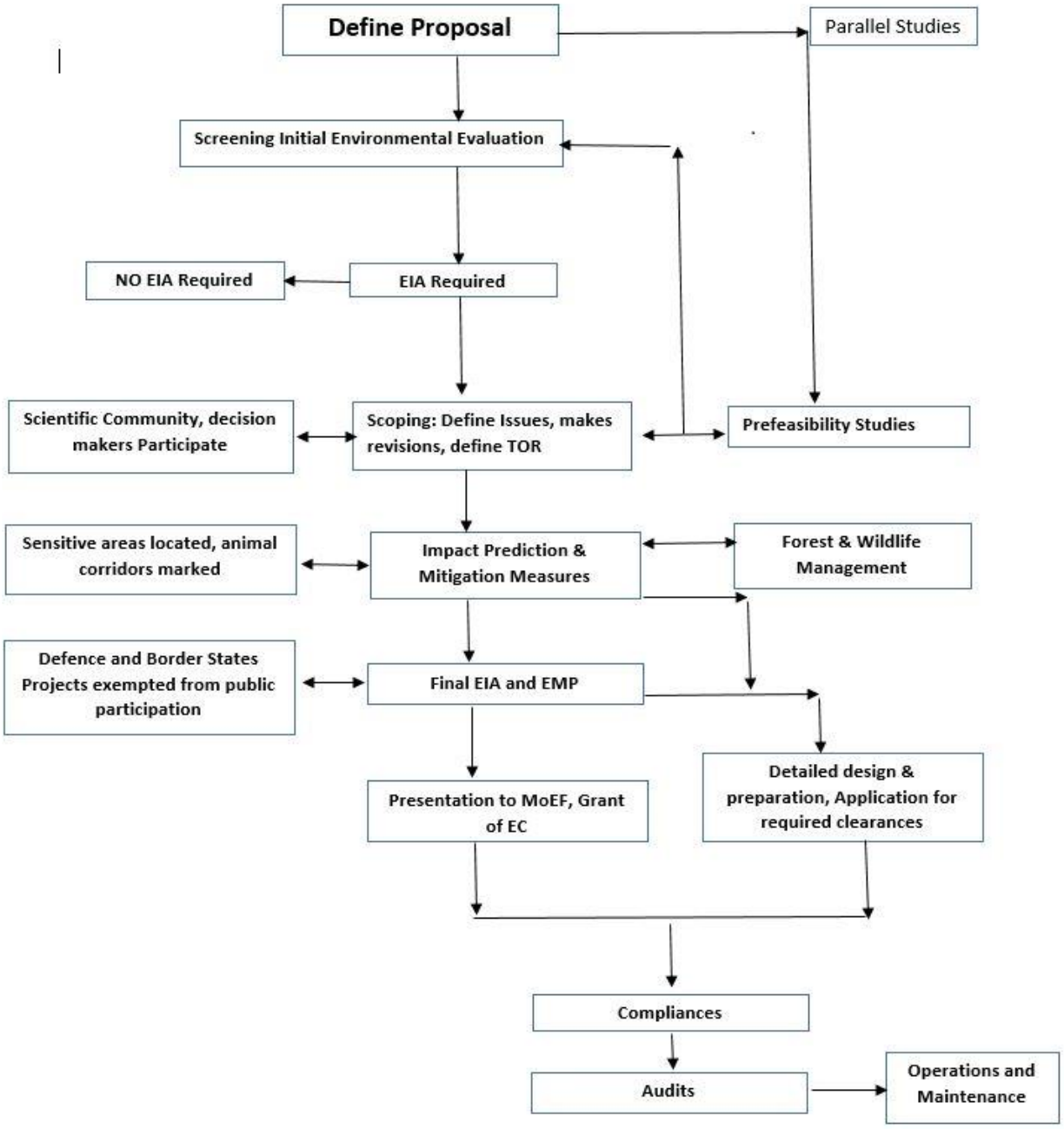
10.2.4.2 Significance of EIA Study

Environmental Impact Assessment (EIA) of a project ensures accountability of all the environmental impacts of the various project activities right from the stages of project initiation. The study incorporates the various environmental issues into planning and design stages of the project. It further guarantees the initiation of the various steps for minimization of the identified project impacts and assures a careful consideration of the different project alternatives. An exhaustive EIA process is inclusive of the various steps as described below:

Screening, Scoping, consideration of alternatives, Baseline data collection, Impact prediction Assessment of alternatives, delineation of mitigation measures and environmental impact statement, Environmental Management Plan Decision –monitors the clearance conditions.

10.2.4.3 Approach & Methodology

The general approach followed for carrying out the EIA for the project is summarized in the enclosed flow chart on the following page.



10.2.5 Environmental Management Plan

Several mitigation measures have been suggested along with the agency responsible for planning, execution, supervision and monitoring of the Environment Management Plan for preconstruction, construction and operation stages to avoid or mitigate the adverse impacts.

Pre-construction Phase

Pre-construction activities include acquisition of land and structures, relocation of utilities, removal of trees, relocation/compensation of common property resources viz. temple, hand pumps, obtaining Environmental Clearance, Consent to Establish from UPSPCB etc. UPEIDA/Concessionaire and concerned departments shall be responsible for those activities.

Construction Phase

Construction activities during this phase include setting up of Construction Camp, setting up of plants namely crusher plant, concrete batching plant, hot mix plant; clearing and grubbing, collection, storage and utilization of topsoil, identification of borrow pit & aggregate quarry (if other than those identified by design consultant), operation of the quarry, plantation on either side of the proposed expressway & at median, environmental protection & monitoring. Concessionaire shall be responsible for obtaining consent for establish and operate of those plants. Concessionaire shall also be responsible for implementation of the environmental protection measures during construction. The Independent Engineer/Authority Engineer shall be responsible for monitoring & supervision of the Concessionaire's activities as per Contract & report it to PIU, NHAI time to time. Project Implementation Unit (PIU), UPEIDA shall be responsible for regulatory compliance.

Operation Phase

Operation phase activities include environmental monitoring and monitoring of survival rate of the plantation etc. The Independent Engineer/Authority Engineer and Concessionaire shall be responsible for those activities.

