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Design:	Rebar - Jan 31, 2025 (5)	Date:	04. 08. 2025
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
Application type	Wall to slab

Product

Mortar	**HIT-HY 200 V3**
Connector	**Rebar #5**
Item number	2334276 HIT-HY 200-R V3 (adhesive)
Effective embedment depth	Existing concrete: $h_{ef,ex}$ = 14.230 in.
Material	ASTM A615 Grade 60
Evaluation Service Report	ESR-4868
Issued	01. 11. 2024
Valid	01. 11. 2026
Proof	Design method ACI 318-19
Epoxy coated reinforcement	no
Additional offset distance	0.000 in

Material

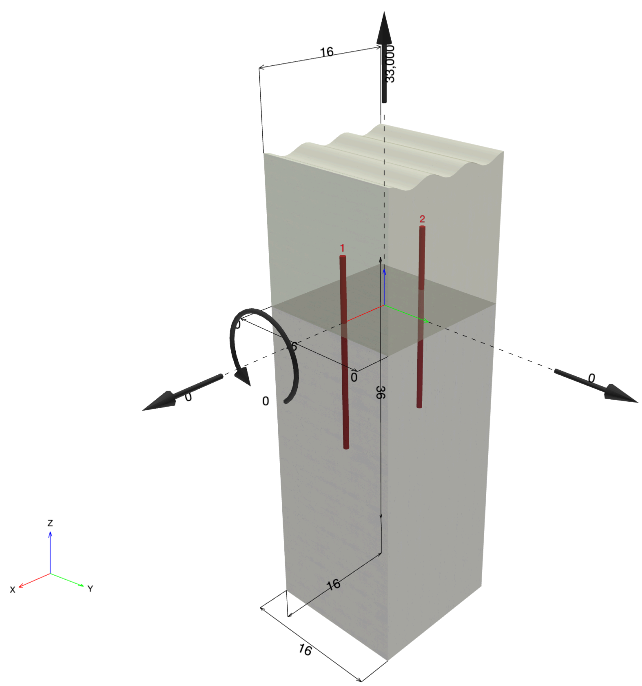
Concrete material	Cracked concrete, 4000, fc' = 4,000 psi;
Surface contact condition	Option (c)
Reinforcement	tension: not present
Steel strain limit	0.02

