

4. PRELIMINARY DESIGN CD STRUCTURES

4.1 Design Standards for Bridges/Structures

The cross drainage structures are classified as culverts, minor bridges and major bridges depending upon the length of structure as per IRC standards. Structures up to 6m length fall into the category of culverts, more than 6m and up to 60m in length as minor bridges and beyond this as major bridges. Widening of existing culverts and bridges for two lanes and all new structures are constructed for two lane carriageway as per Manual.

The design standards and loading considered for culverts & bridges are as per latest IRC codes and/or IS codes.

- (i) The Indian Road Congress (IRC) codes are the basis of bridge designs. For items not covered by latter, provisions of Special Publications and Specification for Roads and Bridges published by IRC are followed.
- (ii) Grades of Concrete for superstructures are as per MOST Specifications and IRC Standards. The Minimum grade is M40 for PSC and M25 for RCC respectively.
- (iii) For substructures Open foundations M35, Box Culvert M25, Approach Slab M30 & for Crash Barrier M40 concrete are proposed for use. For PCC substructures minimum grade of M20 is adopted.
- (iv) For all new 2-lane structures, 3-lane live load is considered as per IRC-6.
- (v) Locations of new Major/Minor Bridges are guided by the alignment of the highway.
- (vi) On economic considerations and for ensuring good riding quality, wherever possible, for the new bridges the layout of the existing bridges having a number of small spans was modified by decreasing the number of spans, maintaining the piers parallel and in line with those of the existing structure.
- (vii) The deck has 2.5% camber/cross fall and 65mm thick Flexible type wearing course is proposed.

4.2 Design of Bridges and Culverts

- i. All the structures up to 60 m length are constructed with all overall width between outermost faces of the railings / parapets / crash barriers equal to the roadway width of the approaches as per IRC-73:2015
- ii. New Major/Minor bridge structures are constructed with an overall width of



16.0 m between the outermost faces of the crash barriers or railings as per IRC-73:2015

4.3 Widening / reconstruction of existing structures

4.3.1 Existing Culverts

All culverts which are found to be structurally distressed are proposed for reconstruction. In general all the existing Culverts are proposed either as New Construction or Reconstruction

4.3.2 Existing Bridges

All existing bridges at site are Bally Bridges with 5.5m width and not as per IRC specifications. New Construction of the bridges are proposed. In general all the existing bridges are proposed either as New Construction or Reconstruction.

4.4 Culverts

3.4.1 New Culverts

RCC BOX Culverts as per relevant IRC and MORTH Specifications are proposed wherever necessary.

3.4.2 Existing Culverts

All Existing slab and pipe culverts are not as per relevant IRC Specifications and replaced with Box culverts as per relevant IRC and MORTH Specifications.

- GADs for minor Bridges and Culverts are submitted along with separate volume including protection works.
- Design philosophy for Bridges and culverts as per directives of MoRT&H as detailed below.
- Overall width of bridges irrespective of length and location (Rural, Urban) is compatible with that of the road adjacent to it as per IRC-73:2015
- All bridges are designed for three lanes for each direction of traffic as per MoRTH guidelines.

4.5 Hydraulic and Hydrological Investigations

- a) The information collected for high flood level (HFL), low water levels (LWL), discharge velocity etc. from available past records, local inquiries and visible signs on the structural components and embankments. Local inquiries are made with regard to the road sections getting overtopped during heavy rains.
- b) The Consultants had made a desk study of available data on satellite images, topography (topographic maps), storm duration, rainfall statistics, top soil



characteristics, vegetation cover etc. so as to assess the catchment areas and hydraulic parameters for all existing and proposed drainage provisions. The findings of the studies are supplemented and augmented by a reconnaissance along the area. All important hydrological features are noted during this field reconnaissance.

- c) For bridges and cross drainage structures having inadequate waterway, history of overtopping are proposed for reconstruction, the detailed hydrological and hydraulic studies are carried out in accordance with IRC Special Publication No. 13 ("Guidelines for Design of small bridges and culverts") and IRC 5 ("Standard Specification and code of Practice for Road Bridges, Section I General Feature of Design").

4.5.1 Hydrological Investigations:

- i) The peak discharge is being calculated by following methods
- Area Velocity Method
 - Rational Method
 - SUH Method

4.5.1.1 Area – Velocity Method (Manning's Formula)

Discharge has been calculated using the Manning's Formula stated as below

$$Q = A \times V$$
$$= A \times [(1/n) \times (R)^{2/3} \times (S)^{1/2}]$$

Where, Q = Discharge in cumecs;
A = Area of the cross section
V = Velocity in m/sec;
R = A / P;

P = Wetted perimeter of the Stream in m,
S = Bed slope of the stream; and
n = Rugosity Co-efficient.



