

SCHEDULE – B
*(See Clause 2.1)***DEVELOPMENT OF THE PROJECT HIGHWAY****1 Development of the Project Highway**

Development of the Project Highway shall include design and construction of the 2 Lane with Paved Shoulder Project Highway as described in this Schedule-B and in Schedule-C.

2 Rehabilitation and augmentation

Rehabilitation and augmentation shall include [Two-Laning and strengthening] of the Project Highway as described in Annex-I of this Schedule-B and in Schedule-C.

3 Specifications and Standards

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

Annex I
(Schedule-B)

Description of Two Laning

Project is construction/ improvement of the existing single lane road to two lane with paved shoulder in accordance with IRC-SP: 73:2015, IRC-SP:48:1998 and other relevant codes including standard good practice of the road construction.

1. SCOPE OF THE PROJECT

1.1 GENERAL

The following sections of this schedule briefly highlight the scope of the work of the 'Project'. The descriptions of the requirements for the various elements of the Project Highway given herein under are the bare minimum requirements for the 'Project'.

In the planning, design and execution of the works and other works in connection with the repair, maintenance or improvement of the Project Highway and functions associated with the construction of the Project Highway and roadside facilities, the Construction Contractor shall take all such actions and do all such things (including, but not limiting to, organizing itself, adopting measures and standards, executing procedures, including inspection procedures and highway patrols, and engaging and managing agents and employees) as will;

- a. enable the NHIDCL to provide an acceptably safe highway in respect of its condition (structural safety) and use (road safety);
- b. enable the NHIDCL to fulfill its statutory and common law obligations;
- c. enable the NHIDCL to provide a congestion free uninterrupted flow of traffic on the Project Highway;
- d. enable the NHIDCL to provide a level of highway service to the public not inferior to that provided on the trunk road during construction or improvement works;
- e. enable the police, local authorities, and others with statutory duties or functions in relation to the Project Highway or adjoining roads to fulfill those duties and functions;
- f. minimize the occurrence and adverse effects of accidents and ensure that all accidents and emergencies are responded to as quickly as possible;
- g. minimize the risk of damage, destruction or disturbance to third party property;
- h. ensure that members of the public are treated with all due courtesy and consideration;
- i. provide a safe, clear and informative system of road signs;
- j. comply with any specified programme requirements, including for the completion of the new road;
- k. enable standards of reliability, durability, accessibility, maintainability, quality control and assurance, and fitness for purpose appropriate to a highway of the character of the Project Highway to be achieved throughout the Contract Period;
- l. ensure adequate off-street parking facilities for both passenger and goods vehicles;

- m. provide adequate bus bays for stopping of buses and bus shelters for commuters to wait under protection;
- n. achieve a high standard in the appearance and aesthetic quality of the Project Highway and achieve integration of the Project Highway with the character of the surrounding landscape through both sensitive design and sensitive management of all visible elements including those on the existing road;
- o. Undertake proper safety audit through an appropriate consultant (i.e. apart from the Independent Consultant) before C.O.D.;
- p. Carry out accident recording and reporting (to NHIDCL) by type on regular basis; and
- q. Ensure adequate safety of the Project Workers on the work site.

2. WIDENING OF THE EXISTING HIGHWAY

- 2.1** Notwithstanding the basic alignment plans enclosed with this document the Construction Contractor shall himself carryout and be responsible for engineering surveys, investigation and detailed engineering designs and prepare the working drawings for all the components relevant for the improvement and up-gradation of the Project Highway to fulfill the scope of the project as envisaged here in under. These shall comply with design specifications and standards given in **Schedule–D**. The designs for different project facilities shall follow the locations and indicative designs given in **Schedule–C** and shall comply with design specifications and standards outlined in **Schedule–D**. All the designs and drawings shall be reviewed by the Authority Engineer prior to execution.

The Project Highway shall follow the existing alignment unless otherwise specified by the Authority and shown in the alignment plans specified in Annex-III of Schedule-A. Geometric deficiencies, if any, in the existing horizontal and vertical profiles shall be corrected as per the prescribed standards for [plain/rolling] terrain to the extent land is available.

2.2 Width of Carriageway

- 2.2.1** Two-Laning with paved shoulders shall be undertaken. The paved carriageway shall be [7(seven) m] wide with paved shoulder in accordance with the typical cross sections drawings in the Manual.
- 2.2.2** Except as otherwise provided in this Agreement, the width of the paved carriageway and cross-sectional features shall conform to paragraph 2.1 above.

3. GEOMETRIC DESIGN AND GENERAL FEATURES

3.1 General

Geometric design and general features of the Project Highway shall be in accordance with Section 2 of the Manual.

3.2 Design speed

The design speed shall be the minimum design speed of [30 km per hr for hilly and mountainous terrain].

3.3 Improvement of the existing road geometries

[Refer to paragraph 2.1 (v) of the Manual and provide details]

The hilly gradients shall be corrected in such a way so as to attain a limiting gradient of 6% in order to achieve longitudinal drainage. Also vertical curves shall be improved/introduced so that the vertical curves meet IRC: SP-73 - 2015 standards.

The horizontal alignment of the Project Highway shall be improved as per the standards set out in **Schedule-D**.

The improvement shall be done in consultation with the Independent consultant / Project Company ensuring that the proposed improvements are accommodated within the land width available as far as practical otherwise action to acquire more land shall be resorted to through NHIDCL.

In the following sections, where improvement of the existing road geometrics to the prescribed standards is not possible, the existing road geometrics shall be improved to the extent possible within the given right of way and proper road signs and safety measures shall be provided:

Improvement due to Realignments: (PKG-II)

SI.NO.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH (m)
	FROM	TO	FROM	TO	
1	33400	33950	36562	37310	550
2	33950	33970	37310	37350	20
3	33970	34280	37350	37690	310
4	34280	34290	37690	37700	10
5	34290	35145	37700	38710	855
6	35145	35155	38710	38720	10
7	35155	35175	38720	38740	20
8	35175	35185	38740	38750	10

Sl.NO.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH (m)
	FROM	TO	FROM	TO	
9	35185	35215	38750	38765	30
10	35215	35235	38765	38785	20
11	35235	35265	38785	38815	30
12	35265	35285	38815	38840	20
13	35285	35530	38840	39190	245
14	35530	35540	39190	39195	10
15	35540	35600	39195	39260	60
16	35600	35610	39260	39270	10
17	35610	35890	39270	39650	280
18	35890	35900	39650	39660	10
19	35900	36030	39660	39823	130
20	36030	36040	39823	39840	10
21	36040	36080	39840	39900	40
22	36080	36090	39900	39910	10
23	36090	36480	39910	40460	390
24	36480	36500	40460	40490	20
25	36500	36790	40490	40860	290
26	36790	36825	40860	40900	35
27	36825	36845	40900	40920	20
28	36845	36855	40920	40930	10
29	36855	36890	40930	40970	35
30	36890	36920	40970	41000	30
31	36920	37005	41000	41112	85
32	37005	37025	41112	41135	20
33	37025	37715	41135	42160	690
34	37715	37725	42160	42170	10
35	37725	37830	42170	42300	105

Two Lining of Joram – koloriang Road (NH-713) on EPC basis from design km 32+050 to km 44+000 [Existing km 35.150 to km 50.050] in the State of Arunachal Pradesh under SARDP-NE

Sl.NO.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH (m)
	FROM	TO	FROM	TO	
36	37830	37850	42300	42320	20
37	37850	38000	42320	42615	150
39	38200	38590	42860	43295	390
Total					4990

