Structural Narrative and Design Criteria

9/16/19
DATE SIGNED

Jean Sweeney Open Space Park
ZACHARY COFFIN'S ROCKSPINNERS
ALAMEDA, CA

Version 2.0 / September 16, 2019
Job # 19067.10

Holmes Structures

Holmes Structures

235 Montgomery Street, Suite 1250
San Francisco, CA 94104
T: 415 693 1600

523 W. 6th Street, Suite 1122
Los Angeles, CA 90014
T: 213 481 5630

holmesstructures.com

May 13, 2019

Revised September 16, 2019

Zachary Coffin
Zachary Studio, Inc.
Alameda, CA

19067.10 Jean Sweeney Open Space Park – Zachary Coffin's Rockspinners Alameda, CA

Zach,

We have examined the structural issues related to the Rockspinner interactive sculptures planned for permanent installation located in Jean Sweeney Open Space Park (JSOSP) in Alameda, CA. Please see below for a summary of our review and recommendations.

Scope of Review

Our review has been limited to the following scope:

- Structural consultation with the Artist for the sculpture including design meetings and shop visits during fabrication to perform structural observation.
- Perform structural calculations to determine the gravity, wind, and seismic demands on the sculpture and its anchorage/foundation.
- Coordinate with the Artist to validate element sizes and geometry.
- Coordinate with the Artist to validate element connections.
- Design anchorage of sculpture to its spread footing
- Design foundation in accordance with the geotechnical engineers recommendations.
- Prepare structural narrative summarizing our basis of design and findings

Structural Criteria

Seismic Design Criteria (2016 California Building Code)
Risk Category 2
Seismic Design Category D
Site Class D
Ss = 1.582g
Sds = 1.055g
S1 = 0.620g
Sd1 = 0.620g
R = 2.0 (Non Building Structure, ASCE 7-10 15.4)
I = 1.0
Cs = 0.53 g
W = 11,000 lbs (approx.)
Veq = Cs * W = 5,600 lb ←GOVERNS

Wind Design Criteria (ASCE 7-10)
Basic Wind Speed: 110 mph
Exposure C
Kz = 0.85
Kzt = 1.0
Kd = 0.85
qz = 22.4 psf
G = 0.85
Cf = 1.55 (from ASCE 7-10, table 29.4.1)
Area, As= 50 sq ft (approx..)

Vwind = qz * G * Cf * As = 1,474 lb

Soil Design Criteria (CBC 1806, Table 1806.2)
Vertical Foundation Pressure = 1,500 psf (DL + LL), 2,000 psf (DL + LL + EQ/Wind)
Lateral Bearing Pressure = 100 psf/ft
Cohesion/Friction = 130 psf

Structure Description:

The proposed project involves the permanent installation of two of Zachary Coffin's "Rockspinner" sculptures in the Jean Sweeney Open Space Park in Alameda, CA. The sculptures are large boulders approximately 10'-0" tall and weight roughly 11,000 lbs. The boulders are epoxy mounted on a bearing hub that allows the stones to rotate about their vertical axis of balance. The bearing hub will be epoxy doweled into the boulder a minimum of 10 inches. The sculptures will be supported on 7'-0" square x 1'-4" thick cast-in-place concrete spread footings based on recommendations in the geotechnical report noted below. Connection to the footing will be made through a stainless steel embed assembly that will be cast-in-place with the foundation and serve as a bolt template for the anchor bolts that will mount to the bearing hub baseplate.

Refer to Appendix A and Appendix B of this narrative for drawings and calculations used as the basis of our design for the sculpture anchorage and foundation.

Design Assumptions:

Our recommendations are based on the following assumptions:

- The sculpture will be installed permanently, and is required to meet the structural criteria of the 2016 California Building Code.
- The sculpture has been designed for gravity, wind, and earthquake loads only. The sculpture has not been designed for any other external loads including, but not limited to, live loads, impact loads, or any other external forces other than those listed above.
- Special inspections will be provided as shown in the Statement of Special Inspections form in Appendix A.

Structural observations will be performed at the following project milestones:

- Foundation reinforcement
- Installation of Rockspinner anchorage/bolting

We also take this opportunity to make the following additional recommendations concerning the installation:

- The condition of all connecting hardware (bolts etc.) should be reviewed by the artist and confirmed to be in good condition prior to installation, or replaced.
- We recommend that consideration be given to painting, galvanizing, or otherwise coating exposed non stainless steel surfaces to reduce the likelihood of rust-stains developing on the finished surface. Particular attention should be paid to the contact area of galvanised steel surfaces in contact with stainless steel surfaces. Neoprene, High Density Polyethylene (HDPE) or nonconductive paint may be used underneath each of the supporting cleat connections.

This design is based on the typical conditions and assumptions outlined above.

Conclusions

Based on the above criteria and assumptions, we have concluded that the sculpture outlined in Appendix A meets the strength and stability structural design requirements of the 2016 California Building Code.

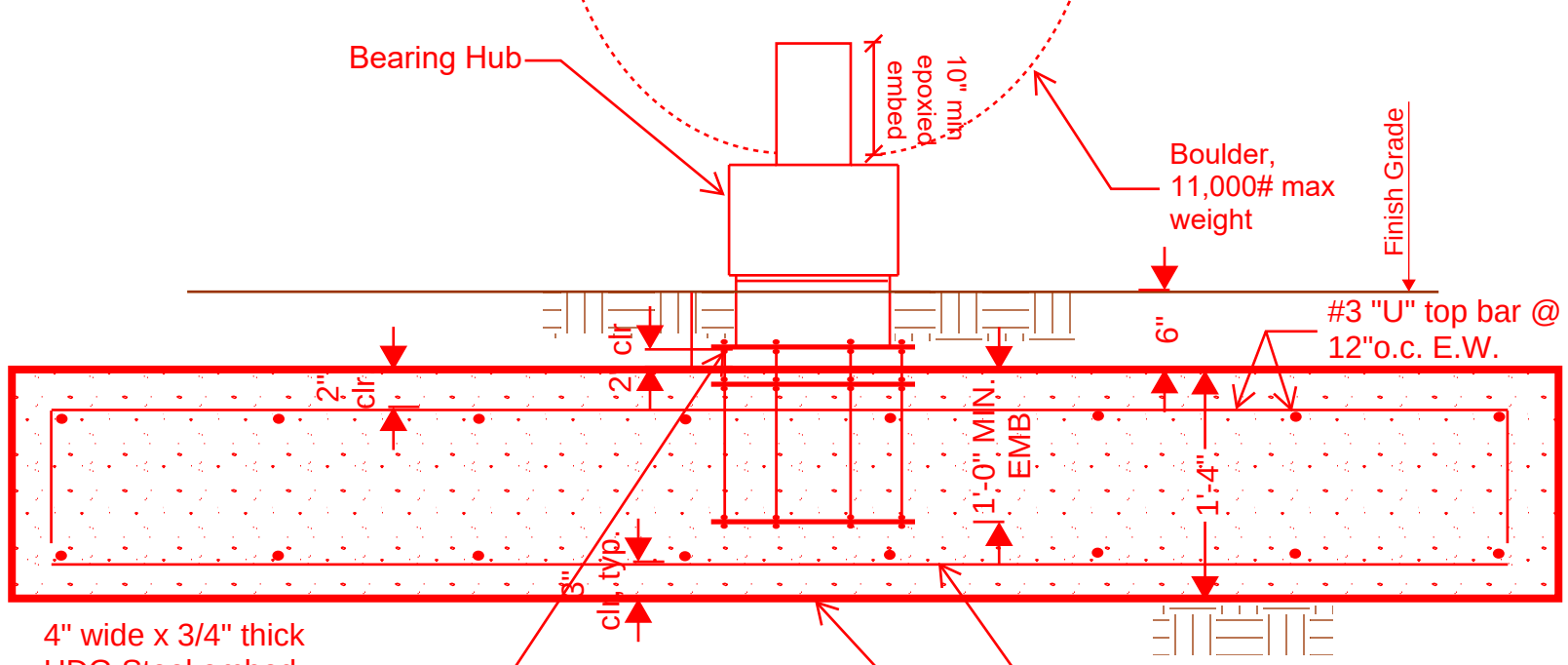
We appreciate the opportunity to be of service. Please contact us if have any questions or require additional information.

Thank you,

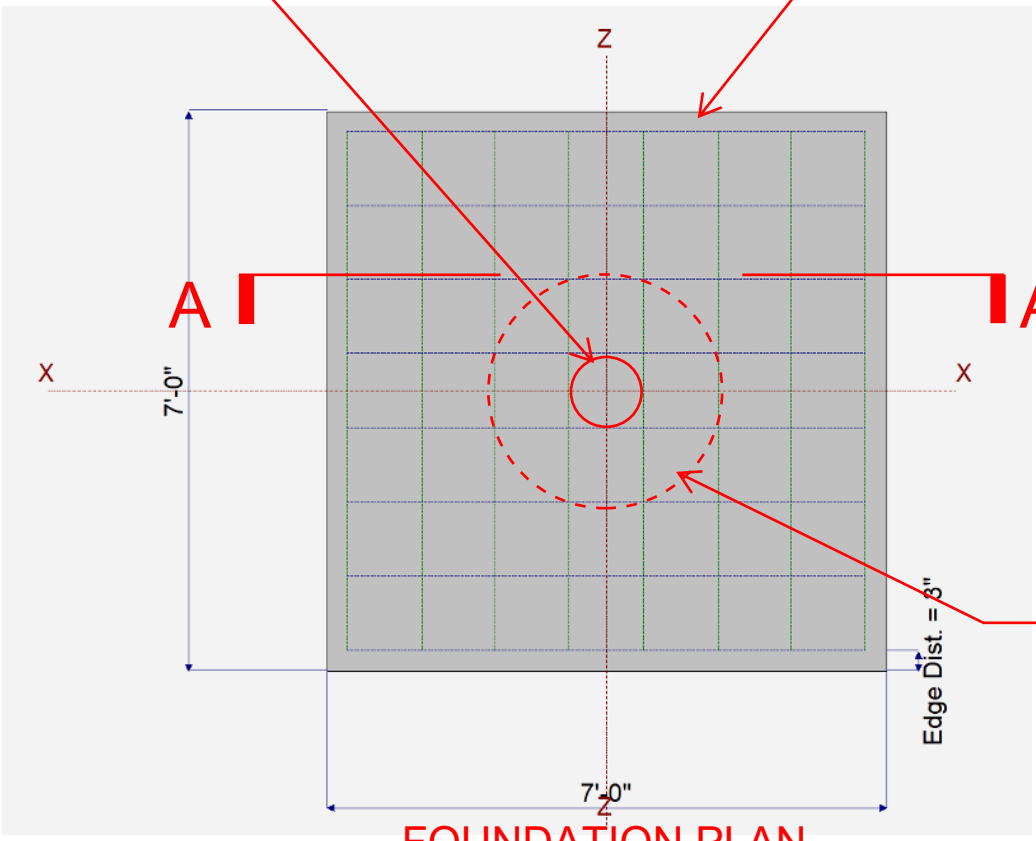
Erik Kneer, SE, LEED AP BD+C
ASSOCIATE PRINCIPAL

Appendix A:

Basis of Design and Structural Sketches



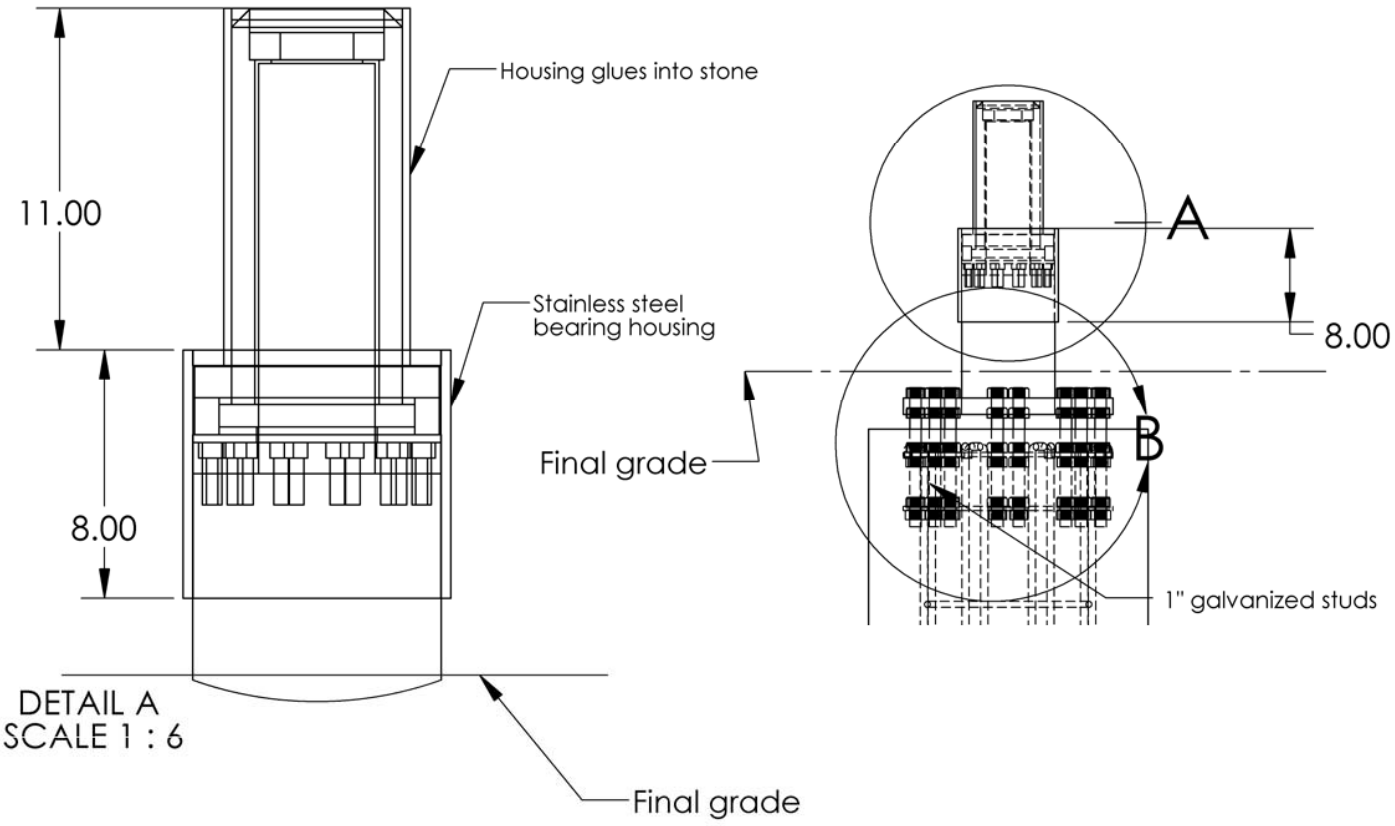
Section A-A



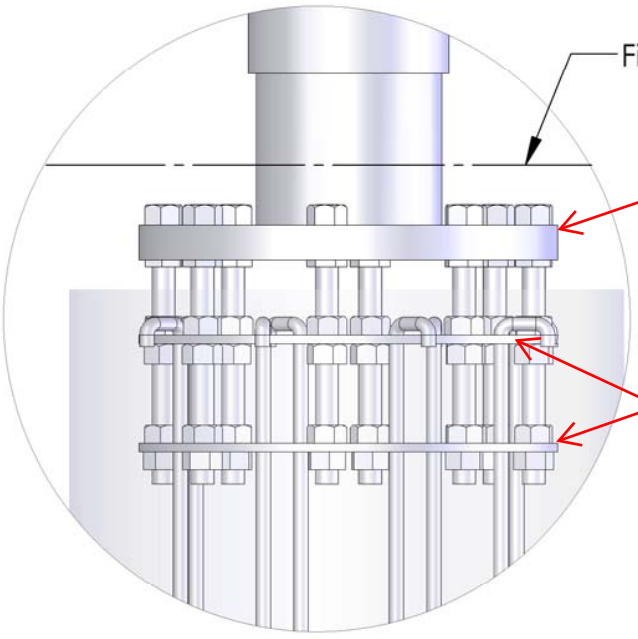
FOUNDATION PLAN

Holmes Structures
235 Montgomery St.
Suite 1250
San Francisco, CA
94104 USA
415 693 1600

Project:	JSOSP Zach Coffin Rockspinners		
Project No:	19067.10	Date:	5/10/19
Sketch Title:	Foundation Plan/Section	Scale:	NTS
Sketch No:	1	Rev: 1	By: EK



DETAIL A
SCALE 1 : 6



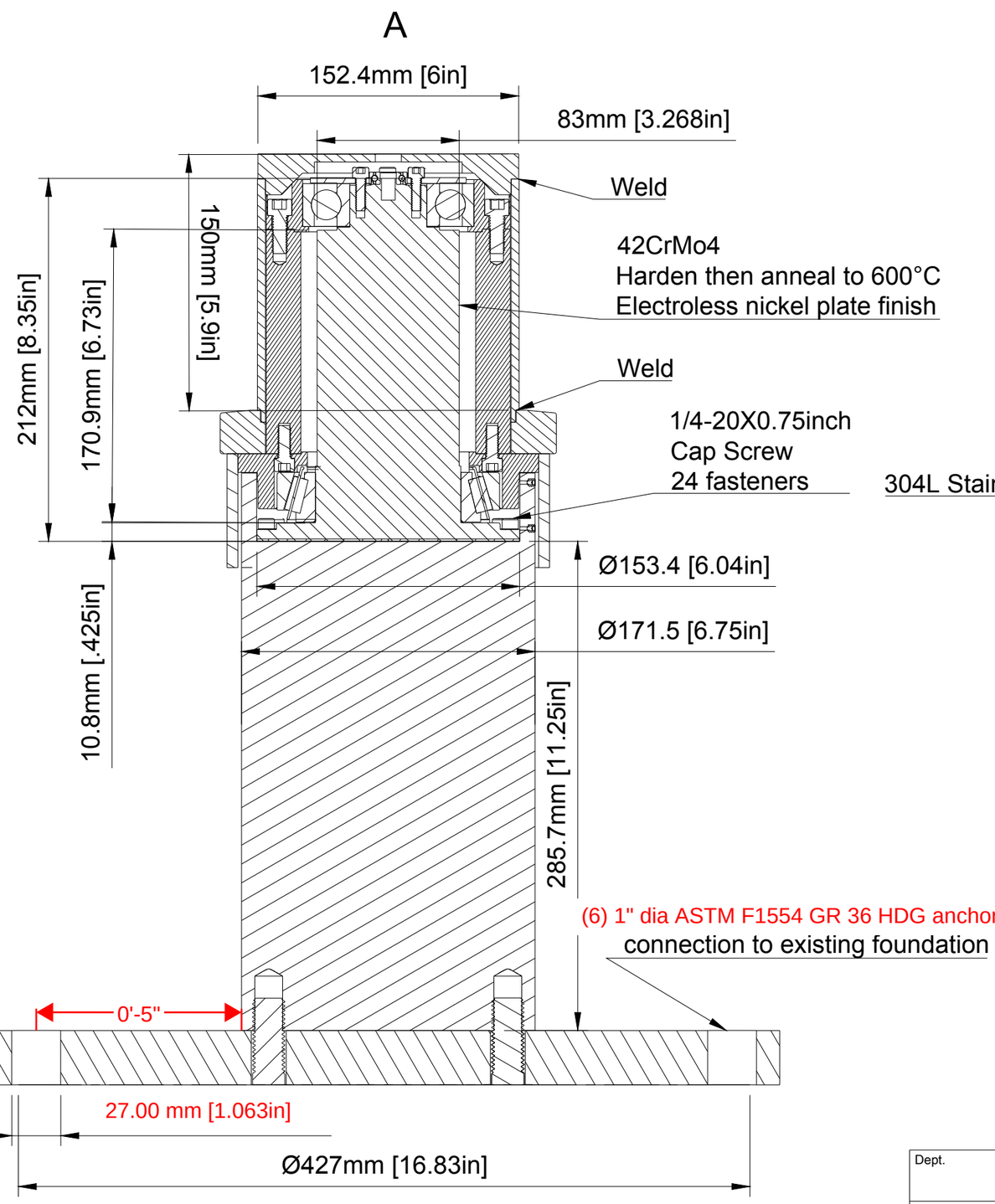
DETAIL B
SCALE 1 : 8

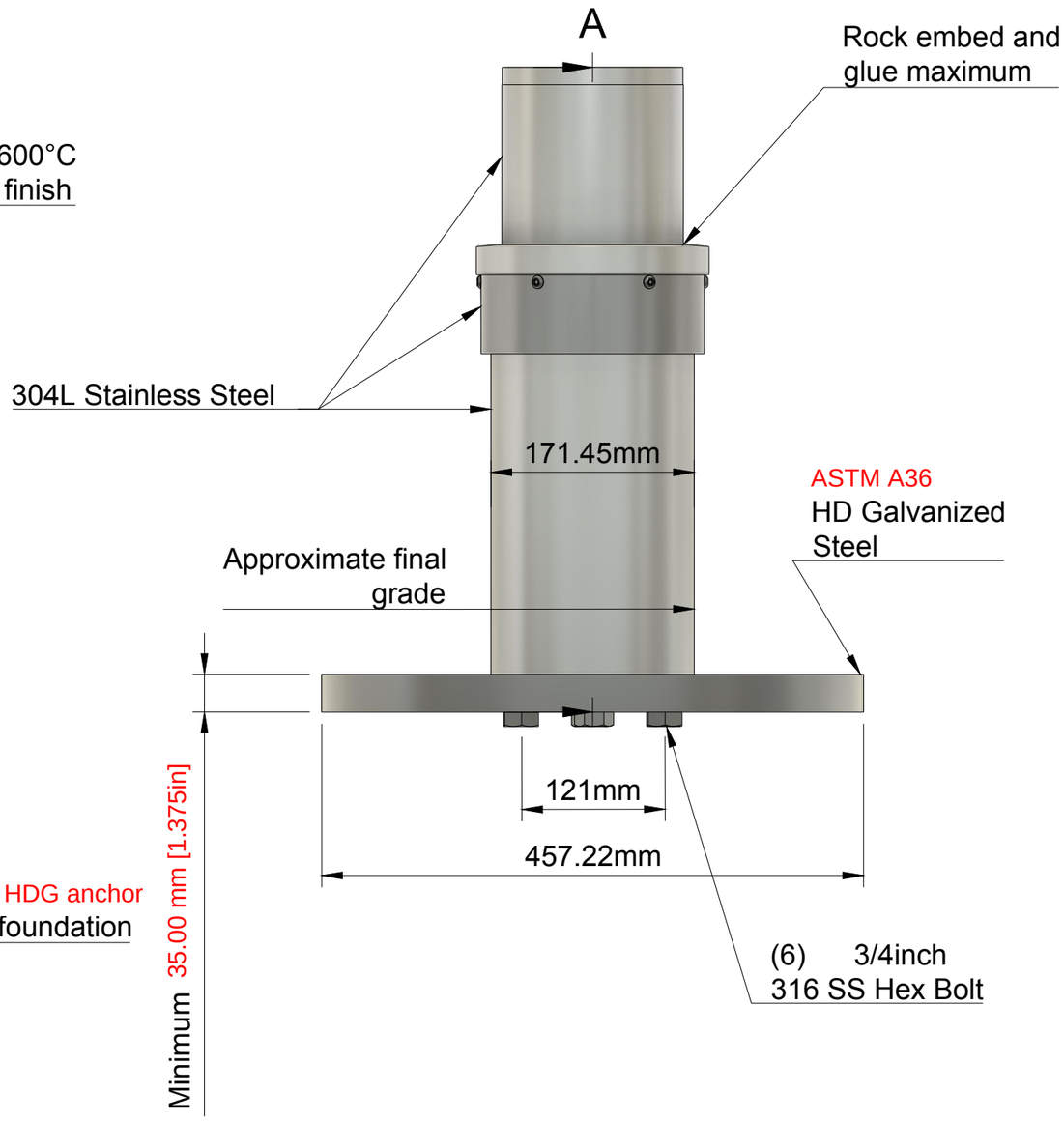
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±		NAME	DATE
			DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
			Q.A.		
		MATERIAL	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

