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 8.000 to 65.0000 i.e. Aizawl-Tuipang Section 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	8+292	69+000	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		
1	**24+659**			RCC T-Beam	2x11.85+1x47.10	7.50

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	8+405	Pipe	1 x 900mm	
2	9+072	Pipe	1 x 800mm	
3	9+183	Box	1.5 X 11 X 1.2	
4	9+329	Pipe	1 x 700mm	
5	9+567	Pipe	1 x 700mm	
6	9+692	Pipe	1 x 600mm	
7	9+742	Pipe	1 x 500mm	
8	9+956	Pipe	1 x 800mm	
9	10+190	Pipe	1 x 1000mm	
10	10+375	Box	1.5 X 10 X 0.8	
11	10+534	Box	1 X 8 X 1.1	
12	11+052	Pipe	1 x 800mm	
13	11+189	Pipe	1 x 1000mm	
14	11+375	Box	1.5 X 9.25 X 1.5	
15	11+496	Pipe	1 x 600mm	
16	11+600	Pipe	1 x 1000mm	
17	11+667	Pipe	1 x 800mm	
18	11+769	Box	0.5 X 9.75 X 0.5	
19	11+819	Box	2.5 X 12.5 X 2.9	
20	12+140	Pipe	2 x 900mm	
21	12+296	Box	1.25 X 7.0 X 0.9	
22	12+437	Pipe	1 x 900mm	
23	12+568	Pipe	1 x 800mm	
24	12+695	Pipe	1 x 1000mm	
25	12+765	Box	2.25 X 7.5 X 2.0	
26	12+842	Pipe	1 x 1000mm	
27	12+937	Box	0.8 X 8.8 X 0.45	
28	13+084	Box	1.0 X 10.25 X 1.1	
29	13+325	Pipe	1 x 1100mm	
30	13+553	Pipe	Abandoned	
31	14+099	Box	1.0 X 8.75 X 1.0	
32	14+263	Box	1.3 X 8.0 X 1.0	
33	14+379	Pipe	1 x 900mm	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
34	14+510	Pipe	1 x 1100mm	
35	14+584	Pipe	1 x 1000mm	
36	14+658	Pipe	1 x 600mm	
37	14+790	Pipe	1 x 1000mm	
38	15+350	Pipe	1 x 1000mm	
39	15+425	Pipe	1 x 900mm	
40	15+566	Pipe	1 x 1200mm	
41	15+643	Pipe	1 x 600mm	
42	15+832	Pipe	1 x 500mm	
43	16+130	Pipe	1 x 600mm	
44	16+387	Pipe	1 x 600mm	
45	16+667	Pipe	1 x 1000mm	
46	16+820	Box	1.0 X 8.4 X 1.0	
47	16+886	Pipe	1 x 800mm	
48	17+097	Pipe	Abandoned	
49	17+287	Pipe	Abandoned	
50	17+613	Pipe	1 x 500mm	
51	17+759	Pipe	1 x 500mm	
52	17+917	Box	1.25 X 7.5 X 1.6	
53	18+128	Pipe	1 x 800mm	
54	18+180	Box	1.0 X 9.0 X 1.0	
55	18+316	Pipe	1 x 1000mm	
56	18+447	Pipe	1 x 500mm	
57	18+824	Pipe	1 x 1000mm	
58	19+066	Box	1.75 X 8.5 X 3.0	
59	19+352	Box	1.75 X 8.0 X 1.6	
60	19+437	Pipe	1 x 600mm	
61	19+676	Pipe	1 x 800mm	
62	19+757	Pipe	1 x 600mm	
63	19+777	Pipe	1 x 800mm	
64	20+087	Box	1.25 X 15.5 X 1.3	
65	20+254	Pipe	1 x 1000mm	
66	20+707	Pipe	1 x 1000mm	
67	20+864	Pipe	1 x 1000mm	
68	21+168	Pipe	1 x 1000mm	
69	21+222	Box	1.25 X 10.5 X 0.75	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
70	21+375	Pipe	1 x 1200mm	
71	21+573	Pipe	1 x 1000mm	
72	21+600	Pipe	1 x 800mm	
73	22+011	Pipe	Abandoned	
74	22+100	Pipe	1 x 1000mm	
75	22+187	Pipe	1 x 1000mm	
76	22+358	Pipe	1 x 800mm	
77	22+492	Pipe	2 x 1000mm	
78	22+581	Pipe	1 x 600mm	
79	22+702	Box	1.0 X 10.0 X 1.1	
80	22+816	Pipe	1 x 1000mm	
81	23+134	Pipe	1 x 500mm	
82	23+381	Pipe	Abandoned	
83	23+444	Pipe	2 x 1000mm	
84	23+515	Pipe	1 x 800mm	
85	23+577	Pipe	1 x 900mm	
86	23+820	Pipe	1 x 600mm	
87	24+162	Box	0.8 X 7.5 X 2.1	
88	24+268	Pipe	1 x 1200mm	
89	24+464	Box	1.0 X 10.5X 2.1	
90	24+496	Pipe	Abandoned	
91	24+795	Pipe	Abandoned	
92	24+882	Box	0.6 X 9.0 X 0.6	
93	25+059	Pipe	1 x 1000mm	
94	25+208	Box	1.3 X7.5 X 1.6	
95	25+431	Box	1.3 X7.5 X 2.2	
96	25+710	Pipe	1 x 800mm	
97	25+894	Box	1.0 X9.25 X 1.8	
98	26+045	Pipe	1 x 1000mm	
99	26+336	Box	1.5X9.0 X 1.6	
100	26+561	Pipe	1 x 900mm	
101	27+087	Pipe	1 x 900mm	
102	27+180	Pipe	1 x 1000mm	
103	27+330	Pipe	Abandoned	
104	27+425	Pipe	1 x 1000mm	
105	27+616	Pipe	Abandoned	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
106	27+667	Box	1.0 X8.5 X 1.0	
107	27+913	Pipe	1 x 1000mm	
108	28+152	Pipe	Abandoned	
109	28+185	Pipe	1 x 800mm	
110	28+262	Pipe	1 x 900mm	
111	28+370	Pipe	1 x 600mm	
112	28+735	Pipe	1 x 1000mm	
113	28+776	Pipe	1 x 1000mm	
114	29+085	Pipe	1 x 800mm	
115	29+230	Pipe	1 x 1000mm	
116	29+583	Pipe	1 x 900mm	
117	29+632	Pipe	1 x 1000mm	
118	29+865	Pipe	1 x 800mm	
119	30+042	Pipe	1 x 900mm	
120	30+223	Pipe	1 x 1000mm	
121	30+552	Pipe	1 x 800mm	
122	31+012	Pipe	1 x 900mm	
123	31+225	Box	1.0 X9.5 X 1.0	
124	31+366	Pipe	1 x 800mm	
125	31+647	Pipe	1 x 700mm	
126	31+968	Pipe	1 x 600mm	
127	32+179	Box	1.0 X8.25 X 1.0	
128	32+412	Pipe	1 x 600mm	
129	32+579	Pipe	1 x 1000mm	
130	33+220	Pipe	1 x 1000mm	
131	33+512	Pipe	1 x 1200mm	
132	33+778	Pipe	1 x 600mm	
133	33+835	Pipe	1 x 900mm	
134	33+970	Pipe	1 x 800mm	
135	34+207	Pipe	1 x 1000mm	
136	34+426	Box	2.0 X9.0 X 1.0	
137	34+722	Pipe	1 x 600mm	
138	34+797	Pipe	1 x 1000mm	
139	34+998	Pipe	1 x 1000mm	
140	35+100	Pipe	1 x 1000mm	
141	35+141	Pipe	1 x 1000mm	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
142	35+350	Pipe	1 x 1000mm	
143	35+642	Pipe	1 x 1000mm	
144	35+762	Pipe	1 x 1000mm	
145	36+068	Pipe	1 x 1000mm	
146	36+138	Box	1.5 X7.0 X 2.0	
147	36+657	Pipe	1 x 1000mm	
148	36+757	Box	1.0 X7.0 X 0.6	
149	37+242	Pipe	1 x 700mm	
150	37+400	Pipe	1 x 600mm	
151	38+211	Box	1.0 X7.0 X 1.2	
152	38+705	Pipe	Abandoned	
153	39+026	Pipe	2 x 1000mm	
154	39+081	Pipe	2 x 1000mm	
155	39+213	Slab	1.5 X8.0 X 2.4	
156	39+476	Box	1.0 X7.0 X 1.7	
157	39+721	Pipe	Abandoned	
158	40+156	Pipe	1 x 1000mm	
159	40+338	Pipe	1 x 1000mm	
160	40+397	Pipe	Abandoned	
161	41+219	Pipe	1 x 600mm	
162	41+339	Pipe	1 x 600mm	
163	41+623	Slab	1.0 X10.0 X 0.8	
164	42+030	Pipe	1 x1000mm	
165	42+279	Pipe	1 x 1200mm	
166	42+497	Pipe	1 x 1000mm	
167	42+842	Box	0.7 X9.0 X 0.8	
168	42+882	Pipe	1 x 1000mm	
169	43+023	Pipe	1 x 700mm	
170	43+233	Pipe	1 x 1000mm	
171	43+364	Pipe	1 x 1000mm	
172	43+830	Pipe	1 x 1000mm	
173	44+080	Pipe	Abandoned	
174	44+540	Box	Abandoned	
175	45+022	Pipe	1 x 1000mm	
176	45+280	Pipe	1 x 1000mm	
177	45+368	Pipe	1 x 800mm	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
178	45+400	Pipe	1 x 1000mm	
179	45+526	Pipe	2 x 1000mm	
180	46+064	Pipe	1 x 1000mm	
181	46+284	Pipe	1 x 800mm	
182	46+326	Pipe	1 x 1000mm	
183	46+496	Pipe	1 x 1000mm	
184	46+576	Pipe	1 x 1000mm	
185	46+853	Box	1.75 X7.75 X 1.0	
186	47+044	Pipe	1 x 800mm	
187	47+508	Pipe	1 x 1000mm	
188	47+640	Pipe	1 x 1000mm	
189	47+695	Pipe	1 x 1000mm	
190	47+750	Box	1.3 X8.0 X 0.8	
191	48+230	Pipe	1 x 1000mm	
192	48+442	Pipe	1 x 1000mm	
193	48+578	Pipe	1 x 1000mm	
194	48+661	Pipe	1 x 750mm	
195	48+820	Pipe	1 x 1000mm	
196	49+068	Pipe	1 x 1000mm	
197	49+571	Pipe	1 x 1000mm	
198	49+754	Box	0.75X6.5 X 1.0	
199	49+860	Pipe	1 x 1000mm	
200	49+966	Box	1.5X7.5 X 1.3	
202	50+343	Pipe	1 x 1000mm	
203	50+486	Pipe	1 x 1000mm	
204	51+119	Pipe	1 x 1000mm	
205	51+240	Pipe	Abandoned	
206	51+362	Pipe	1 x 1000mm	
207	51+541	Pipe	1 x 1000mm	
208	51+770	Pipe	1 x 1000mm	
209	51+864	Pipe	1 x 1000mm	
210	52+174	Box	0.50X8.0X0.50	
211	52+311	Box	0.98X8.25X1.0	
212	52+553	Pipe	1 x 1000mm	
213	52+670	Pipe	1 x 1000mm	
214	52+946	Pipe	1 x 1000mm	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
215	53+135	Pipe	1 x 1000mm	
216	53+297	Box	0.80X6.75 X0.7	
217	53+452	Box	0.87X6.75 X0.7	
218	53+616	Pipe	1 x 1000mm	
219	53+759	Slab	0.83X7.25 X1.0	
220	54+034	Pipe	1 x 500mm	
221	54+414	Box	0.89X6.5 X1.0	
222	54+698	Pipe	1 x 500mm	
223	55+016	Slab	0.85X7.50 X0.50	
224	55+200	Pipe	1 x 1000mm	
225	55+463	Slab	0.73X6.25 X0.60	
226	55+613	Slab	0.80X6.25 X0.50	
227	57+309	Pipe	1 x 500mm	
228	57+569	Pipe	1 x 1000mm	
229	57+683	Pipe	1 x 1000mm	
230	57+798	Slab	0.90X7.25 X1.00	
231	58+607	Pipe	1 x 1000mm	
232	58+813	Pipe	Abandoned	
233	59+175	Pipe	Abandoned	
234	59+593	Pipe	1 x 600mm	
235	59+782	Slab	1.0X7.00X1.00	
236	59+943	Box	1.2X8.00X1.30	
237	60+190	Box	1.2X7.50X1.50	
238	60+594	Pipe	Abandoned	
239	61+357	Pipe	Abandoned	
240	61+482	Pipe	1 x 1000mm	
241	61+566	Box	1.25X8.00X1.30	
242	61+644	Box	1.00X8.00X1.00	
243	61+791	Box	0.85X6.5X1.00	
244	61+948	Box	1.26X8.0X1.20	
245	62+088	Pipe	1 x 1000mm	
246	62+209	Box	1.25X7.0X1.00	
247	62+471	Slab	Abandoned	
248	62+592	Pipe	1 x 1000mm	
249	62+804	Pipe	1 x 1000mm	
250	62+931	Box	0.95X7.0X0.7	
251	63+165	Pipe	1 x 1000mm	

