CHAPTER- 9
IMPROVEMENT/DEVELOPMENT SCHEME

9.1 GENERAL

The traffic studies and traffic projections require the development of the project stretch to 4-lane standards with paved shoulders. The section of this package starts from Km 0+000 and ends at Km 81+204 (existing) of NH 29E. The design chainage after improvements in alignment comes out from start chainage Km 0+000 to Km 79+450. The proposed length of the project road is 79.450 km. The Major items of proposed improvement /development are described in following Para's-

9.2 DESIGN STANDARDS

The formulation of design standards is required in order to avoid inconsistency in design from one section to other and provide desired level of service and safety. For the project section it is proposed to follow design standards given in Manual of Specifications and Standards for 4-laning of National Highway (IRC:SP: 84-2019) and relevant IRC codes, guidelines and Special Publication and MORTH circulars applicable to National Highways in general and decisions conveyed during various meetings/presentations. The latest IRC codes and MORTH specification (Rev-V) as applicable to design criteria of various items have been given in **Chapter 6**of this feasibility report.

The cross sectional features in general have been followed as per standards.

9.3 ALIGNMENT

The present alignment of the project road is passing mainly through plain and rolling terrainand at few stretches having linear alignment with geometrically deficient curves. Alignment of the project road has been designed for a design speed of 100kmph except in some stretches which has been developed to fourlane recently and have speed less than 80 KMPH especially in built up sections. One new two lane (with paved shoulder) Bypass has been constructed to bypass MohanapurDhalaincluding one new ROB (two lane) at design chainage 32+732. Another two bypasses i.e. Natunwa (4 Lane) &Pharenda (Two Lane) were already executed. The proposed alignment of 4 laning has been kept at right side of MohanapurDhala bypass

Speed reduction at few locations are due to matching these newly constructed stretches in certain locations. The project section is also realigned at certain locations to meet the criteria of required geometrical standards and design speed.

9.4 PROPOSED LANE CONFIGURATION

The present road section of the package is two lane with paved shoulder except at few habitation or bult up area where Four Lane TCS was adopted, as per the present traffic and future growth rate, the road section have been proposed to be upgraded to 4-lane with paved shoulder configuration. Serviceroad/slip road has been proposed at the locations of built up area and at major intersections, where grade separated structures have been proposed. Typical cross-section proposed in different sections of the project section of this package has been appended in drawing folder to main Report and also in this report.

9.5 ROW REQUIREMENT AND PROPOSED ROW

The existing available ROW for project highway is varying from 20.00m to 45.72m and at some places, the alignment passes through congested habitations in city / town/villages.

The land records from PWD Municipal authorities and revenue department have been collected and details of existing ROW have been appended in para 3.8 in **Chapter-3** of thisfinalfeasibility report.

At existing four lanes section concentric widening has been proposed with a view to use the existing road and to minimize the land acquisition. For proposed four lane section concentric / eccentric widening has been proposed as per site conditions/constraints.

To meet the proposed cross-sectional features of the various sections of the project road, ROW have been proposed as under-

Table 9.1 -Proposed ROW in Various Sections

S. No.	Design Chainage (Km)		Length (km)	PROW
	From	To		
1	0.000	1.680	1.680	45
2	1.680	10.780	9.100	50
3	10.780	11.080	0.300	140
4	11.080	11.175	0.095	165
5	11.175	11.235	0.060	120

S. No.	Design Chainage (Km)		Length (km)	PROW
	From	To		
6	11.235	11.300	0.065	85
7	11.300	17.320	6.020	45
8	17.320	18.835	1.515	50
9	18.835	18.855	0.020	-
10	18.855	20.500	1.645	45
11	20.500	21.980	1.480	50
12	21.980	27.005	5.025	60
13	27.005	27.055	0.050	Bridge
14	27.055	27.300	0.245	60
15	27.300	27.775	0.475	45
16	27.775	28.215	0.440	50
17	28.215	29.420	1.205	45
18	29.420	30.875	1.455	50
19	30.875	32.260	1.385	45
20	32.260	33.325	1.065	50
21	33.325	33.330	0.005	-
22	33.330	34.280	0.950	50
23	34.280	34.500	0.220	45
24	34.500	39.600	5.100	50
25	39.600	44.280	4.680	45
26	44.280	47.340	3.060	50
27	47.340	49.180	1.840	45
28	49.180	50.576	1.396	50
29	50.576	50.588	0.012	-
30	50.588	51.120	0.532	50
31	51.120	53.600	2.480	45
32	53.600	53.980	0.380	50
33	53.980	58.800	4.820	45
34	58.800	60.060	1.260	50
35	60.060	62.040	1.980	45
36	62.040	63.060	1.020	50
37	63.060	63.440	0.380	45
38	63.440	66.720	3.280	50
39	66.720	68.100	1.380	45
40	68.100	68.520	0.420	50
41	68.520	73.860	5.340	60
42	73.860	73.900	0.040	45
43	73.900	74.200	0.300	125
44	74.200	74.300	0.100	150

S. No.	Design Chainage (Km)		Length (km)	PROW
	From	To		
45	74.300	74.360	0.060	95
46	74.360	74.450	0.090	95
47	74.450	79.450	5.000	45
Total			**79.450**	

9.6 WIDENING SCHEME

The widening scheme along with improvement of alignment has been discussed in detail with NHAI officials during site visit and their views / suggestions have been incorporated in the proposed alignment.

The widening Eccentric (Left or Right) has been provided for the proposed 4-lane section keeping in view to save the newly constructed, save number of cutting of trees, shifting of utilities and least damage to abutting structures. Apart from this, realignments have been proposed for geometric improvement. The detail of proposed widening scheme is shown in table below:

Table 9.2- Widening Scheme

Sl No.	Design Chaiange		Length (Km)	Widening Scheme
	From	To		
1	-	2.720	2.720	Concentric
2	2.720	3.200	0.480	Realignment (Right) already exisitng
3	3.200	10.420	7.220	Concentric
4	10.420	11.500	1.080	Ecentric Right
5	11.500	12.150	0.650	Concentric
6	12.150	12.600	0.450	Ecentric Left
7	12.600	12.800	0.200	Concentric
8	12.800	13.200	0.400	Concentric
9	13.200	15.000	1.800	Ecentric Right
10	15.000	17.400	2.400	Ecentric Left
11	17.400	18.500	1.100	Concentric

Sl No.	Design Chaiange		Length (Km)	Widening Scheme
	From	To		
12	18.500	19.750	1.250	Ecentric Right
13	19.750	20.300	0.550	Concentric
14	20.300	21.980	1.680	Ecentric Left
15	21.980	27.300	5.320	Bypass
16	27.300	27.800	0.500	Ecentric Right
17	27.800	30.600	2.800	Concentric
18	30.600	30.900	0.300	Ecentric Right
19	30.900	33.300	2.400	Realignment (Right) MohnapurDhala bypass
20	33.300	33.950	0.650	Ecentric Right
21	33.950	34.100	0.150	Concentric
22	34.100	34.900	0.800	Ecentric Right
23	34.900	35.800	0.900	Ecentric Left
24	35.800	36.400	0.600	Concentric
25	36.400	36.600	0.200	Ecentric Right
26	36.600	37.600	1.000	Ecentric Left
27	37.600	38.300	0.700	Concentric
28	38.300	39.000	0.700	Ecentric Right
29	39.000	39.900	0.900	Concentric
30	39.900	40.300	0.400	Ecentric Left
31	40.300	41.300	1.000	Ecentric Right
32	41.300	42.900	1.600	Ecentric Left
33				Concentric

Sl No.	Design Chaiange		Length (Km)	Widening Scheme
	From	To		
	42.900	45.500	2.600	
34	45.500	46.400	0.900	Ecentric Right
35	46.400	46.900	0.500	Ecentric Left
36	46.900	47.350	0.450	Concentric
37	47.350	47.900	0.550	Ecentric Left
38	47.900	48.750	0.850	Ecentric Right
39	48.750	49.180	0.430	Ecentric Left
40	49.180	49.620	0.440	Realignment (Left)
41	49.620	51.200	1.580	Ecentric Right
42	51.200	53.300	2.100	Ecentric Left
43	53.300	53.450	0.150	Ecentric Right
44	53.450	53.650	0.200	Realignment/geometric improvement
45	53.650	58.250	4.600	Ecentric Right
46	58.250	60.000	1.750	Ecentric Left
47	60.000	64.300	4.300	Concentric
48	64.300	66.650	2.350	Ecentric Right
49	66.650	68.150	1.500	Ecentric Left
50	68.150	68.300	0.150	Ecentric Right
51	68.300	68.520	0.220	Concentric
52	68.520	73.860	5.340	Bypass
53	73.860	74.450	0.590	Concentric
54	74.450	75.650	1.200	Ecentric Right

Sl No.	Design Chaiange		Length (Km)	Widening Scheme
	From	To		
55	75.650	77.250	1.600	Ecentric Left
56	77.250	78.150	0.900	Ecentric Right
57	78.150	79.450	1.300	Concentric
		Total	**79.45**	**km**

9.7 RECONSTRUCTION/NEW CONSTRUCTION SECTIONS

Reconstruction/New construction of pavement shall be as per the proposed widening scheme and section of realignment. Where ever the existing pavement has been used in either of the lane or both the lanes strengthening / overlay has been proposed and for other side of lane new construction has been proposed. The details of Reconstruction/New construction of pavement accordingly has been shown as under.

In this section whole existing road is recentlyalready developed in two lane / two lane with paved shoulder including three bypasses at Natunwa, MohanapurDalhaandPharenda in habitation four lane has been provided, keeping in view efforts has been made to use the whole road which has be recently constructed and the proposal of overlay is provided in eccentric and concentric widening.

Table 9.3 (a) – Reconstruction

S. NO.	Chainage (km)		Length	Side of Lane
	From	To		
-Nil-				

Table 9.3 (b) – New Construction

S. No.	Design Chainage (km)		Length (m)	Side
	From	To		
1	21+980	27+300	5320	Left (Kolhui bypass)
2	49+180	49+620	440	Left
3	68+520	73+860	5340	Left (Pepegunj bypass)

9.8 RAISING

No section is under submergence and overtopped as the whole road is recently developed as two lane with paved shoulder configuration and in habitation the four lane configuration. No Raising has been proposed. The proposed sections are:-

Table 9.4- Raising Section

S.No.	Design Chainge		Length (m)
	Start	End	
- Nil -			

9.9 REQUIREMENT OF BYPASS

Two new Bypasseshave been proposed tobypassthe major habitation of KolhuiBazar and light habitation of Parsauna and Piprapasuni and Peppeganjsettlement area. There are three existing bypasses already constructed and under operation. Gorakhpur bypass is under construction by other agency which starts from the end point of project road (Ex. Km 81+204) and ends at km stone 251/700 of NH-28, length of Gorakhpur bypass is 16.178 Km.