Improvement due to Sharp Curves: Package-II

SL. No	Design Chainage(m)		Remarks
	From	To	
1	32+056.387	32+074.468	Radius <300
2	32+097.998	32+122.661	Radius <300
3	32+161.863	32+167.684	Radius <300
4	32+205.961	32+251.041	Radius <300
5	32+281.199	32+296.288	Radius <300
6	32+347.346	32+361.960	Radius <300
7	32+394.660	32+407.007	Radius <300
8	32+498.796	32+522.955	Radius <300
9	32+601.986	32+713.448	Radius <300
10	32+760.278	32+777.312	Radius <300
11	32+826.381	32+839.184	Radius <300
12	32+933.075	32+981.895	Radius <300
13	33+051.075	33+099.080	Radius <300
14	33+129.957	33+134.799	Radius <300
15	33+166.320	33+183.582	Radius <300
16	33+223.445	33+224.701	Radius <300
17	33+270.561	33+294.895	Radius <300
18	33+328.014	33+345.848	Radius <300
19	33+402.809	33+438.037	Radius <300
20	33+534.745	33+541.906	Radius <300
21	33+591.525	33+692.969	Radius <300
22	33+697.924	33+739.892	Radius <300
23	33+765.202	33+770.075	Radius <300
24	33+827.487	33+898.720	Radius <300
25	33+973.473	34+022.179	Radius <300
26	34+094.328	34+111.969	Radius <300
27	34+165.237	34+246.370	Radius <300
28	34+353.463	34+374.884	Radius <300
29	34+564.153	34+649.018	Radius <300

SL. No	Design Chainage(m)		Remarks
30	34+691.698	34+742.109	Radius <300
31	34+897.464	34+963.982	Radius <300
32	35+048.656	35+202.844	Radius <300
33	35+265.060	35+316.404	Radius <300
34	35+431.775	35+471.072	Radius <300
35	35+558.111	35+614.175	Radius <300
36	35+783.272	35+914.664	Radius <300
37	36+245.885	36+301.078	Radius <300
38	36+571.682	36+637.256	Radius <300
39	36+656.817	36+758.222	Radius <300
40	36+804.400	36+818.908	Radius <300
41	36+935.807	37+000.802	Radius <300
42	37+046.572	37+133.773	Radius <300
43	37+217.224	37+283.619	Radius <300
44	37+349.522	37+417.257	Radius <300
45	37+574.006	37+650.061	Radius <300
46	37+721.459	37+729.963	Radius <300
47	37+766.839	37+812.890	Radius <300
48	37+934.804	37+998.625	Radius <300
49	38+077.392	38+156.811	Radius <300
50	38+162.511	38+227.459	Radius <300
51	38+330.485	38+340.194	Radius <300
52	38+406.227	38+426.978	Radius <300
53	38+553.749	38+558.240	Radius <300
54	38+602.368	38+608.828	Radius <300
55	38+668.347	38+718.041	Radius <300
56	38+731.260	38+792.792	Radius <300
57	38+866.147	38+899.422	Radius <300
58	38+944.851	38+968.692	Radius <300
59	39+037.009	39+184.090	Radius <300
60	39+205.028	39+266.406	Radius <300
61	39+318.924	39+338.346	Radius <300
62	39+425.147	39+438.451	Radius <300
63	39+485.281	39+645.966	Radius <300
64	39+686.095	39+733.252	Radius <300
65	39+827.325	39+837.045	Radius <300
66	39+932.717	39+962.504	Radius <300
67	40+060.143	40+140.477	Radius <300
68	40+169.207	40+197.624	Radius <300
69	40+312.614	40+330.018	Radius <300
70	40+418.348	40+459.051	Radius <300
71	40+593.928	40+598.434	Radius <300
72	40+682.291	40+699.197	Radius <300

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SL. No	Design Chainage(m)		Remarks
73	40+763.129	40+776.636	Radius <300
74	40+829.714	40+831.799	Radius <300
75	40+912.144	40+973.748	Radius <300
76	41+046.789	41+102.101	Radius <300
77	41+207.805	41+227.758	Radius <300
78	41+245.537	41+327.436	Radius <300
79	41+354.560	41+384.168	Radius <300
80	41+577.227	41+586.164	Radius <300
81	41+631.448	41+653.506	Radius <300
82	41+695.528	41+778.213	Radius <300
83	41+865.679	41+932.430	Radius <300
84	41+997.108	42+020.458	Radius <300
85	42+052.691	42+070.554	Radius <300
86	42+136.536	42+169.126	Radius <300
87	42+194.117	42+215.242	Radius <300
88	42+242.999	42+299.977	Radius <300
89	42+368.990	42+468.942	Radius <300
90	42+528.508	42+637.849	Radius <300
91	42+718.057	42+756.507	Radius <300
92	42+858.864	42+870.637	Radius <300
93	42+918.354	42+926.417	Radius <300
94	42+981.684	42+985.785	Radius <300
95	43+137.964	43+154.135	Radius <300
96	43+278.353	43+311.484	Radius <300
97	43+393.308	43+408.617	Radius <300
98	43+506.249	43+554.303	Radius <300
99	43+616.628	43+781.770	Radius <300
100	43+929.644	43+964.166	Radius <300

3.4 Proposed Right of Way

[Refer to paragraph 2.3 of the Manual]. Details of the proposed Right of Way are tabulated below.

Sl. No	Design Chainage		Length	Width (m)
	From	To		
1.	32.050	44.000	11.950	18m - 35m

3.4.1 The Scheduled date on which the Authority shall provide ROW to the contractor is given in Annexure-II of Schedule A

3.5 Type of Shoulders

[Refer to paragraph 2.6.1 of the Manual and specify]

- (a) In built-up sections, 1.5m paved shoulders with footpath have been considered as TCS-4.
- (b) In open country, paved shoulders of 1.5m in width shall be provided and 1.0m earthen shoulder shall be covered with 150mm thick compacted layer of granular material.
- (c) Design and specifications of paved shoulders and granular material shall conform to the requirements specified in paragraphs 5.9.9 and 5.9.10 of the Manual.

3.6 Lateral and vertical clearances at underpasses

3.6.1 Lateral and vertical clearances at underpasses and provision of guardrails/crash barriers shall be as per paragraph 2.11 of the Manual.

3.6.2 *Lateral clearance:* The width of the opening at the underpasses shall be as follows:

Sl No.	Location [Chainage (km)]		Span/Opening (m)	Remarks
	From	To		
Nil				

3.7 Lateral and vertical clearances at overpasses

3.7.1 Lateral and vertical clearances at overpasses shall be as per paragraph 2.12 of the Manual.

3.7.2 *Lateral clearance:* The width of the opening at the overpasses shall be as follows:

Sl No.	Location [Chainage (km)]		Span/Opening (m)	Remarks
	From	To		
Nil				

3.8 Service roads

Service roads shall be constructed at the locations and for the lengths indicated below:[Refer to paragraph 2.13 of the Manual and provide details]

Sl No.	Location of Service Road (km)		Right Hand Side (RHS) / Left Hand Side (LHS) / Both Sides	Length (km) of Service Road
	From	To		

Sl No.	Location of Service Road (km)		Right Hand Side (RHS) / Left Hand Side (LHS) / Both Sides	Length (km) of Service Road
	From	To		
Nil				

3.9 Grade Separated Structures

3.9.1 Grade separated structures shall be provided as per paragraph 2.14 of the Manual. The requisite particulars are given below:

[Refer to paragraphs 2.14.1 of the Manual and provide details]

Sl No.	Location of Structure	Length (m)	Number and Length of Spans (m)	Approach Gradient	Remarks, if any
Nil					

3.9.2 In the case of grade separated structures, the type of structure and the level of the Project Highway and the cross roads shall be as follows: [Refer to paragraphs 2.14.2 of the Manual and specify the type of vehicular under pass/ overpass structure and whether the cross road is to be carried at the existing level, raised or lowered].

SI No.	Location	Type of Structure/Length (m)	Cross Road at			Remarks, if any
			Existing Level	Raised Level	Lowered Level	
Nil						

3.10 Cattle and pedestrian underpass / overpass

Cattle and pedestrian underpass/overpass shall be constructed as follows: [Refer to paragraph 2.14.3 of the Manual and specify the requirements of cattle and pedestrian underpass/overpass.

Sl No.	Location	Type of Crossing
Nil		

3.11 Typical cross-sections of the Project Highway

Typical cross-sections to be followed as per IRC: SP-73-2015 and in addition the proposed cross section for various situations are given in Fig.B-1 to B-4. These illustrate the widening proposals for the project highway. The Project Highway (length 11.950 km) shall be 2-lane carriageway with 1.5m wide paved and 1.0m wide earthen shoulders facility.

