

# PCC Parking Garage Façade Replacement

## Anchorage, Alaska

Structural Calculations

RM Project 402020.079

January 25, 2021

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### **PCC Garage - Façade**

Wind: 155 psf, exposure B

Suction @ EWA=10sf: 79 psf (LRFD)

Weight of New Façade: 14 psf

Seismic:  $F_p = 0.8 \cdot W = 11.2$  psf << wind suction

#10 tek screw, brick support tray to 16ga hat channel:

ESR-1976

|                 |               |
|-----------------|---------------|
| Vert Spacing =  | 2.625 in      |
| Horiz Spacing = | 16 in         |
| T/screw =       | 14 lbs        |
| V/screw =       | 4 lbs         |
| Tallow =        | 116 lbs       |
| Vallow =        | 289 lbs       |
| %:              | 0.13 <1.0, OK |

3/16" x 1.5" concrete screws, hat channel to concrete:

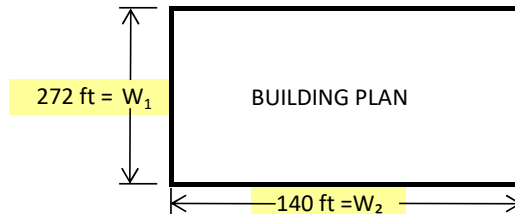
ESR-2202

|                 |               |
|-----------------|---------------|
| Vert Spacing =  | 8 in          |
| Horiz Spacing = | 16 in         |
| T/screw =       | 42 lbs        |
| V/screw =       | 12 lbs        |
| Tallow =        | 252 lbs       |
| Vallow =        | 257 lbs       |
| %:              | 0.22 <1.2, OK |

**ASCE 7-16 Wind Analysis for Enclosed or Partially Enclosed Buildings**

Wind speed for the applicable wind category,  $V = 155$  mph (3-sec gust, Fig 26.5-1A)  
Wind Directionality Factor,  $K_d = 0.85$  (Table 26.6-1)  
Exposure: **B** (Art. 26.7.3)  
Mean Roof Height,  $h = 55$  ft (Spreadsheet maxes out at 110 ft)  
Top of Parapet Height (from ground),  $h_p = 55$  ft  
Enclosure: **Partially Enclosed** (Art. 26.2)  
Roof Slope,  $\theta = 0.0^\circ$

FYI Slope Converter:  $12$   
 $0.0^\circ = 0$  



Roof Type:  
**Flat or Gable**

**Main Wind Force Resisting System - Part 1 (Art. 27.2 - 27.4):**

Exposure Coefficient,  $K_z = 2.01(z/z_g)^{2/\alpha} = 0.83$  (Table 27.3-1)  $z = 55$  ft  $\alpha = 7$   
 $z_g = 1200$  (Table 26.9-1)  
 $q_z = 0.00256 K_z K_{zt} K_d V^2 = 43.6$  psf (Eq. 27.3-1)  
Gust Factor,  $G = 0.85$  (Art. 26.9.1)  
Internal Pressure Factor,  $GC_{pi} = \pm 0.55$  (Table 26.11-1)

**Components and Cladding - Part 1 (Art. 30.4) & Part 3 (Art. 30.6):**

$GC_p$  Values from

**Figure 30.4-2A**

| Zone | 10 SF |       | 20 SF |       | 50 SF |       | 100 SF |       | Exact Solution |       |
|------|-------|-------|-------|-------|-------|-------|--------|-------|----------------|-------|
| 1    | 0.30  | -1.00 | 0.27  | -0.97 | 0.23  | -0.93 | 0.20   | -0.90 | 0.27           | -0.97 |
| 2    | 0.30  | -1.80 | 0.27  | -1.59 | 0.23  | -1.31 | 0.20   | -1.10 | 0.27           | -1.59 |
| 2A   | N/A   | -1.70 | N/A   | -1.67 | N/A   | -1.63 | N/A    | -1.60 | N/A            | -1.67 |
| 3    | 0.30  | -2.80 | 0.27  | -2.29 | 0.23  | -1.61 | 0.20   | -1.10 | 0.27           | -2.29 |
| 3A   | N/A   | -2.80 | N/A   | -2.29 | N/A   | -1.61 | N/A    | -0.80 | N/A            | -2.20 |
| 4    | 0.90  | -0.99 | 0.85  | -0.94 | 0.79  | -0.88 | 0.74   | -0.83 | 0.85           | -0.94 |
| 5    | 0.90  | -1.26 | 0.85  | -1.16 | 0.79  | -1.04 | 0.74   | -0.94 | 0.85           | -1.16 |

