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STRUCTURAL CALCULATIONS

FOR

**RANCHO CUCAMONGA COURTHOUSE
800 MHz TOWER PROJECT
(89-468)**

FOR

DCGA ENGINEERS

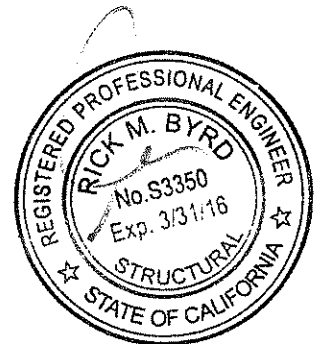
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Description:

Precast Modular Building Foundation Keyplan
Precast Building Foundation Analysis
Generator Anchorage and Foundation Design
Transformer Anchorage and Foundation Design



R. M. BYRD AND ASSOCIATES, Inc.



PROJECT NO.	100-100-00	
DRAWING NO.	100-100-00	
DATE LISTED BY	10/1/00	
DATE	10/1/00	
SCALE	AS NOTED	
REVISIONS		
NO.	DESCRIPTION	DATE
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2		
3		
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10		

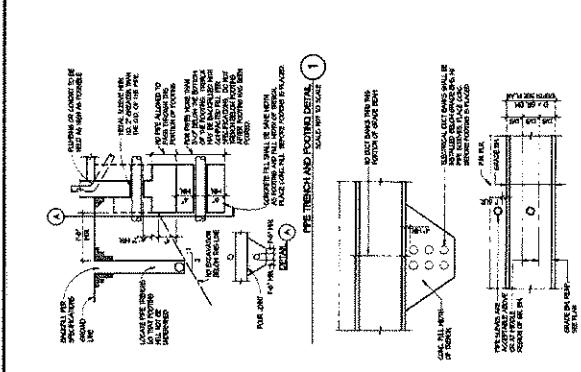
PRE-CAST BUILDING
FOUNDATION PLAN
GENERAL NOTES
AND DETAILS

800 MGHZ TOWER PROJECT
RANCHO CUCAMONGA COURT HOUSE
ADDRESS
9303 HAVEN AVE
RANCHO CUCAMONGA, CA

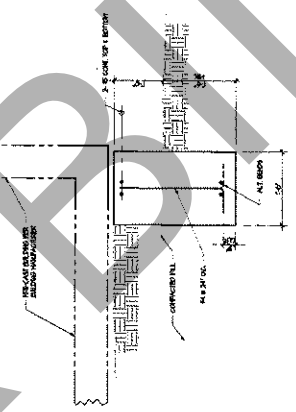
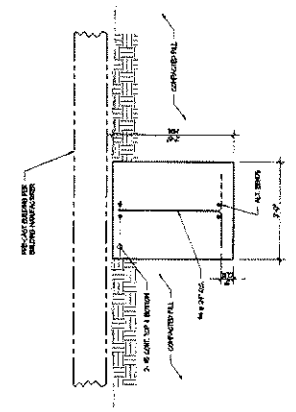
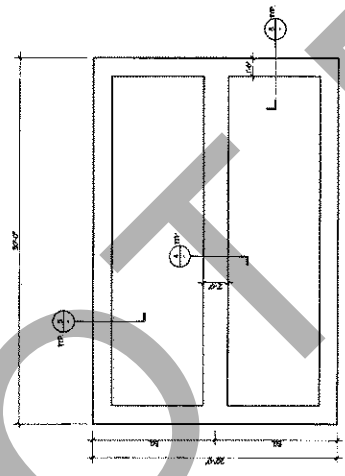
DCGA ENGINEERS
11000 S. GARDEN GATE
DANA POINT, CA 92629
TEL: 949.441.1100
FAX: 949.441.1101
WWW.DCGAENGINEERS.COM

BU BIRD AND ASSOCIATES, INC.
Consulting Structural Engineers
11000 S. GARDEN GATE
DANA POINT, CA 92629
TEL: 949.441.1100
FAX: 949.441.1101
WWW.BUANDASSOCIATES.COM

