POTRERO GATEWAY

PUBLIC ARTWORK
SAN FRANCISCO, CA 94103

PROJECT NOTES

1. Where the terms "approval equal", "equal to," or other general qualifying terms are used in these notes, it shall be understood that reference is made to the ruling and judgment of the Lead Artist.

2. The general contractor shall verify all dimensions and job conditions and shall report to the Lead Artist and Structural Engineer any discrepancies or omissions which would interfere with satisfactory completion of the project.

3. Unless otherwise noted, all dimensions shown are from centerline to centerline, centerline to face of the wall, or face of wall to face of wall.

4. Electrical, mechanical, plumbing, and structural drawings are supplementary to the Lead Artist drawings. Mechanical and electrical fixtures, fittings, outlets, etc. when shown on the Lead Artist drawings are for location information only.

5. It shall be the responsibility of each contractor to check with the Lead Artist drawings before the installation of their work. Any discrepancy between the Lead Artist and consulting engineer's drawings shall be brought to Lead Artist's attention.

6. Any work installed in conflict with the Lead Artist drawing shall be corrected by the contractor at his expense and no expense to the owner.

7. The construction notes and/ or drawings are supplied to illustrate the design and general type of construction desired and are intended to imply the finest quality of construction, material and workmanship throughout. All errors, omissions, and clarifications must be brought to the attention of the Lead Artist and Structural Engineer.

8. The general contractor shall maintain a current and complete set of construction drawings on site during all phases of construction for the use of trades.

9. The general contractor shall notify the Lead Artist and Structural Engineer of any discrepancies between the drawings, these notes, and field conditions before commencing any work and request clarification.

10. The location of the utilities shown on these plans are based on field observation and/or record drawings. The information shown is not necessarily complete and the location of the utilities shown in approximate. The contractor will verify the existence of all utilities in advance of conducting construction operations that could damage these utilities.

11. In the areas where proposed construction may conflict with existing utilities, the contractor will take all necessary precautions to avoid damage to the utilities.

12. Stated amounts are indicative and may be approximate, and not exact amount. Determining amounts is the responsibility of the contractor.

13. In the technical description are generally known products. The contractor must take account of auxiliary equipment, finishes and neat connections.

14. The contractor must provide samples of all image-defining materials.

15. All steel structure that comes into view is to be held to high aesthetic requirements. All carbon steel structure that comes into view is to be galvanized and painted.

16. All wiring and installation should be in accordance with National Electric Code (NEC) and NFPA 70.

17. The illustrated project was designed to comply with all requirements of the Americans with Disability Act ("ADA") and other Federal, State and Local guidelines including but not limited to the Public Rights of Way Accessibility Guidelines ("PROWAG"). If the project is located in the state of California, the California Building Code (CBC).

18. Contractors should be aware that published values for dimension and slope are for finished construction, no tolerance is permitted below minimum or above maximum values. Contractors must set tolerances to ensure constructions which comply with regulations. If contractors observe designs or site conditions that will not comply with the aforementioned rules and regulations it is their responsibility to notify the owner and designer immediately.

19. FUTUREFORMS® retains all rights in the design(s) under the Copyright Act of 1976, 17 U.S.C. §101 et seq., as the sole author of the Artwork for the duration of the copyright. FUTUREFORMS sketches, concepts, schematic designs, technical and fabrication details remain the sole property of FUTUREFORMS, and can only be executed in final form by FUTUREFORMS. Any use of material included herein should clearly credit FUTUREFORMS.

SYMBOL LEGEND

NORTH	NORTH ARROW
00 ART	DETAIL CALL OUT
1 ART	ELEVATION OR SECTIONAL CALL OUT
℄	CENTER LINE
	ELEVATION TARGET
1	REVISION SYMBOL

PROJECT INFORMATION

DESCRIPTION:
FABRICATION AND INSTALLATION OF PUBLIC ART CONSISTING OF (4) INDIVIDUAL STEEL SCULPTURES.

PROJECT CONTACTS:
San Francisco Arts Commission (SFAC)
Aleta Lee, M.A.
Project Manager, Public Art Program
email: aleta.lee@sfgov.org

San Francisco Department of Public Works (SFDPW)
Trent Tieger, PE, PMP
Project Manager
e-mail: trent.tieger@sfdpw.org

Community Contacts:
Potrero Gateway Park Steering Committee (Jean Bogiages, Michael Kerbow, Sheldon Trimble)

Maintenance:
Green Benefits District (Julie Christensen)

Installation Team:
Atthowe Fine Arts Services

SHEET INDEX

9 TOTAL SHEETS

1 **VICINITY MAP**
NTS
NORTH

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SAN FRANCISCO, CA 94107
CONTACT:
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STRUCTURAL ENGINEER:
TUAN and ROBINSON
STRUCTURAL ENGINEERS, INC.
444 SPEAR ST, STE 101
SAN FRANCISCO, CA 94105
(415) 957-2480

REVISIONS
6/10/22 - CD SET

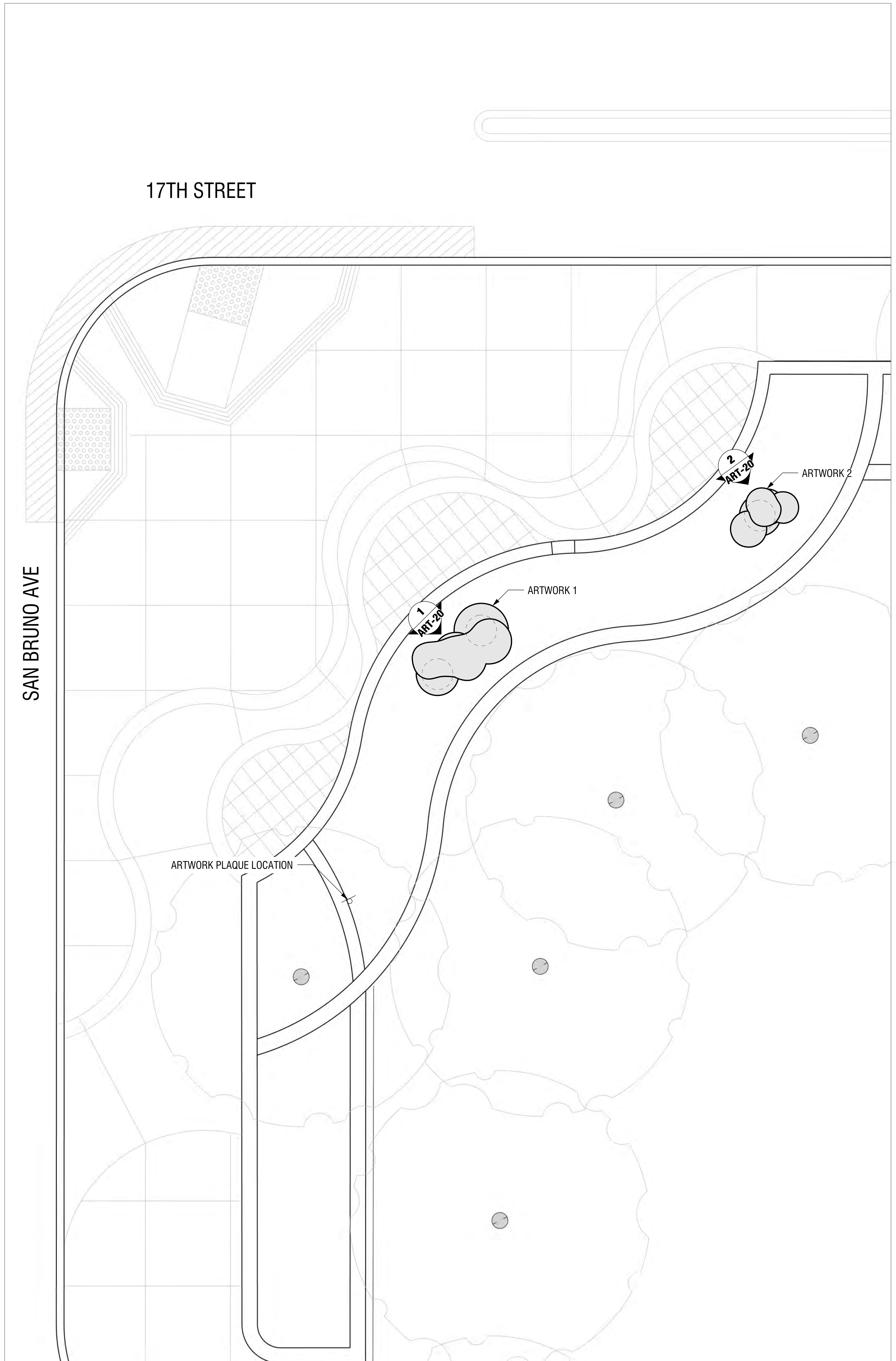
PROJECT NAME
POTRERO GATEWAY
17th ST, BTW VERMONT ST
AND SAN BRUNO AVE
SAN FRANCISCO, CA 94103

SHEET TITLE
PROJECT INFORMATION

DRAWING SCALE
AS NOTED ON DRAWINGS
SHEET SIZE: 24 x 36

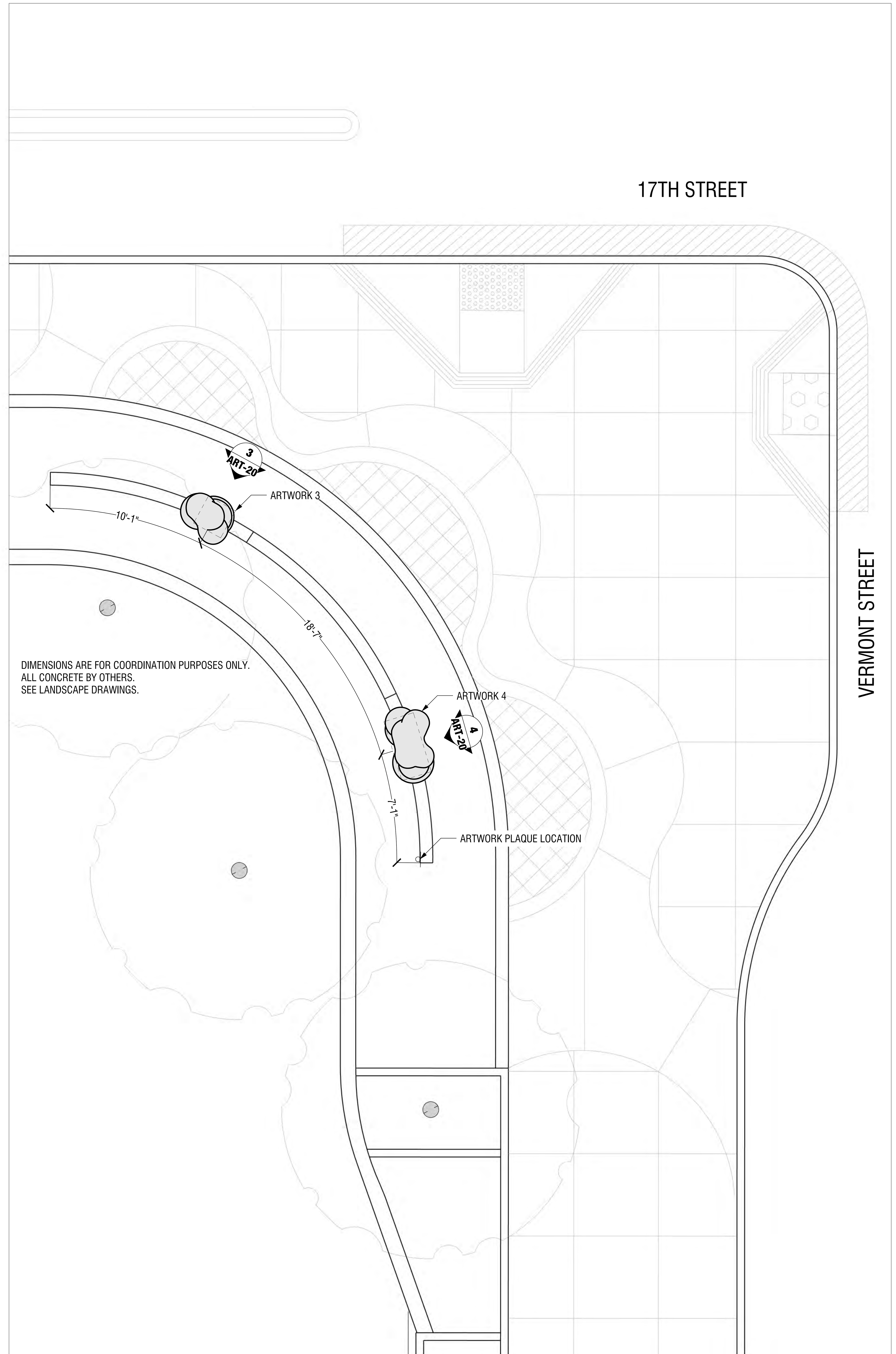
DATE ISSUED
6/10/22

ART-01



1 SITE PLAN - 17TH AND SAN BRUNO AVE

SCALE: 1/4"=1'



2 SITEPLAN - 17TH AND VERMONT ST

SCALE: 1/4"=1'

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SITE PLANS

DRAWING SCALE
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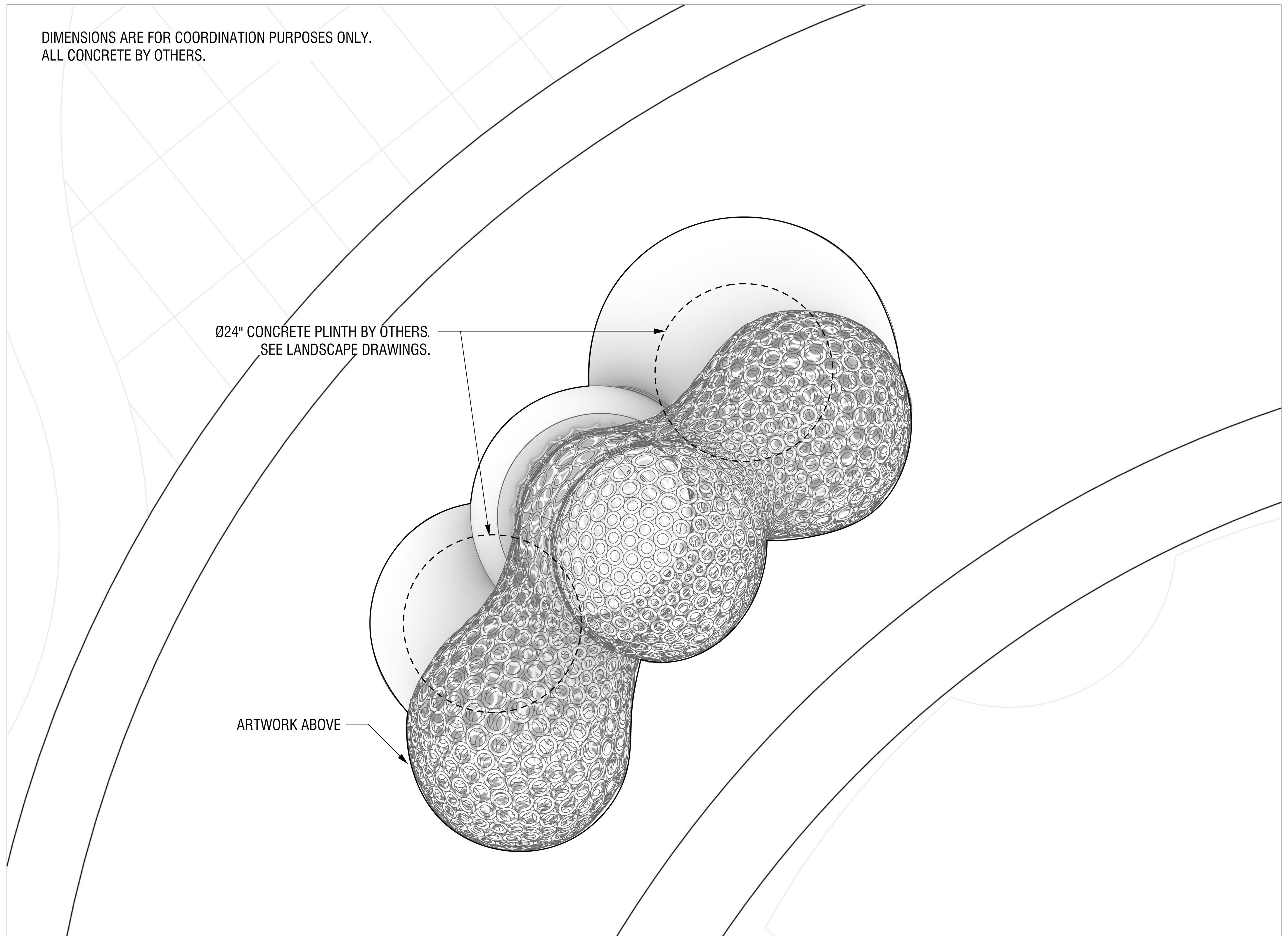
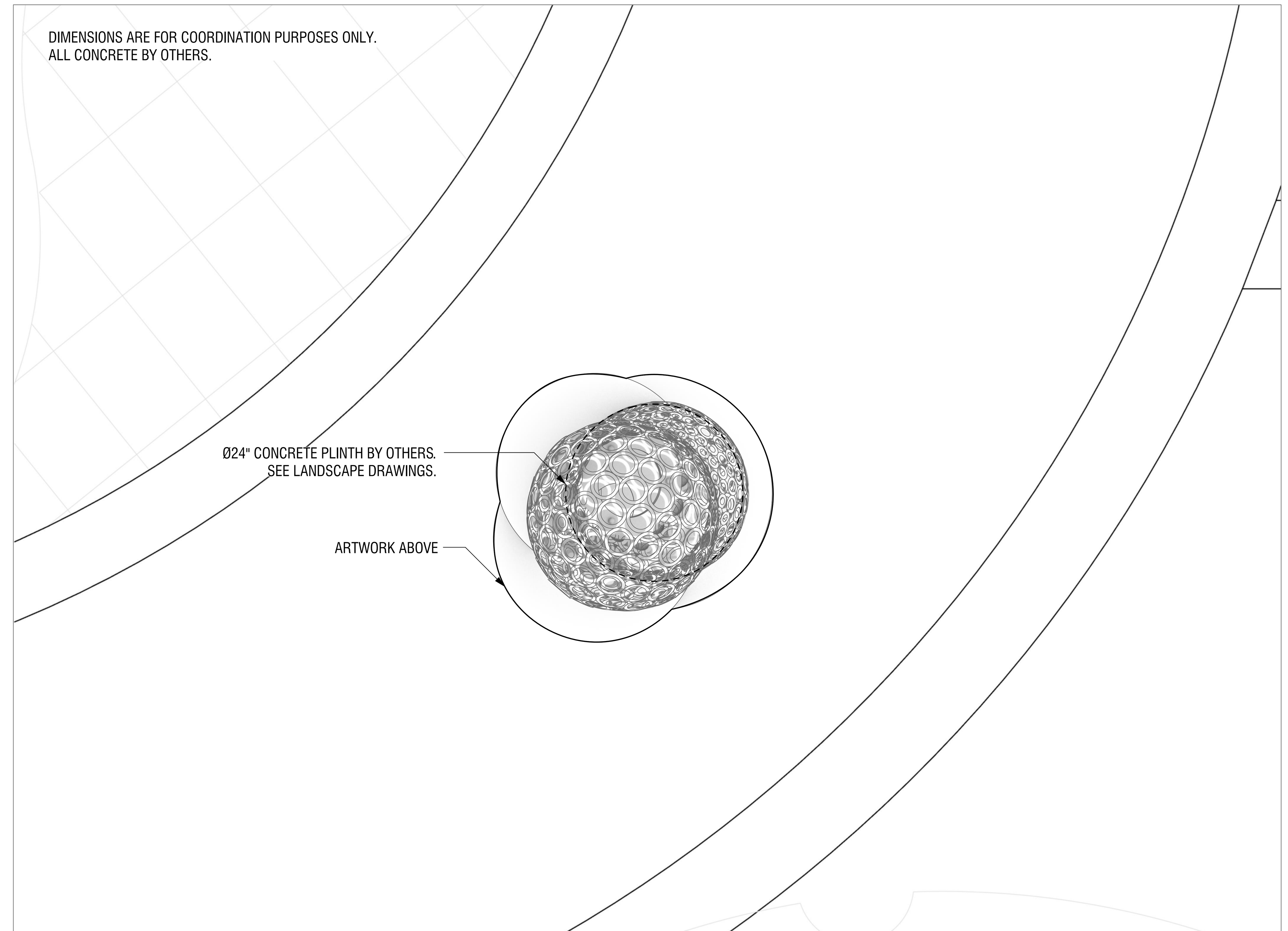
6/10/22



1 TOP PLAN - ARTWORK 1

SCALE: 1"=1'

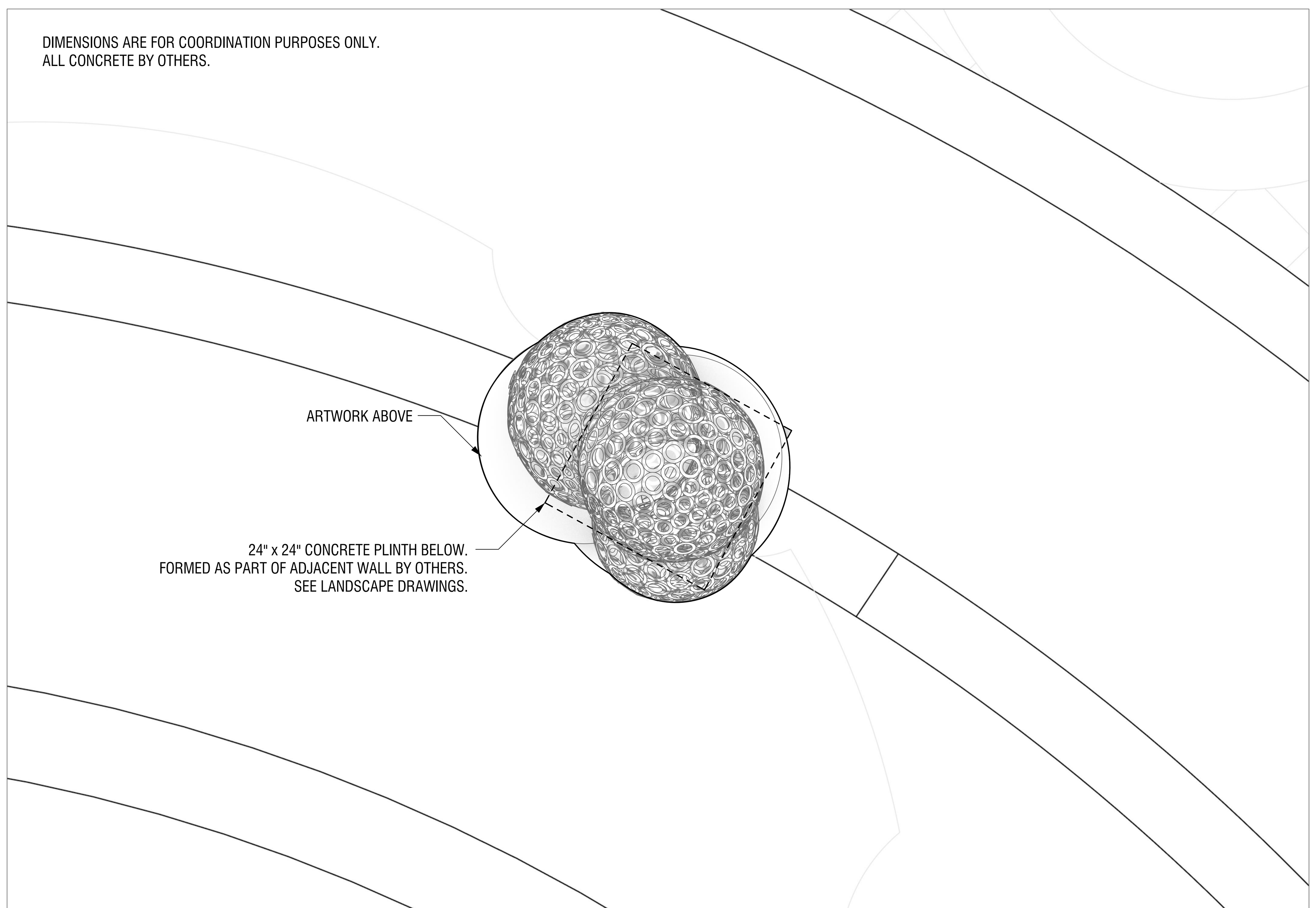
NORTH



2 TOP PLAN - ARTWORK 2

SCALE: 1"=1'

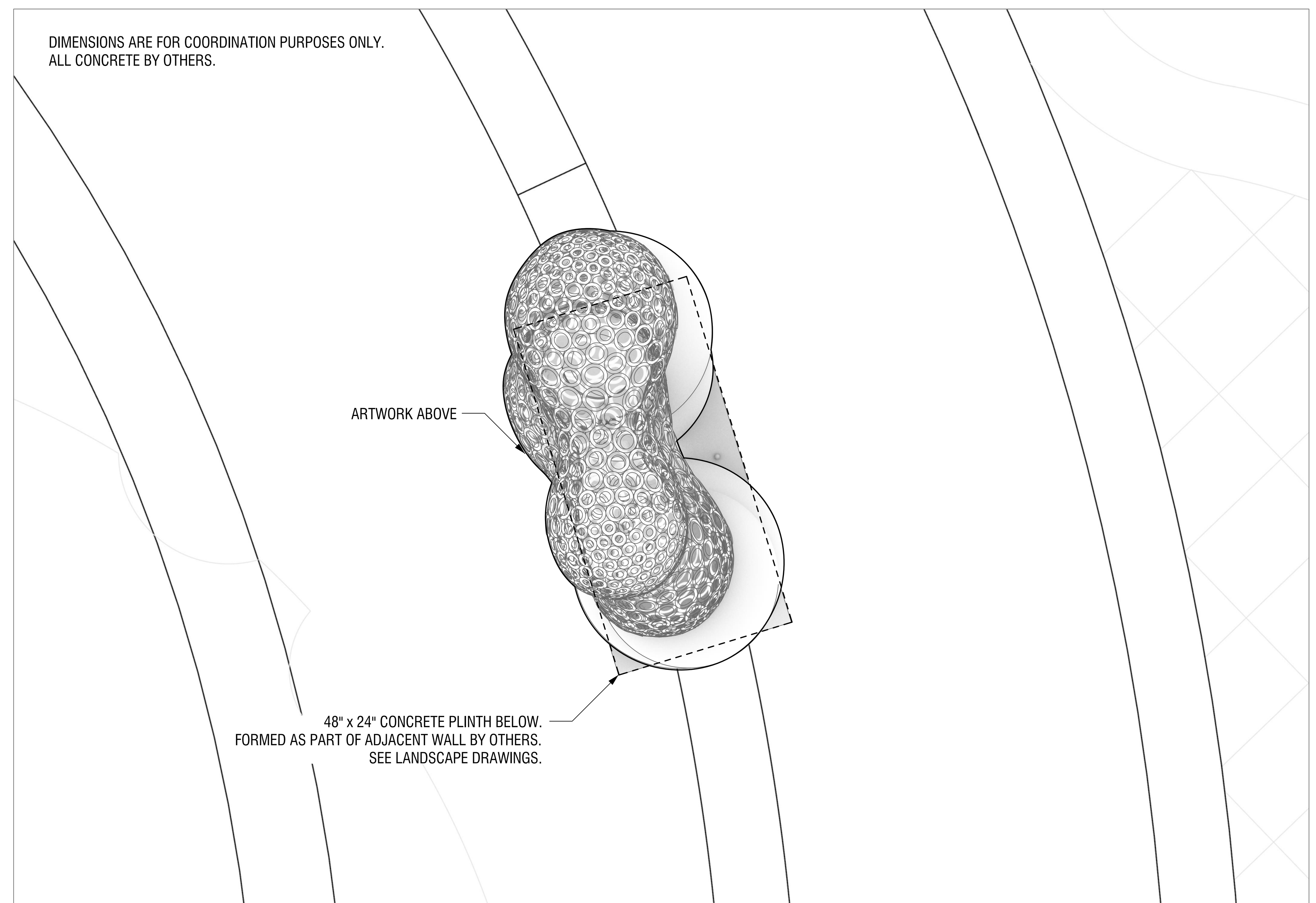
NORTH



3 TOP PLAN - ARTWORK 3

SCALE: 1"=1'

NORTH



4 TOP PLAN - ARTWORK 4

SCALE: 1"=1'

