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| Phone Fax: | | E-Mail: | |
| Design: | Rebar - Mar 4, 2024 | Date: | 21.03.2024 |
| Rebar application: | | | |

Specifier's comments:

1. Input data

General

| | |
|-------------------------------|----------------------|
| Design standard | ACI 318 |
| Calculation method | ACI 318-19 |
| Post installed rebar approach | Joints + Development |
| Loading type | Static |



Product

| | |
|----------------------------|---|
| Mortar | HIT-RE 500 V3 |
| Connector | Rebar #6 |
| Item number | 2123401 HIT-RE 500 V3 (adhesive) |
| Effective embedment depth | Existing concrete: $h_{ef,ex} = 17.076$ in. |
| Material | ASTM A615 Grade 60 |
| Evaluation Service Report | ESR-3814 |
| Issued | 01.01.2023 |
| Valid | 01.01.2025 |
| Proof | Design method ACI 318-19 |
| Epoxy coated reinforcement | no |
| Additional offset distance | 0.000 in |

Material

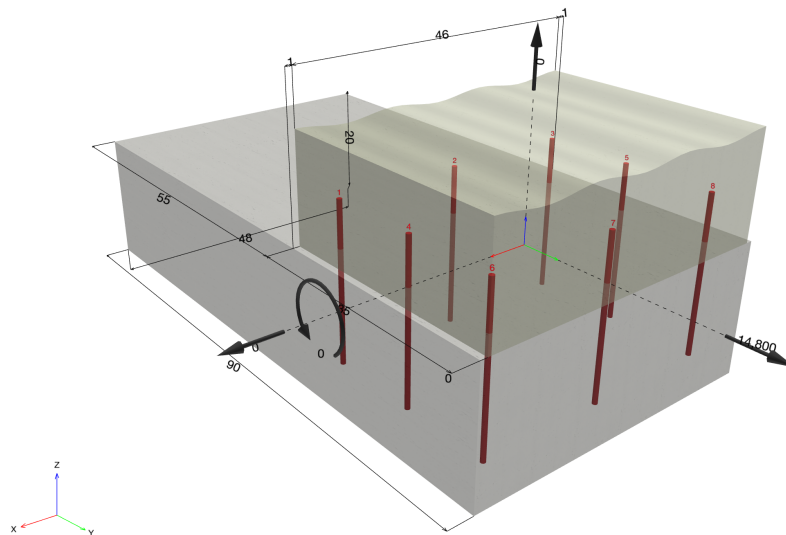
| | |
|---------------------------|---|
| Concrete material | Cracked concrete, 4000, $f_c' = 4,000$ psi; |
| Surface contact condition | Option (c) |
| Reinforcement | tension: not present |
| Steel strain limit | 0.02 |

Installation and temperature

| | |
|--------------|---|
| Temperature | During service: 32 °F / 32 °F (short / long term) |
| Installation | Hammer Drilling, Installation Condition: Dry Concrete |

