Company:		Page:	1
Address:		Specifier:	
Phone | Fax:	|	E-Mail:	
Design:	Pedestal Connection at Base	Date:	16. 11. 2023
Rebar application:			

Specifier's comments:

1. Input data

General

Design standard	ACI 318
Calculation method	ACI 318-14
Post installed rebar approach	Joints + Anchoring for loads
Loading type	Static
Yield design	no

Product

Mortar	**HIT-RE 500 V3**
Connector	**Rebar #4**
Item number	2123404 HIT-RE 500 V3 (adhesive)
Effective embedment depth	Existing concrete: $h_{ef,ex}$ = 6.000 in.
Material	ASTM A615 Grade 60
Evaluation Service Report	ESR-3814
Issued	01. 01. 2023
Valid	01. 01. 2025
Proof	Design method ACI 318-14
Epoxy coated reinforcement	no

Material

Concrete material	Cracked concrete, 5000, fc' = 5,000 psi;
Surface contact condition	Option (c)
Reinforcement	tension: Condition B tension
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

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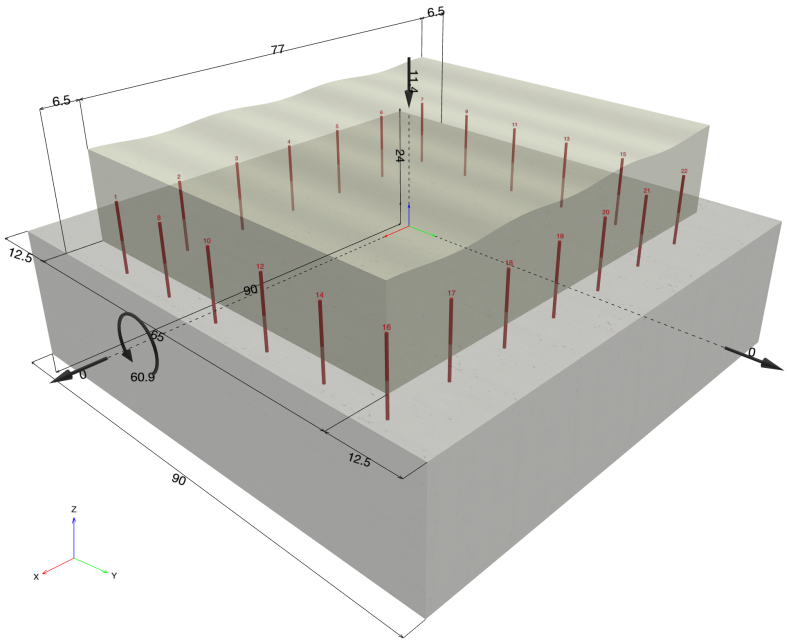
1.1. Geometry & Loading

Geometrical dimensions in [in]. Loading values in [kip, ft-kip]