NORTH

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PROJECT NAME

POTRERO GATEWAY

17th ST, BTW VERMONT ST
AND SAN BRUNO AVE
SAN FRANCISCO, CA 94103

SHEET TITLE

TOP PLANS

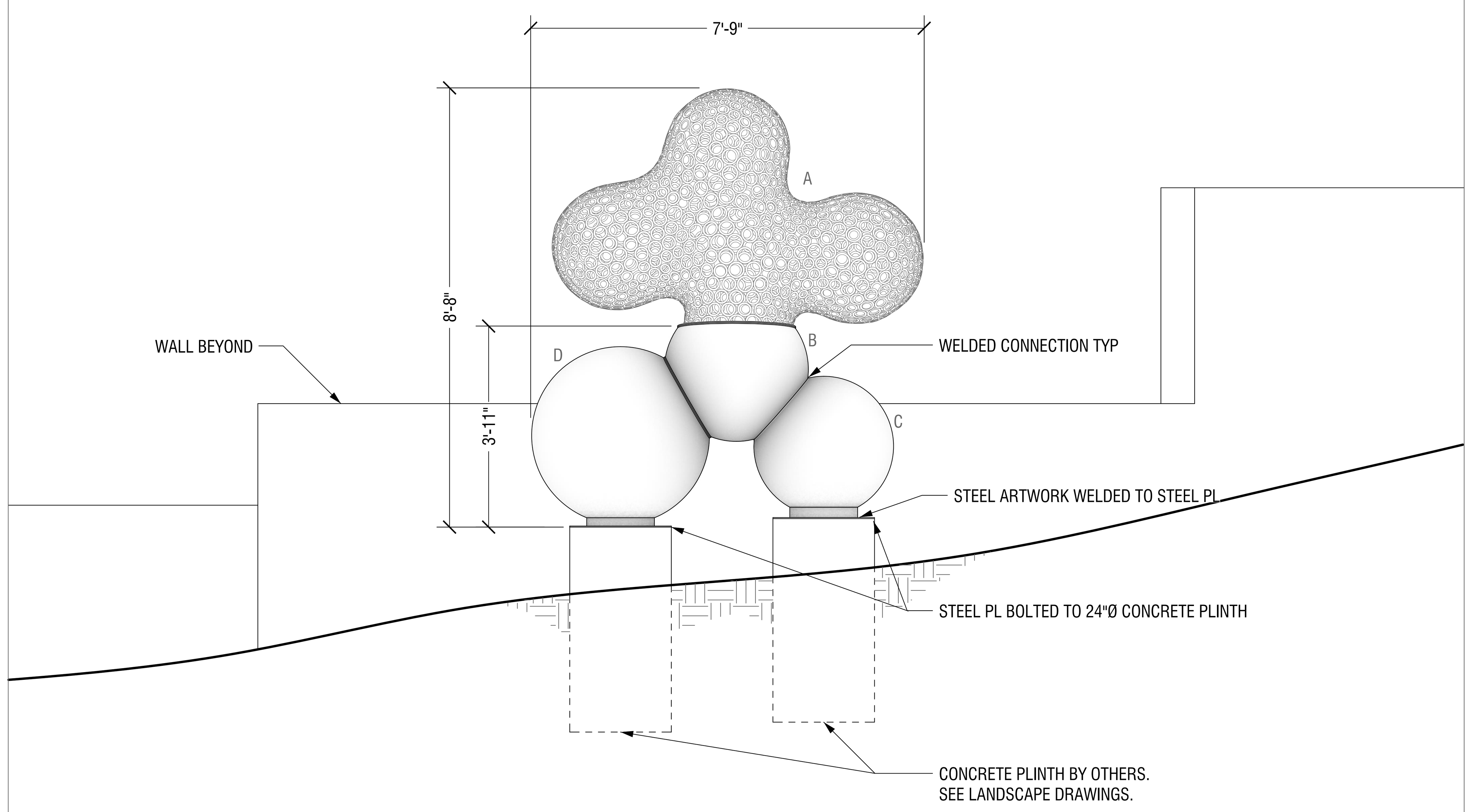
DRAWING SCALE

AS NOTED ON DRAWINGS
SHEET SIZE: 24 x 36

DATE ISSUED

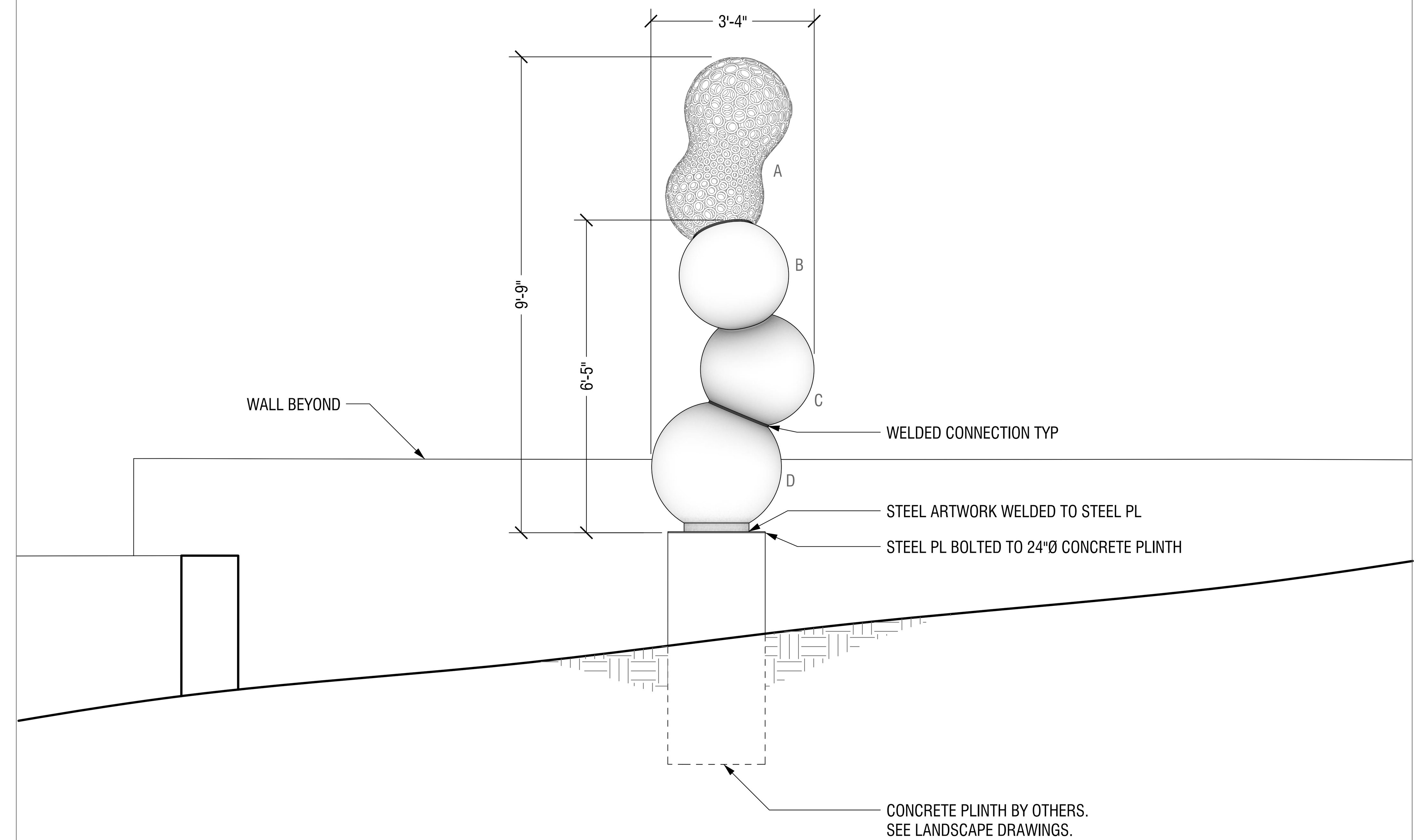
6/10/22

ART-11



1 ELEVATION - ARTWORK 1

SCALE: 1/2"=1'



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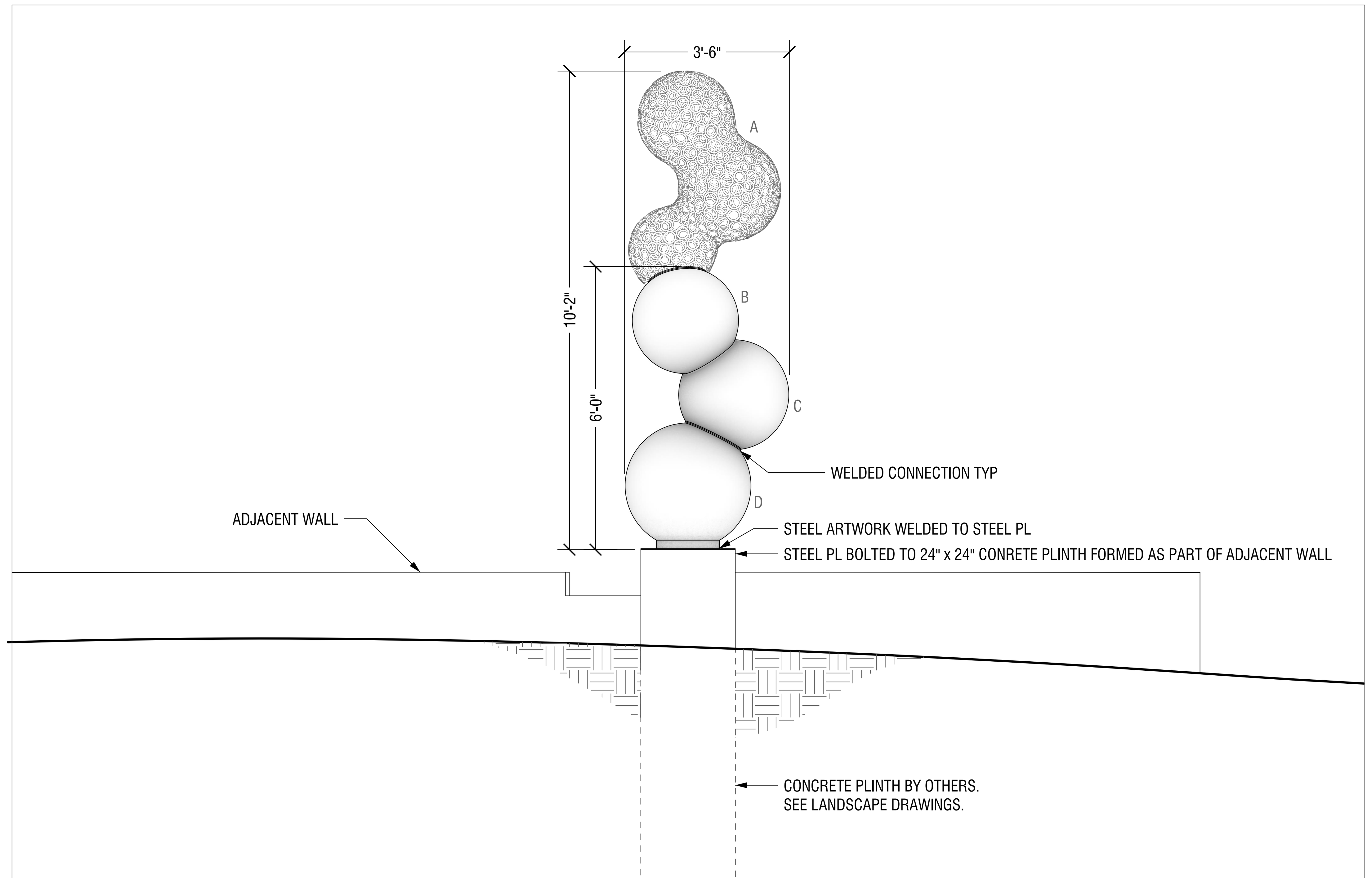
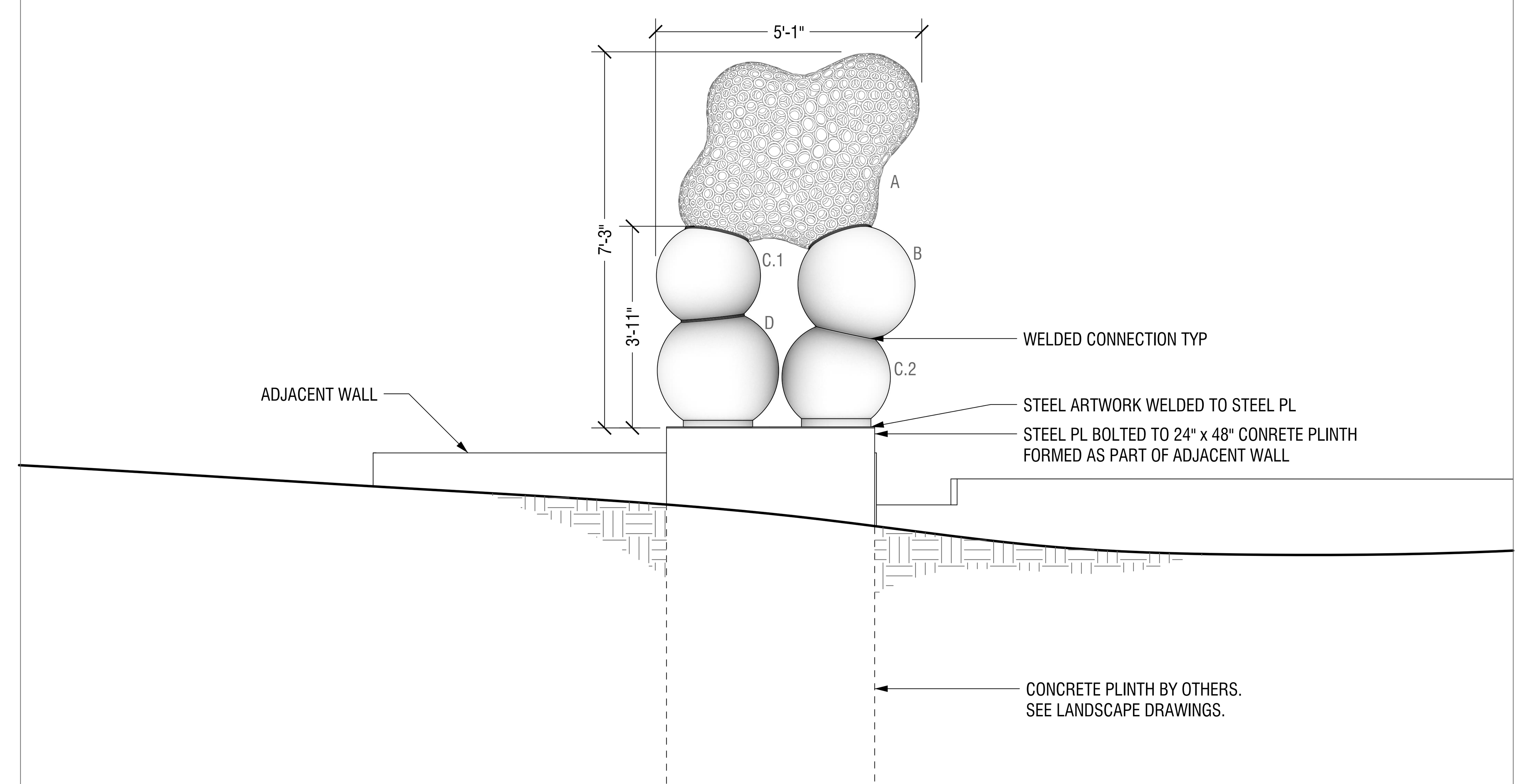
SCALE: 1/2"=1'



3 ELEVATION - ARTWORK 3

SCALE: 1/2"=1'



4 ELEVATION - ARTWORK 4

SCALE: 1/2"=1'

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REVISIONS
6/10/22 - CD SET

PROJECT NAME
POTRERO GATEWAY
17th ST, BTW VERMONT ST
AND SAN BRUNO AVE
SAN FRANCISCO, CA 94103

SHEET TITLE
ELEVATIONS

DRAWING SCALE
AS NOTED ON DRAWINGS
SHEET SIZE: 24 x 36

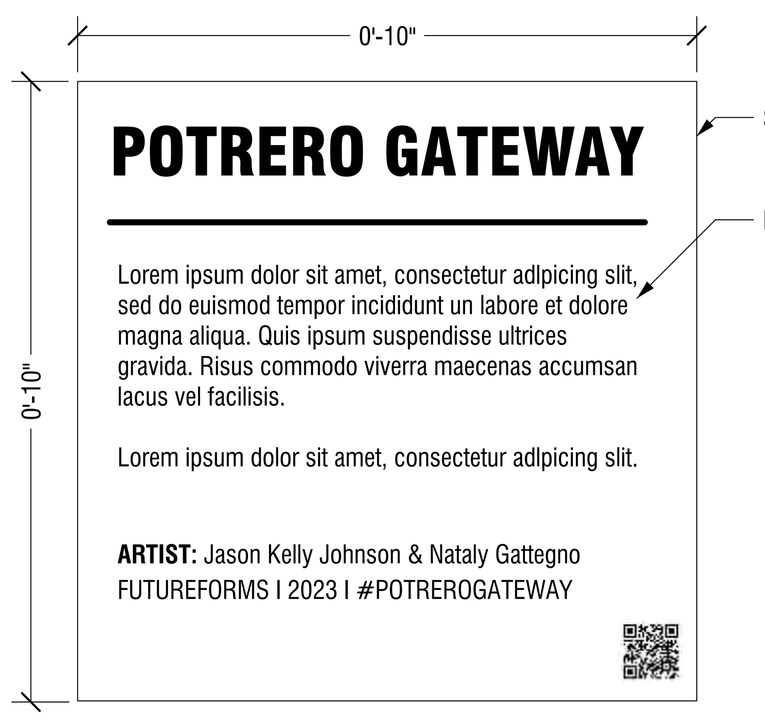
DATE ISSUED
6/10/22

ART-20

ARTWORK ID	PART ID	MATERIAL	FINISH	SURFACE AREA
1	A	18GA 316 SS	ELECTROPOLISH	33 SQFT
1	B	14GA 316 SS	MIRROR POLISH	15 SQFT
1	C	14GA 316 SS	SATIN FINISH	24 SQFT
1	D	14GA 316 SS	PAINTED (SEE DETAIL 4)	39 SQFT
2	A	18GA 316 SS	ELECTROPOLISH	12 SQFT
2	B	14GA 316 SS	MIRROR POLISH	14 SQFT
2	C	14GA 316 SS	SATIN FINISH	15 SQFT
2	D	14GA 316 SS	PAINTED (SEE DETAIL 4)	20 SQFT
3	A	18GA 316 SS	ELECTROPOLISH	14 SQFT
3	B	14GA 316 SS	MIRROR POLISH	13 SQFT
3	C	14GA 316 SS	SATIN FINISH	14 SQFT
3	D	14GA 316 SS	PAINTED (SEE DETAIL 4)	20 SQFT
4	A	18GA 316 SS	ELECTROPOLISH	18 SQFT
4	B	14GA 316 SS	MIRROR POLISH	13 SQFT
4	C.1	14GA 316 SS	SATIN FINISH	10 SQFT
4	C.2	14GA 316 SS	SATIN FINISH	10 SQFT
4	D	14GA 316 SS	PAINTED (SEE DETAIL 4)	14 SQFT

1 MATERIAL AND FINISH SCHEDULE

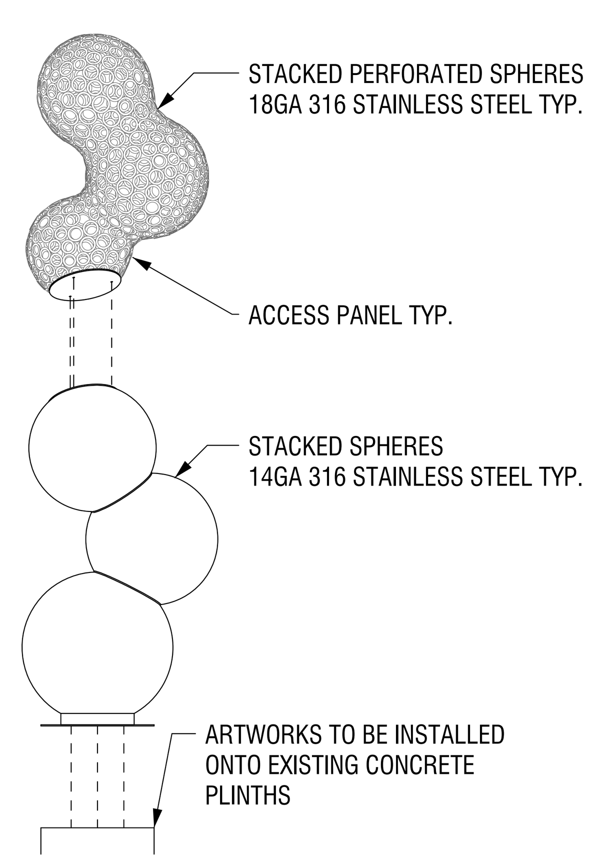
NTS



SEE ART-10 FOR PLAQUE LOCATIONS

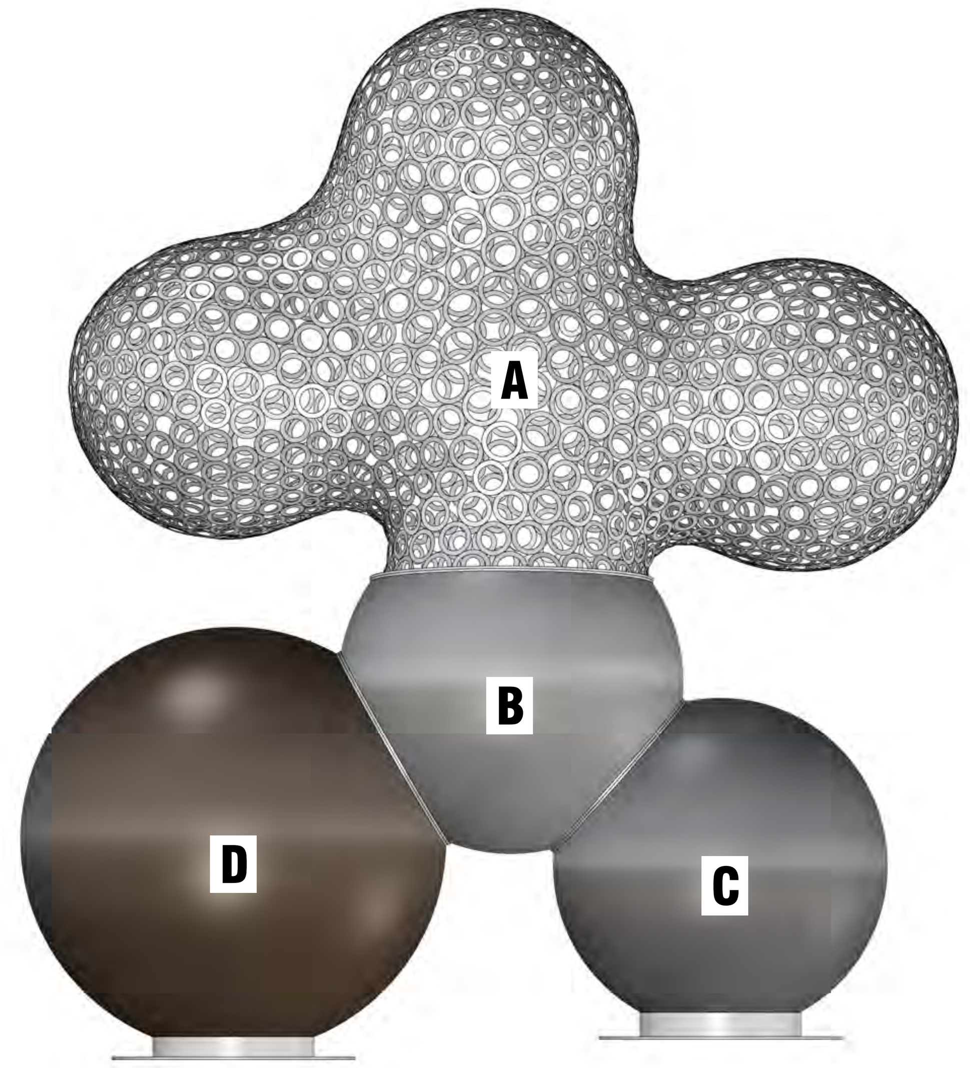
2 ARTWORK PLAQUE

NTS



3 EXPLODED ELEVATION - ARTWORK 3

NTS



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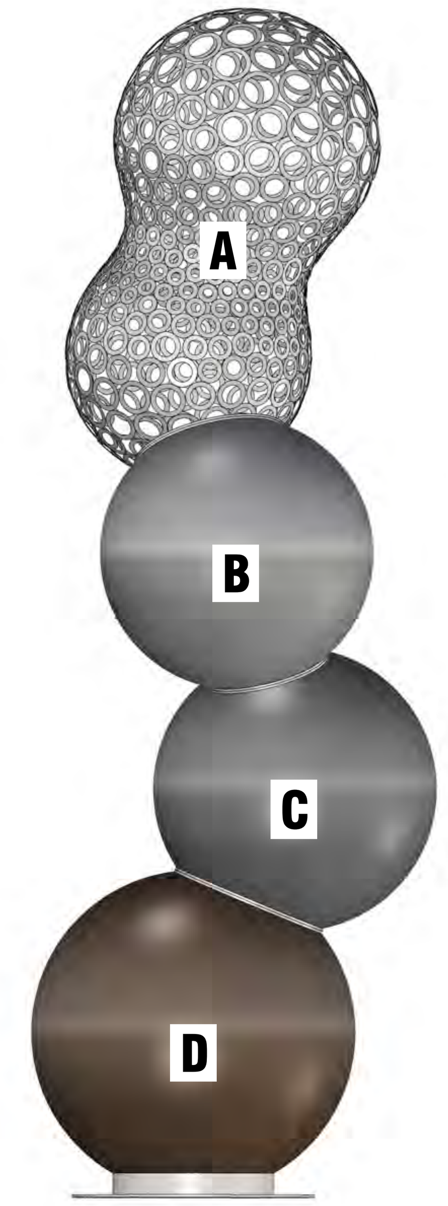
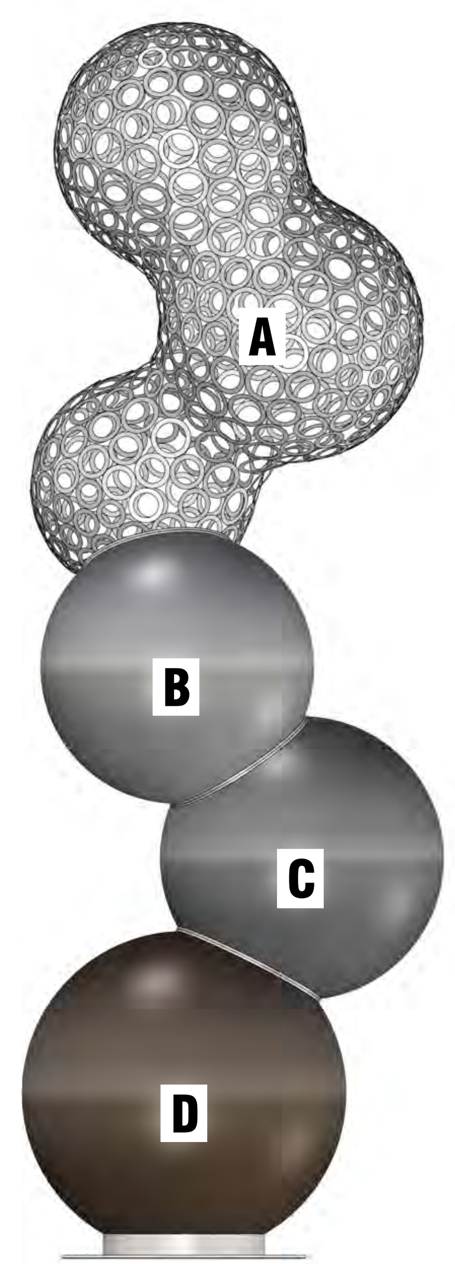
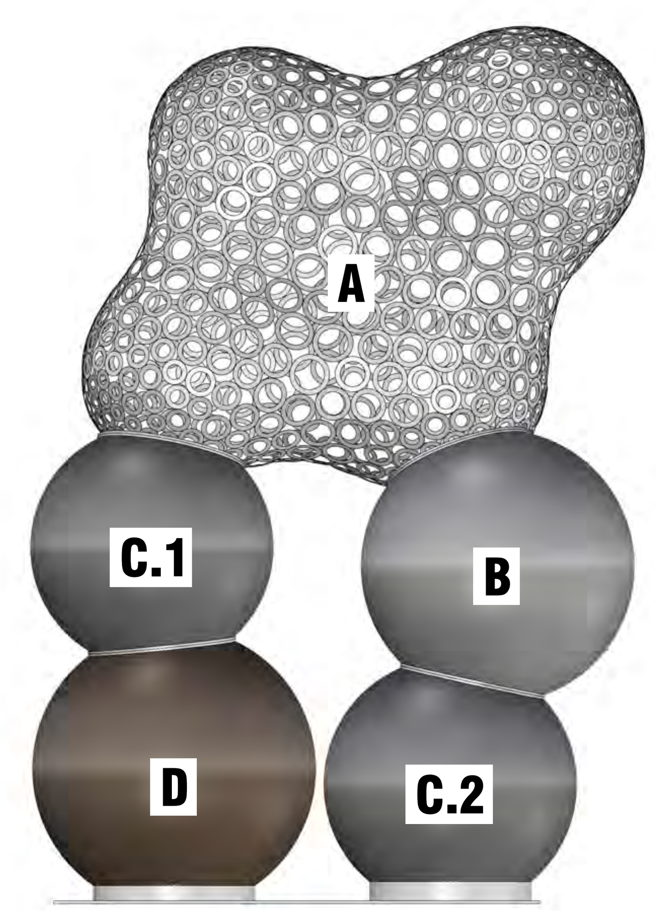


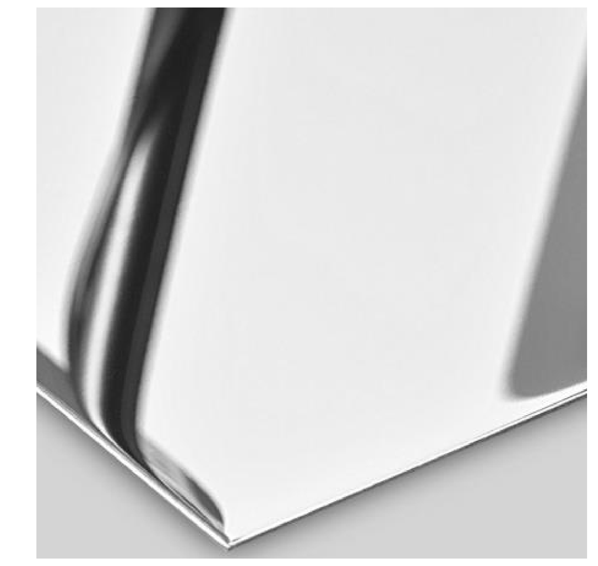
ARTWORK 2



ARTWORK 3

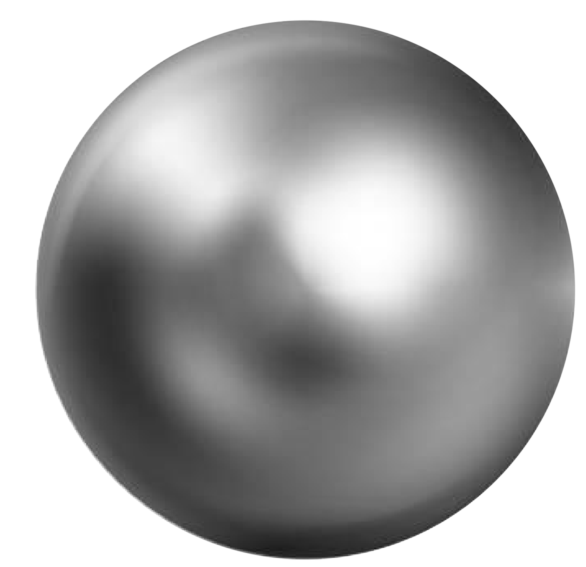


ARTWORK 4



A - ELECTROPOLISHED STAINLESS STEEL

B - POLISHED STAINLESS STEEL



C - SATIN FINISHED STAINLESS STEEL

D - STAINLESS STEEL WITH "BROWN BRONZE" FLUOROPOLYMER BASED METALLIC COATING

4 ARTWORK MATERIALS

NTS

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REVISIONS
6/10/22 - CD SET

PROJECT NAME
POTRERO GATEWAY
17th ST, BTW VERMONT ST
AND SAN BRUNO AVE
SAN FRANCISCO, CA 94103

SHEET TITLE
TYPICAL MATERIALS AND ASSEMBLY

DRAWING SCALE
AS NOTED ON DRAWINGS
SHEET SIZE: 24 x 36

DATE ISSUED
6/10/22

I. GENERAL

1. APPLICABLE CODE:

   CALIFORNIA BUILDING CODE, 2019 EDITION (CBC).