Following typical cross sections shall be provided for the Project Highway:

TCS –1	:	Typical cross section of 2-lane carriageway with retaining wall
TCS –2	:	Typical cross section of 2-lane carriageway without retaining wall

TCS –3 : Typical cross section of 2-lane carriageway at realignment stretches in hill cutting

TCS – 4 : Typical cross section of 2-lane carriageway at built up areas.

The cross section schedule shall be as follows:

Sl.NO.	DESIGN CHAINAGE		LENGTH (m)	TYPE TCS	Remarks / Location
	FROM	TO			
1	32050	33235	1185	2	Reconstruction and widening
2	33235	33245	10	1	Reconstruction and widening with Retaining wall
3	33245	33300	55	2	Reconstruction and widening
4	33300	33310	10	1	Reconstruction and widening with Retaining wall
5	33310	33320	10	2	Reconstruction and widening
6	33320	33330	10	1	Reconstruction and widening with Retaining wall
7	33330	33370	40	2	Reconstruction and widening
8	33370	33400	30	1	Reconstruction and widening with Retaining wall
9	33400	33950	550	3	Realignment
10	33950	33970	20	1	Realignment with Retaining wall
11	33970	34280	310	3	Realignment
12	34280	34290	10	1	Realignment with Retaining wall
13	34290	35145	855	3	Realignment
14	35145	35155	10	1	Realignment with Retaining wall
15	35155	35175	20	3	Realignment
16	35175	35185	10	1	Realignment with Retaining wall
17	35185	35215	30	3	Realignment
18	35215	35235	20	1	Realignment with Retaining wall

SI.NO.	DESIGN CHAINAGE		LENGTH (m)	TYPE TCS	Remarks / Location
	FROM	TO			
19	35235	35265	30	3	Realignment
20	35265	35285	20	1	Realignment with Retaining wall
21	35285	35530	245	3	Realignment
22	35530	35540	10	1	Realignment with Retaining wall
23	35540	35600	60	3	Realignment
24	35600	35610	10	1	Realignment with Retaining wall
25	35610	35890	280	3	Realignment
26	35890	35900	10	1	Realignment with Retaining wall
27	35900	36030	130	3	Realignment
28	36030	36040	10	1	Realignment with Retaining wall
29	36040	36080	40	3	Realignment
30	36080	36090	10	1	Realignment with Retaining wall
31	36090	36480	390	3	Realignment
32	36480	36500	20	1	Realignment with Retaining wall
33	36500	36790	290	3	Realignment
34	36790	36825	35	1	Realignment with Retaining wall
35	36825	36845	20	3	Realignment
36	36845	36855	10	1	Realignment with Retaining wall
37	36855	36890	35	3	Realignment
38	36890	36920	30	1	Realignment with Retaining wall
39	36920	37005	85	3	Realignment

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SI.NO.	DESIGN CHAINAGE		LENGTH (m)	TYPE TCS	Remarks / Location
	FROM	TO			
40	37005	37025	20	1	Realignment with Retaining wall
41	37025	37715	690	3	Realignment
42	37715	37725	10	1	Realignment with Retaining wall
43	37725	37830	105	3	Realignment
44	37830	37850	20	1	Realignment with Retaining wall
45	37850	38000	150	3	Realignment
46	38000	38200	200	2	Reconstruction and widening
47	38200	38590	390	3	Realignment
48	38590	38600	10	1	Realignment with Retaining wall
49	38600	38955	355	3	Realignment
50	38955	38965	10	1	Realignment with Retaining wall
51	38965	39005	40	3	Realignment
52	39005	39015	10	1	Realignment with Retaining wall
53	39015	39055	40	3	Realignment
54	39055	39065	10	1	Realignment with Retaining wall
55	39065	39155	90	3	Realignment
56	39155	39165	10	1	Realignment with Retaining wall
57	39165	39400	235	3	Realignment
58	39400	39410	10	1	Realignment with Retaining wall
59	39410	39460	50	3	Realignment
60	39460	39480	20	1	Realignment with Retaining wall

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SI.NO.	DESIGN CHAINAGE		LENGTH (m)	TYPE TCS	Remarks / Location
	FROM	TO			
61	39480	39515	35	3	Realignment
62	39515	39525	10	1	Realignment with Retaining wall
63	39525	41000	1475	3	Realignment
64	41000	41200	200	2	Reconstruction and widening
65	41200	42300	1100	3	Realignment
66	42300	42600	300	2	Reconstruction and widening
67	42600	42800	200	3	Realignment
68	42800	42960	160	2	Reconstruction and widening
69	42960	44000	1040	3	Realignment
Total			11950		

Note: The extent of cross section type is indicative and shall be reviewed in consultation with the Independent Consultant at the time of construction as per the site condition.

The alternative cross section of the Project Highway at the cross drainage structures shall follow the typical cross section in consultation with the Independent Consultant at the time of construction. The utility services, including optical fiber cables, shall be provided in the utility corridor earmarked for this purpose on the side where it is convenient to the NHIDCL or the fiber cable shall be relocated by the respective owner at a safe place as indicated by NHIDCL in such a way that it causes least hindrances to the execution of project. In urban sections the utility connection, the utility services shall be carried through the nearest cross drainage structure/cattle crossing below its deck slab and above HFL. In absence of such a structure in the vicinity of the purposed location, it shall pass through separate underground ducts. Location and design of the cross utility ducts shall be finalized at the detailed design stage in consonance with the Independent Consultant and NHIDCL.

3.12 Longitudinal Section

As a minimum, the Construction Contractor shall achieve the proposed finished road level as indicated in the plan and profile drawings for this purpose in FFSR. However, the final finished road levels (FRL) will be finalized as per site conditions in consultation with NHIDCL.

3.13 Built-Up Areas

The alignment passes through Built up areas as tabulated below.

Sno	Location/Chainage		Name of Village/town etc
	From (Km)	To (Km)	
Nil			

4. INTERSECTIONS AND GRADE SEPARATORS

All intersections shall be as per Section 3 of the Manual. Existing intersections which are deficient shall be improved to the prescribed standards.

[Refer to paragraphs 3.1.1, 3.1.2 and 3.3 of the Manual and specify the requirements. Explain where necessary with drawings/sketches/general arrangement].

There are no intersections with cross roads having bituminous surfacing. The cross roads fall into the category VRs. The Construction Contractor has to construct the following:

- i) Typical junction treatments as specified in Final Project Report shall be applied. Design types of intersections are as given below:

Properly designed intersections shall be provided at the locations and of the types and features given in the tables below:

- (a) At-grade Intersections

Major Intersections

SI No.	Location of Intersection	Intersection Towards	Existing Configurations				Type of Intersection	Figure No.	Other Features
			Location	Type	Width (m)	Surface			
Nil									

Details of junction improvements shall be as per IRC SP:73-2015.

Minor Intersections

SI No.	Location of Intersection	Type of Intersection	Side
1	32+100	3-Legged	Left side
2	32+130	3-Legged	Right side
3	32+260	3-Legged	Right side
4	32+375	3-Legged	Right side
5	32+460	3-Legged	Left side
6	32+990	3-Legged	Left side

SI No.	Location of Intersection	Type of Intersection	Side
7	34+200	3-Legged	Right side
8	34+750	3-Legged	Right side
9	38+180	3-Legged	Right side
10	38+180	3-Legged	Left side
11	38+660	3-Legged	Right side
12	38+920	3-Legged	Left side
13	39+080	3-Legged	Left side
14	39+540	3-Legged	Right side
15	43+660	3-Legged	Left side
16	43+800	3-Legged	Left side

Details of junction improvements shall be as per IRC SP:73-2015.

(b) Grade Separated Intersections with/without Ramps

SI No.	Location (km)	Salient Features	Minimum Length of Viaduct to be Provided (m)	Road to be Carried Over/Under the Structures
Nil				

5. ROAD EMBANKMENT AND CUT SECTION

5.1 Widening and improvement of the existing road embankment/cuttings and construction of new road embankment/ cuttings shall conform to the Specifications and Standards given in section 4 of the Manual and the specified cross sectional details. Deficiencies in the plan and profile of the existing road shall be corrected.

