SUBMERSIBLE SKEW BRIDGE DESIGN

Comprehensive Engineering Report with Detailed Calculations

Project: Design of Submersible Skew Bridge

Location: Kherwara - Jawas - Suveri Road, Across River Som

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afflux calculation

DESIGN OF SUBMERSIBLE BRIDGE
| |
Name Of Work :- Construction of Submersible Bridge | |
Hydraulic Calculation | |
Computation of Discharge | | 1
Q | = | A x V
A | = | 490.3000000000011
P | = | 190.70731489786334
S | = | 1
| |
n | = | 0.033
| |
V | = | I/nx (A/P) 2/3 x(S) 1/2

HYDRAULICS

DETERMINATION OF VELOCITY AT PROPOSED SUBMERSIBLE | |
Name Of Work :- Construction of Submersible Bridge | |
AS PER UP-STREAM SECTION | |
HIGHEST FLOOD LEVEL | |
CHAINAGE | G.L. | DEPTH OF FLOW IN M
| 102 |
10 | 100.95 |
20 | 98.19 | 2.4099999999999966
30 | 97.58999999999999 | 3.010000000000005
40 | 97.21 | 3.3900000000000006
50 | 96.86999999999999 | 3.730000000000004
60 | 97.95999999999998 | 2.640000000000015

Deck Anchorage

ANCHORAGE OF DECK SLAB TO SUBSTRUCTURE | |
Name Of Work :- Construction of Submersible Bridge | |
| In the case of a submersible bridge, the deck slab |
| One possible solution to this anchorage is as show |
Check Against Uplift | |
| The uplift force shall be maximum when the flow le |
| Total Height | =
| Maximum Uplift Pressure | =
| Area of Slab under effect of buoyancy | =
| Uplift Force on Slab | =
| Self Weight of Slab | =
| Self Weight of Wearing Coat | =

CROSS SECTION

CROSS SECTION OF RIVER DOWN-STREAM | |
Name Of Work :- Construction of Submersible Bridge | |
CROSS SECTION OF RIVER AT PROPOSED BRIDGE SITE | |
HIGHEST FLOOD LEVEL | |
Chainage in M (u/s or d/s) | RL in M | DEPTH OF FLOW IN M
| 102 |
10 | 100.95 |
20 | 98.19 | 2.4099999999999966
30 | 97.58999999999999 | 3.010000000000005
40 | 97.21 | 3.3900000000000006
50 | 96.86999999999999 | 3.730000000000004
60 | 97.95999999999998 | 2.640000000000015

Bed Slope

DETERMINATION OF BED SLOPE OF THE RIVER | |
Name Of Work :- Construction of Submersible Bridge | |
Chainage in M (u/s or d/s) | RL in M |
| 94.505 |
25 | 94.47999999999999 |
50 | 94.45499999999998 |
75 | 94.42999999999998 |
100 | 94.40499999999997 |
125 | 94.37 |
150 | 94.36 |
175 | 94.335 |
200 | 94.30999999999999 |

SBC

SBC RECOMMENDATION AT 3 M DEPTH IN THE WEATHERED R | |
SBC RECOMMENDATION AT 3 M DEPTH IN THE WEATHERED R | |
HOWEVER ADOPTED SBC IS | |
| |
| | OR
| |

STABILITY CHECK FOR PIER

DESIGN OF PIER AND CHECK FOR STABILITY- SUBMERSIBL | |
Name Of Work :- Construction of Submersible Bridge | |
DESIGN DATA | |
1 | RIGHT EFFECTIVE SPAN |
2 | SPAN C/C OF PIERS |
3 | OVERALL WIDTH OF PIER CAP |
4 | H.F.L. |
5 | BUOYANCY |
6 | | AT FOOTING LEVEL
7 | | AT PIER LEVEL
8 | AQUEDUCT FALLS UNDER ZONE-II SO SEISMIC CASE IS NO |
9 | FLOOD DISCHARGE |

abstract of stresses

ABSTRACT OF BASE PRESSURE AND STRESSES | |
Name Of Work :- Construction of Submersible Bridge | |
CASE- 1 FOR SERVICE CONDITION AT R. L.91.97 M | |
CASE- 2 FOR IDLE CONDITION AT R. L.91.97 M | |
CASE- 3 FOR WIND FORCE AT SERVICE CONDITION AT R. | |
CASE- 4 FOR WIND FORCE AT IDLE CONDITION AT R. L.9 | |
CASE- 5 FOR ONE SPAN DISLODGED CONDITION AT R. L.9 | |
| | Maximum
CASE- 6 FOR SERVICE CONDITION AT R. L.92.97 M | |
CASE- 7 FOR IDLE CONDITION AT R. L.92.97 M | |
CASE- 8 FOR WIND FORCE AT SERVICE CONDITION AT R. | |
CASE- 9 FOR WIND FORCE AT IDLE CONDITION AT R. L.9 | |