2. THESE GENERAL NOTES APPLY EXCEPT WHERE SPECIFICALLY SHOWN BY NOTES ON DRAWINGS AND/OR DETAILS.

3. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES.

4. THE CONTRACTOR SHALL COMPARE STRUCTURAL DRAWINGS WITH DRAWINGS OF OTHER DISCIPLINES WITH REFERENCE TO MATERIALS, LAYOUT, DIMENSIONS AND ELEVATIONS BEFORE STARTING WORK, AND ANY DISCREPANCIES SHALL BE REPORTED TO THE ARCHITECT FOR DIRECTION.

5. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AS SHOWN ON DRAWINGS. THE CONTRACTOR SHALL REPORT ANY VARIATION THAT WILL MODIFY THE STRUCTURAL SYSTEM OR ANY STRUCTURAL ELEMENT TO THE STRUCTURAL ENGINEER.

6. DETAILS AND NOTES SHOWN IN THIS SET OF DRAWINGS AND TITLED "TYPICAL" ARE TYPICAL AND SHALL APPLY UNLESS OTHERWISE NOTED. TYPICAL DETAILS REPRESENT THE GENERAL INTENT FOR ALL DETAILING NOT NOTED OR SHOWN IN SPECIFIC DETAILS OR ON PLANS.

7. THE STRUCTURAL DRAWINGS INDICATE PRINCIPAL CONSTRUCTION DETAILS BUT DO NOT ILLUSTRATE EVERY CONDITION. DETAILS OF CONSTRUCTION NOT SPECIFICALLY SHOWN SHALL BE OF THE SAME NATURE AS SHOWN FOR SIMILAR CONDITIONS.

8. DO NOT SCALE STRUCTURAL DRAWINGS, USE WRITTEN DIMENSIONS. IF DIMENSIONS ARE OMITTED OR NOT CLEAR, CONTACT THE ARCHITECT.

9. DIMENSION LINES ON STRUCTURAL DRAWINGS ARE TO CENTER LINES OF ELEMENTS, UNLESS OTHERWISE NOTED.

10. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION.

11. THE CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURE DURING CONSTRUCTION. SUCH MEASURES SHALL INCLUDE, BUT NOT BE LIMITED TO, BRACING, SHORING, GUYING OR OTHER TEMPORARY SUPPORT TO ENSURE CORRECT AND ACCURATE STRUCTURE GEOMETRY.

12. THE CONTRACTOR SHALL BE EXPECTED TO BE THOROUGHLY FAMILIAR WITH THE BUILDING SITE CONDITIONS, GRADES, DRAWINGS AND SPECIFICATIONS, MATERIAL DELIVERY FACILITIES AND ALL OTHER MATTERS AND CONDITIONS WHICH MAY AFFECT THE OPERATION AND COMPLETION OF WORK. THE CONTRACTOR SHALL ASSUME ALL RISKS CONCERNED WITH THE AFOREMENTIONED SITUATIONS, ACTIVITIES AND/OR OPERATIONS.

13. THE CONTRACTOR SHALL TAKE PRECAUTIONARY MEASURES TO ENSURE THAT ALL PROPERTY IS PROTECTED DURING CONSTRUCTION. ANY DAMAGED OR CHANGED CONDITIONS SHALL BE REPAIRED AND RESTORED TO THE PRE-CONSTRUCTION CONDITIONS. THE CONTRACTOR SHALL REPAIR ANY DAMAGE AT HIS/HER OWN EXPENSE.

14. THE CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR THE JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING THE SAFETY OF ALL THE PERSONNEL AND PROPERTY. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND SHALL NOT BE LIMITED TO NORMAL WORKING HOURS.

II. CONCRETE SCREW ANCHORS

1. SIMPSON "TITEN HD" (ICC ESR-2713) HEAVY DUTY CONCRETE SCREW ANCHORS SHALL BE USED FOR ANCHORS EMBEDDED IN CONCRETE. INSTALLATION PER MANUFACTURERS SPECIFICATIONS. ALTERNATIVE ANCHORING SYSTEMS MAY BE USED ONLY WITH PRIOR WRITTEN APPROVAL BY STRUCTURAL ENGINEER.

2. TEST THE FOLLOWING PERCENT OF INSTALLED ANCHORS:
   A. 20% OF ANCHORS UNLESS OTHERWISE NOTED ON DRAWINGS

3. TORQUE TEST LOAD VALUES

BOLT DIAMETER	MINIMUM EMBEDMENT	TORQUE LOAD
3/8"	2 ½"	50 FT-LBS.
1/2"	3 ¼"	65 FT-LBS.
5/8"	4"	100 FT-LBS.
3/4"	5 ½"	150 FT-LBS.

4. IF ANY ANCHOR SHOULD FAIL, IT SHALL BE REPLACED AT THE CONTRACTORS EXPENSE.

III. STRUCTURAL STEEL

1. MATERIALS:

ALL OTHER ROLLED SHAPES, PLATES & BARS:	ASTM A36
ANCHOR BOLTS (RODS)	ASTM F1554, GRADE 36 OR ASTM A36

2. FABRICATION AND CONSTRUCTION SHALL CONFORM TO THE STEEL CONSTRUCTION MANUAL, SPECIFICATIONS AND CODES, 13TH EDITION, BY AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC).

3. WELDING:
   A. ALL SHOP AND FIELD WELDING SHALL BE IN ACCORDANCE WITH STRUCTURAL STEEL WELDING CODE, AWS D1.1.
   B. 70 KSI ELECTRODES SHALL BE USED AT ALL WELDED STEEL CONNECTIONS.
   C. ALL WELDING SHALL BE DONE BY CERTIFIED WELDERS.
   D. A WELDING PROCEDURE SPECIFICATION (WPS) SHALL BE DEVELOPED WITH THE INFORMATION REQUIRED BY AWS D1.1. THE WPS SPECIFICATION SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW, AND SHALL ALSO BE PROVIDED TO THE OWNER, ARCHITECT AND BUILDING OFFICIAL. THE WPS SHALL INCLUDE A LIST OF THE POSITION, ELECTRODE STICKOUT, VOLTAGE AND AMPERAGE (WITH ACCEPTABLE LIMITS), BEAD SIZE, WELD SEQUENCE, STRESS RELIEVING AND OTHER PERTINENT DATA.
   E. ALL WELDS SHALL BE STARTED AND ENDED ON RUNOFF TABS WHERE PRACTICAL. ALL RUNOFF TABS SHALL BE REMOVED.
   F. WELD DAMS SHALL NOT BE ALLOWED PER AWS D1.1.
   G. OWNER SHALL RETAIN A TESTING LABORATORY TO INSPECT AND TEST WELDS (SHOP AND FIELD) AS FOLLOWS:
      (I) PROVIDE SPECIAL INSPECTION FOR ALL WELDS.
      (II) MEASURE 25% OF FILLET WELDS AND CHECK FINAL PASS OF 25% OF MULTI-PASS FILLET WELDS AND PARTIAL PENETRATION WELDS BY MAGNETIC PARTICLE TESTING.
      (III) TEST ALL COMPLETE PENETRATION WELDS ULTRASONICALLY.
   H. ALL DEFECTIVE WELDS, AS ESTABLISHED FROM INSPECTION AND TESTING SHALL BE GROUND OUT, REPAIRED AND RETESTED AT THE CONTRACTOR'S EXPENSE.

4. BOLT HOLES IN STEEL SHALL BE 1/16" LARGER THAN BOLTS, U.O.N. BOLT HOLES IN COLUMN BASE PLATES MAY BE OVERSIZED PER AISC REQUIREMENTS. ALL BOLT HOLES SHALL BE DRILLED OR PUNCHED. BURNING OF BOLT HOLES IS NOT PERMITTED.

5. BEFORE FABRICATION, SHOP DRAWINGS FOR ALL STRUCTURAL STEEL SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW.

IV. HAZARDOUS MATERIALS ON SITE

1. TUAN AND ROBINSON, STRUCTURAL ENGINEERS ASSUMES NO RESPONSIBILITY FOR THE MANAGEMENT OF HAZARDOUS MATERIALS THAT MAY BE ON THE SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSURING THAT PERSONNEL WITHIN THE WORK AREA ARE PROTECTED FROM EXPOSURE TO HAZARDOUS MATERIALS. IF MATERIALS ARE DISCOVERED THAT MAY BE HAZARDOUS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER AND CEASE WORK UNTIL CONDITIONS CAN BE MAINTAINED IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS.

V. SPECIAL INSPECTION

1. THE OWNER SHALL EMPLOY A SPECIAL INSPECTOR TO PERFORM SPECIAL INSPECTION IN ACCORDANCE WITH SECTION 1704 OF THE 2019 CBC AS A MINIMUM. THE SPECIAL INSPECTOR SHALL BE FROM AN APPROVED SPECIAL INSPECTION AGENCY. THE FOLLOWING ITEMS OF WORK REQUIRE SPECIAL INSPECTION:
   A. BOLTS INSTALLED IN CONCRETE
   B. STRUCTURAL WELDING

2. THE TESTING AND INSPECTION AGENCY SHALL COMPILE TESTING AND INSPECTION REPORTS DETAILING THE ITEMS OF WORK WHICH HAVE BEEN INSPECTED. A COPY OF THE REPORTS SHALL BE SENT TO THE OWNER, ARCHITECT, STRUCTURAL ENGINEER AND CONTRACTOR FOR REVIEW.

VI. SPECIAL INSPECTION PROGRAM

1. BOLTS INSTALLED IN CONCRETE (CONTINUOUS INSPECTION DURING PLACEMENT): SPECIAL INSPECTOR SHALL PERFORM SPECIAL INSPECTION PRIOR TO AND DURING THE PLACEMENT OF CONCRETE AROUND BOLTS.

2. WELDING (PERIODIC INSPECTION): SPECIAL INSPECTION OF WELDING SHALL BE IN ACCORDANCE WITH THE 2019 CBC, SECTION 1704, AWS D1.1 AND NOTE III.3 ON THIS SHEET. INSPECTOR SHALL PERFORM OR OBSERVE THE FOLLOWING:
   A. PERFORM VERIFICATION OF AVAILABILITY OF WPS AND MANUFACTURER CONSUMABLE CERTIFICATES.
   B. OBSERVE MATERIALS AND WELDER IDENTIFICATIONS.
   C. OBSERVE FIT-UP OF FILLET AND GROOVE WELDS, AND CONFIGURATION AND FINISH OF ACCESS HOLES.
   D. OBSERVE USE OF QUALIFIED WELDERS.
   E. OBSERVE CONTROL AND HANDLING OF CONSUMABLES, NO WELDING OVER CRACKED TACK WELDS, ENVIRONMENTAL CONDITIONS, WPS IS FOLLOWED AND WELDING TECHNIQUES OF WELDERS.
   F. OBSERVE WELDS ARE CLEANED.
   G. PERFORM VERIFICATION THAT WELDS MEET VISUAL ACCEPTANCE CRITERIA, NOTE OF ARC STRIKES, VERIFICATION OF BACKING BARS REMOVAL, VERIFICATION OF WELD TAB REMOVAL, VERIFICATION OF REPAIR ACTIVITIES.
   H. PERFORM DOCUMENTATION OF ACCEPTANCE OR REJECTION OF WELDED JOINT OR MEMBER.

3. INSPECTION AND TESTING OF ANCHORS AND DOWELS (PERIODIC INSPECTION):
   A. SPECIAL INSPECTOR SHALL OBSERVE THAT DRILLED HOLES ARE FREE OF DUST AND DEBRIS PRIOR TO PLACEMENT OF NON-SHRINK GROUT OR EPOXY OF DRILLED ANCHORS AND DOWELS OR EXPANSION ANCHORS.
   B. ANCHORS SHALL BE PULL TESTED AS SPECIFIED IN NOTES.
   C. TESTING APPARATUS SHALL BE SUCH THAT IT TESTS NOT ONLY THE ANCHOR IN DIRECT TENSION, BUT ALSO THE ADJACENT CONCRETE FOR CONE FAILURE. IF ANY ANCHOR SHOULD FAIL, IT SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE. THE IMMEDIATELY ADJACENT ANCHORS SHALL ALSO BE TESTED AT THE CONTRACTOR'S EXPENSE.
   D. TEST EQUIPMENT SHALL BE CALIBRATED BY AN APPROVED TESTING LABORATORY IN ACCORDANCE WITH STANDARD RECOGNIZED PROCEDURES.
   E. THE FOLLOWING CRITERIA APPLY FOR THE ACCEPTANCE OF INSTALLED ANCHORS: ANCHORS:
      (i) HYDRAULIC RAM METHOD: THE ANCHOR SHALL HAVE NO OBSERVABLE MOVEMENT AT THE APPLICABLE TEST LOAD.
      (ii) TESTING SHALL OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF THE SUBJECT ANCHORS.

City and County of San Francisco
Department of Building Inspection

London Breed , Mayor
Patrick O'Riardan, Interim Director

NOTICE

SPECIAL INSPECTION REQUIREMENTS

Please note that the special inspections shown on the approved plan and checked on the special inspection form issued with the building permit are required for this project. The employment of special inspectors is the direct responsibility of the owner or the engineer/architect of record acting as the owner's representative.

These special inspections are required *in addition to* the called inspections performed by the Department of Building Inspection. The name of special inspector shall be furnished to the district building inspector prior to start of work for which special inspection is required.

For questions regarding the details or extent of required inspection or tests, please call the Plan Checker assigned to this project or **415-558-6132**. If there are any field problems regarding special inspection, please call your District Building Inspector or 415-558-6570.

Before final building inspection is scheduled, documentation of special inspection compliance must be submitted to and approved by the Special Inspection Services staff. To avoid delays in this process, the project owner should request final compliance reports from the architect or engineer of record and/or special inspection agency soon after the conclusion of work requiring special inspection. ***The permit will not be finalized without compliance with the special inspection requirements.***

STRUCTURAL OBSERVATION REQUIREMENTS

Structural observation shall be provided as required per Section 1704.5. **The building permit will not be finalized without the compliance of the structural observation requirements.**

Special Inspection Services Contact Information

1. **Telephone: (415) 558-6132**
2. **Fax: (415) 558-6474**
3. **Email: dbi.specialinspections@sfgov.org**
4. **In Person: 3rd floor at 1660 Mission Street**

Note: We are moving towards a 'paperless' mode of operation. All special inspection submittals, including final letters, may be emailed (preferred) or faxed. We will also be shifting to a paperless fax receipt mode.

Special Inspection Services
1660 Mission Street - San Francisco CA 94103
Office (415) 558-6132 - FAX (415) 558-6474 - www.sfdbi.org

SPECIAL INSPECTION AND STRUCTURAL OBSERVATION

A COPY OF THIS DOCUMENT SHALL BE KEPT WITH THE APPROVED STRUCTURAL DRAWING SET

JOB ADDRESS 17TH STREET BETWEEN VERMONT STREET AND SAN BRUNO AVENUE APPLICATION NO.________ ADDENDUM NO.____

OWNER NAME________ OWNER PHONE NO. (   )________

Employment of Special Inspection is the direct responsibility of the OWNER, or the engineer/architect of record acting as the owner's representative. Special inspection shall be one of those as prescribed in Sec. 1704. Name of special inspector shall be furnished to DBI District Inspector prior to start of the work for which the Special Inspection is required. Structural observation shall be performed as provided by Section 1704.6. A preconstruction conference is recommended for owner/builder or designer/builder projects, complex and highrise projects, and for projects utilizing new processes or materials.

In accordance with Chapter 17 (SFBC), Special Inspection and/or testing is required for the following work:

1. [ ] Concrete (Placement & sampling)
2. [X] Bolts installed in concrete
3. [ ] Special moment - resisting concrete frame
4. [ ] Reinforcing steel and prestressing tendons
5. **Structural welding:**
   A. Periodic visual inspection
   [X] Single pass fillet welds 5/16" or smaller
   [ ] Steel deck
   [ ] Welded studs
   [ ] Cold formed studs and joists
   [ ] Stair and railing systems
   [ ] Reinforcing Steel
   B. Continuous visual inspection and NDT (Section 1704)
   [ ] All other welding (NDT exception: Fillet weld)
   [ ] Reinforcing steel; and [ ] NDT required
   [ ] Moment-resisting frames
   [ ] Others ________
6. [ ] High-strength bolting
7. [ ] Structural masonry
8. [ ] Reinforced gypsum concrete
9. [ ] Insulating concrete fill
10. [ ] Spray-on fireproofing
11. [ ] Piling, drilled piers and caissons
12. [ ] Shotcrete
13. [ ] Special grading, excavation and filling (Geo. Engineered)
14. [ ] Smoke-control system
15. [ ] Demolition
16. [ ] Exterior Facing
17. **Retrofit of unreinforced masonry buildings:**
    [ ] Testing of mortar quality and shear tests
    [ ] Inspection of repointing operations
    [ ] Installation inspection of new shear bolts
    [ ] Pre-installation inspection for embedded bolts
    [ ] Pull/torque test per SFBC Sec.1607C & 1615C
18. **Bolts Installed in existing concrete or masonry:**
    [ ] Concrete [ ] Masonry
    [ ] Pull/torque tests
19. [ ] Shear walls and floor systems used as shear diaphragms
20. [ ] Holdowns
21. **Special cases:**
    [ ] Shoring
    [ ] Underpinning: [ ] Not affecting adjacent property
    [ ] Affecting adjacent property: PA ________
    [ ] Others:________
22. [ ] Crane safety (Apply to the operation of tower cranes on highrise building) (Section 1705.21)
23. [ ] Others: "As recommended by professional of record" ________

24. Structural observation per Sec. 1704.6 for the following: [ ] Foundations [ ] Steel framing
[ ] Concrete construction [ ] Masonry construction [ ] Wood framing
[ ] Other:________

25. Certification is required for: [ ] Glu-lam components

Prepared by:EUGENE TUAN, TUAN AND ROBINSON STRUCTURAL ENGINEERS Phone: (415) 957-2480 X 103
Engineer/~~Architect~~ of Record

Required information:
FAX: (415) 957-2483 Email: ETUAN@TRSEINC.COM

Review by: ________ Phone: (   )________
DBI Engineer or Plan Checker

****

APPROVAL (Based on submitted reports.)

____
DATE DBI Engineer or Plan Checker / Special Inspection Services Staff

QUESTIONS ABOUT SPECIAL INSPECTION AND STRUCTURAL OBSERVATION SHOULD BE DIRECTED TO:
Special Inspection Services (415) 558-6132; or, dbi.specialinspections@sfgov.org ; or FAX (415) 558-6474

REVISIONS	BY:

Tuan & Robinson
Structural Engineers, Inc.
444 Spear Street, Suite 101
San Francisco, California 94105
TEL 415 957 2480 FAX 415 957 2483

TRSE PROJECT NUMBER:2022.003.00

REGISTERED PROFESSIONAL ENGINEER
EUGENE Y. TUAN
No. S3982
Expires 06-30-23
STRUCTURAL
STATE OF CALIFORNIA

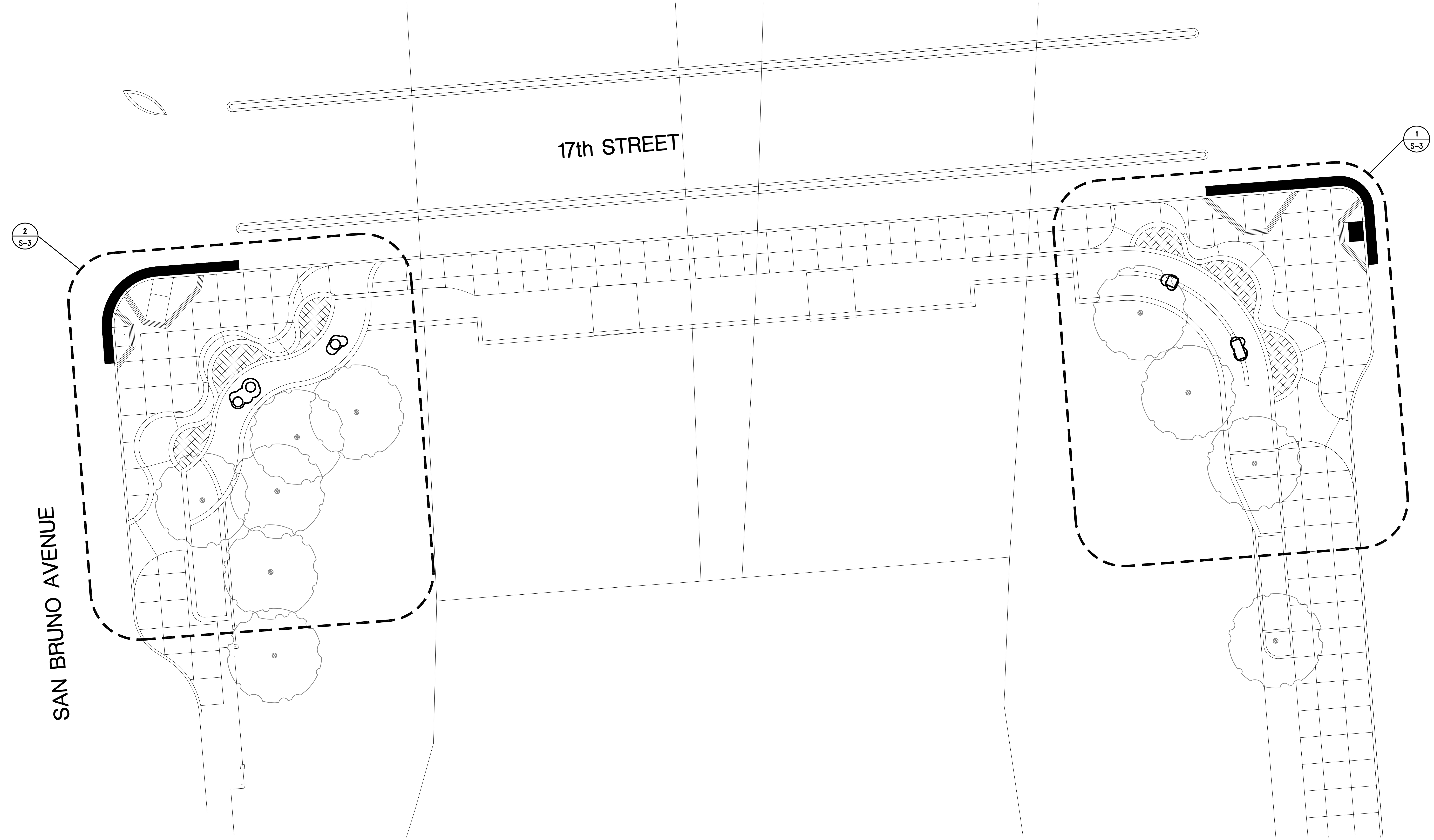
POTRERO GATEWAY ARTWORK
17TH STREET BETWEEN VERMONT STREET
AND SAN BRUNO AVENUE
SAN FRANCISCO, CA

GENERAL NOTES

DATE 06/10/2022
SCALE NONE
DRAWN JC
CHECKED ET
SHEET S-1
OF 4 SHEETS

PLOT DATE: 2022 June 10, Friday - 8:47:15 AM
FILE NAME: L:_Projects\2022\2022-003.00 Potrero Gateway Sculpture Foundation & Anchorage\dwg\S-1.dwg

24" x 36" SHEET SIZE. IF SHEET IS SMALLER, THEN DRAWING HAS BEEN REDUCED.