SSK-2

Rockspinner Bearing Detail
By Zachary Coffin
Gravity Works Inc.
Not to scale, not for building.

SIZE	DWG. NO.	REV.
A	drawing_w_details1	
SCALE:1:32	WEIGHT:	SHEET 1 OF 1





Dimensions for engineering analysis.

Dept.	Technical reference	Created by	Approved by
		Zachary Coffin 4/16/19	
		Document type	Document status
		Title: Rockspinner Bearing	DWG No.: SSK-3
			Rev. / Date of issue / Sheet: 1/1

STATEMENT OF SPECIAL INSPECTION

Community Development • Planning & Building
2263 Santa Clara Ave., Rm. 190
Alameda, CA 94501-4477
alamedaca.gov
510.747.6800 • F: 510.865.4053 • TDD: 510.522.7538
Hours: 7:30 a.m.–3:30 p.m., M–Th

Project Title: Rockspinners by Zachary Coffin Plan Check #: B19-0549

Project Address: 1925 Sherman

This Statement of Special Inspections is submitted in fulfillment of the requirements of California Building Code Sections 1704 and 1705.

Special Inspections and Testing will be performed in accordance with the approved plans and specifications, this statement and California Building Code Sections 1704, 1705, 1707, and 1708.

The attached Summary of Special Inspection lists the special inspections and tests required. Special inspectors will refer to the approved plans and specifications for detailed special inspection requirements.

Any additional tests and inspections required by the approved plans and specifications will also be performed.

Before a Permit Can be Issued

The owner or his representative, on the advice of the registered design professional in responsible charge, shall complete, sign by all parties, and submit two (2) copies of this package to this Division for review and approval.

1. The Owner recognizes his or her obligation to ensure that the construction complies with the approved permit documents and to implement this program of special inspections.
2. Contractor is responsible for proper notification to the Inspection or Testing agency for items listed.
3. Only the testing laboratory should take samples and transport them to their laboratory.
4. Copies of all laboratory reports and inspections are to be sent directly to this Division and to the registered design professional in responsible charge by the testing agency on a weekly basis.
5. Inspection agency to submit names and qualifications of on-site special inspectors to this Division for approval. Submission of qualifications is not required when the agency utilizes the inspectors who are pre-approved by the City. See Item #10 below.

   The agency must provide each special inspector with an identification badge that indicates the following:

   - Name of inspector
   - Photo of inspector
   - The specific areas in which the inspector is qualified to inspect
   - An authorization signature by the registered engineer who is a full-time employee of the agency
   - The authorization signature by the registered engineer who is a full-time employee of the inspector
6. The special inspector is responsible to the Chief Building Official for immediate notification of any concerns and/or problems encountered.
7. It is the responsibility of the contractor to review the Building Division approved plans for additional inspection or testing requirements that may be noted. A pre-construction conference at the job site is recommended to review special inspection procedures.
8. The special inspector shall use only Building Division approved drawings.
9. **Before an occupancy permit can be issued**: A final report of special inspections documenting required special inspections, tests and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy (California Building Code Section 1704.1.2). The final report will document:

   - Required special inspections
   - Correction of discrepancies noted in inspection
10. Attach a City approved matrix list from the Special Inspection Agency for all special inspectors showing inspection areas for which they are qualified by experience and appropriate certifications (see enclosed). This will be cross checked with the list currently residing in our office, to make sure all special inspectors are approved by the City.

ACKNOWLEDGEMENT

Print: Erik Kneer, S.E. Sign: _____ Date: 9/16/19
Registered Design Professional in Responsible Charge

Print: _____ Sign: _____ Date: _____
Owner's authorization

Print: _____ Sign: _____ Date: _____
Contractor

Print: _____ Sign: _____ Date: _____
Special Inspection Agency

Print: _____ Sign: _____ Date: _____
Building Official's Acceptance

Revised 8/1/2016
G:\Comdev\Forms\Building Applications\Statement of Special Inspection.docx

SPECIAL INSPECTION AND TESTING AGENCIES

The following are the testing agencies and special inspectors that will be retained to conduct tests and inspection on this project.

RESPONSIBILITY	FIRM NAME	ADDRESS, TELEPHONE AND E-MAIL
Special Inspection		
Material Testing		

CONTRACTOR'S STATEMENT OF RESPONSIBILITY

Per Section 1706 of the California Building Code, the contractor responsible for the construction of a main wind or seismic force resisting system, designated seismic system or a wind or seismic resisting component listed in the statement of special inspections (structural tests and inspection schedule and as noted on the Building Division approved plans) shall submit a written statement of responsibility to the Building Official and the owner prior to the commencement of work on the system or component.

To comply with the requirements of California Building Code Section 1706 of the California Building Code, the contractor acknowledges that they are aware of the special requirements contained in the statements of special inspections (structural tests and inspection schedule and as noted on the Building Division approved plans) prepared by the engineer of record or the registered design professional per the requirements of California Building Code Section 1705.

ACKNOWLEDGEMENT

Print: _____ Sign: _____ Date: _____
Contractor

SEISMIC AND WIND RESISTANCE

Seismic Requirements (California Building Code Section 1705.3.1)

Description of seismic-force-resisting system and designated seismic systems subject to special inspections in accordance with California Building Code Section 1705.3:

Non Building Structure, Amusement Structures and Monuments, ASCE 7-10 15.4. Special inspection of monument anchorage and foundation reinforcement required.

The extent of the seismic-force-resisting system is defined in more detail in the construction documents.

Wind Requirements (California Building Code Section 1705.4.1)

Description of seismic-force-resisting system and designated seismic systems subject to special inspections in accordance with California Building Code Section 1705.3:

See above.

The extent of the main wind-force-resisting system and wind resisting components is defined in more detail in the construction documents.

SUMMARY OF SPECIAL INSPECTION

Complete the following form to indicate the types of special inspection required on this project. List the required inspections from the California Building Code Chapter 17; indicate Continuous or Periodic or both as required by code. **Reference California Building Code Chapter 17 for a complete list of inspections.**

Construction Type Requiring Inspection	List of Required Inspections	C	P
Steel – Table 1704.3	High-strength bolting		X
	Structural Welding		X
Concrete – Table 1704.4	Concrete Reinforcement		X
	Cast-in-place Anchors		X
Masonry			
Level 1 – Table 1704.5.1			
Level 2 – Table 1704.5.3			
Wood – Section 1704.6			
Soils – Table 1704.7			
Pile Foundations – Table 1704.8			
Pier Foundations – Table 1704.9			
Sprayed Fire-Resistant Materials – Section 1704.10			
Mastic and Intumescent Coatings – Section 1704.11			
Exterior Insulation and Finish Systems – Section 1704.12			
Alternate Materials and Systems – Section 1704.13			
Smoke Control System – Section 1704.14			
Wind Resistance – Section 1705.4			
Seismic Resistance – Section 1707			
Testing for Seismic Resistance – Section 1708			
Specify other tests, inspections, or special instructions as required:			

RECOGNIZED SPECIAL INSPECTION AND TESTING AGENCIES

Updated: May 31, 2013

Key: RC = Reinforced Concrete; PC = Prestressed Concrete; SM = Structural Masonry; SW = Steel Welding; HSB = High-Strength Bolting; NDT = Non-destructive Testing; SWC = Structural Wood Construction; FP = Fireproofing

Agency Name	Address	Phone/Fax	RC	PC	SM	SW	HSB	NDT	SWC	FP	Expiration
A 1 Inspection Services	1754 Mission Street San Francisco, CA 94109	**(415) 621-8001** (415) 358-4409	X	X	X	X	X	X	X	X	8/7/2015
Achievement Engineering Corp.	434 Camille Circle #13 San Jose, CA 95134	**(800) 653-1397** (408) 852-0331	X	X	X		X		X	X	7/10/2015
Advanced Testing & Inspection, LLC	540 Brunken Avenue, Suite B Salinas, CA 93907	**(831) 422-2272** (831) 597-2004	X	X	X	X	X			X	2/5/2016
Apex Testing Laboratories, Inc.	3450 Third Street, Suite 3E San Francisco, CA 94124	**(415) 550-9800** (415) 550-9880	X	X	X	X	X			X	Exp. 3/3/2012
Applied Materials & Engineering, Inc.	980 41st Street Oakland, CA 94608	**(510) 420-8190** (510) 420-8186	X	X	X	X	X	X	X	X	4/11/2016
BAGG Engineers	847 West Maude Avenue Sunnyvale, CA 94085	**(650) 852-9133** (650) 852-9138	X	X	X	X	X	X		X	3/6/2015
Berlogar, Stevens and Associates	5587 Sunol Boulevard Pleasanton, CA 94566	**(925) 484-0220** (925) 846-9645	X	X	X	X	X				6/7/2014
Biggs Cardosa Associates, Inc.	1871 The Alameda, Suite 200 San Jose, CA 95126	**(408) 296-5515** (408) 296-8114	X	X	X	X	X				2/1/2014
B.S.K. Associates	324 Earhart Way Livermore, CA 94551	**(925) 315-3151** (925) 315-3152	X	X	X	X	X	X		X	10/2/2015
Capex Engineering Inc.	571 Seville Place Fremont, CA 94539	**(510) 668-1815** (510) 490-8690	X	X	X	X	X		X	X	4/3/2015
Consolidated Engineering Labs	2001 Crow Canyon Rd, Suite 100 San Ramon, CA 94583	**(925) 314-7100** (925) 855-7140	X	X	X	X	X	X	X	X	3/27/2015
Construction Materials Testing, Inc.	2278-F Pike Court Concord, CA 94520	**(925) 825-2840** (925) 682-7953	X	X	X	X	X			X	3/14/2016
Construction Testing Services	2174 Rheem Drive, Suite A Pleasanton, CA 94588	**(925) 462-5151** (925) 462-5183	X	X	X	X	X	X	X	X	4/25/2016
Construction Testing & Engineering, Inc.	242 West Larch Road, Suite F Tracy, CA 95304	**(209) 839-2890** (209) 839-2895	X	X	X	X	X			X	Exp. 2/2/2013
Earth System Pacific	780 Montague Expy, Suite 205 San Jose, CA 95131	**(408) 934-9302** (408) 946-4569	X	X	X	X	X			X	4/3/2015
EARTHTEC, Inc.	1830 Vernon Street, Suite 7 Roseville, CA 95678	**(916) 786-5262** **(916) 786-5263**	X	X	X	X	X			X	6/1/2013
ENGEO Incorporated	2010 Crow Canyon Pl., Suite 250 San Ramon, CA 94583-1545	**(925) 866-9000** (888) 279-2698	X	X	X	X	X	X	X	X	3/6/2015
Geocon Consultants, Inc.	6671 Brisa Street Livermore, CA 94550	**(925) 371-5900** (925) 371-5915	X	X	X		X			X	5/10/2015
Holdrege & Kull	792 Searls Ave Nevada City, CA 95959	**(530) 478-1305** (530) 478-1019	X	X	X	X	X	X		X	8/6/2015
HP Inspections	690 Sunol Street, Bldg. Hx San Jose, CA 95126	**(408) 288-8460** (408) 271-0902	X	X	X	X	X	X		X	3/1/2014
Inspection Consultants, Inc.	1515 North C Street Sacramento, CA 95814	**(916) 321-5580** (916) 321-5590	X	X	X	X	X			X	10/2/2015
Inspection Services Inc.	1798 University Avenue Berkeley, CA 94703	**(415) 243-3265** (415) 243-3266	X	X	X	X	X	X	X	X	10/2/2015
KC Engineering Co.	865 Cotting Lane, Suite A Vacaville, CA 95688	**(707) 447-4025** (707) 447-4143	X	X	X	X	X			X	12/6/2014
Agency Name	**Address**	**Phone/Fax**	**RC**	**PC**	**SM**	**SW**	**HSB**	**NDT**	**SWC**	**FP**	**Expiration**