10.2.6 Environmental Cost

Environmental costs, the costs for mitigation and management measures have been estimated. These costs along with the social costs have to be incurred by the implementing agency to include environmental and social safeguard measures into the proposed project. The environmental cost estimates include Environmental Mitigation Cost + Environmental Monitoring Cost for construction phase (3 years) and operation phase (5 years).

10.2.7 Validity of Environmental Clearance

The prior environmental clearance granted is valid for a period of five years. The regulatory authority concerned may extend this validity period by a maximum period of five years.

10.2.8 Clearance Requirements for the Project

The summary table showing time requirements for agency responsible for obtaining clearance, and a stage at which clearance will required is given below:

S. No.	Type of Clearance	Statutory Authority	Applicability	Project Stage	Approx Time Required	Responsibility
1	Prior Environmental Clearance	MoEF&CC	Applicable	Pre Construction	7-12 months	UPEIDA
2	Permission for Activities near archaeological protected areas	Archaeological survey of India / the state department of Archaeological	NA	Pre Construction	-	-
3	Clearance for working / diversion of sanctuary	Chief Wild Life Warden	NA	Pre Construction	-	-
4	Forest Clearance	State	Applicable	Pre	9-12	UPEIDA

S. No.	Type of Clearance	Statutory Authority	Applicability	Project Stage	Approx Time Required	Responsibility
		Department of Environment & Forest & MoEF		Construction	months	
5	Tree felling permission	Forest department	Felling of trees	Forest department	3 months	UPEIDA
6	NOC And Consents Under Air , Water, EP Acts & Noise rules of SPCB	State Pollution Control Board	For establishing plants	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
7	NOC And Consents Under Air , Water, EP Acts & Noise rules of SPCB	State Pollution Control Board	For operating Hot mix plants, Crushers and batching plants	Construction (Prior to work initiation)	1-2 months	Concessionaire / Contractor
8	Permission to store Hazardous Materials	State Pollution Control Board	Storage and Transportation Of Hazardous Materials and Explosives	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
9	Explosive license	Chief controller of explosives	Storage of explosive materials	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
10	NOC under Hazardous Waste (Management and Handling) Rules, 1989	State Pollution Control Board	Disposal of bituminous wastes	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
11	PUC certificate for use of vehicles for construction	Department of Transport	For all construction vehicles	Construction (Prior to work initiation)	1-2 months	Concessionaire / Contractor
12	Quarry lease deeds and license	Dept. of Geology and Mines	Quarrying and borrowing operations	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor
13	NOC for water extraction for construction and allied works	Ground Water Authority	Ground water extraction	Construction (Prior to work initiation)	2-3 months	Concessionaire / Contractor

11. FINANCIAL ANALYSIS

Financial Viability Report is attached separately as Volume-VII.

12. ECONOMIC ANALYSIS

Economic Viability Report is attached separately as Volume-VII.

13. COST ESTIMATES

13.1 GENERAL

The cost estimates for the project are extremely important as its entire viability and implementation depends on the project cost. Therefore, cost estimates and rate analysis of the items have been carried out with due care. The project cost estimates have been prepared considering various items of works associated with the identified proposals.

13.2 METHODOLOGY

The process involved in the preliminary cost estimation has been described under the following sections.

13.2.1 Basic rates

The basic rates of construction items have been analyzed using MoRTH Standard Data Book.

The rates of Bitumen have been adopted based on nearby refinery rates. Circle/District wise SOR/DSR rates have been adopted for Material & Labour.

Rates of each construction item have been analyzed based on study of sources of material involved, Prices of the material and Lead (Distance) of the sources from the project site.

For any item, if rates are not available in SOR/DSR, market rates have been adopted.

13.2.2 Quantification of Items / Quantities

Estimation of quantities & cost of various items has been covered as follows:

S. No.	Item	Activities Involved
1	Site clearance and Dismantling	Tree Cutting, Dismantling
2	Earth Work	Excavation for Roadway, Embankment Construction, Subgrade, Earthen Shoulders, Median Filling
3	Granular Sub Base Courses and Base Courses (Non- Bituminous)	Granular Sub Base, Wet Mix Macadam
4	Bituminous Courses	Prime Coat, Tack Coat, Dense Bituminous Macadam, Bituminous Concrete
5	Box Culverts	Box Culverts along the road for Drainage Purpose & balancing culverts
6	Minor Bridges	Bridges along the road having length between 6 m to 60m
7	Major Bridges	Bridges along the road having length > 60m
8	VUP/LVUP/PUP	Vehicular, Cattle & Pedestrian Underpasses proposed along the road
9	ROB	ROBs proposed along the project road for crossing over the Railway Lines
10	Flyover and NH & SH Crossing	Grade Separators for merging & diverging traffic at selected locations
11	Interchange and Junctions	Grade Separators for merging & diverging traffic at selected locations

S. No.	Item	Activities Involved
12	Retaining Wall	Retaining walls proposed along various stretches, wherever required
13	Drainage & Protective Works	Lined Drain, Unlined Drain, Chute Drain, Median Drain, Turfing, Pitching etc.
14	Traffic signs, Road markings and other road appurtenances	Various road signs, road furnitures, markings & appurtenances required along the project road
15	Toll Plaza	Toll Plazas proposed on the project road
16	Approach to Wayside Amenities, Toilet block & Median Opening	Quantities and cost of materials & activities required for approaches to the Way Side Amenities, toilet blocks & median opening
17	Environmental Cost (Civil Works)	Cost of horticulture & Mitigation measures required for development of project road
18	Miscellaneous Works	Precast Concrete Tiles, Utility Ducts, Temporary Diversions, Lighting, High Masts, Solar Panels, Ambulance, Medical Aid Post, Traffic Aid Posts, Beautification of interchanges etc.
19	ATMS for Access Controlled Expressway,	Installation of ATMS on the project road toll plazas

13.2.3 Centages

Following centages have been added in the cost estimate:

1	Contingency	2.8%
2	Agency Charges	1%
3	Supervision	1.5%
4	Maintenance Cost for 5 years	7%
5	Escalation for First Year	Nil
6	Escalation for Second Year	7.5% on 40% cost
7	Escalation for Third Year	12.5% on 40% cost
8	Labour Cess	1%

13.3 SPECIFICATIONS

The Specifications for various items of work have been assumed to follow the MoRT&H Guidelines for Expressway (2010), MoRT&H Specifications for Road & Bridge Works and Manual of Specifications and Standards for Expressways (IRC: SP:99-2013) published by IRC, Government of India.