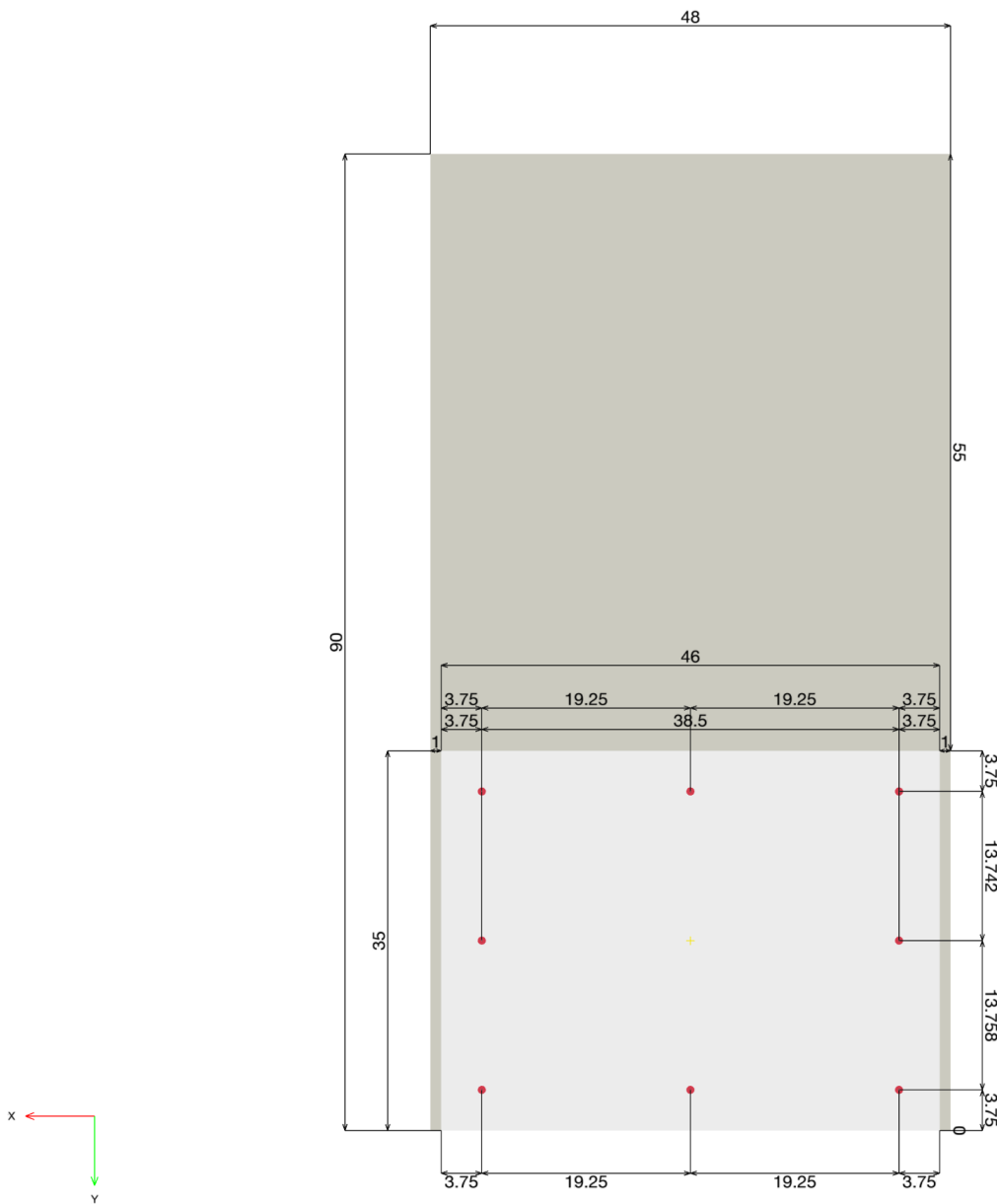
1.1. Geometry & Loading

Geometrical dimensions in [in]. Loading values in [lb, in-lb]



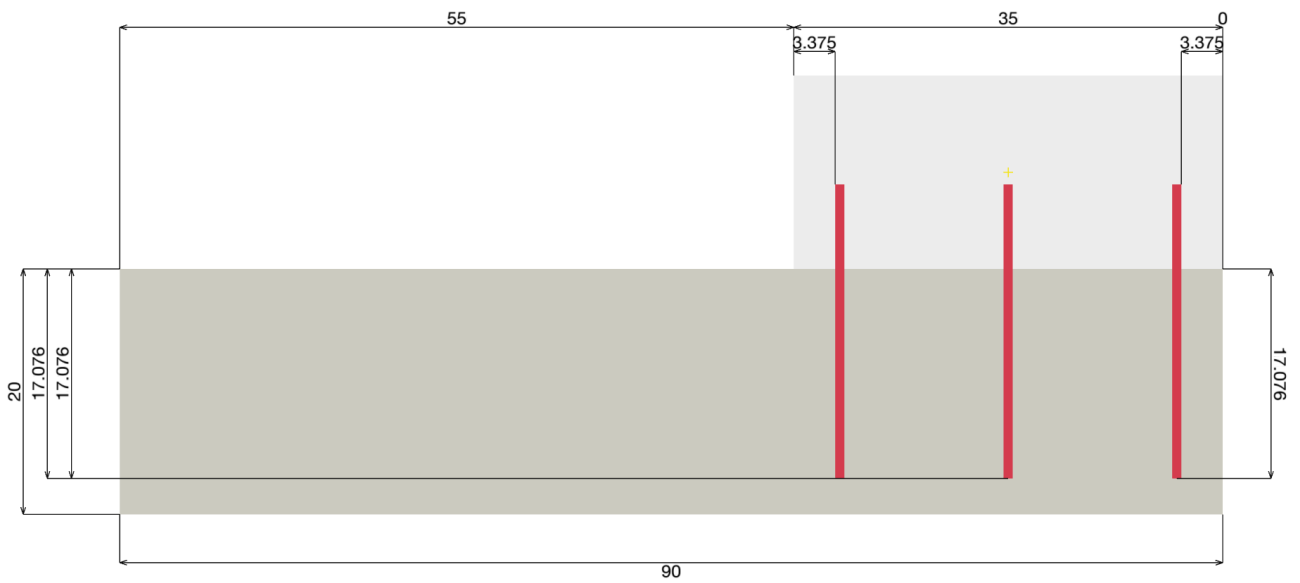


1.2. Cross section view





1.3. Side section view





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2. Loads and Cross section analysis

