BRIEF OF THE PROJECT

0.1 General

SAI Consulting Engineers Pvt. Ltd., Ahmedabad have been appointed as Consultants to carry out the Feasibility study and the Detailed Project Report for rehabilitation and upgradation of existing road to 2 lane with paved shoulders configuration with provision of capacity augmentation. The agreement has been signed on 23.12.2011.

The location of the Project Road has been shown in the **Fig. 1.1 – Location Map**.

Project road starts at 280+800 of NH-8 near Kundal village and follows the existing VR passing through Kundal & Naya Kheda village and meets the SH-50 at Naya Kheda at km 12.500 of SH-50 after traversing 5.5 Km. From km 12.500 of SH-50 the project road alignment follows the route of SH-50 and passes through important settlements like Jhadol, Kolyari, Bichhiwara & Phalasia till km 89.200 of SH-50 at Som.From km 89.200 of SH-50(km 139.000 of SH-10) the project road follows the route of SH-10 till Nalwa at km 133.500 of SH-10(km 0.000 of VR-64).From km 0.000 of VR-64,the project road follows the route of existing VR-64 till km 20.750 of VR-64 at Daiya i.e. (Gujarat Border).i.e.end point of Project Road. The total length of the project road is **108.450kms**.

0.2 Start and End Point of the Project

0.2.1 Start Point

The start point of the project is at kilometre stone 280+800 on NH-8 located at Kundal Village.

0.2.2 End Point

The end point of the project is at Km 20+750 of VR-64 at Daiya (Gujarat Border).

0.3 Existing Carriageway and Pavement

The existing project road generally has a single lane carriageway of 3.0m width except in some places where the carriageway width is 3.75m, 5.5m and 7m (some built-up areas) with 1.0m to 2.0m shoulders on either side of the carriageway. The surface of the carriageway is generally bituminous except in some built-up areas where it is concrete. The surface of shoulders is unpaved. The sections with the variable carriageway width and type is given in **Table 0.1**.The condition of the pavement is generally fair to poor with very little amount of rut, ravelling or potholing. But cracking & edge breaking is prominent for about 85% of the project road with about 50% of patching. The condition of shoulders is also fair to poor .The Kutcha drain of 0.5m width is available to hillside at some places.

Table 0.1: Details of Carriageway width and type

1. _CC Carriageway					
S.No.	**Chainage**		**Length**	**Location**	**Carriageway Width**
	From	**To**			
1	3+200	3+400	200	NayaKheda	3.00
2	32+100	32+300	200	Paba	7.00
3	48+200	48+400	200	Jhadol	7.00

1. _CC Carriageway					
S.No.	**Chainage**		**Length**	**Location**	**Carriageway Width**
4	50+000	50+300	300	Ganeshpura	7.00
5	55+800	56+000	200	Khakhad	7.00
6	56+850	57+000	150	Magwas	7.00
7	64+700	64+850	150	Jhadapeepla	7.00
8	67+000	67+200	200	Kolyari starting	7.00
9	67+700	67+900	200	Kolyari End	7.00
10	76+450	76+800	350	Bichhiwara	7.00
11	80+050	80+350	300	Phalasia	7.00
2. BT Carriageway					
S.No.	**Chainage**		**Length**	**Location**	**Carriageway Width**
	From	**To**			
1	35+200	36+350	1150	Rann Ghati	5.50
2	138+000	133+500	4500	Som Ghat Area	3.75
3. Rest of sections are bituminous type and carriageway width is 3.0m					

The Existing ROW is 7-14m.

0.4 Existing Alignment

The horizontal alignment which is passing through Rolling and Hill terrain in most of its length can cater to the design speed of 20-30 km/hr or even less. Most of the curves are sharp curves and due to hill at inner side of curve, sight distance is inadequate.

The vertical profile is generally varying from smooth to steep gradients as high as 10%.

0.5 Settlements

There are about 42 settlements along the project road. Main towns along the road are, Jhadol and Som.

0.6 Major and Minor Intersections

There are 4 Major and 57 minor crossings with the project road. These are treated with appropriate at-grade junctions.

0.7 Existing Major and Minor Bridges and Culverts

There are no major bridges and forty two (32) minor bridges present in project road section.

Table 0.2: List of Existing Bridges section Udaipur-Kundal-NayaKheda-Jhadol-Som-Nalwa-Daiya (Section of NH-58)

Sr. No.	Existing Chainage (Km)	Type of Bridge	No of Span	No of Span with Spans length(m)	Total outer width of Bridge(m)	Type of Super Structure
Section of SH-50 Km(12+500 to 89+200)						
1	18+300	Minor	5	1x2.7+1x2.3+1x2.4+1x2.5+ 1x2.6	7.30	Solid Slab
2	27+700	Minor	1	1x8.50	7.30	Arch/Brick
3	40+600	Minor	8	1x3.0+1x2.9+1x2.0+1x1.8+ 1x1.8+1x1.8+1x3.0+1x2.7	7.30	Solid Slab
4	41+300	Minor	5	1x3.0+1x2.0+1x1.75+1x2.0 +1x3.0	7.20	Solid Slab
5	45+400	Minor	3	2x3.0+1x2.50	7.40	Solid Slab
6	49+800	Minor	5	3x4.5+1x4.4+1x4.0	5.60	Solid Slab
7	51+100	Minor	2	2x3.50	8.20	Solid Slab
8	54+400	Minor	3	3x3.0	6.40	Solid Slab
9	58+900	Minor	5	4x3.70+1x3.50	6.00	Solid Slab
10	61+700	Minor	2	2x7.0	6.00	Solid Slab
11	64+600	Minor	3	3x7.0	7.40	Solid Slab
12	65+600	Minor	1	1x8.50	8.20	Solid Slab
13	66+300	Minor	1	1x7.20	10.20	Solid Slab
14	67+000	Minor	2	2 x 8.50	8.00	Solid Slab
15	68+200	Minor	3	2x4.0+1x3.8	7.30	Solid Slab
16	68+900	Minor	1	1x8.50	7.00	Solid Slab
17	69+400	Minor	1	1x7.0	7.00	Solid Slab
18	71+700	Minor	1	1x8.80	7.55	Solid Slab
19	72+500	Minor	6	6x7.0	7.20	Solid Slab
20	76+200	Minor	1	1x8.10	7.80	Solid Slab
21	78+400	Minor	1	1x6.80	8.50	Solid Slab
22	79+400	Minor	1	1x7.50	8.10	Solid Slab
23	82+700	Minor	1	1x13.30	7.30	T-beam- 3 girder
24	83+200	Minor	2	2x6.20	9.70	Solid Slab
25	84+000	Minor	3	2x3.8+1x3.4	8.10	Solid Slab
26	85+500	Minor	2	2x5.50	8.10	Solid Slab
27	87+600	Minor	3	1x5.4+1x5.5+1x5.0	8.20	Solid Slab
Section of Sh-10 Km(139.0 to 133.5)						
28	137+256	Minor	2	1x6.0+1x3.6	8.80	Solid Slab
29	135+956	Minor	1	1x7.20	8.10	Solid Slab
Section Nalwa- Daiya to Gujarat border Km(0+000 to 20+645)						
30	4+600	Minor	1	1x7.0	7.60	Solid Slab
31	8+400	Minor	2	2x7.4	7.60	Solid Slab
32	17+950	Minor	5	2x6.9+3x5.5	7.30	Solid Slab

Inventory details of Existing Cross Draiange structures length less than 6m in all the stretches of the project road have been collected during site visit. A total of three hundred twenty one (321) existing CD structures were observed in project road.

Table 0.3: Summary of Existing Cross Drainage Structures section Udaipur- Kundal-NayaKheda-Jhadol-Som-Nalwa-Daiya-Idar (New declared highway NH-58)

Location	Type of Culverts						Total Nos.
	Pipe	Slab	Causeway	Scupper	Pipe/Scupper	Slab/Pipe	
Section VR-58 (0+00 to 5+311 Km)	11	0	0	0	0	0	11
Section of SH-50 (12+500 to 89+200	70	111	6	22	6	0	215
Section of SH-10 (139.0 to 133.5 km)	10	2	0	0	0	0	12
Section Nalwa-Daiya-Gujarat Border (0+00 to 20+645km)	54	6	22	0	0	1	83
Total Nos.	**145**	**119**	**28**	**22**	**6**	**1**	**321**

0.8 Railway Crossings

The project road is having no level crossing.

0.9 CUP

The project road is having no CUP.

0.10 Traffic Survey

- Classified Traffic Volume Count Survey at four locations in four homogenous sections.
- Turning Movement Survey at 11 major junctions.
- OD Survey at 5 locations
- Pedestrian & Animal Crossing Survey at 8 locations.
- Survey for Truck Terminal and Parking Speed and Delay Survey.
- Axle Road Survey at three locations.

- Willingness to Pay Survey.
- Wayside Amenities Survey.

0.10.1 Homogeneous Section

Considering the location of junctions and the towns following homogeneous sections from traffic consideration have been identified.

