Schedules

SCHEDULE - A

(See Clauses 2.1 and 8.1)

SITE OF THE PROJECT

1. The Site

1.1 Site of the 2-lane Project Highway shall include the land, buildings, structure and road works as described in Annex-I of this Schedule –A.

1.2 The dates of handing over Right of Way to the Contractor are specified in the Annex-II of this Schedule-A.

1.3 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 Contractor, and such inventory shall form part of the memorandum referred to in Clause 8.2.1 of this Agreement.

1.4 The alignment plans of the Project Highway are specified in Annex-III. In the case of sections where no modification in the existing alignment of the Project Highway is contemplated, the alignment plan has not been provided. Alignment plans have only been given for sections where the existing alignment is proposed to be upgraded. The proposed profile of the Project Highways shall be followed by the contractor with minimum FRL as indicated in the alignment plan. The contractor, however, has to improve/upgrade the Road Profile as indicated in Annexure-III based on site/design requirement.

1.5 The status of the environment clearances obtained or awaited is given in Annex - IV.

Annexure - I

(Schedule-A)

Site

Note: Through suitable drawings and description in words, the land, buildings, structures and road works comprising the Site are specified briefly but precisely in this Annex-I. All the chainages/location referred to in Annex-I to Schedule A are existing chainages.

1. Site

The Site of the Two-Lane with paved shoulder Project Highway comprises the section of National Highway-54 commencing from km 65.000 to 125.0000 i.e. Aizawl-Tuipang Section of NH-54 in the state of Mizoram. The land, carriageway and structures comprising the Site are described below.

2. Land

The Site of the Project Highway comprises the land (sum total of land already in possession and land to be possessed) as described below:

S. No.	Existing Chainage (km)		ROW (m)		Total	Remarks
	From	To	LHS	RHS		
1	70+000	125+272	varying	varying	24	

3. Carriageway

The present carriageway of the Project Highway is Single Lane/ Intermediate Lane. The type of the existing pavement is flexible.

4. Major Bridges

The Site includes the following Major Bridges:

S. No.	Existing Chainage (km)	Type of Structure			No. of Spans with span length (m)	Width (m)
		Foundation	Sub-Structure	Super-Structure		
NIL						

5. Road over-bridges (ROB)/ Road under-bridges (RUB):

The Site includes the following ROB (road over railway line)/RUB (road under railway line):

S.No.	Existing Chainage (km)	Type of Structure		No. of Spans with span length (m)	Width (m)	ROB/ RUB
		Foundation	Super Structure			
NIL						

6. Grade separators

The Site includes the following grade separators:

S. No	Existing Chainage (km)	Type of Structure		No. of Spans with span length (m)	Width (m)
		Foundation	Superstructure		
NIL					

7. Minor Bridges

The Site includes the following minor bridges

S. No.	Existing Chainage (km)	Type of Structure			No. of Spans with span length (c/c of exp gap)	Total Width (m)
		Foundation	Sub-Structure	Super-Structure		
NIL						

8. Railway level crossings

The Site includes the following level crossings:

S. No.	Location (km)	Remarks
NIL		

9. Underpasses (Vehicular, Non Vehicular)

The Site includes the following underpasses:

S. No.	Chainage (km)	Type of Structure	No. of Spans with span length (m)	Width (m)
NIL				

10. Culverts

The Site has the following culverts:

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
1.	69+593	Pipe	Abandoned	
2.	69+916	Pipe	0.65X6.5X0.6	
3.	70+035	Slab	0.8X6.5X1.6	
4.	70+181	Slab	1.0X7.0X0.8	
5.	70+345	Slab	0.7X6.0X0.6	
6.	70+506	Slab	0.7X6.75X0.4	
7.	70+634	Box	0.75X6.25X0.45	
8.	70+782	Slab	0.75X6.50X1.0	
9.	71+008	Slab	0.75X6.50X0.6	
10.	71+213	Slab	1 x y500mm	
11.	71+393	Pipe	0.65X9.75X1.15	
12.	71+682	Slab	1 x p1000mm	
13.	71+807	Pipe	1 x y1000mm	
14.	71+976	Pipe	0.75X7.0X0.9	
15.	72+068	Slab	1 x p900min	
16.	72+173	Pipe	0.75X7.5X1.0	
17.	72+544	Box	1.0X6.5X1.3	
18.	72+661	Slab	0.75X7.5X1.3	
19.	72+733	Box	1.0X6.75x1.0	
20.	72+912	Pipe	1 x cp1000mm	
21.	73+126	Box	Abandoned	
22.	73+332	Pipe	1 x cp1000mm	
23.	73+432	Box	0.8X6.75x0.4	
24.	73+833	Pipe	Abandoned	
25.	74+379	Pipe	Abandoned	
26.	74+789	Box	12X6.75x0.4	
27.	75+319	Box	0.8X6.75x0.4	
28.	75+595	Box	0.8X7.25x1.0	
29.	75+758	Box	1.0X6.5x0.4	
30.	75+929	Box	1.0X6.5x1.0	
31.	76+152	Box	0.8X6.75x1.0	
32.	76+270	Box	0.8X8.75x0.6	
33.	76+438	Box	1.0X6.5x0.8	
34.	76+545	Box	0.9X7.0x0.3	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
35.	76+679	Pipe	1 x cp1100mm	
36.	76+912	Box	0,8X6.6x0.9	
37.	77+092	Pipe	1 x cp1000mm	
38.	77+193	Box	0.8X6.75x1.5	
39.	77+375	Box	0.9X6.50x0.75	
40.	77+748	Box	1.0X6.50x1.0	
41.	77+891	Pipe	1 x cp1000mm	
42.	78+089	Box	0.8X6.75x0.8	
43.	78+304	Box	1.0X7.25x0.8	
44.	78+425	Box	0.8X6.5x0.8	
45.	78+520	Pipe	1 x p1000mm	
46.	78+682	Box	0.8X6.5x1.9	
47.	78+925	Box	1.0X6.5x1.0	
48.	79+050	Pipe	1 x p1000mm	
49.	79+152	Box	0.9X6.5x0.9	
50.	79+320	Pipe	1 x y1000mm	
51.	79+423	Box	0.8X6.5x0.9	
52.	79+646	Box	1.1X6.5x0.4	
53.	79+855	Box	1.1X6.75x0.5	
54.	79+947	Box	1.0X9.5x0.4	
55.	80+136	Box	1.0X10.0x1.5	
56.	80+238	Box	1.0X8.25x0.8	
57.	80+346	Box	1.0X10.0x0.6	
58.	80+946	Box	0.75X9.75x0.9	
59.	81+300	Box	1.15X8.25x1.5	
60.	81+494	Box	1.0X10.0x1.8	
61.	81+618	Box	1.0X10.0x0.4	
62.	81+961	Box	1.0X10.0x1.1	
63.	82+313	Box	0.6X6.75x1.4	
64.	82+465	Box	1.0X10.0x1.1	
65.	82+823	Box	1.0X6.75x1.0	
66.	82+982	Box	0.75X10.0x0.3	
67.	83+613	Box	1.0X10.0x2.0	
68.	83+848	Box	0.8X7.25x1.6	
69.	84+019	Box	0.8X7.25x1.0	
70.	84+177	Pipe	1 x cp700mm	
71.	84+384	Box	0.9X6.4x1.1	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
72.	84+598	Pipe	1 x cp600mm	
73.	84+704	Box	1.0X7.25x0.8	
74.	84+892	Box	1.25x6.75x1.5	
75.	84+975	Pipe	1 x (p500mm	
76.	85+164	Box	0.8x6.75x0.5	
77.	85+344	Box	0.8x7.0x0.5	
78.	85+843	Box	0.9x7.0x0.6	
79.	85+942	Box	0.9x6.75x1.4	
80.	86+116	Box	Abandoned	
81.	86+279	Box	0.9x7.25x0.9	
82.	86+423	Box	0.9x7.25x1.5	
83.	86+508	Box	0.8x7.0x1.8	
84.	86+700	Box	0.8x7.0x1.5	
85.	86+870	Box	Abandoned	
86.	87+090	Box	0.8x7.0x1.5	
87.	87+198	Box	1.0x7.25x1.3	
88.	87+281	Pipe	1 x cp700mm	
89.	87+408	Box	1.0x7.25x0.7	
90.	87+877	Box	0.75x6.75x0.9	
91.	88+556	Box	0.8x6.75x0.8	
92.	88+793	Box	0.8x7.25x2.2	
93.	88+909	Box	0.8x7.25x1.3	
94.	89+086	Box	0.8x7.25x1.4	
95.	89+445	Box	1.0x7.25x1.0	
96.	89+606	Box	1.0x7.0x1.1	
97.	89+863	Box	0.8x7.25x1.2	
98.	90+076	Box	0.8x7.25x0.8	
99.	90+197	Box	0.8x7.0x0.7	
100.	90+438	Box	0.7x6.4x0.7	
101.	91+147	Box	Abandoned	
102.	91+256	Box	1.0x6.475x1.8	
103.	91+396	Pipe	1 x cp1000mm	
104.	91+529	Box	0.6x6.4x1.0	
105.	92+038	Box	0.8x6.25x1.1	
106.	92+393	Pipe	1 x y1000mm	
107.	92+579	Box	0.8x8.25x1.4	
108.	92+953	Pipe	lx cp1000mm	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
109.	93+096	Box	0.5x6.5x1.4	
110.	93+181	Slab	0.7x6.25x0.7	
111.	93+326	Pipe	1 x cp1000mm	
112.	93+500	Causeway	8.5 x 7.0	
113.	93+556	Box	0.8x7.5x0.8	
114.	93+778	Pipe	1 x cp1000mm	
115.	93+939	Box	0.8x7.25x0.6	
116.	94+027	Pipe	1 x (p1000mm	
117.	94+161	Pipe	1 x (p1000mm	
118.	94+350	Box	0.75x7.25x1.4	
119.	94+588	Pipe	1 x cp1000mm	
120.	94+729	Box	0.75x6.75x0.6	
121.	94+863	Pipe	1 x p1000mm	
122.	94+987	Box	1.0x7.0x0.3	
123.	95+098	Pipe	1 x p1000mm	
124.	95+186	Box	0.9x7.0x0.5	
125.	95+330	Box	0.9x7.25x1.2	
126.	95+809	Box	0.8x6.8x1.3	
127.	96+220	Slab	0.8x11.25x1.5	
128.	97+100	Slab	0.80x10.25x1.5	
129.	97+225	Slab	0.80x10.50x1.2	
130.	97+433	Slab	0.75x9.25x1.0	
131.	97+575	Box	0.80x10.0x0.50	
132.	97+638	Slab	1.5x11.0x0.50	
133.	97+850	Slab	0.75x10.0x1.50	
134.	98+119	Slab	1.0x9.50x1.50	
135.	98+360	Box	0.80x10.25x1.30	
136.	98+484	Box	0.80x11.25x150	
137.	98+613	Box	1.0x10.0x0.40	
138.	98+674	Slab	1.0x10.0x1.0	
139.	98+746	Slab	1.0x10.0x0.60	
140.	98+970	Box	1.0x10.0x2.80	
141.	99+078	Box	0.75x10.75x1.50	
142.	99+534	Box	Abandoned	
143.	99+676	Slab	Abandoned	
144.	99+894	Slab	1.3x12.0x1.7	
145.	100+126	Slab	' 0.75x10.5x1.3	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
146.	100+563	Slab	Abandoned	
147.	100+680	Box	0.75 x 10.0x1.1	
148.	100+785	Box	1.0 x 10.2x0.8	
149.	101+081	Box	1.0 x 10.25x1.4	
150.	101+742	Box	0.75x11.25x1.0	
151.	101+959	Pipe	Abandoned	
152.	102+139	Box	Abandoned	
153.	102+278	Box	0.8x7.0x0.5	
154.	102+764	Box	0.8x7.0x0.4	
155.	103+170	Pipe	lx p700mm	
156.	103+391	Pipe	Abandoned	
157.	103+606	Box	035x7.0x1.3	
158.	103+916	Box	1.0x6.75x0.4	
159.	104+121	Pipe	Abandoned	
160.	104+209	Pipe	Abandoned	
161.	104+602	Pipe	1 x p1000mm	
162.	104+733	Box	0.75x6.75x1.40	
163.	104+825	Box	0.75x11.25x0.80	
164.	104+966	Box	Abandoned	
165.	105+070	Box	Abandoned	
166.	105+426	Pipe	Abandoned	
167.	105+676	Box	0.80x10.0x1.5	
168.	106+005	Pipe	1 x p1000mm	
169.	107+062	Pipe	1 x p1000mm	
170.	107+214	Box	1.0x10.25x3.0	
171.	107+360	Pipe	1 x p1500mm	
172.	107+612	Pipe	1 x cp1200mm	
173.	107+818	Pipe	Abandoned	
174.	108+032	Box	0.80x6.25x2.10	
175.	108+405	Box	1.40x10.0x0.90	
176.	108+566	Box	Abandoned	
177.	108+785	Pipe	1 x cp1000mm	
178.	108+917	Pipe	1 x cp700mm	
179.	109+226	Box	Abandoned	
180.	109+291	Box	0.50x7.25x1.10	
181.	109+425	Pipe	1 x cp1200mm	
182.	109+529	Pipe	1 x cp1200mm	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
183.	109+809	Box	Abandoned	
184.	110+193	Pipe	1 x y1000mm	
185.	110+430	Box	1.0x7.25x1.60	
186.	110+566	Pipe	1 x cp1100mm	
187.	110+600	Box	0.75x7.25x1.60	
188.	110+844	Box	0.80x11.0x1.10	
189.	110+919	Pipe	1 xcp1100mm	
190.	111+300	Causeway	15.0x6.0	
191.	111+330	Slab	Abandoned	
192.	111+740	Box	1.0x10.0x0.70	
193.	112+042	Box	1.4x11.0x0.50	
194.	112+330	Box	1.0x10.50x1.30	
195.	112+634	Pipe	1 x cp1400mm	
196.	112+753	Box	0.75x10.50x0.70	
197.	112+890	Pipe	1 x cp1100mm	
198.	113+009	Box	1.0x10.0x0.40	
199.	113+164	Box	3.50x10.0x3.10	
200.	113+215	Box	1.50x7.5x1.10	
201.	113+364	Box	1.00x9.0x1.0	
202.	113+519	Box	1.00x11.0x1.0	
203.	113+678	Box	0.80x10.0x1.30	
204.	113+895	Box	1.25x10.25x0.40	
205.	114+397	Pipe	1 x cp900mm	
206.	114+582	Box	1.0x6.6x1.0	
207.	114+759	Box	0.8x7.75x1.3	
208.	115+059	Pipe	1 x cp1200mm	
209.	115+304	Box	0.6x7.25x1.3	
210.	115+677	Box	0.7x6.4x1.3	
211.	115+820	Box	0.8x6.4x0.6	
212.	115+569	Pipe	1 x cp1000mm	
213.	116+170	Box	0.8x7.0x1.7	
214.	116+273	Box	2.0x7.75x0.4	
215.	116+384	Pipe	1 x cp1400mm	
216.	116+553	Box	1.0x7.25x0.4	
217.	116+675	Box	0.8x7.0x1.2	
218.	116+862	Box	1.0x6.5x1.4	
219.	117+259	Box	0.75x6.75x0.8	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
220.	117+596	Box	0.75x6.25x1.1	
221.	117+725	Box	0.75x7.0x0.7	
222.	117+892	Pipe	1 x cp1000mrn	
223.	115+059	Pipe	1 x cp1200mm	
224.	115+304	Pipe	Abandoned	
225.	115+677	Box	0.80x6.25x2.10	
226.	115+820	Box	1.40x10.0x0.90	
227.	115+569	Box	Abandoned	
228.	116+170	Pipe	1 x cp1000mm	
229.	116+273	Pipe	1 x cp700mm	
230.	116+384	Box	Abandoned	
231.	116+553	Box	0.50x7.25x1.10	
232.	116+675	Pipe	1 x cp1200mm	
233.	116+862	Pipe	1 x cp1200mm	
234.	117+259	Box	Abandoned	
235.	117+596	Pipe	1 x y1000mm	
236.	117+725	Box	1.0x7.25x1.60	
237.	117+892	Pipe	1 x cp1100mm	
238.	117+998	Box	1.0x7.25x0.4	
239.	118+234	Box	1.5x6.75x2.0	
240.	118+330	Box	1.8x7.5x3.5	
241.	118+483	Box	1x9.25x2.2	
242.	118+615	Pipe	1 x p1000mm	
243.	118+912	Pipe	1 x p1200mm	
244.	119+306	Slab	1.0x8.0x2.0	
245.	119+757	Pipe	1 x p1000mm	
246.	119+829	Box	Abandoned	
247.	119+913	Box	1x6x1	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
248.	120+281	Box	0.5x6.25x0.7	
249.	120+397	Box	0.5x5.25x0.3	
250.	120+565	Box	0.6x6.75x1.2	
251.	120+636	Box	0.8x6.75x0.4	
252.	120+831	Pipe	1 x p1000mm	
253.	120+926	Box	0.85x7.0x0.8	
254.	121+152	Box	0.85x6.75x1.0	
255.	121+294	Box	0.75x7x1.1	
256.	121+680	Pipe	1 x p1000mm	
257.	121+766	Box	1.0x7.0x0.3	
258.	121+874	Box	0.75x7.25x1.7	
259.	121+916	Pipe	1 x p1000mm	
260.	122+053	Box	Abandoned	
261.	122+382	Box	1.0x6.0x0.4	
262.	122+574	Pipe	1 x p900mm	
263.	122+635	Pipe	lx p1000mm	
264.	122+777	Pipe	1 x p1000mm	
265.	122+937	Pipe	1 x p1000mm	
266.	123+016	Box	1.0x8.0x0.4	
267.	123+305	Pipe	1 x p1200mm	
268.	123+422	Box	0.75 x 7.75x1.2	
269.	123+577	Pipe	1 x p1300mm	
270.	123+616	Pipe	1 x p1400min	
271.	123+716	Box	Abandoned	
272.	123+852	Box	Abandoned	
273.	124+346	Slab	0.75 x 11x0.6	
274.	124+772	Slab	0.70x10.0x1.2	

11. Bus bays/Bus Shelters

The details of bus shelters on the Site are as follows:

S. No.	Chainage (km)	Length (m)	Left Hand Side	Right Hand Side
NIL				

12. Truck Lay byes

The details of truck lay byes are as follows:

S. No.	Chainage (km)	Length (m)	Left Hand Side	Right Hand Side
NIL				

13. Road side drains

The details of the roadside drains are as follows:

S. No.	Location (Existing)		Type	
	From km	To km	Masonry/cc (Pucca)	Earthen (Kutcha)
1	67+000	80+000	-	Kutcha
2	80+000	82+000	Pucca Rest Kutcha	Pucca Rest Kutcha
3	82+000	98+000	-	Kutcha
4	98+000	100+000	Pucca Rest Kutcha	Pucca Rest Kutcha
5	100+000	106+000	-	Kutcha
6	106+000	108+000	Pucca Rest Kutcha	Pucca Rest Kutcha
7	108+000	109+000	-	Kutcha
8	109+000	112+000	Pucca Rest Kutcha	Pucca Rest Kutcha
9	112+000	125+000	-	Kutcha

14. Major junctions

The details of major junctions are as follows:

S. No	Chainage (km)		At Grade	Side	Remarks
	Existing Chainage	Design Chainage			
1	114+209	107+700	**At Grade**	**RHS**	**Thenzawl**
2	124+145	117+575	**At Grade**	**LHS**	**Khawlailung**

(NH: National Highway, SH: State Highway, MDR: Major District Road.)

15. Minor junctions

The details of the minor junctions (all at grade) are as follows:

Sr. No	Location (km)		Type of Junction	
	Existing Chainage	Design Chainage	T-Junction	Cross Road
1	67+282	62+755	T	

Sr. No	Location (km)		Type of Junction	
	Existing Chainage	Design Chainage	T-Junction	Cross Road
2	82+454	77+315	T	
3	87+596	82+300		Y
4	99+199	93+325	T	
5	104+424	98+410	T	
6	106+177	100+085	T	
7	106+757	100+665	T	
8	107+627	101+540	T	
9	110+026	103+800	T	

16. Bypasses

The details of the existing road sections proposed to be bypassed are as follows:

S. No	Name of bypass (Town)	Chainage (Km)		Length (Km)
		From	To	
NIL				

17. Other Structures : NIL

18. Design Chainages corresponding to Existing References

SI No	Existing Chainage (Km)	Proposed Chainage (Km)
1	70+000	65+334
2	72+000	67+273
3	73+000	68+249
4	75+000	70+216
5	76+000	71+175
6	77+000	72+082
7	78+000	73+025
8	80+000	74+975
9	81+000	75+891
10	82+000	76+872
11	83+000	77+848
12	84+000	78+812
13	85+000	79+804
14	86+000	80+791
15	87+000	81+741
16	88+000	82+691

SI No	Existing Chainage (Km)	Proposed Chainage (Km)
17	90+000	84+586
18	91+000	85+523
19	92+000	86+523
20	93+000	87+456
21	94+000	88+382
22	95+000	89+364
23	96+000	90+333
24	97+000	91+233
25	98+000	92+186
26	99+000	93+130
27	100+000	94+095
28	101+000	95+075
29	104+000	97+986
30	105+000	98+946
31	106+000	99+909
32	108+000	101+990
33	109+000	102+782
34	110+000	103+770
35	111+000	104+741
36	112+000	105+656
37	113+000	106+587
38	114+000	107+494
39	115+000	108+481
40	116+000	109+462
41	117+000	110+448
42	118+000	111+456
43	119+000	112+303
44	120+000	113+246
45	121+000	114+208
46	122+000	119+190
47	123+000	116+150
48	124+000	117+118
49	125+000	117+961
50	125+272	118+263

Annex - II

(Schedule-A)

Dates for providing Right of Way

The dates on which the Authority shall provide Right of Way to the Contractor on different stretches of the Site are stated below:

. No.	Design Chainage (Km)		Length (km)	Width (Meter)	Dates of Providing ROW
	From	To			
1	2	3	4	5	6
	Full Right of Way As per Clause 2 of Annex-I of Schedule A				Minimum 90% on Appointed Date. Remaining within 90 days of Appointed Date.

Annex-III

(Schedule-A)

Alignment Plans

The existing alignment of the Project Highway shall be modified in the following sections as per the alignment plan indicated below:

The alignment plan of the Project Highway is available on CPP Portal i.e. https://eprocure.gov.in/cppp/ and NHIDCL website i.e. https://nhidcl.com/ .

Annex - IV

(Schedule-A)

Environment Clearances

The project highway does not require environment clearance as per MoEF circular dated 22.08.2013.

In addition, application for the stage-I Forest Clearance is applied online on 04.02.2017 and 07.02.2017 which is likely to be received shortly. Money will be deposited with State Forest Department for final approval on receipt of stage-I clearance. Temporary working provision will be ensured before appointed date. All conditions imposed by MoEF/ State Forest Department while issuing the approval in principle (AIP) and final Forest Clearance (FC) to be adhered during construction stage and after construction stage are to be complied with.

The muck dumping sites in forest area stand identified and freezed by forest department to be abided by agency during dumping of muck as stated in Schedule F.

Annex-V
(Schedule-A)

Index Map of Project Highways

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 Project Highway as described in this Schedule-B and in Schedule-C.

2. Rehabilitation and Upgradation

Widening and Upgradation shall include Two-Laning with Paved shoulder 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 with Paved Shoulder

1. WIDENING OF THE EXISTING HIGHWAY

1.1 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/mountainous/steep terrain to the extent land is available. Additional land if required to meet the specifications may be acquired as per the provisions of the Contract Agreement.

1.2 WIDTH OF CARRIAGEWAY

1.2.1 Two-Laning with paved shoulders shall be undertaken. The paved carriageway shall be a minimum of 7m wide in accordance with the typical cross sections of the Project Highway in paragraphs 2.11 and Schedule-I: Drawings. Additional widths for widening at horizontal curve shall be as per the requirements of the design criteria.

1.2.2 Except as otherwise provided in this Agreement, the width of the paved carriageway and cross-sectional features shall conform to paragraph 1.1 above.

The Project Highway passes through the following built up areas. (Proposed carriageway width in these areas shall not be less than existing carriageway width; however, four laning is not required):

Sr. No.	Built up areas	Existing Chainage (km)	
		From	To
1	Chinchip	74+975	76+872
2	Chhiathlang	92+186	94+095
3	New Serchhip	99+909	101+900
4	Serchhip	102+782	105+656
5	Keitum	117+118	117+961

1.2.3 For the bypass planned section as shown in Table below or shown in Drawing, widening and improvement of existing road is not required. However, replacement or rehabilitation of pavement of the existing road is required for the section.

Sl. No.	Village name	Location (km)		Remarks
		From	To	
1	Chhiahtlang	89+000	91+200	• Widening and improvement of existing road is not required. • Replacement or rehabilitation of pavement of the existing road is required. The design for replacement or rehabilitation will be based on the existing condition of the pavement to be replaced.
2	Serchhip	96+200	105+820	

2. GEOMETRIC DESIGN AND GENERAL FEATURES

2.1 General

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

2.2 Design Speed

The design speed shall be Ruling 100 km per hr & Minimum 80 km per hr for Plain and Rolling terrain, and Ruling 60 km per hr & Minimum 40 km per hr for the mountainous and steep terrain, wherever applicable.

2.3 Improvement of the existing road geometry

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:

Deficient Curves:-

S. No	Stretch (km)		Type of Deficiency	Remarks
	From	To		
NIL				

The proposed horizontal and vertical alignment is available in digital format and this is for information and the Authority shall not be held responsible for any implications of the contract. EPC contractor shall carry out his own survey and investigations and due diligence both during bidding and during design and construction.

2.4 Right of Way

The Site of the Project Highway comprises the land as described in Annexure-II of Schedule-A.

2.5 Type of Shoulders

(a) In built-up sections, footpaths/ paved shoulders shall be provided in the stretches mentioned at clause 1.2.1 above.

(b) In open country, paved shoulders shall be provided in accordance with the typical cross sections drawings in the Manual.

(c) Design and specifications of paved shoulders and granular material shall conform to the requirements specified in paragraphs 5.10 and 5.11 of the Manual.

2.6 Lateral and vertical clearances at underpasses

No underpass is proposed in the Project Highway.

2.7 Lateral and vertical clearances at overpasses

No overpass is proposed in the Project Highway.

2.8 Service roads

No service road is proposed in the Project Highway.

2.9 Grade separated structures

No grade separated structure is proposed in the Project Highway.

2.10 Cattle and pedestrian under pass / over pass

No cattle and pedestrian underpass is proposed in the Project Highway.

2.11 Typical cross-sections of the Project Highway

Indicative typical cross sections along with different types of cross-sections required to be developed in different segments of the project highway are indicated in Figure 2.11 shown below.

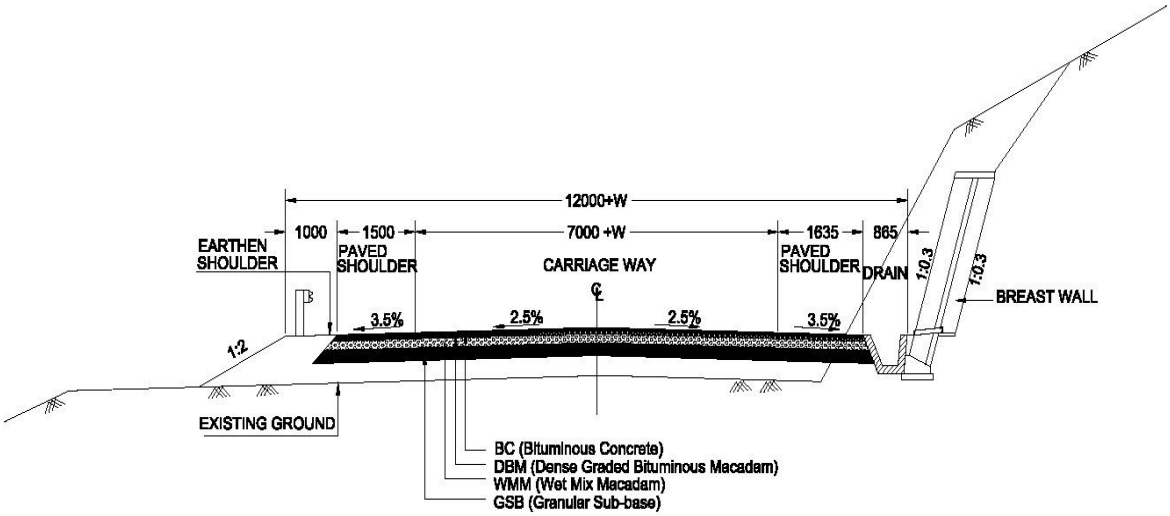


Figure 2.11(1): Typical Cross Section for Widening Primarily to Hill Side

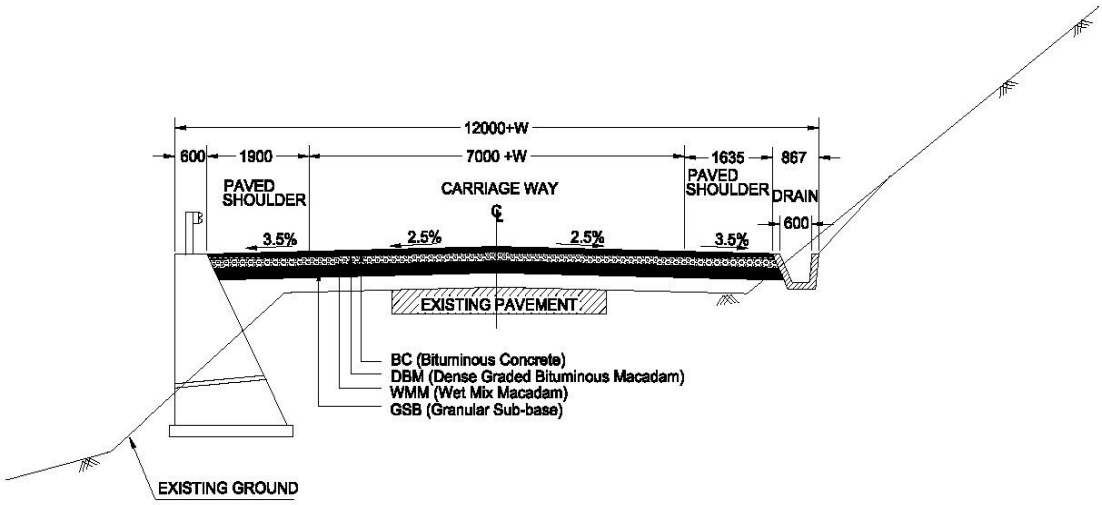


Figure 2.11(2): Typical Cross Section for Widening Primarily to Valley Side

3. INTERSECTIONS AND GRADE SEPARATORS

All intersections and grade separators shall be as per section 3 of the Manual. Existing intersections which are deficient shall be improved to the prescribed standards.

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

a) At-grade intersections (Major Junctions)

S. No.	Location of Intersection	Type of Intersection	Other features	
			LHS	RHS
1	107+700	Y	-	Thenzawl
2	117+575	Y	Khawlailung	-

b) At-grade intersections (Minor Junctions)

S. No.	Location of Intersection	Type of Intersection	Other features	
			LHS	RHS
1	77+315	T	-	Village
2	82+300	Y	Huntha	
3	93+325	T		Chhiathlang Educational Centre
4	98+410	T	Village	-
5	100+085	T	Village	-
6	100+665	T	Army HQ	-
7	101+540	T	Serchhip Watson Division	-

S. No.	Location of Intersection	Type of Intersection	Other features	
			LHS	RHS
8	103+800	T	Chandmari	-

c) Grade separated intersection without ramps

S. No.	Location	Salient features	Minimum length of viaduct to be provided	Road to be carried over/under the structures
NIL				

4. ROAD EMBANKMENT AND CUT SECTION

4.1 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.

4.2 Raising of the existing road

The existing road shall be raised at the required locations as per proposed plan and profile or further raised to meet the requisite specifications.

4.3 All of surplus cutting soils shall be transported and be disposed to the Spoil Banks in accordance with the Clause 3.1 of Schedule D (Specification and Standard for the Construction).

5. PAVEMENT DESIGN

5.1 Pavement design shall be carried out in accordance with Section 5 of the Manual.

5.2 Type of pavement

The contractor is to adopt flexible pavement for the project highway as per manual and technical specifications.