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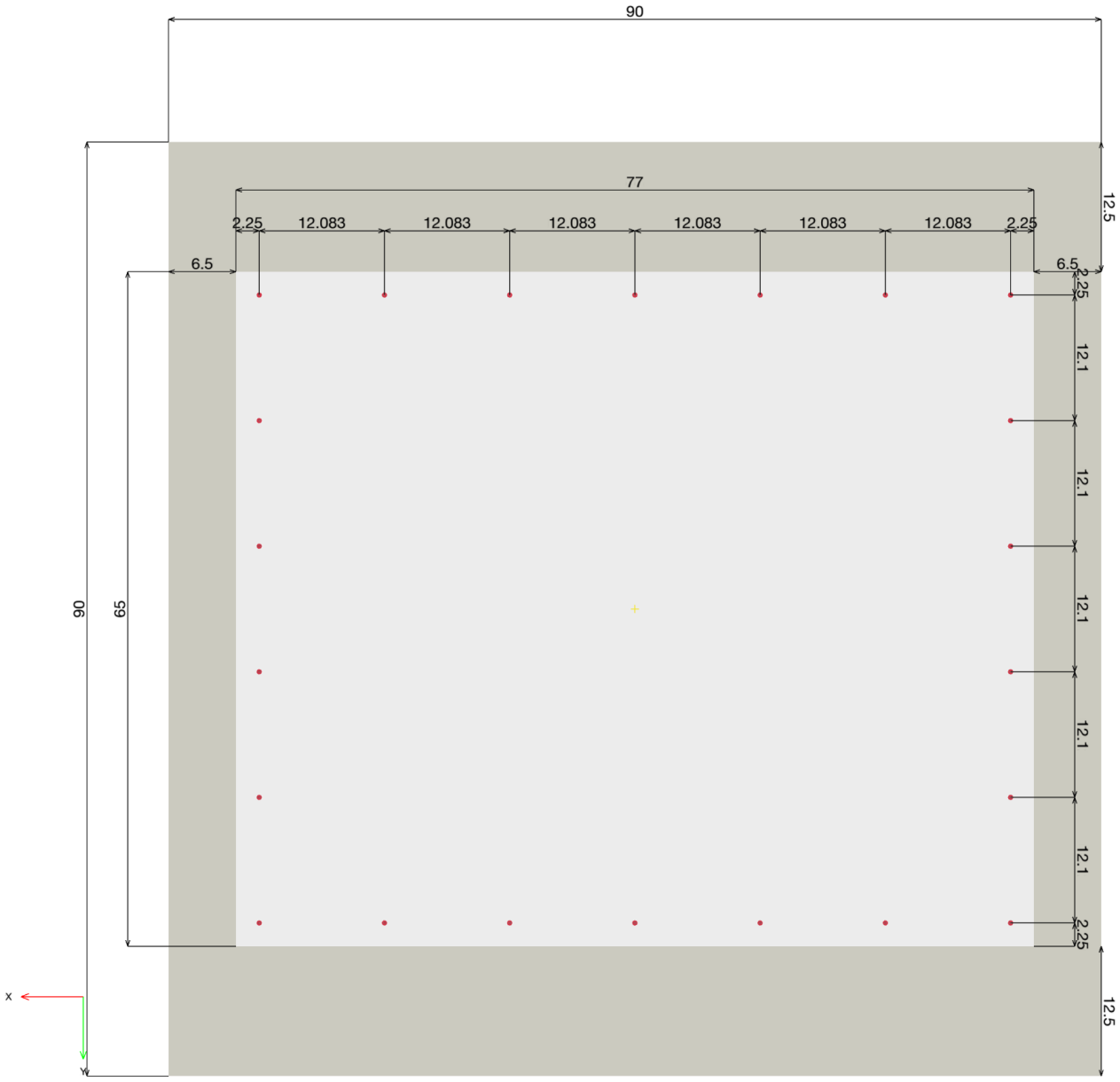
1.2. Cross section view