Table 9.5 –Bypass Details

S. No.	Design Chainage (km)		Length (m)	Side	Settlement Area	Remarks
	From	To				
1	21+980	27+300	5320	Left	Proposed Kolhui Bypass	New
2	68+520	73+860	5340	Left	Proposed Peppeganj Bypass	New
3	4+600	9+400	4800	-	Nautanwa	Existing
4	30+920	33+340	2420	-	MohanapurDhala	Existing
5	49+220	53+580	4360		Pharenda	Existing

9.10 REQUIIREMENT OF REALIGNMENTS

Requirement of realignment at certain locations to the existing alignment has been observed due to non availability of transition/ straight tangent length between two curves. The existing curve radius and available speed limit is also very less. In order to maintain design standards of vehicle speed of the project Highway, the existing alignment needs to be improved by providing realigned sections.

These realignments at following location have been proposed-

S.No.	Design Chainage (km)		Design Length (m)	Side
	From	To		
1	49+180	49+620	440	Left

9.11 GEOMETRIC IMPROVEMENTS DESIGN

The Geometric design consists of the design of the visible elements such as horizontal alignment, vertical alignment and the cross-section of the project road. The design is governed by the design speed fixed up taking into account site conditions including the terrain in which the highway traverses. Since the alignment traverse all through plain /rolling terrain, standards applicable for plain/rolling terrain have been adopted. Geometrical improvements have been done wherever required to achieve the design speed given in design standards.

Table 9.6- Details of Proposed Typical Cross section

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
1	0	1.4	1.4	7	4 Lane divided highway without service roads and with raised median (Concentric Widening) - Open Country Plain/Rolling Terrain - Existing TCS
2	1.4	1.68	0.28	7	4 Lane divided highway without service roads and with raised median (Concentric Widening) - Open Country Plain/Rolling Terrain - Existing TCS
3	1.68	2.9	1.22	2A	4 Lane divided highway with service roads (LHS) and with raised median (Concentric Widening) - Open Country Plain/Rolling Terrain
4	2.9	3.2	0.3	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
5	3.2	4.1	0.9	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
6	4.1	5.12	1.02	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
7	5.12	6.04	0.92	8	4 Lane divided highway without Service Roads and with Raised Median (Paved Shoulder Widening) - Open Country Plain/Rolling terrain (ExsitingNatunwa Bypass)
8	6.04	7.04	1	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
9	7.04	8.88	1.84	8	4 Lane divided highway without Service Roads and with Raised Median (Paved Shoulder Widening) - Open Country Plain/Rolling terrain (ExsitingNatunwa Bypass)
10	8.88	9.94	1.06	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
11	9.94	10.42	0.48	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
12	10.42	10.79	0.37	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
13	10.79	11.25	0.46	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
14	11.25	11.27	0.02	3A	Minor Bridge 4m/1.5m Median width (RHS Widening)

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
15	11.27	11.33	0.06	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
16	11.33	11.5	0.17	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
17	11.5	12.15	0.65	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
18	12.15	12.6	0.45	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
19	12.6	12.8	0.2	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
20	12.8	13.2	0.4	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
21	13.2	15	1.8	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
22	15	17.32	2.32	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
23	17.32	18.3	0.98	9	Cross Section of Light Vehicle Under Pass (LVUP) at Deck Level - with Slip Road - New Construction

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
24	18.3	18.835	0.535	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
25	18.835	18.855	0.02	3A	Minor Bridge 4m/1.5m Median width (RHS Widening)
26	18.855	19.75	0.895	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
27	19.75	20.5	0.75	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
28	20.5	20.713	0.213	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
29	20.713	20.724	0.011	3E	Minor Bridge 4.0 m Median width (Reconstruction with BHS widening) with Minor Bridge on Service Road
30	20.724	21.48	0.756	9	Cross Section of Light Vehicle Under Pass (LVUP) at Deck Level - with Slip Road - New Construction
31	21.48	22.5	1.02	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
32	22.5	27.005	4.505	1C	4 Lane divided highway without Service Roads and with Raised Median (Concentric Widening) - New Bypass

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
33	27.005	27.055	0.05	3C	Minor Bridge 4.0 m Median width (New Construction)
34	27.055	28.04	0.985	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
35	28.04	29.42	1.38	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
36	29.42	30.48	1.06	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
37	30.48	30.9	0.42	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
38	30.9	32.26	1.36	1C	4 Lane divided highway without Service Roads and with Raised Median (Concentric Widening) - New Bypass
39	32.26	32.467	0.207	4	Cross Section of Railway Over Bridge (4 lane divided highway) - (RHS -New Constrcution)
40	32.467	33.3	0.833	4	Cross Section of Railway Over Bridge (4 lane divided highway) - (RHS -New Constrcution)
41	33.3	33.64	0.34	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
42	33.64	33.95	0.31	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
43	33.95	34.1	0.15	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
44	34.1	34.44	0.34	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
45	34.44	35.46	1.02	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
46	35.46	35.8	0.34	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
47	35.8	36.9	1.1	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
48	36.9	37.4	0.5	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
49	37.4	38.46	1.06	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
50	38.46	38.68	0.22	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
51	38.68	39.6	0.92	9	Cross Section of Light Vehicle Under Pass (LVUP) at Deck Level - with Slip Road - New Construction
52	39.6	40.3	0.7	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
53	40.3	41.3	1	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
54	41.3	42.9	1.6	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
55	42.9	44.28	1.38	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
56	44.28	45.3	1.02	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
57	45.3	45.44	0.14	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
58	45.44	46.4	0.96	9	Cross Section of Light Vehicle Under Pass (LVUP) at Deck Level - with Slip Road - New Construction
59	46.4	46.9	0.5	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
60	46.9	47.35	0.45	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
61	47.35	47.9	0.55	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
62	47.9	48.7	0.8	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
63	48.7	50.12	1.42	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
64	50.12	50.576	0.456	5B	Cross Section of Flyover at Deck Level - with Slip Road - (RHS - New Construction)
65	50.576	50.588	0.012	3D	Minor Bridge 4.0 m Median width (RHS New Construction) with Minor Bridge on Service Road
66	50.588	50.84	0.252	5B	Cross Section of Flyover at Deck Level - with Slip Road - (RHS - New Construction)
67	50.84	51.2	0.36	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
68	51.2	53.06	1.86	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
69	53.06	53.98	0.92	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
70	53.98	53.45	-0.53	6	6 Lane divided highway without service roads and with raised median (Restricted Forest Area) ROW 30m - Open Country Plain/Rolling Terrain
71	53.45	53.65	0.2	6	6 Lane divided highway without service roads and with raised median (Restricted Forest Area) ROW 30m - Open Country Plain/Rolling Terrain
72	53.65	58.25	4.6	6	6 Lane divided highway without service roads and with raised median (Restricted Forest Area) ROW 30m - Open Country Plain/Rolling Terrain
73	58.25	58.8	0.55	6	6 Lane divided highway without service roads and with raised median (Restricted Forest Area) ROW 30m - Open Country Plain/Rolling Terrain
74	58.8	59.72	0.92	5C	Cross Section of Flyover at Deck Level-with Slip Road - (LHS - New Construction)
75	59.72	60	0.28	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
76	60	62.04	2.04	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
77	62.04	63.06	1.02	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
78	63.06	63.44	0.38	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
79	63.44	64.46	1.02	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
80	64.46	64.92	0.46	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
81	64.92	65.96	1.04	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
82	65.96	66.65	0.69	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
83	66.65	68.06	1.41	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
84	68.06	68.233	0.173	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
85	68.233	68.246	0.013	3D	Minor Bridge 4.0 m Median width (RHS New Construction) with Minor Bridge on Service Road
86	68.246	68.92	0.674	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
87	68.92	69.64	0.72	1C	4 Lane divided highway without Service Roads and with Raised Median (Concentric Widening) - New Bypass
88	69.64	70.64	1	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
89	70.64	71.12	0.48	1C	4 Lane divided highway without Service Roads and with Raised Median (Concentric Widening) - New Bypass
90	71.12	72.22	1.1	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
91	72.22	72.56	0.34	1C	4 Lane divided highway without Service Roads and with Raised Median (Concentric Widening) - New Bypass
92	72.56	73.54	0.98	5A	Cross Section of Vehicle Under Pass at Deck Level -with Slip Road - VUP (New Construction)
93	73.54	73.8	0.26	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
94	73.8	74.1	0.3	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
95	74.1	74.2	0.1	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain

Sl No.	Design Chaiange		Length (Km)	TCS	Description of TCS
	From	To			
96	74.2	74.45	0.25	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain
97	74.45	75.65	1.2	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
98	75.65	77.25	1.6	1A	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Left) - Open Country Plain/Rolling terrain
99	77.25	78.15	0.9	1B	4 Lane divided highway without Service Roads and with Raised Median (Ecentric Widening Right) - Open Country Plain/Rolling terrain
100	78.15	79.45	1.3	2B	4 Lane divided highway with service roads and with raised median (Concentric Widening) - New Construction - Open Country Plain/Rolling Terrain

Proposed TCS are given below :

The entire geometric design has been based on the ground modeling by highway design software MOSS/ MX. The design of proposed alignment has been carried out by the consultants using various design modules contained in “MX”.

Efforts have been made, during design of horizontal alignment, to accommodate the highway with the optimum use of the existing ROW and least damage to the abutting properties or structures, without making any compromise in standards. Design standards described in **Chapter – 6** have been adopted for the design.

