NATIONAL HIGHWAYS AUTHORITY OF INDIA
(Ministry of Road Transport & Highways)
Government of India

FOUR LANING OF PANVEL - INDAPUR SECTION OF NH-17 FROM KM 0.000 TO KM 84.000 IN THE STATE OF MAHARASHTRA UNDER NHDP PHASE III ON BOT BASIS (PACKAGE NO. NHDP-III/DL4/05)

CONCESSION AGREEMENT

between

NATIONAL HIGHWAYS AUTHORITY OF INDIA
G-5 & 6, Sector – 10, Dwarka, New Delhi – 110 075

and

SUPREME PANVEL INDAPUR TOLLWAYS PRIVATE LIMITED
Supreme City, Hiranandani Complex, Powai, Mumbai 400076, Maharashtra

VOLUME – II

January 2011

Public Private Partnership in

National Highways

SCHEDULEDS

Government of India
New Delhi

SCHEDULE – A
(See Clause 10.1)

SITE OF THE PROJECT

1. The Site

1.1 Site of the Four-Lane Project Highway shall include the land, buildings, structures and road works as described in Annex-I of this Schedule-A.

1.2 An inventory of the Site including the land, buildings, structures, road works, trees and any other immovable property on, or attached to, the Site shall be prepared jointly by the Authority Representative and the Concessionaire, and such inventory shall form part of the memorandum referred to in Clause 10.3.1 of the Agreement.

1.3 Additional land required for Toll Plazas, Traffic Aid Posts, Medical Aid Posts and vehicle rescue posts or for construction of works specified in the Change of Scope Order issued under Clause 16.2.3 of this Agreement shall be acquired in accordance with the provisions of Clause 10.3.6 of this Agreement. Upon acquisition, such land shall form part of the Site and vest in the Authority.

2. Additional land for Six-laning

2.1 Deleted.

2.2 Deleted.

ANNEX – I
(Schedule-A)

SITE FOR FOUR-LANING

Site

The Site of the Project Highway comprises the section of National Highway 17 commencing from Km 0 to Km 84 i.e. the Panvel - Indapur section in the State of Maharashtra. The land, carriageway and structures comprising the Site are described below.

Referencing System

The present chainage of the project stretch is referred to as "Existing chainage" and the proposed chainage is referred to as "Design chainage". Kilometer wise Existing chainage and Design Chainage of the Project Highway is given in Table A-1.

Table A-1: Existing Chainage and Design Chainage

Sr. No.	Existing Chainage (in Km.)	Design Chainage (in Km.)
1	0.000	0.000
2	1.000	1.010
3	2.000	2.013
4	3.000	3.013
5	4.000	4.016
6	5.000	5.017
7	6.000	6.036
8	7.000	7.027
9	8.000	8.080
10	9.000	9.098
11	10.000	10.110
12	11.000	11.112
13	12.000	12.117
14	13.000	13.123
15	14.000	14.125
16	15.000	15.124
17	16.000	16.055
18	17.000	17.280
19	18.000	18.350
20	19.000	19.680
21	20.000	20.355
22	21.000	21.298
23	22.000	22.292
24	23.000	23.300
25	24.000	24.300
26	25.000	25.314

Sr. No.	Existing Chainage (in Km.)	Design Chainage (in Km.)
27	26.000	26.333
28	27.000	27.070
29	28.000	28.317
30	29.000	29.327
31	30.000	30.280
32	31.000	31.330
33	32.000	32.325
34	33.000	33.000
35	34.000	34.550
36	35.000	35.550
37	36.000	36.890
38	37.000	37.530
39	38.000	38.530
40	39.000	39.530
41	40.000	40.530
42	41.000	41.500
43	42.000	42.533
44	43.000	43.528
45	44.000	44.522
46	45.000	45.521
47	46.000	46.526
48	47.000	47.520
49	48.000	48.517
50	49.000	49.520
51	50.000	50.512
52	51.000	51.525
53	52.000	52.517
54	53.000	53.508
55	54.000	54.500
56	55.000	55.495
57	56.000	56.488
58	57.000	57.481
59	58.000	58.487
60	59.000	59.476
61	60.000	60.476
62	61.000	61.476
63	62.000	62.477
64	63.000	63.473
65	64.000	64.475
66	65.000	65.485
67	66.000	66.490
68	67.000	67.515
69	68.000	68.515
70	69.000	69.515

Sr. No.	Existing Chainage (in Km.)	Design Chainage (in Km.)
71	70.000	70.515
72	71.000	71.513
73	72.000	72.470
74	73.000	73.510
75	74.000	74.512
76	75.000	75.465
77	76.000	76.506
78	77.000	77.506
79	78.000	78.506
80	79.000	79.503
81	80.000	80.510
82	81.080	81.493
83	82.000	82.470
84	83.000	83.463
85	84.080	84.467

Land

The Site of the Project Highway comprises the land described below, in Table A-2.

Table A-2: Available ROW Details

S. No.	Existing Chainage (km)	ROW (in m)	S. No.	Existing Chainage (km)	ROW (in m)
1	0-1	20-30	43	42-43	30
2	1-2	30	44	43-44	30
3	2-3	20-30	45	44-45	30
4	3-4	20	46	45-46	30
5	4-5	20	47	46-47	30
6	5-6	20	48	47-48	30
7	6-7	20-30	49	48-49	30
8	7-8	30	50	49-50	30
9	8-9	30	51	50-51	29-30
10	9-10	30	52	51-52	28-30
11	10-11	20-30	53	52-53	28-30
12	11-12	20-30	54	53-54	30-32
13	12-13	20	55	54-55	26-32
14	13-14	20	56	55-56	26-30
15	14-15	20-22	57	56-57	29-31
16	15-16	22-30	58	57-58	27-30
17	16-17	30	59	58-59	30
18	17-18	30	60	59-60	28-30
19	18-19	30-32	61	60-61	30
20	19-20	30	62	61-62	28-30
21	20-21	30	63	62-63	28-30

S. No.	Existing Chainage (km)	ROW (in m)	S. No.	Existing Chainage (km)	ROW (in m)
22	21-22	20-36	64	63-64	30
23	22-23	30	65	64-65	29-31
24	23-24	30	66	65-66	30
25	24-25	30	67	66-67	28.5-32
26	25-26	20-30	68	67-68	28-30
27	26-27	30	69	68-69	28-30
28	27-28	30	70	69-70	30
29	28-29	12	71	70-71	30
30	29-30	12	72	71-72	29-36
31	30-31	12	73	72-73	28-40
32	31-32	12	74	73-74	24-30
33	32-33	12	75	74-75	30-31
34	33-34	12-30	76	75-76	29-30
35	34-35	30	77	76-77	30
36	35-36	30	78	77-78	28-30
37	36-37	30	79	78-79	29-30
38	37-38	30	80	79-80	29-30
39	38-39	30	81	80-81	30
40	39-40	30	82	81-82	27-28
41	40-41	30	83	82-83	27-29
42	41-42	30	84	83-84	27-30

Carriageway

The present carriageway of the Project Highway is a two-lane carriageway with earthen shoulders in its entire length.

Major Bridges

The site includes the following major bridges:

Table A-3: Existing Major Bridges along the Project

Sr. No.	Chainage (km)	Location Description Name of River / Village & Type of Crossing	Type of Bridge	Spans Details	Width (m)
1	15.480	Kharpada	RCC/PSC Girder, RCC Abutment & Piers	2 x 27.00 + 5 x 42.50 + 10 x 27.80 + 1 x 14.41 + 1 x 38.20 + 1 x 21.987 + 7 x 27.80 = 813.700 m	10.9 m
2	20.097	Balganga	RCC Girder, PCC Abutment & Piers	[illegible] 46.50 + 2 x 21.50 + 1 x 16.50 = 76.00 m	8.45 m

Sr. No.	Chainage (km)	Location Description Name of River / Village & Type of Crossing	Type of Bridge	Spans Details	Width (m)
3	26.152	Bhogeshwari	MS I Girder & RCC Deck, CR Masonry Abutment & Piers	10 x 12.80 = 128.00 m	7.85 m
4	44.719	Nigade	RCC Girder, CR Masonry Abutment & Piers	1 x 12.60 + 1 x 12.20 + 1 x 17.00 + 3 x 19.50 + 1 x 12.20 + 1 x 12.60 = 125.100 m	8.1 m
5	58.857	Amba	CR Masonry Arch Deck & CR Masonry Abutment & Piers	9 x 10.65 = 95.80 m	6.9 m
6	72.876	Kundatika	CR Masonry Arch Deck & CR Masonry Abutment & Piers	12 x 10.50 = 126.00 m	6.7 m

Railway Bridges

The Site includes the following Railway Bridges:

Table A-4: Existing Railway Crossings along the Project Road

Sr. No.	Chainage (km)	Location Description	Type of structure	Spans Details	Width (m)
1	15.480	(Kharpada ROB)	Open foundation, RCC pier, PSC Girder and RCC deck slab	1 x 38.2m	10.9
2	28.283	(Pen ROB)	Open foundation, PCC piers, MS Built-up 'I' girder and RCC deck slab	2 x 13.5m	11.5
3	33.860	(Wadkhal RUB)	Steel girders	1 x 24m	-
4	56.560	(Nagothane RUB)	Open foundation, RCC abutments, Steel girders	1 x 24m	-
5	73.250	(Kolaf RUB)	PSC girder and RCC deck slab	3 x 26m	-

Note:

i. *RUB at Sr. No. 3 has been abandoned, since bypass is proposed at this location*

ii. *For RUB at Sr. No. 4 & 5, existing span under railway structure is sufficient for widening to 4 luning.*

Grade Separators

Nil

Minor Bridges

The Site includes the following Minor Bridges:

Table A-3: Existing Minor Bridges along the Project

Sr. No.	Chainage (km)	Location Description	Type of Bridge	Spans Details	Width (m)
1	0.544	Local Nallah	RC Beam & Deck slab, Masonry Abutment & Piers widened on both side by PCC	3 x 6.70 = 20.10	12.9
2	9.363	Local Nallah	RCC Solid slab, Masonry Abutment & Piers	2 x 7.10 = 14.20	11.1
3	20.780	Balivali River	RCC Solid slab, PCC Abutment & Piers	4 x 6.80 = 27.20	13
4	29.728	Vashi Nallah	RCC Solid slab, PCC Abutment & Piers	3 x 7.10 = 21.30	12.6
5	30.557	Uchede Nallah	RCC Solid slab, PCC Abutment & Piers	2 x 6.10 = 12.20	12.4
6	52.089	Nidi River	RCC Solid slab, PCC Abutment & Piers	4 x 8.80 = 35.20	12.05
7	57.926	Patansai River	CR Masonry Arch widened by RCC Solid Slab, CR Masonry Abutment, Piers widened by PCC.	4 x 4.0 = 16.00	12
8	59.335	Canal Crossing	RCC Solid slab, PCC Abutment & Piers	1 x 10.70 = 10.70	8.5
9	59.797	Kodsai	CR Masonry Arch widened by RCC Solid Slab, CR Masonry Abutment, Piers widened by PCC.	2 x 3.80 = 7.60	12.9
10	62.285	Local Nallah	RCC Solid slab, PCC Abutment & Piers	2 x 4.60 = 9.20	13
11	63.233	Canal Crossing	CR Masonry Arch widened by RCC Solid Slab, CR Masonry Abutment, Piers widened by PCC.	2 x 3.70 = 7.40	12
12	64.187	Canal Crossing	RCC Solid slab, PCC Abutment & Piers	2 x 7.25 = 14.50	8.3
13	66.683	Nafavali	RCC Solid slab extended by RCC Solid slab & Masonry Abutment, Pier widened by PCC.	2 x 4.70 = 9.40	12.1
14	67.043	Local Nallah	RCC Solid slab extended by RCC Solid slab & Masonry	2 x 4.60 = 9.20	12.05

Sr. No.	Chainage (km)	Location Description	Type of Bridge	Spans Details	Width (m)
			Abutment, Pier widened by PCC.		
15	67.820	Irrigation Canal	RCC Solid slab, CR Masonry Abutment & Piers	9.95 + 8.95 + 18.90	7.7
16	68.927	Local Nallah	CR Masonry Arch widened by RCC Solid Slab, CR Masonry Abutment, Piers widened by PCC.	4 x 3.20 = 12.80	12
17	69.081	Local Nallah	RCC Solid slab extended by RCC Solid slab & Masonry Abutment, Pier widened by PCC.	3 x 3.70 = 11.10	12.5
18	72.196	Mahisdara Nallah	RCC Girder & RCC Abutments and Piers	3 x 18.30 = 54.90	8
19	73.290	Gedi	Masonry Arch & RCC cantilever slab, PCC Abutment, Piers.	2 x 7.70 + 3 x 7.00 36.400	13.65
20	77.744	Bhovan Nallah	CR Masonry Arch widened by RCC Solid slab, CR Masonry Abutment, Piers widened by PCC.	5 x 3.10 = 15.50	11.9
21	81.606	Vave Nallah	RCC Solid slab, PCC Abutment & Piers	3 x 7.45 = 22.35	12.2
22	83.861	Canal Crossing	RCC Solid slab, PCC Abutment & Piers	1 x 6.40 = 6.40	8.35
23	84.431	Indapur Bridge (God River)	RCC Solid slab, PCC Abutment & Piers	3 x 10.45 = 31.35	11.95

Total number of structures

The total number of structures on the Site is noted below:

a) No. of Major Bridges - 6

b) No. of Railway Over Bridges - 2

c) No. of Railway under Bridges - 3

d) No. of Grade Separators - Nil

e) No. of Minor Bridges - 23

f) No. of Vehicular and Non Vehicular Underpasses - Nil

g) No. of Box Culverts - Nil

h) No. of Pipe Culverts

i)	No. of Slab Culverts		-	133

Bus bays and Truck Lay byes

The total number of bus bays and truck lay byes on the Project Highway is noted below.

1.	(a)	No. of Bus bays on LHS	-	26
2.	(b)	No. of Bus bays on RHS	-	26
3.	(c)	No. of Truck lay-byes on LHS	-	Nil
4.	(d)	No. of Truck lay-byes on RHS	-	Nil

Permanent Bridge, Bypass or Tunnel costing Rs. 50 Crore or more

The site includes the following permanent bridge/ bypass/ tunnel which was constructed at the cost noted below.

Nil.

SCHEDULE - B
(See Clause 2.1)

DEVELOPMENT OF THE PROJECT HIGHWAY

1 Development of the Project Highway

Development of the Project Highway shall include construction of the Project Highway as described in this Schedule-B and in Schedule-C.

2 Four-Laning

2.1 Four-Laning shall include the Four-Lane Project Highway as described in Annex-I of this Schedule-B and Annex-I of Schedule-C.

2.2 Four-Laning shall be completed by the Concessionaire in conformity with the Specifications and Standards set forth in Annex-I of Schedule-D.

3 Six-Laning

3.1 Deleted

3.2 Deleted.

ANNEXURE I
(SCHEDULE B)

DESCRIPTION OF FOUR LANING

Width of Carriageway

1.1 The paved carriageway shall be 17.5 metres wide (including kerb shyness) excluding the median.

1.2 Except as otherwise provided in this Agreement, the width of the paved carriageway shall conform to Clause 1.1 above.

Project Facilities

Project facilities shall be constructed in conformity with Annex-I of Schedule-C.

Specifications and Standards

The Project Highway shall be constructed in conformity with Specifications and Standards specified in Annex-I of Schedule-D.

Other Features of Four Laning

Chainage Reference

All chainages referred in this section are Design Chainages along the project alignment

Cross Sections

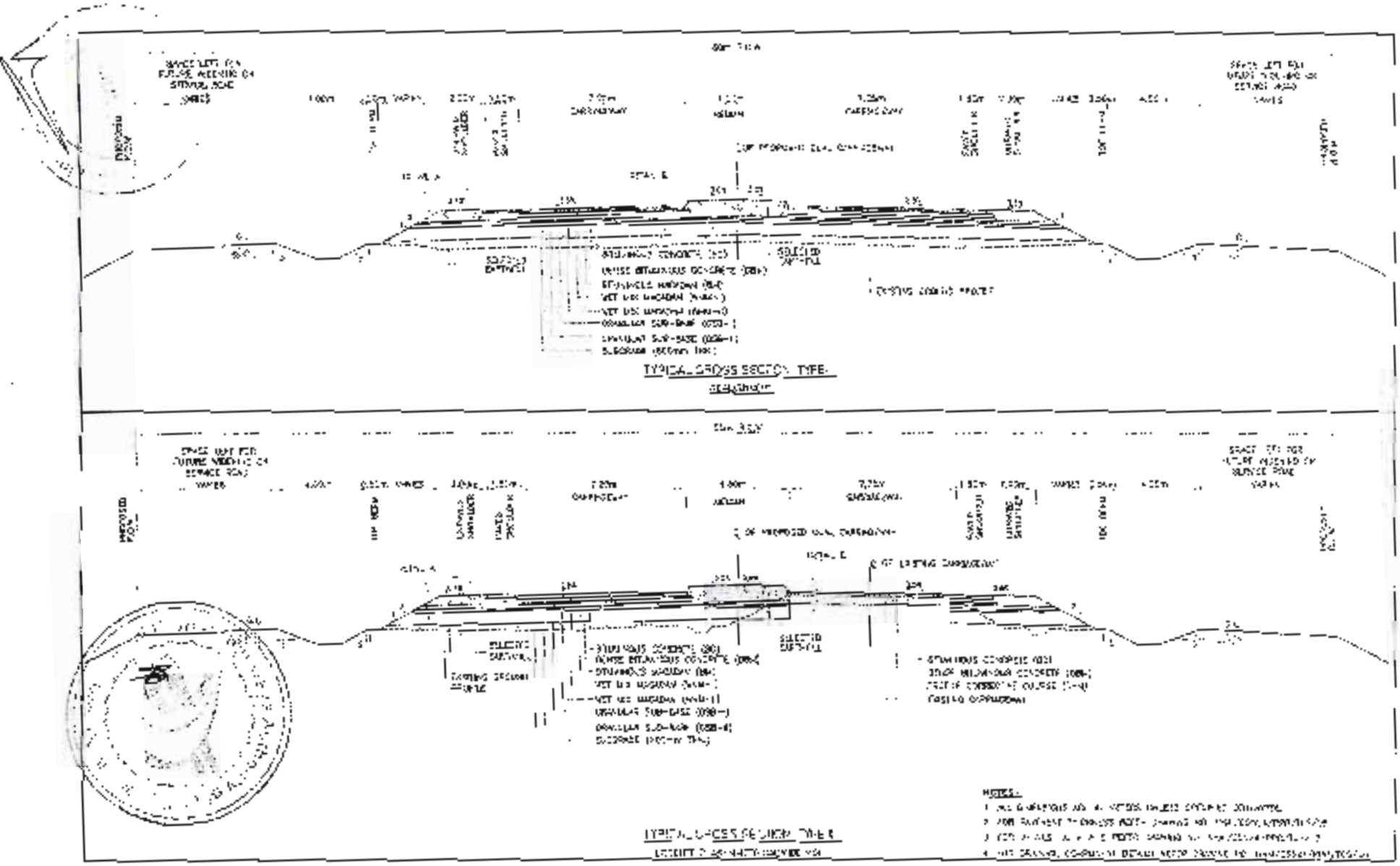
The Project Highway shall be widened to have a Four lane divided carriageway facility with 7.0m service road in urban areas. Table B-1 indicates the location of different types of widening, which shall be followed along with the minimum construction criterion, mentioned below for the development of the Project Highway. Figures TCS-I to TCS-IX presents the various types of cross sections that are to be followed:

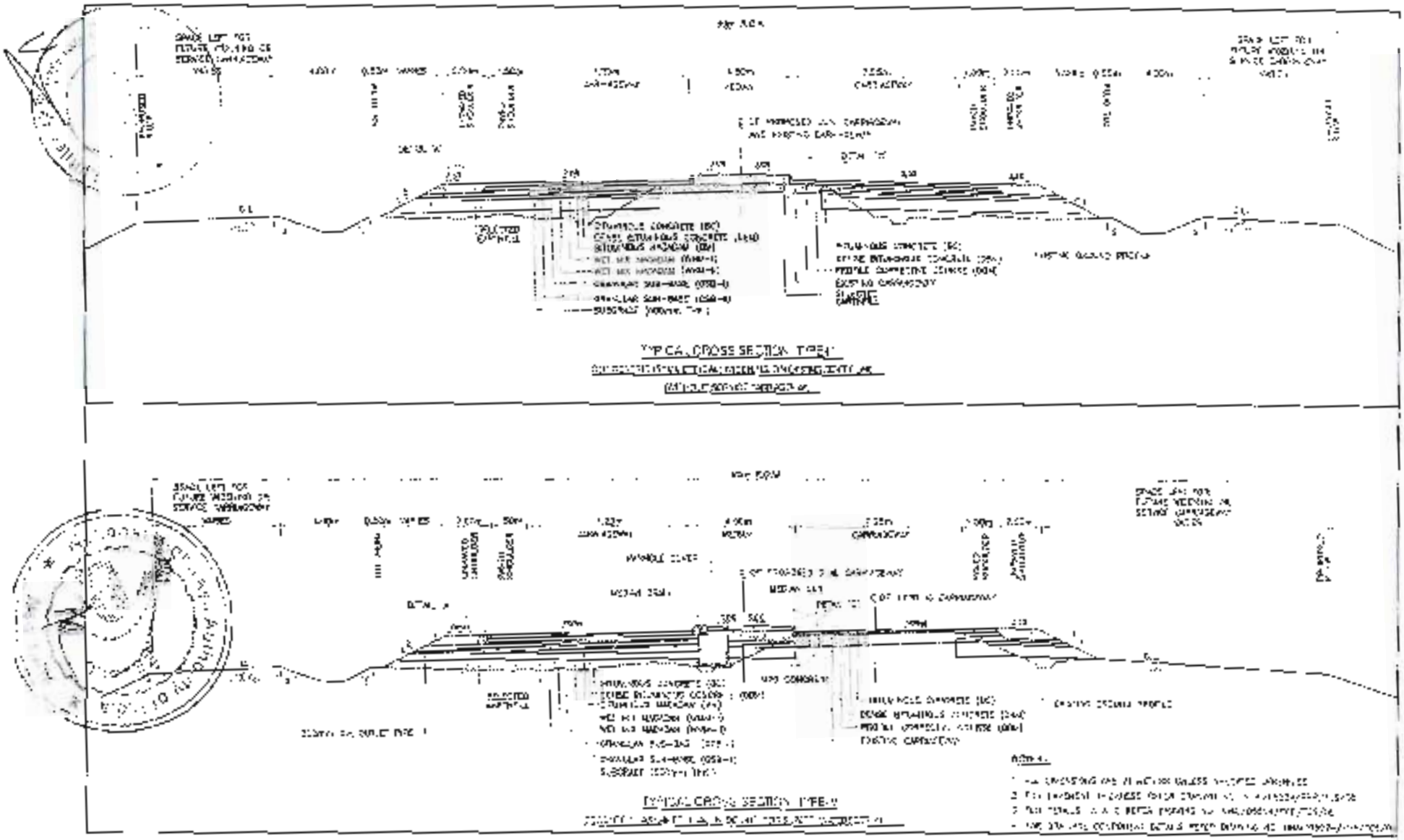
Table B-1: Proposed Widening Scheme of the Project Highway

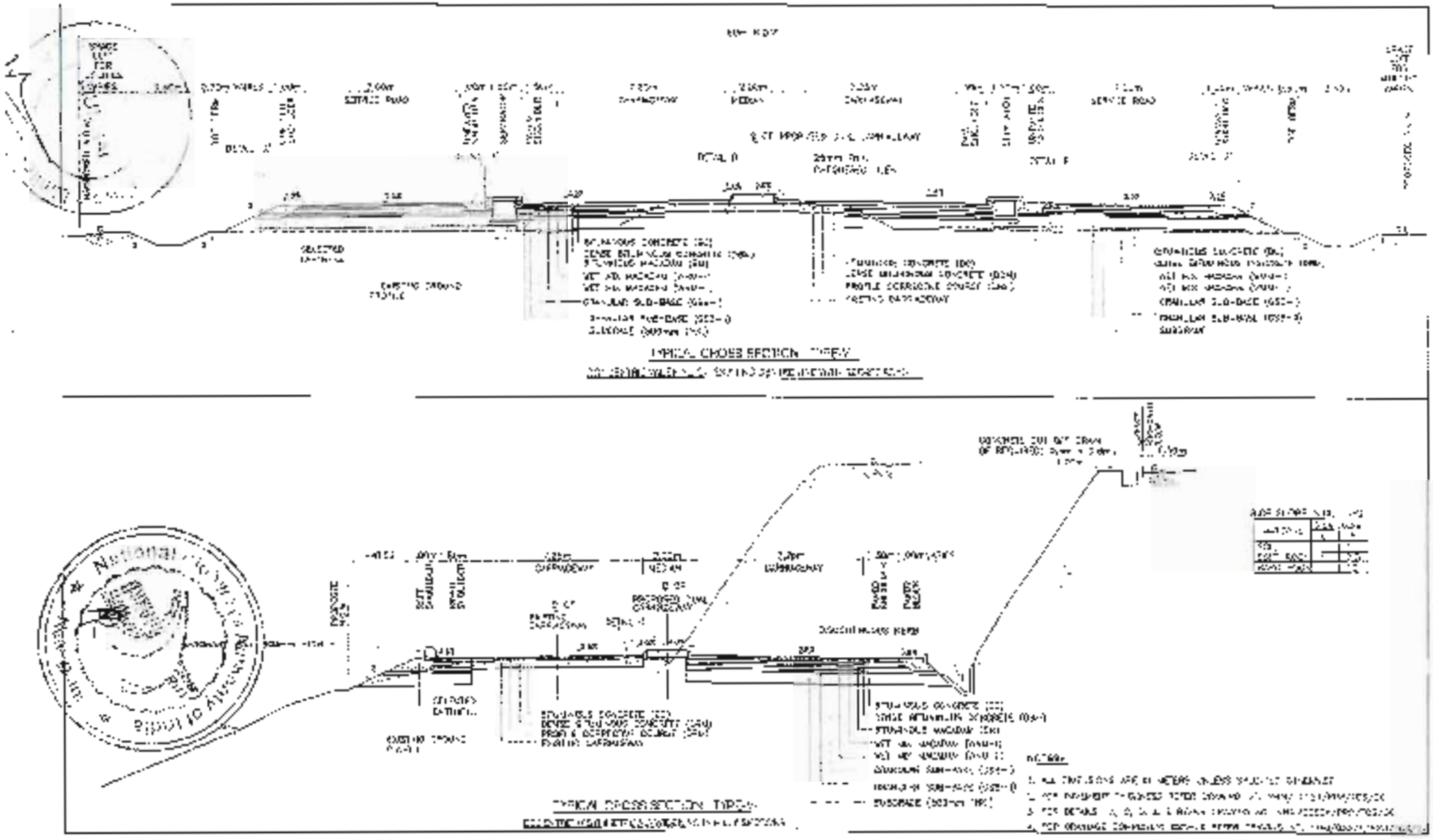
Sr. No.	Chainage From (Km)	Chainage To (Km)	Type of Cross Section	Remark
1	0.000	0.920	TCS III	
2	0.920	2.263	TCS V	Service Road Location:-LHS: 0.950 to 2.263 RHS: 0.920 to 2.263
3	2.263	4.650	TCS II	Rural Alignment
4	4.650	5.384	TCS V	Service Road Location:-LHS: 4.650 to 5.384 RHS: 4.650 to 5.384

Sr. No.	Chainage From (Km)	Chainage To (Km)	Type of Cross Section	Remark
5	5.384	8.300	TCS II	
6	8.300	8.400	TCS VI	
7	8.400	8.500	TCS VII	
8	8.500	8.780	TCS VI	
9	8.780	9.100	TCS III	
10	9.100	9.350	TCS II	RHS widening
11	9.350	9.500	TCS III	
12	9.500	10.150	TCS II	RHS widening
13	10.150	10.760	TCS III	
14	10.760	13.428	TCS II	
15	13.428	14.210	TCS V	Service Road Location:-LHS: 13.435 to 14.210, RHS 13.428 to 14.210
16	14.210	14.300	TCS II	RHS widening
17	14.300	15.250	TCS III	
18	15.250	17.950	TCS II	LHS widening
19	17.950	18.972	TCS V	
20	18.972	19.000	TCS III	
21	19.000	19.300	TCS II	LHS widening
22	19.300	19.400	TCS III	
23	19.400	20.000	TCS II	RHS widening
24	20.000	25.000	TCS VIII	
25	25.000	25.353	TCS II	RHS widening
26	25.343	26.060	TCS V	Service Road Location:-LHS: 25.343 to 26.060
27	26.060	26.372	TCS II	RHS widening
28	26.372	28.000	TCS V	Service Road Location:-LHS: 26.372 to 28.000, RHS: 26.760 to 28.000
29	28.000	28.460	TCS II	
30	28.460	29.597	TCS V	Service Road Location:-LHS: 28.460 to 29.593, RHS: 28.505 to 29.597
31	29.597	29.947	TCS II	
32	29.947	30.483	TCS V	Service Road Location: LHS: 29.947 to 30.483, RHS: 29.950 to 30.473
33	30.483	31.300	TCS III	
34	31.300	31.675	TCS V	Service Road Location:-LHS: 31.300 to 31.675, RHS: 31.300 to 31.630
35	31.675	34.100	TCS I	Wadkhal Realignment
36	34.100	34.635	TCS V	Service Road Location:- RHS: 34.100 to 34.635
37	34.635	37.050	TCS II	LHS widening

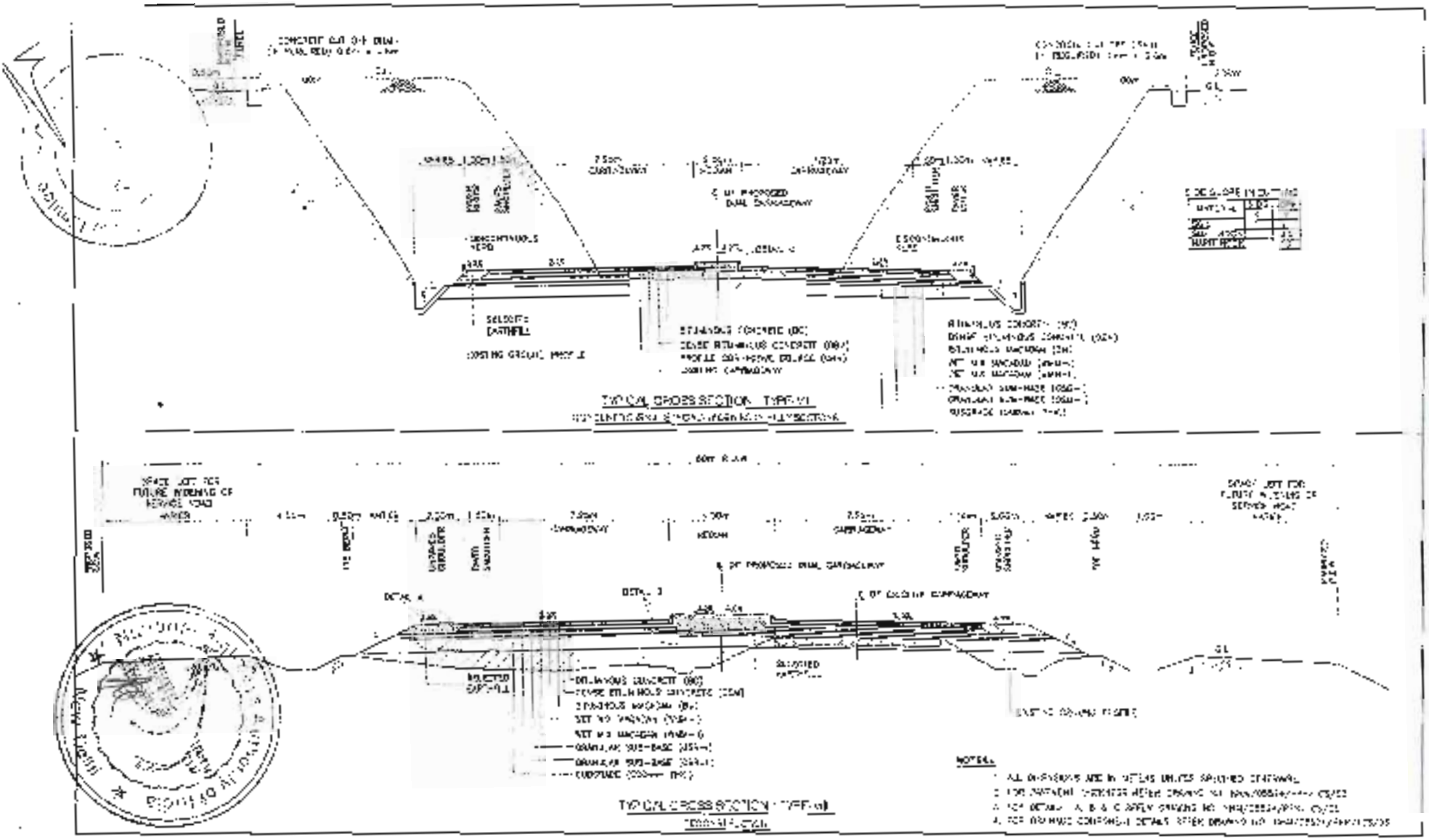
Sr. No.	Chainage From (Km)	Chainage To (Km)	Type of Cross Section	Remark
38	37.050	37.798	TCS V	
39	37.798	40.000	TCS VIII	
40	40.000	41.350	TCS VIII	
41	41.350	42.857	TCS V	Service Road Location:-LHS: 41.350 to 42.857
42	42.857	43.600	TCS II	RHS widening
43	43.600	44.568	TCS III	
44	44.568	45.814	TCS V	Service Road Location:-LHS: 44.711 to 45.814, RHS: 44.568 to 45.600
45	45.814	48.400	TCS II	RHS widening
46	48.400	48.500	TCS III	
47	48.500	49.000	TCS II	RHS widening
48	49.000	49.500	TCS V	
49	49.500	51.000	TCS II	LHS widening
50	51.000	52.000	TCS VIII	
51	52.000	54.170	TCS II	RHS widening
52	54.170	55.090	TCS II	RHS widening
53	55.090	56.585	TCS V	Service Road Location:-LHS: 55.090 to 56.585, RHS: 54.840 to 56.528
54	56.585	57.830	TCS II	RHS widening
55	57.830	58.420	TCS I	
56	58.420	58.500	TCS II	RHS widening
57	58.500	59.200	TCS I	Amba river realignment
58	59.000	64.000	TCS VIII	
59	64.000	64.600	TCS VI	
60	64.600	65.850	TCS II	LHS widening
61	65.850	66.100	TCS IV	
62	66.100	67.700	TCS II	RHS widening
63	67.700	67.910	TCS III	
64	67.910	68.830	TCS V	Service Road Location:-LHS: 67.910 to 68.830, RHS: 67.920 to 68.830
65	68.830	72.300	TCS II	RHS widening
66	72.300	72.650	TCS III	
67	72.650	73.400	TCS II	RHS widening
68	73.400	75.450	TCS V	
69	75.450	75.940	TCS II	RHS widening
70	75.940	76.500	TCS V	
71	76.500	84.600	TCS II	RHS widening







Four Laning of Patvel - Indapur Section of NH-17 from km. 0-000 to km. 84+000 in the State of Maharashtra under NHDP Phase III on BOT (Toll) Basis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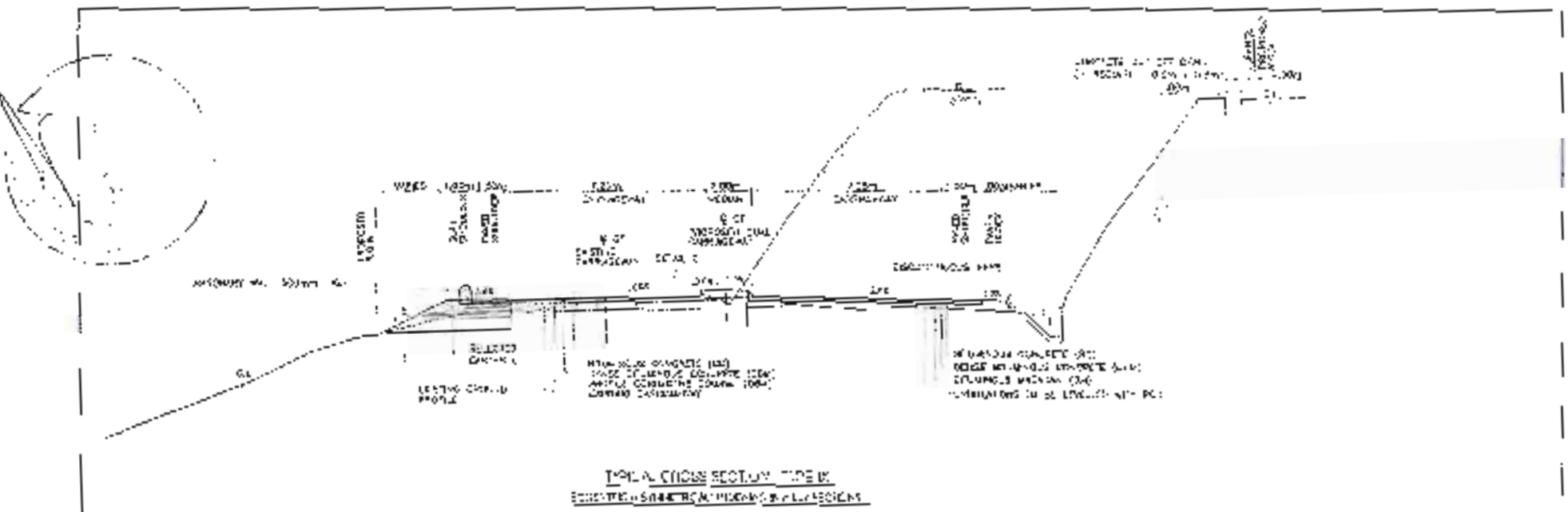


TYPICAL CROSS SECTION TYPE IV

NOTES:

Alignment Plan and Longitudinal Section

An alignment plan and vertical profile of project highway are to be designed as per provision of Manual of Specification and Standards for 4 laning of National Highway through Public Private Partnership published by IRC. (IRC SP 84, 2009)

Alignment plan of project highway prepared under DPR is given in soft copy.

Realignment

The details of realignment to be provided are as given below:

Table B-2: Realignment

Sr. No.	Existing Chainage	Design Chainage	Length in Km	Remark
1	Km 58.000 to Km 58.700	Km 58.500 to Km 59.200	0.7 km	Reconstruction of Amba River bridge

Bypass

The details of bypass to be provided for Wadkhal village are given below:

Sr. No.	Existing Chainage	Design Chainage	Length in Km	Remark
1	Km 31.800 to Km 33.500	Km 31.500 to Km 34.300	2.8 km	Bypass alignment crosses SH-87 and RCF Railway line through flyover.

Permission to build through Karnala Bird Sanctuary

The alignment passes though Karnala Bird Sanctuary from Km 8.5 to Km 10.0 (i.e. 1.5Km in length). If the permission for the works within the sanctuary is not granted, the same would be deducted from the scope of the Concessionaire's work and only maintenance of the same would be included. This however, will be done as a negative variation.

Service Roads

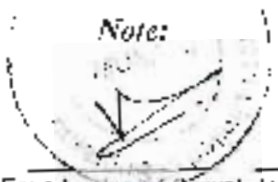
The service roads shall be provided as indicated in Table B-3.

Table B-3: Details of Service Roads (7mt wide)

Sr. No.	From (km)	To (km)	Length (km)	Side	Location
1	0.95	2.26	1.31	LHS	Palaspe
2	0.92	2.26	1.34	RHS	Palaspe
3	4.65	5.38	0.73	LHS	Chinchwan
4	4.65	5.38	0.73	RHS	Chinchwan
5	13.44	14.21	0.77	LHS	Tara
6	13.43	14.21	0.78	RHS	Tara
7	17.95	18.97	1.02	LHS	Jite
8	17.95	18.97	1.02	RHS	Jite
9	25.34	26.06	0.72	LHS	Pen
10	26.37	28.00	1.63	LHS	Pen
11	26.76	28.00	1.24	RHS	Pen
12	28.46	29.59	1.11	LHS	Pen
13	28.51	29.60	1.09	RHS	Pen
14	29.95	30.48	0.54	LHS	Uchede
15	29.95	30.47	0.52	RHS	Uchede
16	31.30	31.68	0.38	LHS	Wadakhal
17	31.30	31.63	0.33	RHS	Wadakhal
18	34.10	34.64	0.53	RHS	Wadakhal
19	37.08	37.80	0.72	LHS	Gadab
20	37.08	37.80	0.72	RHS	Gadab
21	41.35	42.86	1.51	LHS	Kasu, Pandapur, patn
22	44.71	45.81	1.10	LHS	Nigade
23	44.57	45.60	1.03	RHS	Nigade
24	49.00	49.50	0.50	LHS	Koleti
25	49.00	49.50	0.50	RHS	Koleti
26	55.09	56.59	1.50	LHS	Nagothane
27	54.84	56.53	1.69	RHS	Nagothane
28	67.91	68.83	0.92	LHS	Khamb
29	67.92	68.83	0.91	RHS	Khamb
30	73.40	75.45	2.05	LHS	Kolad
31	73.40	75.45	2.05	RHS	Kolad
32	75.94	76.50	0.56	LHS	Talvali
33	75.94	76.50	0.56	RHS	Talvali

In addition to above, it is proposed to construct service road for the length of 5.40 Km. The location of the same will be decided by NHAI authority and IC during execution. Thus, total length of Service Roads in the project is 37.55 km. in which L.H.S service road length is 19.79 Km and R.H.S service road length is 17.76 Km.

Note:



- *It is to be noted that the service road details given in above tables are minimum required. Any additional service roads, if required, shall be finalized in consultation with IC during execution.*

Entry /Exit Ramps

Entry/ Exit ramps shall be provided wherever necessary.

Intersections

Major and minor intersections mentioned in Table B-4 (a) & (b) shall be designed individually in accordance with standards mentioned in Schedule-D.

Table B-4(a): List of Major Junctions

S. No.	Chainage	Type of Crossing	Destination		Improvement Proposal	
			Left	Right	Type of Junction Improvement	Category
1	0/250	+	Pune	Uran	Flyover	National Highway Crossing
2	14/730	T	Aapta Phata		At Grade improvement	State Highway Crossing (SH-83)
3	25/870	T	Khopoli		Vehicular Underpass (left carr)	State Highway Crossing (SH-87)
4	27/730	-	Pen City	Pen Railway Station	Vehicular Underpass	Major junction
5	33/670	T		Alibaug	Flyover	State Highway (SH-87)
6	35/800	Y			At Grade improvement	Ispat Factory
7	54/380	T		Nagothane	At Grade improvement	State Highway (SH-91)
8	55/070	Y		Nagothane	Vehicular Underpass	Major junction
9	58/650	T	Pali		At Grade improvement	State Highway crossing (SH-92)
10	58/960	T		Alibaug	At Grade improvement	State Highway crossing (SH-93)
11	73/700	T		Roha	Vehicular underpass	State Highway (SH-62)
12	74/730	T	Pune		At Grade improvement	State highway (SH-60)

Note:
The At- Grade Roads under Flyovers/ Underpasses shall be improved as per latest IRC guidelines spelt out in Schedule D.

Table B 4(b): List of Minor Junctions

Sr.	Chainage	Crossing	Destination	Improvement Proposal

No.	(km)		Left	Right	Type of Improvement	Category
1	1.14	T	-	Palaspe Gaon	At Grade Improvement	MDR
2	1.22	T	Palaspe Gaon	-	At Grade Improvement	MDR
3	1.49	T	-	Palaspe Gaon	At Grade Improvement	V.R.
4	2.55	T	-	Turmale Gaon	At Grade Improvement	V.R.
5	2.63	T	Giravale Gaon	-	At Grade Improvement	V.R.
6	3.33	T	-	Sangivali Gaon	At Grade Improvement	V.R.
7	4.34	T	Shirdhon Gaon	-	At Grade Improvement	V.R.
8	4.99	T	Shirdhon Gaon	-	At Grade Improvement	MDR
9	11.31	T	-	Kolhe Gaon	At Grade Improvement	V.R.
10	12.02	Y	-	Bandarwadi Gaon	At Grade Improvement	V.R.
11	13.80	T	Tara Gaon	-	At Grade Improvement	MDR
12	16.54	Y	Kharpadagaon	-	At Grade Improvement	V.R.
13	18.23	Y	Jitegaon	-	At Grade Improvement	MDR
14	19.04	T	Tharoshi gaon	-	At Grade Improvement	V.R.
15	20.22	Y	Dursbet gaon	-	At Grade Improvement	MDR
16	21.10	T	Balvali gaon	-	At Grade Improvement	V.R.
17	21.69	T	-	Kopsar	At Grade Improvement	V.R.
18	22.45	Y	Ambivali gaon	-	At Grade Improvement	V.R.
19	23.47	T	-	Paramanandwadi	At Grade Improvement	V.R.
20	24.21	T	-	Virwadi	At Grade Improvement	MDR
21	25.28	T	Tarankhop gaon	-	At Grade Improvement	V.R.
22	25.44	T	Tarankhop gaon	-	At Grade Improvement	V.R.
23	27.08	Y	-	Pen	At Grade Improvement	V.R.
24	27.14	Y	Pen	-	At Grade	MDR

Sr. No.	Chainage (km)	Crossing	Destination		Improvement Proposal	
			Left	Right	Type of Improvement	Category
25	27.30	T	Pen		Improvement At Grade Improvement	V.R.
26	28.55	T	Village	Ranwadi	At Grade Improvement	V.R.
27	29.12	T	Kitwane colony	Umbrarde gaon	At Grade Improvement	V.R.
28	29.66	Y	-	vashi gaon	At Grade Improvement	MDR
29	30.27	T	-	Ochele gaon	At Grade Improvement	V.R.
30	30.67	T	Kanllepada	-	At Grade Improvement	V.R.
31	31.16	T	-	Kanllegaon	At Grade Improvement	V.R.
32	32.65	+	Wadkhal	Wadkhal	At Grade Improvement	V.R.
33	34.59	T	-	Dolvigaon	At Grade Improvement	V.R.
34	36.48	T	Karavegaon	-	At Grade Improvement	MDR
35	37.15	T	-	Gadab	At Grade Improvement	V.R.
36	37.47	T	-	Gadab	At Grade Improvement	V.R.
37	39.67	T	Gadab	-	At Grade Improvement	V.R.
38	40.41	T	-	DeV.R.oli	At Grade Improvement	V.R.
39	40.73	T	Jui	-	At Grade Improvement	V.R.
40	41.39	T	Karajtapegaon	-	At Grade Improvement	V.R.
41	41.65	T	Salindegaon	-	At Grade Improvement	V.R.
42	42.08	T	Kasugaon	-	At Grade Improvement	V.R.
43	42.23	T	Kasugaon	-	At Grade Improvement	V.R.
44	42.43	T	Patani	-	At Grade Improvement	V.R.
45	42.68	T	Pandapur	-	At Grade Improvement	V.R.
46	43.15	T	Aakadevitemple	-	At Grade Improvement	MDR
47	44.00	+	Salinde		At Grade	V.R.

Sr. No.	Chainage (km)	Crossing	Destination		Improvement Proposal	
			Left	Right	Type of Improvement	Category
48	44.42	T	-	Nigadegaon	At Grade Improvement	V.R.
49	44.74	T	-	Palkargaon	At Grade Improvement	MDR
50	44.92	T	-	Amtemgaon	At Grade Improvement	V.R.
51	45.15	T	-	Amtemgaon	At Grade Improvement	V.R.
52	45.25	T	-	Amtemgaon	At Grade Improvement	V.R.
53	46.16	+	Amtemgaon	Amtemgaon	At Grade Improvement	V.R.
54	47.38	T	Khartalegaon	-	At Grade Improvement	V.R.
55	48.51	T	-	Kolotichi wadi	At Grade Improvement	V.R.
56	49.02	+	Village	Kolotichi wadi	At Grade Improvement	V.R
57	50.78	T	Palasgaon	-	At Grade Improvement	V.R.
58	52.73	T	Nidigaon	-	At Grade Improvement	V.R.
59	53.08	T	-	NidiGaon	At Grade Improvement	V.R.
60	53.33	T	Kondgaon	-	At Grade Improvement	V.R.
61	54.09	T	Miranagar	-	At Grade Improvement	V.R.
62	54.92	T	-	Village	At Grade Improvement	V.R.
63	55.18	T	Ramnagar	-	At Grade Improvement	MDR
64	56.32	T	Nagothane	-	At Grade Improvement	MDR
65	56.94	T	Chikanigaon	-	At Grade Improvement	V.R.
66	61.24	T	MSEB (Kansai)	-	At Grade Improvement	V.R.
67	61.88	T	Tansoligaon	-	At Grade Improvement	V.R.
68	63.19	T	-	Sukeligaon	At Grade Improvement	V.R
69	64.33	T	Kherwadi	-	At Grade Improvement	V.R.
70	68.18	T	Khambgaon	-	At Grade	V.R.

Sr. No.	Chainage (km)	Crossing	Destination		Improvement Proposal	
			Left	Right	Type of Improvement	Category
71	68.26	T	-	Khambgaon	At Grade Improvement	V.R.
72	68.35	T	Khambgaon	-	At Grade Improvement	V.R.
73	68.68	T	-	School	At Grade Improvement	MDR
74	69.74	T	-	Village	At Grade Improvement	V.R.
75	69.85	T	Village	-	At Grade Improvement	V.R.
76	70.83	T	Village		At Grade Improvement	V.R.
77	71.36	T	-	Village	At Grade Improvement	V.R.
78	71.73	T	Village	-	At Grade Improvement	V.R.
79	71.94	T	Pugaon	-	At Grade Improvement	V.R.
80	74.53	T	-	Warasgaon	At Grade Improvement	V.R.
81	75.33	T	Kolad Rly Station		At Grade Improvement	V.R.
82	76.26	T	-	Talawaligaon	At Grade Improvement	V.R.
83	76.44	T	Tise gaon		At Grade Improvement	V.R.
84	77.71	Y	-	Bhuvan	At Grade Improvement	MDR
85	78.32	T	Ghotwalgaon	-	At Grade Improvement	MDR
86	79.09	+	School	Ratwadgaon	At Grade Improvement	V.R.
87	79.49	Y	-	Village	At Grade Improvement	MDR
88	81.15	T	Nilajgaon	-	At Grade Improvement	V.R.
89	81.45	T	-	Wavedivaligaon	At Grade Improvement	V.R.
90	81.68	Y	-	Wavedivaligaon	At Grade Improvement	MDR
91	82.58	T	-	Polnergaon	At Grade Improvement	V.R.
92	82.71	T	Gangewadi	-	At Grade Improvement	V.R.
93	83.22	T	Rudroligaon	-	At Grade	V.R.

Sr. No.	Chainage (km)	Crossing	Destination		Improvement Proposal	
			Left	Right	Type of Improvement	Category
					Improvement	
91	84.33	T	-	Nayroli	At Grade Improvement	MDR

V.R.- Village road MDR –Major District road

Note:

i. The treatment at the intersections shall be designed in accordance with the latest IRC guidelines spelt out in Schedule D

Structures

Summary of structures is presented in Table B-5.

Table B-5: Improvement Measures for Structures

Type of Structures	Locations	Repair	Repair & Widening	Re-Construction	New Construction	Total units
Major Bridges (>60m long)	6	3	1	2	6	12
Minor Bridges	23	16	6	1	23	46
Rail Over Bridges	3	2	-	-	4	6
Slab culverts	135	-	133	-	2	135
Pipe culverts	208	-	63	137	8	208
Foot Over Bridges	1	-	-	-	1	1

Note:

i. In case of Major bridges, Minor bridges and Rail Over Bridges, there will be two units of separate structures at each location.

ii. In case of slab culverts, pipe culverts and FOB, there will be single unit of structure at each location

4.8.1 Major Bridge

Major Bridges as listed in **Appendix B-1** shall be provided, widened, reconstructed or extended.

4.8.2 Minor Bridge

Minor Bridges as listed in **Appendix B-2** shall be provided, widened, reconstructed or extended.

4.8.3 Flyover

Flyovers as listed in **Appendix B-3** shall be provided, widened, reconstructed or extended.

4.8.4 Railway Over Bridge

Details of ROB to be provided are given at **Appendix B-4.**

Following points shall be taken care of:

1. The proposed span arrangements of the ROBs are tentative and subject to change as per availability of railway boundaries/ requirement of the railways
2. ROB shall be designed, constructed and maintained as per the requirements of Railway authorities. The construction plans shall be prepared in consultation with the concerned railway authority.
3. The ROB's shall be constructed and maintained by the concessionaire under supervision of the Railways.
4. All expenditure related to construction, maintenance and supervision of ROB (except P&E charges) shall be borne by the Concessionaire.
5. During construction, the existing level crossings shall be widened to 12 meters or two separate level crossings of 7 meters each shall be provided.
6. The existing ROB(s) shall be repaired as per requirement of Railways.

4.8.5 Railway Under Bridge

Details of RUB to be provided are given at **Appendix B-5.**

Sizes of openings of these existing RUBs are sufficient for accommodating four lane highways.

4.8.6 Foot Over Bridge

There is an existing FOB of width 3.0m at Km 54/990 in Nagothane village. The same is proposed to be extended across the proposed four lane highway for the length of 42m excluding stairs.

4.8.7 Vehicular/ Cattle Crossing / Pedestrian Underpasses

Vehicular underpasses shall be provided as shown in Table B-6.

Table B-6: Details of Proposed Vehicular Underpasses along the Corridor

S. No.	Chainage (Km)	Opening Size (m)	Width	Village	Anticipated Type
1	4.992	2 x 12 x 5.5	24 m	Chinchvan	RCC Solid slab
2	25.873	2 x 12 x 5.5	24 m	Khopoli Junction	RCC Solid slab
3	28.040	2 x 12 x 5.5	24 m	Patil	RCC Solid slab
4	31.660	1 x 12 x 5.5	24 m	Vadkal Bypass	RCC Solid slab
5	32.465	1 x 6 x 5.0	27 m	Wavikhal Bypass	RCC Solid slab

S. No.	Chainage (Km)	Opening Size (m)	Width	Village	Anticipated Type
6	55.968	2 x 12 x 5.5	24 m	Nagothane	RCC Solid slab
7	73.699	2 x 12 x 5.5	24 m	Kolad	RCC Solid slab

Pedestrian/ Cattle Crossing shall be provided as shown in Table B-7.

Table B-7: Details of Proposed Pedestrian /Cattle Crossing along the Corridor

S. No.	Chainage (Km)	Opening Size (m)	Width	Village	Anticipated Type
1	1.219	6 x 3.5	24m	Palaspe	Box structure
2	13.796	6 x 3.5	24m	Tara	Box structure
3	18.229	6 x 3.5	24m	Jite	Box structure
4	27.136	6x 3.5	24m	Pen	Box Structure
5	28.550	6x 3.5	24m	Pen	Box Structure
6	30.276	6 x 3.5	24m	Uchede	Box Structure
7	37.453	6 x 3.5	24m	Gadab	Box structure
8	42.075	6 x 3.5	24m	Kasu	Box structure
9	45.149	6 x 3.5	24m	Nigade	Box structure
10	49.280	6 x 3.5	24m	Koleti	Box structure
11	55.749	6 x 3.5	24m	Nagothane	Box structure
12	68.248	6 x 3.5	24m	Khamb	Box structure
13	76.250	6 x 3.5	24m	Talvali	Box structure
14	79.080	6 x 3.5	24m	Ratvad	Box structure

Note:

1. *Apart from above, provision to construct 2 (Two) nos. of additional Vehicular Underpasses and 2 (two) nos. of additional pedestrian underpasses shall be made along the project alignment. The location details will be decided by NHAI / IC*

4.8.8 Culverts

Pipe Culverts as listed in Table B-8 (i) shall be provided, widened, reconstructed or extended.

