

CODES AND STANDARDS

- WHERE DOCUMENTS ARE REFERENCED IN THE GENERAL AND DESIGN NOTES, THEY SHALL BE THE LATEST APPLICABLE EDITIONS, UNLESS OTHERWISE NOTED.
- ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF INTERNATIONAL BUILDING CODE, INCLUDING REFERENCE STANDARDS, ADDENDA AND APPENDICES.
- IN ADDITION, THE FOLLOWING CODES, STANDARDS AND SPECIFICATIONS SHALL APPLY WHERE MORE STRINGENT AND AS MODIFIED BY THE BUILDING CODE:
 - ACI 318 "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE AND COMMENTARY"
 - ACI 530/530.1 "BUILDING CODE REQUIREMENTS AND SPECIFICATIONS FOR MASONRY STRUCTURES AND RELATED COMMENTARIES"
 - AISC "STEEL CONSTRUCTION MANUAL" AND AISC 360 "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS"
 - AISC "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES"
 - AISC "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A 325 OR A 490 BOLTS"
 - AWS D1.1 "STRUCTURAL WELDING CODE"
 - AWS D1.4 "STRUCTURAL WELDING CODE-- REINFORCING STEEL"
 - AISI "SPECIFICATION FOR THE DESIGN OF COLD FORMED STEEL STRUCTURAL MEMBERS"

PROJECT DOCUMENTS

- THIS SET OF DRAWINGS, TOGETHER WITH THE SPECIFICATIONS, CONSTITUTES THE COMPLETE DOCUMENT BY WHICH ALL WORK IS TO BE CARRIED OUT.
- THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS AT THE JOB SITE. THE CONTRACTOR SHALL USE STRUCTURAL DRAWINGS IN CONJUNCTION WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING, FIRE PROTECTION AND ALL OTHER RELEVANT CONSULTANTS DRAWINGS BEFORE COMMENCING WITH THE WORK AND SHALL NOTIFY THE ARCHITECT AND ENGINEER OF RECORD OF ANY DISCREPANCIES REQUIRING CLARIFICATION OR REVISION.
- SCALES NOTED ON THE DRAWINGS ARE FOR GENERAL INFORMATION ONLY. NO DIMENSIONAL INFORMATION SHALL BE OBTAINED BY SCALING FROM THE DRAWINGS.
- IN THE EVENT THAT CERTAIN DETAILS OF THE CONSTRUCTION ARE NOT FULLY SHOWN OR NOTED ON DRAWINGS, THEIR CONSTRUCTION SHALL BE OF THE SAME TYPE AS FOR SIMILAR CONDITIONS THAT ARE SHOWN OR NOTED, SUBJECT TO THE STRUCTURAL ENGINEER'S [PRIOR WRITTEN] APPROVAL.
- REFER TO ARCHITECTURAL DRAWINGS FOR THE FOLLOWING:
 - SIZE AND LOCATION OF ALL DOOR OPENINGS, EXCEPT AS NOTED.
 - SIZE AND LOCATION OF ALL INTERIOR NON-BEARING PARTITIONS.
 - SIZE AND LOCATION OF ALL CONCRETE CURBS, FLOOR DRAINS, SLOPES, INSERTS, ETC. EXCEPT AS SHOWN ON PLAN.
 - FLOOR AND ROOF FINISHES
 - DIMENSIONS NOT SHOWN ON STRUCTURAL DRAWINGS.
- REFER TO MEP DRAWINGS FOR THE FOLLOWING:
 - PIPE AND DUCT RUNS, SLEEVES, HANGERS, TRENCHES, WALL AND SLAB OPENINGS, EXCEPT AS SHOWN OR NOTED.
 - ELECTRICAL CONDUIT RUNS, BOXES, OUTLETS IN WALLS AND SLABS.
 - CONCRETE INSERTS FOR ELECTRICAL, MECHANICAL OR PLUMBING FIXTURES.
 - SIZE AND LOCATION OF MACHINE OR EQUIPMENT BASES, ANCHOR BOLTS FOR MOTOR MOUNTS, EXCEPT AS SHOWN OR NOTED.
- SEE SPECIFICATIONS FOR WATERPROOFING AND DAMP PROOFING.

SUBMITTALS

- CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND CALCULATIONS AS BOTH SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER AS REQUIRED BY THE SPECIFICATIONS, FOR ENGINEER'S APPROVAL.
- ONLY SHOP DRAWINGS MARKED "NO EXCEPTIONS TAKEN", "REVISE AS NOTED" OR "SEE COMMENTS NOTED" MAY BE USED BY CONTRACTOR IN THE WORK. SHOP DRAWINGS MARKED "REJECTED" OR "RESUBMIT FOR REVIEW" SHALL BE CORRECTED AND COMPLETED AS REQUIRED AND RESUBMITTED TO THE ARCHITECT BEFORE THEY ARE USED IN THE WORK.
- CLOUD ALL CHANGES IN RESUBMITTALS OR SUBMITTALS WILL BE RETURNED WITHOUT REVIEW.