The Project corridor is proposed to be improved as per the improvement proposals detailed above. The proposed centreline has been designed in such a way that the total required widening done to the maximum extent. Besides, all geometric improvement shall be proposed considering the availability of ROW and other constraints. The geometric improvements at following locations have been proposed and given in **Table 9.7.**

Table 9.7- Proposed Geometric Improvement

S. No.	Design Chainage (KM)		Length (m)
	From	To	
1	0+195	0+237	42.696
2	0+468	0+531	62.927
3	0+663	0+695	31.217
4	1+004	1+098	93.558
5	1+871	1+926	55.410
6	2+377	2+464	86.998
7	2+741	2+910	168.925
8	3+127	3+452	325.155
9	3+630	3+723	93.784
10	3+892	3+907	15.060
11	4+228	4+327	99.062
12	4+575	4+833	258.198
13	5+523	5+570	47.617
14	5+769	5+779	9.385
15	6+157	6+678	520.606
16	6+919	7+157	237.783
17	7+657	7+780	123.618
18	7+942	7+967	25.459
19	8+298	8+656	357.525
20	9+368	9+422	53.991
21	9+537	9+634	97.293
22	10+349	10+496	147.771
23	10+802	10+880	78.886
24	11+083	11+230	147.714
25	11+483	11+507	23.881
26	12+060	12+352	292.125
27	12+529	12+648	119.365

S. No.	Design Chainage (KM)		Length (m)
	From	To	
28	13+094	13+246	152.533
29	13+331	13+489	157.989
30	13+758	13+848	90.245
31	14+372	14+388	15.462
32	14+888	14+906	17.352
33	15+051	15+199	148.467
34	15+659	15+868	208.318
35	16+184	16+269	85.932
36	17+196	17+231	34.952
37	17+396	17+440	43.867
38	17+706	17+903	196.934
39	18+364	18+447	82.958
40	18+543	18+624	80.717
41	18+853	18+935	81.925
42	19+036	19+114	78.557
43	19+457	19+748	291.217
44	20+143	20+237	94.507
45	20+310	20+396	85.663
46	20+718	20+866	147.493
47	20+904	21+025	121.233
48	21+318	21+358	39.386
49	21+540	21+622	82.117
50	22+023	22+285	262.440
51	23+753	23+981	228.011
52	25+195	25+366	171.381
53	26+474	26+572	97.903
54	27+254	27+478	223.063

S. No.	Design Chainage (KM)		Length (m)
	From	To	
55	27+802	27+872	70.377
56	28+329	28+357	28.440
57	28+605	28+681	76.860
58	28+843	28+886	43.151
59	29+092	29+107	15.236
60	29+382	29+399	16.903
61	29+787	29+882	95.679
62	30+242	30+358	116.454
63	30+538	30+642	104.518
64	30+853	31+293	439.432
65	31+963	32+588	624.751
66	32+849	33+284	434.661
67	33+519	33+548	28.951
68	34+202	34+230	28.691
69	34+421	34+511	89.927
70	34+711	34+782	71.327
71	34+962	35+128	165.755
72	35+426	35+518	91.843
73	35+789	35+884	95.231
74	36+235	36+506	270.528
75	36+841	36+885	43.123
76	37+126	37+345	218.944
77	37+498	37+706	207.997
78	37+934	38+031	96.993
79	38+406	38+526	119.346
80	38+936	39+026	90.881
81	39+213	39+256	42.262
82	39+741	39+936	195.213
83	40+272	40+406	134.079
84	40+609	40+803	194.075
85	41+283	42+087	803.134
86	42+505	42+670	165.726
87	42+921	43+037	115.285
88	43+417	43+576	158.942
89	43+657	43+728	71.483
90	43+969	43+977	8.136

S. No.	Design Chainage (KM)		Length (m)
	From	To	
91	44+615	44+627	12.599
92	45+000	45+077	76.835
93	45+520	45+550	29.432
94	45+932	45+952	19.731
95	46+288	46+375	86.991
96	46+876	46+898	22.034
97	47+154	47+167	12.828
98	47+303	47+450	147.679
99	47+917	47+982	64.641
100	48+301	48+438	136.712
101	48+620	48+626	5.762
102	48+863	48+944	80.719
103	49+192	49+602	409.828
104	49+920	49+958	37.149
105	50+135	50+380	245.661
106	50+513	50+677	163.527
107	50+775	50+841	66.839
108	50+920	51+029	109.350
109	51+296	51+312	16.111
110	51+592	51+721	128.339
111	52+042	52+138	96.729
112	52+514	52+707	193.479
113	53+412	53+587	174.535
114	53+901	54+042	140.501
115	54+268	54+361	93.879
116	54+412	54+540	127.891
117	54+642	54+762	119.840
118	54+909	54+983	73.450
119	55+188	55+250	62.558
120	55+947	56+219	271.999
121	56+723	56+912	188.932
122	57+422	57+562	140.431
123	58+047	58+152	105.215
124	58+369	58+376	6.508
125	58+626	58+805	178.709
126	59+221	59+374	152.179

S. No.	Design Chainage (KM)		Length (m)
	From	To	
127	59+941	60+034	92.537
128	60+074	60+172	97.459
129	60+352	60+418	65.621
130	60+749	60+850	101.992
131	60+999	61+064	65.091
132	61+198	61+276	77.105
133	61+553	61+656	102.409
134	62+297	62+500	202.732
135	62+832	62+954	122.175
136	63+090	63+143	52.951
137	63+408	63+486	78.363
138	63+922	63+935	13.883
139	64+385	64+416	30.430
140	65+077	65+222	145.529
141	65+635	65+699	64.299
142	66+334	66+541	207.255
143	66+761	66+914	153.869
144	67+371	67+492	121.286
145	68+061	68+092	31.896
146	68+490	68+682	191.818
147	69+538	70+055	516.509
148	70+558	70+757	199.032
149	73+647	73+840	192.711
150	74+431	74+506	75.026
151	75+334	75+516	181.754
152	75+700	75+797	96.107
153	76+057	76+313	255.678
154	76+911	76+917	6.082
155	77+182	77+219	36.923
156	77+753	77+828	75.500
157	78+107	78+114	6.313
158	78+385	78+521	136.056
159	78+891	79+020	128.897
160	79+232	79+347	115.308

9.12 HORIZONTAL ALIGNMENT

Horizontal alignment has been designed for the design speed of 100 kmph except some stretches speed reduced due to use of existing four lane road and existing bypasses which was constructed recently or under construction**.**The following Table shows the distribution of radius of existing horizontal curve & proposed Horizontal Curves.

Table 9.8- Distribution of Existing Horizontal Geometric

S.No.	Range of Radius of Curve (m)		No. of Curves	% of Total
	From	to		
1	0	100	17	7%
2	100	360	44	18%
3	>360		178	74%
Total			239	

Table9.9- Distribution of Proposed Horizontal Geometric

S. No.	Range of Radius of Curve		No. of Curves	% of Total
	From	To		
1	0	250	6	3.75%
2	250	400	29	18.13%
3	400	1800	67	41.88%
4	> 1800		58	36.25%
Total			160	

The proposed details of horizontal curves are presented in Annexure of Main report Volume I of this report.

9.13 PROPOSED CENTRE LINE

The centre line of the proposed alignment of project highway has been fixed after up-gradation to four lane section and improvement of curves, proposed realignments. The details of proposed centre line coordinates are presented in Annexure of Main report Volume I of this report.

9.14 EXISTING CENTRE LINE/PROPOSED CENTRE LINE

The proposed centre line of the project highway after making all improvements in alignment, proposed realignments have been shifted either to left or right of the existing centre line. The details of the distance from existing centre line to proposed centre line has been givenin Annexure of Main report Volume I of this report.

9.15 EXISTING CHAINAGE TO CORRESPONDING DESIGN CHAINAGE

The details of the existing chainage to corresponding design chainage have been presented in Annexure of Main report Volume I of this report.

9.16 VERTICAL ALIGNMENT

The vertical profile of the project corridor has been designed with the prescribed standards for flat / rolling terrain. The design vertical profile is within the prescribed standards (Ruling 2.5% and Limiting 3.3%). Due consideration has also been given to sections of overtopping & submergence of the project highway in deciding the vertical profile. No Raising has been founddue to submergence.

Where horizontal and summit curves overlap, the design has been provided for the required sight distance, both in vertical direction along the pavement and in the horizontal direction on the inner side of curve.

The Vertical alignments have smooth longitudinal profile. Emphasis has been made to follow the ISD criteria in most of the section, some section of existing major structure like flyovers and ROB's where it is not possible to maintain ISD due to symmetrical approach of existing side SSD criteria has been used. Grade changes have not been too frequent as to cause kinks and visual discontinuities in the profile.

Design of vertical curve and its co-ordination with horizontal curves have been done in accordance with IRC: SP: 23.

The details of the vertical alignment report have been presented in Annexure of Main report Volume I of this report.

9.17 PAVEMENT DESIGN

The existing pavement of the project stretch is flexible in nature. The guidelines of IRC: 37-2018 - "Guidelines for the design of flexible pavement" (Third Rev) and IRC:115-2014 - "Guidelines for strengthening of flexible road pavements using Falling Weight Deflectometer" and IRC:58:2015 – "Guidelines for the Design of Plain Jointed Rigid

Pavements for Highways (Fourth Rev)" has been followed in Design of pavement. The Design report has been appended in the Feasibility report at **Chapter-8**with above alternative options. The Design life of 30 Years for Rigid pavement and 15 Years for flexible pavement has been kept as per standards for this package. Flexible pavement has been proposed main carriageway and junction improvements. Rigid pavement has been proposed for toll plaza. The design traffic of Service Road has been kept 10 MSA as prescribed in manual.