1) Start of Project Road (Km 280+600 of NH-8) to Jhadol (Km 49+000 of SH-50)

2) Jhadol (Km 49+000 of SH-50 to Som (Km 90 of SH-50 or 139+000 of SH-10)

3) Som (Km 90 of SH-50 or 139+000 of SH-10) to Nalwa Village (Km 133+000 of SH-10

4) Nalwa Village (Km 133+000 of SH-10 or 0+000 of VR-64) to Daiya Village Gujarat Border Km 22+750 of VR-64)

0.10.2 Classified Traffic Volume Count (CVC)

The summary of classified traffic volume count survey is as given **table 0.4.**

Table 0.4: Summary of Classified Traffic Volume Count Survey for Udaipur-Daiya section of NH-58

Homogeneous section.	Location	AADT (No.)	AADT (PCU)
1	Near Jhadol(Km 48/300 of SH-50)	3580	3393
2	Near Som(Km 89/200 of SH-50)	961	1148
3	Near Som (Km 138.900 of SH-10)	554	561
4	Near Nalwa(Km 0/100 of VR-64	355	389

0.10.3 Axle Load Survey

The VDF values as per Axle Load Survey is as given **table 0.5**.

Table 0.5: VDF Values at Three Locations

Sr. No.	Location & Chainage	Type of Vehicle	VDF on Project Road
1.	Jhadol@ KM 48+000 of SH-50	2-Axle	1.5
		3-Axle	3.7
2.	Som@KM 89+200 of SH-50	2-Axle	4.1
3.	Nalwa@KM 138+900 of SH-50	2-Axle	0.9

Some overloading of vehicles occurs due to construction material and daily need. To eliminate the menace of overloading strict enforcement needs to be carried at the source of loading.
The values of VDF are not considerable. The values have been adopted as per IRC which are used in MSA calculation. Adopted VDF Values are 3.5 for all vehicles.

0.10.4 Growth rates

Growth rates were computed by the different methods and final adopted growth rates for design are presented in **table 0.6.**

Table 0.6: Final adopted Traffic Growth Rates for design

Year	2-Wheelers	3-Wheelers	Car/ Jeep /Van/Taxi	Bus	Trucks /Trailor	Tractor
2012-2017	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	5.2
2017-2022	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
2022-2027	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
2027-2032	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
2032-2037	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
2037-2042	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**

0.10.5 Projected Traffic Volume

The normal/total traffic in PCUs on project road sections was projected to horizon year 2042 by applying the vehicle-wise growth rates under most likely scenario to the base year (2012).The year wise calculated PCUs are presented in **Table 0.8.**

Table 0.8: Summary of Projected Total Traffic Volume (in PCUs) for Design

Year	Section-1(near Jhadol at Km 48/300 of SH-50)	Section-2 (near Som at Km 89/200 of SH-50)	Section-3(near Som at Km 138.900 of SH-10)	Section-4 (near Nalwa at Km 0/100 of VR-64)
2012	3394	1147	561	389
2013	3548	1201	587	406
2014	3727	1261	616	426
2015	3914	1324	646	448
2016	4111	1390	677	471
2017	4315	1458	710	494
2018	4529	1530	744	519
2019	4754	1606	780	544
2020	4990	1685	818	571
2021	5237	1768	858	599
2022	5497	1855	899	629
2023	5770	1947	943	660
2024	6057	2043	988	693
2025	6357	2143	1036	727
2026	6673	2249	1087	763
2027	7005	2360	1139	801
2028	7353	2477	1195	840
2029	7718	2600	1253	882
2030	8102	2728	1314	926
2031	8505	2863	1378	971

Year	Section-1(near Jhadol at Km 48/300 of SH-50)	Section-2 (near Som at Km 89/200 of SH-50)	Section-3(near Som at Km 138.900 of SH-10)	Section-4 (near Nalwa at Km 0/100 of VR-64)
2032	8928	3005	1445	1020
2033	9372	3154	1516	1070
2034	9838	3310	1590	1123
2035	10327	3474	1668	1179
2036	10841	3646	1749	1238
2037	11381	3826	1835	1299
2038	11947	4016	1925	1363
2039	12542	4215	2019	1431
2040	13166	4424	2118	1502
2041	13822	4644	2222	1577
2042	14510	4874	2331	1655

0.10.6 Capacity Analysis

The capacity analysis was under taken for the 6 homogeneous sections. Considering the growth rates under the normal scenario, the LOS-B for intermediate lane for section-1(Hilly), Section-2(Hilly), Section-3(Hilly), Section-4(Plain) shall exceed in the year 2018, 2041, beyond 2042, and beyond 2042, respectively.

At present this highway mostly consists local and some through traffic and some of them are tourist traffic going mainly to Ambaji, Mount Abu and other towns of the Gujarat and local traffic between main town namely Girwa, Jhadol, Phalasia, Som, Nalwa and Daiya, Vijaynagar, Idar, himmatnagar.

Due to substandard geometry with steep gradient of road profile and frequent occurrence of accidents, the traffic volume mainly of trucks is low.

After improvement of road to National Highway standard with easy geometry including flat gradient and traffic safety provisions, the traffic will induce along with the existing traffic growth. As per existing traffic growth, without improvement, the sections from Kundal to Jhadol demand 2 lane with paved shoulder where as between Jhadol and Vijaynagar section requires intermediate lane for 15 years design period.But due to induced traffic after improvement of the road would demand 2 lane with paved shoulder for entire length.

Also as per discussion with NHAI, min. two lane with paved shoulder has to be provided for entire length section. Hence entire section from Udaipur to Daiya with two lane paved shoulder has been proposed.

0.11 Design Standards

Manual of Specifications and Standards for Two laning of National Highways, IRC: SP: 73-2007 has been followed for the project.

0.12 Improvements Proposals

0.12.1 Lane configuration

The proposed lane configuration is given below.

Table 0.9: Proposed Lane configuration

Existing Lane configuration	Proposed Lane configuration
0+000 of VR (280+800 of NH-8) to 5+500 of VR (12+500 of SH-10) in Rajasthan portion – Single Lane	0+000 to 5+800 – 2 Lane with paved shoulder in Rajasthan portion *Length – 5.800 km*
12+500 of SH-10 to 13+775 of SH-10 in Rajasthan portion – Single Lane	
13+775 of SH-50 to 89+200 of SH-50 (139+000 of SH-10) in Rajasthan portion – Single Lane	5+800 to 91+000 - 2 Lane with paved shoulder in Rajasthan portion *Length – 85.200 km*
89+200 of SH-50 (139+000 of SH-10) to 147+300 of SH-10 in Rajasthan portion – Single Lane	
147+300 of SH-10 (0+000 of VR) to 3+100 of VR in Rajasthan portion – Single Lane	

0.12.2 Widening

It is proposed to widen the single lane/Intermediate lane sections to two lanes with paved shoulder.

Improvement scheme has been proposed as follows.

Table 0.10: Widening scheme

S.No.	Scheme	Length(kms)
1	Widening & Reconstruction	61.415
5	New Construction	29.585
	Total	***91.000***

Typical Cross-sections

Proposed Typical cross-sections is shown in **Table 0.11** below.

Table 0.11: Typical Cross Sections

S.No.	Type	Description
1	I	Widening & Reconstruction To 2- Lane With Paved Shoulders In Plain/Rolling Terrain
2	II	Widening & Reconstruction Of 3m Existing Road To 10m With Rigid Pavement In Built-up Area
3	III	Widening & Reconstruction To 2 Lane Paved Shoulder Road With Line Drain In Hill Side And Parapet Wall On Valley Side In Hilly Terrain

S.No.	Type	Description
4	IV	New Construction 2-Lane With Paved Shoulder Road With Open Box Cut In Hilly Terrain
5	V	New 2- Lane With Paved Shoulders For Bypass & Realignment In Plain/Rolling Terrain
6	VI	New Construction Of 2 Lane Paved Shoulder Road With Line Drain On Hill Side And Parapet On Valley side In Hilly Terrain
7	VIII	New Construction 2 Lane Road With Line Drain On Hill Side And Parapet On Valley Side In Hilly Terrain
8	IX	2- Lane With Paved Shoulders With Left Side Retaining Wall At AUP
9	X	2- Lane With Paved Shoulders With Both Side Retaining Wall In Cutting At AUP
10	XI	2- Lane With Paved Shoulders With Right Side Retaining Wall At AUP
11	XII	VUP Approaches With Slip Road