5.3 Design Requirements

Pavement design shall be as per section 5 of the Manual and technical specifications.

5.3.1 **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.

5.3.2 **Design Traffic**

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

5.4 Reconstruction of stretches

Reconstruction of stretches for matching the proposed plan & profile or meeting the technical specifications and standards shall be taken up as per actual requirements.

6. ROADSIDE DRAINAGE

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

7. DESIGN OF STRUCTURES

7.1 General

7.1.1 All bridges, culverts and 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.

7.1.2 Width of the carriageway of new bridges and structures shall be as per the manual and technical specifications.

7.1.3 The structures shall be provided with footpaths, if required as per the provisions of the manual and technical specifications.

7.1.4 All bridges shall be high-level bridges.

7.1.5 The structures shall be designed to carry utility services as per the requirement of site.

7.1.6 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.

7.2 Culverts

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

7.2.2 ***Reconstruction of existing culverts***:

The existing culverts at the following locations shall be re-constructed as new culverts. These are guidelines for minimum provisions; however, the Contractor has to design as per requirement of road in accordance with manual.

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
1.	65+288	1/1.2 dia.	Pipe
2.	65+370	1/1.2 dia.	Pipe
3.	65+492	1/1.2 dia.	Pipe
4.	65+661	1/1.2 dia.	Pipe
5.	65+815	1/1.2 dia.	Pipe
6.	65+944	1/1.2 dia.	Pipe
7.	66+082	1/1.2 dia.	Pipe
8.	66+307	1/1.2 dia.	Pipe
9.	66+519	1/1.2 dia.	Pipe
10.	66+681	1/1.2 dia.	Pipe
11.	66+914	1/1.2 dia.	Pipe
12.	67+096	1/1.2 dia.	Pipe
13.	67+254	1/1.2 dia.	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
14.	67+347	1/1.2 dia.	Pipe
15.	67+463	1/1.2 dia.	Pipe
16.	67+819	1/1.2 dia.	Pipe
17.	67+927	1/1.2 dia.	Pipe
18.	68+000	1/1.2 dia.	Pipe
19.	68+177	1/1.2 dia.	Pipe
20.	68+372	1/1.2 dia.	Pipe
21.	68+576	1/1.2 dia.	Pipe
22.	68+673	1/1.2 dia.	Pipe
23.	69+076	1/1.2 dia.	Pipe
24.	69+617	1/1.2 dia.	Pipe
25.	70+019	1/1.2 dia.	Pipe
26.	70+535	1/1.2 dia.	Pipe
27.	70+798	1/1.2 dia.	Pipe
28.	70+947	1/1.2 dia.	Pipe
29.	71+120	1/1.2 dia.	Pipe
30.	71+304	1/1.2 dia.	Pipe
31.	71+423	1/1.2 dia.	Pipe
32.	71+591	1/1.2 dia.	Pipe
33.	71+676	1/1.2 dia.	Pipe
34.	71+808	1/1.2 dia.	Pipe
35.	72+012	1/1.2 dia.	Pipe
36.	72+174	1/1.2 dia.	Pipe
37.	72+278	1/1.2 dia.	Pipe
38.	72+448	1/1.2 dia.	Pipe
39.	72+847	1/1.2 dia.	Pipe
40.	72+946	1/1.2 dia.	Pipe
41.	73+113	1/1.2 dia.	Pipe
42.	73+321	1/1.2 dia.	Pipe
43.	73+441	1/1.2 dia.	Pipe
44.	73+535	1/12 dia.	Pipe
45.	73+693	1/1.2 dia.	Pipe
46.	73+931	1/1.2 dia.	Pipe
47.	74+058	1/1.2 dia.	Pipe
48.	74+161	1/1.2 dia.	Pipe
49.	74+330	1/1.2 dia.	Pipe
50.	74+434	1/t2 dia.	Pipe
51.	74+653	1/1.2 dia.	Pipe
52.	74+863	1/1.2 dia.	Pipe
53.	74+952	1/1.2 dia.	Pipe
54.	75+113	1/1.2 dia.	Pipe
55.	75+218	1/1.2 dia.	Pipe
56.	75+322	1/1.2 dia.	Pipe
57.	75+859	1/1.2 dia.	Pipe
58.	76+192	1/1.2 dia.	Pipe
59.	76+380	1/1.2 dia.	Pipe
60.	76+503	1/1.2 dia.	Pipe
61.	76+842	1/1.2 dia.	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
62.	77+181	1/1.2 dia.	Pipe
63.	77+326	1/1.2 dia.	Pipe
64.	77+679	1/1.2 dia.	Pipe
65.	77+827	1/1.2 dia.	Pipe
66.	78+438	1/1.2 dia.	Pipe
67.	78+675	1/1.2 dia.	Pipe
68.	78+834	1/1.2 dia.	Pipe
69.	78+993	1/1.2 dia.	Pipe
70.	79+193	1/1.2 dia.	Pipe
71.	79+408	1/1.2 dia.	Pipe
72.	79+518	1/1.2 dia.	Pipe
73.	79+708	1/1.2 dia.	Pipe
74.	79+791	1/1.2 dia.	Pipe
75.	79+966	1/1.2 dia.	Pipe
76.	80+120	1/1.2 dia.	Pipe
77.	80+643	1/1.2 dia.	Pipe
78.	80+743	1/1.2 dia.	Pipe
79.	80+909	1/1.2 dia.	Pipe
80.	81+060	1/1.2 dia.	Pipe
81.	81+204	1/1.2 dia.	Pipe
82.	81+290	1/1.2 dia.	Pipe
83.	81+480	1/1.2 dia.	Pipe
84.	81+645	1/1.2 dia.	pipe
85.	81+807	1/1.2 dia.	Pipe
86.	81+915	1/1.2 dia.	Pipe
87.	81+996	1/1.2 dia.	Pipe
88.	82+122	1/1.2 dia.	Pipe
89.	82+573	1/1.2 dia.	Pipe
90.	83+236	1/1.2 dia.	Pipe
91.	83+470	1/1.2 dia.	Pipe
92.	83+580	1/1.2 dia.	Pipe
93.	83+750	1/1.2 dia.	Pipe
94.	84+103	1/1.2 dia.	Pipe
95.	84+254	1/1.2 dia.	Pipe
96.	84+488	1/1.2 dia.	Pipe
97.	84+660	1/1.2 dia.	Pipe
98.	84+781	1/1.2 dia.	Pipe
99.	85+020	1/1.2 dia.	Pipe
100.	85+721	1/1.2 dia.	Pipe
101.	85+831	1/1.2 dia.	Pipe
102.	85+944	1/1.2 dia.	Pipe
103.	86+077	1/1.2 dia.	Pipe
104.	86+560	1/1.2 dia.	Pipe
105.	86+864	1/1.2 dia.	Pipe
106.	87+053	1/1.2 dia.	Pipe
107.	87+416	1/1.2 dia.	Pipe
108.	87+544	1/1.2 dia.	Pipe
109.	87+629	1/1.2 dia.	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
110.	87+758	1/1.2 dia.	Pipe
111.	87+921	1/1.2 dia.	Pipe
112.	87+974	1/1.2 dia.	Pipe
113.	88+190	1/1.2 dia.	Pipe
114.	88+339	1/1.2 dia.	Pipe
115.	88+408	1/1.2 dia.	Pipe
116.	88+532	1/1.2 dia.	Pipe
117.	88+724	1/1.2 dia.	Pipe
118.	88+963	1/1.2 dia.	Pipe
119.	89+107	1/1.2 dia.	Pipe
120.	89+237	1/1.2 dia.	Pipe
121.	89+359	1/1.2 dia.	Pipe
122.	89+466	1/1.2 dia.	Pipe
123.	89+562	1/1.2 dia.	Pipe
124.	89+705	1/1.2 dia.	Pipe
125.	90+170	1/1.2 dia.	Pipe
126.	90+538	1/12 dia.	Pipe
127.	91+319	1/1.2 dia.	Pipe
128.	91+440	1/1.2 dia.	Pipe
129.	91+650	1/1.2 dia.	Pipe
130.	91+781	1/1.2 dia.	Pipe
131.	91+845	1/1.2 dia.	Pipe
132.	92+052	1/1.2 dia.	Pipe
133.	92+297	1/1.2 dia.	Pipe
134.	92+541	1/1.2 dia.	Pipe
135.	92+644	1/1.2 dia.	Pipe
136.	92+770	1/1.2 dia.	Pipe
137.	92+835	1/1.2 dia.	Pipe
138.	92+906	1/1.2 dia.	Pipe
139.	93+120	1/1.2 dia.	Pipe
140.	93+206	1/1.2 dia.	Pipe
141.	93+669	1/1.2 dia.	Pipe
142.	93+799	1/1.2 dia.	Pipe
143.	94+019	1/1.2 dia.	Pipe
144.	94+224	1/1.2 dia.	Pipe
145.	94+671	1/1.2 dia.	Pipe
146.	94+791	1/1.2 dia.	Pipe
147.	94+894	1/1.2 dia.	Pipe
148.	95+156	1/1.2 dia.	Pipe
149.	95+813	1/1.2 dia.	Pipe
150.	96+008	1/12 dia.	Pipe
151.	96+191	1/1.2 dia.	Pipe
152.	96+329	1/1.2 dia.	Pipe
153.	96+808	1/1.2 dia.	Pipe
154.	97+440	1/1.2 dia.	Pipe
155.	97+663	1/1.2 dia.	Pipe
156.	97+963	1/1.2 dia.	Pipe
157.	98+109	1/1.2 dia.	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
158.	98+198	1/1.2 dia.	Pipe
159.	98+590	1/1.2 dia.	Pipe
160.	98+711	1/1.2 dia.	Pipe
161.	98+799	1/1.2 dia.	Pipe
162.	98+938	1/1.2 dia.	Pipe
163.	99+011	1/1.2 dia.	Pipe
164.	99+361	1/1.2 dia.	Pipe
165.	99+612	1/1.2 dia.	Pipe
166.	99+916	1/1.2 dia.	Pipe
167.	100+976	1/1.2 dia.	Pipe
168.	101+132	1/1.2 dia.	Pipe
169.	101+278	1/1.2 dia.	Pipe
170.	101+514	1/1.2 dia.	Pipe
171.	101+721	1/1.2 dia.	Pipe
172.	101+931	1/1.2 dia.	Pipe
173.	102+300	1/1.2 dia.	Pipe
174.	102+459	1/1.2 dia.	Pipe
175.	102+653	1/1.2 dia.	Pipe
176.	102+752	1/1.2 dia.	Pipe
177.	103+006	1/1.2 dia.	Pipe
178.	103+068	1/1.2 dia.	Pipe
179.	103+203	1/1.2 dia.	Pipe
180.	103+306	1/1.2 dia.	Pipe
181.	103+589	1/1.2 dia.	Pipe
182.	103+963	1/1.2 dia.	Pipe
183.	104+209	1/1.2 dia.	Pipe
184.	104+340	1/1.2 dia.	Pipe
185.	104+379	1/1.2 dia.	Pipe
186.	104+624	1/1.2 dia.	Pipe
187.	104+696	1/1.2 dia.	Pipe
188.	104+996	2.0 x 2.0	Box
189.	105+037	1/1.2 dia.	Pipe
190.	105+428	1/1.2 dia.	Pipe
191.	105+703	1/1.2 dia.	Pipe
192.	105+983	1/1.2 dia.	Pipe
193.	106+272	1/1.2 dia.	Pipe
194.	106+360	1/1.2 dia.	Pipe
195.	106+496	1/1.2 dia.	Pipe
196.	106+595	1/1.2 dia.	Pipe
197.	106+754	2.0 x 2.0	Box
198.	106+809	1/1.2 dia.	Pipe
199.	106+960	1/1.2 dia.	Pipe
200.	107+087	1/1.2 dia.	Pipe
201.	107+238	1/1.2 dia.	Pipe
202.	107+435	1/1.2 dia.	Pipe
203.	107+890	1/1.2 dia.	Pipe
204.	108+076	1/1.2 dia.	Pipe
205.	108+249	1/1.2 dia.	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
206.	108+540	1/1.2 dia.	Pipe
207.	108+784	1/1.2 dia.	Pipe
208.	109+157	1/1.2 dia.	Pipe
209.	109+297	1/1.2 dia.	Pipe
210.	109+444	1/1.2 dia.	Pipe
211.	109+632	1/1.2 dia.	Pipe
212.	109+736	1/1.2 dia.	Pipe
213.	109+847	1/1.2 dia.	Pipe
214.	110+013	1/1.2 dia.	Pipe
215.	110+136	1/1.2 dia.	Pipe
216.	110+323	1/1.2 dia.	Pipe
217.	110+706	1/1.2 dia.	Pipe
218.	111+036	1/1.2 dia.	Pipe
219.	111+165	1/1.2 dia.	Pipe
220.	111+323	1/1.2 dia.	Pipe
221.	111+422	1/1.2 dia.	Pipe
222.	111+674	1/1.2 dia.	Pipe
223.	111+773	1/1.2 dia.	Pipe
224.	111+909	1/1.2 dia.	Pipe
225.	112+036	1/1.2 dia.	Pipe
226.	112+290	1/1.2 dia.	Pipe
227.	112+605	1/1.2 dia.	Pipe
228.	113+038	1/1.2 dia.	Pipe
229.	113+104	1/1.2 dia.	Pipe
230.	113+189	1/1.2 dia.	Pipe
231.	113+521	1/1.2 dia.	Pipe
232.	113+640	1/1.2 dia.	Pipe
233.	113+806	1/1.2 dia.	Pipe
234.	113+874	1/1.2 dia.	Pipe
235.	114+063	1/1.2 dia.	Pipe
236.	114+157	1/1.2 dia.	Pipe
237.	114+361	1/1.2 dia.	Pipe
238.	114+503	1/1.2 dia.	Pipe
239.	114+825	1/1.2 dia.	Pipe
240.	114+889	1/1.2 dia.	Pipe
241.	114+971	1/1.2 dia.	Pipe
242.	115+081	1/1.2 dia.	Pipe
243.	115+124	1/1.2 dia.	Pipe
244.	115+243	1/1.2 dia.	Pipe
245.	115+573	1/1.2 dia.	Pipe
246.	115+768	1/1.2 dia.	Pipe
247.	115+826	1/1.2 dia.	Pipe
248.	115+950	1/1.2 dia.	Pipe
249.	116+110	1/1.2 dia.	Pipe
250.	116+166	1/1.2 dia.	Pipe
251.	116+455	1/1.2 dia.	Pipe
252.	116+569	1/1.2 dia.	Pipe
253.	116+716	1/1.2 dia.	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
254.	116+754	1/1.2 dia.	Pipe
255.	116+850	1/1.2 dia.	Pipe
256.	116+987	1/1.2 dia.	Pipe
257.	117+463	1/1.2 dia.	Pipe
258.	117+885	1/1.2 dia.	Pipe

*Road level may be suitably raised to meet the requirement of site as per the standards and specifications.

7.2.3 ***Widening of Existing Culverts***

All existing culverts, which are not to be reconstructed, shall be widened up to the roadway width of the Project Highway & as per the typical cross section given in section 7 of the Manual. Repairs and strengthening of existing structures where required shall be carried out.

Sl. No	Culvert Location	Span opening (m)	Remarks
NIL			

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

Sl. No.	Chainage (km)	Type / Opening of Culvert (m)	Remarks
1	65+170	Pipe culvert dia 1.2m	Re-construction
2	65+370	Pipe culvert dia 1.2m	Re-construction
3	65+520	Pipe culvert dia 1.2m	Re-construction
4	65+640	Pipe culvert dia 1.2m	New
5	65+805	Pipe culvert dia 1.2m	Re-construction
6	65+910	Pipe culvert dia 1.2m	Re-construction
7	66+075	Pipe culvert dia 1.2m	Re-construction
8	66+130	Pipe culvert dia 1.2m	Re-construction
9	66+260	Pipe culvert dia 1.2m	Re-construction
10	66+435	Pipe culvert dia 1.2m	New
11	66+560	Pipe culvert dia 1.2m	Re-construction
12	66+800	Pipe culvert dia 1.2m	Re-construction
13	66+980	Pipe culvert dia 1.2m	Re-construction
14	67+160	Pipe culvert dia 1.2m	Re-construction
15	67+365	Pipe culvert dia 1.2m	Re-construction
16	67+460	Pipe culvert dia 1.2m	Re-construction
17	67+620	Pipe culvert dia 1.2m	New
18	67+880	Pipe culvert dia 1.2m	Re-construction
19	68+120	Pipe culvert dia 1.2m	New
20	68+290	Pipe culvert dia 1.2m	Re-construction
21	68+500	Pipe culvert dia 1.2m	New
22	68+810	Pipe culvert dia 1.2m	Re-construction
23	69+030	Pipe culvert dia 1.2m	New
24	69+170	Pipe culvert dia 1.2m	New
25	69+320	Pipe culvert dia 1.2m	Re-construction
26	69+580	Pipe culvert dia 1.2m	Re-construction
27	69+730	Pipe culvert dia 1.2m	Re-construction

Sl. No.	Chainage (km)	Type / Opening of Culvert (m)	Remarks
28	69+900	Pipe culvert dia 1.2m	Re-construction
29	70+075	Pipe culvert dia 1.2m	Re-construction
30	70+180	Pipe culvert dia 1.2m	Re-construction
31	70+330	Pipe culvert dia 1.2m	Re-construction
32	70+570	Pipe culvert dia 1.2m	Re-construction
33	70+780	Pipe culvert dia 1.2m	Re-construction
34	70+910	Pipe culvert dia 1.2m	Re-construction
35	71+010	Pipe culvert dia 1.2m	Re-construction
36	71+210	Pipe culvert dia 1.2m	Re-construction
37	71+400	Pipe culvert dia 1.2m	New
38	71+480	Pipe culvert dia 1.2m	Re-construction
39	71+690	Pipe culvert dia 1.2m	Re-construction
40	71+830	Pipe culvert dia 1.2m	Re-construction
41	72+030	Pipe culvert dia 1.2m	Re-construction
42	72+150	Pipe culvert dia 1.2m	Re-construction
43	72+240	Pipe culvert dia 1.2m	Re-construction
44	72+390	Pipe culvert dia 1.2m	Re-construction
45	72+610	Pipe culvert dia 1.2m	Re-construction
46	72+700	Pipe culvert dia 1.2m	Re-construction
47	72+770	Pipe culvert dia 1.2m	Re-construction
48	72+880	Pipe culvert dia 1.2m	Re-construction
49	73+000	Pipe culvert dia 1.2m	Re-construction
50	73+170	Pipe culvert dia 1.2m	New
51	73+380	Pipe culvert dia 1.2m	Re-construction
52	73+530	Pipe culvert dia 1.2m	New
53	73+630	Pipe culvert dia 1.2m	Re-construction
54	73+730	Pipe culvert dia 1.2m	Re-construction
55	73+830	Pipe culvert dia 1.2m	Re-construction
56	74+120	Pipe culvert dia 1.2m	New
57	74+240	Pipe culvert dia 1.2m	Re-construction
58	74+400	Pipe culvert dia 1.2m	New
59	74+590	Pipe culvert dia 1.2m	Re-construction
60	74+770	Pipe culvert dia 1.2m	Re-construction
61	74+910	Pipe culvert dia 1.2m	Re-construction
62	75+210	Pipe culvert dia 1.2m	Re-construction
63	75+390	Pipe culvert dia 1.2m	New
64	75+550	Pipe culvert dia 1.2m	Re-construction
65	75+710	Pipe culvert dia 1.2m	Re-construction
66	75+920	Pipe culvert dia 1.2m	New
67	76+040	Pipe culvert dia 1.2m	Re-construction
68	76+210	Pipe culvert dia 1.2m	Re-construction
69	76+350	Pipe culvert dia 1.2m	New
70	76+610	Pipe culvert dia 1.2m	New
71	76+830	Pipe culvert dia 1.2m	Re-construction
72	77+020	Pipe culvert dia 1.2m	Re-construction
73	77+180	Pipe culvert dia 1.2m	Re-construction
74	77+330	Pipe culvert dia 1.2m	Re-construction
75	77+530	Pipe culvert dia 1.2m	Re-construction
76	77+740	Pipe culvert dia 1.2m	Re-construction

Sl. No.	Chainage (km)	Type / Opening of Culvert (m)	Remarks
77	77+860	Pipe culvert dia 1.2m	Re-construction
78	78+020	Pipe culvert dia 1.2m	Re-construction
79	78+100	Pipe culvert dia 1.2m	Re-construction
80	78+270	Pipe culvert dia 1.2m	Re-construction
81	78+450	Pipe culvert dia 1.2m	Re-construction
82	78+700	Pipe culvert dia 1.2m	New
83	78+940	Pipe culvert dia 1.2m	Re-construction
84	79+040	Pipe culvert dia 1.2m	Re-construction
85	79+200	Pipe culvert dia 1.2m	Re-construction
86	79+350	Pipe culvert dia 1.2m	Re-construction
87	79+490	Pipe culvert dia 1.2m	Re-construction
88	79+575	Pipe culvert dia 1.2m	Re-construction
89	79+760	Pipe culvert dia 1.2m	Re-construction
90	79+930	Pipe culvert dia 1.2m	Re-construction
91	80+070	Pipe culvert dia 1.2m	Re-construction
92	80+190	Pipe culvert dia 1.2m	Re-construction
93	80+260	Pipe culvert dia 1.2m	Re-construction
94	80+390	Pipe culvert dia 1.2m	Re-construction
95	80+520	Pipe Culvert dia 1.2m	New
96	80+660	Pipe culvert dia 1.2m	New
97	80+880	Pipe culvert dia 1.2m	Re-construction
98	81+070	Pipe culvert dia 1.2m	New
99	81+255	Pipe culvert dia 1.2m	New
100	81+480	Pipe culvert dia 1.2m	Re-construction
101	81+710	Pipe culvert dia 1.2m	Re-construction
102	81+810	Pipe culvert dia 1.2m	Re-construction
103	81+970	Pipe culvert dia 1.2m	Re-construction
104	82+315	Pipe culvert dia 1.2m	Re-construction
105	82+470	Pipe culvert dia 1.2m	Re-construction
106	82+690	Pipe culvert dia 1.2m	Re-construction
107	82+840	Pipe culvert dia 1.2m	Re-construction
108	82+990	Pipe culvert dia 1.2m	Re-construction
109	83+170	Pipe culvert dia 1.2m	Re-construction
110	83+430	Pipe culvert dia 1.2m	New
111	83+680	Pipe culvert dia 1.2m	New
112	83+900	Pipe culvert dia 1.2m	Re-construction
113	84+110	Pipe culvert dia 1.2m	Re-construction
114	84+440	Pipe culvert dia 1.2m	New
115	84+540	Pipe culvert dia 1.2m	New
116	84+810	Pipe culvert dia 1.2m	New
117	85+000	Pipe culvert dia 1.2m	Re-construction
118	85+190	Pipe culvert dia 1.2m	Re-construction
119	85+330	Pipe culvert dia 1.2m	New
120	85+540	Pipe culvert dia 1.2m	Re-construction
121	85+650	Pipe culvert dia 1.2m	Re-construction
122	85+730	Pipe culvert dia 1.2m	Re-construction
123	85+890	Pipe culvert dia 1.2m	Re-construction
124	86+040	Pipe culvert dia 1.2m	Re-construction
125	86+080	Pipe culvert dia 1.2m	Re-construction
126	86+280	Pipe culvert dia 1.2m	Re-construction

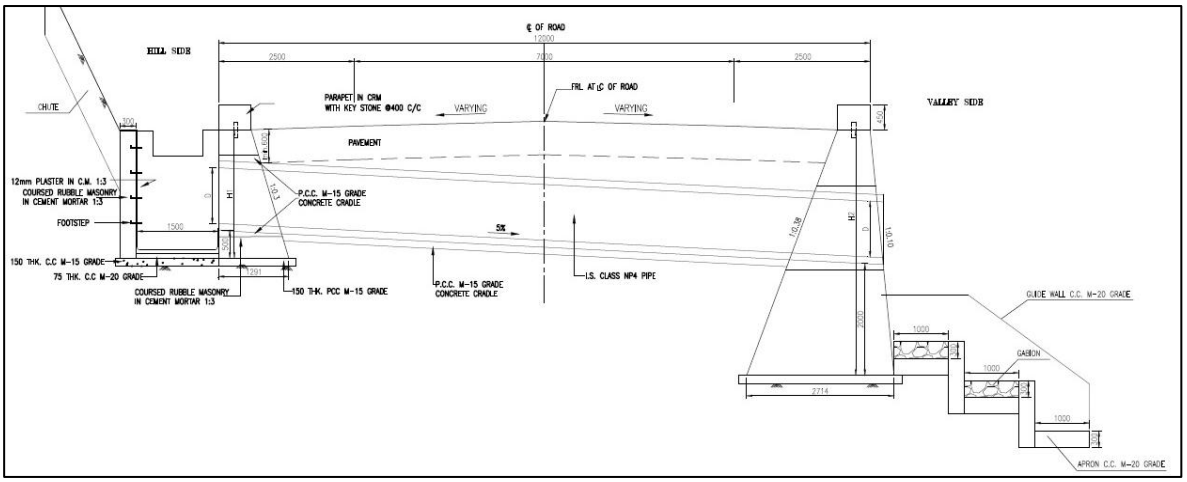
Sl. No.	Chainage (km)	Type / Opening of Culvert (m)	Remarks
127	86+430	Pipe culvert dia 1.2m	Re-construction
128	86+490	Pipe culvert dia 1.2m	Re-construction
129	86+610	Pipe culvert dia 1.2m	Re-construction
130	86+780	Pipe culvert dia 1.2m	Re-construction
131	86+980	Pipe culvert dia 1.2m	Re-construction
132	87+090	Pipe culvert dia 1.2m	Re-construction
133	87+210	Pipe culvert dia 1.2m	Re-construction
134	87+320	Pipe culvert dia 1.2m	Re-construction
135	87+460	Pipe culvert dia 1.2m	Re-construction
136	87+550	Pipe culvert dia 1.2m	Re-construction
137	87+660	Pipe culvert dia 1.2m	Re-construction
138	87+890	Pipe culvert dia 1.2m	New
139	88+130	Pipe culvert dia 1.2m	Re-construction
140	88+440	Pipe culvert dia 1.2m	Re-construction
141	88+690	Pipe culvert dia 1.2m	New
142	88+940	Pipe culvert dia 1.2m	New
Chhiahtlang Bypass Planned Section			
143	91+300	Pipe culvert dia 1.2m	New
144	91+560	Pipe culvert dia 1.2m	Re-construction
145	91+680	Pipe culvert dia 1.2m	Re-construction
146	91+870	Pipe culvert dia 1.2m	Re-construction
147	92+070	Pipe culvert dia 1.2m	New
148	92+300	Pipe culvert dia 1.2m	New
149	92+520	Pipe culvert dia 1.2m	Re-construction
150	92+640	Pipe culvert dia 1.2m	Re-construction
151	92+780	Pipe culvert dia 1.2m	Re-construction
152	93+020	Pipe culvert dia 1.2m	Re-construction
153	93+320	Pipe culvert dia 1.2m	New
154	93+480	Pipe culvert dia 1.2m	New
155	93+670	Pipe culvert dia 1.2m	Re-construction
156	93+840	Pipe culvert dia 1.2m	Re-construction
157	94+030	Pipe culvert dia 1.2m	Re-construction
158	94+160	Pipe culvert dia 1.2m	Re-construction
159	94+280	Pipe culvert dia 1.2m	New
160	94+620	Pipe culvert dia 1.2m	Re-construction
161	94+810	Pipe culvert dia 1.2m	New
162	95+040	Pipe culvert dia 1.2m	Re-construction
163	95+250	Pipe culvert dia 1.2m	Re-construction
164	95+440	Pipe culvert dia 1.2m	Re-construction
165	95+620	Pipe culvert dia 1.2m	New
166	95+760	Pipe culvert dia 1.2m	Re-construction
167	95+900	Pipe culvert dia 1.2m	Re-construction
168	95+990	Pipe culvert dia 1.2m	Re-construction
169	96+150	Pipe culvert dia 1.2m	New
Serchhip Bypass Planned Section			
170	106+040	Pipe culvert dia 1.2m	Re-construction
171	106+210	Pipe culvert dia 1.2m	Re-construction
172	106+380	Pipe culvert dia 1.2m	Re-construction
173	106+660	Pipe culvert dia 1.2m	Re-construction

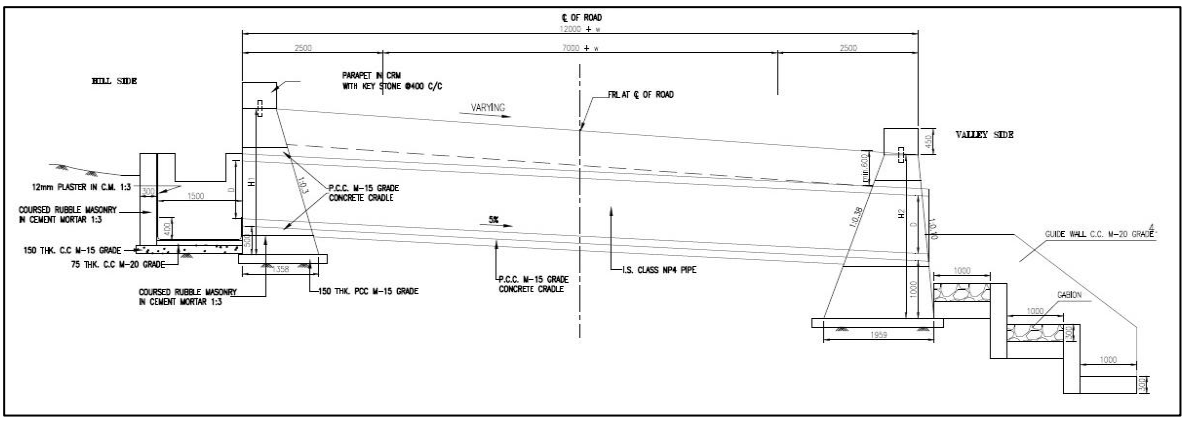
Sl. No.	Chainage (km)	Type / Opening of Culvert (m)	Remarks
174	106+920	Pipe culvert dia 1.2m	Re-construction
175	107+140	Pipe culvert dia 1.2m	New
176	107+290	Pipe culvert dia 1.2m	Re-construction
177	107+420	Pipe culvert dia 1.2m	Re-construction
178	107+570	Pipe culvert dia 1.2m	Re-construction
179	107+750	Pipe culvert dia 1.2m	Re-construction
180	107+850	Pipe culvert dia 1.2m	Re-construction
181	107+960	Pipe culvert dia 1.2m	Re-construction
182	108+130	Pipe culvert dia 1.2m	Re-construction
183	108+250	Pipe culvert dia 1.2m	Re-construction
184	108+620	Pipe culvert dia 1.2m	New
185	108+800	Pipe culvert dia 1.2m	Re-construction
186	109+150	Pipe culvert dia 1.2m	Re-construction
187	109+270	Pipe culvert dia 1.2m	Re-construction
188	109+420	Pipe culvert dia 1.2m	Re-construction
189	109+510	Pipe culvert dia 1.2m	Re-construction
190	109+740	Pipe culvert dia 1.2m	Re-construction
191	109+840	Pipe culvert dia 1.2m	Re-construction
192	109+970	Pipe culvert dia 1.2m	Re-construction
193	110+100	Pipe culvert dia 1.2m	Re-construction
194	110+220	Pipe culvert dia 1.2m	Re-construction
195	110+360	Pipe culvert dia 1.2m	Re-construction
196	110+670	Pipe culvert dia 1.2m	Re-construction
197	110+800	Pipe culvert dia 1.2m	Re-construction
198	110+940	Pipe culvert dia 1.2m	New
199	111+090	Pipe culvert dia 1.2m	Re-construction
200	111+160	Pipe culvert dia 1.2m	Re-construction
201	111+250	Pipe culvert dia 1.2m	Re-construction
202	111+350	Pipe culvert dia 1.2m	New
203	111+580	Pipe culvert dia 1.2m	Re-construction
204	111+680	Pipe culvert dia 1.2m	Re-construction
205	111+840	Pipe culvert dia 1.2m	Re-construction
206	111+920	Pipe culvert dia 1.2m	Re-construction
207	112+080	Pipe culvert dia 1.2m	Re-construction
208	112+190	Pipe culvert dia 1.2m	Re-construction
209	112+370	Pipe culvert dia 1.2m	Re-construction
210	112+530	Pipe culvert dia 1.2m	Re-construction
211	112+680	Pipe culvert dia 1.2m	New
212	112+820	Pipe culvert dia 1.2m	Re-construction
213	112+900	Pipe culvert dia 1.2m	Re-construction
214	112+980	Pipe culvert dia 1.2m	Re-construction
215	113+110	Pipe culvert dia 1.2m	Re-construction
216	113+230	Pipe culvert dia 1.2m	Re-construction
217	113+300	Pipe culvert dia 1.2m	New
218	113+550	Pipe culvert dia 1.2m	Re-construction
219	113+680	Pipe culvert dia 1.2m	Re-construction
220	113+810	Pipe culvert dia 1.2m	Re-construction
221	113+950	Pipe culvert dia 1.2m	Re-construction
222	114+090	Pipe culvert dia 1.2m	Re-construction

Sl. No.	Chainage (km)	Type / Opening of Culvert (m)	Remarks
223	114+140	Pipe culvert dia 1.2m	Re-construction
224	114+420	Pipe culvert dia 1.2m	Re-construction
225	114+550	Pipe culvert dia 1.2m	Re-construction
226	114+660	Pipe culvert dia 1.2m	Re-construction
227	114+710	Pipe culvert dia 1.2m	Re-construction
228	114+800	Pipe culvert dia 1.2m	Re-construction
229	114+940	Pipe culvert dia 1.2m	Re-construction
230	115+200	Pipe culvert dia 1.2m	New
231	115+420	Pipe culvert dia 1.2m	Re-construction
232	115+680	Pipe culvert dia 1.2m	New
233	115+850	Pipe culvert dia 1.2m	Re-construction

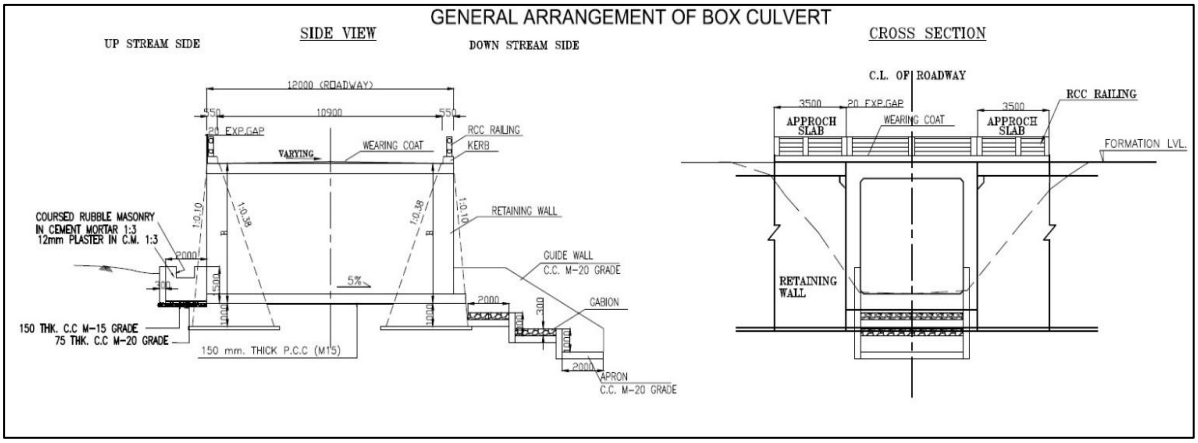
Note:

1. The indication of Remarks either of New or Re-construction is reference only.
2. The culvert location planned as Table above shall be adjusted accordingly to the exact location of cross-water stream or existing culvert located.