13.4 COST ESTIMATES

The Cost Estimates have been prepared for the project expressway (in 12 Packages). Cost estimates includes cost for 6 (six) lanes expressway and the cost of structures has been adopted for 8 (eight) lanes. The summary of cost estimates for all packages of the project road is given in Table 13.1 below:

Table–13.1

Pkg. No.	Chainage (km)		Length	Cost		
	From	To		Civil Cost (Rs)	Civil Cost (Including 12% GST) (Rs)	Capital Cost (Rs)
I	7.9	56.9	49	₹ 16,929,753,704	₹ 18,961,324,148	₹ 3884,35,89,260
II	56.9	86.9	30	₹ 12,539,469,447	₹ 14,044,205,781	₹ 2234,88,68,926
III	86.9	137.6	50.7	₹ 15,529,406,218	₹ 17,392,934,964	₹ 3007,94,69,924
IV	137.6	189.7	52.1	₹ 17,067,827,331	₹ 19,115,966,610	₹ 3054,49,11,158
V	189.7	236.4	46.7	₹ 15,688,567,430	₹ 17,571,195,521	₹ 2716,04,59,294
VI	236.4	289.3	52.9	₹ 17,669,549,599	₹ 19,789,895,550	₹ 3081,09,48,998
VII	289.3	341.7	52.4	₹ 18,510,368,030	₹ 20,731,612,193	₹ 3079,81,79,768
VIII	341.7	391.9	50.2	₹ 17,927,737,151	₹ 20,079,065,609	₹ 3011,44,36,480
IX	391.9	445	53.1	₹ 15,445,750,470	₹ 17,299,240,526	₹ 2742,79,99,371
X	445	496.8	51.8	₹ 16,585,292,104	₹ 18,575,527,157	₹ 2921,29,16,807
XI	496.8	548.8	52	₹ 17,806,124,788	₹ 19,942,859,763	₹ 3246,56,27,563
XII	548.8	601.847	53.047	₹ 15,844,814,925	₹ 17,746,192,716	₹ 3248,92,68,536
Total			**593.947**	**₹ 197,544,661,196**	**₹ 221,250,020,540**	**₹ 36229,66,76,085**

Cost abstracts of all the packages (Package I to XII) are attached below:

No.	*Package No.* →	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*TOTAL*
	LENGTH (Km)	***49***	***30***	***50.7***	***52.1***	***46.7***	***52.9***	***52.4***	***50.2***	***53.1***	***51.8***	***52***	***53.047***	***593.947***
1	Site clearance and Earth Work	267.96	177.35	244.52	273.31	232.24	247.82	293.81	282.83	272.24	291.48	333.87	312.27	3229.69
2	Non- Bituminous	231.49	148.70	285.46	326.44	264.49	299.40	327.11	309.00	276.85	254.51	230.26	215.94	3169.65
3	Bituminous	227.38	148.97	271.33	290.96	259.19	278.15	304.31	283.00	276.19	261.87	249.86	241.57	3092.75
	Sub total	**726.84**	**475.01**	**801.31**	**890.71**	**755.91**	**825.36**	**925.23**	**874.82**	**825.28**	**807.86**	**813.98**	**769.77**	**9492.09**
4	ROB	49.67	0.00	66.06	39.74	0.00	0.00	0.00	41.60	51.70	0.00	91.00	0.00	339.77
5	Major Bridges	127.25	366.66	0.00	43.48	339.74	56.69	107.50	36.01	42.96	0.00	34.60	24.78	1179.65
6	Minor Bridges	68.92	61.07	27.21	3.35	59.99	67.23	129.54	84.09	114.41	246.10	213.42	155.50	1230.86
7	VUP/LVUP/PUP	110.27	66.82	124.56	150.76	98.87	112.29	166.47	108.63	121.34	137.61	122.62	126.61	1446.85
8	Culverts (Box)	58.84	26.69	43.53	48.40	38.58	56.00	52.50	57.89	58.88	45.40	78.55	71.06	636.32
9	Flyover and NH & SH Crossing	195.64	34.94	119.44	127.14	30.53	75.36	92.77	185.47	36.19	81.31	69.67	58.10	1106.55
10	Interchange and Junctions	54.66	16.88	77.66	91.22	0.00	85.26	61.06	73.47	19.48	54.03	64.62	45.44	643.78
11	Retaining Wall	25.34	41.32	18.02	19.94	25.53	25.45	21.96	55.32	23.15	23.41	33.13	60.76	373.32
12	Drainage & Protective Works	116.10	71.30	126.76	133.22	111.00	133.19	137.55	123.83	111.59	115.68	105.54	105.77	1391.54
	Sub total	**806.69**	**685.68**	**603.25**	**657.25**	**704.23**	**611.47**	**769.36**	**766.32**	**579.69**	**703.54**	**813.15**	**648.01**	**8348.63**
13	Toll Plaza	40.94	2.42	15.53	15.76	0.00	17.03	14.09	13.80	2.42	13.11	12.76	41.04	188.90
14	Approach to WSA , Medians	1.91	12.16	7.80	9.70	1.96	14.76	15.05	14.48	13.35	10.53	14.34	1.80	117.84
	Sub total	**42.85**	**14.57**	**23.33**	**25.47**	**1.96**	**31.79**	**29.15**	**28.28**	**15.77**	**23.64**	**27.09**	**42.84**	**306.74**
15	Road Furniture	66.90	45.77	75.78	82.09	66.23	81.14	78.82	75.50	77.32	75.40	76.85	75.20	877.01
16	ATMS	6.60	4.04	6.83	7.02	6.29	7.13	7.06	6.76	7.15	6.98	7.00	7.15	80.00
	Sub total	**73.50**	**49.81**	**82.61**	**89.11**	**72.52**	**88.27**	**85.88**	**82.26**	**84.48**	**82.38**	**83.85**	**82.35**	**957.01**
17	**Environmental Cost (Civil works)**	15.09	9.71	16.27	17.48	15.17	18.53	17.77	16.77	17.37	16.99	16.38	15.71	193.24
18	**AIRSTRIP**	**0**	**0**	**0**	**0**	**0**	**166.70**	**0**	**0**	**0**	**0**	**0**	**0**	**166.70**
19	**Misc.**	**28.01**	**19.15**	**26.19**	**26.77**	**19.06**	**24.84**	**23.65**	**24.34**	**22.00**	**24.12**	**26.15**	**25.79**	**290.06**
	Total (Civil)	**1692.98**	**1253.95**	**1552.94**	**1706.78**	**1568.86**	**1766.95**	**1851.04**	**1792.77**	**1544.58**	**1658.53**	**1780.61**	**1584.48**	**19754.47**
20	**GST @12%**	**203.16**	**150.47**	**186.35**	**204.81**	**188.26**	**212.03**	**222.12**	**215.13**	**185.35**	**199.02**	**213.67**	**190.14**	**2370.54**