Installation and temperature

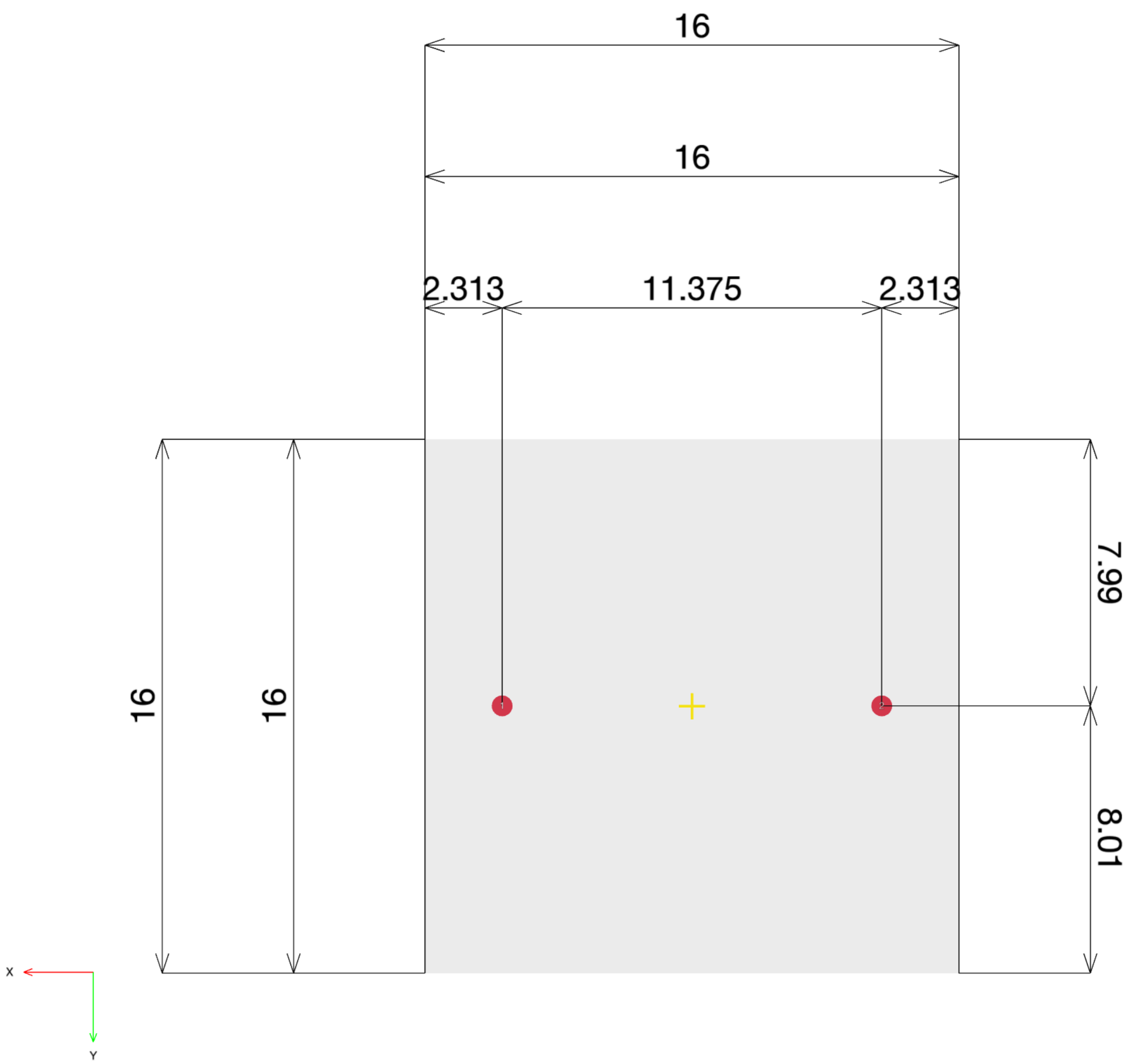
Temperature	During service: 32 °F / 32 °F (short / long term)
Installation	Hammer Drilling, Installation Condition: Dry Concrete