Typical Cross Section for Box Culverts:



Culverts Length = 12m to be confirmed by Detailed Design

7.2.5 Repairs/replacements of railing/parapets, flooring and protection works of the existing culverts shall be undertaken as required as per standards and specifications.

S. No.	Location at km	Remarks
NIL		

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

7.3 Bridges

7.3.1 Existing bridges to be re-constructed/widened:

(i) The Existing bridges at the following locations shall be reconstructed:

S. No	Bridge Location (in Km)	Salient details of Existing Bridge	Adequacy or otherwise of the existing waterway, vertical clearance, etc	Remarks
NIL				

(ii) The following narrow bridges shall be widened:

Sl. No.	Location (km)	Existing width (m)	Extent of widening (m)	Cross-section at deck level for widening @
NIL				

7.3.2 *Additional new bridges*

New bridges at the following locations on the project highway shall be constructed. GADs for the new bridges are attached in the drawings folder.

Sl. No.	Location (km)	Total length (m)	Remarks, if any
NIL			

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

S. No.	Location at km	Remarks
NIL		

7.3.4 Repairs/replacements of railing/parapets of the existing bridges shall be undertaken as follows

S. No.	Location at km	Remarks
NIL		

7.3.5 *Drainage system for bridge deck*
An effective drainage system for bridge decks shall be provided as specified in paragraph 7.20 of the Manual

7.3.6 *Structures in marine environment*
The Project Alignment does not lie in Marine Alignment.

7.4 Rail-road bridges

7.4.1 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].

Sl. No.	Location of Level crossing (chainage km)	Length of bridge (m)
N IL		

7.4.2 Road over-bridges

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

Sl. No.	Location of Level crossing (chainage km)	Length of bridge (m)
N IL		

7.4.3 Road under-bridges

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

Sl. No.	Location of Level crossing (chainage km)	Number and length of span (m)
NIL		

7.5 Grade separated structures

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. **NIL**.

7.6 Repairs and strengthening of bridges and structures

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 Existing Chainage (km)	Nature and extent of repairs /strengthening to be carried out
NIL		

B. ROB / RUB

Sl. No.	Location of ROB/RUB (km)	Nature and extent of repairs /strengthening to be carried out
NIL		

C. Overpasses/Underpasses and other structures

Sl. No.	Location of Structure (km)	Nature and extent of repairs /strengthening to be carried out
NIL		

7.7 List of Major Bridges and Structures

The following is the list of the Major Bridges and Structures:

Sl. No.	Location of bridge Existing Chainage (km)	Remarks
1	75+445	**Steel Arch Bridge**

Note: - *1. The location and vent size of all the culverts proposed for irrigation purposes shall be decided in consultation with Authority's Engineer.*

2. Width of culvert shall be reconciled as per cross section at that location

3. Cross road culvert to be provided at the location of Major Junction/ Minor Junctions or utility purposes etc. shall be decided with independent Engineer shall not be treated as change of scope.

7.8 Slope Protection Structures

7.8.1 Structures for Slope protection and Retaining Walls shall be designed and constructed as stipulated in Schedule-D: Specification and Standards.

7.8.2 Slope protection structures shown in the following Table shall be constructed:

Chainage		Approximate construction length (m)	Slope Countermeasure	Unit	Total Qty
Start	End				
70 + 210	70 + 270	60	Crib work (F300)*	m^2	223

71 + 030	71 + 070	40	Crib work (F300)*	m^2	167
73 + 480	73 + 500	20	Gabion wall	m^3	80
75 + 845	75 + 875	30	Gabion wall	m^3	120
			Earth removal	m^3	180
			Groundwater Drainage	m	75
			Hydroseeding	m^2	180
			Crib work (F300)*	m^2	180
			Rock bolt	m	135
76 + 310	76 + 385	75	Gabion wall	m^3	300
			Hydroseeding	m^2	225
79 + 150	79 + 170	20	Crib work (F300)*	m^2	59
81 + 510	81 + 530	20	Crib work (F300)*	m^2	118
84 + 570	84 + 590	20	Crib work (F300)*	m^2	70
86 + 130	86 + 150	20	Crib work (F300)*	m^2	50
86 + 330	86 + 350	20	Crib work (F300)*	m^2	67
86 + 450	86 + 470	20	Crib work (F300)*	m^2	68
86 + 510	86 + 550	40	Crib work (F300)*	m^2	421
87 + 470	87 + 490	20	Crib work (F300)*	m^2	43
88 + 400	88 + 440	40	Gabion wall	m^3	160
			Groundwater Drainage	m	75
88 + 450	88 + 490	40	Gabion wall	m^3	160
			Groundwater Drainage	m	75
91 + 970	91 + 990	20	Non-frame	m^2	1,600
106 + 420	106 + 450	30	Crib work (F300)*	m^2	338
			Rock bolt	m	253
108 + 830	108 + 850	20	Crib work (F300)*	m^2	68
111 + 290	111 + 310	20	Crib work (F300)*	m^2	130
111 + 370	111 + 390	20	Crib work (F300)*	m^2	153
111 + 410	111 + 430	20	Crib work (F300)*	m^2	108

Total	Gabion wall	m^3	820
	Earth Removal	m^3	180
	Groundwater Drainage	m	225
	Hydroseeding	m^2	405
	Non-frame	m^2	1,600
	Crib work (F300)	m^2	2,263
	Rock bolt	m	388

7.8.3 Structures for Retaining Walls and other works for slope protection shown in the following Table shall be constructed:

Wet Masonry Retaining Wall (H=3m)

Chainage		Length (m)
Start	Start	
65+040	65+060	20
65+560	65+620	60
65+780	65+840	60
65+960	66+000	40
66+180	66+800	400
66+940	66+960	20
67+240	67+260	20
67+440	67+460	20
67+680	67+900	180
68+020	68+220	140
68+360	68+620	220
68+860	68+980	120
69+340	69+360	20
69+520	69+720	140
69+820	70+020	140
70+200	70+220	20
70+380	70+460	80
70+760	70+860	40
71+180	71+380	180
71+540	71+560	20
71+700	71+840	100
71+960	72+140	160
72+300	72+460	120
72+540	72+660	80
72+760	73+540	520
73+660	73+680	20
73+760	73+800	40
73+980	74+080	160
74+280	74+440	80
74+600	74+740	80
74+860	74+880	20
75+040	75+140	60
75+240	75+460	180
75+560	75+660	100
75+940	76+020	60
76+140	76+180	40
76+280	76+980	540
77+120	77+240	80
77+360	77+720	240
77+820	78+420	380
78+500	78+700	120
78+900	78+940	40
79+300	79+540	180
79+660	80+080	240
80+220	80+480	220
80+620	80+660	40
80+760	80+980	200

Chainage		Length (m)
Start	Start	
86+180	86+260	60
86+360	86+400	40
86+660	86+680	20
86+780	87+220	360
87+320	87+420	100
87+500	87+540	40
87+640	87+800	120
87+940	87+980	40
88+100	88+440	300
88+520	88+780	220
88+860	88+920	60
89+020	89+040	20
91+360	91+660	220
91+760	91+860	80
91+940	92+340	220
92+620	92+640	20
93+040	93+140	40
93+500	93+540	40
93+620	93+640	20
93+740	93+840	60
93+980	94+120	140
94+200	94+220	20
94+300	94+800	360
95+040	95+060	20
95+260	95+580	260
95+780	96+120	240
96+220	96+260	40
105+800	105+820	20
105+920	106+260	200
106+420	106+520	80
106+620	107+120	280
107+200	107+280	40
107+380	107+500	80
107+720	107+840	80
108+040	108+120	60
108+320	108+400	80
108+560	108+760	80
108+840	109+260	220
109+360	109+400	40
109+660	109+700	40
109+800	109+920	60
110+040	110+180	80
110+260	110+440	120
110+600	110+620	20
110+720	110+780	60
110+860	110+880	20
111+040	111+140	40

Wet Masonry Retaining Wall (H=3m)

Chainage		Length (m)	Chainage		Length (m)
Start	Start		Start	Start	
81+060	81+180	100	111+300	111+440	60
81+280	81+480	180	111+820	111+900	40
81+620	81+700	80	112+000	112+040	40
81+840	81+920	40	112+120	112+140	20
82+000	82+640	520	112+240	112+260	20
82+820	83+060	160	112+420	112+600	120
83+160	83+300	140	112+860	112+960	60
83+580	83+600	20	113+220	113+400	120
83+720	84+440	620	113+480	113+680	120
84+660	84+980	200	113+840	113+940	60
85+200	85+300	100	114+180	114+260	60
85+420	85+460	40	114+400	114+680	160
85+580	85+680	40	114+960	114+980	20
85+800	85+860	40	115+380	115+460	40
85+940	85+980	40	115+820	115+840	20
86+060	86+080	20	115+920	115+938	30
				Total Length:	14,230

Wet Masonry Retaining Wall (H=7m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
65+420	65+520	100	79+160	79+180	20
65+940	65+960	20	79+540	79+640	60
66+220	66+240	20	79+720	79+740	20
66+600	66+620	20	80+140	80+180	40
67+040	67+080	40	80+700	80+740	40
67+900	67+940	40	81+520	81+600	40
68+100	68+120	20	81+740	81+760	20
68+540	68+640	60	81+860	81+940	40
68+840	68+860	20	82+780	82+800	20
69+440	69+520	80	84+580	84+600	20
69+860	69+880	20	84+940	84+960	20
70+040	70+140	100	85+080	85+160	60
70+220	70+280	60	85+500	86+000	220
70+360	70+380	20	86+140	86+180	40
70+480	70+500	20	86+260	86+360	60
70+700	70+760	60	86+460	86+600	120
71+040	71+180	80	87+480	87+500	20
71+560	71+680	80	87+620	87+640	20
72+420	72+440	20	88+600	88+640	40
72+660	72+840	60	91+600	91+640	40
74+540	74+720	80	94+180	94+200	20
75+020	75+040	20	106+980	107+000	20
75+920	75+940	20	107+180	107+200	20
76+060	76+200	80	108+860	108+880	20
77+800	77+820	20			
				Total Length:	2,200

Gravity Wall (H=1.5m and 2m)

Chainage		Length (m)
Start	End	
65+620	65+660	40
65+800	65+820	20
66+740	66+800	60
66+960	66+980	20
67+920	68+240	140
68+560	68+580	20
68+920	68+940	20
69+020	69+040	20
69+240	69+260	20
69+480	69+500	20
69+600	69+840	100
70+020	70+140	60
70+380	70+400	20
70+760	70+940	60
71+080	71+100	20
71+240	71+260	20
71+340	71+360	20
72+060	72+080	20
72+260	72+280	20
72+400	72+420	20
72+520	72+540	20
72+740	72+760	20
73+240	73+380	80
73+560	73+680	60
73+960	73+980	20
74+240	74+320	60
74+400	74+420	20
74+740	74+900	120
75+020	75+040	20
75+680	75+700	20
75+980	76+000	20
76+140	76+160	20
76+320	76+340	20
76+500	76+640	80
76+800	76+820	20
76+900	76+920	20
77+320	77+340	20
77+560	77+580	20
77+880	77+920	40
78+040	78+080	40
78+220	78+320	60
78+600	78+620	20
78+700	78+820	80
79+300	79+340	40
79+460	79+480	20
79+700	79+720	20
79+980	80+000	20

Chainage		Length (m)
Start	End	
85+500	85+520	20
85+660	85+680	20
85+760	85+780	20
86+000	86+020	20
86+180	86+260	40
86+380	86+400	20
86+760	86+860	40
87+180	87+200	20
88+000	88+020	20
88+120	88+140	20
88+220	88+240	20
88+340	88+380	40
88+520	88+600	40
88+840	88+860	20
89+020	89+060	40
91+300	91+320	20
91+720	91+760	40
91+840	91+860	20
92+400	92+420	20
92+720	92+740	20
92+960	92+980	20
93+060	93+200	60
93+300	93+320	20
93+920	93+940	20
94+100	94+120	20
94+340	94+360	20
94+520	94+700	60
95+040	95+060	20
95+440	95+480	40
95+760	95+780	20
96+100	96+120	20
96+220	96+240	20
105+920	106+120	80
106+260	106+520	120
106+940	106+960	20
107+180	107+280	40
107+380	107+400	20
107+540	107+680	60
108+220	108+280	40
108+400	108+660	100
109+300	109+320	20
109+440	109+460	20
109+920	109+940	20
110+020	110+080	40
110+580	110+600	20
110+760	110+780	20
110+940	110+960	20

Gravity Wall (H=1.5m and 2m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
80+320	80+340	20	111+460	111+480	20
80+440	80+480	40	111+620	111+740	60
80+860	80+920	40	111+920	112+060	60
81+320	81+480	60	112+240	112+260	20
81+920	82+100	80	113+100	113+120	20
82+360	82+380	20	113+380	113+420	40
82+480	82+500	20	113+620	113+640	20
82+600	82+660	40	114+020	114+040	20
83+560	83+580	20	114+160	114+180	20
83+700	83+720	20	114+840	114+940	80
83+880	83+900	20	115+080	115+100	20
84+020	84+040	20	115+180	115+200	20
84+280	84+360	40	115+320	115+340	20
84+480	84+500	20	115+720	115+780	60
84+960	84+980	20	115+880	115+900	20
85+320	85+340	20			
				Total Length:	4,240

Gravity Wall (H=3.0m and 4.0m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
65+000	65+080	30	85+820	85+840	20
65+280	65+360	60	85+940	85+980	40
65+600	65+900	160	86+200	86+300	60
66+120	66+180	40	86+480	86+560	40
66+260	66+280	20	86+660	86+900	120
66+420	66+540	60	87+080	87+220	60
66+700	66+860	100	87+300	87+340	40
67+100	67+120	20	87+460	87+560	60
67+200	67+580	160	87+760	87+880	120
67+680	67+760	40	88+080	88+120	40
67+940	68+140	100	88+260	88+280	20
68+340	68+380	40	88+380	88+440	40
68+520	69+080	280	88+780	88+840	40
69+460	69+540	40	88+920	89+020	60
69+620	69+640	20	91+400	91+440	40
69+740	69+760	20	91+580	91+700	60
69+840	69+940	40	92+060	92+100	40
70+060	70+520	200	92+580	92+620	40
70+660	70+680	20	92+740	92+760	20
70+860	71+140	140	92+840	92+860	20
71+300	71+400	80	93+000	93+300	120
71+500	71+540	40	93+420	93+480	40
71+620	71+640	20	93+560	93+580	20
71+800	71+920	80	93+760	93+780	20
72+080	72+120	40	93+940	93+960	20
72+200	72+260	60	94+120	94+140	20

Gravity Wall (H=3.0m and 4.0m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
72+500	72+560	40	94+420	94+640	120
72+920	73+220	160	95+080	95+220	80
73+380	73+640	100	95+640	95+660	20
73+720	73+740	20	95+780	95+800	20
74+260	74+480	100	95+980	96+280	160
74+720	74+740	20	105+880	105+900	20
74+900	74+920	20	105+980	106+460	220
75+000	75+080	40	106+540	106+560	20
75+160	75+220	40	106+640	106+660	20
75+540	75+580	40	106+740	106+800	40
76+100	76+140	40	106+920	107+020	60
76+260	76+320	40	107+140	107+220	40
76+400	76+580	100	107+340	107+360	20
76+820	76+860	40	107+460	107+500	40
77+060	77+320	160	107+640	107+700	40
77+520	77+540	20	107+840	107+940	40
77+620	77+640	20	108+040	108+340	120
77+720	77+740	20	108+420	108+560	80
77+820	77+860	40	108+660	108+960	160
77+960	78+100	80	109+080	109+200	60
78+240	78+500	140	109+280	109+360	60
78+640	79+080	200	109+720	109+880	80
79+220	79+240	20	110+000	110+020	20
79+340	79+380	40	110+180	110+340	60
79+500	79+520	20	110+540	110+980	180
79+660	79+680	20	111+140	111+240	40
80+080	80+100	20	111+400	111+560	80
80+660	80+840	80	111+640	111+660	20
80+920	80+940	20	111+760	111+800	40
81+080	81+140	60	111+900	112+000	60
81+420	81+440	20	112+080	112+160	40
81+580	81+600	20	112+260	112+440	100
81+780	81+800	20	112+520	112+540	20
82+400	82+520	60	112+660	112+680	20
82+740	82+780	40	112+760	112+780	20
83+680	83+700	20	112+880	112+900	20
83+780	83+880	80	113+000	113+020	20
83+960	83+980	20	113+280	113+380	60
84+140	84+380	120	113+460	113+680	120
84+460	84+480	20	113+860	114+080	100
84+580	84+720	60	114+180	114+200	20
84+880	84+940	40	114+820	114+840	20
85+060	85+180	60	114+940	115+080	120
85+260	85+500	140	115+340	115+360	20
85+580	85+660	40	115+780	115+860	40
				Total Length:	8,410

Gravity Wall (H=5.0m and 6.0m)

Chainage		Length (m)
Start	End	
65+080	65+420	180
65+680	65+760	60
66+020	66+160	60
66+380	66+400	20
66+480	66+580	40
66+860	66+900	40
67+080	67+180	80
67+280	67+380	40
67+580	67+680	100
67+880	67+980	40
68+740	68+860	80
69+380	69+400	20
69+540	69+560	20
69+720	69+820	40
69+900	69+920	20
70+080	70+100	20
70+180	70+360	100
70+460	70+700	120
70+780	70+900	80
71+000	71+060	60
71+180	71+240	40
71+400	71+420	20
71+580	71+620	40
71+820	71+840	20
71+960	72+060	60
72+140	72+160	20
72+480	72+500	20
72+600	72+620	20
72+780	72+800	20
74+320	74+340	20
74+480	74+520	40
74+760	74+800	40
74+920	75+000	80
75+080	75+140	60
75+220	75+240	20
75+840	75+880	40
76+040	76+060	20
76+240	76+300	40
76+440	76+460	20
76+920	77+020	60
77+220	77+300	60
77+760	77+800	40
78+180	78+200	20
78+580	78+600	20
78+720	78+740	20
78+840	78+960	60
79+080	79+160	80
79+240	79+260	20

Chainage		Length (m)
Start	End	
83+720	83+740	20
83+840	83+860	20
83+980	84+260	120
84+440	84+580	60
84+660	84+700	40
85+100	85+200	60
85+340	85+540	100
85+700	85+720	20
86+360	86+380	20
86+460	86+540	40
86+680	86+700	20
86+780	86+800	20
86+900	86+940	40
87+280	87+300	20
87+420	87+620	120
88+400	88+420	20
92+800	92+840	40
93+580	93+600	20
93+780	94+040	160
94+220	94+260	40
94+440	94+520	60
94+700	94+720	20
96+000	96+020	20
96+140	96+200	40
105+900	105+920	20
106+080	106+100	20
106+520	106+540	20
106+700	106+720	20
106+980	107+000	20
107+100	107+140	40
107+220	107+540	160
107+620	107+640	20
107+760	107+780	20
107+960	108+020	40
108+240	108+260	20
108+600	108+800	100
108+920	109+020	80
109+140	109+160	20
109+500	109+520	20
109+640	109+660	20
109+760	109+780	20
110+080	110+100	20
110+200	110+220	20
110+520	110+540	20
110+800	110+820	20
110+980	111+000	20
111+160	111+220	60
111+320	111+380	40

Gravity Wall (H=5.0m and 6.0m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
79+440	79+460	20	111+580	111+760	100
79+560	79+700	60	111+840	111+880	40
80+180	80+200	20	112+060	112+240	80
80+340	80+360	20	112+540	112+660	80
80+480	80+500	20	113+020	113+160	60
80+880	80+900	20	113+300	113+320	20
81+140	81+160	20	113+420	113+460	40
81+540	81+620	60	113+580	113+600	20
81+700	81+740	40	113+680	113+720	40
81+960	82+060	60	113+800	114+060	80
82+320	82+340	20	114+140	114+160	20
				Total Length:	5,180

Reinforced Earth Retaining Wall (H=7.0m and 8.0m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
65+100	65+140	40	86+600	86+660	60
65+380	65+400	20	88+440	88+460	20
65+900	65+920	20	88+940	88+960	20
66+440	66+520	40	95+900	95+920	20
66+900	66+920	20	106+380	106+480	40
69+560	69+580	20	106+660	106+680	20
69+780	69+800	20	106+760	106+780	20
70+520	70+540	20	107+160	107+180	20
72+160	72+180	20	107+560	107+580	20
72+280	72+300	20	107+940	107+960	20
74+520	74+600	40	108+700	108+720	20
75+140	75+160	20	109+840	109+860	20
76+200	76+240	40	109+940	109+960	20
77+040	77+060	20	110+220	110+240	20
77+740	77+760	20	110+680	110+700	20
78+100	78+120	20	110+820	110+840	20
82+660	82+680	20	111+260	111+280	20
84+120	84+140	20	112+200	112+220	20
84+600	84+640	40	112+980	113+000	20
85+720	85+740	20	113+120	113+140	20
85+880	85+900	20	113+640	113+660	20
86+140	86+160	20	114+080	114+100	20
				Total Length:	1,040

Reinforced Earth Retaining Wall (H=9.0m and 10.0m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
65+180	65+200	20	88+980	89+000	20
65+920	65+940	20	106+680	106+700	20
68+800	68+820	20	107+280	107+300	20
69+580	69+600	20	108+900	108+920	20

Reinforced Earth Retaining Wall (H=9.0m and 10.0m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
70+560	70+600	40	109+960	110+000	40
77+540	77+560	20	110+240	110+260	20
79+040	79+060	20	110+660	110+680	20
79+180	79+220	40	111+080	111+100	20
79+580	79+600	20	111+240	111+260	20
85+120	85+140	20	111+340	111+360	20
86+220	86+240	20	111+440	111+460	20
86+500	86+520	20	112+180	112+200	20
87+440	87+460	20			
				Total Length:	560

Seeding and Mulching (Soil Cut Slope)

Chainage		Area (m^2)	Chainage		Area (m^2)
Start	End		Start	End	
65+040	65+080	132	78+820	78+940	362
65+420	65+640	3,504	79+160	79+180	459
65+760	65+840	371	79+300	80+520	8,297
65+940	66+000	698	80+620	81+760	6,804
66+180	66+800	6,180	81+840	82+640	6,987
66+940	66+960	77	82+780	83+600	2,447
67+040	67+080	926	83+700	84+980	10,424
67+180	67+280	404	85+080	87+540	19,493
67+420	67+540	329	87+620	87+800	1,241
67+680	68+240	3,912	87+920	88+440	3,074
70+600	70+620	25	88+520	88+780	3,896
70+700	70+920	2,130	88+860	88+920	376
71+020	71+380	3,719	89+020	89+040	257
71+540	71+840	2,901	91+180	91+200	26
71+960	72+140	2,199	91+340	92+700	5,752
72+300	72+460	2,415	93+040	93+260	480
72+540	73+540	7,597	93+500	93+840	1,614
73+660	73+820	608	93+980	94+220	2,354
73+980	74+100	1,500	94+300	94+800	3,451
74+280	74+440	778	94+900	95+100	763
74+520	74+740	2,417	105+800	106+280	2,199
74+860	74+880	314	106+420	106+520	976
75+020	75+460	3,599	106+620	107+560	6,351
75+540	75+680	1,384	107+700	107+840	775
75+920	76+200	2,866	107+940	108+120	555
76+280	76+980	5,157	108+280	109+260	5,200
77+120	77+240	679	109+360	109+700	1,243
77+340	77+720	2,861	109+800	109+940	1,167
77+800	78+720	4,447	110+040	110+580	3,310
				Total Area:	164,462

Turfing (Embankment)

Chainage		Area (m^2)
Start	End	
65+020	65+060	80
65+260	65+280	36
65+420	65+600	722
65+760	65+780	161
65+940	66+420	1,133
66+540	66+700	359
66+920	67+080	2,102
67+180	67+540	717
67+700	67+920	232
68+060	68+080	214
68+160	68+640	643
68+940	69+520	1,190
69+640	69+680	111
69+860	70+020	197
70+100	70+120	29
70+240	70+260	2
70+400	70+440	51
70+700	70+720	110
70+900	70+920	31
71+140	71+300	163
71+420	72+020	1,708
72+120	72+200	115
72+300	72+480	482
72+560	73+320	4,976
73+400	74+000	1,247
74+080	74+240	215
74+360	74+400	40
74+540	74+720	65
75+040	75+060	6
75+180	76+200	1,490
76+340	76+480	485
76+580	77+040	374
77+160	77+180	22
77+340	77+720	1,221
77+800	78+000	607
78+120	78+300	458
78+380	78+700	533
78+900	78+940	81
79+160	79+180	4
79+260	79+300	52
79+420	79+640	372
79+720	80+860	4,521
80+940	81+080	851
81+160	81+540	2,586
81+620	82+360	2,238
82+440	83+780	4,560
83+900	83+960	992
84+060	84+120	765
84+320	84+440	293

Chainage		Area (m^2)
Start	End	
84+720	85+060	2,405
85+200	85+260	51
85+540	86+180	6,354
86+300	86+460	1,792
86+560	86+600	3
86+720	86+740	125
86+820	86+840	11
86+940	87+420	2,194
87+620	87+760	310
87+880	88+160	1,368
88+240	88+340	120
88+460	88+920	747
89+060	93+120	31,415
93+200	93+840	1,693
93+980	94+420	1,361
94+640	96+040	2,990
96+240	105+980	114,308
106+160	106+260	10
106+420	106+440	3
106+560	106+640	290
106+720	106+920	548
107+020	107+100	130
107+240	107+260	40
107+400	107+420	22
107+580	107+600	92
107+700	108+200	1,542
108+300	108+400	159
108+500	108+580	82
108+740	108+760	71
109+020	109+280	427
109+360	109+720	1,899
109+800	109+920	60
110+040	110+180	832
110+300	110+520	1,853
110+600	110+620	3
110+720	110+760	41
110+860	110+920	183
111+000	111+140	324
111+380	111+580	60
111+800	111+900	21
112+000	112+040	53
112+120	112+140	7
112+280	113+080	2,206
113+160	113+340	534
113+500	113+560	146
113+720	113+940	412
114+100	114+880	2,903
114+960	114+980	13
115+100	115+720	2,633

Turfing (Embankment)

Chainage		Area (m^2)		Chainage		Area (m^2)
Start	End			Start	End	
84+520	84+560	1,391		115+800	115+938	269
					Total Area:	226,150

Note: 1. The above quantities are minimum indicative and may increase as per requirement of site and no change of scope shall be considered on this account. The exact locations for these slope stabilization measures shall be finalised in consultation with Authority's Engineer/ Authority.

2. For executing any of the above type of Slope Protection Works, the Contractor should have the experience of having executed, in last 5 (five) financial years from the date of signing of Agreement, atleast 40% quantity of that type of Slope Protection Work(s) and provide requisite certificates/ documents to verify the same to the Authority/ Authority Engineer.

If the Contractor does not have requisite experience for any/ some of the above type of Slope Protection Works, then he has to engage specialized firm(s) as sub-contractor(s) who has/ have successfully completed in last 5 (five) financial years atleast 40% quantity of such work(s). The Contractor shall submit the credentials and the qualifying experience of the specialized sub-contractor(s) for the approval of Authority before the commencement of such Slope Protection Works.

7.8.4 The cutting slope surface except on Hard Rock classified as per Clause 301.2 of MoRTH Specifications for Road and Bridge Works shall be protected by the Seeding and Mulching as per Clause 308 of MORTH Specification, and the embankment slope shall be protected by Turfing as per Clause 307 of MORTH Specification.

8. TRAFFIC CONTROL DEVICES AND ROAD SAFETY WORK.

8.1 Traffic control devices and road safety works including traffic signs, overhead signs, pavement marking, safety barriers etc. shall be provided in accordance with Section 9 of the Manual.

8.2 Specifications of the reflective sheeting shall be as per Section 9 of the Manual

9. ROAD SIDE FURNITURE

9.1 Road side furniture including Road Boundary Stone, Pedestrian Guard Rail, Pedestrian Crossings, Delineators, MS Railing etc. shall be provided in accordance with the provisions of the Manual and Scheduled D.

9.2 Overhead traffic signs: location and size

Full width overhead signs 2 nos. (Start and end of Project road) and at other locations shall be provided as per requirement of site in consultation with the Authority's Engineer.

9.3 COMPULSORY AFFORESTATION

The number of trees which are required to be planted by the Agency as compensatory afforestation should be as per Forest Conservation Act, thrice the number of trees to be cut.

9.4 HAZARDOUS LOCATIONS

Provide W-beam crash barrier along the project highway at the locations as suggested in the Manual. The safety barriers shall also be provided at all hazardous locations in consultation with the Authority's Engineer.