1 POTRERO GATEWAY ARTWORK SITE PLAN 3/32" = 1'-0"

NORTH

3/32" = 1'-0" 0 8' 16' 24' 32'

REVISIONS	BY:

TR SE Tuan & Robinson Structural Engineers, Inc.
444 Spear Street, Suite 101
San Francisco, California 94105
TEL 415 957 2480 FAX 415 957 2483

TRSE PROJECT NUMBER: 2022.003.00

REGISTERED PROFESSIONAL ENGINEER
EUGENE Y. TUAN
No. S3982
Expires 06-30-23
STRUCTURAL
STATE OF CALIFORNIA

POTRERO GATEWAY ARTWORK
17TH STREET BETWEEN VERMONT STREET
AND SAN BRUNO AVENUE
SAN FRANCISCO, CA

POTRERO GATEWAY
ARTWORK SITE PLAN

DATE 06/10/2022
SCALE 3/32" = 1'-0"
DRAWN JC
CHECKED ET
SHEET S-2
OF 4 SHEETS

PLOT DATE: 2022 June 10, Friday – 8:48:02 AM
FILE NAME: L:_Projects\2022\2022-003.00 Potrero Gateway Sculpture Foundation & Anchorage\dwg\S-2.dwg

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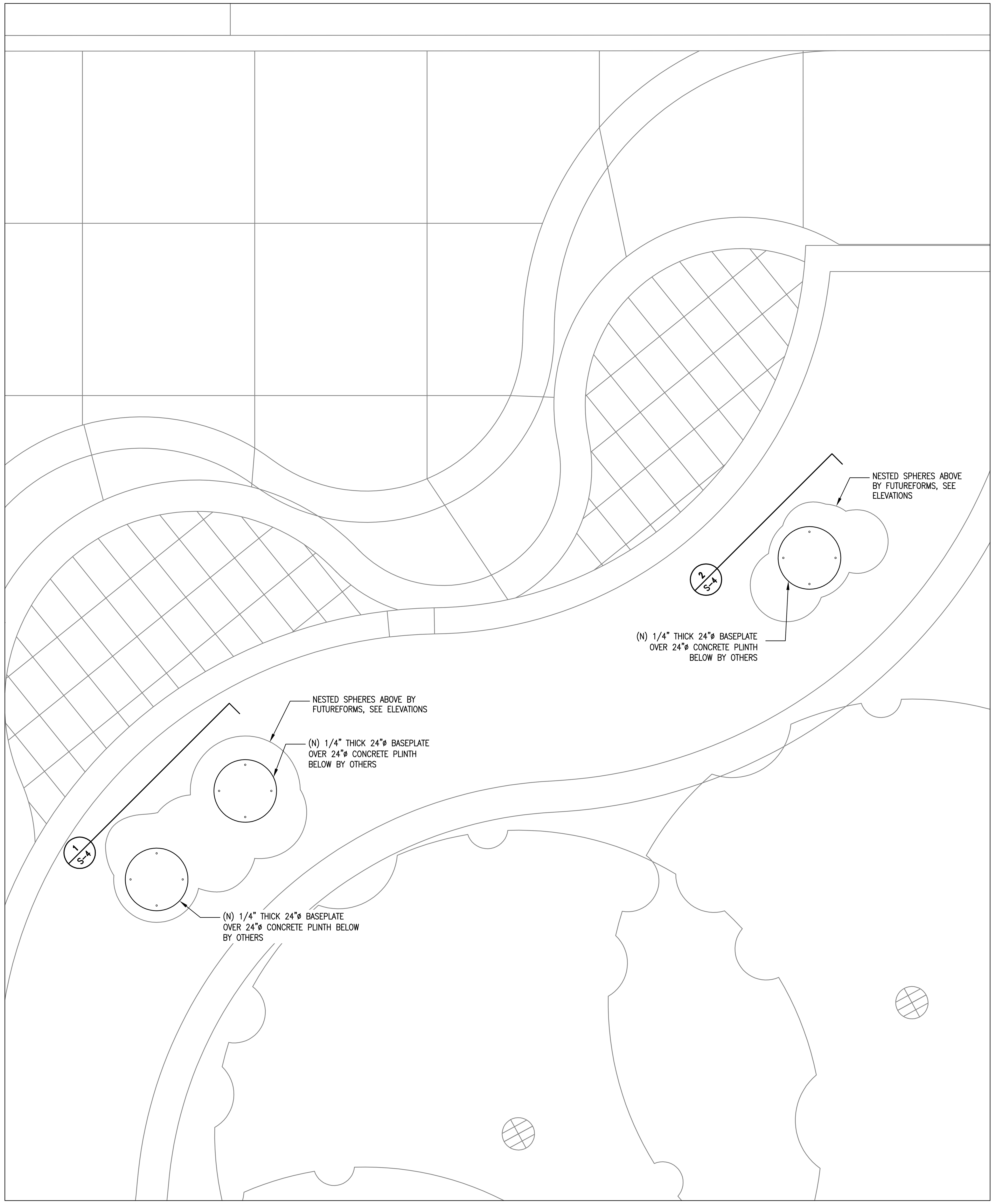


2 ARTWORK BASEPLATE PLAN
17th & SAN BRUNO AVE. 1/2" = 1'-0"

1 ARTWORK BASEPLATE PLAN
17th & VERMONT ST. 1/2" = 1'-0"

REVISIONS	BY:

TR SE
Tuan & Robinson
Structural Engineers, Inc.
444 Spear Street, Suite 101
San Francisco, California 94105
TEL 415 957 2480 FAX 415 957 2483

TRSE PROJECT NUMBER:2022.003.00

REGISTERED PROFESSIONAL ENGINEER
EUGENE Y. TUAN
No. S3982
Expires 06-30-23
STRUCTURAL
STATE OF CALIFORNIA

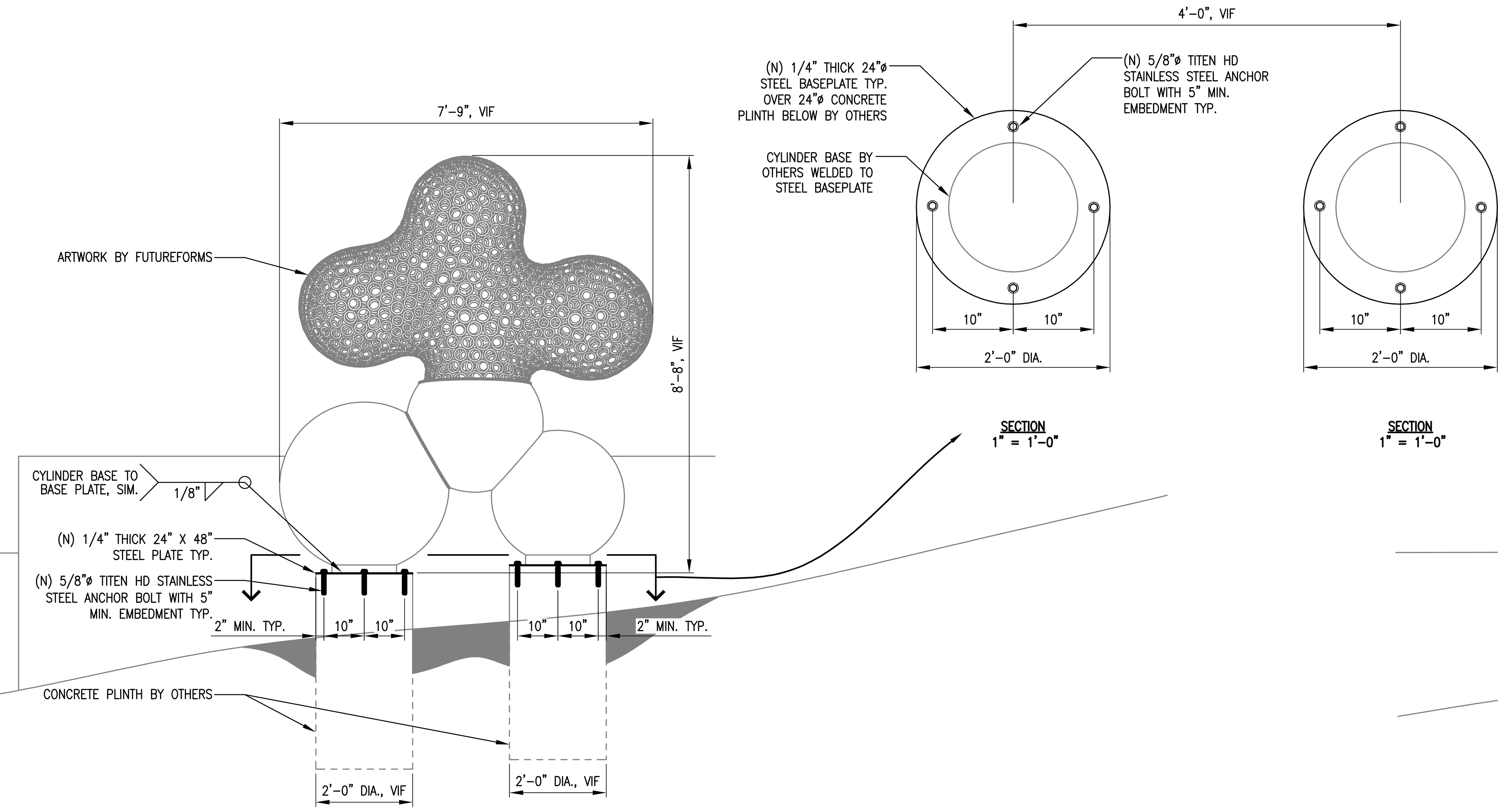
POTRERO GATEWAY ARTWORK
17TH STREET BETWEEN VERMONT STREET
AND SAN BRUNO AVENUE
SAN FRANCISCO, CA

POTRERO GATEWAY
ARTWORK BASEPLATE PLAN

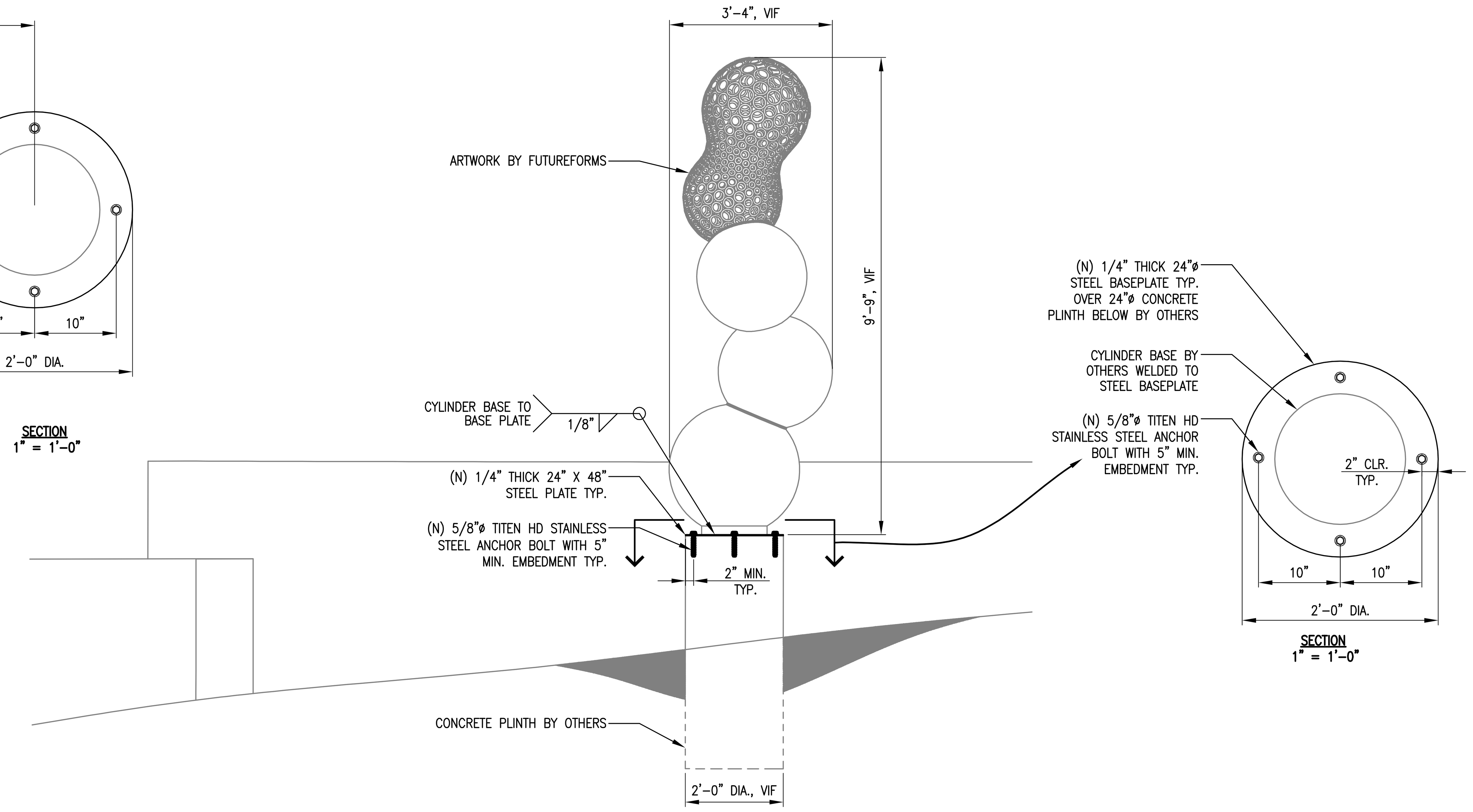
DATE 06/10/2022
SCALE 1/2" = 1'-0"
DRAWN JC
CHECKED ET
SHEET S-3
OF 4 SHEETS

PLOT DATE: 2022 June 10, Friday – 8:48:39 AM
FILE NAME: L:_Projects\2022\2022-003.00 Potrero Gateway Sculpture Foundation & Anchorage\dwg\S-3.dwg

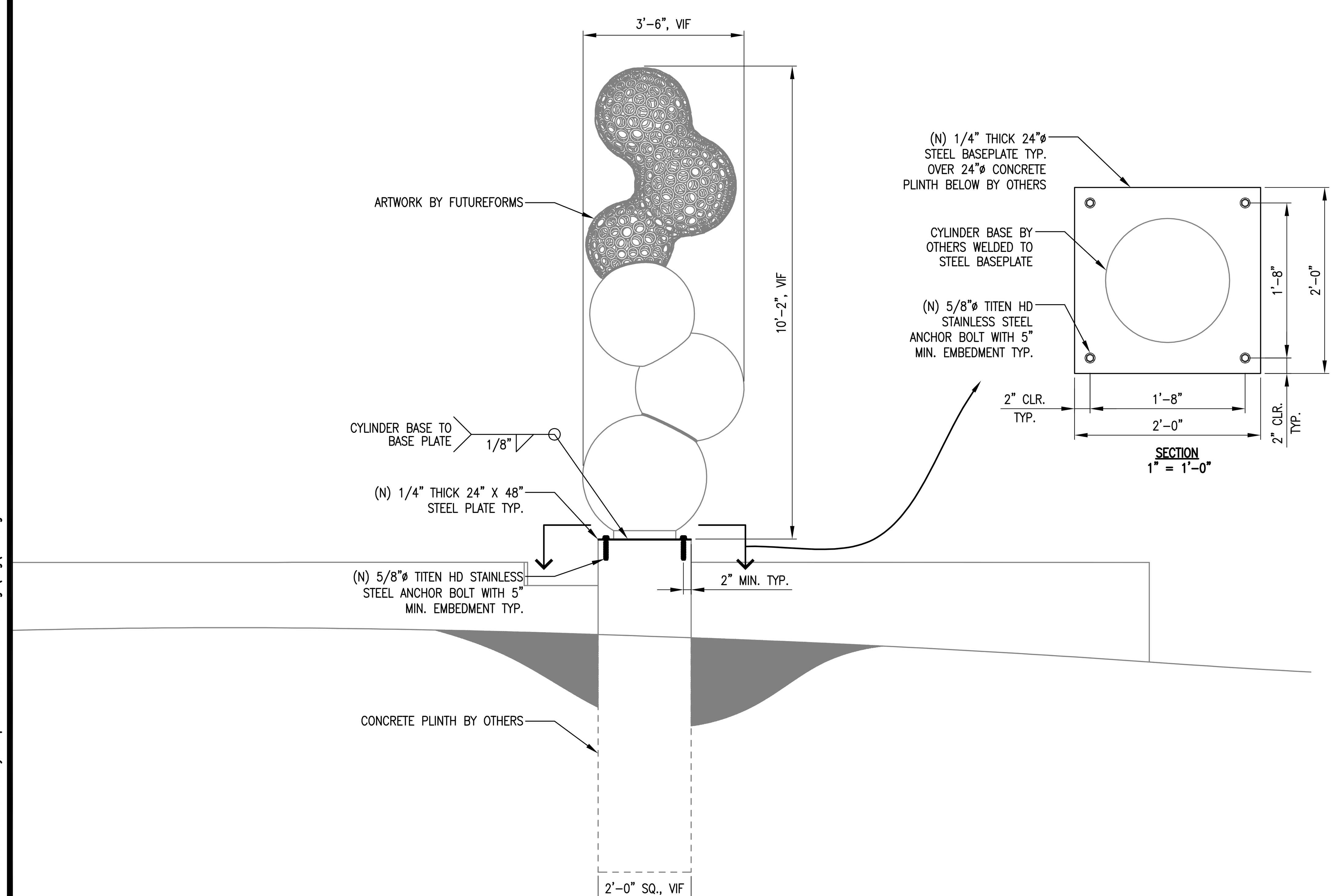
24" x 36" SHEET SIZE. IF SHEET IS SMALLER, THEN DRAWING HAS BEEN REDUCED.



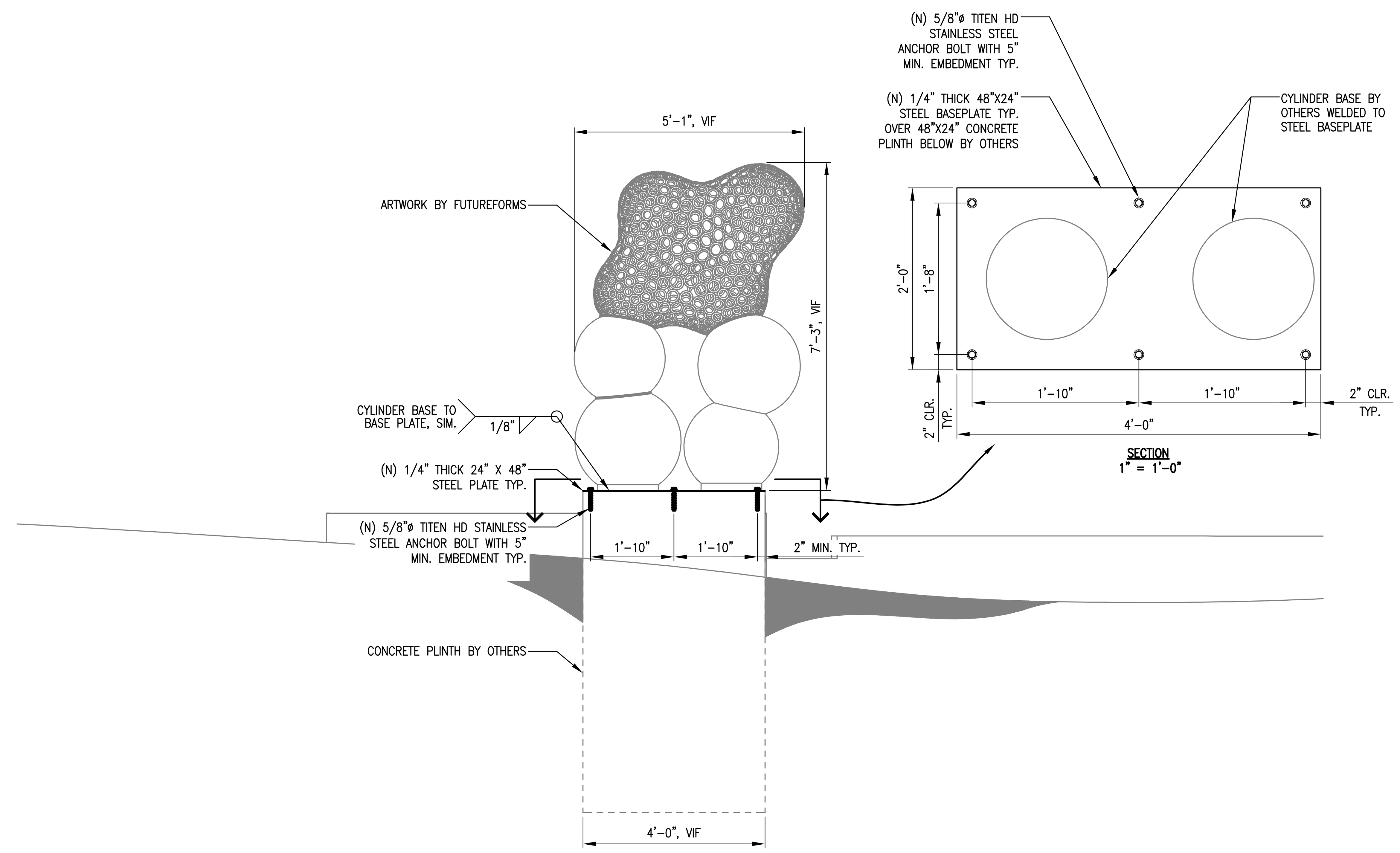
ARTWORK 1 ELEVATION
17th & SAN BRUNO AVE. 1/2" = 1'-0"



ARTWORK 2 ELEVATION
17th & SAN BRUNO AVE. 1/2" = 1'-0"



ARTWORK 3 ELEVATION
17th & VERMONT ST. 1/2" = 1'-0"



ARTWORK 4 ELEVATION
17th & VERMONT ST. 1/2" = 1'-0"

REVISIONS	BY:

Tuan & Robinson
Structural Engineers, Inc.
444 Spear Street, Suite 101
San Francisco, California 94105
TEL 415 957 2480 FAX 415 957 2483

TRSE PROJECT NUMBER: 2022.003.00

REGISTERED PROFESSIONAL ENGINEER EUGENE Y. TUAN No. S3982 Expires 06-30-23 STRUCTURAL STATE OF CALIFORNIA

POTRERO GATEWAY ARTWORK
17TH STREET BETWEEN VERMONT STREET
AND SAN BRUNO AVENUE
SAN FRANCISCO, CA

POTRERO GATEWAY
ARTWORK ELEVATIONS

DATE 06/10/2022
SCALE AS NOTED
DRAWN JC
CHECKED ET
SHEET S-4
OF 4 SHEETS

PLOT DATE: 2022 June 10, Friday – 8:59:51 AM
FILE NAME: L:_Projects\2022\2022-003.00 Potrero Gateway Sculpture Foundation & Anchorage\dwg\S-4.dwg

24" x 36" SHEET SIZE. IF SHEET IS SMALLER, THEN DRAWING HAS BEEN REDUCED.

Tuan and Robinson
Structural Engineers, Inc.
444 Spear Street, Suite 101
San Francisco, CA 94105
Tel: 415 957-2480 Fax: 415 957-2483

STRUCTURAL CALCULATIONS

FOR

POTRERO GATEWAY ARTWORK ANCHORAGE SAN FRANCISCO, CALIFORNIA

TRSE Reference Number: 2022.003.00

June 8, 2022

PREPARED FOR:
Future Forms
2325 3rd Street, Suite 229
San Francisco, CA 94107

REGISTERED PROFESSIONAL ENGINEER
EUGENE Y. TUAN
No. S3982
Expires 06-30-23
STRUCTURAL
STATE OF CALIFORNIA

STRUCTURAL ENGINEER:
Tuan and Robinson, Structural Engineers, Inc.
444 Spear Street, Suite 101
San Francisco, CA 94105
T: (415) 957-2480
F: (415) 957-2483

OSHPD

Vermont St & 17th St, San Francisco, CA 94103, USA

Latitude, Longitude: 37.7646788, -122.404521

Date	1/16/2022, 8:16:49 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.5	MCE_R ground motion. (for 0.2 second period)
S_1	0.6	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.8	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.2	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

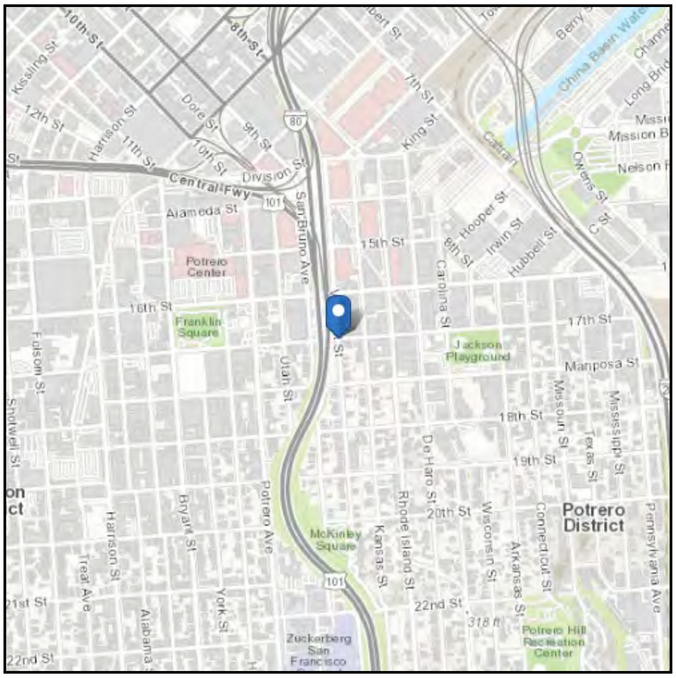
Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.564	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.677	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.775	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.912	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.698	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.767	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.564	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.928	Mapped value of the risk coefficient at short periods
C_{R1}	0.91	Mapped value of the risk coefficient at a period of 1 s

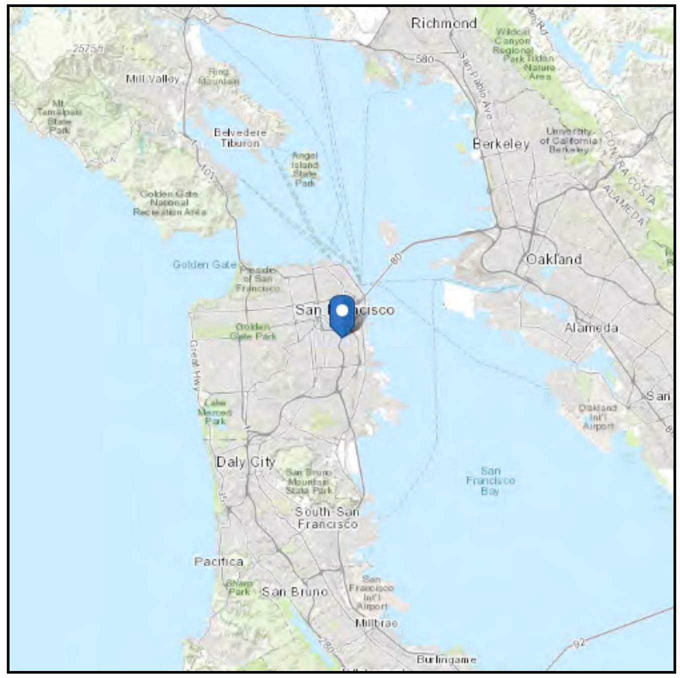
ASCE 7 Hazards Report

Address:
17th St & Vermont St
San Francisco, California
94103

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: Default

Elevation: 55.18 ft (NAVD 88)
Latitude: 37.76468
Longitude: -122.40449





Wind

Results:

Wind Speed	92 Vmph
10-year MRI	64 Vmph
25-year MRI	70 Vmph
50-year MRI	74 Vmph
100-year MRI	78 Vmph
10,000-year MRI	112 Vmph
100,000-year MRI	129 Vmph
1,000,000-year MRI	147 Vmph

Data Source: ASCE/SEI 7-22, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Fri May 20 2022

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-22 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2.

OSHPD

17th St & San Bruno Ave, San Francisco, CA 94103, USA

Latitude, Longitude: 37.7646193, -122.4054858

Date	1/16/2022, 8:15:58 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	**Value**	**Description**
S_S	1.5	MCE_R ground motion. (for 0.2 second period)
S_1	0.6	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.8	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.2	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

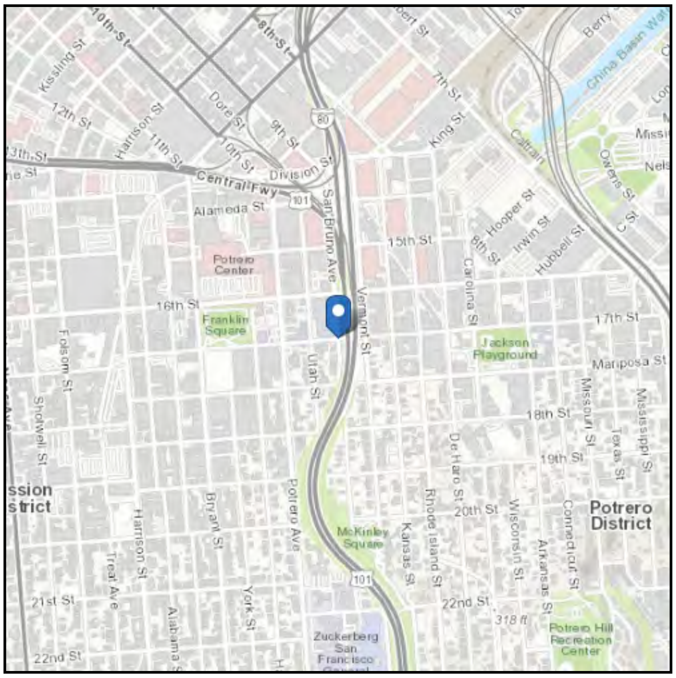
Type	**Value**	**Description**
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.566	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.68	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.778	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.916	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.7	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.769	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.566	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.928	Mapped value of the risk coefficient at short periods
C_{R1}	0.909	Mapped value of the risk coefficient at a period of 1 s

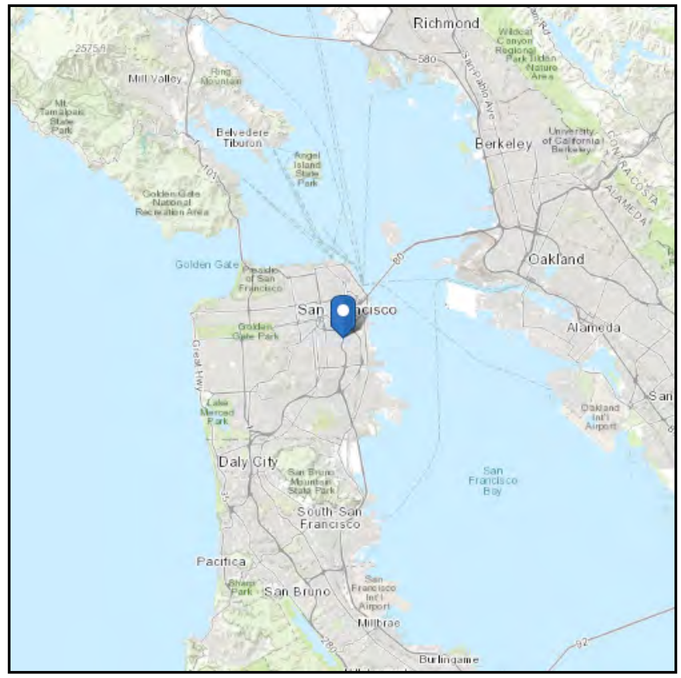
ASCE 7 Hazards Report

Address:
17th St & San Bruno Ave
San Francisco, California
94103

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: Default

Elevation: 71 ft (NAVD 88)
Latitude: 37.76462
Longitude: -122.40546





Wind

Results:

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10,000-year MRI	112 Vmph
100,000-year MRI	129 Vmph
1,000,000-year MRI	147 Vmph

Data Source: ASCE/SEI 7-22, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Fri May 20 2022

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-22 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2.