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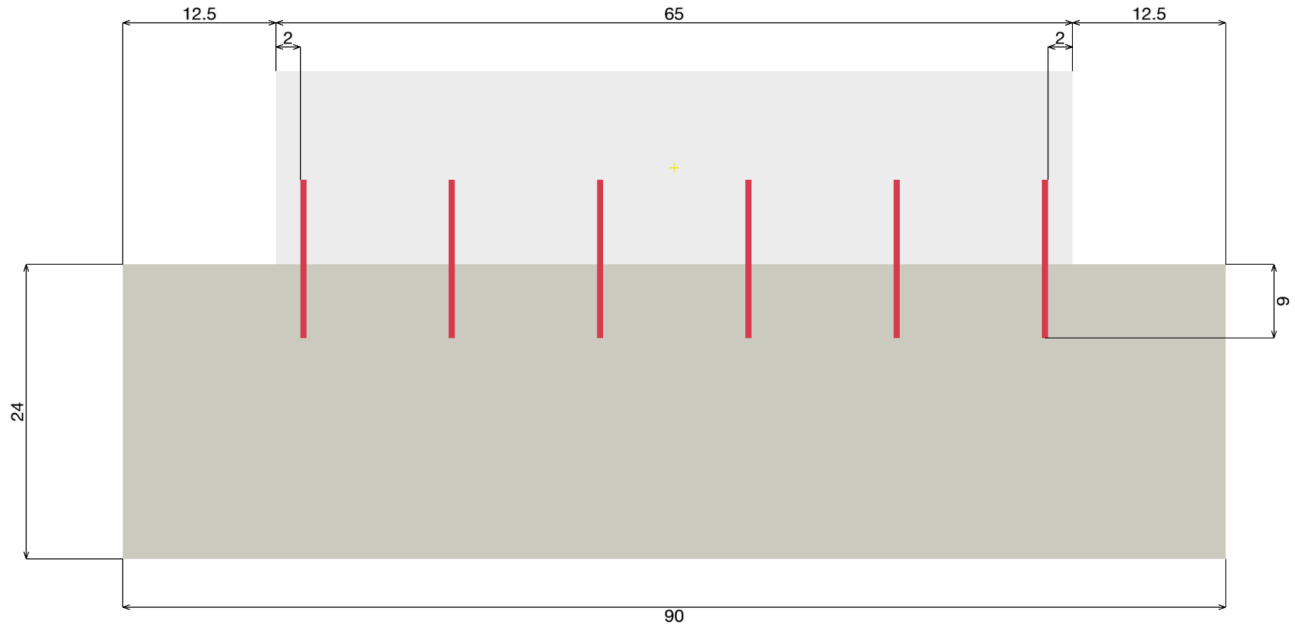
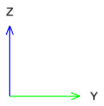
1.3. Side section view





2. Loads and Cross section analysis

2.1. Load combinations

Case	Description	Forces [kip] / Moments [ft-kip]	Load type	Max. Utilization [%]	Embedment depth [in]
1	Combination 1	N = -11.400; V_x = 0.000; V_y = 0.000; M_x = 60.90000; $M_{x,sus}$ = 0.00000; N_{sus} = 0.000;	Static	15	6.000

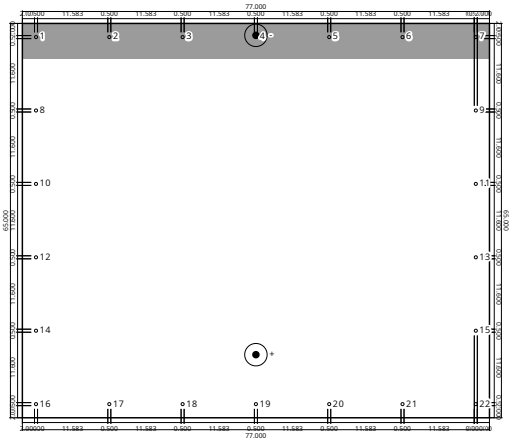
2.2. Cross section analysis ([1] Section 20.2, 21.2, 22.2, 22.3, 22.4)

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	5,000 psi

User-defined reinforcement arrangement and interface results [in]



Rebar Reactions

Force (+Tension, -Compression)

Rebar	Force [kip]	X [in]	Y [in]
1	-0.05	-36.250	30.250
2	-0.05	-24.167	30.250
3	-0.05	-12.083	30.250
4	-0.05	0.000	30.250
5	-0.05	12.083	30.250
6	-0.05	24.167	30.250
7	-0.05	36.250	30.250
8	0.11	-36.250	18.150
9	0.11	36.250	18.150
10	0.27	-36.250	6.050
11	0.27	36.250	6.050
12	0.43	-36.250	-6.050

13	0.43	36.250	-6.050
14	0.59	-36.250	-18.150
15	0.59	36.250	-18.150
16	0.75	-36.250	-30.250
17	0.75	-24.167	-30.250
18	0.75	-12.083	-30.250
19	0.75	0.000	-30.250
20	0.75	12.083	-30.250
21	0.75	24.167	-30.250
22	0.75	36.250	-30.250

max. concrete compressive strain:	0.014 ‰
max. concrete compressive stress:	90 psi
resulting tension force in (x/y) = (-0.000/-22.100):	8.077 kip
resulting compression force in (x/y) = (-0.000/30.539):	20.744 kip

Rebar forces are calculated on the assumption that plane sections remain plane. The (assumed) relationship between concrete compressive stress and strain is represented by a parabolic-rectangular shape.