Table B-8 (i): Repair / Rehabilitation scheme for Pipe Culverts

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Proposed Size Nos. x Dia in meter	Recommendation
1	1/1	0.393	1x1.0	1x1.0	Retaining & Widening

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Proposed Size Nos. x Dia in meter	Recommendation
2	C-2	0.578	-	1x1.0	New Construction
3	C-3	0.657	-	1x1.0	New Construction
4	C-4	0.900	-	1x1.0	New Construction
5	2/1	1.188	1x1.0	1x1.0	Retaining & Widening
6	2/2	1.280	1x1.0	1x1.0	Retaining & Widening
7	2/3	1.667	1x1.0	1x1.0	Retaining & Widening
8	2/4	1.744	1x0.8	1x1.2	Dismantling & Reconstruction
9	2/5	2.092	1x0.8	1x1.2	Dismantling & Reconstruction
10	3/1	2.196	1x0.8	1x1.2	Dismantling & Reconstruction
11	3/2	2.395	1x0.8	1x1.2	Dismantling & Reconstruction
12	3/3	2.660	1x0.8	1x1.2	Dismantling & Reconstruction
13	4/1	3.066	1x0.8	1x1.2	Dismantling & Reconstruction
14	4/2	3.242	1x0.8	1x1.2	Dismantling & Reconstruction
15	4/3	3.401	1x0.8	1x1.2	Dismantling & Reconstruction
16	4/4	3.658	2x1.0	2x1.0	Retaining & Widening
17	4/5	3.884	1x1.0	1x1.0	Retaining & Widening
18	5/1	4.365	1x0.8	1x1.2	Dismantling & Reconstruction
19	5/2	4.794	1x0.8	1x1.2	Dismantling & Reconstruction
20	6/1	5.031	1x0.8	1x1.2	Dismantling & Reconstruction
21	6/2	5.331	1x0.9	1x1.2	Dismantling & Reconstruction
22	6/5	5.637	1x0.5	1x1.2	Dismantling & Reconstruction
23	6/6	5.724	1x1.0	1x1.0	Retaining & Widening
24	6/7	5.756	1x1.0	1x1.0	Retaining & Widening
25	6/8	5.845	1x1.0	1x1.0	Retaining & Widening
26	7/1	6.012	3x1.0	3x1.0	Retaining & Widening
27	7/2	6.183	1x0.8	1x1.2	Dismantling & Reconstruction
28	7/3	6.448	1x0.8	1x1.2	Dismantling & Reconstruction
29	7/5	6.595	2x1.0	2x1.0	Retaining & Widening
30	7/6	6.728	2x0.9	2x1.0	Dismantling &

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Proposed Size Nos. x Dia in meter	Recommendation
31	8/2	7.170	3x1.0	3x1.0	Reconstruction Retaining & Widening
32	8/3	7.308	2x0.9	2x1.0	Dismantling & Reconstruction
33	8/4	7.567	2x1.0	2x1.0	Retaining & Widening
34	8/5	7.811	3x2.0	3x2.0	Retaining & Widening
35	9/1	8.047	1x1.0	1x1.0	Retaining & Widening
36	9/3	8.195	1x0.8	1x1.2	Dismantling & Reconstruction
37	9/4	8.246	2x0.9	2x1.2	Dismantling & Reconstruction
38	9/6	8.499	1x0.8	1x1.2	Dismantling & Reconstruction
39	9/8	8.606	2x1.0	2x1.0	Retaining & Widening
40	9/9	8.670	1x0.8	1x1.2	Dismantling & Reconstruction
41	9/10	8.723	1x1.0	1x1.0	Retaining & Widening
42	9/11	8.758	2x0.8	2x1.2	Dismantling & Reconstruction
43	10/1	8.967	2x2.0	2x2.0	Retaining & Widening
44	10/2	9.107	2x0.8	2x1.2	Dismantling & Reconstruction
45	10/3	9.265	1x0.9	1x1.2	Dismantling & Reconstruction
46	10/6	9.460	2x1.0	2x1.0	Retaining & Widening
47	10/8	9.612	2x1.0	2x1.0	Retaining & Widening
48	10/9	9.705	2x0.8	2x1.2	Dismantling & Reconstruction
49	10/10	9.844	2x0.8	2x1.2	Dismantling & Reconstruction
50	11/2	10.164	1x0.5	1x1.2	Dismantling & Reconstruction
51	11/3	10.260	1x1.0	1x1.0	Retaining & Widening
52	11/4	10.412	1x1.0	1x1.0	Retaining & Widening
53	11/5	10.464	3x1.0	3x1.0	Retaining & Widening
54	11/6	10.602	1x0.8	1x1.2	Dismantling & Reconstruction
55	12/1	10.901	1x1.0	1x1.0	Retaining & Widening
56	12/2	11.100	2x1.0	2x1.0	Retaining & Widening
57	12/3	11.175	1x1.0	1x1.0	Retaining & Widening
58	12/4	11.292	3x1.0	3x1.0	Retaining & Widening
59	12/5	11.422	1x1.0	1x1.0	Retaining & Widening
60	12/6	11.481	2x1.0	2x1.0	Retaining & Widening
61	12/7	11.595	1x1.0	1x1.0	Retaining & Widening

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Prupnsed Size Nos. x Dia in meter	Recommendation
62	12/8	11.678	1x1.0	1x1.0	Retaining & Widening
63	12/9	11.760	1x0.5	1x1.2	Dismantling & Reconstruction
64	12/10	11.877	1x1.0	1x1.0	Retaining & Widening
65	13/1	12.055	1x0.5	1x1.2	Dismantling & Reconstruction
66	13/2	12.144	1x0.5	1x1.2	Dismantling & Reconstruction
67	13/3	12.259	1x1.0	1x1.0	Retaining & Widening
68	13/4	12.497	1x0.5	1x1.2	Dismantling & Reconstruction
69	13/5	12.566	1x1.0	1x1.0	Retaining & Widening
70	13/6	12.658	1x1.0	1x1.0	Retaining & Widening
71	13/7	12.825	1x1.0	1x1.0	Retaining & Widening
72	14/1	13.179	1x1.0	1x1.0	Retaining & Widening
73	14/2	13.395	1x0.5	1x1.2	Dismantling & Reconstruction
74	14/3	13.527	1x0.9	1x1.2	Dismantling & Reconstruction
75	15/1	13.924	1x0.6	1x1.2	Dismantling & Reconstruction
76	15/2	14.172	1x0.5	1x1.2	Dismantling & Reconstruction
77	15/3	14.242	1x0.6	1x1.2	Dismantling & Reconstruction
78	15/4	14.380	1x0.9	1x1.2	Dismantling & Reconstruction
79	15/5	14.511	1x0.9	1x1.2	Dismantling & Reconstruction
80	15/6	14.858	1x1.0	1x1.0	Retaining & Widening
81	16/1	15.169	1x1.0	1x1.0	Retaining & Widening
82	19/1	17.970	1x1.0	1x1.0	Retaining & Widening
83	19/3	18.379	1x0.8	1x1.2	Dismantling & Reconstruction
84	19/5	18.482	1x0.8	1x1.2	Dismantling & Reconstruction
85	20/1	18.556	1x0.5	1x1.2	Dismantling & Reconstruction
86	20/2	18.808	1x0.5	1x1.2	Dismantling & Reconstruction
87	20/3	18.918	2x0.9	2x1.2	Dismantling & Reconstruction
88	20/4	19.208	2x1.2	2x1.2	Retaining & Widening
89	20/5	19.323	2x1.0	2x1.0	Retaining & Widening

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Proposed Size Nos. x Dia in meter	Recommendation
90	22/3	21.284	1x0.8	1x1.2	Dismantling & Reconstruction
91	22/4	21.551	1x0.5	1x1.2	Dismantling & Reconstruction
92	23/1	22.169	1x0.5	1x1.2	Dismantling & Reconstruction
93	24/1	22.804	1x0.5	1x1.2	Dismantling & Reconstruction
94	24/2	23.077	1x0.6	1x1.2	Dismantling & Reconstruction
95	24/3	23.166	1x0.5	1x1.2	Dismantling & Reconstruction
96	24/4	23.315	1x0.5	1x1.2	Dismantling & Reconstruction
97	24/5	23.643	2x0.6	2x1.2	Dismantling & Reconstruction
98	26/1	24.710	2x0.9	2x1.2	Dismantling & Reconstruction
99	26/2	24.848	1x0.9	1x1.2	Dismantling & Reconstruction
100	26/3	24.930	1x0.8	1x1.2	Dismantling & Reconstruction
101	26/4	25.181	1x0.9	1x1.2	Dismantling & Reconstruction
102	26/5	25.301	1x0.5	1x1.2	Dismantling & Reconstruction
103	27/1	25.672	1x0.5	1x1.0	Dismantling & Reconstruction
104	27/2	25.968	1x0.8	1x1.2	Dismantling & Reconstruction
105	27/4	26.578	1x0.8	1x1.2	Dismantling & Reconstruction
106	27/5	26.662	1x1.0	1x1.0	Retaining & Widening
107	28/1	26.769	1x0.5	1x1.0	Dismantling & Reconstruction
108	28/2	26.863	1x1.0	1x1.0	Retaining & Widening
109	28/3	27.132	1x0.6	1x1.2	Dismantling & Reconstruction
110	28/4	27.493	1x0.6	1x1.2	Dismantling & Reconstruction
111	29/1	27.785	2x0.9	2x1.2	Dismantling & Reconstruction
112	29/3	28.583	2x0.5	2x1.2	Dismantling & Reconstruction
113	30/1	29.298	1x1.0	1x1.0	Retaining & Widening

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Proposed Size Nos. x Dia in meter	Recommendation
114	31/2	29.959	1x1.0	1x1.0	Retaining & Widening
115	31/3	30.201	1x1.0	1x1.0	Retaining & Widening
116	32/1	30.700	1x1.0	1x1.0	Retaining & Widening
117	32/3	31.007	2x1.0	2x1.0	Retaining & Widening
118	32/4	31.315	1x1.0	1x1.0	Retaining & Widening
119	32/5	31.449	1x0.8	1x1.2	Dismantling & Reconstruction
120	NEW	32.220	-	2x1.2	New Construction
121	34/6	34.445	2x0.8	2x1.2	Dismantling & Reconstruction
122	35/3	34.793	2x0.9	2x1.2	Dismantling & Reconstruction
123	NEW	35.003	-	1x1.2	New Construction
124	35/4	35.040	1x1.0	-	Retaining & Widening
125	NEW	35.178	-	1x1.2	New Construction
126	35/5	35.238	2x0.8	-	New Construction
127	35/6	35.425	2x1.0	2x1.0	Retaining & Widening
128	35/7	35.529	2x0.9	2x1.2	Dismantling & Reconstruction
129	37/4	37.223	2x0.9	2x1.2	Dismantling & Reconstruction
130	37/5	37.378	1x0.9	1x1.2	Dismantling & Reconstruction
131	38/1	37.586	1x0.9	1x1.2	Dismantling & Reconstruction
132	38/2	37.694	1x0.8	1x1.2	Dismantling & Reconstruction
133	38/3	37.805	1x0.8	1x1.2	Dismantling & Reconstruction
134	42/1	41.736	1x0.8	1x1.2	Dismantling & Reconstruction
135	42/3	42.134	1x1.0	1x1.0	Retaining & Widening
136	42/5	42.325	1x0.5	1x1.2	Dismantling & Reconstruction
137	43/1	42.844	1x0.9	1x1.2	Dismantling & Reconstruction
138	43/5	43.436	1x0.9	1x1.2	Dismantling & Reconstruction
139	44/1	43.637	1x0.9	1x1.2	Dismantling & Reconstruction
140	45/1	44.731	1x0.9	1x1.2	Dismantling & Reconstruction
141	48/3	48.265	1x0.9	1x1.2	Dismantling & Reconstruction

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Proposed Size Nos. x Dia in meter	Recommendation
142	49/1	48.652	1x0.9	1x1.2	Dismantling & Reconstruction
143	49/4	49.073	1x0.9	1x1.2	Dismantling & Reconstruction
144	49/5	49.178	2x0.9	2x1.2	Dismantling & Reconstruction
145	50/1	49.527	2x0.8	2x1.2	Dismantling & Reconstruction
146	50/2	49.683	2x0.8	2x1.2	Dismantling & Reconstruction
147	50/3	49.963	2x0.8	2x1.2	Dismantling & Reconstruction
148	50/4	50.040	2x0.8	2x1.2	Dismantling & Reconstruction
149	50/6	50.365	1x0.9	1x1.2	Dismantling & Reconstruction
150	51/1	50.562	2x0.8	2x1.2	Dismantling & Reconstruction
151	51/2	50.738	1x1.0	1x1.0	Retaining & Widening
152	51/3	50.874	1x0.8	1x1.2	Dismantling & Reconstruction
153	51/4	51.303	2x0.8	2x1.2	Dismantling & Reconstruction
154	52/2	51.705	2x0.8	2x1.2	Dismantling & Reconstruction
155	52/3	51.758	1x1.0	1x1.0	Retaining & Widening
156	52/4	51.916	1x1.0	1x1.0	Retaining & Widening
157	53/1	52.604	2x0.8	2x1.2	Dismantling & Reconstruction
158	53/3	53.126	2x1.0	2x1.0	Retaining & Widening
159	53/4	53.276	2x0.9	2x1.2	Dismantling & Reconstruction
160	54/3	53.977	1x1.0	1x1.0	Retaining & Widening
161	NEW	54.254	-	1x1.2	New Construction
162	54/4	54.446	1x1.0	-	Retaining & Widening
163	55/1	54.563	1x0.8	1x1.2	Dismantling & Reconstruction
164	55/3	54.971	2x0.8	2x1.2	Dismantling & Reconstruction
165	55/4	54.987	1x1.0	-	Retaining & Widening
166	55/5	55.018	1x0.8	1x1.2	Dismantling & Reconstruction
167	56/1	55.553	1x0.8	1x1.2	Dismantling & Reconstruction
168	56/2	55.794	1x0.8	1x1.2	Dismantling &

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Proposed Size Nos. x Dia in meter	Recommendation
					Reconstruction
169	56/4	56.166	1x0.5	1x1.2	Dismantling & Reconstruction
170	57/1	56.544	1x0.8	1x1.2	Dismantling & Reconstruction
171	58/3	57.952	1x0.8	1x1.2	Dismantling & Reconstruction
172	58/5	58.173	1x0.4	1x1.2	Dismantling & Reconstruction
173	58/6	58.222	1x0.7	1x1.2	Dismantling & Reconstruction
174	59/2	59.290	1x0.5	1x1.2	Dismantling & Reconstruction
175	61/1	60.921	1x0.9	1x1.2	Dismantling & Reconstruction
176	63/1	63.000	1x0.8	1x1.2	Dismantling & Reconstruction
177	64/1	63.486	1x1.0	1x1.0	Retaining & Widening
178	64/2	63.805	1x0.4	1x1.2	Dismantling & Reconstruction
179	64/4	64.149	1x0.8	1x1.2	Dismantling & Reconstruction
180	65/1	64.608	1x0.9	1x1.2	Dismantling & Reconstruction
181	65/2	64.685	1x0.9	1x1.2	Dismantling & Reconstruction
182	65/3	64.808	1x0.9	1x1.2	Dismantling & Reconstruction
183	65/4	64.874	1x0.9	1x1.2	Dismantling & Reconstruction
184	65/5	64.915	1x0.9	1x1.2	Dismantling & Reconstruction
185	65/6	65.069	1x0.9	1x1.2	Dismantling & Reconstruction
186	65/7	65.115	1x0.9	1x1.2	Dismantling & Reconstruction
187	65/8	65.348	1x0.9	1x1.2	Dismantling & Reconstruction
188	66/1	65.987	1x0.9	1x1.2	Dismantling & Reconstruction
189	66/2	66.073	1x0.7	1x1.2	Dismantling & Reconstruction
190	66/3	66.314	1x0.8	1x1.2	Dismantling & Reconstruction
191	67/1	67.485	1x0.8	1x1.2	Dismantling &

Sr. No.	CD No.	Chainage (km)	Existing Size Nos. x Dia in meter	Proposed Size Nos. x Dia in meter	Recommendation
					Reconstruction
192	68/1	67.676	1x0.8	1x1.2	Dismantling & Reconstruction
193	68/2	67.743	1x0.8	1x1.2	Dismantling & Reconstruction
194	70/1	69.520	1x0.5	1x1.2	Dismantling & Reconstruction
195	71/1	70.574	1x0.6	1x1.2	Dismantling & Reconstruction
196	71/3	70.765	1x0.7	1x1.2	Dismantling & Reconstruction
197	71/6	71.205	1x0.6	1x1.2	Dismantling & Reconstruction
198	72/1	72.313	1x0.5	1x1.2	Dismantling & Reconstruction
199	75/1	74.591	1x0.9	1x1.2	Dismantling & Reconstruction
200	75/5	74.970	1x0.4	1x1.2	Dismantling & Reconstruction
201	76/7	76.341	1x0.7	1x1.2	Dismantling & Reconstruction
202	79/1	78.537	1x0.8	1x1.2	Dismantling & Reconstruction
203	79/2	78.697	1x0.8	1x1.2	Dismantling & Reconstruction
204	80/1	79.714	1x1.5	1x1.5	Retaining & Widening
205	81/1	80.912	1x0.8	1x1.2	Dismantling & Reconstruction
206	82/2	81.772	1x0.9	1x1.2	Dismantling & Reconstruction
207	83/2	82.986	1x0.5	1x1.2	Dismantling & Reconstruction
208	84/1	83.629	1x1.0	1x1.0	Retaining & Widening

Slab Culverts as listed in Table B-8 (ii) shall be provided, widened, reconstructed or extended.

Table B-8 (ii): Repair/Rehabilitation/Reconstruction scheme for Slab Culverts

Sr. no.	CD No.	Chainage (km)	Existing Size Width x Height (m)	Proposed Size Width x Height (m)	Recommendation
1	6/3	5.349	1.5x1.8	1.5x1.8	Retaining & Widening
2	6/4	5.435	2.5x1.65	2.5x1.65	Retaining & Widening

Sr. no.	CD No.	Chainage (km)	Existing Size Width x Height (m)	Proposed Size Width x Height (m)	Recommendation
3	7/4	6.524	2.3x1.7	2.3x1.7	Retaining & Widening
4	7/7	6.864	2.0x1.8	2.0x1.8	Retaining & Widening
5	8/1	7.011	2.4x2.4	2.4x2.4	Retaining & Widening
6	9/2	8.087	1.5x1.5	1.5x1.5	Retaining & Widening
7	9/5	8.305	2.4x2.5	2.4x2.5	Retaining & Widening
8	9/7	8.541	2.3x2	2.3x2	Retaining & Widening
9	9/12	8.915	1.75x2.0	1.75x2.0	Retaining & Widening
10	10/7	9.571	3.3x1.5	3.3x1.5	Retaining & Widening
11	11/1	9.937	3.6x2.8	3.6x2.8	Retaining & Widening
12	18/1	16.815	2.5x2.4	2.5x2.4	Retaining & Widening
13	18/2	17.514	3.6x3.0	3.6x3.0	Retaining & Widening
14	19/2	18.040	3.2x2.0	3.2x2.0	Retaining & Widening
15	19/4	18.446	1.0x1.0	1.0x1.0	Retaining & Widening
16	22/2	20.963	1.5x2.0	1.5x2.0	Retaining & Widening
17	25/2	24.259	2.85x2.80	2.85x2.80	Retaining & Widening
18	28/5	27.521	2.5x1.4	2.5x1.4	Retaining & Widening
19	29/2	28.383	6.5x2.15	6.5x2.15	Retaining & Widening
20	32/2	30.898	4.5x3.0	4.5x3.0	Retaining & Widening
21	V-2	32.740	-	2.0x1.5	New Construction
22	V-3	33.050	-	2.0x1.5	New Construction
23	34/4	34.100	2.30x1.65	2.30x1.65	Retaining & Widening
24	34/5	34.273	2.3x1.65	2.3x1.65	Retaining & Widening
25	35/1	34.594	1.6x0.9	1.6x0.9	Retaining & Widening
26	35/2	34.726	3.5x2.0	3.5x2.0	Retaining & Widening
27	36/1	35.706	1.3x1.3	1.3x1.3	Retaining & Widening
28	36/2	35.941	1.55x2.5	1.55x2.5	Retaining & Widening
29	36/3	36.157	1.8x1.45	1.8x1.45	Retaining & Widening
30	36/4	36.319	1.9x1.2	1.9x1.2	Retaining & Widening
31	36/5	36.504	1.7x2.0	1.7x2.0	Retaining & Widening
32	37/1	36.665	1.7x2.5	1.7x2.5	Retaining & Widening
33	37/2	36.837	2.85x2.9	2.85x2.9	Retaining & Widening
34	37/3	37.028	1.8x2.0	1.8x2.0	Retaining & Widening
35	37/6	37.432	3.45x3.8	3.45x3.8	Retaining & Widening
36	38/4	38.269	2.7x2.5	2.7x2.5	Retaining & Widening
37	39/1	38.723	1.6x3.0	1.6x3.0	Retaining & Widening
38	39/2	38.952	1.7x3.10	1.7x3.10	Retaining & Widening
39	39/3	39.055	2.9x3.25	2.9x3.25	Retaining & Widening
40	39/4	39.358	3.9x3.0	3.9x3.0	Retaining & Widening
41	39/5	39.454	2.9x2.70	2.9x2.70	Retaining & Widening
42	40/1	39.562	2.9x2.5	2.9x2.5	Retaining & Widening
43	40/2	39.729	2.8x3.0	2.8x3.0	Retaining & Widening
44	40/3	40.168	2.8x2.4	2.8x2.4	Retaining & Widening
45	40/4	40.487	1.9x1.9	1.9x1.9	Retaining & Widening

Sr. no.	CD No.	Chainage (km)	Existing Size Width x Height (m)	Proposed Size Width x Height (m)	Recommendation
46	41/1	40.672	1.7x2.3	1.7x2.3	Retaining & Widening
47	41/2	40.828	1.7x2.2	1.7x2.2	Retaining & Widening
48	41/3	41.047	1.7x2.5	1.7x2.5	Retaining & Widening
49	41/4	41.189	2.9x2.5	2.9x2.5	Retaining & Widening
50	41/5	41.336	2.9x3.0	2.9x3.0	Retaining & Widening
51	41/6	41.481	1.8x2.8	1.8x2.8	Retaining & Widening
52	42/2	41.888	3.9x3.4	3.9x3.4	Retaining & Widening
53	42/4	42.170	3.5x2.4	3.5x2.4	Retaining & Widening
54	42/6	42.442	4.3x2.9	4.3x2.9	Retaining & Widening
55	43/2	42.967	1.7x1.9	1.7x1.9	Retaining & Widening
56	43/3	43.055	2.8x3.2	2.8x3.2	Retaining & Widening
57	43/4	43.326	2.5x2.5	2.5x2.5	Retaining & Widening
58	45/2	45.264	3.65x3.3	3.65x3.3	Retaining & Widening
59	45/3	45.489	1.8x3.6	1.8x3.6	Retaining & Widening
60	46/1	45.672	1.8x3.5	1.8x3.5	Retaining & Widening
61	46/2	45.784	1.7x3.4	1.7x3.4	Retaining & Widening
62	46/3	45.899	1.8x2.5	1.8x2.5	Retaining & Widening
63	46/4	45.939	1.85x3.5	1.85x3.5	Retaining & Widening
64	46/5	46.042	1.7x3.0	1.7x3.0	Retaining & Widening
65	46/6	46.238	3.1x3.0	3.1x3.0	Retaining & Widening
66	47/1	46.544	4.2x3.8	4.2x3.8	Retaining & Widening
67	47/2	47.169	4.8x3.6	4.8x3.6	Retaining & Widening
68	47/3	47.353	1.8x3.3	1.8x3.3	Retaining & Widening
69	48/1	47.552	4.2x3.6	4.2x3.6	Retaining & Widening
70	48/2	47.833	4.1x4.4	4.1x4.4	Retaining & Widening
71	49/2	48.725	1.85x2.7	1.85x2.7	Retaining & Widening
72	49/3	48.800	3.6x2.9	3.6x2.9	Retaining & Widening
73	50/5	50.093	1.8x2.7	1.8x2.7	Retaining & Widening
74	50/7	50.460	1.45x1.9	1.45x1.9	Retaining & Widening
75	51/5	51.407	1.8x3.0	1.8x3.0	Retaining & Widening
76	52/1	51.611	1.8x2.4	1.8x2.4	Retaining & Widening
77	52/6	52.416	1.7x3.4	1.7x3.4	Retaining & Widening
78	53/2	52.773	1.9x2.0	1.9x2.0	Retaining & Widening
79	53/5	53.390	1.8x3.0	1.8x3.0	Retaining & Widening
80	54/1	53.594	3.7x3.5	3.7x3.5	Retaining & Widening
81	54/2	53.825	3.7x4.0	3.7x4.0	Retaining & Widening
82	55/2	54.746	2.3x2.5	2.3x2.5	Retaining & Widening
83	55/6	55.266	1.2x2.6	1.2x2.6	Retaining & Widening
84	56/3	56.099	3.7x2.5	3.7x2.5	Retaining & Widening
85	56/5	56.449	0.55x1.2	0.55x1.2	Retaining & Widening
86	57/2	56.583	1.5x2.2	1.5x2.2	Retaining & Widening
87	57/3	57.022	1.9x1.2	1.9x1.2	Retaining & Widening
88	57/4	57.256	1.9x1.5	1.9x1.5	Retaining & Widening

Sr. no.	CD No.	Chainage (km)	Existing Size Width x Height (m)	Proposed Size Width x Height (m)	Recommendation
89	57/5	57.465	1.6x1.7	1.6x1.7	Retaining & Widening
90	58/1	57.733	0.9x1.7	0.9x1.7	Retaining & Widening
91	58/4	58.133	1.7x1.25	1.7x1.25	Retaining & Widening
92	64/3	64.057	2.0x2.5	2.0x2.5	Retaining & Widening
93	64/6	64.317	2.0x1.4	2.0x1.4	Retaining & Widening
94	68/4	67.977	2.1x1.0	2.1x1.0	Retaining & Widening
95	69/1	68.556	3.6x1.5	3.6x1.5	Retaining & Widening
96	69/2	68.768	2.0x3.0	2.0x3.0	Retaining & Widening
97	70/2	69.789	4.3x1.6	4.3x1.6	Retaining & Widening
98	70/3	70.167	3.5x1.3	3.5x1.3	Retaining & Widening
99	70/4	70.477	3.6x1.1	3.6x1.1	Retaining & Widening
100	71/2	70.636	2.6x0.95	2.6x0.95	Retaining & Widening
101	71/4	70.911	1.6x0.7	1.6x0.7	Retaining & Widening
102	71/5	71.019	3.6x0.3	3.6x0.3	Retaining & Widening
103	71/7	71.441	3.5x1.15	3.5x1.15	Retaining & Widening
104	72/1	71.626	3.5x1.05	3.5x1.05	Retaining & Widening
105	74/1	73.577	1.4x1.2	1.4x1.2	Retaining & Widening
106	74/3	74.264	1.0x1.0	1.0x1.0	Retaining & Widening
107	74/4	74.404	1.3x1.5	1.3x1.5	Retaining & Widening
108	75/2	74.611	4.5x1.5	4.5x1.5	Retaining & Widening
109	75/3	74.750	1.8x1.0	1.8x1.0	Retaining & Widening
110	75/4	74.877	1.2x1.2	1.2x1.2	Retaining & Widening
111	75/6	75.100	3.0x0.9	3.0x0.9	Retaining & Widening
112	75/7	75.306	4.1x0.9	4.1x0.9	Retaining & Widening
113	75/8	75.502	1.3x0.55	1.3x0.55	Retaining & Widening
114	76/1	75.548	3.7x1.00	3.7x1.00	Retaining & Widening
115	76/2	75.730	1.4x0.85	1.4x0.85	Retaining & Widening
116	76/3	75.852	2.5x2.0	2.5x2.0	Retaining & Widening
117	76/4	75.906	1.2x1.05	1.2x1.05	Retaining & Widening
118	76/5	76.038	1.2x1.2	1.2x1.2	Retaining & Widening
119	76/6	76.141	3.9x1.15	3.9x1.15	Retaining & Widening
120	76/8	76.393	1.0x1.0	1.0x1.0	Retaining & Widening
121	77/1	76.512	0.9x1.1	0.9x1.1	Retaining & Widening
122	77/2	76.979	1.5x1.8	1.5x1.8	Retaining & Widening
123	77/3	77.206	2.5x1.15	2.5x1.15	Retaining & Widening
124	77/4	77.315	0.6x1.55	0.6x1.55	Retaining & Widening
125	78/2	77.934	2.4x1.5	2.4x1.5	Retaining & Widening
126	78/3	78.105	1.5x1.6	1.5x1.6	Retaining & Widening
127	79/3	78.803	3.1x1.9	3.1x1.9	Retaining & Widening
128	79/4	79.221	1.0x1.0	1.0x1.0	Retaining & Widening
129	79/5	79.403	0.65x1.40	0.65x1.40	Retaining & Widening
130	80/2	80N10	1.5x1.3	1.5x1.3	Retaining & Widening
131	80/3	80.494	1.8x1.8	1.8x1.8	Retaining & Widening

Sr. no.	CD No.	Chainage (km)	Existing Size Width x Height (m)	Proposed Size Width x Height (m)	Recommendation
132	81/2	81.155	1.5x2.0	1.5x2.0	Retaining & Widening
133	83/1	82.525	2.5x2.0	2.5x2.0	Retaining & Widening
134	84/3	84.252	1.0x1.55	1.0x1.55	Retaining & Widening
135	85/1	84.708	2.5x1.5	2.5x1.5	Retaining & Widening

Speed Breakers on Side Roads

Speed breaker shall be provided on all cross roads intersecting the project highway as per the design standards indicated in Schedule D.

Environment Management Plan

It includes activities viz. soil erosion control, rehabilitation of borow and quarry sites, monitoring and control of environment components, i.e. Air, Noise, Water, ecology.

Slope Protection

The side slope shall be protected by using suitable slope protection measures wherever required along the project highway

Utilities

Provision of accommodating utilities shall be made both over as well as underground wherever required.

Rainwater Harvesting

As per Ministry of Environment and forest Notification, New Delhi dated 14.011997 (as amended on 13.01.1998, 05.01.1999 & 06.11.2000), the construction of Rainwater, harvesting structure is mandatory in and around Water Crisis area, notified by the Centre Ground Water Board.

Note: Not withstanding anything contained herein above, all structures & works shall conform to Manual & Specification and Standards for 4 laning of highways through Public Private Partnership published by Indian Roads Congress, 2009.

SCHEDULE – C
(See Clause 2.1)

PROJECT FACILITIES

1. **Project Facilities**

The Concessionaire shall construct the Project Facilities in accordance with the provisions of this Agreement. Such Project Facilities shall include:

(a) toll plazas;
(b) roadside furniture;
(c) street lighting;
(d) pedestrian facilities;
(e) tree plantation;
(f) rest areas;
(g) truck lay-bys;
(h) bus-bays and bus shelters;
(i) traffic aid posts;
(j) medical aid posts;
(k) vehicle rescue posts;
(l) telecom system;

2 **Project Facilities for Four-Laning**

Project Facilities forming part of Four-Laning and to be completed on or before the Project Completion Date have been described in Annex-I of this Schedule-C.

3. **Project Facilities for Six-Laning**

Deleted

ANNEXURE - I
(SCHEDULE - C)

PROJECT FACILITIES FOR FOUR LANING

1. **Project Facilities**

The concessionaire shall provide the Project facilities described here under to form part of the Project Highway. The Project facilities shall include:

a. Toll plazas;
b. Roadside furniture;
c. Highway lighting;
d. Pedestrian facilities;
e. Tree plantation;
f. Rest areas;
g. Truck lay-bys;
h. Bus-bays and bus shelters,
i. Traffic aid posts;
j. Medical aid posts;
k. Vehicle rescue posts;
l. Telecom system;

2. **Description of Project Facilities**

a) Toll plaza

There will be two no. of toll plaza on the project corridor as explained below:

i. Toll Plaza No. 1 – at Existing Km 15.000 (Design Km 15.124)

Note: There is an existing Toll Plaza at this location, which is collecting toll for Kharpada Bridge till the year Sept 2015. The concessionaire shall develop a temporary toll plaza at km 20.400 till toll plaza at Km 15.000 is taken over by NHAI. Once the concessionaire develops the toll plaza at Km 15.000, the temporary one at Km 20.400 would be discontinued.

ii. Toll plaza No. 2 - at existing km 66.275 (Design Ch.66.775).

Specifications and other requirements of the toll plaza shall be provided in accordance with Section 10 of the Manual of Specifications and Standards for Four Laning of Highway through PPP published by IRC.

b) Road furniture

Road side furniture shall be provided in accordance with Section 9 of the Manual of Specifications and Standards for Four Laning of Highway through PPP published by IRC and in consultation with IC.

c) **Highway lighting**

Street lighting shall be provided in accordance with Section 12.3 of the Manual of Specifications and Standards for Four Laning of Highway through PPP published by IRC.

d) **Pedestrian facilities**

Pedestrian facilities in the form of guard rail, footpath, lighting, etc. shall be provided in accordance with Section 12.2 of the Manual of Specifications and Standards for Four Laning of Highway through PPP published by IRC.

e) **Tree plantation**

Tree plantation shall be provided in accordance with Section 11 of the Manual of specifications and Standards for Four Laning of Highway through PPP published by IRC.

f) **Rest Area**

Rest area shall be provided at one location i.e. existing 59.750 (RHS) (design Ch. 60.250) in accordance with Section 12.6 of the Manual of specifications and Standards for Four Laning of Highway through PPP published by IRC.

g) **Truck Lay-byes**

The Truck lay-byes proposed in Table C-1 are bare minimum. In the event of any practical difficulty, the locations may be shifted in consultation with IC / NHAI. The Truck lay-byes shall be provided in with Section 12.4 of the Manual of specifications and Standards for Four Laning of Highway through PPP published by IRC.

Table C-1: Proposed Locations of Truck lay Byes

Sr. No.	Location	Length (m)	Side
1	3/149	550	LHS
2	5/654	550	RHS
3	62/749	550	LHS
4	63/513	550	RHS

Note: Chainage shown is with reference to Design Km stones.

h) **Bus-Bays and Bus Shelters**

Bus bays and shelters are to be provided at locations given in Table C-2 and at other locations decided by IC as per local requirement. Concessionaire can change the design of shelter with the approval from IC and NHAI. The bus bays shall be provided in with Section 12.5 of the Manual of specifications and Standards for Four Laning of Highway through PPP published by IRC.

Table C-2: Proposed Bus bay

Sr. No	Chainage	Side	Description
1	1.058	RHS	Palaspe
2	1.140	LHS	Palaspe
3	2.560	LHS	Turmale
4	2.620	RHS	Girwale
5	4.244	RHS	Shirdon
6	4.415	LHS	Shirdon
7	11.162	RHS	Kolhe
8	11.406	LHS	kolhe
9	13.700	RHS	Tara
10	13.902	LHS	Tara
11	14.599	RHS	Kasarbhat
12	14.568	LHS	kasarbhat
13	16.666	RHS	kasarbhat
14	16.725	LHS	kasarbbat
15	18.271	RHS	Kharpada
16	18.349	LHS	Kharpada
17	26.003	RHS	Chinchghar
18	26.003	LHS	Chinchghar
19	28.610	RHS	Pen
20	28.659	LHS	Pen
21	29.495	RHS	Pen
22	29.495	LHS	Pen
23	30.090	RHS	Pen
24	30.096	LHS	Pen
25	37.700	LHS	Gadab
26	37.951	RHS	Gadab
27	39.414	RHS	Gadab
28	39.418	LHS	Gadab
29	42.137	RHS	Kasu
30	42.152	LHS	Kasu
31	44.342	RHS	Salinde
32	44.364	LHS	Salinde
33	45.046	RHS	Nigdi
34	45.064	LHS	Nigdi
35	48.903	RHS	Koleti
36	49.129	LHS	Koleti
37	61.324	RHS	Kansai
38	61.368	LHS	Kansai
39	63.200	LHS	Sakeli
40	68.145	RHS	Kharwali
41	68.265	LHS	Kharwali

Sr. No	Chainage	Side	Description
42	70.392	RHS	Pugaon
43	70.407	LHS	Pugaon
44	75.320	LHS	Kolad railway station
45	76.126	RHS	Talavali
46	76.137	LHS	Talavali
47	78.439	RHS	Bhavan
48	78.468	LHS	Bhavan
49	79.600	RHS	Ghotwal
50	79.600	LHS	Ghotwal
51	82.570	RHS	Nagnoli
52	84.330	RHS	Potner

Note: Chainage shown is with reference to proposed km stones.

i) Traffic aid posts

Traffic aid booth shall be provided in accordance with Section 12.8 of the Manual of Specifications and Standards for Four Laning of Highway through PPP published by IRC.

j) Medical aid post

Necessary medical aid shall be provided in accordance with Section 12.9 of the Manual of Specifications and Standards for Four Laning of Highway through PPP published by IRC.

k) Vehicle Rescue posts

Vehicle rescue post shall be provided in accordance with Section 12.10 of the Manual of Specifications and Standards for Four Laning of Highway through PPP published by IRC

l) Telecom System

Telecom posts shall be provided in accordance with Section 12.11 of the Manual of Specifications and Standards for Four Laning of Highway through PPP published by IRC.

SCHEDULE – D
(See Clause 2.1)

SPECIFICATIONS AND STANDARDS

1 Four-Laning

The Concessionaire shall comply with the Specifications and Standards set forth in Annex-I of this Schedule-D for construction of the Four-Lane Project Highway.

2 Six-Laning

Deleted.

ANNEX - I
(Schedule-D)

SPECIFICATIONS AND STANDARDS FOR FOUR-LANING

1. **Manual of Specifications and Standards to apply**

Subject to the provisions of Paragraph 2 of this Annex-I, Four-Laning of the Project Highway shall conform to the Manual of Specifications and Standards for Four laning of highways through PPP published by the IRC. (IRC SP 84:2009)

2. **Deviations from the Manual**

Notwithstanding anything to the contrary contained in the aforesaid Manual, the following Specifications and Standards shall apply to the Four-Lane Project Highway, and for purposes of this Agreement, the aforesaid Manual shall be deemed to be amended to the extent set forth below.

Deviation of Design from "Manual of Specification and Standards for 4-laning of National Highways through PPP"

Sr. No.	Section No./ Clause No.	Item	Provisional of Manual	Deviation from Manual/ Standard followed
1	Section 2 Clause 2.5.1	Width of Median	Width of median in plain & rolling terrain in approach to grade separated structures 4.5 m.	Width of median in plain & rolling terrain in approach to grade separated structures 2.0 m.
2	Section 7 Clause 7.7 (ii)	Pipe Culvert	Existing culvert of diameter 900mm and above, which is in sound condition and functioning satisfactorily, may be extended, using pipe of same diameter.	Existing culvert of diameter 1000mm and above, which are in sound condition and functioning satisfactorily, may be retained and extended.
3	Section 7 Clause 7.7 (ii)	Pipe Culvert	All existing culverts of diameter less than 900mm shall be replaced with pipe of minimum 1200mm diameter under both carriageways.	All existing culverts of diameter less than 1000mm shall be dismantled and reconstructed.

Four-laning of Highways
through
Public Private Partnership

MANUAL
OF
SPECIFICATIONS & STANDARDS

Planning Commission
Government of India
New Delhi

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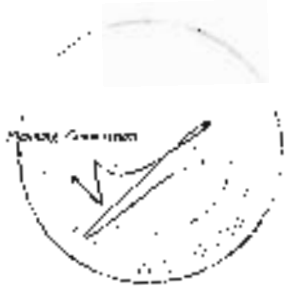


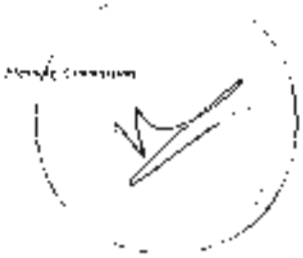
Appendices

Foreword

The Eleventh Plan envisages an investment of Rs. 3,14,152 crore (US$ 80 billion) in the road sector, of which Rs. 1,06,792 crore (US$ 27 billion) is expected from Public Private Partnerships (PPPs) that would serve as the vehicle for attracting private capital in public infrastructure projects aimed at improving efficiencies and reducing costs. Besides the Central Government, several states are pursuing PPPs for developing their respective highways.

A well-defined policy and regulatory framework consistent with international best practices has since been adopted for application to PPP projects in the highway sector. This is reflected in the standardised documents for bidding and award of projects. In particular, the Government of India has adopted a Model Concession Agreement (MCA) for PPPs in National Highways. On similar lines, the Planning Commission has published an MCA for State Highways. These MCAs follow the Design, Build, Finance and Operate (DBFO) approach that requires the Concessionaire to bear the responsibility for detailed design. However, the responsibility for providing safe and reliable roads ultimately rests with the Government and the MCA, therefore, mandates a Manual of Standards and Specifications that the concessionaire must conform to.

Consistent with the DBFO approach, only the core requirements of design, construction, operation and maintenance of the project highway are to be specified. In sum, the framework should focus on the 'what' rather than the 'how' in relation to the delivery of services by the concessionaire. This would enable cost efficiencies to occur because the shift to output based specifications would provide the private sector with a greater opportunity to add value by innovating and optimising designs in a way normally denied to it under conventional input-based procurement specifications.



For evolving standards conforming to the DPR approach, the Planning Commission asked the Indian Roads Congress (IRC), the apex institution of highway engineers in India, to develop this Manual of Standards and Specifications for four lane highways. The Manual has been evolved after extensive consultations with experts and stakeholders. Following the conventions of IRC, deliberations on this Manual were undertaken in several workshops where experts drawn from the Central and State governments, private sector entities, academia and research organisations participated. A Round Table was also organised at the Planning Commission where representatives of Central and State Governments participated, besides several other stakeholders and experts. The present document represents a broad consensus arising out of the aforesaid consultations spanning over four years. This has since been approved by the Council of the Indian Road Congress.

The Manual would, by reference, form an integral part of the MCA and would be binding on the concessionaire. Its provisions would be enforceable and any breach would expose the concessionaire to penalties, including termination of the concession.

The Manual is to be used in relation to Schedule D of the MCA. Besides integrating this Manual into the concession agreement, the said schedule permits deviations from the Manual to address project-specific requirements. However, all such deviations would need to be stated precisely with a view to enabling bidders to assess their costs with some degree of accuracy.

Since the concessionaire would be contractually bound by the provisions of the Manual, care has been taken to ensure that it is consistent with the provisions of the MCA. This Manual and the MCA together should facilitate the respective Governments in taking up a large programme for development of safe and reliable roads through PPP with least cost to the

users and to the public exchequer.

The Manual reflects a delicate balance that was arrived at after extensive deliberations with a view to ensuring development of quality roads and at the same time improving their financial viability by optimizing up costs and obligations. Modifications, if any, should be made by the executing agencies with due regard to their legal, financial and technical implications on the underlying contractual framework.

The office-bearers of IRC, especially its President and Secretary General are to be complimented for their commendable effort in producing this volume with the assistance of eminent experts. The consultative process adopted by the IRC and its experts has helped build a consensus that would enhance the acceptability of this Manual among users, experts and stakeholders. Their contribution would go a long way towards the development of highways through PPPs - a modality that has become inevitable for attracting even larger volumes of investment to this sector.

(Gajendra Haldea)
Adviser to Deputy Chairman,
Planning Commission

May 28, 2010

Section 1

General

SECTION 1

GENERAL

1.1 This Manual is applicable for Four Laning of Highways through Public Private Partnership (PPP) mode. The scope of the work shall be as defined in the Concession Agreement. This Manual shall be read harmoniously with the intent of the Concession Agreement.

1.2 The Project Highway and the project facilities shall conform to the requirements of design and specifications set out in this Manual, which are the minimum prescribed. The project report and other information provided by the Authority[1] shall be used by the Concessionaire only for its own reference and for carrying out further investigations. The Concessionaire shall be solely responsible for undertaking all the necessary surveys, investigations and detailed designs in accordance with good industry practice and due diligence, and shall have no claim against the Authority for any loss, damage, risk, costs, liabilities or obligations arising out of or in relation to the project report and other information provided by the Authority.

1.3 At least 2 weeks prior to commencement of the work, the Concessionaire shall draw up a Quality Assurance Manual (QAM) covering the Quality System (QS), Quality Assurance Plan (QAP) and documentation for all aspects of the bridge and road works and send three copies each to the Independent Engineer (IE) for review. The class of quality assurance shall not be less than Q-3. (Refer IRC SP:47 and IRC:SP:57)

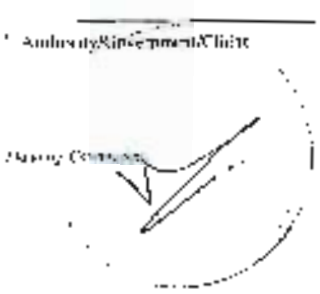
1.4 The Codes, Standards and Technical Specifications applicable for the design and construction of project components are:

(i) Indian Roads Congress (IRC) Codes and Standards: (Refer Appendix-2).

(ii) Specifications for Road and Bridge Works issued by the Ministry of Road Transport & Highways (MORTH) hereinafter referred to as MORTH or Ministry's Specifications.

(iii) Any other standards referred to in the Manual and any supplement issued with the bid document.

[1] Authority/Employer/Client



1.5 Latest version of the Codes, Standards, Specifications, etc., notified/published at least 60 days before the last date of bid submission shall be considered applicable.

1.6 The terms 'Ministry of Surface Transport', 'Ministry of Shipping, Road Transport & Highways' and 'Ministry of Road Transport and Highways' or any successor or substitute thereof shall be considered as synonymous.

1.7 The terms 'Inspector' and 'Engineer' used in MORTH Specifications shall be deemed to be substituted by the term "Independent Engineer", to the extent it is consistent with the provisions of the Concession Agreement and this Manual. The role of the Independent Engineer shall be as defined in the Concession Agreement.

1.8 In case of any conflict or inconsistency in the provisions of the applicable IRC Codes, Standards or MORTH Specifications, the provisions contained in this Manual shall apply.

1.9 In the absence of any specific provision on any particular issue in the aforesaid Codes or Specifications read in conjunction with the Specifications and Standards contained in this Manual, the following standards shall apply in order of priority.

(i) Bureau of Indian Standards (BIS)

(ii) American Association of State Highway and Transportation Officials (AASHTO) Standards or American Society for Testing and Materials (ASTM) Standards or Euro Codes or British Standards or Australian Standards

(iii) Any other specifications/standards proposed by the Concessionaire and reviewed by the IE.

1.10 All items of building works shall conform to Central Public Works Department (CPWD) Specifications for Class I building works[1] and standards given in the National Building Code (NBC). For the Project Highway through the state entity, to the extent specific provisions for building works are made in IRC/MORTH Specifications, the same shall prevail over the CPWD/NBC provisions. For this purpose, building works shall be deemed to include toll plaza complex, road furniture, roadside facilities, landscape elements and/or any other works incidental to the building works.

[1] The State Government may prescribe its own Std. PWD Specifications, if so desired.

1.11 Guidelines for Preparing Schedules of the Concession Agreement

Certain paras (full or part) in Sections 1 to 13 of this Manual refer to the Schedules of the Concession Agreement. While finalizing the feasibility/project report for the Project Highway, and the scope of the project, each of these Paras should be carefully examined and addressed by the Authority with a view to making appropriate provisions in the Schedules of the Concession Agreement. (A list of the Paras that refer to such Schedules has been provided at Appendix-1 for ready reference).

1.12 Alternative Standards and Specifications

The requirements stated in the Manual are the minimum. The Concessionaire will, however, be free to adopt international practices, alternative specifications, materials and standards to bring in innovation in the design and construction provided they are better or comparable with the standards prescribed in the Manual. The specifications and techniques which are not included in the MORTH /IRC Specifications shall be supported with authentic standards and specifications mentioned in Para 1.9. Such a proposal shall be submitted by the Concessionaire to the Independent Engineer. In case, the Independent Engineer is of the opinion that the proposal submitted by the Concessionaire is not in conformity with any of the international standards or codes, then he will record his reasons and convey the same to the Concessionaire for compliance. A record shall be kept by the Independent Engineer, of the non compliance by the Concessionaire of the minimum Specifications and Standards specified in the Manual. Adverse consequences, if any, arising from any such non-compliance, shall be treated as "Concessionaire Default" and shall be dealt in accordance with the provisions of the Concession Agreement.

1.13 General considerations for planning, design and construction

The Project Highway shall be planned as a "partially access controlled highway" where access to the highway shall be provided only at pre-determined locations. In doing so, the Concessionaire shall take measures to overcome the physical and operational constraints and plan, design and construct the Project Highway using appropriate methods, management techniques and technologies. General consideration shall, without being limited to, be as follows:

(a) The constraints

The physical constraints in the existing highway are in the form of limitation of right of way, un-regulated access, inadequate service roads and underpasses, numerous

at grade junctions, lack of physical separation between local and through traffic etc. The operation constraints arise out of the necessity or possibility of closing a portion of the road for construction and/ or diverting the traffic to temporary diversions, thereby reducing the capacity and safety of the existing highway. The solutions evolved by the Concessionaire shall be such that these operational constraints are overcome through appropriate planning, design and construction method, techniques and technologies and by adopting suitable traffic management measures.

(b) Safety of design

All designs shall be safe to ensure that the Project Highway or any part thereof (for example embankment, pavement, retaining structures, bridges, culverts, etc) does not collapse (global stability) nor its serviceability/performance (for example settlement, roughness, undulations, deflections, etc) deteriorates below acceptable level as prescribed in Schedule-K of the Concession Agreement

(c) Durability

The Project Highway shall not only be safe but also durable. This would mean that the deteriorating effects of climate and environment (for example wetting and drying, freezing and thawing, if applicable, temperature differences, aggressive environment leading to corrosion, etc) in addition to the traffic shall be duly considered in design and construction to make the Project Highway durable.

(d) Mitigating disruptive effects of construction

The planning, design and construction of the highway shall be such that the construction of Project Highway does not have adverse impact on the environment and does not disrupt the lives and business activities of the people living close to the Project Highway

1.14 Safety during Construction and Operation & Maintenance

1.14.1 The Concessionaire shall develop, implement and administer a surveillance and safety programme for providing a safe environment on or about the Project Highway, and shall comply with the safety requirements set forth in the Concession Agreement.

1.14.2 Before taking up any construction or maintenance operations, the Concessionaire shall prepare a Traffic Management Plan for each work zone and submit it to the Independent Engineer for comments duly incorporating the following:

(i) Designate a Site Safety Team headed by a qualified Safety Officer.

(ii) Traffic safety devices as per IRC SP:55 with the following specifications

(a) Signages of retro-reflective sheet of high intensity grade.

(b) Delineators in the form of cones/drums (300 to 500 mm dia and 1000 mm high) made of plastic/ rubber having retro reflective red and white band, at a spacing of maximum 5 m along with a reflective tape (red and white band) to be tied in between the gaps of cones/drums. A bulb/ flasher using solar energy is to be placed on the top of the cone/drum for night delineation

(c) Barricades using iron sheet (plain) with adequate iron railing/frame painted with retro reflective paint in alternate black and white (or yellow and black) stripes. Warning lights at 5.0 m spacing shall be mounted on the barricades and kept lit in the dark hours and night.

(iii) The arrangement of traffic during construction and maintenance shall conform to the requirements of Clause 112 of MORTH Specifications. Ensure availability of 7 m paved carriageway for traffic without potholes or other defects. At locations where available carriageway is less than 7 m, provide round the clock traffic signals with marshals carrying mobile/walky-talky at both ends to control both directions of traffic.

(iv) Sprinkling of water for dust control at work zones, haul roads and plant/camp sites.

(v) Noise/Pollution suppression measures at work zones, haul roads and plant/camp sites.

(vi) Mechanical, electrical and fire safety practices

(vii) Safety measures like PPE (Personal Protection Equipment) for workers engaged.

(viii) First Aid and Emergency Response Arrangements i.e. First Aid Box, Ambulance, paramedical staff, alarms, etc

(ix) Safety training/awareness programmes.

(x) Formats to maintain the accident records/emergency response provided during accidents.

(xi) A penalty scheme for violations in provision of adequate traffic control devices and proper traffic management should be proposed by the Concessionaire. In case

of default, the amount of penalty shall be paid by the Concessionaire to the Authority.

(xii) A compensation scheme including insurance cover for third party for workers, road users and road side residents in case of death/injury/damage to the vehicle/property resulting from accidents on the Project Highway, irrespective of the person at fault should be proposed by the Concessionaire.

1.14.3 The Concessionaire shall also be responsible for ensuring compliance of all labour laws and regulations including those relating to the welfare of workers engaged both directly and indirectly on the Project Highway, besides their occupational safety and health.

1.15 The Concessionaire shall set up field laboratory for testing of materials and finished products as stipulated in Clause 121 of MORTH Specifications. It shall make necessary arrangements for additional/confirmatory testing of any materials/products at the government accredited laboratory, for which facilities at site laboratory are not available.

1.16 Environment Mitigation Measures

The Concessionaire shall carry out tests/ monitor various parameters impacting the environment of the Project Highway keeping in view the guidelines of the Ministry of Environment and Forests and submit proposals for mitigation of adverse environment impact including provision of noise barriers, etc. for review and comments of the IE, if any and undertake implementation of the proposals in consultation with the IE.

1.17 Utilities

The details of the new utilities which are to be constructed or provided for along or across the Project Highway shall be as specified in Schedule-B of the Concession Agreement.

1.18 Review and comments by the Independent Engineer

In cases where the Concessionaire is required to send any drawings or documents to the Independent Engineer for review and comments, and in the event such comments are received by the Concessionaire, it shall duly consider such comments in accordance with the Concession Agreement and Good Industry Practice for taking appropriate action thereon. The correspondence between the Concessionaire and the Independent Engineer

shall be deemed valid only if a copy thereof is endorsed to and received by the Authority.

1.19 Definitions and Interpretation

1.19.1 Unless specified otherwise in this Manual, the definations contained in the Model Concession Agreement (MCA) for Public Private Partnership (PPP) in Highways as published by the Planning Commission, Government of India, shall apply

1.19.2 Built up area shall mean sections of the Project Highway that are situated within the limits of a municipal town and shall include sections of 200 m or more in non-municipal areas where dwellings/shops have been built on one or both sides of the Project Highway on at least 50 per cent of the total length comprising such section. The Built up areas shall be as specified in Schedule-B of the Concession Agreement.

1.19.3 The definition of PCU used in this Manual shall be as per IRC Codes and Guidelines.

1.20 This Manual is for 4 laning of the Project Highway. However, in some stretches, as indicated in Schedule-B of the Concession Agreement, 6-lane divided carriageway shall be provided as part of 4-laning of the Project Highway (Refer para 2.18). This shall not be construed as 6 laning of the Project Highway.

Section 2

Geometric Design and General Features

SECTION 2

GEOMETRIC DESIGN AND GENERAL FEATURES

2.1 General

(i) This section lays down the standards for geometric design and general features for four-lane divided carriageway.

(ii) (a) In built-up areas, 6-lane divided carriageway along with service roads shall be provided as part of 4-laning of the Project Highway. Such stretches where the requirement of 6-laning is dispensed with and only 4-laning with or without service road and footpath is to be provided will be as indicated in Schedule-B of the Concession Agreement.

(b) Where there is constraint of ROW width, the Authority may specify construction of a bypass. The alignment of the bypasses shall be as specified in Schedule B and in conformity with the site earmarked in Schedule-A of the Concession Agreement.

(iii) The geometric design of the Project Highway shall conform to the standards set out in this section as a minimum.

(iv) As far as possible, uniformity of design standards shall be maintained throughout the length of the Project Highway. In case of any change, it shall be effected in a gradual manner.

(v) Where the existing road geometrics are deficient with respect to minimum requirements and its improvements to the prescribed standards is not feasible due to any constraint in acquisition of additional land, such stretches shall be as specified in Schedule B of the Concession Agreement.

(vi) Existing horizontal curves, which are found deficient in radius, layout, transition lengths or super-elevation shall be corrected to the standards specified in this section.

(vii) Any deficiencies in the vertical profile in respect of grades, layout of vertical curves and sight distance shall be corrected to meet the minimum requirements specified in this section.

2.2 Design Speed

2.2.1 The design speeds given in Table 2.1 shall be adopted for various terrain classification. Terrain is classified by the general slope of the ground across the highway alignment.

Table 2.1: Design Speed

Nature of Terrain	Cross slope of the ground	Design speed (km/hr)	
		Ruling	Minimum
Plain and rolling	Up to 25 per cent	100	80
Mountainous and steep	More than 25 per cent	60	40

Short stretches (say less than 1 km) of varying terrain met with on the road stretch shall not be taken into consideration while deciding the terrain classification for a given section of Project Highway.

2.2.2 In general, the ruling design speed shall be adopted for the various geometric design features of the road. Minimum design speed shall be adopted only where site conditions are restrictive and adequate land width is not available. Such stretches shall be as indicated in Schedule B of the Concession Agreement.

2.3 Right-of-Way

The ROW available for the Project Highway shall be as given in Schedule-A of the Concession Agreement. The Authority would acquire the additional land required, if any. The land to be acquired shall be indicated in Schedule-B of the Concession Agreement. The minimum Right of Way for non urban and urban areas should be as prescribed in IRC:73 and IRC:86 respectively.