EMAIL FROM ARTWORK DESIGNER REGARDING ARTWORK WEIGHTS

Brian McKinney <brian@futureforms.us>
to Eugene, Nataly, Simon, Jason, me

Tue, May 17, 9:01 AM

Eugene,

You are correct re the base plates.

I'm estimating the weights at:

1= 320 lbs

2= 187 lbs

3= 192 lbs

4= 210 lbs

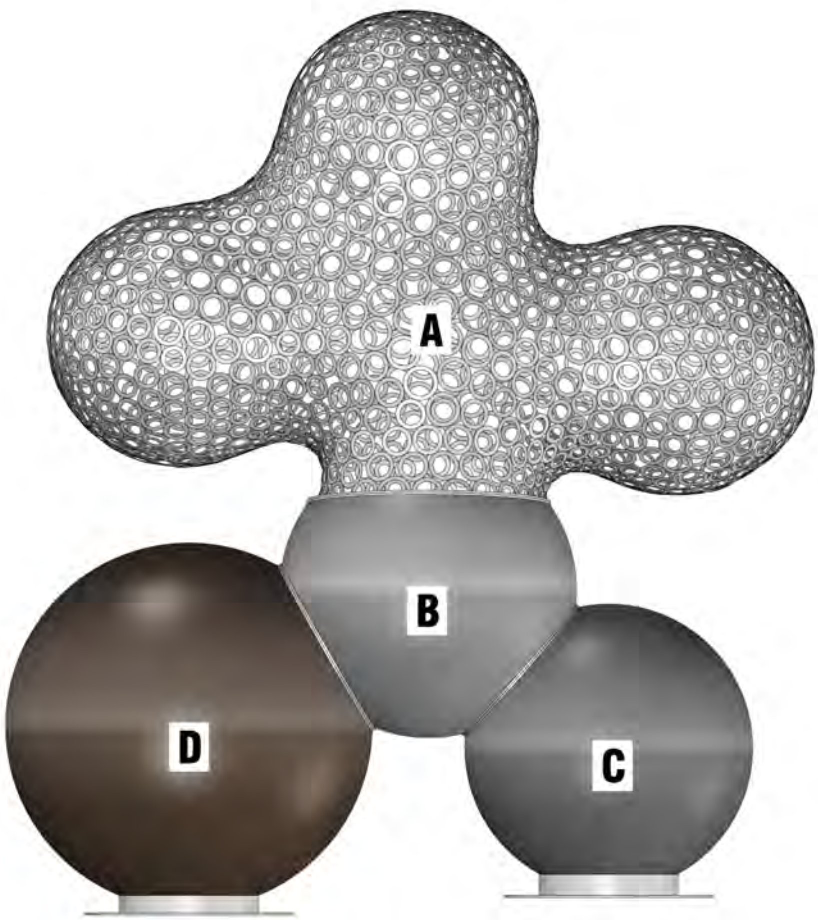
I don't think I have any comments at the moment. Thanks

...

Tuan and Robinson
Structural Engineers, Inc.
444 Spear Street, Suite 101
San Francisco, CA 94105-1693
Tel: (415) 957-2480 Fax: (415) 957-2483

Artwork Calculations

Artwork #1
Total Weight = 320# - per email, see page 6



ARTWORK 1

Approximate Weights of Spheres
Assume whole spheres
Weight of 14GA steel = 3.15psf
Thickness of 14GA Steel = 0.747in

Sphere B
Diameter = 34in
Radius = 17in
Surface Area = $4*pi*r^2$
= $4*pi*(17/12)^2$
Surface Area = $25.22ft^2$
Weight = $25.221ft^2$ *3.15psf
Weight = 79.44#

Projected Surface Area = $pi*r^2$
= $pi*(17/12)^2$
Projected Surface Area = $6.31ft^2$

Sphere B weight and projected surface area is only about 2/3

Weight = 79.44#(2/3) = 52.96#
Projected Surface Area = $6.31ft^2*(2/3)=4.21ft^2$

Sphere C
Diameter = 33in
Radius = 16.5in
Surface Area = $4*pi*r^2$
= $4*pi*(16.5/12)^2$
Surface Area = $23.76ft^2$
Weight = $23.76ft^2$ *3.15psf
Weight = 74.84#

Projected Surface Area = $pi*r^2$
= $pi*(16.5/12)^2$
Projected Surface Area = $5.94ft^2$

Sphere D
Diameter = 42in
Radius = 21in
Surface Area = $4*pi*r^2$
= $4*pi*(21/12)^2$
Surface Area = $38.49ft^2$
Weight = $38.49ft^2$ *3.15psf
Weight = 121.25#

Projected Surface Area = $pi*r^2$
= $pi*(21/12)^2$
Projected Surface Area = $9.62ft^2$

Approximate Weight of Sphere A
Sphere A=320#-52.96#-74.84#-121.25#=70.95#
Assume Sphere A to be solid for calculation purposes - Bigger sphere of Sphere A approximately has a diameter of 32in and approximately 4 spheres
Surface Area = $(4*pi*(16/12)^2)$ x 4 spheres
Surface Area = $89.36ft^2$

Projected Surface Area = $(16/12)^2*pi*4$ spheres
= $22.34ft^2$

Artwork Calculations
Sphere A to Sphere B connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A}$ = 70.95#

Seismic Uplift
E_v = 0.2*S_{DS}*Wp
= 0.2*1.2*70.95#
E_v = 17.03#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*70.95# = 25.54#
F_{ph} = [(0.4*2.5*1.2*70.95#)/(2.5/1.0)][1+2*(1)] = 120.17#
$F_{ph,max}$ = 1.6*1.2*1.0*70.95# = 136.22#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*70.95# = 63.86#
E_v = 17.03#
E_{mh} = Omega*F_{ph} = 2*120.17# = 240.34#

Check Wind Forces

V = 92mph $A_{projected\ surface,A}$ = 22.34ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*22.34ft^2
F = 460.92#

F_{wind} = 460.92# > $F_{seismic}$ = 240.34#

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere A and B

460.92# = 0.46092 kips

Rn/Omega = 0.928*D*L use 1/8" weld -> D = 2

0.46092 kips = 0.928*2*L
L = 0.25in

1/8" Weld Size is adequate - weld all around

Tuan and Robinson
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San Francisco, CA 94105-1693
Tel: (415) 957-2480 Fax: (415) 957-2483

Artwork Calculations
Sphere B to Sphere C connection and Sphere B to Sphere D Connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,(A+B)/2}$ =(70.95#+52.96#)/2=61.96#

Seismic Uplift

$E_v = 0.2*S_{DS}*W_p$
$= 0.2*1.2*61.96\#$
$E_v = 14.87\#$

Seismic Horizontal

$F_{ph,min} = 0.3*1.2*1.0*61.96\# = 22.31\#$
$F_{ph} = [(0.4*2.5*1.2*61.96\#)/(2.5/1.0)][1+2*(1)] = 89.22\#$
$F_{ph,max} = 1.6*1.2*1.0*61.96\# = 118.96\#$

Load Combination

Load Combination #7 = $0.9D-E_v+E_{mh}$
0.9D = 0.9*61.96# = 55.76#
$E_v = 14.87\#$
$E_{mh} = Omega*F_{ph} = 2*89.22\# = 178.44\#$

Check Wind Forces

V = 92mph $A_{projected\ surface,A+B} = 22.34ft^2+4.21ft^2 = 26.55ft^2$ G = 0.85 $C_f = 1.55$
$F= q_h*G*C_f*A_s$
$q_h = 0.00256K_zK_{zt}K_dK_eV^2$
$K_z = 2.01(15/Z_g)^{2/alpha}$
$= 2.01(15/900)^{2/9.5}$
$k_z = 0.85$
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
$q_h = 0.00256*0.85*1.0*0.85*1.0*92^2$
q_h = 15.66psf
$F = 15.66psf*0.85*1.55*26.55ft^2$
F = 547.78#

$F_{wind} = 547.78\# < F_{seismic} = 178.44\#$

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere B and C

547.78# = 0.54778 kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.54778 kips = 0.928*2*L
L = 0.30in

1/8" Weld Size is adequate - weld all around, use same weld for sphere B to sphere D.

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Artwork Calculations
Sphere A, B, and D to cylinder connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,(A+B)/2+D}$ = (70.95#+52.96#)/2 + 121.25# = 183.21#

Seismic Uplift
E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*183.21#
E_v = 43.97#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*183.21# = 65.96#
F_{ph} = [(0.4*2.5*1.2*183.21#)/(2.5/1.0)][1+2*(1)] = 263.82#
$F_{ph,max}$ = 1.6*1.2*1.0*183.21# = 351.76#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*183.21# = 164.89#
E_v = 43.97#
E_{mh} = Omega*F_{ph} = 2*263.82# = 527.64#

Check Wind Forces

V = 92mph $A_{projcted\ surface,(A+B)/2+D}$=(22.34ft^2+4.21ft^2)/2^2+9.62ft^2 =22.90ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*22.90ft^2
F = 472.47#

F_{wind} = 472.47# < $F_{seismic}$ = 527.64#

Seismic governs over wind -> design weld connection for seismic forces

Check weld between Sphere D and cylinder

527.64# = 0.52764kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.52764kips = 0.928*2*L
L = 0.29in

1/8" Weld Size is adequate - weld all around, use same weld to weld cylinder to steel base plate and use same weld for Sphere C to cylinder.

Seismic Demands for Nonstructural Components - ASCE 7-16 Chapter 13

Artwork #1

Seismic Design Criteria : S_{DS} = 1.2

F_{ph},min = $F_p = 0.3 S_{DS} I_p W_p$ (13.3-3)

F_{ph} = $F_p = \dfrac{0.4 a_p S_{DS} W_p}{\left(\dfrac{R_p}{I_p}\right)}\left(1+2\dfrac{z}{h}\right)$ (13.3-1) z = h = z/h = 1

F_{ph},max = $F_p = 1.6 S_{DS} I_p W_p$ (13.3-2)

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1

a_p = 2.50, R_p = 2.50, I_p = 1.00, Omega = 2.00

W_p = 320# - provided by others

Horizontal Seismic Demand Calculations

F_{ph},min = 0.3*1.2*1.0*320# = 115.2#

F_{ph} = [(0.4*2.5*1.2*320#)/(2.5/1.0)][1+2*(1)] = 460.8# ← CONTROLS

F_{ph},max = 1.6*1.2*1.0*320# = 614.4#

Vertical Seismic Demand Calculations

F_{pv} = +/- 0.2SdsWp = +/- 0.2*1.2*320# = 76.8#

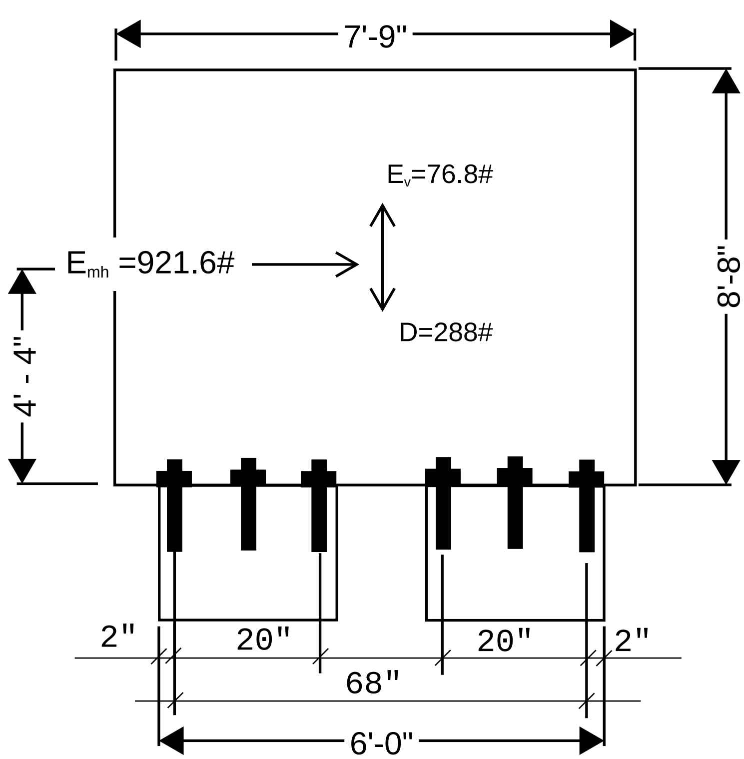
LRFD Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}

0.9D = 0.9*320# = 288#

E_v = 76.8#

E_{mh} = Omega*F_{ph} = 2*460.8# = 921.6#



Check Wind Forces

Artwork #1
Check Wind Forces

V = 92mph $A_{projcted\ surface,All}$=22.34ft^2+4.21ft^2+5.94ft^2+9.62ft^2 =42.11ft^2 G = 0.85 Cf = 1.55

F= q_h*G*C_f*A_s

q_h = 0.00256$K_zK_{zt}K_dK_eV^2$

K_z = 2.01(15/Z_g)$^{2/alpha}$

= 2.01(15/900)$^{2/9.5}$

k_z = 0.85

K_{zt} = 1.0 (ASCE 7-16 26.8.1)

K_d = 0.85 (ASCE 7-16 Table 26.6-1)

K_e = 1.0 (ASCE 7-16 26.5)

q_h = 0.00256*0.85*1.0*0.85*1.0*92^2

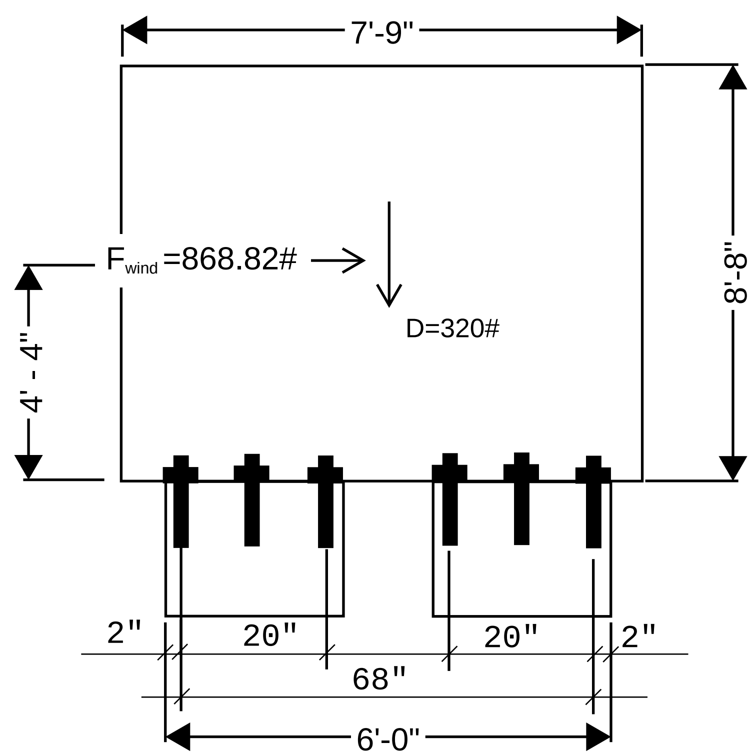
q_h = 15.66psf

F = 15.66psf*0.85*1.55*42.11ft^2

F = 868.82#

F_{wind} = 868.82# < $F_{seismic}$ = 921.6#

<u>Seismic governs over wind -> design weld connection for seismic forces</u>



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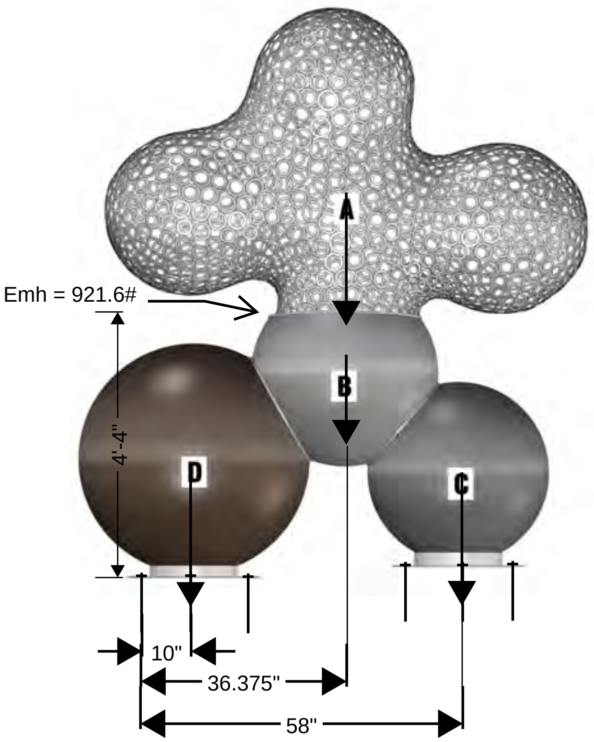
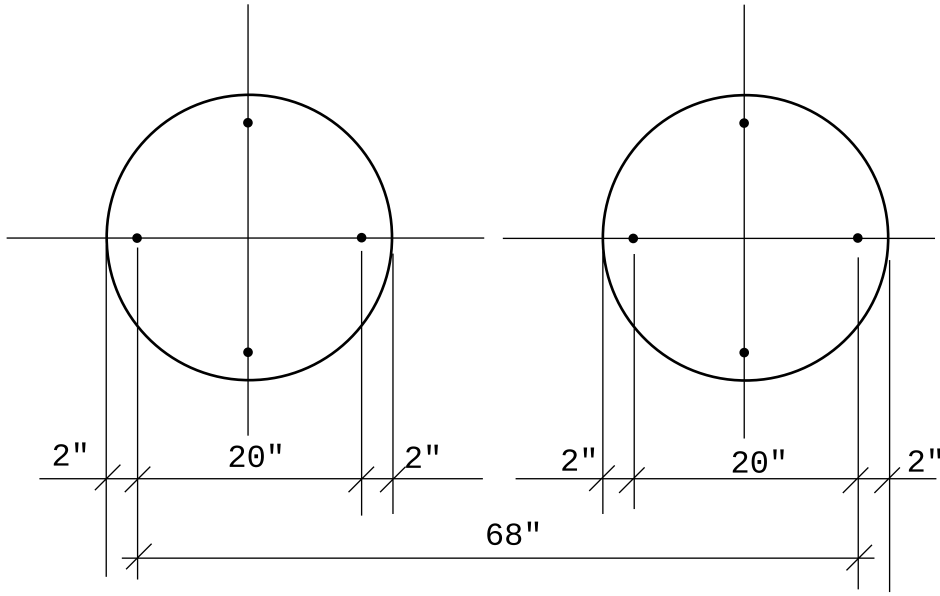
Baseplate Anchor Demands

Artwork #1 Load Demands on Anchors





ANCHOR BOLT LAYOUT

Dead Load

Total Dead Load = 320#

0.9D = 288#

Seismic Uplift

E_v = 76.8#

Overturning Moment:

Seismic = 921.6#*4.33ft = 3993.6#-ft

Sphere A = 0.9*(70.95#*36.375"/12"/ft) = 193.56#-ft

Sphere B = 0.9*(52.96#*36.375"/12"/ft) = 144.48#-ft

Sphere C = 0.9*(74.84#*58"/12"/ft) = 325.55#-ft

Sphere D = 0.9*(121.25#*10"/12"/ft) = 90.94#

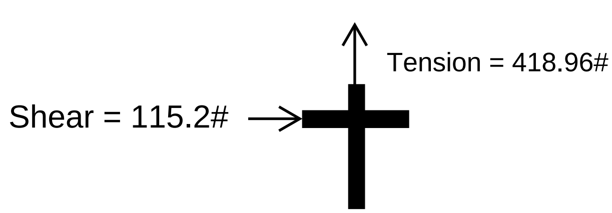
Total Overturning Moment = 4748.13#-ft

Tension Demand Per Anchor = 4748.13#-ft / 68"/12"/ft = 837.91#

837.91#/ 2 pairs of anchors = 418.96#

Shear Demand Per Anchor = 921.6# / 8 anchors = 115.2#

Anchor Demands - Summary



1.Project information

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

Project description: Artwork #1
Location: San Francisco
Fastening description:

2. Input Data & Anchor Parameters

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

Anchor Information:
Anchor type: Concrete screw
Material: Stainless Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 5.000
Effective Embedment depth, h_{ef} (inch): 3.160
Anchor category: 1
Anchor ductility: Yes
h_{min} (inch): 7.67
c_{ac} (inch): 6.25
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 12.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 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: Not applicable
Build-up grout pad: No

Recommended Anchor
Anchor Name: Titen HD® Stainless Steel - 5/8"Ø SS Titen HD, hnom:5" (127mm)

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 2.9.7376.2

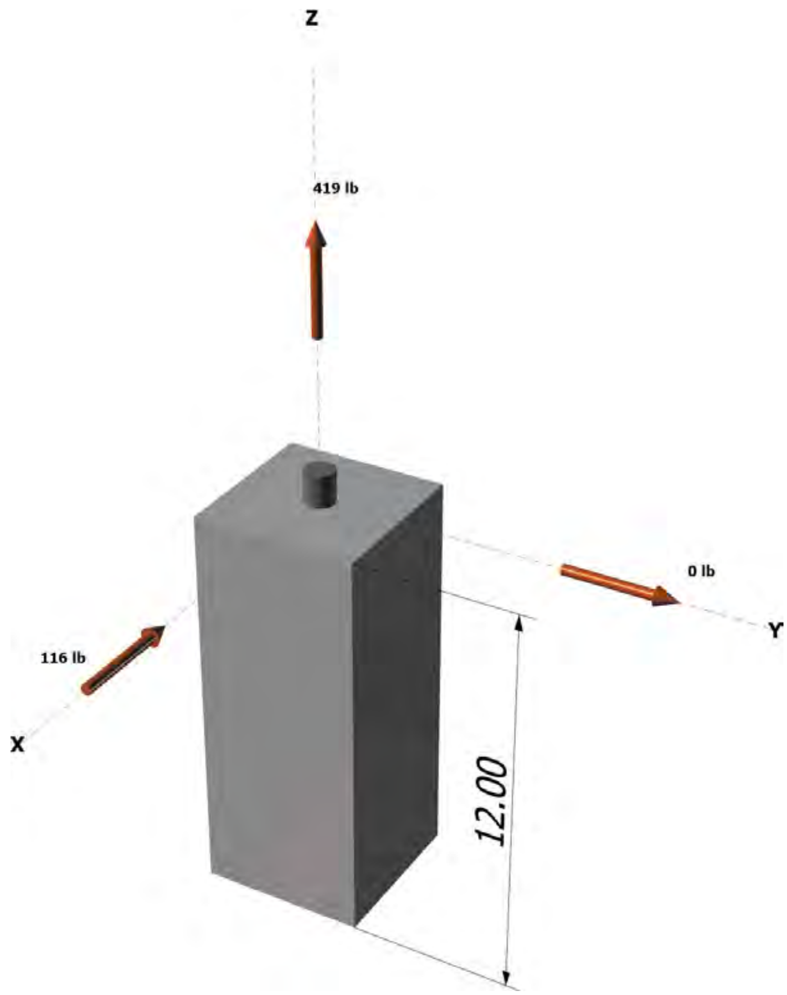
Company:		Date:	6/3/2022
Engineer:		Page:	2/5
Project:			
Address:			
Phone:			
E-mail:			

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.2.3.4.2 not applicable
Ductility section for shear: 17.2.3.5.2 not applicable
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 419
V_{uax} [lb]: -116
V_{uay} [lb]: 0

<Figure 1>

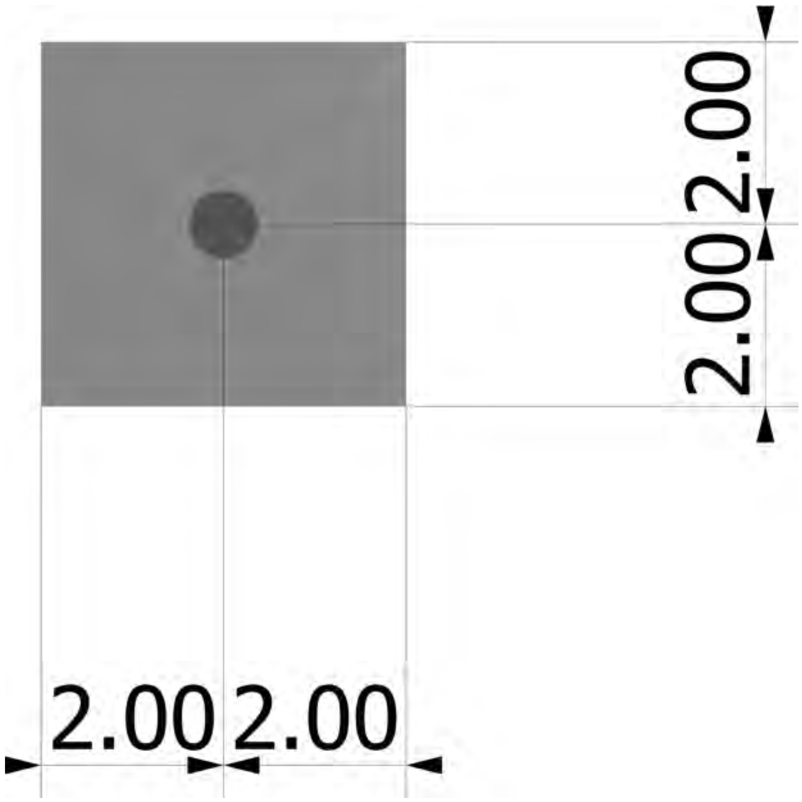


SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.9.7376.2

Company:		Date:	6/3/2022
Engineer:		Page:	3/5
Project:			
Address:			
Phone:			
E-mail:			

<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	419.0	-116.0	0.0	116.0
Sum	419.0	-116.0	0.0	116.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 419
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
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

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

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
28723	0.75	21542

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

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	3000	1.333	1434

$0.75\phi N_{cb} = 0.75\phi\,(A_{Nc} / A_{Nco})\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2	$c_{a,min}$ (in)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	$0.75\phi N_{cb}$ (lb)
16.00	16.00	2.00	1.000	1.00	1.000	1434	0.65	699

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

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
9367	1.0	0.65	6089

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)
3.16	0.625	1.00	3000	2.00	1186

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

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbx} (lb)
12.00	18.00	0.900	1.000	1.000	1186	0.70	498

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)

3.16	0.625	1.00	3000	2.00	1186

$\phi V_{cbx} = \phi\ (2)(A_{Vc} / A_{Vco})\ \Psi_{ed,V}\ \Psi_{c,V}\ \Psi_{h,V} V_{by}$ (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)
12.00	18.00	1.000	1.000	1.000	1186	0.70	1106

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

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

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cp} (lb)
2.0	16.00	16.00	1.000	1.000	1.000	1434	0.70	2007

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	419	21542	0.02	Pass
Concrete breakout	**419**	**699**	**0.60**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	116	6089	0.02	Pass
T Concrete breakout x-	**116**	**498**	**0.23**	**Pass (Governs)**
|| Concrete breakout y-	**116**	**1106**	**0.10**	**Pass (Governs)**
Pryout	116	2007	0.06	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.60	0.00	60.0%	1.0	Pass

5/8"Ø SS Titen HD, hnom:5" (127mm) meets the selected design criteria.

12. Warnings

- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.

- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.