2.1. Load combinations

| Case | Description | Forces [lb] / Moments [in-lb] | Load type | Max. Utilization [%] | Development length [in] |
|------|---------------|---|-----------|----------------------|-------------------------|
| 1 | Combination 1 | $N = 0; V_x = 0; V_y = 14,800;$ $M_x = 0; M_{x,sus} = 0; N_{sus} = 0;$ | Static | 16 | Tension: 17.076 |

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3. Overview of results

3.1. References

[1] Building Code Requirements for Structural Concrete (ACI 318-19), Commentary on Building Code Requirements for Structural Concrete (ACI318R-19)

3.2. Development length in tension ([1] Section 25.4.2)

User input

| Description | Variable | Value |
|--|--------------------------------|------------|
| Rebar diameter | d_b | 0.750 in |
| User-defined steel over-strength factor | Ω_{fy} | 1.00 |
| Reinforcement yield strength, post installed | $\Omega_{fy} \cdot f_{y,PI}$ | 60,000 psi |
| Concrete type influence ([1] Table 25.4.2.5) | λ | 1.000 |
| Concrete compressive strength | f'_c | 4,000 psi |
| Transverse reinforcement effect ([1] 25.4.2.4) | K_{tr} | 0.000 in |
| Rebar coating ([1] Table 25.4.2.5) | | no |
| Excess reinforcement ([1] 25.4.10.1) | $\frac{A_{s,req}}{A_{s,prov}}$ | 1.000 |
| Development length multiplier | ξ | 1.000 |
| Development length offset | l_{off} | 0.000 in |

Development length l_d

$$l_{inst} = \xi \cdot l_d + l_{off}$$

$$l_d = \left(\frac{3}{40} \cdot \frac{f_{y,PI}}{\lambda \cdot \sqrt{f'_c}} \cdot \frac{\psi_t \cdot \psi_e \cdot \psi_s \cdot \psi_g}{\left(\frac{c_b + K_{tr}}{d_b} \right)} \right) \cdot d_b \geq 12 \text{ in} \quad [1] \text{ Eq. (25.4.2.4a)}$$

$$\frac{(c_b + K_{tr})}{d_b} \leq 2.5$$

$$\psi_t \quad [1] \text{ Table 25.4.2.5}$$

$$\psi_e \quad [1] \text{ Table 25.4.2.5}$$

$$\psi_t \cdot \psi_e \leq 1.7 \quad [1] \text{ footnote Table 25.4.2.5}$$

$$\psi_s \quad [1] \text{ Table 25.4.2.5}$$

$$\psi_g \quad [1] \text{ Table 25.4.2.5}$$

$$K_{tr} = \frac{40A_{tr}}{s \cdot n} \quad [1] \text{ Eq. (25.4.2.4b)}$$



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Variables

| | | | | | | |
|-----------------------------|------------------|--------------|---------------|------------|------------|---------------|
| d_b [in] | $f_{y,PI}$ [psi] | f'_c [psi] | λ [-] | c_b [in] | s_b [in] | K_{tr} [in] |
| 0.750 | 60,000 | 4,000 | 1.000 | 4.750 | 6.871 | 0.000 |
| A_{tr} [in ²] | | | | s [in] | | n [-] |
| 0.00 | | | | 0.250 | | 5 |

Calculations

| | | | | | |
|---|--------------|--------------|---------------------------|--------------|--------------|
| $\left(\frac{c_b + K_{tr}}{d_b}\right)$ [-] | ψ_t [-] | ψ_e [-] | $\psi_t \cdot \psi_e$ [-] | ψ_s [-] | ψ_g [-] |
| 2.500 | 1.000 | 1.000 | 1.000 | 0.800 | 1.000 |

Results

| | | | | | |
|-------------------|------------------------------------|---|------------|----------------------|-----------------|
| $l_{d,base}$ [in] | $\frac{A_{s,req}}{A_{s,prov}}$ [-] | $l_{d,base} \cdot \frac{A_{s,req}}{A_{s,prov}}$ [-] | l_d [in] | $\xi \cdot l_d$ [in] | l_{inst} [in] |
| 17.076 | 1.000 | 17.076 | 17.076 | 17.076 | 17.076 |