$GC_{pi} = \pm 0.55$   $q_h = 43.6$  psf

Roof Type: Flat or Gable

for buildings with:

$$h \leq 60' : p = q_h [(GC_p) - (GC_{pi})] \quad (\text{Eq. 30.4-1})$$

$$h > 60' : p = q(GC_p) - q_i(GC_{pi}) \quad (\text{Eq. 30.6-1})$$

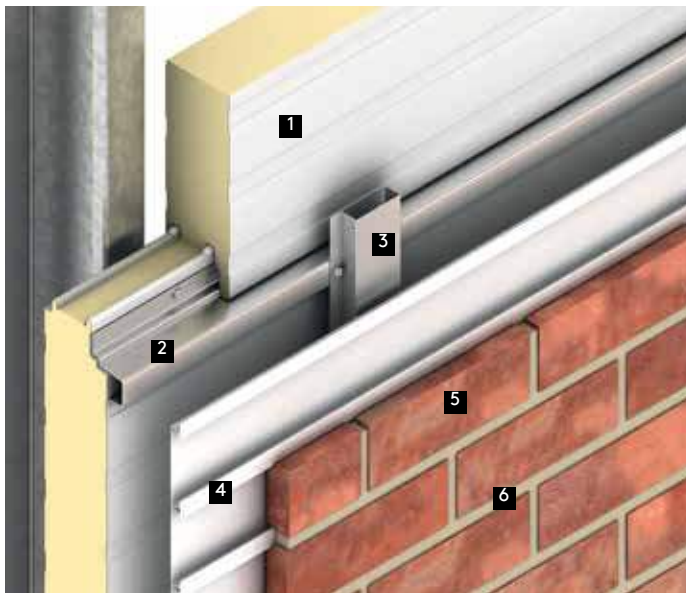
$$a = 14.0 \text{ ft} \quad (H < 60', \text{ FIG 30.5-1})$$

Notes:  $q_i = q_h$  for all cases herein  
(+) pressures are always toward surface

| Components and Cladding Wind Load Chart |        |             |                |            |                |            |                |           |                 |           |
|-----------------------------------------|--------|-------------|----------------|------------|----------------|------------|----------------|-----------|-----------------|-----------|
| Zone                                    |        |             | 10 SQUARE FEET |            | 20 SQUARE FEET |            | 50 SQUARE FEET |           | 100 SQUARE FEET |           |
| ROOF                                    | Int.   | 1           | 37.0 psf       | -67.5 psf  | 35.8 psf       | -66.2 psf  | 34.1 psf       | -64.5 psf | 32.7 psf        | -63.1 psf |
|                                         | Edge   | 2           | 37.0 psf       | -102.3 psf | 35.8 psf       | -93.2 psf  | 34.1 psf       | -81.0 psf | 32.7 psf        | -71.9 psf |
|                                         | E OH   | 2A          | N/A            | -98.0 psf  | N/A            | -96.7 psf  | N/A            | -94.9 psf | N/A             | -93.6 psf |
|                                         | Corner | 3           | 37.0 psf       | -145.9 psf | 35.8 psf       | -123.6 psf | 34.1 psf       | -94.2 psf | 32.7 psf        | -71.9 psf |
|                                         | C OH   | 3A          | N/A            | -145.9 psf | N/A            | -123.6 psf | N/A            | -94.2 psf | N/A             | -58.8 psf |
| WALL                                    | Int.   | 4           | 63.1 psf       | -67.1 psf  | 61.1 psf       | -65.0 psf  | 58.3 psf       | -62.2 psf | 56.2 psf        | -60.1 psf |
|                                         | Edge   | 5           | 63.1 psf       | -78.8 psf  | 61.1 psf       | -74.7 psf  | 58.3 psf       | -69.1 psf | 56.2 psf        | -65.0 psf |
| PARAPET                                 | Int.   | $p_1 + p_2$ | 118 psf        | 82 psf     | 106 psf        | 78 psf     | 105 psf        | 73 psf    | 80 psf          | 68 psf    |
|                                         | Edge   | $p_3 + p_4$ | 161 psf        | 94 psf     | 137 psf        | 88 psf     | 105 psf        | 80 psf    | 80 psf          | 73 psf    |

(Figs. 30.5-1, 30.6-1 & 30.9-1)

\*overhangs pressures from figures 30.4-2A thru C, if these tables do not apply formula is roof uplift + wall per figure 30.10-1



- 1 BENCHMARK By Kingspan Insulated Metal Panel (Barrier Wall)
- 2 BENCHMARK By Kingspan KarrierRail
- 3 Subgirt Secondary Rail
- 4 Thin Brick Rail
- 5 Thin Brick
- 6 Thin Brick Mortar



## Color Palette

BENCHMARK By Kingspan offers a multitude of options for the Thin Brick system:

**Extruded bricks** are a commercial style brick, uniform in size, available in a wide range of colors and textures, ranging from wire cut to tile like smooth.

**Molded texture bricks** are machine-molded and feature a traditional molded texture.

**Antique texture bricks** are also machine-molded, but have a more distinctive, weathered appearance.

**Handmade texture bricks** are hand-molded with a very distinctive texture and possess a rustic look.

We provide a wide array of colored bricks. In addition we offer a variety of standard mortar options as well as custom color matching for truly unique buildings.