Kleinfelder Inc.	21330 Broadway, Suite 1200 Oakland, CA 94612	**(510) 628-9000** (510) 628-9009	X	X	X	X	X	X	X	X	10/2/2015
Korbmacher Engineering Inc.	480 Preston Court, Suite B Livermore, CA 94551	**(925) 454-9033** (925) 454-9564	X	X	X	X	X		X	X	1/27/2015
Krazan and Associates Inc.	6711 Sierra Court, Suite B Dublin, CA	**(925) 307-1160** (925) 307-1161	X	X	X	X	X			X	Exp. 6/9/2012 Pending Review
MatriScope Engineering Laboratories, Inc.	436 14th Street, Suite 1429 Oakland, CA 94612	**(510) 763-3601** (510) 763-1388	X	X	X	X	X	X	X	X	9/24/2015
Moore Twining Associates, Inc.	2527 Fresno Street Fresno, CA 93721	**(559) 268-7021** (559) 268-0740	X	X	X	X	X			X	Exp. 8/11/2012 Pending Review
Neil O. Anderson and Associates	50 Goldenland Ct., #100 Sacramento, CA 95834	**(916) 928-4690** (916) 928-4697	X	X	X	X	X		X	X	4/17/2015
Nicholas Engineering Consultants	6743 Dublin Boulevard, #15 Dublin, CA 94568	**(925) 829-8090** (925) 829-0235	X	X	X	X	X		X	X	8/21/2015
Ninyo & Moore	1956 Webster Street, Suite 400 Oakland, CA 94612	**(510) 633-5640** (510) 633-5646	X	X	X	X	X			X	Exp. 12/11/2012 Pending Review
Purcell, Rhoades & Associates, Inc.	1041 Hook Avenue Pleasant Hill, CA 94523	**(925) 932-1177** (925) 932-2795	X		X						Expired 10/7/2011
Professional Service Industries, Inc.	365 Victor Street, Suite C Salinas, CA 93907	**(831) 757-3536** (831) 757-6265	X		X	X	X			X	3/1/2014
Raney Geotechnical, Inc.	3140 Beacon Blvd. West Sacramento, CA 95691	**(916) 371-0434** (916) 371-1809	X	X	X	X	X			X	5/14/2013
RES Engineers, Inc.	1250 Missouri Street, Suite 207 San Francisco, CA 94107	**(415) 822-4625** (415) 822-8925	X	X	X	X	X	X	X	X	8/7/2015
RMA Group	6293 San Ignacio Ave, Suite A San Jose, CA 95119	**(408) 362-4920** (408) 362-4926	X	X	X	X	X			X	10/4/2014
Salem Engineering Group, Inc.	4055 W. Shaw Ave, Suite 110 Fresno, CA 93722	**(559) 271-9700** (559) 275-0827	X	X	X	X	X	X			5/3/2014
Signet Testing Laboratories	3526 Breakwater Ct. Hayward, CA 94545	**(510) 887-8484** (510) 783-4295	X	X	X	X	X			X	Exp. 9/28/2012
Smith-Emery Company	Hunters Point Shipyard, Building 114 San Francisco, CA 94188	**(415) 642-7326** (415) 642-7055	X	X	X	X	X	X	X	X	1/9/2016
Stevens Ferrone & Bailey	1600 Willow Pass Court Concord, CA 94520	**(925) 688-1001** (925) 688-1005	X	X	X	X	X		X	X	7/5/2014
Summit Associates	2300 Clayton Road, Suite 1380 Concord, CA 94520	**(925) 363-5560** (925) 363-5511	X		X	X	X	X	X	X	3/6/2015
T. Makdissy Consulting, Inc.	23 Las Colinas Lane, Suite 106 San Jose, CA 95119	**(408) 227-8595** (408) 227-1672	X	X	X	X				X	1/29/2016
Testing Engineers Inc.	2811 Teagarden Street San Leandro, CA 94577	**(510) 835-3142** (510) 834-3777	X	X	X	X	X	X	X	X	5/3/2014
Twining	1572 Santa Ana Avenue Sacramento, CA 95838	**(916) 649-9000** (916) 921-8532	X	X	X	X	X			X	4/3/2015
Valley Inspection	326 Woodrow Avenue Vallejo, CA 94591	**(707) 552-7037** (707) 552-7022				X			X	X	2/7/2015
Wallace-Kuhl & Associates, Inc.	3050 Industrial Boulevard West Sacramento, CA 95691	**(916) 372-1434** (916) 372-2565	X	X	X	X	X	X		X	4/19/2016
Youngdahl Consulting Group, Inc.	1234 Glenhaven Court El Dorado Hills, CA 95762	**(916) 933-0633** (916) 933-6482	X	X	X	X	X	X	X	X	8/17/2015

Agencies may have offices in more than one location. Agencies with a “Pending Review” status are recognized. Other agencies may be approved by local jurisdictions.

Appendix B:

Structural Calculations

PROJECT SCOPE/DESCRIPTION

Holmes Structures has been engaged to design the structural anchorage and foundations for Zachary Coffin's Rockspinner installations at Jean Sweeney Open Space Park in Alameda, CA.

The sculpture consists of an 11,000 lb boulder balanced on a stainless steel bearing hub which allows it to spin about its vertical axis. The bearing is anchored to the shallow spread footings through a cast-in-place embed assembly. The boulder's center of gravity was approximated by the Artist to be located at approximately 6'-0" above grade. Refer to the project design criteria for more information.

The following calculations outline the structural design criteria and evaluate the necessary anchorage and foundation elements to secure the anchor to meet the requirements of the 2016 California Building Code (CBC).

LIMITATIONS

The calculations provided herein are for the sole use of Zachary Coffin, and are provided for the purpose of obtaining a building permit with City of Alameda for the structural design of the project's anchorage and foundations. These calculations are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses.

TABLE OF CONTENTS

1.0 - DESIGN CRITERIA

DESIGN CRITERIA

Note: all current errata and supplements apply

			Governing Jurisdiction			
Category	Document Label	Document Title	2007 CBC	2010 CBC	2013 CBC	2016 CBC
General	CBC	California Building Code	2007	2010	2013	2016
General	IBC	International Building Code	2006	2009	2012	2015
General	IRC	International Residential Code	2006	2009	2012	2015
General	CRC	California Residential Code	2007	2010	2013	2016
General	CGBSC	California Green Building Standards Code	2007	2010	*	*
General	SFGBC	San Francsico Green Building Code	-	-	2013	2016
Loading	ASCE/SEI 7	Minimum Design Loads for Buildings and Other Structures	2005	2005	2010	2010
Loading	ASCE 41	Seismic Rehabilitation of Existing Buildings	2006	2006	2006	2013
Concrete	ACI 318	Building Code Requirements for Structural Concrete	2005	2008	2011	2014
Steel	AISC 360	Specification for Structural Steel Buildings	2005	2005	2010	2010
Steel	AISC 358	Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications	2005	2005	2010	2010
Steel	AISC 341	Seismic Provisions for Structural Steel Buildings	2005	2005	2010	2010
Steel	AWS D1.1	Structural Welding Code - Steel	2006	2008	2010	2010
Steel	AWS D1.4	Structural Welding Code - Reinforcing Steel	2005	2005	2011	2011
Steel	AWS D1.8	Structural Welding Code - Seismic Supplement	-	2009	2009	2009
Cold-Formed Steel	AISI S100	North American Specifications for the Design of Cold-Formed Steel Structural Members	2001**	2007	2007	2007
Cold-Formed Steel	AISI S213	North American Standard for Cold-formed Steel Framing-Lateral Design	2004***	2007	2007	2007
Wood	AF&PA NDS	National Design Specification for Wood Construction	2005	2005	2012	2015
Wood	AF&PA SDPWS	Special Design Provisions for Wind and Seismic	2005	2008	2008	2015
Masonry	MSJC	Masonry Standards Joint Committee: Building Code Requirements for Masonry Structures	2005	2008	2011	2013
Masonry	TMS 402	Building Code Requirements for Masonry Structures	2005	2008	2011	2013
Masonry	ACI 530	Building Code Requirements for Masonry Structures	2005	2008	2011	2013
Masonry	ASCE 5	Building Code Requirements for Masonry Structures	2005	2008	2011	2013
Aluminum	ADM 1	Aluminum Design Manual	2005	2005	2005	2015

* California Green Building Code requirements were transferred to the San Francisco Green Building Code

LOAD COMBINATIONS

A. LRFD Load Combinations per CBC 2016 Section 1605.2

Eq.		Combination
(16-1)	a	1.4 D + 1.4 F
(16-2)	a	1.2 D + 1.2 F + 1.6 L + 1.6 H + 0.5 Lr
	b	1.2 D + 1.2 F + 1.6 L + 1.6 H + 0.5 S
	c	1.2 D + 1.2 F + 1.6 L + 1.6 H + 0.5 R
(16-3)	a	1.2 D + 1.2 F + 1.6 Lr + 1.6 H + f1 L
	b	1.2 D + 1.2 F + 1.6 S + 1.6 H + f1 L
	c	1.2 D + 1.2 F + 1.6 R + 1.6 H + f1 L
	d	1.2 D + 1.2 F + 1.6 Lr + 1.6 H + 0.5 W
	e	1.2 D + 1.2 F + 1.6 S + 1.6 H + 0.5 W
	f	1.2 D + 1.2 F + 1.6 R + 1.6 H + 0.5 W
(16-4)	a	1.2 D + 1.2 F + 1.0 W + f1 L + 1.6 H + 0.5 Lr
	b	1.2 D + 1.2 F + 1.0 W + f1 L + 1.6 H + S Lr
	c	1.2 D + 1.2 F + 1.0 W + f1 L + 1.6 H + R Lr
(16-5)	a	1.2 D + 1.2 F + 1.0 E + f1 L + 1.6 H + f2 S
	b	1.41 D + 1.0 Q_E + f1 L + 0.2 S ASCE 7-16 Section 12.14.3.1
	c	1.41 D + #N/A Q_E + f1 L + 0.2 S ASCE 7-16 Section 12.14.3.2; Ωo
(16-6)	a	0.9 D + 1.0 W + 1.6 H
(16-7)	a	0.9 D + 0.9 F + 1.0 E + 1.6 H
	b	0.69 D + 1.0 Q_E + 1.6 H ASCE 7-16 Section 12.14.3.1
	c	0.69 D + #N/A Q_E + 1.6 H ASCE 7-16 Section 12.14.3.2; Ωo

*f1 = 1.0 (1 for places of public assembly L in excess of 100 psf and parking garages; 0.5 otherwise)

**f2 = 0.7 (0.7 for roof configurations that do not shed snow off the structure; 0.2 otherwise)

*** where the effect of H resists the primary variable load effect, a load factor of 0.9 shall be included with H where H is permanent and H shall be set to zero for all other conditions.