STEEL IN FLARED PIER BASE

REINFORCEMENT CALCULATION IN PIER IN LOWER FLARED | |
Name Of Work :- Construction of Submersible Bridge | |
| R.L. | 92.96999999999998
FOR SERVICE CONDITION | |
| VERTICAL LOADS |
| SUPER STRUCTURE | =
| SUB STRUCTURE | =
| SUB STRUCTURE | =
| LIVE LOAD | =
| Total Load without Buoyancy | =
| Total Load with Buoyancy | =
| Total LONGITUDINAL MOMENT |

STEEL IN PIER

REINFORCEMENT CALCULATION IN PIER | |
Name Of Work :- Construction of Submersible Bridge | |
| R.L. | 93.56999999999998
FOR SERVICE CONDITION | |
| VERTICAL LOADS |
| SUPER STRUCTURE | =
| SUB STRUCTURE | =
| SUB STRUCTURE | =
| LIVE LOAD | =
| Total Load without Buoyancy | =
| Total Load with Buoyancy | =
| Total LONGITUDINAL MOMENT |

FOOTING DESIGN

DESIGN OF PIER FOOTING SUBMERSIBLE BRIDGE | |
Name Of Work :- Construction of Submersible Bridge | |
FOR WIND AT SERVICE CONDITION | |
| Length of footing | lf
| Width of Footing | lb
| Width of Pier |
| Vertical Load | P
| Longitudinal Moment | Me
| Transverse Moment | Mb
| el | = Me/P
| eb | = Mb/P
| el/lf |

Footing STRESS DIAGRAM

| |
| | 1.2999999999999998
| |
| | m
| |
| |
| |
DESIGN OF PIER FOOTING | |

Pier Cap LL tracked vehicle

LIVE LOAD CALCULATION :- | |
[1] CLASS AA TRACKED VEHICLE :- | |
(a) Dispersion width along the span | |
According to clause 305.13 IRC- 21-2000 | |
= Length of Contact + 2 (Wearing coat + depth | |
= | 3.6 | + 2 (0.075 + 0.775)
= | 5.3 | M
(b) Dispersion width across the span | |
According to clause 305.13 IRC- 21-2000 | |
be = K x (1 - x/Le) +bw | |
K = A Constant having the value depending upon t | |
(L1/Le where. | |

Pier Cap

DESIGN OF PIER CAP :- | |
D.L./ M Width along bridge | |
DL. Of Slab = | | 0.75
D.L. of Wearing coat = | | 0.075
| |
D.L. of Slab & Wearing coat on half of the pier | |
| |
L.L. on Pier cap including impact along bridge | |
| |
(Refer Live Load Computation) | |
Dispersion width across the span for | |
70 T TRACKED VEHTCLE | |

LLOAD

CALCULATION OF LIVE LOAD REACTION FOR PIER SUBSTR | |
FOR SIMPLY SUPPORTED SPANS OF A TWO LANE BRIDGE ST | |
Centre line of pier w.r.t. the bearings :- | |
Rb | = | 0.3
Rc | = | 0.3
Reaction has been calculated for the following cas | |
1. | One lane of class 70-R(W) |
2. | One lane of class - A |
3. | Two lane of class - A |
4. | Three lane of class - A |
5. | One lane of class 70-R(W) + One lane of class - A |
Condition A: | | MAXIMUM LONGITUDINAL MOMENT CASE

loadsumm

Summary of Loads | |
Max. Longitudinal Moment | |
Max. vertical reaction (t) | Transverse moment (t.m) |
60.35928143712574 | 175.34371257485026 |
55.4 | 160.66000000000003 |
13.932934131736522 | 16.022874251497004 |
18.809461077844304 | 13.166622754491016 |
60.5931736526946 | 115.92694131736523 |
| | Max.Transverse Moment
Load case | | Max. vertical reaction (t)
1L class 70 - R | | 53
1L class - A | | 34.62227544910179