Table 0.12: Cross Section Schedule

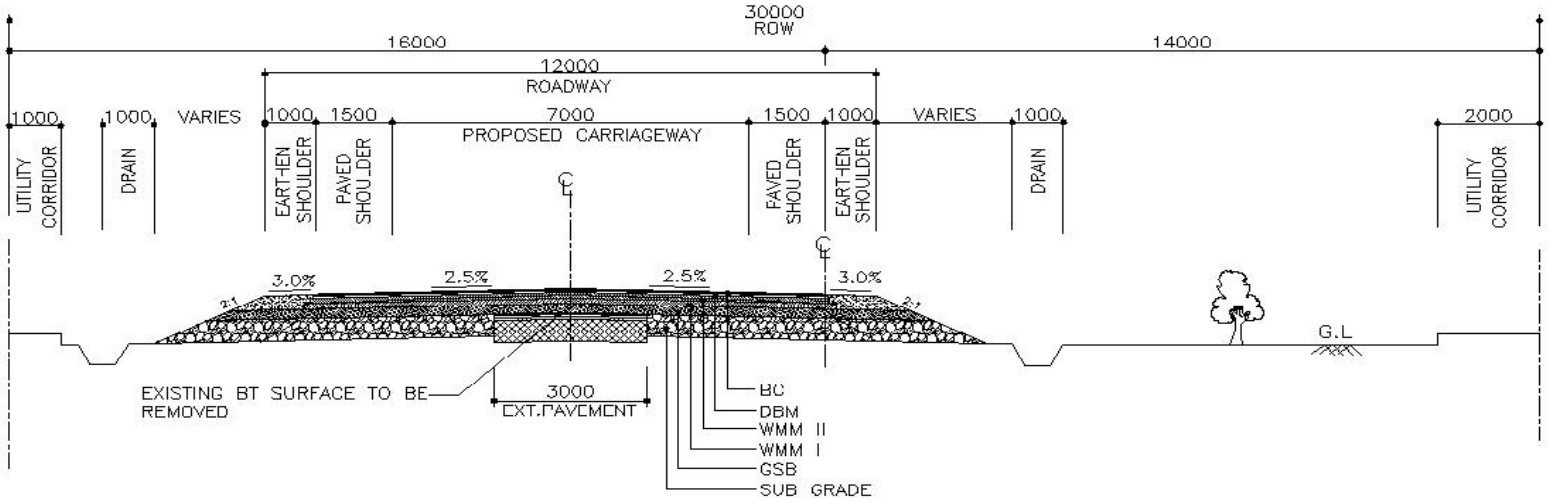
S. No.	Existing Chainage		Existing Length	Proposed Chainage		Design Length	CS Type
	From	To		From	To		
1	0+000	0+875	0+875	0+000	0+875	0+875	V
2	0+875	1+520	0+645	0+875	1+350	0+475	IV
3	1+520	1+700	0+180	1+350	1+550	0+200	I
4	1+700	2+060	0+360	1+550	1+850	0+300	IV
5	2+060	NA	4+000	1+850	2+000	0+150	III
6	NA	NA		2+000	2+350	0+350	IV
7	NA	NA		2+350	3+300	0+950	V
8	NA	13+825		3+300	5+850	2+550	VI
9	13+825	14+125		5+850	6+300	0+450	VIII
10	14+125	14+225	0+100	6+300	6+400	0+100	I
11	14+225	14+525	0+300	6+400	6+700	0+300	V
12	14+525	15+175	0+650	6+700	7+350	0+650	I
13	15+175	15+475	0+300	7+350	7+650	0+300	IX
14	15+475	16+350	0+875	7+650	8+500	0+850	I
15	15+175	16+863	1+688	8+500	9+000	0+500	V
16	16+863	16+988	0+125	9+000	9+125	0+125	I
17	16+988	17+171	0+183	9+125	9+300	0+175	VI

S. No.	Existing Chainage		Existing Length	Proposed Chainage		Design Length	CS Type
	From	To		From	To		
18	17+171	17+308	0+137	9+300	9+400	0+100	V
19	17+308	18+428	1+120	9+400	10+500	1+100	VI
20	18+428	18+729	0+301	10+500	10+800	0+300	I
21	NA	NA	0+902	10+800	11+200	0+400	VI
22	NA	NA		11+200	11+500	0+300	IV
23	19+631	19+827	0+196	11+500	11+700	0+200	I
24	19+827	20+022	0+195	11+700	11+900	0+200	V
25	20+022	20+226	0+204	11+900	12+100	0+200	I
26	20+226	20+327	0+101	12+100	12+200	0+100	V
27	20+327	22+518	2+191	12+200	15+200	3+000	IV
28	22+518	22+771	0+253	15+200	15+450	0+250	I
29	22+771	22+958	0+187	15+450	15+650	0+200	IV
30	22+958	23+650	0+692	15+650	16+750	1+100	I
31	23+650	23+950	0+300	16+750	17+050	0+300	
32	23+950	24+257	0+307	17+050	17+200	0+150	I
33	24+257	24+757	0+500	17+200	17+700	0+500	IV
34	24+757	25+028	0+271	17+700	17+950	0+250	I
35	25+028	25+322	0+294	17+950	18+200	0+250	IV
36	25+322	26+000	0+678	18+200	18+900	0+700	II
37	26+000	26+493	0+493	18+900	19+400	0+500	IV
38	26+493	26+900	0+407	19+400	19+800	0+400	V
39	26+900	27+366	0+466	19+800	20+200	0+400	IV
40	27+366	27+666	0+300	20+200	20+500	0+300	V
41	27+666	28+165	0+499	20+500	21+000	0+500	I
42	28+165	29+416	1+251	21+000	22+250	1+250	II
43	29+416	29+945	0+529	22+250	22+700	0+450	V
44	NA	NA	9+555	22+700	22+950	0+250	VI
45	NA	NA		22+950	23+050	0+100	V
46	NA	NA		23+050	24+600	1+550	IV

S. No.	Existing Chainage		Existing Length	Proposed Chainage		Design Length	CS Type
	From	To		From	To		
47	NA	NA		24+600	25+100	0+500	VI
48	NA	NA		25+100	25+500	0+400	V
49	NA	NA		25+500	27+750	2+250	IV
50	NA	NA		27+750	27+850	0+100	V
51	NA	NA		27+850	28+100	0+250	VI
52	NA	NA		28+100	29+300	1+200	V
53	NA	NA		29+300	30+800	1+500	I
54	NA	NA		30+800	31+030	0+230	VI
55	NA	NA		31+030	31+330	0+300	X
56	NA	NA		31+330	31+450	0+120	IV
57	39+500	39+770	0+270	31+450	31+750	0+300	X
58	39+815	41+524	1+709	31+750	33+500	1+750	I
59	41+524	44+676	3+152	33+500	36+600	3+100	VI
60	44+676	44+981	0+305	36+600	36+900	0+300	IV
61	44+981	46+585	1+604	36+900	38+500	1+600	I
62	NA	NA	4+930	38+500	38+950	0+450	V
63	NA	NA		38+950	39+500	0+550	IV
64	NA	NA		39+500	40+820	1+320	V
65	NA	NA		40+820	41+120	0+300	XII
66	NA	NA		41+120	41+450	0+330	V
67	NA	NA		41+450	41+700	0+250	IV
68	NA	NA		41+700	43+900	2+200	V
69	51+515	56+694	5+179	43+900	49+100	5+200	I
70	56+694	57+265	0+571	49+100	49+800	0+700	II
71	57+265	57+765	0+500	49+800	50+300	0+500	I
72	57+765	58+467	0+702	50+300	50+900	0+600	II
73	58+467	59+550	1+083	50+900	51+950	1+050	I
74	59+550	59+850	0+300	51+950	52+250	0+300	XI
75	59+850	62+525	2+675	52+250	54+900	2+650	I

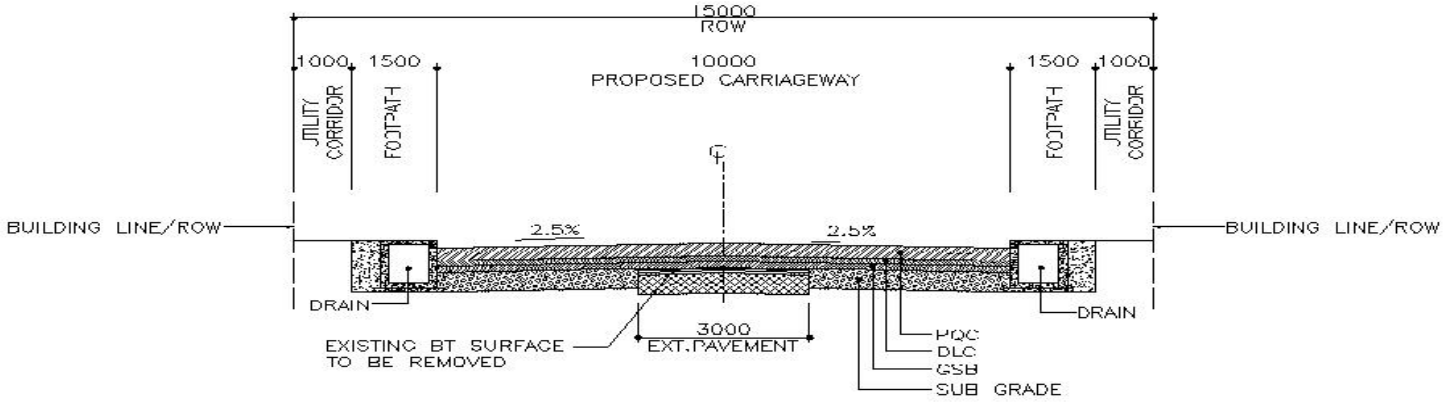
S. No.	Existing Chainage		Existing Length	Proposed Chainage		Design Length	CS Type
	From	To		From	To		
76	62+525	63+809	1+284	54+900	56+100	1+200	IV
77	63+809	64+099	0+290	56+100	56+400	0+300	I
78	64+099	64+453	0+354	56+400	56+750	0+350	IV
79	64+453	66+460	2+007	56+750	58+700	1+950	I
80	66+460	68+938	2+478	58+700	61+400	2+700	V
81	68+938	69+246	0+308	61+400	61+700	0+300	IV
82	69+246	71+968	2+722	61+700	64+400	2+700	I
83	71+968	72+698	0+730	64+400	65+100	0+700	V
84	72+698	73+017	0+319	65+100	65+400	0+300	I
85	73+017	73+318	0+301	65+400	65+700	0+300	IV
86	73+318	74+809	1+491	65+700	66+600	0+900	V
87	74+809	76+048	1+239	66+600	68+400	1+800	I
88	76+048	77+639	1+591	68+400	70+000	1+600	V
89	77+639	79+297	1+658	70+000	71+100	1+100	I
90	79+297	80+705	1+408	71+100	72+400	1+300	V
91	80+705	84+085	3+380	72+400	75+800	3+400	I
92	84+085	84+410	0+325	75+800	76+100	0+300	V
93	84+410	84+960	0+550	76+100	76+650	0+550	I
94	84+960	85+260	0+300	76+650	76+950	0+300	
95	85+260	86+825	1+565	76+950	78+500	1+550	V
96	86+825	87+332	0+507	78+500	79+000	0+500	I
97	87+332	87+656	0+324	79+000	79+300	0+300	V
98	87+656	88+275	0+619	79+300	79+850	0+550	I
99	88+275	139+800	1+425	79+850	81+200	1+350	V
100	139+800	140+700	0+900	81+200	82+100	0+900	I
101	140+700	141+310	0+610	82+100	82+650	0+550	V
102	141+310	143+940	2+630	82+650	85+250	2+600	I
103	143+940	144+105	0+165	85+250	85+400	0+150	IV
104	144+105	144+359	0+254	85+400	85+650	0+250	I