9.5 SPECIAL REQUIREMENTS FOR HILL ROAD

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

9.6 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.

SCHEDULE - C

(See Clause 2.1)

PROJECT FACILITIES

1. Project Facilities

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

(a) roadside furniture;

(b) pedestrian facilities;

(c) tree plantation;

(d) truck lay-byes;

(e) bus-bays and bus shelters;

(f) others

(i) View Point

(ii) Highway Lighting

(iii) Spoil Bank

2. Description of Project Facilities

Each of the Project Facilities is described below:

(a) Roadside Furniture/Traffic control devices/Road safety devices

Road side furniture/Traffic control devices/Road safety devices shall be provided in accordance with the Manual of Specifications and Standards as referred in schedule "D" including the provisions mentioned in Schedule "B".

(b) Pedestrian Facilities

Pedestrian Facilities shall be provided in accordance with the Manual of Specifications and Standards as referred in schedule "D".

(c) Landscaping and Tree Plantation

Landscaping of the highway shall be done in accordance with the Manual of Specifications and Standards as referred in schedule "D".

(d) Truck Lay-byes

NIL.

(e) Bus-Bays and Bus Shelters

The Contractor shall provide minimum 4 nos. of Bus Bays with Bus Shelter on one side along the project highway. Tentative locations for Bus Bays are indicated below, however, the same shall be finalized as per suitability of location and site requirement in consultation with the Authority's Engineer/ Authority.

S. No.	Existing Chainage (km)	Design Chainage (km)	Location	Side	Number of Buses at stop	Length (m)
1	74+716	69+932	Buhkang Kawn	RHS	2	70.70
2	81+043	75+934	Chhingchhip	RHS	2	70.70
3	101+131	95+206	Chhiahtlang	LHS	2	70.70
4	108+794	102+576	New Serchhip	LHS	2	70.70

(f) Others:

(i) View Point

The Contractor shall construct minimum 4 nos. of View Points along the project highway. The same shall be finalized as per suitability of location and site requirement in consultation with the Authority's Engineer/ Authority:

(ii) Highway Lighting

High Mast Lighting shall be provided as per Schedule D at all requisite areas including built-up areas except for Minor Junctions where solar lighting may be provided.

(iii) Spoil Banks

Spoil bank shall be proposed in accordance with the Clause 3.1 of Schedule-D (Specification and Standard for the Construction).

Tentative locations for spoil banks are indicated below. However, the actual number, each location and volume of spoil banks shall be determined by the Contractor with approval of Authority's Engineer/Authority.

Any variation in number, each location and volume of spoil banks in this Schedule-B shall not constitute a Change of Scope.

S. No.	Design Chainage (km)	Side	Maximum Capacity (Rough Estimation) (Cum)
1	66+100	LHS	13,000
2	72+200	RHS	54,000
3	72+700	RHS	84,000
4	79+200	LHS	31,000
5	81+200	RHS	99,000
6	81+800	RHS	43,000
7	82+500	RHS	19,000
8	82+700	RHS	62,000
9	87+440	RHS	18,000
10	87+440	LHS	31,000
11	89+400	LHS	50,000
12	92+500	LHS	23,000

S. No.	Design Chainage (km)	Side	Maximum Capacity (Rough Estimation) (Cum)
13	93+100	LHS	46,000
14	96+700	LHS	37,000
15	104+800	LHS	17,000
16	109+400	RHS	13,000

Note: Estimated capacity of each spoil bank shall be confirmed by the Contractor based on his final design drawings and the Plan for Earthworks submitted for review and approval by the Authority's Engineer.

(iv) Other Facilities

(a) Supply of project record in digital format in two copies (one for the Engineer and the other for the Employer) including video recording updated on monthly basis throughout the construction period.

(b) As per the direction of Engineer-in-charge.

3. Facilities for the Authority and the Authority's Engineer

The facilities to be provided for the Authority and the Authority's Engineer, comprehending the Site Offices and Accommodation shall be as follows:

Table 1: Facilities for the Authority and the Authority's Engineer to be provided by the Contractors

Section	**Package**	**Offices** *(Note 1)*	**Accommodation** *(Note 2)*	
			Staff	**Period** (months)
Phase-I NH54 Section 1	S1-2: Package 2	Site Office Type 2 Location: Serchhip Period: 48 months	- National Experts .....6 - Sub-Professional Staff .....8 - Office Supporting Staff .....3 - Authority (Site Staff) 1	General .....42 Surveyor 2: 48

Note (1): *Site Office*: The layout shall be prepared by the Contractor and submitted for review and approval by the Authority's Engineer. The locations shown in this table are tentative and shall be confirmed by the Authority's Engineer.

Note (2): *Accommodation*: Depending upon the Authority's Engineer acceptance, rental of existing buildings will be allowed depending the proximity of the works to the nearby cities or towns, and comfortability.

3.1 Site Office for the Authority and the Authority's Engineer

3.1.1 Construction of Site Offices

The basic layout of each site office shall be prepared by the Contractor and submitted to the Authority's Engineer for review and respective acceptance.

The building shall comply with India's applicable specifications for architectural and structural works for buildings.

a. Basic Layout

The layout shall be prepared in accordance with the number of staff shown in Table-1 to accommodate properly the following (note: the plan area shown below are the minimum requirement to be considered):

(1) Core Office – Office Type 1: (to be provided by Package-1 in Aizawl)

(2) Site Office – Office Type 2: (to be located nearby Serchhip)

- Minimum Area: 270 sqm
  - One office room for Resident Engineer ..... 20 sqm
  - One office room for the Authority's representative (private arrangement) ..... 25 sqm
  - One office room for experts visiting the Site or meetings for coordination..... 30 sqm
  - One office room for National Experts ..... 40 sqm
  - One office room for Sub-Professional Staff ..... 60 sqm
  - One reception/administration office room ..... 40 sqm
  - A kitchen (Pantry) plan area well equipped with sink, draining board, cupboards, shelving, etc. ..... 12 sqm
  - Male (1) and Female (1) toilets with shower and wash-hand basin facilities for the sole use of the Authority's representative, International Experts, National Experts, and administration staff (office manager and secretary) ..... 2 units
  - Male (2) toilets for Sub-Professional and Supporting staff ..... 2 units
  - Corridor for connecting all rooms (approx..20 sqm) .....1.50 m width
  - Parking for the vehicles used by the Authority's Engineer and visitor's vehicles ..... 6 veh.

b. Basic Requirements

The Contractor shall, not later than 7 days after the starting date, submit full details of the Design Drawings to the Authority's Engineer, including floor plans, elevations, construction principles and materials, before commencing the erection of the facilities.

The Contractor shall be responsible for raising the ground (if necessary), grading and drainage in the vicinity of the building(s), with suitable access and walkways. The Contractor shall construct a covered hard-standing parking area, for the exclusive use of the Authority's Engineer and his visitors and respective access road to the parking area. The access road shall be paved and hard enough in order to be transited even during heavy rains. Outside lighting shall be installed around the buildings and the parking area, and appropriate signs shall be erected to indicate the purpose of the facilities.

All facilities shall conform to current fabrication standards for the required types. The facilities described above shall represent the minimum requirements. The Contractor shall provide all additional incidentals and necessary items, so that the facilities will be completely adequate and satisfactory in every respect for their intended use. Painting both the exterior and the interior shall be as agreed with the Authority's Engineer.

The building shall be completed with all services connected with clean water supply by water bowser (including elevated water tank and the tower for capacity of 2,000 liters for Office Type 2), electricity and sewerage. Each room shall be provided with at least four electrical outlet sockets. All power shall be 220V-240V, 50Hz except where otherwise agreed by the Authority's Engineer. All rooms shall be illuminated by fluorescent lighting. Each toilet shall be provided with a flushing toilet and warm water hand washing and shower facilities and extractor fans.

Telephone services (minimum 1 telephone lines and 3 extension lines completed with equipment for the office), including international direct dialing shall be provided. In addition, extra lines shall be provided for facsimile and internet connections. Each office shall be equipped with a telephone connected to the main reception telephone.

Offices and meeting rooms shall be air-conditioned. The air-conditioning may be either individual units or a central ducted system and shall be adequate to maintain temperature of not more than 24°C (dry bulb) at a relative humidity of 50% during the hottest season of the year. The noise level of the air-conditioning while working should be sufficiently low to allow normal voice level discussions to take place.

Office rooms shall be capable of providing at all times environmental conditions suitable for the operation of specified electronic office equipment.

The building shall be weather proof, fire protected, heat-insulated and secured. Windows shall give adequate light and ventilation and be protected with metal mosquito-proof gauze and have security bars and Venetian, or other approved sun blinds. Ceiling height above the floor level shall be at least 2.75 m. All internal walls shall be sound insulated. Floors shall be PVC tile covered. In toilets and other washing areas the floors shall have drains to assist cleaning.

3.1.2 Maintaining and Servicing of the Offices

The construction of the new office building for the Authority's Engineer shall be completed within 60 days since the date of commencement of the Contract and shall be equipped and maintained by the Contractor to the satisfaction of the Authority's Engineer until 3 months after the issue of a Completion Certificate for the Works or such earlier time as instructed by the Authority's Engineer whereupon the furniture shall be removed and any internal partition walls modified as required by the Authority's Engineer.

The Contractor shall provide all laborers, materials and equipment for maintaining and cleaning offices, furniture and fittings. The Contractor shall replace and/or restore, as directed, any facilities or parts thereof that become damaged, worn out, lost or stolen. The Contractor shall provide an adequate stock of all expendable and consumable items including refreshments, clean water supply and drinking water, paper towels, toilet

rolls, soaps, washing up liquid, brooms/mops and shall ensure proper and continuing functioning of all components and parts of the facilities during the contract period.

The Offices shall be provided with waste disposal material and these shall be emptied and disposed of daily by the Contractor.

3.1.3 Equipment and Expenses for Running-Off the Offices

The Contractor shall provide the following furniture and equipment to be used by the Authority's Engineer at Site.

Furniture and Equipment for Site Offices (each office)

Item	Unit	Quantity	Remarks
Refrigerator (deodorizer and no-frost system)	unit	1	Office Type 2: 150liters' minimum capacity
Water Dispenser (19 liters capacity including bottles and 6 spares bottles/gallon)	set	1	Office Type 2
Electric Kitchen Stove	unit	1	Size and model shall be discussed
Electric Kettle	unit	1	
Diesel Generator Set		1	Office Type 2: 60 KVA

3.2 Accommodation for the Authority and the Authority's Engineer Staff

3.2.1 Temporary Accommodation (initial period)

(1) General

Immediately after the date for Commencement of Works, during the first 3 months or until the permanent installations are prepared and approved, the Contractor shall provide rented houses as per the accommodation for all staff of the Authority's Engineer.

The accommodation shall be equipped with security grilles and mosquito netting, and shall be fully furnished and equipped with new items by the Contractor to the satisfaction of the Authority's Engineer, including curtains, linen, blankets, glassware, cutlery, crockery and kitchen utensils.

Each house shall be wired to permit the use of standby generators as well as mains for the supply of electricity. The generators shall be fitted with automatic starting switchgear if so directed by the Engineer. Covered, hard standing areas for positioning generators and storing fuel shall be provided.

Each house designated for the Engineer's International Experts and National Experts shall be provided with one telephone line and internet connection. Telephone installation shall be made by the Contractor but the cost of calls shall be paid by the Authority's Engineer staff.

Each house shall be provided with a TV (including cable and satellite connection). The installation shall be made by the Contractor but the cost of calls shall be paid by the Authority's Engineer staff.

Each house shall be provided with hot and cold water in the kitchen and the bathrooms.

The Contractor shall provide watchmen for security purposes to the approval of the Authority's Engineer.

The accommodation shall be available and ready for occupation within the number of days approved by the Authority's Engineer after the Commencement Date.

In the event that the Contractor fails to provide the required accommodation within the time specified or subsequently agreed by the Authority's Engineer, the Contractor shall provide, at no cost to the Employer, suitable hotel accommodation until such time as the accommodation is ready for occupation.

When a house is no longer required by the Authority's Engineer, all furniture, fittings and equipment provided by the Contractor for that house shall become the property of the Contractor.

(2) Housing Types

- ✧ House for the Authority near to Core Office (Central Team: 1 per 1 person)

  (to be provided by Package-1 nearby Aizawl)
- ✧ Team Leader (Authority's Engineer)

  (to be provided by Package-1 nearby Aizawl).
- ✧ International Experts (1 per 3 experts)
  (to be provided by Package-1 nearby Aizawl).
- ✧ House for the Authority near to Site Office (Site Staff: 1 per 1 person)

  One detached house, internal floor area approximately 60sqm, comprising 1 x sitting room, 1 x dining room, 1 x bedroom with attached bathrooms, 1 x kitchen. Split type air-conditioners to the sitting room, dining room and bedrooms. Moreover, a garage for one vehicle and fully equipped quarters for two servants shall be provided.
- ✧ National Experts (1 per 3 experts)

  One detached house, internal floor area approximately 80sqm, comprising 1 x sitting room, 1 x dining room, 1 x bedroom with attached bathrooms, 1 x kitchen. Split type air-conditioners to the sitting room, dining room and bedrooms. Moreover, a fully equipped quarter for one servants shall be provided.
- ✧ Sub-Professional Staff and Office Supporting Staff (1 per 3 persons)

  One detached house, internal floor area approximately 60sqm, comprising 1 x sitting room, 1 x dining room, 3 x bedroom, 1 x bathroom, 1 x kitchen. Split type air-conditioners to the sitting room, dining room and bedrooms. Moreover, a fully equipped quarter for one servants shall be provided.
- ✧ Secretary or Ladies Staff (1 per 3 persons)

  One detached house, internal floor area approximately 60sqm, comprising 1 x sitting room, 1 x dining room, 3 x bedroom, 1 x bathroom, 1 x kitchen. Split type air-conditioners to the sitting room, dining room and bedrooms. Moreover, a fully equipped quarter for one servants shall be provided.

(3) Maintenance

The Contractor shall be responsible for supplying all utilities, including electricity (whether by mains or generator), water, timber for open fires, drainage and telephone services, and shall meet the cost of these services, except the cost of telephone calls.

The Contractor shall maintain the accommodation, and all furniture, fittings and equipment, whether supplied by him or not, in good repair and to the satisfaction of the Authority's Engineer as long as such accommodation is occupied by the staff of the Authority's Engineer for the purposes of the Contract.

3.2.2 Construction of Houses for Accommodation (after lasted the initial period)

The procedures and standards for construction approved for the construction of the Site Offices will be applied for the construction of houses for accommodation of the staff of the Authority's Engineer.

The layout and design of the houses shall maintain equivalency with the houses approved for the Initial Period.

The location and house type shall be submitted for review and approval to Authority's Engineer.

The Initial Period will be defined and proposed by the Contractor based on the approved Construction Programme but not later than 3 months or the period accepted by the Authority's Engineer.

SCHEDULE – D

(See Clause 2.1)

SPECIFICATIONS AND STANDARDS

1. Construction

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

2. Design Standards

The Project Highway including Project Facilities shall conform to design requirements set out in the following documents:

Manual of Specifications and Standards for Two- Laning of Highways (IRC: SP: 73-**latest version**), referred to herein as the Manual.

Annex - I

(Schedule-D)

Specifications and Standards for Construction

1. Specification and Standards

All Materials, works and construction operations shall conform to the Manual of Specifications and Standards for Two-Lanning of Highways (IRC: SP:73-2015), referred to as the Manual, and MORTH Specifications for Road and Bridge Works. Where the specification for a work is not given in this Schedule or is silent on any aspect, Good Industry Practice shall be adopted to the satisfaction of the Authority's Engineer.

2. Deviations from the Specifications and Standards

2.1. The terms "Concessionaire", "Independent Engineer" and "**Concession Agreement**" used in the Manual shall be deemed to be substituted by the terms "Contractor", "Authority's Engineer" and "Agreement" respectively.

2.2. Notwithstanding anything to the contrary contained in Paragraph 1 above, the following Specifications and Standards shall apply to the Project Highway, and for purposes of this Agreement, the aforesaid Specifications and Standards shall be deemed to be amended to the extent set forth below:

a. In case of usage of soil stabilization technology, soil stabilizer shall be accredited by IRC.

b. Carriageway shall be 7.0m with 1.5m hard shoulder wherever ROW is available. IRC: SP: 73-2015 shall be followed to the extent as required for execution of work in consonance with plan & profile and TCS.

S. No.	Clause Referred in Manual	Provisions as per Manual	Modified Provision
1	7.3 (iv)	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 30 on either side approaches	The existing bridge proposed to be repaired and rehabilitated as specified and to be retained without widening.
2	12.6.3 (ii)	For hilly areas, where there is a general constraint on space, the layout indicated in fig 12.3 may be adopted for Bus	The width & Length has been designed as available in field.

S. No.	Clause Referred in Manual	Provisions as per Manual	Modified Provision
		bay	
3	12.5.2	A typical lay out is given in **Fig. 12.1**.	The width & Length has been designed as available in field.
4		View Point	The width & Length has been designed as available in field.
5		Steel Arch Bridge	As the depth of gorge is quite high pre stressed RC bridge has not been considered & so Steel Arch Bridge to be designed as Proposed
6		Rock Anchor Bolt	As the site needs this type of Typical arrangement, necessary typical drawing has been given in drawing volume to be executed by Manufacturer / expert designer as per their design standard needed as per site condition
7		Design Standard	As per Clause 3 given below

3. Particular Specifications

3.1 Earthworks: Re-Usable and Unsuitable Materials

In addition, and without detriment to the requirements specified in Section 4 of the Manual and Section 301 of the MORTH Specifications for Road and Bridge Works related to the re-use and unsuitable material, the following requirements shall be included:

a. Previous to perform the earthworks for road construction (minimum 28 days before commencement of earthworks), the Contractor shall submit for review and approval by the Authority's Engineer, a "Plan for Earthworks" detailed by sections showing the cutting and embankment with respective hauling distances, quantities and location of the re-usable material and respective spoil-banks for wasting of unsuitable material, not re-usable material or exceeding material (from the balance between cutting excavation and fill embankment works), and respective time schedule. The Plan for Earthworks shall be updated and reviewed periodically every 3 months or when required by the Authority's Engineer.

b. When unsuitable material below sub-grade level in cut or below embankment foundation level is planned to be removed, the soil left in place after the removal of the unsuitable material shall be compacted to a depth of 20 cm and a density of

90 percent of the maximum dry density determined according to the relevant specifications.

c. The material to be disposed of as Unsuitable Material shall not be wasted until it is duly approved or directed by the Authority's Engineer.

d. Unsuitable Material shall be removed and disposed of in waste areas provided by the Contractor in such a manner as to present a neat appearance and not to obstruct drainages to any highway nor to cause injury to highway works or property. If it becomes necessary for the Contractor to locate or relocate any waste areas, the Contractor shall obtain previously the approval from the Authority's Engineer to commence the operation for spreading any waste.

e. The Contractor is responsible to perform and follow all the required procedures to obtain respective authorizations for the usage of the areas where it is intended to waste the unsuitable material or to open quarries for borrow material.

f. The relevant and applicable provisions "Environmental Control and Protection" shall be adhered to the Plan for Earthworks for the hauling and disposal of unsuitable materials.

g. Spoil Banks:

The following requirements shall be satisfied for the proper implementation of Spoil-Banks:

- ✧ The Contractor shall submit, at least 15 days before commencing the works for any Spoil-Bank, for review and approval by the Authority's Engineer a detailed plan for implementation of the Spoil-Banks that are being considered in his "Plan for Earthworks" showing the location, capacity, time schedule and method statement for construction

- ✧ The Spoil-Banks shall be constructed applying the same technical specifications used for road embankment construction regarding preparation of the ground, leveling, thickness and compaction of each layer.

- ✧ The drainage to be implemented in the Spoil-Banks shall be constructed following the applicable standards for road drainage and in accordance with the drawings prepared by the Contractor in accordance with the Article 10: "Design and Construction of the Project Highway" of the Contract Agreement, and reviewed & approved by the Authority's Engineer.

- ✧ The Spoil-Banks shall be design in accordance with the requirements shown in **Table-1** and the typical arrangement shown in **Figure-1**.

Table-1: Requirements for Design and Construction Spoil Banks

Design Conditions:		
Item	**Description**	**Criteria**
- Topography	Depression or hilly	Prevention against disasters due to landslide and collapse
- Ground Inclination	Less than 22°	ditto
- Embankment' Size	Embankment height shall be 30m or less	ditto
- Land's Use	Land is not urbanized	Environmental protection
- Environment	Not considered as environmental nature reservation. Residential areas (if any) shall not located at downstream of spoil bank.	ditto
Design Requirements:		
Item		**Remarks**
- Installation of open drain or canal		Drain is treated from upstream
- Installation of surface drainage system		Slope feet and berms
- Installation of underground drainage		Swamps and Valley
- Installation of internal-horizontal drainage of embankment		Reduction of water filtration in the embankment and prevention against superficial collapse
- Implementation of the works for Slope Protection		Turfing or Seeding
- Construction of retaining wall in the lower edge		Prevention against collapse
- Installation of check dam structure on the upstream inlets		Concrete Wall
- Implementation of the works for scouring prevention along downstream outlet		Gabion Mat
Special Provisions on the Specifications:		
Item	**Description**	**Special Provision**
- Drainage	Works for channels drainages	50 years return period
	Gutters	25 years return period Minimum 40cm x 40cm
	Horizontal drainage sheet (50cm width, 2m interval)	Every 5m height; L=20m
- French Drain	Large Drain Basin	Perforated pipes of 300mm minimum diameter shall be applied
	Small Drain Basin	Perforated pipes of 100mm minimum diameter shall be applied
- Slope Protection	Sodding	As the standards
- Retaining Wall	Retaining wall by Gabion or Gravity Type	As the standards
- Embankment	Compaction and layer thickness	Compaction of embankment equal or higher than 90% shall be secured. Layer thickness same than road embankment.

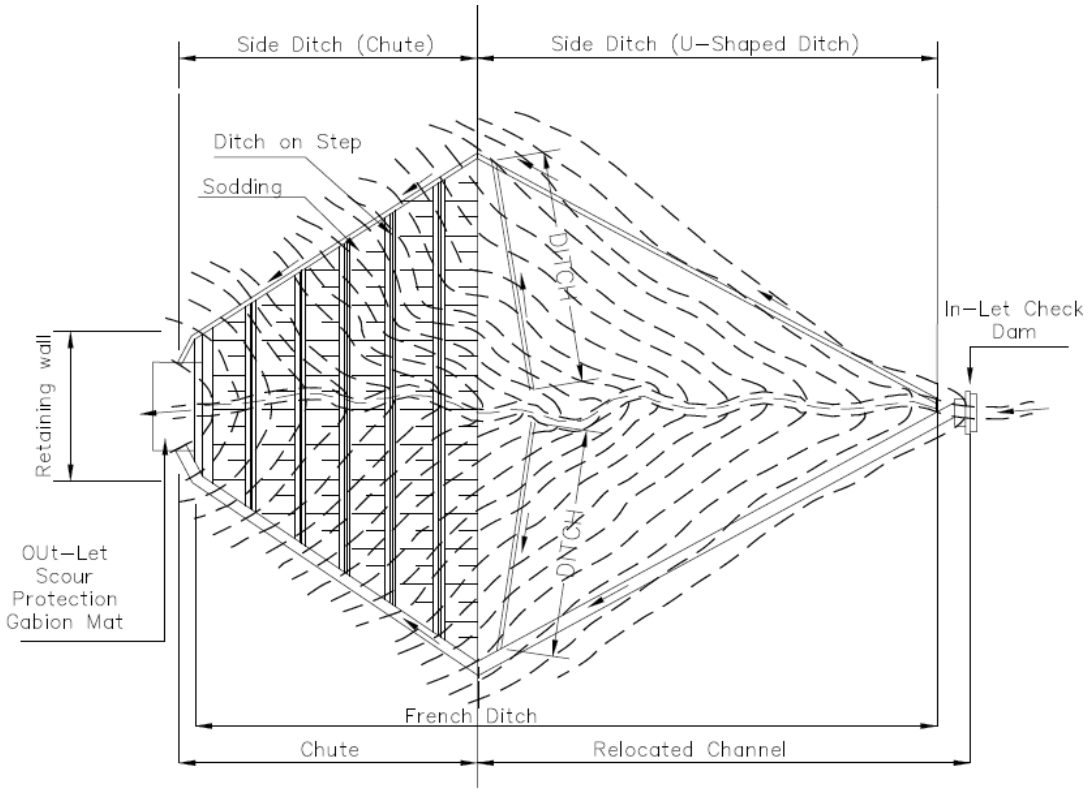


Figure-1(a): Typical Arrangement for Spoil Banks: Plan

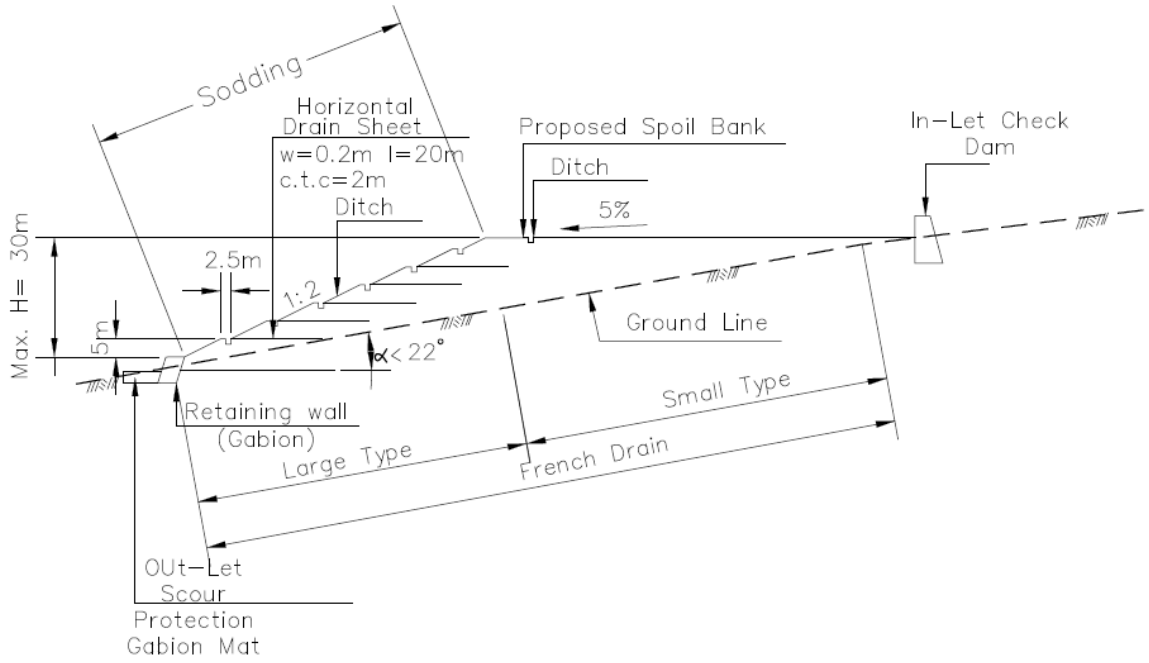


Figure-1(b): Typical Arrangement for Spoil Banks: Profile

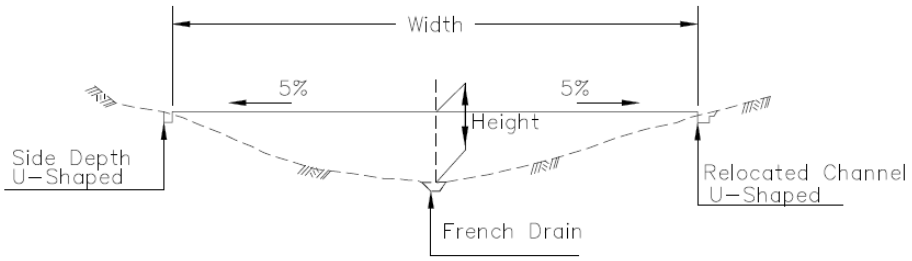


Figure-1(c): Typical Arrangement for Spoil Banks: Cross Section of French Drain

h. Supplementary Works in Case of Disasters by Landslides

The works to be performed in the event of disasters due to landslides, slope failure or soil/rock collapses, etc. occurred during the construction period shall be treated by the Contractor under the following conditions and requirements:

- The material from the disaster area which is disrupting the traffic or operation of the Project road shall be removed and treated as unsuitable material, and shall be disposed in a Spoil Bank in accordance with these specifications.
- The slopes remaining after the effect of the disaster shall be re-arranged and the affected drainages shall be reestablished.
- The quantities and costs for these works will be deemed to be covered in the quoted price and no separate or additional payments will be made under this account.

3.2 Design and Construction Specification for Slope Prevention Works

Slope protection of NH54 shall be designed in accordance with requirements and design conditions described in these Specifications and the requirements specified by IRC: SP 102-2014: "Guidelines for Design and Construction of Reinforced Soil Walls" as applicable. The preliminary design drawings are to be used as per reference.

3.2.1 Sub-Surface Drainage

a. General

In conducting groundwater drainage works, it is important to investigate groundwater conditions, surrounding facilities, etc. beforehand in consideration of its purpose.

b. Planning

The sub-surface drainage shall be able to drain promptly the groundwater that is affecting the landslide activity, taking it to in/outside of the landslide.

The following items shall be considered for preparation of the planning for sub-drainage drainage:

i) Implementation of boreholes of a diameter of 66mm or more to drain shallow groundwater.

ii) The free groundwater shall be drained during the time of rain.

iii) The planned height for groundwater drawdown shall be about 3 m at the landslide layer thickness of about 20 m.

iv) Evaluation of the effect shall be made taking into account the water level before construction, the water level after construction, and the amount of discharge water.

c. Investigation

The groundwater investigation shall be conducted during the rainy season and the dry season and grasp the groundwater level affecting the landslide activity.

The investigation on the groundwater level shall be conducted by using boring holes carried out on the landslide that will be treated.

d. Save Record

Changes in the groundwater level shall be recorded and kept by the responsible person in order to contribute to the evaluation and engineering judgment of the effect of the design / countermeasure work.

e. Material

The following material and respective method for application shall be used:

i) *Groundwater Drainage*: Strainer-processed drainage pipes shall be inserted.

ii) *Drainage Pipe*: PVC pipe (VP-50 [outer diameter 60 mm, inner diameter 51 mm]) shall be used.

iii) *Strainer*: The strainer or slotted type shall be processed for the total length. The diameter of strainer is 2 to 5 mm.

iv) *Protection of Strainer*: Strainers shall be wrapped or covered with a polyethylene sheet for protection to prevent from clogging and disruption.

f. Design and Construction

The design and construction of sub-surface drainage shall apply the following basic procedure or method:

i) Placement in-site of the drainage pipes

ii) Radial or parallel arrangement of the drainage pipes without affecting to other facilities located nearby or around the area

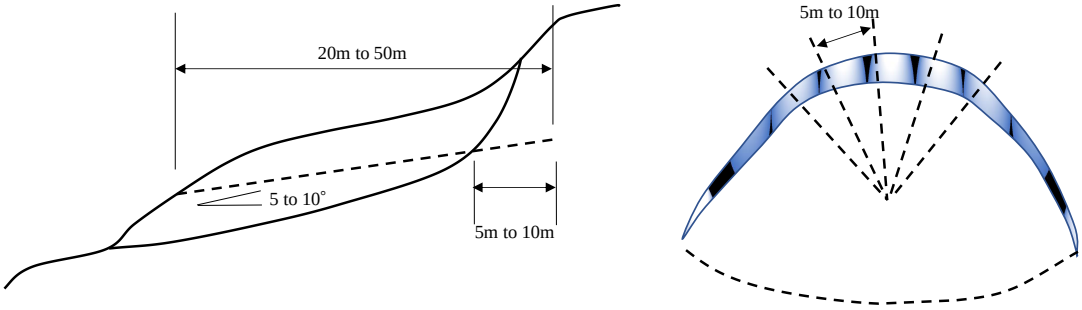
iii) Confirmation of the angle for installation of the drainage pipes. Drainage pipes shall be installed upwardly 5° to 10°.

iv) Confirmation of the length of drainage pipes:

- All pipes shall be about 20m to 50m long
- The pipes shall be inserted into the sliding surface in 5m to 10m and shall be installed with a spacing of 5m to 10m

vi) Protection of drilling mouth

- The drilling mouth shall be set on a stable ground.
- To install gabions or concrete walls so that the discharged water does not wash out sediment around the drain outlet.



g. Maintenance

The works for maintenance of the drainage system shall take into account the following main items:

i) Inspection of drainage operative efficiency

The main objective of the groundwater drainage system is to drain promptly all the groundwater at the time of heavy rain.

