REINFORCEMENT CALCULATION IN PIER

Name Of Work :- Construction of Submersible Bridge on ON KHERWARA - JAWAS - SUVERI ROAD IN KM 9/000, ACROSS RIVER SOM

R.L. 93.57 M TO 100.80 M

FOR SERVICE CONDITION

VERTICAL LOADS					
SUPER STRUCTURE	=	**1463.62**	kN		
SUB STRUCTURE	=	**2821.21**	kN		Without Buoyancy
SUB STRUCTURE	=	**2271.84**	kN		With Buoyancy
LIVE LOAD	=	**788.27**	kN		
Total Load without Buoyancy	=	**5073.09**	kN		
Total Load with Buoyancy	=	**4523.72**	kN		
Total LONGITUDINAL MOMENT					
Moment @ R. L.	93.57 M =		328.88	kN-m	
Total TRANSVERSE MOMENT					
Moment @ R. L.	93.57 M =		2332.51	kN-m	
CONCRETE MIX	M-25				
CHARACTERISTIC STRENGTH OF REINFORCEMENT				415	N/mm2
PERMISSIBLE STRESSES					
IN STEEL		190			
IN CONCRETE					
CHARACTERISTIC STRENGTH OF					
Concrete	fck =			30	N/mm2
Permissible Compressive Stress in Bending	σcbc =			8	N/mm2
Permissible Compressive Stress in Direct Compression	σcc =			8	N/mm2
	σct =			3.6	N/mm2

Ultimate Axial Load P_U	=	1.5	X	5073.09	=	7609.631	kN	
Ultimate Longitudinal Moment M_U	=	1.5	X	328.88	=	493.323	kN-m	
Ultimate Transverse Moment M_U	=	1.5	X	2332.51	=	3498.765	kN-m	
INCREASE WHEN WIND CONDITION IS CONSIDERED				33.33	%			

Neglecting area of Cut and Ease water parts Rectangular Section considered is

12000 mm x 1200 mm

Assume cover as 75

d^1/d	=	87.5	/	1200	=	0.0729			
$P_U/(f_{ck}\ b\ d)$	=	7609.63	x	1000	/ (	30	x	12000	x 1200)
	=	0.0176							
FOR LONGITUDINAL MOMENT									
$Mu/(f_{ck}\ b\ d^2)$	=	493.32	x	1000000	/ (	30	x	12000	x 1200^2)
	=	0.0010							

Refer Chart 31 & 32 of Design Aids for Reinforced concrete SP-16 the point lies below the range of applicability. Hence provide minimum percentage of steel.

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CRITERIA 1 FOR MINIMUM STEEL Pt = 0.8 % OF CROSS SECTION AREA OF COLUMN REQUIRED FOR COMPRESSION

Area Required due to Compression = 4523.72 x 1000 / 8

= 565465 mm^2

Area of steel @ 0.8% = 0.8 x 565465 / 100

= **4524 mm^2**

CRITERIA 2 FOR MINIMUM STEEL Pt = 0.3 % OF GROSS SECTION AREA OF COLUMN

Area of steel @ 0.3% = 0.3 x 12000 x 1200 / 100

= **43200 mm^2**

PROVIDE STEEL AREA = **43200 mm^2**

NO. OF 25 MM BARS = 88 Nos.

SPACING = **290** MM

FOR TRANSVERSE MOMENT

$Mu/(f_{ck}\ b\ d^2)$ = 3498.76 x 1000000 / (30 x 12000 x 1200 ^{2})

= 0.0067

Refer Chart 31 & 32 of Design Aids for Reinforced concrete SP-16 the point lies below the range of applicability. Hence provide minimum percentage of steel.

TRANSVERSE REINFORCEMENT

Shear Force to be resisted by the pier In Accordance to IS 1893

2332.51 / 11.87 = 196.46 kN

Check for Shear

Nominal Shear Stress = 196.46 x 1000 / (12000 x 1200)

= 0.01 N/mm^2

Pt 0.30

Permissible Shear Stress = 0.40 N/mm^2 Refer table 61

Nominal Shear Reinforcement will suffice

According to IRC 21-1987 Clause 306.3

Dia of Transverse Reinforcement = 25 / 4 = 6.25 mm

Provide 12 mm dia rings

Pitch of the Transverse should be least of

a) Least lateral Dimension = 1200 mm

b) 12 d = 12 x 12 = 144 mm

c) 300 mm = 300 mm

d) As per IS IS 13920:1993 Cl. 7.4.6 < or = 100 mm

Provide 12 mm dia rings @ 100 mm c/c.

This spacing is in accordance to IS 13920:1993 Cl. 7.4.6

CODE OF PRACTICE FOR DUCTILE DETAILING OF REINFORCED CONCRETE STRUCTURES SUBJECTED TO SEISMIC FORCES

Check for Size of Hoop Reinforcement **Refer IS 13920:1993 Cl. 7.4.8**

Ash= 0.18 Sh (Fck/Fy)x(Ag/Ak-1)

S = 100.00 mm

h = 300.00 N/mm^2 (Spacing of long. bars+ effective cover) or 300 mm whichever is less

Fck = 30.00 N/mm^2 **Cover 75 mm to main reinforcement**

Fy = 415.00 N/mm^2

Ag	=	1200.00	mm^2	Considering 1 mm Wide Pier	
Ak	=	1099.00	mm^2	Considering 1 mm Wide Pier Effective	
Hence Ash	=	35.87	mm^2		
Ash ProvideD	=	113.04	mm^2	Which is OK	

d) As per IS IS 13920:1993 Cl. 7.4.6 < or = 100 mm

Provide 12 mm dia rings @ 100 mm c/c.

This spacing is in accordance to IS 13920:1993 Cl. 7.4.6

CODE OF PRACTICE FORDUCTILE DETAILING OF REINFORCED CONCRETE STRUCTURES SUBJECTED TO SEISMIC FORCES

ABSTRACT

LONGITUDINAL REINFORCEMENT	**25 MM BARS**	**290**	**MM**	**However Adopt spacing as 250 mm**
TRANSVERSE REINFORCEMENT	**12mm dia rings @100mm c/c.**			