S. No.	Existing Chainage		Existing Length	Proposed Chainage		Design Length	CS Type
	From	To		From	To		
105	144+359	144+608	0+249	85+650	85+900	0+250	IV
106	144+608	145+140	0+532	85+900	86+400	0+500	V
107	145+140	145+500	0+360	86+400	86+700	0+300	IV
108	145+500	146+447	0+947	86+700	87+650	0+950	I
109	146+447	146+719	0+272	87+650	87+900	0+250	IV
110	146+719	147+015	0+296	87+900	88+200	0+300	I
111	147+015	147+300	0+285	88+200	88+500	0+300	V
112	147+300	0+240	0+240	88+500	88+750	0+250	I
113	0+240	0+495	0+255	88+750	88+900	0+150	IV
114	NA	NA	1+655	88+900	90+300	1+400	I
115	NA	3+100 of VR Raj	1+990	90+300	91+000	0+700	IV



TYPICAL CROSS SECTION: TYPE - I

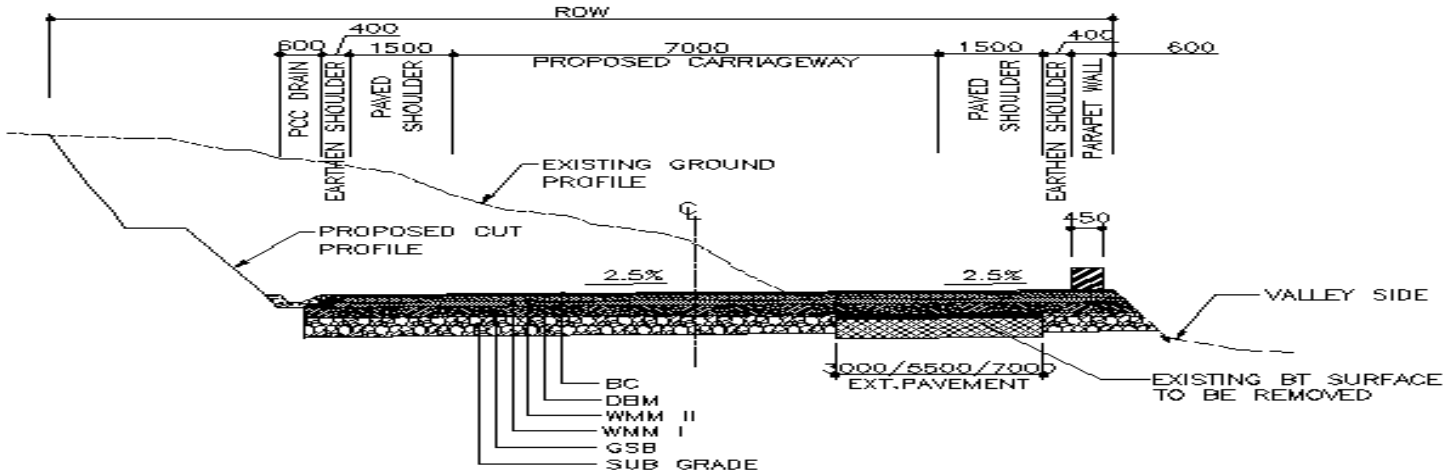
WIDENING & RECONSTRUCTION TO 2- LANE WITH PAVED SHOULDER IN PLAIN/ROLLING TERRAIN



TYPICAL CROSS SECTION: TYPE - II

WIDENING & RECONSTRUCTION TO 10m WIDE RIGID PAVEMENT IN BUILTUP AREA INCLUDING DRAIN & FOOTPATH BOTH SIDE IN PLAIN/ROLLING TERRAIN

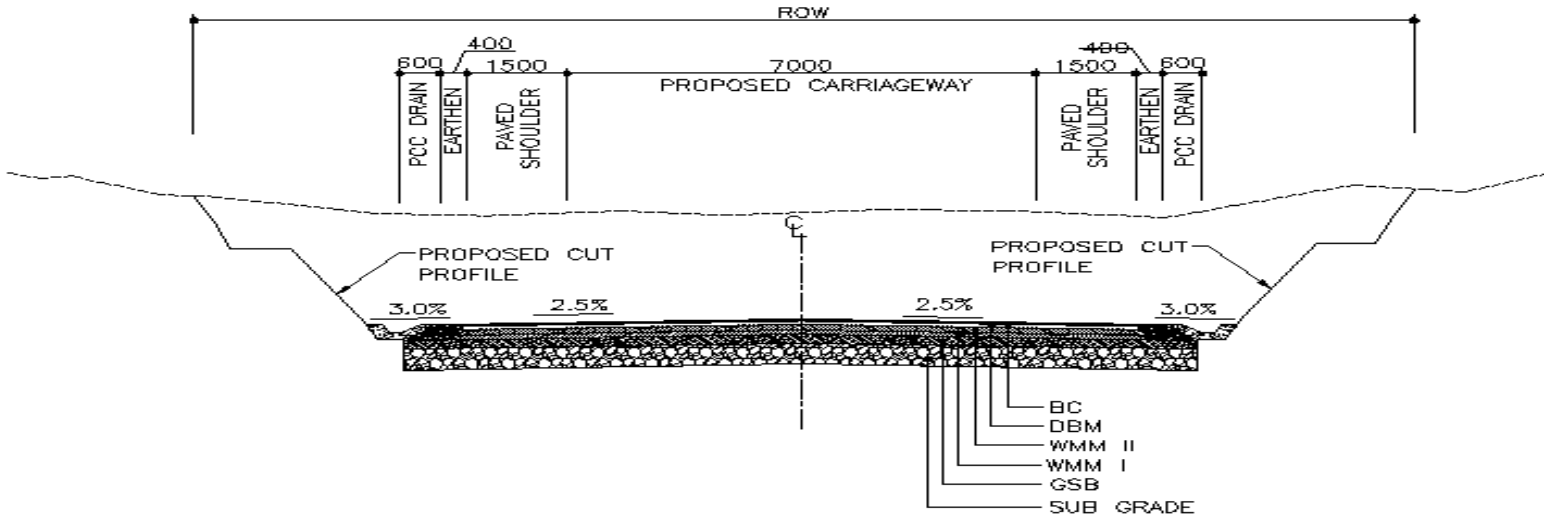
ANNEXURE VIII



TYPICAL CROSS SECTION: TYPE - III

WIDENING & RECONSTRUTION TO 2 LANE PAVED SHOULDER ROAD WITH LINE DRAIN IN HILL SIDE AND PARAPET WALL ON VALLEY SIDE IN HILLY TERRAIN