In order to secure the drainage in good and efficient operative efficiency conditions, periodically inspection is necessary to observe the quantity of drained water immediately after heavy rain to confirm the landslide activity and drainage function.

The period for periodically inspection shall be about 3 to 5 years.

ii) Inspection of drainage pipe

After 10 years or more, the drainage pipe might be clogged at the drilling mouth by the effect of ferric oxide. Therefore, it is necessary to perform regularly inspection of the facilities that have been over operating 10 years or longer period.

Based on the results of the inspection, after confirmation of the existence or absence of clogging, the works for cleaning and washing shall be applied as necessary.

h. Applicable Design Standard

Followings are IRC Specifications, Standards and Design codes majorly applied for the design;

- IRC: Special Report: State of the Art: Landslide Correction Techniques. Sub-Clause 7.8
- IRC: SP 48 -1998: Hill Road Manual. Sub-Clause 11.6.3

3.2.2 Rockfall Prevention Fence and Rockfall Prevention Retaining Wall

a. Rockfall Prevention Fence

✧ General

Rockfall prevention fence is a countermeasure installed besides the road to prevent against the rocks falling from the slopes.

For the design of rockfall prevention fence, it is necessary to assume the external forces that will be applied on the structure. The assumed falling-

rock weight, falling speed, direction of action on the protection fence, action position, etc. are different depending on the topography, geology, weathering condition of the slope, and vegetation on each site. Therefore, in designing a rockfall prevention, it is necessary to estimate the value that seems to be the most appropriate on the basis of the investigation at the site and experience of falling rocks in the past.

✧ Design Concept

Rockfall prevention fences are effective as countermeasures against falling rocks of relatively small scale, and the type and size shall be determined according to the situation of the slope. Rockfall prevention fences have the following types:

i) *Wire Rope and Wire Mesh Type*: Using H steel as a support, wire rope and wire mesh are attached to it.

ii) *H Steel Type*: H steel is used as a support, horizontal steel of H steel and expanded metal are attached, and usually old tires are applied as cushioning material.

iii) *High Energy Absorption Type*: A mechanism that easily absorbs energy by elastic-plastic deformation of members such as net (wire mesh), wire rope or strut is incorporated.

✧ Load

The load is the falling-rock load. The falling-rock for design is assumed as a rock with a maximum diameter of 50 cm, a falling height of 10 m or less (within the site range), and with an unit volume weight 26 kN/m3.

✧ Allowable maximum displacement amount and possible absorbed energy

Allowable maximum displacement amount and possible absorbed energy shall be calculated.

b. Rockfall Prevention Retaining Wall

✧ General

Rockfall Prevention Retaining Wall is usually built as gravity type concrete retaining wall. The basic idea is to convert the kinetic energy of the falling rock into deformation energy of the supporting ground and to stop the falling-rock by absorbing it.

For the design, it is necessary to consider the stability of the *Rockfall Prevention Retaining Wall* and reinforcement of the cross section of the structure, taking into consideration the topography and geology as well as the expected falling rock weight, falling height.

✧ Stability of Retaining Wall during Rockfall Collision

Stability of retaining wall during rockfall collision shall be considered.

✧ At Ordinary Times, At Deposition, During Earthquake

Stability of retaining wall at ordinary times, at deposition, during earthquake shall be considered.

c. Applicable Design Standard

The following are IRC Specifications, Standards and Design codes majorly applied for the design;

- IRC: Special Report State of the Art: Landslide Correction Techniques. Sub-Clause 7.3.6 and Sub-Clause 7.9
- IRC: SP 48 -1998: Hill Road Manual. Sub-Clause 8.2.1
- IRC: 78-2014 Standard Specifications and Code of Practice for Road Bridges Section VII Foundation and Substructure (Revised Edition). Sub-Clause 710.7
- IRC: 24-2010 Standard Specifications and Code of Practice for Road Bridges Section V Steel Road Bridge (Third Revision). Clause 502.

The following specifications of JIS (Japanese Industrial Standards) or equivalent shall be applied for the materials:

- JIS G 3101: H steel
- JIS G 3525: Wire rope
- JIS G 3552: Wire net

3.2.3 Anchor Works

a. Design

✧ General

i) In designing an anchor, consideration should be given to safety, workability and economic efficiency so as to conform to the purpose, and to have no harmful influence on surrounding structures, buried objects and so on.

ii) In designing an anchor, in principle, a basic test shall be conducted. If it cannot be carried out before design, it shall be carried out immediately after the start of construction to confirm the validity of the design.

✧ Investigation

i) General investigation: (investigation other than geotechnical investigation)

- literature investigation
- investigation of adjacent structures and their influence
- investigation of buried objects of underground
- surrounding investigation
- investigation of construction conditions.

ii) Geotechnical investigation:

- Investigation on corrosion
- Investigation for design anchor force
- Investigation for finding the installation position of anchor bodies
- Investigation for finding the extreme pull-out force of anchor
- Investigation for design of reaction force body
- Investigation on workability
- Investigation of groundwater

iii) Basic investigation test:

- Pull out test (test to set limiting friction resistance and ultimate bearing resistance of the ground)
- Long term test (Test to presume of decrease tendency of residual tensile force of anchor planned for important structures)

iv) Save record:

- Materials related to the investigation of anchor shall be kept by the responsible person.

✧ Material

i) General:

- Materials shall comply with the IRC's prescribed standards, international standards, Japanese Industrial Standards or equivalent approved by the Authority's Engineer.
- When materials used for anchors are being assembled, materials that do not affect adversely to other materials shall be used.

ii) Grout:

- Cement-based grout: Cement shall conform the requirements of Section 1000 of the Specifications for Road and Bridge Works of MORTH.
- When grouts other than cement-based grout are used, those having required quality and performance shall be used.

iii) Tendon

- Materials of tendon shall conform the requirements of Section 1009 of the Specifications for Road and Bridge Works of MORTH. Also, it shall obtain approval from the Authority's Engineer.
- When steel material is used as a tensile material constituting tendon, it is necessary to use one conforming to the standards and standards of public institutions (JIS G 3536-2008, JIS G 3109-2008, JIS G 3137-2008).
- When continuous fiber reinforcement material is used as a tensile material constituting tendon, it is necessary to use one conforming

to the standards of JSCE-E 131-1999 (Japan Society of Civil Engineering).

iv) Fixture

- The fixture shall have a structure and strength that does not break or impair the performance of the anchor before the tensile material is broken.
- The fixing tool shall have a structure adapted to the structure and purpose of use.

v) Other materials

- Head Cap: The head cap shall protect the anchor head and shall have a leak prevention function and strength and durability of the anticorrosive material.
- Bearing Pressure Plate: The bearing pressure plate shall have a shape and strength suitable for the fixture and the structure.
- Sheath: The sheath shall have undamaged abrasion resistance and strength, durability and water tightness against harmful substances when assembling, transporting, inserting and grouting of the tendon.
- Others: The other materials shall be of a shape and material that does not interfere with the function of the anchor, depending on the type of anchor and purpose of use.

✧ Corrosion protection

i) General:

Considering the corrosive environment around the structure, the service period and the importance of the structure, the anchor shall be ensured corrosion prevention so that the function of the anchor is maintained during its use period.

ii) Anticorrosive materials:

The following, or others proposed by the Contractor and approved by the Authority's Engineer, are the applicable anticorrosive materials:

- Filler: Greases, petrolatums, synthetic resins are often used.
- Covering material (sheath): Synthetic resin (polyethylene, polypropylene, etc.), stainless steel, steel materials and so on.
- Coating material: Galvanizing, anti-rust plating, epoxy material and so on.

iii) Anticorrosion method

- The anticorrosive structure of the anchor body shall not interfere with the structure of the anchor body which transmits the tensile force to the ground.
- Corrosion protection of the tension part should be a structure that combines the sheath and other anticorrosive material and shall be able to follow the change of the tension.

- The anti-corrosion structure of the anchor head shall not interfere maintenance and management such as lift-off test or re-tension.
- Since the risk of corrosion is particularly high at the boundary between the tension part and the anchor body or between the tension part and the anchor head part, corrosion protection shall be performed in a reliable manner.

✧ Design

i) Anchor arrangement

- *Anchor arrangement plan*: Anchor placement shall be planned taking into consideration the overall stability including the surrounding ground of the structure fixed by the anchor, the influence on the adjacent structure, the geology and so on.
- *Tilt angle of anchor*: The tilt angle of anchor shall be determined to ensure that a given anchor can be constructed. But, angles between -5° and + 5° may effect on the anchor strength by residual slime or grout breathing, so this range should be avoided.
- *Anchor body installation interval*: The installation interval of the anchor bodies shall be determined in consideration of the interaction of the anchors. Generally, an interval of 1.5 m or more shall be secured.

ii) Anchor length

- *Anchor Free Length*: In principle, the minimum length of the anchor free length shall be 4 m, and the anchor free length shall be determined in consideration of the thickness of the earth covering, the stability of the entire structure system and so on.
- *Tendon Free Length*: Tendon's free length shall be determined to allow for deformation and to ensure the required tension.
- *Anchor length*: In principle, the length of the anchor is 3 m or more and 10 m or less, and it shall be determined in consideration of the drawing force of the ground and grout, and the binding force of grout and tendon.

iii) Anchor body

The anchor body shall have a required strength and durability during tension or service period and have a structure that can reliably transmit the anchor force to the ground. The compressive strength of grout such as cement paste and mortar used for anchor bodies shall be 24N/mm^2 or more in consideration of durability against deterioration of grout during service period.

iv) Anchor head

- The anchor head, that is, the fixing tool and the pressure bearing plate is a part provided for reliably transmitting the anchor force to the structure or the ground. It shall have a required strength against

the anchor force and be a structure that does not cause harmful deformation.

- The anchoring force decreases with time due to creep of the ground and relaxation of the tensile material. Therefore, when it can be predicted that re-tension is required, the tensile material constituting the tendon shall use a tensile margin which has sufficient length or a fixing tool which can be re-strained.

v) Anchor force

- The design anchor force (Td: the tensile force used for the design): Td shall not exceed the allowable anchor force (Ta).
- The allowable anchor force (Ta) shall be examined for the following three items, and the smallest value shall be adopted:

  - Tendon allowable tensile stress (Tas)

  The tendon allowable tensile force (Tas) shall be set to a smaller value among the Tendon's ultimate tensile force (Tus: the tensile force obtained from the maximum test force prescribed by JIS such as steel used for tendon) and the tendon's yield tensile force (Tys: the tensile force obtained from the test force against 0.2% permanent elongation prescribed by JIS such as steel used for tendon) multiplied by the reduction rate.

  - Allowable binding force of Tendon (Tab)

  Tendon's allowable binding force (Tab: the value obtained by dividing the ultimate binding force of Tendon by the safety factor) shall be a value considering the stress transmission method from tendon to grout material and design standard strength of grout material.

  - Allowable pull-out force of anchor (Tag)

  The allowable pull-out force (Tag) of the anchor shall be a value obtained by dividing the ultimate pull-out force (Tug: the value at which the resistance due to adhesion, friction or bearing occurring between the ground and the anchor body becomes the ultimate limit state) of the anchor by the safety factor.

vi) Tension force at fixing time

The tension force at fixing time shall be determined depending on the purpose of use, considering the stability of the entire structure including the ground.

- *Initial tensile force*: Maximum tensile force when tensioning and fixing the anchor head.
- *Tension force at fixing time*: Tensile force acting on tendon after fixing time is completed.
- *Residual tensile force*: It is the tensile force that ultimately acts on tendon due to ground creep, relaxation of tensile material, and other external forces.

vii) Basic investigation test

- *Pull-out test*: The pull-out test is carried out to confirm the ultimate pull-out force of the anchor and its behavior, and to determine various constants parameters used for anchor's design. For the anchor used in the pull-out test, the specifications of the anchor shall be specified so that the ultimate pull-out force can be confirmed.

  From the test results, it is possible to calculate the ultimate skin friction resistance (τa) or the ultimate bearing resistance (qu) of the anchor body.

  - Test Anchor

  The test anchor shall be carried out in the same way as the anchor to be used. The planned maximum load shall be planned so that ultimate destruction occurs between the ground and the anchor body and can be pulled out.

  - Loading Method

  The loading method shall be carried out in a multi-cycle system in which the relationship between load and elastic displacement amount and plastic displacement amount can be obtained. The number of cycles is decided by the responsible technician's judgment.

- *Long term test*: Long term tests are performed to confirm the long-term behavior of the anchor and to determine the constants used for designing the anchor. The test anchor used for the long-term test shall be carried out with an anchor constructed under the same use conditions as the actually-used anchor

- *Test load*: The maximum load for test shall be as follows:
  - PC steel material: yield tensile load × 0.9 or less
  - Continuous fiber reinforcement material: ultimate tensile load × 0.75 or less

b. Construction

✧ General

In anchor construction, ground conditions, environmental conditions, construction contents and on-site construction conditions shall be grasped to ensure safety, disaster prevention and the surrounding environment conservation. In addition, construction plans shall be formulated to satisfy the design specifications and obtain appropriate quality. Construction shall be carried out by specialized workers under the guidance of responsible technicians who have sufficient knowledge and experience regarding anchors.

✧ Construction plan

i) When constructing an anchor, a construction plan document that defines the construction method, construction management method, and management standard at each construction stage shall be prepared in order to construct an anchor that satisfies the design specifications.

The standard items described in the construction plan document are as follows:

- construction purpose
- construction outline
- plan/design condition
- process
- construction management organization table
- equipment used
- material used
- temporary plan
- work procedure, construction procedure
- construction management, quality control plan
- safety management plan
- technical document, brochure, etc.
- others

ii) The construction plan should take into consideration safety and environmental conservation at the site and its surroundings, and maintenance and management of the anchor.

✧ Construction and construction management

i) Construction and construction management of anchors shall be implemented based on the construction plan.

ii) In the construction of anchors, if a situation different from the conditions assumed at the time of planning occurs, it is necessary to promptly investigate the cause and take appropriate measures as necessary.

✧ Material storage

i) The materials to be used (fixtures, tendons, other materials for processing) shall be kept so as not to impair their functions. The storage location should be level so as not to touch the ground. In addition, it is necessary to take into consideration not to adversely affect the quality due to adhesion of rain water, moisture, salt, mud and the like.

ii) At the time of storage of materials, safety data sheets such as material chemical substances (injection material, rust preventive material, waterproof material, etc.,) should be clearly showed so that the workers can view them at any time as necessary.

✧ Drilling

i) Drilling of the anchor shall satisfy the control value specified in the construction plan concerning the position, hole diameter, length, direction, etc. indicated in the design documents. In drilling, the following points shall be considered:

- The drilling method shall be able to prevent the collapse of the hole wall and be adopted a method that can reliably perform tendon insertion and grout injection. For this reason, it is necessary to select an appropriate method with casing drilling as a standard.
- The control value of drilling precision shall be determined in consideration of the importance of the structure, purpose of use, anchor specification, etc. so that the anchor will not adversely affect other existing structures. Also, it is necessary to set so that the anchors to be constructed do not interfere with each other.
- It is necessary to estimate the position and layer thickness of the installation ground of the anchor body based on the color / state of the slime discharged during drilling and the drilling speed, etc., and to confirm the validity as the installation ground.

ii) If there is concern about the influence on the surrounding ground due to the drilling of the anchor, it shall be prevented by an appropriate method.

iii) In the case where the groundwater level is higher than the drilling mouth, or in the case of artesian water, spouting of considerable water or sediment is assumed from the drilling mouth during the anchor construction, and the state that adversely affects the quality of grout of the anchor body is presumed. If such a situation is assumed, appropriate measures shall be taken to prevent this condition until the anchor body is completed.

iv) Cleaning in the drilling hole shall be carried out by a method using fresh water or air depending on ground conditions and construction conditions. Drilling of soft rocks with slaking properties such as mudstone and tuff shall be taken care as drilling surfaces tend to become muddy and there is a possibility that prescribed skin friction resistance cannot be obtained.

v) In the case of the ground such as gravel, talus or rocks with many cracks, there is a concern that grout of the anchor body may flow out into the ground. In this case, it is necessary to conduct pre-injection with grout.

✧ Assembling and processing Tendon

i) Tendon shall be assembled so as not to impair its function based on design specifications. Since assembly and processing are carried out using parts such as a sheath and a centralizer, each component shall be handled carefully.

ii) Tendon shall ensure the covering of the predetermined grout and assemble to be located it in the center of the hole.

iii) Cutting of tendon is not a method of applying heat such as gas cutting, but it shall be done using a disk cutter and so on so as not to impair its characteristics.

✧ Tendon handling

Tendon shall be handled carefully so as not to scratch, bend sharply, or destroy anticorrosive material. The tendon of the anchor body to which the grout adheres shall be handled carefully so as not to adhere to the oil or soil that impairs the function.

✧ Insertion and retaining of Tendon

Insertion of the tendon shall be performed precisely in a predetermined position so as not to cause harmful damage or deformation and hold the tendon so as not to move until the grout hardens.

✧ Injection

The injection is performed by replacement injection, pressurized injection and filling injection.

i) Substitution Injection:

Replacement injection shall start from the lowest part of the anchor hole in order to smooth drainage and exhaust air in the hole. The work shall be carried out continuously without interruption until the grout having the same properties (the same degree of concentration) as the injected grout is discharged from the drilling mouth.

ii) Pressurized injection:

Methods of pressurized injection include casing pressurization and packer pressurization. The injection shall be carried out by using an appropriate method according to the ground conditions around the anchor body.

iii) Filling Injection:

This purpose is to increase the anticorrosion function of the free length part by filling the gap between the outside of the anchor free long sheath and the ground with grout, and to control the looseness and weathering of the ground around the hole wall.

✧ Curing

The anchor shall be cured so as not to adhere foreign matter or not to receive deformation and vibration such as impairing function during the period from the end of the grout injection to the tension of the tendon and from the fixing to the head treatment.

✧ Tension and fixings

i) After the grout reaches the predetermined strength, the predetermined test load and displacement characteristics shall be confirmed by the aptitude test / confirmation test, and the initial tensioning force shall be introduced to obtain the required residual tensile force.

ii) The anchor head fixing work shall be carried out so as to obtain a predetermined fixing tension force. The allowable error of the installation angle at the anchor head shall be ± 5 ° or less.

iii) The initial tensile force shall be determined taking into consideration the set amount (the length by which the tension material is drawn in fixing the anchor).

iv) The tensioning device shall be calibrated.

✧ Head treatment

i) On the back of the anchor head, head treatment shall be carried out in the manner shown in the design documents before tensioning / fixing in order to prevent corrosion at the boundary between the anchor head part and the free length part of the anchor.

ii) The head treatment of the anchor shall be carried out quickly after tension and fixing for the purpose of corrosion prevention and protecting of the anchor head. Specifically, the anchor head shall be covered with a cap, and the cap shall be filled with an anticorrosive material such as rust preventive oil.

✧ Record

At the stage of anchor maintenance management, necessary data shall be recorded and saved.

✧ Acceptance inspection

i) Aptitude test

The aptitude test is carried out in order to check whether the design and construction of the anchor are appropriate from the load-displacement amount characteristic by loading up to a predetermined load in multiple cycles with an anchor to be actually used.

The test shall be selected from a part of the anchors actually used and shall be 5% of the construction quantity and 3 or more in consideration of the ground on which the anchor body is installed, the specifications of the anchor, the setting method.

ii) Confirmation test

The confirmation test is carried out to load the anchor actually used up to a predetermined load in one cycle and to confirm that the anchor is safe against the designed anchor force. The anchor used for the confirmation test shall be carried out against all anchor except for the anchor used for the aptitude test.

✧ Maintenance and management

i) General

- The anchor shall be conducted inspections and investigations, etc. systematically, to maintain the original function. Inspections are basically based on periodic inspections, but if abnormal weather such as heavy rain or earthquakes occurred, they shall be checked promptly as necessary.
- As a result of inspection, if it is judged necessary, soundness investigation should be carried out, and appropriate measures shall be taken against anchors considered to be problematic in soundness.

ii) Inspection of anchor

- *Inspection item*: It shall be decided in consideration of the site situation.
- *Duration and Frequency of Inspection*: The inspection shall be continued, and its frequency shall be determined in consideration of the anchor's purpose, application, circumstances, etc.
- *Records*: It is necessary to record the inspection result and evaluate it. Based on that, it is necessary to judge whether further detailed soundness investigation is necessary or not.

iii) Soundness investigation of anchor

- *Investigation method*: As for investigation of soundness of anchor, preliminary investigation shall be carried out and gather materials necessary for planning soundness investigation. Based on that, it is necessary to select an appropriate method considering the condition of the target anchor and the site conditions, etc. The soundness investigation plan shall be planned in detail in consideration of safety and environmental conservation at the site and its surroundings, regarding the implemental method of investigations and tests and the construction management method. The investigation and test items of the soundness investigation are as follows. a) visual inspection in head detail investigation, b) exposure investigation in head detail investigation, c) lift-off test, d) head back investigation, e) monitoring
- *Evaluation of investigation results*: The necessity and method of countermeasures shall be considered by evaluation of soundness from the investigation results.

iv) Measures

The countermeasures shall be planned after clarifying the purpose of durability improvement measures, repair / reinforcement, renewal, etc.

v) Record

Maintenance records related to inspection / soundness investigation / countermeasures shall be preserved during the service period of the anchor.

c. Applicable Design Standard

Followings are IRC Specifications, Standards and Design codes majorly applied for the design;

- IRC: Special Report: State of the Art: Landslide Correction Techniques. Sub-Clause 7.3
- Ministry of Road Transport & Highways: Specifications for Road and Bridge Works (Fifth Revision) 2013; Section 1700: Structural Concrete.

Followings are design and construction standard of Japanese Geotechnical Society and Anchor materials of JIS (Japanese Industrial Standards). The materials shall be JIS or equivalent.

- Ground anchor design and construction standard: JGS 4101-2012 (Japan Society of Civil Engineering).
- Concrete standard specifications: Civil Engineering Society

3.2.4 Rock Bolt Works

a. Design

✧ General

It is a feature to stabilize the slope by the reinforcement effect of the ground by reinforcing material.

✧ Material

Materials shall comply with the IRC's prescribed standards, international standards, Japanese Industrial Standards, and/or equivalent, and with the approval of the Authority's Engineer.

i) Reinforcing material

- Reinforcing material shall conform the requirements of Section 1000 of the Specifications for Road and Bridge Works of MORTH.
- The reinforcing material shall have a predetermined tensile strength, flexural rigidity and durability.
- The reinforcing material shall be a fully threaded hollow bar steel (self-piercing rod: JIS G 4051 or equivalent: permissible load of 129 kN, yield load of 196 kN) or full screw steel (SD 490-D 22: JIS G 3112 or equivalent: permissible load of 96.8 kN, Yield load 190 kN) shall be used.
- In order to ensure durability, the reinforcing material shall be subjected to surface treatment (hot dip galvanizing treatment, etc.).

ii) Bearing pressure plate

- The bearing pressure plate shall have a predetermined strength (JIS G 3101 or equivalent).
- In order to ensure durability, the bearing pressure plate shall be subjected to surface treatment (hot dip galvanizing treatment, etc.).

iii) Injection material

- The injection material shall ensure pulling resistance force, and shall be superior adhesion, fast strength.
- For cement used for injection material, ordinary Portland cement (JIS R 5210 or equivalent) or blast furnace cement (JIS R 5211 or equivalent) shall be used.

✧ Design

The design of the lock bolt shall be designed so that stability is ensured by sufficient consideration of ground conditions, groundwater condition, surrounding structures etc.

i) Fixing length

The fixing length of the reinforcing material shall be set so as to satisfy the required deterring force against the assumed surface collapse.

ii) Installation angle of reinforcing material

The installation angle of the reinforcing material shall be perpendicular to the sliding surface. However, on a natural slope, it shall be perpendicular to the average slope gradient.

iii) Length of reinforcing material

The length of the reinforcing material shall be equal to or more than "assumed collapse layer thickness + fixing length + surplus length".

b. Construction

✧ General

i) In rock bolt construction, ground conditions, environmental conditions, construction contents and construction conditions shall be grasped to ensure safety, disaster prevention and the surrounding environment conservation.

ii) Construction plans shall be formulated to satisfy the design specifications and obtain appropriate quality.

iii) Construction shall be carried out by specialized workers under the guidance of responsible technicians who have sufficient knowledge and experience regarding rock bolt.

✧ Construction plan

i) When constructing the lock bolt, a construction plan shall be prepared to satisfy the design specifications. The standard items described in the construction plan document are as follows.

- construction purpose,
- construction outline
- plan / design condition
- process
- construction management
- quality control plan
- safety management plan
- technical document, brochure

ii) The construction plan should take into consideration safety and environmental conservation at the site and its surroundings, and maintenance and management.

✧ Construction and construction management

i) Construction and construction management of rock bolt shall be implemented based on the construction plan.

ii) In the construction of rock bolt, if a situation different from the conditions assumed at the time of planning occurs, it is necessary to promptly investigate the cause and take appropriate measures as necessary.

✧ Drilling

Drilling methods include self-drilling, rotary drilling and leg hammer drilling. Drilling shall select an appropriate excavator in consideration of geological and topographical conditions. Drilling shall be carried out based on the design drawing and guided by the Authority's Engineer.

✧ Insertion of reinforcing material

Immediately after the excavation is completed, the lock bolt shall be easily inserted into the borehole to the specified depth. Materials "oil, mud, rust" that reduce the adhesion between lock bolt and grout shall be cleaned before insertion. When using a casing, a spacer shall be attached so that the reinforcing material is arranged in the center of the hole so that mud etc. does not adhere.

✧ Injection

i) Before grout injection, air shall be sent to wash the inside of the hole.

ii) Injection is carried out from the bottom of the hole and shall be injected until the cement milk is discharged from the hole mouth.

iii) The water cement ratio is 40% to 50%.

✧ Curing

After the grout injection is completed, the lock bolt shall be cured so as not to receive deformation or vibration that may impair the function.

✧ Acceptance inspection (Confirmation test)

i) In order to confirm whether or not the fixing power of the reinforcing material satisfies the design value, an acceptance inspection (confirmation test) shall be carried out.

ii) The number of tests shall be 3 or more and 3% or more of the total number.

iii) The maximum test load shall be the design load, but it shall not exceed 80% of the allowable stress degree.

iv) The load cycle shall be a single cycle.

✧ Head treatment

i) A bearing pressure plate shall be installed on the reinforcing material head.

ii) The head of the reinforcing material shall be tightened with a nut.

iii) After tensioning, a cap filled with anticorrosive oil shall be installed.

✧ Record

The necessary data for maintenance and management shall be recorded and preserved.

c. Applicable Design Standard

Followings are IRC Specifications, Standards and Design codes majorly applied for the design;

- Ministry of Road Transport & Highways: Specifications for Road and Bridge Works (Fifth Revision) 2013

3.2.5. Crib Works

a. Design

✧ General

The crib works is a construction method aimed at stabilizing the slope by creating a continuous lattice frame against cutting surfaces and natural slopes. In the grating crib works for stabilizing the slope, there are a shotcrete grating crib works and a cast -in -place grating crib works.

✧ Material

i) General

Materials shall comply with the IRC's prescribed standards, international standards, Japanese Industrial Standards, and equivalent, and with the approval of the Authority's Engineer.

ii) Cement

- Cement-based grout: Cement shall conform the requirements of Section 1000 of the Specifications for Road and Bridge Works of MORTH or JIS R 5210, or equivalent.
- When cement other than ordinary Portland cement is used, it must be confirmed that required performance can be obtained beforehand.

iii) Aggregate

- Aggregate shall be clean, rigid, durable and suitable particle size, and free of dirt, mud, organic impurities, chloride, etc.
- Aggregate shall conform the requirements of Section 1000 of the Specifications for Road and Bridge Works of MORTH or JIS A 5005, or equivalent.
- The sand used as fine aggregate shall have a dry density of 2.5 g/cm3 or more and a water absorption of 3.5% or less.
- The fine aggregate shall be chemically and physically stable.
- Hazardous aggregate showing alkali silica reaction shall not be used.

iv) Admixture

- The admixture shall be of quality assured.

- AE agent, water reducing agent and AE water reducing agent used as admixture shall be one conforming the requirements of Section 1000 of the Specifications for Road and Bridge Works of MORTH or JIS A 6204, or equivalent.

v) Reinforcing Streel

- Reinforcing steel shall conform the requirements of Section 1000 of the Specifications for Road and Bridge Works of MORTH or JIS G 3112, or equivalent.
- Reinforcing bars to be used shall use the ones shown in the design drawing.

vi) Wire Mesh and Formwork

- For wire mesh used for shotcrete grating crib works, rhombus wire mesh conforming to JIS G 3552 or welded wire mesh conforming to JIS G 3551 or equivalent shall be standard.
- The material of the formwork for shotcrete shall be selected by checking the quality and carefully examining the construction conditions, spraying conditions, spraying materials, construction method, etc.

✧ Design

i) General

Based on natural conditions and field survey, the design of grating crib works shall be designed taking into consideration its type, function and scope.

ii) Load

- The load acting on the framework is its own weight (framework material and filling material), the assumed load of collapsed soil, ground reaction force.
- The design load shall be the value obtained by multiplying the working load by the load coefficient.

iii) Inspection

Inspection of the grating crib works shall be conducted according to a prescribed procedure (Reference: Designing and Construction Guidelines for Grating Crib Works: Revised Edition 3rd Edition; 2013 National Specific Slope Protection Association).

b. Construction

✧ General

i) The construction of the shotcrete grating crib works shall be carried out in accordance with the construction plan in consideration of strength, durability, slope condition, environment etc. sufficiently, further considering the safety of the construction, construction environment, etc.

ii) Construction management shall be performed by a technician with sufficient knowledge concerning construction of the shotcrete crib works.

iii) Construction shall be carried out by specialized workers under the guidance of responsible engineers with sufficient knowledge and experience.

✧ Construction plan

i) When constructing the grating crib work, a construction plan shall be prepared to satisfy the design specifications. The standard items described in the construction plan document are as follows:

- construction purpose
- construction outline
- plan / design condition
- process
- construction management
- quality control plan
- safety management plan
- technical document, brochure

ii) The construction plan should take into consideration safety and environmental conservation at the site and its surroundings, and maintenance and management.

✧ Construction and construction management

i) Construction and construction management of rock bolt shall be implemented based on the construction plan.

ii) In the construction of rock bolt, if a situation different from the conditions assumed at the time of planning occurs, it is necessary to promptly investigate the cause and take appropriate measures as necessary.

✧ Assembling the formwork

i) Those that are likely to affect the quality of spraying mortar such as floating stones on the slope and the root system of vegetation shall be removed.

ii) The formwork shall be assembled so as to satisfy a predetermined standard.

✧ People who handles nozzle

Since the quality of the shotcrete mortar is affected by the skill of the person who handles the nozzle, the skill of that person shall be confirmed in advance.

✧ Spraying and surface treatment

i) At the time of spraying, the rebounding mortar shall be removed and cleaned.

ii) Surface treatment of the grating crib works shall be finished smoothly.

iii) After spraying, the interior of the frame shall be cleaned.

✧ Record

The necessary data for maintenance and management shall be recorded and preserved.

c. Applicable Design Standard

Followings are IRC Specifications, Standards and Design codes majorly applied for the design;

- Ministry of Road Transport & Highways: Specifications for Road and Bridge works (Fifth Revision) 2013

3.2.6. Non-Frame Works

a. Design

✧ General

i) The non-frame works is a construction method to stabilize the slope without cutting trees.

ii) This method is characterized by stabilizing the slope due to the reinforcement effect of the reinforcing material "lock bolt", the bearing pressure effect of the surface ground by the bearing pressure plate, and the group effect by head connection.

iii) Because the construction material is lightweight and easy to handle, it is excellent for steep slope construction.