****See CBC Section 1605.2.1 for other loads

B. ASD Load Combinations per CBC 2016 Section 1605.3.1

Eq.		Combination																
(16-8)	a	1.0	D	+	1.0	F												
(16-9)	a	1.0	D	+	1.0	H	+	1.0	F	+	1.0	L						
(16-10)	a	1.0	D	+	1.0	H	+	1.0	F	+	1.0	Lr						
	b	1.0	D	+	1.0	H	+	1.0	F	+	1.0	S						
	c	1.0	D	+	1.0	H	+	1.0	F	+	1.0	R						
(16-11)	a	1.0	D	+	1.0	H	+	1.0	F	+	0.75	L	+	0.75	Lr			
	b	1.0	D	+	1.0	H	+	1.0	F	+	0.75	L	+	0.75	S			
	c	1.0	D	+	1.0	H	+	1.0	F	+	0.75	L	+	0.75	R			
(16-12)	a	1.0	D	+	1.0	H	+	1.0	F	+	0.6	W						
	b	1.0	D	+	1.0	H	+	1.0	F	+	0.7	E						
	c	1.15	D	+	1.0	H	+	1.0	F	+	0.7	Q_E	ASCE 7-16 Section 12.14.3.1					
	d	1.15	D	+	1.0	H	+	1.0	F	+	#N/A	Q_E	ASCE 7-16 Section 12.14.3.2; Ωo					
(16-13)	a	1.0	D	+	1.0	H	+	1.0	F	+	0.45	W	+	0.75	L	+	0.75	Lr
	b	1.0	D	+	1.0	H	+	1.0	F	+	0.45	W	+	0.75	L	+	0.75	S
	c	1.0	D	+	1.0	H	+	1.0	F	+	0.45	W	+	0.75	L	+	0.75	R
(16-14)	a	1.0	D	+	1.0	H	+	1.0	F	+	0.525	E	+	0.75	L	+	0.75	S
	b	1.11	D	+	1.0	H	+	1.0	F	+	0.525	Q_E	+	0.75	L	+	0.75	Lr
	c	1.11	D	+	1.0	H	+	1.0	F	+	0.525	Q_E	+	0.75	L	+	0.75	S
	d	1.11	D	+	1.0	H	+	1.0	F	+	0.525	Q_E	+	0.75	L	+	0.75	R
	e	1.11	D	+	1.0	H	+	1.0	F	+	#N/A	Q_E	+	0.75	L	+	0.75	Lr
	f	1.11	D	+	1.0	H	+	1.0	F	+	#N/A	Q_E	+	0.75	L	+	0.75	S
	g	1.11	D	+	1.0	H	+	1.0	F	+	#N/A	Q_E	+	0.75	L	+	0.75	R
(16-15)	a	0.6	D	+	0.6	W	+	1.0	H									
(16-16)	a	0.6	D	+	0.6	F	+	0.7	E	+	1.0	H						
	b	0.45	D	+	0.7	Q_E	+	1.0	H									
	c	0.45	D	+	#N/A	Q_E	+	1.0	H									

* crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load

** flat roof snow loads of 30 psf or less and roof live loads of 30 psf or less need not be combined with seismic loads. Where flat roof snow loards exceed 30 psf, 20 percent shall be combined with seismic

*** where the effect of H resists the primary variable load effect, a load factor of 0.6 shall be included with H where H is permanent and H shall be set to zero for all other conditions.

**** in ASCE 7-16 eq. 16-15, W is permitted to be reduced in accordance with Exception 2 of Section

***** in Equation 16-16, 0.6D is permitted to be increased to 0.9D for the design of special reinforced masonry shear walls complying with Chapter 21 of the 2015 IBC

C. Alternate ASD Load Combinations per CBC 2016 Section 1605.3.2

Eq.		Combination										
(16-17)	a	1.0	D	+	1.0	L	+	1.0	Lr			
	b	1.0	D	+	1.0	L	+	1.0	S			
	c	1.0	D	+	1.0	L	+	1.0	R			
(16-18)	a	1.00	D	+	1.0	L	+	0.78	W			
	b	0.67	D	+	1.0	L	+	0.78	W			
(16-19)	a	1.00	D	+	1.0	L	+	0.78	W	+	0.5	S
	b	0.67	D	+	1.0	L	+	0.78	W	+	0.5	S
(16-20)	a	1.00	D	+	1.0	L	+	1.0	S	+	0.39	W
	b	0.67	D	+	1.0	L	+	1.0	S	+	0.39	W
(16-21)	a	1.0	D	+	1.0	L	+	1.0	S	+	0.714	E
(16-22)	a	0.9	D	+	0.714	E						

MATERIAL PROPERTIES

Materials (All values below are default values in general notes.)

1. Concrete, f'_c=2500 psi for all normal weight concrete.
2. Structural Steel
    a.) All Steel plates, gussets and tabs are ASTM A572 (F_y = 50 ksi, U.O.N.).
    b.) Wide Flange Beams & Columns are ASTM A992 (F_y = 50 ksi).
    c.) Steel pipe is ASTM A53, Grade B (F_y = 35 ksi).
    d.) Rectangular structural steel tubing or HSS sections are ASTM A500, Grade B (F_y = 46 ksi).
    e.) Round structural steel tubing or HSS sections are ASTM A500, Grade B (F_y = 42 ksi).
    f.) All metal studs, track, etc. is ASTM A653, Grade 33.
    g.) All stainless steel fabrications shall be ASTM A304L
3. Rebar is ASTM A615, Grade 60 U.O.N.
4. Structural Fasteners
    a.) Erection, grouted, and timber connection bolts are ASTM A307, Grade A.
    b.) High strength bolts are ASTM A325.
    c.) Anchor rods and anchor bolts are ASTM F1554, Grade 36.

2.0 - LATERAL DESIGN

SEISMIC PARAMETERS

USGS Design Maps Summary https://seismicmaps.org/

5/10/2019 U.S. Seismic Design Maps

OSHPD

JSOSP Zach Coffin Rockspinners

Jean Sweeney Open Space Park, Atlantic Ave, Alameda, CA 94501, USA

Latitude, Longitude: 37.7789762, -122.2631533

Date	5/10/2019, 4:11:35 PM
Design Code Reference Document	ASCE7-10
Risk Category	I
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.582	MCE_R ground motion. (for 0.2 second period)
S_1	0.62	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.582	Site-modified spectral acceleration value
S_{M1}	0.93	Site-modified spectral acceleration value
S_{DS}	1.055	Numeric seismic design value at 0.2 second SA
S_{D1}	0.62	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.612	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.612	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	2.59	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.46	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.582	Factored deterministic acceleration value. (0.2 second)
S1RT	0.952	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.925	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.

S1D	0.62	Factored deterministic acceleration value. (1.0 second)
PGAd	0.612	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	1.053	Mapped value of the risk coefficient at short periods

N/S SEISMIC FORCES per ASCE 7-16 & 2015 IBC

Site Data

S_S= 1.58g S_1= 0.64g (both for MCE_R)

Design Spectrum

Site Class = D

F_a = 1.0 IBC Table 1613.5.3(1)

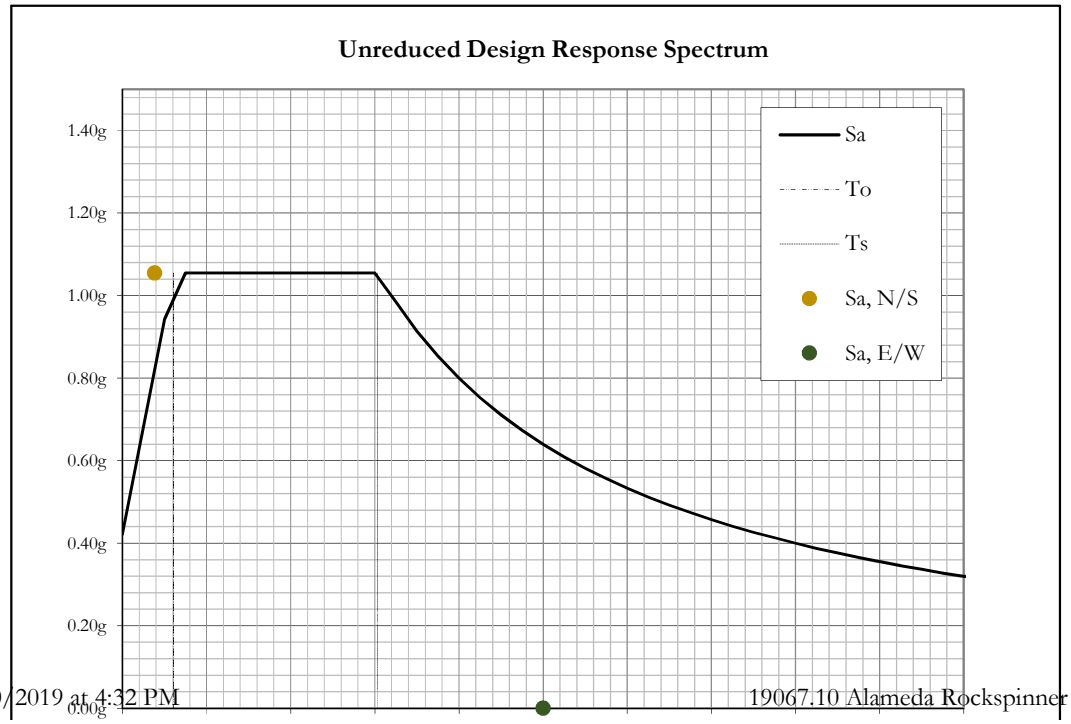
F_v = 1.5 IBC Table 1613.5.3(2)

S_{MS} = 1.58g $=F_aS_S$

S_{M1} = 0.96g $=F_vS_1$
S_{DS} = 1.05g $=(2/3)S_{MS}$
S_{D1} = 0.64g $=(2/3)S_{M1}$
T_0 = 0.12sec $=0.2(S_{D1}/S_{DS})$
T_S = 0.61sec $=(S_{D1}/S_{DS})$