The composition proposed for main carriageway with flexible pavement shown in below Table:-

Table 9.9 (a) – The composition proposed for Flexible Pavement

Proposed Crust thickness for different MSA (New Construction)

S.No	Design Chainage		Adopted MSA	BC	DBM	WMM	GSB	Effective CBR (%)
	From	Km						
1	79+450	50+000	45	40	90	250	200	8
2	50+000	0+000	100	40	120	250	200	8

Adopted Overlay Thickness

Design Chainage (Km)		Length (Km)	Bituminous Overlay (mm) –VG40		
From	To		BC	DBM	Total
0+000	7+000	7.000	40	70	110
7+000	17+500	10.500	40	70	110
17+500	79+450	61.950	40	70	110

Table 9.9 (b) -The composition proposed for Rigid pavement

Sl. No	Rigid Pavement elements	Proposed Crust Thickness (mm)	
		HS-I (Km 79+450 – 50+000)	HS-II (Km 0.000 – 50.000)
A	For Concrete Panel size of 3.5 m x 4.5 m		
1	Pavement Quality Concrete (PQC)	300	280
2	Dry Lean Concrete(DLC)	150	150
3	Granular Sub Base (GSB)	150	150
4	Total	600	580

The composition proposed for Service Road & Slip Roads with flexible pavement overSub-grade is -

GSB	-	200 mm
WMM	-	250 mm
DBM	-	50 mm
BC	-	40mm
Total	**-**	**540mm**

9.18 SHOULDERS

(a) In built up / habitation section, footpath/paved shoulders and walkway have been proposed to be provided as under –

Paved Shoulders	-	2.5m width on both sides of carriageway
Foot Path/drain	-	1.5m, as shown TCS

Table 9.10 – Shoulders/Foot path in Built up section in Four Lane Configuration

Sl No.	Design Chainage		Length (Km)	TCS	Drain/footpath width (m)	
	From	To			LHS	RHS
1	-	1.400	1.400	7	1.5 (Ex)	1.5 (Ex)
2	1.400	1.680	0.280	7	1.5 (Ex)	1.5 (Ex)
3	1.680	2.900	1.220	2A	1.5	-
4	3.200	4.100	0.900	2B	1.5	1.5
5	4.100	5.120	1.020	5A	1.5	1.5
6	6.040	7.040	1.000	5A	1.5	1.5
7	8.880	9.940	1.060	5A	1.5	1.5
8	9.940	10.420	0.480	2B	1.5	1.5
9	11.500	12.150	0.650	2B	1.5	1.5
10	12.600	12.800	0.200	2B	1.5	1.5

Sl No.	Design Chainage		Length (Km)	TCS	Drain/footpath width (m)	
	From	To			LHS	RHS
11	12.800	13.200	0.400	2B	1.5	1.5
12	17.320	18.300	0.980	9	1.5	1.5
13	19.750	20.500	0.750	2B	1.5	1.5
14	20.500	20.713	0.213	2B	1.5	1.5
15	20.724	21.480	0.756	9	1.5	1.5
16	21.480	22.500	1.020	5A	1.5	1.5
17	27.055	28.040	0.985	5A	1.5	1.5
18	28.040	29.420	1.380	2B	1.5	1.5
19	29.420	30.480	1.060	5A	1.5	1.5
20	32.260	32.467	0.207	4	1.5	1.5
21	32.467	33.300	0.833	4	1.5	1.5
22	33.300	33.640	0.340	5A	1.5	1.5
23	33.950	34.100	0.150	2B	1.5	1.5
24	34.100	34.440	0.340	2B	1.5	1.5
25	34.440	35.460	1.020	5A	1.5	1.5
26	35.800	36.900	1.100	5A	1.5	1.5
27	37.400	38.460	1.060	5A	1.5	1.5
28	38.680	39.600	0.920	9	1.5	1.5
29	42.900	44.280	1.380	2B	1.5	1.5
30	44.280	45.300	1.020	5A	1.5	1.5
31	45.440	46.400	0.960	9	1.5	1.5

Sl No.	Design Chainage		Length (Km)	TCS	Drain/footpath width (m)	
	From	To			LHS	RHS
32	46.900	47.350	0.450	2B	1.5	1.5
33	48.700	50.120	1.420	5A	1.5	1.5
34	50.120	50.576	0.456	5B	1.5	1.5
35	50.588	50.840	0.252	5B	1.5	1.5
36	53.060	53.980	0.920	5A	1.5	1.5
37	53.980	53.450	0.530	6	-	1.5
38	53.450	53.650	0.200	6	-	1.5
39	53.650	58.250	4.600	6	-	1.5
40	58.250	58.800	0.550	6	-	1.5
41	58.800	59.720	0.920	5C	1.5	1.5
42	60.000	62.040	2.040	2B	1.5	1.5
43	62.040	63.060	1.020	5A	1.5	1.5
44	63.060	63.440	0.380	2B	1.5	1.5
45	63.440	64.460	1.020	5A	1.5	1.5
46	64.920	65.960	1.040	5A	1.5	1.5
47	68.060	68.233	0.173	2B	1.5	1.5
48	68.246	68.920	0.674	5A	1.5	1.5
49	69.640	70.640	1.000	5A	1.5	1.5
50	71.120	72.220	1.100	5A	1.5	1.5
51	72.560	73.540	0.980	5A	1.5	1.5
52				2B	1.5	1.5

Sl No.	Design Chainage		Length (Km)	TCS	Drain/footpath width (m)	
	From	To			LHS	RHS
	73.540	73.800	0.260			
53	73.800	74.100	0.300	2B	1.5	1.5
54	74.100	74.200	0.100	2B	1.5	1.5
55	74.200	74.450	0.250	2B	1.5	1.5
56	78.150	79.450	1.300	2B	1.5	1.5

(b) In open country section, paved shoulders and Earthier shoulders have been proposed to be provided as under -

Paved shoulder - 2.5 m on both sides of carriageway

Earthen shoulder - 1.5 m on both sides of carriageway

Earthen shoulders shall be covered with 150mm thick compacted layer of granular material.

Table 9.11 – Shoulders in open country section in Four lane Configuration

Sl No.	Design Chainage		Length (Km)	TCS
	From	To		
1	5.120	6.040	0.920	8
2	7.040	8.880	1.840	8
3	10.420	10.790	0.370	1B
4	10.790	11.250	0.460	1B
5	11.270	11.330	0.060	1B
6	11.330	11.500	0.170	1B
7	12.150	12.600	0.450	1A
8	13.200	15.000	1.800	1B
9	15.000	17.320	2.320	1A
10	18.300	18.835	0.535	1B
11	18.855	19.750	0.895	1B
12	22.500	27.005	4.505	1C

Sl No.	Design Chainage		Length (Km)	TCS
	From	To		
13	30.480	30.900	0.420	1B
14	30.900	32.260	1.360	1C
15	33.640	33.950	0.310	1B
16	35.460	35.800	0.340	1A
17	36.900	37.400	0.500	1A
18	38.460	38.680	0.220	1B
19	39.600	40.300	0.700	1A
20	40.300	41.300	1.000	1B
21	41.300	42.900	1.600	1A
22	45.300	45.440	0.140	1B
23	46.400	46.900	0.500	1A
24	47.350	47.900	0.550	1A
25	47.900	48.700	0.800	1B
26	50.840	51.200	0.360	1B
27	51.200	53.060	1.860	1A
28	59.720	60.000	0.280	1A
29	64.460	64.920	0.460	1B
30	65.960	66.650	0.690	1B
31	66.650	68.060	1.410	1A
32	68.920	69.640	0.720	1C
33	70.640	71.120	0.480	1C
34	72.220	72.560	0.340	1C
35	74.450	75.650	1.200	1B
36	75.650	77.250	1.600	1A
37	77.250	78.150	0.900	1B

(c) Design and specification of paved shoulder and granular material shall be confirming to the requirement specified in para 5.10 of the manual (IRC:SP:84:2019)

(d) Truck Lay Byes and Bus Byes –

Interlocking Concrete Block Pavement for Bus bay/Truck lay bye has been proposed as per IRC: SP 63- 2018 and the composition of the pavement for the same are furnished in Table 9.12, given below.

Table 9.12 : Pavement layer thickness (in mm) for Truck Lay byes & Bus Byes

Description	Interlocking concrete blocks	Sand Cushion, mm	Base (WMM), mm	Sub Base (GSB), mm
Bus Bays & Truck Lay byes	100	20-40	250	200

Note: 500 mm subgrade of minimum 8% soaked CBR shall be provided. Grade of Concrete of Interlocking block shall be M40.

9.19 INTERSECTIONS

The efficiency, safety, speed, cost of operation and capacity of all highways is influenced by the design of the intersections. Each intersection involves through or cross traffic movements on one or more of the roads concerned and turning movements between these roads may also be involved.These movements may be handled by various means depending on the type of intersections. However, looking to the traffic Survey data, At-grade junctions shall be required to be developed at most of the intersections.

Number of major & minor junctions/cross roads are existing on the road. These junctions have been proposed to be improved as per standards along with signages. At some important junctions Grade Separated Structures (VUP /LVUP) have been proposed as per the necessity.

Proposed Major Junctions –

Table 9.13–Major Junctions

Sr. No.	Existing Chainage	Design Chainage	Type of Junction	Side (Left/Right/Both)	Cross Road Leads To	Remark (improvement Proposal)
1	1+650	1+663	T	Right	Proposed link road to International check post	At Grade
2	30+650	30+875	Y	Left	MohnapurDhala Town	At Grade

Table 9.14-Minor Junctions

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
1	5+050	5+038	X	Both	Left - Nautanwa, Right -
2	5+500	5+480	X	Both	Left - Nautanwa, Right - Sukrauli
3	6+205	6+180	T	Right	CC Road
4	6+527	6+500	Y	Right	
5	6+567	6+540	+	Both	Left - Nautanwa, Right - Khanua

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
6	7+060	7+040	Y	Left	Nautanwa Town
7	7+160	7+140	T	Left	Nautanwa Town
8	7+500	7+480	T	Left	Nautanwa Town
9	7+820	7+800	T	Left	Nautanwa Town
10	8+053	8+050	+	Both	CC Road
11	8+157	8+155	+	Both	Left - nautanwa; Right -
12	8+540	8+540	+	Both	Left - nautanwa; Right -
13	8+870	8+850	T	Right	Nautanwa Town
14	9+030	9+010	T	Right	
15	9+400	9+380	T	Right	CC Road
16	11+380	11+360	Y	Left	
17	12+460	12+410	T	Right	CC Road
18	12+920	12+870	Y	Right	
19	12+920	12+880	T	Right	
20	13+000	12+970	T	Left	
21	14+465	14+445	T	Right	
22	14+547	14+530	T	Left	Barwa Kalan
23	15+915	15+885	T	Right	
24	15+950	15+935	T	Left	Kavlahi
25	17+823	17+805	T	Left	Sampatiya
26	18+100	18+080	T	Right	
27	19+342	19+325	T	Right	
28	19+804	19+790	T	Left	
29	20+285	20+270	T	Left	Bataediha
30	21+030	21+010	T	Left	
31	21+954	21+930	T	Right	KHERA GHAT
32	Kolhui Bazar Bypass	22+550	X	Both	
33		23+060	X	Both	
34		23+660	Y	Left	
35		23+790	+	Both	
36		25+210	X	Both	Kolhui Bazar
37		26+080	X	Both	
38		26+185	T	Left	
39		26+660	Y	Left	
40		26+715	T	Right	
41	29+546	27+360	T	Left	
42	30+217	28+040	T	Left	