- GENERAL NOTES:**
1. FOUNDATION SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS PROVIDED BY THE CALIFORNIA FOUNDATION DESIGN MANUAL (CFDM) AND THE CALIFORNIA BUILDING CODE (CBC) AND THE CALIFORNIA GEOTECHNICAL ENGINEERING MANUAL (CGEM). ALL FOUNDATION SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS PROVIDED BY THE CALIFORNIA FOUNDATION DESIGN MANUAL (CFDM) AND THE CALIFORNIA BUILDING CODE (CBC) AND THE CALIFORNIA GEOTECHNICAL ENGINEERING MANUAL (CGEM).
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PRE-CAST BUILDING FOUNDATION PLAN

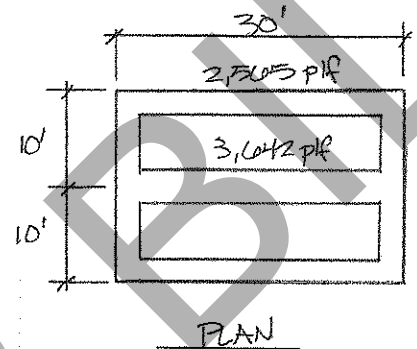


R.M. BYRD AND ASSOCIATES, INC.
 Consulting Structural Engineers
 1047 West Sixth Street, Suite A
 Ontario, CA 91762
 (909) 983-5599 Fax (909) 983-4456

JOB _____
 SHEET NO. _____ OF _____
 CALCULATED BY _____ DATE _____
 CHECKED BY _____ DATE _____
 SCALE _____

OLD CASTLE 20'x30' PREFAB STRUCTURE FOUNDATION

TOTAL STRUCTURE WEIGHT = 114,000 lb
 ROOF LIVE LOAD = 0.75 psf
 FLOOR LIVE LOAD = 250 psf



EXT. FTG.:

$$DL: 114,000 / (20' \times 2 + 30' \times 2) = 1,140 \text{ pif}$$

$$Lr: 0.75 \text{ psf} (20' / 2) = 0.75 \text{ pif}$$

$$L: 250 \text{ psf} (10' / 2) = 1,250 \text{ pif}$$

$$W_{MAX} = 1,140 + 0.75(0.75) + 0.75(1,250) = 2,560.5 \text{ pif}$$

$$q_{ALLOW} = 2,000 \text{ psf} \quad \text{PER SOILS REPORT}$$

$$b_{REQ} = 2,560.5 / 2,000 = 1.28' \quad \text{USE } 1.5'$$

USE 18" WIDE CONT. FTG. w/ 2-#5 BARS T & B @ EXT. PERIMETER

INT. FTG.:

$$DL: = 1,142 \text{ pif}$$

$$L: 250 \text{ psf} (20' / 2) = 2,500 \text{ pif}$$

$$= 3,642 \text{ pif}$$

$$b_{REQ} = 3,642 / 2,000 = 1.82' \quad \text{USE } 2'$$

USE 24" WIDE CONT. FTG. w/ 2-#5 BARS T & B @ INT. FTG.

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 Consulting Structural Engineers
 1047 West Sixth Street, Suite A
 Ontario, CA 91762
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FOUNDATION DESIGN CONT.

SEISMIC: $S_{DS} = 1.002$ PER SOILS REPORT
 $R = 4.0$ ORDINARY CONCRETE SHEARWALL

$$V = \frac{1.002}{(4.0/1.5)} W$$

$$= 0.374 W \times 0.7$$

$$= 0.2618 W \quad \text{ASD}$$

$$V = 0.2618 (114 k) = 30 k \quad \text{ASD}$$

OVERTURNING:

$$OTM = 30 k \times 10' / 2 = 150 \text{ ft-k}$$

$$M_R = 0.6 \times 114 k \times 20' / 2 = 684 \text{ ft-k} > OTM \quad \text{OK}$$

NO OVERTURNING.