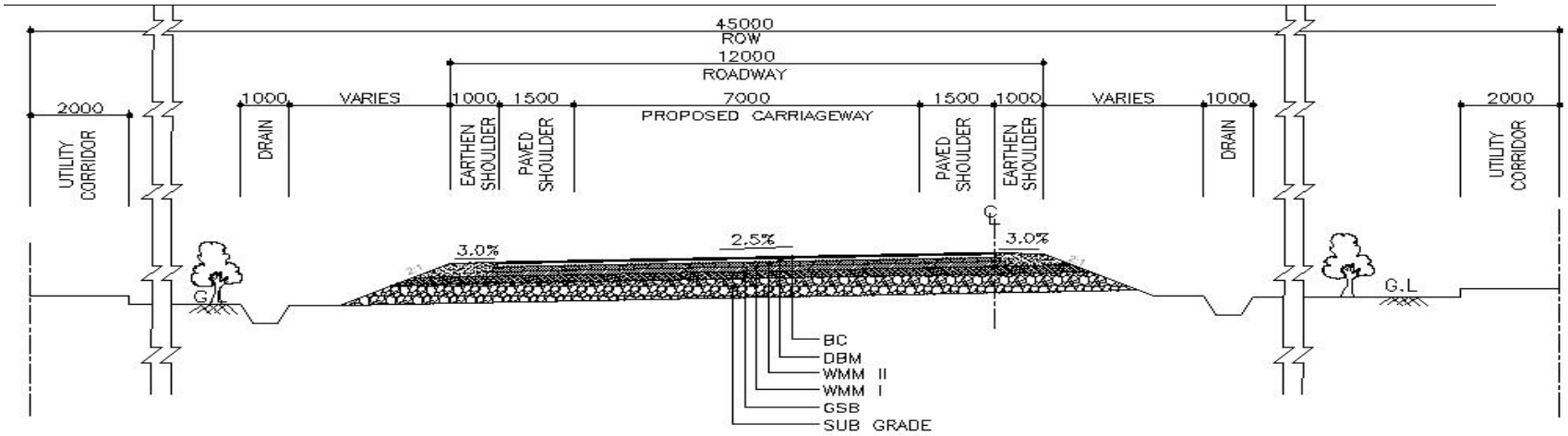
ANNEXURE VIII



TYPICAL CROSS SECTION: TYPE - IV

NEW CONSTRUCTION OF 2-LANE PAVED SHOULDER ROAD WITH OPEN BOX CUT IN HILLY TERRAIN

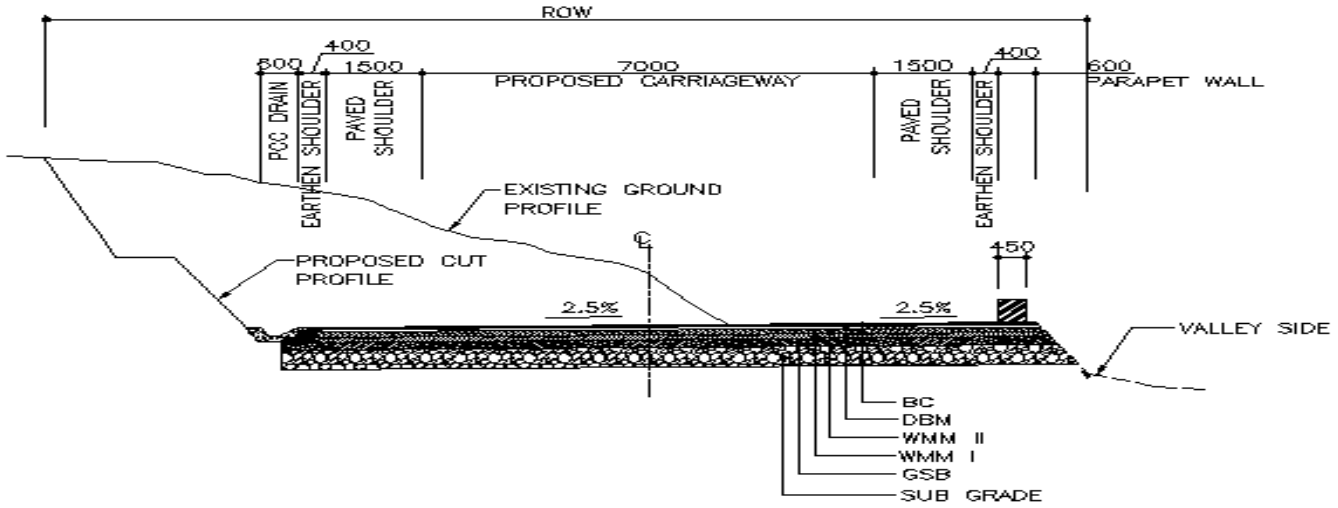
ANNEXURE VIII



TYPICAL CROSS SECTION: TYPE - V

NEW 2- LANE WITH PAVED SHOULDERS FOR BYPASS & REALIGNMENT IN PLAIN/ROLLING TERRAIN

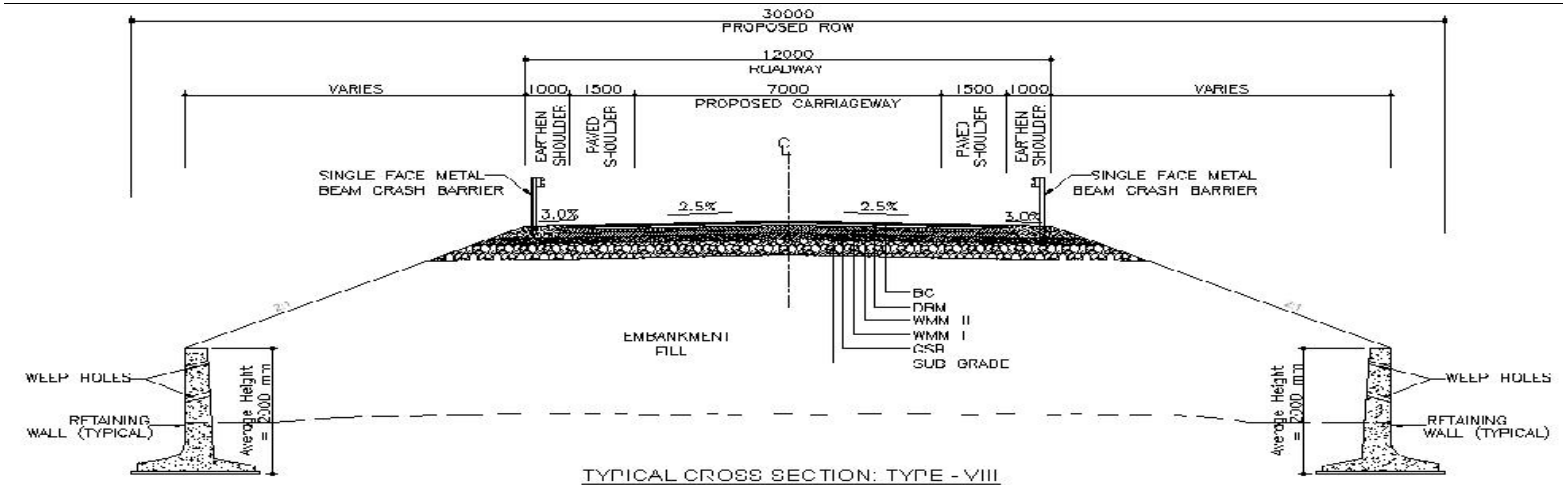
ANNEXURE VIII



TYPICAL CROSS SECTION: TYPE - VI

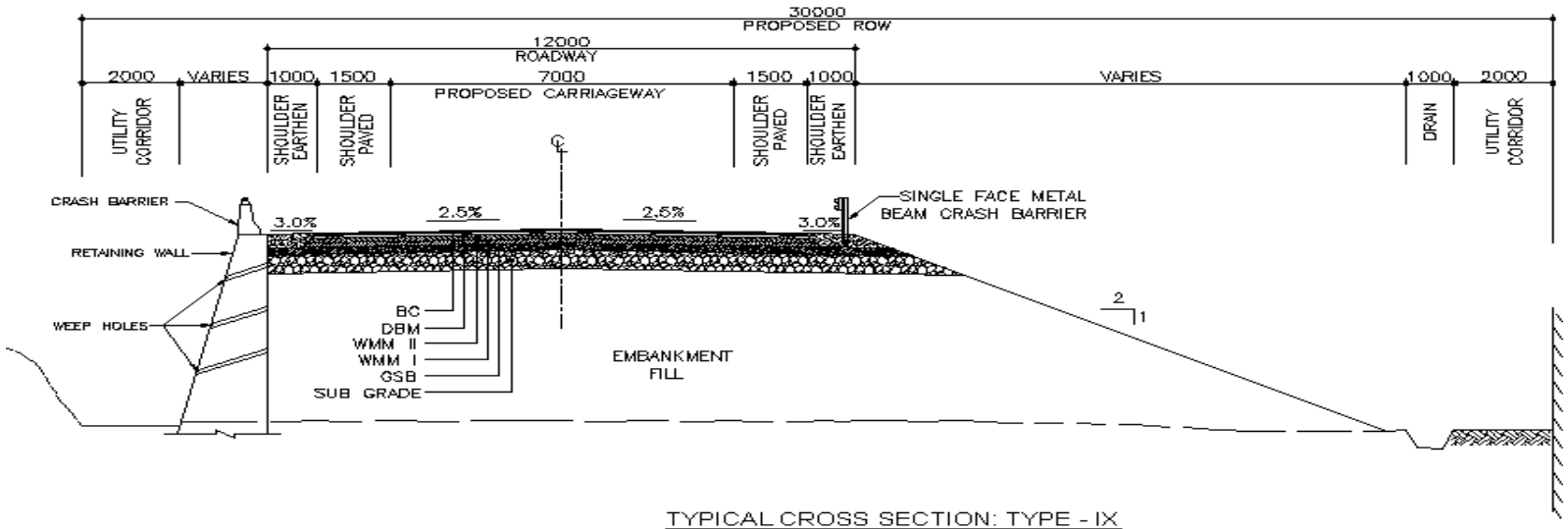
NEW CONSTRUCTION OF 2 LANE PAVED SHOULDER ROAD WITH LINE DRAIN ON HILL SIDE AND PARAPET ON VALLEYSIDE IN HILLY TERRAIN