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
43	30+430	28+250	T	Right	
44	30+845	28+665	T	Right	
45	32+093	29+910	T	Right	Belauhi
46	32+120	29+940	T	Left	Lachmipur
47	32+842	30+670	T	Right	
48	Ex. Bypass	31+670	+	Both	Left - Mohanapuadhala; Right - SinhpurThatauli
49	Ex. Bypass	32+460	+	Both	Left - Mohanapuadhala; Right - Shaldah
50	35+850	33+710	T	Left	
51	36+360	34+220	Y	Left	
52	36+800	34+670	T	Left	
53	37+047	34+910	T	Right	Jhamar
54	37+095	34+960	T	Left	Karmahawa Khurd
55	37+735	35+610	T	Left	
56	38+495	36+370	T	Right	
57	39+190	37+060	Y	Right	
58	39+560	37+480	T	Right	
59	40+000	37+930	+	Both	Left - SoharwaliaKhurs; Right - Purandarpur RLY Station
60	40+470	38+410	T	Right	
61	41+890	39+760	T	Left	
62	42+918	40+790	T	Left	
63	42+975	40+850	Y	Right	
64	43+682	41+565	T	Right	
65	44+161	42+060	T	Left	
66	44+650	42+550	T	Left	
67	44+932	42+840	T	Right	
68	45+162	43+040	T	Left	
69	45+670	43+545	T	Right	
70	45+940	43+820	T	Right	
71	46+065	43+940	T	Left	
72	46+720	44+600	Y	Left	
73	46+910	44+790	T	Right	
74	47+142	45+010	T	Left	
75	47+730	45+600	T	Right	
76	48+023	45+900	T	Left	
77	49+648	47+530	+	Both	

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
78	50+090	47+960	T	Right	
79	50+465	48+335	T	Left	To ParsaMahanth
80	53+243	51+090	+	Both	
81	54+080	51+840	T	Right	
82	54+630	52+400	T	Left	
83	55+780	53+520	Y	Right	
84	56+635	54+355	T	Left	
85	57+974	55+695	T	Right	
86	58+650	56+370	T	Right	
87	59+862	57+580	T	Right	
88	62+208	59+940	T	Left	
89	62+492	60+225	T	Right	
90	62+634	60+365	T	Right	
91	62+660	60+390	T	Left	
92	62+930	60+665	T	Right	
93	63+493	61+205	T	Right	
94	63+748	61+465	T	Right	
95	64+073	61+795	T	Left	
96	64+830	62+550	+	Both	
97	65+146	62+860	T	Left	
98	65+384	63+100	T	Left	
99	66+010	63+720	Y	Right	
100	66+225	63+930	T	Left	
101	66+916	64+630	T	Left	
102	67+385	65+100	T	Left	
103	67+725	65+450	+	Both	
104	68+359	66+070	Y	Left	
105	69+180	66+890	T	Right	
106	69+881	67+595	T	Right	
107	69+913	67+630	T	Left	
108	70+228	67+945	Y	Left	
109	70+254	67+970	T	Right	
110	70+800	68+530	T	Left	
111	71+265	68+980	T	Right	To GangalBihuli
112	Peppeganj	69+720	x	Both	To Sahbganj
113		70+165	x	Both	Left - Sahbganj Right - Pipiganj RLY Station

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
114		70+580	x	Both	Left - Sahbganj Right - Pipiganj RLY Station
115		71+680	+	Both	Left -Sarahari ; Right - Pipiganj
116		72+985	+	Both	Left -Makhanha ; Right - Pipiganj
117	76+127	74+375	T	Right	
118	76+210	74+455	T	Left	
119	78+097	76+340	T	Right	
120	79+568	77+890	T	Right	
121	80+270	78+520	X	Both	
122	80+520	78+770	T	Right	
123	81+213	79+460	T	Right	

9.20 SLIP ROAD/SERVICE ROAD

The slip road on both the sides have also been proposed at locations of proposed vehicular/Light vehicular under passes/ROB and their approaches to cater the traffic to cross roads and habitations. Carriageway width for service road / slip road have been kept 5.75 to 7.0 m and the traffic loading is considered 10 MSA as per IRC SP 84 2019. Locations of slip/service roads have been proposed at following locations –

Table 9.15 : Proposed Slip Road/Service Road

Sl No.	Design Chainage		Length (Km)	TCS	Service Road	
	From	To			LHS	RHS
1	1.680	2.900	1.220	2A	7.00	
2	3.200	4.100	0.900	2B	7.00	7.00
3	4.100	5.120	1.020	5A	5.75	5.75
4	6.040	7.040	1.000	5A	5.75	5.75
5	8.880	9.940	1.060	5A	5.75	5.75
6	9.940	10.420	0.480	2B	7.00	7.00
7	11.500	12.150	0.650	2B	7.00	7.00
8	12.600	12.800	0.200	2B	7.00	7.00
9	12.800	13.200	0.400	2B	7.00	7.00
10	17.320	18.300	0.980	9	5.75	5.75

Sl No.	Design Chainage		Length (Km)	TCS	Service Road	
	From	To			LHS	RHS
11	19.750	20.500	0.750	2B	7.00	7.00
12	20.500	20.713	0.213	2B	7.00	7.00
13	20.713	20.724	0.011	3E	7.00	7.00
14	20.724	21.480	0.756	9	5.75	5.75
15	21.480	22.500	1.020	5A	5.75	5.75
16	27.055	28.040	0.985	5A	5.75	5.75
17	28.040	29.420	1.380	2B	7.00	7.00
18	29.420	30.480	1.060	5A	5.75	5.75
19	32.260	32.467	0.207	4	5.5 (Ex)	7.00
20	32.467	33.300	0.833	4	5.5 (Ex)	7.00
21	33.300	33.640	0.340	5A	5.75	5.75
22	33.950	34.100	0.150	2B	7.00	7.00
23	34.100	34.440	0.340	2B	7.00	7.00
24	34.440	35.460	1.020	5A	5.75	5.75
25	35.800	36.900	1.100	5A	5.75	5.75
26	37.400	38.460	1.060	5A	5.75	5.75
27	38.680	39.600	0.920	9	5.75	5.75
28	42.900	44.280	1.380	2B	7.00	7.00
29	44.280	45.300	1.020	5A	5.75	5.75
30	45.440	46.400	0.960	9	5.75	5.75
31	46.900	47.350	0.450	2B	7.00	7.00
32	48.700	50.120	1.420	5A	5.75	5.75
33	50.120	50.576	0.456	5B	7.00	7.00
34	50.576	50.588	0.012	3D	7.00	7.00
35	50.588	50.840	0.252	5B	7.00	7.00
36	53.060	53.980	0.920	5A	5.75	5.75
37	58.800	59.720	0.920	5C	7.00	7.00
38	60.000	62.040	2.040	2B	7.00	7.00
39	62.040	63.060	1.020	5A	5.75	5.75
40	63.060	63.440	0.380	2B	7.00	7.00
41	63.440	64.460	1.020	5A	5.75	5.75
42	64.920	65.960	1.040	5A	5.75	5.75

Sl No.	Design Chainage		Length (Km)	TCS	Service Road	
	From	To			LHS	RHS
43	68.060	68.233	0.173	2B	7.00	7.00
44	68.233	68.246	0.013	3D	7.00	7.00
45	68.246	68.920	0.674	5A	5.75	5.75
46	69.640	70.640	1.000	5A	5.75	5.75
47	71.120	72.220	1.100	5A	5.75	5.75
48	72.560	73.540	0.980	5A	5.75	5.75
49	73.540	73.800	0.260	2B	7.00	7.00
50	73.800	74.100	0.300	2B	7.00	7.00
51	74.100	74.200	0.100	2B	7.00	7.00
52	74.200	74.450	0.250	2B	7.00	7.00
53	78.150	79.450	1.300	2B	7.00	7.00

TheEntry/Exit ramps for entering into or existing from the main carriageway to above slip road shall also be provided.

9.21 CULVERTS

There are total 100 culverts existing on project section road, out of which 42 are pipe culvert, 28 slab culverts &30 box culverts. Looking to the structure condition and required cross-sectional features these are proposed for Widening/ Rehabilitation / Reconstruction / New Construction. These have been proposed keeping in view the guidelines given in manual IRC: 84:2019 at Para 7.3. The proposal is summarized in Table below:

Table 9.16 - Proposal for Slab / Box Hume Pipe Culverts

S. No.	Type of Culvert	Existing (Nos.)	Abandoned	Widening (Nos.)	Re-habilitation (Nos.)	Re-construction (Nos.)	Abandoned (Nos.)	New construction (Nos.)	Total Proposal (Nos.)
1	Box Culvert	30	6	24	-	-	-	26	50
2	Slab Culvert	28	4	24(box)	-	-	-	-	24
3	Pipe Culvert	42	9	33	-	-	-	-	33
4	VUP	1		1				21	22
5	LVUP							4	4
6	Minor Bridge	6		6					
7	ROB	1		1					1

8	Flyover	2		2					2
Total		**110**	**19**	**91**	**0**	**0**	**0**	**26**	**136**

The details of the proposal of these culverts are given in **Table 9.19**

9.22 BRIDGES AND STRUCTURES

All the Major and Minor Bridges on the project road section are having less width of carriageway as compared to the requirements laid down in manual. Looking to the required site cross sectional features, condition of structure and High Flood level, these bridges have been proposed to be widened / rehabilitation/ abandoned/ new construction as given in **Table 9.17& 9.18.**

Table 9.17 – Details of Proposed Minor & Major Bridges

(A) Major Bridges

S.No.	Ex. Chainage in KM	Design Chainage km	No. Of span	Span Size(Exp. Joint To Joint) (m)	Clear Span	Type Of Bridge	Total Outer Width (m)	Road Way Width (m)	PROPOSAL FOR EXISTING BRIDGE				PROPOSAL IN ADDITIONAL TWO LANE				Remark
									Proposal	Type of Structure	Span Arrangement	Width of Structure (m)	Proposal	Type of Structure	Span Arrangement	Width of Structure	
-Nil-																	