CHECK SLIDING:

$$\text{BLDG:} \quad = 114 k$$

$$\text{FTG: } 150 \text{ pcf } (1.5' (2.5') (30') \times 3 + 1.5' (2.5') (20') \times 2) = 73 k$$

$$= 187 k$$

$$C.O.F. = 0.25$$

$$\text{RESISTING BASE SHEAR} = 0.25 (187 k) = 46.8 k > 30 k \quad \text{OK}$$

SLIDING OK. PASSIVE NEGLECTED.



OPI File:
Date:

ESTIM-8740
7/6/2015

411 E Frye Road Chandler, AZ 85225

Exhibit "A"

A. Building Specification

Item	Scope of Work Item & Description	Quantity
Exhibit "A" is to become part of the Contract or Purchase Order for clarification purposes.		
Building Specification		
1.	Oldcastle Model: (2030-RCS)	1-Lot
2.	Building Dimensions (Exterior): <u>30'0" Long x 20' Wide x 10'1" High</u>	1-Lot
3.	Building Dimensions (Finished Interior): 29'0" Long x 19' Wide x 9'0" High	1-Lot
4.	Weight: <u>140,000-lbs Total</u>	1-Lot
5.	Floor Equipment Load: <u>250 LBS / PSF</u>	1-Lot
6.	Roof Live Load: <u>65 LBS / PSF</u>	1-Lot
7.	Wind Speed: 110 MPH (When secured to proper foundation)	1-Lot
8.	Floor Thickness: 6"	1-Lot
9.	Wall Thickness: 4"	1-Lot
10.	Concrete Specification: 5000 PSI Light Weight	1-Lot
11.	Fire Rating: Two Hour Equivalent	1-Lot
12.	Seismic Acceleration: Standard Design 50% g (IBC and ASCE7)	1-Lot
13.	Bullet Resistance: UL752, Level 4 (.30-06 at 15 Ft.)	1-Lot
Engineering - Shelter		
Detailed engineering and drawings will be provided for all items in this Building Scope of Work. The structural drawings will be stamped by a professional engineer registered in the state or province of building placement		
Oldcastle will receive state or province approval as required. As such, Oldcastle reserves the right to amend the proposed Scope of Work to comply with any code or regulation required to obtain state approval		
Local/municipal inspections and approvals, including site inspections, building permits, and zoning approvals are not included. Oldcastle is not responsible for determining such local requirements.		
Finishes		
14.	Finished Wall Surface: Exposed Aggregate Finish with tinted sealer, trim painted Desert Tan	1-Lot
15.	Finished Roof: Duro-Last Roofing	1-Lot
16.	Walls:R-11, Rigid Board Type with Moisture Barrier	1-Lot
17.	Ceiling: R-11, Rigid Board Type with Moisture Barrier	1-Lot
18.	Walls: .030" NuPoly Laminated to ½" Thick Moisture Board and R-11 insulation, Color: White	1-Lot
19.	Ceiling: .030" NuPoly Laminated to ½" Thick Moisture Board and R-11 insulation, Color: White	1-Lot
20.	Floor: Tile 12" x 12" Floor Tile (Standard) with 4" Vinyl Cove Base	1-Lot

R.M. BYRD AND ASSOCIATES, INC.

Consulting Structural Engineers

Client DCGA Engineers
 Job Name Rancho Cucamonga Courthouse
 800 MHz Tower
 Job Number 89-468

Unit Number: G1 & G2

Unit Type: Generators/Batteries
 Unit Location: Ground
 Occupancy category IV

Code Factors:

Importance factor (I_p) = 1.5
 $A_p = 1$
 $R_p = 2.5$
 $S_{DS} = 1.002$

Unit Parameters:

(h/z) For anchors = 0.5

$L = 204.0$ in

Ht. of Curb = 0.0 in

$F_p \text{ min} = 6357.7$ lb

$F_p \text{ max} = 33907.7$ lb

$F_p = 6781.5$ lb

$F_p \text{ used} = 6781.5$ lb

Overturn Moment = 339077 in-lb

Res. Moment (Min) = 172626 in-lb

Anchor spacing = 24 in o.c.