5.2 Raising of the existing road [Refer to paragraph 4.2.2 of the Manual and specify sections to be raised].

The existing road shall be raised in the following sections:

SI No.	Section (km)		Length (km)	Extent of Raising*	Remarks
	From	To			
Nil					

* Difference between levels at proposed c/l and existing road/ground below proposed c/l

6. PAVEMENT DESIGN

6.1 Pavement design shall be carried out in accordance with section 5 of the Manual. The detailed pavement design including overlay and pavement characteristics requirements of the Project Highway shall be done in accordance with Schedule D. Flexible pavement shall be

considered for the project road. Flexible Pavement design shall be carried out in accordance with Section 5 of the Two Lane Manual (IRC: SP 73 -2015).

6.2 Type of pavement

Flexible pavement shall be adopted for Project Highway in accordance with IRC: 37-2012. Clause 2.2 of IRC:37-2012 identifies five type of flexible pavements. The estimated cost of civil works is based on flexible pavements consisting of Granular base, Sub base, DBM and Be. Since, the successful bidders under EPC mode can use any type of five flexible pavements mentioned Clause 2.2 of IRC: 37-2012, they may carry out their own diligence to arrive at project cost before submitting bids.

6.3 Design requirements

[Refer to paragraph 5.4, 5.9 and 5.1'0 of the Manual and specify design requirements and strategy]

6.3.1 Design Period and strategy

Flexible pavement for new pavement or for widening and strengthening of the existing pavement shall be designed for a minimum design period of 15 years. Stage construction shall not be permitted.

6.3.2 Design Traffic

Notwithstanding anything to the contrary contained in this Agreement or the Manual, the Contractor shall design the pavement for design traffic of 20 million standard axles as follows.

PACKAGE	Design Chainage (km)		Length (km)	15 Year MSA*
	From	To		
II	32+050	44+000	11.950	20

*As per 5.4.1 of IRC:SP:73-2015

6.3.3 Design Parameters

The flexible pavement for the main carriageway is a 2-lane carriageway having 1.5 m wide paved shoulder and 1.0 m wide earthen shoulder in some stretches. This shall be designed using the IRC 37: 2012 Method for the projected traffic levels and the following indicative design input parameters:

Indicative Design Parameters

(i)	Performance Period	15 years + Construction Period of 24 months
(ii)	Traffic on Design Lane	Minimum 20msa as per IRC:SP:73-2015. Design should take care of the maximum wheel load derived from the axle load survey on the design

		lane
(iii)	Design serviceability Loss	2.0
(iv)	Reliability	90%
(v)	Overall Standard Deviation	0.49
(vi)	Effective Roadblock Soil Resilient Modulus	Corresponding to 4-day soaked CBR value of 8.0% to 10.0%
(vii)	Layer Coefficients	As per the IRC 37 : 2012 procedures
(viii)	Drainage quality of Pavement	Good

6.3.4 The Project highway will be a light-trafficked section connecting the major arterial network of the country. The design exercise should therefore duly take into account the importance of the road, the performance level and the maintenance requirements during the performance period. The provision of Wet Mix Macadam (granular base)/cement-treated base/ sub-base (crushed stone only)/ subgrade layer(s) and the use of 60/70 Bitumen in bituminous base layers and polymer modified bitumen (PMB 40) in wearing course shall be considered while deciding about the composition of the pavement structure. The design should also accompany the Quality Assurance Plan (QAP) along with its implementation scheme for the construction of the pavement structure.

6.3.5 However, in case of a change in the pavement design at the detailed engineering stage, the same shall not be considered as a change in scope of work nor shall qualify for a variation order.

6.3.6 Paved shoulders of 1.5 m width shall have same thickness of the pavement as that of the main carriageway with same composition as that of main carriageway for monolithic construction.

6.3.7 Contractor shall design the pavement for design traffic of 20 million standard axles (msa) with corresponding subgrade CBR.

6.3.8 Rigid Pavement

No rigid pavement has been considered for the Project Highway.

6.4 Reconstruction/ Realignment/ Bypass of sections

[Refer to paragraph 5.9.7 of the Manual and specify the sections, if any, to be reconstructed.]

The following sections of the existing road shall be reconstructed. These shall be designed as new pavement.

Sl No.	Section (km)	Remarks
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	From	To	
1	32.050	44.000	Poor condition of existing pavement

7. ROADSIDE DRAINAGE

Drainage system including surface and subsurface drains for the Project Highway shall be provided as per section 6 of the Manual.

The improvements in the drainage and the slope erosion shall be made as per the following norms:

7.1 Drainage Measures

Following measures shall be adopted:

- i) Open side Trapezoidal drains at the hill side for widening at hill sides.
- ii) Open side Trapezoidal drains at both sides in realignment stretches by hill cut.

Open side trapezoidal cross section drain shall be provided on hill sides of the project highway in order to intercept surface water from the carriageway, shoulders and hill slopes. RCC Lined drains have slopes also been proposed in urban/semi urban/intersection stretches. The concrete drains shall be covered in reaches along commercial establishments and intersections. The drains outfall into the natural water courses i.e. either in culverts or bridges. Table below gives the location of lined drains.

These are guidelines for minimum provisions. However, contractor has to design as per requirement of road in accordance with manual.

Details of Lined Drains

Sl.NO.	Package	DESIGN CHAINAGE		LENGTH	Side	Remarks
		FROM	TO	(m)		
1	PKG-2	32050	33235	1185	One	Reconstruction and widening
2	PKG-2	33235	33245	10	One	Reconstruction and widening with Retaining wall
3	PKG-2	33245	33300	55	One	Reconstruction and widening
4	PKG-2	33300	33310	10	One	Reconstruction and widening with Retaining wall
5	PKG-2	33310	33320	10	One	Reconstruction and widening

6	PKG-2	33320	33330	10	One	Reconstruction and widening with Retaining wall
7	PKG-2	33330	33370	40	One	Reconstruction and widening
8	PKG-2	33370	33400	30	One	Reconstruction and widening with Retaining wall
9	PKG-2	33400	33950	1100	Both	Realignment
10	PKG-2	33950	33970	20	One	Realignment with Retaining wall
11	PKG-2	33970	34280	620	Both	Realignment
12	PKG-2	34280	34290	10	One	Realignment with Retaining wall
13	PKG-2	34290	35145	1710	Both	Realignment
14	PKG-2	35145	35155	10	One	Realignment with Retaining wall
15	PKG-2	35155	35175	40	Both	Realignment
16	PKG-2	35175	35185	10	One	Realignment with Retaining wall
17	PKG-2	35185	35215	60	Both	Realignment
18	PKG-2	35215	35235	20	One	Realignment with Retaining wall
19	PKG-2	35235	35265	60	Both	Realignment
20	PKG-2	35265	35285	20	One	Realignment with Retaining wall
21	PKG-2	35285	35530	490	Both	Realignment
22	PKG-2	35530	35540	10	One	Realignment with Retaining wall
23	PKG-2	35540	35600	120	Both	Realignment
24	PKG-2	35600	35610	10	One	Realignment with Retaining wall
25	PKG-2	35610	35890	560	Both	Realignment

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26	PKG-2	35890	35900	10	One	Realignment with Retaining wall
27	PKG-2	35900	36030	260	Both	Realignment
28	PKG-2	36030	36040	10	One	Realignment with Retaining wall
29	PKG-2	36040	36080	80	Both	Realignment
30	PKG-2	36080	36090	10	One	Realignment with Retaining wall
31	PKG-2	36090	36480	780	Both	Realignment
32	PKG-2	36480	36500	20	One	Realignment with Retaining wall
33	PKG-2	36500	36790	580	Both	Realignment
34	PKG-2	36790	36825	35	One	Realignment with Retaining wall
35	PKG-2	36825	36845	40	Both	Realignment
36	PKG-2	36845	36855	10	One	Realignment with Retaining wall
37	PKG-2	36855	36890	70	Both	Realignment
38	PKG-2	36890	36920	30	One	Realignment with Retaining wall
39	PKG-2	36920	37005	170	Both	Realignment
40	PKG-2	37005	37025	20	One	Realignment with Retaining wall
41	PKG-2	37025	37715	1380	Both	Realignment
42	PKG-2	37715	37725	10	One	Realignment with Retaining wall
43	PKG-2	37725	37830	210	Both	Realignment
44	PKG-2	37830	37850	20	One	Realignment with Retaining wall
45	PKG-2	37850	38000	300	Both	Realignment
46	PKG-2	38000	38200	200	One	Reconstruction and widening