2.4 Lane width of Carriageway

The standard lane width of the Project Highway shall be 3.5 m.

2.5 Median

2.5.1 The median shall be either raised or depressed. The width of median is the distance between inside edges of carriageway. The type of median shall depend upon the availability of Right of Way. The minimum width of median, subject to availability of Right of Way, for various locations shall be as in Table 2.2.

Table 2.2: Width of Median

Type of Section	Minimum Width of Median (m)		
	Plain and Rolling terrain		Mountainous and Steep terrain
	Raised	Depressed median	Raised
Open country with isolated built up area	4.5	7.0	2.0
Built up area	2.0	Not Applicable	2.0
Approach to grade separated structures	4.5	Not Applicable	2.0

The type and widths of median in various stretches of Project Highway shall be as indicated in Schedule B.

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

2.5.3 In case of depressed median, a minimum 0.6 m width adjacent to carriageway in either direction shall be paved

2.5.4 As far as possible, the median shall be of uniform width in a particular section of the highway. However, where changes are unavoidable, a transition of 1 in 20 shall be provided.

2.5.5 In the case of depressed median, metal beam type (double beam) crash barriers shall be provided at either side of the median. Suitable stubs as per Section 11 of this Manual shall be provided

2.5.6 Suitable antiglare measures such as metal/plastic screens shall be provided in flat stretches or on horizontal curves to reduce headlight glare from opposite traffic. The total height of screen including the height of the barrier shall be 1.5 m.

2.6 Shoulders

2.6.1 *Width of Shoulders*

The shoulder width on the outer side (left side of carriageway) shall be as given in Tables 2.3 and 2.4.

Table 2.3: Width of Shoulders in Plain and Rolling Terrain

Type of Section	Width of Shoulder (m)		
	Paved	Earthen	Total
Open country with isolated built up area	1.5	2.0	3.5
Built up area	2.0		2.0
Approaches to grade separated structures	2.0	-	2.0
Approaches to bridges	1.5	2.0	3.5

Table 2.4: Width of Shoulders in Mountainous and Steep Terrain (Hilly Area)

Type of Section	Width of Shoulder, including drain and crash barrier as applicable (m)	
Open country with isolated built up area	1.5 (on hill side) 2.0 (on valley side)	Earthen Shoulders
Built up area and approaches to grade separated structures /bridges	1.5 (on hill side) 2.0 (on valley side)	Raised Footpath along with provision of adequate drainage along and across the footpath

Note: In mountainous and steep terrain, the scope of work defined by the Authority may be two-lane carriageways on different alignments (contours). In that case, IRC:SP:73–2007 Manual of Specifications and Standards for two laning of Highways shall apply to the two-lane carriageways on different alignments (contours).

2.6.2 *Type of Shoulder*

The type of shoulder shall be as below:

(i) In the built up sections and approaches to the grade separated structures, the shoulder shall be paved in full width

(ii) Earthen shoulders shall be covered with 150 mm thick layer of granular material conforming to the requirements given in Clause 401 of MORTH Specifications.

(iii) In embankments with height more than 6.0 m, the granular shoulder may be raised with provision of kerb channel to channelize the drainage as an erosion control device in accordance with Section 6

(iv) The composition and specification of the paved shoulder shall be same as of the main carriageway.

2.7 Roadway Width

2.7.1 The width of roadway shall depend upon the width of carriageway, shoulders and the median.

2.7.2 On horizontal curves with radius up to 300 m, width of pavement and roadway in each carriageway shall be increased as per Table 2.5.

Table 2.5: Extra Width of Pavement and Roadway in each carriageway

Radius of Curve	Extra Width
75-100 m	0.9 m
101-300 m	0.6 m

2.8 Crossfall

2.8.1 The crossfall on straight sections of road carriageway, paved shoulders and paved portion of median shall be 2.5 per cent for bituminous surface and 2.0 per cent for cement concrete surface.

2.8.2 The crossfall shall be unidirectional for either side carriageway sloping towards the shoulder in straight reaches and towards the lower edge on horizontal curves. The camber on the existing road shall be modified to unidirectional crossfall.

2.8.3 The crossfall for granular shoulders on straight portions shall be at least 0.5 per cent steeper than the slope of the pavement and paved shoulder subject to a minimum of 3.0 per cent. On super elevated sections, the earthen portion of the shoulder on the outer side of the curve would be provided with reverse crossfall of 6.0 per cent so that the earth does not drain on the carriageway and the storm water drains off with minimum travel path.

2.9 Geometric Design

2.9.1 Geometric design shall conform to IRC:73, except as otherwise indicated in this Manual.

2.9.2 All horizontal curves shall consist of circular portion flanked by spiral transitions at both ends.

2.9.3 Superelevation

Superelevation shall be limited to 7 per cent, if radius of curve is less than desirable minimum radius. It shall be limited to 5 per cent, if radius is more than desirable minimum

2.9.4 *Radii of Horizontal Curves*

The minimum and absolute minimum radii of horizontal curves for various classes of terrain are given in Table 2.6

Table 2.6: Minimum Radii of Horizontal Curves

Nature of terrain	Desirable minimum	Absolute minimum
Plain and rolling	400 m	250 m
Mountainous and steep	150 m	75 m

The radius of horizontal curves for various terrain conditions shall not be less than the desirable minimum values given in Table 2.6 except for Sections as indicated in Schedule B. For such Sections, the radius shall not be less than absolute minimum.

2.9.5 *Sight Distance*

The safe stopping sight distance and desirable minimum sight distance for divided carriageway for various design speeds are given in Table 2.7. The desirable values of sight distance shall be adopted unless there are site constraints. A minimum of safe stopping sight distance shall be available throughout.

Table 2.7: Safe Sight Distance

Design Speed (km/hr)	Safe Stopping sight distance (m)	Desirable minimum sight distance (m)
100	180	360
80	130	260
60	90	180
40	45	90

2.9.6 *Vertical Alignment*

2.9.6.1 The vertical alignment should provide for a smooth longitudinal profile. Grade changes shall not be too frequent as to cause kinks and visual discontinuities in the profile. In this regard, directions given in IRC:73 should be kept in view.

2.9.6.2 Gradients

The ruling and limiting gradients are given in Table 2.8.

Table 2.8: Gradients

Nature of terrain	Ruling gradient	Limiting gradient
Plain and rolling	3.3%	5.0%
Mountainous	5.0%	6.0%
Steep	6.0%	7.0%

2.9.6.3 Long sweeping vertical curves shall be provided at all grade changes. These shall be designed as square parabolas.

2.9.6.4 Design of vertical curves and its coordination with horizontal curves, shall be in accordance with IRC:SP:23.

2.10 Lateral and Vertical Clearance at Underpasses

Wherever a cross road is proposed to be taken below the Project Highway, minimum clearances at underpasses shall be as follows.

2.10.1 *Lateral Clearance*

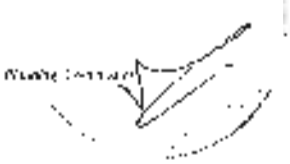
(i) Full roadway width at the approaches shall be carried through the underpass. This width shall not be less than 12 m (7 m carriageway + 2 × 2.5 m shoulder width on either side) or as indicated in Schedule-B.

(ii) Guardrails/crash barriers shall be provided for protection of vehicles from colliding with the abutments and piers and the deck of the structures.

(iii) The width of cattle and/or pedestrian underpass shall not be less than 5 m.

2.10.2 *Vertical Clearance*

Vertical clearance at underpasses shall not be less than the values given below:



(i)	Vehicular underpass	5.5 m
(ii)	Pedestrian and Cattle underpass	3.0 m (to be increased to 4.5m, in case certain categories of animals such as elephant/camel are expected to cross the Project Highway frequently. This will be as specified in Schedule B.)

Wherever existing slab culverts and minor bridges allow a vertical clearance of more than 2 m, these can be used in dry season for pedestrian and cattle crossing by providing necessary fencing. This will not be a substitute for normal requirements of pedestrian and cattle crossings as per para 2.13.3.

2.11 Lateral and Vertical Clearance at Overpasses

Wherever any structure is provided over the Project Highway; the minimum clearances at overpasses shall be as follows:

2.11.1 *Lateral Clearance*

Full roadway width shall be carried through the overpass structure unless otherwise specified in Schedule-B. Provision shall also be made for future widening of the Project Highway to 6-lane with service roads. The abutments and piers shall be provided with suitable protection against collision of vehicles. Crash barriers shall be provided on abutment side and on sides of piers for this purpose. The ends of crash barriers shall be turned away from the line of approaching traffic.

2.11.2 *Vertical Clearance*

A minimum 5.5 m vertical clearance shall be provided at all points of the carriageway of the Project Highway.

2.12 Access Control

2.12.1 *Access*

Access to the Project Highway shall be partially controlled. In general, access to the Project Highway shall be provided at the following locations:

(i) Intersection with National Highways

(ii) Intersection with State Highways

(iii) Intersection with Major District Roads

(iv) Intersection with Village Roads/Other District Roads, subject to a minimum distance of 3 km from the nearest intersection.

The locations of intersections shall be specified in Schedule-B

2.12.2 *Service Roads*

2.12.2.1 The location and length of service roads, to be constructed by the Concessionaire shall be specified in Schedule-B of the Concession Agreement. The width of the service road shall be 7.0 m.

2.12.2.2 For the stretches where total length of a bridge is less than 60 m and the service road is required to be provided on both sides of the stream, then the service road, shall continue across the stream and suitably designed 2-lane bridge structure shall be provided. In cases involving bridges of 60 m length or more, separate bridge structures may not be provided and service road shall be merged with the Project Highway at 50 m distance before the bridge structure, unless otherwise specified in Schedule-B of the Concession Agreement.

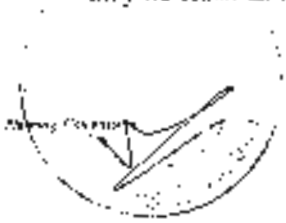
2.12.2.3 Wherever service roads are provided, provision shall be made for proper entry and exit ramps between the main highway and the service roads, duly keeping in view future widening of main highway to six-lanes. The layout shall be as per Figure 2.1A to 2.1D

2.13 Grade Separated Structures

2.13.1 The type, location, length, number and the openings required and approach gradients for various grade separated structures shall be as specified in Schedule-B of the Concession Agreement. The approach gradient to the grade separated structure shall not be steeper than 2.5 per cent (1 in 40).

2.13.2 *Vehicular Underpass/Overpass*

The vehicular under/overpass structures shall be provided at the intersection of the Project Highway with all the National Highways and State Highways. Such under/over passes shall also be provided across other categories of roads carrying an average daily traffic of more than 5000 Passenger Car Units (PCUs) on the date of inviting bid. The structure may be either an underpass or an overpass depending upon the nature of terrain, vertical



profile of road, availability of adequate right of way, etc. Unless otherwise specified in Schedule B of the Concession Agreement, the Project Highway shall be carried at the existing level in rural areas and the cross road would be either an underpass or overpass and the entire cost involved in lowering or raising, the existing cross road would be included as part of the cost of the Project Highway. However, in urban areas, the cross road shall be carried at the existing level, unless otherwise specified in Schedule-B of the Concession Agreement. Decision whether the cross road or the Project Highway will be carried at the existing level will be taken at the time of preparing the feasibility report and would be based on considerations of drainage, land acquisition, provision of ramps for the grade separated facility, height of embankment and project economy etc

2.13.3 *Cattle and Pedestrian Underpass/Overpass*

These shall be provided as specified in Schedule-B of the Concession Agreement.

(i) An underpass/overpass for crossing of cattle and pedestrians may not be necessary within a distance of 2 km from Vehicular underpasses.

(ii) The width of Pedestrian or Cattle crossing shall not be less than 5 m.

(iii) The pedestrian crossings shall have provision for movement of physically challenged persons.

(iv) Underpasses shall be preferred to overpasses.

(v) Pedestrian underpass/overpass shall also be provided within a distance of 200 m from a school or hospital or factory/industrial area.

2.13.4 Road Over Bridges (ROBs)/Road Under Bridges (RUBs) shall be provided as per Section 7 of this Manual.

2.14 Median openings

2.14.1 Median openings shall not be spaced closer than 2 km. Additional controlled openings shall also be provided for inspection, and diversion of traffic during, repair and rehabilitation.

2.14.2 Median opening shall not be provided in front of the service road entry. The distance between the service road entry and the median opening shall be at least equal to the sum of length of acceleration lane, weaving length, and deceleration length. Location of opening shall be so decided as to minimize turnallow. This distance shall however be not less than 150 m.

2.14.3 All median openings shall be provided with additional 3.5 m wide shelter lane by the side of median in both directions for waiting of vehicles to take U turn. Wherever required, horizontal geometries of the road shall be suitably adjusted.

2.14.4 Length of median opening shall not be less than 20 m.

2.15 Fencing

Fencing shall be provided between the service road and the Project Highway to prevent the pedestrians, local vehicles and animals entering the highway. The fencing shall be either of metal double beam crash barrier or pedestrian guardrail given in Para 9.10 of this Manual.

2.16 Typical cross sections

Typical cross sections of Project Highway are given in Fig 2.2 to 2.10 for various locations as below:

Figure 2.2 shows typical cross section Type A1 for 4 lane divided highway in open country with isolated built up area in plain/rolling terrain, without service roads and with depressed median.

Figure 2.3 gives typical cross section Type-A2 for 4 lane divided highway in open country in plain/rolling terrain with service roads on both sides and with depressed median.

Figure 2.4 shows typical cross section Type A3 for 4-lane divided highway in open country with isolated built up area in plain/rolling terrain, without service roads and with raised median.

Figure 2.5 gives typical cross section Type-A4 for 4 lane divided highway in open country in plain/rolling terrain with service roads on both sides and with raised median.

Figure 2.6 shows typical cross section Type-B for 4-lane divided highway in built-up section in plain and rolling terrain with service roads on both sides and with raised median.

Figure 2.7 shows typical cross section Type-C1 for 4 lane divided highway on different contours in open country with isolated built-up area in mountainous terrain.

Figure 2.8 shows typical cross section Type C2 for 4 lane divided highway on different contours in built up section in mountainous terrain.

Figure 2.9 shows typical cross section Type-C3 for 4 lane divided highway at same level in open country with isolated built up area in mountainous terrain.

Figure 2.10 shows typical cross section Type-C4 for 4 lane divided highway at same level in built up section in mountainous terrain.

2.17 Capacity of Four-lane highway

For the purpose of augmentation of the facilities and upgradation of the Project Highway, the design service volume for different terrain conditions and level of service shall be as specified in Table 2.9.

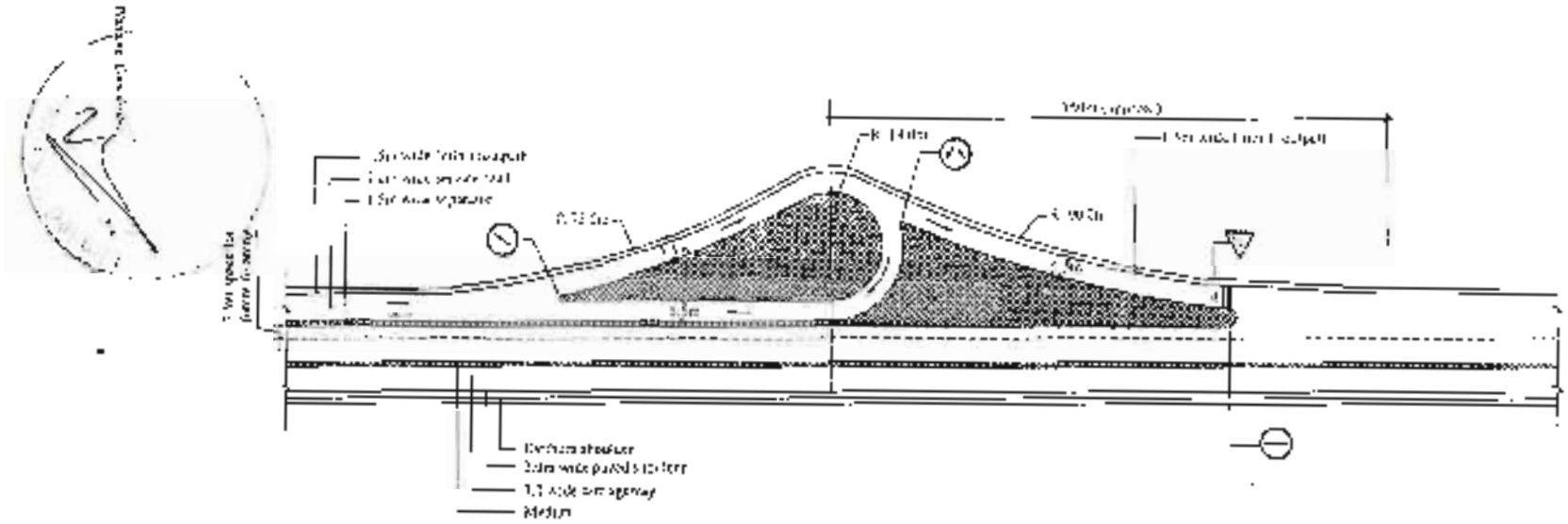
Table 2.9: Design Service Volume for Four-Lane Highways in PCUs per day

Terrain	Design Service Volume in PCUs per day	
	Level of Service 'B'	Level of Service 'C'
Plain and rolling	40,000	60,000
Mountainous and steep	20,000	30,000

Note: The definition of PCU here is as per IRC Codes and Guidelines and not the definition given in MCA.

2.18 Warrants for Six-Laning

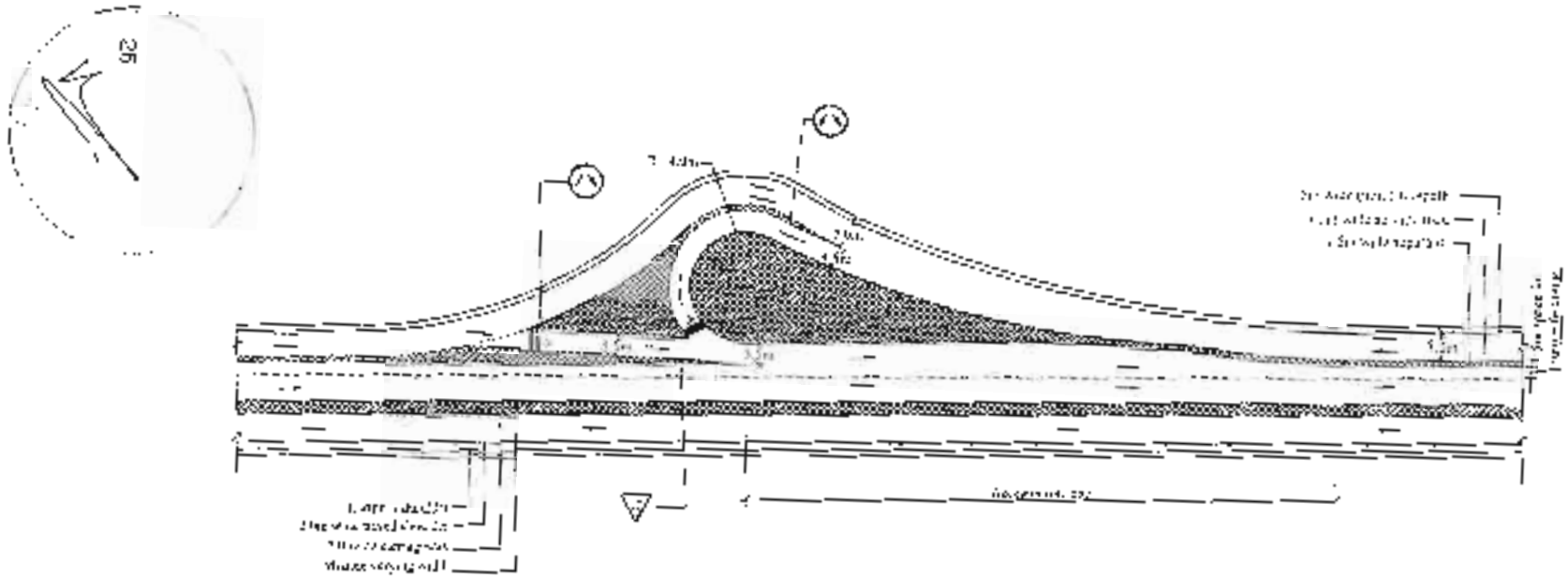
Unless otherwise specified in the Concession Agreement, the Project Highway shall be widened to 6 lane when total traffic including the traffic on service roads, if any, reaches the design service volume corresponding to Level of Service 'C' for 4 lane highway specified in Table 2.9.



Note:
1. Detailed System of Road Marking as per IRC:35.
2. Detailed System of Road Signs as per IRC:67.

Suggestive layout for entry ramp to highway
(At the end of service road)

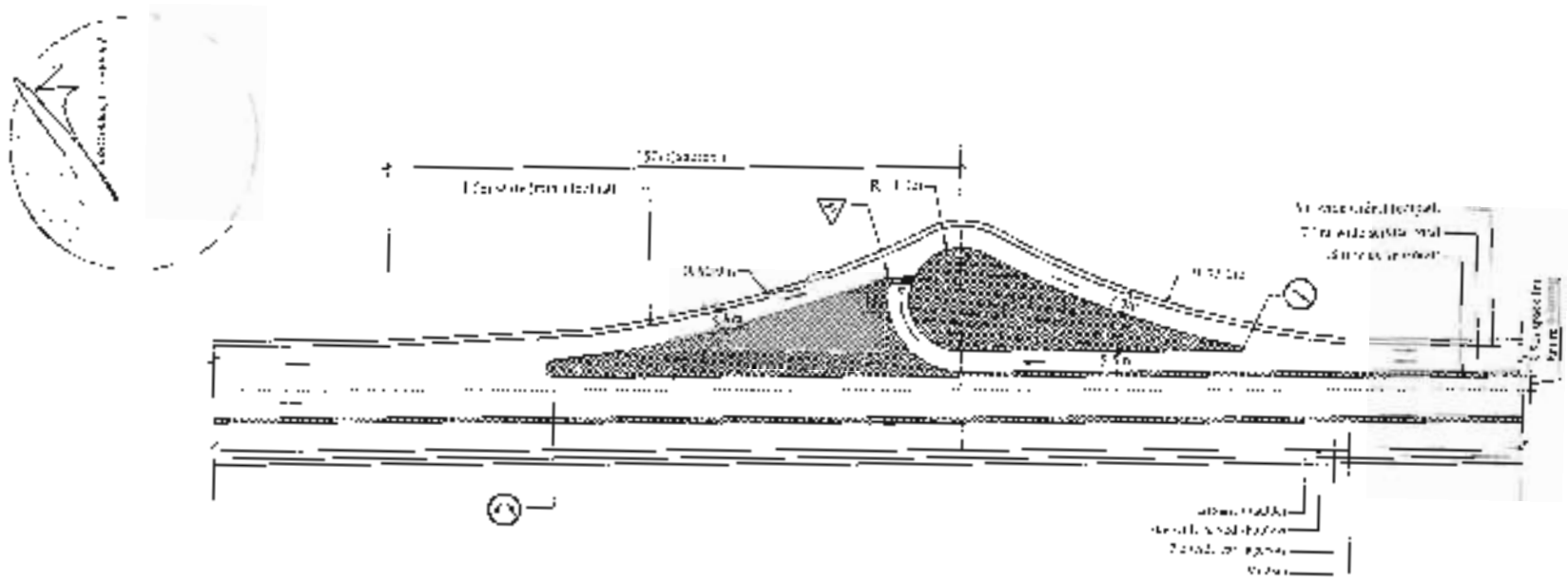
Fig. 2.1A



Note:
1. Detailed System of Road Marking as per IRC:35.
2. Detailed System of Road Signs as per IRC:67

Suggestive layout for entry ramp to highway
(Service road on both sides of entry ramp)

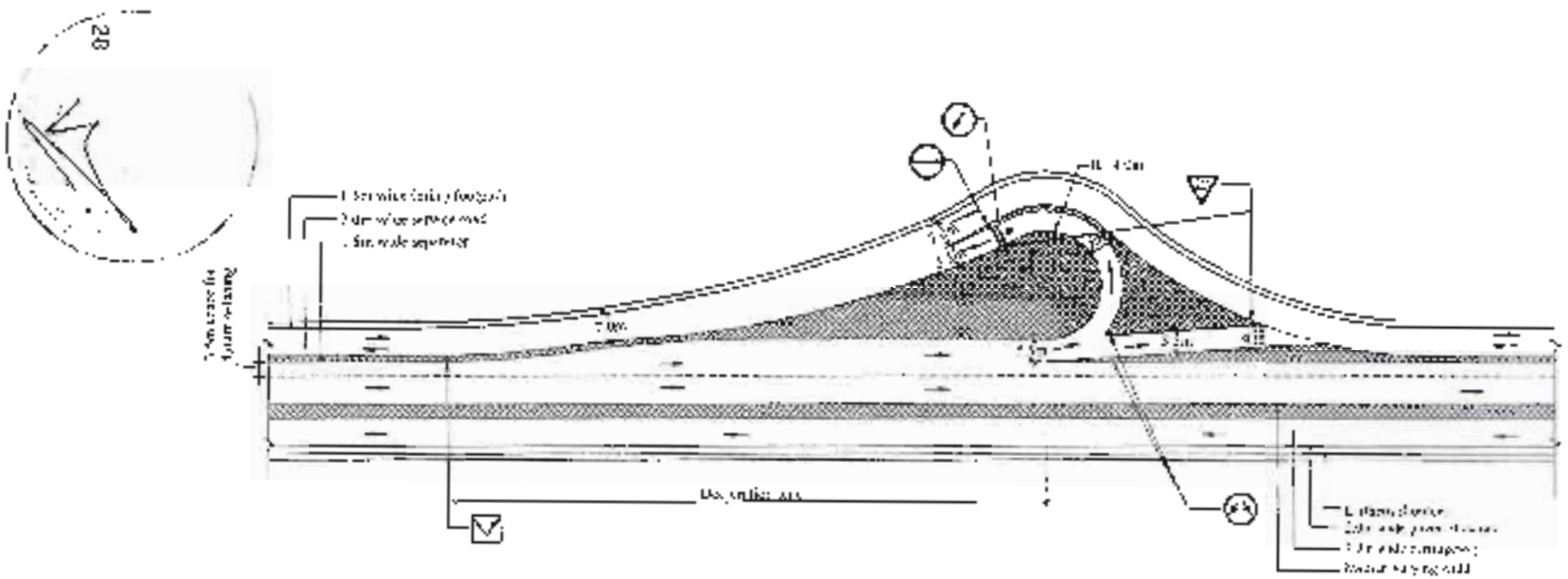
Fig. 2.16



Note:
1. Detailed System of Road Marking as per IRC:35
2. Detailed System of Road Signs as per IRC:67

Suggestive layout for exit ramp from highway
(At the end of service road)

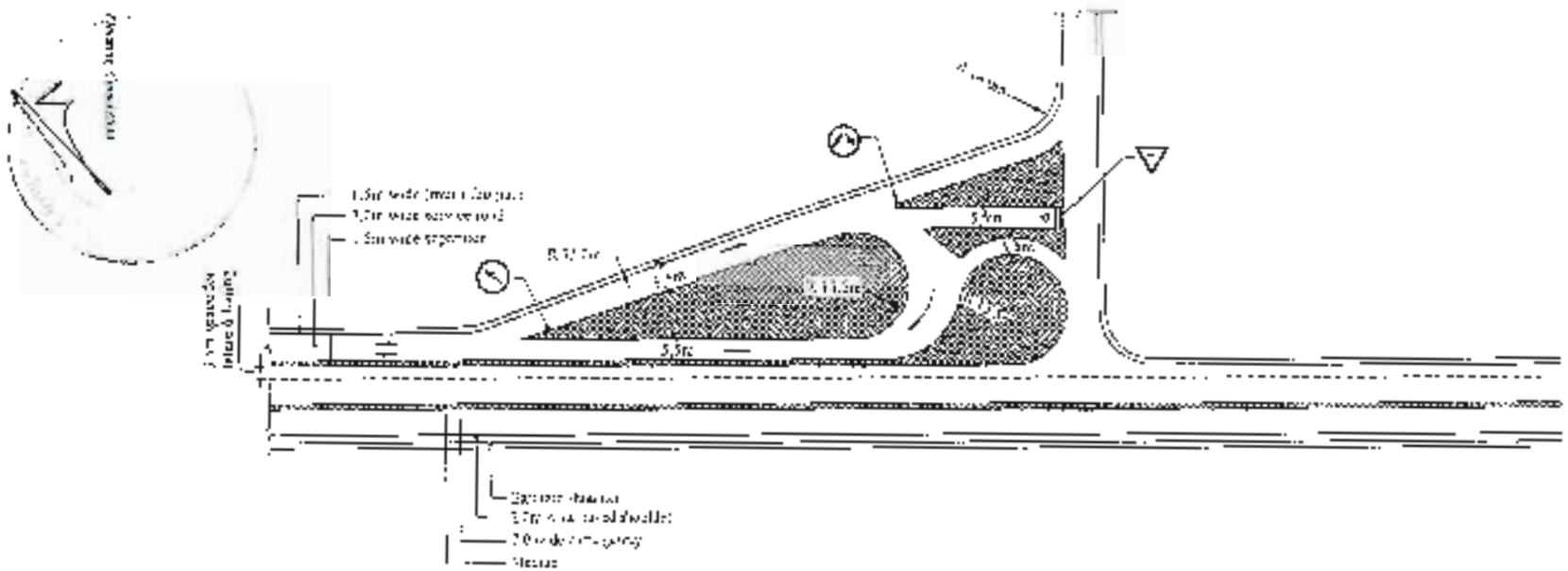
Fig. 2.1C



Note:
1. Detailed System of Road Marking as per IRC:35.
2. Detailed System of Road Signs as per IRC:67.

Suggestive layout for exit ramp from highway
(Service road on both sides of exit ramp)

Fig. 2.10

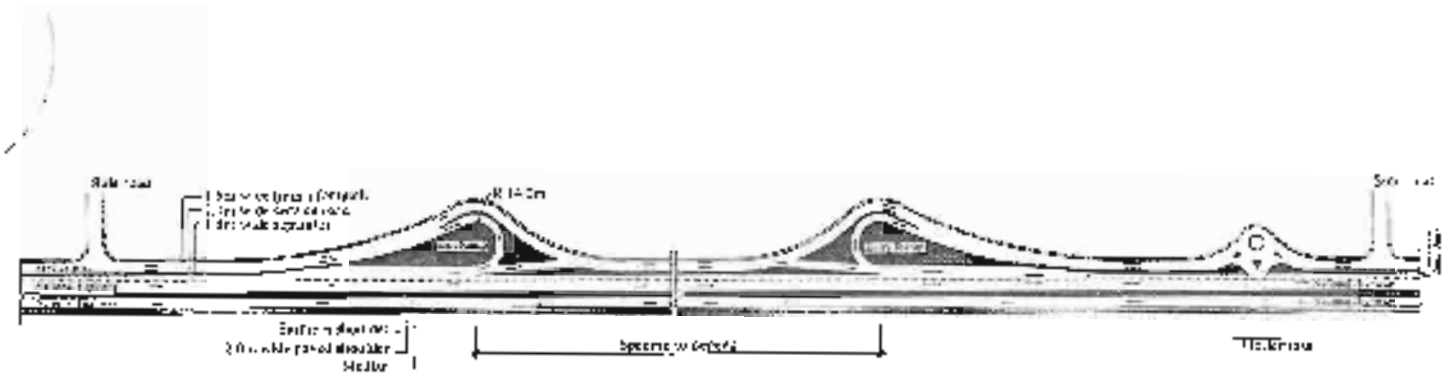


Note:

1. The suggestive layout shows meeting of service road with a cross road. The movements from cross road etc. to the main highway shall be dealt in accordance with section, 2.2.10(3)
2. The other end of service road shall be provided with end treatment as per figure 2.1B.
3. Detailed system of road marking as per IRC:35
4. Detailed system of road signs as per IRC:67

Suggestive layout of service road ending
at a junction with cross-road

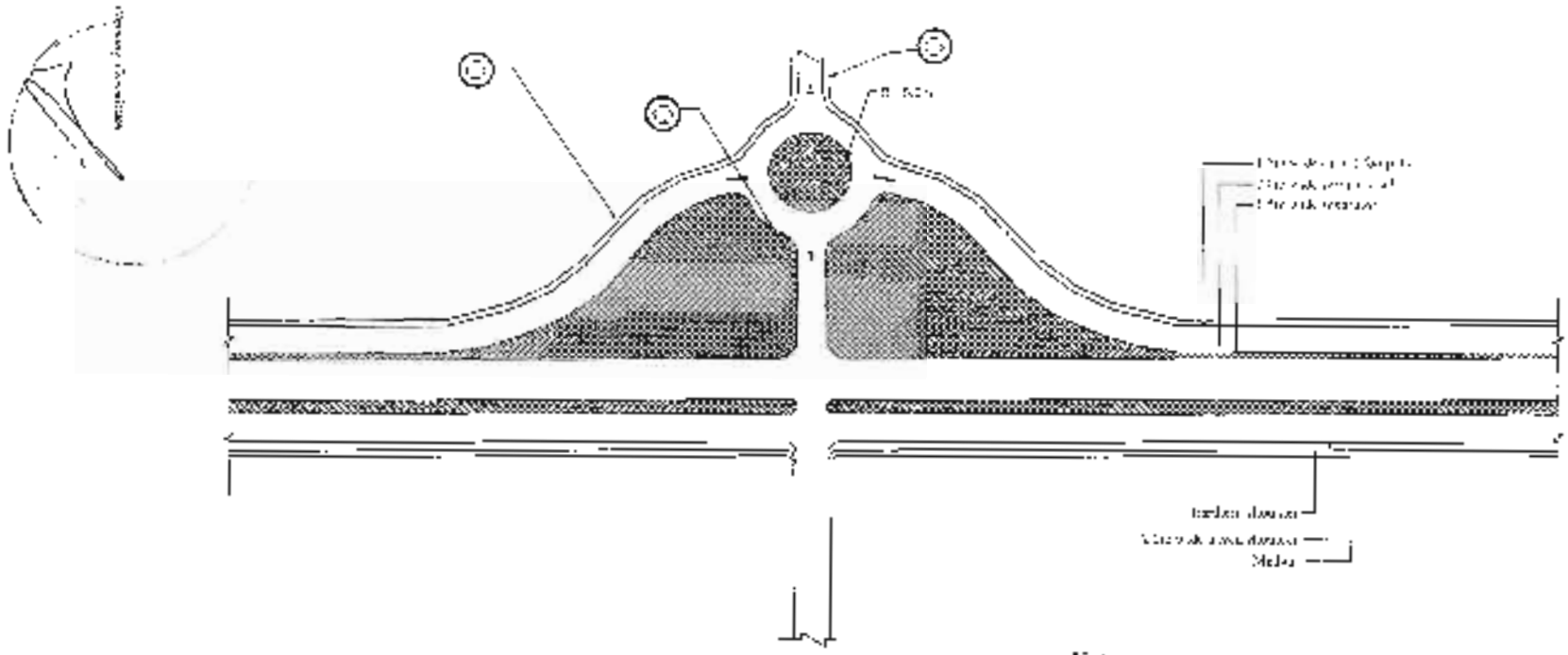
Fig. 2.1E



Note:
1. Detailed System of Road Marking as per IRC:35
2. Detailed System of Road Signs as per IRC:67

Suggestive layout showing configuration of service road, entry/exit ramps, side road and underpass

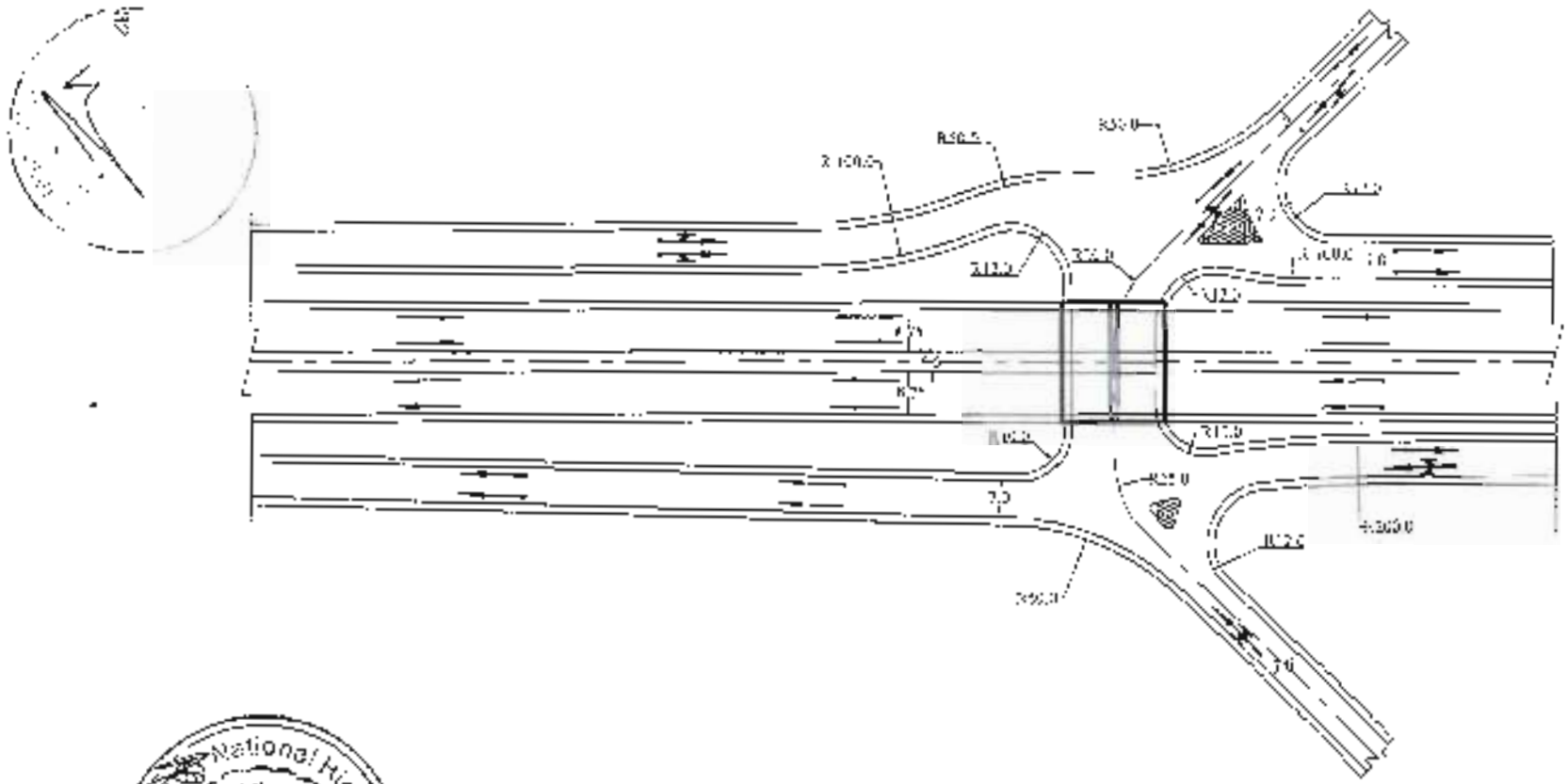
Fig. 2.1F



Note:
1. Detailed System of Road Markings as per IRC:35

Suggestive layout of service road continuing at intersection

Fig. 2.1G



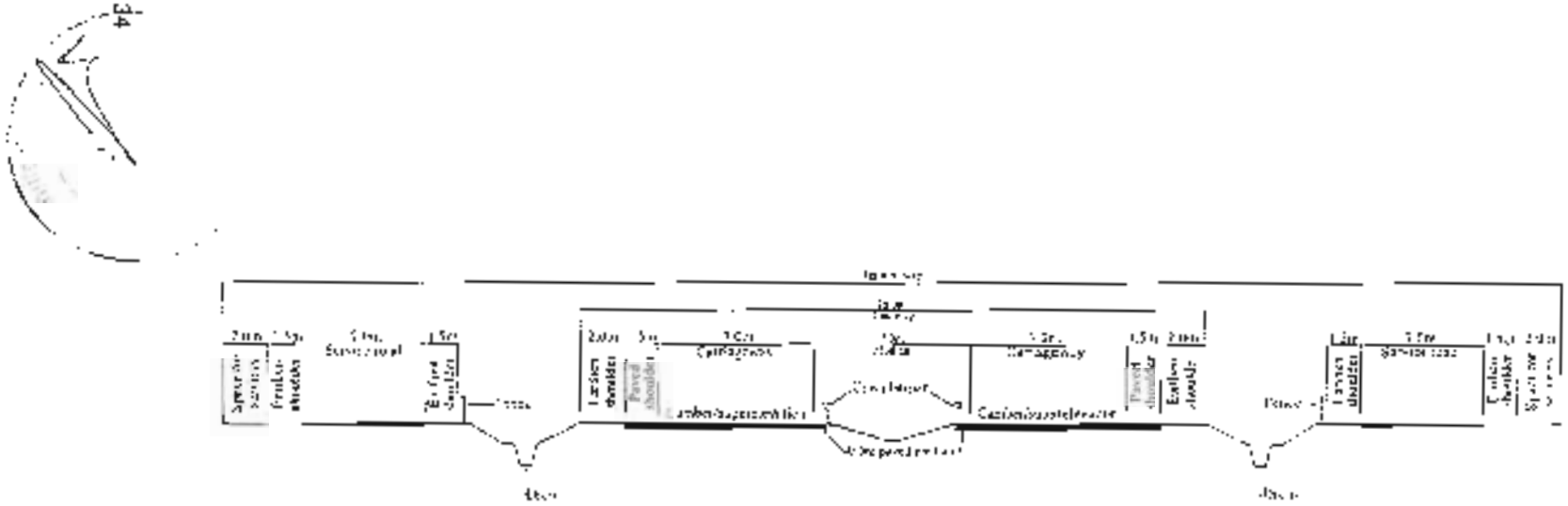
Note:
.. All dimensions in mm

Suggestive layout for connecting service road to underpass on cross road

Fig. 2.1H

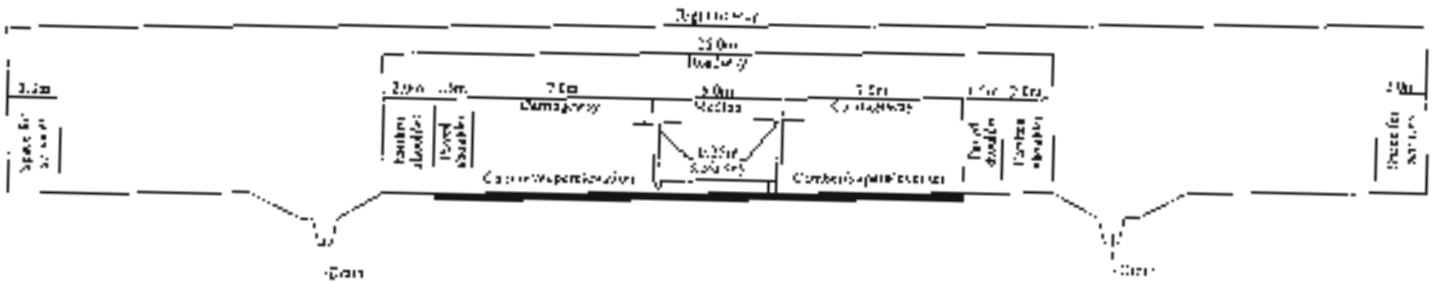
Typical cross section type-A1
(Open country-plain/rolling terrain)
4-lane divided highway without service roads and with depressed median

Fig. 2.2



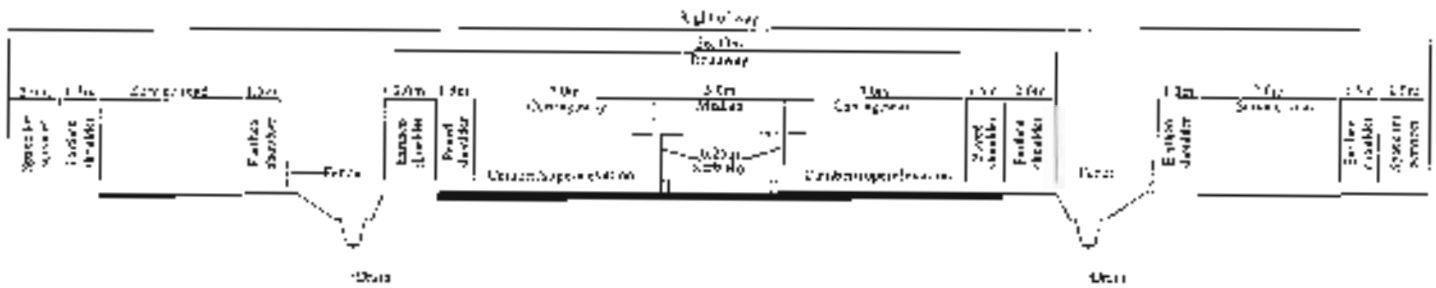
Typical cross section type-A2
(Open country-plain/rolling terrain)
4-Lane divided highway with service roads and with depressed median

Fig. 2.3



Typical cross section type-A3
(Open country-plain/rolling terrain)
4-Lane divided highway without service roads and with raised median

Fig. 2.4

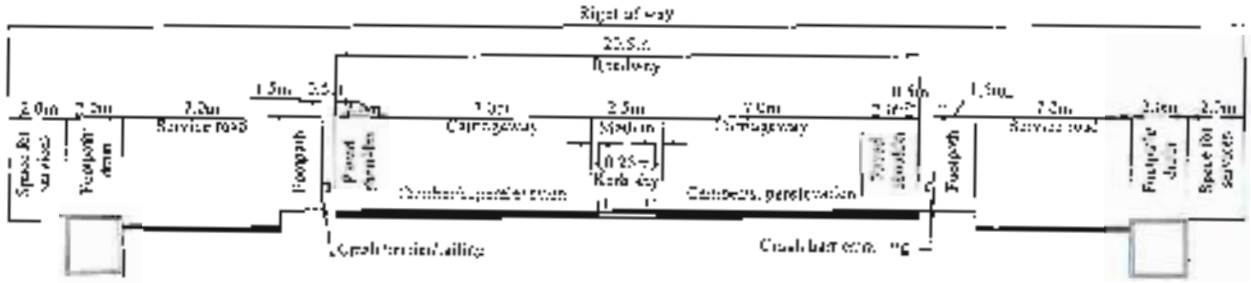


Typical cross section type-A4

(Open country-plain/rolling terrain)

4-lane divided highway with service roads and with raised median

Fig. 2.5

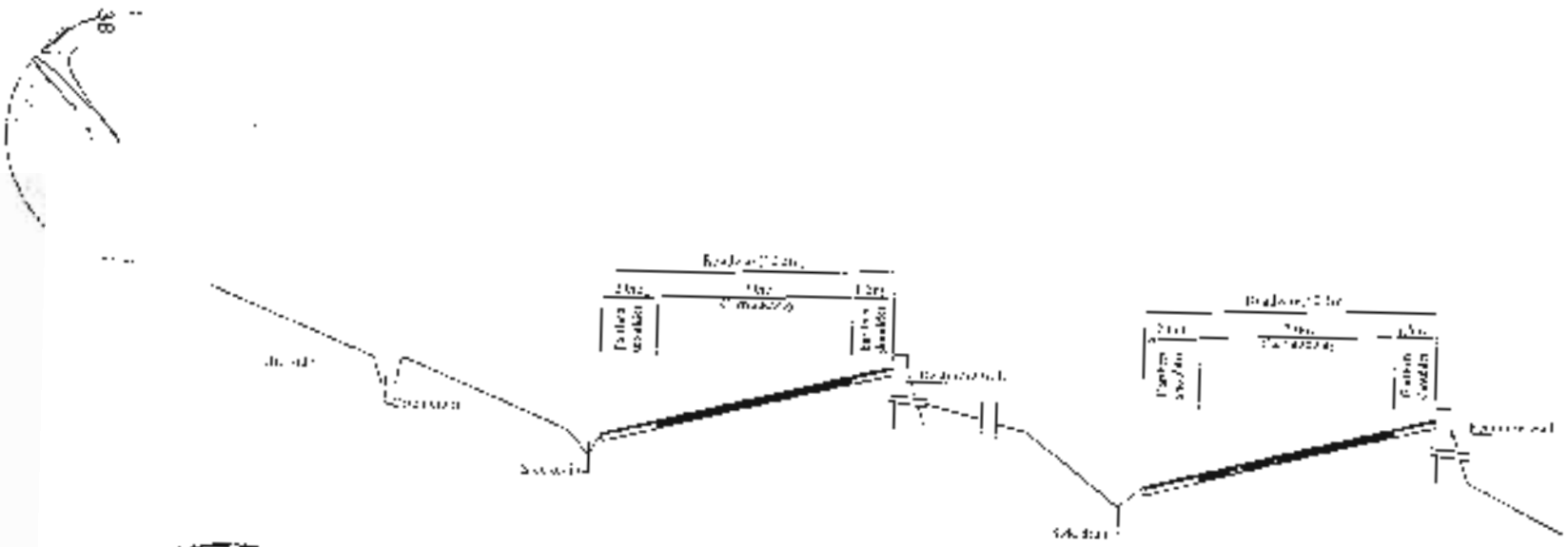


Typical cross section type-B

(Built-up section - plain/rolling terrain)

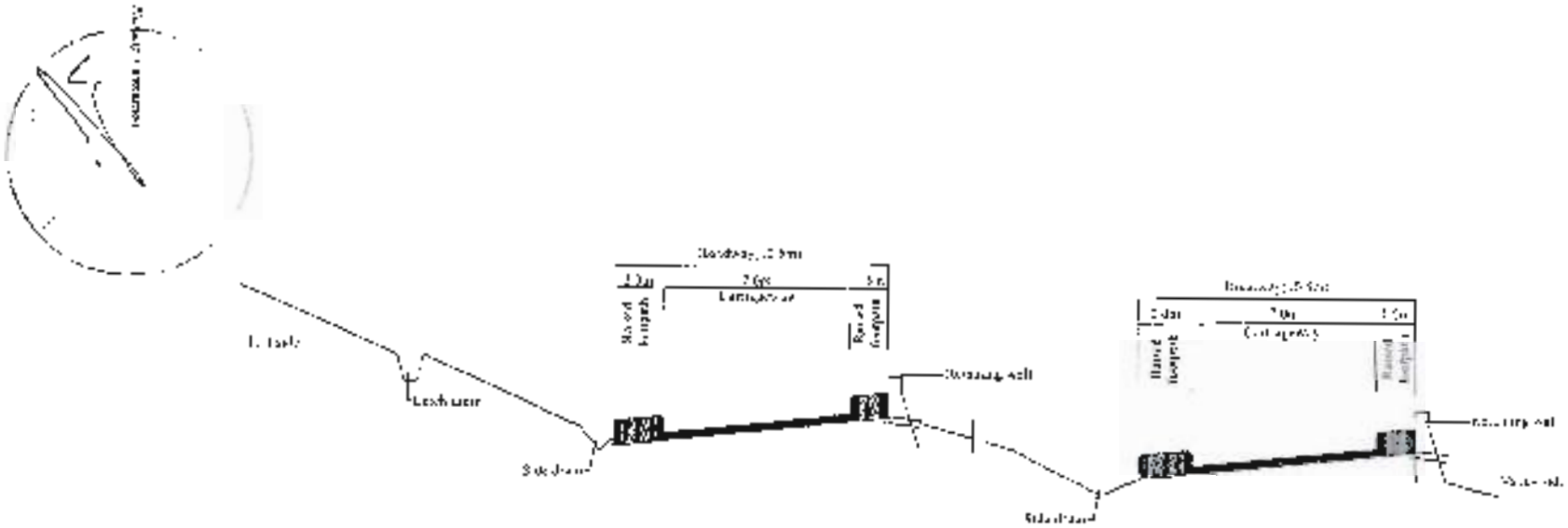
4-lane divided highway with service roads and with raised median

Fig. 2.6



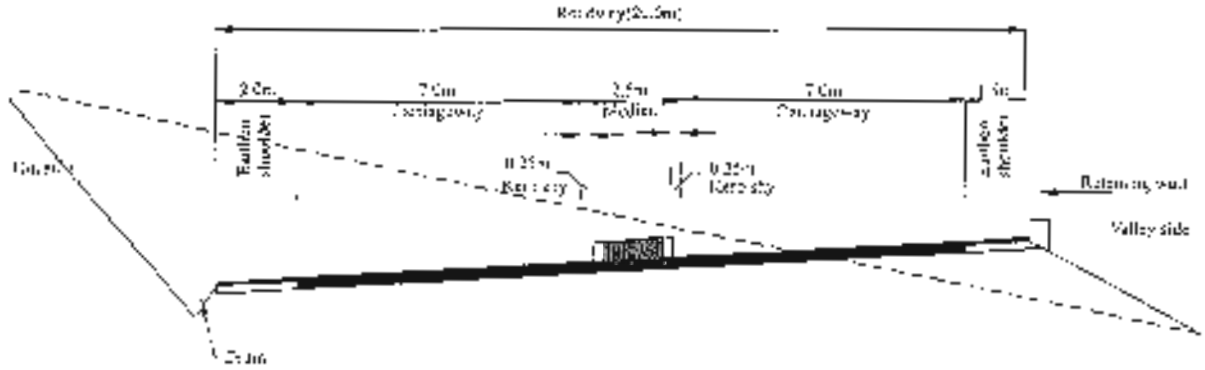
Typical cross section type-C1
(Open country - mountainous terrain)
4-lane divided highway on different contours

Fig. 2.7



Typical cross section type-C2
(Built up section - mountainous terrain)
4-lane divided highway on different contours

Fig. 2.8

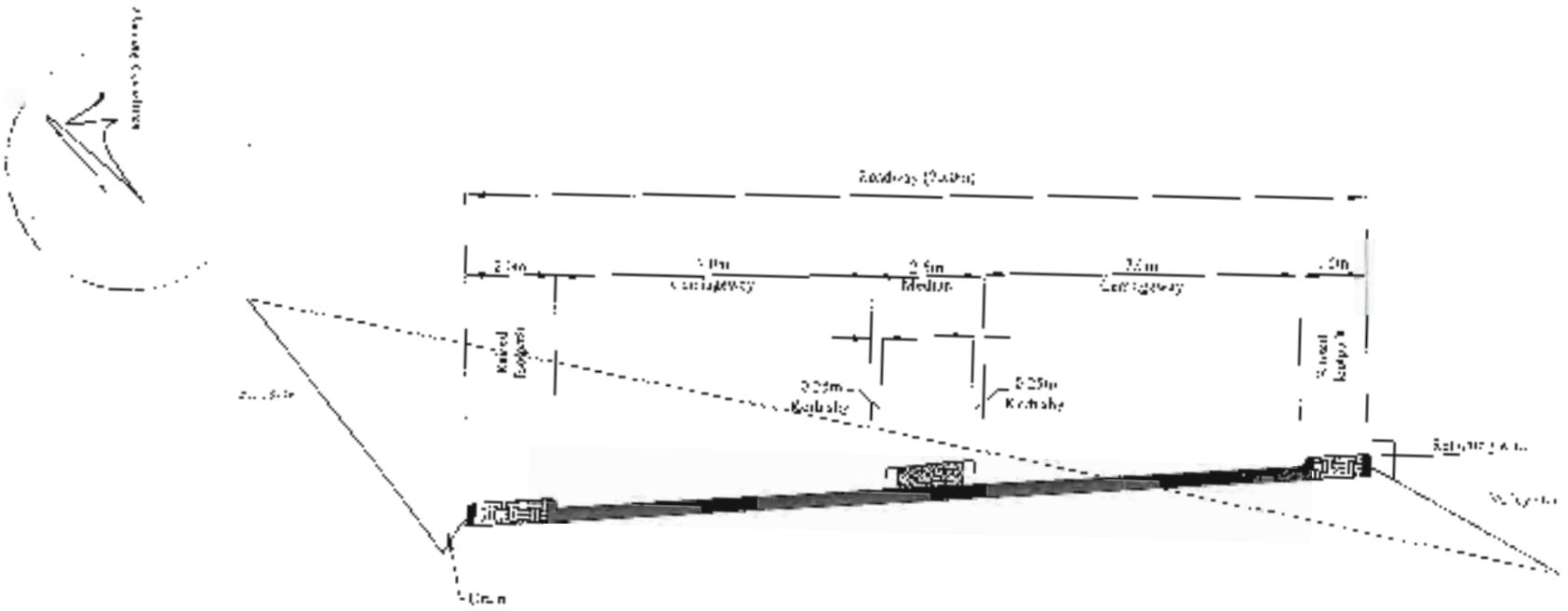


Typical cross section type-C3

(Open country - mountainous terrain)

4-lane divided highway at some level with raised median

Fig. 2.9



Typical cross section type-C4
(Built up section - mountainous terrain)
4-lane divided highway at same level with raised median

Fig. 2.10

Section 3

Intersections and Grade Separators

SECTION 3

INTERSECTIONS AND GRADE SEPARATORS

3.1 Introduction

3.1.1 The intersections to be provided shall be one of the following types

(i) At-grade Intersections

(ii) Grade separated Intersections without ramps

(iii) Interchanges

The types and locations of Intersections, Interchanges and Grade separated Intersections without ramps shall be based on requirements stipulated in IRC:SP:41, IRC:8, IRC:92, MORTH Specifications for Road and Bridge works. These shall be specified in Schedule B of the Concession Agreement.