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.

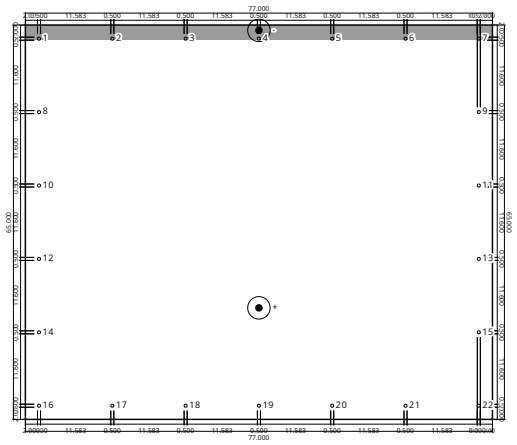
Verification results at Ultimate Limit State

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 (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:	$T.C.: \varepsilon_t \geq 0.005,$ $C.C.: \varepsilon_t \leq \varepsilon_{ty}$

Interface results at Ultimate Limit State [in]



Verification

Variables

d_b [in]	$f_{y,PI}$ [psi]	ε_{ty} [-]	f'_c [psi]
0.500	60,000	0.002	5,000

Calculations

ε_t [-]	c [in]	Tension ULS [kip]	Compression ULS [kip]
0.020	2.464	176.714	425.568

Results

ϕ [-]	N_n [kip]	$M_{x,n}$ [ft-kip]
0.900	-223.968	-1,196.45845

3. Overview of results

3.1. References

[1] Building Code Requirements for Structural Concrete (ACI 318-14), Commentary on Building Code Requirements for Structural Concrete (ACI 318R-14)

3.2. Anchoring to concrete ([1] Section 17)

User input

Description	Variable	Value
Rebar diameter	d_a	0.500 in
Reinforcement ultimate strength, post installed	$f_{u,PI}$	80,000 psi
Concrete compressive strength	f'_c	5,000 psi

Verifications for applied loads in tension

User-defined embedment $h_{ef} = 6.000\ in$

Overview Table

Failure Mode	Load N_{ua} [kip]	Capacity ϕN_n [kip]	Utilization [%]	Status
Steel strength	0.752	10.400	8	Ok
Bond strength	8.077	57.099	15	Ok
Concrete breakout strength	8.077	62.176	13	Ok

Steel strength

$$N_{sa} = A_{se,N} \cdot f_{u,PI}$$
$$\phi N_{sa} \geq N_{ua}$$ [1] Table 17.3.1.1

Variables

$A_{se,N}$ [in²]	$f_{u,PI}$ [psi]
0.20	80,000

Calculations

N_{sa} [kip]
16.000

Results

N_{sa} [kip]	ϕ_{steel}	ϕN_{sa} [kip]	N_{ua}
16.000	0.650	10.400	0.752

Bond Strength

N_{ag}	$= \frac{A_{Na}}{A_{Na0}} \cdot \psi_{ec1,Na} \cdot \psi_{ec2,Na} \cdot \psi_{ed,Na} \cdot \psi_{cp,Na} \cdot N_{ba}$	[1] Eq. (17.4.5.1b)
ϕN_{ag}	$\geq N_{ua}$	[1] Table 17.3.1.1
A_{Na}	see [1] Section 17.4.5.1, Fig. R 17.4.5.1(b)	
A_{Na0}	$= (2c_{Na})^2$	[1] Eq. (17.4.5.1c)
c_{Na}	$= 10d_a\sqrt{\frac{\tau_{uncr}}{1100}}$	[1] Eq. (17.4.5.1.d)
$\psi_{ec,Na}$	$= \left(\frac{1}{1+\frac{e'_N}{c_{Na}}}\right) \leq 1.0$	[1] Eq. (17.4.5.3)
$\psi_{ed,Na}$	$= 0.7 + 0.3\left(\frac{c_{a,min}}{c_{Na}}\right) \leq 1.0$	[1] Eq. (17.4.5.4b)
$\psi_{cp,Na}$	$= 1.0$	[1] Eq. (17.4.5.5b)
N_{ba}	$= \lambda_a \cdot \tau_{k,c} \cdot \pi \cdot d_a \cdot h_{ef}$	[1] Eq. (17.4.5.2)