	Grand Total (Civil)	**1896.14**	**1404.42**	**1739.29**	**1911.60**	**1757.12**	**1978.99**	**2073.16**	**2007.91**	**1729.92**	**1857.55**	**1994.29**	**1774.62**	**22125.00**
21	**Contingency @ 2%**	**33.86**	**25.08**	**31.06**	**34.14**	**31.38**	**35.34**	**37.02**	**35.86**	**30.89**	**33.17**	**35.61**	**31.69**	**395.09**
22	**Agency Charges @ 1%**	**16.93**	**12.54**	**15.53**	**17.07**	**15.69**	**17.67**	**18.51**	**17.93**	**15.45**	**16.59**	**17.81**	**15.84**	**197.54**
23	**Supervision @ 1.5%**	**25.39**	**18.81**	**23.29**	**25.60**	**23.53**	**26.50**	**27.77**	**26.89**	**23.17**	**24.88**	**26.71**	**23.77**	**296.32**
	Sub total	**76.18**	**56.43**	**69.88**	**76.81**	**70.60**	**79.51**	**83.30**	**80.67**	**69.51**	**74.63**	**80.13**	**71.30**	**888.95**
24	**Maintenance Cost for 5 years @ 7%**	**118.51**	**87.78**	**108.71**	**119.47**	**109.82**	**123.69**	**129.57**	**125.49**	**108.12**	**116.10**	**124.64**	**110.91**	**1382.81**
25	**Escalation for Second Year (7.5% x 40%)**	**50.79**	**37.62**	**46.59**	**51.20**	**47.07**	**53.01**	**55.53**	**53.78**	**46.34**	**49.76**	**53.42**	**47.53**	**592.63**
26	**Escalation for Third Year (12.5% x 40%)**	**84.65**	**62.70**	**77.65**	**85.34**	**78.44**	**88.35**	**92.55**	**89.64**	**77.23**	**82.93**	**89.03**	**79.22**	**987.72**
	Sub total	**135.44**	**100.32**	**124.24**	**136.54**	**125.51**	**141.36**	**148.08**	**143.42**	**123.57**	**132.68**	**142.45**	**126.76**	**1580.36**
27	**Labour Cess - 1%**	16.93	12.54	15.53	17.07	15.69	17.67	18.51	17.93	15.45	16.59	17.81	15.84	197.54
28	**Utility shifting Cost**	49.50	30.31	51.22	52.63	47.18	53.44	52.93	50.71	53.64	52.33	52.53	53.59	600.00
29	**Land Acquisation Cost**	**1575**	**533**	**882**	**723**	**574**	**669**	**557**	**568**	**625**	**654**	**817**	**1078**	**9255.00**
29	**Enviormental & Mitigation Cost (Non Civil works)**	**16.50**	**10.10**	**17.07**	**17.54**	**15.73**	**17.81**	**17.64**	**16.90**	**17.88**	**17.44**	**17.51**	**17.86**	**200.00**
30	**Grand Total (Package)**	**3884.36**	**2234.89**	**3007.95**	**3054.49**	**2716.05**	**3081.09**	**3079.82**	**3011.44**	**2742.80**	**2921.29**	**3246.56**	**3248.93**	**36229.67**
	Per Km Cost	*35*	*42*	*31*	*33*	*34*	*33*	*35*	*36*	*29*	*32*	*34*	*30*	*33*

(Package-I): From Village- Bijoli (Dist. Meerut) to Village- Chandner (Dist. Hapur) (Km 7.900 to Km 56.900)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	35876319	0.212
2	Bill No. 2 : Earth Work	2643761321	15.616
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	2314944802	13.674
4	Bill No. 4 : Bituminous Courses	2273802648	13.431
5	Bill No. 5 : Box Culverts	588353433	3.475
6A	Bill No. 6A : Minor Bridges	689240910	4.071
6B	Bil No. 6B : Major Bridges	1272506071	7.516
6C	Bill No. 6C : VUP/LVUP/SVUP	1102729407	6.514
6D	Bill No. 6D : ROB	496739386	2.934
6E	Bill No. 6E : Flyover and NH & SH Crossing	1956377243	11.556
6F	Bill No. 6F : Interchange and Junctions	546579136	3.229
6G	Bill No. 6G : Retaining Wall	253381612	1.497
7	Bill No. 7 : Drainage & Protective Works	1161022873	6.858
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	668984569	3.952
9	Bill No. 9: Toll Plaza	409353444	2.418
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	19128788	0.113
11	Bill No. 11 : Enviormental Cost (Civil Works)	150911190	0.891
12	Bill No. 12 : Miscellaneous Works	280061400	1.654
13	Bill No. 13 : ATMS for Access Controlled Expressway,	65999155	0.390
a)	**Civil Construction Cost**	**16929753704**	100.00
b)	**GST @ 12%**	**2031570444**	
	Total Civil Cost (a+b)	**18961324148**	
c)	Contingency @ 2 % of Total Civil Construction Cost	338595074	
	Total (a+b+c)	**19299919222**	
d)	Agency Charges @ 1% of a) Civil Construction Cost	169297537	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	253946306	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1185082759	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	507,892,611	
i)	Escalation for Third Year (12.5% x 40%)	846,487,685	
j)	Labour Cess - 1%	169297537	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**22431923658**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	494993661	
	Land Acquisition Cost	15751674054	
	Enviormental & Mitigation Cost (Non Civil works)	164997887	
	Grand Total	**38843589260**	