### Thin Brick Mortar Choices



NOTE: The above colors are not a comprehensive list of the available colors and textures. To see the full color offering please reach out to your BENCHMARK By Kingspan representative.

### F - Member (Furring or Hat Channel)

#### DESCRIPTION

**Hat Channel's** are fabricated in 1/2", 7/8", 1-1/2" depth, from 25 gauge to 14 gauge steel. The Web size is 1-1/4". Length - 12'-0" and 20'-0". Special lengths are available.

#### MATERIALS

**Hat Channel** section is fabricated from **25TI to 14 gauge** hot-dipped galvanized steel.

#### COLOR CODE

| Traditional     | Elite                           |
|-----------------|---------------------------------|
| 18 mil - Clear  | 25TI Gauge — Clear/White Stripe |
| 24 mil - Brown  | 20TI Gauge — Clear/Red Stripe   |
| 27 mil - Black  | 30ED Gauge — Red and Blue       |
| 30 mil - Pink   | 33ES Gauge — Purple             |
| 33 mil - White  | 43ES Gauge — Brown              |
| 43 mil - Yellow | 54ES Gauge — Light Blue         |
| 54 mil - Green  |                                 |
| 68 mil - Orange |                                 |

#### ASTM & CODE STANDARDS

- IBC 2009/2012
  - AISI NASPEC 2007
  - Meets or exceeds:
    - ASTM C955 & ASTM C645
    - ASTM E119 & E90
    - ASTM A370
    - ASTM A1003
    - ASTM C1513 & A754
- Please reference Steeler ICC-ES Report ESR-2054 for further information. Available for download at [www.steeler.com/technicalinfo.php](http://www.steeler.com/technicalinfo.php)

#### MANUFACTURER CONTACT INFORMATION

**Seattle Plant** | 10023 MLK Jr. Way S. Seattle, WA 98178 | P: 206-725-2500

**Newark Plant** | 6851 Smith Ave. Newark, CA 94560 | P: 510-505-9574

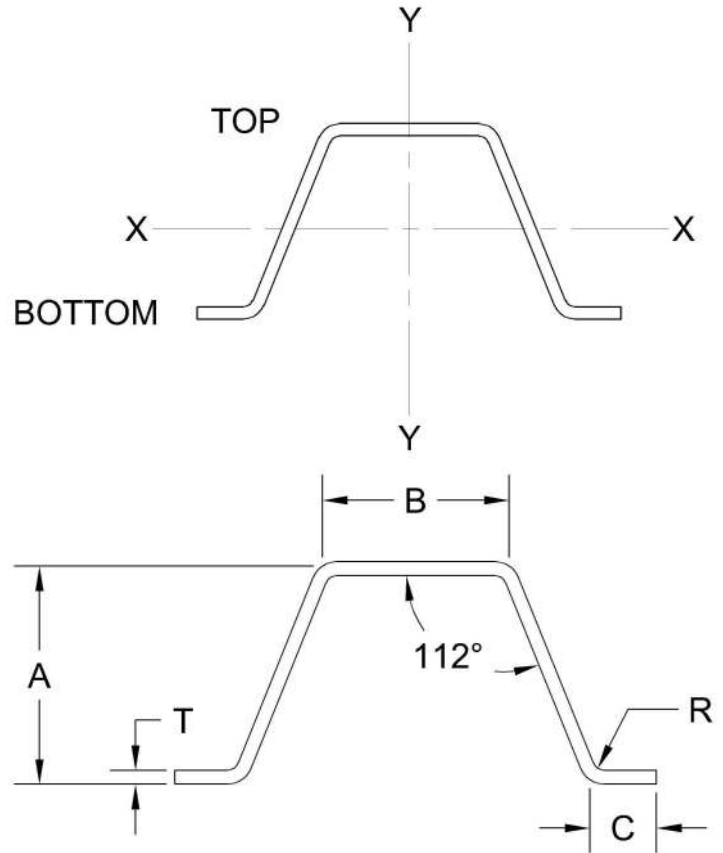


Table 1-F-Member (Furring or Hat Channel) Section Properties; Traditional Thickness Members