ANNEXURE VIII



TYPICAL CROSS SECTION: TYPE - VIII

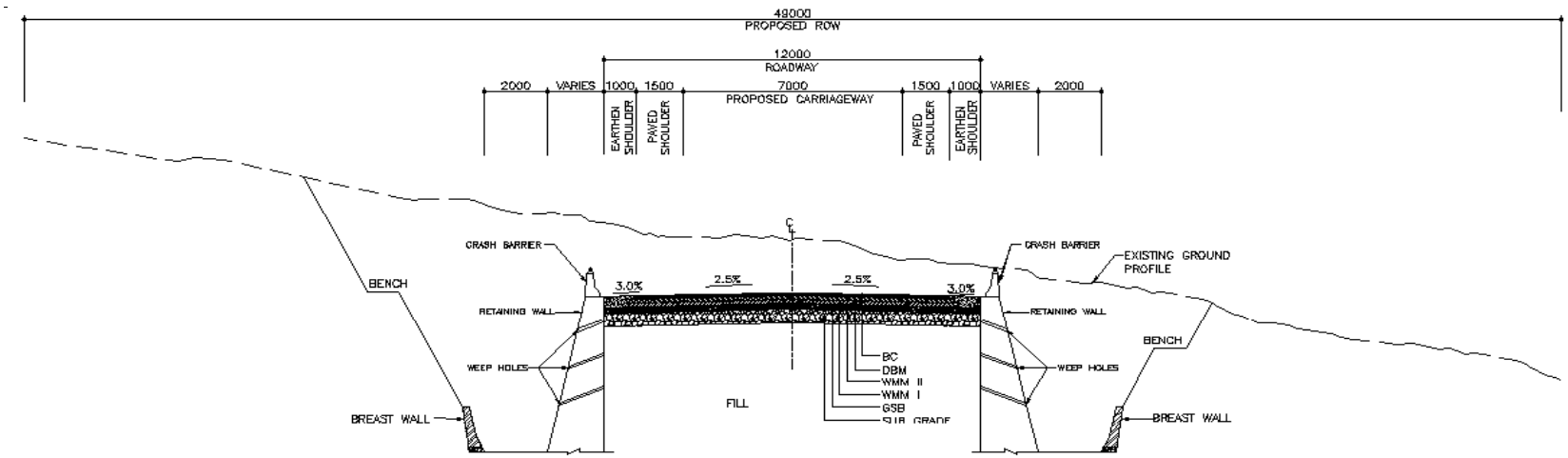
2- LANE WITH PAVED SHOULDERS WITH BOTH SIDE RETAINING WALL AT AUP



TYPICAL CROSS SECTION: TYPE - IX

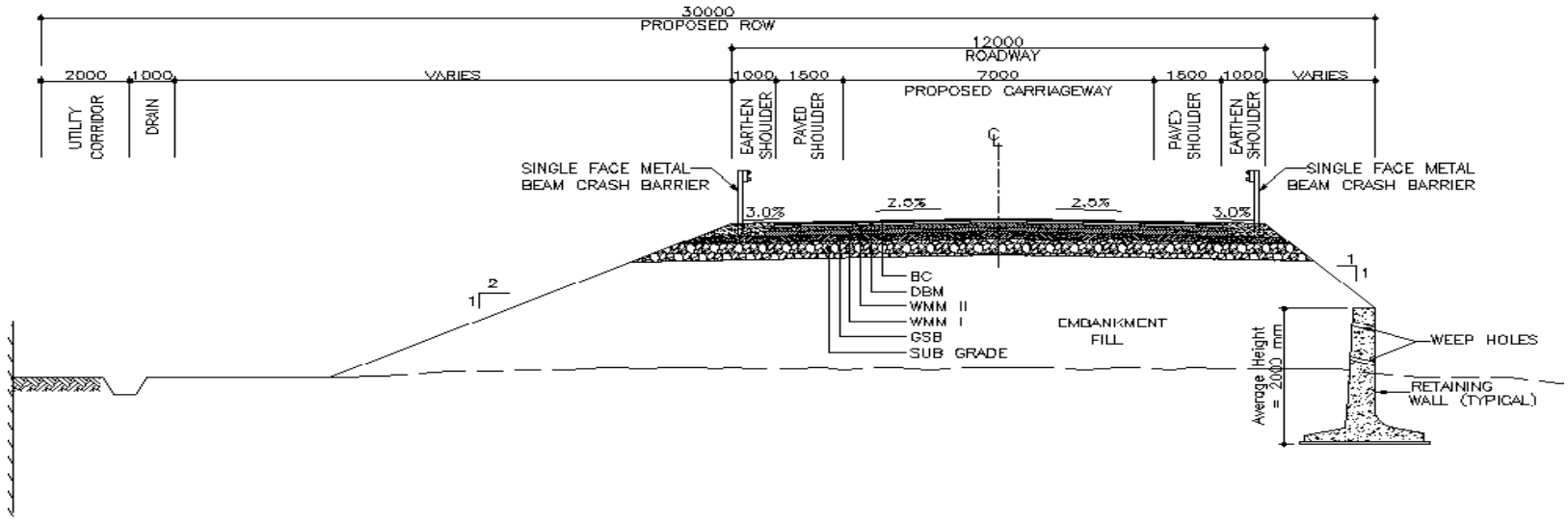
2- LANE WITH PAVED SHOULDERS WITH LEFT SIDE RETAINING WALL AT AUP

ANNEXURE VIII



TYPICAL CROSS SECTION: TYPE - X

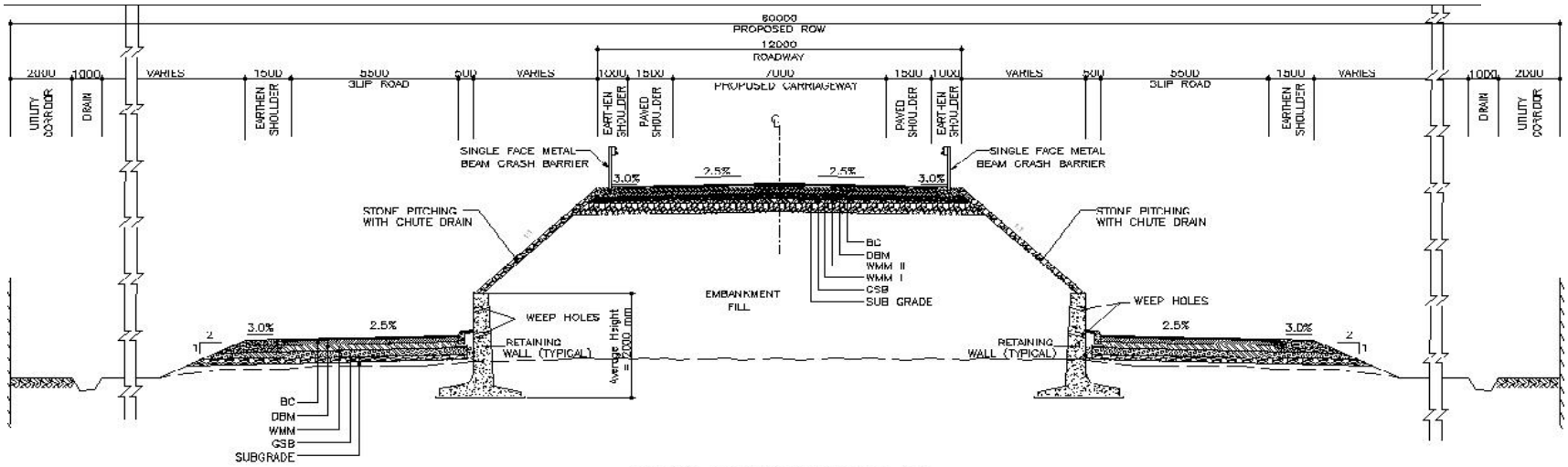
2- LANE WITH PAVED SHOULDERS WITH BOTH SIDE RETAINING WALL IN CUTTING AT AUP



TYPICAL CROSS SECTION. TYPE - XI

2- LANE WITH PAVED SHOULDERS WITH RIGHT SIDE RETAINING WALL AT AUP

ANNEXURE VIII



TYPICAL CROSS SECTION: TYPE - XII

2- LANE WITH PAVED SHOULDERS WITH SLIP ROAD ON BOTH SIDE FOR ONE SIDE APPROACH OF ROB / VUP

Junctions

At **one location** in Jhadol Bypass **VUP** has been proposed. At remaining places on project road there are 2 major and 43 minor junctions .These junctions shall be improved as at-grade junctions as per IRC standards.

0.12.3 Geometric alignment

The existing alignment is substandard. The design speed of existing alignment works out to as low as 20 km per hour or even less. Some horizontal curves are even 10 m radius. The alignment has been improved a great deal. The design speed is now 50 km per hour in the hilly terrain. The design speed is about 80 km/hour in rolling terrain. Many short realignments have been proposed to improve geometric alignment.

0.12.4 Proposed Bypasses

There are some settlements along the Project road. The population of all the settlements except Jhadol is less than 5000.The difficulty is to widen to two lanes. To widen the existing road to 2-lane with paved shoulders facility without major disturbance to inhabitants in six locations, namely Kundal, Nayakheda, Jhadol Koliyari, Bichhwara and Phalasia, it is proposed to plan bypasses at these six villages. The alignment options of Bypasses are given in C**hapter-3**. In addition the wild life sanctuary portion between 135 Km to 133.5 Km of SH10 and Km 0 to 18 of V.R 64 is being proposed to be bypassed.
Based on Alignment Options Study for realignment/bypasses, the alignment of project road as recommended by the Consultants is described below.

Kundal Bypass

The recommended bypass takes off at start point of road from km 280.800 of NH-8 towards RHS and passes through rolling terrain and meets the existing village road at Km 1.525 after traversing 1.35 Km to bypass the Kundal Village.
The total Length of Bypass will be 1.35Km.

Nayakheda Bypass

The recommended bypass **i.e. Alternate 1** takes off at km 2.220 of VR towards LHS and passes through rolling/Hilly terrain and meets the existing SH-50 at Km 13.775 after traversing 4.00 Km to bypass the Nayakheda Village.
The total Length of Bypass will be 3.700Km.

Undri Bypass

The project road is passing through the Undri settlement , which is very congested and there is no scope for improvement of sub standard geometrics unless many structures are acquired.

Considering all aspects a bypass for a length of 1.100 Km has been proposed.

Jhadol Bypass

The recommended bypass **i.e. Alternate 1** takes off at km 46.550 of SH-50 towards RHS and passes through rolling terrain and meets the existing SH-50 at Km 51.400 after traversing 4.800 Km to bypass the Jhadol Village.
The total Length of Bypass will be 5.000Km.

Kolyari Bypass

The recommended bypass **i.e. Alternate 1** takes off at km 66.525 of SH-50 towards RHS and passes through rolling terrain and meets the existing SH-50 at Km 68.525 after traversing 2.350 Km to bypass the Kolyari Village.
The total Length of Bypass will be 2.335Km.