(B) Minor Bridges

S.No.	Ex. Chainage in KM	Design Chainage	No. Of span	Span Size(Exp. Joint To Joint)	Total Outer Width	Existing Structure Type	PROPOSAL FOR EXISTING LANE				PROPOSAL FOR ADDITIONAL TWO LANE				PROPOSAL FOR SERVICE ROAD			Remarks
							Proposal	Type of Structure	Span Arrangement	Width of Str.	Proposal	Type of Structure	Span Arrangement	Width of Str.	Proposal	Type of Structure	Span Arrangement.	
1	11+312	11+260	2	10	12.9	RCC Deck Slab	Retained (LHS)	RCC Deck Slab	2 x 10	12.9	New Construction (RHS)	RCC Deck Slab	2 x 10	16				
2	18+895	18+845	2	10	12.9	RCC Deck Slab	Retained (LHS)	RCC Deck Slab	2 x 10	12.9	New Construction (RHS)	RCC Deck Slab	2 x 10	16				

S.No.	Ex. Chainage in KM	Design Chainage	No. Of span	Span Size(Exp. Joint To Joint)	Total Outer Width	Existing Structure Type	PROPOSAL FOR EXISTING LANE				PROPOSAL FOR ADDITIONAL TWO LANE				PROPOSAL FOR SERVICE ROAD			Remarks
							Proposal	Type of Structure	Span Arrangement	Width of Str.	Proposal	Type of Structure	Span Arrangement	Width of Str.	Proposal	Type of Structure	Span Arrangement .	
3	20+768	20+719	3	3.75	12.9	RCC Slab	Reconstruction with BHS Widen	Box	3 x 3.75	12.9	-	-	-	16	New Construction	Box	2 x 8.050	
4	29+455	-	4	12.5	12.9	Box	Abandoned due to Kolhui bazaar bypass											
5		27+030	-	-	-	-	-	-	-	-	New Construction	PSC Girder	2 x 25	2 x 16				
6	52+885	50+582	2	6	12.9	Box	New construction RHS with dismantling SR	Box	2 x 6	12.9				16	New Construction	Box	1 X 8.05	
7	70+582	68+240	3	4.5	12.9	RCC Slab	Reconstruction (LHS)	Box	3 x 4.5	12.9	New Construction (RHS)	Box	3 X 4.5	16	New Construction	Box	2 x 8.050	

(C) Fly Over, VUP and ROB

S.No.	Existing Chainage Km	New Design Chainage Km	Number of Span	SPAN ARRANGEMENT (EXPANSION JOINT TO EXPANTION JOINT)(M)	CLEAR SPANS	CLEAR ROADWAY WIDTH BETWEEN KERBS(M)	TOTAL OUTER WIDTH OF BRIDGE (M)	PROPOSAL FOR EXISTING LANE				PROPOSAL FOR ADDITIONAL TWO LANE			
								Proposal	Type of Structure	Span Arrangement	Width of Str.	Proposal	Type of Structure	Span Arrangement	Width of Str.
VUP															
1	34+677	32+467	1	8.5	7	10.5	12.9	Retained (LHS)	Box	1 x 7.0 x 5.5	12.9	New Construction (RHS)	Box	1 x 7.0 x 5.5	16
ROB															
1	34+910	32+732	1	24	-	10.5	12.9	Retained (LHS)	RCC Girder	1 x 24	12.9	New Construction (RHS)	Steel Girder	1 x 24	16
FLY OVER															
1	52+724	50+428	1	32	-	10.5	12.9	Retained (LHS)	PSC Girder	1 x 32	12.9	New Construction (RHS)	PSC Girder	1 x 32	16
2	61+574	59+257	1	32	-	10.5	12.9	Retained (RHS)	PSC Girder	1 x 32	12.9	New Construction (LHS)	PSC Girder	1 x 32	16`

9.23 OTHER STRUCTURES

Grade separated intersections, have been proposed at locations where traffic on cross roads is moderate to heavy and At-grade intersection fails to handle the volume of turning, merging and directing traffic. The cross-sectional features and vertical / lateral clearance to the Vehicular Underpass / Pedestrian / Cattle Underpass have been provided as per requirement given in manual.

Due provision of Slip Road has also been made with proper entry/ exist ramps between the main carriageway on both sides of the approaches of the structures to facilitate the movement to cross roads.

Thus as per site requirement and from traffic volume the following structures have been proposed in this project Section.

Table 9.21 - Other New Proposed Structures

(D) Other Structures

As per site requirement and from traffic volume new box culverts,VUP, LVUPetc. have been proposed on the project roads as given below.

Details of other Proposed Structures as below:

Sl. No.	New Design Chainage in (m)	Proposal for New Culvert					Remark
		Proposal	Type of Structure	Span Arrangement	Structure Width	TCS	
BOX CULVERT							
1	2+825	New Construction	Box	1 x 2 x 2	Roadway Width		On Realignment
2	3+000	New Construction	Box	1 x 2 x 2	Roadway Width		On Realignment
3	22+110	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar in VUP Approach
4	22+255	New Construction	Box	1 x 2.5 x 2.5	Roadway Width		On Bypass Kolhui Bazar in VUP Approach
5	22+365	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar in VUP Approach
6	22+900	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
7	23+270	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
8	23+600	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
9	23+840	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
10	24+300	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
11	24+730	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
12	24+900	New Construction	Box	1 x 2 x 2	Roadway		On Bypass Kolhui Bazar

					Width		
13	25+240	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
14	25+600	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
15	25+950	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
16	26+190	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
17	26+450	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
18	26+720	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar
19	27+200	New Construction	Box	1 x 2 x 2	Roadway Width		On Bypass Kolhui Bazar in VUP Approach
20	49+300	New Construction	Box	1 x 2 x 2	Roadway Width		On Realignment in VUP Approach
21	49+420	New Construction	Box	1 x 2.5 x 2	Roadway Width		On Realignment in VUP Approach
22	70+695	New Construction	Box	1 x 2 x 2	Roadway Width		On PP Ganj Bypass
23	71+045	New Construction	Box	1 x 2.5 x 2	Roadway Width		On Peppe Ganj Bypass
24	71+645	New Construction	Box	1 x 2 x 2	Roadway Width		On Peppe Ganj Bypass in VUP Approach
25	72+055	New Construction	Box	1 x 2 x 2	Roadway Width		On Peppe Ganj Bypass in VUP Approach
26	72+645	New Construction	Box	1 x 2 x 2	Roadway Width		On Peppe Ganj Bypass in VUP Approach
VUP							
1	04+622	New Construction	Box	(15+30+15)x5.5	30.5	*TCS 5A*	Habitation
2	06+540	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	Habitation
3	09+400	New	Box	(15+30+15)x5.5	30.5	TCS 5A	open

		Construction					
4	21+932	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	open
5	27+540	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	Habitation
6	29+933	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	Habitation
7	33+330	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	open
8	34+940	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	open
9	36+369	New Construction	Box	(15+30+15)x5.5	30.5	TCS 5A	Habitation
10	37+921	New Construction	Box	(15+30+15)x5.5	30.5	TCS 5A	Habitation
11	44+783	New Construction	Box	(15+30+15)x5.5	30.5	TCS 5A	Habitation
12	49+180	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	Habitation
13	49+600	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	Habitation
14	53+515	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	open
15	62+549	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	Habitation
16	63+932	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	Habitation
17	65+446	New Construction	Box	(15+30+15)x5.5	30.5	TCS 5A	Habitation
18	68+525	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	open
19	70+157	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	open
20	71+674	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	open
21	72+977	New Construction	Box	1 x 15.0 x 5.5	30.5	TCS 5A	open

	LVUP						
1	17+803	New Construction	Box	1 x 12 x 4	30.5	TCS9	Habitation
2	21+008	New Construction	Box	1 x 12 x 4	30.5	TCS9	Open
3	39+114	New Construction	Box	1 x 12 x 4	30.5	TCS9	Habitation
4	45+890	New Construction	Box	1 x 12 x 4	30.5	TCS9	Habitation

9.24 ROAD SIDE DRAINAGE

Drainage system including surface and subsurface drains for the project have been proposed to be carried out in accordance with requirement of section-6 of Manual.

In service/slip road of built up area's and proposed slip road sections covered RCC drain with manhole at suitable interval to desilt the drain with footpath have been proposed at locations –

Table 9.23 – RCC Drain

Sl No.	Design Chainage		Length (Km)	Drain Cum Footpath width	
	From	To		LHS (m)	RHS (m)
1	0.000	1.400	1.400	1.5 (Ex)	1.5 (Ex)
2	1.400	1.680	0.280	1.5 (Ex)	1.5 (Ex)
3	1.680	2.900	1.220	1.5	-
4	3.200	4.100	0.900	1.5	1.5
5	4.100	5.120	1.020	1.5	1.5
6	6.040	7.040	1.000	1.5	1.5
7	8.880	9.940	1.060	1.5	1.5
8	9.940	10.420	0.480	1.5	1.5
9	11.500	12.150	0.650	1.5	1.5
10	12.600	12.800	0.200	1.5	1.5
11	12.800	13.200	0.400	1.5	1.5
12	17.320	18.300	0.980	1.5	1.5
13	19.750	20.500	0.750	1.5	1.5
14	20.500	20.713	0.213	1.5	1.5
15	20.724	21.480	0.756	1.5	1.5
16	21.480	22.500	1.020	1.5	1.5
17	27.055	28.040	0.985	1.5	1.5
18	28.040	29.420	1.380	1.5	1.5
19	29.420	30.480	1.060	1.5	1.5
20	32.260	32.467	0.207	1.5	1.5
21	32.467	33.300	0.833	1.5	1.5
22	33.300	33.640	0.340	1.5	1.5
23	33.950	34.100	0.150	1.5	1.5
24	34.100	34.440	0.340	1.5	1.5
25	34.440	35.460	1.020	1.5	1.5
26	35.800	36.900	1.100	1.5	1.5
27	37.400	38.460	1.060	1.5	1.5
28	38.680	39.600	0.920	1.5	1.5

Sl No.	Design Chainage		Length (Km)	Drain Cum Footpath width	
	From	To		LHS (m)	RHS (m)
29	42.900	44.280	1.380	1.5	1.5
30	44.280	45.300	1.020	1.5	1.5
31	45.440	46.400	0.960	1.5	1.5
32	46.900	47.350	0.450	1.5	1.5
33	48.700	50.120	1.420	1.5	1.5
34	50.120	50.576	0.456	1.5	1.5
35	50.588	50.840	0.252	1.5	1.5
36	53.060	53.980	0.920	1.5	1.5
37	53.980	53.450	-0.530	-	1.5
38	53.450	53.650	0.200	-	1.5
39	53.650	58.250	4.600	-	1.5
40	58.250	58.800	0.550	-	1.5
41	58.800	59.720	0.920	1.5	1.5
42	60.000	62.040	2.040	1.5	1.5
43	62.040	63.060	1.020	1.5	1.5
44	63.060	63.440	0.380	1.5	1.5
45	63.440	64.460	1.020	1.5	1.5
46	64.920	65.960	1.040	1.5	1.5
47	68.060	68.233	0.173	1.5	1.5
48	68.246	68.920	0.674	1.5	1.5
49	69.640	70.640	1.000	1.5	1.5
50	71.120	72.220	1.100	1.5	1.5
51	72.560	73.540	0.980	1.5	1.5
52	73.540	73.800	0.260	1.5	1.5
53	73.800	74.100	0.300	1.5	1.5
54	74.100	74.200	0.100	1.5	1.5
55	74.200	74.450	0.250	1.5	1.5
56	78.150	79.450	1.300	1.5	1.5

The size or drain shall however be not less than as shown in TCS.