✧ Material

i) General

Conform to the chapter on lock bolt.

ii) Reinforcing material

Conform to the chapter on lock bolt.

iii) Bearing pressure plate

Conform to the chapter on lock bolt.

iv) Head coupling material

- The head connecting material shall have sufficient strength to withstand the tensile force.
- Head connecting material consists of wire rope (JIS G 3525 or equivalent), turn buckle (JIS G 3445, JIS G 3101 or equivalent) etc.
- In order to ensure durability, the head connecting material shall be subjected to surface treatment (alloy plating, hot dip galvanizing treatment, etc.).

v) Injection material

Conform r to the chapter on lock bolt.

✧ Design

i) General

The design of the Non-frame works shall be designed so that stability is ensured by sufficient consideration of ground conditions, groundwater condition, surrounding structures etc.

ii) Arrangement of reinforcement

The arrangement of the reinforcing materials shall be arranged so as to draw an equilateral triangle such that the length of one side is 2 m in principle.

iii) Fixing length

Conform to the chapter on lock bolt.

iv) Installation angle of reinforcing material

Conform to the chapter on lock bolt.

v) Length of reinforcing material

Conform to the chapter on lock bolt.

vi) Bearing pressure plate and Head connecting material

Bearing pressure plates shall be arranged in an equilateral triangle shape and connected by a connecting material.

b. Construction

✧ General

Conform to the chapter on lock bolt.

✧ Construction plan

Conform to the chapter on lock bolt.

✧ Construction and construction management

Conform to the chapter on lock bolt.

✧ Positioning

i) The arrangement of the reinforcing materials shall be arranged so as to draw an equilateral triangle such that the length of one side is 2 m in principle.

ii) When the bearing pressure plate cannot be placed, it shall be positioned so that the length of one side is 3 m and the total of the three sides does not exceed 7 m.

✧ Scaffolding

i) The scaffold area shall be about 2 m × 2 m in the case of self-drilling.

ii) When the casing is used, the scaffold area should be suitable for the weight of the drilling machine.

✧ Drilling

Conform to the chapter on lock bolt.

✧ Insertion of reinforcing material

Conform to the chapter on lock bolt.

✧ Injection

Conform to the chapter on lock bolt.

✧ Curing

After the grout injection is completed, the lock bolt shall be cured so as not to receive deformation or vibration that may impair the function.

✧ Acceptance inspection (Confirmation test)

Conform to the chapter on lock bolt.

✧ Head treatment

Conform to the chapter on lock bolt.

✧ Head connecting material

Head connecting material shall be properly attached to the bearing pressure plate and tensioned (the slack of the wire is less than 2cm).

✧ Record

Conform to the chapter on lock bolt.

c. Applicable Design standard

Followings are IRC Specifications, Standards and Design codes majorly applied for the design:

- Ministry of Road Transport & Highways: Specifications for Road and Bridge works (Fifth Revision) 2013.

3.2.7. Reinforced Earth Wall

a. General

Reinforced earth wall shall be designed and constructed based on followings guidelines and specifications;

- IRC: SP:102-2014, Guidelines for Design and Construction of Reinforced Soil Wall
- MORTH Specifications for Road and Bridge works (Fifth Revision), 2013
- Japanese design or construction standards for reinforced earth walls or equivalent international standards as necessary

b. Elements of Reinforced Earth Wall

✧ Facing Elements

Facing elements shall be designed in accordance with IRC: SP:102-2014 and MORTH Specifications, 2013.

✧ Reinforcement Material

Reinforcement material shall be in accordance with IRC: SP:102-2014 and MORTH Specifications, 2013.

i) Drainage

In order to drain out the water remaining at back of reinforced earth wall, the filter material such as filter geofabric shall be provided properly as shown in the Drawings.

ii) Foundation

In order to avoid the stability failure of the structure, foundation of reinforced earth wall shall be embedded more than 0.5m into rock ground as shown in Drawings.

For reinforced earth wall installed at steep slope terrain, the foundation may be composed as multistage of base concrete as shown in the Drawing. In addition, rock anchors may be required to provide adequate structural stability in some case as shown in Drawing.

When such advanced foundation was applied, the design, material, construction methodology and etc. shall be proposed by the Contractor and require the approval by the Authority's Engineer.

iii) Others

For reinforced earth wall installed at steep slope terrain, it may be difficult to provide enough width of the wall at back side and length of reinforcement materials adequate without huge excavation of slope terrain. In such case, advanced structural details shall be considered in order to reduce the wall width. One of the method to is "Reinforced soil wall by fixing reinforced material with anchor bar" as shown in the Drawings.

When such advanced method was applied, the design of each members, material, connection details, construction methodology and etc. shall be proposed by the Contractor and require the approval by the Authority's Engineer.

c. Design Principles

Basically, reinforced earth wall shall be designed in accordance with IRC:SP: 102-2014 and MORTH Specifications,2013. For the foundation and wall with advanced method applied, the design shall be proposed by the Contractor and require the approval by the Authority's Engineer.

d. Construction and Quality Control Tests

Basically, reinforced earth wall shall be constructed in accordance with IRC: SP:102-2014 and MORTH Specifications,2013. For the foundation and wall with advanced method applied, construction methodology and quality control tests shall be proposed by the Contractor and require the approval by the Authority's Engineer.

3. Table for Clause 3

Geometric design criteria of the Project Highway shall be in accordance with the Table below.

Table: Summary of Geometric Design Criteria for Highway

Design Elements			Type/Value	Remarks
1	Highway Classification		National Highway	
2	Terrain Classification		Steep	
3	Design Speed (km/h)			
		Ruling (km/h)	40	
		Minimum (km/h)	30	
4	Cross-Sectional Elements	Basic Lane Width (m)	3.5	
		Number of Lanes	2	
		Formation Width (m)	12.0	
		Carriageway Width (m)	2 x 3.5	
		Outer Shoulder Paved Width (m)	2 x 1.5	
		Outer Shoulder Earthen Width (m)	2 x 1.0	
		Crossfall of Roadway (%)	2.5	
		Slope of Earthworks		
		Fill	V : H = 1:1.75	
		Cut (soil)	V : H = 1:1.2	Varies
		Cut (rock)	V : H = 1:0.2-0.5	Varies
5	Sight Dist.	Stopping Sight Distance, SSD (m)	30 (45)	() 40km/h
		Intermediate Sight Distance, ISD (m)	60 (90)	() 40km/h
		Overtaking Sight Distance, OSD (m)	(165)	() 40km/h
6	Horizontal Alignment	Horizontal Curve		
		Absolute Minimum Radius of Horizontal Curve (m)	30	
		Ruling Minimum Radius of Horizontal Curve (m)	50	
		Widening of Carriageway on Horizontal Curves		
		Widening for Absolute Minimum Radius (20m-40m)	1.5	
		Widening for Ruling Minimum Radius (41m-60m)	1.2	
		Widening for Radius (61m-100m)	0.9	
		Widening for Radius (101m-300m)	0.6	
		Superelevation (Se)		
		Maximum Se for Absolute Minimum Radius (%)	7.0	
		Superelevation Runoff Rate	1/60	
		Transition Curve		
		Minimum Length for Absolute Minimum Radius (m)	30	
		Minimum Length for Ruling Minimum Radius (m)	20	
7	Vertical Alignment	Vertical Gradient		
		Ruling Gradient (%)	6.0	
		Critical length of continuous Ruling Gradient (m)	2000	120m rise in 2km
		Limiting Gradient (%)	7.0	
		Exceptional Gradient (%)	8.0	
		Critical Length for Exceptional Gradient (m)	100	
		Minimum Gradient for Drainage (%)	0.5	Cut sections with
		Vertical Curve		
		Minimum Length of Vertical Curve (m)	15	
		Minimum Radius of Summit (Crest) Curve (m)		
		Absolute Minimum Radius (m)	205	From SSD
		Minimum Radius (m)	375	From ISD
		Desirable Minimum Radius (m)	1500	From OSD
		Minimum Radius of Valley (Sag) Curve (m)		
		Absolute Minimum Radius (m)	355	

4. Environment Management Plan

4.1 Overview

Descriptions of environment management measures during different stages of the project are provided in this chapter.

4.1.1. Pre-construction Stage

Required management measures during the pre-construction stage include the clearance of the ROW, plantation of trees, the measures for protecting/replacing community resources such as electric poles, public urinals and water points that are likely to be impacted. Their enhancement shall also be completed before construction work starts so that the community can start using these when the construction activity begins.

4.1.2. Construction Stage

This will be most crucial and active stage for the Environmental Management Plan (EMP). In addition to the monitoring of the construction activity itself to ensure that the environment is not damaged beyond permissible limits, the enhancement of cultural and community properties, mitigation and enhancement measures for water bodies through proper treatment of spoil soils will be undertaken as the construction progresses. To facilitate implementation of the enhancement and mitigation measures suggested, working drawings of the same have been provided in the Appendices. In addition, the provision of proper risk management with respect to construction activities such as accidental spillage is critical at this stage to avoid damage to flora and fauna, agricultural land and other sensitive resources. Typical locations of concerns include the locations of hot-mix plants (spillage of fuel, bitumen etc.) and labor camp sites.

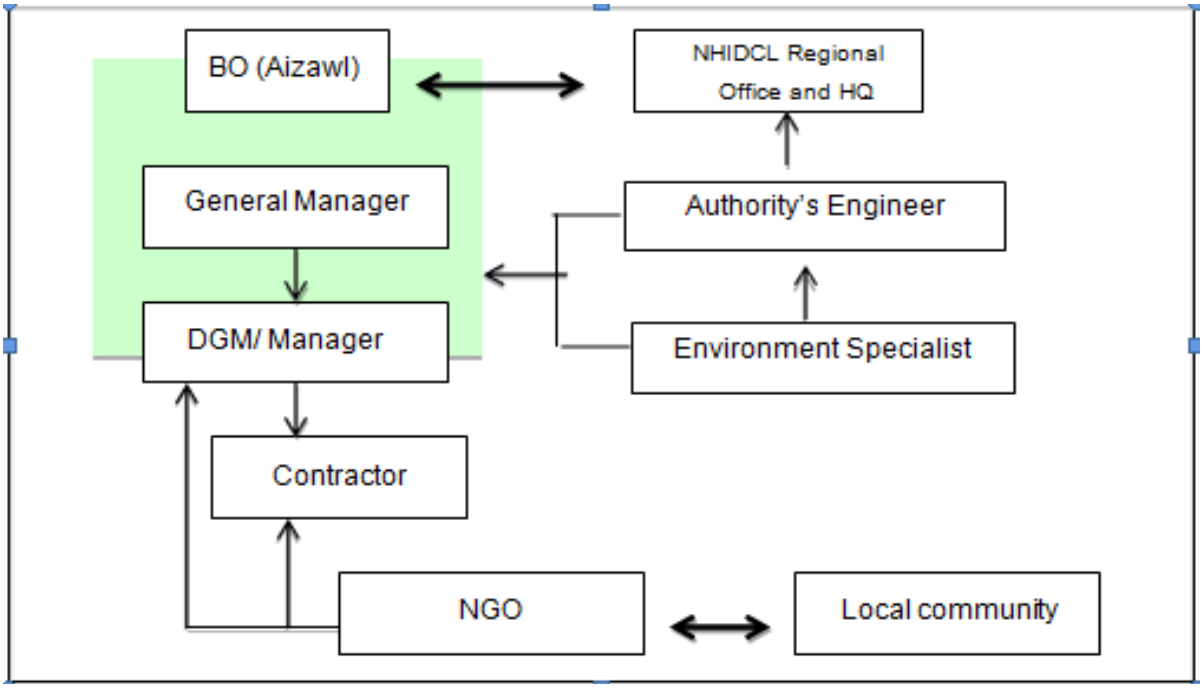
4.1.3. Operation Stage

The operation stage will essentially entail monitoring activity along the project area. In addition to checking the efficacy of the protection/ mitigation/ enhancement measures implemented, this will help verify or refuse the predictions made as a part of the impact assessment. Thus, it will complete a very important feedback loop for the project.

4.2. Environment Management Plan for Mitigation of Negative Impacts

The detailed measures adopted and/or to be adopted during different stages of the project to mitigate negative impacts and enhance positive aspects are shown in Table. The responsibility for implementation and supervision of EMPs are vested with three agencies, namely Contractors, Branch Office (BO), and Authority's Engineer (AE). The Contractors herein mean the agency hired for execution of the construction works for the respective contract packages. BO would be implementation agency. The Figure below indicates implementation structure of the EMP.

Fig: Institutional Arrangement for EMP Implementation



It has been proposed that General Manager (Projects) based in Aizawl will be in charge for the implementation of EIA and EMP for this project. General Manager will be assisted by Deputy General Manager/Manager by Authority's Engineer (and Environment Specialist) and contractor.

The Authority's Manager are expected to have in-house capacity to advise on and supervise the implementation of the EMP including suggesting enhancement design options and modifications, as necessary. For this purpose, the Authority's Engineer will employ a full-time environmental specialist.

The NGO will be one of the stakeholders in the entire project cycle with primary responsibility of facilitating the implementation of RAP and help NHIDCL/State Government in mitigating the adverse impacts of the project. Meanwhile, they can play a role in successful implementation of EMP, for example by supporting afforestation activity and awareness-raising campaign for traffic safety/risk of HIV/AIDS among others. Compensatory plantation and maintenance and protection of vegetation will be required as part of environmental mitigation and enhancement works. Likewise, spoil soils shall be used, where possible, to create community assets such as playground as per request of the community. In these types of works, the project may engage NGO to liaise with local community for effective implementation of the project.

Sl. No	Environmental Impacts/Issues	Mitigation Measures	Location	Time Frame	Responsibility	
					Implementation	Supervision
P1	Relocation of Project Affected Persons (PAP)	• All requirements of the RAP as applicable shall be complete before start of construction stage. The activities broadly include acquisition of land and structures, relocation of utilities, payment of compensation and provision assistance	All areas	Before construction begins	Government of Mizoram, District Revenue authorities, Village Councils, NGO	BO, AE
P2	Removal of vegetation	• Minimize the scale of vegetation clearing by factoring vegetation/forest cover in the final design of the road alignment process • Removal of trees to be carried out after forest clearance is obtained • Reforestation/replantation of trees at a term as instructed by the Forest Dept. or by the Forest Dept. • Activity shall be supervised to avoid poaching of animals	All areas	Before construction begins (Reforestration/replan tation may extend to during/after construction)	BO,Contractor, Forest Dept.	BO, AE, Forest Dept.

P3	Setting up construction camps	• Camps shall be located at least 500m away from the nearest built-up area. • Sewage system for a construction laborer's camp shall be designed, built and operated so that no pollution to ground or adjacent water bodies/ watercourses takes place. Garbage bins shall be provided in the camps and regularly emptied and the garbage disposed off in a hygienic manner, to the satisfaction of the relevant norms and the Engineer. • In relation to underground water resources, the contractor shall take all necessary precaution to prevent interference with such water resources. • All relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996 shall be adhered to.	All construction campsite identified by the contractor and approved by AE	During Establishment, Operation and Dismantling of Such Camps.	Contractor	BO, AE
P4	Setting up hot mix plants	• Hot mix plants and batching plants shall be located sufficiently away from habitation and agricultural operations. • Where possible such plants will be located at least 1000m away from the nearest habitation.	All hot-mix and batching plants	During Erection, Testing, Operation and Dismantling of Such Plants.	Contractor	BO, AE
P5	Finalizing sites for surplus soil dumping	• Location of dumping sites shall be finalized. The sites shall meet following conditions: i) dumping does not impact natural drainage courses; ii) no endangered/rare flora is impacted by such dumping	All areas identified as potential dumping sites	During mobilization	Contractor	BO, AE

P6	Identification of hazard-prone locations	• The contractor shall identify locations sensitive to landslides (in addition to the ones that area already identified) and shall duly report these to the Supervision Consultant (AE) and to BO.	All area	During mobilization	Contractor	BO, AE
P7	Identify and prepare relocation sites	• Location of relocation sites shall be identified in consultation with district/village authorities and PAPs. • Sites to be developed including provision of necessary utilities such as water and electricity.	Near villages with large-scale resettlement		BO	BO

Table 4.2 Environmental Management Plan for Construction Stage

Sl. No	Environmental Impacts/Issues	Mitigation Measures	Location	Time Frame	Responsibility	
					Implementation	Supervision
Soil						
C1	Soil Erosion in Borrow Pits	• The depth of borrow pits shall be restricted so that sides of the excavation shall have a slope not steeper than 1:4, from the edge of the final section of the bank. (if applicable)	On approved locations of borrow pits.	Construction Stage	Contractor and Authority's Engineer	BO
C2	Loss of top soil in Borrow pits	• Agricultural fields or productive land shall be avoided for borrowing earth. If unavoidable topsoil shall be preserved and used for tree plantation. (if applicable)	On approved locations of borrow pits.	Construction Stage	Contractor and Authority's Engineer	BO
C3	Compaction of Soil	• Construction equipment and vehicles shall be restricted to move only within designated area to avoid compaction of productive soil.	Throughout corridor.	Construction Stage	Contractor and Authority's Engineer	BO
C4	Soil erosion in embankments	• Pitching shall be done for slope stabilization as per the IRC guidelines (if applicable)	At the places of embankments	Construction Stage	Contractor and Authority' s Engineer	BO
C5	Contamination of soil from fuel and lubricants	• Construction vehicles and equipment shall be operated and maintained in such a manner so that soil contamination due to its spillage shall be minimum. • Fuel storage shall only be done on wasteland and will be kept away from drainages channels and natural water bodies.	Near Labor camp And sites of installation of Construction machineries	Construction Stage	Contractor and Authority's Engineer	BO

C6	Contamination of land from construction waste and quarry materials	• Debris generated due to the dismantling of the existing pavement structure and the cutting of the hillside for the widening shall be suitably reused in the proposed construction, such as for fill materials for embankments. • Debris and other material obtained from existing embankment shall be dumped in approved landfill site already identified by concerned agency. All spoils shall be disposed off as desired and the site shall be fully cleaned before handing over. • Construction waste including non-bituminous and bituminous waste shall be dumped in approved landfill site identified by State Pollution Control Board (SPCB) or competent authority. All spoils shall be disposed off as desired and the site shall be fully cleaned before handing over.	Solid waste dump Site identified and approved by SPCB. or competent authority. Throughout the area	Construction Stage	Contractor and Authority's Engineer	BO
C7	Loss of top soil in land acquisition	• Topsoil shall be stripped, stored and shall be laid on ground for landscaping purpose. (if feasible)	Throughout the area	Construction Stage	Contractor and Authority's Engineer	BO
Water						

C8	Contamination of water by fuel/ oil spillage of vehicle	• Construction vehicles / equipment shall be operated and maintained in such a manner to avoid contamination of water bodies due to oil spillage. • Fuel storage shall only be done on wasteland and will be kept away from drainage channels and natural water bodies.	Near labor camp and sites of installation of Construction machineries.	Construction Stage	Contractor and Authority's Engineer	BO
C9	Contamination of stagnant water body by fecal matters from labor camp.	• Labor camp shall not be allowed near any of the water bodies. • The proper sanitation facilities shall be provided.	Preapproved locations away from the water bodies.	Construction Stage	Contractor and Authority's Engineer	BO

C10	Deposition of dust in open wells near construction site	• The mouth/opening of the well shall be covered with suitable material during any of the construction activity so as to prevent dust entering in the well.	All the wells along the project corridor.	Construction Stage	Contractor and Authority's Engineer	BO
C11	Using drinking water for construction purpose	• The contractor shall make arrangements for water required for construction in such a way that water availability and supply to nearby community is unaffected. • Wastage of water shall be kept minimum during construction.	At respective planned construction sites	Construction Stage	Contractor and Authority's Engineer	BO
C12	Hand pump close to road may get affected in widening	• All the Hand pumps shall be relocated to suitable alternate place.	At the respective locations	Construction Stage	Contractor and Authority's Engineer	BO
C13	Wells or water stoarge system may get affected in widening	• Alternate arrangements will be made for all the Wells or water storage system.	At the respective locations	Construction Stage	Contractor and Authority's Engineer	BO
C14	Altering flow of natural drains	• Drain shall be channelized with Slope protection - Gabion Structure.	At the respective locations	Construction Stage	Contractor and Authority's Engineer	BO
C15	Sanitation of waste disposal in construction camps	• The construction of camps will be done with sufficient buffer from habitation. • At construction sites and labor camps sufficient no of latrines will be provided. • The sewage generated from the camps will be properly disposed off so that it does not affect water bodies	Wherever labor camp is located	Construction Stage	Contractor and Authority's Engineer	BO

Air						
C16	Emission from construction vehicles and machinery.	• All vehicles, equipment and machinery shall be selected to meet recognized international and national standards for emissions and shall be maintained and operated in a manner that ensures relevant air, noise and discharge rules. • Only unleaded petrol and low sulphur diesel or sulphur free diesel shall be used as fuel for vehicles, equipment and machinery.	Wherever the hot mix plant and batching plant is setup.	Construction Stage	Contractor and Authority's Engineer	BO
C17	Air pollution from various plants affecting settlements	• The asphalt plants, crushers and batching plants shall not be sited at least 500 m in leeward direction from nearest human settlement	Locations near Settlement	Construction Stage	Contractor and Authority's Engineer	BO
C18	Air pollution may exceed the limits prescribed by Central Pollution Control Board.	• Regular monitoring or air quality parameters during the construction period as envisaged in the Environmental Monitoring Plan.	Locations given in Environmental Monitoring Plan.	Construction Stage	Contractor and Authority's Engineer	BO
C19	Vehicles will generate dust and suspended particles.	• The dust generated by vehicles on site shall be arrested using a water tanker fitted with sprinkler capable of applying water uniformly with a controllable rate of flow to variable widths of surface but without any flooding.	Wherever the plants are setup and sensitive locations as suggested in monitoring plan.	Construction Stage	Contractor and Authority's Engineer	BO

Noise						
C20	Noise levels from vehicles. Asphalt plants and equipment	• The plants and equipment used for construction shall confirm to CPCB norms. • Vehicles and equipment used shall be fitted with silencer. • Any vehicle and machinery shall be kept in good working order and engines turned off when not in use. • All equipment and plants shall strictly be placed away from educational institutes and hospitals. • Regular monitoring of noise parameters (Leq) during the construction period as envisaged in the Environmental Monitoring Plan.	Wherever the plants are setup.	Construction Stage	Contractor and Authority's Engineer	BO
C21	Noise from blasting operations	• Blasting as per Indian Explosives act will be carried out. • People living near such blasting operation sites shall be informed before the operational hours. • Workers at blasting sites shall be provided with earplugs.	At the sites where the blasting is required and in quarry sites	Construction Stage	Contractor and Authority's Engineer	BO
C22	Noise barriers	• Construction of noise barriers in the form of walls at Sensitive locations upon consultation with stakeholders.	All along the corridor wherever the sensitive locations like schools, hospitals and other community places are located	Construction Stage	Contractor and Authority's Engineer	BO
Flora and Fauna						

C23	Tree cutting for widening.	• Three trees shall replace each tree cut for the purpose. • The Engineer shall approve such felling only when the NHIDCL receives a "clearance" for such felling from the MOEF, as applicable. • Trees felled shall be replaced as per the compensatory afforestation criteria in accordance with the Forests (Conservation) Act, 1980.	Throughout the project area.	Construction stage	Contractor And Authority's Engineer Forest Dept.	BO
C24	Damage or Loss of Important Flora	• During construction, at any point of time, if a rare/ threatened/endangered flora species is found, it shall be conserved in a suitable manner in consultation with authorities. The Engineer shall approve detailed conservation processes, plans and designs as well as associated modification in the project design.	Throughout the project area.	Construction Stage	Contractor and Authority's Engineer	BO
Health and Hygiene						

C25	Health hazard to workers due to bad water and sanitation	• At every workplace, good and sufficient portable water (as per IS 10500) supply shall be ensured to avoid water borne diseases and secure the health of the workers • Adequate drainage, sanitation and waste disposal shall be provided at workplaces. • Preventive medical care shall be provided to the worker.	Wherever labor camp is setup	Construction Stage	Contractor and Authority's Engineer	BO
C26	Health hazard to workers by various construction activity	• Personal protective equipment shall • be provided to worker as per the Factories Act.	Throughout the project area.	Construction Stage	Contractor and Authority's Engineer	BO
C27	Health/ social hazard, sexual harassment to female workers	• Segregation of male and female areas in labor camp shall be executed.	Wherever labor camp is setup	Construction Stage	Contractor and Authority's Engineer	BO

C28	Hygiene at Construction Camps	• On completion of the works, the whole of such temporary structures shall be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the whole of the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer.				
C29	Abandoned Quarry will accumulate water and act as a breading ground for disease vectors.	• Reclamation measure shall be adopted with garland of trees around the periphery. The quarry dust and waste shall be used for refilling. The remaining portion should be covered with trees.	All quarry locations.	Construction Stage	Contractor and Authority's Engineer	BO
Safety						
C30	Safety of vehicles plying on road while the construction activity is going on.	• Prior arrangement/traffic diversion for safe passage of vehicles shall be made with proper direction and signage at the construction site. • Detailed Traffic Control Plans shall be prepared and submitted to the Site Engineer/ Project Director for approval 5 days prior to commencement of works on any section of road. The traffic control plans shall contain details of temporary diversions, details of arrangements for construction under traffic and details of traffic arrangement after cessation of work each day.	Throughout the project area.	Construction stage	Contractor and Authority's Engineer	BO

C31	Risk from Operations	• The Contractor is required to comply with all the precautions as required for the safety of the workmen as far as those are applicable to this contract. • The contractor shall supply all necessary safety appliances such as safety goggles, helmets, masks, etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.	All construction sites	Construction stage	Contractor and Authority's Engineer	BO
C32	Risk from Electrical Equipment	• Adequate precautions will be taken to prevent danger from electrical equipment. No material or any of the sites will be so stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the Engineer.	All construction Site	Construction stage	Contractor and Authority's Engineer	BO

C33	Risk at Hazardous Activity	• All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Stone-breakers will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals. • The use of any herbicide or other toxic chemical shall be strictly in accordance with the manufacturer's instructions. The Engineer shall be given at least 6 working day's notice of the proposed use of any herbicide or toxic chemical. A register of all herbicides and other toxic chemicals delivered to the site shall be kept and maintained up to date by the Contractor. The register shall include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, safe handling and storage procedures, and emergency and first aid procedures for the product. This should comply with Hazardous Material Act.	All construction sites	Construction stage	Contractor and Authority's Engineer	BO

C34	Risk of Lead Pollution	• Nobody below the age of 18 years and no woman shall be employed on the work of painting with products containing lead in any form. No paint containing lead or lead products will be used except in the form of paste or readymade paint. • Facemasks will be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped	All construction sites	Construction stage	Contractor and Authority's Engineer	BO

C35	Risk caused by Force' Majure	● All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.	All construction Site	Construction stage	Contractor and Authority's Engineer	BO
C36	Risk from Explosives	● Except as may be provided in the contract or ordered or authorized by the Engineer, the Contractor shall not use explosives. Where the use of explosives is so provided or ordered or authorized, the Contractor shall comply with the requirements of the following Sub-Clauses of this Clause besides the law of the land as applicable. ● The Contractor shall at all times take every possible precaution and shall comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives and shall, at all times when engaged in blasting operations, post sufficient warning flagmen, to the full satisfaction of the Engineer. ● The Contractor shall at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whatsoever concerned or affected or likely to be concerned or affected by blasting operations.	Place of use of Explosives	Construction stage	Contractor and Authority's Engineer	BO
C37	Malarial risk	● The Contractor shall, at his own expense, conform to all anti-malarial instructions given to him by the Engineer, including filling up any borrow pits which may have been dug by him	All construction sites, particularly beyond Lunglei district	Construction stage	Contractor and Supervision Consultant	BO

C38	First Aid	• At every workplace, a readily available first aid unit including an adequate supply of sterilized dressing material and appliances will be provided.	At the construction site /labor camp	Construction stage	Contractor	BO
Disruption to Users						
C39	Loss of Access	• At all times, the Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock to and from side roads and property accesses connecting the project road. Work that affects the use of side roads and existing accesses shall not be undertaken without providing adequate provisions to the prior satisfaction of the Engineer. • The works shall not interfere unnecessarily or improperly with the convenience of public or the access to, use and occupation of public or private roads, railways and any other access footpaths to or of properties whether public or private.	Throughout the project area, particularly in built-up areas	During Construction.	Contractor	Authority's Engineer

C40	Traffic Jams and Congestion	• Detailed Traffic Control Plans shall be prepared and submitted to the Site Engineer/ Project Director for approval 5 days prior to commencement of works on any section of road. The traffic control plans shall contain details of temporary diversions, details of arrangements for construction under traffic and details of traffic arrangement after cessation of work each day. • Temporary diversion (including scheme of temporary and acquisition) will be constructed with the approval of the designated Engineer. While approving temporary diversion construction, the Engineer will seek endorsement from the BO. • Special consideration shall be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night. • The Contractor shall ensure that the running surface is always properly maintained, particularly during the monsoon so that no disruption to the traffic flow occurs. As far as possible idling of engines shall be avoided to curb pollution. • The temporary traffic detours shall be kept free of dust by frequent application of water, if necessary.	Throughout Corridor	During Construction.	Contractor	Authority's Engineer

C41	Traffic Control and Safety	• The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades,including signs, markings, flags, lights and flagmen as may be required by the Authority's Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement. • All signs, barricades, pavement markings shall be as per the MORTH specification. Before taking up construction on any section of the highway, a traffic control plan shall be devised to the satisfaction of the Authority's Engineer as per EMP. Excavated pits shall be filled to avoid falling of animals/ human beings.	Throughout the project area	During Construction.	Contractor	Authority's Engineer
Environment Enhancement						
C42	Hand pumps enhancement/relocation for ground water recharging	• Hand pumps within Right of Way shall be enhanced/relocated.	At the respective locations along the corridor.	Construction Stage	Contractor and Authority's Engineer	BO
C43	Roadside landscape development	• Avenue plantation of foliage trees mixed with flowering trees, shrubs and aromatic plants shall be carried out where ever land is available between ditches and Right of Way.	Throughout the corridor	Construction Stage	Contractor and Authority's Engineer	BO
C44	Providing better bus bays	• Bus shelters shall be provided at given locations	As per traffic plan	Construction Stage	Contractor and Authority's	BO

					Engineer	
C45	Better sitting arrangements where small space is available	• Designed sitting arrangements shall be provided.	As per the design	Construction Stage	Contractor and Authority's Engineer	BO
C46	Landscaping of junctions	• All rotary junctions shall be landscaped suitably	As per landscape design at the respective locations	Construction Stage	Contractor and Authority's Engineer	BO
C47	Abandoned Quarry will accumulate water and act as a breeding ground for disease vectors.	• The abandoned quarry locations shall be planted suitably as the plan	Wherever quarries are located and abandoned	Construction Stage	Contractor and Authority's Engineer	BO
C48	Erosion of embankments, shoulders, side slopes, and pavement leading to deterioration and affecting stability and integrity of road	• Earth works specifications will include provision for stable slope construction, compacting and laying out turf including watering until ground cover is fully established • Proper construction of Breast wall and retaining wall at the locations identified by the design team to avoid soil erosion • The measures proposed for slope stabilization are: Discharge zones of drainage structures (culverts and minor bridges) provided with riprap • Construction in erosion and flood prone areas will not be in monsoon /season. • Side slopes will be kept flatter wherever possible, and in case of steeper slopes it will be supported by the retaining wall.	At the respective locations throughout the project area.	Construction Stage	Contractor and Authority's Engineer	BO

Table 4.3 Environmental Management Plan for Operation Stage

Sl. No	Environmental Impacts/Issues	Mitigation Measures	Location	Time Frame	Responsibility	
					Implementation	Supervision
O1	Water quality degradation due to road-run-off	• Silt fencing, oil & grease traps, etc. shall be provided at sensitive water bodies to ensure that the water quality is not impaired due to contaminants from road run-off • Monitoring shall be carried out as specified in the monitoring plan	As specified in the monitoring plan	As per monitoring plan	BO, SPCB	BO
O2	Soil and water contamination from accidental spills	• Contingency plans to be in place for cleaning up of spills of oil, fuel and toxic chemicals • Monitoring shall be carried out as specified in the Monitoring Plan	All area and as specified in the monitoring plan	Plan to be developed at state/district level by early operation stage	BO, SPCB, Local Government Bodies	BO
O3	Air quality degradation due to increases in traffic volume	• Monitoring shall be carried out as specified in the Monitoring plan • Share air quality data with SPBC and relevant agencies and discuss options for mitigate air quality degradation associated with greater traffic volume	As specified in the monitoring plan	As per monitoring plan	BO, SPCB	BO
O4	Increases in noise and vibration due to greater traffic volume	• Monitoring shall be carried out as specified in the Monitoring plan • Install noise barrier (wall etc.) in sensitive areas, if necessary	As specified in the monitoring plan	As per monitoring plan	BO, SPCB	BO
O5	Traffic safety	• Traffic control measures including speed limits to be enforced strictly. • Local government bodies and development authorities will be encouraged to control building development along the highway.	All area	Throughout operation stage	BO, Local Government Bodies	BO

O6	Accidents involving hazardous materials	• Compliance with the Hazardous Wastes (Management and Handling) Rules, 1989 including: ✓ For delivery of hazardous substances, permit license, driving license and guidance license will be required. ✓ These vehicles will only be harbored at designated parking lots. ✓ In case of spill of hazardous materials, the relevant departments will be notified at once to deal with it with the spill contingency plan.	All area	Manual/guideline to be prepared during early operation stage	BO	BO
O7	Roadside tree plantation, flora and fauna	• Trees planted along the corridor shall be maintained for a period of three years. Maintenance works include, watering of the saplings, replacement of the bamboo fence every year for 3 years and all necessary measures for survival of the sapling. • Monitoring of flora and fauna along the highway shall be carried out to assess conditions of ecosystem against the baseline	All area and as per the monitoring plan	Immediately from the planting of sapling, and as per monitoring plan	BO, NGO	BO

Environment Monitoring Plan

To ensure effective implementation of the EMP, it is essential that an effective monitoring plan be designed and carried out. The environmental monitoring plan provides such information on which management decision may be taken during construction and operational phases. It provides basis for evaluating the efficiency of mitigation and enhancement measures and suggest further actions that need to be taken to achieve the desired effect. The monitoring includes: i) Visual observations; ii) Selection of environmental parameters at specific locations; and iii) Sampling and regular testing of these parameters

Monitoring methodology covers the following key aspects: Components to be monitored; parameters for monitoring of the above components; monitoring frequency; monitoring standards; responsibilities for monitoring; direct responsibility, overall responsibility; and monitoring costs. Environmental monitoring of the parameters involved and the threshold limits specified are discussed below.