| Member ID<br>Designation | Dimensions in |      |      | Full Properties         |              |                                   |                      |                                   |                      |                                       | Torsional                         |                      |               | 33 ksi Effective Properties |                                        |                                        |                                        |               | 50 ksi Effective Properties |                                        |                                        |                                        |  |
|--------------------------|---------------|------|------|-------------------------|--------------|-----------------------------------|----------------------|-----------------------------------|----------------------|---------------------------------------|-----------------------------------|----------------------|---------------|-----------------------------|----------------------------------------|----------------------------------------|----------------------------------------|---------------|-----------------------------|----------------------------------------|----------------------------------------|----------------------------------------|--|
|                          | A             | B    | C    | Area<br>in <sup>2</sup> | Wt.<br>lb/ft | I <sub>x</sub><br>in <sup>4</sup> | r <sub>x</sub><br>in | I <sub>y</sub><br>in <sup>4</sup> | r <sub>y</sub><br>in | J<br>10 <sup>-3</sup> in <sup>4</sup> | C <sub>w</sub><br>in <sup>6</sup> | r <sub>o</sub><br>in | Ma(+)<br>k-in | Ma(-)<br>in <sup>4</sup>    | I <sub>xe</sub> (+)<br>in <sup>4</sup> | S <sub>xe</sub> (t)<br>in <sup>3</sup> | S <sub>xe</sub> (b)<br>in <sup>3</sup> | Ma(+)<br>k-in | Ma(-)<br>in <sup>4</sup>    | I <sub>xe</sub> (+)<br>in <sup>4</sup> | S <sub>xe</sub> (t)<br>in <sup>3</sup> | S <sub>xe</sub> (b)<br>in <sup>3</sup> |  |
| 125 F050-030             | 0.50          | 1.25 | 0.45 | 0.095                   | 0.324        | 0.004                             | 0.205                | 0.049                             | 0.717                | 0.031                                 | 0.000                             | 0.833                | 0.314         | 0.314                       | 0.004                                  | 0.018                                  | 0.014                                  |               |                             |                                        |                                        |                                        |  |
| 125 F050-033             | 0.50          | 1.25 | 0.45 | 0.105                   | 0.358        | 0.004                             | 0.204                | 0.054                             | 0.715                | 0.042                                 | 0.504                             | 0.830                | 0.346         | 0.346                       | 0.004                                  | 0.020                                  | 0.016                                  |               |                             |                                        |                                        |                                        |  |
| 125 F050-043             | 0.50          | 1.25 | 0.45 | 0.136                   | 0.461        | 0.005                             | 0.199                | 0.068                             | 0.708                | 0.092                                 | 0.001                             | 0.820                | 0.437         | 0.437                       | 0.005                                  | 0.024                                  | 0.020                                  |               |                             |                                        |                                        |                                        |  |
| 125 F050-054             | 0.50          | 1.25 | 0.45 | 0.167                   | 0.569        | 0.006                             | 0.195                | 0.082                             | 0.701                | 0.178                                 | 0.001                             | 0.808                | 0.526         | 0.526                       | 0.006                                  | 0.028                                  | 0.023                                  | 0.782         | 0.782                       | 0.006                                  | 0.028                                  | 0.023                                  |  |
| 125 F087-018             | 0.875         | 1.25 | 0.45 | 0.074                   | 0.250        | 0.009                             | 0.352                | 0.048                             | 0.809                | 0.009                                 | 0.001                             | 1.114                | 0.367         | 0.325                       | 0.008                                  | 0.020                                  | 0.016                                  |               |                             |                                        |                                        |                                        |  |
| 125 F087-027             | 0.875         | 1.25 | 0.45 | 0.110                   | 0.373        | 0.013                             | 0.348                | 0.071                             | 0.803                | 0.029                                 | 0.002                             | 1.104                | 0.604         | 0.545                       | 0.013                                  | 0.033                                  | 0.028                                  |               |                             |                                        |                                        |                                        |  |
| 125 F087-030             | 0.875         | 1.25 | 0.45 | 0.121                   | 0.410        | 0.015                             | 0.347                | 0.077                             | 0.801                | 0.039                                 | 0.002                             | 1.101                | 0.664         | 0.664                       | 0.015                                  | 0.036                                  | 0.031                                  |               |                             |                                        |                                        |                                        |  |
| 125 F087-033             | 0.875         | 1.25 | 0.45 | 0.133                   | 0.454        | 0.016                             | 0.346                | 0.085                             | 0.799                | 0.053                                 | 0.002                             | 1.097                | 0.734         | 0.734                       | 0.016                                  | 0.040                                  | 0.034                                  |               |                             |                                        |                                        |                                        |  |
| 125 F087-043             | 0.875         | 1.25 | 0.45 | 0.172                   | 0.586        | 0.020                             | 0.342                | 0.108                             | 0.793                | 0.117                                 | 0.002                             | 1.086                | 0.946         | 0.946                       | 0.020                                  | 0.050                                  | 0.042                                  |               |                             |                                        |                                        |                                        |  |
| 125 F087-054             | 0.875         | 1.25 | 0.45 | 0.213                   | 0.725        | 0.024                             | 0.337                | 0.132                             | 0.786                | 0.228                                 | 0.003                             | 1.074                | 1.168         | 1.168                       | 0.024                                  | 0.061                                  | 0.051                                  | 1.736         | 1.736                       | 0.024                                  | 0.061                                  | 0.051                                  |  |
| 125 F087-068             | 0.875         | 1.25 | 0.45 | 0.263                   | 0.896        | 0.029                             | 0.331                | 0.159                             | 0.777                | 0.446                                 | 0.003                             | 1.057                | 1.435         | 1.435                       | 0.029                                  | 0.072                                  | 0.061                                  | 2.125         | 2.125                       | 0.029                                  | 0.072                                  | 0.061                                  |  |
| 125 F150-027             | 1.50          | 1.25 | 0.45 | 0.148                   | 0.503        | 0.047                             | 0.565                | 0.132                             | 0.944                | 0.039                                 | 0.005                             | 1.587                | 1.276         | 1.154                       | 0.047                                  | 0.067                                  | 0.058                                  |               |                             |                                        |                                        |                                        |  |
| 125 F150-030             | 1.50          | 1.25 | 0.45 | 0.163                   | 0.553        | 0.052                             | 0.564                | 0.144                             | 0.942                | 0.053                                 | 0.006                             | 1.584                | 1.408         | 1.408                       | 0.052                                  | 0.074                                  | 0.065                                  |               |                             |                                        |                                        |                                        |  |
| 125 F150-033             | 1.50          | 1.25 | 0.45 | 0.180                   | 0.612        | 0.057                             | 0.563                | 0.159                             | 0.940                | 0.072                                 | 0.007                             | 1.580                | 1.563         | 1.563                       | 0.057                                  | 0.081                                  | 0.071                                  |               |                             |                                        |                                        |                                        |  |
| 125 F150-043             | 1.50          | 1.25 | 0.45 | 0.233                   | 0.792        | 0.073                             | 0.559                | 0.203                             | 0.934                | 0.158                                 | 0.008                             | 1.569                | 2.036         | 2.036                       | 0.073                                  | 0.104                                  | 0.091                                  |               |                             |                                        |                                        |                                        |  |
| 125 F150-054             | 1.50          | 1.25 | 0.45 | 0.289                   | 0.984        | 0.089                             | 0.554                | 0.249                             | 0.927                | 0.309                                 | 0.010                             | 1.556                | 2.550         | 2.550                       | 0.089                                  | 0.127                                  | 0.111                                  | 3.789         | 3.789                       | 0.089                                  | 0.127                                  | 0.111                                  |  |
| 125 F150-068             | 1.50          | 1.25 | 0.45 | 0.360                   | 1.223        | 0.108                             | 0.547                | 0.303                             | 0.918                | 0.609                                 | 0.011                             | 1.540                | 3.193         | 3.193                       | 0.108                                  | 0.154                                  | 0.135                                  | 4.727         | 4.727                       | 0.108                                  | 0.154                                  | 0.135                                  |  |