Seismic Design Category (SDC)

Risk Category = II
Seismic Importance Factor, I_e = 1.00
Design Category (based on S_{DS}) = D IBC Table 1613.5.6(1)
Design Category (based on S_{D1}) = D IBC Table 1613.5.6(2)
Design Category (governing) = D Worst Case



SEISMIC FORCES per ASCE 7-16 & 2015 IBC

Structural System

Seismic Force Resisting System: Amusement Structures and Monuments (ASCE 7-10, Table 15.4-2)
Response Modification Coefficient, R: 2.00

Structure Period

T = building period by analysis

type = Other Structural System

h_n =	6.0 ft	Structure height
T_L =	12.0sec	Long period Transition
T_a =	0.08 sec	ASCE 7-16 eq. (12.8-7)
C_u =	1.40	Period Cap Does not Apply

T_{used} =	0.08 sec	Base Shear Period used	T_{used} =	0.00 sec	<-- For Drifts

Calculate Base Shear

	Strength		Drifts (period cap not considered)		
C_s =	0.53g	= $\frac{S_{DS}}{(R/I_e)}$	0.53g	= $\frac{S_{DS}}{(R/I_e)}$	C_s shall equal the value from ASCE 7 eq. (12.8-2)
C_s =	4.17g	= $\frac{S_{D1}}{T(R/I_e)}$	N.R.	= $\frac{S_{D1}}{T(R/I_e)}$	However, C_s need not exceed ASCE 7 eq. (12.8-3) if T is less than T_L
C_s =	653.20g	= $\frac{S_{D1}T_L}{T^2(R/I_e)}$	N.R.	= $\frac{S_{D1}T_L}{T^2(R/I_e)}$	& C_s need not exceed ASCE 7 eq. (12.8-4) if T is greater the T_L
C_s =	0.05g	= $\frac{\max(0.044 S_{Ds}I_e, 0.01)}{(R/I_e)}$	N.R.	= $\frac{\max(0.044 S_{Ds}I_e, 0.01)}{(R/I_e)}$	C_s shall not be less than ASCE 7 eq. (12.8-5)
C_s =	0.16g	= $\frac{0.5S_1}{(R/I_e)}$	0.16g	= $\frac{0.5S_1}{(R/I_e)}$	& if S_1 is greater than 0.60g than C_s Shall not be less than ASCE 7 eq. (12.8-6)

C_s =	0.53g	ASCE 7 eq. (12.8.2) Governs	<-- for strength
C_s =	0.53g	ASCE 7 eq. (12.8.2) Governs	<-- for drifts

WIND DESIGN

Conditions, Limitations and General Requirements

WIND LOADS ON OTHER STRUCTURES AND BUILDING APPURTENANCES-MWFRS
(PER ASCE 7-10, CHAPTER 29, SECTION 29.4.1 - solid freestanding walls and solid signs)

Applies only to:
- -regular shaped building as defined in Section 26.2
- -not subject to across wind loading, vortex shedding, etc.
- -no unusual response characteristics

No reductions are allowed due to shielding

Item C2 Geometry

	As, area of sign =	50	ft2

Step 1: Risk Category

Per Table 1.5-1	Risk Category =	I	-

Step 2: Basic Wind Speed

Per Figure 26.5-A	Basic Wind Speed =	110	mph

Step 3: Wind Load Parameters

Per Section 26.6	Wind Directionality, Kd =	0.85	-
Per Section 26.7	Exposure Category =	C	-
Per Section 26.8	Topographic Factor, Kzt =	1.0	-
Per Section 26.9	Gust Effect Factor =	0.85	-

Step 4: Velocity Pressure Exposure Coefficient

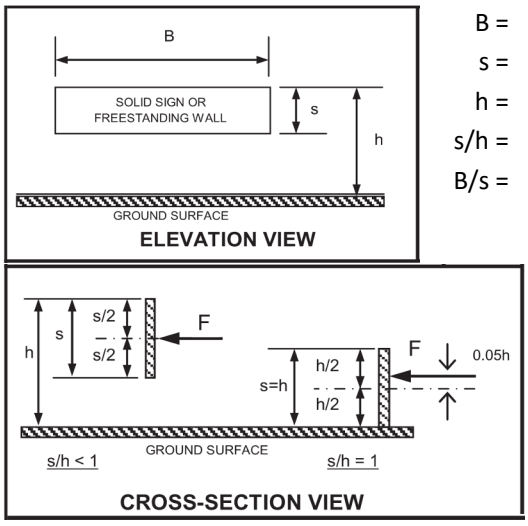
Per Table 29.3-1	Kh = Kz =	0.85	-

Step 5: Velocity pressure

Per Equation 29.3-1	q_h =	22.4	psf

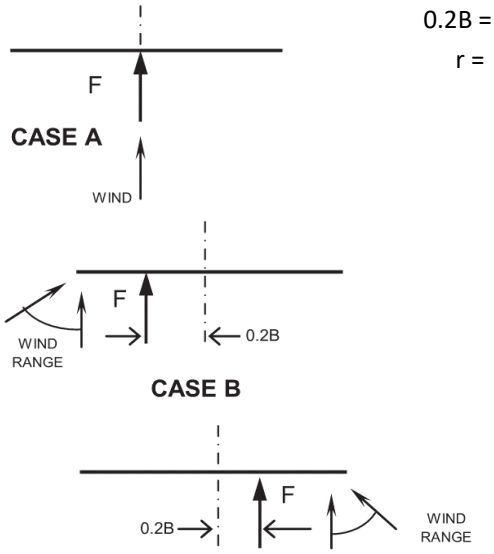
Step 6: Force Coefficient

Per Figure 29.4-1



B =	5	ft
s =	10	ft
h =	10	ft
s/h =	1.0	-
B/s =	0.5	-

Case A & Case B



Cf =	1.55	-	
0.2B =	1.00	-	
r =	0.50	ft	(vert distance of F from centroid)

Step 7: Wind Force

Per Equation 29.4-1

p=	29	psf	
F =	1474	#	(for Case A & B)
r =	0.50	ft	(for Case A & B)

Check Overturning Stability & Anchorage:

W	11	k	
COG	6	ft	
B	1	ft	
Cs	0.5273	g	
V, eq	5.8007	k	<-----Seismic Governs
Vwind	1.4743	k	
Mot	8.8458	k-ft	
Mres	4.95	k-ft	
DCR	1.79		<-------Needs Anchorage for Stability

USE (6) 1" dia F1554 anchor rods w/ 12" embed, See Anchor Designer Calcs

Check bolts from bearing hub to baseplate

Mnet	3.8958	k-ft	
diameter of bolts	4.75	in	
Tu, bolts	9.8419	kips	<---conservative, in actuality (2) bolts engaged
Fy	45	ksi	
Fu	85	ksi	
A,bolt	0.334	in^2	
phi	0.75		
phi Tn	21.293	kips	
DCR	0.4622		

USE (6) 3/4" dia SS 316 bolts to bearing hub

Size baseplate thickness:

Anchor Tu	12.4	k	<-----From Simpson Anchorage Calcs
Moment Arm	4.125	in	
Mu	51.15	k-in	
b, pl	4	in	
Fy, pl	36	ksi	
Z, req'd	1.5787	in^3	Z = bd^2/4
t, req'd	1.2565	in	t = (4Z/b)^1/2

USE 1 3/8" thick ASTM A36 Baseplate

3.0 - FOUNDATION DESIGN

Zach Coffin - Alameda Rockspinners

Holmes Structures

Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 16 SEP 2019, 9:21PM

General Footing

n\data\HStr\home\HStr.STR\2019\19067.10\2BORDR~V\0B3PCE~R\19067.10_Alameda Rockspinner Calcs.ec6

Lic. # : KW-06000326 — **Licensee : HOLMES STRUCTURES**

Description : Rockspinner Footings

Code References

Calculations per ACI 318-14, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : ASCE 7-10

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	Yes

Soil Design Values

Allowable Soil Bearing	=	2.0 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	100.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Footing base depth below soil surface	=	1.50 ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

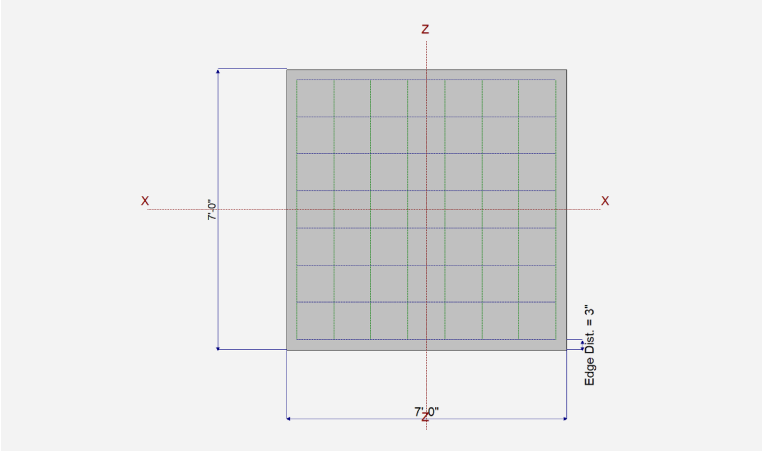
Width parallel to X-X Axis	=	7.0 ft
Length parallel to Z-Z Axis	=	7.0 ft
Footing Thickness	=	16.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0 in



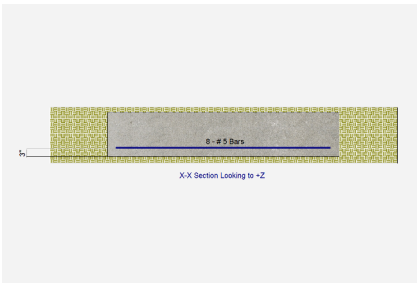
Reinforcing

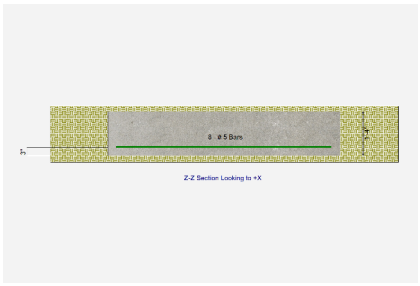
Bars parallel to X-X Axis		
Number of Bars	=	8.0
Reinforcing Bar Size	=	# 5
Bars parallel to Z-Z Axis		
Number of Bars	=	8.0
Reinforcing Bar Size	=	# 5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation: n/a

# Bars required within zone	n/a
# Bars required on each side of zone	n/a





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	11.0		0.50					k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=						36.0		k-ft
V-x	=						6.0		k
V-z	=								k