Surface (Natural Stream)	Perfect	Good	Fair	Bad
1. Clear, straight bank, no rift or deep Pools	0.025	0.0275	0.030	0.033
2. Same as (1) but some weeds & stones	0.030	0.0330	0.035	0.040
3. Winding some poles and shoals, clear	0.035	0.040	0.045	0.050
4. Same as (3) but more ineffective slope and section	0.040	0.045	0.050	0.055
5. Same as (3) but some weeds and Stones	0.033	0.035	0.040	0.045
6. Same as (4) but stony section	0.045	0.050	0.055	0.060
2. Sluggish river reaches rather weedy	0.050	0.060	0.070	0.080
8. Very weedy reaches	0.075	0.100	0.125	0.150

4.5.2.2 Rational Formula

Discharge has been calculated using the formula stated as below:

$$Q=0.278CIA$$

Where Q= Design flood discharge for 50 year return period in cumsecs

C=Run off Coefficient,

I= Rainfall Intensity for t_c hour duration in mm/hr

T_c =Time of concentration,

A=Area of catchment in sq km.

Time of concentration, t_c (in hours), shall be calculated using formula,

$$t_c = 0.0195L^{0.77} \times S^{-0.385}$$

4.5.2.3.Synthetic Unit Hydrograph Method

This method is based on unit hydrograph principle, used when catchment area is greater than 25 sq km. CWC has published Flood Estimation Reports for different zones for India. Comprehensive hydraulic analysis of various CD structures has been carried out based on detailed topographical survey and satellite images.



A detailed approach and equations of unit hydrograph has been given in the report "*Flood Estimation Report*". In this method the design flood discharge has been calculated as per guidelines given in the report.

Design discharge has been taken as the maximum of the peak flood discharge by different methods

1) Scour Depth:

When the velocity of stream exceeds the limiting velocity, which the erodible particles of bed material can stand, the scour occurs. The normal scour depth is the depth of water on the middle of stream when it is carrying the peak flood discharge.

The probable maximum depth of scour to be taken for the purpose of designing foundations of abutment and piers shall be estimated after considering all local conditions. If possible the soundings depth of scour shall be taken in the vicinity of bridge site during or immediately after the flood but before the score holes had time to silt up appreciably. Allowance shall be made for increased depth resulting from

- a. The design discharge being greater than flood discharge.
- b. The increased velocity due to obstruction to flow caused by construction of bridge.
- c. The increase in scour in the proximity of piers and abutments.

Theoretically the scour can be estimated as below. However, this method is applicable for natural channel flowing over scourable bed.

$$\text{Mean depth of score } d_{sm} = 1.34 [Qb^2 / K_{sf}]$$

$$^{1/3}Qb = \text{Discharge in cumec per meter width .}$$

K_{sf} = the slit factor for representative sample of bed material obtained up to the level of deepest anticipated scour = 1.76 dm

Heredm = Weighted mean particle diameter in mm.

The discharge per meter width (Qb) shall be maximum of the total design discharge divided by effective linear waterway between abutments. The value obtained taking in to account any concentration of flow through a portion of the waterway assessed from the study of the cross section of river.

The value of Silt Factor K_{sf} for various grades of bed material is given in Table 2.



Table 2 : Value of silt factor (Ksf) for various bed materials

Bed Material	Grain size in mm	Silt factor(Ksf)
Coarse Silt	0.04	0.35
Silt / Fine Sand	0.081 to 0.158	0.5 to 0.6
Medium Sand	0.233 to 0.505	0.8 to 1.25
Coarse Sand	0.725	1.50
Fine bajri& Sand	0.988	1.75
Heavy Sand	1.290 to 2.00	2.0 to 2.42

II) Maximum Depth of Scour for Foundation Design:

The maximum depth of scour below the highest flood level (H.F.L.) shall be estimated from value of mean depth of scour (dsm) in following manner:

- a) for the design of piers and abutments located in a straight reach and having individual foundations without any flood protection work.
 1. In the vicinity of pier - 2.00 dsm.
 2. Near abutments - 1.27 dsm for approach retained.
- 2.00 dsm for scour all round.
 3. Raft foundations - 1.0 dsm (with u/s & d/s protection apron)
- b) For the design of protection to raft foundation, shallow foundation or flood protection the scour depth should be considered as follows :
 - i) in a straight reach - 1.27 dsm.
 - ii) at a moderate bend - 1.50 dsm



- | | | |
|----------------------------|---|-----------|
| iii) at a severe bend | - | 1.75 dsm. |
| iv) at a right angled bend | - | 2.00 dsm. |

The above scour values can suitably be increased if actual observation data is available on similar structures in the vicinity.

In the following abnormal conditions, special studies should be undertaken for determining maximum scour depth for the design of foundations.

1. Bridge located in a bend of the river involving a curvilinear flow or excessive shoal formation.
2. Bridge located at a site where deep channel in the river hugs to one side.
3. Bridge having very thick piers inducing heavy local scours.
4. Where the obliquity of flow in the river is considerable.
5. Where a bridge is required to be constructed across a canal or across river downstream of storage works, with the possibility of the relatively clear water inducing greater scour.
6. Bridge in the vicinity of the dam, weir, barrage or other irrigation structures where concentration of flow, aggradations /degradation of bed, etc., are likely to affect behavior of structure.