LL-ABSTRACT

Maximum Reaction due Live Load including Impact | |
Maximum Longitudinal moment due to Live Load inclu | |
Maximum Transverse moment due to Live Load includi | |

TYPE1-AbutMENT Drawing

Name Of Work :- Construction of Submersible Bridge | |
Deck Level | |
Foundation Level | |
Thickness of Deck Slab | |
Thickness of Approach Slab | |
Height below Approach Slab | |
Length of Heel projection | |
Length of Toe projection | |
Width of Stem | |
Thickness of Abutment Cap | |
Thickness of Dirt Wall | |
Depth of Footing | |

TYPE1-STABILITY CHECK ABUTMENT

Design of ABUTMENT | |
Name Of Work :- Construction of Submersible Bridge | |
(a) Data | Preliminary dimensions | : Assumed as in Fig. TYPABUT-01
| Superstructure | : RCC Slab Bridge
| | overall length = 8.80 m
| Type of abutment | : Reinforced concrete
| Loading | : As for National Highway
| Back fill | : Gravel with angle of repose ¦ =
| | Unit weight of back fill, w =
| | Angle of internal friction of soil on wall, z =
| Approach slab | : R.C. slab 300 mm thick, adequately reinforced
| Load from superstructure per running foot of abutm |

TYPE1-ABUTMENT FOOTING DESIGN

DESIGN OF ABUTMENT FOOTING | |
Name Of Work :- Construction of Submersible Bridge | |
REDISTRIBUTION OF PRESSURE | |
FOR WIND AT SERVICE CONDITION | |
| Length of footing | lf
| Width of Footing | lb
| Width of Abutment just above footing |
| Vertical Load | P
| Longitudinal Moment | Me
| Transverse Moment | Mb
| el | = Me/P
| eb | = Mb/P

TYPE1- Abut Footing STRESS

| |
| 1 | m
| |
| 258.56357441323684 | m
| |
| |
| |
DESIGN OF ABUTMENT FOOTING | |

TYPE1-STEEL IN ABUTMENT

REINFORCEMENT CALCULATION IN ABUTMENT SUBMERSIBLE | |
Name Of Work :- Construction of Submersible Bridge | |
Minimum Shrinkage and Temperature reinforcement re | |
in any RC structure is 250 Sq mm per m in each dir | |
| Shrinkage and Temperature reinforcement required p |
| Area Of One Bar | 12
| Spacing S |
| Provide Bars Of Dia And Spacing | 12
| Provide Bars Of Dia And Spacing | 12
| HORIZONTAL SHRINKAGE &TEMPERATURE REINFORCEMENT |
| VERTICAL SHRINKAGE &TEMPERATURE REINFORCEMENT |

TYPE1-Abutment Cap

| DESIGN OF Abutment CAP SUBMERSIBLE BRIDGE |
Name Of Work :- Construction of Submersible Bridge | |
DESIGN OF Abutment CAP :- | |
D.L./ M Width along bridge | |
DL. Of Slab = | | 0.975
D.L. of Wearing coat = | | 0.075
| |
D.L. of Slab & Wearing coat on half of the Abutm | |
| |
L.L. on Abutment cap including impact along bri | |
| |
(Refer Live Load Computation) | |

TYPE1-DIRT WALL REINFORCEMENT

DESIGN OF DIRT WALL AS COLUMN WITH BENDING | |
AXIAL LOAD ON THE DIRT WALL | |
ASSUME WIDTH OF DIRT WALL | |
ASSUME DEPTH OF DIRT WALL | |
MOMENT TRANSFERRED TO DIRT WALL | |
FACTORED AXIAL LOAD | |
FACTORED MOMENT | |
DIA OF LONGITUDINAL REINFORCEMENT | |
CLEAR COVER | |
d' | |
d'/D | |
ADOPT d'/D | |

TYPE1-DIRT DirectLoad_BM

Design of Dirt Wall | |
| Dirt wall is subjected to |
| (1) | Live load
| (2) | Live load surcharge
| (3) | Braking force
| (3) | Earth Pressure
| 1) | Consider 70 T tracked vehicle case is
| | governing & 14 T Axle over dirt wall,
| | Dispersion width at top of DIRT WALL
| = | 2.9
| = | 2.9
| = | 5.255