(Package-II): From Chandner (Dist.Hapur) to Village-Mirzapur Dugar (Dist. Amroha) (Km 56.900 to Km 86.900)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	21318290	0.170
2	Bill No. 2 : Earth Work	1752175491	13.973
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	1486968640	11.858
4	Bill No. 4 : Bituminous Courses	1489673908	11.880
5	Bill No. 5 : Box Culverts	266942151	2.129
6A	Bill No. 6A : Minor Bridges	610680205	4.870
6B	Bil No. 6B : Major Bridges	3666583253	29.240
6C	Bill No. 6C : VUP/LVUP/PUP	668152479	5.328
6D	Bill No. 6D : ROB	0	0.000
6E	Bill No. 6E : Flyover and NH & SH Crossing	349361561	2.786
6F	Bill No. 6F : Interchange and Junctions	168838585	1.346
6G	Bill No. 6G : Retaining Wall	413216369	3.295
7	Bill No. 7 : Drainage & Protective Works	713045408	5.686
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	457677214	3.650
9	Bill No. 9: Toll Plaza	24151753	0.193
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	121582105	0.970
11	Bill No. 11 : Enviormental Cost (Civil Works)	97144987	0.775
12	Bill No. 12 : Miscellaneous Works	191549400	1.528
13	Bill No. 13 : ATMS for Access Controlled Expressway,	40407646	0.322
a)	**Civil Construction Cost**	**12539469447**	100.00
b)	**GST @ 12%**	**1504736334**	
	Total Civil Cost (a+b)	**14044205781**	
c)	Contingency @ 2 % of Total Civil Construction Cost	250789389	
	Total (a+b+c)	**14294995170**	
d)	Agency Charges @ 1% of a) Civil Construction Cost	125394694	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	188092042	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	877762861	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	376184083	
i)	Escalation for Third Year (12.5% x 40%)	626973472	
j)	Labour Cess - 1%	125394694	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**16614797017**	
	Utility Shifting, Land Acquisation & EMP Cost		
	Utility shifting Cost	303057344	
	Land Acquisation Cost	5329995450	
	Enviormental Cost (Non Civil works)	101019115	
	Grand Total	**22348868926**	

(Package-III): From Village- Mirzapur Dugar (Dist. Amroha) to Village-Nagla Baraha (Dist. Budaun) (Km 86.900 to Km 137.600)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	36610883	0.236
2	Bill No. 2 : Earth Work	2408555188	15.510
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	2854598761	18.382
4	Bill No. 4 : Bituminous Courses	2713289459	17.472
5	Bill No. 5 : Box Culverts	435316285	2.803
6A	Bill No. 6A : Minor Bridges	272102927	1.752
6B	Bil No. 6B : Major Bridges	0	0.000
6C	Bill No. 6C : VUP/LVUP/SVUP	1245616680	8.021
6D	Bill No. 6D : ROB	660558541	4.254
6E	Bill No. 6E : Flyover and NH & SH Crossing	1194374138	7.691
6F	Bill No. 6F : Interchange and Junctions	776634992	5.001
6G	Bill No. 6G : Retaining Wall	180245987	1.161
7	Bill No. 7 : Drainage & Protective Works	1267606297	8.163
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	757788284	4.880
9	Bill No. 9: Toll Plaza	155305870	1.000
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	77965515	0.502
11	Bill No. 11 : Enviormental Cost (Civil Works)	162669690	1.047
12	Bill No. 12 : Miscellaneous Works	261877800	1.686
13	Bill No. 13 : ATMS for Access Controlled Expressway,	68288921	0.440
a)	**Civil Construction Cost**	**15529406218**	100.00
b)	**GST @ 12%**	**1863528746**	
	Total Civil Cost (a+b)	**17392934964**	
c)	Contingency @ 2 % of Total Civil Construction Cost	310588124	
	Total (a+b+c)	**177003523089**	
d)	Agency Charges @ 1% of a) Civil Construction Cost	155294062	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	232941093	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1087058435	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	465882187	
i)	Escalation for Third Year (12.5% x 40%)	776470311	
j)	Labour Cess - 1%	155294062	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**20576463239**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	512166911	
	Land Acquisation Cost	8820117471	
	Enviormental Mitigation Cost (Non Civil works)	170722304	
	Grand Total	**30079469924**	

(Package-IV): From Village-Nagla Baraha (Dist. Budaun) to Village-Binawar (Dist. Budaun) (Km 137.600 to Km 189.700)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	39897973	0.234
2	Bill No. 2 : Earth Work	2693250483	15.780
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	3264407958	19.126
4	Bill No. 4 : Bituminous Courses	2909573686	17.047
5	Bill No. 5 : Box Culverts	484005001	2.836
6A	Bill No. 6A : Minor Bridges	33548458	0.197
6B	Bil No. 6B : Major Bridges	434795457	2.547
6C	Bill No. 6C : VUP/LVUP/SVUP	1507555585	8.833
6D	Bill No. 6D : ROB	397389479	2.328
6E	Bill No. 6E : Flyover and NH & SH Crossing	1271379289	7.449
6F	Bill No. 6F : Interchange and Junctions	912205350	5.345
6G	Bill No. 6G : Retaining Wall	199361995	1.168
7	Bill No. 7 : Drainage & Protective Works	1332226808	7.805
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	820917717	4.810
9	Bill No. 9: Toll Plaza	157642992	0.924
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	97032956	0.569
11	Bill No. 11 : Enviormental Cost (Civil Works)	174809453	1.024
12	Bill No. 12 : Miscellaneous Works	267652080	1.568
13	Bill No. 13 : ATMS for Access Controlled Expressway,	70174612	0.411
a)	**Civil Construction Cost**	**17067827331**	100.00
b)	**GST @ 12%**	**2048139280**	
	Total Civil Cost (a+b)	**19115966610**	
c)	Contingency @ 2 % of Total Civil Construction Cost	341356547	
	Total (a+b+c)	**19457323157**	
d)	Agency Charges @ 1 % of a) Civil Construction Cost	170678273	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	256017410	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1194747913	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	512034820	
i)	Escalation for Third Year (12.5% x 40%)	853391367	
j)	Labour Cess - 1%	170678273	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**22614871213**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	526309587	
	Land Acquisation Cost	7228293830	
	Enviormental & Mitigation Cost (Non Civil works)	175436529	
	Grand Total	**30544911158**	

