

LIFTING INSERT DESIGN CALL

(WORK W/ CARRARA SITE OWNERS)

PRECAST APPROACH SLAB

WT OF SLAB = 16.0 T

THERE ARE (4) LIFT POINTS AND ASSUME
A 60° SWING ANGLE W/ THE HORIZONTAL.

DESIGN LOAD / INSERT = $\frac{16.0 \times 2}{4 \times 0.866} = 9.2^k$

FROM ATTACHED PRODUCT LITERATURE

DIE 8" x 6 3/4" S.L. SWL = 11.2^k > 9.2^k, O.K.
4:1 S.F.

Revise, does not match
lifting insert shown on
drawing AS1.

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P-52 Swift Lift® Anchor Tensile and Shear Capacity

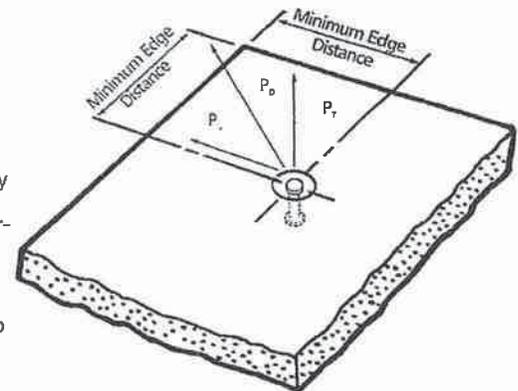
When anchors are used in the face of thin concrete elements

The following table lists the P-52 Swift Lift Anchors that are currently manufactured. Other sizes and lengths are available on special order. However, the sizes and lengths of anchors shown will handle the majority of flat precast concrete elements.

When the P-52 Swift Lift Anchor is properly embedded in normal weight concrete, the tabulated working loads are applicable for any direction of load. This applies even if the direction of load is parallel to the axis of the anchor, perpendicular to it or at any other angle.

Minimum distance between anchors is twice the minimum edge distance.

It is critical to remember that in order to obtain the safe working loads listed in the table below, the normal weight concrete must have obtained the minimum concrete strength shown, prior to initial load application.



Swift Lift Anchor Ton x Length	Safe Working Load	Minimum Concrete Strength	Minimum Edge Distance
1 ton x 2-5/8"	1,700 lbs.	3,500 psi	8"
1 ton x 3-3/8"	2,000 lbs.	2,200 psi	10"
1 ton x 4-3/8"	2,000 lbs.	1,600 psi	10"
1 ton x 8"	2,000 lbs.	1,600 psi	10"
1 ton x 9-1/2"	2,000 lbs.	1,600 psi	10"
2 ton x 2-3/4"	2,100 lbs.	3,500 psi	8"
2 ton x 3-3/8"	2,900 lbs.	3,500 psi	10"
2 ton x 5-1/2"	4,000 lbs.	1,600 psi	13"
2 ton x 6"	4,000 lbs.	1,600 psi	13"
2 ton x 6-3/4"	4,000 lbs.	1,600 psi	13"
2 ton x 11"	4,000 lbs.	1,600 psi	14"
4 ton x 3-3/4"	4,000 lbs.	3,500 psi	12"
4 ton x 4-1/4"	4,900 lbs.	3,500 psi	13"
4 ton x 4-3/4"	5,800 lbs.	3,500 psi	14"
4 ton x 5-1/2"	7,400 lbs.	3,500 psi	17"
4 ton x 5-3/4"	7,900 lbs.	3,500 psi	17"
4 ton x 7-1/8"	8,000 lbs.	1,800 psi	20"
4 ton x 9-1/2"	8,000 lbs.	1,600 psi	17"
4 ton x 14"	8,000 lbs.	1,600 psi	18"
4 ton x 19"	8,000 lbs.	1,600 psi	20"
8 ton x 4-3/4"	6,400 lbs.	3,500 psi	16"
8 ton x 6-3/4"	11,200 lbs.	3,500 psi	21"
8 ton x 10"	16,000 lbs.	3,500 psi	19"
8 ton x 13-3/8"	16,000 lbs.	1,600 psi	23"
8 ton x 26-3/4"	16,000 lbs.	1,600 psi	27"
20 ton x 10"	25,000 lbs.	3,500 psi	24"
20 ton x 19-3/4"	40,000 lbs.	3,500 psi	

Safe Working Loads provide a factor of safety of approximately 4 to 1 in r concrete. Safe Working Load is based on anchor setback from face of co dimension, as shown on page 26.