47	PKG-2	38200	38590	780	Both	Realignment
48	PKG-2	38590	38600	10	One	Realignment with Retaining wall
49	PKG-2	38600	38955	710	Both	Realignment
50	PKG-2	38955	38965	10	One	Realignment with Retaining wall
51	PKG-2	38965	39005	80	Both	Realignment
52	PKG-2	39005	39015	10	One	Realignment with Retaining wall
53	PKG-2	39015	39055	80	Both	Realignment
54	PKG-2	39055	39065	10	One	Realignment with Retaining wall
55	PKG-2	39065	39155	180	Both	Realignment
56	PKG-2	39155	39165	10	One	Realignment with Retaining wall
57	PKG-2	39165	39400	470	Both	Realignment
58	PKG-2	39400	39410	10	One	Realignment with Retaining wall
59	PKG-2	39410	39460	100	Both	Realignment
60	PKG-2	39460	39480	20	One	Realignment with Retaining wall
61	PKG-2	39480	39515	70	Both	Realignment
62	PKG-2	39515	39525	10	One	Realignment with Retaining wall
63	PKG-2	39525	41000	2950	Both	Realignment
64	PKG-2	41000	41200	200	One	Reconstruction and widening
65	PKG-2	41200	42300	2200	Both	Realignment
66	PKG-2	42300	42600	300	One	Reconstruction and widening
67	PKG-2	42600	42800	400	Both	Realignment
68	PKG-2	42800	42960	160	One	Reconstruction and widening
69	PKG-2	42960	44000	2080	Both	Realignment

Total	21315		
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Note: (The above locations shall be reviewed in consultation with the Independent Consultant at the time of construction as per the site condition).

Trapezoidal section for the drain/ditch has been proposed as it is more economical and efficient as compared to rectangular cross section V-Shaped. These road side drains have been designed of adequate capacity to carry 100% surface runoff of the drainage area of highway ROW and the adjoining land. The side slopes have been kept as 1H:1V in case of unlined drain/ditches. However, successful bidder may adopt any type of PCC drain as per IRC and accordingly they may carry out their own diligence to arrive at project cost before submitting the bid.

7.2 Slope Protection Measures

7.2.1 Breast Wall and Retaining Wall

Following measures shall be adopted:

Slope protection along hill slope side shall be with breast walls with PCC minimum M15 grade concrete. However, at the zones prone to sliding breast walls will be of sausage type (by stone-mesh gabions) or specialized treatment as per good engineering practices. Retaining wall has been considered at valley sides. Retaining wall has been considered at valley sides. The height of breast walls is varying from 1.5 m to 3m as per site requirement and to be finalized by consultation with Authority Engineers. The breast wall of height 3m has been considered if the height of hill cut is more than 9m and in this circumstances 3m berm with catch water drain is required to be provided. The maximum cut slope at hill side is 55° (0.7H to 1V). Slide prone zones is from Km 38+200 to Km 38+700.

7.2.2 Embankment less than 3m in height shall be turfed as per MoRTH Specifications.

7.2.3 Vetiver Plantation, Hydro Seeding and Hydro Mulching etc or similar works is to be done for slope protection and site mitigation measure upto a height of 12-15 m all along the slopes in each cutting locations except hard rock location which needs to be protected with appropriate applicable technologies, if required.

7.3 Rip rap Protection:

The riprap protection or similar work to be provided at valley side shoulder over the granular sub base layer in the following locations as special safety feature on valley side on curves.

Sl. No	Chainage		Length(m)
	From	To	
1	32050	33235	1185
2	33235	33245	10

Sl. No	Chainage		Length(m)
3	33245	33300	55
4	33300	33310	10
5	33310	33320	10
6	33320	33330	10
7	33330	33370	40
8	33370	33400	30
9	33950	33970	20
10	34280	34290	10
11	35145	35155	10
12	35175	35185	10
13	35215	35235	20
14	35265	35285	20
15	35530	35540	10
16	35600	35610	10
17	35890	35900	10
18	36030	36040	10
19	36080	36090	10
20	36480	36500	20
21	36790	36825	35
22	36845	36855	10
23	36890	36920	30
24	37005	37025	20
25	37715	37725	10
26	37830	37850	20
27	38000	38200	200

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Sl. No	Chainage		Length(m)
28	38590	38600	10
29	38955	38965	10
30	39005	39015	10
31	39055	39065	10
32	39155	39165	10
33	39400	39410	10
34	39460	39480	20
35	39515	39525	10
36	41000	41200	200
37	42300	42600	300
38	42800	42960	160

8. DESIGN OF STRUCTURES

8.1 General

The Project road from Deed to Dam, includes provision of no major bridges (span \geq 60m), 1 no minor bridge (span $<$ 60m) and 71 RCC box/ Slab culverts. All culverts and other structures shall be designed and constructed in accordance with section 7 of the Manual and shall conform to the cross-sectional features and other details specified therein. New bridges and culverts shall be constructed wide enough to accommodate the adjacent road cross section as given in this Schedule-B. The details of existing culverts are given in Schedule–A.

The details of culverts shall be provided by the EPC Contractor and locations are given in Clause 8.2 of Schedule-B.

All the cross-drainage structures and other structures shall be designed in accordance with the design standards set out in **Schedule–D**.

The following guidelines shall be followed:

- i) All the cross drainage structures for the new carriageway shall be designed in such way so that the outer most face of railing/parapet shall be in line with the out most edge of shoulder.

- ii) The existing culverts shall be extended to match the new road cross sections.
- iii) The adequacy of the vent size for all culverts/bridges shall be ascertained through detailed hydrological surveys and finalized in consultation with the IC/Project Company. The highest flood level/maximum supply level shall be properly assessed after collecting flood histories from local authorities/interviews with locals/irrigation authorities.
- iv) For drainage purpose the new/to be reconstructed box culverts of minimum span 2.0 m shall be provided.
- v) Suitable river training works, bank protection and embankment protection works ensuring safety of bridge structure and its approaches against damage by flood water / rain water shall be provided.

The cross drainage plan of the highway shall be finalized in consultation with IC/Project Company and if required additional culverts shall be provided.

Cross-section of the new culverts and bridges at deck level for the Project Highway shall conform to the typical cross-sections given in section 7 of the Manual.

8.2 Culverts

8.2.1 Overall width of all culverts shall be equal to the roadway width of the approaches.

8.2.2 Reconstruction of existing culverts

The existing culverts at the following locations shall be re-constructed as new culverts: [Refer to paragraph 7.3 (i) of the Manual and provide details]. These are guidelines for minimum provisions. However, contractor has to design as per requirement of road in accordance with manual.

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Proposal	Proposed Span
1	35+270	32+130	RCC Box/ Slab	2.0
2	35+330	32+190	RCC Box/ Slab	2.0
3	35+460	32+310	RCC Box/ Slab	2.0
4	35+970	32+810	RCC Box/ Slab	2.0
5	36+175	33+010	RCC Box/ Slab	2.0
6	36+300	33+150	RCC Box/ Slab	2.0
7	36+490	33+320	RCC Box/ Slab	2.0
8	37+100	33+730	RCC Box/ Slab	2.0
9	37+880	34+470	RCC Box/ Slab	2.0

10	42+925	38+260	RCC Box/ Slab	2.0
11	43+150	38+470	RCC Box/ Slab	2.0
12	43+300	38+600	RCC Box/ Slab	2.0
13	43+390	38+670	RCC Box/ Slab	2.0
14	43+400	38+690	RCC Box/ Slab	2.0
15	43+580	38+810	RCC Box/ Slab	2.0
16	44+075	39+130	RCC Box/ Slab	2.0
17	44+150	39+215	RCC Box/ Slab	2.0
18	44+330	39+390	RCC Box/ Slab	2.0
19	44+500	39+540	RCC Box/ Slab	2.0
20	44+925	39+830	RCC Box/ Slab	2.0
21	45+270	40+050	RCC Box/ Slab	2.0
22	45+520	40+170	RCC Box/ Slab	2.0
23	45+740	40+300	RCC Box/ Slab	2.0
24	46+940	41+320	RCC Box/ Slab	2.0
25	47+050	41+430	RCC Box/ Slab	2.0
26	47+900	42+160	RCC Box/ Slab	2.0
27	48+050	42+260	RCC Box/ Slab	2.0
28	48+330	42+500	RCC Box/ Slab	2.0
29	48+500	42+670	RCC Box/ Slab	2.0
30	48+700	42+820	RCC Box/ Slab	2.0
31	48+900	42+980	RCC Box/ Slab	2.0
32	49+150	43+240	RCC Box/ Slab	2.0
33	49+200	43+300	RCC Box/ Slab	6.0
34	49+270	43+370	RCC Box/ Slab	2.0
35	49+950	43+910	RCC Box/ Slab	2.0
36	49+990	43+940	RCC Box/ Slab	2.0
37	50+050	44+000	RCC Box/ Slab	2.0

* Specify modifications, if any, required in the road level etc.