Variables

$\tau_{k,c,uncr}$ [psi]	d_a [in]	h_{ef} [in]	$c_{a,min}$ [in]	$\tau_{k,c}$ [psi]
2,069	0.500	6.000	8.750	1,509

$e_{c1,N}$ [in]	$e_{c2,N}$ [in]	c_{ac} [in]	λ_a
0.000	7.983	10.588	1.000

Calculations

c_{Na} [in]	A_{Na} [in²]	A_{Na0} [in²]	$\psi_{ed,Na}$
6.827	2,497.94	186.42	1.000

$\psi_{ec1,Na}$	$\psi_{ec2,Na}$	$\psi_{cp,Na}$	N_{ba} [kip]
1.000	0.461	1.000	14.222

Results

N_{ag} [kip]	ϕ_{bond}	ϕN_{ag} [kip]	N_{ua}
87.845	0.650	57.099	8.077

Concrete breakout strength

N_{cbg}	$= \left(\frac{A_{Nc}}{A_{Nc0}}\right) \cdot \psi_{ec,N} \cdot \psi_{ed,N} \cdot \psi_{c,N} \cdot \psi_{cp,N} \cdot N_b$	[1] Eq. (17.4.2.1b)
ϕN_{cbg}	$\geq N_{ua}$	[1] Table 17.3.1.1
A_{Nc}	see [1] Section 17.4.2.1, Fig. R 17.4.2.1(b)	
A_{Nc0}	$= 9 \cdot h_{ef}^2$	[1] Eq. (17.4.2.1 (c))
$\psi_{ec,N}$	$= \left(\frac{1}{1+\frac{2e'_N}{3h_{ef}}}\right) \leq 1.0$	[1] Eq. (17.4.2.4)
$\psi_{ed,N}$	$= 0.7 + 0.3\left(\frac{c_{a,min}}{1.5 \cdot h_{ef}}\right) \leq 1.0$	[1] Eq. (17.4.2.5b)
$\psi_{cp,N}$	$= 1.0$	[1] Eq. (17.4.2.7b)
N_b	$= k_c \cdot \lambda_a \cdot \sqrt{f'_c} \cdot h_{ef}^{1.5}$	[1] Eq. (17.4.2.2a)

Variables

h_{ef} [in]	$e_{c1,N}$ [in]	$e_{c2,N}$ [in]	$c_{a,min}$ [in]	$\psi_{c,N}$
6.000	0.000	7.983	8.750	1.000

c_{ac} [in]	k_c	λ_a	f'_c [psi]
10.588	17.000	1.000	5,000

Calculations

A_{Nc} [in²]	A_{Nc0} [in²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [kip]
3,338.20	324.00	1.000	0.530	0.992	1.000	17.667

Results

N_{cbg} [kip]	$\phi_{concrete}$	ϕN_{cbg} [kip]	N_{ua}
95.656	0.650	62.176	8.077

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.

Anchor Design calculation results are shown for the average resistance per anchor

Interface meets the design criteria!

5. Installation data

Mortar: HIT-RE 500 V3 + Rebar
Item number: 2123404 HIT-RE 500 V3 (adhesive)

Connector: Rebar #4

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: 0.625 in

Drill hole depth in the base material: 6.000 in

Minimum thickness of existing concrete: 7.283 in

Specification text: HIT-RE 500 V3 + Rebar #4 ASTM A615 Grade 60 with 6.000 in embedment depth

Number of bars x: 7

Number of bars y: 6

Cover: 2.000 in

6. Remarks; Your cooperation duties

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