(Package-V): From Village- Binawar (Dist. Budaun) to Village- Girdharpur (Dist. Shahjahanpur) (Km 189.700 to 236.400)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	30847825	0.197
2	Bill No. 2 : Earth Work	2291531262	14.606
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	2644879216	16.859
4	Bill No. 4 : Bituminous Courses	2591860385	16.521
5	Bill No. 5 : Box Culverts	385750816	2.459
6A	Bill No. 6A : Minor Bridges	599874772	3.824
6B	Bil No. 6B : Major Bridges	3397356825	21.655
6C	Bill No. 6C : VUP/LVU/SVUP	988710377	6.302
6D	Bill No. 6D : ROB	0	0.000
6E	Bill No. 6E : Flyover and NH & SH Crossing	305336820	1.946
6F	Bill No. 6F : Interchange and Junctions	0	0.000
6G	Bill No. 6G : Retaining Wall	255283053	1.627
7	Bill No. 7 : Drainage & Protective Works	1110015213	7.075
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	662338484	4.222
9	Bill No. 9: Toll Plaza		0.000
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	19581274	0.125
11	Bill No. 11 : Enviormental Cost (Civil Works)	151705431	0.967
12	Bill No. 12 : Miscellaneous Works	190594440	1.215
13	Bill No. 13 : ATMS for Access Controlled Expressway,	62901235	0.401
a)	**Civil Construction Cost**	**15688567430**	100.00
b)	**GST @ 12%**	**1882628092**	
	Total Civil Cost (a+b)	**17571195521**	
c)	Contingency @ 2 % of Total Civil Construction Cost	313771349	
	Total (a+b+c)	**17884966870**	
d)	Agency Charges @ 1 % of a) Civil Construction Cost	156885674	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	235328511	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1098199720	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	470657023	
i)	Escalation for Third Year (12.5% x 40%)	784428371	
j)	Labour Cess - 1%	156885674	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**20787351844**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	471759265	
	Land Acquisation Cost	5744095097	
	Enviormental & Mitigation Cost (Non Civil works)	157253088	
	Grand Total	**27160459294**	

(Package-VI): From Village- Girdharpur (Dist. Shahjahanpur) to Village-Ubariya Khurd (Dist. Hardoi) (Km 236.400 to Km 289.300)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	37145420	0.210
2	Bill No. 2 : Earth Work	2441051194	13.815
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	2993968798	16.944
4	Bill No. 4 : Bituminous Courses	2781454571	15.742
5	Bill No. 5 : Box Culverts	560025918	3.169
6A	Bill No. 6A : Minor Bridges	672320461	3.805
6B	Bil No. 6B : Major Bridges	566860568	3.208
6C	Bill No. 6C : VUP/LVUP/SVUP	1122860080	6.355
6D	Bill No. 6D : ROB	0	0.000
6E	Bill No. 6E : Flyover and NH & SH Crossing	753594265	4.265
6F	Bill No. 6F : Interchange and Junctions	852617742	4.825
6G	Bill No. 6G : Retaining Wall	254511319	1.440
7	Bill No. 7 : Drainage & Protective Works	1331860304	7.538
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	811427549	4.592
9	Bill No. 9: Toll Plaza	170288028	0.964
10	Bill No. 10: Approach to Wayside Amenities & Median Opening	147616519	0.835
11	Bill No. 11 : Enviormental Cost (Civil Works)	185276980	1.049
12	Bill No. 12 : Miscellaneous Works	248373760	1.406
13	Bill No. 13 : ATMS for Access Controlled Expressway,	71252149	0.403
14	Bill No. 14 : Airstrip	1667043975	9.435
a)	**Civil Construction Cost**	**17669549599**	100.00
b)	**GST @ 12%**	**2120345952**	
	Total Civil Cost (a+b)	**19789895550**	
c)	Contingency @ 2 % of Total Civil Construction Cost	353390992	
	Total (a+b+c)	**20143286542**	
d)	Agency Charges @ 1 % of a) Civil Construction Cost	176695496	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	265043244	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1236868472	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	530086488	
i)	Escalation for Third Year (12.5% x 40%)	883477480	
j)	Labour Cess - 1%	176695496	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**23412153218**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	534391116	
	Land Acquisation Cost	6686274293	
	Enviormental Cost (Non Civil works)	178130372	
	Grand Total	**30810948998**	

(Package-VII): From Village- Ubariya Khurd (Dist. Hardoi) to Village- Pandra Lakhanpur (Dist. Hardoi) (Km 289.300 to Km 341.700)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	37726349	0.204
2	Bill No. 2 : Earth Work	2900344736	15.669
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	3271136466	17.672
4	Bill No. 4 : Bituminous Courses	3043080067	16.440
5	Bill No. 5 : Box Culverts	525049986	2.837
6A	Bill No. 6A : Minor Bridges	1295441603	6.998
6B	Bil No. 6B : Major Bridges	1074973954	5.807
6C	Bill No. 6C : VUP/LVUP/SVUP	1664735962	8.994
6D	Bill No. 6D : ROB	0	0.000
6E	Bill No. 6E : Flyover and NH & SH Crossing	927697848	5.012
6F	Bill No. 6F : Interchange and Junctions	610602020	3.299
6G	Bill No. 6G : Retaining Wall	219591188	1.186
7	Bill No. 7 : Drainage & Protective Works	1375491947	7.431
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	788237298	4.258
9	Bill No. 9: Toll Plaza	140945103	0.761
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	150548030	0.813
11	Bill No. 11 : Enviormental Cost (Civil Works)	177694785	0.960
12	Bill No. 12 : Miscellaneous Works	236492000	1.278
13	Bill No. 13 : ATMS for Access Controlled Expressway,	70578688	0.381
a)	**Civil Construction Cost**	**18510368030**	100.00
b)	**GST @ 12%**	**2221244164**	
	Total Civil Cost (a+b)	**20731612193**	
c)	Contingency @ 2 % of Total Civil Construction Cost	370207361	
	Total (a+b+c)	**21101819554**	
d)	Agency Charges @ 1% of a) Civil Construction Cost	185103680	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	277655520	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1295725762	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	555311041	
i)	Escalation for Third Year (12.5% x 40%)	925518401	
j)	Labour Cess - 1%	185103680	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**24526237640**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	529340160	
	Land Acquisation Cost	5566155249	
	Enviormental Cost (Non Civil works)	176446720	
	Grand Total	**30798179768**	