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

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

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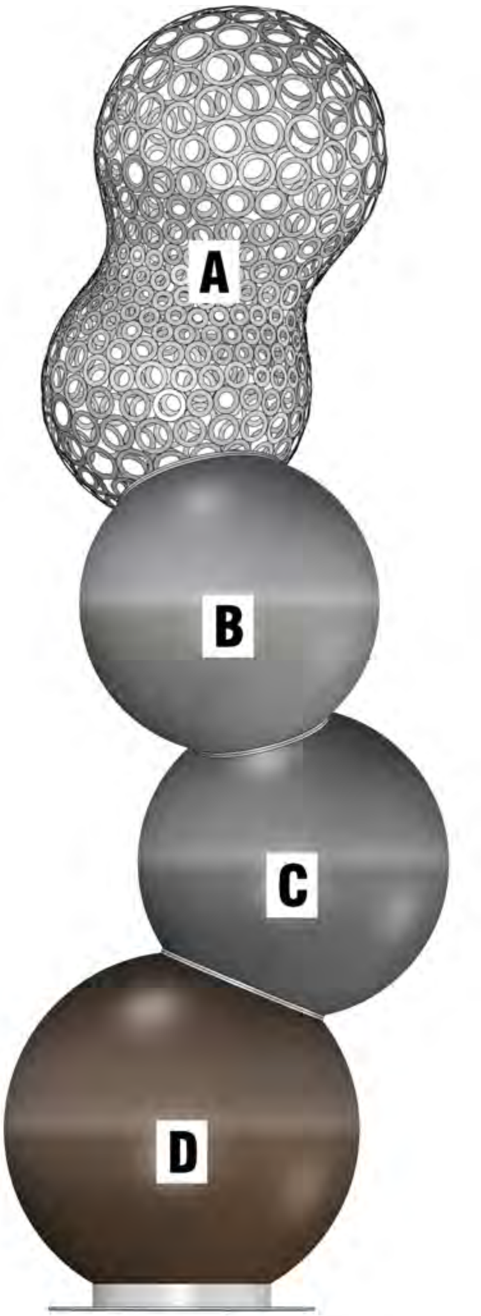
Artwork Calculations

Artwork #2

Total Weight = 187# - per email, see page 6



ARTWORK 2

Approximate Weights of Spheres

Assume whole spheres

Weight of 14GA steel = 3.15psf

Thickness of 14GA Steel = 0.747in

Sphere B

Diameter = 26in

Radius = 13in

Total Surface Area = 4*pi*r^2

= 4*pi*$(13/12)^2$

Total Surface Area = 14.75ft^2

Weight = 14.75ft^2 *3.15psf

Weight = 46.46#

Projected Surface Area = pi*r^2

= pi*$(13/12)^2$

Projected Surface Area = 3.69ft^2

Sphere C

Diameter = 28in

Radius = 14in

Surface Area = 4*pi*r2

= 4*pi*$(14/12)^2$

Surface Area = 17.10ft^2

Weight = 17.10ft^2 *3.15psf

Weight = 53.87#

Projected Surface Area = pi*r^2

= pi*$(14/12)^2$

Projected Surface Area = 4.28ft^2

Sphere D

Diameter = 32in

Radius = 16in

Surface Area = 4*pi*r^2

= 4*pi*$(16/12)^2$

Surface Area = 22.34ft^2

Weight = 22.34ft^2 *3.15psf

Weight = 70.37#

Projected Surface Area = pi*r^2

= pi*$(16/12)^2$

Projected Surface Area = 5.59ft^2

Approximate Weight of Sphere A

Sphere A = 187# - 46.46# - 53.87# - 70.37#

= 16.3#

Assume Sphere A to be solid for calculation purposes - Bigger sphere of Sphere A approximately has a diameter of 26in.

Surface Area = 14.75ft^2 x 2 spheres

Surface Area = 29.5ft^2

Projected Surface Area = 3.69ft^2 x 2 = 7.38ft^2

Artwork Calculations
Sphere A to Sphere B connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A}$ = 16.3#

Seismic Uplift

E_v = 0.2*S_{DS}*Wp
= 0.2*1.2*16.3#
E_v = 3.91#

Seismic Horizontal

$F_{ph,min}$ = 0.3*1.2*1.0*16.3# = 5.87#
F_{ph} = [(0.4*2.5*1.2*16.3#)/(2.5/1.0)][1+2*(1)] = 23.47#
$F_{ph,max}$ = 1.6*1.2*1.0*16.3# = 31.3#

Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*16.3# = 14.67#
E_v = 3.91#
E_{mh} = Omega*F_{ph} = 2*23.47# = 46.94#

Check Wind Forces

V = 92mph $A_{projected\ surface\ ,A}$ = 7.38ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*7.38ft^2
F = 152.27#

F_{wind} = 152.27# > $F_{seismic}$ = 46.94#

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere A and B

152.27# = 0.15227 kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.15227 kips = 0.928*2*L
L = 0.09in

1/8" Weld Size is adequate - weld all around

Artwork Calculations
Sphere A and B to Sphere C connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B}$ = 16.3# + 46.46# = 62.76#

Seismic Uplift
E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*62.76#
E_v = 15.06#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*62.76# = 22.60#
F_{ph} = [(0.4*2.5*1.2*62.76#)/(2.5/1.0)][1+2*(1)] = 97.45#
$F_{ph,max}$ = 1.6*1.2*1.0*62.76# = 120.50#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*62.76# = 56.49#
E_v = 15.06#
E_{mh} = Omega*F_{ph} = 2*97.45# = 194.9#

Check Wind Forces

V = 92mph $A_{projected\ surface,A+B}$ = 7.38ft^2+3.69ft^2 = 11.07ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*11.07ft^2
F = 228.40#

F_{wind} = 228.40# > $F_{seismic}$ = 194.4#

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere B and C

228.40# = 0.2284 kips

Rn/Omega = 0.928*D*L use 1/8" weld -> D = 2

0.2284 kips = 0.928*2*L
L = 0.13in

1/8" Weld Size is adequate - weld all around

Artwork Calculations
Sphere A and B and C to Sphere D connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B+C}$ = 16.3# + 46.46# + 53.87# = 116.63#

Seismic Uplift
E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*116.63#
E_v = 28#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*116.63# = 42#
F_{ph} = [(0.4*2.5*1.2*116.63#)/(2.5/1.0)][1+2*(1)] = 167.95#
$F_{ph,max}$ = 1.6*1.2*1.0*116.63# = 223.93#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*116.63# = 104.96#
E_v = 28#
E_{mh} = Omega*F_{ph} = 2*167.95# = 335.9#

Check Wind Forces

V = 92mph $A_{projected\ surface,A+B+C}$ = 7.38ft^2+3.69ft^2 + 4.28ft^2 = 15.35ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*15.35ft^2
F = 316.71#

F_{wind} = 316.71# < $F_{seismic}$ = 335.9#

Seismic governs over wind -> design weld connection for seismic forces

Check weld between Sphere C and D

335.9# = 0.3359kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.3359 kips = 0.928*2*L
L = 0.19in

1/8" Weld Size is adequate - weld all around

Artwork Calculations
Sphere A, B, C, and D to cylinder connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B+c+D}$ = 16.3# + 46.46# + 53.87# + 70.37#= 187#

Seismic Uplift

E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*187#
E_v = 44.88#

Seismic Horizontal

$F_{ph,min}$ = 0.3*1.2*1.0*187# = 67.32#
F_{ph} = [(0.4*2.5*1.2*187#)/(2.5/1.0)][1+2*(1)] = 269.28#
$F_{ph,max}$ = 1.6*1.2*1.0*187# = 359.04#

Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*182# = 168.3#
E_v = 44.88#
E_{mh} = Omega*F_{ph} = 2*269.28# = 538.56#

Check Wind Forces

V = 92mph $A_{projected\ surface,A+B+C+D}$ = 7.38ft^2+3.69ft^2 +4.28ft^2+5.59ft^2=20.94ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*20.94ft^2
F = 1726.7#

F_{wind} = 432.04# > $F_{seismic}$ = 538.56#

Seismic governs over wind -> design weld connection for seismic forces

Check weld between Sphere D and cylinder

432.04# = 0.43204kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.43204 kips = 0.928*2*L
L = 0.24in

1/8" Weld Size is adequate - weld all around, use same weld for welding cylinder to steel base plate

Seismic Demands for Nonstructural Components - ASCE 7-16 Chapter 13

Artwork #2

Seismic Design Criteria : S_{DS} = 1.2

F_{ph},min = $F_p = 0.3 S_{DS} I_p W_p$ (13.3-3)

F_{ph} = $F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)}\left(1 + 2\frac{z}{h}\right)$ (13.3-1) z = h = z/h = 1

F_{ph},max = $F_p = 1.6 S_{DS} I_p W_p$ (13.3-2)

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1

a_p = 2.50, R_p = 2.50, I_p = 1.00, Omega = 2.00

W_p = 187# - provided by others

Horizontal Seismic Demand Calculations

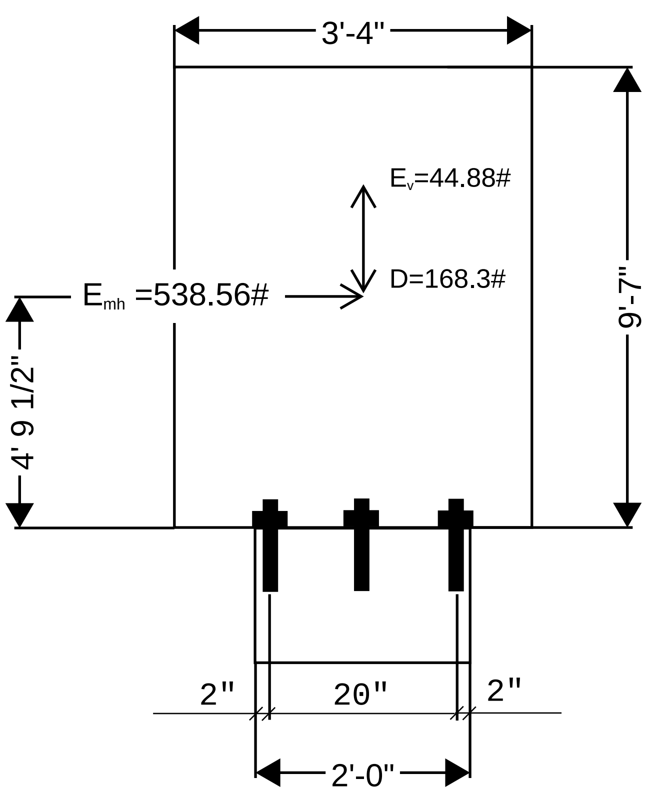
F_{ph},min = 0.3*1.2*1.0*187 = 67.32#
F_{ph} = [(0.4*2.5*1.2*187#)/(2.5/1.0)][1+2*(1)] = 269.28 ← CONTROLS
F_{ph},max = 1.6*1.2*1.0*187# = 359.04#

Vertical Seismic Demand Calculations

F_{pv} = +/- 0.2SdsWp = +/- 0.2*1.2*187# = 44.88#

LRFD Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*187# = 168.3#
E_v = 44.88#
E_{mh} = Omega*F_{ph} = 2*269.28# = 538.56#



Check Wind Forces

Artwork #2
Check Wind Forces

V = 92mph $A_{projected\ surface,\ all\ spheres} = 20.94ft^2$ G = 0.85   Cf = 1.55

$F = q_h * G * C_f * A_s$

$q_h = 0.00256 K_z K_{zt} K_d K_e V^2$

$K_z = 2.01(15/Z_g)^{2/alpha}$

$= 2.01(15/900)^{2/9.5}$

$k_z = 0.85$

$K_{zt} = 1.0$ (ASCE 7-16 26.8.1)

$K_d = 0.85$ (ASCE 7-16 Table 26.6-1)

$K_e = 1.0$ (ASCE 7-16 26.5)

$q_h = 0.00256*0.85*1.0*0.85*1.0*92mph^2$

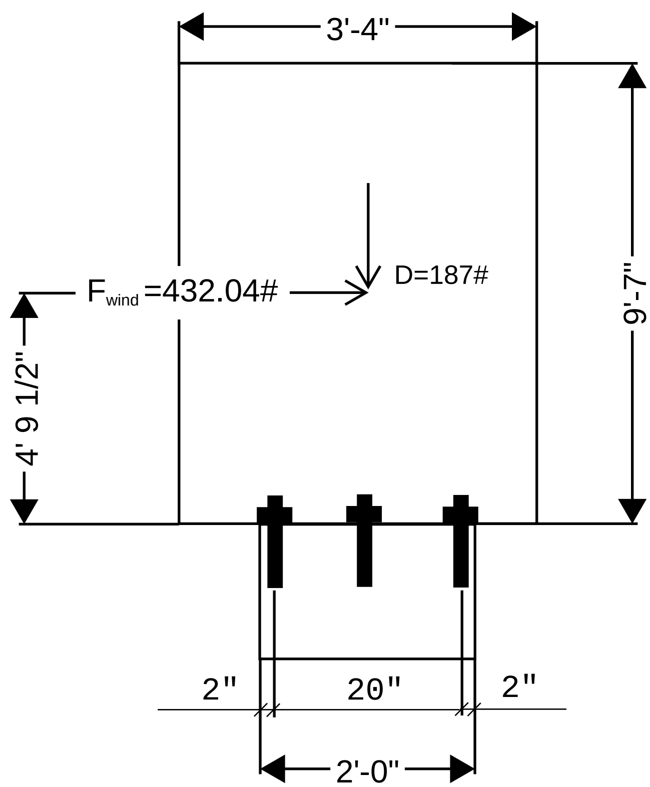
$q_h = 15.66psf$

$F = 15.66psf*0.85*1.55*20.94ft^2$

F = 432.04#

$F_{wind} = 432.04\# < F_{seismic} = 538.56\#$

Seismic load governs over wind load - design base connection for seismic load



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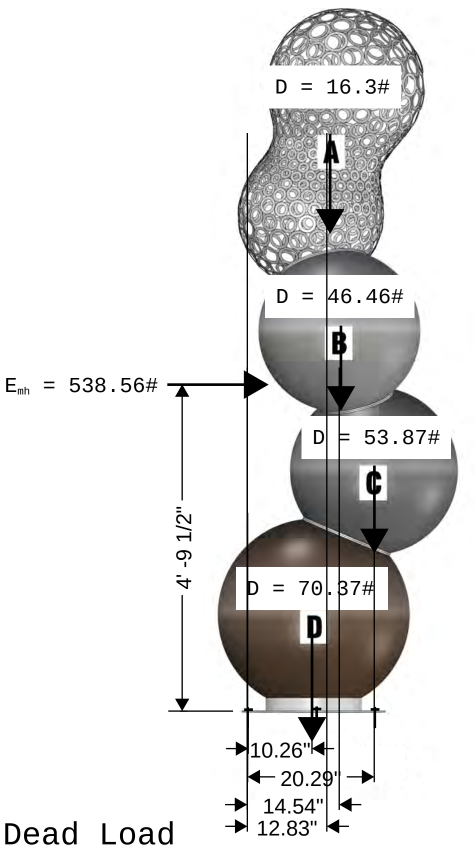
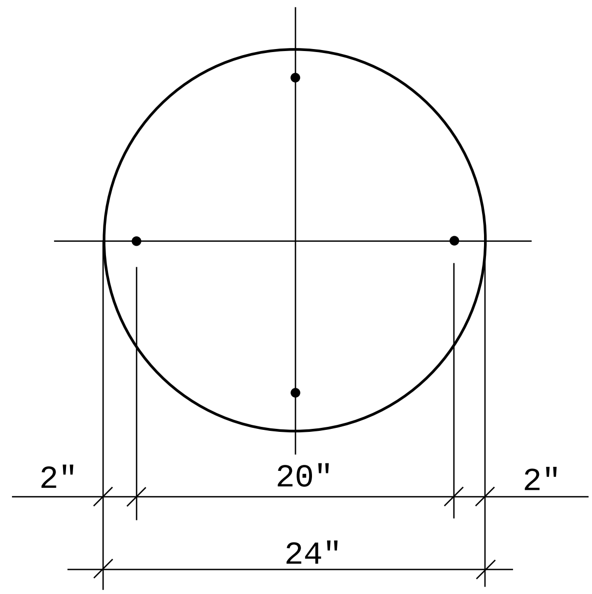
Baseplate Anchor Demands

Artwork #2

Load Demands on Anchors





ANCHOR BOLT LAYOUT

Dead Load

Total Dead Load = 187#

0.9D = 168.3#

Seismic Uplift

E_v = 44.88#

Overturning Moment:

Seismic = 538.56# * 4'-9 1/2" = 2580.6#-ft

Sphere A = 0.9*(16.3# * 12.83"/12"/ft)= 15.69#-ft

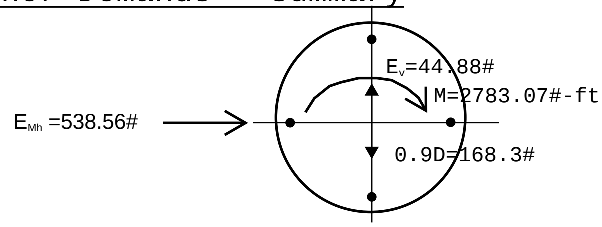
Sphere B = 0.9*(46.46# * 14.54"/12"/ft) = 50.67#-ft

Sphere C = 0.9*(53.87# * 20.29"/12"/ft) = 81.96#-ft

Sphere D = 0.9*(70.37# * 10.26"/12"/ft) = 54.15#-ft

Total Overturning Moment = 2783.07#-ft

Anchor Demands - Summary



SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.9.7376.2

Company:		Date:	5/22/2022
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

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

Project description: Artwork #2
Location: San Francisco
Fastening description:

2. Input Data & Anchor Parameters

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

Anchor Information:
Anchor type: Concrete screw
Material: Stainless Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 5.000
Effective Embedment depth, h_{ef} (inch): 3.160
Anchor category: 1
Anchor ductility: Yes
h_{min} (inch): 7.67
c_{ac} (inch): 6.25
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 10.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 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: Not applicable
Build-up grout pad: No

Base Plate
Diameter x Thickness (inch): 24.00 x 0.25

Recommended Anchor
Anchor Name: Titen HD® Stainless Steel - 5/8"Ø SS Titen HD, hnom:5" (127mm)

SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.9.7376.2

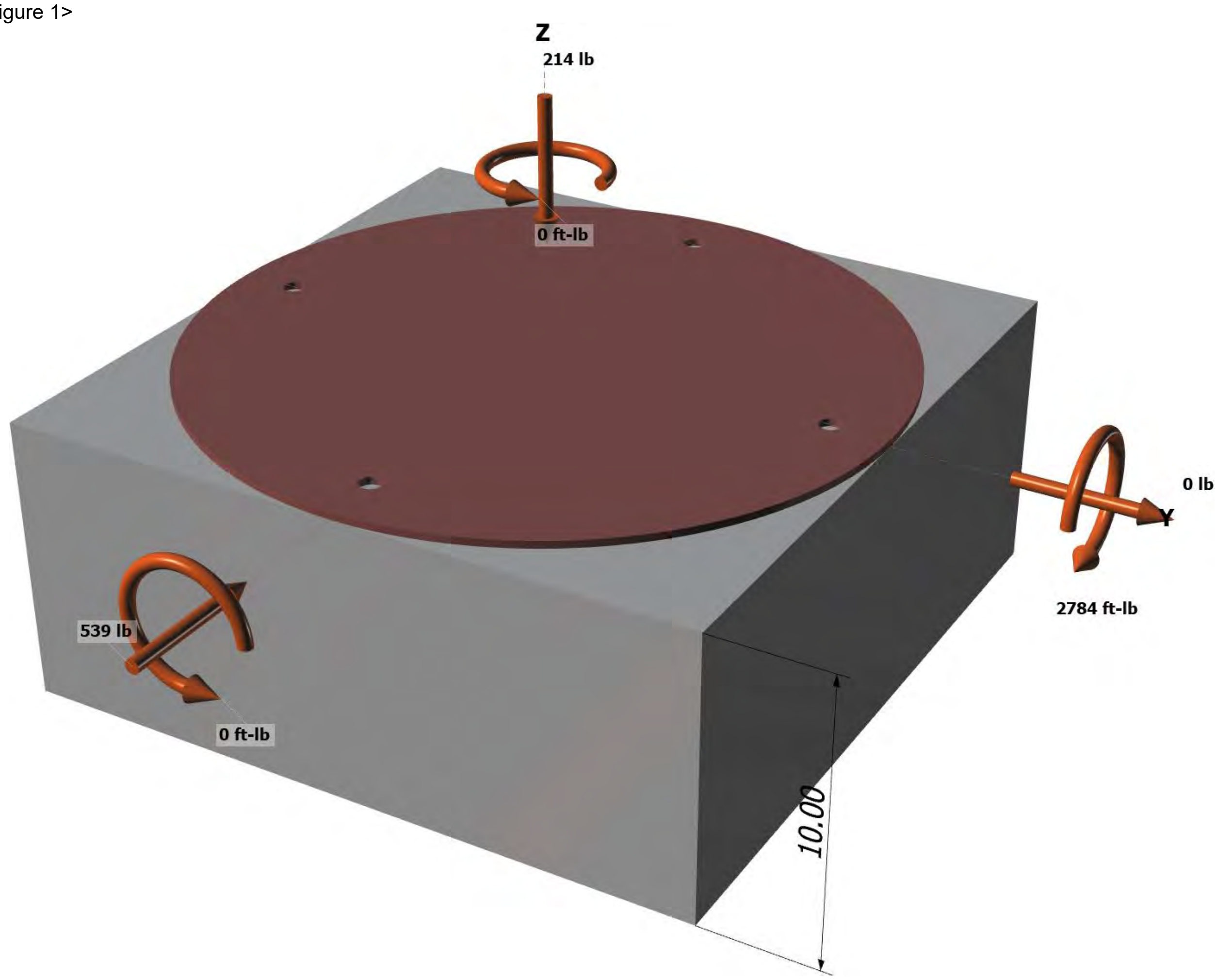
Company:		Date:	5/22/2022
Engineer:		Page:	2/5
Project:			
Address:			
Phone:			
E-mail:			

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.2.3.4.2 not applicable
Ductility section for shear: 17.2.3.5.2 not applicable
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: -214
V_{uax} [lb]: -539
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: -2784
M_{uz} [ft-lb]: 0

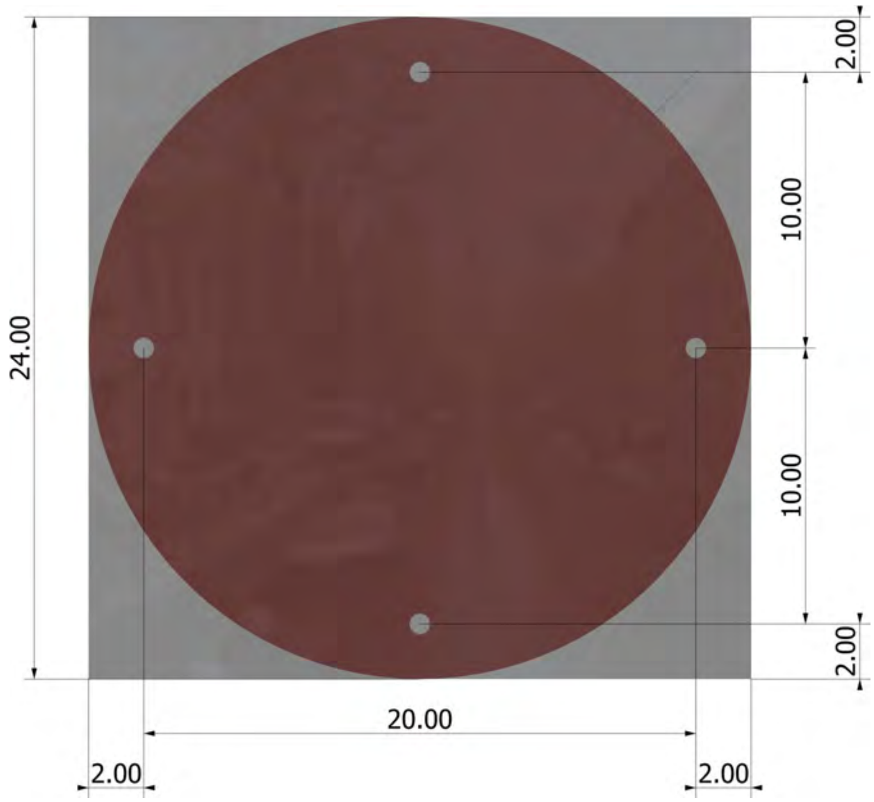
<Figure 1>



SIMPSON Strong-Tie® Anchor Designer™ Software
Version 2.9.7376.2

Company:		Date:	5/22/2022
Engineer:		Page:	3/5
Project:			
Address:			
Phone:			
E-mail:			

<Figure 2>

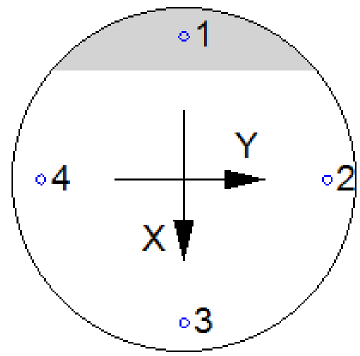


3. Resulting Anchor Forces

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	0.0	-134.8	0.0	134.8
2	467.9	-134.8	0.0	134.8
3	1072.9	-134.8	0.0	134.8
4	467.9	-134.8	0.0	134.8
Sum	2008.6	-539.0	0.0	539.0

Maximum concrete compression strain (‰): 0.02
Maximum concrete compression stress (psi): 101
Resultant tension force (lb): 2009
Resultant compression force (lb): 2224
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 2.01
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)
28723	0.75	21542

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

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	3000	3.160	5230

$0.75\phi N_{cbg} = 0.75\phi\,(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N} N_b$ (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	$0.75\phi N_{cbg}$ (lb)
191.69	89.87	2.00	0.702	0.827	1.00	1.000	5230	0.65	3158

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

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
9367	1.0	0.65	6089

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)
3.16	0.625	1.00	3000	2.00	1186

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

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbx} (lb)
18.00	18.00	1.000	1.000	1.000	1186	0.70	830

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)
3.16	0.625	1.00	3000	2.00	1186

$\phi V_{cbx} = \phi\,(2)(A_{Vc} / A_{Vco})\,\Psi_{ed,V}\,\Psi_{c,V}\,\Psi_{h,V}V_{by}$ (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)
18.00	18.00	1.000	1.000	1.000	1186	0.70	1660

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	64.00	16.00	1.000	1.000	1.000	1.000	1434	0.70	8028

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	1073	21542	0.05	Pass
Concrete breakout	**2009**	**3158**	**0.64**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, $øV_n$ (lb)	Ratio	Status
Steel	135	6089	0.02	Pass
T Concrete breakout x-	**135**	**830**	**0.16**	**Pass (Governs)**
|| Concrete breakout y-	**135**	**1660**	**0.08**	**Pass (Governs)**
Pryout	539	8028	0.07	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.64	0.00	63.6%	1.0	Pass

5/8"Ø SS Titen HD, hnom:5" (127mm) meets the selected design criteria.

12. Warnings

- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.

- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.

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

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

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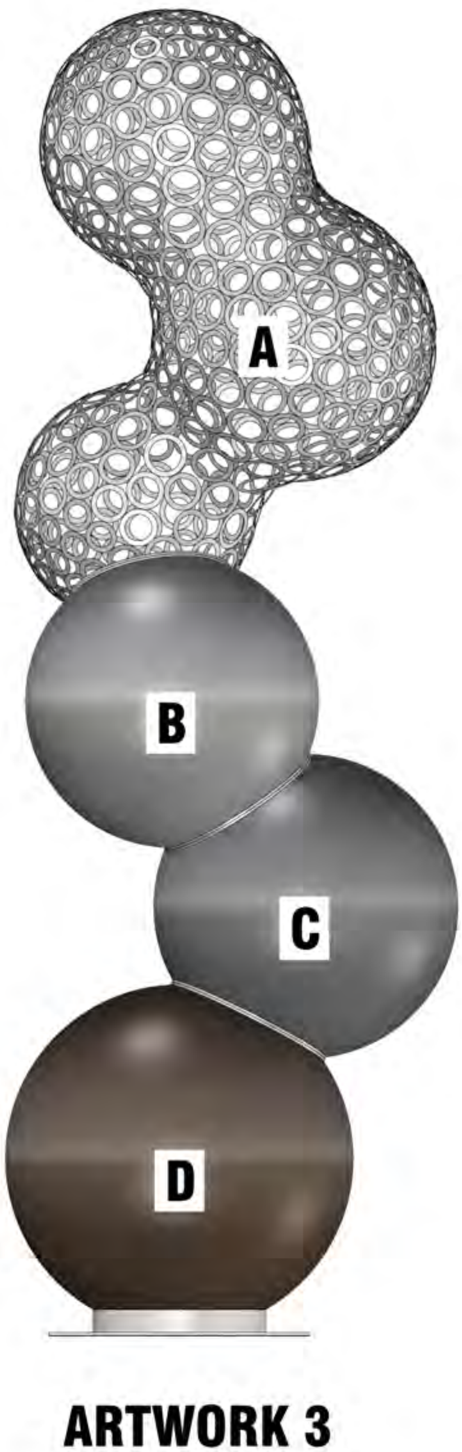
Artwork Calculations

Artwork #3
Total Weight = 192# - per email, see page 6



Approximate Weights of Spheres
Assume whole spheres
Weight of 14GA steel = 3.15psf
Thickness of 14GA Steel = 0.747in

Sphere B
Diameter = 26in
Radius = 13in
Surface Area = $4*pi*r^2$
= $4*pi*(13/12)^2$
Surface Area = $14.75ft^2$
Weight = $14.75ft^2$ *3.15psf
Weight = 46.46#

Projected Surface Area = $pi*r^2$
= $pi*(13/12)^2$
Projected Surface Area = $3.69ft^2$

Sphere C
Diameter = 28in
Radius = 14in
Surface Area = $4*pi*r^2$
= $4*pi*(14/12)^2$
Surface Area = $17.10ft^2$
Weight = $17.10ft^2$ *3.15psf
Weight = 53.87#

Projected Surface Area = $pi*r^2$
= $pi*(14/12)^2$
Projected Surface Area = $4.28ft^2$

Sphere D
Diameter = 32in
Radius = 16in
Surface Area = $4*pi*r^2$
= $4*pi*(16/12)^2$
Surface Area = $22.34ft^2$
Weight = $22.34ft^2$ *3.15psf
Weight = 70.37#

Projected Surface Area = $pi*r^2$
= $pi*(16/12)^2$
Projected Surface Area = $5.59ft^2$

Approximate Weight of Sphere A
Sphere A = 192# - 46.46# - 53.87# - 70.37#
= 21.3#

Assume Sphere A to be solid for calculation purposes - Bigger sphere of Sphere A approximately has a diameter of 26in.