General Footing

Lic. # : KW-06000326 **Licensee : HOLMES STRUCTURES**

Description : Rockspinner Footings

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.5480	Soil Bearing	1.096 ksf	2.0 ksf	+0.60D+0.70E+0.60H about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.950	Overturning - Z-Z	23.10 k-ft	45.052 k-ft	+0.60D+0.70E+0.60H
PASS	1.105	Sliding - X-X	4.20 k	4.639 k	+0.60D+0.70E+0.60H
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.2547	Z Flexure (+X)	5.109 k-ft/ft	20.061 k-ft/ft	+0.90D+E+0.90H
PASS	0.09596	Z Flexure (-X)	1.925 k-ft/ft	20.061 k-ft/ft	+1.40D+1.60H
PASS	0.09596	X Flexure (+Z)	1.925 k-ft/ft	20.061 k-ft/ft	+1.40D+1.60H
PASS	0.09596	X Flexure (-Z)	1.925 k-ft/ft	20.061 k-ft/ft	+1.40D+1.60H
PASS	0.1697	1-way Shear (+X)	12.726 psi	75.0 psi	+0.90D+E+0.90H
PASS	0.06581	1-way Shear (-X)	4.936 psi	75.0 psi	+1.40D+1.60H
PASS	0.06581	1-way Shear (+Z)	4.936 psi	75.0 psi	+1.40D+1.60H
PASS	0.06581	1-way Shear (-Z)	4.936 psi	75.0 psi	+1.40D+1.60H
PASS	0.1480	2-way Punching	22.198 psi	150.0 psi	+1.40D+1.60H

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, +D+H	2.0	n/a	0.0	0.4378	0.4378	n/a	n/a	0.219
X-X, +D+L+H	2.0	n/a	0.0	0.4480	0.4480	n/a	n/a	0.224
X-X, +D+Lr+H	2.0	n/a	0.0	0.4378	0.4378	n/a	n/a	0.219
X-X, +D+S+H	2.0	n/a	0.0	0.4378	0.4378	n/a	n/a	0.219
X-X, +D+0.750Lr+0.750L+H	2.0	n/a	0.0	0.4455	0.4455	n/a	n/a	0.223
X-X, +D+0.750L+0.750S+H	2.0	n/a	0.0	0.4455	0.4455	n/a	n/a	0.223
X-X, +D+0.60W+H	2.0	n/a	0.0	0.4378	0.4378	n/a	n/a	0.219
X-X, +D+0.70E+H	2.0	n/a	0.0	0.4378	0.4378	n/a	n/a	0.219
X-X, +D+0.750Lr+0.750L+0.450W+H	2.0	n/a	0.0	0.4455	0.4455	n/a	n/a	0.223
X-X, +D+0.750L+0.750S+0.450W+H	2.0	n/a	0.0	0.4455	0.4455	n/a	n/a	0.223
X-X, +D+0.750L+0.750S+0.5250E+H	2.0	n/a	0.0	0.4455	0.4455	n/a	n/a	0.223
X-X, +0.60D+0.60W+0.60H	2.0	n/a	0.0	0.2627	0.2627	n/a	n/a	0.131
X-X, +0.60D+0.70E+0.60H	2.0	n/a	0.0	0.2627	0.2627	n/a	n/a	0.131
Z-Z, +D+H	2.0	0.0	n/a	n/a	n/a	0.4378	0.4378	0.219
Z-Z, +D+L+H	2.0	0.0	n/a	n/a	n/a	0.4480	0.4480	0.224
Z-Z, +D+Lr+H	2.0	0.0	n/a	n/a	n/a	0.4378	0.4378	0.219
Z-Z, +D+S+H	2.0	0.0	n/a	n/a	n/a	0.4378	0.4378	0.219
Z-Z, +D+0.750Lr+0.750L+H	2.0	0.0	n/a	n/a	n/a	0.4455	0.4455	0.223
Z-Z, +D+0.750L+0.750S+H	2.0	0.0	n/a	n/a	n/a	0.4455	0.4455	0.223
Z-Z, +D+0.60W+H	2.0	0.0	n/a	n/a	n/a	0.4378	0.4378	0.219
Z-Z, +D+0.70E+H	2.0	17.228	n/a	n/a	n/a	0.0	0.9842	0.492
Z-Z, +D+0.750Lr+0.750L+0.450W+H	2.0	0.0	n/a	n/a	n/a	0.4455	0.4455	0.223
Z-Z, +D+0.750L+0.750S+0.450W+H	2.0	0.0	n/a	n/a	n/a	0.4455	0.4455	0.223
Z-Z, +D+0.750L+0.750S+0.5250E+H	2.0	12.699	n/a	n/a	n/a	0.04544	0.8455	0.423
Z-Z, +0.60D+0.60W+0.60H	2.0	0.0	n/a	n/a	n/a	0.2627	0.2627	0.131
Z-Z, +0.60D+0.70E+0.60H	2.0	28.713	n/a	n/a	n/a	0.0	1.096	0.548

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, +D+H	None	0.0 k-ft	Infinity	OK
X-X, +D+L+H	None	0.0 k-ft	Infinity	OK
X-X, +D+Lr+H	None	0.0 k-ft	Infinity	OK
X-X, +D+S+H	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750Lr+0.750L+H	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750L+0.750S+H	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W+H	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E+H	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750Lr+0.750L+0.450W+H	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750L+0.750S+0.450W+H	None	0.0 k-ft	Infinity	OK

General Footing

Description : Rockspinner Footings

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, +D+0.750L+0.750S+0.5250E+H	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W+0.60H	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E+0.60H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+L+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+Lr+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+S+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.750Lr+0.750L+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.750L+0.750S+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.60W+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.70E+H	23.10 k-ft	75.087 k-ft	3.251	OK
Z-Z, +D+0.750Lr+0.750L+0.450W+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.750L+0.750S+0.450W+H	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.750L+0.750S+0.5250E+H	17.325 k-ft	76.399 k-ft	4.410	OK
Z-Z, +0.60D+0.60W+0.60H	None	0.0 k-ft	Infinity	OK
Z-Z, +0.60D+0.70E+0.60H	23.10 k-ft	45.052 k-ft	1.950	OK

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, +D+H	0.0 k	7.214 k	No Sliding	OK
X-X, +D+L+H	0.0 k	7.364 k	No Sliding	OK
X-X, +D+Lr+H	0.0 k	7.214 k	No Sliding	OK
X-X, +D+S+H	0.0 k	7.214 k	No Sliding	OK
X-X, +D+0.750Lr+0.750L+H	0.0 k	7.326 k	No Sliding	OK
X-X, +D+0.750L+0.750S+H	0.0 k	7.326 k	No Sliding	OK
X-X, +D+0.60W+H	0.0 k	7.214 k	No Sliding	OK
X-X, +D+0.70E+H	4.20 k	7.214 k	1.718	OK
X-X, +D+0.750Lr+0.750L+0.450W+H	0.0 k	7.326 k	No Sliding	OK
X-X, +D+0.750L+0.750S+0.450W+H	0.0 k	7.326 k	No Sliding	OK
X-X, +D+0.750L+0.750S+0.5250E+H	3.150 k	7.326 k	2.326	OK
X-X, +0.60D+0.60W+0.60H	0.0 k	4.639 k	No Sliding	OK
X-X, +0.60D+0.70E+0.60H	4.20 k	4.639 k	1.105	OK
Z-Z, +D+H	0.0 k	7.214 k	No Sliding	OK
Z-Z, +D+L+H	0.0 k	7.364 k	No Sliding	OK
Z-Z, +D+Lr+H	0.0 k	7.214 k	No Sliding	OK
Z-Z, +D+S+H	0.0 k	7.214 k	No Sliding	OK
Z-Z, +D+0.750Lr+0.750L+H	0.0 k	7.326 k	No Sliding	OK
Z-Z, +D+0.750L+0.750S+H	0.0 k	7.326 k	No Sliding	OK
Z-Z, +D+0.750L+0.750S+0.450W+H	0.0 k	7.326 k	No Sliding	OK
Z-Z, +D+0.750L+0.750S+0.5250E+H	0.0 k	7.326 k	No Sliding	OK
Z-Z, +0.60D+0.60W+0.60H	0.0 k	4.639 k	No Sliding	OK
Z-Z, +0.60D+0.70E+0.60H	0.0 k	4.639 k	No Sliding	OK
Z-Z, +D+0.60W+H	0.0 k	7.214 k	No Sliding	OK
Z-Z, +D+0.70E+H	0.0 k	7.214 k	No Sliding	OK
Z-Z, +D+0.750Lr+0.750L+0.450W+H	0.0 k	7.326 k	No Sliding	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D+1.60H	1.925	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.40D+1.60H	1.925	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	1.750	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	1.750	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+1.60L+0.50S+1.60H	1.750	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+1.60L+0.50S+1.60H	1.750	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+1.60Lr+0.50L+1.60H	1.681	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+1.60Lr+0.50L+1.60H	1.681	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	1.650	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	1.650	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50L+1.60S+1.60H	1.681	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50L+1.60S+1.60H	1.681	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK

General Footing

Lic. # : KW-06000326 **Licensee : HOLMES STRUCTURES**

Description : Rockspinner Footings

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.20D+1.60S+0.50W+1.60H	1.650	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+1.60S+0.50W+1.60H	1.650	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50Lr+0.50L+W+1.60H	1.681	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50Lr+0.50L+W+1.60H	1.681	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50L+0.50S+W+1.60H	1.681	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50L+0.50S+W+1.60H	1.681	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50L+0.20S+E+1.60H	1.681	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +1.20D+0.50L+0.20S+E+1.60H	1.681	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +0.90D+W+0.90H	1.238	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +0.90D+W+0.90H	1.238	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +0.90D+E+0.90H	1.238	+Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
X-X, +0.90D+E+0.90H	1.238	-Z	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.40D+1.60H	1.925	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.40D+1.60H	1.925	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	1.750	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	1.750	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	1.750	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	1.750	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+1.60Lr+0.50L+1.60H	1.681	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+1.60Lr+0.50L+1.60H	1.681	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	1.650	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	1.650	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50L+1.60S+1.60H	1.681	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50L+1.60S+1.60H	1.681	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	1.650	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	1.650	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50Lr+0.50L+W+1.60H	1.681	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50Lr+0.50L+W+1.60H	1.681	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50L+0.50S+W+1.60H	1.681	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50L+0.50S+W+1.60H	1.681	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50L+0.20S+E+1.60H	1.269	-X	Top	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +1.20D+0.50L+0.20S+E+1.60H	5.016	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +0.90D+W+0.90H	1.238	-X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +0.90D+W+0.90H	1.238	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +0.90D+E+0.90H	1.176	-X	Top	0.3456	Min Temp %	0.3543	20.061	OK
Z-Z, +0.90D+E+0.90H	5.109	+X	Bottom	0.3456	Min Temp %	0.3543	20.061	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	4.94 psi	4.94 psi	4.94 psi	4.94 psi	4.94 psi	75.00 psi	0.07	OK
+1.20D+0.50Lr+1.60L+1.60H	4.49 psi	4.49 psi	4.49 psi	4.49 psi	4.49 psi	75.00 psi	0.06	OK
+1.20D+1.60L+0.50S+1.60H	4.49 psi	4.49 psi	4.49 psi	4.49 psi	4.49 psi	75.00 psi	0.06	OK
+1.20D+1.60Lr+0.50L+1.60H	4.31 psi	4.31 psi	4.31 psi	4.31 psi	4.31 psi	75.00 psi	0.06	OK
+1.20D+1.60Lr+0.50W+1.60H	4.23 psi	4.23 psi	4.23 psi	4.23 psi	4.23 psi	75.00 psi	0.06	OK
+1.20D+0.50L+1.60S+1.60H	4.31 psi	4.31 psi	4.31 psi	4.31 psi	4.31 psi	75.00 psi	0.06	OK
+1.20D+1.60S+0.50W+1.60H	4.23 psi	4.23 psi	4.23 psi	4.23 psi	4.23 psi	75.00 psi	0.06	OK
+1.20D+0.50Lr+0.50L+W+1.60H	4.31 psi	4.31 psi	4.31 psi	4.31 psi	4.31 psi	75.00 psi	0.06	OK
+1.20D+0.50L+0.50S+W+1.60H	4.31 psi	4.31 psi	4.31 psi	4.31 psi	4.31 psi	75.00 psi	0.06	OK
+1.20D+0.50L+0.20S+E+1.60H	3.41 psi	12.63 psi	4.31 psi	4.31 psi	12.63 psi	75.00 psi	0.17	OK
+0.90D+W+0.90H	3.17 psi	3.17 psi	3.17 psi	3.17 psi	3.17 psi	75.00 psi	0.04	OK
+0.90D+E+0.90H	3.02 psi	12.73 psi	3.17 psi	3.17 psi	12.73 psi	75.00 psi	0.17	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	22.20 psi	150.00 psi	0.148	OK
+1.20D+0.50Lr+1.60L+1.60H	20.18 psi	150.00 psi	0.1345	OK
+1.20D+1.60L+0.50S+1.60H	20.18 psi	150.00 psi	0.1345	OK
+1.20D+1.60Lr+0.50L+1.60H	19.39 psi	150.00 psi	0.1292	OK
+1.20D+1.60Lr+0.50W+1.60H	19.03 psi	150.00 psi	0.1268	OK
+1.20D+0.50L+1.60S+1.60H	19.39 psi	150.00 psi	0.1292	OK
+1.20D+1.60S+0.50W+1.60H	19.03 psi	150.00 psi	0.1268	OK
+1.20D+0.50Lr+0.50L+W+1.60H	19.39 psi	150.00 psi	0.1292	OK