(Package-VIII): From Village- Pandra Lakhanpur (Dist. Hardoi) to Village- Raiyamau (Dist. Unnao) (Km 341.700 to Km 391.900)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	35984510	0.201
2	Bill No. 2 : Earth Work	2792280990	15.575
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	3089987694	17.236
4	Bill No. 4 : Bituminous Courses	2829955036	15.785
5	Bill No. 5 : Box Culverts	578917572	3.229
6A	Bill No. 6A : Minor Bridges	840916432	4.691
6B	Bil No. 6B : Major Bridges	360116561	2.009
6C	Bill No. 6C : VUP/LVUP/SVUP	1086308996	6.059
6D	Bill No. 6D : ROB	416009731	2.320
6E	Bill No. 6E : Flyover and NH & SH Crossing	1854671827	10.345
6F	Bill No. 6F : Interchange and Junctions	734689101	4.098
6G	Bill No. 6G : Retaining Wall	553193427	3.086
7	Bill No. 7 : Drainage & Protective Works	1238346280	6.907
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	754971203	4.211
9	Bill No. 9: Toll Plaza	137962464	0.770
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	144799054	0.808
11	Bill No. 11 : Enviormental Cost (Civil Works)	167659813	0.935
12	Bill No. 12 : Miscellaneous Works	243351000	1.357
13	Bill No. 13 : ATMS for Access Controlled Expressway,	67615461	0.377
a)	**Civil Construction Cost**	**17927737151**	100.00
b)	**GST @ 12%**	**2151328458**	
	Total Civil Cost (a+b)	**20079065609**	
c)	Contingency @ 2 % of Total Civil Construction Cost	358554743	
	Total (a+b+c)	**20437620352**	
d)	Agency Charges @ 1 % of a) Civil Construction Cost	179277372	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	268916057	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1254941601	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	537832115	
i)	Escalation for Third Year (12.5% x 40%)	896386858	
j)	Labour Cess - 1%	179277372	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**23754251725**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	507115955	
	Land Acquisation Cost	5684030148	
	Enviormental Cost (Non Civil works)	169038652	
	Grand Total	**30114436480**	

(Package-IX): From Village- Raiyamau (Dist. Unnao) to Village- Sarso (Dist. Unnao) (Km 391.900 to Km 445.000)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	37837845	0.245
2	Bill No. 2 : Earth Work	2684519638	17.380
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	2768542495	17.924
4	Bill No. 4 : Bituminous Courses	2761902444	17.881
5	Bill No. 5 : Box Culverts	588750131	3.812
6A	Bill No. 6A : Minor Bridges	1144108684	7.407
6B	Bil No. 6B : Major Bridges	429567438	2.781
6C	Bill No. 6C : VUP/LVUP/SVUP	1213448323	7.856
6D	Bill No. 6D : ROB	516960452	3.347
6E	Bill No. 6E : Flyover and NH & SH Crossing	361902270	2.343
6F	Bill No. 6F : Interchange and Junctions	194750475	1.261
6G	Bill No. 6G : Retaining Wall	231476361	1.499
7	Bill No. 7 : Drainage & Protective Works	1115908003	7.225
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	773233675	5.006
9	Bill No. 9: Toll Plaza	24181386	0.157
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	133525106	0.864
11	Bill No. 11 : Enviormental Cost (Civil Works)	173656450	1.124
12	Bill No. 12 : Miscellaneous Works	219957760	1.424
13	Bill No. 13 : ATMS for Access Controlled Expressway,	71521533	0.463
a)	**Civil Construction Cost**	**15445750470**	100.00
b)	**GST @ 12%**	**1853490056**	
	Total Civil Cost (a+b)	**17299240526**	
c)	Contingency @ 2 % of Total Civil Construction Cost	308915009	
	Total (a+b+c)	**17608155536**	
d)	Agency Charges @ 1 % of a) Civil Construction Cost	154457505	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	231686257	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1081202533	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	463,372,514	
i)	Escalation for Third Year (12.5% x 40%)	772,287,523	
j)	Labour Cess - 1%	154457505	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**20465619373**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	536411498	
	Land Acquisation Cost	6247164667	
	Enviormental Cost (Non Civil works)	178803833	
	Grand Total	**27427999371**	

(Package-X): From Village- Sarso (Dist. Unnao) to Village- Terukha (Dist. Raebareli) (Km 445.000 to Km 496.800)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	37366272	0.225
2	Bill No. 2 : Earth Work	2877430527	17.349
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	2545146096	15.346
4	Bill No. 4 : Bituminous Courses	2618656898	15.789
5	Bill No. 5 : Box Culverts	454023447	2.738
6A	Bill No. 6A : Minor Bridges	2461029627	14.839
6B	Bil No. 6B : Major Bridges	0	0.000
6C	Bill No. 6C : VUP/LVUP/SVUP	1376127206	8.297
6D	Bill No. 6D : ROB	0	0.000
6E	Bill No. 6E : Flyover and NH & SH Crossing	813090048	4.902
6F	Bill No. 6F : Interchange and Junctions	540251132	3.257
6G	Bill No. 6G : Retaining Wall	234051367	1.411
7	Bill No. 7 : Drainage & Protective Works	1156800920	6.975
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	754007699	4.546
9	Bill No. 9: Toll Plaza	131134592	0.791
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	105288973	0.635
11	Bill No. 11 : Enviormental Cost (Civil Works)	169868366	1.024
12	Bill No. 12 : Miscellaneous Works	241248400	1.455
13	Bill No. 13 : ATMS for Access Controlled Expressway,	69770535	0.421
a)	**Civil Construction Cost**	**16585292104**	100.00
b)	**GST @ 12%**	**1990235053**	
	Total Civil Cost (a+b)	**18575527157**	
c)	Contingency @ 2 % of Total Civil Construction Cost	331705842	
	Total (a+b+c)	**18907232999**	
d)	Agency Charges @ 1 % of a) Civil Construction Cost	165852921	
e)	Supervision @ 1.5% of a) Civil Construction Cost	248779382	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1160970447	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	497,558,763	
i)	Escalation for Third Year (12.5% x 40%)	829,264,605	
j)	Labour Cess - 1%	165852921	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**21975512038**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	523279013	
	Land Acquisation Cost	6539699418	
	Enviormental Cost (Non Civil works)	174426338	
	Grand Total	**29212916807**	