8.2.3 Additional new culverts shall be constructed as per particulars given in the table below:

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Proposal	Span
1	36+890	33+560	RCC Box/ Slab	2.0
2	37+370	33+990	RCC Box/ Slab	2.0
3	37+490	34+080	RCC Box/ Slab	2.0
4	38+360	34+860	RCC Box/ Slab	2.0
5	39+450	35+760	RCC Box/ Slab	2.0
6	39+640	35+880	RCC Box/ Slab	2.0
7	40+500	36+510	RCC Box/ Slab	2.0
8	40+700	36+680	RCC Box/ Slab	2.0
9	40+840	36+760	RCC Box/ Slab	2.0
10	40+950	36+880	RCC Box/ Slab	6.0
11	41+210	37+060	RCC Box/ Slab	2.0

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12	41+550	37+170	RCC Box/ Slab	2.0
13	41+730	37+310	RCC Box/ Slab	2.0
14	41+810	37+390	RCC Box/ Slab	2.0
15	42+160	37+560	RCC Box/ Slab	2.0
16	42+340	37+860	RCC Box/ Slab	2.0
17	42+560	37+930	RCC Box/ Slab	2.0
18	44+700	39+700	RCC Box/ Slab	2.0
19	45+050	39+940	RCC Box/ Slab	2.0
20	45+675	40+270	RCC Box/ Slab	2.0
21	46+210	40+680	RCC Box/ Slab	2.0
22	47+300	41+710	RCC Box/ Slab	2.0
23	47+350	41+780	RCC Box/ Slab	2.0
24	49+600	43+670	RCC Box/ Slab	2.0

8.2.4 Repairs/replacements of railing/parapets, flooring and protection. works of the existing culverts shall be undertaken as follows:

[Refer to paragraph 7.23 of the Manual and provide details]

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Proposal	Proposed Span
1	35+700	32+350	RCC Box/ Slab	2.0
2	37+790	34+370	RCC Box/ Slab	2.0
3	38+420	34+920	RCC Box/ Slab	2.0
4	38+500	34+950	RCC Box/ Slab	2.0
5	38+640	35+080	RCC Box/ Slab	2.0
6	38+710	35+150	RCC Box/ Slab	2.0
7	38+940	35+370	RCC Box/ Slab	2.0
8	39+125	35+485	RCC Box/ Slab	2.0
9	40+260	36+260	RCC Box/ Slab	2.0
10	49+850	43+820	RCC Box/ Slab	3.0

8.2.5 Floor protection works shall be as specified in the relevant IRC Codes and Specifications.

8.3 Bridges

8.3.1 The existing bridges to be reconstructed/widened

(i) The existing bridges at the following locations shall be reconstructed as new structures(Minor Bridge)

Sl No.	Existing Chainage	Design Chainage	Proposed Span(m)	Proposed Width(m)	Remarks
1	38+000	34+611	1 x 31	16.0	Reconstruction

Sl	Bridge	Salient Details of Existing Bridge	Adequacy or	E a l
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No	Location (km)	Span Arrangement (m)	Carriageway Width (m)	Total Width (m)	Type of Superstructure	Type of Foundation	Otherwise of the Existing Waterway, Vertical Clearance etc.	
1	36+500	1 X 30.5	3.5	5.3	DS type Bailey bridge	Open	Vertical Clearance ~7.3m	Narrow Bridge

8.3.2 The following structures shall be provided with footpaths:

SI No.	Location (km)	Remarks
1	34+611	Footpath on both sides

8.3.3 Additional New Minor Bridges

New minor bridges at the following locations on the project highways shall be constructed

SI No.	Bridge at km	Utility Services to be Carried	Remarks
Nil			

8.3.4 Additional new bridges

[Specify additional new bridges if required, and attach GAD]

No new bridges at the following locations on the Project Highway shall be constructed.

SI No.	Location (km)	Total Length (m)	Remarks
Nil			

8.3.5 The railings of existing bridges shall be replaced by crash barriers at the following locations:

[Refer to paragraph 7.18 (iv) of the Manual and provide details]

SI No.	Location (km)	Remarks
Nil		

8.3.6 Repairs/replacements of railings/parapets of the existing bridges shall be undertaken as follows:

[Refer to paragraph 7.18 (v) of the Manual and provide details]

SI No.	Location (km)	Remarks
--------	---------------	---------

Nil

8.3.7 Drainage system for bridge decks

An effective drainage system for bridge decks shall be provided as specified in paragraph 7.21 of the Manual

8.3.8 Structures in marine environment

[Refer to paragraph 7.22 of the Manual and specify the necessary measures / treatments for protecting structures in marine environment, where applicable]

8.4 Rail-road Bridges

8.4.1 Design, construction and detailing of ROB/RUB shall be as specified in section 7 of the Manual. [Refer to paragraph 7.19 of the Manual and specify modification, if any]

8.4.2 Road over-bridges

Road over-bridges (road over rail) shall be provided at the following level crossings, as per GAD drawings attached:

SI No.	Location of Level Crossing (km)	Length of Bridge (m)
Nil		

8.1.1 Road under-bridges

Road under-bridges (road under railway line) shall be provided at the following level crossings, as per GAD drawings attached:

SI No.	Location of Level Crossing (km)	Number and Length of Span (m)
Nil		

8.5 Grade Separated Structures

[Refer to paragraph 7.20 of the Manual]

The grade separated structures shall be provided at the locations and of the type and length specified in paragraphs 2.9 and 3 of this Annex-I.

8.6 Underpasses/Overpasses

There is no Underpass/Overpass proposed on the Project Highway.

8.7 Repairs and strengthening of bridges and structures

[Refer to paragraph 7.23 of the Manual and provide details]

The existing bridges and structures to be repaired/strengthened, and the nature and extent of repairs/strengthening required are given below:

A. Bridges

Sl No.	Location of Bridge (km)	Nature and Extent of Repairs/Strengthening to be Carried out
Nil		

B. ROB / RUB

Sl No.	Location of Bridge (km)	Nature and Extent of Repairs/Strengthening to be Carried out
Nil		

C. Overpasses / Underpasses and Other Structures

Sl No.	Location of Bridge (km)	Nature and Extent of Repairs/Strengthening to be Carried out
Nil		

8.8 List of Major Bridges and Structures

The following is the list of Major Bridges

Sl No.	Location (km)
Nil	

9. TRAFFIC CONTROL DEVICES AND ROAD SAFETY WORKS

9.1 General

Traffic control devices and road safety works shall be provided in accordance with Section 9 of the Manual.

Specifications of the reflective sheeting [Refer to paragraph 9.3 of the Manual and specify]

Traffic signs and pavements markings shall include roadside signs, overhead signs, curve amounting signs and road marking along the Project Highway. The design and marking for the project Highway shall be as per design standards indicated in **Schedule-D** and the location for various treatments shall be finalized in consultation with the Independent Consultant and Project Company.

The road markings shall be applied to lane lines, road center lines, edge lines, continuity line, stop lines, give way lines, directional arrows, diagonal/chevron markings, and Zebra crossings at parking areas.

PCC kerbs (duly painted) approximately 170 RM (minimum) shall be provided by EPC Contractor in bus bays and Islands.

9.2 Traffic Signs

- (i) A complete range of permanent retro-reflective traffic signs as per the requirements defined in but not limited to the FPR, for the safe and efficient movement of traffic. These sign are to be of regulatory, warning and informatory types and placed on the roadside except at the start and end of the project road and start and end of two bypasses where overhead directional and lane designation signs shall be mounted on the steels portals.
- (ii) Temporary traffic and construction signs are to be provided during construction and maintenance operations for traffic diversion and pedestrian safety.