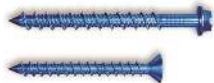
For SI: 1 inch = 25.4 mm, 1 in<sup>2</sup> = 645 mm<sup>2</sup>, 1 in<sup>3</sup> = 1.64x10<sup>4</sup> mm<sup>3</sup>, 1 in<sup>4</sup> = 4.16x10<sup>5</sup> mm<sup>4</sup>, 1 in<sup>6</sup> = 2.69x10<sup>8</sup> mm<sup>6</sup>, 1 kip-in = 113.3 N-m, 1 lb/ft = 14.6 N/m, 1 kip = 4.4 kN

## CALCULATION SHEET FOR RED HEAD ANCHORS

|                              |                             |
|------------------------------|-----------------------------|
| Company : Reid Middleton     | Phone number : 907-562-3439 |
| Carried out by : D Stierwalt | Mail address :              |
| Company : Project name :     |                             |
| Contact name :               | Location :                  |
| Phone number :               | Fastening point :           |
| Mail address :               |                             |
| Comment :                    |                             |

### Recommended anchors

#### Tapcon Anchors Carbon Steel with Blue Climaseal 3/16



Effective embedment : 1.5 in

ESR 2202 issued 2019/12/01 / 2021/10/01

### Base material

Concrete Strength 4000 psi  
 Concrete condition: Uncracked  
 Thickness of concrete : 12 in  
 Tension load conditions: Condition A Tension  
 Shear load conditions: Condition A Shear  
 Edge reinforcement : None or < no. 4 bar  
 Longitudinal reinforcement should be provided along the edge of the member

### Anchor plate

Thickness of part to be fixed : 0.1 in  
 Recommended plate thickness : The base plate thickness has not been checked  
 Clearance diameter : 0.2 in  
 Profile :  
 Profile position : Ex = 0 in ; Ey = 0 in  
 Stand-off : None

### Conditions

Installation conditions : Dry concrete  
 Hole drilling method: Hammer drilling  
 Short term temperature : 130 °F  
 Long term temperature : 110 °F