If a river is of flashy nature and the bed does not lend itself readily to the scouring effect of floods, the formula for dsm given above shall not apply. In such cases the maximum depth of scour shall be assessed from actual observations.

For bridges located across streams having bouldary beds the formula given in above para may be applied with a judicious choice of values for D_b and K_{sf} and results may be compared with the actual observations at site or from experience on similar structures nearby and there performance.

II) Vertical Clearance:

It is the height from the design highest flood level with afflux of the Channel to the lowest point of bridge superstructure. Clearance shall also be provided according to navigational or anti - obstruction requirement. Where these considerations do not arise, vertical clearance in case of high level bridges shall be as follow:



Discharge (m ³ /sec.)	Minimum Vertical Clearance(in mm)
Up to 0.3	150
0.3 to 3.0	450
3.0 to 30	600
30 to 300	900
300 to 3000	1200
above 3000	1500

In structures with metallic bearings, no part of the bearing shall be at a height less than 500 mm above affluxed design highest flood level.

IV) Afflux:

When the bridge is constructed, the abutment and pier structures as well as approaches on either side cause the reduction of natural waterway area. The contraction of stream is desirable because it leads to tangible saving in the cost especially of alluvial streams whose natural surface is too large than required for stability. Therefore to carry maximum flood discharge within bridge portion, the velocity under the bridge increases. This increased velocity gives rise to sudden heading up of water on the upstream. This heading up phenomenon is known as afflux. Greater the afflux greater will be the velocity under downstream side of the bridge and greater will be the depth of foundations required.

Afflux should be as small as possible and generally shall not exceed 0.6m. Where the floods spread over the banks is large use of average velocity for calculating the afflux will give an erroneously low afflux. In such cases, the velocity in the main channel /compartment should be used. The permissible afflux will be governed by the submergence effect on joining structures, fields etc. on upstream side. The afflux is calculated by one of the following formula:

- (a) Afflux at H.F.L. by Molesworth formula (In case of high level bridge) $\text{Afflux (ha)} = [V^2 / 12.86 + 0.0153] [(Q / Q_1) - 1]$

Where V = Mean Velocity in m/sec.

Total design discharge (Manning's) / Total area of channel (Manning's)

Q = Total design discharge in cum/sec.



Q_1 = Unobstructed discharge in cum/sec.

Analysis and Interpretation of hydrological and sub-soil explorations are appended with respective preliminary bridge design calculations.

4.6 Drainage Assessment

The performance of a pavement is improved considerably and adequate precautions are taken to obviate the accumulation of water on the pavement structure. To maintain drainage pattern the proposed cross drainage structures are 7 Minor bridges, 270 Box culverts along the project road.

In addition to this for entire project road length excavated drains & where embankment height is more than 3m chute drains with energy dissipation basins are proposed.

4.7 Reference to Codes & Guidelines

Various IRC Codes guides / special publications need to be referred while preparing the improvement / widening proposals. An exhaustive list of such codes / special publications and other recommendation are appended.

4.8 Existing Cross Drainage Structures

There are 7 Minor bridges and 270 Box culverts along the project road. The improvement proposals for these structures are given here under:

4.9 Improvement proposals for Cross Drainage Structures

All CD structures constructed in RCC are proposed for reconstruction. Reconstruction/ widening / new construction of the Slab drains are proposed to meet the latest National Highway standards.

The improvement proposals for cross drainage structures are as follows:

Abstract for CD structure

Improvement Proposal	Type of structure								
	Major Bridge	Minor Bridge / Box Bridge	Slab/Box Culvert	Pipe Culvert	Pipe Culvert at Junction	ROB	RUB	Underpass	Overpass
New construction	-	02	29	-	-	-	-	-	-



Improvement Proposal	Type of structure								
	Major Bridge	Minor Bridge /BoxBridge e	Slab/Box Culvert	Pipe Culvert	Pipe Culvert atJunction	ROB	RUB	Underpass	Overpass
Reconstruction	-	05	241	-	-	-	-	-	-
Under Construction	-	-	-	-	-	-	-	-	-
Widening, repair & Strengthening	-	-	-	-	-	-	-	-	-
Retained, repair & Strengthening	-	-	-	-	-	-	-	-	-

Details of Major Bridge (Retained)

Sr. No.	Existing Chainage (Km)	Proposed Chainage (Km)	Details of Existing structure	Existing Width (m)	Remark
			No. x Span		
NIL.					