S. No	Existing Chainage (km)	Type of culvert	Span/ Opening with Span length (m)	Width (m)
252	63+371	Pipe	1 x 1000mm	
253	63+441	Pipe	1 x 1000mm	
254	63+513	Pipe	1 x 1000mm	
255	63+726	Pipe	1 x 1000mm	
256	63+826	Box	1.00X6.25X1.00	
257	63+989	Pipe	Abandoned	
258	64+078	Box	1.00X7.0X1.30	
259	64+480	Pipe	Abandoned	
260	64+636	Box	0.8X8.0X0.7	
261	64+780	Pipe	1 x 1000mm	
262	65+598	Box	0.8X7.0X0.4	
263	65+772	Box	1.0X7.0X0.5	
264	66+079	Box	1.0X6.5X0.8	
265	66+166	Pipe	1 x φ1000mm	
266	66+305	Pipe	1 x φ1000mm	
267	66+662	Pipe	Abandoned	
268	67+457	Slab	0.65X6.5X0.6	
269	67+590	Slab	0.8X6.5X1.6	
270	67+730	Slab	1.0X7.0X0.8	
271	67+848	Slab	0.7X6.0X0.6	
272	67+958	Box	0.7X6.75X0.4	
273	68+224	Slab	0.75X6.25X0.45	
274	68+684	Slab	0.75X6.50X1.0	
275	68+772	Slab	0.75X6.50X0.6	
276	68+905	Pipe	1 x φ500mm	
277	68+955	Slab	0.65X9.75X1.15	
278	69+208	Pipe	1 x φ1000mm	
279	69+337	Pipe	1 x φ1000mm	
280	69+509	Slab	0.75X7.0X0.9	

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	8+292	9+000	Pucca	Rest Kutcha
2	9+000	24+000	-	Kutcha
3	24+000	25+000	Pucca	Rest Kutcha
4	25+000	39+000	-	Kutcha
5	39+000	41+000	Pucca	Rest Kutcha
6	41+000	44+000	-	Kutcha
7	44+000	46+000	Pucca	Rest Kutcha
8	46+000	56+000	-	Kutcha
9	56+000	57+000	Pucca	Rest Kutcha
10	57+000	58+000	-	Kutcha
11	58+000	60+000	Pucca	Rest Kutcha
12	60+000	64+000	-	Kutcha
13	64+000	65+000	Pucca	Rest Kutcha
14	65+000	66+000	-	Kutcha
15	66+000	67+000	Pucca	Rest 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	38+000	35+305	At Grade	LHS	NH-150
2	40+856	38+000	At Grade	LHS	Champai

(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	13+500	13+500	T	
2	20+975	20+975		Y
3	37+775	37+775		Y
4	38+850	38+850	T	
5	42+585	42+585	T	
6	55+335	55+335		Y
7	62+755	62+755	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	8+292	8+000
2	9+000	8+400
3	10+000	9+380
4	11+000	10+232
5	12+000	11+050
6	13+000	12+019
7	15+000	13+807
8	16+000	14+840
9	17+000	15+804
10	18+000	17+202
11	19+000	17+736
12	20+000	18+896
13	21+000	19+782
14	22+000	20+482
15	23+000	21+478
16	24+000	22+296
17	25+000	23+375
18	26+000	10+336
19	27+000	25+139
20	28+000	26+060
21	29+000	26+804
22	30+000	27+692
23	31+000	28+625
24	32+000	29+589
25	33+000	30+498
26	34+000	31+475
27	35+000	32+489
28	36+000	33+481
29	37+000	34+464
30	40+000	37+161
31	41+000	38+136
32	42+000	38+975
33	43+000	40+005
34	44+000	41+002
35	46+000	41+981
36	47+000	43+757
37	48+000	44+682
38	49+000	45+677
39	50+000	46+648

40	51+000	47+343
41	52+000	48+256
42	53+000	49+187
43	54+000	50+107
44	55+000	51+048
45	56+000	52+018
46	57+000	53+017
47	58+000	53+975
48	59+000	54+808
49	60+000	55+762
50	62+000	57+726
51	63+000	58+586
52	64+000	59+525
53	65+000	60+491
54	66+000	64+485
55	67+000	62+471
56	68+000	63+456
57	69+000	64+412
58	70+000	65+334

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:

S.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 ~~dated~~ 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 terrain to the extent land is available.

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.

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	Zemabawk	8+000	8+400
2	Tuirail	22+296	23+375
3	Seling	37+161	38+136
4	Thingsulthliah	41+002	41+981
5	Darlawng	52+081	53+017
6	Tlungvel	53+975	55+762
7	Phulmawi	59+525	60+491
8	Khumtung	64+485	62+471

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.

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	
N/A				

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 40 km per hr & Minimum 30 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.

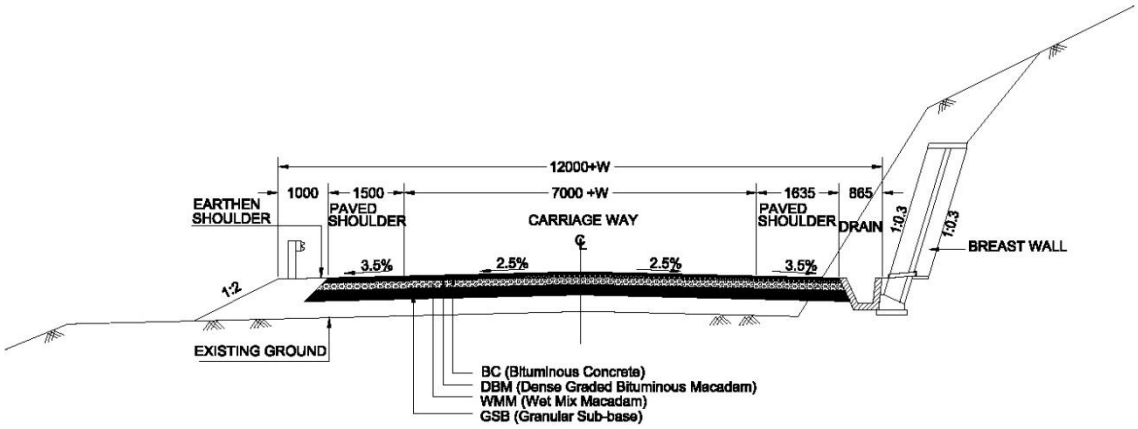


Figure 2.11(1): Typical Cross Section for Widening Primarily to Hill Side

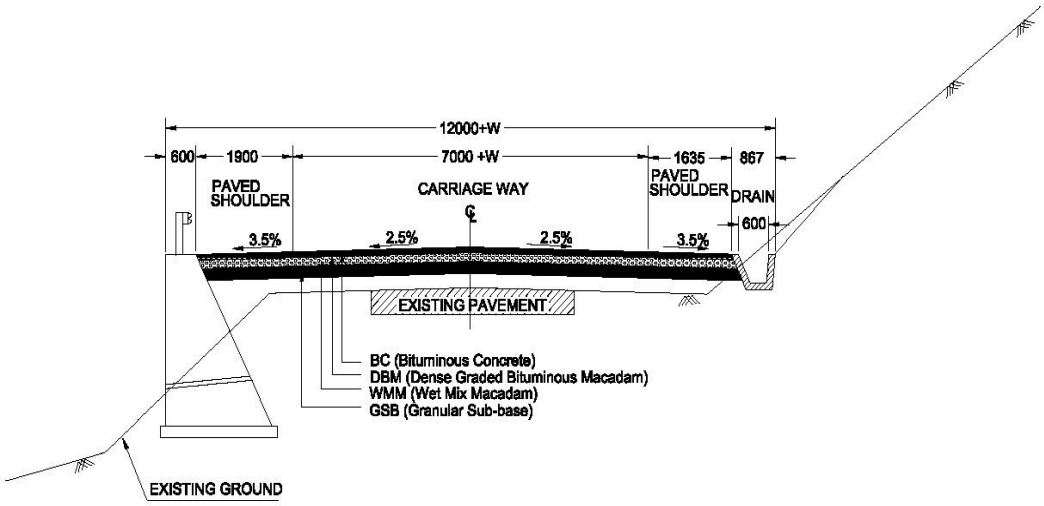


Figure 2.11(2): Typical Cross Section for Widening Primarily to Valley Side

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	35+305	T	NH-150	-
2	38+000	Y	Champai	-

b) At-grade intersections (Minor Junctions)

S. No.	Location of	Type of	Other features

	Intersection	Intersection	LHS	RHS
1	13+500	T	Govt. Primary School	-
2	20+975	Y	-	Lapcha basti
3	37+775	Y	Assam Rifels	-
4	38+850	T	-	Selling govt. school
5	42+585	T	Telephone Office	-
6	55+335	Y	-	Benghun, Zotui
7	62+755	T	-	PMGSY Road

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 2 f (iii) of Schedule C (Project Facilities).

