CONCRETE FIBER SOLUTIONS

704-571-1323

Rack Post Load Design Calculation Details

Date: 5/1/2014

Name: Sample Project

Location: Buffalo Grove

Engineer: Mike McPhee

Poisson's Ratio	μ	=	0.15
Section Width	b	=	1 meter
Slab Thickness	h	=	10.50 in
Concrete Compressive Strength	F_c	=	4,000.00 psi
Modulus of Elasticity	E	=	3,602,728.70 psi
Concrete Flexural Strength	F_r	=	600.00 psi
Modulus of Subgrade Reaction	k	=	100.00 pci
Post Load	P	=	12,000.00 lb
Contact Area Dimensions	x	=	6.00 in
	y	=	6.00 in
Load Spacing	W	=	42.00 in
	L	=	96.00 in
	Z	=	14.00 in

Radius of Relative Stiffness

$$l = \left| \frac{E * h^3}{12(1 - \mu^2) * k} \right|^{0.25}$$

l = **43.37 in**

(1,101.66 mm)

Load Percentage

Post System Configuration = **Back to Back**

Main Rack			Adjacent Rack		
Post	=	100.0%	$Post_Z$	=	40.3%
$Post_W$	=	12.9%	$Post_{Z+L}$	=	0.4%
$Post_L$	=	1.1%	$Post_{ZW}$	=	11.7%
$Post_{WL}$	=	0.7%	$Post_{(Z+L)W}$	=	0.1%

A = **23,091.42 lb**

(10.31 tonne)

Load Contact Radius - If Rack to Rack Distance(Sz) >= (2 * h) then

$$a = \left| \frac{x * y}{\Pi} \right|^{0.5}$$

else

$$a = \left| \frac{(Sw + x) * y}{\Pi} \right|^{0.5}$$

a = **3.39 in**

(0.09 m)

If contact radius(a) < (1.72 * h) then

$$b = \left| 1.6 * a^2 + h^2 \right|^{0.5} - (0.675 * h)$$

else

b = a

b = **4.25 in**

(0.11 m)

Slab Stress - Interior Loading

$$f_b = 2.70 * (1 + \mu) * (P / h^2) * (4.0 * \log(R / b) + 1.069) * 10^6$$

f_b = **333.09 psi**

(2,296.60 kN/m²)

Interior Safety Factor

$$FS = \frac{f_r}{f_b}$$

Corner = 1.48

Edge = 1.28

FS = **1.80**

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