Bichhiwara Bypass

The recommended bypass **i.e. Alternate** 1 takes off at km 76.025 of SH-50 towards RHS and passes through rolling terrain and meets the existing SH-50 at Km 77.870 after traversing 1.825 Km to bypass the Bichhiwara Village.
The total Length of Bypass will be 1.600Km.

Phalasia Bypass

The recommended bypass **i.e. Alternate** 1 takes off at km 79.350 of SH-50 towards RHS and passes through rolling terrain and meets the existing SH-50 at Km 80.700 after traversing 1.250 Km to bypass the Phalasia Village.
The total Length of Bypass will be 1.250Km.

Som Bypass

The recommended bypass takes off at km 88.300 of SH-50 towards LHS and passes through rolling terrain and meets the existing SH-10 at Km 139.800 after traversing 1.350 Km to bypass the Som Village.
The total Length of Bypass will be 1.350Km.

Ambhabhelly Bypass

The recommended bypass takes off at km 1+600 of VR in Rajasthan towards LHS and passes through rolling terrain and again crosses existing and passes RHS through rolling terrain and meets the existing VR at 9+600 in Gujarat after traversing 2.750 Km to bypass the Ambhabhelly Village.
The total Length of Bypass will be 2.750Km.

The List of Bypasses is given below.

Table 0.13 List of Bypasses

S.No.	Name of Bypass	Existing Chainage		Existing Length	Proposed Chainage		Proposed Length
		From	To		From	To	
1	Kundal	0+000	1+525	1+525	0+000	1+350	1+350
2	Nayakheda	2+220	13+775 of SH-50	3+415	2+100	5+800	3+700
3	Undri	17+300	18+425	1+125	9+400	10+500	1+100
4	Jhadol	46+550	51+100	4+550	38+500	43+500	5+000
5	Kolyari	66+525	68+625	2+100	58+765	61+100	2+335
6	Bichhiwara	76+075	77+870	1+845	68+450	70+050	1+600
7	Phalasiya	79+350	80+700	1+350	71+150	72+400	1+250
8	Som	88+300 of SH-50	139+800 of SH-10	2+500	79+850	81+200	1+350
9	Ambhabhelly	9+600 of VR in Rajathan VR in Rajasthan	9+600 of VR in Gujarat	1+500	90+000	92+750	2+750
Total length of Bypasses							**17+685**

Phulwari Ki Naal Wild Life Sanctuary Area

The recommended re-alignment starts from km 139.000 of SH-10 at Som village and follows the same till Km 147.200 of SH-10 at Garanwas village. This stretch is having single lane carriageway and 1.50m earthen shoulder both side. From km 147.200 the alignment turns to right and traverses to Ambabhely village, which is the last village of Rajasthan state and also end of realignment. This portion of the length of 3.00km and it is a single lane carriageway having variation in shoulder width between 1m-2m both side.

0.12.5 Proposal for Realignments

Consultant has proposed the realignment of length about **9.150kms** to improve the design speed as per proposed design standard. Locations are given below.

Table 0.14 List of Realignments

S.No.	Name of Realignment	Existing Chainage		Existing Length	Proposed Chainage		Proposed Length
		From	To		From	To	
1	Ghat	20+325	21+775	1+450	12+200	14+450	2+250

	Section-I						
2	Ghat Section-II	29+575	37+200	7+625	22+400	29+300	6+900
Total length of Realignments							**9+150**

0.12.6 Bridges

This report has considered the reconstruction and improvements necessary to rehabilitate and extent the life of existing bridges and CD structures.

Bridges

There are nil major bridges and thirty one (31) minor bridges on the existing alignment of the project road section Udaipur- Kundal-Naya Kheda-Jhadol-Som-Nalwa-Daiya (Section of NH-58)

There are two (02) major bridges and thirty four (34) minor bridges on the preferred alignment of the project road section Udaipur- Kundal- Naya Kheda –Jhadol- Som-Ganarwas–Ambabelly (Section of NH-58).

Table 0.15 List of the existing bridge on the preferred alignment Kundal Naya Kheda –Jhadol-Som - Ganarwas – Ambabelly (Section of NH-58)

Sr. No.	Ex. Ch.	Survey Ch.	Proposed Ch.	Prop. Bridge No.	Type of Bridges	Span Arrangement	Total width (m)	Type of Super Structure
Section of SH-50 (Ex Ch.12+500 to 89+200 km)								
1	-	-	10+033	11/2	Minor	1x10.00	12.00	Solid Slab
2	-	-	10+436	11/3	Minor	2x7.00	12.00	Solid Slab
3	27+700	27+403	20+237	21/1	Minor	1x10.00	12.00	Solid Slab
4	40+600	40+626	32+599	33/3	Minor	2x10.00	12.00	Solid Slab
5	-	41+325	33+307	34/2	Minor	1x12.00	12.00	Solid Slab
6	45+400	45+375	37+300	38/3	Minor	1x10.00	12.00	Solid Slab
Jhadol Bypass Proposed (37+850 to 42+650)								
7	-	-	40+640	41/2	Major	4x20.00	12.00	RCC T beam Girder
8	-	-	41+197	42/1	Major	4x20.00	12.00	RCC T beam Girder
9	-	51+182	43+572	44/3	Minor	1x7.00	12.00	Solid Slab
10	54+400	54+380	46+796	47/3	Minor	1x10.0	12.00	Solid Slab

ANNEXURE VIII

Sr. No.	Ex. Ch.	Survey Ch.	Proposed Ch.	Prop. Bridge No.	Type of Bridges	Span Arrangement	Total width (m)	Type of Super Structure
11	-	58+800	51+238	52/2	Minor	2x10.0	12.00	Solid Slab
12	61+700	61+510	53+904	54/4	Minor	2x7.00	12.00	Solid Slab
13	64+600	64+540	56+845	57/4	Minor	2x11.00	12.00	Solid Slab
14	65+600	65+543	57+844	58/6	Minor	1x10.0	12.00	Solid slab
15	66+300	66+222	58+471	59/1	Minor	1x7.0	12.00	Solid Slab
Kolyari Bypass Proposed (58+750 to 61+145 km)								
16	-	-	58+887	59/3	Minor	1x10.00	12.00	Solid slab
17	-	-	60+579	61/4	Minor	2x6.00	12.00	Solid slab
18	68+900	68+775	61+266	62/1	Minor	1x10.0	12.00	Solid slab
19	69+400	69+258	61+712	62/3	Minor	1x10.00	12.00	Solid slab
20	71+700	71+310	63+749	64/4	Minor	1x10.0	12.00	Solid slab
21	72+500	72+350	64+763	65/2	Minor	2x21.00	12.00	RCC T beam Girder
22	76+200	75+958	68+316	69/1	Minor	1x8.1	12.00	Solid slab
Bichhiwara Bypass Proposed (68+284 to 70+284 km)								
23	-	-	69+170	70/1	Minor	3x8.00	12.00	Solid slab
24	-	-	69+744	70/4	Minor	1x10.00	12.00	Solid slab
25	78+400	78+150	70+515	71/4	Minor	1x6.50	12	Solid slab
Phalasiyal Bypass Proposed (70+500 to 71+760)								
26	-	-	71+421	72/1	Minor	1x10.00	12.00	Solid slab
27	82+700	82+735	74+431	75/2	Minor	2x7.00	12.00	Solid slab
28	83+200	83+250	74+973	75/3	Minor	2x7.00	12.00	Solid slab
29	84+000	84+018	75+739	76/4	Minor	1x12.00	12.00	Solid slab
30	85+500	85+462	77+154	78/1	Minor	1x11.00	12.00	Solid slab
31	87+600	-	79+057	80/1	Minor	2x8.50	12.00	Solid slab
Section of SH-10 (Som-Garanwas-Vijaynagar)								
32	139+675	-	81+001	82/1	Minor	1x8.00	12.00	Solid slab
33	-	-	82+507	83/4	Minor	2x10.00	12.00	Solid slab
34	-	-	82+617	83/5	Minor	3x8.00	12.00	Solid slab
35	143+300	143+308	84+634	85/3	Minor	1x10.00	12.00	Solid slab
36	146+130	146+166	87+335	88/2	Minor	2x10.50	12.00	Solid slab

On the proposed alignment of the project road there are four (02) major bridges and thirty (30) minor bridges and following improvement proposal is given:

Structure Section as shown below in **Table: 0.16**

Table 0.16: Improvement proposals for bridges on the proposed alignment

Improvement type of Bridges	Nos
New construction of bridges due to realignment or bypass	20 Nos.
New Construction of additional 2 L bridge	Nil
Reconstruction of existing single lane into 2 lanes	10 Nos.
Widening of single lane to 2 lane	02 Nos.
Repair and Rehabilitation of existing two lane bridges	Nil

Culverts

There are three seventy eight (256) numbers of CD structures on the existing alignment of the project road section Udaipur- Kundal-Naya Kheda-Jhadol-Som-Nalwa-Daiya (Section of NH-58).