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	8+114	1/1.2 dia	Pipe
2	8+475	1/1.2 dia	Pipe
3	8+590	1/1.2 dia	Pipe
4	8+736	1/1.2 dia	Pipe
5	8+970	1/1.2 dia	Pipe
6	9+090	1/1.2 dia	Pipe
7	9+145	1/1.2 dia	Pipe
8	9+355	1/1.2 dia	Pipe
9	9+565	1/1.2 dia	Pipe
10	9+734	1/1.2 dia	Pipe
11	9+892	1/1.2 dia	Pipe
12	10+280	1/1.2 dia	Pipe
13	10+415	1/1.2 dia	Pipe
14	10+573	1/1.2 dia	Pipe
15	10+680	1/1.2 dia	Pipe
16	10+782	1/1.2 dia	Pipe
17	10+845	1/1.2 dia	Pipe
18	10+940	1/1.2 dia	Pipe
19	10+988	1/1.2 dia	Pipe
20	11+175	2.0 x 2.0	Box
21	11+340	1/1.2 dia	Pipe
22	11+477	1/1.2 dia	Pipe
23	11+600	1/1.2 dia	Pipe
24	11+712	1/1.2 dia	Pipe
25	11+789	1/1.2 dia	Pipe
26	11+868	1/1.2 dia	Pipe
27	11+964	1/1.2 dia	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
28	12+091	1/1.2 dia	Pipe
29	12+327	1/1.2 dia	Pipe
30	12+558	1/1.2 dia	Pipe
31	13+100	1/1.2 dia	Pipe
32	13+230	1/1.2 dia	Pipe
33	13+340	1/1.2 dia	Pipe
34	13+512	1/1.2 dia	Pipe
35	13+621	1/1.2 dia	Pipe
36	13+696	1/1.2 dia	Pipe
37	13+818	1/1.2 dia	Pipe
38	14+170	1/1.2 dia	Pipe
39	14+240	1/1.2 dia	Pipe
40	14+369	1/1.2 dia	Pipe
41	14+447	1/1.2 dia	Pipe
42	14+632	1/1.2 dia	Pipe
43	14+970	1/1.2 dia	Pipe
44	15+220	1/1.2 dia	Pipe
45	15+497	1/1.2 dia	Pipe
46	15+648	1/1.2 dia	Pipe
47	15+712	1/1.2 dia	Pipe
48	15+902	1/1.2 dia	Pipe
49	16+097	1/1.2 dia	Pipe
50	16+448	1/1.2 dia	Pipe
51	16+598	1/1.2 dia	Pipe
52	16+748	1/1.2 dia	Pipe
53	16+920	1/1.2 dia	Pipe
54	16+970	1/1.2 dia	Pipe
55	17+099	1/1.2 dia	Pipe
56	17+210	1/1.2 dia	Pipe
57	17+572	1/1.2 dia	Pipe
58	17+817	2.0 x 2.0	Box
59	18+353	2.0 x 2.0	Box
60	18+436	1/1.2 dia	Pipe
61	18+661	1/1.2 dia	Pipe
62	18+740	1/1.2 dia	Pipe
63	18+764	1/1.2 dia	Pipe
64	18+950	1/1.2 dia	Pipe
65	19+103	1/1.2 dia	Pipe
66	19+544	1/1.2 dia	Pipe
67	19+664	1/1.2 dia	Pipe
68	19+940	3.0 x 3.0	Box
69	19+993	1/1.2 dia	Pipe
70	20+144	1/1.2 dia	Pipe
71	20+340	1/1.2 dia	Pipe
72	20+370	1/1.2 dia	Pipe
73	20+495	1/1.2 dia	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
74	20+587	1/1.2 dia	Pipe
75	20+676	1/1.2 dia	Pipe
76	20+836	1/1.2 dia	Pipe
77	20+971	1/1.2 dia	Pipe
78	21+065	1/1.2 dia	Pipe
79	21+187	1/1.2 dia	Pipe
80	21+297	1/1.2 dia	Pipe
81	21+610	1/1.2 dia	Pipe
82	21+852	1/1.2 dia	Pipe
83	21+925	3.0 x 3.0	Box
84	21+987	1/1.2 dia	Pipe
85	22+045	1/1.2 dia	Pipe
86	22+290	1/1.2 dia	Pipe
87	22+449	1/1.2 dia	Pipe
88	22+551	1/1.2 dia	Pipe
89	22+746	1/1.2 dia	Pipe
90	22+778	1/1.2 dia	Pipe
91	23+094	1/1.2 dia	Pipe
92	23+182	1/1.2 dia	Pipe
93	23+369	1/1.2 dia	Pipe
94	23+583	1/1.2 dia	Pipe
95	23+775	1/1.2 dia	Pipe
96	24+029	1/1.2 dia	Pipe
97	24+214	1/1.2 dia	Pipe
98	24+420	1/1.2 dia	Pipe
99	24+672	2.0 x 2.0	Box
100	24+878	1/1.2 dia	Pipe
101	25+229	1/1.2 dia	Pipe
102	25+320	1/1.2 dia	Pipe
103	25+439	1/1.2 dia	Pipe
104	25+522	1/1.2 dia	Pipe
105	25+714	1/1.2 dia	Pipe
106	25+763	1/1.2 dia	Pipe
107	25+997	1/1.2 dia	Pipe
108	26+185	1/1.2 dia	Pipe
109	26+218	1/1.2 dia	Pipe
110	26+290	1/1.2 dia	Pipe
111	26+380	1/1.2 dia	Pipe
112	26+708	1/1.2 dia	Pipe
113	26+751	1/1.2 dia	Pipe
114	26+938	1/1.2 dia	Pipe
115	27+070	1/1.2 dia	Pipe
116	27+373	1/1.2 dia	Pipe
117	27+424	1/1.2 dia	Pipe
118	27+622	1/1.2 dia	Pipe
119	27+714	1/1.2 dia	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
120	27+901	1/1.2 dia	Pipe
121	28+240	1/1.2 dia	Pipe
122	28+635	1/1.2 dia	Pipe
123	28+828	1/1.2 dia	Pipe
124	28+960	1/1.2 dia	Pipe
125	29+242	1/1.2 dia	Pipe
126	29+560	1/1.2 dia	Pipe
127	29+754	1/1.2 dia	Pipe
128	29+964	1/1.2 dia	Pipe
129	30+138	1/1.2 dia	Pipe
130	30+720	1/1.2 dia	Pipe
131	31+006	1/1.2 dia	Pipe
132	31+265	1/1.2 dia	Pipe
133	31+330	1/1.2 dia	Pipe
134	31+460	1/1.2 dia	Pipe
135	31+688	1/1.2 dia	Pipe
136	31+909	1/1.2 dia	Pipe
137	32+208	1/1.2 dia	Pipe
138	32+281	1/1.2 dia	Pipe
139	32+483	1/1.2 dia	Pipe
140	32+588	1/1.2 dia	Pipe
141	32+632	1/1.2 dia	Pipe
142	32+844	1/1.2 dia	Pipe
143	33+144	1/1.2 dia	Pipe
144	33+255	1/1.2 dia	Pipe
145	33+548	1/1.2 dia	Pipe
146	33+618	1/1.2 dia	Pipe
147	34+265	1/1.2 dia	Pipe
148	34+374	1/1.2 dia	Pipe
149	34+708	1/1.2 dia	Pipe
150	34+848	1/1.2 dia	Pipe
151	35+517	1/1.2 dia	Pipe
152	36+078	1/1.2 dia	Pipe
153	36+339	1/1.2 dia	Pipe
154	36+395	1/1.2 dia	Pipe
155	36+538	1/1.2 dia	Pipe
156	36+789	1/1.2 dia	Pipe
157	37+033	1/1.2 dia	Pipe
158	37+323	1/1.2 dia	Pipe
159	37+499	1/1.2 dia	Pipe
160	37+557	1/1.2 dia	Pipe
161	38+408	1/1.2 dia	Pipe
162	38+527	1/1.2 dia	Pipe
163	38+795	1/1.2 dia	Pipe
164	39+005	1/1.2 dia	Pipe
165	39+250	1/1.2 dia	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
166	39+473	1/1.2 dia	Pipe
167	39+818	1/1.2 dia	Pipe
168	39+860	1/1.2 dia	Pipe
169	40+001	1/1.2 dia	Pipe
170	40+262	1/1.2 dia	Pipe
171	40+411	1/1.2 dia	Pipe
172	40+874	1/1.2 dia	Pipe
173	41+076	1/1.2 dia	Pipe
174	41+531	1/1.2 dia	Pipe
175	42+004	1/1.2 dia	Pipe
176	42+270	1/1.2 dia	Pipe
177	42+362	1/1.2 dia	Pipe
178	42+395	1/1.2 dia	Pipe
179	42+518	1/1.2 dia	Pipe
180	42+986	1/1.2 dia	Pipe
181	43+071	1/1.2 dia	Pipe
182	43+146	1/1.2 dia	Pipe
183	43+314	1/1.2 dia	Pipe
184	43+398	1/1.2 dia	Pipe
185	43+666	1/1.2 dia	Pipe
186	43+801	1/1.2 dia	Pipe
187	44+267	1/1.2 dia	Pipe
188	44+394	1/1.2 dia	Pipe
189	44+448	1/1.2 dia	Pipe
190	44+504	1/1.2 dia	Pipe
191	44+912	1/1.2 dia	Pipe
192	45+124	1/1.2 dia	Pipe
193	45+260	1/1.2 dia	Pipe
194	45+338	1/1.2 dia	Pipe
195	45+498	1/1.2 dia	Pipe
196	45+745	1/1.2 dia	Pipe
197	46+247	1/1.2 dia	Pipe
198	46+431	1/1.2 dia	Pipe
199	46+539	1/1.2 dia	Pipe
200	46+626	1/1.2 dia	Pipe
201	46+984	1/1.2 dia	Pipe
202	47+117	1/1.2 dia	Pipe
203	47+460	1/1.2 dia	Pipe
204	47+583	1/1.2 dia	Pipe
205	47+694	1/1.2 dia	Pipe
206	47+867	1/1.2 dia	Pipe
207	48+071	1/1.2 dia	Pipe
208	48+156	1/1.2 dia	Pipe
209	48+418	1/1.2 dia	Pipe
210	48+555	1/1.2 dia	Pipe
211	48+769	1/1.2 dia	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
212	48+863	1/1.2 dia	Pipe
213	49+144	1/1.2 dia	Pipe
214	49+314	1/1.2 dia	Pipe
215	49+473	1/1.2 dia	Pipe
216	49+620	1/1.2 dia	Pipe
217	49+779	1/1.2 dia	Pipe
218	49+905	1/1.2 dia	Pipe
219	50+141	1/1.2 dia	Pipe
220	50+514	1/1.2 dia	Pipe
221	50+780	1/1.2 dia	Pipe
222	51+062	1/1.2 dia	Pipe
223	51+236	1/1.2 dia	Pipe
224	51+486	1/1.2 dia	Pipe
225	51+688	1/1.2 dia	Pipe
226	53+315	1/1.2 dia	Pipe
227	53+568	1/1.2 dia	Pipe
228	53+678	1/1.2 dia	Pipe
229	53+891	1/1.2 dia	Pipe
230	54+435	1/1.2 dia	Pipe
231	54+634	1/1.2 dia	Pipe
232	54+980	1/1.2 dia	Pipe
233	55+398	1/1.2 dia	Pipe
234	55+583	1/1.2 dia	Pipe
235	55+742	1/1.2 dia	Pipe
236	55+965	1/1.2 dia	Pipe
237	56+370	1/1.2 dia	Pipe
238	57+124	1/1.2 dia	Pipe
239	57+234	1/1.2 dia	Pipe
240	57+321	1/1.2 dia	Pipe
241	57+398	1/1.2 dia	Pipe
242	57+547	1/1.2 dia	Pipe
243	57+694	1/1.2 dia	Pipe
244	57+816	1/1.2 dia	Pipe
245	57+934	1/1.2 dia	Pipe
246	58+232	1/1.2 dia	Pipe
247	58+357	1/1.2 dia	Pipe
248	58+461	1/1.2 dia	Pipe
249	58+580	1/1.2 dia	Pipe
250	58+735	1/1.2 dia	Pipe
251	58+921	1/1.2 dia	Pipe
252	58+990	1/1.2 dia	Pipe
253	59+058	1/1.2 dia	Pipe
254	59+256	1/1.2 dia	Pipe
255	59+358	1/1.2 dia	Pipe
256	59+510	1/1.2 dia	Pipe
257	59+600	1/1.2 dia	Pipe

Sl. No	Proposed Chainage (km)	Span opening (m)	Remarks
258	60+002	1/1.2 dia	Pipe
259	60+157	1/1.2 dia	Pipe
260	60+302	1/1.2 dia	Pipe
261	61+088	1/1.2 dia	Pipe
262	61+264	1/1.2 dia	Pipe
263	61+563	1/1.2 dia	Pipe
264	61+645	1/1.2 dia	Pipe
265	61+775	1/1.2 dia	Pipe
266	62+134	1/1.2 dia	Pipe
267	62+929	1/1.2 dia	Pipe
268	63+063	1/1.2 dia	Pipe
269	63+199	1/1.2 dia	Pipe
270	63+320	1/1.2 dia	Pipe
271	63+428	1/1.2 dia	Pipe
272	63+658	1/1.2 dia	Pipe
273	64+117	1/1.2 dia	Pipe
274	64+198	1/1.2 dia	Pipe
275	64+326	1/1.2 dia	Pipe
276	64+377	1/1.2 dia	Pipe
277	64+612	1/1.2 dia	Pipe
278	64+739	1/1.2 dia	Pipe
279	64+886	1/1.2 dia	Pipe
280	64+971	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			

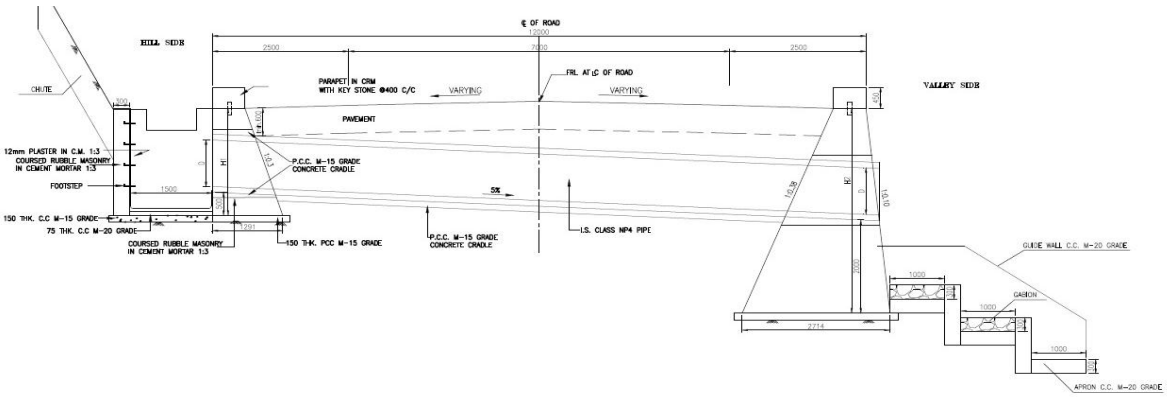
7.2.4 Additional new culverts shall be constructed as per particulars given in the table below:

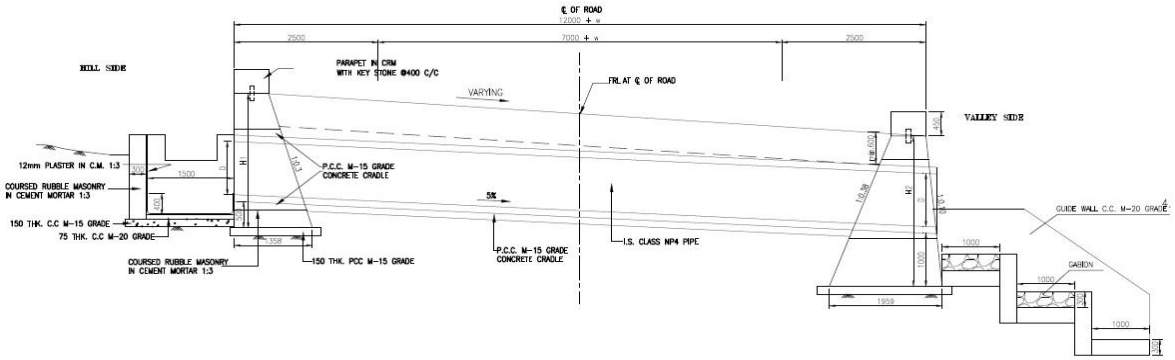
S. No.	Culvert Location (Proposed Chainage)	Span/ opening (m)	Remarks (Type of Culvert)
1.	8+180	1/1.2 dia	Pipe
2.	8+350	1/1.2 dia	Pipe

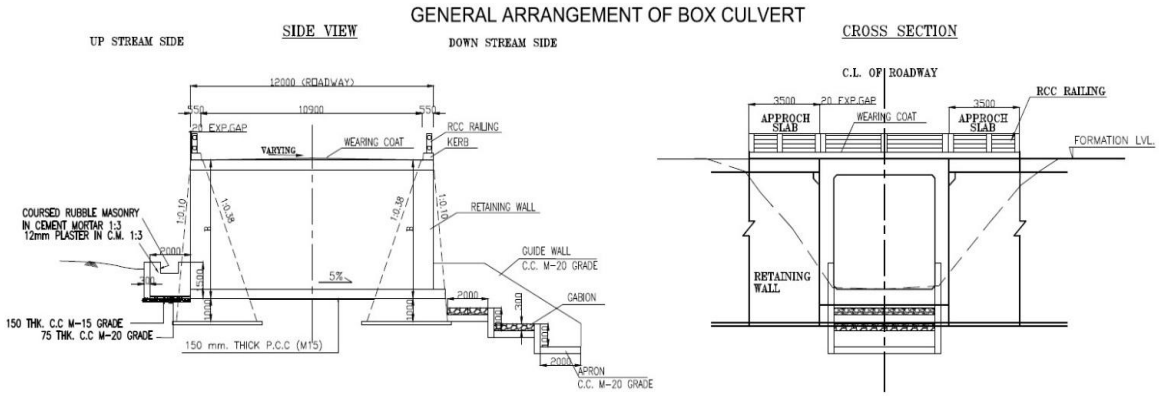
S. No.	Culvert Location (Proposed Chainage)	Span/ opening (m)	Remarks (Type of Culvert)
3.	10+037	1/1.2 dia	Pipe
4.	12+180	1/1.2 dia	Pipe
5.	12+448	1/1.2 dia	Pipe
6.	12+855	1/1.2 dia	Pipe
7.	14+011	1/1.2 dia	Pipe
8.	15+058	1/1.2 dia	Pipe
9.	16+277	1/1.2 dia	Pipe
10.	17+410	1/1.2 dia	Pipe
11.	17+650	1/1.2 dia	Pipe
12.	19+375	1/1.2 dia	Pipe
13.	23+955	1/1.2 dia	Pipe
14.	24+530	1/1.2 dia	Pipe
15.	26+492	2.0 x 2.0	Box
16.	28+090	1/1.2 dia	Pipe
17.	28+470	1/1.2 dia	Pipe
18.	29+390	1/1.2 dia	Pipe
19.	29+861	1/1.2 dia	Pipe
20.	30+285	1/1.2 dia	Pipe
21.	30+413	1/1.2 dia	Pipe
22.	30+575	1/1.2 dia	Pipe
23.	30+870	1/1.2 dia	Pipe
24.	33+415	1/1.2 dia	Pipe
25.	33+925	1/1.2 dia	Pipe
26.	34+526	1/1.2 dia	Pipe
27.	34+942	1/1.2 dia	Pipe
28.	35+020	1/1.2 dia	Pipe
29.	35+213	1/1.2 dia	Pipe
30.	35+280	1/1.2 dia	Pipe
31.	35+723	1/1.2 dia	Pipe
32.	35+933	1/1.2 dia	Pipe
33.	36+635	1/1.2 dia	Pipe
34.	37+225	1/1.2 dia	Pipe

S. No.	Culvert Location (Proposed Chainage)	Span/ opening (m)	Remarks (Type of Culvert)
35.	37+810	1/1.2 dia	Pipe
36.	38+185	1/1.2 dia	Pipe
37.	38+290	1/1.2 dia	Pipe
38.	38+670	1/1.2 dia	Pipe
39.	39+638	1/1.2 dia	Pipe
40.	40+585	1/1.2 dia	Pipe
41.	40+905	1/1.2 dia	Pipe
42.	41+202	1/1.2 dia	Pipe
43.	41+345	1/1.2 dia	Pipe
44.	41+710	1/1.2 dia	Pipe
45.	41+834	1/1.2 dia	Pipe
46.	44+075	1/1.2 dia	Pipe
47.	44+696	1/1.2 dia	Pipe
48.	45+163	1/1.2 dia	Pipe
49.	46+870	1/1.2 dia	Pipe
50.	47+290	1/1.2 dia	Pipe
51.	50+341	1/1.2 dia	Pipe
52.	50+632	1/1.2 dia	Pipe
53.	50+870	1/1.2 dia	Pipe
54.	51+363	1/1.2 dia	Pipe
55.	51+931	1/1.2 dia	Pipe
56.	52+080	1/1.2 dia	Pipe
57.	52+170	1/1.2 dia	Pipe
58.	52+250	1/1.2 dia	Pipe
59.	52+433	1/1.2 dia	Pipe
60.	52+598	1/1.2 dia	Pipe
61.	52+729	1/1.2 dia	Pipe
62.	53+029	1/1.2 dia	Pipe
63.	53+401	1/1.2 dia	Pipe
64.	54+079	1/1.2 dia	Pipe
65.	54+290	1/1.2 dia	Pipe
66.	54+760	1/1.2 dia	Pipe

S. No.	Culvert Location (Proposed Chainage)	Span/ opening (m)	Remarks (Type of Culvert)
67.	55+495	1/1.2 dia	Pipe
68.	55+836	1/1.2 dia	Pipe
69.	56+200	1/1.2 dia	Pipe
70.	56+500	1/1.2 dia	Pipe
71.	56+675	1/1.2 dia	Pipe
72.	56+827	1/1.2 dia	Pipe
73.	56+960	1/1.2 dia	Pipe
74.	59+790	1/1.2 dia	Pipe
75.	60+523	1/1.2 dia	Pipe
76.	60+755	1/1.2 dia	Pipe
77.	60+975	1/1.2 dia	Pipe
78.	61+870	1/1.2 dia	Pipe
79.	62+377	1/1.2 dia	Pipe
80.	62+595	1/1.2 dia	Pipe
81.	62+690	1/1.2 dia	Pipe
82.	62+833	1/1.2 dia	Pipe
83.	63+855	1/1.2 dia	Pipe







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
1	24+659	Wearing coat, handrails/parapet, bearings, expansion joints, drainage spouts, spalling of concrete, provision of R. C. C. crash barriers on bridge decks etc.

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	24+659	**RCC T-Beam 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 Structures for Retaining Walls and other works for slope protection shown in the following Table shall be constructed:

Chainage		Approximate construction length (m)	Slope Countermeasure	Unit	Total Qty
Start	End				
8 + 400	8 + 460	60	Gabion wall	m^3	120
			Groundwater Drainage	m	500
			Earth removal	m^3	7,950
			Anchor works	m	1,300
			Crib work (F500)	m^2	900
			Crib work (F300)	m^2	900
			Seeding and Mulching	m^2	2,000
			Vegetation mat	m^2	1,300
10 + 460	10 + 490	30	Gabion wall	m^3	90
11 + 580	11 + 880	240	Gabion wall	m^3	480
12 + 580	12 + 900	220	Rockfall prevention wall (H=3m)	m^3	957
			Rockfall prevention fence (H=2m)	m	220
16 + 420	16 + 500	80	Gabion wall	m^3	240
			Groundwater Drainage	m	200
18 + 460	18 + 540	80	Gabion wall	m^3	320
			Groundwater Drainage	m	320
18 + 690	18 + 730	40	Gabion wall	m^3	160
			Earth removal	m^3	80
			Groundwater Drainage	m	100

Chainage		Approximate construction length (m)	Slope Countermeasure	Unit	Total Qty
Start	End				
			Hydroseeding	m^2	160
18 + 730	18 + 770	40	Gabion wall	m^3	160
19 + 370	19 + 420	50	Gabion wall	m^3	200
			Groundwater Drainage	m	240
22 + 660	22 + 700	40	Gabion wall	m^3	160
			Earth removal	m^3	160
			Hydroseeding	m^2	200
25 + 710	25 + 750	40	Gabion wall	m^3	160
25 + 820	25 + 900	80	Gabion wall	m^3	320
33 + 760	33 + 810	50	Gabion wall	m^3	200
35 + 220	35 + 250	30	Gabion wall	m^3	120
52 + 610	52 + 640	30	Non-frame	m^2	1,200
55 + 170	55 + 200	30	Gabion wall	m	120
			Groundwater Drainage	m	60
55 + 230	55 + 300	70	Gabion wall	m	280
			Groundwater Drainage	m	140
55 + 560	55 + 700	140	Rockfall prevention wall (H=3m)	m^3	609
			Rockfall prevention fence (H=2m)	m	140
55 + 700	55 + 900	200	Rockfall prevention wall (H=3m)	m^3	870
			Rockfall prevention fence (H=2m)	m	200
58 + 850	59 + 000	150	Gabion wall	m	300
			Groundwater Drainage	m	450
			Anchor works	m	3,150
			Crib work (F500)	m^2	2,550
			Vegetation mat	m^2	1,800

Total	Gabion wall	m^3	3,430
	Groundwater Drainage	m	2,010
	Earth removal	m^3	8,190
	Hydroseeding	m^2	360
	Vegetation mat	m^2	3,100
	Seeding and Mulching	m^2	2,000
	Rockfall prevention wall (H=3m)	m^3	2,436
	Rockfall prevention fence (H=2m)	m	560
	Non-frame	m^2	1,200
	Crib work (F300)	m^2	900

Chainage		Approximate construction length (m)	Slope Countermeasure	Unit	Total Qty
Start	End				
			Crib work (F500)	m^2	3,450
			Anchor works	m	4,450

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	
8+440	8+460	20
8+620	8+660	40
8+760	8+900	120
9+080	9+100	20
9+260	9+400	80
9+520	9+540	20
9+960	10+120	100
10+240	10+260	20
10+380	10+420	40
10+500	10+580	40
10+700	10+840	100
11+160	11+180	20
11+300	11+400	60
11+560	11+580	20
12+000	12+240	160
13+560	13+800	200
13+880	14+080	120
14+240	14+500	160
14+620	14+640	20
14+740	14+800	40
14+900	14+940	40
15+040	15+700	480
15+780	16+060	240
16+300	16+520	180
16+600	16+700	60
16+840	16+860	20
16+960	17+520	360
17+600	17+680	40
17+760	18+360	340
18+660	18+700	40
18+780	18+960	100
19+040	19+280	140
19+520	19+760	200
19+840	19+960	80
20+040	20+140	40
20+420	20+720	280
20+800	20+820	20

Chainage		Length (m)
Start	Start	
37+480	37+820	280
37+960	38+100	100
38+360	38+540	80
38+620	38+640	20
38+720	38+760	40
38+840	38+880	40
38+960	39+000	40
39+080	39+140	40
39+540	39+560	20
39+660	39+720	60
40+120	40+140	20
40+340	40+360	20
41+280	41+380	80
41+480	41+580	60
42+040	42+280	200
42+400	42+740	280
42+820	43+020	180
43+360	43+600	200
43+720	43+760	40
44+080	44+140	40
44+320	44+640	260
44+800	44+900	80
44+980	45+020	40
45+100	45+140	40
45+440	45+460	20
45+580	45+800	200
45+900	45+940	40
46+020	46+180	120
46+280	46+420	80
46+500	46+520	20
46+680	46+700	20
46+780	46+840	40
46+940	47+120	180
47+320	47+360	40
47+480	47+660	120
47+740	48+180	260
48+320	48+640	280

Wet Masonry Retaining Wall (H=3m)