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Using Design Calculation 2246C-014 11/10, 10/20/04

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FAIRFIELD BRIDGES
JPC # 23446-014

LIFTING LOOP DESIGN CALCULATION

Revise, inserts shown on drawings.

SOUTH ROAD BRIDGE

WT OF SLAB 16.76^T

THERE ARE 4 LIFT POINT AND ASSUMING
A 60° SLING ANGLE W/ THE HORIZONTAL,
DESIGN LOAD EACH LIFT POINT

$$= \frac{16.76 \times 2}{4 \times 0.866} = 9.7^k$$

FROM ATTACHED PCI LITERATURE (BY INTERPOLATION)

USE DOUBLE 1/2" ϕ X 270 KSI STRAND LIFTING LOOP,

MID EMBELEMNT 14" W/ 12" HOOKS

$$SWL @ 16^k > 9.7^k (4:1 S.F.), O.K.$$

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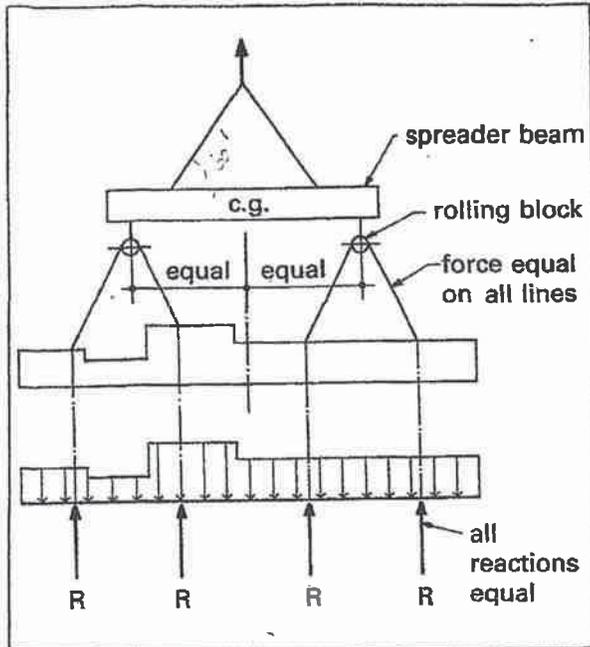
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Fig. 5.2.10 Arrangement for equalizing lifting loads



lines equal. The member can then be analyzed as a beam with varying load supported by equal reactions.

The force in inclined lift lines can be determined from Fig. 5.2.7.

5.2.8 Handling devices

The most common lifting devices are prestressing strand or cable loops projecting from the concrete, threaded inserts, or special proprietary devices.

Since lifting devices are subject to dynamic loads, ductility of the material is part of the design requirement. Deformed reinforcing bars should not be used since the deformations result in stress concentrations from the shackle pin. Also, reinforcing bars are often hard-grade or re-rolled rail steel with little ductility and low impact strength at cold temperatures. Smooth bars of a known steel grade may be used if adequate embedment or mechanical anchorage is provided. The diameter must be such that localized failure will not occur by bearing on the shackle pin.

Prestressing strand is often used for lifting loops. The variables involved make it almost impossible to calculate a capacity which can be used for all situations. Generally, producers will establish standard criteria for use in handling the standard products manufactured by that plant. Table 5.2.3 is an example which has been used successfully.

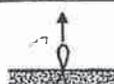
Reduced capacities for shorter embedment lengths may be suitable. In shallow products, providing a 90° bend can reduce the required embedment length significantly. Lightly rusted strand has better bond than bright strand.

The diameter of the bend of the loop should be at least 4 in. For smaller diameters, the loop capacities in Table 5.2.3 should be reduced to:

- 1 in. dia. — 70 %
- 2 in. dia. — 85 %
- 3 in. dia. — 90 %

The angle of incline of lifting has little effect on the strand lifting loop capacity if the angle from the horizontal is more than about 20°. Typical handling methods are usually such that this angle is no less than 60°.

Table 5.2.3 Capacity of 1/2 in. diameter, 270 ksi strands used as lifting loops

Lifting angle	Embedment length (in.)	Single loop (kips)	Double loop (kips)	Triple loop (kips)
45 degrees 	16	5	8.5	11.5
	22	8	13	17.5
	28	10	18	23
	34	11	23	29
Vertical 	16	7.5	12.5	16.5
	22	11.5	19	24.5
	28	15.5	25.5	33
	34	16	32.5	41

1. These values are limited by slippage rather than strand strength, with a factor of safety of 4. For other strand diameters, multiply table values by 0.75 for 3/8 in. diameter, 0.85 for 7/16 in. diameter, and 1.1 for 0.6 in. diameter.
2. Minimum $f'_c = 3000$ psi.
3. Multiple strand loops must be fabricated to ensure equal force on each strand.