Anchors Long Side (N_L) = 10

Anchors Short Side (N_S) = 2

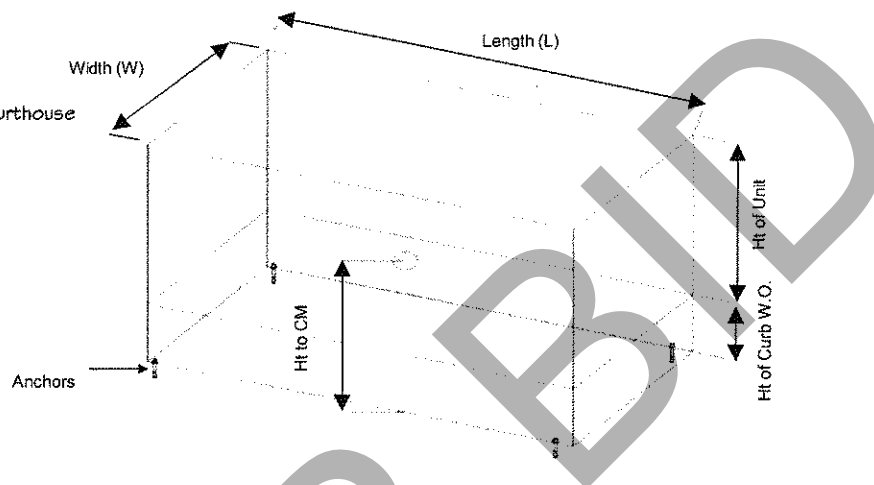
Total Anchors = 20

Net Uplift to Anchors = 1188.9 lb

Shear per bolt = 847.7 lb

Anchor Type: Hilti KB-TZ

Anchor Size and Embed: See Hilti Profis Output



$W_p = 14100$ lb

$W = 35.0$ in

Ht. of Unit = 100.0 in

Ht. to C.M. = 50.0 in

$$\text{Eqn (13.3-3)} = 0.3S_{DS}I_pW_p$$

$$\text{Eqn (13.3-2)} = 1.6S_{DS}I_pW_p$$

$$\text{Eqn (13.3-1)} = [4A_pS_{DS}W_p(1 + 2(Z/h))]/(R_p/I_p)$$

STRENGTH

$\Omega = 2.5$

$$M_{ot} = F_p \cdot (\text{Ht. to C.M.})$$

$$M_{res} = (0.9 - 0.2 \cdot S_{ds}) \cdot W_p \cdot (W/2)$$

$$\Omega \cdot [(M_{ot} - M_{res})/W]/N_L = (\text{Omega Level Uplift per anchor per side of the unit with added vertical seismic load per ASCE-7})$$