**Design method :** ACI 318-14 Design for static, quasi-static loading

### Design Actions :

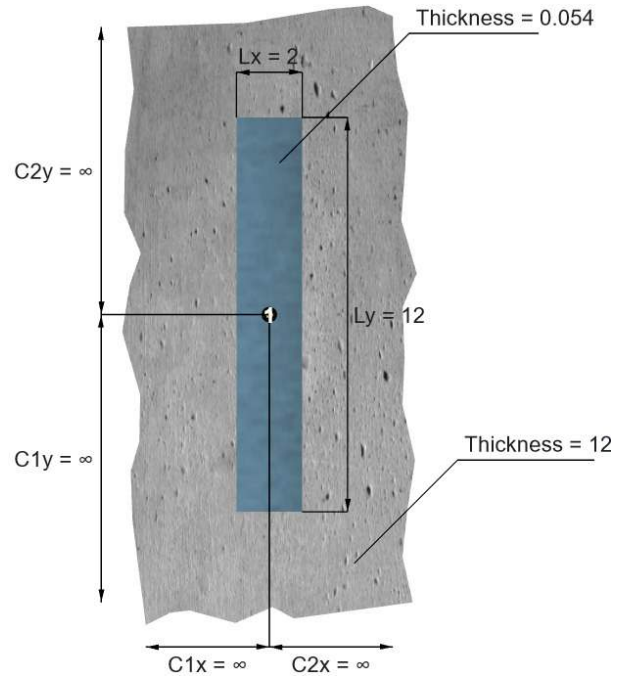
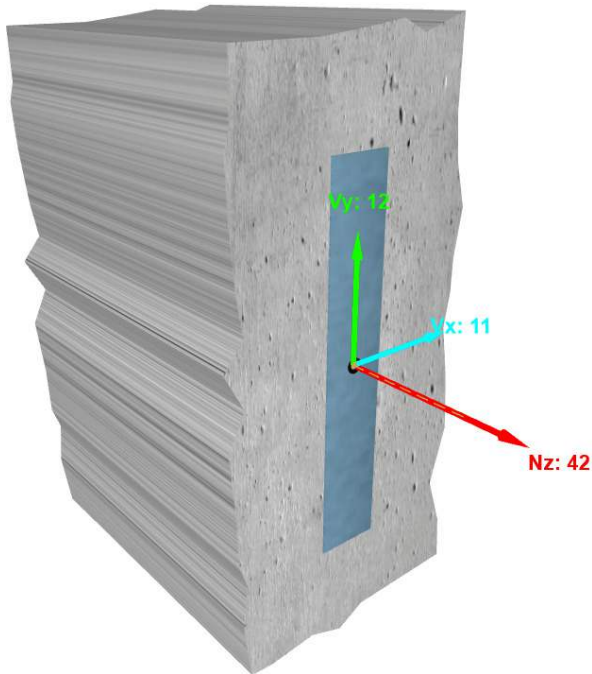
| Action [lbf] / [lbf ft] | Action type | Nuz | Vux | Vuy | Muz | Mux | Muy |
|-------------------------|-------------|-----|-----|-----|-----|-----|-----|
| Combination 3           | Static      | 42  | 11  | 12  | 0   | 0   | 0   |

### Specifications :

Static

Sustained Load : False

### Geometry :



### Calculation Hypothesis :

The anchoring plate is assumed to be sufficient to resist deformation imposed by the load actions.

REDHEAD can only be held responsible if the calculation examples exactly reflect the application and if the installation is carried out according to the instruction given in the REDHEAD specifications. The calculation is correct for REDHEAD anchors only. The contractor or specifier should make sure that the base material is able to support the loads especially in the case of a group of anchors. REDHEAD cannot be held responsible if this software package is modified without its written approval.

## Resulting anchors forces

### Loads on anchors

| Anchor | Tensile | Shear[x] | Shear[y] |
|--------|---------|----------|----------|
| 1      | 42 lbf  | 11 lbf   | 12 lbf   |

| $N^g$ [lbf] | $N^h$ [lbf] | $e_{Nx}$ [in] | $e_{Ny}$ [in] |
|-------------|-------------|---------------|---------------|
| 42          | 42          | 0             | 0             |
| $V^h$ [lbf] | $V^h$ [lbf] |               |               |
| 16          | 16          |               |               |

### Utilization

| Tension load               | Tension force $N_{ua}$ [lbf] | Capacity $\Phi N_n$ [lbf] | $\beta_N = N_{ua} / \Phi N_n$ [%] |
|----------------------------|------------------------------|---------------------------|-----------------------------------|
| Pull out strength          | 42                           | 420                       | 10.0                              |
| Concrete breakout strength | 42                           | 1812                      | 2.3                               |
| Steel strength             | 42                           | 1316                      | 3.2                               |

| Shear load                 | Shear force $V_{ua}$ [lbf] | Capacity $\Phi V_n$ [lbf] | $\beta_V = V_{ua} / \Phi V_n$ [%] |
|----------------------------|----------------------------|---------------------------|-----------------------------------|
| Concrete Breakout Strength | /                          | /                         | /                                 |
| Pryout strength            | 16                         | 1691                      | 0.96                              |
| Steel strength             | 16                         | 429                       | 3.79                              |

### Combined tension and shear loads

$$\beta_{Nc}^{5/3} + \beta_{Vc}^{5/3} = [0.1]^{5/3} + [0.04]^{5/3} = 0.03 \leq 1$$