9.3 Pavement Marking

- (i) Retro-reflective thermoplastic paint is proposed for use.
The road markings shall be applied to lane lines, road center lines, edge lines, continuity line, stop lines, give way lines, diagonal/chevron markings, Zebra crossings and at parking areas.
- i) Delineators bollards and other safety devices shall be provided on entire project Highway and other locations as directed by NHIDCL.
- ii) All signs shall be the reflectorized type with high intensity retro-reflective sheeting conforming to ASTM D 4956-01, type VIII and /or type IX of micro prismatic type. All sign boards of size more than 1.2 m and less than 0.9 m shall be provided at the locations finalized in consultation with NHIDCL.
- iii) Cautionary sign boards (900mm Equilateral Triangle), stop sign (900mm Octagonal) mandatory sign boards(600mm dia), Village name boards (600X900mm), Hazard Plate (300X900mm), chevron signboard (600X750mm), Facility information sign (600X800mm), Advance direction sign (1800X1200mm), Place identification sign (1200X900mm) shall be provided by the Construction Contractor with suitable interval in consultation with NHIDCL.

The minimum quantity of Traffic signages and pavement marking are tabulated here

Traffic Signages, Road Marking and other appurtenances	unit	Quantity
Centre line on straight portion	sqm	946.440
Centre line on curve portion	sqm	358.500
Edge Line at Paved Shoulder	sqm	4780.000

Traffic Signages, Road Marking and other appurtenances	unit	Quantity
Add 15% for Misc. including Pedestrian X-ings etc	sqm	912.741
Directional Arrows, letter marking etc.	Nos.	45.000
Advance Direction signs size 1800X1200 mm	Nos.	5.000
Village name boards size 600X900 mm	Nos.	46.000
Place Identification signs size 1200X900 mm	Nos.	3.000
90 cm Triangle	Nos.	7.000
90 cm Octagon	Nos.	6.000
Hazard plate 300X900 mm	Nos.	34.000
800 x 600 mm Size	Nos.	14
60 cm Circuler	Nos.	75
Boundary Stone	Nos.	115
5th km stone	Nos.	1
Km stone	Nos.	8
Enamel Paint	sqm	1286
Rip Rap	Rm	2585
Convex Mirror	No	42
Delineator	No	862
W Type metal Crash Barrier	Rm	3574

10. ROADSIDE FURNITURE

10.1.1 Roadside furniture shall be provided in accordance with the provisions of Section 11 of the Manual.

10.1.2 Overhead traffic signs: location and size

[Refer to paragraph 11.5 of the Manual and provide details]

The overhead signs shall be the reflectorized type with high intensity retro-reflective sheeting conforming to ASTM D 4956-01, type VIII and /or type IX of micro prismatic type. The retro reflected sheets of Engineering Grade and high intensity grade (ordinary) shall not be used. The height, lateral clearance, location and instillation shall be as per relevant clauses of MoRTH specifications. Overhead sign shall be installed ahead of major

intersections and urban areas as per detailed design requirements. The minimum number of overhead signs shall be 02 Cantilever as per this manual.

SI No.	Location (km)	Size	Remarks
1	35+000	5.5m x 2.1m	Cantilever
2	41+500	5.5m x 2.1m	Cantilever

11. COMPULSORY AFFORESTATION

[Refer to paragraph 12.1 of the Manual and specify the number of trees which are required to be planted by the Contractor as compensatory afforestation.]

Minimum 780 nos. trees are required to be planted.

12. HAZARDOUS LOCATIONS

- iv) Metal Beam crash barrier length of minimum 9160m (single runner, heavy duty and W-shape) shall be provided at the locations of bridge approaches and high embankments (3.0m and more), at sharp curves on both sides. Heavy duty metal beam crash barriers shall be provided on this project by the Construction Contractor at the locations finalized in consultation with NHIDCL. Typical details of metal crash barrier are given in as per manual.

The safety barriers shall also be provided at the following hazardous locations:

SI No.	Location		Length (m)	Remarks
	From	To		
1	32+205.961	32+251.041	45.08	Radius<300m
2	32+394.660	32+407.007	12.35	Radius<300m
3	32+601.986	32+713.448	111.46	Radius<300m
4	32+760.278	32+777.312	17.03	Radius<300m
5	33+166.320	33+183.582	17.26	Radius<300m
6	33+223.445	33+224.701	01.26	Radius<300m
7	33+270.561	33+294.895	24.33	Radius<300m
8	33+328.014	33+345.848	17.83	Radius<300m
9	33+402.809	33+438.037	35.23	Radius<300m
10	33+534.745	33+541.906	07.16	Radius<300m
11	33+591.525	33+692.969	101.44	Radius<300m
12	33+697.924	33+739.892	41.97	Radius<300m
13	33+765.202	33+770.075	04.87	Radius<300m
14	33+973.473	34+022.179	48.71	Radius<300m
15	34+094.328	34+111.969	17.64	Radius<300m
16	34+353.463	34+374.884	21.42	Radius<300m
17	34+691.698	34+742.109	50.41	Radius<300m

Sl No.	Location		Length (m)	Remarks
	From	To		
18	34+897.464	34+963.982	66.52	Radius<300m
19	35+048.656	35+202.844	154.19	Radius<300m
20	35+265.060	35+316.404	51.34	Radius<300m
21	35+431.775	35+471.072	39.30	Radius<300m
22	35+558.111	35+614.175	56.06	Radius<300m
23	35+783.272	35+914.664	131.39	Radius<300m
24	36+245.885	36+301.078	55.19	Radius<300m
25	36+571.682	36+637.256	65.57	Radius<300m
26	36+656.817	36+758.222	101.40	Radius<300m
27	36+804.400	36+818.908	14.51	Radius<300m
28	36+935.807	37+000.802	65.00	Radius<300m
29	37+046.572	37+133.773	87.20	Radius<300m
30	37+217.224	37+283.619	66.39	Radius<300m
31	37+574.006	37+650.061	76.06	Radius<300m
32	37+721.459	37+729.963	08.50	Radius<300m
33	37+766.839	37+812.890	46.05	Radius<300m
34	37+934.804	37+998.625	63.82	Radius<300m
35	38+077.392	38+156.811	79.42	Radius<300m
36	38+162.511	38+227.459	64.95	Radius<300m
37	38+330.485	38+340.194	09.71	Radius<300m
38	38+406.227	38+426.978	20.75	Radius<300m
39	38+553.749	38+558.240	04.49	Radius<300m
40	38+602.368	38+608.828	06.46	Radius<300m
41	38+668.347	38+718.041	49.69	Radius<300m
42	38+731.260	38+792.792	61.53	Radius<300m
43	38+866.147	38+899.422	33.28	Radius<300m
44	38+944.851	38+968.692	23.84	Radius<300m
45	39+037.009	39+184.090	147.08	Radius<300m
46	39+205.028	39+266.406	61.38	Radius<300m
47	39+318.924	39+338.346	19.42	Radius<300m
48	39+425.147	39+438.451	13.30	Radius<300m
49	39+485.281	39+645.966	160.68	Radius<300m
50	39+686.095	39+733.252	47.16	Radius<300m
51	39+827.325	39+837.045	09.72	Radius<300m
52	39+932.717	39+962.504	29.79	Radius<300m
53	40+060.143	40+140.477	80.33	Radius<300m
54	40+312.614	40+330.018	17.40	Radius<300m
55	40+418.348	40+459.051	40.70	Radius<300m
56	40+593.928	40+598.434	04.51	Radius<300m
57	40+682.291	40+699.197	16.91	Radius<300m
58	40+763.129	40+776.636	13.51	Radius<300m

Two Laning of Joram – koloriang Road (NH-713) on EPC basis from design km 32+050 to km 44+000 [Existing km 35.150 to km 50.050] in the State of Arunachal Pradesh under SARDP-NE