General Footing

Description : Rockspinner Footings

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.20D+0.50L+0.50S+W+1.60H	19.39 psi	150.00 psi	0.1292	OK
+1.20D+0.50L+0.20S+E+1.60H	19.47 psi	150.00 psi	0.1298	OK
+0.90D+W+0.90H	14.27 psi	150.00 psi	0.09513	OK
+0.90D+E+0.90H	14.82 psi	150.00 psi	0.09881	OK

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 2.7.6990.0

Company:	Holmes Structures	Date:	5/8/2019
Engineer:	EK	Page:	1/6
Project:	Alameda Rockspinners		
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

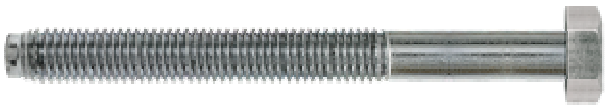
General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Cast-in-place
Material: F1554 Grade 36
Diameter (inch): 1.000
Effective Embedment depth, h_{ef} (inch): 13.750
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 15.50
C_{min} (inch): 6.00
S_{min} (inch): 6.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 16.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: No
Build-up grout pad: Yes

Base Plate
Diameter x Thickness (inch): 18.00 x 1.25

Recommended Anchor
Anchor Name: Heavy Hex Bolt - 1"Ø Heavy Hex Bolt, F1554 Gr. 36

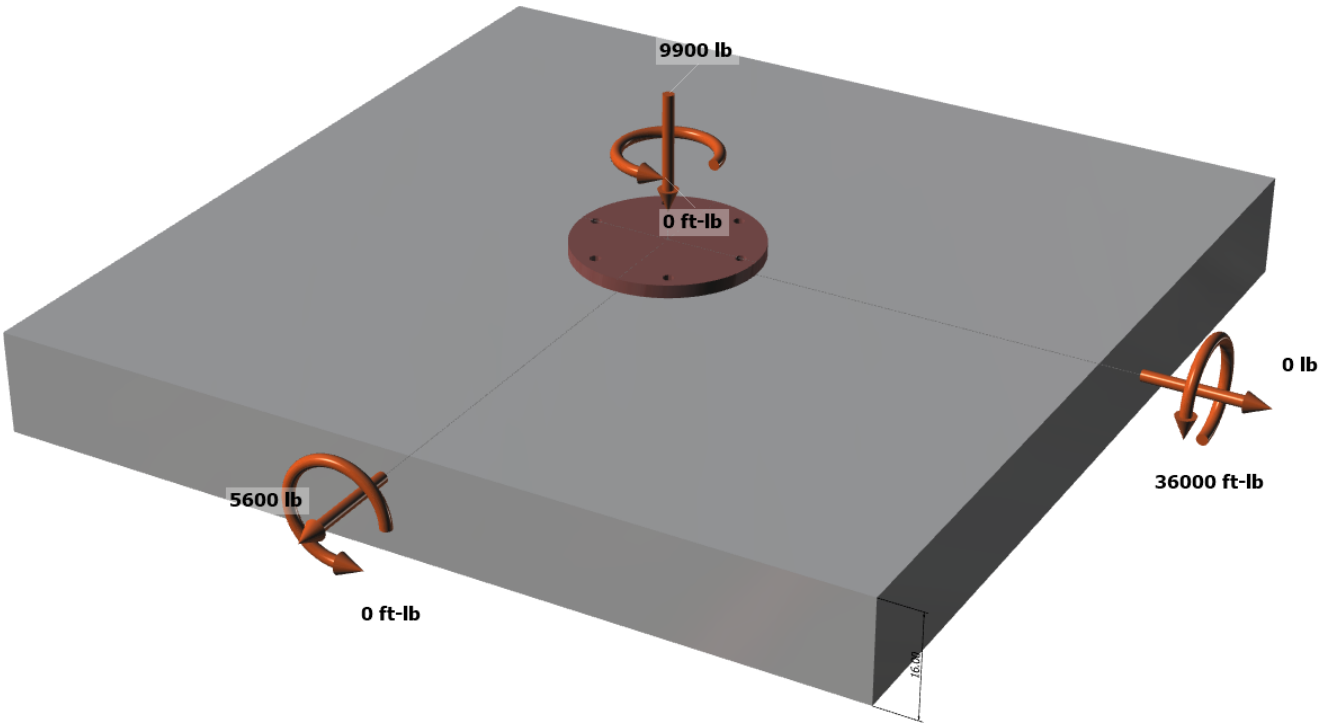


Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

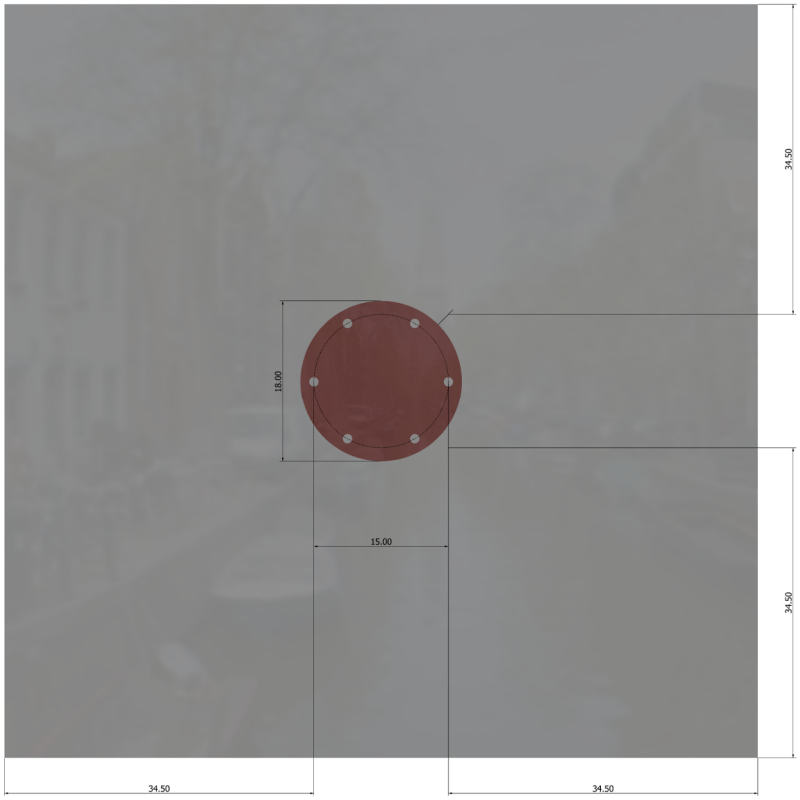
Strength level loads:

N_{ua} [lb]: -9900
V_{uax} [lb]: 5600
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 36000
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

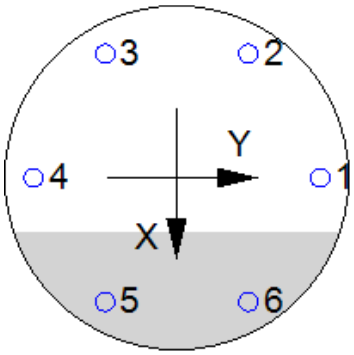


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	3768.4	933.3	0.0	933.3
2	12380.0	933.3	0.0	933.3
3	12380.0	933.3	0.0	933.3
4	3768.4	933.3	0.0	933.3
5	0.0	933.3	0.0	933.3
6	0.0	933.3	0.0	933.3
Sum	32296.8	5600.0	0.0	5600.0

Maximum concrete compression strain (‰): 0.30
Maximum concrete compression stress (psi): 1324
Resultant tension force (lb): 32297
Resultant compression force (lb): 42195
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 1.73
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
35150	0.75	26363

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = 16\lambda_a\sqrt{f'_c}h_{ef}^{5/3}$ (Eq. 17.4.2.2b)

λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
1.00	2500	13.750	63134

$\phi N_{cbg} = \phi\,(A_{Nc}/A_{Nco})\,\Psi_{ec,N}\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1b)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
2636.95	1701.56	34.50	0.923	1.000	1.00	1.000	63134	0.70	63182

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$\phi N_{pn} = \phi\Psi_{c,P}N_p = \phi\Psi_{c,P}8A_{brg}f'_c$ (Sec. 17.3.1, Eq. 17.4.3.1 & 17.4.3.4)

$\Psi_{c,P}$	A_{brg} (in^2)	f'_c (psi)	ϕ	ϕN_{pn} (lb)
1.0	1.50	2500	0.70	21014

8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
21090	0.8	0.65	10967

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in x-direction:

$V_{bx} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
8.00	1.000	1.00	2500	25.50	57946

$\phi V_{cbgx} = \phi\,(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. 17.3.1 & Eq. 17.5.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
1344.00	2926.13	1.000	1.000	1.000	1.546	57946	0.70	28806

Shear parallel to edge in x-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
8.00	1.000	1.00	2500	28.00	66673

$\phi V_{cbx} = \phi\,(2)(A_{Vc} / A_{Vco})\,\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.3.1, 17.5.2.1(c) & Eq. 17.5.2.1a)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbx} (lb)
1344.00	3528.00	1.000	1.000	1.620	66673	0.70	57612

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cpg} = \phi k_{cp}N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	2953.59	1701.56	1.000	1.000	1.000	1.000	63134	0.70	153424

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.6.)

Tension	Factored Load, N_{ua} (lb)	Design Strength, øN_n (lb)	Ratio	Status
Steel	12380	26363	0.47	Pass
Concrete breakout	32297	63182	0.51	Pass
Pullout	**12380**	**21014**	**0.59**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	933	10967	0.09	Pass
T Concrete breakout x+	**5600**	**28806**	**0.19**	**Pass (Governs)**
|| Concrete breakout y-	**933**	**57612**	**0.02**	**Pass (Governs)**
Pryout	5600	153424	0.04	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.59	0.00	58.9%	1.0	Pass

1"Ø Heavy Hex Bolt, F1554 Gr. 36 with hef = 13.750 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.