## CALCULATION DETAILS

### Tension load - Pull out Strength

$$\Phi N_{pn,fc} \geq N_{ua} \quad [\text{ACI 318 - 14 Table.17.3.1.1}]$$

$$N_{pn,fc} = N_{p,2500} \cdot \lambda_a \cdot \sqrt{\frac{f_c}{2500}} \quad [\text{ESR approval}]$$

|                   |   |         |              |   |          |
|-------------------|---|---------|--------------|---|----------|
| $\Phi N_{pn,fc}$  | = | 420 lbf | $N_{p,2500}$ | = | 590 lbf  |
| $N_{pn,fc}$       | = | 646 lbf | $f_c$        | = | 3000 psi |
| $\Phi_{concrete}$ | = | 0.75    | $\lambda_a$  | = | 1        |

### Tension load - Concrete breakout Strength

$$\Phi N_{cbg} \geq N_{ua} \quad [\text{ACI 318 - 14 Table.17.3.1.1}]$$

$$N_{cbg} = N_b \cdot \frac{A_{Nc}}{A_{Nc0}} \cdot \psi_{ec,N} \cdot \psi_{ed,N} \cdot \psi_{c,N} \cdot \psi_{cp,N} \quad [\text{ACI 318 - 14 Eq.(17.4.2.1b)}]$$

$$N_b = k_c \cdot \lambda_a \cdot \sqrt{f_c} \cdot h_{ef}^{1.5} \quad [\text{ACI 318 - 14 Eq.(17.4.2.2a)}]$$

$$A_{Nc} \quad [\text{ACI 318 - 14 Section 17.4.2.1 - Fig. R17.4.2.1(b)}]$$

$$A_{Nc0} = 9 \cdot h_{ef}^2 \quad [\text{ACI 318 - 14 Eq.(17.4.2.1c)}]$$

$$\psi_{ed,N} = 0.7 + 0.3 \cdot \frac{c_{a,min}}{1.5 \cdot h_{ef}} \leq 1 \quad [\text{ACI 318 - 14 Eq.(17.4.2.5b)}]$$

$$\psi_{cp,N} = \max\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 \cdot h_{ef}}{c_{ac}}\right) \leq 1 \quad [\text{ACI 318 - 14 Eq.(17.4.2.7b)}]$$

$$\psi_{ec,N} = \frac{1}{1 + (2 \cdot e_N / 3 \cdot h_{ef})} \leq 1 \quad [\text{ACI 318 - 14 Eq.(17.4.2.4)}]$$

|                   |   |          |                  |   |                    |              |   |          |
|-------------------|---|----------|------------------|---|--------------------|--------------|---|----------|
| $\Phi N_{cbg}$    | = | 1812 lbf | $N_b$            | = | 2416 lbf           | $k_c$        | = | 24       |
| $N_{cbg}$         | = | 2416 lbf | $A_{Nc}/A_{Nc0}$ | = | 1.03               | $f_c$        | = | 3000 psi |
| $\Phi_{concrete}$ | = | 0.75     | $A_{Nc}$         | = | 21 in <sup>2</sup> | $\lambda_a$  | = | 1        |
|                   |   |          | $A_{Nc0}$        | = | 20 in <sup>2</sup> | $\psi_{c,N}$ | = | 1.00     |
|                   |   |          | $\psi_{ec,Nx}$   | = | 1.00               | $h_{ef}$     | = | 1.5 in   |
|                   |   |          | $\psi_{ec,Ny}$   | = | 1.00               | $c_{ac}$     | = | 4 in     |
|                   |   |          | $\psi_{ed,N}$    | = | 1.00               | $e_{Nx}$     | = | 0 in     |
|                   |   |          | $\psi_{cp,N}$    | = | 1.00               | $e_{Ny}$     | = | 0 in     |

### Tension load - Steel Strength

$$\Phi N_{sa} \geq N_{ua} \quad [\text{ACI 318 - 14 Table.17.3.1.1}]$$

$$N_{sa} \quad [\text{ESR approval}]$$

|                |   |          |
|----------------|---|----------|
| $\Phi N_{sa}$  | = | 1316 lbf |
| $N_{sa}$       | = | 2025 lbf |
| $\Phi_{steel}$ | = | 0.65     |

