DESIGN OF PIER CAP :-

D.L./ M Width along bridge

DL. Of Slab =	0.75	x	8.40	x.	2.4 =	15.12 T
D.L. of Wearing coat =	0.08	x	8.40	x.	2.4 =	1.51 T
					TOTAL	16.63 T
D.L. of Slab & Wearing coat on half of the pier		=				
			16.63	/	2 =	8.32 T
L.L. on Pier cap including impact along bridge						
		=	82.50	x	1.1375 =	93.84 T
(Refer Live Load Computation)						
Dispersion width across the span for						
70 T TRACKED VEHTCLE		=	6.695	M		
(Refer Solid slab design page SS-16)						
Live Load u.d.l. on Pier		=	93.84	/	6.695 =	14.02 T
Per M width						
Total Load on Half =	8.32	+	14.02		=	22.33 T
of pier along bridge						Per M width

Effective depth of slab =90-2.5-2.5/2 = 71.25 cm

Placement of the live load at effective depth from the support (taking support width 750 mm)

Eccentricity = 71.25 -75/2 = 33.75 cm = 0.34 M

Bending Moment along the bridge =

22.33 x 0.34 7.54 T - M/M width

=

7.54 x 10.00 = **75.4 kN-M/M width**

This moment is too small hence it will not/be the governing B.M.

Moment in pier cap		**75.40**	**kN-m**
CONCRETE GRADE		**M30**	
FOR THIS GRADE σcbc		**10**	N/mm2
m		**9.33**	
σst		**200**	
factor k		0.318	
j		0.894	
R		1.422	
Effective Depth Required		230	mm
Adopt Total Depth		1200	mm
Cover		50	mm
Assume Bar Dia		25	mm
Keeping A Cover Of 50 mm Effective Depth		1138	mm
Adopt Effective Depth		1137.5	mm
Steel Required Ast		371	mm^2
Area Of One Bar		491	mm^2
Spacing S		1323	mm
Provide Bars Of Dia And Spacing	25 mm	**100**	mm **Adopt spacing as 100 mm**
Provide Bars Of Dia And Spacing for Top Main Steel	25 mm	100	mm
Provide Bars Of Dia And Spacing for Bottom Steel	16 mm	100	mm

PIER SECTION ACROSS BRIDGE

DEAD LOAD MOMENT PER METRE Width across bridge :-

Slab D.L.	0.975	x	15	x.	2.4 =	35.10 T
D.L. of Wearing coat =	0.075	x	12	x.	2.4 =	2.16 T
					TOTAL	**37.26** T
D.L. of Slab & Wearing coat on half of the pier		=				
			37.26	/	2 =	18.63 T/ M width

L.L on pier = 64.69 T

Dispersion width along the span for
70 T Tracked vehical = 5.3 M

L.L. . per M width on pier = 64.69 / 5.3 = 12.21 T/ M width
Total D.L. + L.L. on half of Pier across bridge per M width 18.63 + 12.21 = 30.84 T Per M width

The Live Load is with clearance from the Footpath and kerb. The cantilever portion of pier cap and width of footpath is 1500 mm
Hence There is no eccentricity.

Bending Moment across the bridge =

30.84 x 0 = 0.00 T - M/M width

Provide Minimum steel

Minimum Reinforcement calculation for Pier cap :-

As per clause 710.8.2, IRC- 78 - 2000, the thickness of pier cap shall be at least 200 mm However the thickness of Pier cap here is 1200 MM.

Grade of Concrete M 30

Minimum Shrinkage and Temperature reinforcement required as per Clause 305.10 IRC 21-2000 in any RC structure is 250 Sq mm per m in each direction. Allowable maximum spacing is 300 mm.

Shrinkage and Temperature reinforcement required = 250 x 1.2 = 300 mm^2

Provide 25 mm tor reiforcement @ 100 mm c/c (14 Nos.) in top along the pier cap

Provide 16 mm tor reiforcement @ 100 mm c/c (14 Nos.) in bottom along the pier cap

Area of Steel Provided at top
= (14x 491) = 6874 mm^2 > 300 mm^2 OK

Area of Steel Provided at bottom
= (14x 201) = 2814 mm^2 > 300 mm^2 OK

CHECK FOR SHEAR ALONG BRIDGE DIRECTION

V = 30.84 T
Shear Force 308.40 kN
V=V' + M/d tanB (B=0) Hence V =V'
Actual Shear Stress 0.27 **N/mm^2**
Percentage Steel 100As/bd 0.25
Tc 0.23 **N/mm^2**
k=1
Permissble Shear Stress = k Tc 0.23 **N/mm^2**

< Actual Shear Stress hence Shear Reinforcement should be provided

Dia Of two Legged Stirrups 16 mm

Area Of One Bar In Distribution Reinforcement 201 mm^2
Using The Bars Spacing Required s= Asw ts d/V 296 mm
Provide Bars Of Dia And Spacing 16 mm 100 mm **Adopt spacing as 100 mm**

HOWEVER

Provide 16 mm tor 2 legged vertical stirrups @ 100 mm centre to centre along the pier cap

Provide 16 mm tor 2 legged horizontal stirrups @ 100 mm centre to centre along the pier cap

SHEAR CHECK ACROSS BRIDGE DIRECTION

V = 20.3 T
Shear Force 203.00 kN
V=V' + M/d tanB (B=0) Hence V =V'

Actual Shear Stress		0.18 **N/mm^2**
Percentage Steel	100As/bd	0.25
Tc		0.23 **N/mm^2**
k=1		
Permissble Shear Stress = k Tc		0.23 **N/mm^2**

> Actual Shear Stress hence No Shear Reinforcement is required.

HOWEVER

Provide 16 mm tor 2 legged vertical stirrups @ 100 mm centre to centre along the pier cap

Provide 16 mm tor 2 legged horizontal stirrups @ 100 mm centre to centre along the pier cap