REINFORCED CONCRETE

- STRUCTURAL CONCRETE STRENGTHS AND TYPES USED IN THIS PROJECT SHALL BE AS FOLLOWS:

CALL OUT IN DOCUMENTS	f _c (PSI)	AGGREGATE
STANDARD CONCRETE	5000	NORMAL WEIGHT
LIGHTWEIGHT CONCRETE	4000	LIGHTWEIGHT

- ALL CONCRETE MIXES SHALL COMPLY WITH THE REQUIREMENTS OF THE BUILDING CODE AND THE ACI 318. MIX DESIGNS FOR EACH TYPE AND STRENGTH SHALL BE PREPARED BY CONTRACTOR AND TESTED BY AN INDEPENDENT TESTING LABORATORY. THE MIX DESIGNS SHALL THEN BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.

- PORTLAND CEMENT SHALL CONFORM TO ASTM C150. WHERE CONCRETE IS IN CONTACT WITH SOIL, THE TYPE OF EXPOSURE SHALL DETERMINE THE CEMENT TYPE:

A. SEVERE SULFATE EXPOSURE	TYPE V
B. MODERATE SULFATE EXPOSURE	TYPE II
C. ALL OTHER	TYPE I

- CONTRACTOR SHALL DETERMINE THE LEVEL OF EXPOSURE BY TESTING OR OTHER SUITABLE MEANS.
- FLY ASH MAY BE USED IN CONCRETE MIXES. THE FLY ASH SHALL CONFORM TO ASTM C618, CLASS F AND ITS ADDITION SHALL NOT EXCEED 15% OF THE CEMENT WEIGHT.
- NORMAL WEIGHT AGGREGATE SHALL CONFORM TO THE REQUIREMENTS OF ASTM C33.
- LIGHTWEIGHT AGGREGATE SHALL CONFORM TO THE REQUIREMENTS OF ASTM C330 AND ASTM C157.
- CONCRETE FORMS SHALL BE LAID OUT AND CONSTRUCTED TO PROVIDE THE SPECIFIED CAMBERS INDICATED ON THE STRUCTURAL DRAWINGS, AND SHALL COMPLY WITH REQUIREMENTS OF ACI 318
- THE PROJECTING CORNERS OF COLUMNS, BEAMS, WALLS, ETC. SHALL BE FORMED WITH 3/4 INCH CHAMFER, UNLESS OTHERWISE NOTED ON ARCHITECTURAL DRAWINGS.
- CONSTRUCTION JOINTS SHALL BE DOWELLED, KEYED AND THE SURFACES SHALL BE CLEANED AND LAITANCE REMOVED. ALTERNATIVELY, WHERE APPROVED BY ENGINEER, PROVIDE JOINTS CLEANED AND ROUGHENED TO 1/4 INCH AMPLITUDE BY MECHANICAL METHODS.
- LOCATION OF CONSTRUCTION JOINTS SHALL BE AS INDICATED ON STRUCTURAL DRAWINGS. PROVIDE WATERSTOPS FOR ALL CONSTRUCTION JOINTS BELOW WATER TABLE. ADDITIONAL CONSTRUCTION JOINTS MAY BE ADDED ONLY WITH APPROVAL OF ARCHITECT AND ENGINEER OF RECORD.
- REINFORCING BARS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A615, GRADE 60. REINFORCING BARS, WHICH ARE TO BE WELDED, SHALL CONFORM TO APPLICABLE ASTM AND AWS SPECIFICATIONS.
- ALL REINFORCING BARS MARKED "CONTINUOUS" SHALL BE TENSION SPLICED, UNLESS OTHERWISE SHOWN ON DRAWINGS.
- ALL BARS AT NON-CONTINUOUS ENDS SHALL HAVE A STANDARD HOOK.
- PROVIDE DEVELOPMENT AND SPLICES OF REINFORCEMENT ACCORDING TO THE TYPICAL DETAIL TABLES.
- UNLESS OTHERWISE NOTED, ALL DOWELS SHALL BE FULLY DEVELOPED IN TENSION, UNLESS OTHERWISE NOTED.
- DOWEL TO WALLS AND COLUMNS SHALL MATCH THE CORRESPONDING REINFORCING OF THE WALL OR COLUMN.
- WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185. USE ONLY FLAT SHEETS.
- MINIMUM LAP OF WELDED WIRE FABRIC SHALL BE 6 INCHES OR ONE FULL MESH, WHICHEVER IS GREATER.
- ALL REINFORCING STEEL SHALL BE SECURELY HELD IN ORDER TO MAINTAIN ITS POSITION WHILE CONCRETE IS POURED. CHAIRS, TIES, SPACERS, ADDITIONAL BARS AND STIRRUPS, ETC. SHALL BE PROVIDED BY THE CONTRACTOR.
- CONTRACTOR SHALL COORDINATE AND INSTALL ALL REQUIRED EMBEDDED ITEMS, SLEEVES, POCKETS, ETC. PRIOR TO CONCRETE PLACEMENT. REFER TO TYPICAL DETAILS OF PENETRATIONS FOR LIMITATIONS ON THEIR POSITIONING IN RESPECT TO REINFORCING. DO NOT CUT ANY REINFORCING THAT MIGHT INTERFERE WITH EMBEDDED ITEMS PLACEMENT.
- MECHANICAL PIPES AND/OR ELECTRICAL CONDUITS SHALL NOT PASS THROUGH CONCRETE COLUMNS AND BEAMS, UNLESS SPECIFICALLY DETAILED ON DRAWINGS.
- NO ALUMINUM SHALL BE EMBEDDED IN CONCRETE.
- CONTRACTOR SHALL NOTIFY TESTING AGENCY AND OWNER, 24 HOURS BEFORE POURING OF CONCRETE, FOR INSPECTION OF REINFORCEMENT LAYOUT. NO CONCRETE SHALL BE POURED UNLESS ALL REINFORCEMENT AND INSTALLATIONS HAVE BEEN INSPECTED AND APPROVED BY THE TESTING AGENCY.
- CONCRETE CAST ON SLOPED SURFACES SHALL BEGIN AT THE LOWEST ELEVATION AND CONTINUE MONOLITHICALLY TOWARD THE HIGHER ELEVATION.