3.1.2 The existing intersections, which are deficient with respect to the minimum requirements shall be improved to the prescribed standards. Additional land, if any, required for improving the existing intersections shall be provided by the Authority.

3.2 At-grade Intersections

3.2.1 The type of intersections to be adopted shall be decided on the basis of parameters like number of intersecting legs, traffic volume/speed, type of traffic control etc. Properly designed intersections shall be provided at all at-grade crossings. Rotary shall not be provided.

3.2.2 (i) The intersections shall be designed having regard to flow, speed, composition, distribution and future growth of traffic. Design shall be specific to each site with due regard to physical conditions of the site available. The design of different elements of intersection shall be done as per IRC: SP: 41 "Guidelines on Design of At-grade Intersections in Rural and Urban Areas" including other criteria given in this Manual. MORTH Type Designs for Intersections on National Highways may also be referred to, wherever required to develop suitable layout and design of At-grade Intersections.

(iii) At multi leg intersections, the points of conflict should be studied carefully and possibilities of realigning one or more of the intersecting legs and combining some movements to reduce the conflicting movements shall be examined. The object shall be to simplify the design and appropriate control devices added to ensure more efficient and safe operation.

(iii) The channelising islands shall start from the edge of the paved shoulder. This principle shall also apply in case of MORTH – Type Designs for Intersections on National Highways.

3.2.3 Cross roads shall join directly on to service roads and the entry to and exit from the Project Highway shall be through end connections as shown in figures 2.1A to H.

3.3 Grade separated Intersections and Interchanges

3.3.1 Grade separated intersections, without ramps, shall be provided at locations where traffic on cross roads is moderate to heavy. Under this type, two cross roads separate at different grades (as Road Under Bridge or Road Over Bridge). The access from Project Highway to the cross roads in case of such grade separated intersections without ramps, shall be through other existing roads/ service roads.

3.3.2 An interchange is justified at locations where traffic on cross road is heavy and an at grade intersection fails to handle the volume of turning, merging and diverting traffic.

3.3.3 *Geometric Standards for design*

The geometric design standards for various elements of grade separators shall be as given in IRC:92. Gradient for approaches shall not be steeper than 2.5 per cent (1 in 40).

3.3.4 *Design of Structures*

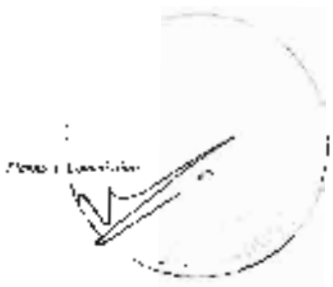
Design of structures shall conform to Section 7 of this Manual. Minimum length of viaduct required to be provided shall be specified in Schedule-B.

3.3.5 *Lighting*

Lighting requirement shall be as per Section 12 of this Manual. The top and underside of the grade separated structures and interchange area at the ground level upto 50 m beyond the point from where flaring of the main carriageway takes place shall be provided with lighting.

3.4 Detailed Design and Data for review by the IE

The Concessionaire shall submit the details of the ground surveys, traffic data, traffic forecast, design and drawings of the intersections and interchanges showing all safety features to the Independent Engineer for review and comments, if any.



Section 4

Embankment and Cut Sections

SECTION 4

EMBANKMENT AND CUT SECTIONS

4.1 General

4.1.1 The design and construction of the road in embankment and in cuttings shall be carried out in accordance with Section 300 of MORTH Specifications and the requirements and standards and specifications given in this Section. This Section also covers specifications for subgrade and earthen shoulders.

4.1.2 Efforts should be made to remove the inherent deficiencies in plan and profile of the existing road. The final centre line of the road and the road levels shall be fixed duly considering all the relevant factors covering structural soundness, safety and functional requirements as per relevant IRC Codes and provisions of this Manual.

4.1.3 The existing road embankment shall be widened/ modified to the specified cross-sectional details.

4.2 Embankment

4.2.1 The height of the embankment shall be measured with respect to the finished road levels. The following principles shall be kept in view while fixing the road level:

(i) No section of the road is overtopped. The finished road level shall be at least 0.6 m above ground level (except in cutting and transition length).

(ii) The bottom of subgrade is generally 1.0 m above the high flood level/high water table. However, in the case of existing old roads where it may be difficult to fulfill this criterion without needing reconstruction or raising in substantial length, the criteria may be relaxed depending on site conditions, ensuring that the bottom of subgrade is 0.6 m above High Flood Level (HFL). The HFL should be decided by intelligent inspections, local observations, enquiries and studying the past records. If raising of any section(s) of the existing road is required, the same shall be specified in Schedule-B of the Concession Agreement.

4.2.2 *Materials and Physical Requirements*

4.2.2.1 Sourcing of materials for embankment and subgrade construction, as well as compliance with environmental requirements in respect of excavation and borrow areas, under the applicable laws shall be the sole responsibility of the Concessionaire.

4.2.2.2 The material to be used in subgrade shall satisfy the design California Bearing Ratio (CBR) at the specified density and moisture content.

4.2.2.3 The embankment and subgrade shall be compacted to satisfy the minimum compaction requirements given in Clause 305 of MORTH Specifications.

4.2.3 *Structural features and design of embankment*

4.2.3.1 Embankment with height 6.0 m or above shall be designed in accordance with IRC:75 taking into account slope stability, bearing capacity, consolidation, settlement and safety considerations based on geotechnical and investigation data. Where the embankment is to be supported on a weak stratum, appropriate remedial/ground improvement measures shall be taken.

4.2.3.2 Side slopes shall not be steeper than 2H:1V unless soil is retained by suitable soil retaining structures.

4.2.3.3 The side slopes shall be protected against erosion by providing a suitable vegetative cover, kerb channel, chute, stone/cement concrete block pitching or any other suitable protection measures depending on the height of the embankment and susceptibility of soil to erosion. Drainage arrangement shall be provided as per Section 6 of this Manual.

4.2.4 *Use of Pond Ash for Embankment Construction*

Where pond ash is used for embankment construction in pursuance of the instructions of the Ministry of Environment and Forests or otherwise, the embankment shall be designed and constructed in accordance with IRC: SP:58.

4.3 Roadway in Cutting

The road level shall be fixed, keeping in view the provisions of relevant IRC Codes.

4.4 Soil Investigations and Design Report

4.4.1 General

The Concessionaire shall carry out necessary soil surveys, and field and laboratory investigations for selecting appropriate borrow pits, identifying and treating problematic ground locations, if any, and for finalizing structural features and design of the embankment and cut sections and establishing improved ground properties. A report on the soil investigation shall be furnished along with the design.

4.4.2 *Soil Investigations for Embankment*

Soil investigations shall cover the following:

(a) Soil investigations and tests in accordance with the requirements specified in IRC: SP:19 and shall be reported in the Proforma given in Table 1 of IRC:SP:19. In addition to this, all tests as per the requirements of MORTH Specifications shall be reported.

(b) In respect of embankments with height more than 6 m, additional investigations and soil tests as per IRC:78 and Appendix 10 of IRC:SP 19.

(c) Information regarding the topography, high flood level, natural drainage conditions, highest sub-soil water level, and the nature and extent of inundation, if any.

(d) The characteristics of embankment foundation including the presence of any unsuitable/weak strata, marshy areas, water logged areas, etc.

(e) Along the alignment of the road, where unstable strata, soft material or poor subsoil conditions have been met with at the foundation level, the soil profile shall be drawn after determining through borings, the type of soil at different levels. The borings shall be at maximum interval of 100 m to a depth of 2 m or more below the existing ground as necessary. In the case of high embankments, the borings shall be taken down to a depth equal to twice the height of the embankment.

(f) Any particular construction problems of the area or other important features

(g) Geotechnical properties of pond ash, covering parameters specified in Table 1 of IRC: SP: 58 and Optimum Moisture Content (OMC) – dry density relationship for heavy compaction. This information shall be furnished, in case pond ash is used in embankment construction.

4.4.3 *Soil Investigations for Cut Sections*

Soil investigations and tests shall be carried out in accordance with the requirements specified in IRC:SP:19 and information regarding depth of water table, seepage flow, presence of any weak, unstable or problematic strata.

4.4.4 *Design Report*

The Concessionaire shall prepare the design report with all relevant details including the following

(i) Road Embankment

(a) The detailed design of the embankment, remedial/ground improvement treatment where required. For embankments with height more than 6 m, construction methodology should also be included.

(b) Design of retaining walls/reinforced earth structures

(c) Design of protection measures for embankment slope and drainage arrangement.

(d) Design of pond ash embankment in case use of pond ash is proposed.

(e) Any additional information relevant to the design of embankment.

(ii) Cut Section

(a) Type of cutting involved and proposed cut slopes shall be provided in accordance with the nature of the soil encountered. Where required, benching including use of slope stability measures like pitching, breast walls, etc. shall be adopted to make the slopes stable and safe

(b) Design and details of erosion control, slope protection measures, etc

(c) In cut sections in hilly terrain, the problem of seepage flow is common. Where such conditions exist, necessary measures shall be taken including provision of deep side drains to intercept the seepage flow and discharge the drained water into suitable outlets to avoid any damage to road and cut slopes. Design and details of drainage arrangement for sub-soil and surface water shall be furnished. It should be ensured that rain water and seepage water is quickly drained out. The gradient of drain shall not be flatter than 1 in 200.

(d) Any other additional information relevant to the design of cut slopes.

Section 5

Pavement Design

SECTION 5

PAVEMENT DESIGN

5.1 General

5.1.1 The design and construction of new pavement sections, and of strengthening measures (overlay) for the existing pavement shall be carried out in accordance with the criteria, standards and specifications given in this section. Where alternative specifications or materials are proposed to bring in innovation in design etc., provisions of Para 1.12 of this Manual shall apply.

5.1.2 The design of new pavement sections or strengthening of existing pavements shall take into account all relevant factors for assuring reliable performance and shall also satisfy the specified minimum performance requirements.

5.1.3 The Concessionaire shall undertake the necessary soil, material and pavement investigations and traffic volume and axle load studies in accordance with the good industry practice for preparing detailed designs.

5.1.4 The materials, mixes and construction practice shall meet the requirements prescribed in the MORTH/IRC Specifications.

5.1.5 Where problematic conditions such as expansive soils, swamps or marshes, flooding, poor drainage, frost susceptible areas etc. are found to exist, adequate measures shall be adopted to deal with such site conditions.

5.2 Type of Pavement

5.2.1 Unless otherwise specified in Schedule-B, the Concessionaire may adopt any type (flexible/rigid) of pavement structure for new construction.

5.2.2 Strengthening of the existing flexible pavement will be carried out by providing appropriate bituminous overlay, unless specified otherwise in Schedule-B of the Concession Agreement.

5.2.3 The Authority may require provision of cement concrete pavement on the new carriageway and/or replacement of existing pavement depending upon specific site conditions. Such requirements shall be as specified in Schedule-B of the Concession Agreement. The minimum design, construction, performance and maintenance requirements for cement

concrete pavements will be specified by the Authority and Schedule-K of the Concession Agreement will be modified accordingly

5.3 Method of Design – New Pavements

5.3.1 *Method of Design of Flexible Pavement*

The new pavement shall be designed in accordance with the IRC:37 Guidelines for the Design of Flexible Pavements.

5.3.2 *Method of Design of Rigid Pavement*

Rigid pavement shall be designed in accordance with the method prescribed in IRC:58 "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways".

5.4 Design Requirements for New Pavement Sections

5.4.1 *Flexible Pavement -Design Period and Strategy*

(i) Flexible pavement shall be designed for a minimum design period of 15 years or operation period, whichever is more. Stage construction will be permissible subject to the requirements specified in para (ii) below.

(ii) Alternative strategies or combination of initial design, strengthening and maintenance can be developed by the Concessionaire to provide the specified level of pavement performance over the operation period subject to satisfying the following minimum design requirements.

(a) The thickness of sub-base and base of pavement section is designed for a minimum design period of 15 years or the operation period, whichever is more and the initial bituminous surfacing for a minimum design period of 10 years.

(b) The pavement shall be strengthened by bituminous overlay as and when required to extend the pavement life to full operation period. The thickness of bituminous overlay shall be determined on the basis of IRC:81

5.4.2 *Rigid Pavement–Design Period and Strategy*

(i) Rigid pavement shall be designed for a minimum design period of 30 years. The stage construction shall not be permitted.

(ii) The Pavement Quality Concrete (PQC) shall rest over Dry Lean Concrete (DLC) subbase of 150 mm thickness.

(iii) The DLC will meet the minimum cement and compressive strength requirement as prescribed in IRC:SP:49. DLC will extend beyond the PQC (including that in shoulder, if any) by 0.5 m on either side.

(iv) Below DLC layer, a properly designed drainage layer Granular Sub Base (GSB) of 150 mm thickness shall be provided throughout the road width. It shall be designed to obtain a drainage coefficient of not less than 20 in per day.

5.1.3 *Pavement Performance Requirements*

(i) The pavement structure shall be capable of giving the specified performance over the entire operation period.

(ii) The new pavement surface shall satisfy the following standards,

(a)	Surface Finish	As per requirements of Clauses 902 and 903 of MORTH Specifications
(b)	Roughness In each lane	Not more than 2000 mm/km for each lane in a km length
(c)	Rutting In wheel path measured by 3 m Straight Edge.	Nil
(d)	Cracking or any other distress	Nil

(iii) During the operation period, the pavement surface roughness or any structural or functional distress shall not exceed the values specified in Schedule-K of the Concession Agreement. Generally the pavement condition in terms of roughness, cracking and rutting should not deteriorate to the maximum values specified in Schedule-K for rectification, earlier than 5 years from the original level/from the year of rectification. Any treatment in the form of overlay/overlay carried out or required to restore/correct/improve the riding quality or any distress shall be of such thickness and specification that will restore the riding quality to roughness not exceeding 2000 mm/km.

(iv) During the operation and maintenance period, the pavement strength shall be evaluated periodically through deflection measurements (Refer to para 5.8 (ii) of this Section) and the stretches exhibiting any structural deficiency shall be rectified.

5.5 Design Traffic

5.5.1 The design traffic shall be estimated in terms of cumulative number of standard axles (8160 kg) to be carried by the pavement during the design period.

5.5.2 Estimate of the initial daily average traffic flow shall be based on at least 7 days, 24 hr classified traffic counts. IRC:9 may be used as guidance for carrying out the traffic census.

5.5.3 Any likely change in traffic due to proposed four laning of the facility and/or future development plans, land use, shall be duly considered in estimating the design traffic.

5.5.4 Traffic growth rate shall be established for each category of commercial vehicles to be considered for design of pavement. For traffic projections, the procedure outlined in IRC: 108 may be followed. The Concessionaire shall adopt a realistic value of the rate of traffic growth, provided that annual rate of growth of commercial vehicles shall not be adopted less than 5 per cent.

5.5.5 The design traffic in case of service road shall be five million standard axles. The axle composition shall be provided accordingly.

5.6 Subgrade

The subgrade, whether in cut or fill, shall meet the requirements stipulated in Clause 305 of MORTH Specifications. The thickness of subgrade shall not be less than 500 mm.

5.7 Pavement Components and Materials

(i) The pavement construction materials for sub base, base and bituminous surfacing shall conform to the requirements prescribed in MORTH Specifications and IRC Standards.

(ii) Where several materials will adequately serve as a component within the pavement structure, such as a sub base or a base course, the Concessionaire shall have the option of using any of the materials/specifications subject to sound engineering practice and product quality requirements.

5.8 Performance Evaluation

(i) Roughness in each lane for full length shall be measured bi annually using appropriate approved method and equipment.

(ii) The structural evaluation of the pavement shall be made by taking deflection measurements every 5 years in accordance with the procedure given in IRC:81, unless needed earlier for stretches exhibiting severe distress during the operation and maintenance period.

5.9 Strengthening of Existing Pavements

5.9.1 Before strengthening treatment is prescribed, a detailed pavement condition survey and evaluation shall be carried out in accordance with IRC:81 to determine

(i) The extent of distress and nature of deficiency in the existing pavement structure, and

(ii) Whether any special treatments e.g. provision for remedying reflection cracking, pavement internal drainage, subgrade improvement/ reconstruction, or rectification of any other deficiencies are warranted.

5.9.2 Necessary corrective measures to treat the identified deficiency shall be taken along with strengthening of the pavement.

5.9.3 In stretches where the pavement is damaged/deteriorated to such an extent that the use of Benkelman Beam method may not result in a realistic assessment of the strengthening treatment, pavement shall be designed as new pavement.

5.9.4 Where an existing pavement is built over an untreated expansive/black cotton soil subgrade, its improvement/ strengthening shall be treated separately. Such stretches shall require reconstruction with provision of necessary measures such as replacement/treatment of expansive subgrade, drainage, etc. as per the prescribed specifications and IRC:37; and shall be designed as new pavement. Stretches to be reconstructed, whether due to expansive subgrade or having grossly deteriorated, etc. shall be specified in Schedule-B of the Concession Agreement.

5.9.5 No granular layer shall be provided over an existing bituminous surfacing. Situations may arise where it is envisaged to strengthen grossly deficient existing road with a granular layer in addition to the bituminous overlay, or where for camber and/or grade correction substantial thickness of profile corrective course is needed. In such cases, the existing bituminous surfacing shall be completely removed by scarifying/milling first, then the

pavement built up with the granular layer(s) and bituminous overlay. The thickness and composition of bituminous surfacing (Binder course and Wearing course) over the granular layer shall conform to IRC:37.

5.9.6 *Design of Overlay*

(i) The thickness of the bituminous overlay shall be determined on the basis of Benkelman Beam Deflection Technique and the design traffic as per the procedure outlined in IRC:81 "Guidelines for Strengthening of Flexible Road Pavements using Benkelman Beam Deflection Technique" as also from structural numbers of existing pavement layers.

(ii) The design period will be the same as specified for the new pavement sections vide Para 5.4.1 of this Section. The initial strengthening shall be done for a minimum design period of 10 years. Subsequent strengthening to extend the pavement to full operation period shall be implemented at the end of initial design period or earlier, in case of any structural distress in the pavement or if the surface roughness exceeds the value specified in Schedule-K of the Concession Agreement.

(iii) The design traffic will be estimated as per the procedure described for new pavement.

(iv) The thickness of bituminous overlay for pavement strengthening shall not be less than 50 mm bituminous concrete, after attending to the requirements of profile corrective course.

5.9.7 *Bituminous Mix for Overlay*

(i) The specifications for the bituminous mixes for the overlay shall be as specified for bituminous surfacing for new pavement sections.

(ii) Design of recycled mix where provided shall conform to the requirements of Clause 517 of MORTH Specifications.

5.9.8 *Pavement Performance Requirements and Evaluation*

(i) The strengthened pavement shall satisfy the minimum standard and maintenance requirements specified for new pavement sections in this Manual and Schedule K of the Concession Agreement.

(ii) The performance measurement and evaluation will be done as given in this Manual.

5.10 Paved Shoulders

(i) Paved shoulders shall be provided as specified in this Manual

(ii) If the thickness of the existing paved shoulder, if any, is less than the thickness of the existing pavement, the paved shoulders shall be reconstructed to the pavement thickness in the adjoining carriageway.

5.11 Construction, Workmanship and Quality of Works

All materials, construction operations, workmanship, surface finish and quality of completed construction for all pavement works including sub grade, sub-base, base course, bituminous surface courses for both new pavement and strengthening of exisong pavements, shoulders, service roads, etc, shall conform to the specified requirements and comply with the provisions of Section 900 of the MORTH Specifications

5.12 Premature Distress

Notwithstanding the minimum design, specifications and standards specified in the preceding paras for new pavements and strengthening of existing pavements, if the pavement shows premature distress in the form of cracking, rutting, patching, loss of camber or any other structural or functional distress, necessary remedial measures by strengthening/resurfacing/recycling shall be undertaken for conforming to the minimum requirements prescribed in Schedule-K of the Concession Agreement. In case of repetition of the distress, reconstruction shall be resorted to after proper investigations.

5.13 Detailed Design Report

5.13.1 The new pavement design and strengthening proposals formulated on the basis of the detailed investigations and studies shall be submitted to the Independent Engineer alongwith Data Collection, Data Evaluation and Design Reports.

5.13.2 *Data Collection*

Following details shall be included in the report:

(i) Soil investigation data for new pavements as per Table 1 & 2 of IRC SP:19. Report shall include OMC dry density relationship with heavy compaction and soaked CBR values in addition to other data and information as per the prescribed Proforma.

(ii) Test values of aggregate for pavement courses as per Tables 13.3 and 13.4 of IRC: SP:19. All tests as per requirements of MORTH Specifications shall be reported in addition to the tests and information included in the above mentioned Tables.

(iii) Classified traffic counts in Proforma 1 of IRC:SP:19.

(iv) Axle load surveys and VDF values for each category of commercial vehicles as per Proforma 4 of IRC:SP:19.

(v) Estimation of traffic growth and traffic projections for pavement design.

(vi) Pavement condition data in the Proforma given in Table 2 of IRC 81

(vii) Pavement roughness data determined through appropriate method as approved by the Authority

(viii) Pavement Deflection Data measured by Benkelman Beam as per the procedure detailed in IRC:81. Pavement deflection data shall be recorded in the prescribed Proforma vide Table 3 of IRC:81. The deflection data shall be accompanied with the characteristics of the subgrade soil covering type of sub grade soil, field moisture content (at the time of deflection survey), average annual rainfall in the area, and pavement temperature at the time of deflection survey.

(ix) Any other relevant information required by the Independent Engineer for review and comments, if any

5.13.3 *Data Evaluation*

The report shall inter alia cover:

(i) Data evaluated–soil characteristics and subgrade strength, pavement distress, pavements deflection, riding quality, skid resistance, drainage aspects, etc.

(ii) Pavement deficiencies, drainage and constraints.

(iii) Any other relevant details.

5.13.4 *Detailed Design*

The Report shall contain the detailed design of the preferred solution along with any special treatment proposed for adoption. Any departures from the specifications stated herein shall be supported with authentic standards and specifications and accepted practice.

Section 6

Highway Drainage

SECTION 6

HIGHWAY DRAINAGE

6.1 General

6.1.1 The design and construction of surface and subsurface drains for highway drainage shall be carried out in accordance with the requirements of this Section.

6.1.2 For efficient drainage system for the entire Project Highway including structures and facilities, directions contained in Clause 309 of MORTH Specifications, IRC:SP:42 and IRC:SP:50 as relevant shall be followed.

6.1.3 In road sections in cuttings and at underpasses where it may not be possible to drain out the water using gravity flow, necessary arrangement for pumping shall be made.

6.1.4 Detailed survey for levels along the proposed longitudinal drains shall be carried out on both sides of the Project Highway. The bottom levels of these drains shall meet the culverts and bridges

6.2 Surface Drainage

6.2.1 The selection of type of roadside drains shall be based on the magnitude and duration of flow. The roadside drains shall be designed on the principles of flow in open channel.

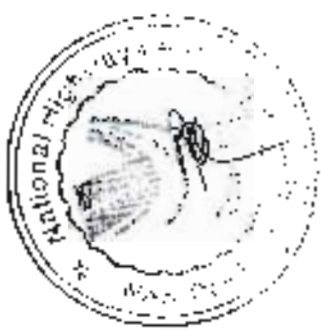
6.2.2 The road side drains shall not pose any danger to traffic, slopes of cuttings, embankment, pavement or structures.

6.2.3 As far as possible, longitudinal slope shall not be less than 0.5 per cent for lined drains and 1.0 per cent for unlined drains. Permissible non-erodible flow velocity for corresponding earth surface as mentioned in Clause 9.4 of IRC:SP:42 shall be kept in view.

6.2.4 The side slopes of the unlined drains shall be as flat as possible and shall not be steeper than 2H: 1V.

6.2.5 The drains shall be provided with CC lining in the following situations:

(i) When due to space constraint, the drains are located near the toe of the embankment or near structures.



(ii) Drains located in built up areas.

(iii) Flow velocity is more than 0.3 m to 1 m/s in silt and sand, and more than 1.5 m/s in stiff clay.

6.3.6 In built up areas, covered or piped drains, with manholes at suitable intervals to desilt the pipes, shall be provided.

6.3 Median Drainage

6.3.1 Proper arrangement for drainage of median shall be provided. The median drain should have adequate longitudinal slope to the nearest culvert to drain off transversely.

6.3.2 In case the carriageway is sloping towards unkerbed median (wider than 5 m), provision of a central swale shall be made for drainage of the median. The swale shall slope longitudinally for drainage, water intercepted by inlets at intervals and discharged through transverse drains into outlet channel.

6.3.3 Median of width 9 m or less shall be turfed or paved and could be crowned for drainage across the pavement.

6.3.4 In superelevated sections, proper arrangement for drainage of raised carriageway and median shall be made without allowing water to drain on the other carriageway.

6.4 Drainage of Embankment with Height Above 3 m

6.4.1 In embankments with height more than 3 m and approaches to bridges, special arrangement for protection of embankment slopes shall be essential in order to ensure that embankment slopes maintain their shape during the monsoon season. In this respect, directions contained in Clause 7 of IRC:SP:42 may be followed as appropriate for the climatic conditions of the area of the Project Highway.

6.4.2 Drainage arrangement shall include provision of kerb channel at the edges of the roadway to channelise the water, and Cement Concrete (CC) lined chutes along the slopes at designed intervals to discharge the water into side channels at the bottom alongwith appropriate protection of the slope. The slope protection material and chutes shall be kept well maintained at all times.

6.4.3 The chute drains and drains at toe of the embankment shall be of Plain Cement Concrete (M 15 grade), over proper bedding.

6.5 Catch Water Drains

6.5.1 Suitable catch water drains shall be provided on the hill slope above cutting to collect and remove surface water run off from upper reaches. These drains shall be of trapezoidal shape and stone lined and cement pointed

6.5.2 The catch water drains shall be designed to carry the intercepted water to the nearest culvert or natural drainage channel

6.5.3 It shall be ensured that the catch water drains are provided in stable hill slopes outside the periphery of slide/unstable areas.

6.5.4 Where required, lined chutes shall be provided to lead the discharge to the catch pit of culvert or to a natural drainage channel.

6.6 Sub-surface Drains

6.6.1 The sub surface drainage shall be provided

(i) for lowering the level of water table for drainage of subgrade;

(ii) to intercept or drain out free water in cut slopes; and

(iii) for drainage of pervious subbase in situations where it may not be practicable to extend the subbase across the shoulder

6.6.2 Sub surface drains shall not be used for surface drainage.

6.6.3 The sub surface drains shall be:

(i) Close jointed perforated pipes or open jointed unperforated pipes in trenches with backfill material around pipes.

(ii) Aggregate drains consisting of free draining material in the trench without any pipe.

6.6.4 Perforated pipes and unperforated pipes shall meet the requirements of Clause 309.2 of the MORTH Specifications.

6.6.5 The internal diameter of the pipe shall not be less than 150 mm.

6.6.6 The sub-surface drains shall be located not less than 0.5 m below the subgrade.

6.6.7 *Backfill material*

(i) Backfill material shall be free draining, sand, gravel or crushed stone designed on inverted filter criteria for filtration and permeability, or of an appropriate grading conforming to the requirements of Table 300.3 of the MORTH Specifications.

(ii) Thickness of backfill material around the pipe shall not be less than 150 mm. The minimum thickness of material above the top of the pipe shall be 300 mm.

6.6.8 Sub surface drains outside the road pavement shall be sealed at the top to avoid percolation of surface water into these drains.

6.6.9 *Use of Geo-textile*

(i) The sub-surface drains may be designed using appropriate geotextile to serve the functions of filtration and separation.

(ii) The sub-surface drains can be provided with geotextile either along the trench or around the pipe or both.

(iii) The geotextile shall satisfy the requirements of Clause 702 of the MORTH Specifications.

6.6.10 Trench excavation, laying of pipe, backfilling, and use of geosynthetics shall conform to the requirements of Clause 309.3 of the MORTH Specifications.

6.6.11 The drain outlet shall be a free outlet and shall be provided as per Clause 309.3 of the MORTH Specifications.

6.6.12 *Aggregate drains*

(i) The trench for aggregate drain shall be of minimum 300 mm width and cut to a depth to expose the granular pavement courses to be drained.

(ii) Aggregate for the drain shall be gravel, stone aggregate or slag of grading as per Table 8 of IRC:SP:42.

(iii) The aggregate drain shall be provided with a geo-textile wrap to act as filtration and separation layer.

6.6.1.5 Design of subsoil drainage shall be based on a rational basis. Reference may be made to IRC:SP:42.

6.7 Internal Drainage of Pavement Structure

(i) Boxed type construction in which pavement is housed in earthen shoulders shall not be provided.

(ii) The sub-base shall be extended across the shoulders for efficient drainage of pavement.

(iii) The granular sub-base shall be of proper design and grading to perform satisfactorily as a drainage layer. The drainage layer shall not have material finer than 75 micron size.

(iv) A suitable filter of granular material or geotextile to act as filtration and separation layer shall be incorporated, where necessary, between the sub-grade and sub base to prevent clogging.

6.8 Survey, Investigation and Design Report

The Concessionaire shall carry out proper surveys and investigations for detailed design of the drainage system. The proposal for drainage system supported with survey investigation report and detailed design report shall be submitted to the Independent Engineer for review and comments, if any.

6.8.1 *Drainage Studies*

The survey and investigation and drainage studies shall include:

(i) Alignment plan, longitudinal and cross sections, contour map

(ii) Hydrological data

Drainage area, watershed delineation, direction of flow, location of outfalls, existing surface drains, ground surface condition, rainfall, flood frequency, etc.

(iii) Data for hydraulic design of drains

(iv) Geo technical investigations for sub surface strata, level of water table, seepage flow etc.

(v) Identification of areas requiring sub-surface drainage.

(vi) Any other relevant information

IRC:SP:19, IRC:SP:42, IRC:SP:48 and IRC:SP:50 may be referred to.

6.8.2 *Design Details*

The report shall include:

(i) Estimation of design discharge.

(ii) Design of surface drains.

(iii) Design of sub-surface drains.

(iv) Drainage arrangement plan along with cross section of drains with longitudinal levels, cross drainage works and a strip chart.

(v) Specifications of drains.

(vi) Any additional information as required by the IE for review of the drainage system.

6.8.3 *Responsibility for Design and Adequacy*

The Concessionaire shall be fully responsible for design and adequacy of the drainage system throughout the operation period as per the requirements of the Concession Agreement.

Section 7

Design of Structures

SECTION 7

DESIGN OF STRUCTURES

7.1 General

(i) All bridges shall be designed in accordance with the relevant Codes, Standards and Specifications and Special Publications and Guidelines of the IRC. All construction of bridges shall conform to MORTH Specifications for Road and Bridge Works.

(ii) All bridges shall have independent superstructure for each direction of travel unless specified otherwise in Schedule-B. Culverts may have single or independent superstructure.

(iii) All bridges shall be high level bridges unless specified otherwise in Schedule-B of the Concession Agreement.

(iv) Viaduct spans shall be provided if the height of solid embankment in built up sections is more than 5 m.

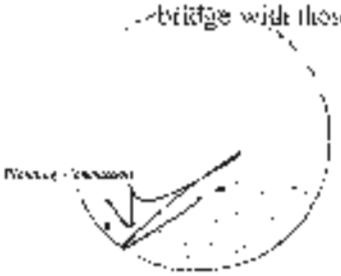
(v) The width of median in the culvert and bridge portion shall, as far as possible, be kept same as that in the approaches. In case width of median is different from that of approach section due to site constraints, suitable transition shall be provided near approaches for guiding vehicular traffic.

(vi) The median in the portion of structures shall be treated as below:

(a) A suitably designed catch pit shall be provided to collect and carry discharge from median drain.

(b) For bridges, where the median is more than 1.2 m wide, the median shall be open to sky. The safety barrier on the median side shall be provided at a clear distance of 0.5 m from the edge of carriageway.

(vii) Suitable provision shall be made for retaining the earth in the median portion either by extending the abutment wall or constructing a new returning wall. The abutment wall shall have provision for taking the discharge from the median. Care shall also be taken to merge the wing wall, return wall and flooring of the old bridge with those of the new bridge.



(viii) Any utility service to be carried by the structures shall be specified in Schedule-B of the Concession Agreement.

7.2 Design Loads and Stresses

(i) The design loads and stresses shall be as per IRC:6 appropriate for the width of carriageway, velocity of stream, location, altitude, environment, etc.

(ii) All new structures shall be designed for the condition when footpath is used as carriageway. The footpath portion may be provided at the same level as the bridge carriageway and separated by crash barrier in non built-up areas. In built up areas, raised footpaths shall be provided.

(iii) All the components of structures shall be designed for a service life of 100 years except appurtenances like crash barriers, wearing surface and rubberized components in expansion joints and elastomeric bearings. All the requirements to achieve durability and serviceability shall be implemented.

7.3 Width of Structures

Width of the culverts and bridges shall be adopted as below:

(i) New culverts

Overall width of all new culverts shall be equal to roadway width at the approaches. The outer most face of railing/parapet shall be in line with the outer most edge of shoulder. Typical cross section of the new culverts for a 4-lane project highway is given in Fig 7.1.

(ii) New bridges

(a) The overall width of new bridges shall be same as the roadway width of the approaches. All new bridges shall have a footpath on left side of the traffic. Typical cross section of such type of new bridge with footpath for a 4 lane project highway is given in Fig. 7.2

(b) Where the daily traffic exceeds 30,000 PCUs at the time of feasibility study/bidding, the width of new bridge shall be as per 6 lane standards vide details given in Fig. 7.3 with footpath. Such cases shall be indicated in Schedule-B.

(c) Where the length of bridge structure including grade separated structures exceeds one km. provision shall be made for passing place at the rate of one passing place for every one km (or part thereof). These shall be indicated in Schedule B of the Concession Agreement. However, no passing place would be provided where structures are 6-lane wide.

(iii) Existing culverts

(a) All culverts which are structurally distressed or not having sufficient vent/ size shall be reconstructed as new structures of width as per Sub Para 7.3 (i) of this Section.

(b) All existing culverts which are not to be reconstructed shall be widened equal to the roadway width of the approaches

(c) The culverts and Hume pipe structures shall be widened so as to make the deck width same as specified in Sub Para 7.3 (i) of this Section. If the width of additional widening is less than 0.5 m on either side, the widening of the structure may be dispensed with and traffic shall be guided with the help of crash barriers in a transition of 1 in 20 on either side approaches

(d) List of culverts to be reconstructed and/or widened shall be specified in Schedule-B of the Concession Agreement.

(iv) Existing bridges

(a) All bridges which are structurally distressed shall be reconstructed as new bridges of width as per Sub Para 7.3 (ii)

(b) Components like bearings, expansion joints, railings, crash barriers, wearing surface, etc., which are not in sound condition, shall be replaced. Minor non-structural works shall be suitably repaired.

(c) If the width of additional widening is 1.0 m (0.5 m on each side) or less, the widening of the structure may be dispensed with and traffic shall be guided with the help of crash barriers in a transition of 1 in 20 on either side approaches.

(d) The bridges having 2-lane carriageway particularly those with T-beam/Box type superstructure with well/pile foundation, which are in sound condition, may be retained and proper transition between approach and bridge shall be provided. Typical cross sections at deck level for bridges with and without

footpaths showing new bridge on one side and existing / later bridge on the other side are given in Fig. 7.4 A and Fig. 7.4 B respectively.

(e) The width of the new structures constructed on the other side of the existing bridge shall be as specified in Sub Para 7.3 (ii) of this Section

(f) List of bridge structures to be reconstructed and/or widened shall be specified in Schedule-B of the Concession Agreement.

7.4 Structure Types

(i) The bridge structure should aesthetically blend with the environment.

(ii) The type and span arrangement may be fixed so as to provide riding comfort.

(iii) Wherever box girders are proposed for superstructure, the minimum clear depth inside the box shall be 1.50 m with suitable openings in the diaphragms and box to facilitate inspection. Manholes of minimum size of 300 mm (horizontal) and 150 mm (vertical) shall be provided at the extreme corners of the box section. Suitable arrangements for lighting shall be made to enable inspection of the box.

(iv) The following types of structures shall not be accepted

(a) Drop in spans with halved joints (articulations)

(b) Trestle type frames for substructures

(v) If construction of structures like cable stayed/ suspension bridge or with special techniques is envisaged, it shall be specified in Schedule-B of the Concession Agreement.

7.5 Hydrology

All the structures shall have adequate waterway, which shall in any case be not less than that of existing bridge (except when such waterways can be reduced in cases like clogging or silting of spans, etc.). The design discharge shall be evaluated for flood of 100 year return period.

7.6 Sub-Soil Investigations

Independent sub soil investigations shall be carried out to establish the soil parameters required for detailed design of foundations in accordance with relevant provisions of IRC:78 and MORTH Specifications

7.7 Culverts and Bridges using Pipes

(i) Reinforced concrete pipes for culverts and bridge structures shall be of Non Pressure (NP) 4 type conforming to the requirements of IS: 458. Minimum diameter of pipes for new pipe culverts shall be 1200 mm.

(ii) Existing culverts of diameter 900 mm and above, which are in sound condition and functioning satisfactorily, may be extended, using pipes of same diameter. All culverts having pipe diameter less than 900 mm shall be replaced with pipes of minimum 1200 mm diameter under both the carriageways. Minimum depth of earth cushion over pipe including road crust shall not be less than 1000 mm for new/reconstructed culverts. In case of existing sound and safe culverts, a minimum cushion of 600 mm may be acceptable. In case the cushion is insufficient, encasing of pipe in concrete shall be ensured. Flood protection shall be as specified in the relevant IRC Codes and Specifications.

7.8 Temporary Works

7.8.1 *Form Work*

The Concessionaire shall be responsible for the safe, workable design and methodology for all temporary or permanent forms, staging and centering required for supporting and forming the concrete of shape, dimensions and surface finish as shown on the drawings (Refer IRC:87). Adequate foundation for the staging shall be ensured. Redundancy in support system shall also be ensured by providing diagonals and additional members. The following guidelines shall be adopted:

(i) Formwork shall be of steel, marine ply or laminated plywood.

(ii) Only such shuttering oil (release agent) shall be used, which permits easy removal of shutters without leaving stains or other marks on the surface of the concrete. Requirements given under Clause 3.5 of IRC:87 shall also be complied with.

(iii) In case of tubular staging of heights more than 10 m, special attention shall be paid to the structural adequacy of the system, efficacy of the connections (clamps etc), and foundations. Foundation blocks of adequate thickness in M15 cement concrete shall be provided under the base plates to prevent differential settlements. All best tubular props shall be straightened before re-use and the members with deviation from straightness more than 1 in 600 of its length shall not be re-used. For re-used props, suitable reduction in the permissible loads shall be made depending upon

their condition in accordance with recommendations of the manufacturer and as reviewed by the IE.

(iv) In case of prestressed concrete members, the side forms shall be removed as early as possible and the soffit forms shall permit movement of member without restraint, when prestress is applied. Form supports and forms for cast-in-situ members shall not be removed until sufficient prestress has been applied to carry all anticipated loads during construction stage.

(v) Adequate foundations for formwork shall be ensured.

7.8.2 *Special Temporary and Enabling Works*

Designs, drawings and methodology proposed by the Concessionaire in the use of special temporary and enabling works like Launching Girders, Cantilever Construction Equipment, Tall Formwork, Shoring for Earth Retention, Lifting and Handling Equipments and the like shall be submitted to the Independent Engineer (IE) for his review and comments if any. The Concessionaire shall be fully responsible for the design and structural adequacy of all temporary and enabling works. Review by IE shall not relieve the Concessionaire of this responsibility.

7.9 Foundations and Sub-structures

7.9.1 The design of foundations and sub-structures shall conform to IRC:78.

7.9.2 *Open Foundations*

The design of open foundations shall conform to IRC:78. Floor protection shall be provided as per Section 2501 of MORTH Specifications.

7.9.3 *Pile Foundations*

(i) The design of pile foundations shall be done as per IRC:78. The Concessionaire shall submit a method statement supported by the following:

(a) Bore-log details for each foundation;

(b) Design assumptions;

(c) Design calculations both for single pile or group of piles and for pile type;

(d) Type of piles-Bored cast-in-situ piles and driven piles;

(e) Procedure adopted for installation of piles.

(f) Arrangements for load testing of piles,

(g) Format for reporting of test results.

(iii) The Concessionaire shall submit the following information regarding proposed proprietary system of piling:

(a) General features of the process/system alongwith specifications and standards

(b) Authenticated copies of license/agreement, if any;

(c) Details of plant and equipment to be used along with the names of manufacturers and name of process/system;

(d) Details of projects where the process/system has been successfully used;

(e) Limitations, if any;

(f) Acceptance tests and criteria;

(g) Installation and maintenance procedure and schedule; and

(h) Performance warranty.

7.9.4 *Well Foundations*

(i) For conventional method of well sinking, the Concessionaire shall submit a method statement including the following:

(a) Design calculations and drawings,

(b) Procedure for sinking and plugging of well,

(c) Format for reporting of test results.

(ii) If proprietary system of well sinking like jack down method is proposed to be used, the Concessionaire shall submit relevant information covering inter alia the following:

(a) General features of the system along with specifications and standards and justification for the thickness of steining proposed to be adopted;

(b) Authenticated copies of license/agreement, if any;

(c) Details of plant and equipment to be used along with the names of manufacturers and name of process/system;

(d) Details of projects where the process/system has been successfully used;

(e) Limitations, if any;

(f) Acceptance tests and criteria;

(g) Installation and maintenance procedure and schedule; and

(h) Performance warranty.

(iii) The Concessionaire in his Methods Statement shall include the procedure for sinking by special methods, carrying out tests, if any, of wells including design criteria/calculations, drawings and formats for reporting test results.

7.10 Approach Slabs

Approach slabs shall be provided as per Clause 217 of IRC:6 and Section 2700 of MORTH Specifications.

7.11 Superstructures

7.11.1 The design of reinforced and pre-stressed concrete superstructures shall be as per IRC:21 and IRC:18 respectively. The design of steel and steel-concrete composite super structures shall conform to IRC:24 and IRC:22 respectively.

7.11.2 The Concessionaire shall submit Method Statement indicating inter alia the following:

(i) Sources of materials,

(ii) Design, erection and removal of formwork,

(iii) Layout of casting yard together with necessary details,

(iv) Production, transportation, laying, compacting and curing of concrete,

(v) Sequence of concreting in cast-in-situ construction, side shifting of girders, if applicable and placing of girders on the bearings,

(vi) Details of construction joints,

(vii) Prestressing system, if required,

(viii) Methodology and equipment for side shifting and launching of pre-cast girders,

(ix) Key personnel for execution and supervision,

(x) Testing and sampling procedure,

(xi) Equipment details.

7.12 Bearings

7.12.1 All bearings shall be easily accessible for inspection, maintenance and replacement. Suitable permanent arrangements shall be made for inspection of bearings from bridge deck. Design and specifications of bearings shall be as per IRC:83 (Part I, II & III). Spherical bearings shall conform to the requirements of BS:5400. The materials of bearings may however conform to the relevant BIS codes nearest to the specifications given in BS 5400. The drawing of bearings shall include the layout plan showing exact location on top of pier and abutment cap and the type of bearings i.e. fixed/free/rotational at each location along with notes for proper installation. The bearing should cater for movement in both longitudinal and lateral direction in respect of bridge structures more than 12 m wide.

7.12.2 The Concessionaire shall procure bearings only from the manufacturers approved by MORTH.

7.12.3 The Concessionaire, shall submit detailed specifications, designs and drawings including installation drawings and maintenance manual incorporating the replacement procedure.

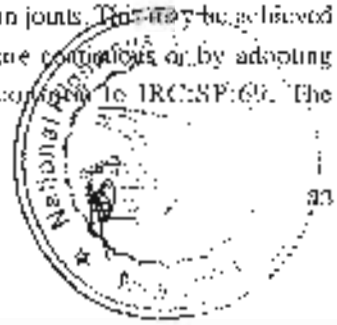
7.12.4 The Concessionaire shall obtain and submit a complete Quality Assurance Programme (QAP) from the manufacturer. The QAP shall give the full details of the process of quality control, raw material testing, various stages of manufacture, testing of bearing components as well as testing of complete bearing in conformity with relevant part of IRC:83, prior to the commencement of manufacture of the bearings.

7.12.5 In addition to the routine testing of the materials and bearings at the manufacturer's premises, the Concessionaire shall arrange testing of random samples of one per cent (minimum one number of each type) of bearings from independent agency approved by the IE.

7.12.6 The Concessionaire shall submit a certificate of confirmation regarding quality control measures taken during manufacture of the bearings and the material conforming to the prescribed standards and specifications. Full lot of bearings of the sample found to have inferior specifications to those certified by the manufacturer or to have major discrepancy in material specifications or which fail to meet the acceptance criteria, shall be rejected.

7.13 Expansion Joints

(i) Structures shall have minimum number of expansion joints. This may be achieved by adopting longer spans, making the superstructure continuous or by adopting integral structures. Expansion joints shall conform to IRC:SP:69. The



Concessionaire shall furnish guarantee/proprietary indemnity bonds from the manufacturers/suppliers of expansion joints for a period of 10 years.

(ii) For existing bridges, all expansion joints, which are older than 15 years shall be replaced.

(iii) The Concessionaire shall procure expansion joints only from manufacturers approved by MORTH.

(iv) The expansion joints should cater for movement in both longitudinal and lateral direction in respect of bridge structures more than 12 m wide.

7.14 Wearing Coat

(i) The wearing coat may be either bituminous concrete or cement concrete. For new bridges and culverts, the wearing coat shall have unidirectional camber and shall be in conformity with Section 2700 of MORTH Specifications. For existing bridges, the camber as existing may be retained.

(ii) Wearing coat older than 15 years or in damaged/distressed condition shall be replaced.

7.15 Reinforced Earth Retaining Structures

7.15.1 Reinforced earth retaining structures shall not be provided for height more than 6 m unless otherwise specified, and near water bodies. Such structures should be given special attention in design, construction, ground improvement where necessary, maintenance and selection of System/System design. Local and global stability of the structure shall be ensured.

7.15.2 Design Accreditation and warranty for life of the structure from the approved supplier/ manufacturer shall be obtained and furnished. A qualified and experienced technical representative of the approved supplier/manufacturer shall be present on site throughout during the casting and erection phases to ensure that the quality of the works executed by the Concessionaire is in accordance with good industry practice.

7.15.3 The Concessionaire shall submit relevant information on the system covering inter-alia the following:

(i) General features of the system along with specifications and standards;

(ii) Authenticated copies of license/agreement, if any;

(iii) Details of plant and equipment to be used along with the names of manufacturers and name of process/system;

(iv) Details of projects where the process/system has been successfully used;

(v) Limitations, if any;

(vi) Acceptance tests and criteria;

(vii) Installation and maintenance procedure and schedule; and

(viii) Performance warranty.

7.15.4 The Concessionaire shall submit a method statement including the following

(i) Design assumptions, calculations and drawings,

(ii) Construction Procedure ,

(iii) Tests to be conducted including frequency and the formats for reporting the test results.

7.15.5 The packaging of reinforcing elements shall clearly indicate the name of the manufacturer/ supplier and brand name, date of production, expiry, if any and batch identification number along with the manufacturer's test certificates.

7.16 River Training and Protective Works

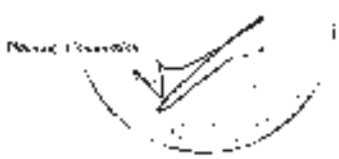
River training and protective works shall be provided wherever required for ensuring the safety of bridges and their approaches on either side. The special features and design of various types of river training and protective works shall be in accordance with IRC:89.

7.17 Safety Barriers

(i) For bridges without foot paths, concrete crash barriers shall be provided at the edge of the carriageway on all new bridges

(ii) The type design for the crash barriers may be adopted as per IRC:5. The design loading for the crash barriers shall be as per Clause 209.7 of IRC:6.

(iii) For bridges with foot paths, pedestrian railing shall be provided on the outer side of footpath.



(iv) The railings of existing bridges shall be replaced by crash barriers, where specified in Schedule B of the Concession Agreement.

(v) Parapets/Railings of the existing bridges/culverts to be repaired/replaced shall be specified in Schedule-B of the Concession Agreement.

7.18 Rail-Road Bridges

7.18.1 Unless otherwise specified in Schedule-B of the Concession Agreement, ROB/RUB to be provided shall be as specified in this Manual, with particular reference to the provisions of Para 7.3 of this Section.

7.18.2 *Road Over Bridge (Road over Rail)*

(i) In case a 2 lane bridge exists over the railway tracks, another two-lane bridge shall be constructed for one side traffic. The treatment to existing structure shall be given as in Sub-Para 7.3 (iv) of this Section

(ii) In case the bridge is to be provided over an existing level crossing, twin 2 lane bridges shall be constructed with overall width as given in Sub-Para 7.3 (ii) of this Section. If the alignment of road at the existing railway crossing has skew angle more than 45 degrees, the alignment of road or of pier/abutment shall be suitably designed to reduce skew angle up to 45 degrees.

(iii) The horizontal and vertical clearances to be provided shall be as per requirement of the Railway authorities.

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

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

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

7.18.3 *Road under Bridges (Road under Railway line)*

(i) Full roadway width as in the approaches shall pass below the bridge structure allowing for widening of Project Highway to 6-lane at a later date. The service roads where provided shall be continued in the bridge portion also.

(ii) The vertical and lateral clearances shall be as per guidelines given in Section 2 of this Manual.

(iii) These structures shall be designed to carry railway loads. The Concessionaire shall be required to obtain approvals of all designs and drawings from the concerned Railway authorities. The design of structure shall be in accordance with relevant Railway codes

(iv) The construction of RUB and its approaches shall be carried out in conformity with the terms specified in the approval granted by the Railway authorities

7.19 Grade Separated Road Structures

(i) The location, type and length of grade separated structures to be provided on the Project Highway shall be as specified in Schedule-B of the Concession Agreement.

(ii) The vertical and lateral clearances shall be as per requirements given in Section 2 of this Manual. Design of structures shall conform to requirements specified in this Manual.

7.20 Drainage

An effective drainage system for the bridge deck shall be planned, designed and installed so as to ensure that water from the deck is taken down to ground level/drainage courses by adequate size of drainage spouts and pipes. The type of such arrangement shall be specified in Schedule-B of the Concession Agreement

7.21 Structures in Marine Environment

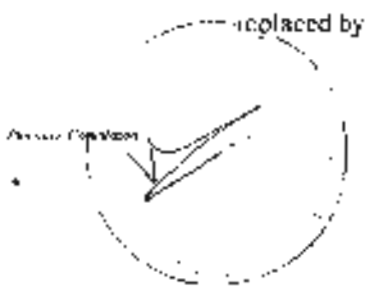
Necessary measures/treatments for protecting structures in marine environment shall be as specified in Schedule-B of the Concession Agreement

7.22 Repairs and Strengthening

(i) Structures requiring repairs and strengthening shall be specified in Schedule-B of the Concession Agreement. This shall be based on detailed condition survey of existing structures and shall bring out the nature and extent of repairs to be carried out, covering the following in addition to other specific requirements:

(a) Repair/replacement of damaged railings and parapets, provision of crash barriers,

(b) Replacement of wearing coat (old wearing coat shall be removed and replaced by bituminous wearing coat)



(c) Replacement of expansion joints,

(d) Replacement of bearings,

(e) Structural repairs to substructure/super structure, including replacement of substructure/superstructure if required.

(f) Repair to flooring and protection works.

(ii) The Concessionaire shall submit repairs and strengthening plan for structures in para (i) above to the Independent Engineer for review and comments, if any. For all other structures with minor deficiencies, not affecting structural inadequacies and integrity, appropriate repair measures may be proposed and submitted to the Independent Engineer for review and comments, if any.

(iii) Strengthening/rehabilitation work shall be carried out in accordance with relevant IRC Codes and Guidelines.

(iv) The Concessionaire shall take up repair and widening of existing bridge at a particular site only after the new bridge at that site is constructed and the same can be used by the traffic. Before taking up the works of repair and widening of the existing bridge, the Concessionaire shall make all arrangements to ensure that both way traffic can use the new bridge and a smooth flow of traffic is maintained. The Concessionaire shall take all precautions to guard against any traffic accident due to such diversion and shall use all necessary road signs, traffic management measures etc. for the purpose. After completion of repair and widening of the existing bridge, all arrangements shall be made so that both the old and the new bridges at the site can be used by the traffic. Repair works for substructure, foundation, and abutment etc., which will not affect or disturb the flow of traffic over the existing bridges, may, however, be taken up before completion of the new bridge. In such cases where new 2-lane bridges is not required to be constructed before COD, the existing bridge shall be repaired/strengthened by suitably regulating the traffic on the bridge or by temporary diversion.

7.23 Design Report

The Concessionaire shall furnish the design report including the following to the Independent Engineer for his review and comments, if any

(i) Sub soil exploration report as per IRC:78 as specified in para 7.6 above.

(ii) Hydrological investigation report including design discharge calculation for the bridges, in case of any change in the proposed waterway of any bridge as specified in para 7.5 above.

(iii) Designs and drawings of temporary works, foundations, substructures and superstructure of structures.

(iv) Detailed report regarding the bridges whose width is less than the roadway width and the proposal for their improvement.

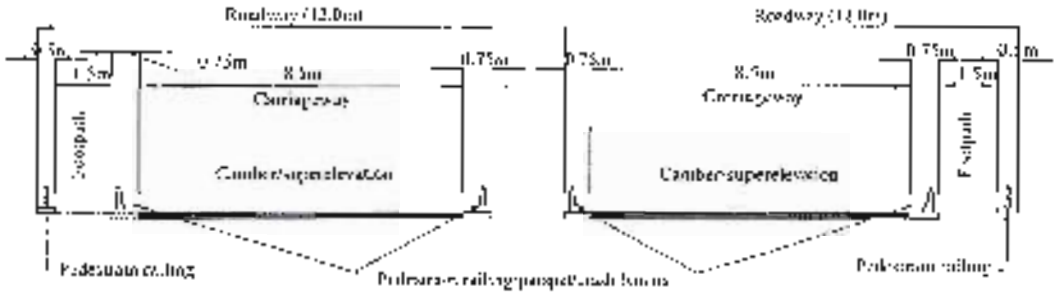
(v) Any other information relevant to the design report.

7.24 Responsibility for Design and Structural Adequacy

The Concessionaire shall be fully responsible for the design, structural adequacy and detailing of bridge and culvert structures. Review by IE shall not relieve the Concessionaire of this responsibility.