### Shear load - Concrete Breakout Strength

Failure mode is not applicable

### Shear load - Pryout Strength

|                                                                                                                                                 |                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| $\Phi V_{cbg} \geq V_{ua}$                                                                                                                      | [ACI 318 - 14 Table.17.3.1.1]                       |
| $V_{cbg} = k_{cp} \cdot \left( N_b \cdot \frac{A_{Nc}}{A_{Nc0}} \cdot \Psi_{ec,N} \cdot \Psi_{ed,N} \cdot \Psi_{c,N} \cdot \Psi_{cp,N} \right)$ | [ACI 318 - 14 - Eq. (17.5.3.1b)]                    |
| $N_b = k_c \cdot \lambda_a \cdot \sqrt{f'_c} \cdot h_{ef}^{1.5}$                                                                                | [ACI 318 - 14 - Eq. (17.4.2.2a)]                    |
| $A_{Nc}$                                                                                                                                        | [ACI 318 - 14 Section 17.4.2.1 - Fig. R17.4.2.1(b)] |
| $A_{Nc0} = 9 \cdot h_{ef}^2$                                                                                                                    | [ACI 318 - 14 - Eq. (17.4.2.1c)]                    |
| $\Psi_{ed,N} = 0.7 + 0.3 \cdot \frac{C_{a,min}}{1.5 \cdot h_{ef}} \leq 1$                                                                       | [ACI 318 - 14 - Eq. (17.4.2.5b)]                    |
| $\Psi_{cp,N} = \max \left( \frac{C_{a,min}}{C_{ac}}, \frac{1.5 \cdot h_{ef}}{C_{ac}} \right) \leq 1$                                            | [ACI 318 - 14 - Eq. (17.4.2.7b)]                    |
| $\Psi_{ec,N} = \frac{1}{1 + (2 \cdot e_N / 3 \cdot h_{ef})} \leq 1$                                                                             | [ACI 318 - 14 - Eq. (17.4.2.4)]                     |

|                                   |                             |                           |
|-----------------------------------|-----------------------------|---------------------------|
| $\Phi V_{cpg} = 1691 \text{ lbf}$ | $K_{cp} = 1$                | $k_c = 24$                |
| $V_{cpg} = 2416 \text{ lbf}$      | $N_{br} = 2416 \text{ lbf}$ | $f'_c = 3000 \text{ psi}$ |
| $\Phi_{concrete} = 0.75$          | $A_{Nc}/A_{Nc0} = 1.03$     | $\lambda_a = 1$           |
|                                   | $A_{Nc} = 21 \text{ in}^2$  | $\Psi_{c,N} = 1.00$       |
|                                   | $A_{Nc0} = 20 \text{ in}^2$ | $h_{ef} = 1.5 \text{ in}$ |
|                                   | $\Psi_{ec,Nx} = 1.00$       | $C_{ac} = 4 \text{ in}$   |
|                                   | $\Psi_{ec,Ny} = 1.00$       | $C_{a,min} = \infty$      |
|                                   | $\Psi_{ed,N} = 1.00$        | $e_{Nx} = 0 \text{ in}$   |
|                                   | $\Psi_{cp,N} = 1.00$        | $e_{Ny} = 0 \text{ in}$   |

### Shear load - Steel Strength

|                                 |                               |
|---------------------------------|-------------------------------|
| $\Phi V_{sa} \geq V_{ua}$       | [ACI 318 - 14 Table.17.3.1.1] |
| $V_{sa}$                        | [ESR approval]                |
| $\Phi V_{sa} = 429 \text{ lbf}$ |                               |
| $V_{sa} = 715 \text{ lbf}$      |                               |
| $\Phi_{steel} = 0.60$           |                               |

## INSTALLATION DATA

### Tapcon Anchors Carbon Steel with Blue Climaseal 3/16

Effective embedment : 1.5 in



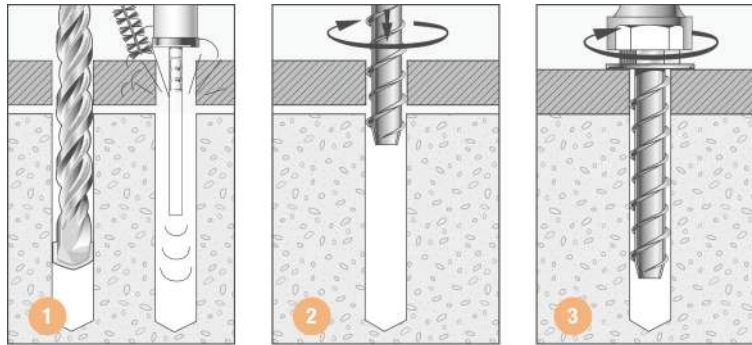
ESR 2202 issued 2019/12/01 / 2021/10/01

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|                                      |         |
|--------------------------------------|---------|
| Effective embedment :                | 1.5 in  |
| Minimum thickness of base material : | 4 in    |
| Hole diameter in the base material : | 0.2 in  |
| Min. hole depth in base material     | 2.25 in |
| Design installation torque           | \       |
| Max. base plate thickness            | 0.1 in  |
| Profile family (section type) :      |         |
| Clearance diameter :                 | 0.2 in  |

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## INSTALLATION Method



1. Drill hole to correct diameter and depth. Clean thoroughly with brush. Remove debris by way of vacuum or hand pump, compressed air etc.
2. Using a socket wrench, screw the Tapcon® into the hole using slight pressure until the self tapping action starts.
3. Tighten the Tapcon® until flush with fixture. If resistance is experienced when tightening, unscrew anchor one turn and re-tighten. Ensure not to over tighten.