Chainage		Length (m)	Chainage		Length (m)
Start	Start		Start	Start	
20+900	20+980	80	48+760	48+820	60
21+120	21+160	40	48+900	49+040	100
21+260	21+320	60	49+220	49+700	300
21+760	21+980	180	49+780	49+980	140
22+060	22+260	120	50+180	50+260	80
22+520	22+980	240	50+340	50+360	20
23+060	23+100	40	50+480	50+500	20
23+260	23+280	20	50+680	50+720	40
23+480	23+960	340	51+340	51+420	80
24+040	24+080	40	52+020	52+780	440
24+180	24+340	120	53+000	53+040	40
24+420	24+720	200	53+120	53+200	80
24+840	24+960	60	53+400	53+500	60
25+040	25+260	100	53+580	54+100	360
25+340	25+360	20	54+300	55+240	500
25+500	25+600	60	55+320	55+340	20
25+760	25+780	20	56+800	56+940	140
26+000	26+040	40	57+020	57+480	320
26+360	26+380	20	57+900	58+060	120
26+460	26+480	20	58+280	58+520	120
26+560	26+700	140	58+620	58+640	20
26+900	27+480	340	58+780	58+800	20
27+760	27+860	80	58+880	59+280	180
27+980	28+820	680	59+540	59+560	20
28+920	28+940	20	59+700	59+720	20
29+020	29+240	160	59+800	59+820	20
29+320	29+340	20	59+900	59+960	40
29+420	29+740	220	60+080	60+440	240
30+000	30+180	180	60+680	60+860	120
30+320	32+200	1,260	61+080	61+100	20
32+280	32+340	60	61+240	61+280	40
32+500	32+660	100	61+420	61+540	60
32+780	32+900	80	61+640	62+040	200
33+000	33+020	20	62+120	62+140	20
33+240	33+480	160	62+300	62+380	80
33+560	33+600	40	62+580	62+600	20
33+700	34+440	500	62+680	62+860	80
34+600	34+660	60	62+960	63+160	100
34+780	34+840	60	63+240	63+340	100
34+980	35+140	100	63+520	63+860	140
35+300	35+320	20	64+000	64+220	140
35+560	35+580	20	64+380	64+620	120
35+680	36+500	600	64+720	64+740	20
36+600	37+000	240	64+820	64+960	60
37+160	37+220	60			
				Total Length:	19,700

Wet Masonry Retaining Wall (H=7m)

Chainage		Length (m)
Start	End	
8+680	8+700	20
8+860	8+880	20
9+000	9+080	80
9+180	9+520	220
10+140	10+440	200
10+520	10+560	40
10+640	10+700	60
10+800	11+100	200
11+180	11+240	60
13+800	14+000	100
14+120	14+160	40
14+260	14+280	20
14+660	14+840	100
15+200	15+220	20
15+420	15+440	20
15+620	15+780	80
16+020	16+080	40
16+380	16+440	40
16+560	16+600	40
16+740	16+840	60
16+920	16+960	40
17+080	17+100	20
17+220	17+260	40
17+340	17+400	40
17+480	17+640	80
17+820	17+940	80
18+060	18+120	40
18+920	18+940	20
19+060	19+080	20
19+160	19+180	20
19+280	19+300	20
19+580	19+600	20
20+520	20+540	20
20+820	20+900	40
20+980	21+120	140
21+320	21+360	40
21+440	21+460	20
21+980	22+060	80
22+480	22+560	60
22+660	22+680	20
22+760	22+780	20
23+100	23+200	80
23+320	23+480	160
23+560	23+620	60
23+980	24+040	60
24+120	24+180	60
24+260	24+280	20

Chainage		Length (m)
Start	End	
25+780	25+800	20
25+940	25+980	40
26+240	26+260	20
26+480	26+520	40
26+880	26+900	20
27+180	27+200	20
27+320	27+440	60
29+280	29+320	40
29+400	29+420	20
32+220	32+280	60
32+580	32+600	20
32+680	32+720	40
32+800	32+860	40
33+420	33+860	280
34+440	34+580	140
34+660	34+860	140
35+040	35+100	60
35+180	35+200	20
35+420	35+560	80
35+740	35+860	60
37+820	37+840	20
40+940	41+000	60
42+220	42+360	80
42+800	42+820	20
43+040	43+180	60
46+300	46+320	20
46+480	46+500	20
46+700	46+900	80
47+140	47+180	40
47+420	47+440	20
47+660	47+700	40
48+180	48+320	100
48+640	48+700	60
48+860	49+200	160
50+020	50+140	60
52+560	52+680	60
52+860	52+960	60
53+540	53+580	40
59+960	60+020	60
60+440	60+680	160
61+660	61+760	40
62+080	62+220	100
62+720	62+800	40
63+400	63+420	20
63+600	63+700	40
63+780	63+800	20
63+920	63+960	40

24+400	24+420	20	64+160	64+320	100
24+920	25+080	80	64+620	64+860	120
25+180	25+500	160			
				Total Length:	6,000

Gravity Wall (H=1.5m and 2m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
8+000	8+100	30	37+560	37+600	40
8+260	8+280	20	37+760	37+860	60
8+640	8+660	20	38+040	38+120	40
8+840	8+940	60	38+300	38+360	40
9+060	9+080	20	38+600	38+620	20
9+200	9+600	200	38+900	39+060	80
9+680	9+700	20	39+140	39+200	40
9+860	9+900	40	39+280	39+300	20
10+320	10+380	60	39+580	39+660	40
11+200	11+340	60	40+120	40+140	20
11+500	11+520	20	40+240	40+280	40
11+840	11+860	20	40+360	40+480	60
12+000	12+020	20	40+620	40+640	20
12+120	12+140	20	40+960	40+980	20
12+420	12+520	60	41+080	41+100	20
12+720	12+760	40	41+180	41+340	80
12+920	13+060	80	42+120	42+240	60
13+160	13+180	20	42+380	42+420	40
13+700	13+760	60	42+840	42+980	80
14+000	14+020	20	43+100	43+120	20
14+740	14+840	80	43+240	43+260	20
15+100	15+200	60	43+440	43+540	40
15+540	15+560	20	43+620	43+640	20
15+680	15+780	40	43+760	43+800	40
15+900	16+000	40	43+920	43+940	20
16+200	16+220	20	44+100	44+120	20
16+380	16+580	120	44+200	44+300	40
16+720	16+740	20	45+080	45+120	40
16+860	16+880	20	45+260	45+280	20
17+020	17+040	20	45+360	45+380	20
17+220	17+240	20	46+300	46+380	60
17+380	17+440	60	46+780	46+800	20
17+900	17+920	20	47+140	47+160	20
18+140	18+160	20	47+400	47+520	60
18+480	18+500	20	47+680	47+700	20
19+240	19+260	20	47+780	47+800	20
19+440	19+460	20	48+040	48+060	20
19+900	20+100	120	48+300	48+320	20
20+260	20+380	80	48+440	48+460	20
20+580	20+640	40	48+880	48+940	60
20+740	20+760	20	49+020	49+040	20

Gravity Wall (H=1.5m and 2m)

Chainage		Length (m)
Start	End	
20+860	20+880	20
21+540	21+560	20
21+780	21+800	20
21+960	22+040	60
22+620	22+700	80
22+880	22+960	80
23+060	23+080	20
23+400	23+420	20
23+560	23+580	20
23+720	23+740	20
23+880	23+900	20
24+160	24+200	40
24+720	24+740	20
24+940	24+960	20
25+380	25+400	20
25+580	25+620	40
25+960	25+980	20
26+320	26+380	60
26+460	26+520	60
26+620	26+640	20
27+140	27+160	20
28+260	28+280	20
28+660	28+680	20
28+800	28+900	40
29+080	29+100	20
29+380	29+400	20
29+680	29+780	60
30+040	30+160	60
30+240	30+260	20
30+360	30+380	20
30+780	30+800	20
31+040	31+100	40
31+300	31+440	80
31+800	31+820	20
32+020	32+040	20
32+160	32+180	20
32+520	32+660	80
32+800	32+820	20
33+480	33+500	20
33+800	33+820	20
34+300	34+320	20
34+640	34+720	60
34+840	34+860	20
35+200	35+220	20
35+380	35+400	20
35+620	35+640	20
35+860	35+920	40

Chainage		Length (m)
Start	End	
49+260	49+300	40
49+440	49+460	20
50+300	50+360	40
50+720	50+740	20
50+880	50+900	20
51+140	51+160	20
51+280	51+420	100
51+600	51+780	80
51+860	52+020	120
52+640	52+660	20
53+100	53+200	40
53+340	53+360	20
53+460	53+480	20
53+560	53+960	160
54+380	54+460	60
54+900	54+960	60
55+080	55+120	40
55+260	55+280	20
55+500	55+580	60
55+740	55+760	20
55+880	55+900	20
56+660	56+680	20
56+800	56+820	20
56+920	56+940	20
57+060	57+240	100
57+600	57+620	20
57+820	57+840	20
58+060	58+080	20
58+200	58+220	20
58+780	58+800	20
59+080	59+100	20
59+320	59+580	160
59+680	59+720	40
60+140	60+160	20
60+300	60+320	20
60+560	60+600	40
60+780	60+800	20
61+040	61+080	40
61+180	61+240	40
61+440	61+500	40
61+640	61+700	60
61+880	61+900	20
62+520	62+540	20
63+140	63+160	20
63+480	63+540	40
63+820	63+840	20
64+080	64+100	20

Gravity Wall (H=1.5m and 2m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
36+100	36+120	20	64+380	64+400	20
36+260	36+280	20	64+560	64+600	40
36+460	36+560	40	64+740	64+760	20
36+900	36+960	60			
				Total Length:	6,870

Gravity Wall (H=3.0m and 4.0m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
8+120	8+140	20	36+740	36+760	20
8+240	8+260	20	36+960	36+980	20
8+380	8+500	60	37+440	37+460	20
8+680	8+740	60	37+660	37+700	40
8+860	8+900	40	37+800	37+980	80
8+980	9+060	40	38+260	38+420	80
9+160	9+380	100	38+500	38+520	20
9+720	9+820	40	38+680	38+740	60
9+940	9+960	20	39+100	39+280	140
10+440	10+460	20	40+080	40+240	60
10+560	10+580	20	40+420	40+540	80
10+680	10+720	40	40+660	40+940	160
10+820	10+840	20	41+020	41+180	100
11+240	11+260	20	41+340	41+360	20
11+340	11+360	20	41+820	41+840	20
11+620	11+680	40	42+080	42+120	40
11+780	11+840	40	42+200	42+220	20
12+040	12+060	20	42+440	42+640	100
12+540	12+580	40	42+900	42+920	20
12+760	12+960	100	43+020	43+060	40
13+260	13+280	20	43+160	43+240	60
13+680	13+700	20	43+320	43+380	60
13+920	14+000	80	43+600	43+620	20
14+160	14+220	60	43+800	43+840	40
14+460	14+740	160	44+000	44+020	20
14+840	14+860	20	44+120	44+140	20
15+040	15+060	20	44+260	44+440	100
15+800	15+880	40	44+600	44+860	120
15+960	15+980	20	45+000	45+080	60
16+260	16+280	20	45+160	45+260	60
16+540	16+560	20	45+400	45+500	60
16+900	17+180	100	46+100	46+180	60
17+300	17+380	80	46+620	46+640	20
17+720	17+800	40	47+100	47+120	20
17+920	17+940	20	47+420	47+440	20
18+160	18+180	20	47+800	47+840	40
18+500	18+520	20	47+940	48+240	140

Gravity Wall (H=3.0m and 4.0m)

Chainage		Length (m)
Start	End	
18+800	18+920	60
19+080	19+100	20
19+180	19+200	20
19+600	19+620	20
19+760	19+780	20
20+180	20+320	80
20+760	20+840	40
21+180	21+260	60
21+560	21+580	20
21+940	22+020	40
22+720	22+740	20
22+840	22+860	20
23+140	23+480	140
23+580	23+600	20
23+700	23+760	40
23+900	24+040	60
24+240	24+260	20
24+580	24+640	60
24+900	24+920	20
25+040	25+060	20
25+220	25+300	40
25+620	25+660	40
25+860	25+920	40
26+040	26+320	120
26+420	26+440	20
26+700	26+880	100
27+060	27+080	20
27+280	27+320	40
27+700	27+740	40
28+200	28+260	60
28+600	28+640	40
28+840	28+880	40
29+620	29+720	60
29+940	30+000	60
30+080	30+300	140
30+400	30+660	140
30+880	30+900	20
31+440	31+460	20
31+720	31+740	20
31+900	31+920	20
32+080	32+360	180
32+560	32+600	40
32+700	32+720	20
32+860	32+900	40
33+200	33+220	20
33+400	33+480	60
33+660	33+680	20