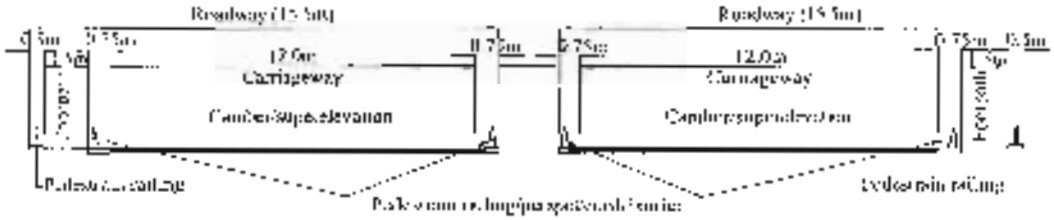
Cross section of pipe culverts at road level
4-lane divided highway

Fig. 7.1



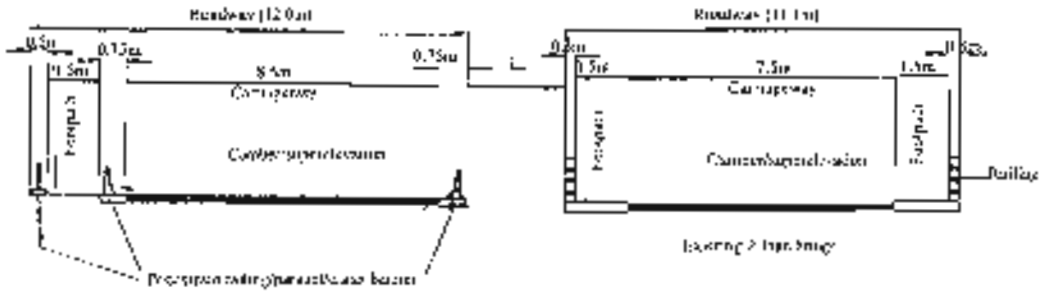
Cross section of bridge at deck level - with footpath
4-lane divided highway

Fig. 7.2



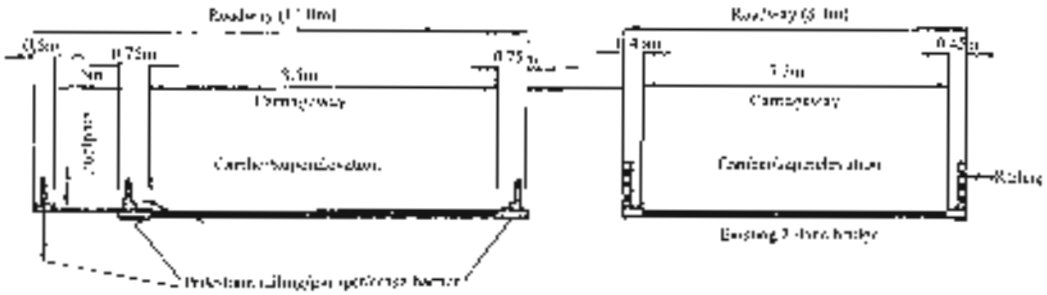
Cross section of bridge at deck level - with footpath
4-lane divided highway (both sides new bridges for 6-lane standards)

Fig. 7.3



Cross section of bridge at deck level-with footpath
(T-beam/box girder type/well/pile foundation)
4-lane divided highway (one side new bridge and other sides existing for 2-lane bridge)

Fig. 7.4A



Cross section of bridge at deck level-without footpath
(T beam/box girder type/well/pile foundation)
4-lane divided highway (one side new bridge and other sides existing for 2-lane bridge)

Fig. 7.4B

8.2 Structural Concrete

The Concrete for use in structures shall conform to the provisions in Clauses 302.6 to 302.9 of IRC:21 and Section 1700 of MORTH Specifications. Wherever High Performance Concrete (HPC) is proposed to be used, the same shall conform to the provisions of IRC:SP:70. Sampling and testing of concrete shall be as per Clause 302.10 of IRC:21. Acceptance criteria for concrete shall conform to Clause 302.11 of IRC:21.

8.3 Cement

Any type of cement specified in IRC:21 may be used for the works subject to limitations, if any, specified therein.

8.4 Coarse Aggregates

Before commencement of the works, at least three samples, in accordance with the procedure laid down in IS:2430, shall be taken for each quarry source to ascertain the quality, suitability and fitness of the available material for use in the works. Fresh tests shall be conducted in case there is any change in the source or the type of rock being quarried. The proposal, along with a copy of test reports, shall be submitted.

8.5 Sand/Fine Aggregates

(i) All fine aggregates shall conform to IS:383 and tests for conformity shall be carried out as per IS:2386 (Part I to VIII). The fineness modulus of fine aggregates shall be between 2.0 and 3.5.

(ii) Before the commencement of the works, at least three samples as per IS:2430 shall be taken for each quarry source to ascertain the quality, suitability and fitness of the available material for use in the works and the proposal along with a copy of test reports shall be submitted to the IE for review and comments, if any.

(iii) Fine aggregates having positive alkali-silica reaction shall not be used.

8.6 Water

(i) Water for use in the works for mixing and curing of concrete shall be in conformity with Clause 302.4 of IRC:21.

(ii) Water from each source shall be tested before the start of works and thereafter every three months and after each monsoon till the completion of the works and

the proposal along with a copy of test reports shall be submitted to the IE for review and comments, if any

8.7 Chemical Admixtures

8.7.1 The following guidelines shall apply in selection and use of admixtures:

(i) Chemical admixtures shall comply with IS:9103 and meet the requirements stipulated in clause 5.5 of IS:456

(ii) Admixtures generating hydrogen or nitrogen or containing nitrates, sulphides, sulphates, or any other material liable to affect the reinforcement/embedments or concrete shall not be used.

(iii) Compatibility of admixture with the cement being used shall be tested before actual use in the works. The test shall be repeated in case of change of type or grade or source of cement.

(iv) Admixtures shall not impair the durability of concrete. They shall not combine with the ingredients to form harmful compounds or endanger the protection of reinforcement against corrosion.

(v) The packaging of admixtures shall clearly indicate the name of the manufacturer/ supplier, brand name (name of the product), date of production and expiry, batch/ identification number.

8.7.2 In addition to the details as stipulated in Clause 1012.1 of MORTH Specifications, following information shall also be furnished:

(i) pH value and colour.

(ii) Latest date of test and name of the laboratory.

(iii) Shelf life, maximum and minimum temperature for storage, precautions to be taken while mixing and any other instructions for use.

8.8 Steel

8.8.1 *Steel for Prestressing*

In addition to the requirement mentioned in Clause 1002 of MORTH Specifications, the steel for prestressing shall satisfy following conditions:

(i) Uncoated stress relieved low relaxation steel conforming to IS:14268.

(ii) Prestressing steel shall be subjected to acceptance tests in respect of modulus of elasticity, relaxation loss at 1000 hrs, minimum ultimate tensile strength, stress-strain curve etc. prior to actual use on works as per guidelines contained in BS:6447. The modulus of elasticity value, as per acceptance tests, shall conform to the design value, which shall be within a range not more than 5 per cent between the maximum and the minimum.

8.8.2 *Reinforcement/Untensioned Steel*

(i) Only Fe 500 grade of steel shall be used on works and all reinforcing steel for use in works shall be procured from main/ major producers. Fe 415 grade of steel can also be used where permissible as per IRC Codes and Guidelines

(ii) Only fresh steel shall be brought to the site. Every bar shall be inspected before assembling on the work: and defective, brittle or burnt bars shall be discarded Cracked ends of bars shall be cut before use.

(iii) Only Thermo Mechanically Treated (TMT) bars conforming to IS:1786 shall be used as reinforcing steel.

(iv) All reinforcement shall be free from loose rust and coats of paints, oil, mud or any other substance, which may destroy or reduce bond. The reinforcement bars bent and fixed in position shall be free from loose rust or scales, coats of paints, oil, mud or chloride contamination and other corrosion products. Where cleaning of corroded portions is required, proposal for effective method of cleaning such as sand blasting shall be submitted to the IE for prior review and comments.

(v) Proprietary steel products will be permissible provided they conform to the minimum requirements.

8.8.3 *Steel for Bearings*

Mild steel, high tensile steel, cast steel, steel forgings, and stainless steel shall conform to the provisions contained in clause 925.1 of IRC:83 (Part II)

8.8.4 *Structural Steel*

All structural steel, castings and forgings, fasteners (bolts, nuts, washers and rivets), welding consumables and wire ropes and cables shall conform to the provisions of clause 905.1.2, 905.2, 905.3, 905.4 and 905.6 respectively of IRC:24.

8.9 Bitumen

Bitumen shall be paving bitumen of viscosity grade complying with Indian Standard Specifications for "Paving bitumen" IS:73:2006 of grade appropriate for the traffic and climatic conditions of the Project Highway. The heavily trafficked roads in hot areas may find harder grade bitumen more appropriate while pavements in mountainous regions subject to sub-zero temperatures during winter months carrying relatively lower traffic loads and subject to the phenomenon of "Frost Heave" may find less viscous bitumen resistant to fatigue and cold cracking more appropriate.

8.10 Storage of Materials

All materials shall be stored at proper places so as to prevent their deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged or is otherwise considered defective after review by the Independent Engineer shall not be used in the works and shall be removed from site by the Concessionaire at his cost. Such materials shall not be made acceptable by any modifications

8.11 Report to be submitted

The Concessionaire shall prepare and submit report containing test results of all materials and finished products proposed to be used in the Project Highway.

Section 9

Traffic Control Devices/Road Safety Devices/Road Side Furniture

SECTION 9

TRAFFIC CONTROL DEVICES /ROAD SAFETY DEVICES/ ROAD SIDE FURNITURE

9.1 General

Traffic Control Devices/Road Safety Devices/Road Side Furniture shall comprise of road signs, road markings, object markers, hazard markers, studs, delineators, attenuators, safety barriers, pedestrian guard rails, boundary stones, kilometre stones, etc. Guidelines given in IRC:8, IRC:25, IRC:26, IRC:35, IRC:67, IRC:79, IRC:103 and Section 800 of MORTH Specifications shall be used for providing these items unless otherwise specified in this Section.

9.2 Road Signs

The three types of road signs viz., mandatory/regulatory signs, cautionary/warning signs and informatory signs shall be provided as given in IRC:67 and section 802 of MORTH Specifications. Proper signs shall be provided for left in and left out at service roads for safe guidance of traffic. Clustering and proliferation of road signs shall be avoided for enhancing their effectiveness.

9.2.1 The material and specifications for Road Signs shall be governed by the Specifications for Road and Bridge Works issued by the MORTH.

9.2.2 There shall be corresponding road markings with stop signs, give way signs, merging or diverging traffic signs, lane closed signs, road narrowing signs, slip roads/diversion signs, compulsory keep left/right signs, or any other signs as per IRC:67.

9.2.3 Wherever the Project Highway alignment is on a curve, there shall be advance cautionary signs for sharp curves (depending on whether it is on left or right) and chevron signs (rectangular in shape with traffic yellow background and black arrow) at the outer edge of the curve. The sign for the curve ahead particularly in mountainous and steep terrain shall always be accompanied with chevron signs at the outer edge of the curve and appropriate delineation.

9.2.4 The Specifications and Standards of roads signs such as chevron, overhead, etc., which are not covered by IRC:67 would be as per International Standards

9.2.5 All road signs shall be with retro reflective sheeting of high intensity grade with encapsulated lens fixed over aluminium sub strata as per clause 801 of MORTH Specifications.

9.2.6 Kerb mounted signs shall be supported on GI pipes. Overhead signs shall be placed on a structurally sound gantry or cantilever structure made of GI pipes. Its height, lateral clearance and installation shall be as per MORTH Specifications. The pedestal supporting the gantry or cantilever structure of the overhead signs shall be flushed at the ground level and in no case shall protrude more than 150 mm above ground level.

9.2.7 Locations and size of overhead traffic signs shall be specified in Schedule-B of the Concession Agreement. The following conditions may be considered while deciding about the locations of overhead signs:

(i) Traffic volume at or near capacity.

(ii) Restricted sight distance,

(iii) Built up stretches,

(iv) Insufficient space for ground mounted signs,

(v) Distances of important places and route highways at suitable intervals,

(vi) Before major intersections.

9.2.8 No sign, signal or any other device erected for traffic control, traffic guidance and/or traffic information shall obscure any other traffic sign. Further, the signs and signals shall not carry any advertisement.

9.2.9 Each exit ramp shall have signs mounted on posts indicating the name of the place and the important roads it would lead to.

9.3 Road Markings

All road markings shall conform to IRC:35. Road markings shall comprise of carriageway markings, markings on intersections, hazardous locations, parking areas, etc. Where service roads are provided, proper layout and road markings shall be provided so that merging with traffic is safe. The markings shall be done by means of a self propelled machine which has a satisfactory cut-off value capable of applying broken line automatically.

9.3.1 *Material*

(i) Hot applied thermoplastic paint with glass beads shall be used as road marking material

(ii) Road markings may also be in the form of prefabricated sheet material, e.g. plastic sheets, which may be set into the pavement with upper surface flush with the pavement surface.

9.4 Road Delineators

These are roadway indicators, hazard markers and object markers as given in IRC:79.

9.4.1 *Roadway Indicators*

Circular Iron Posts of 1.0 m height covered with reflectorised synthetic material/film, as per criteria, placement and spacing given in IRC:79 shall be provided

9.4.2 Hazard Markers shall be provided as given in IRC:79. In addition, the objects close to the road shall be painted with black and yellow stripes using the paint conforming to IS:164

9.4.3 Object Markers shall be provided as given in IRC:79. In addition, the kerbs in the median/ traffic islands shall be painted with black and white stripes (black and yellow stripes at highly hazardous locations) using the paint conforming to IS:164

9.4.4 Lighted Bollards shall be provided in the median/ traffic islands of all major/minor junctions as per International Standards.

9.5 Raised Pavement Markers (Cat's Eyes/Road Studs)

The cat's eyes or road studs shall be provided to improve the visibility in night-time and wet weather conditions. These shall be prismatic retroreflective type two way markers conforming to ASTM D 4280 and provided as per Table 9.1

Table 9.1:Warrants for Road Studs

S. No.	Description of sections	Length of section to be provided with studs	Spacing of studs	Location of studs
1	All sections of Project Highway having radius of horizontal curve below 700m	Length of horizontal curve including its transitions	5 m	Centre of the carriageway
2	All sections of Project Highway where vertical grade is steeper than 5 per cent	Till the grade comes to 5 per cent	5 m	Centre of the carriageway
3	All major/minor junctions and median openings	(i) 100 m on either side of the junction/median opening (approaching side)	5 m	Centre of the carriageway
		(ii) Three Rows of studs at a spacing of 0.15 m	0.15 m	across the main carriageway and the cross roads (approaching side 50 m before the junction/median opening)
4	All built-up areas	Length of built-up area	5 m	Centre of the carriageway
5	Uncontrolled Pedestrian Crossings	One row of studs across crossings the main carriageway		

Note :

1. Solar Studs shall be provided for locations at S. No. 3 (i) and 5 in Table 9.1.
2. White colour road studs shall be used at locations where lane marking in white colour is prescribed in

   IRC:35 Amber colour shall be used at locations where lane marking in amber colour is prescribed in

   IRC:35-Red colour may be used to indicate no entry (like contraflow-side).

9.6 Attenuators

Attenuators shall be provided at hazard markers locations given in IRC 79, structural columns of large direction signs, illumination lamp posts and at approaching traffic islands of toll plaza. It shall take repeated impacts without any additional recovery procedures and with minimal or no repairs. The attenuators modules shall be moulded from HDPE plastic. The design, size, number of modules, etc. of attenuators shall be as per International Standards and location specific duly considering the likely impact.

9.7 Road Side and Median Safety Barriers

There are two types of safety barriers viz., roadside safety barriers, and median safety barriers.

9.7.1 *Road Side Safety Barriers*

(i) Warrants: The longitudinal roadside barriers are basically meant to shield two types of roadside hazards i.e. embankments and roadside obstacles and also for preventing the vehicles veering off the sharp curves. The warrants for a fill section in terms of the height and slope needing protection with roadside barriers are shown in Fig.9.1. The barrier is not warranted for embankment having a fill slope of 3 H:1 V or flatter. The warrants for roadside objects are mainly dependent upon the type of obstacle and the probability of their being hit. A barrier shall be installed only if the result of vehicle striking the barrier is likely to be less severe than the severity of accident resulting from the vehicle impacting the unshielded obstacle. Some of the commonly encountered roadside obstacles are bridge piers, abutments and railing ends, roadside rock mass, culverts, pipes and headwalls cut slopes, retaining walls, lighting supports, traffic signs and signal supports, trees and utility poles.

(ii) Types of Roadside Safety Barriers : There are three types of longitudinal roadside safety barriers viz:

(a) Flexible type (like wire rope fencing)

(b) Semi-rigid type like

- "W" beam type steel barrier
- Thrie beam type steel barrier

These steel barriers are of strong post type and usually remain functional after moderate collisions thereby eliminating the need for immediate repair.

(c) Rigid type (like concrete crash barriers)

(iii) Road Side Steel Barriers

(a) Design Aspects: The "W" beam type safety barrier consists of steel posts and a 3 mm thick "W" beam rail element which is spaced away from the posts. The spacer minimizes vehicular snagging and reduces the likelihood of a vehicle vaulting over the barrier. The steel posts and the blocking out spacer shall both be channel section of 75mm x 150 mm size and 5 mm thick. The rail shall be 700 mm above ground level and posts shall be spaced 2 m center to center. Typical details are shown in Fig.9.2.

The thrie beam safety barrier shall have posts and spacers similar to the ones mentioned above for "W" beam type. The rail shall be placed at 650 mm above the ground level. This barrier has higher initial cost than the "W" beam type but is less prone to damages to vehicle collisions especially for shallow angle impacts. Typical details of Thrie beam barrier are shown in Fig 9.3.

The "W" beam, the Thrie beam and the posts spacers and fasteners for steel barriers shall be galvanized by hot dip process.

(b) End treatment for steel barrier: An untreated end of the roadside barrier can be hazardous, if hit, because the barrier beam can penetrate the passenger compartment and cause the impact vehicle to stop abruptly. End treatments should, therefore, form an integral part of safety barriers and the end treatment not spear vault or roll a vehicle for head on or angled impacts. The two end treatments recommended for steel barriers are "Turned down guardrail and Anchored in back slope".

Turned down guardrails have the "W" or Thrie sections reduced from full height to ground level with a gentle slope over a distance of 8 to 9 meters. The turned down rail is intended to collapse on impact allowing the vehicle to pass over it without becoming airborne or unstable. In order to locate the barrier terminal away from the traveled way and to minimize drivers' reaction to a hazard near the road by gradually introducing a parallel barrier installation or to transition a roadside barrier nearer the roadway such as a bridge parapet or a railing, the turned down shall be flared away from the

roadway. Suggested flare rates depending upon the design speed and type of barrier are given in Table 9.2.

Table 9.2 Flare Rates

Design speed in km per hour	Flare Rates	
	Rigid barriers	Semi-rigid barriers
100	17:1	13:1
80	14:1	11:1
60	11:1	9:1
40	8:1	7:1

The posts at the end treatment should have the same cross sections as provided in the main barrier

At road cross sections in cutting or if the road transitions from cut to fill, the safety barriers can be anchored in back slopes. The back slope covering the anchored portion of the barrier should be graded flat with side slopes preferably not steeper than 10:1. The anchored portion should develop a tensile strength in the rail element to prevent the rail from pulling out of the anchorage. The barrier can also be anchored in an earth berm specially constructed for this purpose provided the new berm itself is not a hazard to the traffic. The earth berm should be made impervious to erosion.

(c) Placement: Placement recommendations determine the exact layout of the barrier and shall be made by the design engineer keeping in view the lateral offset of the barrier and flare rate. The final layout shall be a site-specific combination of these factors. The barriers shall be as far away from the traffic as possible and shall preferably have uniform clearance between the traffic and the hazard

As far as possible the safety barrier shall be placed beyond 2.5 m of the traveled way. For long and continuous stretches, this offset is not critical. The distance between the barrier and the hazard shall not be less than the deflection of the barrier by an impact of a full sized vehicle. In case of embankments, a minimum distance of 600 mm shall be maintained between the barrier and the start of embankment slope of a hazard to prevent the wheels from dropping over the edge. Typical details are shown in Fig.9.4

Flatter flare rates may be used particularly where extensive grading would be required to ensure a flat approach from the traveled way subject to the availability of right of way.

(iv) Road Side Concrete Barriers

(a) *Design Aspects:* Roadside Concrete safety barriers are rigid barriers having a sloped front face and a vertical back face. The recommended designs of the cast in situ and precast barriers are shown in Figs 9.5 and 9.6 respectively. Based on evaluation of vehicle direction, sight distance, structural stability and the psychological effect of barrier height on driver reaction, the most desirable height of the median barrier is 800 mm. Variations upto 50 mm in height of barrier can be made in the total height of the barrier to meet the site requirements. It is however, important to maintain the height of lower slope between 200 mm and 350 mm so as to reduce the chances of overturning of the vehicles.

The concrete barrier may be precast in lengths of upto 6 m depending upon the feasibility of transport and lifting arrangements. Concrete grade for the barriers shall not be lesser than M30. The minimum thickness of foundations shall be 25 mm thick cement concrete or hot mix asphalt placed at the base of barrier to provide lateral restraint. Where more than 75 mm thick overlay on the road pavement is anticipated, the foundation step may be increased to 125 mm. However, longitudinal roadside concrete barrier should have elaborate footing design which is structurally safe unless sufficient earth support is available.

(b) *End Treatment:* Safety barrier shall be provided with an end treatment, which shall be obtained by tapering the height of terminating end of the median barrier within a length of 8 m to 9 m.

(c) *Placement:* Placement recommendations for roadside steel barriers, mentioned in para 9.7.1 (iii) (c) above are applicable to concrete barriers as well.

9.7.2 *Median Barriers*

(i) General: Head-on-collisions, especially on highways with narrow medians, caused by out-of control vehicles jumping across the medians are a major source of accidents. Fixed objects on medians also require shielding from the traffic flow. Provision of median safety barrier in such conditions is an important requirement.

(ii) Warrants: The requirement of a median barrier is a function of the width of the median and the traffic volume on the road. Fig.9.7 indicates the warrants for provision of median barriers in terms of the combination of median width and Average Daily Traffic (ADT) in PCUs. At ADT less than 20,000 PCUs and with medians wider than 9 m, the probability of a vehicle crossing across the median is relatively low and median barriers in such cases are optional. Medians with width between 9 m and 15 m do not warrant a barrier unless there is an adverse history of median crossovers.

Median barriers may be impractical where a road has a large number of closely spaced median openings since the barrier needs to be terminated with an end treatment at these points.

An evaluation of the number of median openings, accident history, alignment, sight distance, design speed, traffic volume and median width shall be made prior to taking a decision to install a median barrier.

Median barriers shall also be provided to shield fixed objects in a narrow median. If necessary, median barriers shall be flared to encompass a fixed object, which may be a lamp post, foundation of overhead signs, bridge pier etc.

(iii) Types of Median Barriers

There are three types of median safety barrier viz., "W" beam type steel barrier, (Strong post type), Thrie beam type steel barrier, (Strong post type) and Concrete barriers.

(a) Steel Median Barriers

Design Aspects: The "W" beam barrier shall be similar to the roadside barrier described in para 9.7.1 (iii) (a) above except that the "W" beam shall be provided on both sides of the post with similar spacers. Typical details are indicated in Fig.9.8.

The Thrie beam barrier shall be similar to the roadside barrier described in para 9.7.1 (iii) above, except that the Thrie beam shall be provided on both sides of the post with similar spacers. Typical details are shown in Fig 9.9.

End Treatment: Steel median barriers shall be provided with a "Turned down guardrail" end treatment as described in para 9.7.1 (iii) (b) above except that no flaring is to be provided.

Placement: At locations, where the two adjacent carriageways are at the same level, the barrier shall be placed in the center of the median, duly taking into consideration, the drainage requirements. The placement of median barriers in cases where the two carriageways are at different levels is a function of the slopes between the two medians. Recommended placement for various combinations is indicated in Fig.9.10. In case the median barriers need to be flared e.g. for the protection of supports to overhead signs, the flare rates given in Table 9.2 shall be followed

(b) Concrete Median Barriers

Design Aspects: The design of cast in situ and precast median barriers is indicated in Figs. 9.11 and 9.12.

Median barrier shall be terminated sufficiently away from the median opening with the twin objectives of preventing impact by the turning traffic and providing adequate sight distance to the turning traffic. The terminating end of the median barrier shall be tapered in a length of 8 to 9 meters

Placement: Placement recommendations for steel median barriers mentioned in para 9.7.2 (iii) (a) above apply to concrete median barriers also.

(iv) General

Raised kerbs or drains shall not be provided between the traveled way and the barriers. These destabilize the vehicle balance and disturb its equilibrium before it strikes the barrier, thus defeating the essential purpose of safety and redirection of the impacting vehicle. Steel barriers shall be provided in rural sections whereas concrete barriers shall be provided in built-up sections. In addition to the warrants given in Para 9.7.1 (b) and 9.7.2 (ii) above, the safety barriers shall also be provided at the following locations :

(a) Where embankment is retained by a retaining structure.

(b) On valley side of highway in mountainous and steep terrain.

(c) Between main carriageway and footpath in bridges.

(d) At hazardous locations identified in Schedule D or through safety audit.

The requirements of Safety Barriers for structures are given in Para 7.3.3 of this Manual

9.8 Road Boundary Stones (RBS)

Road boundary stones shall be provided at the boundary on both sides of the Right of Way. These shall be spaced at 200 m. The boundary stones shall be of cement concrete as per Type Design given in IRC:25. The boundary stones shall be painted with cement primer and enamel paint and marked 'RBS' by paint.

9.9 Kilometre and Hectometre Stones

(i) The kilometre stones shall be provided at each kilometre on both sides of the Project Highway. The design and specification of kilometre stones shall conform to IRC 8. The matter to be written on various kilometre stones and the pattern thereof shall be as specified in IRC:8.

(ii) Hectometre (200 m) Stones shall be provided at every 200 m distance on both sides of the Project Highway. The design and specification of 200 m stones shall conform to IRC:26. The matter to be written on the 200 m stones shall be as specified in IRC:26

9.10 Pedestrian Railings /Guard Rails

Pedestrian Guardrails at iron/ steel sections shall be provided as per IRC:103. The iron/ steel guard rails shall be finished with epoxy primer and two coats of synthetic enamel paint after sand blasting (appropriate corrosion protection layer shall be provided in corrosive environment). In case iron/steel sections are not suitable in corrosive environment even after providing corrosion protection layer, concrete guard rails as per IRC:103 shall be provided in those sections.

9.11 Solar Based Beacons or Flashing Signals

These shall be provided at uncontrolled pedestrian crossings; near the public gathering places like educational institutions, worship places, hospitals, etc; cross roads; and median opening locations.

9.12 Design Report

The Concessionaire shall submit the proposals for traffic control/road safety devices and road furniture together with drawings and details to the Independent Engineer for review and comments, if any. The proposals shall include type, location, material specifications, installation details and the requisite warranties for satisfactory field performance (as applicable)

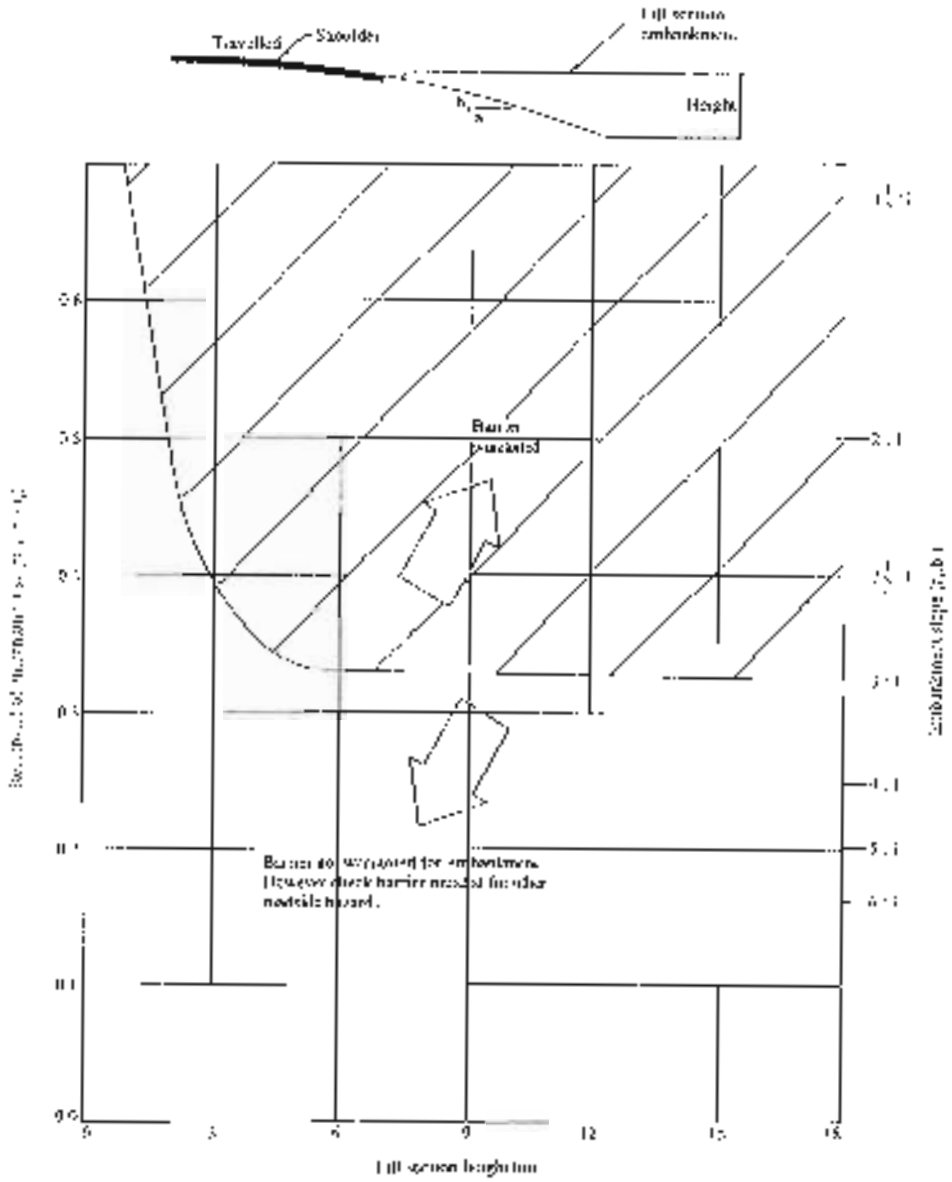
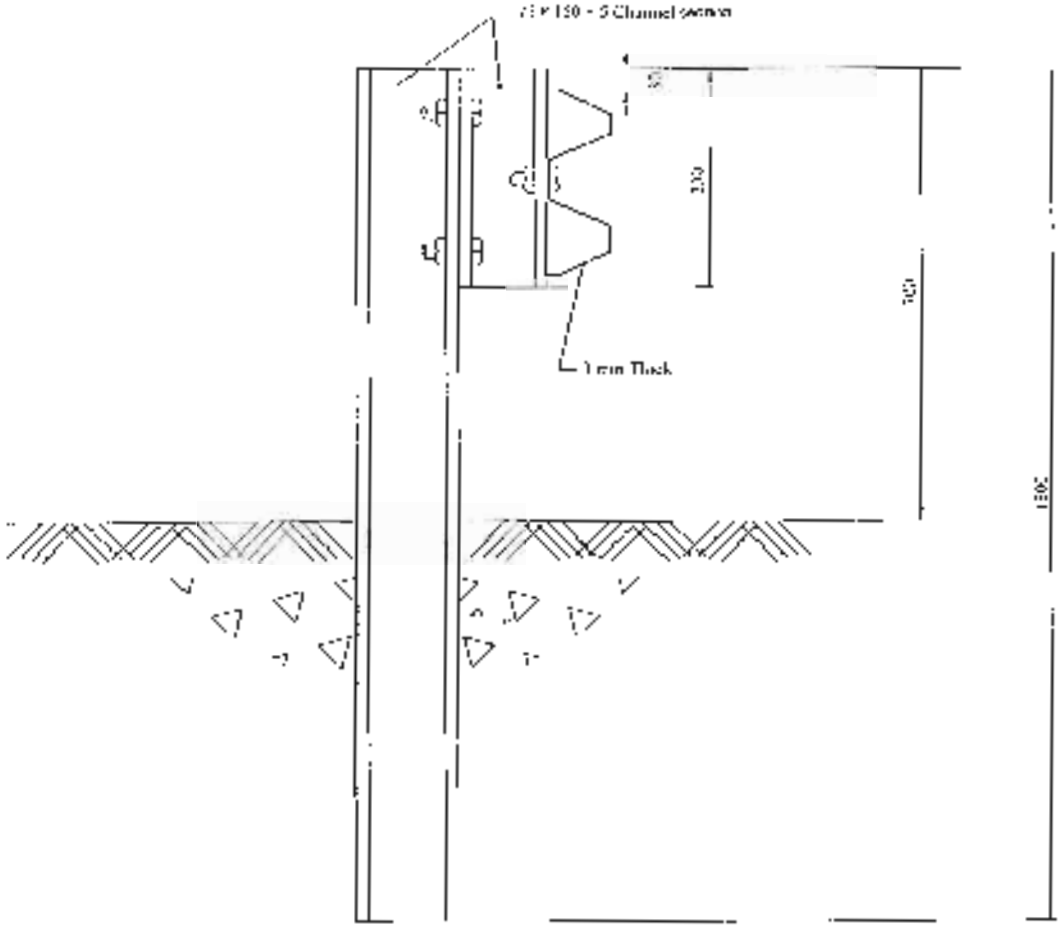
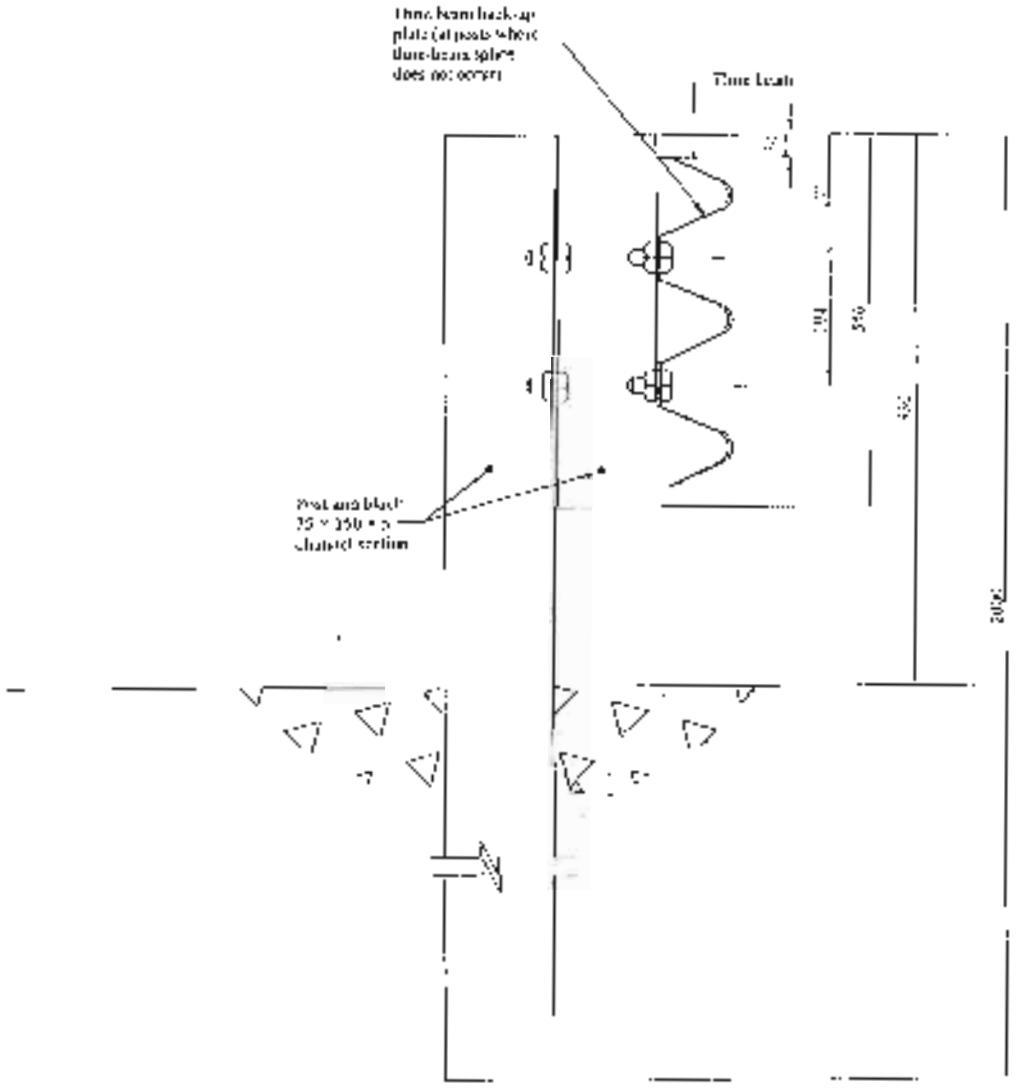


Fig. 9.1 : Warrants for roadside barriers on embankments



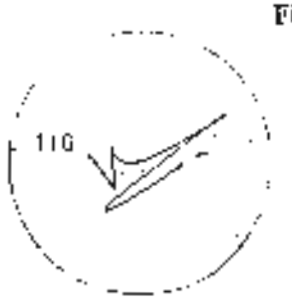
Note:
1. All dimensions are in mm

Fig. 9.2 : Typical details of "W" beam section.



Note:
1. All dimensions are in mm.

Fig. 9.3 : Typical details of flute beam section



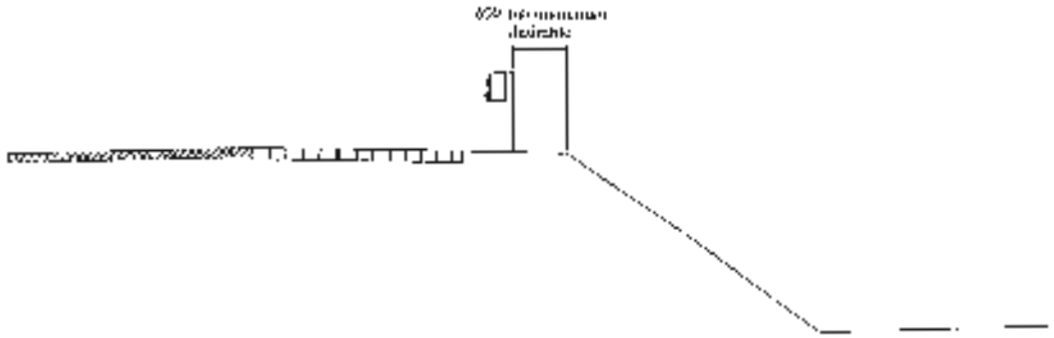
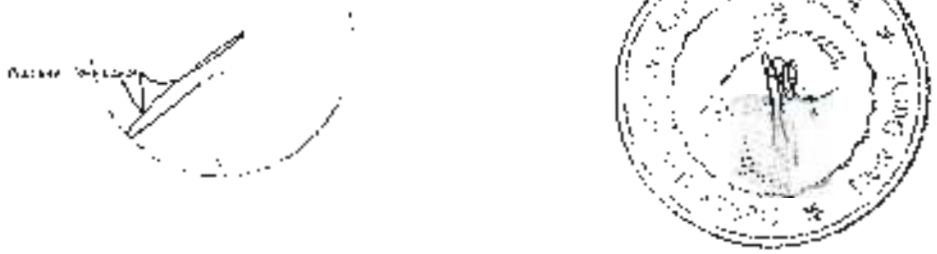
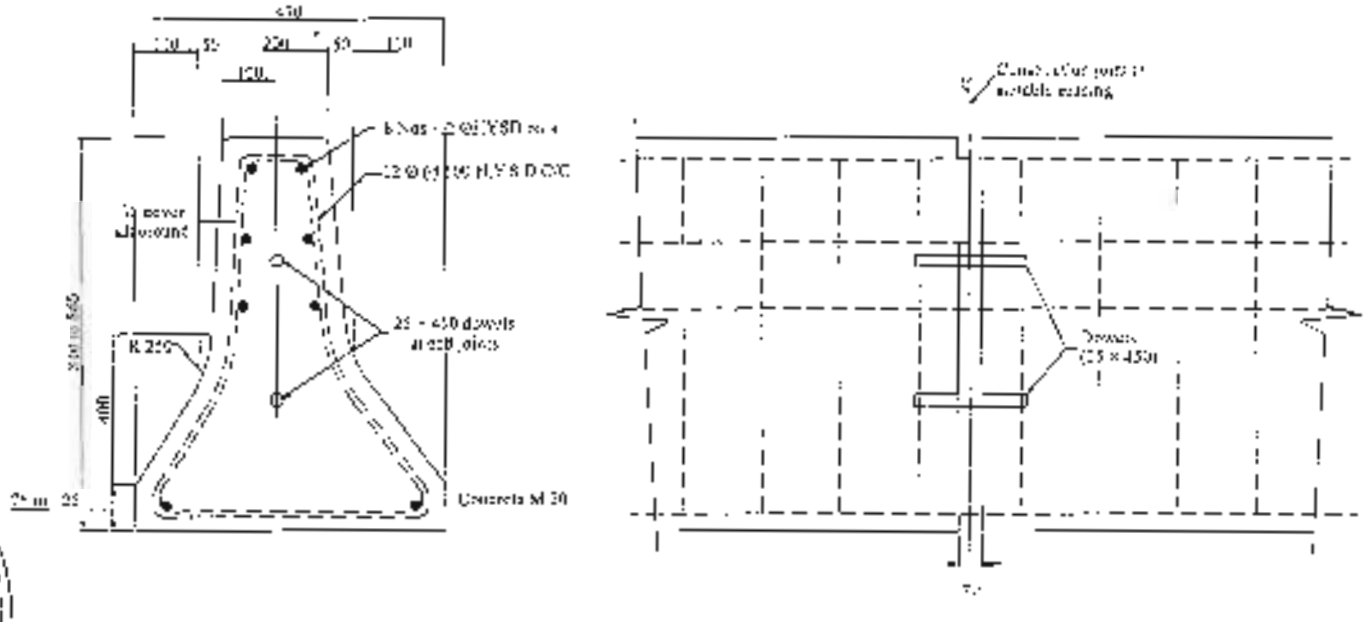


Fig. 9.4 : Recommended barrier placement





Note:
1. HYSD - High yield strength deformed reinforcement
2. All dimensions are in mm

Fig. 9.5 : Road side barrier cast-in-situ design

Fig. 9.6 : Road side barrier precast design

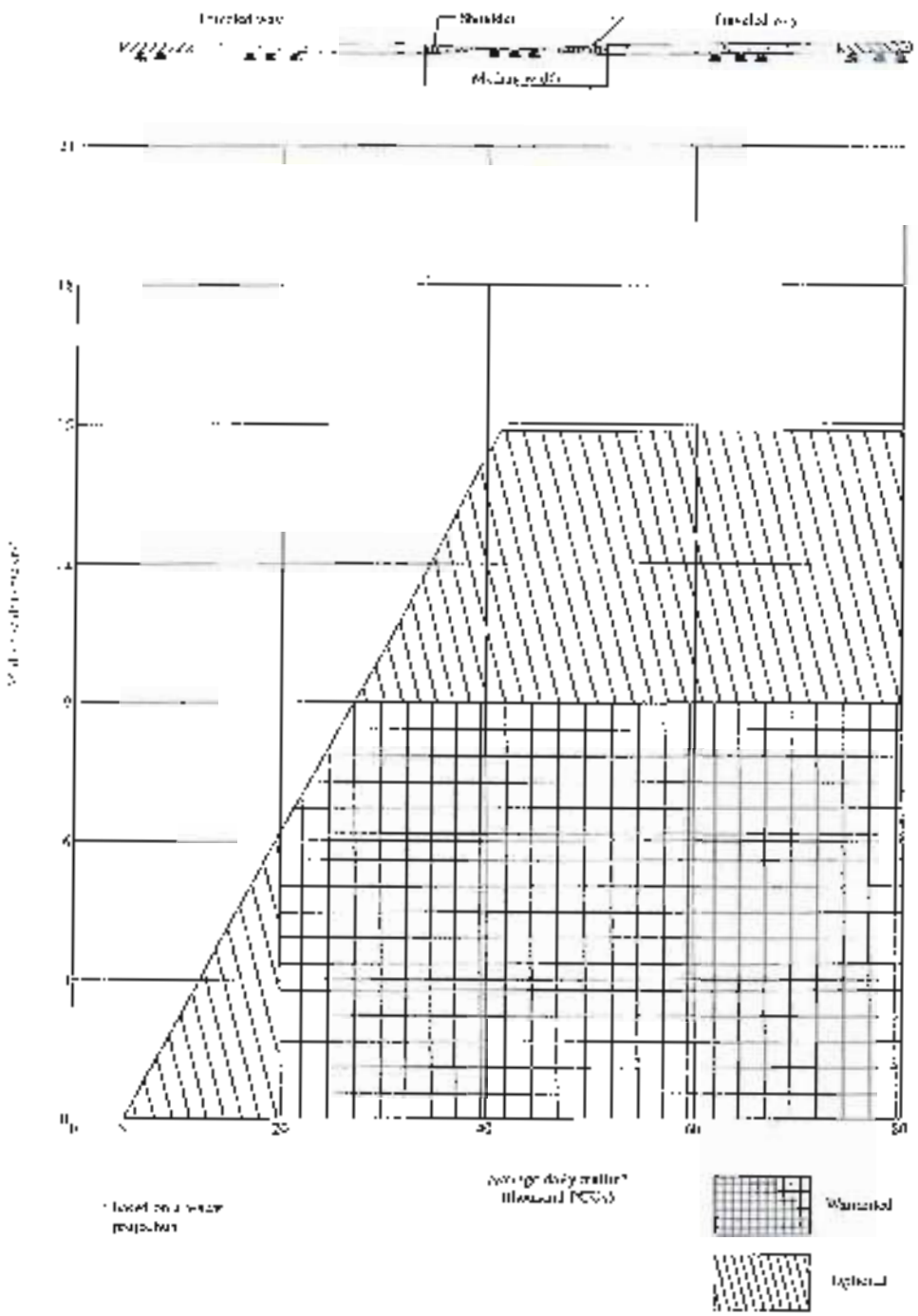
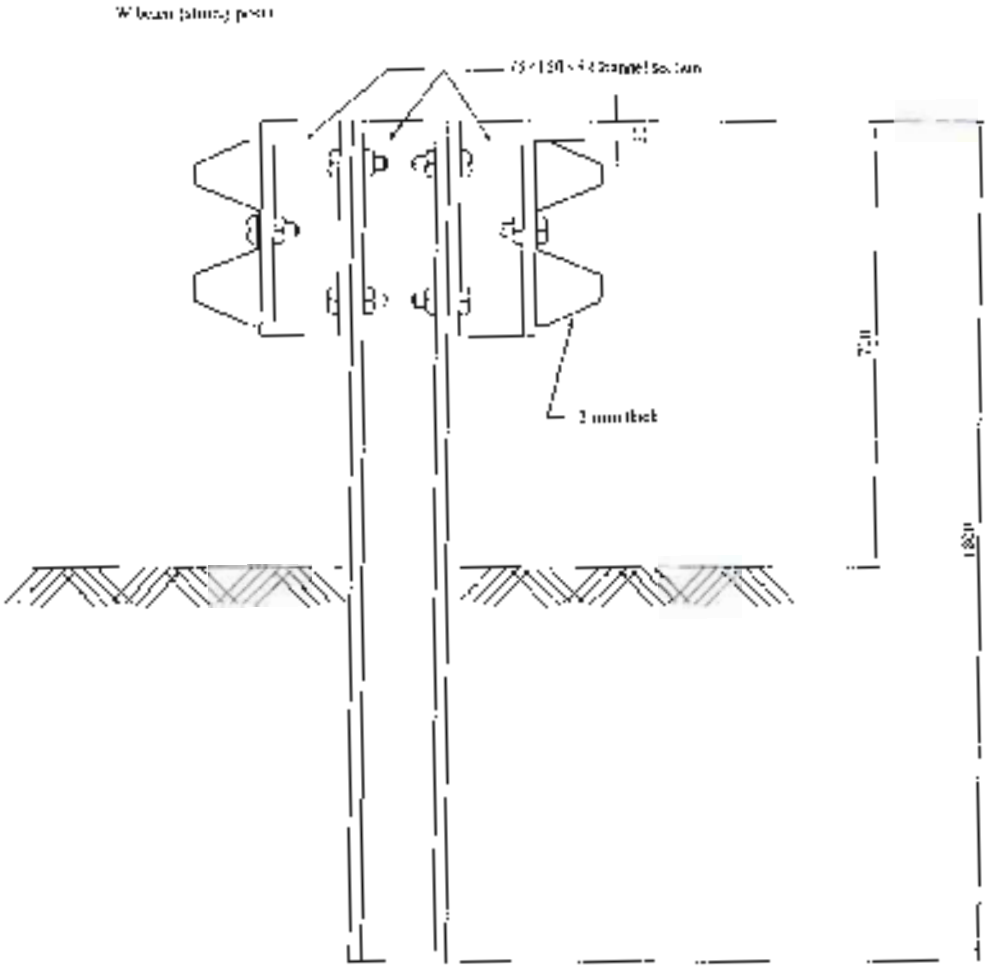
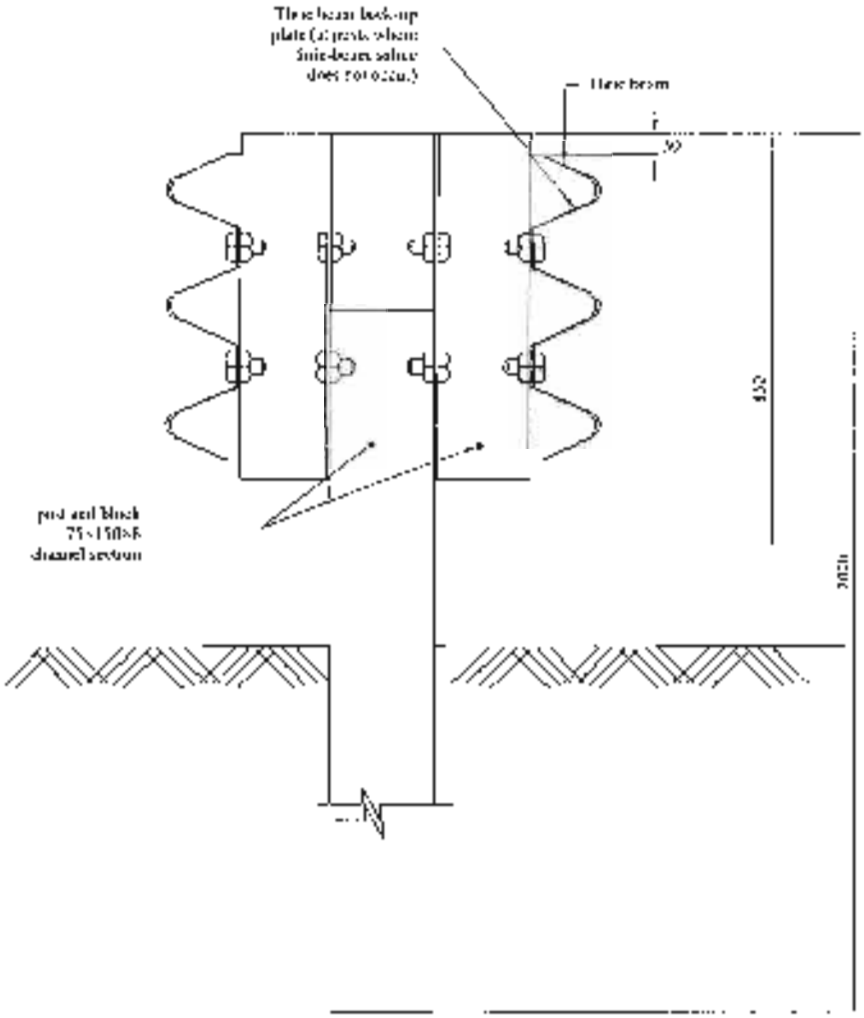


Fig. 9.7 : Median barrier warrants



Note:
All dimensions are in mm.

Fig. 9.8 : Typical details of "W" beam median barrier



Notes
All dimensions are in mm

Fig. 9.9 : Typical details of thrie beam median barrier

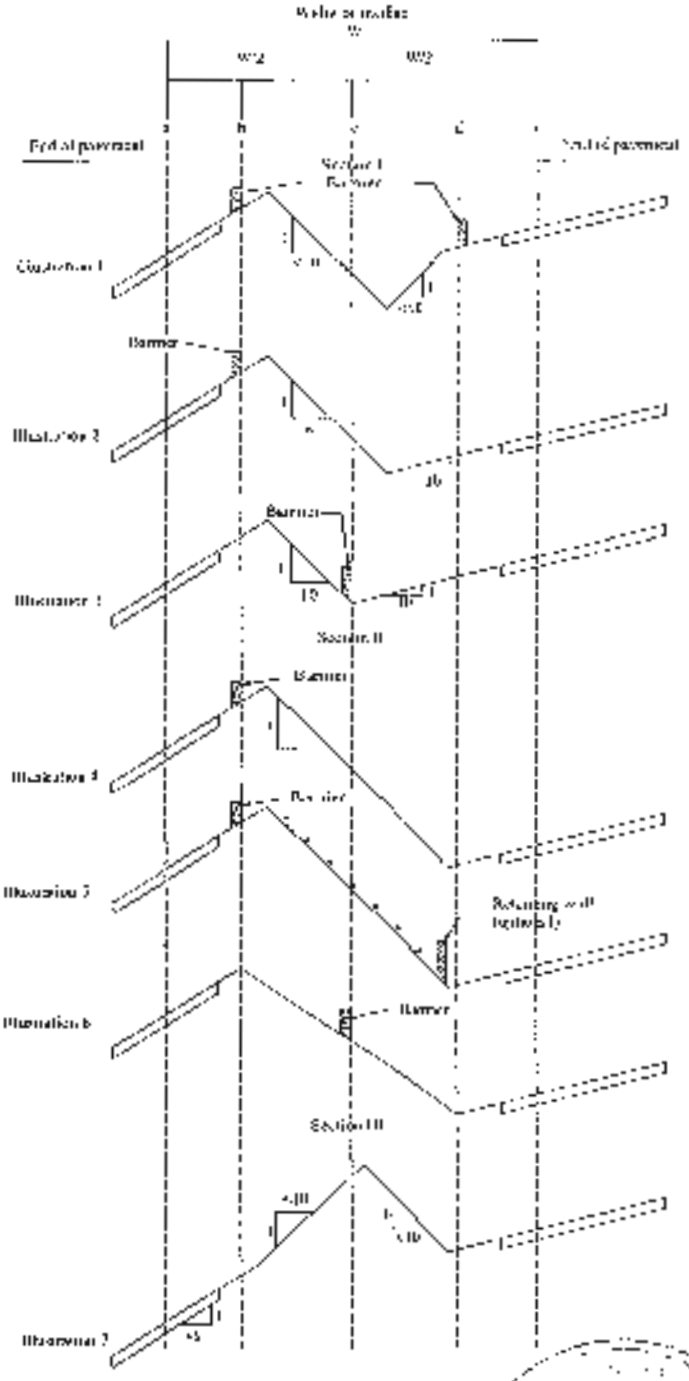
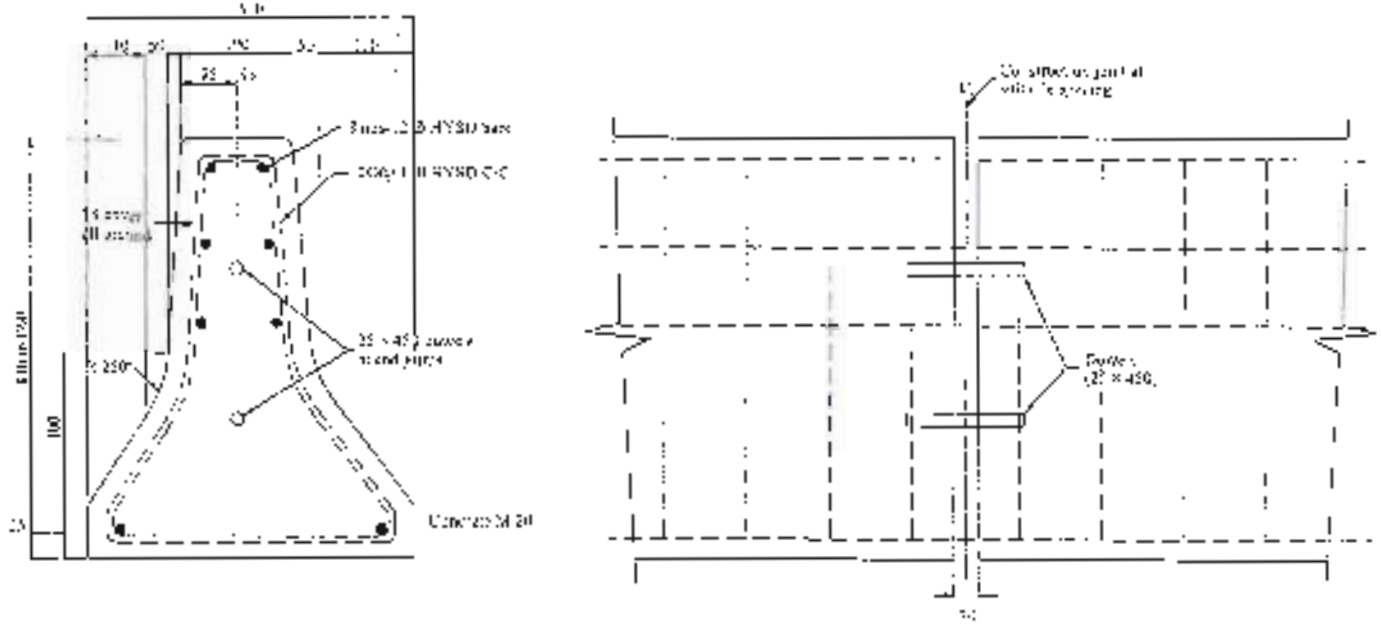
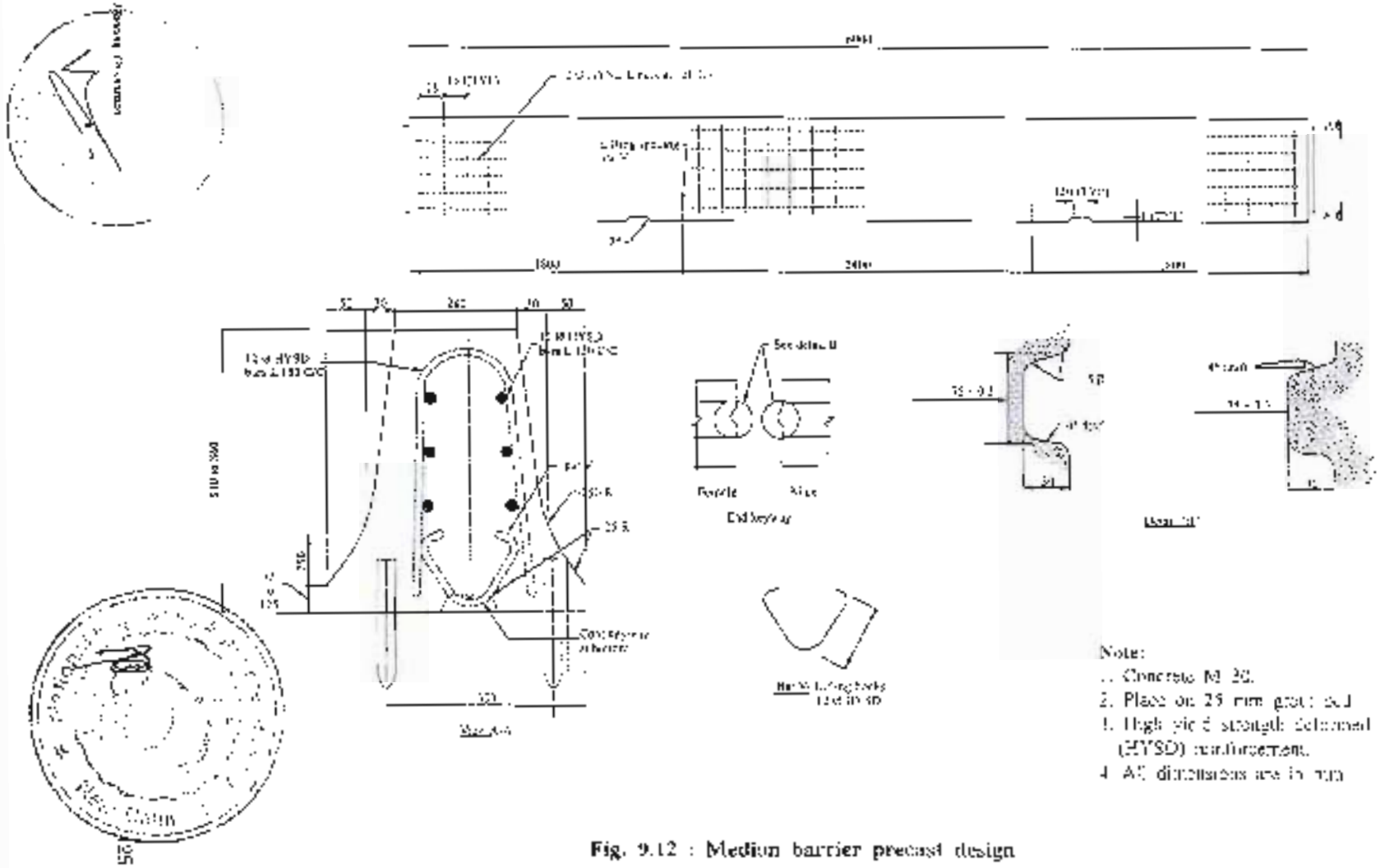


Fig. 9.10 : Recommended median barrier placement for non-level median



Note:
1. HYSD-high yield strength deformed reinforcement
2. All dimensions are in mm

Fig. 9.11 : Median barrier cast-in-situ design



Note:
1. Concrete M 20.
2. Place on 25 mm grout bed
3. High yield strength deformed (HYSD) reinforcement.
4. All dimensions are in mm

Fig. 9.12 : Medium barrier precast design

Section 10

Toll Plazas

SECTION 10

TOLL PLAZAS

10.1 General

The Concessionaire shall provide the Toll Plazas at the locations specified in Schedule C for collection of toll/fee as per the Concession Agreement. The fee collection system shall be speedy, efficient and user friendly. The design of the Toll Plazas should be such that they are aesthetically pleasing, and efficient and the fee collection staff should be quick, courteous and adequately trained before deployment.