Surface Area = $14.75ft^2$ x 3 spheres
Surface Area = $44.25ft^2$

Projected Surface Area = $3.69ft^2$ x 3= $11.07ft^2$

Artwork Calculations
Sphere A to Sphere B connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A}$ = 21.3#

Seismic Uplift

E_v = 0.2*S_{DS}*Wp
= 0.2*1.2*21.3#
E_v = 5.11#

Seismic Horizontal

$F_{ph,min}$ = 0.3*1.2*1.0*21.3# = 7.67#
F_{ph} = [(0.4*2.5*1.2*21.3#)/(2.5/1.0)][1+2*(1)] = 30.67#
$F_{ph,max}$ = 1.6*1.2*1.0*21.3# = 40.8#

Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*21.3# = 19.17#
E_v = 5.11#
E_{mh} = Omega*F_{ph} = 2*30.67# = 61.34#

Check Wind Forces

V = 92mph $A_{projected\ surface,A}$ = 11.07ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*11.07ft^2
F = 228.4#

F_{wind} = 228.4# > $F_{seismic}$ = 46.94#

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere A and B

228.4# = 0.2284 kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.2284 kips = 0.928*2*L
L = 0.13in

1/8" Weld Size is adequate - weld all around

Artwork Calculations
Sphere A and B to Sphere C connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B}$ =21.3# + 46.46# = 67.76#

Seismic Uplift
E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*67.76#
E_v = 16.26#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*67.76# = 24.39#
F_{ph} = [(0.4*2.5*1.2*67.76#)/(2.5/1.0)][1+2*(1)] = 97.57#
$F_{ph,max}$ = 1.6*1.2*1.0*67.76# = 130.1#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*67.76# = 60.98#
E_v = 16.26#
E_{mh} = Omega*F_{ph} = 2*97.57# = 195.14#

Check Wind Forces

V = 92mph $A_{projected\ surface,A+B}$ = 11.07ft^2+3.69ft^2 = 14.76ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*14.76ft^2
F = 304.53#

F_{wind} = 304.53# > $F_{seismic}$ = 194.4#

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere B and C

304.53# = 0.30453 kips

Rn/Omega = 0.928*D*L use 1/8" weld -> D = 2

0.30453 kips = 0.928*2*L
L = 0.67in

1/8" Weld Size is adequate - weld all around

Artwork Calculations
Sphere A and B and C to Sphere D connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B+C}$ = 21.3# + 46.46# + 53.87# = 121.63#

Seismic Uplift

E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*121.63#
E_v = 29.2#

Seismic Horizontal

$F_{ph,min}$ = 0.3*1.2*1.0*121.63# = 43.8#
F_{ph} = [(0.4*2.5*1.2*121.63#)/(2.5/1.0)][1+2*(1)] = 175.15#
$F_{ph,max}$ = 1.6*1.2*1.0*121.63# = 233.53#

Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*121.63# = 109.47#
E_v = 29.2#
E_{mh} = Omega*F_{ph} = 2*175.15# = 350.3#

Check Wind Forces

V = 92mph $A_{projcted\ surface,A+B+C}$ = 11.07ft^2+3.69ft^2 +4.28ft^2 =19.04ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_z K_{zt} K_d K_e V^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*19.04ft^2
F = 392.84#

F_{wind} = 392.84# > $F_{seismic}$ = 335.9#

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere C and D

392.84# = 0.39284kips

Rn/Omega = 0.928*D*L use 1/8" weld -> D = 2

0.39284 kips = 0.928*2*L
L = 0.22in

1/8" Weld Size is adequate - weld all around

Artwork Calculations
Sphere A, B, C, and D to cylinder connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B+c+D}$ = 21.3# + 46.46# + 53.87# + 70.37#= 192#

Seismic Uplift

E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*192#
E_v = 46.08#

Seismic Horizontal

$F_{ph,min}$ = 0.3*1.2*1.0*192# = 69.12#
F_{ph} = [(0.4*2.5*1.2*192#)/(2.5/1.0)][1+2*(1)] = 276.48#
$F_{ph,max}$ = 1.6*1.2*1.0*192# = 368.64#

Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*192# = 153.6#
E_v = 46.08#
E_{mh} = Omega*F_{ph} = 2*276.48# = 552.96#

Check Wind Forces

V = 92mph $A_{projcted\ surface,all}$=11.07ft^2+3.69ft^2 +4.28ft^2 +5.59ft^2 =24.63ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*24.63ft^2
F = 508.17#

F_{wind} = 508.17# < $F_{seismic}$ = 552.96#

Seismic governs over wind -> design weld connection for seismic forces

Check weld between Sphere D and cylinder

552.96# = 0.55296kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.55296kips = 0.928*2*L
L = 0.30in

1/8" Weld Size is adequate - weld all around, use same weld to weld cylinder to steel base plate

Seismic Demands for Nonstructural Components - ASCE 7-16 Chapter 13

Artwork #3

Seismic Design Criteria : S_{DS} = 1.2

F_{ph},min = $F_p = 0.3 S_{DS} I_p W_p$ (13.3-3)

F_{ph} = $F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)}\left(1 + 2\frac{z}{h}\right)$ (13.3-1) z = h = z/h = 1

F_{ph},max = $F_p = 1.6 S_{DS} I_p W_p$ (13.3-2)

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1

a_p = 2.50, R_p = 2.50, I_p = 1.00, Omega = 2.00

W_p = 192# - provided by others

Horizontal Seismic Demand Calculations

F_{ph},min = 0.3*1.2*1.0*192 = 69.12#

F_{ph} = [(0.4*2.5*1.2*192#)/(2.5/1.0)][1+2*(1)] = 276.48 ⟵ CONTROLS

F_{ph},max = 1.6*1.2*1.0*192# = 368.64#

Vertical Seismic Demand Calculations

F_{pv} = +/- 0.2SdsWp = +/- 0.2*1.2*192# = 46.08#

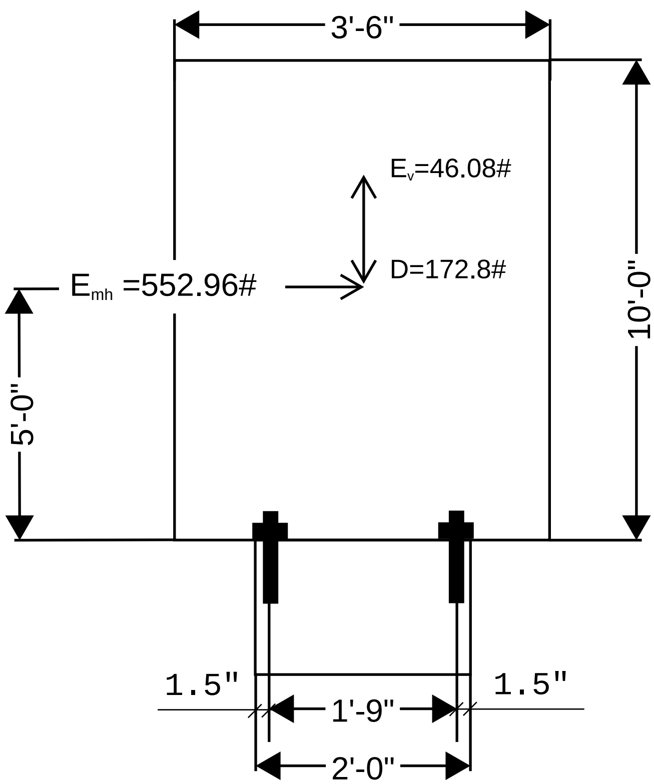
LRFD Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}

0.9D = 0.9*192# = 172.8#

E_v = 46.08#

E_{mh} = Omega*F_{ph} = 2*276.48# = 552.96#



Tuan and Robinson
Structural Engineers, Inc.
444 Spear Street, Suite 101
San Francisco, CA 94105-1693
Tel: (415) 957-2480 Fax: (415) 957-2483

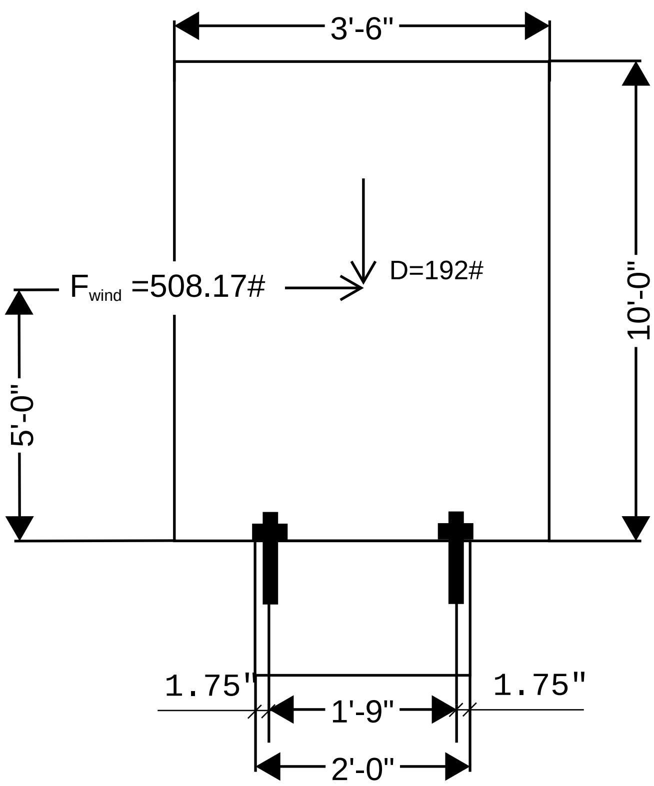
Check Wind Forces

Artwork #3
Check Wind Forces

V = 92mph $A_{projcted\ surface,all}$=11.07ft^2+3.69ft^2+4.28ft^2+5.59ft^2=24.63ft^2 G = 0.85   Cf = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K^z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92mph^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*24.63ft^2
F = 508.17#

F_{wind} = 508.17# < $_{Fseismic}$ = 552.96#

Seismic governs over wind -> design base connection for seismic forces



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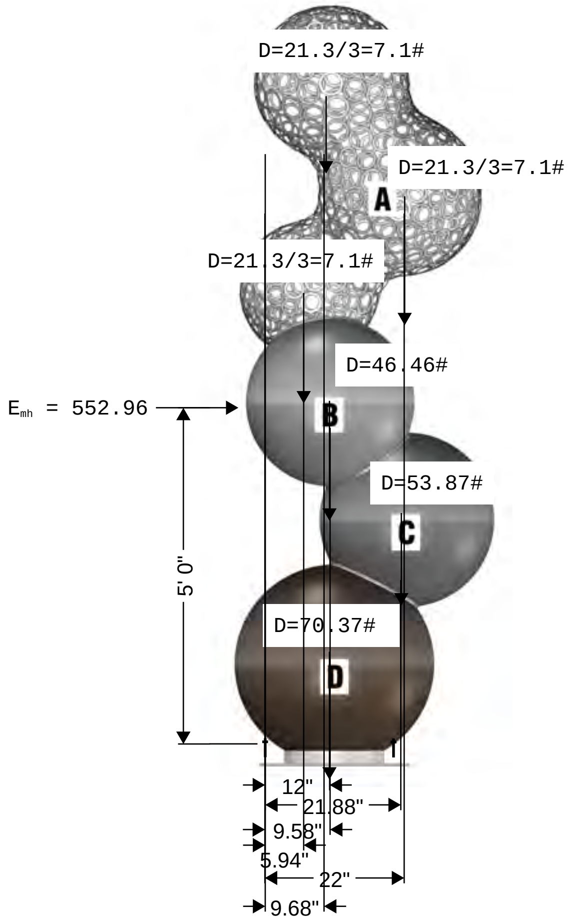
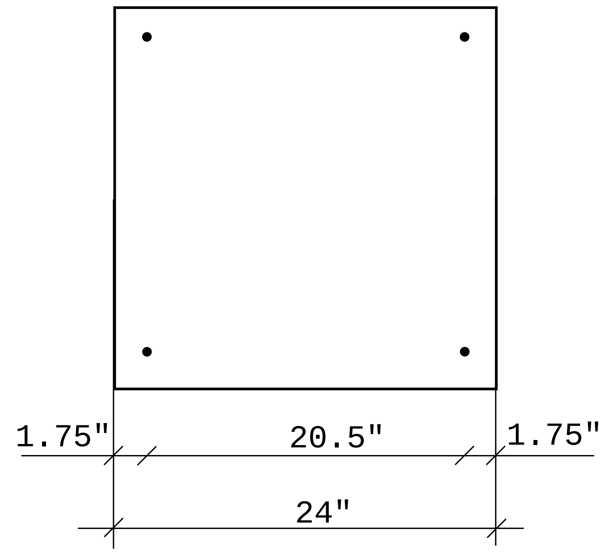
444 Spear Street, Suite 101
San Francisco, CA 94105-1693
Tel: (415) 957-2480 Fax: (415) 957-2483

Baseplate Anchor Demands

Artwork #3

Load Demands on Anchors





ANCHOR BOLT LAYOUT

Dead Load

Total Dead Load = 192#

0.9D = 172.8#

Seismic Uplift

E_v = 46.08#

Overturning Moment:

Seismic = 552.96#*5ft = 2764.8#-ft

Sphere A=0.9*((7.1#*9.68"/12)+(7.1#*22"/12)+(7.1#*5.94"/12))=20.04#-ft

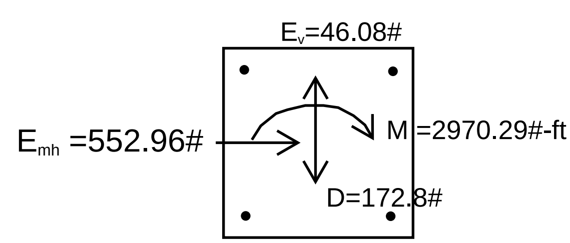
Sphere B=0.9*(46.46#*9.58"/12)=33.39#-ft

Sphere C=0.9*(53.87#*21.88"/12)=88.40#-ft

Sphere D=0.9*(70.37#*12"/12) = 63.66#

Total Overturning Moment = 2970.29#-ft

Anchor Demands - Summary



SIMPSON Strong-Tie® Anchor Designer™ Software
Version 2.9.7376.2

Company:	TRSE	Date:	5/22/2022
Engineer:	JC	Page:	1/5
Project:	Potrero Gateway Artwork		
Address:			
Phone:			
E-mail:			

1.Project information

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

Project description: Artwork #3
Location: San Francisco
Fastening description:

2. Input Data & Anchor Parameters

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

Anchor Information:
Anchor type: Concrete screw
Material: Stainless Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 5.000
Effective Embedment depth, h_{ef} (inch): 3.160
Anchor category: 1
Anchor ductility: Yes
h_{min} (inch): 7.67
c_{ac} (inch): 6.25
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 10.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 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: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 24.00 x 24.00 x 0.25

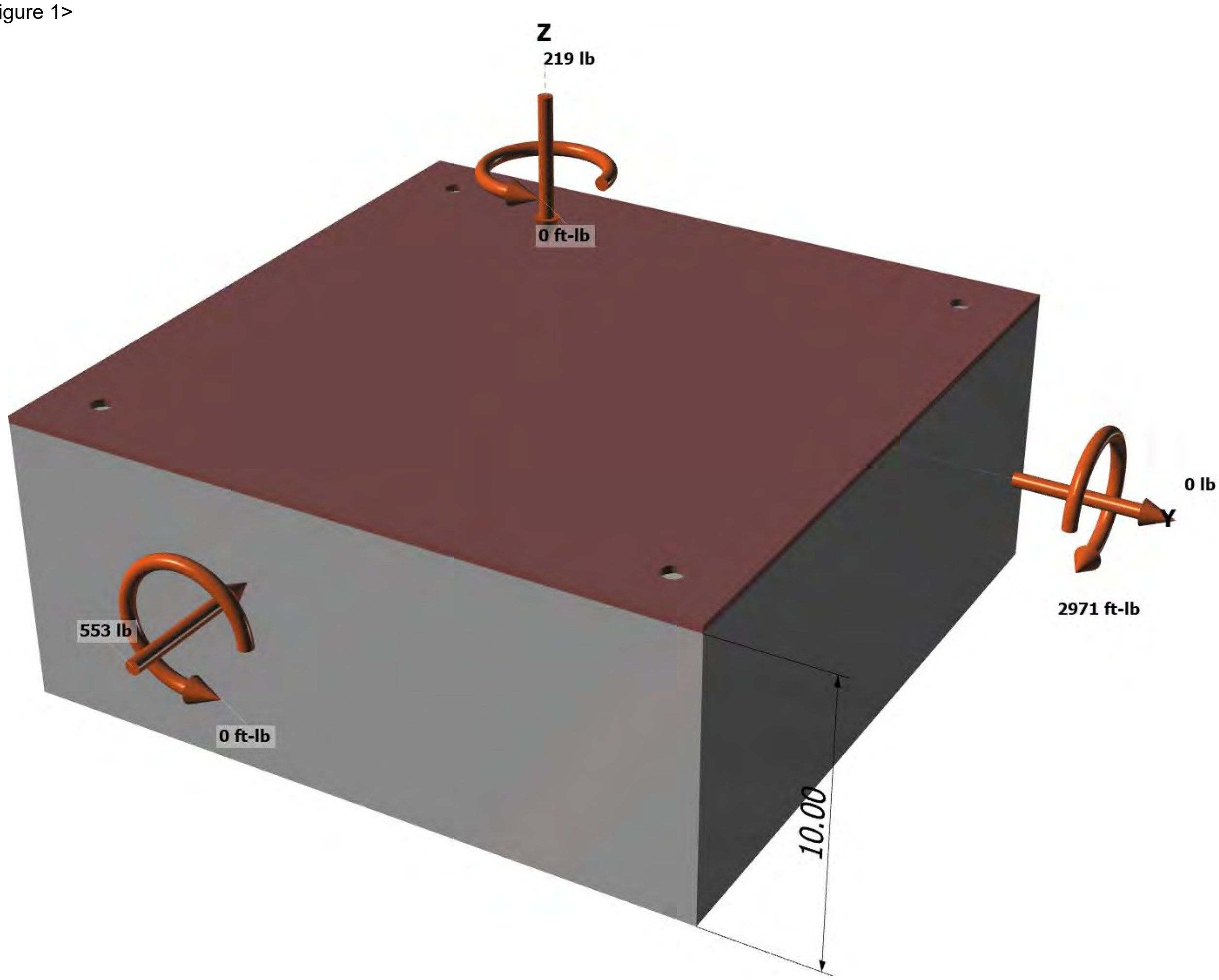
Recommended Anchor
Anchor Name: Titen HD® Stainless Steel - 5/8"Ø SS Titen HD, hnom:5" (127mm)

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.2.3.4.2 not applicable
Ductility section for shear: 17.2.3.5.2 not applicable
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: -219
V_{uax} [lb]: -553
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: -2971
M_{uz} [ft-lb]: 0

<Figure 1>

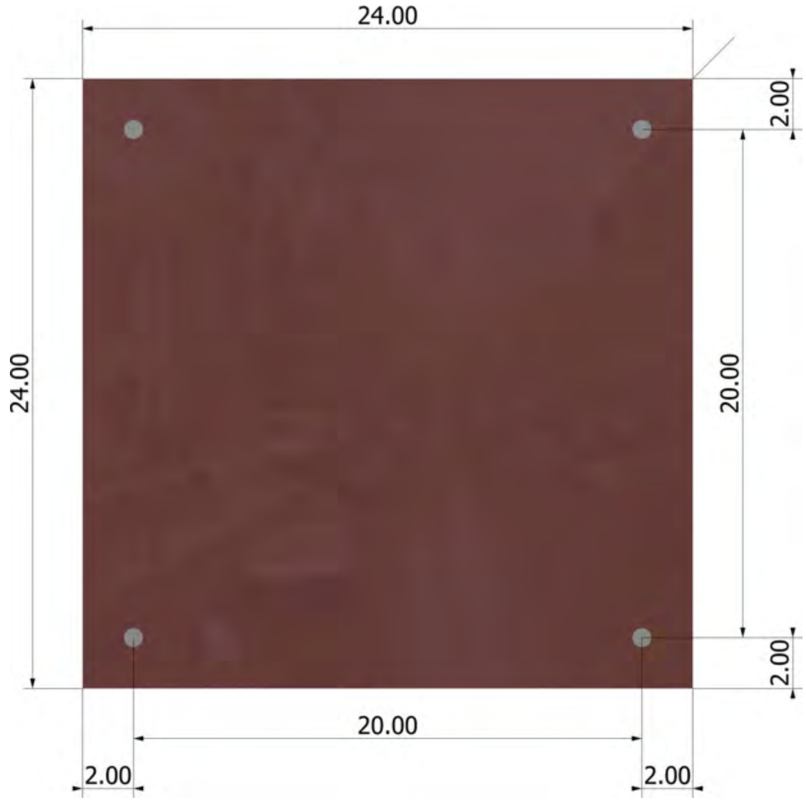


SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.9.7376.2

Company:	TRSE	Date:	5/22/2022
Engineer:	JC	Page:	3/5
Project:	Potrero Gateway Artwork		
Address:			
Phone:			
E-mail:			

<Figure 2>

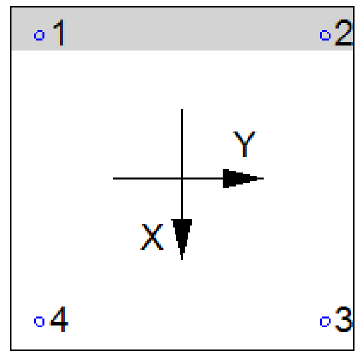


3. Resulting Anchor Forces

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	0.0	-138.3	0.0	138.3
2	0.0	-138.3	0.0	138.3
3	792.0	-138.3	0.0	138.3
4	792.0	-138.3	0.0	138.3
Sum	1584.0	-553.0	0.0	553.0

Maximum concrete compression strain (‰): 0.01
Maximum concrete compression stress (psi): 49
Resultant tension force (lb): 1584
Resultant compression force (lb): 1803
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
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)
28723	0.75	21542

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

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	3000	3.160	5230

$0.75\phi N_{cbg} = 0.75\phi\,(A_{Nc}/A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (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	$0.75\phi N_{cbg}$ (lb)
90.86	89.87	2.00	1.000	0.827	1.00	1.000	5230	0.65	2131

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

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
9367	1.0	0.65	6089

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)
3.16	0.625	1.00	3000	2.00	1186

$\phi V_{cbgx} = \phi\,(A_{Vc}/A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (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)
30.00	18.00	1.000	0.900	1.000	1.000	1186	0.70	1245

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Engineer:	JC	Page:	5/5
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Address:			
Phone:			
E-mail:			

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)
3.16	0.625	1.00	3000	2.00	1186

$\phi V_{cbgx} = \phi\ (2)(A_{Vc} / A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.3.1, 17.5.2.1(c) & 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_{by} (lb)	ϕ	ϕV_{cbgx} (lb)
30.00	18.00	1.000	1.000	1.000	1.000	1186	0.70	2766

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	181.71	89.87	1.000	0.827	1.000	1.000	5230	0.70	12238

11. Results

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

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	792	21542	0.04	Pass
Concrete breakout	**1584**	**2131**	**0.74**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	138	6089	0.02	Pass
T Concrete breakout x-	**277**	**1245**	**0.22**	**Pass (Governs)**
|| Concrete breakout y-	**277**	**2766**	**0.10**	**Pass (Governs)**
Pryout	553	12238	0.05	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.74	0.00	74.3%	1.0	Pass

5/8"Ø SS Titen HD, hnom:5" (127mm) meets the selected design criteria.

12. Warnings

- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.

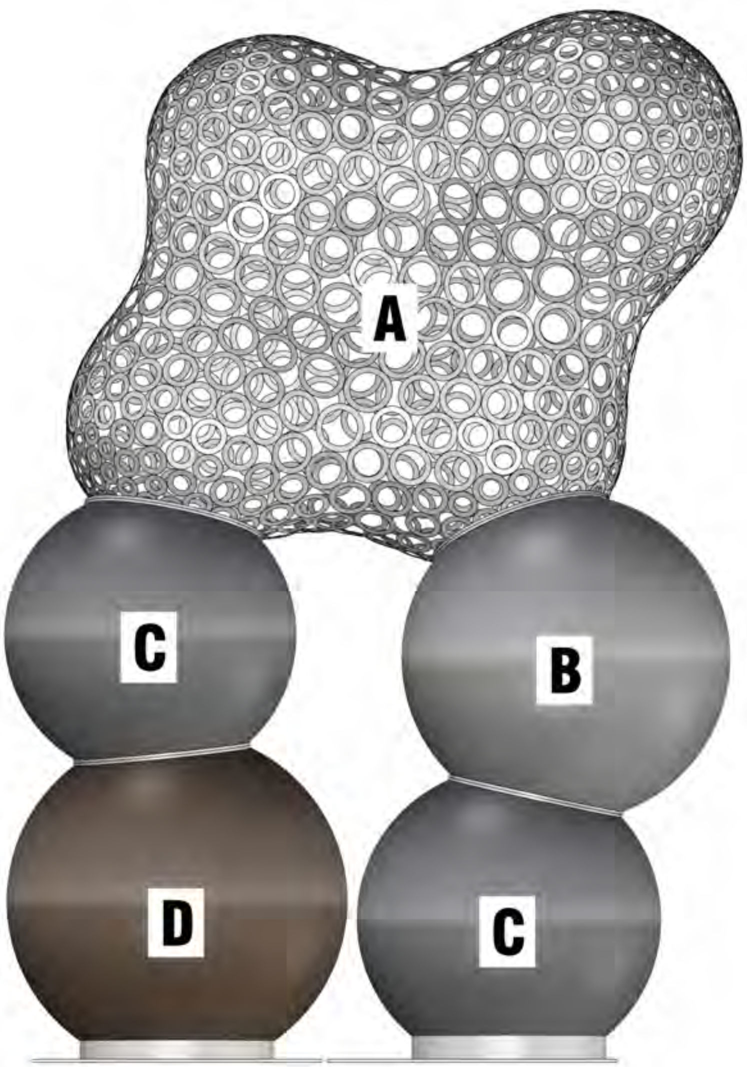
- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.

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

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Artwork Calculations

Artwork #4
Total Weight = 210# - per email, see page 6



ARTWORK 4

Approximate Weights of Spheres
Assume whole spheres
Weight of 14GA steel = 3.15psf
Thickness of 14GA Steel = 0.747in

Sphere B
Diameter = 27in
Radius = 13.5in
Surface Area = $4*pi*r^2$
$= 4*pi*(13.5/12)^2$
Surface Area = $15.91ft^2$
Weight = $15.91ft^2$ *3.15psf
Weight = 50.12#

Projected Surface Area = $pi*r^2$
$= pi*(13.5/12)^2$
Projected Surface Area = $3.98ft^2$

Sphere C
Diameter = 25in
Radius = 12.5in
Surface Area = 4*pi*r2
$= 4*pi*(12.5/12)^2$
Surface Area = $13.64ft^2$
Weight = $13.64ft^2$ *3.15psf
Weight = 42.97#

Projected Surface Area = $pi*r^2$
$= pi*(12.5/12)^2$
Projected Surface Area = $3.41ft^2$

Sphere D
Diameter = 28in
Radius = 14in
Surface Area = $4*pi*r^2$
$= 4*pi*(14/12)^2$
Surface Area = $17.10ft^2$
Weight = $17.10ft^2$ *3.15psf
Weight = 53.86#

Projected Surface Area = $pi*r^2$
$= pi*(14/12)^2$
Projected Surface Area = $4.28ft^2$

Approximate Weight of Sphere A
Sphere A = 210# - 50.12# - 42.97# - 53.86#
= 63.05#

Assume Sphere A to be solid for calculation purposes - Bigger sphere of Sphere A approximately has a diameter of 24in.