STRUCTURAL MASONRY

- MASONRY WORK SHALL CONFORM TO REQUIREMENTS OF THE BUILDING CODE AND ACI 530/530.1 "BUILDING CODE REQUIREMENTS AND SPECIFICATIONS FOR MASONRY STRUCTURES AND RELATED COMMENTARIES".
- MASONRY MATERIAL TYPES AND STRENGTHS USED IN THIS PROJECT SHALL BE AS FOLLOWS:

MATERIAL	ASTM STANDARD	TYPE
MORTAR	C270	TYPE N
GROUT	C476	f _g = 2500 PSI
REINFORCING BARS	A615	GRADE 60

- THE NET AREA COMPRESSIVE STRENGTH OF THE MASONRY ASSEMBLY (f_m) SHALL NOT BE LESS THAN 2000 PSI.
- GROUT SHALL BE FINE GROUT. GROUT SHALL BE FLUID ENOUGH IN ORDER TO FLOW IN ALL JOINTS OF THE MASONRY WITHOUT SEGREGATION.
- ALL CELLS AND BOND BEAMS WITH REINFORCING SHALL BE FILLED SOLID WITH GROUT.
- MORTAR AND GROUT MIX DESIGNS FOR EACH TYPE AND STRENGTH SHALL BE PREPARED BY CONTRACTOR AND TESTED BY AN INDEPENDENT TESTING LABORATORY. THE MIX DESIGNS SHALL THEN BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.

- FOR DIMENSIONS OF UNITS, SURFACE FINISHES, COURSE PATTERNS AND JOINT TYPES REFER TO ARCHITECTURAL DRAWINGS.
- CORING OPENINGS IN GROUTED MASONRY IS NOT PERMITTED.
- NO PIPES OR ELECTRICAL CONDUITS SHALL PASS THROUGH MASONRY LINTELS AND/OR REINFORCED, GROUTED CELLS.
- SEE ARCHITECTURAL DRAWINGS FOR NON-LOAD BEARING WALLS DIMENSION AND LOCATIONS.
- PROVIDE LATERAL SUPPORT AT THE TOP OF NON LOAD-BEARING MASONRY WALLS, ACCORDING TO TYPICAL DETAILS.

STRUCTURAL STEEL

- ALL STEEL MEMBERS SHALL BE HOT-DIP GALVANIZED ACCORDING TO ASTM A123.
- STRUCTURAL STEEL SHALL BE PROVIDED AS FOLLOWS:

SHAPE	ASTM STANDARD	F _y (KSI)
WIDE FLANGES	A992	50
CHANNELS	A36	36
HSS (RECTANGULAR AND SQUARE)	A500 GRADE B	46
HSS (ROUND)	A500 GRADE B	42
PIPES	A53 GRADE B	35
ANGLES	A36	36
PLATES	A36	36
TEES	A992	50