Lined drains in median are also proposed to be provided in super elevation section in built up and open area's of the project highway with outlet drain pipes across the road. The median drain in built up area's are suitably covered.

Additional unlined trapezoidal drain approxbase width 600 mm on both sides have also been proposed as shown in Typical Cross Section at end of ROW for drainage of

houses/shops. This drain should be also connected to existing city drainage system/natural source of drainage.

9.25 TRAFFIC CONTROL DEVICES & ROAD SAFETY WORKS

Traffic control devices, Road safety Devices and Road side furniture which comprises of road signs, road marking, object markers, hazard markers, studs, delineators, attenuators, safety barriers, pedestrian guard rails / railings etc are proposed to be provided on the project highway.

The Road signs comprises of mandatory / regulatory signs, cautionary / warning signs and informatory signs have been proposed to be provided as per IRC:67 2012 for main carriage way, service and slip roads, toll plaza and other project Highway facilities.Km stones and Road Boundary stones have also been proposed to be provided.

Road Safety barriers, median safety barriers proposed to be provided on embankments with height more than 3 m. W-beam barrier have also been proposed to be provided along all curves having radius up to 450 m for complete length including transition and 20 m further before the curve.

9.26 MISCELLANEOUS WORKS

(a) Entry/Exit Ramps -

Entry/Exit Ramps for entering into or exit from the project highway have been proposed to be provided where–ever necessary through properly designed acceleration and deceleration length.

(b) Slope & Shoulder Protection –

The side slopes have been proposed to be protected against erosion by providing a suitable vegetation cover, kerb channel, chute, stone/cement concrete block pitching or any other suitable protection measures depending on height of embankment and susceptibility to soil to erosion.

(c) Embankment Protection

In embankments with height more than 6.0 m and approaches to bridges, protection of embankments as per directions contained in clause 7 of IRC:SP:42:2014 “Guide lines on Road Drainage (First Rev.) have been proposed to be followed. Proper Drainage arrangements essentially are required to be made at such locations.

(d) Utility Ducts –

Utility ducts in form of 600 mm dia NP-4 pipes across the project highway along with inspection box/chamber at 500m interval have also been proposed for crossing of under ground utilities in rural area's and at 200 m interval in urban area's.

9.27 PROJECT FACILITIES

The project facilities shall be provided on the project Highway section in accordance to requirement as described in manual.

These facilities mainly includes following :

9.27.1 Pedestrian Facilities :

Raised Footpath/drain (RCC Box) of minimum 1.5 m width on either side (200 mm above road surface), along with Metal Beam Barrier (Double Beam – one side) or pedestrian guard rail as given in Manual at the edge of footpath (towards carriageway side) shall be provided between service road and carriageway as shown in Typical Cross Section.

Pedestrian facilities in form of guard rails, foot path, railing etc shall be provided as per requirement described in manual.

At grade pedestrian crossing have been proposed to be provided for all intersection of cross roads. Provision of zebra crossings have been made.

9.27.2 Street Lighting:

Wherever the alignment passes through the habitation / populated area and on grade separated structures & the provision for Street lightening shall be kept. In habitations the street lightening is provided on median for main Carriageway and on footpath for service road and on structures approaches the same is provided on median and on RE panel for Service roads/ slip road.

Lighting at Toll Plaza location, Rest area's, Truck lay-bye, Bus bay & Bus Shelter location in addition to proposed built up section & Grade Separated structure, as mentioned above also been proposed to be provided as per specifications and according to provisions in para 12.3 of manual.

9.27.3 Toll Plaza:

Two Toll Plazas at tentative location Ch. 11+014near Mudila village andCh. 74+140near Jarhadconfirming to the notification of MORTH have been proposed. Drawing & layout of Toll Plaza shall be governed by the guidelines mentioned in IRC: SP: 84-2019 (Manual of Specification Standard for 4-lane Highway). The exact location of Toll Plaza be as per the existing toll plaza. It is found suitable it may be shifted in consultation with the Client/Authority Engineer.

9.27.4 Truck Lay-Byes :

Truck lay-byes shall be located near places of conventional stops of the truck operators etc. The place be identified on the basis of field surveys and shall have adequate space for facilities and scope of future growth.

(i) Paved parking

(ii) Rest area with toilets & drinking water.

(iii) Telephone

Proper lighting system to be also done as specified in the manual.

Four nos. of Truck lay bye is proposed in this section project highway. The suitable location shall be finalised in consultation with Client/Authority engineer.

Table 9.24–Truck Lay Bye

S. No.	Existing Chainage (km)	Proposed Chainage (km)	Village	SIDE	Remark
1	10+528	10+500	Nautanwa	Right	New
2	11+736	11+690	Mudila	Left	New
3	Peppeganj Bypass	73+350	BagahiBhari	Right	New
4	76+727	74+970	Raipur	Left	New

9.27.5 Bus Bays & Bus Shelter:

The buses shall be allowed to stop for dropping and picking up passengers only at the Bus stops/Bus bays. The location on the project highway has been identified as per the guidelines and principles described in manual. The layout, Design, pavement, drainage, road marking, signages, landscaping and lightning shall be provided in accordance to the requirements of the manual. The shelter structure shall be structurally safe and functional so as to protect the passengers adequately from sun, rain and wind. It should

also be convenient for physically challenged persons as well. The tentative location proposed for Bus bays with Bus shelter on the project section are as under-

Table 9.25 - Bus – Bays & Bus Shelter

S. No.	Existing Chainage (km)	Proposed Chainage (km)	Village	SIDE
1	3+590	3+520	Kunserva	Right
2	3+650	3+580	Kunserva	Left
3	5+360	5+340	sukrauli	Left
4	5+400	5+380	sukrauli	Right
5	8+660	8640	Notanwa	Right
6	8+720	8700	Notanwa	Left
7	13+240	13230	Mudila	Left
8	13+360	13330	Mudila	Right
9	17+120	17100	KURAHAVA KHURD	Left
10	18+540	18520	KURAHAVA KHURD	Right
11	20+240	20200	Eksadwa	Left
12	20+260	20220	Eksadwa	Right
13	30560	28380	Jagdishpur	Left
14	30580	28400	Jagdishpur	Right
15	32+480	30600	MOHANPURA	Left
16	32+580	30700	MOHANPURA	Right
17		32040	MOHANPURA Bypass	Left
18		32060	MOHANPURA Bypass	Right
19	36+060	33920	BOKAWA	Left
20	36+080	33940	BOKAWA	Right
21	37+630	35500	Devpur	Left
22	37+650	35520	Devpur	Right
23	40+610	38540	MANIKORA	Left
24	40+630	38560	MANIKORA	Right
25	43+260	41160	Pepramoni	Left
26	43+285	42185	Pepramoni	Right
27	48+605	46480	balkata	Left
28	48+625	46500	balkata	Right
29	50+170	48040	parshamhnecorahaya	Left
30	50560	48460	parshamhnecorahaya	Right
31	53+746	51500	pharenda	Right
32	60+610	58340	campierganj	Left

S. No.	Existing Chainage (km)	Proposed Chainage (km)	Village	SIDE
33	60+630	58360	campierganj	Right
34	62+860	60580	campierganj	Left
35	63+600	61330	alenabad	Right
36	69+830	67520	peppeganj	Left
37	69+850	67540	peppeganj	Right
38		70800	Peppeganj Bypass	Right
39		70820	Peppeganj Bypass	Left
40	77+160	75400	bagahibhari	Right
41	77+860	76040	bagahibhari	Left
42	80+180	78420	jungle kodiya	Right
43	81+000	79280	jungle kodiya	Left

The above locations are tentative and can be changed to appropriate location as found suitable in consultation with Client/Authority Engineer

9.27.6 Rest Area's :

Two Restareashave been proposed to be constructed with facilities such as toilets, telephones, cafeteria/restaurant, parking for car, buses & trucks, dormitory, rest rooms shops, fuel station, first aid etc. These minimum facilities shall be provided as per provisions prescribed in manual. This will be provided on the land procured by the Authority (Approx 2 Hac.).

9.27.7 Highway PatrolUnit:

Two highway patrolunits with required equipments is proposed to be established & operate at the Toll Plaza location with control room as specified in manual.

9.27.8 Medical Aid Posts for Emergency Medical Services :

This will include setting up Medical Aid post of Toll Plaza location with one ambulance and medical staff with provision of medicines and equipments.

9.27.9 Crane Services :

One crane of adequate capacity at Toll Plaza location with necessary equipments have been proposed to clear the disabled/accidental vehicles from highway.

9.27.10 Communication System :

Provision of suitable communication system be made with all necessary equipment for meeting O & M obligations.

9.27.11 Advanced Traffic Management Systems (ATM's) :

As per provisions applicable in MoRTH Specification.

9.27.12 O & M Centre :

O & M centre probably either at Toll Plaza area or any other location along the project highway is to be established with all facilities to meet the O & M obligations.