USE 20- 1/2" ϕ Hilti KB-TZ W/ 3 1/4" MIN. EMBED PER HILTI PROFIS OUTPUT


Profis Anchor 2.6.0
www.hilti.us

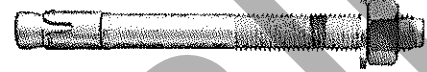
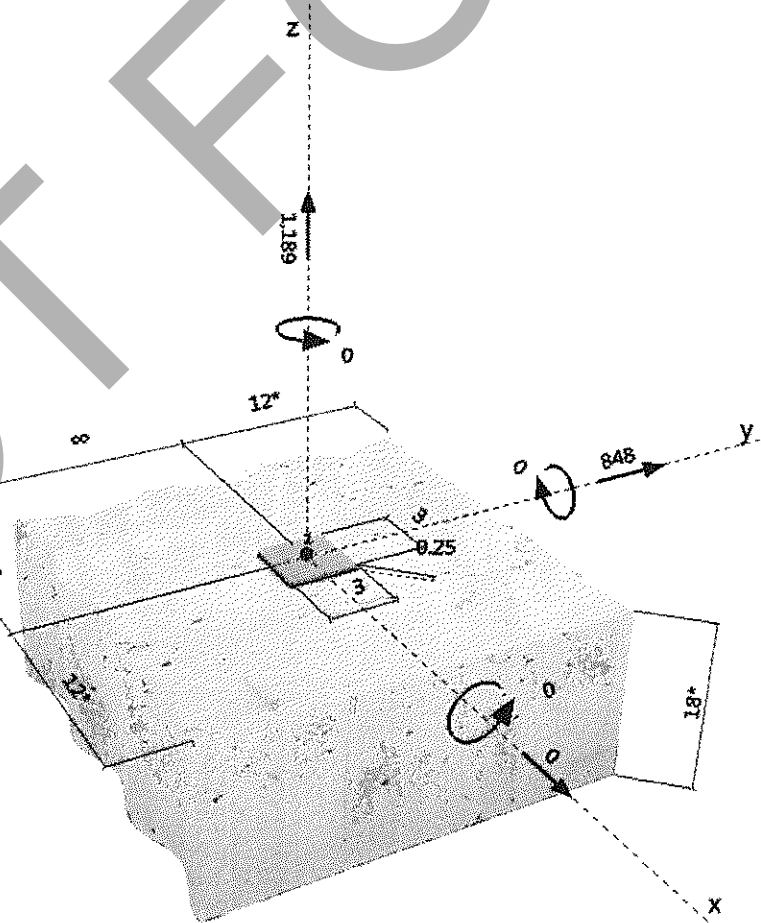
 Company:
 Specifier:
 Address:
 Phone | Fax:
 E-Mail:

 Page: 1
 Project:
 Sub-Project | Pos. No.:
 Date: 7/30/2015

Specifier's comments:

1 Input data

Anchor type and diameter:	Kwik Bolt TZ - CS 1/2 (3 1/4)
Effective embedment depth:	$h_{ef,act} = 3.250$ in., $h_{nom} = 3.625$ in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-1917
Issued Valid:	5/1/2013 5/1/2015
Proof:	Design method ACI 318-11 / Mech.
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.250$ in.
Anchor plate:	$l_x \times l_y \times t = 3.000$ in. \times 3.000 in. \times 0.250 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 2500 , $f'_c = 2500$ psi; $h = 18.000$ in.
Installation:	hammer drilled hole, Installation condition: Dry
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or \leq No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (D.3.3.4.3 (d)) Shear load: yes (D.3.3.5.3 (c))


Geometry [in.] & Loading [lb, in.lb]




www.hilti.us

Profis Anchor 2.6.0

Company:
Specifier:
Address:
Phone | Fax:
E-Mail:

Page: 2
Project:
Sub-Project | Pos. No.:
Date: 7/30/2015

2 Proof | Utilization (Governing Cases)

Loading	Proof	Design values [lb]		Utilization	Status
		Load	Capacity	β_N / β_V [%]	
Tension	Pullout Strength	1189	2396	50 / -	OK
Shear	Steel Strength	848	3572	- / 24	OK

Loading	β_N	β_V	ζ	Utilization $\beta_{M,V}$ [%]	Status
Combined tension and shear loads	0.496	0.237	5/3	41	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

4 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

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Consulting Structural Engineers

1047 West Sixth Street, Suite A

Ontario, CA 91762

(909) 983-5599 Fax (909) 983-4456

JOB RANCHO CUCAMONGA COURTHOUSESHEET NO. 800 MHz TOWER OF 89-408

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

GENERATOR PAD

$$DL: W = 7.7k + 3.2k \times 2 = 14.1k$$

$$PAD: 150 \text{ psf} (19') (5') (1.5') = 21.4k$$

$$= 35.5k$$

$$F_p = 0.8k \times 0.7 \quad \text{SEE GENERATOR ANCHOR}$$

$$= 4.8k \text{ ASD}$$

$$OTM = 4.8k \times 50''/12 = 20 \text{ ft-k}$$

$$M_R = 0.6 \times 35.5k \times 5'/2$$

$$= 0.6 \times 88.8 \text{ ft-k}$$

$$= 53.3 \text{ ft-k} > OTM \text{ OK}$$

SOIL PRESSURE:

$$e = 20/35.5 = 0.56' < L/6 = 5'/6 = 0.83' \quad \therefore \text{FULL BEARING}$$