- F_y IS THE MINIMUM TENSILE YIELDING STRESS TO BE PROVIDED UNLESS OTHERWISE NOTED.
- ALL BOLTED CONNECTIONS SHALL BE MADE WITH HIGH STRENGTH BOLTS CONFORMING TO ASTM A 325 OR ASTM A 490. ALL CONNECTIONS SHALL BE TYPE N UNLESS OTHERWISE NOTED ON DRAWINGS. FASTENERS AND CONNECTING PARTS SHALL BE HOT-DIP GALVANIZED ACCORDING TO ASTM A153.
- NUTS SHALL CONFORM TO ASTM A563, 1H OR ASTM A194, 2H. PROVIDE WASHERS CONFORMING TO ASTM F436 AT EACH THREADED ROD OR BOLT. NUTS AND WASHERS SHALL BE HOT-DIP GALVANIZED ACCORDING TO ASTM A153.
- BOLT HOLES IN STEEL MEMBERS, WITH THE EXCEPTION OF BASE PLATES, SHALL BE 1/16 INCH LARGER IN DIAMETER THAN THE NOMINAL SIZE OF BOLT USED, UNLESS NOTED OTHERWISE ON DRAWINGS.
- BOLT HOLES IN STEEL BASE PLATES SHALL BE OF THE SIZE MARKED ON DRAWINGS. PROVIDE WELDED PLATE WASHERS 3"x 3"x 3/8" THICK MINIMUM.
- ANCHOR BOLTS SHALL BE ROUND BAR STOCK, THREADED, CONFORMING TO ASTM F1554, GRADE 36 UNLESS OTHERWISE NOTED. ANCHOR BOLTS SHALL BE SUPPLIED WITH CORRESPONDING NUTS AND WASHERS. ANCHOR BOLTS SHALL BE HOT-DIP GALVANIZED.
- THREADED RODS SHALL HAVE THREADS CONFORMING TO UNC CLASS 2A (EXTERIOR THREADS) AND 2B (INTERNAL THREADS). THREADED RODS SHALL BE HOT-DIP GALVANIZED.
- WELDING MATERIALS SHALL CONFORM TO AWS D1.1. ELECTRODES SHALL HAVE A MINIMUM TENSILE STRENGTH OF 70 KSI AND BE LOW-HYDROGEN TYPE.
- WELD LENGTHS CALLED FOR ON PLANS ARE THE NET EFFECTIVE LENGTHS REQUIRED.
- AT PARTIAL PENETRATION WELDS THE SIZE GIVEN IS THE MINIMUM EFFECTIVE THROAT. FABRICATOR SHALL PROVIDE PROPER JOINT PREPARATION TO ACHIEVE THE MINIMUM EFFECTIVE THROAT AS REQUIRED BY THE AWS CODE.
- SPLICES SHALL BE DESIGNED TO DEVELOP THE FULL CAPACITY OF THE MEMBER AT THE POINT OF SPLICE. SPLICES SHALL BE MADE ONLY AT LOCATIONS INDICATED ON DRAWINGS. FULL DETAIL AND BACK-UP CALCULATIONS OF SPLICES REQUIRE REVIEW AND APPROVAL BY THE ENGINEER.
- SHAPE AND SIZE GUSSET PLATES IN SUCH A MANNER AS TO CLEAR ALL ARCHITECTURAL FINISHES AND MECHANICAL FIXTURES (DUCTS, PIPES, ETC.). SUBMIT THE CONFIGURATION OF ALL GUSSET PLATES EXPOSED TO VIEW TO ARCHITECT AND ENGINEER FOR REVIEW AND APPROVAL.
- CONTRACTOR SHALL PROVIDE ALL NECESSARY TEMPORARY BRACING, GUYING AND CONNECTING MEMBERS REQUIRED TO ERECT THE STRUCTURE, MAINTAIN CORRECT ALIGNMENT AND SAFELY RESIST ALL POSSIBLE COMBINATIONS OF DEAD, CONSTRUCTION, ERECTION, WIND AND OTHER LATERAL LOADS.
- REFER TO SPECIFICATIONS FOR STEELWORK PROTECTION AND COATINGS.

STEEL FRAMING NOTES

- STEEL MEMBERS ARE ASSUMED TO BE VERTICAL AND DIMENSIONED TO THEIR CENTERLINE UNLESS OTHERWISE INDICATED.
- STEEL MEMBERS NOT LOCATED IN PLAN BY A DIMENSION LINE SHALL BE EQUALLY SPACED BETWEEN DIMENSIONED MEMBERS.

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1	07/13/18	30% FD SUBMISSION	



SCALE:



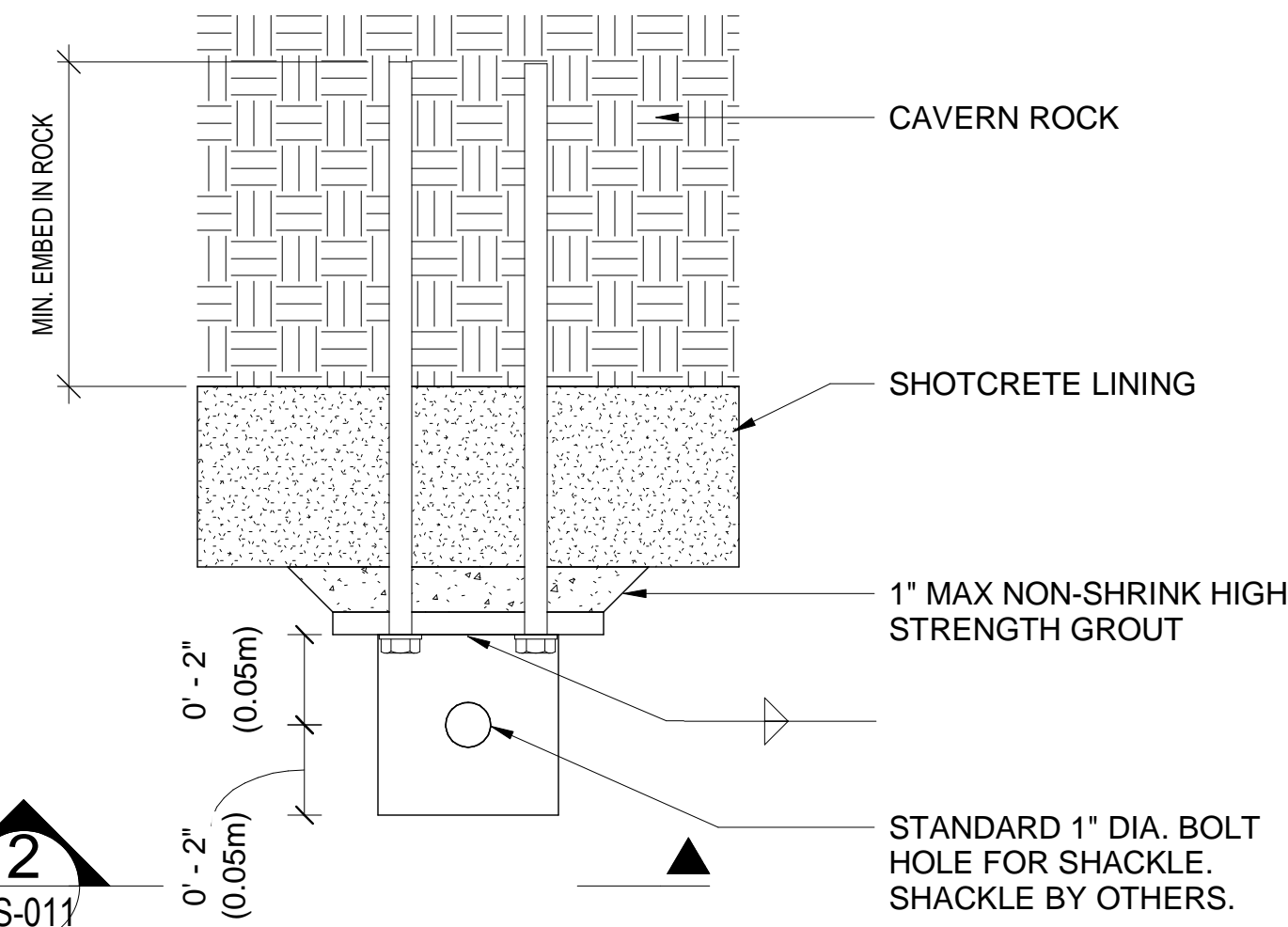
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CHECKED	IB	ARUP

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**EXC UNDERGROUND
STRUCTURAL
GENERAL NOTES**

DRAWING NO. **15-1-6F UG-FD-SS-010** REV. **1**

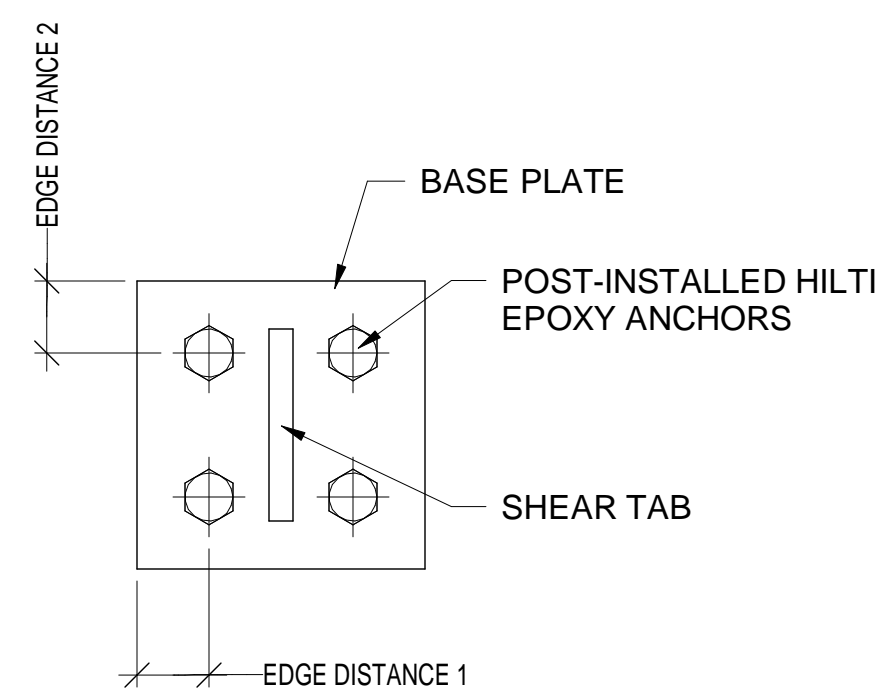
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STAND-ALONE LIFTING EYE CROSS SECTION

SCALE: 3" = 1'-0"