3.3. Shear strength verification for shear friction reinforcement ([1] Section 22.9)

User input

| Description | Variable | Value |
|---|---------------------------|--------------------------|
| Rebar diameter | d_b | 0.750 in |
| Reinforcement yield strength, post installed | $f_{y,PI}$ | 60,000 psi |
| Concrete type influence ([1] Table 19.2.4.1(b)) | λ | 1.000 |
| Coefficient of friction depending on the surface roughness category ([1] Table 22.9.4.2(c)) | $\mu = 0.6 \cdot \lambda$ | 0.600 |
| Permanent net compression across the shear plane ([1] Section 22.9.4.5) Note: per [1] 22.9.4.6, net tension across the shear plane (permanent or temporary) requires additional reinforcement to resist the tensile force. | N_p | 0 lb |
| Concrete compressive strength | f'_c | 4,000 psi |
| Surface area of interface | A_c | 1,610.00 in ² |

Calculation of the required area of reinforcement

$$A_{vf,reqd} = \frac{V_u - \phi \cdot \mu \cdot N_p}{\phi \cdot \mu \cdot f_{y,PI}} \quad [1] \text{ Eq. (R22.9.4.2), Section 22.9.4.5}$$

Required area of reinforcement $A_{vf,reqd} = 0.55 \text{ in}^2$



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Verification

| Shear Strength | Load V_u [lb] | Capacity ϕV_n [lb] | Utilization $\frac{V_u}{\phi V_n}$ [%] | Status |
|----------------|--------------------|-----------------------------|---|--------|
| | 14,800 | 95,426 | 16 | Ok |

$\phi V_n \geq V_u$ [1] Eq. (22.9.3.1)
 $V_n = \min(\mu \cdot A_{vf} \cdot f_{y,PI} + \mu \cdot N_p; V_{n,max})$ [1] Eq. (22.9.4.2) Section 22.9.4.5
 $A_{vf} = n \cdot \frac{\pi \cdot d_b^2}{4}$
 $V_{n,max} = \min(0.2 \cdot f'_c \cdot A_c; 800 \cdot A_c)$ [1] Table 22.9.4.4

Variables

| d_b [in] | $f_{y,PI}$ [psi] | λ | μ | N_p [lb] | f'_c [psi] | A_c [in ²] |
|---------------------------|------------------|-----------|-------|------------|--------------|--------------------------|
| 0.750 | 60,000 | 1.000 | 0.600 | 0 | 4,000 | 1,610.00 |
| n [-] | | | | | | |
| 8 | | | | | | |

Calculations

| A_{vf} [in ²] | $\mu \cdot A_{vf} \cdot f_{y,PI}$ [lb] | $\mu \cdot N_p$ [lb] |
|---------------------------------|--|----------------------|
| 3.53 | 127,234 | - |
| $0.2 \cdot f'_c \cdot A_c$ [lb] | $800 \cdot A_c$ [lb] | |
| 1,288,000 | 1,288,000 | |

Results

| $V_{n,max}$ [lb] | V_n [lb] | ϕ | ϕV_n [lb] | V_u [lb] |
|------------------|------------|--------|-----------------|------------|
| 1,288,000 | 127,234 | 0.750 | 95,426 | 14,800 |



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4. Warnings

This design exclusively considers the local load transfer in the considered interface between new and existing concrete. The joint surfaces for concreting must be roughened to fulfil the design assumption.

The capacity of the cross-section has to be designed separately.

The installation (drilling, cleaning, setting) must be according to the approval!

The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.

The software does not check the minimum cover requirements to meet exposure conditions and exposure classes. It is the responsibility of the user to review minimum code requirements for concrete cover.

Interface meets the design criteria!



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5. Installation data

Mortar: HIT-RE 500 V3 + Rebar

Item number: 2123401 HIT-RE 500 V3 (adhesive)

Connector: Rebar #6

Connector material: ASTM A615 Grade 60

Drilling method: Hammer Drilling

Hole type: Dry Concrete

Contact surface condition: Option (c)

Drill hole diameter in the base material: 1.000 in

Drill hole depth in the base material: 17.076 in

Minimum thickness of existing concrete: 19.576 in

Specification text: HIT-RE 500 V3 + Rebar #6 ASTM A615 Grade 60 with 17.076 in installation length

Top layer 1

Number of bars: 3

Top cover: 3.375 in

Side cover: 3.375 in

Top layer 2

Number of bars: 2

Clear spacing between rows: 12.992 in

Side cover: 3.375 in

Bottom layer 1

Number of bars: 3

Bottom cover: 3.375 in

Side cover: 3.375 in



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6. Remarks; Your cooperation duties

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