There are three seventy nine (254) numbers of CD structures on the preferred alignment on the project road section Udaipur- Kundal- Naya Kheda –Jhadol- Som-Ganarwas–Ambabelly(Gujarat Border(Section of NH-58)

Table 0.17 Summary of the existing culverts on the preferred alignment Udaipur- Kundal – NayaKheda – Jhadol - Som-Ganarwas – Ambabelly

Location	Type of Culverts						Total Nos.
	Pipe	Slab	Causeway	Scupper	Pipe/Scupper	Arch	
Section VR-58 (0+00 to 5+311 Km)	11	0	0	0	0	0	11
Section of SH-50 (12+500 to 89+200	70	111	6	22	6	0	215
Section of SH-10 (139.0 to 147.300 km)	15	5	1	1	0	0	22
Section Garanwas -Khokhara (0+00 to 2+645km)	5	0	2	0	0	0	7
Total Nos.	**101**	**116**	**9**	**23**	**6**	**0**	**254**

Due to realignment/Bypasses, total numbers of CD structures on the proposed alignment of the project road has increase to 294 numbers

Table 0.18: Improvement proposals for CD Work on proposed alignment (Section of NH-58)

Type of Structure	Reconstruction	New on bypass / realignment	Additional culvert as balancer	Widen	Repair	Total
Pipe	42	84	18	9	3	**156**
Slab	70	52	Nil	16	Nil	**138**

0.12.7 ROB

NIL

0.12.8 VUP

There is one VUP proposed at design chainage 40+832.

0.12.9 PUP

NIL

0.12.10 AUP

There are 32 AUPs proposed (Animal Under pass).

0.12.11 Pavement design

The VDF as per axle load survey of various types of commercial vehicle is as given in T**able 0.5.**

The cumulative standard axle based on VDF and the traffic has been computed and is tabulated below as T**able 0.19.**

Table 0.19: Design Traffic for 15 Years

S.No	Section (Km)	Design Traffic (msa)

1	1.Start of the project(Km 280+800 of NH-8) to Jhadol town(km 49+000 of SH-50)	9.00
2	2. Jhadol town(km 49+000 of SH-50) to Som town(km 89+200 of SH50)	5.33
3	3. Som town(km 89+200 of SH50) to Nalwa village(m 133+500 of SH-10 or 0+000 of VR-64)	1.28
4	4.Nalwa village(m 133+500 of SH-10 or 0+000 of VR-64) to 20+750 of VR-64	0.69

20 MSA has been adopted for the new pavement. And **10% CBR** value of subgrade soil has been taken for design of pavement. Proposed layer of New Pavement is given in T**able 0.20**

Table 0.20: Proposed Layer of the New Pavement

S.No.	Sections (km)	Layer Thickness (mm)				
		BC	DBM	WMM	GSB	Total
1	Design Ch.0/000 to 91/000 of NH58	40	80	250	200	570
2						
3						
4						

Proposed Layer of the Overlay

BC-40mm and DBM-50mm has been proposed for entire length of the project.

Proposed Layer for Slip/Service Roads

Same layer as main carriageway has been proposed.

0.13 Road User Facilities

Bus Bays

Bus Bays shall be provided at locations given below:

Table 0.21: Bus Bays

Sr. No.	Existing	Design	Side	Location
1	-	0+250	Right	Kundal Bypass
2	-	0+345	Left	Kundal Bypass

Sr. No.	Existing	Design	Side	Location
3	13+788 of SH-50	5+800	Right	Nadeshwar Temple
4	13+646 of SH-50	5+665	Left	
5	17+105 of SH-50	9+239	Left	Undri Village
6	18+582 of SH-50	10+653	Right	
7	25+900 of SH-50	18+777	Left	Peepalwas
8	25+998 of SH-50	18+875	Right	
9	39+950 of SH-50	31+883	Left	Paliyakheda
10	40+098 of SH-50	32+064	Right	
11	46+375 of SH-50	38+290	Left	Before Jhadol Bypass
12	46+473of SH-50	38+388	Right	
13	51+400of SH-50	43+785	Left	End of Jhadol Bypass
14	51+500 of SH-50	43+885	Right	
15	66+295 of SH-50	58+800	Right	Before Kolyari Bypass
16	66+425 of SH-50	58+664	Left	
17	75+900 of SH-50	68+250	Left	Before Bichhiwara Bypass
18	76+015 of SH-50	68+365	Right	
19	79+085 of SH-50	70+889	Right	End of Phalasia Bypass
20	79+192 of SH-50	70+996	Left	
21	87+875 of SH-50	79+500	Right	Before Som Village
22	88+085 of SH-50	79+720	Left	
23	146+267 of SH-10	87+428	Left	Garanwas Village
24	146+367 of SH-10	87+526	Right	

Truck Lay Byes

Truck Lay byes shall be provided at locations given below:

Table 0.22: Truck Lay byes

Existing (Km)	Design Chainage (Km)	Carriage way
55+000 of SH-50	47+400	Left hand side

Toll Plazas

There are two Toll plazas are proposed for entire project length. It shall be designed as per the guidelines of manual.

Table 0.23: Toll plazas

Sr. No.	Existing Chainage	Proposed Chainage
1	Toll Plaza–1–km. 23/800 of SH-50 (Rajasthan)	16+750
2	Toll Plaza–2–km. 85/110 of SH-50 (Rajasthan)	76+800

0.14 Cost Estimate

Preliminary cost estimate for the project Road is finalised based on the improvement proposed. The preliminary cost estimate is worked out based on the block quantities calculated for major items of work to be executed in the project and also rates derived after detail analysis.

Table 0.24: Cost of Civil Works

State	Proposed Length(km)	Cost in Cr.	Cost per km
Total	91.000	455.99	5.05

0.15 Results of Economic Analysis

Economic analysis was carried out using HDM-4 software. The sensitivity analysis is carried out by varying cost and benefit as under:

S1: Base costs plus 15% and base benefits
S2: Base cost and base benefits minus 15%
S3: Base costs plus 15% and base benefits minus 15%

The analysis has been done by changing the cost and benefit streams independently as well as in combination. The end results of this study have been presented in a series of EIRRs and NPVs.
The summary of economic analysis and sensitivity analysis with benefits due to traffic time savings for project road is summarised below:

Table 0.25: Results of Economic Analysis

Option	Net Economic Benefit (NPV @ 12%)	Economic Internal Rate of Return (%)			
		Base Case	S1	S2	S3
With time saving with project	1632.58	16.00	14.28	13.20	12.33

The project road is economically viable for proposed improvement in normal case as well as in various sensitivity cases as it yields more than 12% return (assumed interest rate for the analysis).

0.16 Assumptions of Financial Analysis

To assess whether the project is a profitable proposition, the returns to investors are measured by the post-tax project FIRR and the equity FIRR, which is estimated from the cash-flow statements, based on discounted cash-flow technique. To qualify the project in terms of attractive financial returns, the following criteria have been adopted:

- Post tax IRR on Project Investment : minimum 12%
- Post tax IRR on Equity : minimum 15%
- DSCR : >1.0
- BCR : >1.3
- NPV @ 12% : must be positive

0.17 Findings of Financial Analysis

With the assumptions already stated above the financial analysis for the project corridor has been undertaken. The results of financial analysis have been presented in the table given below for BOT and annuity option;

Table 0.26: Findings of Financial Analysis (BOT)

Concession Period	Govt. Grant (Const.) In %	Debt : Equity	FIRR (post tax)		Average DSCR	BCR	NPV @ 12 % (Cr.)
			On Whole Investment	On Equity			
17.5 Years	40.00% (222.74)	70 : 30	-	-	-	-	-397.81

Table 0.27: Findings of Financial Analysis (Annuity)

Concession Period	Debt : Equity	FIRR (post tax)	Annuity Amount (cr. / Year)
		On Whole Investment	
17.5 Years	70 : 30	12.003%	42.38 Crore

Financial analysis results show that the project is not getting viable under BOT option with 40 % grant. Annuity option for the project road with single package and 17.5 years concession period has also been examined. The annuity amount is Rs. 42.38 crores with IRR of 12.00%. It is not possible to take up the project under DBFOT or Annuity. It is recommended that the project be implemented as EPC project to be financed by NHAI.

0.18 Recommendations

It is intended that the conclusions and recommendations included in this report would generate discussion and interpretation of the environmental and social assessment scope of work. The following general recommendations are made:

- The project road from Udaipur to Ambabelly (Gujarat Border) two lane with paved shoulder has been proposed.

- In the built-up areas, the urban sections have been proposed with covered drain /footpath.

- The project road requires realignment to avoid significant adverse environmental impacts to the natural, social, economic or cultural environments. The project road is passing through Phulwari Naal Wild Life Sanctuary Realignment bypassing the Wild Life Sanctuary has been proposed from km 139.00 of SH-10 near Som village and along SH-10 upto 147.2 of SH-10 and thereafter through Ambhabhelly village at Gujarat Border. The realignment is recommended.

- **Bypasses** have been proposed at Kundal, Nayakheda, Jhadol, Kolyari, Bichhiwara, Phalasia, Som, Ambhabhelly.The total length of all bypasses is **17.685 Km**.Realignments have been proposed at Undri ,Ghat section-1,Ghat section-2 and length of total realignment is **9.150km**.

- One Truck lay bye and 24 Bus bays have been proposed.

- Provision of Road Marking and Road Signs have been taken.

- Existing geometry of the project highway has been improved to achieve the minimum design speed of 50km/hr in hilly terrain and 80 km/hr in plain/Rolling terrain.

- The process of land acquisition has been initialised.

- The process of clearance has also been initiated.

  The project can be constructed within 30 months period with strategic planning and through one construction package.

- Financial analysis results show that the project is not getting viable under BOT option with 40 % grant. Therefore annuity option for the project road with single package and 17.5 years concession period has also been examined. The annuity amount is Rs. 42.38 crores with IRR of 12.00%. The project can also be implemented under EPC mode. The consultant recommends adoption of EPC mode for implementation with funding by NHAI.

- The project road is economically viable for proposed improvement in normal case as well as in various sensitivity cases as it yields more than 12% return (assumed interest rate for the analysis) and can be taken up under EPC fully financed by NHAI