1



LIFTING EYE BASE PLATE

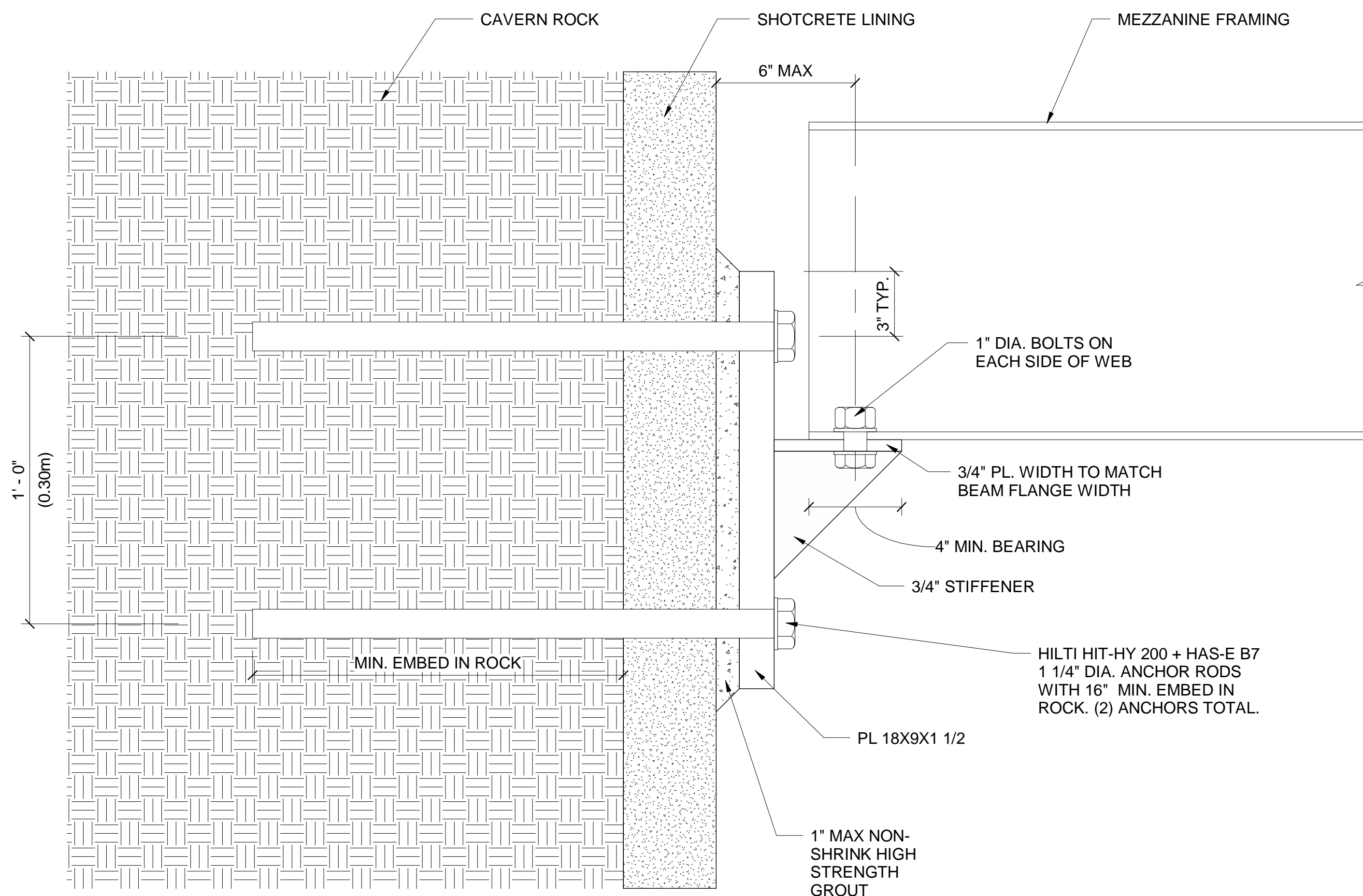
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2

NOTES:

- 1. SEE DRAWINGS UG-FD-C-200 TO 203 FOR LOCATIONS OF HANGERS, LIFTING EYES AND MEZZANINE SUPPORT.
- 2. SEE DRAWING UG-FD-C-500 FOR ROCK ANCHOR DETAILS