(Package-XI): From Village-Terukha (Dist. Raebareli) to Village- Arro (Dist. Pratapgarh) (Km 496.800 to Km 548.800)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	37307463	0.210
2	Bill No. 2 : Earth Work	3301373247	18.541
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	2302570012	12.931
4	Bill No. 4 : Bituminous Courses	2498564418	14.032
5	Bill No. 5 : Box Culverts	785521078	4.412
6A	Bill No. 6A : Minor Bridges	2134248889	11.986
6B	Bil No. 6B : Major Bridges	345960444	1.943
6C	Bill No. 6C : VUP/LVUP/SVUP	1226207464	6.886
6D	Bill No. 6D : ROB	910001597	5.111
6E	Bill No. 6E : Flyover and NH & SH Crossing	696725107	3.913
6F	Bill No. 6F : Interchange and Junctions	646190089	3.629
6G	Bill No. 6G : Retaining Wall	331299609	1.861
7	Bill No. 7 : Drainage & Protective Works	1055372866	5.927
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	768457064	4.316
9	Bill No. 9: Toll Plaza	127576822	0.716
10	Bill No. 10: Approach to Wayside Amenities & Median Opening	143368807	0.805
11	Bill No. 11 : Enviormental Cost (Civil Works)	163837812	0.920
12	Bill No. 12 : Miscellaneous Works	261502080	1.469
13	Bill No. 13 : ATMS for Access Controlled Expressway,	70039919	0.393
a)	**Civil Construction Cost**	**17806124788**	100.00
b)	**GST @ 12%**	**2136734975**	
	Total Civil Cost (a+b)	**19942859763**	
c)	Contingency @ 2 % of Total Civil Construction Cost	356122496	
	Total (a+b+c)	**20298982259**	
d)	Agency Charges @ 1 % of a) Civil Construction Cost	178061248	
e)	Supervision @ 1.5 % of a) Civil Construction Cost	267091872	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1246428735	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	534,183,744	
i)	Escalation for Third Year (12.5% x 40%)	890,306,239	
j)	Labour Cess - 1%	178061248	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**23593115344**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	525299395	
	Land Acquisation Cost	8172113024	
	Enviormental & Mitigation Cost (Non Civil works)	175099798	
	Grand Total	**32465627563**	

(Package-XII): Village- Arro (Dist. Pratapgarh) to Village- Judapur Dando, (Dist. Prayagraj) (Km 548.800 to Km 601.847)			
Sr. No.	**Particulars**	**Amount**	**% of Cost**
1	Bill No. 1: Site clearance and Dismantling	36796229	0.232
2	Bill No. 2 : Earth Work	3085923175	19.476
3	Bill No. 3 : Grannular Sub Base Courses and Base Courses (Non- Bituminous)	2159357566	13.628
4	Bill No. 4 : Bituminous Courses	2415671841	15.246
5	Bill No. 5 : Box Culverts	710582019	4.485
6A	Bill No. 6A : Minor Bridges	1555038751	9.814
6B	Bil No. 6B : Major Bridges	247781434	1.564
6C	Bill No. 6C : VUP/LVUP/PUP	1266067559	7.990
6D	Bill No. 6D : ROB	0	0.000
6E	Bill No. 6E : Flyover and NH & SH Crossing	580966565	3.667
6F	Bill No. 6F : Interchange and Junctions	454411110	2.868
6G	Bill No. 6G : Retaining Wall	607553127	3.834
7	Bill No. 7 : Drainage & Protective Works	1057706715	6.675
8	Bill No. 8 : Traffic signs, Road markings and other road appurtunences	752018656	4.746
9	Bill No. 9: Toll Plaza	410441916	2.590
10	Bill No. 10: Approach to Wayside Amenities, Toilet block & Median Opening	17996956	0.114
11	Bill No. 11 : Enviormental Cost (Civil Works)	157144880	0.992
12	Bill No. 12 : Miscellaneous Works	257906280	1.628
13	Bill No. 13 : ATMS for Access Controlled Expressway,	71450146	0.451
a)	**Civil Construction Cost**	**15844814925**	100.00
b)	**GST @ 12%**	**1901377791**	
	Total Civil Cost (a+b)	**17746192716**	
c)	Contingency @ 2 % of Total Civil Construction Cost	316896298	
	Total (a+b+c)	**18063089014**	
d)	Agency Charges @ 1% of a) Civil Construction Cost	158448149	
e)	Supervision @ 1.5% of a) Civil Construction Cost	237672224	
f)	Maintenance Cost for 5 years @ 7% of a) Civil Construction Cost	1109137045	
g)	Escalation for First Year		
h)	Escalation for Second Year (7.5% x 40%)	475,344,448	
i)	Escalation for Third Year (12.5% x 40%)	792,240,746	
j)	Labour Cess - 1%	158448149	
	Total Project Cost (a+b+c+d+e+f+g+h+i+j)	**20994379776**	
	Utility Shifting, Land Acquisition & EMP Cost		
	Utility shifting Cost	535876097	
	Land Acquisation Cost	10780387298	
	Enviormental Cost (Non Civil works)	178625366	
	Grand Total	**32489268536**	