1.1. Geometry & Loading

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



1.2. Cross section view



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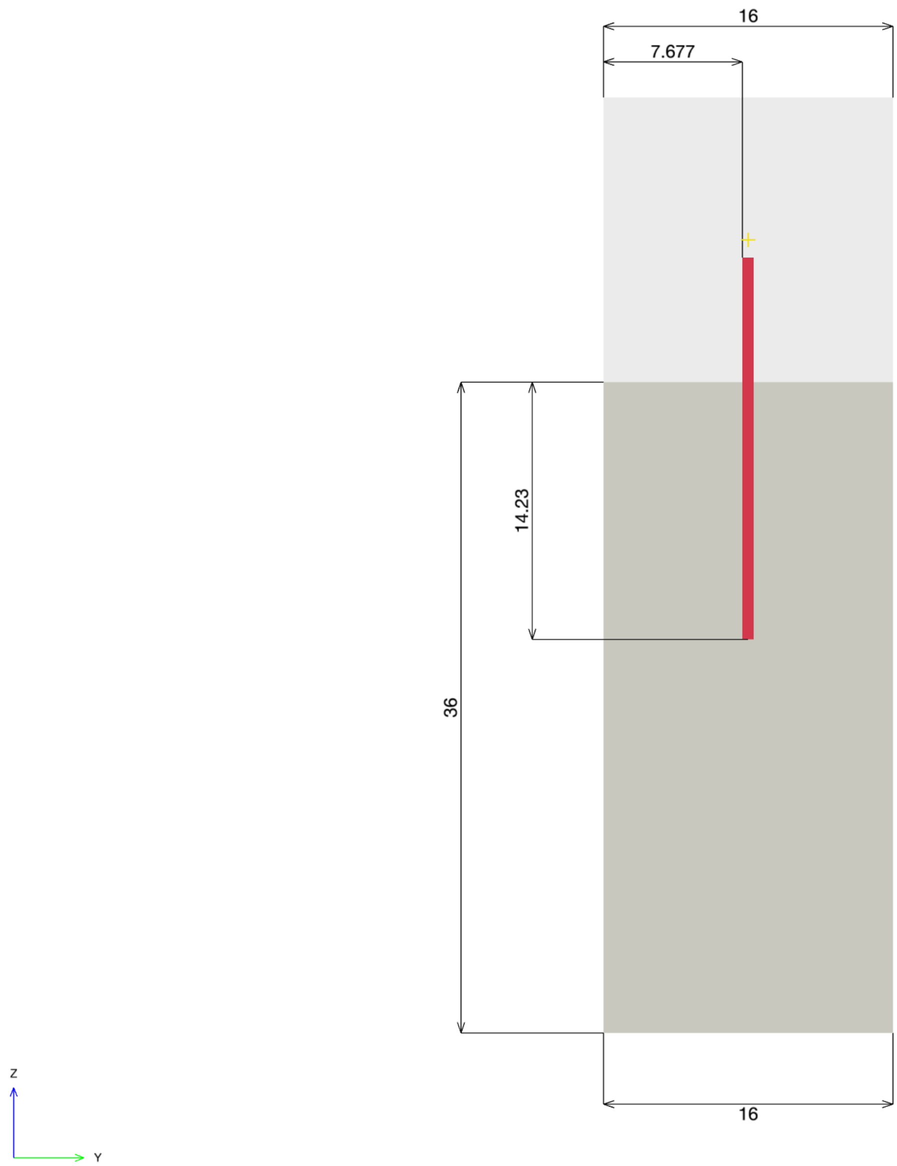
1.3. Side section view



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 = 33,000; V_x = 0; V_y = 0; M_x = 0; $M_{x,sus}$ = 0; N_{sus} = 0;	Static	-	Tension: 14.230

2.2. Cross section analysis ([1] Section 20.2, 21.2, 22.2, 22.3, 22.4)

User input

Rebar arrangement and diameter at the interface; see figure below

Description	Variable	Value
Reinforcement yield strength, post installed	$f_{y,PI}$	60,000 psi
Concrete compressive strength	f_c'	4,000 psi

Verification results at Ultimate Limit State

Input and assumptions

The cross section verification is performed on the assumption that plane sections remain plane. The (assumed) relationship between concrete compressive stress and strain is represented by a parabola-rectangle diagram. The following stress-strain relationship (Figure 3.3) for the design of the concrete cross-section under compression is used according to EN 1992-1-1, Section 3.1.7 (1).

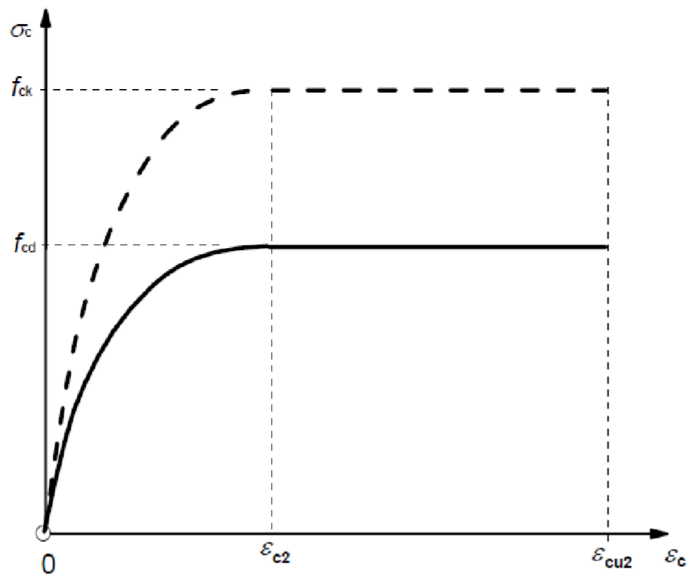


Figure 3.3: Parabola-rectangle diagram for concrete under compression.