Chainage		Length (m)
Start	End	
48+400	48+520	80
48+620	48+640	20
48+940	48+960	20
49+220	49+420	120
49+800	49+820	20
49+900	49+940	40
50+120	50+620	280
50+740	50+800	60
50+900	50+920	20
51+020	51+340	220
51+520	51+640	100
52+140	52+160	20
52+320	52+440	80
52+800	52+860	60
52+980	53+000	20
53+080	53+100	20
53+280	53+300	20
53+520	53+760	80
53+900	54+040	60
54+180	54+380	80
54+460	54+540	60
54+640	54+720	40
54+800	54+900	80
54+980	55+000	20
55+180	55+220	40
55+440	55+460	20
55+720	56+060	160
56+180	56+220	40
56+300	56+320	20
56+460	56+480	20
56+640	56+860	80
56+940	56+960	20
57+040	57+060	20
57+200	57+220	20
57+340	57+360	20
57+580	57+680	40
58+180	58+200	20
58+800	58+820	20
59+140	59+180	40
59+380	59+400	20
59+480	59+820	180
59+940	59+960	20
60+080	60+200	80
60+340	60+420	60
60+520	60+540	20
60+620	60+720	100
61+380	61+400	20

Gravity Wall (H=3.0m and 4.0m)

Chainage		Length (m)
Start	End	
34+020	34+040	20
34+120	34+140	20
34+260	34+360	40
34+500	34+540	40
34+660	34+680	20
34+800	34+840	40
35+040	35+100	40
35+260	35+600	160
35+820	35+860	40
35+960	36+100	80
36+180	36+240	60
36+440	36+540	60

Chainage		Length (m)
Start	End	
61+500	61+640	80
61+720	61+740	20
61+940	62+060	60
62+200	62+300	60
62+400	62+580	100
62+660	63+520	420
63+720	64+000	120
64+180	64+220	40
64+400	64+540	80
64+660	64+680	20
64+840	64+960	70
Total Length:		10,250

Gravity Wall (H=5.0m and 6.0m)

Chainage		Length (m)
Start	End	
8+100	8+120	20
8+660	8+680	20
9+100	9+160	60
9+540	9+580	40
9+660	9+680	20
9+780	9+940	100
10+460	10+480	20
10+580	10+740	60
10+880	10+900	20
11+220	11+280	40
11+420	11+560	80
11+760	11+820	40
12+020	12+040	20
12+700	12+720	20
12+900	13+000	40
13+180	13+200	20
14+220	14+240	20
14+500	14+540	40
14+700	14+720	20
14+800	14+900	40
14+980	15+000	20
15+320	15+340	20
15+780	15+860	60
16+160	16+260	60
16+400	16+420	20
16+520	16+540	20
16+880	16+900	20
17+280	17+300	20
17+740	17+780	40

Chainage		Length (m)
Start	End	
35+880	35+900	20
36+020	36+040	20
36+240	36+320	60
36+400	36+420	20
36+580	36+600	20
36+760	36+860	40
37+780	37+800	20
37+900	37+960	60
38+120	38+260	120
38+420	38+440	20
40+780	40+920	100
41+240	41+260	20
42+300	42+320	20
42+520	42+540	20
42+640	42+660	20
42+760	42+800	40
43+060	43+160	60
43+480	43+500	20
44+220	44+260	40
44+720	44+780	40
45+020	45+040	20
45+540	45+560	20
45+940	46+020	40
46+180	46+200	20
46+280	46+340	40
46+440	46+460	20
46+660	46+940	140
47+180	47+280	40
47+440	47+460	20

Gravity Wall (H=5.0m and 6.0m)

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
17+880	17+900	20	47+920	47+940	20
18+420	18+440	20	48+240	48+260	20
18+740	18+760	20	48+380	48+400	20
19+300	19+320	20	48+640	48+660	20
19+580	19+600	20	48+740	48+760	20
20+020	20+120	60	49+040	49+220	120
20+320	20+400	40	49+420	49+440	20
21+500	21+520	20	49+520	49+660	60
21+620	21+740	60	50+040	50+060	20
23+020	23+060	40	50+140	50+180	40
23+200	23+280	40	50+260	50+280	20
24+100	24+120	20	50+360	50+380	20
24+260	24+280	20	50+540	50+720	120
24+640	24+760	60	51+100	51+120	20
24+980	25+000	20	52+160	52+200	40
25+140	25+220	40	52+460	52+580	60
25+740	25+760	20	53+380	53+400	20
25+840	25+940	60	53+580	53+600	20
26+100	26+180	40	53+920	54+060	60
26+280	26+300	20	54+500	54+520	20
26+840	26+940	40	54+620	54+700	60
27+040	27+060	20	55+120	55+180	40
27+640	27+760	80	55+680	55+720	40
28+680	28+700	20	55+860	55+920	40
29+260	29+280	20	56+320	56+440	80
29+360	29+380	20	56+540	56+760	80
30+200	30+220	20	56+960	57+040	40
30+380	30+400	20	58+220	58+240	20
30+540	30+560	20	59+780	59+800	20
30+960	30+980	20	59+980	60+000	20
31+060	31+080	20	60+120	60+140	20
31+260	31+300	40	60+240	60+560	160
31+820	31+840	20	61+740	61+940	100
32+180	32+200	20	62+100	62+480	180
32+600	32+620	20	62+600	62+820	120
32+720	32+800	60	63+020	63+140	80
32+900	33+060	60	63+240	63+260	20
33+140	33+200	60	63+660	63+680	20
33+280	33+300	20	63+880	63+980	40
34+040	34+060	20	64+120	64+140	20
34+780	34+800	20	64+260	64+380	60
35+020	35+200	100	64+640	64+660	20
35+280	35+300	20	64+880	64+900	20
35+460	35+540	40			
				Total Length:	5,680

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

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
9+740	9+760	20	46+640	46+660	20
10+300	10+320	20	46+860	46+880	20
10+620	10+640	20	47+120	47+140	20
11+400	11+420	20	47+280	47+300	20
11+640	11+660	20	47+380	47+480	40
14+300	14+320	20	47+700	47+740	40
14+860	14+880	20	48+000	48+020	20
15+720	15+740	20	48+260	48+280	20
19+320	19+440	60	48+700	48+780	40
19+920	19+940	20	50+520	50+540	20
23+100	23+140	40	52+480	52+540	40
23+300	23+320	20	52+900	52+920	20
24+760	24+780	20	55+980	56+080	40
24+960	24+980	20	56+440	56+460	20
25+520	25+540	20	57+000	57+020	20
25+660	25+680	20	57+240	57+260	20
25+800	25+840	40	57+360	57+400	40
25+980	26+100	60	60+200	60+220	20
29+340	29+360	20	60+420	60+440	20
30+840	30+860	20	61+700	61+720	20
32+200	32+220	20	61+840	61+860	20
32+980	33+140	100	62+140	62+160	20
34+280	34+300	20	62+500	62+520	20
35+320	35+340	20	62+640	62+660	20
35+660	35+680	20	63+220	63+240	20
36+420	36+440	20	63+440	63+460	20
40+140	40+160	20	63+580	63+600	20
41+220	41+240	20	64+020	64+040	20
42+280	42+300	20	64+480	64+500	20
43+500	43+520	20	64+700	64+720	20
46+220	46+240	20			
				Total Length:	1,540

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

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
9+760	9+780	20	41+140	41+160	20
10+600	10+620	20	46+240	46+280	40
10+960	10+980	20	48+720	48+740	20
14+960	14+980	20	49+540	49+560	20
17+000	17+020	20	56+980	57+000	20
19+360	19+400	40	57+260	57+280	20
20+400	20+420	20	60+220	60+240	20
23+180	23+300	60	61+760	61+780	20
24+880	24+900	20	62+060	62+080	20
25+720	25+740	20	62+940	62+960	20

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

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
26+200	26+220	20	63+460	63+480	20
32+760	32+780	20	64+340	64+360	20
35+340	35+360	20	64+460	64+480	20
35+600	35+620	20	64+780	64+800	20
				Total Length:	640

Seeding and Mulching (Soil Cut Slope)

Chainage		Area (m^2)	Chainage		Area (m^2)
Start	End		Start	End	
8+140	8+160	30	37+460	37+860	2,385
8+440	8+480	155	37+960	38+100	1,376
8+620	9+100	2,366	39+740	39+860	738
9+180	9+540	3,106	40+100	40+400	516
9+780	9+800	101	40+680	40+820	177
9+960	11+240	9,046	40+920	41+020	976
13+560	14+160	4,224	41+120	41+140	38
14+240	14+940	3,224	41+260	41+580	1,240
15+040	16+100	4,625	41+860	41+880	36
16+300	17+680	7,905	41+980	43+180	9,548
17+760	18+360	4,376	43+300	43+600	2,419
18+460	18+480	189	43+720	43+780	140
18+600	19+300	2,477	43+880	44+140	388
19+520	19+760	1,291	44+320	44+640	1,699
19+840	19+960	169	44+800	44+900	693
20+040	20+140	177	44+980	45+020	322
20+420	20+720	1,904	45+100	45+160	369
20+800	21+160	2,230	45+440	45+820	1,750
21+240	21+360	696	45+900	45+940	73
21+440	21+460	398	46+020	46+180	1,102
21+580	21+600	60	46+280	46+520	2,191
21+760	22+260	2,440	46+680	47+180	4,218
22+480	24+720	15,169	47+320	50+260	21,717
24+840	25+600	5,197	50+340	50+580	652
25+760	25+800	551	50+680	50+740	170
25+940	26+040	864	51+140	51+160	31
26+240	26+260	98	51+320	51+460	320
26+360	26+700	1,744	52+020	52+780	3,921
26+880	27+480	3,769	52+860	53+200	1,661
27+600	27+620	104	53+360	53+580	1,649
27+760	27+860	255	59+120	59+380	1,237
27+980	28+940	4,041	59+460	59+600	340
29+020	29+740	3,353	59+700	60+880	6,701
29+860	30+180	1,809	61+040	61+100	136
30+320	32+340	11,485	61+240	61+320	79
32+480	32+900	2,645	61+400	61+540	214
33+000	33+020	38	61+620	62+380	5,106
33+240	34+860	12,635	62+520	62+860	1,099
34+980	35+580	3,739	62+960	63+420	2,380

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

Chainage		Length (m)	Chainage		Length (m)
Start	End		Start	End	
35+680	37+040	10,798	63+520	64+960	9,437
37+160	37+220	329			
				Total Area:	219,058

Turfing (Embankment)

Chainage		Area (m^2)	Chainage		Area (m^2)
Start	End		Start	End	
8+020	8+640	795	36+480	36+900	989
8+740	8+840	94	36+980	37+760	953
8+940	9+100	49	38+020	38+100	51
9+180	9+200	13	38+220	38+240	204
9+400	9+500	64	38+360	39+100	615
9+600	9+720	214	39+300	40+420	2,314
9+960	10+180	205	40+500	40+660	197
10+260	10+300	32	40+760	40+780	178
10+380	10+560	68	40+940	41+080	73
10+660	10+880	169	41+280	42+580	3,271
10+980	11+200	4,414	42+660	42+840	122
11+300	11+760	1,688	42+920	43+100	52
11+860	12+000	571	43+180	43+760	515
12+080	12+700	719	43+840	44+200	650
12+800	12+880	93	44+320	44+720	434
13+020	13+680	2,621	44+800	45+000	194
13+760	13+920	483	45+120	46+220	3,016
14+020	14+160	593	46+380	46+620	980
14+240	14+460	976	46+700	47+380	1,122
14+560	14+640	257	47+520	47+760	455
14+900	15+760	1,247	47+840	47+920	113
15+880	16+440	439	48+060	48+440	406
16+580	17+280	1,392	48+520	48+700	225
17+440	17+720	473	48+780	48+880	1,749
17+800	19+300	6,608	49+000	49+180	44
19+400	19+900	857	49+300	49+380	33
20+000	20+020	69	49+500	50+120	2,759
20+120	20+240	181	50+220	50+260	134
20+420	21+780	2,824	50+620	50+640	141
21+900	21+940	40	50+800	51+020	418
22+040	22+320	408	51+160	51+200	51
22+420	22+620	892	51+420	51+520	136
22+700	22+880	778	51+660	51+920	180
22+960	23+100	55	52+020	52+460	545
23+440	24+580	2,732	52+540	53+740	2,348
24+680	25+580	3,849	53+820	53+880	94
25+680	25+800	205	54+000	54+420	511
25+940	26+040	43	54+540	54+620	45
26+240	26+280	30	54+720	54+860	150

Turfing (Embankment)

Chainage		Area (m^2)		Chainage		Area (m^2)
Start	End			Start	End	
26+380	26+800	1,343		54+960	55+680	1,792
26+880	27+640	2,807		55+780	55+820	166
27+760	28+200	4,319		55+960	56+920	2,102
28+280	30+040	4,948		57+100	57+160	33
30+120	30+140	2		57+280	59+440	7,750
30+300	30+460	59		59+740	60+080	1,067
30+580	31+260	1,538		60+460	60+500	11
31+340	32+120	1,377		60+600	60+620	5
32+260	32+280	31		60+720	61+580	1,152
32+360	32+520	754		61+800	61+820	32
32+660	32+700	28		61+900	62+100	70
32+820	33+040	397		62+180	62+200	55
33+220	34+640	3,554		62+320	62+380	10
34+720	34+780	126		62+580	62+600	38
34+860	35+140	783		62+680	62+700	65
35+220	35+260	355		62+780	62+860	24
35+440	35+560	200		62+960	63+080	139
35+640	35+820	1,824		63+280	63+300	5
35+920	36+020	18		63+540	64+320	366
36+120	36+180	78		64+420	64+440	17
36+320	36+400	74		64+540	64+960	283
					Total Area:	103,499

Note: 1 The Contractor shall be responsible for accurate assessment of the actual requirement as per site situation and prepare design for slope protection and stabilization as per specification and standards stipulated in Schedule-D and submit the same to the Authority's Engineer/ Authority for review through the Proof Consultant and implement it accordingly thereafter.