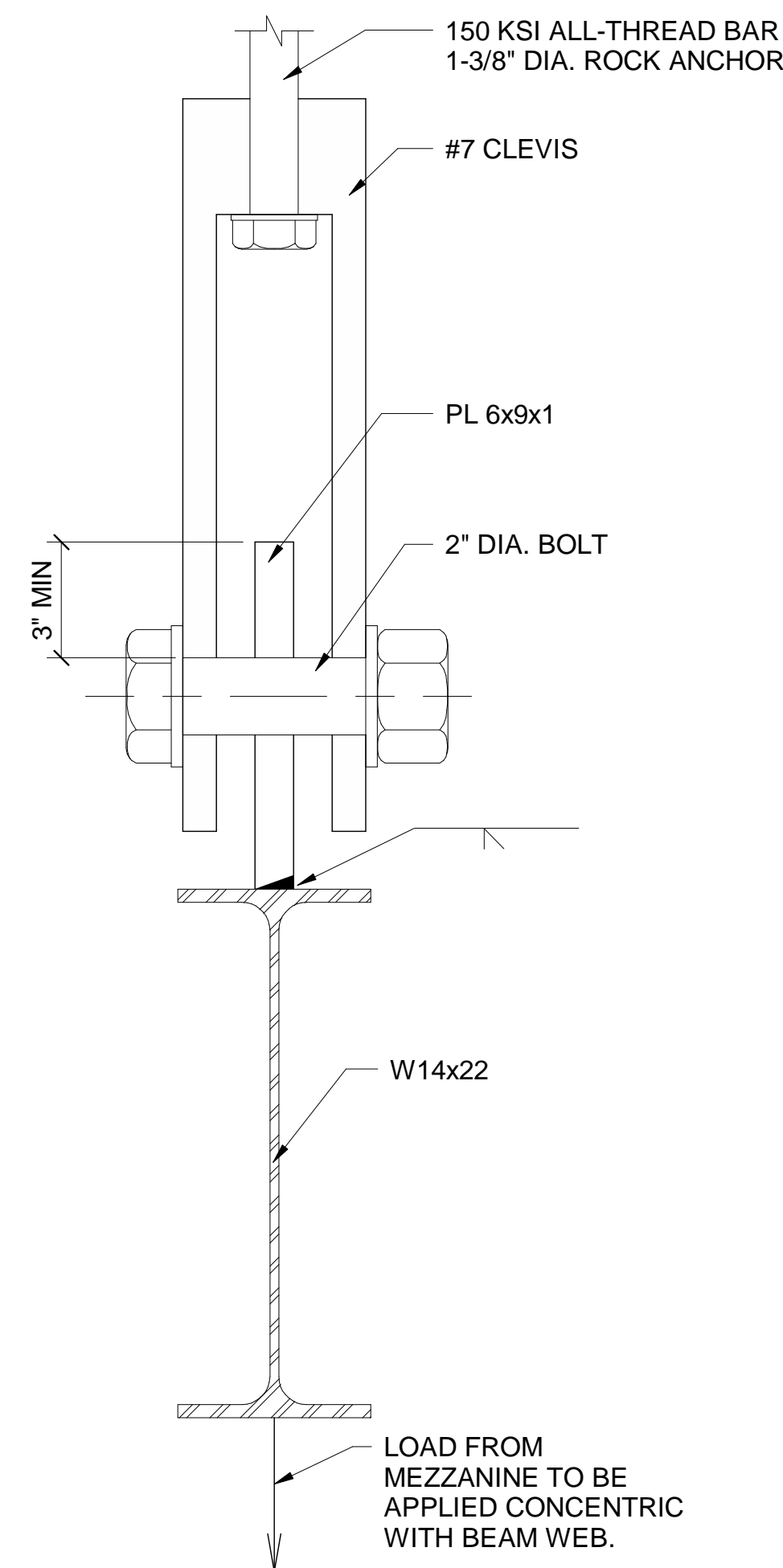
LIFTING EYE SCHEDULE						
LIFTING EYE LOCATION	BASE PLATE	SHEAR TAB	EDGE DISTANCE 1	EDGE DISTANCE 2	ANCHOR	ANCHOR EMBED
OVER MEZZANINE	15x15x3/4	4x4x3/4	2"	2"	HILTI HIT-HY 200 + HAS-E 1 1/4" ANCHOR ROD	10"
OVER LAR PUMPS	6x6x1/2	4x4x1/2	1 1/2"	1 1/2"	HILTI HIT-HY 200 + HAS-E 1/2" ANCHOR ROD	10"



MEZZANINE SUPPORT CROSS SECTION

SCALE: 3" = 1'-0"