SI No.	Location		Length (m)	Remarks
	From	To		
59	40+829.714	40+831.799	02.08	Radius<300m
60	40+912.144	40+973.748	61.60	Radius<300m
61	41+046.789	41+102.101	55.31	Radius<300m
62	41+207.805	41+227.758	19.95	Radius<300m
63	41+245.537	41+327.436	81.90	Radius<300m
64	41+354.560	41+384.168	29.61	Radius<300m
65	41+577.227	41+586.164	08.94	Radius<300m
66	41+631.448	41+653.506	22.06	Radius<300m
67	41+695.528	41+778.213	82.69	Radius<300m
68	41+865.679	41+932.430	66.75	Radius<300m
69	41+997.108	42+020.458	23.35	Radius<300m
70	42+368.990	42+468.942	99.95	Radius<300m
71	42+528.508	42+637.849	109.34	Radius<300m
72	42+718.057	42+756.507	38.45	Radius<300m
73	42+858.864	42+870.637	11.77	Radius<300m
74	42+918.354	42+926.417	08.06	Radius<300m
75	42+981.684	42+985.785	04.10	Radius<300m
76	43+137.964	43+154.135	16.17	Radius<300m
77	43+278.353	43+311.484	33.13	Radius<300m
78	43+393.308	43+408.617	15.31	Radius<300m
79	43+506.249	43+554.303	48.05	Radius<300m
80	43+616.628	43+781.770	165.14	Radius<300m
81	43+929.644	43+964.166	34.52	Radius<300m

The safety barriers, protective works shall also be provided at the hazardous location/lengths. The minimum quantity of protection work is presented in the following table:

Type of Protection Work with Minimum Quantity		
Protection Work	Unit	Quantity
1.Parapet	Rm	2150
2.Breast wall (PCC)		
a)1.5m height	Rm	2533
b) 2.0m height	Rm	2460
c) 3.0m height	Rm	2790
3. Breast wall sausage type by gabion/ specialized treatment for slide protection	Rm	1000
4. Retaining Wall by PCC	Rm	

a)2m Height	Rm	90
b)3m Height	Rm	140
c)4m Height	Rm	210

13. ROAD LAND BOUNDARY

Road land (ROW) boundary shall be demarcated by putting RCC boundary pillars of size 60cm x 15cm x 15 cm embedded in concrete (as per IRC:25) along the Project Highway at 200 m interval on both sides. All the components used in delineating road land boundary shall be aesthetically pleasing, sturdy and vandal proof. The road land boundary shall be demarcated in consultation with NHIDCL.

14. SPECIAL REQUIREMENT FOR HILL ROADS

[Refer to paragraphs 14.5 and 14.8 of the Manual and provide details where relevant and required.]

15. CHANGE OF SCOPE

The length of Structures and bridges specified hereinabove shall be treated as an approximate assessment. The actual lengths as required on the basis of detailed investigations shall be determined by the Contractor in accordance with the Specifications and Standards. Any variations in the lengths specified in this Schedule-B shall not constitute a Change of Scope, save and except any variations in the length arising out of a Change of Scope expressly undertaken in accordance with the provisions of Article 13.

16. PRE-CONSTRUCTION ACTIVITIES**16.1 Land Acquisition (L.A.)**

Existing Road is single lane road. Proposed ROW is varying from 18m to 35m to accommodate 2-lane configuration as given in clause 3.4 above.

The land is to be acquired by NHIDCL and all related costs shall be borne by NHIDCL.

16.2 Utility Shifting and Removal of Trees

All the utilities are to be got shifted by NHIDCL and the related cost shall be borne by NHIDCL. The permission regarding cutting of trees is to be given by NHIDCL. The cost towards utility shifting, environmental and forest clearances, railway clearances etc. shall be borne by NHIDCL as per the demand note of the concerned government/semi government departments/agencies.

16.3 Clearance to be obtained

NHIDCL shall provide all necessary clearances from all the concerned authorities required for implementing the project at his own cost.

16.4 Encroachment Removal

Encroachments shall be removed by NHIDCL at his own cost and the State Government will provide administrative support to maintain law and order.

16.5 Compensatory Afforestation:

Refer Clause 11 of this Schedule-B.

17. LANDSCAPING

The finished road facility shall exhibit adequate landscaping of aesthetically pleasing view. All the borrow areas shall be properly dressed maintaining drain ability outward from the road facility. The side slopes shall be turfed.

Planting along the highway shall follow a variety of schemes depending upon location requirement as per the IRC and MoRTH guidelines. On island, planting of dust and gaseous substance absorbing shrubs such as aneurism oleander album is recommended. To ensure survival from herbivorous animals, shrubs/plants containing latex shall only be planted. Trees shall be provided with tree guards.

The treatment of highway embankment slopes shall be with vegetative turfing, hydro seeding and hydro mulching as per IRC: 56-2011, depending on the soil types involved. Pitching works along with filter material on slopes shall be as per MoRTH specifications.

18. Fixed Parameters for Design

- (i) The Construction Contractor shall consider the following fixed parameters for design
 - (a) In general Drawings are provided for reference. The Construction Contractor can follow the same as it is with the review of IC. The Construction Contractor can also follow the alternate Design/Drawings with the prior approval of NHIDCL. However the Construction Contractor shall be responsible for all design and Drawings and not be absolved from their liabilities even if they follow the DPR Drawings without any change.
 - (b) The scope of work shall be as specified in **Schedule-B** together with the provision of Project facilities as given in **Schedule-C** and in conformity with the specifications & standards set forth in **Schedule-D**.
 - (c) The finished top level of the road (Formation level) as shown in the P&P (Plan & Profile) drawing shall not be reduced/lowered unless there are some

apparent errors / deficiencies in the FFSR and the Construction Contractor is able to demonstrate sound and durable design by lowering the formation levels with proper geometry as recommended in IRC: SP:73-2015 or other codes as applicable to the National Highways but no portion of Road should be allowed under submergence.

- (d) The numbers and sizes of the culverts as well as waterway as provided in the FFSR shall not be reduced in any case, however the locations can be suitably modified in consultation & approval of the IC if required. Any additional requirement of culverts as per site conditions or increase in size due to hydrologic requirement should be assessed by the Construction Contractor and incorporated accordingly.
- (e) Alternative design for structures i.e. bridges, culverts, and retaining walls etc. can be adopted by the Construction Contractor in accordance with Design Requirements subject to review of the same by Authority Engineer. However, the span length (total clear span/water way) as shown in the drawings shall be considered as minimum requirement and cannot be reduced.
- (f) The length and/or the nos. of various project facilities like Drain, Bus bays, etc. as mentioned in Schedule B and Schedule C shall be minimum, however the locations can be suitably modified in consultation with the Authority Engineer.
- (g) The Geometric Design Standards for the Project/Project Facilities shall be as per IRC: 73 or other codes as applicable to the National Highways. These should be adhered to and minimum requirements should be maintained for the Project Highway. The Construction Contractor may adopt better standards for enhancing the requirements of safety and mobility.
- (h) *Pavement Design*
 - i) The typical cross sections shall be followed as far as possible. Alternate cross sections shall be accepted subjected to approval from the Authority Engineer without altering the pavement widths and subject to the restriction of ROW widths. Pavement of the main carriageway has been designed for a period of 15 years + 24 months of construction period.
 - ii) The composition of Pavement Layers of the paved shoulders shall not be lower than the adjacent flexible pavement of the mainline project highway.
- (i) All the slopes having embankment height more than 1.0m shall be protected by vegetation mulching. Filter material shall be provided below the pitching where ever embankment is exposed to water bodies.
- (j) W- Beam crash barrier shall be provided on sections of the road
 - i) sharp curves having radius less than 300m

- (k) All culverts shall be replaced by box culverts.
- (l) Reinforced Earth/RCC Retaining Wall type shall be liberally provided through areas for high fill/embankment with aesthetically pleasing appearance. These shall be of varying height constructed of several sections, located mainly between main line and where land constraint exists. Design life of reinforcing elements for earth retaining structures shall be 100 years minimum.
- (m) Riprap protection to be provided at the valley side on curves as special safety features.
- (n) All road signs shall be with retro-reflective sheet of high intensity grade conforming to ASTM D-4957-01/ (type VIII and type IX) and as per clause 801 of MoRTH specifications. The retro reflective sheet with engineering grade shall not be used and instead micro-prismatic shall be used.