Ambient air quality

Ambient air quality parameters recommended for monitoring road transportation developments are PM10, PM 2.5, Carbon Monoxide (CO), Oxides of Nitrogen (NO_X), Sulphur Dioxide (SO_2) and Lead (Pb). These will be monitored at designated locations starting from the commencement of construction activity. Data should be generated at all identified locations in accordance to the National Ambient Air Quality Standards, 2009. The location, duration and the pollution parameters will be monitored and the responsible institutional arrangements are detailed out in the Monitoring Plan.

Water quality

The physical and chemical parameters recommended for analysis of water quality relevant to road development projects are pH, total solids, total dissolved solids, total suspended solids, oil and grease, COD, chloride, lead, zinc and cadmium. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan. The monitoring of the water quality is to be carried out at all identified locations in accordance to the Indian Standard Drinking Water Specification – IS 10500: 1991.

Noise

The measurements for monitoring noise levels would be carried out at all designated locations in accordance to the Ambient Noise Standards formulated by Central Pollution Control Board (CPCB) in 1989. Noise should be recorded at an “A” weighted frequency using a “slow time response mode” of the measuring instrument. The location, duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan

The monitoring plan for the various performance indicators of the project in the construction and operation stages is summarized in the Table 8.4.

Sl. No	Item	Project Stage	Parameters	Guidance	Standards	Location	Frequency	Duration	Responsibility	
									Implementation	Supervision
M1	Air	Construction	SPM, RSMP, SO_2, NOx, CO, HC	• Dust sampler to be located 50m from the plan in the downwind direction. • Use method specified by CPCB for analysis	Air (P&CP) Rules, CPCB, 1994	Hot mix plant/ batching plant	Twice a year for three years	Continuous 24 hours	Contractor through approved monitoring agency	BO
M2		Construction	SPM, RSPM	• Dust sampler to be located 50m from the earthworks site downwind direction. Follow CPCD method for analysis	Air (P&CP) Rules, CPCB, 1994	Stretch of road where construction is underway	Twice a year for three years	Continuous 24 hours	Contractor through approved monitoring agency	BO
M3		Operation	SPM, RSMP, SO_2, NOx, CO, HC	• Use method specified by CPCB for analysis	Air (P&CP) Rules, CPCB, 1994	Sampling location specified in EIA report	Twice a year for one year	Continuous 24 hours	BO	BO
M4	Water	Construction	pH, BOD, COD, TDS, TSS, DO, Oil & Grease and Pb	• Sample collected from source and analyze as per Standard Methods for Examination of Water and Wastewater	Water quality standards by CPCB	Sampling locations specified in EIA report	Twice a year for three years		Contractor through approved monitoring agency	BO
M5		Operation	pH, BOD, COD, TDS, TSS, DO, Oil & Grease and Pb	• Grab sample collected • from source and analyze as per Standard Methods for Examination of Water • and Wastewater	Water quality standards by CPCB	Sampling locations specified in EIA report	Twice a year for one year		BO	BO
M6		Operation	Cleaning of drains and water bodies	• Choked drains, water bodies undergoing siltation and subject to debris disposal should be monitored under cleaning operations	To the satisfaction of the engineer (PWD)	All area	Post-monsoon		BO	BO

M7	Noise and vibration	Construction	Noise levels on dB (A) scale	• Free field at 1m from the equipment whose noise levels are being determined	Noise standards by CPCB	At equipment yard	Once every 3 Month (max) for three years, as required by the Authority's engineer	Reading to be taken at 15 seconds interval for 15 minutes every hour and then averaged	Contractor through approved monitoring agency	BO
M8		Operation	Noise levels on dB (A) scale	• Equivalent Noise levels using an integrated noise level meter kept at a distance of 15 m from edge of Pavement	Noise standards by CPCB	At maximum 15 sites inc. those listed in EIA report for noise monitoring locations	Twice a year for 1 years	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	BO	BO
M9	Soil erosion	Construction	Turbidity in Storm water; Silt load in ponds, water courses	• Visual observations during site visits	As specified by the Authority's engineer / Water quality standards	At locations of stream crossings and at locations of retaining wall and breast wall	Pre-monsoon and post-monsoon for three years		Contractor	BO
M10		Operation	Turbidity in Storm water; Silt load in ponds, water courses	• Visual observations during site visits	As specified by the Authority's engineer / Water quality standards	As directed by the engineer	Pre-monsoon and post-monsoon for one year		BO	BO

M11	Construction Camp	Construction	Monitoring of: 1.Storage Area; 2. Drainage Arrangement 3. Sanitation in Camps	• Visual Observations and as directed by the Authority's engineer	To the satisfaction of the Authority's engineer and Water quality standards	At storage area and construction workers' camp	Quarterly during construction stage		BO	BO

M12	Affores tation	Construction and operation	Plant survival	• The success of tree planting. Monitor the rate of survival after six months, one year and 18 months in relation to total numbers of trees planted		All area	Minimum three years after planting		NGO, BO	BO
M13	Flora and Fauna	Construction and Operation	Condition of ecosystem	• Comparison to pre-project flora and fauna	As specified in TOR	As specified in TOR	Twice a year for three years		BO	BO

*Any amendment/ Corrigendum/ revision of standards as per latest status shall be applicable.

Schedule – E

(See Clause 2.1 and 14.2)

MAINTENANCE REQUIREMENTS

1. Maintenance Requirements

1.1. The Contractor shall, at all-time maintain the Project Highway in accordance with the provisions of this Agreement, Applicable Laws and Applicable Permits.

1.2 The Contractor shall repair or rectify any Defect or deficiency set forth in Paragraph 2 of this Schedule-E within the time limit specified therein and any failure in this behalf shall constitute non-fulfillment of the Maintenance obligations by the Contractor. Upon occurrence of any breach hereunder, the Authority shall be entitled to effect reduction in monthly lump sum payment as set forth in Clause 14.6 of this Agreement, without prejudice to the rights of the Authority under this Agreement, including Termination thereof.

1.3. All Materials, works and construction operations shall conform to the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (FIFTH REVISION, April 2013)", including latest corrections slips, issued by the Ministry of Surface Transport & Highways, Government of India and published by the Indian Roads Congress.

Where the specifications for a work are not given, Good Industry Practice shall be adopted to the satisfaction of the Authority's Engineer.

2. Repair/rectification of Defects and deficiencies

The obligations of the Contractor in respect of Maintenance Requirements shall include repair and rectification of the Defects and deficiencies specified in Annex-I of this Schedule-E within the time limit set forth therein.

3. Other Defects and deficiencies

In respect of any Defect or deficiency not specified in Annex-I of this Schedule-E, the Authority's 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 Contractor within the time limit specified by the Authority's Engineer.

4. Extension of time limit

Notwithstanding anything to the contrary specified in this Schedule-E, if the nature and extent of any Defect or deficiency justifies more time for its repair or rectification than the time specified herein, the Contractor shall be entitled to additional time in conformity with Good Industry Practice. Such additional time shall be determined by the Authority's Engineer and conveyed to the Contractor and the Authority with reasons thereof;

5. Emergency repairs/restoration

Notwithstanding anything to the contrary contained in this Schedule-E, if any Defect, deficiency or deterioration in the Project Highway poses a hazard to safety or risk of damage to property, the Contractor shall promptly take all reasonable measures for eliminating or minimizing such danger.

6. Daily inspection by the Contractor

The Contractor 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 Authority's Engineer may specify. Such record shall be kept in safe custody of the Contractor and shall be open to inspection by the Authority and the Authority's Engineer at any time during office hours.

7. Pre-monsoon inspection / Post-monsoon inspection

The Contractor shall carry out a detailed pre-monsoon inspection of all bridges, culverts and drainage system before [1st June] every year in accordance with the guidelines contained in IRC: SP:35. Report of this inspection together with details of proposed maintenance works as required on the basis of this inspection shall be sent to the Authority's Engineer before the [10th June] every year. The Contractor shall complete the required repairs before the onset of the monsoon and send to the Authority's Engineer a compliance report. Post monsoon inspection shall be done by the [30th September] and the inspection report together with details of any damages observed and proposed action to remedy the same shall be sent to the Authority's Engineer.

8. Repairs on account of natural calamities

All damages occurring to the Project Highway on account of torrential rains, floods, earthquake or other natural disasters shall be undertaken by the Contractor at its own cost and/or out of the proceeds of insurance.

Annex – I
(Schedule-E)

Repair/rectification of Defects and deficiencies

The Contractor shall repair and rectify the defects and deficiencies specified in this Annex-I of Schedule-E within the time limit set forth in the table below.

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 (fifteen) days
(ii)	Roughness value exceeding 2,200 mm in a stretch of 1 km (as measured by a calibrated bump integrator)	120 (one hundred and twenty) days
(iii)	Pot holes	24 hours
(iv)	Any cracks in road surface	15 (fifteen) days
(v)	Any depressions, rutting exceeding 10 mm in road surface	30 (Thirty) days
(vi)	Bleeding/Skidding	7 (seven) days
(vii)	Any other defect/distress on the road	15 (fifteen) days
(viii)	Damage to pavement edges	15 (fifteen) days
(ix)	Removal of debris, dead animals	6 hours
(b)	**Granular earth shoulders, side slopes, drains and culverts**	
(i)	Edge drop at shoulders exceeding 40 mm	7 (Seven) days
(ii)	Variation by more than 1% in the prescribed slope of camber/cross fall (shall not be less than the camber on the main carriageway)	7 (seven) days
(iii)	Variation by more than 15% in the prescribed side (embankment) slopes	30 (thirty) days

(iv)	Rain cuts/gullies in slope	7 (Seven) days
(v)	Damage to or silting of culverts and side drains	7 (Seven) days
(vi)	Desilting of drains in urban/semi-urban areas	24 hours
(vii)	Railing, parapets, crash barriers	7 (Seven) days (Restore immediately if causing safety hazard)
(c)	**Road side furniture including road sign and pavement marking**	
(i)	Damage to shape or position, poor visibility or loss of retro-reflectivity	48 hours
(ii)	Painting of KM stone, railing, parapets, crash barriers	As and when required/Once every year
(iii)	Damaged/missing road signs required replacement	7 (Seven) days
(iv)	Damage to road mark ups	7 (Seven) days
(d)	**Road lighting**	
(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)	Removal of fallen trees from carriageway	4 hours
(iii)	Deterioration in health of trees and bushes	Timely watering and treatment
(iv)	Trees and bushes requiring replacement	30 (Thirty) days
(v)	Removal of vegetation affecting sight line and road structures	15 (fifteen) days
(f)	**Rest area**	
(i)	Cleaning of toilets	Every 4 hours
(ii)	Defects in electrical, water and sanitary installation	24 hours
(g)	**Toll Plaza**	

(h)	**Other Project Facilities, Rest Area and Approach roads**	
(i)	Damage in pedestrian facilities, truck lay-buys, bus-bays, bus-shelters, cattle, crossings, [Traffic Aid Posts, Medical Aid Posts] and service roads	15 (fifteen) days
(ii)	Damaged vehicles or debris on the road	4 (Four) hours
(iii)	Malfunctioning of the mobile cranes	4 (four) hours
Bridges		
(a)	**Superstructure**	
(i)	Any damage, cracks, spalling/scaling Temporary measures Permanent measures	 Within 48 hours Within 15 (fifteen) days or as specified by the Authority's Engineer
(b)	**Foundations**	
(i)	Scouring and/or cavitation	15 (fifteen) days
(c)	**Piers, abutments, return walls and wing walls**	
(i)	Cracks and damages including settlement and tilting, Spalling, scaling	30 (thirty) days
(d)	**Bearings (metallic) of bridges**	
(i)	Deformation	15 (fifteen) days Greasing of metallic bearings once in a year
(e)	**Joints**	
(i)	malfunctioning of joints	15 (fifteen) days
(f)	**Other items**	
(i)	Deforming of pads in elastomeric bearings	7 (seven) days
(ii)	Gathering of dirt in bearings and joints; or clogging of spouts, weep holes and vent-	3 (three) days

	holes	
(iii)	Damage or deterioration in kerbs, parapets, handrails and crash barriers	3 (three) days (immediately within 24 hours if posing danger of safety)
(iv)	Rain-cuts or erosion of banks of the side slopes of approaches	7 (seven) days
(v)	Damage to wearing coat	15 (fifteen) days
(vi)	Damage or deterioration in approach Slabs, pitching, apron, toes, floor or guide bunds	30 (thirty) days
(vii)	Growth of vegetation affecting the structure or obstructing the waterway	15 (fifteen) days
(g)	**Hill Roads**	
(i)	Damage to retaining wall/breast wall	7 (seven) days
(ii)	Landslides requiring clearance	12 (twelve) hours
(iii)	Snow requiring clearance	24 (twenty four) hours

[**Note:** Where necessary, the Authority may modify the time limit for repair/rectification, or add to the nature of Defect or deficiency before issuing the bidding document, with the approval of the competent authority.]

Schedule-F

(See Clause 3.1.5(a))

APPLICABLE PERMITS

1. **Applicable Permits**

The Contractor shall obtain, as required under the Applicable Laws, the following Applicable Permits:

(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) License for use of explosives;

(d) Permission of the State Government for drawing water from river/reservoir;

(e) License 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 setting up asphalt plant;

(h) Permission of Village Panchayats and State Government for borrow earth; and

(i) Any other permits, clearances or approvals required under Applicable Laws.

1.2 Applicable permits, as required, relating to environmental protection and conservation shall have been produced by the Authority in accordance with the provisions of this Agreement

Schedule-G

(See Clause 7.1.1, 7.5.3 and 19.2)

FORM OF BANK GUARANTEE

Annex-I

(See Clause 7.1.1)

PERFORMANCE SECURITY

The Managing Director,
NHIDCL,
3rd Floor, PTI Building, 4, Parliament Street,
New Delhi-110001

WHEREAS:

(A) _____ [name and address of contractor] (hereinafter called "the Contractor") and **NHIDCL**, (**"the Authority"**) have entered into an agreement (the **"Agreement"**) for "**widening and upgradation to 2 lane with paved shoulder configuration and geometric improvement from km 65.000 to km 125.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram *on EPC mode (Package 2) with JICA loan assistance***", subject to and in accordance with the provisions of the Agreement.

(B) The Agreement requires the Contractor to furnish a Performance Security for due and faithful performance of its obligations, under and in accordance with the Agreement, during the Construction Period and Defects Liability Period (as defined in the Agreement) in a sum of Rs. …. …….Crore (Rupees …. Crore) (the "**Guarantee Amount**").

(C) We, ……..through our branch at ……. (the "**Bank**") have agreed to furnish this bank guarantee (hereinafter called the "**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 Contractor's obligations during Construction

Period and Defects Liability 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 Contractor, such sum or sums up to 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 sum specified therein.

2. A letter from the Authority, under the hand of an officer not below the rank of General Manager in the NHIDCL that the Contractor 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 Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final, and binding on the Bank, notwithstanding any difference between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other Authority or body, or by the discharge of the Contractor 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 Contractor 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 Contractor 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, fulfillment and/or performance of all or any of the obligations of the Contractor 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 Contractor, 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 Contractor 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 fulfillment, compliance and/or performance of all or any of the obligations of the Contractor 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 for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under 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 Guarantee shall cease to be in force and effect on ****[$1]. Unless a demand or claim under this Guarantee is made in writing before expiry of the Guarantee, the Bank shall be discharged from its liabilities hereunder.

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 authorized 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 up to the date specified in Para 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

12. This guarantee shall also be operable at our…… Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension/ renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder

[$] Insert date being 2 (two) years from the date of issuance of this Guarantee (in accordance with Clause 7.2 of the Agreement).

claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

13. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication no. 758, except that the supporting statement under Article 15 (a) is hereby excluded.

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.

Annex-II

(Schedule-G)

(See Clause 7.5.3)

Form for Guarantee for Withdrawal of Retention Money

The Managing Director,
NHIDCL,
3rd Floor, PTI Building, 4, Parliament Street
New Delhi-110001

WHEREAS:

(A) [Name and address of contractor] (hereinafter called "**the Contractor**") has executed an agreement (hereinafter called the "Agreement") with the **NHIDCL**, (hereinafter called "the Authority") for the "**widening and upgradation to 2 lane with paved shoulder configuration and geometric improvement from km 65.000 to km 125.000 on Aizawl-Serchhip section of NH-54 in the State of Mizoram *on EPC mode (Package 2) with JICA loan assistance***", subject to and in accordance with the provisions of the Agreement.

(B) In accordance with the Clause 7.5.3 of the Agreement, the Contractor may withdraw the retention money (hereinafter called "**Retention Money**") after furnishing to the Authority a bank guarantee for an amount equal to the proposed withdrawal.

(C) We, ……..through our branch at ……. (the "**Bank**") have agreed to furnish this bank guarantee (hereinafter called the "**Guarantee**") for the amount of Rs. ……Cr. (Rs……. in words) (the "**Guarantee Amount"**).

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably 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 Contractor, such sum or sums up to 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 sum specified therein.

2. A letter from the Authority, under the hand of an officer not below the rank of General Manager in the NHIDCL that the Contractor 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 Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final, and binding on the Bank, notwithstanding any difference between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other Authority or body, or by the discharge of the Contractor 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 Contractor 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 Contractor 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 Retention Money and any of the rights and powers exercisable by the Authority against the Contractor, 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 Contractor 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 Retention Money.

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 for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under 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 Guarantee shall cease to be in force and effect 90 (ninety) days after the date of the Completion Certificate specified in Clause 12.4 of the Agreement.

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 authorized 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 up to the date specified in para 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

12. This guarantee shall also be operable at our…… Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension/ renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment there under claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

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.

Annex-III

(Schedule-G)

(See Clause 19.2)

Form for Guarantee for Advance Payment

The Managing Director,
NHIDCL,
3rd Floor, PTI Building, 4, Parliament Street,
New Delhi-110001

WHEREAS:

(A) [name and address of contractor] (hereinafter called "**the Contractor**") has executed an agreement (hereinafter called the "Agreement") with the [**NHIDCL**], (hereinafter called "**the Authority**") for the "**widening and upgradation to 2 lane with paved shoulder configuration and geometric improvement from km 65.000 to km 125.000 on Aizawl-Serchhip section of NH-54 in the State of Mizoram *on EPC mode (Package 2) with JICA loan assistance***", subject to and in accordance with the provisions of the Agreement.

(B) In accordance with the Clause 19.2 of the Agreement, the Authority shall make to the Contractor an interest bearing (@ Bank Rate) advance payment (hereinafter called "**Advance Payment**") equal to 10% (ten per cent) of the contract price; and that the Advance Payment shall be made in two installments subject to the Contractor furnishing an irrevocable and unconditional guarantee by a scheduled bank for an amount equivalent to 110% (one hundred and ten percent) of such installment to remain effective till the complete and full repayment of the installment of the Advance Payment as security for compliance with its obligations in accordance with the Agreement. The amount of {first/second} installment of the Advance Payment is Rs. ------ cr. (Rupees ------ crore) and the amount of this Guarantee is Rs. ------- cr. (Rupees ------ crore) (the **"Guarantee Amount")** [$2]**.**

(C) We, ……..through our branch at ……. (the "**Bank**") have agreed to furnish this bank guarantee (hereinafter called the "**Guarantee**") for the Guarantee Amount.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevoc**ably, guarantee**s and affirms as follows:

[$]The Guarantee Amount should be equivalent to 110% of the value of the applicable installment.

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful repayment on time of the aforesaid installment of the Advance Payment 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 Contractor, such sum or sums up to 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 sum specified therein.

2. A letter from the Authority, under the hand of an officer not below the rank of General Manager in the NHIDCL, that the Contractor has committed default in the due and faithful performance of all or any of its obligations for the repayment of the installment of the Advance Payment 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 Contractor is in default in due and faithful performance of its obligations during and under the Agreement and its decision that the Contractor is in default shall be final, and binding on the Bank, notwithstanding any difference between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other Authority or body, or by the discharge of the Contractor 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 Contractor 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 Contractor 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 Advance Payment or to extend the time or period of its repayment or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, 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 Contractor 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 Advance Payment.

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 for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under 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 guarantee shall cease to be in force and effect on ****[$3] Unless a demand or claim under this Guarantee is made in writing on or before the aforesaid date, the Bank shall be discharged from its liabilities hereunder.

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 authorized 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 up to the date specified in Para 8 above or until it is released earlier by the Authority pursuant to the provisions of the Agreement.

12. This guarantee shall also be operable at our…… Branch at New Delhi, from whom, confirmation regarding the issue of this guarantee or extension/ renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation.

[$]Insert a date being 90 (ninety) days after the end of one year from the date of payment of the Advance payment to the Contractor (in accordance with Clause 19.2 of the Agreement).

13. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication no. 758, except that the supporting statement under Article 15 (a) is hereby excluded.

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)

Schedule-H

(See Clause 19.3)

Contract Price Weightages

1.1 The Contract Price for this Agreement is Rs (…….)

1.2 Proportions of the Contract Price for different stages of Construction of the Project Highway shall be as specified below:

Item	Weightage in percentage to the Contract Price	Stage for Payment	Percentage weightage to Particular item(col.2)
1	2	3	4
Road works including culverts, widening & repair of culverts.	**60.33**	**A- <u>Widening and strengthening of existing road/ Reconstruction/ New 2-lane realignment</u>**	
		(1) Earthwork upto top of the sub-grade	14.73
		(2) Spoil Bank construction by cutting surplus soil	8.80
		(3) Sub-Base Course	17.09
		(4) Non Bituminous Base Course	14.12
		(5) Bituminous Base Course	25.02
		(6) Wearing Coat	10.68
		(7) Widening and repair of culverts/ Re-Construction and New culverts on existing road, realignments	9.56
Minor Bridges/ Underpasses/ Overpasses	**0.00**	**A.1- Widening and Repair of Minor bridges (length > 6 m and < 60 m)** Minor bridges	0.00
		A.2- New Minor bridges (length >6 and <60 m.)	0.00
Major Bridge(length > 60 m.) works and ROB/RUB/ elevated	**0.00**	**A.1- Widening and repairs of Major Bridges**	0.00

sections/flyovers including viaducts, if any		**A.2- New Major Bridges**	0.00
Other works	**39.67**	(i) Toll Plaza	0.00
		(ii) Drainage/ Road side drains	5.16
		(iii) Road signs, markings, km stones, safety devices, and other road Appurtenances, Safety and traffic management during construction, etc….	3.71
		(iv) Project facilities (a) Bus Bays (b) Truck lay-bys (c) View points (d) Development of Junctions (e) Office & Vehicle for Authority and Office for Authority's Engineer	 1.26 0.00 0.12 1.30 1.30
		(v) Road side plantation	0.00
		(vi) Construction/ Repair of protection works other than approaches to the bridges, elevated sections/ flyovers/ grade separators and ROBs/RUBs	
		a) Wet Masonry Retaining Wall (H=3m)	12.20
		b) Wet Masonry Retaining Wall (H=7m)	6.81
		c) Gravity Wall (H=1.5m)	1.45
		d) Gravity Wall (H=2m)	3.91
		e) Gravity Wall (H=3m)	10.27
		f) Gravity Wall (H=4m)	9.48
		g) Gravity Wall (H=5m)	9.99
		h) Gravity Wall (H=6m)	9.43
		i) Reinforced Earth Retaining Wall (H=7m)	7.90
		j) Reinforced Earth Retaining Wall (H=8m)	3.01

		k) Reinforced Earth Retaining Wall (H=9m)	2.34
		l) Reinforced Earth Retaining Wall (H=10m)	5.50
		m) Gabion Wall (1:0.3)	0.15
		n) Rockfall Prevention Wall (H=3m)	0.00
		o) Rockfall Prevention Fence (H=2m)	0.00
		p) Hydroseeding (t=5cm)	0.09
		q) Seeding and Mulching (Soil Cut Slope)	2.23
		r) Turfing (Embankment)	1.03
		s) Vegetation Mat (Steep Slope)	0.00
		t) Crib Work (F300)	0.44
		u) Crib Work (F500)	0.00
		v) Non-frame	0.79
		w) Anchor Work	0.00
		x) Rock-bolt Work	0.13

1.3 Procedure of estimating the value of work done.

1.3.1 **Road works**

Procedure for estimating the value of road work done shall be as follows:

Table 1.3.1

Stage for Payment	Percentage weightage	Payment Procedure
A- <u>Widening and strengthening of existing road/ Reconstruction/ New 2-lane realignment</u>		
(1) Earthwork upto top of the sub-grade including Construction of Spoil Bank	14.73	Unit of measurement is linear length. Payment of each stage shall be made on pro rata basis on completion of a stage in a length of not less than 10 (ten) percent of the total length[$].
(2) Spoil Bank construction by cutting surplus soil	8.80	Unit of measurement is unit. Cost of each Spoil Bank shall be determined on pro-rata basis with respect to the total number of Spoil Banks and the total volume estimated based on the

		approved "Plan for Earthworks"
(2) Sub-Base Course	17.09	Unit of measurement is linear length. Payment of each stage shall be made on pro rata basis on completion of a stage in a length of not less than 10 (ten) percent of the total length[$].
(3) Non Bituminous Base Course	14.12	
(4) Bituminous Base Course	25.02	
(5) Wearing Coat	10.68	
(6) Widening and repair of culverts/ Re-Construction and New culverts on existing road, realignments	9.56	Cost of completed culverts shall be determined pro rata basis with respect to the total no. of culverts. The payment shall be made on the completion of at least five culverts.

@ For example, if the total length of bituminous work to be done is 100 km, the cost per km of bituminous work shall be determined as follows:

Cost per km = P x weightage for road work x weightage for bituminous work x (1/L)

Where P= Contract Price

L = Total length in km

Similarly, the rates per km for other stages shall be worked out accordingly.

Note: The length affected due to law and order problems or litigation during execution due to which the Contractor is unable to execute the work, may be deducted from the total project length for payment purposes. The total length calculated here is only for payment purposes and will not affect and referred in other clauses of the Contract Agreement.

1.3.2 Minor Bridges and Underpasses/ Overpasses.

Procedure for estimating the value of Minor bridge andUnderpasses/Overpassesshall be as stated in table 1.3.2:

Table 1.3.2

[$] If existing road length (excluding bypasses, re-alignment structure) is say **'L' km** and the unencumbered length along the existing road as handed over on the appointed date is **'L_1' km** and the balance length i.e. **'L_2' km (L-L_1)** is to be handed over on a later date as per the memorandum signed under provision of Clause 8.2.1 of the Contract Document, then the stage payment shall be worked out for the **'L_1' km** length handed over on the appointed date. The stage payment for the remaining **'L_2' km** length shall be worked out on prorata basis from the date of handing over the such length.

In order for the above dispensation to come into operation, it is necessary that a suitable mechanism (like escrow account) is evolved between the parties to the effect that the payments released to the contractor under the above dispensation would be used for completion of the project in the first instance and shall be available to the Contractor only after meeting his project related commitments.

Stage for Payment	Percentage weightage	Payment Procedure
A.1- Widening and Repair of Minor bridges (length > 6 m and < 60 m) Minor bridges	0.00	Cost of each minor bridge shall be determined on pro rata basis with respect to the total linear length of the minor bridges. Payment shall be made on the completion of widening & repair works of a minor bridge.

1.3.3 Major Bridge works ROB/RUB and Structures.

Procedure for estimating the value of Major Bridge works, ROB/RUB and Structures shall be as stated in table 1.3.3:

Table 1.3.3

Stage for Payment	Percentage weightage	Payment Procedure
A.1- Widening and repairs of Major Bridges **A.2- New Major Bridges**	0.00 0.00	Cost of each major bridge shall be determined on pro rata basis with respect to the total linear length of the major bridges. Payment shall be made on the completion of widening & repair works of a major bridge.

1.3.4 Other works.

Procedure for estimating the value of other works done shall be as stated in table 1.3.4.

Table 1.3.4

Stage for Payment	Percentage weightage	Payment Procedure
(i) Toll Plaza	0.00	Unit of measurement is each completed toll plaza. Payment of each toll plaza shall be made on pro rata basis with respect to the total of all toll plazas.
(ii) Drainage/ Road side drains	5.16	Unit of measurement is linear length in km. Payment shall be made on pro rata basis on completion of a stage in a length of not less than 10 % (ten
(iii) Road signs, markings, km stones, safety devices and other road Appurtenances, Safety and traffic	3.71	

management during construction, etc….		per cent) of the total length.
(iv) Project facilities (a) Bus Bays (b) Truck lay-bys (c) View points (d) Development of Junctions	 1.26 0.00 0.12 1.30	Payment shall be made on pro rata basis for completed facilities.
(e) Office & Vehicle for Authority and Office for Authority's Engineer	1.30	35% of cost shall be paid on completion and handing over of office and vehicle to the Authority/ Authority's Engineer during first quarter; remaining shall be paid on quarterly basis @ 5% per quarter upto completion period.
(v) Roadside plantation	0.00	Unit of measurement is linear length. Payment shall be made on pro rata basis on completion of a stage in a length of not less than 10% (ten per cent) of the total length.
(vi) Construction/ Repair of protection works other than approaches to the bridges, elevated sections/ flyovers/ grade separators and ROBs/RUBs		
a) Wet Masonry Retaining Wall (H=3m)	12.20	Unit of measurement is linear length. Payment shall be made on pro rata basis on completion of a stage in a length of not less than 10% (ten per cent) of the total length*.
b) Wet Masonry Retaining Wall (H=7m)	6.81	
c) Gravity Wall (H=1.5m)	1.45	
d) Gravity Wall (H=2m)	3.91	
e) Gravity Wall (H=3m)	10.27	
f) Gravity Wall (H=4m)	9.48	
g) Gravity Wall (H=5m)	9.99	
h) Gravity Wall (H=6m)	9.43	
i) Reinforced Earth Retaining Wall (H=7m)	7.90	
j) Reinforced Earth Retaining Wall (H=8m)	3.01	
k) Reinforced Earth Retaining	2.34	

Wall (H=9m) l) Reinforced Earth Retaining Wall (H=10m)	5.50	
m) Gabion Wall (1:0.3)	0.15	Unit of measurement is cum. Payment shall be made on pro rata basis on completion of a stage in a quantity of not less than 10% (ten per cent) of the total quantity; however payment for any reach shall be considered only after work is complete in that reach.
n) Rockfall Prevention Wall (H=3m) o) Rockfall Prevention Fence (H=2m)	0.00 0.00	Unit of measurement is linear length. Payment shall be made on pro rata basis on completion of a stage in a length of not less than 10% (ten per cent) of the total length*.
p) Hydroseeding (t=5cm) q) Seeding and Mulching (Soil Cut Slope) r) Turfing (Embankment) s) Vegetation Mat (Steep Slope) t) Crib Work (F300) u) Crib Work (F500) v) Non-frame	0.09 2.23 1.03 0.00 0.44 0.00 0.79	Unit of measurement is sqm. Payment shall be made on pro rata basis on completion of a stage in an area of not less than 10% (ten per cent) of the total area; however payment for any reach shall be considered only after work is complete in that reach.
w) Anchor Work x) Rock-bolt Work	0.00 0.13	Unit of measurement is linear length. Payment shall be made on pro rata basis on completion of a stage in a length of not less than 10% (ten per cent) of the total length.