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LIFTING LOOP DESIGN CALCULATIONS
(WORK W/ CARRARA SHOP DWGS &
ATTACHED SKETCHES)

SOUTH ROAD BRIDGE #14 ABUTMENT FA-AB1 & FA-AB2

$$WT = 34.54^k$$

THERE ARE (2) LIFTING LOOPS AND THE
MINIMUM SLING ANGLE W/ THE HORIZONTAL IS 60°

$$DESIGN LOAD / LIFT LOAD = \frac{34.54 \times 2}{2 \times 0.866} = 39.9^k$$

FROM ATTACHED PCI LITERATURE, IT'S 28

USE (1) 0.600" ϕ X 214 (K) STRANDS / LIFT LOOPS,
MIN EMBED 4'-9", SWL (4:1 S.F.) = $\frac{1.1 \times (29 + 91)}{2}$
= $38.5^k \approx 39.9^k$, O.K. (W/ ACCEPT)

CHECK USING ATTACHED PCI LITERATURE, FIG 6.15.7A

$$\phi^k_{PC1} = \phi \cdot 2.67 \sqrt{f'_c} (x_1)(y_1)$$

$$= \frac{0.85 \times 2.67 \sqrt{3500} (36)(72)}{1000} ; 6' \text{ BETWEEN } 2' \text{ HORIZ.}$$

$$\approx 348^k$$

FOR 4:1 S.F.

$$SWL = \frac{348}{4} = 87^k > 39.9^k, \text{ O.K.}$$

SEE SHEET 6 FOR LIFT LOOP LOCATION

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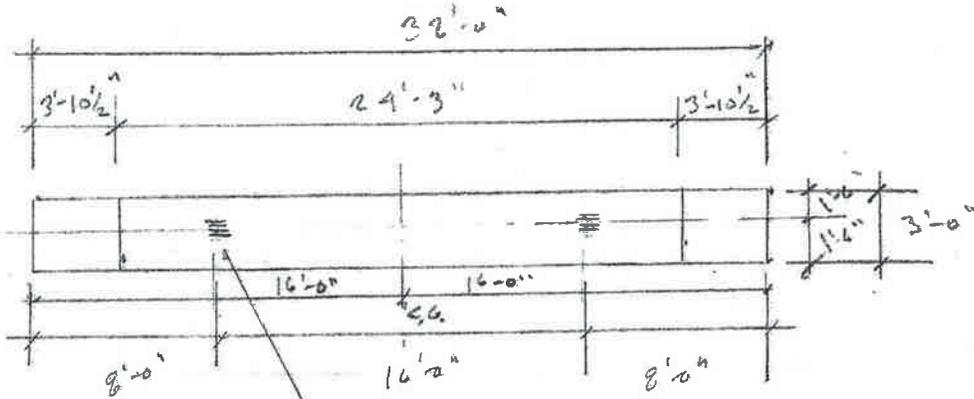
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FA-AB1/AB2 WF 39.54^T

PARTIAL PLAN VIEW



(4) 6.600" ϕ x 270 ksi STRANDS LIFTING LOOP
 MIN EMBED 4'-9", TYP 2 LOC

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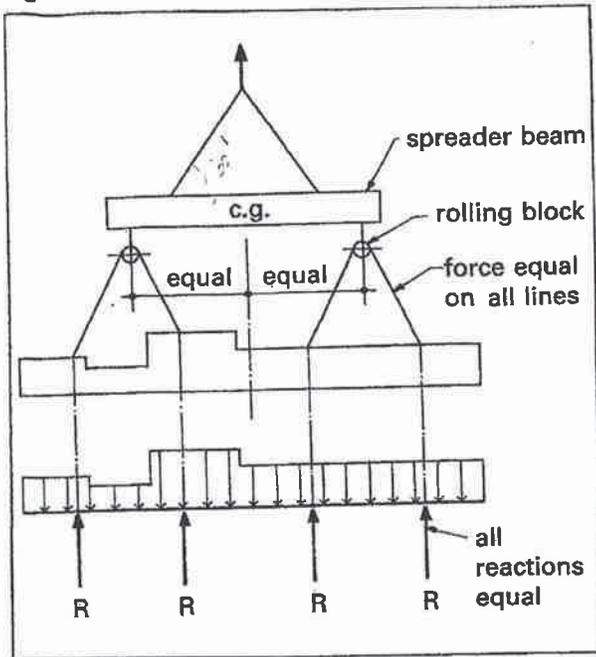
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NOTE: LIFTING LOOP LOCATION MAY BE
 ADJUSTED SLIGHTLY TO FACILITATE
 FABRICATION