Details of Overpass (Retained)

Sr. No.	Existing Chainage (Km)	Proposed Chainage (Km)	Details of Existing structure	Existing Width (m)	Remark
			No. x Span		

Details of Minor Bridge (New Construction)

SI No.	Proposed	Details of Proposed Bridge		
	Chainage (Km)	Span Arrangement	Width (m)	Type of Super Structure
1	91.52	1x10	16	Slab
2	132.922	1x 8	16	Slab



Details of Minor Bridge (Reconstruction)

SI No.	Existing	Proposed	Details of Proposed Bridge		
	Chainage (Km)	Chainage (Km)	Span Arrangement	Width (m)	Type of Super Structure
1	82.559	82.02	1x22	16	RCC Girder
2	84.585	84.09	1x 52	16	PSC Box Girder
3	110.588	109.35	1x55	16	PSC Box Girder
4	125.090	122.98	1x19	16	RCC Girder
5	128.248	126.09	1x19	16	RCC Girder

Details of Culverts (Reconstruction)

SI No.	Existing Chainage	Type of Structure	Proposed Chainage	Type of Structure	Span Arrangement	Remarks
1	70535	SLAB	70470	Box Culvert	1/22/0	Re-Construction
2	70704	SLAB	70610	Box Culvert	1/33/0	Re-Construction
3	70784	SLAB	70693	Box Culvert	1/22/0	Re-Construction
4	70946	SLAB	70835	Box Culvert	1/22/0	Re-Construction
5	71135	SLAB	71028	Box Culvert	1/44/0	Re-Construction
6	71263	SLAB	71165	Box Culvert	1/33/0	Re-Construction
7	71570	SLAB	71444	Box Culvert	1/33/0	Re-Construction
8	71711	SLAB	71567	Box Culvert	1/44/0	Re-Construction
9	71824	SLAB	71680	Box Culvert	1/33/0	Re-Construction



10	71975	SLAB	71780	Box Culvert	1/33/0	Re-Construction
11	72032	SLAB	71838	Box Culvert	1/44/0	Re-Construction
12	72115	SLAB	71915	Box Culvert	1/22/0	Re-Construction
13	72189	SLAB	71987	Box Culvert	1/22/0	Re-Construction
14	72271	SLAB	72070	Box Culvert	1/33/0	Re-Construction
15	72545	SLAB	72248	Box Culvert	1/33/0	Re-Construction
16	72650	SLAB	72350	Box Culvert	1/22/0	Re-Construction
17	72770	SLAB	72445	Box Culvert	1/33/0	Re-Construction
18	72900	SLAB	72576	Box Culvert	1/22/0	Re-Construction
19	73013	SLAB	72676	Box Culvert	1/33/0	Re-Construction
20	73102	SLAB	72765	Box Culvert	1/33/0	Re-Construction
21	73355	SLAB	72980	Box Culvert	1/33/0	Re-Construction
22	73637	SLAB	73270	Box Culvert	1/33/0	Re-Construction
23	74043	SLAB	73700	Box Culvert	1/33/0	Re-Construction
24	74367	SLAB	74000	Box Culvert	1/66/3	Re-Construction
25	74775	SLAB	74415	Box Culvert	1/44/0	Re-Construction
26	75587	SLAB	75330	Box Culvert	1/33/0	Re-Construction
27	75970	SLAB	75755	Box Culvert	1/44/0	Re-Construction
28	76325	SLAB	76115	Box Culvert	1/33/0	Re-Construction
29	76464	SLAB	76220	Box Culvert	1/33/0	Re-Construction
30	76724	SLAB	76460	Box Culvert	1/66/3	Re-Construction
31	77018	SLAB	76865	Box Culvert	1/22/0	Re-Construction
32	77363	SLAB	77240	Box Culvert	1/34/0	Re-Construction
33	77910	SLAB	77770	Box Culvert	1/22/0	Re-Construction



34	78355	SLAB	77975	Box Culvert	1/22/0	Re-Construction
35	78630	SLAB	78210	Box Culvert	1/66/3	Re-Construction
36	78715	SLAB	78300	Box Culvert	1/22/0	Re-Construction
37	78765	SLAB	78350	Box Culvert	1/22/0	Re-Construction
38	78845	SLAB	78430	Box Culvert	1/33/0	Re-Construction
39	79132	SLAB	78685	Box Culvert	1/33/0	Re-Construction
40	79330	SLAB	78870	Box Culvert	1/33/0	Re-Construction
41	80038	SLAB	79575	Box Culvert	1/33/0	Re-Construction
42	80345	SLAB	79880	Box Culvert	1/22/0	Re-Construction
43	80674	SLAB	80170	Box Culvert	1/33/0	Re-Construction
44	81016	SLAB	80490	Box Culvert	1/33/0	Re-Construction
45	81453	SLAB	80900	Box Culvert	1/33/0	Re-Construction
46	81667	SLAB	81110	Box Culvert	1/33/0	Re-Construction
47	81990	SLAB	81415	Box Culvert	1/22/0	Re-Construction
48	82359	SLAB	81760	Box Culvert	1/43/0	Re-Construction
49	82455	SLAB	81870	Box Culvert	1/66/3	Re-Construction
50	82713	SLAB	82170	Box Culvert	1/66/3	Re-Construction
51	82855	SLAB	82290	Box Culvert	1/43/0	Re-Construction
52	83110	SLAB	82540	Box Culvert	1/33/0	Re-Construction
53	83290	SLAB	82720	Box Culvert	1/33/0	Re-Construction
54	83915	SLAB	83380	Box Culvert	1/33/0	Re-Construction
55	84352	SLAB	83810	Box Culvert	1/33/0	Re-Construction
56	84720	SLAB	84290	Box Culvert	1/53/0	Re-Construction
57	85425	SLAB	84970	Box Culvert	1/43/0	Re-Construction