*If actual height of retaining/ gravity wall constructed at site is different than those mentioned in above table, than height for payment purpose shall be considered as the height of wall from the above table which is just less than the actual height of wall. Similar treatment shall be considered for Rockfall Prevention Wall/ Fence. No Change of Scope shall be considered for increase of length/ height/ quantity of above mentioned slope protection works.

2. Procedure for payment for Maintenance

1.2 The cost for maintenance shall be as stated in Clause 14.1.1.

1.3 Payment for Maintenance shall be made in quarterly installments in accordance with the provisions of Clause 19.7.

Schedule-I

(See Clause 10.2)

DRAWINGS

1. Drawings

In compliance of the obligations set forth in Clause 10.2 of this Agreement, the Contractor shall furnish to the Authority's Engineer, free of cost, all Drawings listed in Annex-I of this Schedule-I.

2. Additional Drawings

If the Authority's 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 Contractor to prepare and furnish such drawings forthwith. Upon receiving a requisition to this effect, the Contractor shall promptly prepare and furnish such drawings to the Authority's Engineer, as if such drawings formed part of Annex-I of this Schedule-I.

Annex-I

(Schedule-I)

List of Drawings

1. A minimum list of the drawings of the various components/elements of the project highway and project facility required to be submitted by the Contractor is given below:

(a) Drawing of horizontal alignment, vertical profile and detailed cross sections;

(b) Drawings of cross drainage works, i.e. Bridges/Culverts/Flyovers and Other Structures;

(c) Drawings for River Training works;

(d) Drawings of interchanges, major intersections and underpasses;

(e) Drawing of control centre;

(f) Drawings of road furniture items including traffic signage, marking, safety barriers, etc;

(g) Drawings of traffic diversions plans and traffic control measures;

(h) Drawings of road drainage measures;

(i) Drawings of typical details slope protection measures;

(j) Drawings of landscaping and horticulture;

(k) Drawings of pedestrian crossing;

(l) Drawings of street lighting;

(m) General Arrangement showing Base Camp and Administrative Block;

(n) Any other drawings as per instruction of Authority Engineer.

Schedule-J

(See Clause 10.3.2)

PROJECT COMPLETION SCHEDULE

1. Project Completion Schedule

During Construction period, the Contractor shall comply with the requirements set forth in this Schedule J for each of the Project Milestones and the **Scheduled Completion Date.** Within 15 (fifteen) days of the date of each Project Milestone, the Contractor shall notify the Authority of such compliance along with necessary particulars thereof.

2. Project Milestone-I[$]

2.1 2.1 Project Milestone-I shall occur on the date falling on the 320th (three hundred and twenty) day from the Appointed Date (the "**Project Milestone-I**").

2.2 Prior to the occurrence of Project Milestone-I, the Contractor shall have commenced construction of the Project Highway and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 10% (ten per cent) of the Contract Price.

3. Project Milestone-II[$]

3.1 Project Milestone-II shall occur on the date falling on the 639th (six hundred and thirty nine) day from the Appointed Date (the "**Project Milestone-II**").

3.2 Prior to the occurrence of Project Milestone-II, the Contractor shall have continued with construction of the Project Highway and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 30% (thirty per cent) of the Contract Price.

4. Project Milestone-III[$]

4.1 Project Milestone-III shall occur on the date falling on the 958th (nine hundred and fifty eight) day from the Appointed Date (the "**Project Milestone-III**").

[$] If total project length is say **'L' km** and the unencumbered length along existing road as handed over on the appointed date is **'L_1' km** (including bypasses, re-alignment, structure etc.) and balance length i.e. **'L2' km (L-L1)** is to be handed over on a later date as per the memorandum signed under provision of Clause 8.2.1 of the Contract Document, then the Project Milestone-I, II and III shall be linked to stage payment statement for amount in percentage of the contract price worked out on prorata basis for the **'L_1' km** length handed over of balance length, the subsequent Project Milestone shall be linked to stage payment statement for amount in percentage of the total contract price.

For example:

If the date for Milestone-I and Milestone-II is 180th and 300th day from appointed date and balance **'L_2' km** length is handed over after 300th day from appointed date, then the stage payment statement required for achieving Milestone-I and Milestone-II should be linked to Contract Price worked out on prorata basis for the **L_1 km length** [**i.e. for Contract Price x L_1/L**]. Subsequent Milestone i.e. Milestone-III will be linked to stage payment statement for amount in percentage of the total contract price. **In no case, there shall be any change in the schedule completion date unless extension of time has been granted by the Authority under Clause 10.3 and 10.5 of the contract agreement.**

In order for the above dispensation to come into operation, it is necessary that a suitable mechanism (like escrow account) is evolved between the parties to the effect that the payments released to the contractor under the above dispensation would be used for completion of the project in the first instance and shall be available to the Contractor only after meeting his project related commitments.

4.2 Prior to the occurrence of Project Milestone-III, the Contractor shall have continued with construction of the Project Highway and submitted to the Authority duly and validly prepared Stage Payment Statements for an amount not less than 60% (sixty per cent) of the Contract Price.

5 Schedule Completion Date

5.1 The Scheduled Completion Date shall occur on the 1278th (one thousand and two hundred and seventy eight) day from the Appointed Date.

5.2 On or before the Scheduled Completion Date, the Contractor shall have completed construction in accordance with this Agreement.

6 Extension of time

Upon extension of any or all of the aforesaid Project Milestones or the Scheduled Completion 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-K

(See Clause 12.1.2)

Tests on Completion

1. Schedule for Tests

1.1 The Contractor shall, no later than 30 (thirty) days prior to the likely completion of construction, notify the Authority's Engineer and the Authority of its intent to subject the Project Highway to Tests, and no later than 10 (ten) days prior to the actual date of Tests, furnish to the Authority's Engineer and the Authority detailed inventory and particulars of all works and equipment forming part of Works.

1.2 The Contractor shall notify the Authority's Engineer of its readiness to subject the Project Highway to Tests at any time after 10 (ten) days from the date of such notice, and upon receipt of such notice, the Authority's Engineer shall, in consultation with the Contractor, 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 Authority's Engineer shall thereupon conduct the Tests itself or cause any of the Tests to be conducted in accordance with Article 12 and this Schedule K.

2 Tests

2.1 Visual and physical test: The Authority's Engineer shall conduct a visual and physical check of construction to determine that all works and equipment forming part thereof conform to the provisions of this Agreement. The physical tests shall include: all the tests specified in IRC code, manual and MORTH specifications for the road and Bridge works, 5th revision, 2013.

2.2 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 [2,000 (two thousand)] mm for each kilometer.

2.3 Tests for bridges: All major and minor bridges 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 Nondestructive Testing Techniques, at two spots in every span, to be chosen at random by the Authority's Engineer. Bridges with a span of 15 (fifteen) meters or more shall also be subjected to load testing.

2.4 Other tests: The Authority's Engineer may require the Contractor 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.

2.5 Environmental audit: The Authority's 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.

2.6 Safety Audit: The Authority's Engineer shall carry out or cause to be carried out, a safety audit to determine conformity of the Project Highway with the safety requirements and Good Industry Practice.

3 Agency for conducting Tests

All Tests set forth in this Schedule-K shall be conducted by the Authority's Engineer or such other agency or person as it may specify in consultation with the Authority.

4. Completion Certificate

Upon successful completion of Tests, the Authority's Engineer shall issue the Completion Certificate in accordance with the provisions of Article 12.

Schedule-L

(See Clause 12.2 and 12.4)

PROVISIONAL CERTIFICATE

1. I, …….. (Name of the Authority's Engineer), acting as Authority's Engineer, under and in accordance with the Agreement dated …….. (the "**Agreement**"), for construction of the "**widening and upgradation to 2 lane with paved shoulder configuration and geometric improvement from km 65 .000 to km 125.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram *on EPC basis (Package 2)* with JICA loan assistance** through ……. (Name of Contractor), hereby certify that the Tests in accordance with Article 12 of the Agreement have been undertaken to determine compliance of the Project Highway with the provisions of the Agreement.

2. Works that are incomplete on account of Time Extension have been specified in the Punch List appended hereto, and the Contractor has agreed and accepted that it shall complete all such works in the time and manner set forth in the Agreement. In addition, certain minor works are incomplete and these are not likely to cause material inconvenience to the users of the Project Highway or other their safety. The contractor has agreed and accepted that as a condition of this Provisional Certificate, it shall complete such minor works within 30 (thirty) days hereof. These minor works have also been specified in the aforesaid punch list.

3. In view of the foregoing, I am satisfied that that Project Highway from km 65.000 to km 125.000 can be safety and reliably placed in service of the users thereof, and in terms of the Agreement, the Project Highway is hereby provisionally declared fit for entry into operation on this the …day of……. 20 ……

ACCEPTED

SIGNED, SEALED AND DELIVERED	SIGNED, SEALED AND DELIVERED
For and on behalf of	For and on behalf of
CONTRACTOR by	Authority's Engineer by:
(Signature)	(Signature)

COMPLETION CERTIFICATE

1. I, …….. (Name of the Authority's Engineer), acting as Authority's Engineer, under and in accordance with the Agreement dated …….. (the "**Agreement**"), for construction of the "**widening and upgradation to 2 lane with paved shoulder configuration and geometric improvement from km 65.000 to km 125.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram *on EPC basis (Package 2) with JICA loan assistance*** through ……. (Name of Contractor), hereby certify that the Tests in accordance with Article 12 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 safety and reliably placed in service of the Users thereof.

2. It is certified that, in terms of the aforesaid Agreement, all works forming part of Project Highway have been completed, and the Project Highway is hereby declared fit for entry into operation on this the ……..day of ……..20 …..

SIGNED, SEALED AND DELIVERED

For and on behalf of

The Authority's Engineer by:

(Signature)

(Name)

(Designation)

(Address)

Schedule-M

(See Clauses 14.6., 15.2 and 19.7)

PAYMENT REDUCTION FOR NON-COMPLIANCE

1. Payment reduction for non-compliance with the Maintenance Requirements

1.1 Monthly lump sum payments for maintenance shall be reduced in the case of non-compliance with the Maintenance Requirements set forth in Schedule-E.

1.2 Any deduction made on account of non-compliance with the maintenance Requirements shall not be paid even after compliance subsequently. The deduction shall continue to be made every month until compliance is done.

1.3 The Authority's Engineer shall calculate the amount of payment reduction on the basis of weightage in percentage assigned to non-conforming items as given in Paragraph 2.

2. Percentage reductions in lump sum payments

2.1 The following percentages shall govern the payment reduction:

S. No.	Item/Defect/Deficiency	Percentage
(a)	**Carriageway/Pavement**	
(i)	Potholes, cracks, other surface defects	15%
(ii)	Repairs of Edges, Rutting	5%
(b)	**Road, Embankment, Cuttings, Shoulders**	
(i)	Edge drop, inadequate crossfall, undulations, settlement, potholes, ponding, obstructions	10%
(ii)	Deficient slopes, raincuts, disturbed pitching, vegetation growth, pruning of trees	5%
(c)	**Bridges and Culverts**	
(i)	Desilting, cleaning. vegetation growth, damaged pitching, flooring, parapets, wearing course, footpaths, any damage to foundations	20%
(ii)	Any Defects in superstructures, bearings and sub-structures	10%
(iii)	Painting, repairs/replacement kerbs, railings, parapets, guideposts/crash barriers	5%

(d)	**Roadside Drains**	
(i)	Cleaning and repair of drains	5%
(e)	**Road Furniture**	
(i)	Cleaning, painting, replacement of road signs, delineators, road markings, 200 m/km/5th km stones	5%
(f)	**Miscellaneous Items**	
(i)	Removal of dead animals, broken down/accidented vehicles, fallen trees, road blockades or malfunctioning of mobile crane	10%
(ii)	Any other Defects in accordance with paragraph 1.	5%
(g)	**Defects in Other Project Facilities**	5%

2.2 The amount to be deducted from monthly lump-sum payment for non-compliance of particular item shall be calculated as under:

R=P/100 * M * L1/L

Where: P= Percentage of particular item//Defect/deficiency for deduction

M = Monthly lump-sum payment in accordance with the Bid

L1 = Non-complying length

L = Total length of the road,

R = Reduction (the amount to be deducted for noncompliance for a particular item/Defect/deficiency

The total amount of reduction shall be arrived at by summation of reductions for such items/Defects/deficiency or noncompliance.

For any Defect in a part of one kilometer, the non-conforming length shall be taken as one kilometer.

Schedule-N

(See Clause 18.1.1)

SELECTION OF AUTHORITY'S ENGINEER

1 Selection of Authority's Engineer

1.1 The provisions of the Model Request for Proposal for Selection of Technical Consultants, issued by the Ministry of Finance in May 2009, or any substitute thereof shall apply for selection of an experienced firm to discharge the functions and duties of an Authority's Engineer.

1.2 The Authority shall invite Expression of Interest from Consulting Engineering firms for bodies corporate to undertake and perform the duties and functions set for in Annexure-I of Schedule-N and thereupon shortlist qualified firms in accordance with pre-determined criteria.

1.3 The Authority shall invite the aforesaid firms in the panel of firms to submit their respective technical and financial offers, each in separate sealed cover. All the technical bids so received shall be opened at pursuant to the evaluation thereof, the Authority shall open the financial bids in respect of each shortlisted firm and the order of priority as among these firms shall be determined on the basis of a weighted evaluation where technical and financial score shall be assigned respective weights of 80:20.

1.4 In the event of termination of the Technical Consultants appointed in accordance with the provisions of above Paragraphs, the Authority shall appoint another firm of Technical Consultants forthwith and may engage a government-owned entity in accordance with the provisions of Paragraph 3 of this Schedule-N.

2 Terms of Reference

The Terms of Reference for the Authority's Engineer (the "**TOR**") shall substantially conform with Annex 1 to this Schedule N.

3 Appointment of Government entity as Authority's Engineer

Notwithstanding anything to the contrary contained in this Schedule, the Authority may in its discretion appoint a government-owned entity as the Authority's Engineer; provided that such entity shall be a body corporate having as one of its primary functions 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 shall not be eligible for appointment as Authority's Engineer.

Annex – I

(Schedule - N)

TERMS OF REFERENCE FOR AUTHORITY'S ENGINEER

1. Scope

1.1 These Terms of Reference (the "**TOR**") for the Authority's Engineer are being specified pursuant to the EPC Agreement dated..... (the "**Agreement**), which has been entered into between the Ministry of Road Transport and Highways (the "**Authority**") and ..... (the "**Contractor**") for "**widening and upgradation to 2 lane with paved shoulder configuration and geometric improvement from km 65.000 to km 125.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram *on EPC mode (Package 2) with JICA loan assistance***" and a copy of which is annexed hereto and marked as Annex-A to form part of this TOR.

1.2 The TOR shall apply to construction and maintenance of the Project Highway.

2. Definitions and interpretation

2.1 The words and expressions beginning with or in capital letters 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. General

3.1 The Authority's Engineer shall discharge its duties in a fair, impartial and efficient manner, consistent with the highest standards of professional integrity and Good Industry Practice.

3.2 The Authority's Engineer shall perform the duties and exercise the authority in accordance with the provisions of this Agreement, but subject to obtaining prior written approval of the Authority before determining:

(a) Any Time extension;

(b) Any additional cost to be paid by the Authority to the Contractor;

(c) The Termination Payment; or

(d) Any other matter which is not specified in (a), (b) or (c) above and which creates an obligation or liability on either Party for a sum exceeding 0.2% of Contract Price.

3.3 The Authority's Engineer shall submit regular periodic reports, at least once every month, to the Authority in respect of its duties and functions under this Agreement.

Such reports shall be submitted by the Authority's Engineer within 10 (ten) days of the beginning of every month.

3.4 The Authority's Engineer shall inform the Contractor of any delegation of its duties and responsibilities to its suitably qualified and experienced personnel; provided, however, that it shall not delegate the authority to refer any matter for the Authority's prior approval in accordance with the provisions of Clause 18.2.

3.5 The Authority's Engineer shall aid and advise the Authority on any proposal for Change of Scope under Article 13.

3.6 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 authority's Engineer shall specify such meaning, scope and nature by issuing a reasoned written statement relying on good industry practice and authentic literature.

4 Construction Period

4.1 During the Construction Period, the Authority's Engineer shall review the Drawings furnished by the Contractor along with supporting data, including the geo-technical and hydrological investigations, characteristics of materials from borrow areas and quarry sites, topographical surveys, and the recommendations of the Safety Consultant in accordance with the provisions of Clause 10.1.6. The Authority's Engineer shall complete such review and send its observations to the Authority and the Contractor within 15 (fifteen) days of receipt of such Drawings; provided, however that in case of a Major Bridge or Structure, the aforesaid period of 15 (fifteen) days may be extended upto 30 (thirty) days. 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 Authority's Engineer shall review any revised Drawings sent to it by the Contractor and furnish its comments within 10 (ten) days of receiving such Drawings.

4.3 The Authority's Engineer shall review the Quality Assurance Plan submitted by the Contractor and shall convey its comments to the Contractor within a period of 21 (twenty-one) days stating the modifications, if any, required thereto.

4.4 The Authority's Engineer shall complete the review of the methodology proposed to be adopted by the Contractor for executing the Works, and convey its comments to the Contractor within a period of 10 (ten) days from the date of receipt of the proposed methodology from the Contractor.

4.5 The Authority's Engineer shall grant written approval to the Contractor, where necessary, for interruption and diversion of the flow of traffic in the existing lane(s) of the Project Highway for purposes of maintenance during the Construction Period in accordance with the provisions of Clause 10.4.

4.6 The Authority's Engineer shall review the monthly progress report furnished by the Contractor and send its comments thereon to the Authority and the Contractor within 7 (seven) days of receipt of such report.

4.7 The Authority's Engineer shall inspect the Construction Works and the Project Highway and shall submit a monthly Inspection Report bringing out the results of inspections and the remedial action taken by the Contractor in respect of Defects or deficiencies. In particular, the Authority's Engineer shall include in its Inspection Report, the compliance of the recommendations made by the Safety Consultant.

4.8 The Authority's Engineer shall conduct the pre-construction review of manufacturer's test reports and standard samples of manufactured Materials, and such other Materials as the Authority's Engineer may require.

4.9 For determining that the Works conform to Specifications and Standards, the

Authority's Engineer shall require the Contractor to carry out, or cause to be carried out, tests at such time and frequency and in such manner as specified in the Agreement and in accordance with Good Industry Practice for quality assurance. For purposes of this Paragraph 4.9, 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 MORTH (the "Quality Control Manuals") or any modification/substitution thereof shall be deemed to be tests conforming to Good Industry Practice for quality assurance.

4.10 The Authority's Engineer shall test check at least 20 (twenty) percent of the quantity or number of tests prescribed for each category or type of test for quality control by the Contractor.

4.11 The timing of tests referred to in Paragraph 4.9, and the criteria for acceptance/ rejection of their results shall be determined by the Authority's 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 Contractor for its own quality assurance in accordance with Good Industry Practice.

4.12 In the event that results of any tests conducted under Clause 11.10 establish any Defects or deficiencies in the Works, the Authority's Engineer shall require the Contractor to carry out remedial measures.

4.13 The Authority's Engineer may instruct the Contractor to execute any work which is urgently required for the safety of the Project Highway, whether because of an accident, unforeseeable event or otherwise; provided that in case of any work required on account of a Force Majeure Event, the provisions of Clause 21.6 shall apply.

4.14 In the event that the Contractor fails to achieve any of the Project Milestones, the Authority's Engineer shall undertake a review of the progress of construction and identify potential delays, if any. If the Authority's Engineer shall determine that completion of the Project Highway is not feasible within the time specified in the Agreement, it shall require the Contractor 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 Contractor, the Authority's Engineer shall review the same and send its comments to the Authority and the Contractor forthwith.

4.15 The Authority's Engineer shall obtain from the Contractor a copy of all the Contractor's quality control records and documents before the Completion Certificate is issued pursuant to Clause 12.4.

4.16 Authority's Engineer may recommend to the Authority suspension of the whole or part of the Works if the work threatens the safety of the Users and pedestrians. After the Contractor has carried out remedial measure, the Authority's Engineer shall inspect such remedial measures forthwith and make a report to the Authority recommending whether or not the suspension hereunder may be revoked.

4.17 In the event that the Contractor carries out any remedial measures to secure the safety of suspended works and Users, and requires the Authority's Engineer to inspect such works, the Authority's Engineer shall inspect the suspended works within 3 (three) days of receiving such notice, and make a report to the Authority forthwith, recommending whether or not such suspension may be revoked by the Authority.

4.18 The Authority's Engineer shall carry out, or cause to be carried out, all the Tests specified in Schedule-K and issue a Completion Certificate or Provisional Certificate, as the case may be. For carrying out its functions under this Paragraph 4.18 and all matters incidental thereto, the Authority's Engineer shall act under and in accordance with the provisions of Article 12 and Schedule-K.

5. Maintenance Period

5.1 The Authority's Engineer shall aid and advise the Contractor in the preparation of its monthly Maintenance Programme and for this purpose carry out a joint monthly inspection with the Contractor.

5.2 The Authority's Engineer shall undertake regular inspections, at least once every month, to evaluate compliance with the Maintenance Requirements and submit a Maintenance Inspection Report to the Authority and the Contractor.

5.3 The Authority's Engineer shall specify the tests, if any, that the Contractor 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 Contractor in this behalf.

5.4 In respect of any defect or deficiency referred to in Paragraph 3 of Schedule- E, the Authority's 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.

5.5 The Authority's Engineer shall examine the request of the Contractor for closure of any lane(s) of the Project Highway for undertaking maintenance/repair thereof, and shall grant permission with such modifications, as it may deem necessary, within 5 (five) days of receiving a request from the Contractor. Upon expiry of the permitted period of closure, the Authority's Engineer shall monitor the reopening

of such lane(s), and in case of delay, determine the Damages payable by the Contractor to the Authority under Clause 14.5.

6 Determination of costs and time

6.1 The Authority's Engineer shall determine the costs, and/or their reasonableness, that are required to be determined by it under the Agreement.

6.2 The Authority's Engineer shall determine the period of Time Extension that is required to be determined by it under the Agreement.

6.3 The Authority's Engineer shall consult each Party in every case of determination in accordance with the provisions of Clause 18.5.

7. Payments

7.1 The Authority's Engineer shall withhold payments for the affected works for which the Contractor fails to revise and resubmit the Drawings to the Authority's Engineer in accordance with the provisions of Clause 10.2.4 (d).

7.2 Authority's Engineer shall -

(a) within 10 (ten) days of receipt of the Stage Payment Statement from the Contractor pursuant to Clause 19.4, determine the amount due to the Contractor and recommend the release of 90 (ninety) percent of the amount so determined as part payment, pending issue of the Interim Payment Certificate; and

(b) within 15 (fifteen) days of the receipt of the Stage Payment Statement referred to in Clause 19.4, deliver to the Authority and the Contractor an Interim Payment Certificate certifying the amount due and payable to the Contractor, after adjustments in accordance with the provisions of Clause 19.10.

7.3 The Authority's Engineer shall, within 15 (fifteen) days of receipt of the Monthly Maintenance Statement from the Contractor pursuant to Clause 19.6, verify the Contractor's monthly statement and certify the amount to be paid to the Contractor in accordance with the provisions of the Agreement.

7.4 The Authority's Engineer shall certify final payment within 30 (thirty) days of the receipt of the final payment statement of Maintenance in accordance with the provisions of Clause 19.16.

8. Other duties and functions

The Authority's Engineer shall perform all other duties and functions as specified in the Agreement.

9 Miscellaneous

9.1 A copy of all communications, comments, instructions, Drawings or Documents sent by the Authority's Engineer to the Contractor pursuant to this TOR, and a copy of all the test results with comments of the Authority's Engineer thereon, shall be furnished by the Authority's Engineer to the Authority forthwith.

9.2 The Authority's 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.

9.3 Within 90 (ninety) days of the Project Completion Date, the Authority's Engineer shall obtain a complete set of as-built Drawings, in 2 (two) hard copies and in micro film form or in such other medium as may be acceptable to the Authority, reflecting the Project Highway as actually designed, engineered and constructed, including an as-built survey illustrating the layout of the Project Highway and setback lines, if any, of the buildings and structures forming part of Project Facilities; and shall hand them over to the Authority against receipt thereof.

9.4 The Authority's Engineer, if called upon by the Authority or the Contractor or both, shall mediate and assist the Parties in arriving at an amicable settlement of any Dispute between the Parties.

9.5 The Authority's Engineer shall inform the Authority and the Contractor of any event of Contractor's Default within one week of its occurrence.

SCHEDULE - O

(See Clauses 19.4.1, 19.6.1, and 19.8.1)

Forms of Payment Statements

1. Stage Payment Statement for Works

The Stage Payment Statement for Works shall state:

(a) The estimated amount for the Works executed in accordance with Clause 19.3.1 subsequent to the last claim;

(b) Amounts reflecting adjustments in price for the aforesaid claim;

(c) The estimated amount of each Change of Scope Order executed subsequent to the last claim;

(d) Amounts reflecting adjustment in price, if any, for (c) above in accordance with the provisions of Clause 13.2.3 (a);

(e) Total of (a), (b), (c) and (d) above;

(f) Deductions:

- (i) Any amount to be deducted in accordance with the provisions of the Agreement except taxes;
- (ii) Any amount towards deduction of taxes; and
- (iii) Total of (i) and (ii) above.

(g) Net claim: (e) – (f) (iii);

(h) The amounts received by the Contractor upto the last claim:

- (i) For the Works executed (excluding Change of Scope orders);
- (ii) For Change of Scope Orders, and
- (iii) Taxes deducted

2. Monthly Maintenance Payment Statement

The monthly Statement for Maintenance Payment shall state:

(a) the monthly payment admissible in accordance with the provisions of the agreement;
(b) the deductions for maintenance work not done;
(c) net payment for maintenance due, (a) minus (b);
(d) amounts reflecting adjustments in price under Clause 19.12; and
(e) amount towards deduction of taxes

3. Contractor's claim for Damages

Note: The Contractor shall submit its claims in a form acceptable to the Authority.

Schedule-P

(See Clause 20.1)

INSURANCE

1. Insurance during Construction Period

1.1 The Contractor shall effect and maintain at its own cost, from the Appointed Date till the date of issue of the last Completion Certificate, the following insurances for any loss or damage occurring on account of Non Political Event of Force Majeure, malicious act, accidental damage, explosion, fire and terrorism:

(a) insurance of Works, Plant and Materials and an additional sum of [15 (fifteen)] per cent of such replacement cost to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature; and

(b) Insurance for the Contractor's equipment and Documents brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.

1.2 The insurance under paragraph 1.1 (a) and (b) above shall cover the authority and the Contractor against all loss or damage from whatsoever cause arising under paragraph 1.1 other than risks which are not insurable at commercial terms.

2. Insurance for Contractor's Defects Liability

The Contractor shall effect and maintain insurance cover for the works from the date of issue of the Completion Certificate until the end of the Defects Liability Period for any loss or damage for which the Contractor is liable and arises from a cuase occurring prior to the issue of Completion Certificate. The Contractor shall also maintain other insurances for maximum sums as may be required under the Applicable Laws and in accordance with Good Industry Practice.

3. Insurance against injury to persons and damage to property

3.1. The Contractor shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Paragraph l and 2 of this Schedule or to any person (except persons insured under Clause 20.9), which may arise out of the Contractor's performance of this agreement and occurring before the issue of the Performance Certificate. This insurance shall be for a limit per occurrence of not less than the amount stated below with no limit on the number of occurrences.

The insurance cover shall be as per the applicable laws of government and procedure in vogue.

3.2 The insurance shall be extended to cover liability for all loss and damage to the Authority's property arising out of the Contractor's performance of this Agreement excluding:

(a) the Authority's right to have the construction works executed on, over, under, in or through any land, and to occupy this land for the Works; and

(b) Damage which is and unavoidable result of the Contractor's obligations to execute the Works.

4. Insurance to be in joint names

The insurance under paragraphs 1 to 3 above shall be in the joint names of the Contractor and the Authority.

SCHEDULE-Q

(See Clause 14.10)

Tests on Completion of Construction

1. **Riding Quality test:**

   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 [2,500 (two thousand five hundred)] mm for each kilometer.

2. **Visual and physical test:**

   The Authority's Engineer shall conduct a visual and physical check of construction to determine that all works and equipment forming part thereof conform to the provisions of this Agreement. The physical tests shall include measurement of cracking, rutting, stripping and potholes and the permissible values are given below: • Area of cracking not more than 2 % area

   • Area of rutting with rut depth more than 10 mm - not more than 1 …. % area

   • Area of stripping: not more than 2 % area

   • Area of potholes: Nil

   • Edge drop – Shall not be more than 15 mm

SCHEDULE-R

(See Clause 14.10)

Taking Over Certificate

I, ……. (Name and designation of the Authority's representative) under and in accordance with the Agreement dated

…… (the "Agreement"), for **widening and upgradation to 2 lane with paved shoulder configuration and geometric improvement from km 65.000 to km 125.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram on EPC mode *(Package 2) with JICA loan assistance*** (the "**Project Highway**") on Engineering, Procurement and Construction (EPC) basis through……. (Name of Contractor), hereby certify that the Tests on completion of Maintenance Period in accordance with Article 14 of the Agreement have been successfully undertaken to determine compliance of the Project Highway with the provisions of the Agreement and I hereby certify that the Authority has Taken over the Project Highway from the Contractor on this day .....

SIGNED, SEALED AND DELIVERED

(Signature)

(Name of Authority's Engineer)

(Address)

SCHEDULE-S

(See Clause 17.7.2)

Performance Certificate

I, ……. (Name and designation of the Authority's representative) under and in accordance with the Agreement dated …… (the "Agreement"), for [construction and maintenance of the **widening and upgradation to 2 lane with paved shoulder configuration and geometric improvement from km 65.000 to km 125.000 on Aizawl-Serchhip section of NH-54 in the State of Mizoram *on EPC mode with JICA loan assistance (Package 2) with JICA loan assistance*** (the "**Project Highway**") on Engineering, Procurement and Construction (EPC) basis through ……. (Name of Contractor), hereby certify that the Contractor has discharged all its obligations under the Agreement and in accordance with Article 17 of the Agreement I hereby issue Performance Certificate to the Contractor on this day.....

SIGNED, SEALED AND DELIVERED

(Signature)

(Name of Authority's Engineer)

(Address)

SCHEDULE-T

(See Clause 19.1.6)

Name of Currency	A Amount of Currency	B Rate of Exchange Prevailing on the Base Date (Local Currency per Unit of Foreign Currency)	C Local Currency Equivalent	D Percentage of Net Bid Price (NTP) (100 x C) / NTP
Local Currency (Indian Rupees)				
Foreign Currency 1 (Japanese Yen)				
Foreign Currency 2 (US Dollar)				
Net Bid Price				**100.00**

* The fixed rates of exchange shall be the selling rates 28 days prior to the deadline for submission of bids published by the **Reserve Bank of India**.

1. Change in scope would require agreement between parties on currency.
2. Regarding damages by the Authority, financing charges for a payment delays will be in corresponding currency amounts.
3. Delay damages will be recovered in currencies in proportion which in which contract price is payable.