$$\sigma_c = f_{cd}\left[1-\left(1-\frac{\varepsilon_c}{\varepsilon_{c2}}\right)^n\right] \text{ for } 0 \le \varepsilon_c \le \varepsilon_{c2} \quad (3.17)$$

$$\sigma_c = f_{cd} \text{ for } \varepsilon_{c2} \le \varepsilon_c \le \varepsilon_{cu2} \quad (3.18)$$

where:
n is the exponent (=2)
ε_{c2} is the strain at reaching the maximum strength
ε_{cu2} is the ultimate strain

The (bi-linear) design properties of the reinforcement (acc. to [1] section 20.2.2.1) are as follows. The stress below f_y shall be E_s times steel strain. For strains greater than that corresponding to f_y, stress shall be considered independent of strain and equal to f_y.

ϕ values acc. to [1] Table 21.2.1 (a) and 21.2.2:	$\phi_{T.C.} = 0.90, \phi_{C.C.} = 0.65$
Net tensile strain acc. to [1] Table 21.2.2:	$T.C.: \varepsilon_t \ge \varepsilon_{ty} + 0.003,$ $C.C.: \varepsilon_t \le \varepsilon_{ty}$

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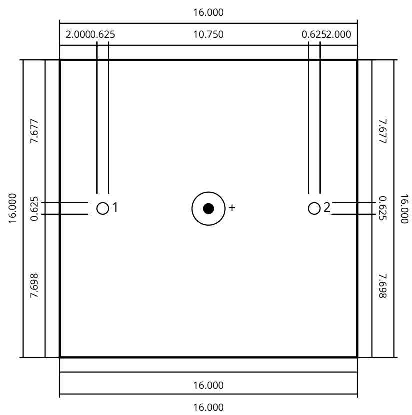
Interface results at Ultimate Limit State [in]



The compression zone / compressed rebars is / are the default area / rebars used for shear transfer.

Origin of the coordinate system (0, 0) is located at the geometrical center of the cross-section.

Verification

Variables

d_b [in]	f_{cd} [psi]	ε_{c2} [-]	ε_{cu2} [-]	$f_{y,PI}$ [psi]	ε_{ty} [-]	f'_c [psi]
0.625	3,400.001	0.0020	0.0030	60,000	0.0021	4,000

Calculations

ε_t [-]	c [in]	Tension ULS [lb]	Compression ULS [lb]
0.0021	0.000	36,816	-

Results

ϕ [-]	ϕN_n [lb]	$\phi M_{x,n}$ [in-lb]
0.900	33,134	-0

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	0.625 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

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

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

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

ψ_t [1] Table 25.4.2.5

ψ_e [1] Table 25.4.2.5

$\psi_t \cdot \psi_e \leq 1.7$ [1] footnote Table 25.4.2.5

ψ_s [1] Table 25.4.2.5

ψ_g [1] Table 25.4.2.5

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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]
0.625	60,000	4,000	1.000	2.313	5.687	0.000

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]
14.230	1.000	14.230	14.230	14.230	14.230

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 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!

5. Installation data

Mortar: HIT-HY 200 V3 + Rebar
Item number: 2334276 HIT-HY 200-R V3 (adhesive)

Connector: Rebar #5

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: 0.750 in

Drill hole depth in the base material: 14.230 in

Minimum thickness of existing concrete: 16.230 in

Specification text: HIT-HY 200 V3 + Rebar #5 ASTM A615 Grade 60 with 14.230 in installation length

Top layer 1

- Number of bars: 2
- Top cover: 7.677 in
- Side cover: 2.000 in

6. Remarks; Your cooperation duties

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