10.2 Location of Toll Plaza

The location of toll plaza shall be indicated in Schedule-C of the Concession Agreement. Their locations shall be decided keeping in view the following factors:

(i) Land availability

(ii) Stream of traffic on Toll Plaza

(iii) Visibility for the approaching traffic

(iv) Reasonably away from road intersections and/or rail crossings

(v) Free from risk of flooding and submergence, etc

(vi) Preferably on flat land and away from congested urban locations.

10.3 Land for Toll Plaza

Adequate land for Toll Plaza shall be acquired to permit the provision of toll lanes for a projected peak hour traffic of 20 years subject to a minimum number of 16 toll lanes including all other buildings and structures to be accommodated at the Toll Plaza location. Land shall be acquired as per provisions of the Concession Agreement.

10.4 Lay out and Design of Toll Plaza

10.4.1 Typical layout of 5+5 toll plaza is given in Fig. 10.1. The layout shall provide for future expansion of toll lanes. Stage construction of Toll Plaza in respect of number of toll lanes shall be allowed. However, other structures as envisaged in the Concession Agreement shall be provided at the initial stage itself.

10.4.2 *Width of toll lane*

The width of each toll lane shall be 3.2 m, except for the lane for over dimensioned vehicles, where it shall be 4.5 m.

10.4.3 *Traffic Islands at the Toll Plaza*

Between each toll lane of the toll plaza, traffic islands are required to accommodate toll booth. These islands shall be of minimum 25 m length and 1.8 m width. Protective barriers of reinforced concrete and traffic impact attenuators shall be placed at the front of each island to prevent out of control approaching vehicles crashing into the toll booth. They would be painted with reflective chevron markings.

10.4.4 *Toll Booths*

Toll booths may be provided of prefabricated materials or of masonry. The toll booths shall have adequate space for seating of toll collector, computer, printer, cash box, etc. It should have provision for light, fan and air conditioning. The typical details of traffic island with toll booth are given in Fig. 10.2.

Toll booth shall be placed at the centre of each traffic island. The toll booth shall have large glass window to provide the toll collector with good visibility of approaching vehicles. The bottom of the toll window should be placed at such a height (0.9 m) above ground level so as to provide convenience of operation. The toll booths shall be ergonomically designed and vandal proof. There shall be CCTV camera installed at each booth.

10.4.5 *Tunnels*

For the movement between toll office and toll booth of each toll lane, an underground tunnel across all toll lanes shall be provided. Its dimension would be sufficient to accommodate the required wiring/cable system and for convenient movement of personnel. It should also be provided with lighting and ventilation system so that the movement is convenient.

10.4.6 *Transition*

A transition of 1 in 20 to 1 in 10 may be provided from four lane section to the widened width at Toll Plaza on either side.

10.4.7 *Canopy*

All the toll lanes and toll booths shall be covered with a canopy. The canopy shall be wide enough to provide weather protection to toll operators, drivers and facilities. The canopy shall be of aesthetically pleasing design with cylindrical support columns located at traffic island so that there is no restriction on visibility and traffic movement. The vertical clearance shall be as prescribed in this Manual.

10.4.8 *Drainage*

The toll plaza shall be provided with surface and sub surface drainage system so that all the storm water is drained off efficiently and no ponding or stagnation of water takes place at any area of the toll plaza.

10.4.9 *Equipment for Toll Lanes*

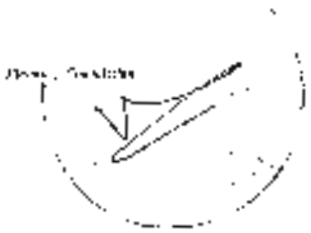
Each entry lane shall be equipped with a micro controller based Vehicle Counting cum-Classifier Unit for counting the number of vehicles and their axle number and for identification of the category of vehicle. The semi automatic toll collection system shall also have a ticket issuing machine for issue of the tickets for user fee at the press of a button on a touch panel and entry lane controller for controlling the equipment of the entry lane and for sending the data to the data processing equipment at toll plaza office. Each toll lane shall have electronically operated boom barrier along with synchronised system for traffic lights.

10.4.10 *Electronic Toll Collection*

The Electronic Toll Collection (ETC) system shall consist of an On Board Unit (with a Smart Card) fixed on a vehicle and a roadside antenna (Road Side Unit) to receive communication for identification of its code and other stored data and a system for transmitting data to and from the on board unit to the customer information management system through the road side unit.

10.4.11 *Prevention of Overloading*

Toll plaza location shall also be provided with system for checking and preventing overloading of vehicles at toll plaza. For this purpose, weigh in motion systems at approaches to each toll lane are to be installed. Separate space for static weigh bridge and area to hold off-loaded goods from overloaded vehicles shall be provided after the toll barriers for each direction of travel.



10.4.12 *Number of lanes at Toll Plaza*

The total number of toll booths and lanes shall be such as to ensure the service time of not more than 10 seconds per vehicle at peak flow regardless of methodology adopted for fee collection. For purpose of guidance following parameters are suggested as a capacity of individual toll lane for design purpose:

(i)	Semi-automatic toll lane (Automatic vehicle identification but manual fee transaction)	240 veh/hour
(ii)	Electronic toll collection (ETC lanes) (Toll collection through on board unit and no stoppage of vehicles)	1200 veh/hour

At least two toll lanes in each direction of travel shall be provided with the system of payment through ETC. Not less than 2 middle toll lanes shall be capable of being used as reversible lanes to meet the demand of tidal flow.

Toll plazas shall be designed for projected peak hour traffic of 20 years. As mentioned in Para 10.4.1, the stage construction of toll plaza in respect of number of toll lanes shall be allowed. If at any time, the queue of vehicles becomes so large that the waiting time of the user exceeds three minutes, the number of toll lanes shall be increased so that the maximum waiting time is brought down to less than three minutes.

10.4.13 *Toll Collection System*

For smooth and efficient functioning of toll collection, the following arrangements/ facilities shall be provided:

(i) The staff posted at the counters in the semi-automatic system of toll collection shall be provided with sufficient electronic equipment for the collection of toll and recording data, and small denumeration notes/coins at the start of each shift.

(ii) Intercom facility shall be provided between booths and the office of the supervisors.

(iii) If the booth is closed for any reason, incoming traffic shall be guided into the adjoining working booth with the help of appropriate signs.

(iv) The entire fee collection complex shall be adequately guarded.

10.4.14 *Pavement*

Concrete pavement shall be provided in the Toll Plaza area including tapering areas, from durability and long time serviceability consideration and to permit the provision of toll lanes initially for a projected peak hour traffic of 10 years. The concrete pavement may be widened to provide for future toll lanes required as per stage construction. The rigid pavement shall be designed as per IRC:58. For this work, use of paver shall not be insisted.

10.4.15 *Traffic Signs*

A well thought out strategy should be evolved for providing traffic signs and road markings in and around the Toll Plaza in accordance with IRC:67 and IRC:35. The Concessionaire would design the configuration/placement of signs for toll plaza which are not given in IRC:67 and furnish to IE for review so as to ensure uniformity of signs in use on all the highways across the country

Signs should be placed along the Project Highway, roadway of Toll Plaza to guide and render assistance to the drivers approaching the Toll Plaza. It is necessary to alert the driver about the existence of Toll Plaza one km ahead with a repeater sign 500 m ahead. Stop sign shall always be used in combination with certain road markings such as stop line and the word 'STOP' marked on the pavement.

The Toll Plaza sign should be supplemented by the sign advising the users of the notified toll rates (fees) for various types of vehicles and exempted categories of vehicles

Appropriate Signs and Signals shall also be provided on the canopy of toll plaza to properly guide the approaching vehicles about the lane in operation, lane applicable to specific category of vehicle, lane with Electronic Toll System, reversible lane, etc.

10.4.16 *Road Markings*

The road markings shall be used in accordance with Section 9 of this Manual. The road markings for the Toll Plaza area shall consist of lane markings, diagonals, chevron markings. Single centre line is provided at the centre of carriageway at toll gate to demarcate each service lane. Diagonal markings for central traffic island and chevron markings at side traffic island shall be provided to guide the approaching and separating traffic.

In order to control overspeeding of the vehicle approaching toll booth, transverse bar markings, as per typical details given in Fig 10.3 shall be provided.

10.4.1 *Lighting*

The toll plaza shall have lighting system to provide visibility to drivers for the use of facility especially to access the correct service lane and also to the toll collector. Indian Standard 'Code of Practice for Lighting of Public Thoroughfare' IS: 1944 shall be followed. This would be done by interior and exterior lighting as indicated below. Power supply shall be from public power supply system, but stand by generating set of the capacity to supply the required power shall be provided at toll plaza.

Interior Lighting: The toll booths and facility building office shall be illuminated adequately. Indoor lighting shall be with fluorescent lamps. Lighting should be provided in such a manner that glare is avoided or minimised. The level of illumination shall be 200 to 300 Lux as per IS: 6665 part II.

Exterior Lighting: Lighting of the Toll Plaza is important for enhancing the night visibility. The lighting system shall consist of the following major components.

(i) High Mast lighting

(ii) Lighting on both side approaches to the Toll Plaza

(iii) Canopy lighting of complex

High Mast Lighting: Normal low light poles are not able to give the required lighting conditions. It is, therefore, necessary to install high mast. A height of 30 m for the mast is considered suitable to have uniform spread of desired level of illumination in the Toll Plaza area for safe movement of vehicles.

Highway Lighting: A minimum requirement of illumination on the road surface of 40 Lux shall be ensured. Lighting in minimum 500 m length on either side approaches of toll plaza shall be provided to enhance the safety at night on the Project Highway and to make the drivers conscious of their approaching the toll gate. These shall be provided on die cold steel welded tubular pole of 10 m height from road surface and with 2 m overhang. Sodium Vapour lamp of 200-250 watts should be provided for these poles on both sides at 50 m staggered spacing. There should be provision for flashing signals for foggy weather condations.

Canopy Lighting: A higher level of illumination upto 100 Lux by providing 150 watt metal halide lamps shall be provided at the toll gate and at toll booth locations. 1000 watt halogen lamps shall be provided at the selected nodes of space frame of the canopy to ensure uniform illumination of the area.

10.4.18 *Water Supply*

Adequate water supply shall be provided. For working out water requirement and internal drainage system, reference may be made to IS: 1172, IS:5339 and IS:1742.

10.4.19 *Fire Fighting System*

Toll Plaza shall have fire fighting equipment, including smoke detectors and audio visual alarm system as per section 4 [7.1 of National] Building Code, so that the personnel working in the complex and the office and the toll users are protected against fire hazards.

10.4.20 *Toll Plaza Complex*

Toll plaza shall have a separate office building so as to provide comfortable office space for manager, cashier and other staff. There shall be separate rooms for TV monitors, meetings, toilets, and for the sale of passes, smart cards, on board units and public interaction. The building shall have a strong room for keeping the cash and a garage to accommodate the security van (during operation of loading the collected revenue). There shall be parking space in the same campus for vehicles for the staff and workers and other vehicles engaged in the operation of the Project Highway.

The size of the office complex depends on the minimum requirement of above facilities

Provision for future expansion: The office building shall be located taking into consideration of future expansion.

10.4.21 *Toll Audit*

The toll plaza shall have toll audit system and fraud protection measures. The operations for toll collection, supervision, auditing and cash handling shall be done through the qualified personnel with adequate number so that each operation is efficiently handled

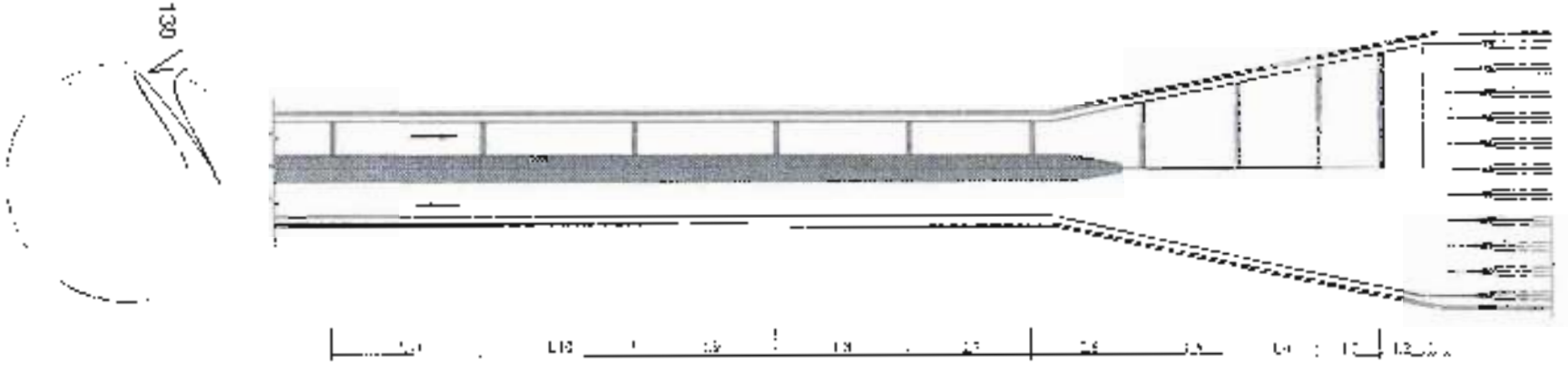
10.5 Report to be submitted

The design and layout of Toll Plaza complex including all facilities shall be submitted to the Independent Engineer for review and comments, if any.

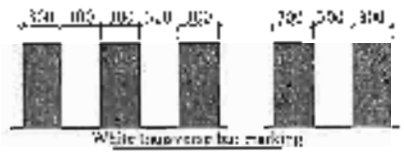
Note:
Detailed system of toll metering as per IRC:35.

Fig. 10.1 : Typical layout for a toll plaza

Fig. 10.2 : Typical layout for traffic island with toll booth



Distance from previous bar marking (m)	No. of bar markings
L1=3	
L2=4	1
L3=5	2
L4=7	3
L5=10	2
L6=25	2
L7=30	3
L8=35	3
L9=39	3
L10=42	3
L11=45	3



Note:
Detailed system of road marking as per IRC:35

Fig. 10.3 : Details of suggestive transverse bar marking for speed control at toll plaza

Section 11

Landscaping and Tree Plantation

SECTION 11

LANDSCAPING AND TREE PLANTATION

11.1 General

The Concessionaire shall plant trees and shrubs of required number and type at the appropriate locations within the Right of Way and in the land earmarked by the Authority for afforestation keeping in view the IRC Guidelines on Landscaping and Tree Plantation. The Authority will specify the number of trees which are required to be planted by the Concessionaire as compensatory afforestation or otherwise. The Concessionaire shall also maintain the trees and shrubs in good condition during the Concession Period as per the maintenance schedule. The guidelines given in this Section shall be followed in plantation of trees and shrubs.

11.2 Design considerations in various locations

11.2.1 *Set-back distance of trees and other plantation:*

Trees on the roadside shall be sufficiently away from the roadway so that they are not a hazard to road traffic or restrict the visibility. Most vulnerable locations in this regard are the inside of curves, medians, junction corners and cut slopes. Trees shall be placed at a minimum distance of 54 m from the centre line of the extreme traffic lane to provide recovery area for the vehicle that runs off the road. A second row of trees 6m further away will also be planted wherever possible. Preferably the first row of trees shall consist of species with thick shade and other rows of vertical type providing thin shade. Expansion of the Project Highway to 6 lanes shall be taken into consideration while locating the trees so that land is free of trees when further widening takes place. The distances for alternative rows of trees shall be reckoned from the nearest edge of the unidirectional carriageway. No plantation shall be allowed on the embankment slopes.

11.2.2 *Set back of Trees on Curves:*

Experience has been that growth of thick vegetation close to the formation on inside of horizontal curve leads to serious reduction of sight distance and causes avoidable accidents with cattle/children suddenly emerging from the side. Uncontrolled trees/vegetation, may also affect visibility of traffic control devices and road signs. Therefore, in plain terrain a stopping sight distance of 180 m corresponding to the design speed of 100 km per hour may be ensured on all curved sections of the Project Highway along the innermost lane.

However, where there are site restrictions their requirement may be reduced to 130 m corresponding to the design speed of 80 km per hour as a special case. The existing trees and vegetation on the sides have to be suitably thinned/ trimmed, or even removed if necessary and a regular programme of pruning of the offending trees shall be undertaken as part of the maintenance operations.

In all cases, location of trees shall be checked to ensure that clear vision of all highway signs/signals is available at all times to the motorists. Also, the foliage or trees shall not come in the way of roadway lighting.

11.2.3 *Vertical clearance of trees and other plantations:*

For safe traffic operation, the vertical clearance available across the roadway shall be minimum 5 m. From this angle, the probable size of all plants shall be anticipated in advance, at the time of initial planting.

To allow for the effects of growth, wind and rain, trees shall be trimmed to 6 m and 6.5 m above the pavement in rural and urban areas respectively.

11.2.4 *Plantation in medians:*

In the sections of the Project Highway where median width is more than 3 m, shrubs shall be planted and maintained to cut off headlight glare from traffic in the opposite direction. Flowering plants and shrubs are eminently suited for the purpose. These shall be planted either in continuous rows or in the form of baffles. The height of shrubs shall be maintained at 1.5m to cut off the effect of traffic lights coming from the opposite direction.

In the sections, where the width of median is less than 3 m, shrubs or flowery plants may be planted in between crash barriers or other means like metal/plastic strips to cut off glare shall be provided.

The shape of shrubs and plants shall be suitably regulated so that there is no overgrowth either vertically or horizontally beyond the edge of the paved median.

In the vicinity of road intersections and median openings, median plantation shall be avoided or restricted to low-growing varieties to ensure adequate visibility.

11.2.5 *Spacing of Avenue Trees:*

The spacing of avenue trees will depend on the type and growth characteristics of trees, requirement of maintenance, penetration of distant views, etc. A range of 10-15 m would meet the requirement for most varieties.

11.2.6 *Choice of Trees:*

The following guidelines shall be kept in view while selecting the species of trees to be planted:

(i) Trees shall be selected with due regard to soil, rainfall, temperature and water level.

(ii) Trees which become very wide shall be avoided as their maintenance would cause interference with traffic flow.

(iii) The species must be capable of developing a straight and clean bole upto a height of 2.5 to 3.5 m from the ground level.

(iv) The selected trees shall, preferably, be fast growing and wind-firm. These shall not be thorny or drop too many leaves.

(v) The trees shall be deep rooted, as shallow roots injure pavements.

(vi) In urban areas, the species selected shall be of less spreading type, so that these do not interfere with overhead services, clear views of signs/signals, and efficiency of roadway lighting.

11.3 Report to be submitted

The Concessionaire shall submit scheme for plantation and maintenance of plants and trees to the Independent Engineer for review and comments, if any.

Section 12

Project Facilities

SECTION 12

PROJECT FACILITIES

12.1 General

The requirement of the project facilities to be provided shall be indicated in Schedule C of the Concession Agreement. This shall include information regarding location and size of the facilities. Land required for provision of facilities shall be acquired by the Authority and the date of handing over of the land to the Concessionaire shall be indicated in the Concession Agreement.

12.2 Pedestrian Facilities

12.2.1 *General*

Pedestrians are vulnerable to being involved in accidents. Therefore, adequate consideration shall be given to their safety through provision of facilities. The facilities for pedestrians given in this Section shall be provided on the Project Highway.

12.2.2 *Footpaths (Sidewalks)*

(i) The sidewalks shall be provided in the built-up sections, on both sides, by barrier type (non mountable) kerbs of height 200 mm above the adjacent road surface.

(ii) The width of sidewalks depends upon the expected pedestrian flow and shall be fixed subject to land availability, but shall not be less than 1.5 m.

12.2.3 *Pedestrian Guard Rails*

Pedestrian guardrails shall be provided as specified in Section 9 of this Manual.

12.2.4 *Pedestrian Crossings*

Pedestrian crossings shall be provided where they will be well used. Pedestrian crossings shall be suitably integrated with the overall design of the intersection.

The following criteria shall be followed regarding selection of pedestrian crossings:

(i) At Grade Pedestrian Crossing (Pedestrian Crosswalk): Pedestrian crosswalks shall be provided at all important intersections and such other locations where substantial conflict exists between vehicular and pedestrian movements. Wherever possible

the crosswalks shall be at right angles to the carriageway and properly marked so that the pedestrians are subjected to minimum inconvenience. Crosswalks shall not substantially increase the walk distance of pedestrians. Adequate visibility, freedom from obstructions and sufficient space for waiting are the other important requirements for location of crosswalks.

At-grade pedestrian crossings shall be controlled. Controlled form of crossing shall be achieved through provision of Zebra Crossings, whether at signalized intersection or pedestrian actuated signal.

(ii) Zebra Crossing: A Zebra Crossing shall not be sited within 150 m of another such crossing. The Zebra Crossing shall be somewhat set back from the carriageway line. However, the set back distance shall not be so much as to cause an appreciable increase in walking distance for the pedestrians. Pedestrian guardrails may be necessary where the setback distance is appreciable or at the skew crossings.

The width of the Zebra Crossing shall be adequate and shall generally lie within a range of 2.0 m to 4.0 m. The crossing shall, as far as possible, proceed uninterrupted through the median strip. In the event of the median strip being used as pedestrian refuge, adequate width of median shall be provided. In case of raised mediums, such portion could be suitably depressed with kerb height not exceeding 150 mm.

In the vicinity of Zebra crossing, guardrails of sufficient length shall be provided to deter pedestrians from crossing the road at any arbitrary point along the road.

(iii) Pedestrian Underpasses/Overpasses: The pedestrian underpasses/ overpasses shall be provided as specified in Para 2.13.3 of this Manual.

12.3 Street Lighting

12.3.1 *General*

(i) The Concessionaire shall provide lighting at locations of the Project Highway specified in Schedule-B, using appropriate system and source of electric power as per the requirements of this Section.

(ii) The Concessionaire shall make suitable arrangements for procuring power supply to ensure uninterrupted lighting during night and when visibility is low, including provision of DG sets as standby arrangement.

(m) The Concessionaire shall bear all costs of procurement, installation, running and operation cost of all lighting, including cost of energy consumption specified in this Section.

12.3.7 *Specifications*

(i) Unless stated otherwise elsewhere in this Manual, the minimum level of illumination on the stretches of the Project Highway including Toll Plazas, truck lay-byes, interchanges etc. shall be 40 Lux.

(ii) The layout of the lighting system together with type of luminaries for different locations shall be prepared by the Concessionaire in such a manner that the minimum illumination level prescribed in Para 12.3.2(i) can be achieved and shall be submitted to the Independent Engineer for review and comments, if any, for compliance by the Concessionaire

(iii) Overhead electrical power and telecommunication lines erected within the ROW by the Concessionaire shall be provided with adequate clearance so that safe use of the highway is not affected.

(iv) Vertical and horizontal clearances for electrical installations shall conform to IRC:32.

(v) All the fixtures, wires/cables, lights shall conform to relevant BIS specifications as a minimum. The Concessionaire with the prior review and comments of the Independent Engineer can use fixtures with better specifications.

12.3.8 *Locations where lighting is to be provided*

Unless specified otherwise in Schedule C of the Concession Agreement and elsewhere in this Manual, the Concessionaire shall provide lighting at the following locations of the Project Highway:

(i) Toll Plaza Area: The lighting in and around Toll Plaza, toll booths, office building, on the approach road, etc. shall be as per Section 10 of this Manual.

(ii) Truck lay byes: Lighting at the truck lay byes shall be as per para 12.4 of this Manual.

(iii) At interchanges: Lighting at the interchanges shall be as per para 3.3.5 of this Manual.

(iv) At Built-up sections on the Project Highway.

12.4 Truck Lay-byes

12.4.1 *General*

The Concessionaire shall construct and maintain adequate number and size of truck lay-byes for parking of trucks by the side of the Project Highway as indicated in Schedule-B of the Concession Agreement. The guidelines, as given here, shall be followed in regard to location, size and facilities to be provided at the truck lay-byes.

12.4.2 *Location and size*

Truck lay-byes shall, in general, be located near check barriers, interstate borders, places of conventional stops of the truck operators, etc. The places be identified on the basis of field survey and shall have adequate space for facilities as specified in subsequent para 12.4.3 and future growth.

12.4.3 *Facilities*

The truck lay-byes shall have the following facilities.

(i) Paved parking,

(ii) Rest areas with toilets, drinking water,

(iii) Telephone.

12.4.4 *Lighting*

The truck lay-byes and 50 m length of the Project Highway on its either side shall be illuminated at night to provide a minimum illumination of 40 Lux. Suitably designed electric poles having aesthetic appeal and energy saving bulbs may be used to provide required illumination. Alternatively, photo voltaic lamps may be used.

12.5 Bus Bays and Passenger Shelters

12.5.1 *General*

The buses shall be allowed to stop for dropping and picking up passengers only at the bus bays. The Authority will indicate in Schedule C of the Concession Agreement, the number and broad location of bus bays to be provided by the Concessionaire. The bus bays shall conform to the specifications and standards given in this Section. In cases where bus stands are provided by the concerned State Government Transport Authorities, the Concessionaire shall provide only access road within the right-of-way.

12.5.2 *Location*

The location of the bus bays shall be fixed on the basis of following principles:

(i) The bus stops shall be sited away from bridges and other important structures and embankment sections more than 3 m high

(ii) As far as possible, bus bays shall not be located on horizontal curves or at the summit of vertical curves.

(iii) The location shall have good visibility, not less than the safe stopping sight distance.

(iv) The bus bays shall not be located too close to the road intersections. A gap of 300 m from the tangent point of intersections to start/end of the bus bay shall be desirable. At minor intersections (e.g. junctions with village roads), distance of 60 m may be adopted. However, if a substantial volume of buses is to turn right at the intersection, it is necessary that the bus bay shall be located sufficiently ahead of the intersection so that the buses can be manoeuvered easily from the pick-up stop on the left hand side to the extreme right lane for turning. The location of the bus bays may be fixed after due consultation with the local communities expected to use such facilities.

(v) At major four-way intersections involving transfer of a substantial number of passengers from one pick-up stop to the other, it might be desirable to construct a single, composite bus stop of suitable design to cater to all the bus routes collectively.

(vi) In hilly areas, the bus bays shall be located, preferably, where the road is straight on both sides, gradients are flat and the visibility is reasonably good (usually not less than 50 m). Subject to these requirements, it will be advisable to choose locations where it is possible to widen the roadway economically for accommodating bus bays.

(vii) Where grade separator is provided, the location of bus bays shall be as under:

(a) Sufficiently away from the ground intersection.

(b) Sufficiently away from the longitudinal slope of the approaches

(viii) The bus bay and passenger shelter shall be designed to provide for safe and convenient use by physically challenged persons as well.

12.5.3 *Layout and Design*

(i) For plain area, typical layouts of bus bays given in Fig. 12.1 shall be adopted. The length "L" shown in Fig. 12.1 shall be 15 m, which shall be increased in multiples of 15 m if more than one bus is likely to halt at the bus bay at one time.

(ii) For hilly areas, where there is a general constraint on space, the layout indicated in Fig. 12.2 may be adopted.

(iii) The channelizing island between the paved shoulder and bus bay shall not be raised, it shall be paved.

(iv) Bus bays shall be provided on both carriageways of the Project Highway for each direction of travel independently. At intersections, the bus bays for up and down direction shall be located on farther sides of the intersection.

(v) The bus bay shall be provided with a shelter for passengers. The shelter shall be structurally safe and aesthetic in appearance, while also being functional so as to protect the waiting passengers adequately from sun, wind and rain. If the shelter is constructed on the hillside, slopes shall be properly dressed and suitably protected to avoid slips. The shelter shall be set back from the kerb line by at least 500 mm.

12.5.4 *Pavement*

The pavement in the bus bays shall have adequate crust with respect to the wheel loads expected. Also, the surfacing shall be strong enough to withstand forces due to frequent braking and acceleration by the buses. The colour and texture of the bus bay surfacing shall be preferably distinctive from that of the main carriageway.

12.5.5 *Drainage*

(i) The bus bays shall have proper cross slope to drain off the excess water. No water, which is likely to splash on the waiting passengers, shall be allowed to collect near the bus shelters.

(ii) Suitable kerb gutter section with requisite longitudinal slope and outlets at intervals to ensure quick disposal of water shall be provided.

12.5.6 *Road Markings*

Pavement markings as specified in Section 9 of this Manual shall be provided at the bus stops as shown in Figs. 12.1 and 12.2 with the word "BUS" written prominently on the

pavement. Pedestrian crossings shall be marked slightly behind the standing position of the buses in order to reduce pedestrian conflicts. The kerbs shall be marked with continuous yellow line to indicate "No Parking".

12.6 Rest Areas

Location and Layout of the rest areas shall be as indicated in Schedule-B of the Concession Agreement. Rest areas shall be provided by the Concessionaire on the lands included in the Site and procured by the Authority. Within the areas so provided, the Concessionaire shall construct and operate, or cause to be constructed and operated, paid facilities such as toilets, telephones, cafeteria, parking, etc.

12.7 Cattle Crossings

Facility for cattle crossings shall be provided as specified in para 2.13.3 of this Manual.

12.8 Traffic Aid Posts

12.8.1 Traffic Aid Posts shall be established at Toll Plaza locations in accordance with the provisions of the Concession Agreement.

12.8.2 The Concessionaire shall establish and operate Highway patrol unit(s) manned by at least two persons apart from the driver for every unit which shall continuously patrol the highway in a stretch not exceeding 50 km and shall remain in contact with the Control Room on a real time basis. The patrol shall render assistance to users in distress and disabled vehicles through own intervention or by calling for assistance from Control Room, Crane operators or ambulance as required. The patrol shall promptly clear the road of any obstruction. Where the obstructions take time to be cleared, the section shall be cordoned off by placing traffic cones, which shall be illuminated during night. The patrol vehicle shall be large enough for seating at least four personnel besides the driver and space to carry essential traffic and incidence management and safety tools. It shall also have a light on its top and a siren on board. It shall be equipped with traffic cones and other accessories for traffic control which are fully visible during night time.

12.9 Medical Aid Posts

12.9.1 Medical Posts shall be established at Toll Plaza locations in accordance with the provisions of the Concession Agreement.

12.9.2 The Concessionaire shall provide ambulance(s) manned by at least two trained and certified paramedics so that the response time is not more than 20 minutes of call. Each ambulance shall be equipped with first aid, life saving medical services and support system implements for transporting the victims to the nearest trauma care hospitals, and providing emergency medical aid during transportation of victims from accident site to the nearest trauma care hospital.

12.10 Vehicle Rescue Posts

12.10.1 The Concessionaire shall provide a vehicle rescue post at Toll plaza location with all necessary equipment as specified in the Concession Agreement.

12.10.2 Crane(s) shall be available at the site of the incident within 30 minutes of call to clear the disabled/accidented vehicles.

12.11 Telecom System

The Concessionaire shall provide a Telecom System at Toll plaza location with all necessary equipment as specified in Schedule-B of the Concession Agreement.

12.12 Highway Traffic Management Systems (HTMS)

12.12.1 A real time system working round the clock shall be established for informing the road users of the road, traffic, and weather conditions on the Project Highway when the daily traffic exceeds 40,000 PCUs, for making interventions as required for smooth, safe and efficient traffic operation; and for providing rescue and relief to the users in distress. The system shall be capable of

(i) acquisition of data from various sources such as the road, the users, the maintenance and operation patrol, the ambulance, and the intervention team

(ii) three way communication between the data source and a Central Control Room, the Control Room and the data sources and display units, and between the maintenance and operation teams, through a transmission system, and

(iii) A Central Control Room to process all data and control the highway operation.

12.12.2 The systems and equipment of HTMS shall meet the following main climatic and environmental requirement as specified in IS:9000

a) Temperature Range of Operation – Low of 0°C (± 3°C) to high of 60°C (± 2°C)

b) Relative Humidity of 95 per cent

c) Vibration Frequency Range of 10 Hz - 55 Hz

12.12.3 *Data acquisition system*

This shall consist of (a) Automatic Traffic Counter and Classifier (ATCC), with an in-road loop detectors and treadles. (b) Video cameras installed on road with such pan and tilts that a length of 2 km road is captured for video monitoring of traffic, (c) Emergency Call Boxes installed at every 2 km to enable any user to be instantly in contact with the Control Room, (d) Meteorological sensors for capturing data on temperature, weather, wind. (e) Mobile radios for patrol vehicles and ambulances to be in communication with Central Control Room and among themselves.

12.12.4 Emergency call boxes (ECB) with loud speaker, micro phone, activation button with LED indicating conversation, shall be housed in a vandal proof casing and operate in full to play mode in noise level of up to 95 decibels with in built diagnostic features for automatic detection in case of damage by any object. Mobile communication system shall comprise the mobile radio base stations and control centre equipments. It shall have provision for mounted mobile set on ambulances, cranes and patrolling vehicles. The system shall have the facility to connect mobile to mobile, mobile to controller, and controller to mobile along with the systems for waiting, holding, and transfer of calls. The system shall use a pair of frequencies to be allotted to the Concessionaire with the approval of wireless planning and coordination (WPC), Deptt. of Telecommunications and shall operate for full duplex mode.

12.12.5 The design for the Variable Message Signs (VMS) will be modular with sign panels using LEDs/High-Gain Trans Reflective LCDs for outdoor ambient lights. The sign panel should be such that a display is legible from a distance of about 300 m. For this purpose, panels shall have minimum dimensions of 3m length x 1.8 m depth. The minimum height of the characters shall be 300 mm. The contrast ratio shall be more than 30 perpendicular to the bold face and more than 10 at an angle of ± 70 degrees to the perpendicular. The equipment shall be capable of storing minimum 10 frames that can be triggered on receiving the tele command. The sign panels shall be installed on the structure in such a manner that they are aesthetically pleasing and can withstand wind pressures. The equipment shall be capable of storing minimum semi-duplex, route and other known forces. The minimum vertical clearance available at VMS shall be 5.5 m from the road

surface. Power supply shall be fed from the integrator locations. The locations for VMS shall be specified in Schedule-B.

12.12.6 The meteorological sensors shall comprise thermocouple /pyrometer, humidity meter, anemometer , visibility meter and sensor for measuring pavement surface temperature. They shall be installed on a single pole with a specific attachment and power supply fed from the integrator. They shall have the facility to communicate on Polythene Insulated Jelly Filled copper cables (PIJF) /Optical Fibre Cable.

12.12.7 The Automatic Traffic Counter-cum-Classifier (ATCC) shall be capable of detecting and recording all categories of vehicles plying on the Project Highway based on their length and number of axles. The system shall be robust and capable of operating with minimum maintenance and may be either piezo-electric or infrared. It should have minimum accuracy level of 99 per cent. The logic units shall be microprocessor based. The system should be able to record and store vehicle data for a period of at least two weeks with a Daily Traffic Volume of up to 1,00,000 vehicles. The system shall have compatibility to transfer the data on PIJF/Optical Fibre Cable by using any of the available communication mode like GSM (Global System for Mobile Communications) / GPRS (General Packet Radio Service), landline modem, CDMA (Code Division Multiple Access) depending upon the effective and economic operation of the particular mode available at the site. The system shall be electric/solar power operated depending upon the availability of source.

12.12.8 The Closed Circuit Television (CCTV) Surveillance shall comprise video camera, its housing and pan, and Tilt Heads. The video camera shall be mounted at a height so as to cover the target length of highway and the housing shall be able to withstand adverse weather conditions. It shall have a 360 degrees angular travel in the horizontal plane and a tilt of 90 degrees down from 0 degrees horizontal. It shall have zoom lens with minimum power of 30 X, auto iris and infrared filter, infrared compatibility for night operation and remotely selectable operating modes. It shall have compatibility with co axial cable/ optical fibre cable.

12.12.9 The main control centre shall be designed for round-the clock operations of monitoring, on line information acquisition and processing the same for decision making. The Main Control Centre shall have equipment of central computer, call centre, terminal junction box, uninterrupted power supply (UPS) , counsel operator with monitors and joy sticks, rack accommodation, large display board, line printer and general purpose office computer with monitor, printer, fax and telephone. The system shall also have Network Management system (NMS) for real-time monitoring of Emergency Call Boxes (ECBs) and network diagnostics.

12.12.10 *Transmission System*

The shall consist of a backbone Optical Fiber Transmission system, cable system, interface system, network management system, repeater/ amplification system, and power supply system. There shall be 3 or 4 sub-centres (as appropriate) housing all the interface equipment apart from the Control Centre, provided with, as appropriate, cables, interface, terminals (such as optical line terminals and interface, network management system equipment, optical fiber cable interface equipment and control centre interface equipment, data acquisition system interface, etc). The cables from ECBs, VMS, meteorological data systems, ATCC shall be Polythene Insulated Jelly Filled (PIJF) copper cables and those from CCTV cameras shall be coaxial cables. Repeaters/ amplifiers shall be used to maintain the quality of signals. All the cables shall have at least 20 per cent spare capacity to allow for expansion. The interface system shall be capable of handling the composite audio, video and data signals at various interface levels and process them.

12.12.11 *Central Control Room (Control Centre)*

The Central Control Room (CCR) shall be the repository of all the data acquired from the field and their processing, storing, and archiving. All the information for real time monitoring of the Project Highway shall be generated at the CCR and the relevant information shall be disseminated to the users through Variable message signs, and to the operation and management teams through mobile radio communication system for appropriate intervention. Another important function to be performed at the Control centre shall be the operation and management of the HTMS itself along with its various sub systems.

CCR shall have the following minimum equipment, hardware and software:

(i) A Central Computer Server with integrated ITMS and HTMS software.

(ii) A Traffic Manager's Terminal for operation of the integrated traffic management system

(iii) Call system equipment comprising Operator PC along with sub-systems and digital voice recorder.

(iv) Mobile radio terminal comprising Operator PC and engineering terminal.

(v) Computers for Network Management System (NMS) for Fiber Optic Communication System.

(vi) CCTV Console Equipment.

(vii) Computers for VMS, AVCC, MET, Traffic Control.

(viii) A large size screen.

(ix) A line Printer.

(x) An Office Computer.

(xi) A Power Supply and back up system.

12.12.2 *Dissemination of information*

Information generated at the Control Centre shall be disseminated in the following manner:

(a) To the users: By displays on the Variable Message Signs, via internet web pages, and by creating a node at the wayside amenities to display the relevant information

(b) To the Operation and maintenance teams: By mobile phones.

(c) To the ambulances: By mobile phones.

(d) To the trauma care centres: Via ambulances.

12.13 Operation and Maintenance Centre

12.13.1 There shall be operation and maintenance centre(s) either at the toll plaza(s) or at any other location along the Project Highway as identified by the Concessionaire. The land for the same shall be acquired by the Concessionaire at his cost and risk. The operation and maintenance centre would have following minimum facilities:

(i) Main control centre and Administrative block.

(ii) Equipment for operation and maintenance and storage space for them

(iii) Storage space for equipment and material for traffic signs and markings.

(iv) Workshop.

(v) General garage and repair shop.

(vi) Testing laboratory.

(vii) Parking space for minimum 4 number of large vehicles and for other expected vehicle during peak hours including those for working staff and visitors.

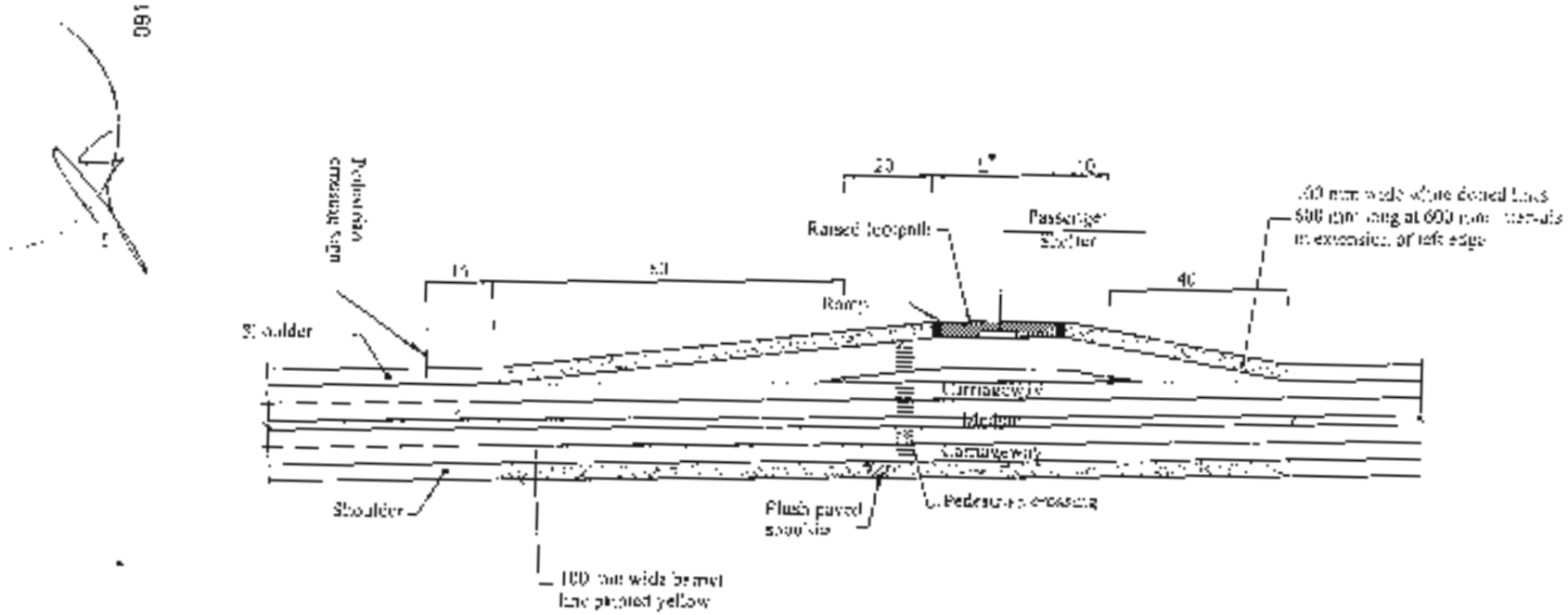
12.13.2 All building works shall be designed to meet the functional requirements and shall be compatible with regional architecture and micro climate. Locally available materials shall be given preference but not at the cost of construction quality.

12.13.3 The circulation roads and parking spaces in the O&M centre shall be paved to withstand vehicle loads and forces due to frequent acceleration and deceleration of vehicles. Parking bays/lots shall have proper cross slope and drainage. The marking of the parking bays shall be as per IRC:35 to demarcate parking and circulation space. Parking lots shall have illumination as provided in IS:1944 (Parts I and II).

12.13.4 The whole campus of operation and maintenance centre shall have system for security with safe entry and exit.

12.14 Report to be submitted

The Concessionaire shall submit report containing the proposals for provision of project facilities on the Project Highway to the IE for review and comments, if any.



1* = 3.5m if only one bus is expected to stop at a time, it may be increased by 15m for every additional bus expected to stop.

Fig. 12.1 : Layout of bus stop

Notes:
All dimensions are in metres
except as shown otherwise

Fig. 12.2 : Layout of pick-up bus stop in hilly area

Section 13

Special Requirements for Hill Roads

SECTION 13

SPECIAL REQUIREMENTS FOR HILL ROADS

13.1 General

13.1.1 The additional/new carriageway in hilly areas may either be constructed at the same level as that of the existing carriageway or at different levels to form a split highway depending upon the feasibility and geo-technical stability of the area

13.1.2 The Concessionaire shall pay due attention to geo-technical, environmental and social aspects of hill roads and take appropriate measures to ensure the following:

(The guidelines given in IRC:SP:48 may be referred to, for details).

(i) Stability against geological disturbances

(ii) Prevention of soil erosion.

(iii) Provision of efficient drainage and preservation of natural drainage system.

13.1.3 If there are any landslide prone areas along the road alignment, adequate investigation shall be undertaken and appropriate remedial measures shall be provided as per guidelines given in IRC:SP:48.

13.1.4 Where any new construction/realignment is involved, the alignment shall avoid large scale cutting and filling and follow the profile of land, as far as possible.

Areas having potential landslide or settlement problems shall be avoided. Adverse impact on the environment shall be reduced by adopting proper mitigation measures. Refer to guidelines given in IRC:SP:48.

13.1.5 Unstable hill slopes shall be adequately addressed by providing appropriate bioengineering and stabilization measures.

13.1.6 Necessary safeguard shall be taken to protect ecologically sensitive areas like wild life and bird sanctuaries, reserve forests, national parks, etc.

13.1.7 Protective structures for traffic such as parapets, railings, roadside safety barriers, boulder nets, etc. shall be provided, where necessary.

13.1.8 In mountainous and steep terrain, the scope of work defined by the Authority may be two-lane carriageways on different alignments (contours). In this case, the Manual of

Specifications and Standards for two-laning of Highways shall apply to the two-lane carriageways on different alignments (contours)

13.2 Set Back Distance at Horizontal Curves

Requisite sight distance should be available across the inside of horizontal curves. Lack of visibility in the lateral direction may arise due to obstructions like walls, cut-slopes, wooded areas, etc. Set back distance from the central line of the carriageway, within which the offending obstructions should be cleared to ensure the needed visibility, can be determined using the Equation given in IRC:52.

13.3 Grade Compensation at Curves

At horizontal curves, the gradient shall be eased by applying the grade compensation correction for gradients steeper than 4 per cent in accordance with IRC:52.

13.4 Hairpin Bends

Hairpin bends, where unavoidable, may be designed either as a circular curve with transition curves at each end or as a compound circular curve.

Design criteria given in IRC:52 shall be adopted for the design of hairpin bends. At hairpin bends, the full roadway width shall be surfaced.

13.5 Climbing Lane

Climbing lane shall be provided, where specified in Schedule-B of the Concession Agreement, in order to address the necessity of making available separate lane for safe overtaking for vehicle traveling uphill.

Proper signs and road markings shall be provided to ensure that the absolute right of way for climbing vehicles is available.

13.6 Rock Blasting

Heavy rock blasting should be avoided. Controlled blasting shall be resorted to. Blasting shall be supervised by experienced personnel. Blasting and related operations shall be carried out in accordance with Clause 302 of MORTH Specifications.

13.7 Cut Slopes

Cut slopes shall be rendered stable in the construction stage itself, by cutting at the correct angle and benching etc. including slope stabilizing structures like drains, breast walls, pitching, etc.

13.8 Tunnels

Where it is necessary to cross hills or high ridges, the various alternatives including construction of tunnel to avoid deep cuts shall be considered and the most preferred alternative shall be chosen. The alternative to be followed shall be indicated in Schedule-B of the Concession Agreement. Where road is to be taken through tunnel, its salient details shall be indicated in Schedule-B of the Concession Agreement.

13.9 Drainage

For drainage of water from roadside, an effective system of drainage shall be constructed to lead the run-off to natural water courses. In particular, catch water drains (Refer to para 6.5 of this Manual) shall be provided above the cut slopes. It shall be ensured that water is not drained into villages and cultivated land. Location of cross drains and culverts should be so chosen as to avoid erosion of the outlet. Erosion control works like drop walls, apron at out-fall points along with pitching/paving of the channel shall be provided where required.

13.10 Retaining Walls

13.10.1 Retaining walls shall be provided

(i) To support the down hill side unstable strata or fills.

(ii) To achieve width of roadway, where cutting into hill is restricted,

(iii) To arrest damage caused to the valley side and the road, by under cutting by a streams or other water course,

(iv) At valley points, where water flows over the road,

(v) At places where the valley side gets saturated in the monsoons and is likely to result in slips and damage to the road,

(vi) At any other locations warranting provision of retaining walls.

13.10.2 The retaining walls on the existing roads shall be inspected by the Concessionaire to check and assess the requirements of repairs and/or strengthening or reconstruction. If so required, the repair, strengthening or reconstruction work shall be carried out as per the assessment.

13.10.3 For general features, arrangement and design, guidelines given in IRC:SP:48 may be referred to.

13.11 Aprons etc.

Construction of apron, pitching, flooring shall conform to Clauses 2503 to 2507 of MORTH Specifications.

13.12 Disposal of debris

Disposal sites shall be identified by the Concessionaire for disposal of waste, debris, etc. Tipping of waste into valley sides, stream channels, water bodies, and forest areas shall not be resorted to

13.13 Report to be submitted

The Concessionaire shall submit report containing proposal for special requirements in hill areas to the IE for review and comments, if any.

Appendices

APPENDIX-I

[Reference Para 1.1(1)

List of Paras for preparing schedules of the Concession Agreement

Section	Para	Particulars to be specified
Section 1	1.17	Utilities to be constructed/shifted
	1.19.2	List of sections passing through built up areas
	1.20	List of stretches where 6 lanning shall be provided as part of 4-lanning of the Project Highway
Section 2	2.1 (ii) (a)	List of stretches where requirement of 6-lanning passing through built up areas is dispensed with
	2.1 (ii) (b)	Construction of bypass, alignment and land for the bypass
	2.1 (v)	Land for geometric improvements, and such stretches
	2.2.2	Land for geometric improvements and such stretches for ruling design speed
	2.3	Right of way available and land to be acquired.
	2.5.1	Type and widths of median in various stretches
	2.9.6	List of sections where radius of curve less than desirable minimum
	2.10.1 (i)	Width of underpasses
	2.10.2 (ii)	Pedestrain and cattle underpasses where vertical clearance shall be 4.5 m
	2.13.1	Width of overpasses
	2.12.1	Locations of intersections
	2.12.2.1	Locations and length of service roads
	2.12.2.2	Treatment of service road at bridge locations
	2.13.1	Location and other features of grade separated structures
	2.13.2	Type of structure for vehicular underpass or overpass and whether cross road shall be carried at the existing level
	2.13.3	Location of cattle and pedestrian under passes or overpasses
	2.18	List of stretches that are not required to be constructed as 6-lanes when traffic exceeds specified design service volume.

