Design of Bearing Pad

Given

Max. Dead Load	=	1850	kN
f_{ck}	=	30	
Thickness	=	75	mm
Live load	=	365	
	=	365	kN
Horizontal force due to live load	=	80	kN
Assumed Size of bearing pad			
Effective Breadth of pad(bp)	=	550	mm
Effective Length of pad(Lp)	=	950	mm
Side cover(Sc)	=	6	mm
Thickness of steel	=	10	mm

Step 1-

Thickness should be between breadth of pad(bp)/10 to Length of pad(Lp)/5

55 to 110

O.K

Step 2-

Live load	=	400	kN
Loaded area	=	(bp*Lp)-(2(bp+Lp)*Sc)	
		5E+05	mm^2
Total load (Nmax)	=	DL+LL	
	=	1390	kN
Approx.	~	1400	kN
Nmin	=	1025	kN
A1	=	4	
A2	=	2	
A1/A2	=	2	

Step 3- Grade Provided M30 :-

Allowable contact pressure = $0.25 \times fck \times \sqrt{\frac{A1}{A2}}$

10.61 Mpa

Effective area of bearing required	=	1400*1000/10.61	
	=	13.2	mm^2
σ_m	=	total load/loaded area	
	=	2.775	Mpa

Step 4- Thickness of individual Elastomer layer

hi	=	15	mm
No.	=	5	
Thickness of steel Laminates	=	10	mm
Overall thickness of bearing	=	75	mm
Side cover	=	6	mm
Total thickness of elastomer(t)	=	55	mm
Shear modules assumed , d	=	1	N/mm^2
Shear strain due to creep, shrinkage , temprature(L)	=	5E-04	
From temp. sheet(K)	=	41000	
Shear strain per bearing due to creep, shrinkage ,temprature	=	(L*K)/2t	

= 0.186

Shear strain due to longitudinal force = 80*1000/504500

0.159

Shear strain due to translation = B/loaded area

= 0.345 Safe

Step 5- Calculation of rotation,

$\sigma_{,min}$ = 0.5*σm*hi/b*s^2

Effective Breadth of pad(bp) N = 550-12

= 538 mm

Effective Length of pad(Lp) O = 950-12

= 938 mm

s = 15

(I) Shape factor (s) = Loaded area/(2(N+O)h_i)

= 11.39 safe

(ii) Assume, σ_m, max. = 10 MPa

αb_i , max. = 0.5*σm*hi/b*s^2

= 0.001 radians

P = 2.973

β = P/10

= 0.297 MPa

Permissible rotation = β*Effective Breadth of pad(bp) N*αbi , max.

= 0.002 MPa

Step 6- Friction

Shear strain(Z) = 0.345 MPa

Check:-

= 0.2+0.1*σ_m

= 0.478 safe

where, σ_m = 2.775

Check:- 2MPa<σm<10MPa satisified

Total Shear Stress

Step 7- Shear stress due to compression(X) = (1.5*σm)/s

= 0.365 MPa

Shear Stess due to Horizonal deformation(Y) = 0.5*b/hi^2*αbi

= 0.688 MPa

Shear Stess due to Horizonal rotation = X+Y+Z

= 1.398 MPa safe