2. Any increase in quantity over and above the tentative quantity as mentioned in above table or through change in specifications will not be considered as change of scope. Therefore, Contractor shall make through investigation at site and assess the requirement of slope protection and slide prone zone and other safety features at his own before submission of bid.

3. 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, Bridges, Culverts and Slope Protection works 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; and

(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

No truck Lay-bye has been proposed. However, if any Truck Lay-bye(s) are required as per the requirement of site, then Contractor shall

provide the same as per suitability of location and site requirement in consultation with the Authority's Engineer/ Authority.

(e) Bus-Bays and Bus Shelters

The Contractor shall provide minimum 6 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	10+460	9+840	Zemabawk	RHS	2	70.70
2	25+125	23+500	Tuirial	RHS	2	70.70
3	41+971	38+946	Seling	LHS	2	70.70
4	46+503	43+260	Thingsulthliah	LHS	2	70.70
5	59+236	55+044	Tlungvel	LHS	2	70.70
6	64+569	60+060	Phulmawi	LHS	2	70.70

(f) Others:

(i) View Point

The Contractor shall construct minimum 5 nos. of View Points along the project highway. Tentative locations for View Points 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	10+245	9+625	Zemabawk	LHS	3	29.00
2	38+136	35+600	Seling	RHS	3	29.00
3	42+620	39+625	Seling	RHS	3	29.00
4	49+198	45+875	Thingsulthliah	RHS	3	29.00
5	61+449	57+175	Tlungvel	LHS	3	29.00

(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 in consultation with State Government and local Authorities.

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	Estimated Capacity (Rough Estimation) (Cum)
1	11+000	LHS	75,000
2	13+500	LHS	68,000
3	15+500	LHS	24,000
4	18+800	LHS	167,000
5	21+500	LHS	247,000
6	25+000	LHS	66,000
7	29+000	LHS	50,000
8	33+200	RHS	92,000
9	36+300	LHS	47,000
10	37+500	LHS	203,000
11	38+000	LHS	11,000
12	38+600	LHS	120,000
13	39+800	LHS	38,000
14	41+500	LHS	28,000
15	43+800	LHS	60,000
16	44+200	LHS	26,000
17	45+200	LHS	98,000
18	45+700	LHS	14,000
19	48+100	LHS	53,000
20	49+200	LHS	46,000
21	49+500	RHS	45,000
22	52+500	LHS	8,000
23	53+000	LHS	19,000
24	58+000	LHS	93,000
25	64+900	RHS	73,000

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.

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 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	S1-1: Package 1	Core Office Type 1 Location: Aizawl Period: 60 months	- Team Leader (T/L): .....1 - International Experts: .....4 - National Experts .....3 - Sub-Professional Staff .....9 - Office Supporting Staff.....9 - Authority (Central Team) 1	T/L: ..... 48 Int. Experts..... 45 General..... 42 R/E 1: ..... 60 Safeguard Expert:..... 48 Q/Surveyor 1: ..... 54 CAD Engineer 1..... 48 Field Eng.1&2: ..... 60 Surveyor 1:..... 48 Supporting Staff: 60

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 located in Aizawl)

- Minimum Area: 450 sqm
  - One office room for Team Leader (private arrangement).....25 sqm
  - One office room for the Authority's representative (private arrangement).....25 sqm

- One office room for International Experts .....45 sqm
- One office room for National Experts .....30 sqm
- One office room for Sub-Professional Staff .....80 sqm
- One Meeting/Conference Room .....40 sqm
- One reception/administration office room.....56 sqm
- One office room for working tables .....50 sqm
- A kitchen (Pantry) plan area well equipped with sink, draining board, cupboards, shelving, etc. .....20 sqm
- Male (3) 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 secretaries) ..... 4 units
- Male (2) toilets for Sub-Professional and Supporting staff ..... 2 units
- Corridor for connecting all rooms (approx..60 sqm) .....2m width
- Parking for the vehicles used by the Authority's Engineer and visitor's vehicles..... 12 veh.

(2) Site Office – Office Type 2: (to be provided by Package-2 nearby Serchhip)

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 3,000 liters and 2,000 liters for Office Type 1), 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 3 telephone lines and 6 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 1: 300liters' minimum capacity
Water Dispenser (19 liters capacity including bottles and 6 spares bottles/gallon)	set	2	Office Type 1
Electric Kitchen Stove	unit	1	Size and model shall be discussed
Electric Kettle	unit	1	
Diesel Generator Set	unit	1	Office Type 1: 125 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)

  One detached house, internal floor area approximately 80sqm, comprising 1 x sitting room, 1 x dining room, 2 x bedrooms with attached bathrooms, 1 x kitchen, 1 x office, 1 x veranda. 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.

- ✧ House for the Authority near to Core 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.

- ✧ Team Leader (Authority's Engineer)

  One detached house, internal floor area approximately 100sqm, comprising 1 x sitting room, 1 x dining room, 2 x bedrooms with attached bathrooms, 1 x kitchen, 1 x office, 1xmaid's room, 1 x veranda. Split type air-conditioners to the sitting room, dining room and bedrooms. Moreover, a garage for two vehicles and fully equipped quarters for two servants shall be provided.

- ✧ International Experts (1 per 3 experts)

  One detached house, internal floor area approximately 120sqm, 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 servant 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 in charge.

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

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 bay	The width & length has been designed as available in field.
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		Rock Anchor Work	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
6		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:

c. 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.

d. 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.

e. 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.

f. 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.

g. 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.

h. 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.

i. 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.

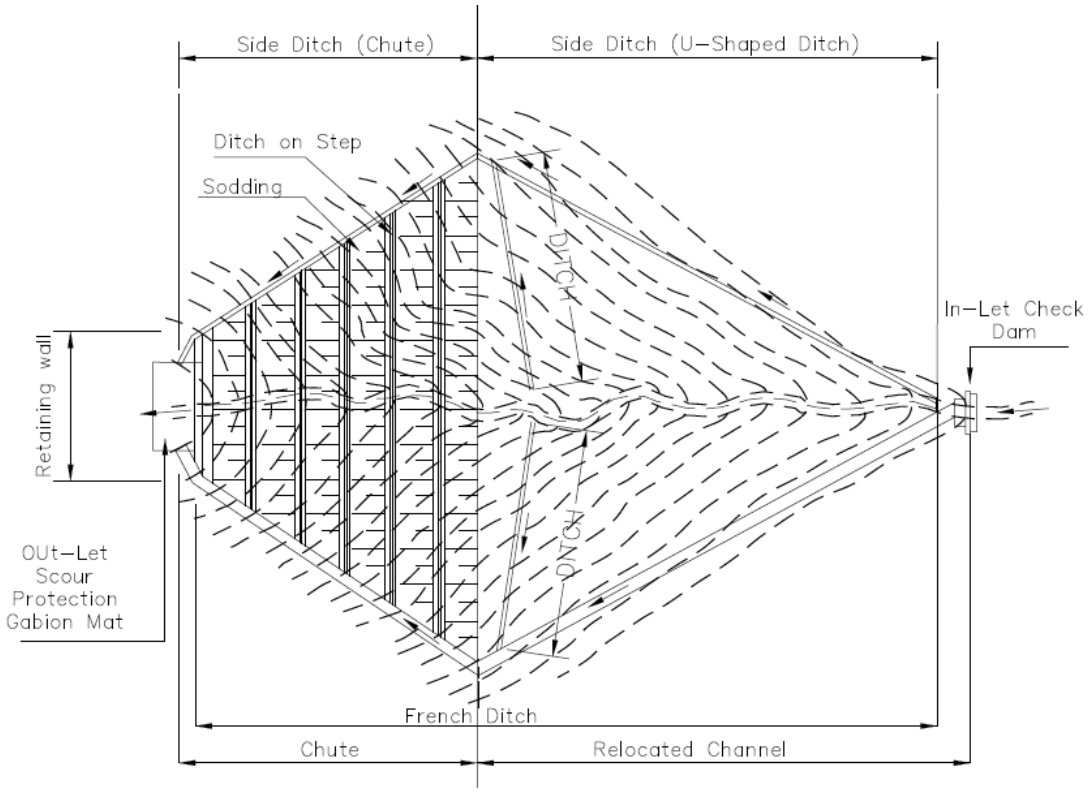


Figure-1(a): Typical Arrangement for Spoil Banks: Plan

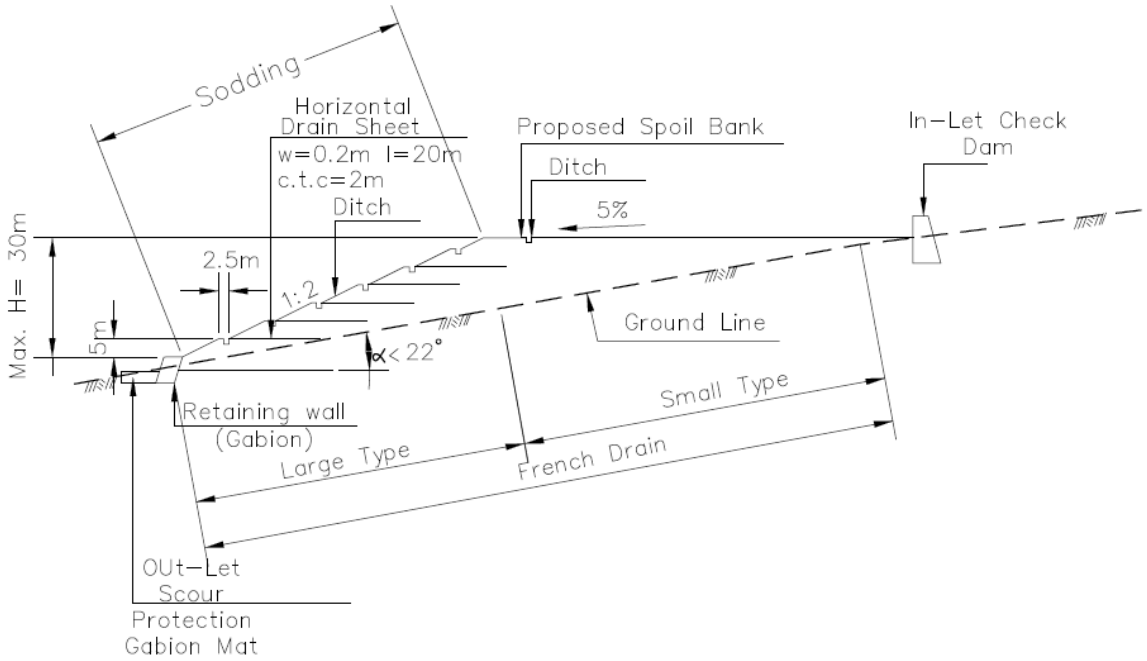


Figure-1(b): Typical Arrangement for Spoil Banks: Profile

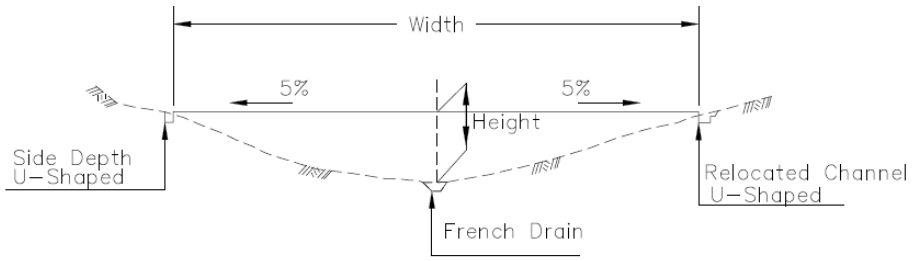


Figure-1(c): Typical Arrangement for Spoil Banks: Cross Section of French Drain

j. 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

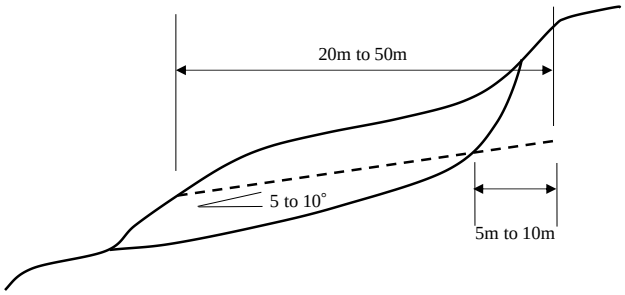
iii) Confirmation of the angle for installation of the drainage pipes. Drainage pipes shall be installed upwardly 5° to 10°.