Section	Para	Particulars to be specified
Section 3	3.1.1 & 3.1.2	Location and type of intersection/interchange, other features and land requirements
	3.3.4	Length of viaduct at grade separated structures
Section 4	4.2.1 (ii)	Sections of existing road to be raised
Section 5	5.2.1	Type of pavement for new construction
	5.2.2	Type of strengthening of existing flexible pavement, if not bituminous overlay
	5.2.3	Requirement of CC pavement, and design, performance, construction and maintenance requirements
	5.9.4	Stretches to be reconstructed
Section 7	7.1 (ii)	Bridges which are not required to have independent superstructure
	7.1 (iii)	Bridges which are not required to be high level bridges
	7.1 (viii)	Utility services to be carried over the structures
	7.3 (i) (b)	List of bridges required to be 6 lane wide
	7.3 (ii) (c)	List of bridges or grade separated structures where passing places are to be provided
	7.3 (iii) (d)	List of culverts to be reconstructed and/or widened
	7.3 (iv) (f)	List of bridge structures to be reconstructed and/or widened
	7.4 (v)	Requirement of special structures like cable stayed/ superstructure bridge, etc.
	7.15.1	Requirement of reinforced earth retaining structures when height more than 10m.
	7.17 (iv)	Requirement of Crash barriers for existing bridges
	7.17 (v)	Parapets/railings of existing bridges to be repaired/replaced
	7.18.1	Locations where railway level crossings not to be replaced with ROBs/RUBs
	7.19 (i)	Location and type of grade-separated structures
	7.20	Type of drainage arrangement for the bridge deck
	7.21	Measures for protecting structures in marine environment

Section	Para	Particulars to be specified
	7.22 (i)	Structures to be repaired/strengthened, nature and extent of repairs
Section 9	9.2.7	Locations and size of overhead traffic signs
	9.7.2 (iv)	Locations (hazardous) that require safety barriers
Section 10	10.1	Location of Toll Plaza
Section 11	11.1	Number of trees to be planted
Section 12	12.1	Project facilities and land for providing project
	12.3.1	Locations for providing lighting
	12.3.3	Situations/locations where lighting to be provided
	12.4.1	Location and number of truck lay-byes to be provided
	12.5.1	Location and number of bus bays to be provided
	12.6	Location and layout of rest areas
	12.12.5	Locations of VMS
Section 13	13.5	Requirement of climbing lane
	13.8	Alignment/construction of tunnel and its salient details

APPENDIX 2

(Reference Para 1.4)

List of IRC Publications

S. No.	Code/ Document No.	Title of the Publication
1. IRC SPECIFICATIONS, STANDARDS, DESIGN CODES		
1.	IRC:2-1968	Route Marker Signs for National Highways (First Revision)
2	IRC:3-1983	Dimensions & Weights of Road Design Vehicles (First Revision)
3.	IRC:5-1998	Standard Specifications and Code of Practice for Road Bridges, Section I General Features of Design (Seventh Revision)
4.	IRC:6-2000	Standard Specifications and Code of Practice for Road Bridges, Section II Loads and Stresses (Fourth Revision)
5.	IRC:7-1971	Recommended Practice for Numbering Bridges and Culverts (First Revision)
6.	IRC:8-1960	Type Designs for Highway Kilometre Stones (Second Revision)
7.	IRC:9-1972	Traffic Census on Non Urban Roads (First Revision)
8	IRC:10-1961	Recommended Practice for Borrowpits for Road Embankments Constructed by Manual Operation
9.	IRC:11-1962	Recommended Practice for the Design and Layout of Cycle Tracks
10	IRC:12-1983	Recommended Practice for Location and Layout of Roadside Motor-Fuel Filling and Motor-Fuel Filling-cum-Service Stations (Second Revision)
11.	IRC:14-2004	Recommended Practice for Open Graded Premix Carpets (Third Revision)
12	IRC:15-2002	Standard Specifications and Code of Practice for Construction of Concrete Roads (Third Revision)

S. No.	Code Document No.	Title of the Publication (Titles given in bold types have been Just Published)
13.	**IRC:16-2008**	**Standard Specifications and Code of Practice for Prime and Tack Coat (Second Revision)**
14.	IRC:17-1965	Tentative Specification for Single Coat Bituminous Surface Dressing **(Amalgamated with IRC:110-2005)**
15	IRC:18-2000	Design Criteria for Prestressed Concrete Road Bridges (Post Tensioned Concrete) (Third Revision)
16.	**IRC:19-2005**	**Standard Specification and Code of Practice for Water Bound Macadam (Third Revision)**
17.	IRC:20-1966	Recommended Practice for Bituminous Penetration Macadam (Full Grout)
18	IRC:21-2000	Standard Specifications and Code of Practice for Road Bridges, Section III - Cement Concrete (Plain and Reinforced) (Third Revision)
19.	**IRC:22-2008**	**Standard Specifications and Code of Practice for Road Bridges, Section-VI - Composite Construction (Limit States Design) (Second Revision)**

SCHEDULE - E
(See Clause 4.1.3)

APPLICABLE PERMITS

1 **Applicable Permits**

1.1 The Concessionaire shall obtain, as required under the Applicable Laws, the following Applicable Permits on or before the Appointed Date, save and except to the extent of a waiver granted by the Authority in accordance with Clause 4.1.3 of the Agreement:

(a) Permission of the State Government for extraction of boulders from quarry;

(b) Permission of Village Panchayat and Pollution Control Board for installation of crushers;

(c) Licence for use of explosives;

(d) Permission of the State Government for drawing water from river/reservoir;

(e) Licence from Inspector of factories or other competent authority for setting up Batching Plant;

(f) Clearance of Pollution Control Board for setting up Batching Plant;

(g) Clearance of Village Panchayats and Pollution Control Board for Asphalt Plant;

(h) Permission of Village Panchayat and State Government for borrow earth;

(i) Permission of State Government for cutting of trees; and

(j) Any other permits or clearances required under Applicable Laws.

1.2 Applicable Permits, as required, relating to environmental protection and conservation shall have been procured by the Authority as a Condition Precedent.

SCHEDULE –F
(See Clause 9.1)

PERFORMANCE SECURITY

The Chairman,
National Highways Authority of India
New Delhi

WHEREAS:

(A) Supreme Panvel Indapur Tollways Private Limited (the "**Concessionaire**") and the Chairman, National Highways Authority of India (the "**Authority**") have entered into a Concession Agreement dated ..... (the "**Agreement**") whereby the Authority has agreed to the Concessionaire undertaking Four-Laning of the **Panvel** to **Indapur** section of National Highway No. 17 on design, build, finance, operate and Transfer ("**DBFOT**") basis, subject to and in accordance with the provisions of the Agreement.

(B) The Agreement requires the Concessionaire to furnish a Performance Security to the Authority in a sum of Rs. 47.14 cr. (Rupees Forty Seven crore and one four lakh) (the "**Guarantee Amount**") as security for due and faithful performance of its obligations, under and in accordance with the Agreement, during the Construction Period (as defined in the Agreement).

(C) We, ... through our Branch at ..... (the "**Bank**") have agreed to furnish this Bank Guarantee by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful performance of the Concessionaire's obligations during the Construction Period, under and in accordance with the Agreement, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Concessionaire, such sum or sums upto an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sums specified therein.

2. A letter from the Authority, under the hand of an Officer not below the rank of General Manager in the National Highways Authority of India, that the Concessionaire has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Agreement shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Concessionaire is in default in due and faithful performance of its obligations during the Construction Period under the Agreement and its decision that the Concessionaire is in default shall be final, and binding on the Bank, notwithstanding any differences between the

Authority and the Concessionaire, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Concessionaire for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Concessionaire and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.

4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Concessionaire before presenting to the Bank its demand under this Guarantee.

5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Agreement or to extend the time or period for the compliance with, fulfilment and/ or performance of all or any of the obligations of the Concessionaire contained in the Agreement or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Concessionaire, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Agreement and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Concessionaire or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.

6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Agreement or for the fulfilment, compliance and/or performance of all or any of the obligations of the Concessionaire under the Agreement.

7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force until the earlier of the 1st (first) anniversary of the Appointed Date or compliance of the conditions specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee, no later than 6 (six) months from the date of expiry of this Guarantee, all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.

8. The Performance Security shall cease to be in force and effect when the Concessionaire shall have expended on Project construction an aggregate sum not less than 20% (twenty per cent) of the Total Project Cost which is deemed to be Rs.942.69 cr. (Rupees Nine Forty Two crore and sixty nine Lakhs) for the purposes of this Guarantee, and provided the Concessionaire is not in breach of this Agreement. Upon request made by the Concessionaire for release of the

Performance Security alongwith the particulars required hereunder, duly certified by a statutory auditor of the Concessionaire, the Authority shall release the Performance Security forthwith.

9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.

10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred Branch, which shall be deemed to have been duly authorised to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.

11 This Guarantee shall come into force with immediate effect and shall remain in force and effect for a period of one year and six months or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

Signed and sealed this ..... day of ....., 20..... at .....

SIGNED, SEALED AND DELIVERED
For and on behalf of
the BANK by:

(Signature)
(Name)
(Designation)
(Code Number)
(Address)

NOTES:

(i) The bank guarantee should contain the name, designation and code number of the officer(s) signing the guarantee.

(ii) The address, telephone number and other details of the Head Office of the Bank as well as of issuing Branch should be mentioned on the covering letter of issuing Branch.

SCHEDULE -G
(See Clause 12.1)

PROJECT COMPLETION SCHEDULE

1 **Project Completion Schedule**

During Construction Period, the Concessionaire shall comply with the requirements set forth in this Schedule-G for each of the Project Milestones and the Scheduled Four-Laning Date (the "**Project Completion Schedule**"). Within 15 (fifteen) days of the date of each Project Milestone, the Concessionaire shall notify the Authority of such compliance alongwith necessary particulars thereof.

2 **Project Milestone-I**

2.1 Project Milestone – I shall occur on the date falling on the first anniversary of the Appointed Date (the "project Milestone – I").

Prior to the occurrence of Project Milestone - 1, the Concessionaire shall have achieved a physical progress of not less than 25% and expended not less than 25% (twenty five percent) of the total capital cost set forth in the Financial Package.

3 **Project Milestone-II**

3.1 Project Milestone – II shall occur on the date falling on the second anniversary of the Appointed Date (the "Project Milestone-II").

Prior to the occurrence of Project Milestone – II, the Concessionaire shall have achieved a physical progress of not less than 65% and expended not less than 65% (sixty five percent) of the total capital cost set forth in the Financial Package.

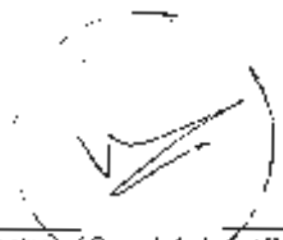
4 **Scheduled Four-Laning Date**

4.1 The scheduled four-laning shall occur on the date falling six months after the second anniversary of the Appointed Date.

On or before the Schedule Project Completion Date, the Concessionaire shall have completed the four - lane Project Highway in accordance with this Agreement.

5 **Extension of period**

Upon extension of any or all of the aforesaid Project Milestones or the Scheduled Four-Laning Date, as the case may be, under and in accordance with the provisions of this Agreement, the Project Completion Schedule shall be deemed to have been amended accordingly.



SCHEDULE –H
(See Clause 12.3)

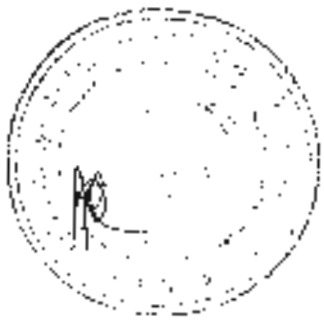
DRAWINGS

1 Drawings

In compliance of the obligations set forth in Clause 12.3 of this Agreement, the Concessionaire shall furnish to the Independent Engineer, free of cost, all Drawings listed in Annex-I of this Schedule-H.

2 Additional drawings

If the Independent Engineer determines that for discharging its duties and functions under this Agreement, it requires any drawings other than those listed in Annex-I, it may by notice require the Concessionaire to prepare and furnish such drawings forthwith. Upon receiving a requisition to this effect, the Concessionaire shall promptly prepare and furnish such drawings to the Independent Engineer, as if such drawings formed part of Annex-I of this Schedule-H.



Annex I
(Schedule II)

List of Drawings

1. The Project Highway drawings, as defined in the Concession Agreement, shall consist:

(a) Working Drawings of all the components/elements of the Project Highway as determined by Independent Engineer/NHAI, and

(b) As-built drawings for the Project Highway components/elements as determined by IE/NHAI. As-built drawings shall be duly certified by Independent Engineer.

2. A broad list of the drawings of the various components/elements of the Project Highway and project facilities required to be submitted by the Concessionaire is given below:

(a) Drawings of horizontal alignment, vertical profile and cross sections
(b) Drawings of cross drainage works
(c) Drawings of interchanges, major intersections, grade separators, underpasses and ROB's
(d) Drawings of toll plaza layout, toll collection systems and roadway near toll plaza
(e) Drawings of Control Centre
(f) Drawings of bus-bay and bus shelters with furniture and drainage system
(g) Drawing of a truck parking lay bye with furniture and drainage system
(h) Drawings of road furniture items including traffic signage, markings, safety barriers, etc.
(i) Drawings of traffic diversion plans and traffic control measures
(j) Drawings of road drainage measures
(k) Drawings of typical details slope protection measures
(l) Drawings of landscaping and horticulture
(m)Drawings of pedestrian crossings
(n) Drawings of street lighting
(o) Layout/Configuration of ITMS
(p) General arrangement of Base camp and Administrative Block

SCHEDULE - I
(See Clause 14.1.2)

TESTS

1 **Schedule for Tests**

1.1 The Concessionaire shall, no later than 30 (thirty) days prior to the likely completion of Four-Laning, notify the Independent Engineer and the Authority of its intent to subject the Project Highway to Tests, and no later than 7 (seven) days prior to the actual date of Tests, furnish to the Independent Engineer and the Authority detailed inventory and particulars of all works and equipment forming part of Four-Laning.

1.2 The Concessionaire shall notify the Independent Engineer of its readiness to subject the Project Highway to Tests at any time after 7 (seven) days from the date of such notice, and upon receipt of such notice, the Independent Engineer shall, in consultation with the Concessionaire, determine the date and time for each Test and notify the same to the Authority who may designate its representative to witness the Tests. The Independent Engineer shall thereupon conduct the Tests itself or cause any of the Tests to be conducted in accordance with Article 14 and this Schedule-I.

2 **Tests**

2.1 Visual and physical Test: The Independent Engineer shall conduct a visual and physical check of Four-Laning to determine that all works and equipment forming part thereof conform to the provisions of this Agreement.

2.2 Test drive: The Independent Engineer shall undertake a test drive of the Project Highway by a Car and by a fully loaded Truck to determine that the quality of service conforms to the provisions of the Agreement.

2.3 Riding quality Test: Riding quality of each lane of the carriageway shall be checked with the help of a calibrated bump integrator and the maximum permissible roughness for purposes of this Test shall be [1,800 (one thousand and eight hundred)] mm for each kilometre.

2.4 Pavement Composition Test: The thickness and composition of the pavement structure shall be checked on a sample basis by digging pits to determine conformity of such pavement structure with Specifications and Standards. The sample shall consist of one pit in each direction of travel to be chosen at random in each stretch of 5 (five) kilometres of the Project Highway. The first pit for the sample shall be selected by the Independent Engineer through an open draw of lots and every fifth kilometre from such first pit shall form part of the sample for this pavement quality Test.

2.5 Cross-section Test: The cross-sections of the Project Highway shall be checked on a sample basis through physical measurement of their dimensions for determining the conformity thereof with Specifications and Standards. For the road portion, the

sample shall consist of one spot to be selected at random in each stretch of 1 (one) kilometre of the Project Highway. The first spot for the sample shall be selected by the Independent Engineer through an open draw of lots and the spots located at every one kilometre from such first spot shall form part of the sample. For the bridge portion, one spot shall be selected at random by the Independent Engineer in each span of the bridge.

2.6 Structural Test for bridges: All major and minor bridges constructed by the Concessionaire shall be subjected to the Rebound Hammer and Ultrasonic Pulse Velocity tests, to be conducted in accordance with the procedure described in Special Report No. 17: 1996 of the IRC Highway Research Board on Non-destructive Testing Techniques, at two spots in every span, to be chosen at random by the Independent Engineer. Bridges with a span of 15 (fifteen) metres or more shall also be subjected to load testing.

2.7 Other Tests: The Independent Engineer may require the Concessionaire to carry out or cause to be carried additional Tests, in accordance with Good Industry Practice, for determining the compliance of the Project Highway with Specifications and Standards.

2.8 Environmental audit: The Independent Engineer shall carry out a check to determine conformity of the Project Highway with the environmental requirements set forth in Applicable Laws and Applicable Permits.

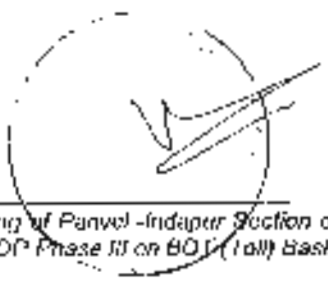
2.9 Safety review: Safety audit of the Project Highway shall have been undertaken by the Safety Consultant as set forth in Schedule-L, and on the basis of such audit, the Independent Engineer shall determine conformity of the Project Highway with the provisions of this Agreement.

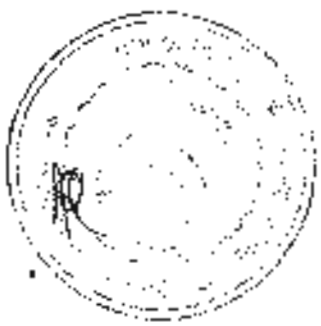
3 Agency for conducting Tests

All Tests set forth in this Schedule-I shall be conducted by the Independent Engineer or such other agency or person as it may specify in consultation with the Authority.

4 Completion/Provisional Certificate

Upon successful completion of Tests, the Independent Engineer shall issue the Completion Certificate or the Provisional Certificate, as the case may be, in accordance with the provisions of Article 14.





SCHEDULE -J

(See Clauses 14.2 & 14.3)

COMPLETION CERTIFICATE

1 I, ... (Name of the Independent Engineer), acting as Independent Engineer, under and in accordance with the Concession Agreement dated ..... (the "**Agreement**"), for Four-Laning of the **Panvel to Indapur** section (km **0.000** to km **84.000**) of National Highway No. 17 (the "**Project Highway**") on design, build, finance, operate and Transfer (DBFOT) basis, through Supreme Panvel Indapur Tollways Pvt Ltd. (Name of Concessionaire), hereby certify that the Tests specified in Article 14 and Schedule-I of the Agreement have been successfully undertaken to determine compliance of the Project Highway with the provisions of the Agreement, and I am satisfied that the Project Highway can be safely and reliably placed in commercial service of the Users thereof.

2 It is certified that, in terms of the aforesaid Agreement, all works forming part of Four-Laning have been completed, and the Project Highway is hereby declared fit for entry into commercial operation on this the ..... day of ..... 20. ...

SIGNED, SEALED AND DELIVERED
For and on behalf of
the INDEPENDENT ENGINEER by:

(Signature)
(Name)
(Designation)
(Address)

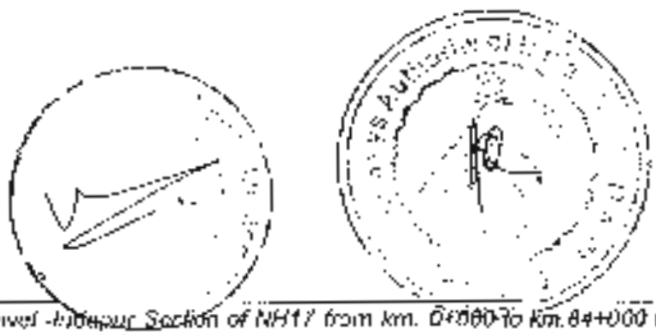
PROVISIONAL CERTIFICATE

1 I, ... (Name of the Independent Engineer), acting as Independent Engineer, under and in accordance with the Concession Agreement dated ..... (the "**Agreement**"), for [Four-Laning] [and subsequent Six-Laning] of the Panvel to Indapur section (km 0.000 to km 84.000) of National Highway No. 17 (the "**Project Highway**") on design, build, finance, operate and Transfer (DBFOT) basis through Supreme Panvel Indapur Tollways Private Limited (Name of Concessionaire), hereby certify that the Tests specified in Article 14 and Schedule-I of the Agreement have been undertaken to determine compliance of the Project Highway with the provisions of the Agreement.

2 Construction Works that were found to be incomplete and/or deficient have been specified in the Punch List appended hereto, and the Concessionaire has agreed and accepted that it shall complete and/or rectify all such works in the time and manner set forth in the Agreement. (Some of the incomplete works have been delayed as a result of reasons attributable to the Authority or due to Force Majeure and the Provisional Certificate cannot be withheld on this account. Though the remaining incomplete works have been delayed as a result of reasons attributable to the Concessionaire,)[38] I am satisfied that having regard to the nature and extent of such incomplete works, it would not be prudent to withhold commercial operation of the Project Highway, pending completion thereof.

3 In view of the foregoing, I am satisfied that the Project Highway can be safely and reliably placed in commercial service of the Users thereof, and in terms of the Agreement, the Project Highway is hereby provisionally declared fit for entry into commercial operation on this the ..... day of ..... 20.....

ACCEPTED, SIGNED, SEALED AND DELIVERED For and on behalf of CONCESSIONAIRE by: (Signature)	SIGNED, SEALED AND DELIVERED For and on behalf of INDEPENDENT ENGINEER by: (Signature)
(Name and Designation) (Address)	(Name and Designation) (Address)



SCHEDULE –K

(See Clause 1 / 2)

MAINTENANCE REQUIREMENTS

1 Maintenance Requirements

1.1 The Concessionaire shall, at all times, operate and maintain the Project Highway in accordance with the provisions of the Agreement, Applicable Laws and Applicable Permits. In particular, the Concessionaire shall, at all times during the Operation Period, conform to the maintenance requirements set forth in this Schedule-K (the "**Maintenance Requirements**").

1.2 The Concessionaire shall repair or rectify any defect or deficiency set forth in Paragraph 2 of this Schedule-K within the time limit specified therein and any failure in this behalf shall constitute a breach of the Agreement. Upon occurrence of any breach hereunder, the Authority shall be entitled to recover Damages as set forth in Clause 17.8 of the Agreement, without prejudice to the rights of the Authority under the Agreement, including Termination thereof.

2 Repair/rectification of defects and deficiencies

The obligations of the Concessionaire in respect of Maintenance Requirements shall include repair and rectification of the defects and deficiencies specified in Annex - I of this Schedule - K within the time limit set forth therein.

3 Other defects and deficiencies

3.1 In respect of any defect or deficiency not specified in Annex - I of this Schedule-K, the Concessionaire shall undertake repair or rectification in accordance with Good Industry Practice.

3.2 In respect of any defect or deficiency not specified in Annex - I of this Schedule-K, the Independent Engineer may, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards, and any deviation or deterioration beyond the permissible limit shall be repaired or rectified by the Concessionaire within the time limit specified by the Independent Engineer.

4 Extension of time limit

Notwithstanding anything to the contrary specified in this Schedule-K, if the nature and extent of any defect or deficiency justifies more time for its repair or rectification than the time specified herein, the Concessionaire shall be entitled to additional time in conformity with Good Industry Practice. Such additional time shall be determined by the Independent Engineer and conveyed to the Concessionaire and the Authority with reasons thereof.

5 Emergency repairs/restoration

Notwithstanding anything to the contrary contained in this Schedule-K, if any

defect, deficiency or deterioration in the Project Highway poses a hazard to safety or risk of damage to property, the Concessionaire shall promptly take all reasonable measures for eliminating or minimizing such danger.

6 **Daily Inspection by the Concessionaire**

The Concessionaire shall, through its engineer, undertake a daily visual inspection of the Project Highway and maintain a record thereof in a register to be kept in such form and manner as the Independent Engineer may specify. Such record shall be kept in safe custody of the Concessionaire and shall be open to inspection by the Authority and the Independent Engineer at any time during office hours.

7 **Divestment Requirements**

All defects and deficiencies specified in this Schedule-K shall be repaired and rectified by the Concessionaire so that the Project Highway conforms to the Maintenance Requirements on the Transfer Date.

8 **Display of Schedule - K**

The Concessionaire shall display a copy of this Schedule-K at the Toll Plaza[s] along with the Complaint Register stipulated in Article 46.

Annex - I
(Schedule K)

Repair/Rectification of Defects and Deficiencies

The Concessionaire shall repair and rectify the defects and deficiencies specified in this Annex-I of Schedule-K within the time limit set forth herein.[26]

	Nature of defect or deficiency		**Time limit for repair/ rectification**
ROADS			
(a)	**Carriageway and paved shoulders**		
(i)	Breach or blockade	-	Temporary / restoration of traffic within 24 hours; permanent restoration within 15 days
(ii)	Roughness value exceeding 2,500 mm in a stretch of 1 km (as measured by a standardised roughometer/bump integrator)	-	180 days
(iii)	Pot holes	-	48 hours
(iv)	Cracking in more than 5% of road surface in a stretch of 1 km	-	30 days
(v)	Rutting exceeding 10 mm in more than 2% of road surface in a stretch of 1 km (measured with 3 m straight edge)	-	30 days
(vi)	Bleeding/skidding	-	7 days
(vii)	Ravelling/Stripping of bitumen surface exceeding 10 sq m	-	15 days
(viii)	Damage to pavement edges exceeding 10 cm	-	15 days
(ix)	Removal of debris	-	6 hours
(b)	**Hard/earth shoulders, side slopes, drains and culverts**		

[26] MoSRTH may, in consultation with DRC, by order modify the values and periods specified herein, but such modification shall take effect only if it is included in the respective bidding documents.

(i)	Variation by more than 2% in the prescribed slope of camber/cross fall	-	30 days
(ii)	Edge drop at shoulders exceeding 40 mm	-	7 days
(iii)	Variation by more than 15% in the prescribed side (embankment) slopes	-	30 days
(iv)	Rain cuts/gullies in slope	-	7 days
(v)	Damage to or silting of culverts and side drains during and immediately preceding the rainy season	-	7 days
(vi)	Desilting of drains in urban/semi-urban areas	-	48 hours
(c)	**Road side furniture including road signs and pavement marking**		
(i)	Damage to shape or position; poor visibility or loss of retro-reflectivity	-	48 hours
(d)	**Street lighting and telecom (ATMS)**		
(i)	Any major failure of the system	-	24 hours
(ii)	Faults and minor failures	-	8 hours
(e)	**Trees and plantation**		
(i)	Obstruction in a minimum head-room of 5 m above carriageway or obstruction in visibility of road signs	-	24 hours
(ii)	Deterioration in health of trees and bushes	-	Timely watering and treatment
(iii)	Replacement of trees and bushes	-	90 days
(iv)	Removal of vegetation affecting sight line and road structures	-	15 days
(f)	**Rest areas**		
(i)	Cleaning of toilets	-	Every 4 hours
(ii)	Defects in electrical, water and sanitary installations	-	24 hours

(g)	**Toll plaza[s]**		
(i)	Failure of toll collection equipment or lighting	-	8 hours
(ii)	Damage to toll plaza	-	7 days
(h)	**Other Project Facilities and Approach roads**		
(i)	Damage or deterioration in Approach Roads, [pedestrian facilities, truck lay-bys, bus-bays, bus-shelters, cattle crossings, Traffic Aid Posts, Medical Aid Posts and other works]	-	15 days

BRIDGES

(a)	**Superstructure of bridges**		
(i)	Cracks Temporary measures Permanent measures	- -	within 48 hours within 45 days
(ii)	Spalling/scaling	-	15 days
(b)	**Foundations of bridges**		
(i)	Scouring and/or cavitation	-	15 days
(c)	**Piers, abutments, return walls and wing walls of bridges**		
(i)	Cracks and damages including settlement and tilting	-	30 days
(d)	**Bearings (metallic) of bridges**		
(i)	Deformation	-	15 days
(e)	**Joints in bridges**		
(i)	Loosening and malfunctioning of joints	-	15 days
(f)	**Other items relating to bridges**		
(i)	Deforming of pads in elastomeric bearings	-	7 days
(ii)	Gathering of dirt in bearings and joints; or clogging of spouts, weep holes and vent-holes	-	3 days
(iii)	Damage or deterioration in parapets and handrails	-	3 days

(iv)	Rain cuts or erosion of banks of the side slopes of approaches	-	15 days
(v)	Damage to wearing coat	-	15 days
(vi)	Damage or deterioration in approach slabs, pitching, apron, toes, floor or guide bunds	-	30 days
(vii)	Growth of vegetation affecting the structure or obstructing the waterway	-	15 days

SCHEDULE –L

(See Clause 18.1.1)

SAFETY REQUIREMENTS

1 Guiding principles

1.1 Safety Requirements aim at reduction in injuries, loss of life and damage to property resulting from accidents on the Project Highway, irrespective of the person(s) at fault.

1.2 Users of the Project Highway include motorised and non-motorised vehicles as well as pedestrians and animals involved in, or associated with accidents. Vulnerable Road Users (VRU) include pedestrians as well as riders of motorised two-wheelers, bicycles and other vehicles which do not provide adequate occupant protection.

1.3 Safety Requirements apply to all phases of construction, operation and maintenance with emphasis on identification of factors associated with accidents, consideration of the same, and implementation of appropriate remedial measures.

1.4 Safety Requirements include measures associated with traffic management and regulation such as road signs, pavement marking, traffic control devices, roadside furniture, highway design elements, enforcement and emergency response.

2 Obligations of the Concessionaire

The Concessionaire shall abide by the following insofar as they relate to safety of the Users:

(a) Applicable Laws and Applicable Permits;

(b) Manual for Safety in Road Design, issued by MOSRTH;

(c) relevant Standards/Guidelines of IRC relating to safety, road geometrics, bridges, culverts, road signs, pavement marking and roadside furniture;

(d) provisions of this Agreement; and

(e) Good Industry Practice.

3 Appointment of Safety Consultant

For carrying out safety audit of the Project Highway under and in accordance with this Schedule-L, the Authority shall appoint from time to time, one or more qualified firms or organisations as its consultants (the "**Safety Consultant**"). The Safety Consultant shall employ a team comprising, without limitation, one road

safety expert and one traffic planner to undertake safety audit of the Project Highway.

4 Safety measures during Development Period

4.1 No later than 90 (ninety) days from the date of this Agreement, the Authority shall appoint a Safety Consultant for carrying out safety audit at the design stage of the Project. The Safety Consultant shall collect data on all fatal crashes and other road accidents which occurred on the Project Highway in the preceding two years by obtaining copies of the relevant First Information Reports (FIRs) from the police stations having jurisdiction. The information contained in such FIRs shall be summarised in the form prescribed by IRC/MOSRTH for this purpose and the data shall be analysed for the type of victims killed or injured, impacting vehicles, location of accidents and other relevant factors.

4.2 The Concessionaire shall provide to the Safety Consultant, in four copies, the relevant drawings containing the design details that have a bearing on safety of Users (the "**Safety Drawings**"). Such design details shall include horizontal and vertical alignments; sightlines; layouts of intersections; interchanges; road cross-section; bridges and culverts; side drains; provision for parked vehicles, slow moving vehicles (tractors, bullock carts, bicycles) and pedestrians; bus bays; truck lay-bys; and other incidental or consequential information. The Safety Consultant shall review the design details and forward three copies of the Safety Drawings with its recommendations, if any, to the Independent Engineer who shall record its comments, if any, and forward one copy each to the Authority and the Concessionaire.

4.3 The accident data and the design details shall be compiled, analysed and used by the Safety Consultant for evolving a package of recommendations consisting of safety related measures for the Project Highway. The safety audit shall be completed in a period of three months and a report thereof (the "**Safety Report**") shall be submitted to the Authority, in five copies. One copy each of the Safety Report shall be forwarded by the Authority to the Concessionaire and the Independent Engineer forthwith.

4.4 The Concessionaire shall endeavour to incorporate the recommendations of the Safety Report in the design of the Project Highway, as may reasonably be required in accordance with Applicable Laws, Applicable Permits, Manuals and Guidelines of MOSRTH and IRC, Specifications and Standards, and Good Industry Practice. If the Concessionaire does not agree with any or all of such recommendations, it shall state the reasons thereof and convey them to the Authority forthwith. In the event that any or all of the works and services recommended in the Safety Report fall beyond the scope of Schedule-B, Schedule-C or Schedule-D, the Concessionaire shall make a report thereon and seek the instructions of the Authority for funding such works in accordance with the provisions of Article 18.

4.5 Without prejudice to the provisions of Paragraph 4.4, the Concessionaire and the Independent Engineer shall, within 15 (fifteen) days of receiving the Safety Report, send their respective comments thereon to the Authority, and no later than

15 (fifteen) days of receiving such comments, the Authority shall review the same alongwith the Safety Report and by notice direct the Concessionaire to carry out any or all of the recommendations contained therein with such modifications as the Authority may specify; provided that any works or services required to be undertaken hereunder shall be governed by the provisions of Article 18.

5 Safety measures during Construction Period

5.1 A Safety Consultant shall be appointed by the Authority, no later than 4 (four) months prior to the expected Project Completion Date, for carrying out a safety audit of the completed Construction Works.

5.2 The Safety Consultant shall collect and analyse the accident data for the preceding two years in the manner specified in Paragraph 4.1 of this Schedule-L. It shall study the Safety Report for the Development Period and inspect the Project Highway to assess the adequacy of safety measures. The Safety Consultant shall complete the safety audit within a period of 4 (four) months and submit a Safety Report recommending a package of additional road safety measures, if any, that are considered essential for reducing accident hazards on the Project Highway. Such recommendations shall be processed, *mutatis mutandis*, and acted upon in the manner set forth in Paragraphs 4.3, 4.4 and 4.5 of this Schedule-L.

5.3 The Concessionaire shall make adequate arrangements during the Construction Period for the safety of workers and road Users in accordance with the guidelines of IRC for safety in construction zones, and notify the Authority and the Independent Engineer about such arrangements.

6 Safety measures during Operation Period

6.1 The Concessionaire shall develop, implement and administer a surveillance and safety programme for Users, including correction of safety violations and deficiencies and all other actions necessary to provide a safe environment in accordance with this Agreement.

6.2 The Concessionaire shall establish a Highway Safety Management Unit (the "**HSMU**") to be functional on and after COD, and designate one of its officers to be in-charge of the HSMU. Such officer shall have specialist knowledge and training in road safety and traffic engineering by having attended a course conducted by a reputed organisation on the subject.

6.3 The Concessionaire shall keep a copy of every FIR recorded by the Police with respect to any accident occurring on the Project Highway. In addition, the Concessionaire shall also collect data for all cases of accidents not recorded by the Police but where a vehicle rolled over or had to be towed away. The information so collected shall be summarised in the form prescribed by IRC/ MOSRTH for this purpose. The Concessionaire shall also record the exact location of each accident on a road map. The aforesaid data shall be submitted to the Authority at the conclusion of every quarter and to the Safety Consultant as and when

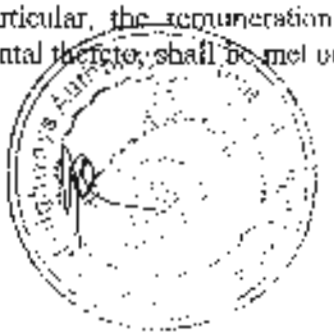
appointed.

6.4 The Concessionaire shall submit to the Authority before the 31st (thirty first) May of each year, an annual report (in ten copies) containing, without limitation, a detailed listing and analysis of all accidents of the preceding Accounting Year and the measures taken by the Concessionaire pursuant to the provisions of Paragraph 6.1 of this Schedule-I, for averting or minimising such accidents in future.

6.5 Once in every Accounting Year, a safety audit shall be carried out by the Safety Consultant to be appointed by the Authority. It shall review and analyse the annual report and accident data of the preceding year, and undertake an inspection of the Project Highway. The Safety Consultant shall complete the safety audit within a period of 1 (one) month and submit a Safety Report recommending specific improvements, if any, required to be made to the road, bridges, culverts, markings, signs, road furniture and Project Facilities, including cattle crossings and pedestrian crossings. Such recommendations shall be processed, *mutatis mutandis*, and acted upon in the manner set forth in Paragraphs 4.3, 4.4 and 4.5 of this Schedule-I.

7 Costs and expenses

Costs and expenses incurred in connection with the Safety Requirements set forth herein, including the provisions of Paragraph 2 of this Schedule, shall be met in accordance with Article 18, and in particular, the remuneration of the Safety Consultant, safety audit, and costs incidental thereto, shall be met out of the Safety Fund.



SCHEDULE –M
(See Clause 19.5)

MONTHLY FEE STATEMENT

Project Highway: **Month:**

Type of Vehicle	For corresponding month of previous year		For preceding month		For the month reported upon		
	No. of Vehicles	Fee collected (in lakh Rs.)	No. of Vehicles	Fee collected (in lakh Rs.)	Fee per Vehicle (in Rs.)	No. of Vehicles	Fee collected (in lakh Rs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A Car							
B LCV							
C Bus							
D Truck							
E Multi-axle Truck							
F Oversized vehicle							
G Total							

Note 1: The above statement does not include Local Users and vehicles travelling on Passes

Note 2: Monthly Fee Statements for Passes have been prepared separately in the above format and are enclosed.

Remarks, if any:

SCHEDULE –N
(See Clause22.1)

WEEKLY TRAFFIC CENSUS

Project Highway: **Week ending:**

Type of Vehicle	No. of vehicles using the Project Highway during		
	Corresponding week/last year	Preceding week	Week of report
(1)	(2)	(3)	(4)
A Fee paying Traffic			
A1 Car			
A2 LCV			
A3 Bus			
A4 Truck			
A5 Multi-axle Truck			
A6 Oversized vehicle			
Total (A)			
B Local Users			
B1 Car			
Total (B)			
C Exempted Vehicles			
C1 Motor Cycle			
C2 Car			
C3 LCV			
C4 Bus			
C5 Truck			
C6 Tractor			
Total (C)			
D Total Traffic (A+B-C)			
D1 Motor Cycle			
D2 Car			
D3 LCV			
D4 Bus			
D5 Truck			
D6 Multi-axle Truck			
D7 Oversized vehicle			
D8 Tractor			
Grand Total (E)			

Remarks, if any:

WEEKLY REPORT FOR WEIGH STATIONS

Project Highway: **Week ending:**

Type of Vehicle	Permitted Gross Vehicle Weight (Tonnes)	No. of Vehicles weighed (Sample Size)	No. of Vehicles carrying load:			
			Within permissible limits	Up to 10% in excess	Over 10% and up to 20% in excess	Over 20% in excess
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A LCV						
B Truck						
C Multi-axle Truck						
D **Total**						

Note: Sample size shall not be less than 200 Trucks per week and 20 Trucks per day, and should include a proportionate number of Multi-axle Trucks.

Remarks, if any:

SCHEDULE O
(See Clause 22.3.1)

TRAFFIC SAMPLING

1 Traffic sampling

The Authority may, in its discretion and at its own cost, undertake traffic sampling, pursuant to Clause 22.3, in order to determine the actual traffic on the Project Highway. Such traffic sampling shall be undertaken through the Independent Engineer in the manner set forth below.

2 Manual traffic count

The Independent Engineer shall employ the required number of enumerators who shall count, classify and record all the vehicles as they pass by, and divide the survey into fixed time periods. The count stations shall be located near the Toll Plaza[s] on a straight section of the road with good visibility. The survey shall be conducted continuously for a minimum of 24 (twenty four) hours and maximum of 7 (seven) days at a time. The count period shall be 15 (fifteen) minutes with results summarised hourly.

3 Automatic traffic count

For automatic traffic count to be conducted on intermittent (non-continuous) basis, the Independent Engineer shall use suitable and standardised equipment to classify and record the range of vehicles passing through the Toll Plaza[s]. For this purpose, the counter shall be checked with at least 100 (one hundred) vehicles, including all major vehicle types, over a range of speeds to ensure that all vehicles are being counted and classified correctly.

4 Variation between manual and automatic count

Average Daily Traffic (ADT) for each type of vehicle shall be determined separately by the aforesaid two methods and in the event that the number of vehicles in any category, as counted by the manual method, varies by more than 1% (one per cent) of the number of such vehicles as counted by the automatic method, the manual and automatic count of such category of vehicles shall be repeated, and in the event of any discrepancy between the two counts in the second enumeration, the average thereof shall be deemed to be the actual traffic. For the avoidance of doubt, it is expressly agreed that the Authority may, in consultation with the Concessionaire, adopt modified or alternative processes of traffic sampling for improving the reliability of such sampling.

SCHEDULE P
(See Clause 23.1)

SELECTION OF INDEPENDENT ENGINEER

1 Selection of Independent Engineer

1.1 The provisions of Part II of the Standard Bidding Documents for Consultancy Assignments: Time Based (Volume V) issued by the Ministry of Finance, GOI in July, 1997 or any substitute thereof shall apply, *mutatis mutandis*, for invitation of bids and evaluation thereof save as otherwise provided herein.

1.2 The Authority shall invite expressions of interest from consulting engineering firms or bodies corporate to undertake and perform the duties and functions set forth in Schedule-Q and thereupon shortlist 10 (ten) qualified firms in accordance with pre-determined criteria. The Authority shall convey the aforesaid list of firms to the Concessionaire for scrutiny and comments, if any. The Concessionaire shall be entitled to scrutinise the relevant records of the Authority to ascertain whether the selection of firms has been undertaken in accordance with the prescribed procedure and it shall send its comments, if any, to the Authority within 15 (fifteen) days of receiving the aforesaid list of firms. Upon receipt of such comments, if any, the Authority shall, after considering all relevant factors, finalise and constitute a panel of 10 (ten) firms (the "**Panel of Firms**") and convey its decision to the Concessionaire.

1.3 The Authority shall invite the aforesaid firms in the Panel of Firms to submit their respective technical and financial offers, each in a separate sealed cover. All the technical bids so received shall be opened and pursuant to the evaluation thereof, the Authority shall shortlist 3 (three) eligible firms on the basis of their technical scores. The financial bids in respect of such 3 (three) firms shall be opened and the order of priority as among these firms shall be determined on the basis of a weighted evaluation where technical and financial scores shall be assigned respective weights of 80:20.

1.4 In the event that the Authority shall follow the selection process specified in the Model RFP for selection of Technical Consultants, as published by the Ministry of Finance/ Planning Commission, the selection process specified in this Schedule-P shall be deemed to be substituted by the provisions of the said Model RFP and the Concessionaire shall be entitled to scrutinise the relevant records forming part of such selection process.

2 Fee and expenses

2.1 In determining the nature and quantum of duties and services to be performed by the Independent Engineer during the Development Period and Construction Period, the Authority shall endeavour that payments to the Independent Engineer on account of fee and expenses do not exceed 2% (two per cent) of the Total Project Cost. Payments not exceeding such 2% (two per cent) shall be borne equally by the Authority and the Concessionaire in accordance with the provisions of this Agreement and any payments in excess thereof shall be borne entirely by

the Authority.

2.3 The nature and quantum of duties and services to be performed by the Independent Engineer during the Operation Period shall be determined by the Authority in conformity with the provisions of this Agreement and with due regard for economy in expenditure. All payments made to the Independent Engineer on account of fee and expenses during the Operation Period, [including the construction of Six Laning,] shall be borne equally by the Authority and the Concessionaire.

3 Constitution of fresh panel

No later than 3 (three) years from the date of this Agreement, and every 3 (three) years thereafter, the Authority shall prepare a fresh panel of firms in accordance with the criteria set forth in this Schedule-P; provided that the Authority may, at any time, prepare a fresh panel with prior written consent of the Concessionaire.

4 Appointment of government entity as Independent Engineer

Notwithstanding anything to the contrary contained in this Schedule, the Authority may in its discretion appoint a government-owned entity as the Independent Engineer; provided that such entity shall be a body corporate having as one of its primary function the provision of consulting, advisory and supervisory services for engineering projects; provided further that a government-owned entity which is owned or controlled by the Authority and/or MoSRTH shall not be eligible for appointment as Independent Engineer.

SCHEDULE Q
(See Clause 23.2.1)

TERMS OF REFERENCE FOR INDEPENDENT ENGINEER

1 Scope

1.1 These Terms of Reference for the Independent Engineer (the "**TOR**") are being specified pursuant to the Concession Agreement dated ..... (the "**Agreement**"), which has been entered into between the Authority and Supreme Panvel Indapur Tollways Private Limited (the "**Concessionaire**") for Four-Laning of the **Panvel – Indapur** section (km **0.000** to km **84.000**) of National Highway No. **17** in the State on design, build, finance, operate and Transfer (DBFOT) basis, and a copy of which is annexed hereto and marked as Annex-A to form part of this TOR.

1.2 This TOR shall apply to construction, operation and maintenance of the Four-Lane Project Highway, and shall apply, *mutatis mutandis*, thereof.

2 **Definitions and interpretation**

2.1 The words and expressions beginning with or in capital letters used in this TOR and not defined herein but defined in the Agreement shall have, unless repugnant to the context, the meaning respectively assigned to them in the Agreement.

2.2 References to Articles, Clauses and Schedules in this TOR shall, except where the context otherwise requires, be deemed to be references to the Articles, Clauses and Schedules of the Agreement, and references to Paragraphs shall be deemed to be references to Paragraphs of this TOR.

2.3 The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Agreement shall apply, *mutatis mutandis*, to this TOR.

3 **Role and functions of the Independent Engineer**

3.1 The role and functions of the Independent Engineer shall include the following:

(i) review of the Drawings and Documents as set forth in Paragraph 4;

(ii) review, inspection and monitoring of Construction Works as set forth in Paragraph 5;

(iii) conducting Tests on completion of construction and issuing Completion/ Provisional Certificate as set forth in Paragraph 5;

(iv) review, inspection and monitoring of O&M as set forth in Paragraph 6;

(v) review, inspection and monitoring of Divestment Requirements as set forth in Paragraph 7;

(vi) determining, as required under the Agreement, the costs of any works or

services and/or their reasonableness;

(vii) determining, as required under the Agreement, the period or any extension thereof, for performing any duty or obligation;

(viii) assisting the Parties in resolution of disputes as set forth in Paragraph 9; and

(ix) undertaking all other duties and functions in accordance with the Agreement.

3.2 The Independent Engineer shall discharge its duties in a fair, impartial and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice.

4 Development Period

4.1 During the Development Period, the Independent Engineer shall undertake a detailed review of the Drawings to be furnished by the Concessionaire along with supporting data, including the geo-technical and hydrological investigations, characteristics of materials from borrow areas and quarry sites, topographical surveys and traffic surveys. The Independent Engineer shall complete such review and send its comments/observations to the Authority and the Concessionaire within 15 (fifteen) days of receipt of such Drawings. In particular, such comments shall specify the conformity or otherwise of such Drawings with the Scope of the Project and Specifications and Standards.

4.2 The Independent Engineer shall review any modified Drawings or supporting Documents sent to it by the Concessionaire and furnish its comments within 7 (seven) days of receiving such Drawings or Documents.

4.3 The Independent Engineer shall review the Drawings sent to it by the Safety Consultant in accordance with Schedule-I, and furnish its comments thereon to the Authority and the Concessionaire within 7 (seven) days of receiving such Drawings. The Independent Engineer shall also review the Safety Report and furnish its comments thereon to the Authority within 15 (fifteen) days of receiving such report.

4.4 The Independent Engineer shall review the detailed design, construction methodology, quality assurance procedures and the procurement, engineering and construction time schedule sent to it by the Concessionaire and furnish its comments within 15 (fifteen) days of receipt thereof.

4.5 Upon reference by the Authority, the Independent Engineer shall review and comment on the EPC Contract or any other contract for construction, operation and maintenance of the Project Highway, and furnish its comments within 7 (seven) days from receipt of such reference from the Authority.

5 Construction Period

5.1 In respect of the Drawings, Documents and Safety Report received by the Independent Engineer for its review and comments during the Construction

Period, the provisions of Paragraph 4 shall apply, *mutatis mutandis*.

5.2 The Independent Engineer shall review the monthly progress report furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 7 (seven) days of receipt of such report.

5.3 The Independent Engineer shall inspect the Construction Works and the Project Highway once every month, preferably after receipt of the monthly progress report from the Concessionaire, but before the 20th (twentieth) day of each month in any case, and make out a report of such inspection (the "**Inspection Report**") setting forth an overview of the status, progress, quality and safety of construction, including the work methodology adopted, the materials used and their sources, and conformity of Construction Works with the Scope of the Project and the Specifications and Standards. In a separate section of the Inspection Report, the Independent Engineer shall describe in reasonable detail the lapses, defects or deficiencies observed by it in the construction of the Project Highway. The Inspection Report shall also contain a review of the maintenance of the existing lanes in conformity with the provisions of the Agreement. The Independent Engineer shall send a copy of its Inspection Report to the Authority and the Concessionaire within 7 (seven) days of the inspection.

5.4 The Independent Engineer may inspect the Project Highway more than once in a month if any lapses, defects or deficiencies require such inspections.

5.5 For determining that the Construction Works conform to Specifications and Standards, the Independent Engineer shall require the Concessionaire to carry out, or cause to be carried out, tests on a sample basis, to be specified by the Independent Engineer in accordance with Good Industry Practice for quality assurance. For purposes of this Paragraph 5.5, the tests specified in the IRC Special Publication-11 (Handbook of Quality Control for Construction of Roads and Runways) and the Specifications for Road and Bridge Works issued by MOSRTH (the "**Quality Control Manuals**") or any modification/substitution thereof shall be deemed to be tests conforming to Good Industry Practice for quality assurance. The Independent Engineer shall issue necessary directions to the Concessionaire for ensuring that the tests are conducted in a fair and efficient manner, and shall monitor and review the results thereof.

5.6 The sample size of the tests, to be specified by the Independent Engineer under Paragraph 5.5, shall comprise 10% (ten per cent) of the quantity or number of tests prescribed for each category or type of tests in the Quality Control Manuals; provided that the Independent Engineer may, for reasons to be recorded in writing, increase the aforesaid sample size by up to 10% (ten per cent) for certain categories or types of tests.

5.7 The timing of tests referred to in Paragraph 5.5, and the criteria for acceptance/ rejection of their results shall be determined by the Independent Engineer in accordance with the Quality Control Manuals. The tests shall be undertaken on a random sample basis and shall be in addition to, and independent of, the tests that may be carried out by the Concessionaire for its own quality assurance in accordance with Good Industry Practice.

5.8 In the event that the Concessionaire carries out any remedial works for removal or rectification of any defects or deficiencies, the Independent Engineer shall require the Concessionaire to carry out, or cause to be carried out, tests to determine that such remedial works have brought the Construction Works into conformity with the Specifications and Standards, and the provisions of this Paragraph 5 shall apply to such tests.

5.9 In the event that the Concessionaire fails to achieve any of the Project Milestones, the Independent Engineer shall undertake a review of the progress of construction and identify potential delays, if any. If the Independent Engineer shall determine that completion of the Project Highway is not feasible within the time specified in the Agreement, it shall require the Concessionaire to indicate within 15 (fifteen) days the steps proposed to be taken to expedite progress, and the period within which the Project Completion Date shall be achieved. Upon receipt of a report from the Concessionaire, the Independent Engineer shall review the same and send its comments to the Authority and the Concessionaire forthwith.

5.10 If at any time during the Construction Period, the Independent Engineer determines that the Concessionaire has not made adequate arrangements for the safety of workers and Users in the zone of construction or that any work is being carried out in a manner that threatens the safety of the workers and the Users, it shall make a recommendation to the Authority forthwith, identifying the whole or part of the Construction Works that should be suspended for ensuring safety in respect thereof.

5.11 In the event that the Concessionaire carries out any remedial measures to secure the safety of suspended works and Users, it may, by notice in writing, require the Independent Engineer to inspect such works, and within 3 (three) days of receiving such notice, the Independent Engineer shall inspect the suspended works and make a report to the Authority forthwith, recommending whether or not such suspension may be revoked by the Authority.

5.12 If suspension of Construction Works is for reasons not attributable to the Concessionaire, the Independent Engineer shall determine the extension of dates set forth in the Project Completion Schedule, to which the Concessionaire is reasonably entitled, and shall notify the Authority and the Concessionaire of the same.

5.13 The Independent Engineer shall carry out, or cause to be carried out, all the Tests specified in Schedule-I and issue a Completion Certificate or Provisional Certificate, as the case may be. For carrying out its functions under this Paragraph 5.13 and all matters incidental thereto, the Independent Engineer shall act under and in accordance with the provisions of Article 14 and Schedule-I.

5.14 Upon reference from the Authority, the Independent Engineer shall make a fair and reasonable assessment of the costs of providing information, works and services as set forth in Article 16 and certify the reasonableness of such costs for payment by the Authority to the Concessionaire.

5.15 The Independent Engineer shall aid and advise the Concessionaire in preparing the Maintenance Manual.

6 **Operation Period**

6.1 In respect of the Drawings, Documents and Safety Report received by the Independent Engineer for its review and comments during the Operation Period, the provisions of Paragraph 4 shall apply, *mutatis mutandis*.

6.2 The Independent Engineer shall review the annual Maintenance Programme furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 15 (fifteen) days of receipt of the Maintenance Programme.

6.3 The Independent Engineer shall review the monthly status report furnished by the Concessionaire and send its comments thereon to the Authority and the Concessionaire within 7 (seven) days of receipt of such report.

6.4 The Independent Engineer shall inspect the Project Highway once every month, preferably after receipt of the monthly status report from the Concessionaire, but before the 20th (twentieth) day of each month in any case, and make out an O&M Inspection Report setting forth an overview of the status, quality and safety of O&M including its conformity with the Maintenance Requirements and Safety Requirements. In a separate section of the O&M Inspection Report, the Independent Engineer shall describe in reasonable detail the lapses, defects or deficiencies observed by it in O&M of the Project Highway. The Independent Engineer shall send a copy of its O&M Inspection Report to the Authority and the Concessionaire within 7 (seven) days of the inspection.

6.5 The Independent Engineer may inspect the Project Highway more than once in a month, if any lapses, defects or deficiencies require such inspections.

6.6 The Independent Engineer shall in its O&M Inspection Report specify the tests, if any, that the Concessionaire shall carry out, or cause to be carried out, for the purpose of determining that the Project Highway is in conformity with the Maintenance Requirements. It shall monitor and review the results of such tests and the remedial measures, if any, taken by the Concessionaire in this behalf.

6.7 In respect of any defect or deficiency referred to in Paragraph 3 of Schedule-K, the Independent Engineer shall, in conformity with Good Industry Practice, specify the permissible limit of deviation or deterioration with reference to the Specifications and Standards and shall also specify the time limit for repair or rectification of any deviation or deterioration beyond the permissible limit.

6.8 The Independent Engineer shall determine if any delay has occurred in completion of repair or remedial works in accordance with the Agreement, and shall also determine the Damages, if any, payable by the Concessionaire to the Authority for such delay.

6.9 The Independent Engineer shall examine the request of the Concessionaire for closure of any lane(s) of the carriageway for undertaking maintenance/repair thereof, keeping in view the need to minimise disruption in traffic and the time required for completing such maintenance/repair in accordance with Good Industry Practice. It shall grant permission with such modifications, as it may

deem necessary, within 3 (three) days of receiving a request from the Concessionaire. Upon expiry of the permitted period of closure, the Independent Engineer shall monitor the re-opening of such lane(s), and in case of delay, determine the Damages payable by the Concessionaire to the Authority under Clause 17.7.

6.10 The Independent Engineer shall monitor and review the curing of defects and deficiencies by the Concessionaire as set forth in Clause 19.4

6.11 In the event that the Concessionaire notifies the Independent Engineer of any modifications that it proposes to make to the Project Highway, the Independent Engineer shall review the same and send its comments to the Authority and the Concessionaire within 15 (fifteen) days of receiving the proposal.

6.12 The Independent Engineer shall undertake traffic sampling, as and when required by the Authority, under and in accordance with Article 22 and Schedule-O

7 Termination

7.1 At any time, not earlier than 90 (ninety) days prior to Termination but not later than 15 (fifteen) days prior to such Termination, the Independent Engineer shall, in the presence of a representative of the Concessionaire, inspect the Project Highway for determining compliance by the Concessionaire with the Divestment Requirements set forth in Clause 38.1 and, if required, cause tests to be carried out at the Concessionaire's cost for determining such compliance. If the Independent Engineer determines that the status of the Project Highway is such that its repair and rectification would require a larger amount than the sum set forth in Clause 39.2, it shall recommend retention of the required amount in the Escrow Account and the period of retention thereof.

7.2 The Independent Engineer shall inspect the Project Highway once in every 15(fifteen) days during a period of 90 (ninety) days after Termination for determining the liability of the Concessionaire under Article 39, in respect of the defects or deficiencies specified therein. If any such defect or deficiency is found by the Independent Engineer, it shall make a report in reasonable detail and send it forthwith to the Authority and the Concessionaire.

8 Determination of costs and time

8.1 The Independent Engineer shall determine the costs, and/or their reasonableness, that are required to be determined by it under the Agreement.

8.2 The Independent Engineer shall determine the period, or any extension thereof, that is required to be determined by it under the Agreement.

9 Assistance in Dispute resolution

9.1 When called upon by either Party in the event of any Dispute, the Independent Engineer shall mediate and assist the Parties in arriving at an amicable settlement.

9.2 In the event of any disagreement between the Parties regarding the meaning, scope and nature of Good Industry Practice, as set forth in any provision of the

Agreement, the Independent Engineer shall specify such meaning, scope and nature by issuing a reasoned written statement relying on good industry practice and authentic literature.

10 Other duties and functions

The Independent Engineer shall perform all other duties and functions specified in the Agreement.

11 Miscellaneous

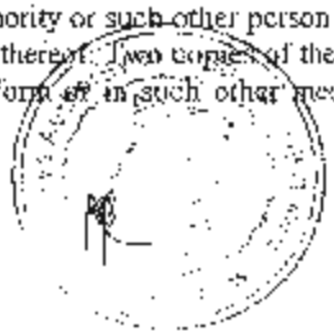
11.1 The Independent Engineer shall notify its programme of inspection to the Authority and to the Concessionaire, who may, in their discretion, depute their respective representatives to be present during the inspection.

11.2 A copy of all communications, comments, instructions, Drawings or Documents sent by the Independent Engineer to the Concessionaire pursuant to this TOR, and a copy of all the test results with comments of the Independent Engineer thereon shall be furnished by the Independent Engineer to the Authority forthwith.