Surface Area = $(4*pi*12/12)^2$ x 4 spheres
Surface Area = $50.27ft^2$

Projected Surface Area = $3.14ft^2$ x 4= $12.57ft^2$

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Artwork Calculations
Sphere A to Sphere B connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A/2}$ = 63.05#/2 = 31.53# <- assume half the weight of Sphere A goes to Sphere C and half to Sphere B

Seismic Uplift
E_v = 0.2*S_{DS}*Wp
= 0.2*1.2*31.53#
E_v = 7.57#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*31.53# = 11.35#
F_{ph} = [(0.4*2.5*1.2*31.53#)/(2.5/1.0)][1+2*(1)] = 45.40#
$F_{ph,max}$ = 1.6*1.2*1.0*31.53# = 60.54#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*31.53# = 28.38#
E_v = 7.57#
E_{mh} = Omega*F_{ph} = 2*45.40# = 90.8#

Check Wind Forces

V = 92mph $A_{projected\ surface,A}$ = $12.57ft^2/2$ = $6.29ft^2$ G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = $0.00256K_zK_{zt}K_dK_eV^2$
K_z = $2.01(15/Z_g)^{2/alpha}$
= $2.01(15/900)^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*922
q_h = 15.66psf
F = 15.66psf*0.85*1.55*6.29ft^2
F = 129.78#

F_{wind} = 129.78# > $F_{seismic}$ = 90.8#

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere A and B

129.78# = 0.12978 kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.12978 kips = 0.928*2*L
L = 0.07in

1/8" Weld Size is adequate - weld all around

Artwork Calculations
Sphere A to Sphere C connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A/2}$ = 63.05#/2 = 31.53# <- assume half the weight of Sphere A goes to Sphere C and half to Sphere B

Seismic Uplift
E_v = 0.2*S_{DS}*Wp
= 0.2*1.2*31.53#
E_v = 7.57#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*31.53# = 11.35#
F_{ph} = [(0.4*2.5*1.2*31.53#)/(2.5/1.0)][1+2*(1)] = 45.40#
$F_{ph,max}$ = 1.6*1.2*1.0*31.53# = 60.54#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*31.53# = 28.38#
E_v = 7.57#
E_{mh} = Omega*F_{ph} = 2*45.40# = 90.8#

Check Wind Forces

V = 92mph $A_{projected\ surface,A}$ = 12.57ft^2/2 = 6.29ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*922
q_h = 15.66psf
F = 15.66psf*0.85*1.55*6.29ft^2
F = 129.78#

F_{wind} = 129.78# > $F_{seismic}$ = 90.8#

Wind governs over seismic -> design weld connection for wind forces

Check weld between Sphere A and B

129.78# = 0.12978 kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.12978 kips = 0.928*2*L
L = 0.07in

1/8" Weld Size is adequate - weld all around

Artwork Calculations
Sphere A and B to Sphere C connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B}$ =63.05#/2 + 50.12# = 81.65#

Seismic Uplift

E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*81.65#
E_v = 19.60#

Seismic Horizontal

$F_{ph,min}$ = 0.3*1.2*1.0*81.65# = 29.39#
F_{ph} = [(0.4*2.5*1.2*81.65#)/(2.5/1.0)][1+2*(1)] = 116.14#
$F_{ph,max}$ = 1.6*1.2*1.0*81.65# = 156.77#

Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*81.65# = 73.49#
E_v = 19.60#
E_{mh} = Omega*F_{ph} = 2*116.14# = 232.28#

Check Wind Forces

V = 92mph $A_{projected\ surface,A+B}$ = $(12.57ft^2/2)+3.98ft^2 = 10.27ft^2$ G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = $0.00256K_zK_{zt}K_dK_eV^2$
K_z = $2.01(15/Z_g)^{2/alpha}$
= $2.01(15/900)^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = $0.00256*0.85*1.0*0.85*1.0*92^2$
q_h = 15.66psf
F = $15.66psf*0.85*1.55*10.27ft^2$
F = 211.89#

F_{wind} = 211.89# < $F_{seismic}$ = 232.28#

Seismic governs over wind -> design weld connection for seismic forces

Check weld between Sphere B and C

232.28# = 0.23228 kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.23228 kips = 0.928*2*L
L = 0.13in

1/8" Weld Size is adequate - weld all around

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Artwork Calculations
Sphere A and C to Sphere D connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B}$ =63.05#/2 + 42.97# = 74.5#

Seismic Uplift
E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*74.5#
E_v = 17.88#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*74.5# = 26.82#
F_{ph} = [(0.4*2.5*1.2*74.5#)/(2.5/1.0)][1+2*(1)] = 107.28#
$F_{ph,max}$ = 1.6*1.2*1.0*74.5# = 143.04#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*74.5# = 67.05#
E_v = 17.88#
E_{mh} = Omega*F_{ph} = 2*107.28# = 214.56#

Check Wind Forces

V = 92mph $A_{projected\ surface,A+c}$ = (12.57ft^2/2)+3.41ft^2 = 9.70ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*9.70ft^2
F = 200.13#

F_{wind} = 200.13# < $F_{seismic}$ = 214.56#

Seismic governs over wind -> design weld connection for seismic forces

Check weld between Sphere B and C

214.56# = 0.21456 kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.21456 kips = 0.928*2*L
L = 0.12in

1/8" Weld Size is adequate - weld all around

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Artwork Calculations
Sphere A, B, and C to cylinder connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B+c+D}$ = (63.05#/2) + 50.12# + 42.97# = 124.62#

Seismic Uplift
E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*124.62#
E_v = 29.91#

Seismic Horizontal
$F_{ph,min}$ = 0.3*1.2*1.0*124.62# = 44.86#
F_{ph} = [(0.4*2.5*1.2*124.62#)/(2.5/1.0)][1+2*(1)] = 179.45#
$F_{ph,max}$ = 1.6*1.2*1.0*124.62# = 239.27#

Load Combination
Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*124.62# = 112.16#
E_v = 29.91#
E_{mh} = Omega*F_{ph} = 2*179.45# = 358.9#

Check Wind Forces

V = 92mph $A_{projcted\ surface,A/2+B+C}$=(12.57/2)$ft^2$+3.98$ft^2$ +3.41ft^2 =13.68ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01$(15/Z_g)^{2/alpha}$
= 2.01$(15/900)^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*13.68ft^2
F = 282.25#

F_{wind} = 282.25# < $F_{seismic}$ = 358.9#

Seismic governs over wind -> design weld connection for seismic forces

Check weld between Sphere D and cylinder

358.9# = 0.3589kips

Rn/Omega = 0.928*D*L use 1/8" weld -> D = 2

0.3589kips = 0.928*2*L
L = 0.20in

1/8" Weld Size is adequate - weld all around, use same weld to weld cylinder to steel base plate

Artwork Calculations
Sphere A, C, and D to cylinder connection

Check Seismic Forces

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1
ap = 2.50, Rp = 2.50, Ip = 1.00, Omega = 2.00
S_{DS} = 1.2
D = $W_{p,A+B+c+D}$ = (63.05#/2) + 42.97# + 53.86# = 128.36#

Seismic Uplift

E_v = 0.2*S_{DS}*W_p
= 0.2*1.2*128.36#
E_v = 30.81#

Seismic Horizontal

$F_{ph,min}$ = 0.3*1.2*1.0*128.36# = 46.21#
F_{ph} = [(0.4*2.5*1.2*128.36#)/(2.5/1.0)][1+2*(1)] = 184.84#
$F_{ph,max}$ = 1.6*1.2*1.0*128.36# = 246.45#

Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}
0.9D = 0.9*128.36# = 115.53#
E_v = 30.81#
E_{mh} = Omega*F_{ph} = 2*184.84# = 369.68#

Check Wind Forces

V = 92mph $A_{projcted\ surface,A/2+C+D}$=(12.57/2)ft^2+3.41ft^2+4.28ft^2 =13.98ft^2 G = 0.85 C_f = 1.55
F= q_h*G*C_f*A_s
q_h = 0.00256$K_zK_{zt}K_dK_eV^2$
K_z = 2.01(15/Z_g)$^{2/alpha}$
= 2.01(15/900)$^{2/9.5}$
k_z = 0.85
K_{zt} = 1.0 (ASCE 7-16 26.8.1)
K_d = 0.85 (ASCE 7-16 Table 26.6-1)
K_e = 1.0 (ASCE 7-16 26.5)
q_h = 0.00256*0.85*1.0*0.85*1.0*92^2
q_h = 15.66psf
F = 15.66psf*0.85*1.55*13.98ft^2
F = 288.44#

F_{wind} = 288.44# < $F_{seismic}$ = 369.68#

Seismic governs over wind -> design weld connection for seismic forces

Check weld between Sphere D and cylinder

369.68# = 0.36968kips

Rn/Omega = 0.928*D*L   use 1/8" weld -> D = 2

0.36968kips = 0.928*2*L
L = 0.20in

1/8" Weld Size is adequate - weld all around, use same weld to weld cylinder to steel base plate

Seismic Demands for Nonstructural Components - ASCE 7-16 Chapter 13

Artwork #4

Seismic Design Criteria : S_{DS} = 1.2

F_{ph},min = $F_p = 0.3 S_{DS} I_p W_p$ (13.3-3)

F_{ph} = $F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)}\left(1 + 2\frac{z}{h}\right)$ (13.3-1) z = h = z/h = 1

F_{ph},max = $F_p = 1.6 S_{DS} I_p W_p$ (13.3-2)

Appendages and Ornamentations - ASCE 7-16 Table 13.5-1

a_p = 2.50, R_p = 2.50, I_p = 1.00, Omega = 2.00

W_p = 210# - provided by others

Horizontal Seismic Demand Calculations

F_{ph},min = 0.3*1.2*1.0*210 = 75.6#

F_{ph} = [(0.4*2.5*1.2*210#)/(2.5/1.0)][1+2*(1)] = 302.4# ← CONTROLS

F_{ph},max = 1.6*1.2*1.0*210# = 403.2#

Vertical Seismic Demand Calculations

F_{pv} = +/- 0.2SdsWp = +/- 0.2*1.2*210# = 50.4#

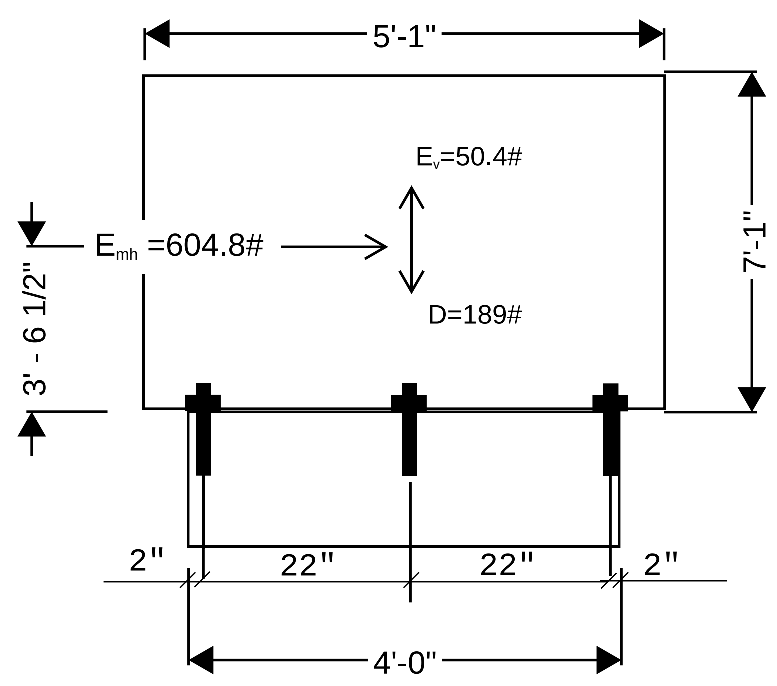
LRFD Load Combination

Load Combination #7 = 0.9D-E_v+E_{mh}

0.9D = 0.9*210# = 189#

E_v = 50.4#

E_{mh} = Omega*F_{ph} = 2*302.4# = 604.8#



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Check Wind Forces

Artwork #4
Check Wind Forces

$V = 92mph$ $A_{projcted\ surface,All}=12.57ft^2+3.96ft^2+3.41ft^2+4.28ft^2 =24.22ft^2$ $G = 0.85$ $Cf = 1.55$

$F= q_h*G*C_f*A_s$

$q_h = 0.00256K_zK_{zt}K_dK_eV^2$

$K_z = 2.01(15/Z_g)^{2/alpha}$

$= 2.01(15/900)^{2/9.5}$

$k_z = 0.85$

$K_{zt} = 1.0$ (ASCE 7-16 26.8.1)

$K_d = 0.85$ (ASCE 7-16 Table 26.6-1)

$K_e = 1.0$ (ASCE 7-16 26.5)

$q_h = 0.00256*0.85*1.0*0.85*1.0*92^2$

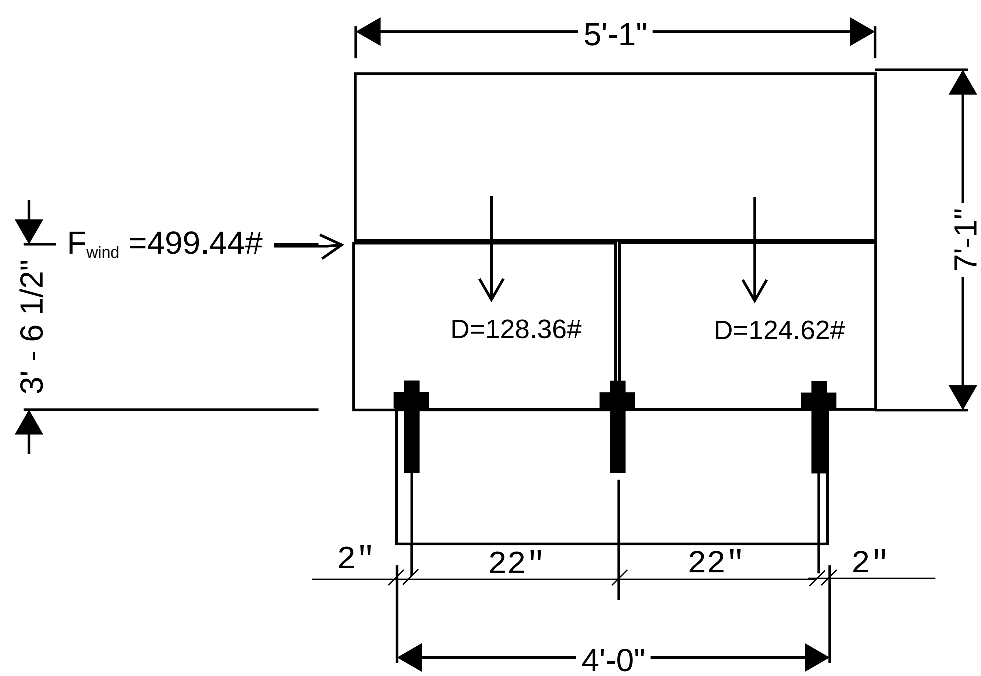
$q_h = 15.66psf$

$F = 15.66psf*0.85*1.55*24.22ft^2$

$F = 499.71\#$

$F_{wind} = 499.44\# < F_{seismic} = 604.8\#$

Seismic governs over wind -> design weld connection for seismic forces



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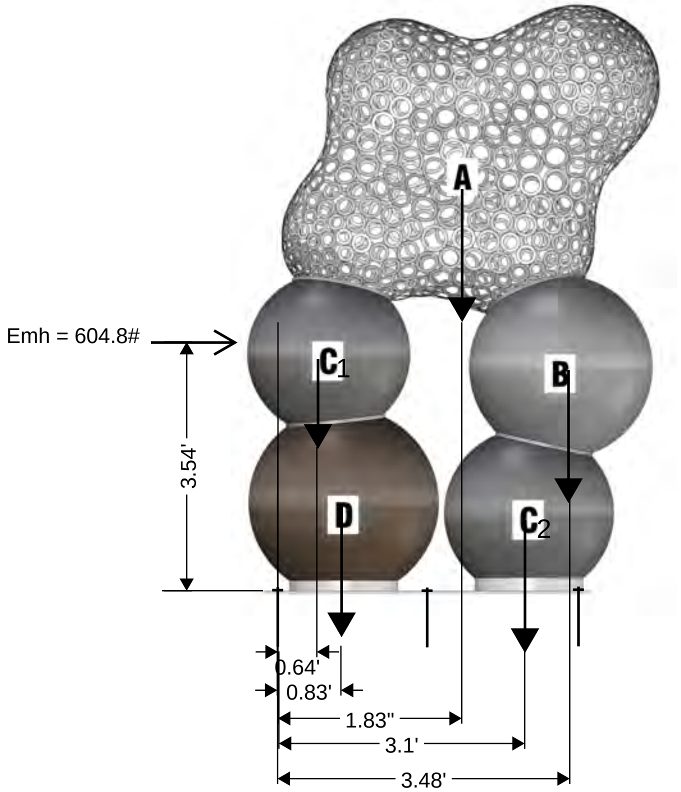
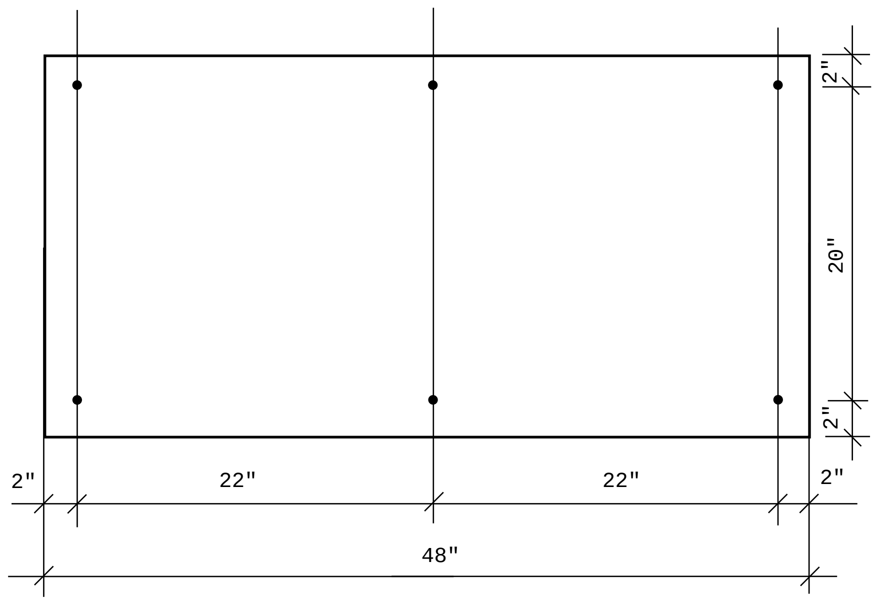
Baseplate Anchor Demands

Artwork #4 Load Demands on Anchors





ANCHOR BOLT LAYOUT

Dead Load

Total Dead Load = 210#

0.9D = 189#

Seismic Uplift

E_v = 50.4#

Overturning Moment:

Seismic = 604.8#*3.54ft = 2141#-ft

Sphere A = 0.9*(63.05#*1.83ft) = 104.4#-ft

Sphere B = 0.9*(50.12#*3.48ft) = 157.5#ft

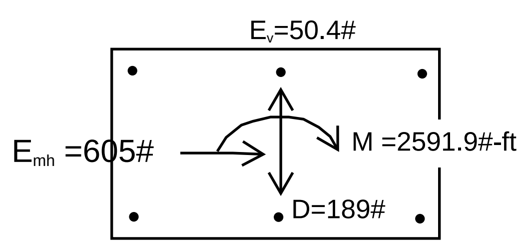
Sphere C1 = 0.9*(42.97#*0.64ft) = 25.2#-ft

Sphere C2 = 0.9*(42.97#*3.1ft) = 120.6#-ft

Sphere D = 0.9*(53.86#*0.83ft) = 43.2#

Total Overturning Moment = 2591.9#-ft

Anchor Demands - Summary



SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.9.7376.2

Company:		Date:	5/22/2022
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

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

Project description: Artwork #4
Location: San Francisco
Fastening description:

2. Input Data & Anchor Parameters

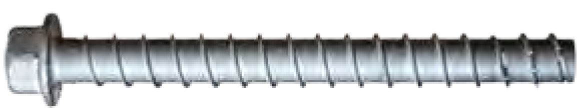
General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Stainless Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 4.000
Effective Embedment depth, h_{ef} (inch): 2.310
Anchor category: 1
Anchor ductility: Yes
h_{min} (inch): 6.00
c_{ac} (inch): 6.00
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 10.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 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: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 48.00 x 24.00 x 0.25

Recommended Anchor
Anchor Name: Titen HD® Stainless Steel - 5/8"Ø SS Titen HD, hnom:4" (102mm)

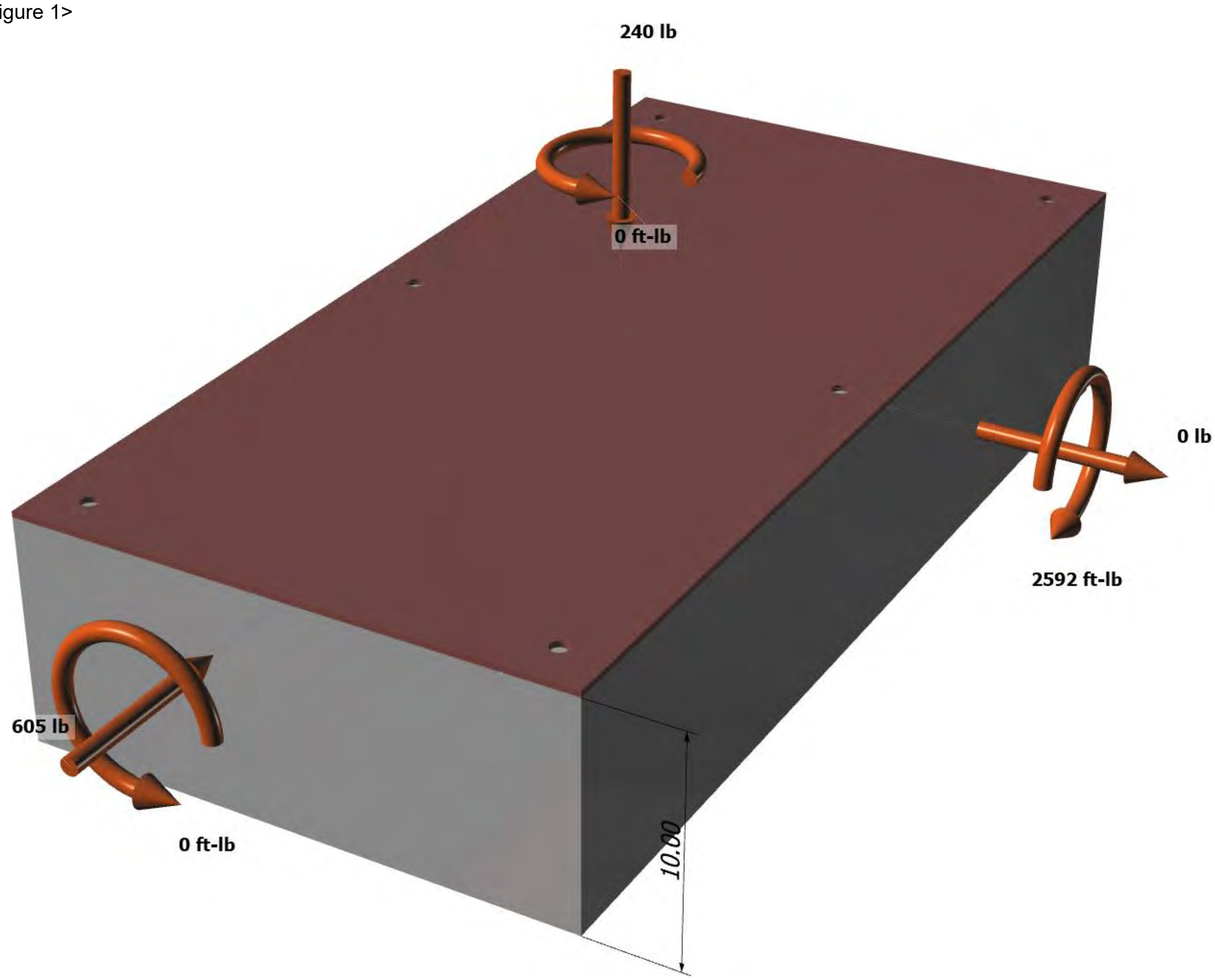


Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.2.3.4.2 not applicable
Ductility section for shear: 17.2.3.5.2 not applicable
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

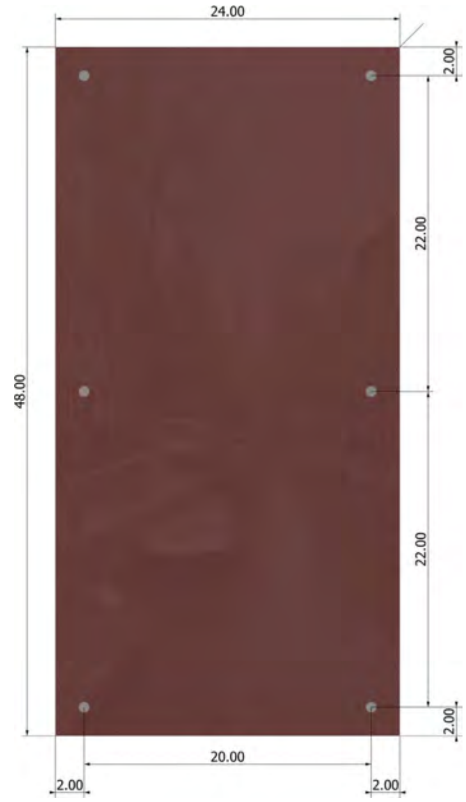
Strength level loads:

N_{ua} [lb]: -240
V_{uax} [lb]: -605
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: -2592
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

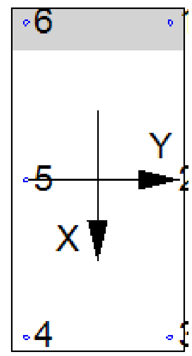


3. Resulting Anchor Forces

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	0.0	-100.8	0.0	100.8
2	108.1	-100.8	0.0	100.8
3	238.8	-100.8	0.0	100.8
4	238.8	-100.8	0.0	100.8
5	108.1	-100.8	0.0	100.8
6	0.0	-100.8	0.0	100.8
Sum	693.8	-605.0	0.0	605.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 13
Resultant tension force (lb): 694
Resultant compression force (lb): 934
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 4.14
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)
28723	0.75	21542

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

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	3000	2.310	3269

$0.75\phi N_{cbg} = 0.75\phi\,(A_{Nc}/A_{Nco})\,\Psi_{ec,N}\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N} N_b$ (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	$0.75\phi N_{cbg}$ (lb)
135.48	48.02	2.00	0.455	0.873	1.00	1.000	3269	0.65	1788

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

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
9367	1.0	0.65	6089

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)
2.31	0.625	1.00	3000	2.00	1113

$\phi V_{cbgx} = \phi\,(A_{Vc}/A_{Vco})\,\Psi_{ec,V}\,\Psi_{ed,V}\,\Psi_{c,V}\,\Psi_{h,V} V_{bx}$ (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)
30.00	18.00	1.000	0.900	1.000	1.000	1113	0.70	1169

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Company:		Date:	5/22/2022
Engineer:		Page:	5/5
Project:			
Address:			
Phone:			
E-mail:			

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)
2.31	0.625	1.00	3000	2.00	1113

$\phi V_{cbgx} = \phi\ (2)(A_{Vc} / A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.3.1, 17.5.2.1(c) & 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_{by} (lb)	ϕ	ϕV_{cbgx} (lb)
48.00	18.00	1.000	1.000	1.000	1.000	1113	0.70	4157

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)
1.0	195.21	48.02	1.000	0.873	1.000	1.000	3269	0.70	8122

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	239	21542	0.01	Pass
Concrete breakout	**694**	**1788**	**0.39**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	101	6089	0.02	Pass
T Concrete breakout x-	**202**	**1169**	**0.17**	**Pass (Governs)**
|| Concrete breakout y-	**303**	**4157**	**0.07**	**Pass (Governs)**
Pryout	605	8122	0.07	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.39	0.00	38.8%	1.0	Pass

5/8"Ø SS Titen HD, hnom:4" (102mm) meets the selected design criteria.

12. Warnings

- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.

- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.

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

- Refer to manufacturer's product literature for hole cleaning and installation instructions.