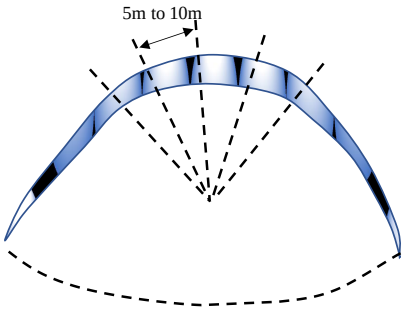
iv) Confirmation of the length of drainage pipes:

- 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 Steel

- 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.

4. 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	
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) Carriageway Width (m) Outer Shoulder Paved Width (m) Outer Shoulder Earthen Width (m)	12.0 2 x 3.5 2 x 1.5 2 x 1.0	
		Crossfall of Roadway (%)	2.5	
		Slope of Earthworks Fill Cut (soil) Cut (rock)	 V : H = 1:1.75 V : H = 1:1.2 V : H = 1:0.2-0.5	 Varies Varies
5	Sight	Stopping Sight Distance, SSD (m) Intermediate Sight Distance, ISD (m) Overtaking Sight Distance, OSD (m)	30 (45) 60 (90) (165)	Figures in () corresponds to speed of 40km/h
6	g n m	Horizontal Curve Absolute Minimum Radius of Horizontal Curve (m) Ruling Minimum Radius of Horizontal Curve (m)	 30 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	

5. Environment Management Plan

4.1 Overview

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

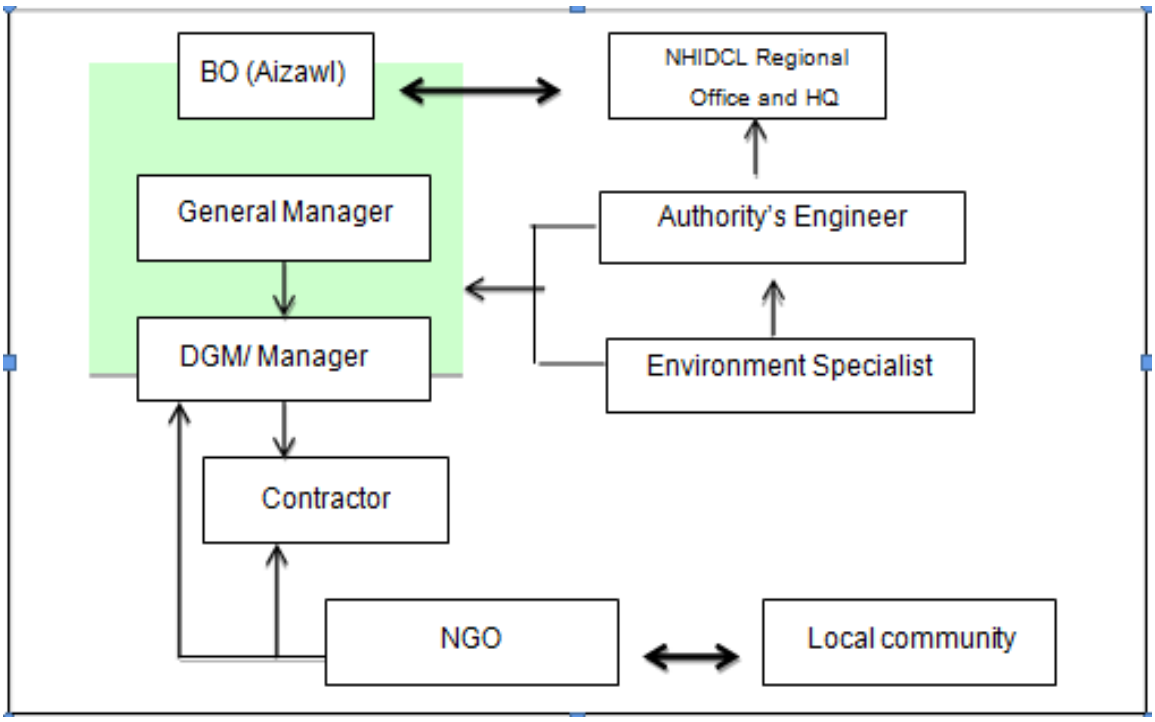
5.1.1. Pre-construction Stage

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.

5.1.2. 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.

5.1.3. 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.

5.2. 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.

Table 4.1 Environmental Management Plan for Pre-Construction Stage

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	All areas identified as potential dumping sites	During mobilization	Contractor	BO, AE

		courses; ii) no endangered/rare flora is impacted by such dumping				
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	• The Contractor during the progress of work will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labor to standards and scales approved by the resident engineer. • These shall be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, separately for each for these, as per standards set by the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. There shall be adequate supply of water, close to latrines and urinals. • All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and regularly emptied and the garbage disposed off in a lined landfill sites. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force.	Wherever labor camp is setup	Construction Stage	Contractor and Authority's Engineer	BO

C29	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	BO

					Authority's 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 shall be junctions 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	At the respective locations throughout the project area.	Construction Stage	Contractor and Authority's Engineer	BO

		of steeper slopes it will be supported by the retaining wall.				

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
Q4	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

4.3 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.

Table 4.4 Environmental Monitoring Plan

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	30 (thirty) days

	prescribed side (embankment) slopes	
(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-holes	3 (three) days
(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 8.000 to km 65.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram *on EPC mode (Package 1) 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 8.000 to km 65.000 on Aizawl-Serchhip section of NH-54 in the State of Mizoram *on EPC mode (Package 1) 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 8.000 to km 65.000 on Aizawl-Serchhip section of NH-54 in the State of Mizoram *on EPC mode (Package 1) 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]**.**

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

(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:

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.

[$]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).

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.

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 10.1.4 and 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.	**59.38**	**A- <u>Widening and strengthening of existing road/ Reconstruction/ New 2-lane realignment</u>**	
		(1) Earthwork upto top of the sub-grade	12.94
		(2) Spoil Bank construction by cutting surplus soil	8.76
		(3) Sub-Base Course	17.43
		(4) Non Bituminous Base Course	14.36
		(5) Bituminous Base Course	25.45
		(6) Wearing Coat	10.84
		(7) Widening and repair of culverts/ Re-Construction and New culverts on existing road, realignments	10.23
Minor Bridges/ Underpasses/ Overpasses	**0.51**	**A.1- Widening and Repair of Minor bridges (length > 6 m and < 60 m)** Minor bridges	100.00
		A.2- New Minor bridges (length >6 and <60 m.)	0.00

Major Bridge(length > 60 m.) works and ROB/RUB/ elevated sections/flyovers including viaducts, if any	**0.00**	**A.1- Widening and repairs of Major Bridges** **A.2- New Major Bridges**	0.00 0.00
Other works	**40.11**	(i) Toll Plaza	0.00
		(ii) Drainage/ Road side drains	5.95
		(iii) Road signs, markings, km stones, safety devices, and other road Appurtenances, Safety and traffic management during construction, etc….	2.15
		(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	 1.72 0.00 0.06 1.99 0.66
		(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)	11.57
		b) Wet Masonry Retaining Wall (H=7m)	12.73
		c) Gravity Wall (H=1.5m)	1.91
		d) Gravity Wall (H=2m)	3.94
		e) Gravity Wall (H=3m)	8.46
		f) Gravity Wall (H=4m)	8.08
		g) Gravity Wall (H=5m)	6.37
		h) Gravity Wall (H=6m)	8.44
		i) Reinforced Earth	6.80

		Retaining Wall (H=7m)	
		j) Reinforced Earth Retaining Wall (H=8m)	4.44
		k) Reinforced Earth Retaining Wall (H=9m)	2.50
		l) Reinforced Earth Retaining Wall (H=10m)	3.57
		m) Gabion Wall (1:0.3)	0.42
		n) Rockfall Prevention Wall (H=3m)	0.59
		o) Rockfall Prevention Fence (H=2m)	0.21
		p) Hydroseeding (t=5cm)	0.06
		q) Seeding and Mulching (Soil Cut Slope)	2.05
		r) Turfing (Embankment)	0.32
		s) Vegetation Mat (Steep Slope)	0.27
		t) Crib Work (F300)	0.12
		u) Crib Work (F500)	0.79
		v) Non-frame	0.41
		w) Anchor Work	3.40
		x) Rock-bolt Work	0.00

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	12.94	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	8.76	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"
(3) Sub-Base Course	17.43	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[$].
(4) Non Bituminous Base Course	14.36	
(5) Bituminous Base Course	25.45	
(6) Wearing Coat	10.84	
(7) Widening and repair of culverts/ Re-Construction and New culverts on existing road, realignments	10.23	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.

[$]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.

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

Stage for Payment	Percentage weightage	Payment Procedure
A.1- Widening and Repair of Minor bridges (length > 6 m and < 60 m) Minor bridges	100.00	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	5.95	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 per cent) of the total length.
(iii) Road signs, markings, km stones, safety devices and other road Appurtenances, Safety and traffic management during construction, etc….	2.15	
(iv) Project facilities (a) Bus Bays (b) Truck lay-bys (c) View points (d) Development of Junctions	 1.72 0.00 0.06 1.99	Payment shall be made on pro rata basis for completed facilities.
(e) Office & Vehicle for Authority and Office for Authority's Engineer	0.66	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)	11.57	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)	12.73	
c) Gravity Wall (H=1.5m)	1.91	
d) Gravity Wall (H=2m)	3.94	
e) Gravity Wall (H=3m)	8.46	
f) Gravity Wall (H=4m)	8.08	
g) Gravity Wall (H=5m)	6.37	
h) Gravity Wall (H=6m)	8.44	
i) Reinforced Earth Retaining Wall (H=7m)	6.80	

j) Reinforced Earth Retaining Wall (H=8m) k) Reinforced Earth Retaining Wall (H=9m) l) Reinforced Earth Retaining Wall (H=10m)	4.44 2.50 3.57	
m) Gabion Wall (1:0.3)	0.42	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)	0.59 0.21	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	0.06 2.05 0.32 0.27 0.12 0.79 0.41	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 3.40	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

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

2.2. 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 twentieth) 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 ninth) 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 eighth) 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 eighth) 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 the 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 8.000 to km 65.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram on EPC mode (Package 1) 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 affect 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 8.000 to km 65.000 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 8.000 to km 65.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram on EPC mode (Package 1) 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 x M xL1/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 non compliance.

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 or 'Guidelines for Employment of Consultants under Japanese ODA Loans' or a combination of certain provisions 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 or bodies corporate to undertake and perform the duties and functions set forth 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 shortlisted firms to submit their respective technical and financial offers, each in separate sealed cover and/or upload online. All the technical bids so received shall be opened and 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 1.1 to 1.3, 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 8.000 to km 65.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram on EPC mode (Package 1) 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.

4. Monthly Maintenance Payment Statement

The monthly Statement for Maintenance Payment shall state:

(f) the monthly payment admissible in accordance with the provisions of the agreement;

(g) the deductions for maintenance work not done;

(h) net payment for maintenance due, (a) minus (b);

(i) amounts reflecting adjustments in price under Clause 19.12; and

(j) amount towards deduction of taxes

5. 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 cause 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. 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 not less than: Rs. [*****]

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 Maintenance Period

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 8.000 to km 65.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram *on EPC mode (Package 1) with JICA loan assistance*** (the "**Project Highway**") on Engineering, Procurement and Construction (EPC) mode 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 8.000 to km 65.000 on Aizawl-Tuipang section of NH-54 in the State of Mizoram *on EPC mode (Package 1) with JICA loan assistance*** (the "Project Highway") on Engineering, Procurement and Construction (EPC) mode 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* (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.