58	85700	SLAB	85270	Box Culvert	1/33/0	Re-Construction
59	85860	SLAB	85400	Box Culvert	1/22/0	Re-Construction
60	85905	SLAB	85450	Box Culvert	1/33/0	Re-Construction
61	86125	SLAB	85670	Box Culvert	1/33/0	Re-Construction
62	86377	SLAB	85920	Box Culvert	1/22/0	Re-Construction
63	86523	SLAB	86055	Box Culvert	1/22/0	Re-Construction
64	86837	SLAB	86370	Box Culvert	1/44/0	Re-Construction
65	87250	SLAB	86750	Box Culvert	1/44/0	Re-Construction
66	87347	SLAB	86850	Box Culvert	1/33/0	Re-Construction
67	87568	SLAB	87070	Box Culvert	1/22/0	Re-Construction
68	87952	SLAB	87420	Box Culvert	1/22/0	Re-Construction
69	88020	SLAB	87500	Box Culvert	1/22/0	Re-Construction
70	88117	SLAB	87600	Box Culvert	1/22/0	Re-Construction
71	88332	SLAB	87815	Box Culvert	1/44/0	Re-Construction
72	88457	SLAB	87940	Box Culvert	1/33/0	Re-Construction
73	88765	SLAB	88230	Box Culvert	1/22/0	Re-Construction
74	88881	SLAB	88350	Box Culvert	1/33/0	Re-Construction
75	89078	SLAB	88530	Box Culvert	1/33/0	Re-Construction
76	89270	SLAB	88715	Box Culvert	1/44/0	Re-Construction
77	89358	SLAB	88805	Box Culvert	1/44/0	Re-Construction
78	89920	SLAB	89310	Box Culvert	1/22/0	Re-Construction
79	90035	SLAB	89410	Box Culvert	1/33/0	Re-Construction
80	90273	SLAB	89650	Box Culvert	1/33/0	Re-Construction
81	91016	SLAB	90395	Box Culvert	1/33/0	Re-Construction



82	91045	SLAB	90425	Box Culvert	1/33/0	Re-Construction
83	91478	SLAB	90900	Box Culvert	1/63/0	Re-Construction
84	91680	SLAB	91015	Box Culvert	1/22/0	Re-Construction
85	91931	SLAB	91225	Box Culvert	1/33/0	Re-Construction
86	92030	MHPC	91340	Box Culvert	1/33/0	Re-Construction
87	92380	SLAB	91705	Box Culvert	1/33/0	Re-Construction
88	92455	SLAB	91795	Box Culvert	1/66/3	Re-Construction
89	92995	SLAB	92320	Box Culvert	1/44/0	Re-Construction
91	95792	SLAB	95070	Box Culvert	1/33/0	Re-Construction
92	96190	SLAB	95480	Box Culvert	1/22/0	Re-Construction
93	96585	SLAB	95880	Box Culvert	1/22/0	Re-Construction
94	96782	SLAB	96080	Box Culvert	1/33/0	Re-Construction
95	97150	SLAB	96440	Box Culvert	1/22/0	Re-Construction
96	97418	SLAB	96690	Box Culvert	1/33/0	Re-Construction
97	97764	SLAB	97040	Box Culvert	1/33/0	Re-Construction
98	97900	SLAB	97170	Box Culvert	1/22/0	Re-Construction
99	98183	SLAB	97445	Box Culvert	1/22/0	Re-Construction
100	98282	SLAB	97545	Box Culvert	1/33/0	Re-Construction
101	98670	SLAB	97919	Box Culvert	1/33/0	Re-Construction
102	98900	SLAB	98140	Box Culvert	1/33/0	Re-Construction
103	99218	SLAB	98450	Box Culvert	1/44/0	Re-Construction
104	99415	SLAB	98650	Box Culvert	1/44/0	Re-Construction
105	99471	SLAB	98730	Box Culvert	1/22/0	Re-Construction
106	99715	SLAB	98970	Box Culvert	1/33/0	Re-Construction