Fig. 5.2.10 Arrangement for equalizing lifting loads



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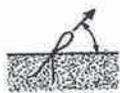
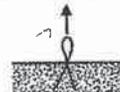
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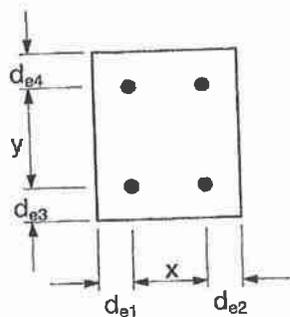
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Figure 6.15.7A (continued) Design tensile strength for $h \geq h_{min}$, ϕP_{c1} —Case 6



x and y are the overall dimensions (width and length) of the stud group.

Case 6: Free edges on four adjacent sides

$$\phi P_{c1} = \phi 2.67 \lambda \sqrt{f'_c} (x_1)(y_1)$$

$$\phi = 0.85$$

where: x_1 and y_1 are the dimensions of the flat bottom of the part of the truncated pyramid.

For Case 6: $x_1 = x + d_{e1} + d_{e2}$ $y_1 = y + d_{e3} + d_{e4}$

Note: Table values are based on $\lambda = 1.0$ and $f'_c = 5000$ psi;

for different material properties, multiply table values by $\lambda \sqrt{f'_c} / 5000$

l_e in.	x_1, y_1 in.	Design tensile strength, ϕP_{c1} (kips)														
		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	1	1	2	3	3	4	5	5	6	7	7	8	9	9	9
	4	1	3	4	5	7	8	9	10	11	13	14	15	17	18	18
	6	2	4	6	8	9	11	13	15	17	19	21	23	25	27	27
	8	3	5	8	10	13	15	18	21	23	25	29	31	33	36	36
	10	3	7	9	13	16	19	23	25	29	32	35	39	42	45	45
	12	4	8	11	15	19	23	27	31	35	39	42	46	50	54	54
	14	5	9	13	18	23	27	31	36	41	45	49	54	59	63	63
16	5	10	15	21	25	31	36	41	46	51	57	61	67	72	72	
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	1	1	2	3	3	4	5	5	6	7	7	8	9	9	9
	4	1	3	4	5	7	8	9	10	11	13	14	15	17	18	18
	6	2	4	6	8	9	11	13	15	17	19	21	23	25	27	27
	8	3	5	8	10	13	15	18	21	23	25	28	31	33	36	36
	10	3	7	9	13	16	19	23	25	29	32	35	39	42	45	45
	12	4	8	11	15	19	23	27	31	35	39	42	46	50	54	54
	14	5	9	13	18	23	27	31	36	41	45	49	54	59	63	63
16	5	10	15	21	25	31	36	41	46	51	57	61	67	72	72	
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	1	1	2	3	3	4	5	5	6	7	7	8	9	9	9
	4	1	3	4	5	7	8	9	10	11	13	14	15	17	18	18
	6	2	4	6	8	9	11	13	15	17	19	21	23	25	27	27
	8	3	5	8	10	13	15	18	21	23	25	28	31	33	36	36
	10	3	7	9	13	16	19	23	25	29	32	35	39	42	45	45
	12	4	8	11	15	19	23	27	31	35	39	42	46	50	54	54
	14	5	9	13	18	23	27	31	36	41	45	49	54	59	63	63
16	5	10	15	21	25	31	36	41	46	51	57	61	67	72	72	
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	1	1	2	3	3	4	5	5	6	7	7	8	9	9	9
	4	1	3	4	5	7	8	9	10	11	13	14	15	17	18	18
	6	2	4	6	8	9	11	13	15	17	19	21	23	25	27	27
	8	3	5	8	10	13	15	18	21	23	25	28	31	33	36	36
	10	3	7	9	13	16	19	23	25	29	32	35	39	42	45	45
	12	4	8	11	15	19	23	27	31	35	39	42	46	50	54	54
	14	5	9	13	18	23	27	31	36	41	45	49	54	59	63	63
16	5	10	15	21	25	31	36	41	46	51	57	61	67	72	72	

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