11.3 The Independent Engineer shall obtain, and the Concessionaire shall furnish in two copies thereof, all communications and reports required to be submitted, under this Agreement, by the Concessionaire to the Independent Engineer, whereupon the Independent Engineer shall send one of the copies to the Authority along with its comments thereon.

11.4 The Independent Engineer shall retain at least one copy each of all Drawings and Documents received by it, including 'as-built' Drawings, and keep them in its safe custody.

11.5 Upon completion of its assignment hereunder, the Independent Engineer shall duly classify and list all Drawings, Documents, results of tests and other relevant records, and hand them over to the Authority or such other person as the Authority may specify, and obtain written receipt thereof. Two copies of the said documents shall also be furnished in micro film form or in such other medium as may be acceptable to the Authority.



SCHEDULE –R

(See Clause 27.1.1)

FEE NOTIFICATION

MINISTRY OF SHIPPING, ROAD TRANSPORT AND HIGHWAYS

(Department of Road Transport and Highways)

NOTIFICATION

New Delhi, the ....., 20...

S.O. ... . Whereas, by the notification of the Government of India in the Ministry of Shipping, Road Transport and Highways, number ***** dated the *****, issued under section 11 of the National Highways Authority of India Act, 1988 (68 of 1988), the Central Government has entrusted the section of National Highway from Km 0.000 to Km 84.000 (Panvel - Indapur Section) of National Highway No. 17 in the state of Maharashtra to the National Highways Authority of India (hereinafter referred to as the "Authority");

And Whereas, pursuant to the provisions of section 14 of the said Act, the Authority has entered into an agreement with ....., having its Registered Office at .... (hereinafter referred to as "Concessionaire") for the development of the Panvel - Indapur section from Km 0.000 to Km 84.000 (hereinafter referred to as the said section) of the National Highway No. 17 on Design, Build, Finance, Operate and Transfer (DBFOT) basis;

Now, therefore, in exercise of the powers conferred by section 8A of the National Highways Act, 1956 (48 of 1956), read with Rule 3 of the National Highways Fee (Determination of Rates and Collection) Rules, 2008, the Central Government, having regard to the expenditure involved in building, maintenance, management and operation of the said section of the said national highway, interest on the capital invested, reasonable return, the volume of traffic and the period of said agreement between the Authority and the Concessionaire, hereby notifies that there shall be levied and collected fees on mechanical vehicles for the use of the section from Km 0.000 to Km 84.000 (Zero to Eighty Four) of National Highway No. 17, including the permanent bridge/ bypass/ tunnel having an estimated cost of Rs. 256.09 crores (Rupees Two hundred and Fifty six crores and nine lakhs), in the State of Maharashtra at the rates specified in the aforesaid Rules and authorises the said Concessionaire to collect and retain the said fees on and from the date of commercial operation of the said section of national highway, subject to and in accordance with the said Rules and the provisions of the aforesaid agreement.

The fee levied and collected hereunder shall be due and payable at the following Toll Plazas for the distance specified for each such Toll Plaza:

S. No.	Location of Toll Plaza (chainage)	Length (in km) for which Fee is payable
1	15.00*	42.30
2	66.67	42.30

*The existing toll plaza at km 15.00 is currently operated by M/s IRB Amcya Developer Pvt. Ltd. towards toll collection for an ROB and a major bridge across river Patal Ganga for which the concession period is up to 30.09.2015. A temporary toll plaza at km 17.00 is being proposed through this project and tolling for the project highway would be carried out at toll plaza located at km 17.00 till the concession of the ROB and major bridge stands terminated, post which the tolling for the project highway would be carried out at toll plaza located at km 15.00.

F.No. RW/NH-.....

(Name)

Deputy Secretary

Government of India

SCHEDULE - S
(See Clause 31.1.2)

ESCROW AGREEMENT

THIS ESCROW AGREEMENT is entered into on this the ..... day of ..... 20....

AMONGST

1 .....LIMITED, a company incorporated under the provisions of the Companies Act, 1956 and having its registered office at ..... (hereinafter referred to as the "**Concessionaire**" which expression shall, unless repugnant to the context or meaning thereof, include its successors, permitted assigns and substitutes);

2 .....name and particulars of Lenders' Representative and having its registered office at .....acting for and on behalf of the Senior Lenders as their duly authorised agent with regard to matters arising out of or in relation to this Agreement (hereinafter referred to as the "**Lenders' Representative**" which expression shall, unless repugnant to the context or meaning thereof, include its successors and substitutes);

3 .....name and particulars of the Escrow Bank and having its registered office at .....(hereinafter referred to as the "**Escrow Bank**" which expression shall, unless repugnant to the context or meaning thereof, include its successors and substitutes); and

4 The National Highways Authority of India, established under the National Highways Authority Act 1988, represented by its Chairman and having its principal offices at G-5 & 6, Sector 10, Dwarka, New Delhi-110075 (hereinafter referred to as the "**Authority**" which expression shall, unless repugnant to the context or meaning thereof, include its administrators, successors and assigns).

WHEREAS:

(A) The Authority has entered into a Concession Agreement dated ..... with the Concessionaire (the "**Concession Agreement**") for Four-Laning of the Panvel – Indapur section (km 0.000 to km 84.000) of National Highway No. 17 in the State of Maharashtra on design, build, finance, operate and Transfer (DBFOT) basis, and a copy of which is annexed hereto and marked as Annex-A to form part of this Agreement.

(B) Senior Lenders have agreed to finance the Project in accordance with the terms and conditions set forth in the Financing Agreements.

(C) The Concession Agreement requires the Concessionaire to establish an Escrow Account, *inter alia*, on the terms and conditions stated therein.

NOW, THEREFORE, in consideration of the foregoing and the respective covenants and agreements set forth in this Agreement, the receipt and sufficiency of which is hereby acknowledged, and intending to be legally bound hereby, the Parties agree as follows:

1 DEFINITIONS AND INTERPRETATION

1.1 Definitions

In this Agreement, the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively assigned to them:

"**Agreement**" means this Escrow Agreement and any amendment thereto made in accordance with the provisions contained herein;

"**Concession Agreement**" means the Concession Agreement referred to in Recital (A) above and annexed hereto as Annex-A, and shall include all of its Recitals and Schedules and any amendments made thereto in accordance with the provisions contained in this behalf therein;

"**Cure Period**" means the period specified in this Agreement for curing any breach or default of any provision of this Agreement by the Concessionaire, and shall commence from the date on which a notice is delivered by the Authority or the Lenders' Representative, as the case may be, to the Concessionaire asking the latter to cure the breach or default specified in such notice;

"**Escrow Account**" means an escrow account established in terms of and under this Agreement, and shall include the Sub-Accounts;

"**Escrow Default**" shall have the meaning ascribed thereto in Clause 6.1;

"**Lenders' Representative**" means the person referred to as the Lenders' Representative in the foregoing Recitals;

"**Parties**" means the parties to this Agreement collectively and "Party" shall mean any of the Parties to this Agreement individually;

"**Payment Date**" means, in relation to any payment specified in Clause 4.1, the date(s) specified for such payment; and

"**Sub-Accounts**" means the respective Sub-Accounts of the Escrow Account, into which the monies specified in Clause 4.1 would be credited every month and paid out if due, and if not due in a month then appropriated proportionately in such month and retained in the respective Sub Accounts and paid out therefrom on the Payment Date(s).

1.2 Interpretation

1.2.1 References to Lenders' Representative shall, unless repugnant to the context or meaning thereof, mean references to the Lenders' Representative, acting for and on behalf of Senior Lenders.

1.2.2 The words and expressions beginning with capital letters and defined in this Agreement shall have the meaning ascribed thereto herein, and the words and expressions used in this Agreement and not defined herein but defined in the

Concession Agreement shall, unless repugnant to the context, have the meaning ascribed thereto in the Concession Agreement.

1.2.3 References to Clauses are, unless stated otherwise, references to Clauses of this Agreement.

1.2.4 The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Concession Agreement shall apply, *mutatis mutandis*, to this Agreement

2 ESCROW ACCOUNT

2.1 Escrow Bank to act as trustee

2.1.1 The Concessionaire hereby appoints the Escrow Bank to act as trustee for the Authority, the Lenders' Representative and the Concessionaire in connection herewith and authorises the Escrow Bank to exercise such rights, powers, authorities and discretion as are specifically delegated to the Escrow Bank by the terms hereof together with all such rights, powers, authorities and discretion as are reasonably incidental hereto, and the Escrow Bank accepts such appointment pursuant to the terms hereof.

2.1.2 The Concessionaire hereby declares that all rights, title and interest in and to the Escrow Account shall be vested in the Escrow Bank and held in trust for the Authority, the Lenders' Representative and the Concessionaire, and applied in accordance with the terms of this Agreement. No person other than the Authority, the Lenders' Representative and the Concessionaire shall have any rights hereunder as the beneficiaries of, or as third party beneficiaries under this Agreement.

2.2 Acceptance of Escrow Bank

The Escrow Bank hereby agrees to act as such and to accept all payments and other amounts to be delivered to and held by the Escrow Bank pursuant to the provisions of this Agreement. The Escrow Bank shall hold and safeguard the Escrow Account during the term of this Agreement and shall treat the amount in the Escrow Account as monies deposited by the Concessionaire, Senior Lenders or the Authority with the Escrow Bank. In performing its functions and duties under this Agreement, the Escrow Bank shall act in trust for the benefit of, and as agent for, the Authority, the Lenders' Representative and the Concessionaire or their nominees, successors or assigns, in accordance with the provisions of this Agreement.

2.3 Establishment and operation of Escrow Account

2.3.1 Within 30 (thirty) days from the date of this Agreement, and in any case prior to the Appointed Date, the Concessionaire shall open and establish the Escrow Account with the ..... (name of Branch) Branch of the Escrow Bank. The Escrow Account shall be denominated in Rupees.

2.3.2 The Escrow Bank shall maintain the Escrow Account in accordance with the terms of this Agreement and its usual practices and applicable regulations, and pay the

maximum rate of interest payable to similar customers on the balance in the said account from time to time.

2.3.3 The Escrow Bank and the Concessionaire shall, after consultation with the Lenders' Representative, agree on the detailed mandates, terms and conditions, and operating procedures for the Escrow Account, but in the event of any conflict or inconsistency between this Agreement and such mandates, terms and conditions, or procedures, this Agreement shall prevail.

2.4 Escrow Bank's fee

The Escrow Bank shall be entitled to receive its fee and expenses in an amount, and at such times, as may be agreed between the Escrow Bank and the Concessionaire. For the avoidance of doubt, such fee and expenses shall form part of the O&M Expenses and shall be appropriated from the Escrow Account in accordance with Clause 4.1.

2.5 Rights of the parties

The rights of the Authority, the Lenders' Representative and the Concessionaire in the monies held in the Escrow Account are set forth in their entirety in this Agreement and the Authority, the Lenders' Representative and the Concessionaire shall have no other rights against or to the monies in the Escrow Account.

2.6 Substitution of the Concessionaire

The Parties hereto acknowledge and agree that upon substitution of the Concessionaire with the Nominated Company, pursuant to the Substitution Agreement, it shall be deemed for the purposes of this Agreement that the Nominated Company is a Party hereto and the Nominated Company shall accordingly be deemed to have succeeded to the rights and obligations of the Concessionaire under this Agreement on and with effect from the date of substitution of the Concessionaire with the Nominated Company.

3 DEPOSITS INTO ESCROW ACCOUNT

3.1 Deposits by the Concessionaire

3.1.1 The Concessionaire agrees and undertakes that it shall deposit into and/or credit the Escrow Account with:

(a) all monies received in relation to the Project from any source, including the Senior Lenders, lenders of Subordinated Debt and the Authority;

(b) all funds received by the Concessionaire from its share-holders, in any manner or form;

(c) all Fee levied and collected by the Concessionaire;

(d) any other revenues, rentals, deposits or capital receipts, as the case may be, from or in respect of the Project Highway; and

(c) all proceeds received pursuant to any insurance claims

3.1.2 The Concessionaire may at any time make deposits of its other funds into the Escrow Account, provided that the provisions of this Agreement shall apply to such deposits.

3.2 Deposits by the Authority

The Authority agrees and undertakes that, as and when due and payable, it shall deposit into and/or credit the Escrow Account with:

(a) Grant and any other monies disbursed by the Authority to the Concessionaire;

(b) Revenue Shortfall Loan;

(c) all Fee collected by the Authority in exercise of its rights under the Concession Agreement; and

(d) Termination Payments:

Provided that, notwithstanding the provisions of Clause 4.1.1, the Authority shall be entitled to appropriate from the aforesaid amounts, any Concession Fee due and payable to it by the Concessionaire, and the balance remaining shall be deposited into the Escrow Account.

3.3 Deposits by Senior Lenders

The Lenders' Representative agrees, confirms and undertakes that the Senior Lenders shall deposit into and/or credit the Escrow Account with all disbursements made by them in relation to or in respect of the Project: provided that notwithstanding anything to the contrary contained in this Agreement, the Senior Lenders shall be entitled to make direct payments to the EPC Contractor under and in accordance with the express provisions contained in this behalf in the Financing Agreements.

3.4 Interest on deposits

The Escrow Bank agrees and undertakes that all interest accruing on the balances of the Escrow Account shall be credited to the Escrow Account: provided that the Escrow Bank shall be entitled to appropriate therefrom the fee and expenses due to it from the Concessionaire in relation to the Escrow Account and credit the balance remaining to the Escrow Account.

4 WITHDRAWALS FROM ESCROW ACCOUNT

4.1 Withdrawals during Concession Period

4.1.1 At the beginning of every month, or at such shorter intervals as the Lenders' Representative and the Concessionaire may by written instructions determine, the Escrow Bank shall withdraw amounts from the Escrow Account and appropriate them in the following order by depositing such amounts in the relevant Sub-

Accounts for making due payments, and if such payments are not due in any month, then retain such monies in such Sub-Accounts and pay out therefrom on the Payment Date(s):

(a) all taxes due and payable by the Concessionaire for and in respect of the Project Highway;

(b) all payments relating to construction of the Project Highway, subject to and in accordance with the conditions, if any, set forth in the Financing Agreements;

(c) O&M Expenses, subject to the ceiling, if any, set forth in the Financing Agreements;

(d) O&M Expenses incurred by the Authority, provided it certifies to the Escrow Bank that it had incurred such expenses in accordance with the provisions of the Concession Agreement and that the amounts claimed are due to it from the Concessionaire;

(e) Concession Fee due and payable to the Authority;

(f) monthly proportionate provision of Debt Service due in an Accounting Year;

{(g) Premium due and payable to the Authority;}

(h) all payments and Damages certified by the Authority as due and payable to it by the Concessionaire pursuant to the Concession Agreement, including repayment of Revenue Shortfall Loan;

(i) monthly proportionate provision of debt service payments due in an Accounting Year in respect of Subordinated Debt;

(j) any reserve requirements set forth in the Financing Agreements; and

(k) balance, if any, in accordance with the instructions of the Concessionaire.

4.1.2 No later than 60 (sixty) days prior to the commencement of each Accounting Year, the Concessionaire shall provide to the Escrow Bank, with prior written approval of the Lenders' Representative, details of the amounts likely to be required for each of the payment obligations set forth in this Clause 4.1; provided that such amounts may be subsequently modified, with prior written approval of the Lenders' Representative, if fresh information received during the course of the year makes such modification necessary.

4.2 Withdrawals upon Termination

Upon Termination of the Concession Agreement, all amounts standing to the credit of the Escrow Account shall, notwithstanding anything in this Agreement, be appropriated and dealt with in the following order:

(a) all taxes due and payable by the Concessionaire for and in respect of the

Project Highway;

(b) 90% (ninety per cent) of Debt Due excluding Subordinated Debt;

(c) outstanding Concession Fee,

(d) all payments and Damages certified by the Authority as due and payable to it by the Concessionaire pursuant to the Concession Agreement, including (Premium,) repayment of Revenue Shortfall Loan and any claims in connection with or arising out of Termination;

(e) retention and payments arising out of, or in relation to, liability for defects and deficiencies set forth in Article 39 of the Concession Agreement;

(f) outstanding Debt Service including the balance of Debt Due;

(g) outstanding Subordinated Debt;

(h) incurred or accrued O&M Expenses;

(i) any other payments required to be made under the Concession Agreement; and

(j) balance, if any, in accordance with the instructions of the Concessionaire:

Provided that the disbursements specified in Sub-clause (j) of this Clause 4.2 shall be undertaken only after the Vesting Certificate has been issued by the Authority.

4.3 Application of insufficient funds

Funds in the Escrow Account shall be applied in the serial order of priority set forth in Clauses 4.1 and 4.2, as the case may be. If the funds available are not sufficient to meet all the requirements, the Escrow Bank shall apply such funds in the serial order of priority until exhaustion thereof.

4.4 Application of insurance proceeds

Notwithstanding anything in this Agreement, the proceeds from all insurance claims, except life and injury, shall be deposited into and/or credited to the Escrow Account and utilised for any necessary repair, reconstruction, reinstatement, replacement, improvement, delivery or installation of the Project Highway, and the balance remaining, if any, shall be applied in accordance with the provisions contained in this behalf in the Financing Agreements.

4.5 Withdrawals during Suspension

Notwithstanding anything to the contrary contained in this Agreement, the Authority may exercise all or any of the rights of the Concessionaire during the period of Suspension under Article 36 of the Concession Agreement. Any instructions given by the Authority to the Escrow Bank during such period shall be complied with as if such instructions were given by the Concessionaire under this Agreement and all actions of the Authority hereunder shall be deemed to have

been taken for and on behalf of the Concessionaire.

5 OBLIGATIONS OF THE ESCROW BANK

5.1 Segregation of funds

Monies and other property received by the Escrow Bank under this Agreement shall, until used or applied in accordance with this Agreement, be held by the Escrow Bank in trust for the purposes for which they were received, and shall be segregated from other funds and property of the Escrow Bank.

5.2 Notification of balances

7 (seven) business days prior to each Payment Date (and for this purpose the Escrow Bank shall be entitled to rely on an affirmation by the Concessionaire and/or the Lenders' Representative as to the relevant Payment Dates), the Escrow Bank shall notify the Lenders' Representative of the balances in the Escrow Account and Sub-Accounts as at the close of business on the immediately preceding business day.

5.3 Communications and notices

In discharge of its duties and obligations hereunder, the Escrow Bank:

(a) may, in the absence of bad faith or gross negligence on its part, rely as to any matters of fact which might reasonably be expected to be within the knowledge of the Concessionaire upon a certificate signed by or on behalf of the Concessionaire;

(b) may, in the absence of bad faith or gross negligence on its part, rely upon the authenticity of any communication or document believed by it to be authentic;

(c) shall, within 5 (five) business days after receipt, deliver a copy to the Lenders' Representative of any notice or document received by it in its capacity as the Escrow Bank from the Concessionaire or any other person hereunder or in connection herewith; and

(d) shall, within 5 (five) business days after receipt, deliver a copy to the Concessionaire of any notice or document received by it from the Lenders' Representative in connection herewith.

5.4 No set off

The Escrow Bank agrees not to claim or exercise any right of set off, banker's lien or other right or remedy with respect to amounts standing to the credit of the Escrow Account. For the avoidance of doubt, it is hereby acknowledged and agreed by the Escrow Bank that the monies and properties held by the Escrow Bank in the Escrow Account shall not be considered as part of the assets of the Escrow Bank and being trust property, shall in the case of bankruptcy or liquidation of the Escrow Bank, be wholly excluded from the assets of the Escrow Bank in such bankruptcy or liquidation.

5.5 Regulatory approvals

The Escrow Bank shall use its best efforts to procure, and thereafter maintain and comply with, all regulatory approvals required for it to establish and operate the Escrow Account. The Escrow Bank represents and warrants that it is not aware of any reason why such regulatory approvals will not ordinarily be granted to the Escrow Bank.

6 ESCROW DEFAULT

6.1 Escrow Default

6.1.1 Following events shall constitute an event of default by the Concessionaire (an "Escrow Default") unless such event of default has occurred as a result of Force Majeure or any act or omission of the Authority or the Lenders' Representative:

(a) the Concessionaire commits breach of this Agreement by failing to deposit any receipts into the Escrow Account as provided herein and fails to cure such breach by depositing the same into the Escrow Account within a Cure Period of 5 (five) business days;

(b) the Concessionaire causes the Escrow Bank to transfer funds to any account of the Concessionaire in breach of the terms of this Agreement and fails to cure such breach by depositing the relevant funds into the Escrow Account or any Sub-Account to which such transfer should have been made, within a Cure Period of 5 (five) business days; or

(c) the Concessionaire commits or causes any other breach of the provisions of this Agreement and fails to cure the same within a Cure Period of 5 (five) business days.

6.1.2 Upon occurrence of an Escrow Default, the consequences thereof shall be dealt with under and in accordance with the provisions of the Concession Agreement.

7 TERMINATION OF ESCROW AGREEMENT

7.1 Duration of the Escrow Agreement

This Agreement shall remain in full force and effect so long as any sum remains to be advanced or is outstanding from the Concessionaire in respect of the debt, guarantee or financial assistance received by it from the Senior Lenders, or any of its obligations to the Authority remain to be discharged, unless terminated earlier by consent of all the Parties or otherwise in accordance with the provisions of this Agreement.

7.2 Substitution of Escrow Bank

The Concessionaire may, by not less than 45 (forty five) days prior notice to the Escrow Bank, the Authority and the Lenders' Representative, terminate this Agreement and appoint a new Escrow Bank, provided that the new Escrow Bank is acceptable to the Lenders' Representative and arrangements are made

satisfactory to the Lenders' Representative for transfer of amounts deposited in the Escrow Account to a new Escrow Account established with the successor Escrow Bank. The termination of this Agreement shall take effect only upon coming into force of an Escrow Agreement with the substitute Escrow Bank.

7.3 Closure of Escrow Account

The Escrow Bank shall, at the request of the Concessionaire and the Lenders' Representative made on or after the payment by the Concessionaire of all outstanding amounts under the Concession Agreement and the Financing Agreements including the payments specified in Clause 4.2, and upon confirmation of receipt of such payments, close the Escrow Account and Sub-Accounts and pay any amount standing to the credit thereof to the Concessionaire. Upon closure of the Escrow Account hereunder, the Escrow Agreement shall be deemed to be terminated.

8 SUPPLEMENTARY ESCROW AGREEMENT

8.1 Supplementary escrow agreement

The Lenders' Representative and the Concessionaire shall be entitled to enter into a supplementary escrow agreement with the Escrow Bank providing, inter alia, for detailed procedures and documentation for withdrawals from Sub-Accounts pursuant to Clause 4.1.1 and for matters not covered under this Agreement such as the rights and obligations of Senior Lenders and lenders of Subordinated Debt, investment of surplus funds, restrictions on withdrawals by the Concessionaire in the event of breach of this Agreement or upon occurrence of an Escrow Default, procedures relating to operation of the Escrow Account and withdrawal therefrom, reporting requirements and any matters incidental thereto; provided that such supplementary escrow agreement shall not contain any provision which is inconsistent with this Agreement and in the event of any conflict or inconsistency between provisions of this Agreement and such supplementary escrow agreement, the provisions of this Agreement shall prevail.

9 INDEMNITY

9.1 General indemnity

9.1.1 The Concessionaire will indemnify, defend and hold the Authority, Escrow Bank and the Senior Lenders, acting through the Lenders' Representative, harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of any breach by the Concessionaire of any of its obligations under this Agreement or on account of failure of the Concessionaire to comply with Applicable Laws and Applicable Permits.

9.1.2 The Authority will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Authority to fulfil any of its obligations under this Agreement materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement or this Agreement, other than any loss, damage, cost and expense arising out of

acts done in discharge of their lawful functions by the Authority, its officers, servants and agents.

9.1.3 The Escrow Bank will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Escrow Bank to fulfil its obligations under this Agreement materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement other than any loss, damage, cost and expense, arising out of acts done in discharge of their lawful functions by the Escrow Bank, its officers, servants and agents.

9.2 Notice and contest of claims

In the event that any Party hereto receives a claim from a third party in respect of which it is entitled to the benefit of an indemnity under Clause 9.1 or in respect of which it is entitled to reimbursement (the "**Indemnified Party**"), it shall notify the other Party responsible for indemnifying such claim hereunder (the "**Indemnifying Party**") within 15 (fifteen) days of receipt of the claim and shall not settle or pay the claim without the prior approval of the Indemnifying Party, which approval shall not be unreasonably withheld or delayed. In the event that the Indemnifying Party wishes to contest or dispute the claim, it may conduct the proceedings in the name of the Indemnified Party and shall bear all costs involved in contesting the same. The Indemnified Party shall provide all cooperation and assistance in contesting any claim and shall sign all such writings and documents as the Indemnifying Party may reasonably require.

10 DISPUTE RESOLUTION

10.1 Dispute resolution

10.1.1 Any dispute, difference or claim arising out of or in connection with this Agreement, which is not resolved amicably, shall be decided finally by reference to arbitration to a Board of Arbitrators comprising one nominee of each Party to the dispute, and where the number of such nominees is an even number, the nominees shall elect another person to such Board. Such arbitration shall be held in accordance with the Rules of Arbitration of the International Centre for Alternative Dispute Resolution, New Delhi (the "Rules") or such other rules as may be mutually agreed by the Parties, and shall be subject to the provisions of the Arbitration and Conciliation Act, 1996.

10.1.2 The Arbitrators shall issue a reasoned award and such award shall be final and binding on the Parties. The venue of arbitration shall be Delhi and the language of arbitration shall be English.

11 MISCELLANEOUS PROVISIONS

11.1 Governing law and jurisdiction

This Agreement shall be construed and interpreted in accordance with and governed by the laws of India, and the Courts at Delhi shall have jurisdiction over

all matters arising out of or relating to this Agreement.

11.2 Waiver of sovereign immunity

The Authority unconditionally and irrevocably:

(a) agrees that the execution, delivery and performance by it of this Agreement constitute commercial acts done and performed for commercial purpose;

(b) agrees that, should any proceedings be brought against it or its assets, property or revenues in any jurisdiction in relation to this Agreement or any transaction contemplated by this Agreement, no immunity (whether by reason of sovereignty or otherwise) from such proceedings shall be claimed by or on behalf of the Authority with respect to its assets;

(c) waives any right of immunity which it or its assets, property or revenues now has, may acquire in the future or which may be attributed to it in any jurisdiction; and

(d) consents generally in respect of the enforcement of any judgement or award against it in any such proceedings to the giving of any relief or the issue of any process in any jurisdiction in connection with such proceedings (including the making, enforcement or execution against it or in respect of any assets, property or revenues whatsoever irrespective of their use or intended use of any order or judgement that may be made or given in connection therewith).

11.3 Priority of agreements

In the event of any conflict between the Concession Agreement and this Agreement, the provisions contained in the Concession Agreement shall prevail over this Agreement.

11.4 Alteration of terms

All additions, amendments, modifications and variations to this Agreement shall be effectual and binding only if in writing and signed by the duly authorised representatives of the Parties.

11.5 Waiver

11.5.1 Waiver by any Party of a default by another Party in the observance and performance of any provision of or obligations under this Agreement:

(a) shall not operate or be construed as a waiver of any other or subsequent default hereof or of other provisions of or obligations under this Agreement;

(b) shall not be effective unless it is in writing and executed by a duly authorised representative of the Party; and

(c) shall not affect the validity or enforceability of this Agreement in any manner.

11.5.2 Neither the failure by any Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement or any obligation thereunder nor time or other indulgence granted by any Party to another Party shall be treated or deemed as waiver of such breach or acceptance of any variation or the relinquishment of any such right hereunder.

11.6 No third party beneficiaries

This Agreement is solely for the benefit of the Parties and no other person or entity shall have any rights hereunder.

11.7 Survival

11.7.1 Termination of this Agreement:

(a) shall not relieve the Parties of any obligations hereunder which expressly or by implication survive termination hereof; and

(b) except as otherwise provided in any provision of this Agreement expressly limiting the liability of either Party, shall not relieve either Party of any obligations or liabilities for loss or damage to the other Party arising out of, or caused by, acts or omissions of such Party prior to the effectiveness of such termination or arising out of such termination.

11.7.2 All obligations surviving the cancellation, expiration or termination of this Agreement shall only survive for a period of 3 (three) years following the date of such termination or expiry of this Agreement.

11.8 Severability

If for any reason whatever any provision of this Agreement is or becomes invalid, illegal or unenforceable or is declared by any court of competent jurisdiction or any other instrumentality to be invalid, illegal or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected in any manner, and the Parties will negotiate in good faith with a view to agreeing to one or more provisions which may be substituted for such invalid, unenforceable or illegal provisions, as nearly as is practicable to such invalid, illegal or unenforceable provision. Failure to agree upon any such provisions shall not be subject to dispute resolution under Clause 10.1 of this Agreement or otherwise.

11.9 Successors and assigns

This Agreement shall be binding on and shall inure to the benefit of the Parties and their respective successors and permitted assigns.

11.10 Notices

All notices or other communications to be given or made under this Agreement shall be in writing and shall either be delivered personally or sent by courier or

registered post with an additional copy to be sent by facsimile or e-mail. The address for service of each Party, its facsimile number or e-mail are set out under its name on the signing pages hereto. A notice shall be effective upon actual receipt thereof, save that where it is received after 5.30 (five thirty) p.m. on a business day, or on a day that is not a business day, the notice shall be deemed to be received on the first business day following the date of actual receipt. Without prejudice to the foregoing, a Party giving or making a notice or communication by facsimile or e-mail shall promptly deliver a copy thereof personally, or send it by courier or registered post to the addressee of such notice or communication. It is hereby agreed and acknowledged that any Party may by notice change the address to which such notices and communications to it are to be delivered or mailed. Such change shall be effective when all the Parties have notice of it.

11.11 Language

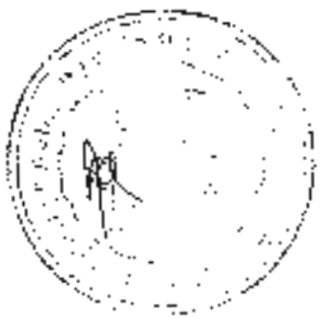
All notices, certificates, correspondence and proceedings under or in connection with this Agreement shall be in English.

11.12 Authorised representatives

Each of the Parties shall, by notice in writing, designate their respective authorised representatives through whom only all communications shall be made. A Party hereto shall be entitled to remove and/or substitute or make fresh appointment of such authorised representative by similar notice.

11.13 Original Document

This Agreement may be executed in four counterparts, each of which when executed and delivered shall constitute an original of this Agreement.



IN WITNESS WHEREOF THE PARTIES HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN.

THE COMMON SEAL OF CONCESSIONAIRE has been affixed pursuant to the resolution passed by the Board of Directors of the Concessionaire at its meeting held on the ..... day of 20..... hereunto affixed in the presence of ....., Director, who has signed these presents in token thereof and ....., Company Secretary / Authorised Officer who has countersigned the same in token thereof[8]:

SIGNED, SEALED AND DELIVERED
For and on behalf of
SENIOR LENDERS by the
Lenders' Representative:

(Signature)
(Name)
(Designation)
(Address)
(Fax No.)
(e-mail address)

SIGNED, SEALED AND DELIVERED
For and on behalf of
ESCROW BANK by:

(Signature)
(Name)
(Designatio
(Address)
(Fax No.)
(e-mail address)

SIGNED, SEALED AND DELIVERED
For and on behalf of
NATIONAL HIGHWAYS AUTHORITY OF INDIA by:

(Signature)
(Name)
(Designation)
(Address)
(Fax No.)
(e-mail address)

In the presence of:

1.

2.

[8] To be affixed in accordance with the articles of association of the Concessionaire.

SCHEDULE –T

(See Clause 33.2.1)

PANEL OF CHARTERED ACCOUNTANTS

1 **Panel of Chartered Accountants**

Pursuant to the provisions of Clause 33.2.1 of the Agreement, the Authority and the Concessionaire shall prepare a mutually agreed panel of 10 (ten) reputable firms of Chartered Accountants having their registered offices in India (the "**Panel of Chartered Accountants**"). The criteria for preparing such Panel and the procedure to be adopted in this behalf shall be as set forth in this Schedule-T.

2 **Invitation for empanelment**

2.1 The Authority shall invite offers from all reputable firms of Chartered Accountants who fulfil the following eligibility criteria, namely:

(a) the firm should have conducted statutory audit of the annual accounts of at least one hundred companies registered under the Companies Act, 1956, of which at least ten should have been public sector undertakings;

(b) the firm should have at least 5 (five) practising Chartered Accountants on its rolls, each with a minimum experience of ten years in the profession;

(c) the firm or any of its partners should not have been disqualified or black-listed by the Comptroller and Auditor General of India or the Authority; and

(d) the firm should have an office in the State or in an adjacent State with at least 2 (two) practising Chartered Accountants on its rolls in such State.

2.2 Interested firms meeting the eligibility criteria shall be required to submit a statement of their capability including the bio-data of all the practising Chartered Accountants on its rolls. In particular, each firm shall be required to furnish year wise information relating to the names of all the companies with an annual turnover exceeding Rs. 100,00,00,000 (Rs. one hundred crore) whose annual accounts were audited by such firm in any of the preceding 5 (five) Accounting Years.

3 **Evaluation and selection**

3.1 The information furnished by each firm shall be scrutinised and evaluated by the Authority and 1 (one) point shall be awarded for each annual audit of the companies specified in Paragraph 2.2 above. (For the avoidance of doubt, a firm which has conducted audit of the annual accounts of any such company for five years shall be awarded five points).

3.2 The Authority shall prepare a list of all the eligible firms along with the points scored by each such firm and 10 (ten) firms scoring the highest points shall be identified and included in the draft Panel of Chartered Accountants.

4 **Consultation with the Concessionaire**

The Authority shall convey the aforesaid panel of firms to the Concessionaire for scrutiny and comments, if any. The Concessionaire shall be entitled to scrutinise the relevant records of the Authority to ascertain whether the selection of firms has been undertaken in accordance with the prescribed procedure and it shall send its comments, if any, to the Authority within 15 (fifteen) days of receiving the aforesaid panel.

5 **Mutually agreed panel**

5.1 The Authority shall, after considering all relevant factors including the comments, if any, of the Concessionaire, finalise and constitute a panel of 10 (ten) firms which shall be deemed to be the mutually agreed Panel of Chartered Accountants.

5.2 After completion of every five years from the date of preparing the mutually agreed Panel of Chartered Accountants, or such earlier period as may be agreed between the Authority and the Concessionaire, a new panel shall be prepared in accordance with the provisions of this Schedule - T.

SCHEDULE –G

(See Clause38.1)

VESTING CERTIFICATE

1 The Chairman, National Highways Authority of India (the "**Authority**") refers to the Concession Agreement dated ..... (the "**Agreement**") entered into between the Authority and .... (the "**Concessionaire**") for Four-Laning of the Panvel - Indapur Section of National Highway No.17 (the "**Project Highway**") on design, build, finance, operate and Transfer ("**DBFOT**") basis.

2 The Authority hereby acknowledges compliance and fulfilment by the Concessionaire of the Divestment Requirements set forth in Clause 38.1 of the Agreement on the basis that upon issue of this Vesting Certificate, the Authority shall be deemed to have acquired, and all title and interest of the Concessionaire in or about the Project Highway shall be deemed to have vested unto the Authority, free from any encumbrances, charges and liens whatsoever.

3 Notwithstanding anything to the contrary contained hereinabove, it shall be a condition of this Vesting Certificate that nothing contained herein shall be construed or interpreted as waiving the obligation of the Concessionaire to rectify and remedy any defect or deficiency in any of the Divestment Requirements and/or relieving the Concessionaire in any manner of the same.

Signed this .... day of ....., 20..... at Delhi.

AGREED, ACCEPTED AND SIGNED	SIGNED, SEALED AND DELIVERED
For and on behalf of	For and on behalf of
CONCESSIONAIRE by:	NATIONAL HIGHWAYS AUTHORITY OF INDIA by:
(Signature)	(Signature)
(Name)	(Name)
(Designation)	(Designation)
(Address)	(Address)

In the presence of:

1. 

2. 

SCHEDULE V

(See Clause 40.3.1)

SUBSTITUTION AGREEMENT

THIS SUBSTITUTION AGREEMENT is entered into on this the .... day of ..... 20....

AMONGST

1 The National Highways Authority of India, established under the National Highways Authority Act 1988, represented by its Chairman and having its principal offices at G-5 & 6, Sector 10, Dwarka, New Delhi-110075 (hereinafter referred to as the "Authority" which expression shall unless repugnant to the context or meaning thereof include its administrators, successors and assigns);

2 .... LIMITED, a company incorporated under the provisions of the Companies Act, 1956 and having its registered office at ....., (hereinafter referred to as the "**Concessionaire**" which expression shall unless repugnant to the context or meaning thereof include its successors and permitted assigns and substitutes);

3 .....name and particulars of Lenders' Representative and having its registered office at ....., acting for and on behalf of the Senior Lenders as their duly authorised agent with regard to matters arising out of or in relation to this Agreement (hereinafter referred to as the "**Lenders' Representative**", which expression shall unless repugnant to the context or meaning thereof include its successors and substitutes);

WHEREAS:

(A) The Authority has entered into a Concession Agreement dated ..... , with the Concessionaire (the "**Concession Agreement**") for Four-Laning of the Panvel - Indapur section (km 0.000 to km 84.000) of National Highway No. 17 in the State of Maharashtra on design, build, finance, operate and Transfer basis (DBFOT), and a copy of which is annexed hereto and marked as Annex-A to form part of this Agreement.

(B) Senior Lenders have agreed to finance the Project in accordance with the terms and conditions set forth in the Financing Agreements.

(C) Senior Lenders have requested the Authority to enter into this Substitution Agreement for securing their interests through assignment, transfer and substitution of the Concession to a Nominated Company in accordance with the provisions of this Agreement and the Concession Agreement.

(D) In order to enable implementation of the Project including its financing, construction, operation and maintenance, the Authority has agreed and undertaken to transfer and assign the Concession to a Nominated Company in accordance with the terms and conditions set forth in this Agreement and the Concession Agreement.

NOW, THEREFORE, in consideration of the foregoing and the respective covenants and agreements set forth in this Agreement, the receipt and sufficiency of which is hereby acknowledged, and intending to be legally bound hereby, the Parties agree as follows:

1 DEFINITIONS AND INTERPRETATION

1.1 Definitions

In this Substitution Agreement, the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively assigned to them:

"**Agreement**" means this Substitution Agreement and any amendment thereto made in accordance with the provisions contained in this Agreement;

"**Financial Default**" means occurrence of a material breach of the terms and conditions of the Financing Agreements or a continuous default in Debt Service by the Concessionaire for a minimum period of 3 (three) months;

"**Lenders' Representative**" means the person referred to as the Lenders' Representative in the foregoing Recitals;

"**Nominated Company**" means a company, incorporated under the provisions of the Companies Act, 1956, selected by the Lenders' Representative, on behalf of Senior Lenders, and proposed to the Authority for assignment/transfer of the Concession as provided in this Agreement;

"**Notice of Financial Default**" shall have the meaning ascribed thereto in Clause 3.2.1; and

"**Parties**" means the parties to this Agreement collectively and "Party" shall mean any of the Parties to this Agreement individually.

1.2 Interpretation

1.2.1 References to Lenders' Representative shall, unless repugnant to the context or meaning thereof, mean references to the Lenders' Representative, acting for and on behalf of Senior Lenders.

1.2.2 References to Clauses are, unless stated otherwise, references to Clauses of this Agreement.

1.2.3 The words and expressions beginning with capital letters and defined in this Agreement shall have the meaning ascribed thereto herein, and the words and expressions used in this Agreement and not defined herein but defined in the Concession Agreement shall, unless repugnant to the context, have the meaning ascribed thereto in the Concession Agreement.

1.2.4 The rules of interpretation stated in Clauses 1.2, 1.3 and 1.4 of the Concession Agreement shall apply, *mutatis mutandis*, to this Agreement.

2 ASSIGNMENT

2.1 Assignment of rights and title

The Concessionaire hereby agrees to assign the rights, title and interest in the Concession to, and in favour of, the Lenders' Representative pursuant to and in accordance with the provisions of this Agreement and the Concession Agreement by way of security in respect of financing by the Senior Lenders under the Financing Agreements.

3 SUBSTITUTION OF THE CONCESSIONAIRE

3.1 Rights of substitution

3.1.1 Pursuant to the rights, title and interest assigned under Clause 2.1, the Lenders' Representative shall be entitled to substitute the Concessionaire by a Nominated Company under and in accordance with the provisions of this Agreement and the Concession Agreement.

3.1.2 The Authority hereby agrees to substitute the Concessionaire by endorsement on the Concession Agreement in favour of the Nominated Company selected by the Lenders' Representative in accordance with this Agreement. (For the avoidance of doubt, the Senior Lenders or the Lenders' Representative shall not be entitled to operate and maintain the Project Highway as Concessionaire either individually or collectively).

3.2 Substitution upon occurrence of Financial Default

3.2.1 Upon occurrence of a Financial Default, the Lenders' Representative may issue a notice to the Concessionaire (the "**Notice of Financial Default**") along with particulars thereof, and send a copy to the Authority for its information and record. A Notice of Financial Default under this Clause 3 shall be conclusive evidence of such Financial Default and it shall be final and binding upon the Concessionaire for the purposes of this Agreement.

3.2.2 Upon issue of a Notice of Financial Default hereunder, the Lenders' Representative may, without prejudice to any of its rights or remedies under this Agreement or the Financing Agreements, substitute the Concessionaire by a Nominated Company in accordance with the provisions of this Agreement.

3.2.3 At any time after the Lenders' Representative has issued a Notice of Financial Default, it may by notice require the Authority to suspend all the rights of the Concessionaire and undertake the operation and maintenance of the Project Highway in accordance with the provisions of Article 36 of the Concession Agreement, and upon receipt of such notice, the Authority shall undertake Suspension under and in accordance with the provisions of the Concession Agreement. The aforesaid Suspension shall be revoked upon substitution of the Concessionaire by a Nominated Company, and in the event such substitution is not completed within 180 (one hundred and eighty) days from the date of such Suspension, the Authority may terminate the Concession Agreement forthwith by issuing a Termination Notice in accordance with the provisions of the Concession Agreement; provided that upon written request from the Lenders' Representative and the Concessionaire, the Authority may extend the aforesaid period of 180 (one hundred and eighty) days by a period not exceeding 90 (ninety) days. For the avoidance of doubt, the Authority expressly agrees and undertakes to terminate the Concession Agreement forthwith, upon receipt of a written request from the Lenders' Representative at any time after 240 (two hundred and forty) days from the date of Suspension hereunder.

3.3 Substitution upon occurrence of Concessionaire Default

3.3.1 Upon occurrence of a Concessionaire Default, the Authority shall by a notice inform the Lenders' Representative of its intention to issue a Termination Notice and grant 15 (fifteen) days time to the Lenders' Representative to make a representation, stating the intention to substitute the Concessionaire by a Nominated Company.

3.3.2 In the event that the Lenders' Representative makes a representation to the Authority within the period of 15 (fifteen) days specified in Clause 3.3.1, stating that it intends to substitute the Concessionaire by a Nominated Company, the Lenders' Representative shall be entitled to undertake and complete the substitution of the Concessionaire by a Nominated Company in accordance with the provisions of this Agreement within a period of 180 (one hundred and eighty) days from the date of such representation, and the Authority shall either withhold Termination or undertake Suspension for the aforesaid period of 180 (one hundred and eighty) days; provided that upon written request from the Lenders' Representative and the Concessionaire, the Authority shall extend the aforesaid period of 180 (one hundred and eighty) days by a period not exceeding 90 (ninety) days.

3.4 Procedure for substitution

3.4.1 The Authority and the Concessionaire hereby agree that on or after the date of Notice of Financial Default or the date of representation to the Authority under Clause 3.3.2, as the case may be, the Lenders' Representative may, without prejudice to any of the other rights or remedies of the Senior Lenders, invite, negotiate and procure offers, either by private negotiations or public auction or tenders for the take over and transfer of the Project Highway including the Concession to the Nominated Company upon such Nominated Company's assumption of the liabilities and obligations of the Concessionaire towards the Authority under the Concession Agreement and towards the Senior Lenders under the Financing Agreements.

3.4.2 To be eligible for substitution in place of the Concessionaire, the Nominated Company shall be required to fulfil the eligibility criteria that were laid down by the Authority for shortlisting the bidders for award of the Concession; provided that the Lenders' Representative may represent to the Authority that all or any of such criteria may be waived in the interest of the Project, and if the Authority determines that such waiver shall not have any material adverse effect on the Project, it may waive all or any of such eligibility criteria.

3.4.3 Upon selection of a Nominated Company, the Lenders' Representative shall request the Authority to:

(a) accede to transfer to the Nominated Company the right to construct, operate and maintain the Project Highway in accordance with the provisions of the Concession Agreement;

(b) endorse and transfer the Concession to the Nominated Company, on the same terms and conditions, for the residual Concession Period; and

(c) enter into a Substitution Agreement with the Lenders' Representative and the Nominated Company on the same terms as are contained in this Agreement.

3.4.4 If the Authority has any objection to the transfer of Concession in favour of the Nominated Company in accordance with this Agreement, it shall within 15 (fifteen) days from the date of proposal made by the Lenders' Representative, give a reasoned order after hearing the Lenders' Representative. If no such objection is raised by the Authority, the Nominated Company shall be deemed to have been accepted. The Authority thereupon shall transfer and endorse the Concession within 15 (fifteen) days of its acceptance/deemed acceptance of the Nominated Company; provided that in the event of such objection by the Authority, the Lenders' Representative may propose another Nominated Company whereupon the procedure set forth in this Clause 3.4 shall be followed for substitution of such Nominated Company in place of the Concessionaire.

3.5 Selection to be binding

The decision of the Lenders' Representative and the Authority in selection of the Nominated Company shall be final and binding on the Concessionaire. The Concessionaire irrevocably agrees and waives any right to challenge the actions of the Lenders' Representative or the Senior Lenders or the Authority taken pursuant to this Agreement including the transfer/assignment of the Concession in favour of the Nominated Company. The Concessionaire agrees and confirms that it shall not have any right to seek revaluation of assets of the Project or the Concessionaire's shares. It is hereby acknowledged by the Parties that the rights of the Lenders' Representative are irrevocable and shall not be contested in any proceedings before any court or Authority and the Concessionaire shall have no right or remedy to prevent, obstruct or restrain the Authority or the Lenders' Representative from effecting or causing the transfer by substitution and endorsement of the Concession as requested by the Lenders' Representative.

4 PROJECT AGREEMENTS

4.1 Substitution of Nominated Company in Project Agreements

The Concessionaire shall ensure and procure that each Project Agreement contains provisions that entitle the Nominated Company to step into such Project Agreement, in its discretion, in place and substitution of the Concessionaire in the event of such Nominated Company's assumption of the liabilities and obligations of the Concessionaire under the Concession Agreement.

5 TERMINATION OF CONCESSION AGREEMENT

5.1 Termination upon occurrence of Financial Default

At any time after issue of a Notice of Financial Default, the Lenders' Representative may by a notice in writing require the Authority to terminate the Concession Agreement forthwith, and upon receipt of such notice, the Authority shall undertake Termination under and in accordance with the provisions of Article 37 of the Concession Agreement.

5.2 Termination when no Nominated Company is selected

In the event that no Nominated Company acceptable to the Authority is selected and recommended by the Lenders' Representative within the period of 180 (one hundred and eighty) days or any extension thereof as set forth in Clause 3.3.2, the Authority may terminate the Concession Agreement forthwith in accordance with the provisions thereof.

5.3 Realisation of Debt Due

The Authority and the Concessionaire hereby acknowledge and agree that, without prejudice to their any other right or remedy, the Lenders' Representative is entitled to receive from the Concessionaire, without any further reference to or consent of the Concessionaire, the Debt Due upon Termination of the Concession Agreement. For realisation of the Debt Due, the Lenders' Representative shall be entitled to make its claim from the Escrow Account in accordance with the provisions of the Concession Agreement and the Escrow Agreement.

6 DURATION OF THE AGREEMENT

6.1 Duration of the Agreement

This Agreement shall come into force from the date hereof and shall expire at the earliest to occur of the following events:

(a) Termination of the Agreement; or

(b) no sum remains to be advanced, or is outstanding to the Senior Lenders, under the Financing Agreements.

7 INDEMNITY

7.1 General indemnity

7.1.1 The Concessionaire will indemnify, defend and hold the Authority and the Lenders' Representative harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense of whatever kind and nature arising out of any breach by the Concessionaire of any of its obligations under this Agreement or on account of failure of the Concessionaire to comply with Applicable Laws and Applicable Permits.

7.1.2 The Authority will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Authority to fulfil any of its obligations under this Agreement, materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement or this Agreement, other than any loss, damage, cost and expense, arising out of acts done in discharge of their lawful functions by the Authority, its officers, servants and agents.

7.1.3 The Lenders' Representative will indemnify, defend and hold the Concessionaire harmless against any and all proceedings, actions and third party claims for any loss, damage, cost and expense arising out of failure of the Lenders' Representative to fulfil its obligations under this Agreement, materially and adversely affecting the performance of the Concessionaire's obligations under the Concession Agreement, other than any loss, damage, cost and expense, arising out

of acts done in discharge of their lawful functions by the Lenders' Representative, its officers, servants and agents.

7.2 **Notice and contest of claims**

In the event that any Party hereto receives a claim from a third party in respect of which it is entitled to the benefit of an indemnity under Clause 7.1 or in respect of which it is entitled to reimbursement (the "**Indemnified Party**"), it shall notify the other Party responsible for indemnifying such claim hereunder (the "**Indemnifying Party**") within 15 (fifteen) days of receipt of the claim and shall not settle or pay the claim without the prior approval of the Indemnifying Party, such approval not to be unreasonably withheld or delayed. In the event that the Indemnifying Party wishes to contest or dispute the claim, it may conduct the proceedings in the name of the Indemnified Party and shall bear all costs involved in contesting the same. The Indemnified Party shall provide all cooperation and assistance in contesting any claim and shall sign all such writings and documents as the Indemnifying Party may reasonably require.

8 DISPUTE RESOLUTION

8.1 Dispute resolution

8.1.1 Any dispute, difference or claim arising out of or in connection with this Agreement which is not resolved amicably shall be decided by reference to arbitration to a Board of Arbitrators comprising one nominee each of the Authority, Concessionaire and the Lenders' Representative. Such arbitration shall be held in accordance with the Rules of Arbitration of the International Centre for Alternative Dispute Resolution, New Delhi (the "Rules") or such other rules as may be mutually agreed by the Parties, and shall be subject to provisions of the Arbitration and Conciliation Act, 1996.

8.1.2 The Arbitrators shall issue a reasoned award and such award shall be final and binding on the Parties. The venue of arbitration shall be Delhi and the language of arbitration shall be English.

9 MISCELLANEOUS PROVISIONS

9.1 Governing law and jurisdiction

This Agreement shall be construed and interpreted in accordance with and governed by the laws of India, and the Courts at Delhi shall have jurisdiction over all matters arising out of or relating to this Agreement.

9.2 Waiver of sovereign immunity

The Authority unconditionally and irrevocably:

(a) agrees that the execution, delivery and performance by it of this Agreement constitute commercial acts done and performed for commercial purpose;

(b) agrees that, should any proceedings be brought against it or its assets, property or revenues in any jurisdiction in relation to this Agreement or any transaction contemplated by this Agreement, no immunity (whether by reason of sovereignty or otherwise) from such proceedings shall be claimed by or on behalf of the Authority with respect to its assets;

(c) waives any right of immunity which it or its assets, property or revenues now has, may acquire in the future or which may be attributed to it in any jurisdiction; and

(d) consents generally in respect of the enforcement of any judgement or award against it in any such proceedings to the giving of any relief or the issue of any process in any jurisdiction in connection with such proceedings (including the making, enforcement or execution against it or in respect of any assets, property or revenues whatsoever irrespective of their use or intended use of any order or judgement that may be made or given in connection therewith).

9.3 Priority of agreements

In the event of any conflict between the Concession Agreement and this Agreement, the provisions contained in the Concession Agreement shall prevail over this Agreement.

9.4 Alteration of terms

All additions, amendments, modifications and variations to this Agreement shall be effectual and binding only if in writing and signed by the duly authorised representatives of the Parties.

9.5 Waiver

9.5.1 Waiver by any Party of a default by another Party in the observance and performance of any provision of or obligations under this Agreement:

(a) shall not operate or be construed as a waiver of any other or subsequent default hereof or of other provisions of or obligations under this Agreement;

(b) shall not be effective unless it is in writing and executed by a duly authorised representative of the Party; and

(c) shall not affect the validity or enforceability of this Agreement in any manner.

9.5.2 Neither the failure by either Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement or any obligation thereunder nor time or other indulgence granted by a Party to another Party shall be treated or deemed as waiver of such breach or acceptance of any variation or the relinquishment of any such right hereunder.

9.6 No third party beneficiaries

This Agreement is solely for the benefit of the Parties and no other person or entity shall have any rights hereunder.

9.7 Survival

9.7.1 Termination of this Agreement:

(a) shall not relieve the Parties of any obligations hereunder which expressly or by implication survive termination hereof; and

(b) except as otherwise provided in any provision of this Agreement expressly limiting the liability of either Party, shall not relieve either Party of any obligations or liabilities for loss or damage to the other Party arising out of or caused by acts or omissions of such Party prior to the effectiveness of such termination or arising out of such termination.

9.7.2 All obligations surviving the cancellation, expiration or termination of this Agreement shall only survive for a period of 3 (three) years following the date of such termination or expiry of this Agreement.

9.8 Severability

If for any reason whatever any provision of this Agreement is or becomes invalid, illegal or unenforceable or is declared by any court of competent jurisdiction or any other instrumentality to be invalid, illegal or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected to any manner, and the Parties will negotiate in good faith with a view to agreeing to one or more provisions which may be substituted for such invalid, unenforceable or illegal provisions, as nearly as is practicable to such invalid, illegal or unenforceable provision. Failure to agree upon any such provisions shall not be subject to dispute resolution under Clause 8 of this Agreement or otherwise.

9.9 Successors and assigns

This Agreement shall be binding on and shall inure to the benefit of the Parties and

their respective successors and permitted assigns.

9.10 Notices

All notices or other communications to be given or made under this Agreement shall be in writing, shall either be delivered personally or sent by courier or registered post with an additional copy to be sent by facsimile or e-mail. The address for service of each Party, its facsimile number and e-mail address are set out under its name on the signing pages hereto. A notice shall be effective upon actual receipt thereof, save that where it is received after 5.30 (five thirty) p.m. on any day, or on a day that is a public holiday, the notice shall be deemed to be received on the first working day following the date of actual receipt. Without prejudice to the foregoing, a Party giving or making a notice or communication by facsimile or e-mail shall promptly deliver a copy thereof personally, or send it by courier or registered post to the addressee of such notice or communication. It is hereby agreed and acknowledged that any Party may by notice change the address to which such notices and communications to it are to be delivered or mailed. Such change shall be effective when all the Parties have notice of it.

9.11 Language

All notices, certificates, correspondence and proceedings under or in connection with this Agreement shall be in English.

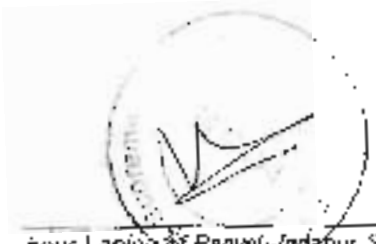
9.12 Authorised representatives

Each of the Parties shall by notice in writing designate their respective authorised representatives through whom only all communications shall be made. A Party hereto shall be entitled to remove and/or substitute or make fresh appointment of such authorised representative by similar notice.

9.13 Original Document

This Agreement may be executed in three counterparts, each of which when executed and delivered shall constitute an original of this Agreement.

IN WITNESS WHEREOF THE PARTIES HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN.



THE COMMON SEAL OF CONCESSIONAIRE has been affixed pursuant to the resolution passed by the Board of Directors of the Concessionaire at its meeting held on the ..... day of 20..... hereunto affixed in the presence of ... ., Director, who has signed these presents in token thereof and ....., Company Secretary / Authorised Officer who has countersigned the same in token thereof[5]:

SIGNED, SEALED
AND DELIVERED
For and on behalf of
NATIONAL HIGHWAYS
AUTHORITY OF INDIA by:

(Signature)
(Name)
(Designation)
(Address)
(Fax No.)
(e-mail address)

SIGNED, SEALED AND DELIVERED

For and on behalf of

SENIOR LENDERS by the Lenders' Representative:

(Signature)
(Name)
(Designation)
(Address)
(Fax)
(e-mail address)

In the presence of:

1. 2.

[5] To be affixed in accordance with the articles of association of the Concessionaire.