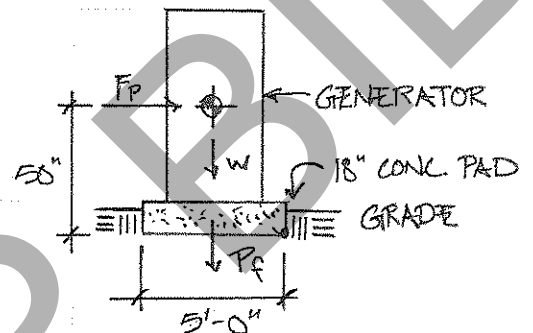
$$A = 19' \times 5' = 95 \text{ ft}^2$$

$$S = 1/6 (19')(5')^2 = 79.2 \text{ ft}^3$$

$$q_{soil} = 35.5/95 + 20/79.2$$

$$= 0.76 \text{ psf}$$

USE 19'-0" x 5'-0" x 18" THICK CONC. PAD w/ #5 @ 12" O.C. E.W. T&B



R.M. BYRD AND ASSOCIATES, INC.

Consulting Structural Engineers

Client DCGA Engineers
 Job Name Rancho Cucamonga Courthouse
 800 MHz Tower
 Job Number 89-468

Unit Number: TR-1

Unit Type: Generators/Batteries
 Unit Location: Ground
 Occupancy category IV

Code Factors:
 Importance factor (I_p) = 1.5
 $A_p = 1$
 $R_p = 2.5$
 $S_{DS} = 1.002$

Unit Parameters:

(h/z) For anchors = 0.5

$L = 32.0$ in

Ht. of Curb = 0.0 in

F_p min = 360.7 lb

F_p max = 1923.8 lb

$F_p = 384.8$ lb

F_p used = 384.8 lb

Overturn Moment = 8465 in-lb

Res. Moment (Min) = 7556 in-lb

Anchor spacing = One Anchor per Corner

Anchors Long Side (N_L) = 2

Anchors Short Side (N_S) = 2

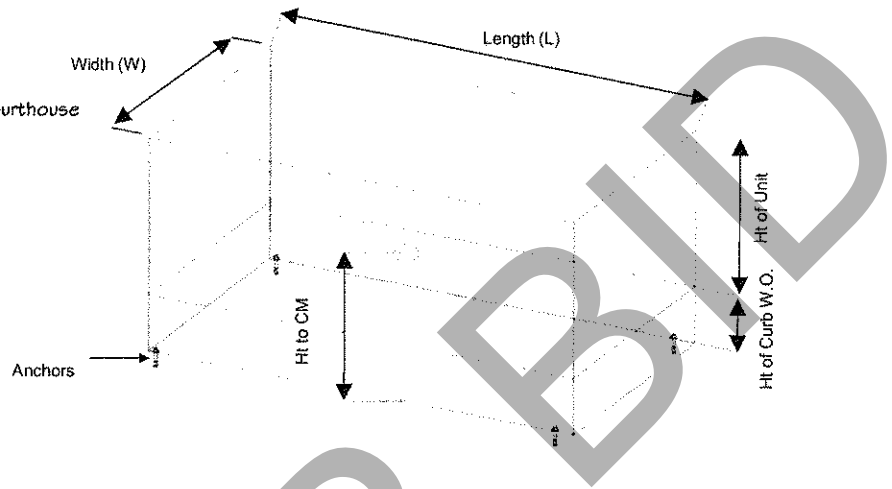
Total Anchors = 4

Net Uplift to Anchors = 42.1 lb

Shear per bolt = 240.5 lb

Anchor Type: Hilti KB-TZ

Anchor Size and Embed: See Hilti Profis Output



$W_p = 800$ lb

$W = 27.0$ in

Ht. of Unit = 44.0 in

Ht. to C.M. = 22.0 in

Eqn (13.3-3) = $0.35 S_{DS} I_p W_p$

Eqn (13.3-2) = $1.65 S_{DS} I_p W_p$

Eqn (13.3-1) = $[.4 A_p S_{DS} W_p (1 + 2(Z/h)) / (R_p / I_p)]$

STRENGTH

$\Omega = 2.5$

Mot = $F_p \cdot (\text{Ht. to C.M.})$

Mres = $(0.9 - 0.2 \cdot S_{ds}) \cdot W_p \cdot (W/2)$

$\Omega \cdot [(Mot - Mres) / W] / N_L = (\text{Omega Level Uplift per anchor per side of the unit with added vertical seismic load per ASCE-7})$

USE 4- 1/2" ϕ Hilti KB-TZ W/ 3 1/4" MIN. EMBED PER HILTI PROFIS OUTPUT

SEE GENERATOR PROFIS OUTPUT

R.M. BYRD AND ASSOCIATES, INC.

Consulting Structural Engineers

1047 West Sixth Street, Suite A

Ontario, CA 91762

(909) 983-5599 Fax (909) 983-4456

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

TRANSFORMER PAD

$$DL: W = 0.8 \text{ k}$$

$$PAD = 150 \text{ psf} (4.75') (4.25') (1.5') = 4.5 \text{ k}$$

$$= 5.3 \text{ k}$$

$$F_p = 385 \text{ lb} \times 0.7 \quad \text{SEE TRANSFORMER ANCHOR}$$

$$= 270 \text{ lb ASD}$$

$$OTM = 270 \text{ lb} \times 40''/12 = 900 \text{ ft-lb}$$

$$M_R = 0.6 \times 5.3 \text{ k} \times 4.25'/2$$

$$= 0.6 \times 11,203 \text{ ft-lb}$$

$$= 6,758 \text{ ft-lb} > OTM \quad \text{OK}$$

SOIL BEARING:

$$e = 900/5,300 = 0.17' < L/6 = 4.25'/6 = 0.71' \quad \therefore \text{FULL BEARING}$$

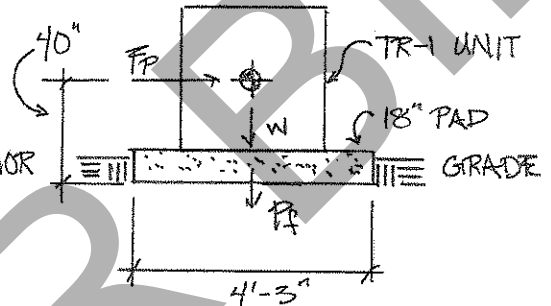
$$A = 4.75' \times 4.25' = 20.2 \text{ ft}^2$$