107	99975	SLAB	99220	Box Culvert	1/33/0	Re-Construction
108	100097	SLAB	99360	Box Culvert	1/33/0	Re-Construction
109	100260	SLAB	99480	Box Culvert	1/33/0	Re-Construction
110	100710	SLAB	99963	Box Culvert	1/22/0	Re-Construction
111	100889	SLAB	100130	Box Culvert	1/33/0	Re-Construction
112	101030	SLAB	100235	Box Culvert	1/33/0	Re-Construction
113	101211	SLAB	100415	Box Culvert	1/33/0	Re-Construction
114	101338	SLAB	100545	Box Culvert	1/22/0	Re-Construction
115	101465	SLAB	100670	Box Culvert	1/33/0	Re-Construction
116	101678	SLAB	100860	Box Culvert	1/44/0	Re-Construction
117	101773	SLAB	100960	Box Culvert	1/44/0	Re-Construction
118	102020	SLAB	101212	Box Culvert	1/44/0	Re-Construction
119	102579	SLAB	101763	Box Culvert	1/22/0	Re-Construction
120	103115	SLAB	102293	Box Culvert	1/33/0	Re-Construction
121	103557	SLAB	102717	Box Culvert	1/22/0	Re-Construction
122	103800	SLAB	102924	Box Culvert	1/33/0	Re-Construction
123	103964	SLAB	103083	Box Culvert	1/43/0	Re-Construction
124	104089	SLAB	103237	Box Culvert	1/22/0	Re-Construction
125	104500	SLAB	103620	Box Culvert	1/33/0	Re-Construction
126	104671	SLAB	103800	Box Culvert	1/22/0	Re-Construction
127	104820	SLAB	103940	Box Culvert	1/22/0	Re-Construction
128	105470	SLAB	104585	Box Culvert	1/43/0	Re-Construction
129	105690	SLAB	104786	Box Culvert	1/53/0	Re-Construction
130	106040	SLAB	105129	Box Culvert	1/22/0	Re-Construction



131	106582	SLAB	105664	Box Culvert	1/22/0	Re-Construction
132	106885	SLAB	105952	Box Culvert	1/22/0	Re-Construction
133	107070	SLAB	106148	Box Culvert	1/22/0	Re-Construction
134	107590	SLAB	106652	Box Culvert	1/33/0	Re-Construction
135	108514	SLAB	107567	Box Culvert	1/33/0	Re-Construction
136	108772	SLAB	107779	Box Culvert	1/22/0	Re-Construction
138	109305	BOX	108319	Box Culvert	1/33/0	Re-Construction
139	109631	SLAB	108635	Box Culvert	1/22/0	Re-Construction
140	110818	SLAB	109866	Box Culvert	1/43/0	Re-Construction
141	111171	BOX	110168	Box Culvert	1/43/0	Re-Construction
142	111352	BOX	110347	Box Culvert	1/43/0	Re-Construction
143	111488	BOX	110488	Box Culvert	1/22/0	Re-Construction
144	111596	BOX	110600	Box Culvert	1/33/0	Re-Construction
145	111990	BOX	110952	Box Culvert	1/44/0	Re-Construction
146	112257	BOX	111173	Box Culvert	1/43/0	Re-Construction
147	112706	BOX	111594	Box Culvert	1/33/0	Re-Construction
148	112900	BOX	111773	Box Culvert	1/33/0	Re-Construction
149	112950	BOX	111817	Box Culvert	1/33/0	Re-Construction
150	113461	BOX	112301	Box Culvert	1/22/0	Re-Construction
151	113517	BOX	112366	Box Culvert	1/22/0	Re-Construction
152	113924	BOX	112707	Box Culvert	1/22/0	Re-Construction
153	113970	BOX	112755	Box Culvert	1/22/0	Re-Construction
154	114372	BOX	113131	Box Culvert	1/22/0	Re-Construction
155	114515	BOX	113270	Box Culvert	1/33/0	Re-Construction



156	114878	BOX	113558	Box Culvert	1/22/0	Re-Construction
157	115720	SLAB	114383	Box Culvert	1/33/0	Re-Construction
158	115825	SLAB	114461	Box Culvert	1/33/0	Re-Construction
159	115910	SLAB	114543	Box Culvert	1/43/0	Re-Construction
160	116025	SLAB	114681	Box Culvert	1/22/0	Re-Construction
161	116133	SLAB	114780	Box Culvert	1/33/0	Re-Construction
162	116411	SLAB	115040	Box Culvert	1/33/0	Re-Construction
163	116930	SLAB	115377	Box Culvert	1/53/0	Re-Construction
164	117240	SLAB	115659	Box Culvert	1/33/0	Re-Construction
165	117647	SLAB	115975	Box Culvert	1/53/0	Re-Construction
166	117857	SLAB	116189	Box Culvert	1/33/0	Re-Construction
167	118068	SLAB	116399	Box Culvert	1/22/0	Re-Construction
168	118179	SLAB	116513	Box Culvert	1/22/0	Re-Construction
169	118322	SLAB	116664	Box Culvert	1/43/0	Re-Construction
170	118443	BOX	116787	Box Culvert	1/43/0	Re-Construction
171	118503	BOX	116841	Box Culvert	1/33/0	Re-Construction
172	118676	BOX	117009	Box Culvert	1/33/0	Re-Construction
173	118738	SLAB	117068	Box Culvert	1/33/0	Re-Construction
174	118817	SLAB	117144	Box Culvert	1/34/0	Re-Construction
175	118947	BOX	117274	Box Culvert	1/44/0	Re-Construction
176	119225	BOX	117551	Box Culvert	1/33/0	Re-Construction
177	119340	SLAB	117710	Box Culvert	1/53/0	Re-Construction
178	119778	BOX	118106	Box Culvert	1/43/0	Re-Construction
179	119933	SLAB	118265	Box Culvert	1/33/0	Re-Construction