9.28 LAND SCAPING AND TREE PLANTATION

The plants and shrubs of required number and type at appropriate locations within the Right of way and in the land earmarked by the Authority for afforstation keeping in view the IRC guidelines on Landscaping & Tree Plantation. flowering plants and shrubs in sections of project Highway where medium width is more than 2-5 m have been proposed to be planted.

9.29 PROPOSED CONSTRUCTION OF PIPE CULVERTS AT JUNCTIONS

On the project section for proper road side drainage new pipe culverts at following junctions have been proposed on approach roads.

Table 9.26 – Proposed Pipe Culverts at Junction

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
1	1+650	1+660	T	Right	1 x 1200 mm dia pipe
2	5+050	5+038	X	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
3	5+500	5+480	X	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
4	6+205	6+180	T	RIGHT	1 x 1200 mm dia pipe
5	6+527	6+500	Y	RIGHT	1 x 1200 mm dia pipe
6	6+567	6+540	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
7	7+060	7+040	Y	LEFT	1 x 1200 mm dia pipe
8	7+160	7+140	T	LEFT	1 x 1200 mm dia pipe
9	7+500	7+480	T	LEFT	1 x 1200 mm dia pipe
10	7+820	7+800	T	LEFT	1 x 1200 mm dia pipe
11	8+053	8+050	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
12	8+157	8+155	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
13	8+540	8+540	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
14	8+870	8+850	T	RIGHT	1 x 1200 mm dia pipe
15	9+030	9+010	T	RIGHT	1 x 1200 mm dia pipe
16	9+400	9+380	T	RIGHT	1 x 1200 mm dia pipe
17	11+380	11+360	Y	LEFT	1 x 1200 mm dia pipe
18	12+460	12+410	T	RIGHT	1 x 1200 mm dia pipe
19	12+920	12+870	Y	RIGHT	1 x 1200 mm dia pipe
20	12+920	12+880	T	RIGHT	1 x 1200 mm dia pipe
21	13+000	12+970	T	LEFT	1 x 1200 mm dia pipe
22	14+465	14+445	T	RIGHT	1 x 1200 mm dia pipe
23	14+547	14+530	T	LEFT	1 x 1200 mm dia pipe
24	15+915	15+885	T	RIGHT	1 x 1200 mm dia pipe
25	15+950	15+935	T	LEFT	1 x 1200 mm dia pipe
26	17+823	17+805	T	LEFT	1 x 1200 mm dia pipe
27	18+100	18+080	T	RIGHT	1 x 1200 mm dia pipe
28	19+342	19+325	T	RIGHT	1 x 1200 mm dia pipe
29	19+804	19+790	T	LEFT	1 x 1200 mm dia pipe
30	20+285	20+270	T	LEFT	1 x 1200 mm dia pipe
31	21+030	21+010	T	LEFT	1 x 1200 mm dia pipe
32	21+954	21+930	T	RIGHT	1 x 1200 mm dia pipe
33	Kolhui Bazar Bypass	22+550	X	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
34		23+060	X	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
35		23+660	Y	LEFT	1 x 1200 mm dia pipe
36		23+790	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
37		25+210	X	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
38		26+080	X	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
39		26+185	T	LEFT	1 x 1200 mm dia pipe
40		26+660	Y	LEFT	1 x 1200 mm dia pipe
41		26+715	T	RIGHT	1 x 1200 mm dia pipe
42	29+546	27+360	T	LEFT	1 x 1200 mm dia pipe
43	30+217	28+040	T	LEFT	1 x 1200 mm dia pipe

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
44	30+430	28+250	T	RIGHT	1 x 1200 mm dia pipe
45	30+845	28+665	T	RIGHT	1 x 1200 mm dia pipe
46	32+093	29+910	T	RIGHT	1 x 1200 mm dia pipe
47	32+120	29+940	T	LEFT	1 x 1200 mm dia pipe
48	32+842	30+670	T	RIGHT	1 x 1200 mm dia pipe
49	30+650	30+875	Y	Left	1 x 1200 mm dia pipe
50	Ex. Bypass	31+670	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
51	Ex. Bypass	32+460	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
52	35+850	33+710	T	LEFT	1 x 1200 mm dia pipe
53	36+360	34+220	Y	LEFT	1 x 1200 mm dia pipe
54	36+800	34+670	T	LEFT	1 x 1200 mm dia pipe
55	37+047	34+910	T	RIGHT	1 x 1200 mm dia pipe
56	37+095	34+960	T	LEFT	1 x 1200 mm dia pipe
57	37+735	35+610	T	LEFT	1 x 1200 mm dia pipe
58	38+495	36+370	T	RIGHT	1 x 1200 mm dia pipe
59	39+190	37+060	Y	RIGHT	1 x 1200 mm dia pipe
60	39+560	37+480	T	RIGHT	1 x 1200 mm dia pipe
61	40+000	37+930	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
62	40+470	38+410	T	RIGHT	1 x 1200 mm dia pipe
63	41+890	39+760	T	LEFT	1 x 1200 mm dia pipe
64	42+918	40+790	T	LEFT	1 x 1200 mm dia pipe
65	42+975	40+850	Y	RIGHT	1 x 1200 mm dia pipe
66	43+682	41+565	T	RIGHT	1 x 1200 mm dia pipe
67	44+161	42+060	T	LEFT	1 x 1200 mm dia pipe
68	44+650	42+550	T	LEFT	1 x 1200 mm dia pipe
69	44+932	42+840	T	RIGHT	1 x 1200 mm dia pipe
70	45+162	43+040	T	LEFT	1 x 1200 mm dia pipe
71	45+670	43+545	T	RIGHT	1 x 1200 mm dia pipe
72	45+940	43+820	T	RIGHT	1 x 1200 mm dia pipe
73	46+065	43+940	T	LEFT	1 x 1200 mm dia pipe
74	46+720	44+600	Y	LEFT	1 x 1200 mm dia pipe
75	46+910	44+790	T	RIGHT	1 x 1200 mm dia pipe
76	47+142	45+010	T	LEFT	1 x 1200 mm dia pipe
77	47+730	45+600	T	RIGHT	1 x 1200 mm dia pipe

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
78	48+023	45+900	T	LEFT	1 x 1200 mm dia pipe
79	49+648	47+530	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
80	50+090	47+960	T	RIGHT	1 x 1200 mm dia pipe
81	50+465	48+335	T	LEFT	1 x 1200 mm dia pipe
82	53+243	51+090	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
83	54+080	51+840	T	RIGHT	1 x 1200 mm dia pipe
84	54+630	52+400	T	LEFT	1 x 1200 mm dia pipe
85	55+780	53+520	Y	RIGHT	1 x 1200 mm dia pipe
86	56+635	54+355	T	LEFT	1 x 1200 mm dia pipe
87	57+974	55+695	T	RIGHT	1 x 1200 mm dia pipe
88	58+650	56+370	T	RIGHT	1 x 1200 mm dia pipe
89	59+862	57+580	T	RIGHT	1 x 1200 mm dia pipe
90	62+208	59+940	T	LEFT	1 x 1200 mm dia pipe
91	62+492	60+225	T	RIGHT	1 x 1200 mm dia pipe
92	62+634	60+365	T	RIGHT	1 x 1200 mm dia pipe
93	62+660	60+390	T	LEFT	1 x 1200 mm dia pipe
94	62+930	60+665	T	RIGHT	1 x 1200 mm dia pipe
95	63+493	61+205	T	RIGHT	1 x 1200 mm dia pipe
96	63+748	61+465	T	RIGHT	1 x 1200 mm dia pipe
97	64+073	61+795	T	LEFT	1 x 1200 mm dia pipe
98	64+830	62+550	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
99	65+146	62+860	T	LEFT	1 x 1200 mm dia pipe
100	65+384	63+100	T	LEFT	1 x 1200 mm dia pipe
101	66+010	63+720	Y	RIGHT	1 x 1200 mm dia pipe
102	66+225	63+930	T	LEFT	1 x 1200 mm dia pipe
103	66+916	64+630	T	LEFT	1 x 1200 mm dia pipe
104	67+385	65+100	T	LEFT	1 x 1200 mm dia pipe
105	67+725	65+450	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
106	68+359	66+070	Y	LEFT	1 x 1200 mm dia pipe
107	69+180	66+890	T	RIGHT	1 x 1200 mm dia pipe
108	69+881	67+595	T	RIGHT	1 x 1200 mm dia pipe
109	69+913	67+630	T	LEFT	1 x 1200 mm dia pipe
110	70+228	67+945	Y	LEFT	1 x 1200 mm dia pipe

S.No.	Existing Chainage	Design Chainage	Junction Type	Side	Link / Approach to
111	70+254	67+970	T	RIGHT	1 x 1200 mm dia pipe
112	70+800	68+530	T	LEFT	1 x 1200 mm dia pipe
113	71+265	68+980	T	RIGHT	1 x 1200 mm dia pipe
114	Peppeganj	69+720	x	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
115		70+165	x	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
116		70+580	x	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
117		71+680	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
118		72+985	+	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
119	76+127	74+375	T	RIGHT	1 x 1200 mm dia pipe
120	76+210	74+455	T	LEFT	1 x 1200 mm dia pipe
121	78+097	76+340	T	RIGHT	1 x 1200 mm dia pipe
122	79+568	77+890	T	RIGHT	1 x 1200 mm dia pipe
123	80+270	78+520	X	BOTH	1 x 1200 mm dia pipe
					1 x 1200 mm dia pipe
124	80+520	78+770	T	RIGHT	1 x 1200 mm dia pipe
125	81+213	79+460	T	RIGHT	1 x 1200 mm dia pipe

9.30 RAIN WATER HARVESTING SYSTEM

(i) Water Harvesting system have been proposed all along the project highway at 500 m interval on both sides and to be carried out as per NHAI Circular No. NHAI/TIC/VIP Ref/2012 dt. 26th Oct. 2015 and as directed by the Authority Engineer.

(ii) Reuse of water from water harvesting system have been proposed to be planned for watering land scaping and plantation etc.

9.31 ROAD SAFETY MEASURE

Road Safety Engineering Measure shall be carried out as per Ministry's letter No. RW/NH-35072/04/2004 – S&T(R) (Pt) dt. 19th Oct. 2015.