$$S = \frac{1}{6} (4.75') (4.25')^2 = 14.3 \text{ ft}^3$$

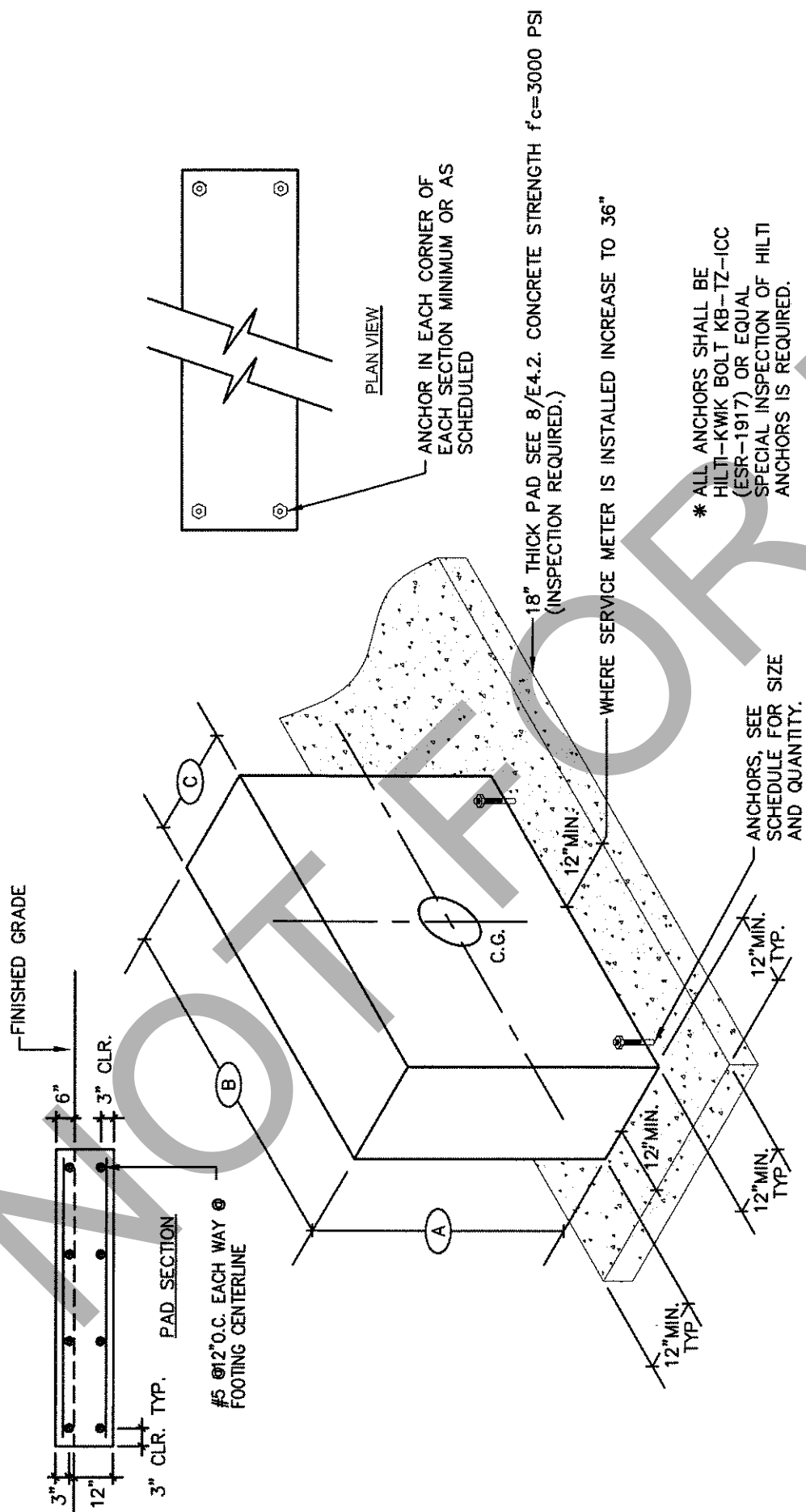
$$q_{allow} = \frac{5,300}{20.2} + \frac{900}{14.3}$$

$$= 325 \text{ psf} < 1,500 \text{ psf}$$

USE 4'-9" x 4'-3" x 18" THICK CONG. PAD W/ #5 BARS @ 12" O.C. E.W. T&B



TRANSFORMER/GENERATOR/CONCRETE PAD MOUNTING DETAIL



* ALL ANCHORS SHALL BE HILTI-KWIK BOLT KB-TZ-ICC (ESR-1917) OR EQUAL SPECIAL INSPECTION OF HILTI ANCHORS IS REQUIRED.

SYMBOL	(A)	(B)	(C)	WEIGHT	MIN. NO ANCHORS	SIZE OF ANCHORS	MINIMUM EMBEDMENT
"TR-1"	44"	32"	27"	725 LBS	4	1/2" ϕ	3 1/2"
"G1" & "G2" (EACH)	70"	114"	41"	3139 LBS	8	1/2" ϕ	3 1/2"

* PLACE ANCHORS FOR GENERATOR AT +24" O.C. MAXIMUM