180	120071	BOX	118401	Box Culvert	1/33/0	Re-Construction
181	120190	BOX	118513	Box Culvert	1/33/0	Re-Construction
182	120665	SLAB	118966	Box Culvert	1/43/0	Re-Construction
183	120745	SLAB	119060	Box Culvert	1/33/0	Re-Construction
184	121392	BOX	119694	Box Culvert	1/44/0	Re-Construction
185	121656	SLAB	119965	Box Culvert	1/22/0	Re-Construction
186	121833	SLAB	120140	Box Culvert	1/22/0	Re-Construction
187	122182	SLAB	120397	Box Culvert	1/22/0	Re-Construction
188	122245	SLAB	120452	Box Culvert	1/22/0	Re-Construction
189	122322	SLAB	120532	Box Culvert	1/22/0	Re-Construction
190	122708	SLAB	120874	Box Culvert	1/22/0	Re-Construction
191	122828	SLAB	120991	Box Culvert	1/22/0	Re-Construction
192	123057	SLAB	121209	Box Culvert	1/22/0	Re-Construction
193	123232	SLAB	121398	Box Culvert	1/33/0	Re-Construction
194	123952	SLAB	121953	Box Culvert	1/22/0	Re-Construction
195	125087	SLAB	123140	Box Culvert	1/33/0	Re-Construction
196	125347	SLAB	123410	Box Culvert	1/33/0	Re-Construction
197	125632	SLAB	123675	Box Culvert	1/22/0	Re-Construction
198	126154	SLAB	124155	Box Culvert	1/22/0	Re-Construction
199	126425	SLAB	124415	Box Culvert	1/22/0	Re-Construction
200	126613	SLAB	124602	Box Culvert	1/22/0	Re-Construction
201	126862	SLAB	124785	Box Culvert	1/22/0	Re-Construction
202	127144	BOX	125049	Box Culvert	1/33/0	Re-Construction
203	127233	BOX	125142	Box Culvert	1/22/0	Re-Construction



204	127375	BOX	125280	Box Culvert	1/22/0	Re-Construction
205	127785	SLAB	125699	Box Culvert	1/22/0	Re-Construction
206	128000	BOX	125907	Box Culvert	1/43/0	Re-Construction
207	128466	SLAB	126456	Box Culvert	1/33/0	Re-Construction
208	128703	BOX	126678	Box Culvert	1/33/0	Re-Construction
209	129043	BOX	127002	Box Culvert	1/22/0	Re-Construction
210	129314	BOX	127226	Box Culvert	1/33/0	Re-Construction
211	129402	BOX	127340	Box Culvert	1/44/0	Re-Construction
212	129505	BOX	127426	Box Culvert	1/33/0	Re-Construction
213	129614	SLAB	127545	Box Culvert	1/22/0	Re-Construction
214	130075	BOX	128005	Box Culvert	1/22/0	Re-Construction
215	130315	BOX	128233	Box Culvert	1/33/0	Re-Construction
216	130416	BOX	128332	Box Culvert	1/33/0	Re-Construction
217	130508	SLAB	128429	Box Culvert	1/33/0	Re-Construction
218	130766	BOX	128685	Box Culvert	1/33/0	Re-Construction
219	130863	BOX	128782	Box Culvert	1/33/0	Re-Construction
220	131084	BOX	128990	Box Culvert	1/33/0	Re-Construction
221	131215	BOX	129125	Box Culvert	1/33/0	Re-Construction
222	131370	BOX	129271	Box Culvert	1/43/0	Re-Construction
223	131443	BOX	129354	Box Culvert	1/43/0	Re-Construction
224	131572	SLAB	129481	Box Culvert	1/43/0	Re-Construction
225	131677	BOX	129592	Box Culvert	1/33/0	Re-Construction
226	131814	SLAB	129730	Box Culvert	1/22/0	Re-Construction
227	131973	SLAB	129868	Box Culvert	1/22/0	Re-Construction



228	132300	SLAB	130185	Box Culvert	1/22/0	Re-Construction
229	132464	SLAB	130345	Box Culvert	1/53/0	Re-Construction
230	132604	SLAB	130489	Box Culvert	1/22/0	Re-Construction
231	133114	SLAB	130985	Box Culvert	1/43/0	Re-Construction
232	133235	SLAB	131120	Box Culvert	1/43/0	Re-Construction
233	133877	SLAB	131733	Box Culvert	1/43/0	Re-Construction
234	134130	SLAB	131948	Box Culvert	1/22/0	Re-Construction
235	134224	SLAB	132028	Box Culvert	1/22/0	Re-Construction
236	134353	SLAB	132158	Box Culvert	1/22/0	Re-Construction
237	134547	SLAB	132340	Box Culvert	1/22/0	Re-Construction
238	134576	SLAB	132376	Box Culvert	1/22/0	Re-Construction
239	134700	SLAB	132508	Box Culvert	1/22/0	Re-Construction
240	134767	SLAB	132570	Box Culvert	1/22/0	Re-Construction
241	135058	SLAB	132845	Box Culvert	1/22/0	Re-Construction

Details of Slab/Box Culverts (New Construction)

Sl No.	Proposed Chainage	Type of Structure	Span Arrangement	Remarks
1	70295	Box Culvert	1/22/0	New-Construction
2	72880	Box Culvert	1/33/0	New-Construction
3	73050	Box Culvert	1/33/0	New-Construction
4	73165	Box Culvert	1/33/0	New-Construction
5	73612	Box Culvert	1/43/0	New-Construction
6	82420	Box Culvert	1/43/0	New-Construction
7	82605	Box Culvert	1/22/0	New-Construction
8	85050	Box Culvert	1/33/0	New-Construction



Sl No.	Proposed Chainage	Type of Structure	Span Arrangement	Remarks
9	86485	Box Culvert	1/33/0	New-Construction
10	86975	Box Culvert	1/22/0	New-Construction
11	88450	Box Culvert	1/22/0	New-Construction
12	88950	Box Culvert	1/22/0	New-Construction
13	89220	Box Culvert	1/22/0	New-Construction
14	90720	Box Culvert	1/43/0	New-Construction
15	90810	Box Culvert	1/53/0	New-Construction
16	91110	Box Culvert	1/64/0	New-Construction
17	92000	Box Culvert	1/66/3	New-Construction
18	93506	Box Culvert	1/43/0	New-Construction
19	94777	Box Culvert	1/66/3	New-Construction
20	99820	Box Culvert	1/22/0	New-Construction
21	101510	Box Culvert	1/22/0	New-Construction
22	102628	Box Culvert	1/33/0	New-Construction
23	104078	Box Culvert	1/22/0	New-Construction
24	106570	Box Culvert	1/22/0	New-Construction
25	107020	Box Culvert	1/34/0	New-Construction
26	109695	Box Culvert	1/22/0	New-Construction
27	111980	Box Culvert	1/22/0	New-Construction
28	112090	Box Culvert	1/22/0	New-Construction
29	115795	Box Culvert	1/33/0	New-Construction

Details of Pipe Culverts (Retained)

Sr. No.	Existing	Proposed	Details of Existing Structure			Details of Proposed structure		
	Chainage (Km)	Chainage (Km)	Type of Structure	No. x Dia.	Width of Structure (m)	No. x Dia.	Proposed Width (m)	Remark
---NIL---								



Details of Pipe Culverts (Reconstruction)

Sr. No.	Existing	Proposed	Details of Existing Structure			Details of Proposed structure		
	Chainage (Km)	Chainage (Km)	Type of Structure	No. x Dia.	Width of Structure (m)	No. x Dia.	Proposed Width (m)	Remark
---NIL---								

Details of Pipe Culverts (New Construction)

Sr. No.	Proposed Chainage (Km)	Details of Proposed structure			
		Type of Structure	No. x Dia.	Proposed Width (m)	Remark
---NIL---					

Details of Underpass (New construction)

Sl. No.	Existing Ch (Km)	Proposed Ch. (Km)	Details of Existing Structure		Details of Proposed Structure		Proposed Width (m)	Remarks
			Type of Structure	Span Arrangement	Type of Structure	Span Arrangement		
-NIL-								

Details of Proposed New Construction of ROB

Sr. No	Location	Railway Chainage	Level Crossing no.	TVU NO.	DOH	Existing structure	Proposed Structure type	Proposed span Arrangement in mtr.	Total width of the structure
---NIL---									



Repair, Maintenance and Strengthening of Existing ROB

Sl No.	Existing Chainage	Design Chainage	Type of Structure	Existing Span Arrangement (inMtr.)	Width of roadway at RUB (In mtr.)	Remark
NIL						

Details of Pipe Culverts (New construction)

Sr. No	Type of Junction	Nos.	Details of Proposed Structure		
			No. x Dia.	Proposed Width (m)	Remark
---NIL---					

Repairs and strengthening of bridges and structures, Repairs/replacements of railing/parapets, flooring and protection works of the existing culverts are proposed at following locations.

1. ROB: - NIL

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

2 Major Bridges: - NIL

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

3 Minor Bridges: - NIL

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



4 Box Culverts – NIL

Sr. No.	Location of Structure (km)	Type	Remark
NIL.			

5 HP Culverts – NIL

Sr. No.	Location of Structure (km)	Type	Remark
NIL.			