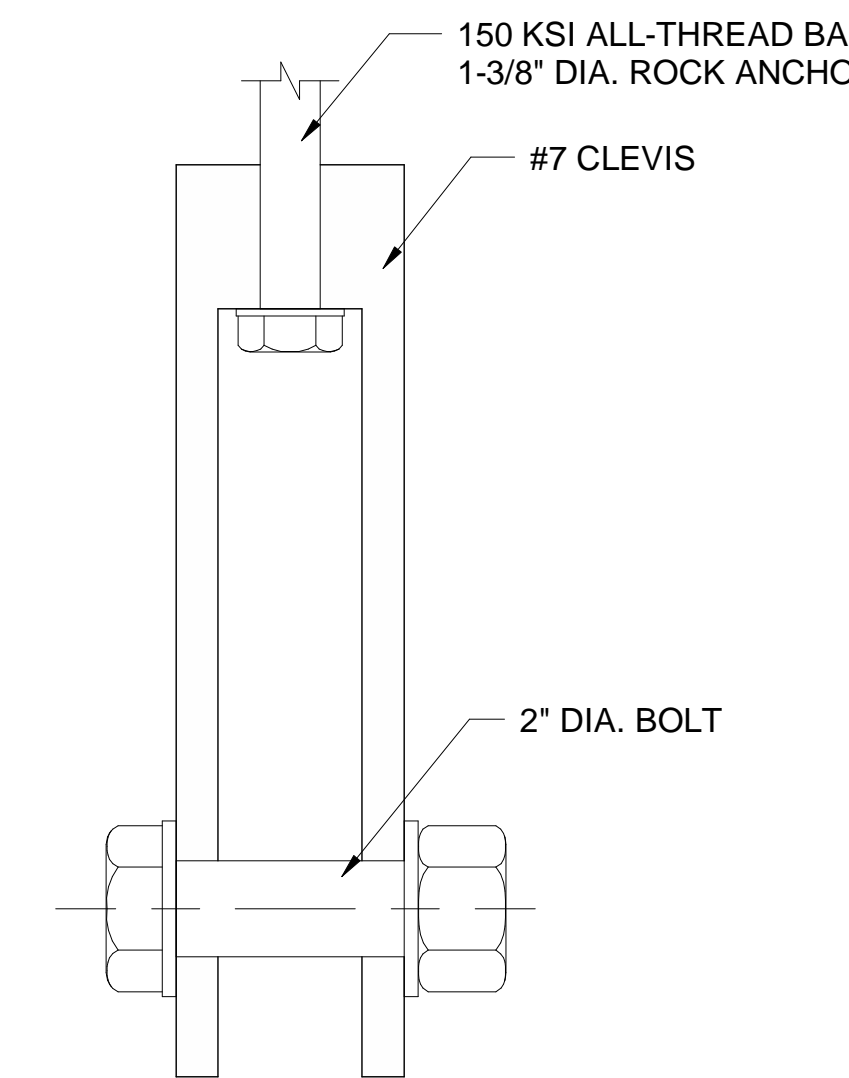
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MEZZANINE HANGAR CROSS SECTION

SCALE: 3" = 1'-0"

4



LIFTING EYE INTEGRATED WITH ROCK ANCHOR

SCALE: 3" = 1'-0"

5

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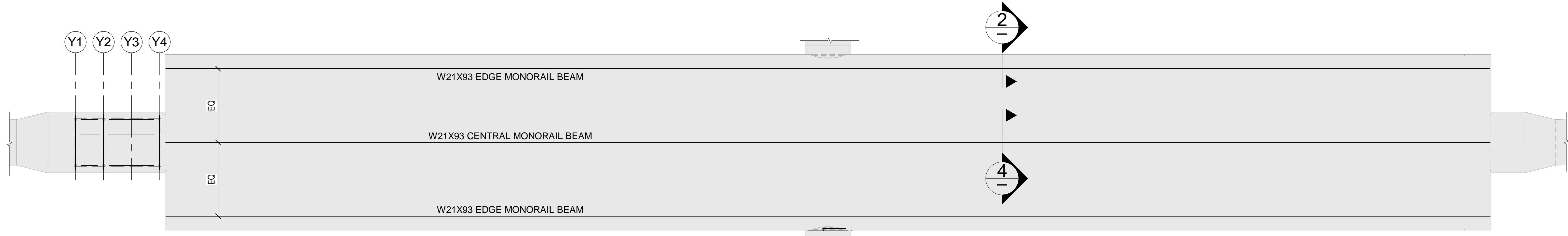


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4850 LEVEL
STRUCTURAL DETAILS

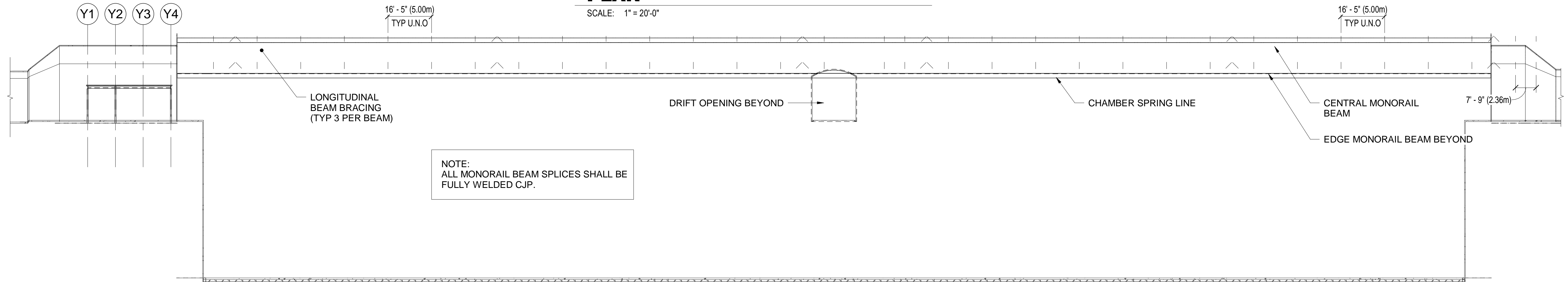
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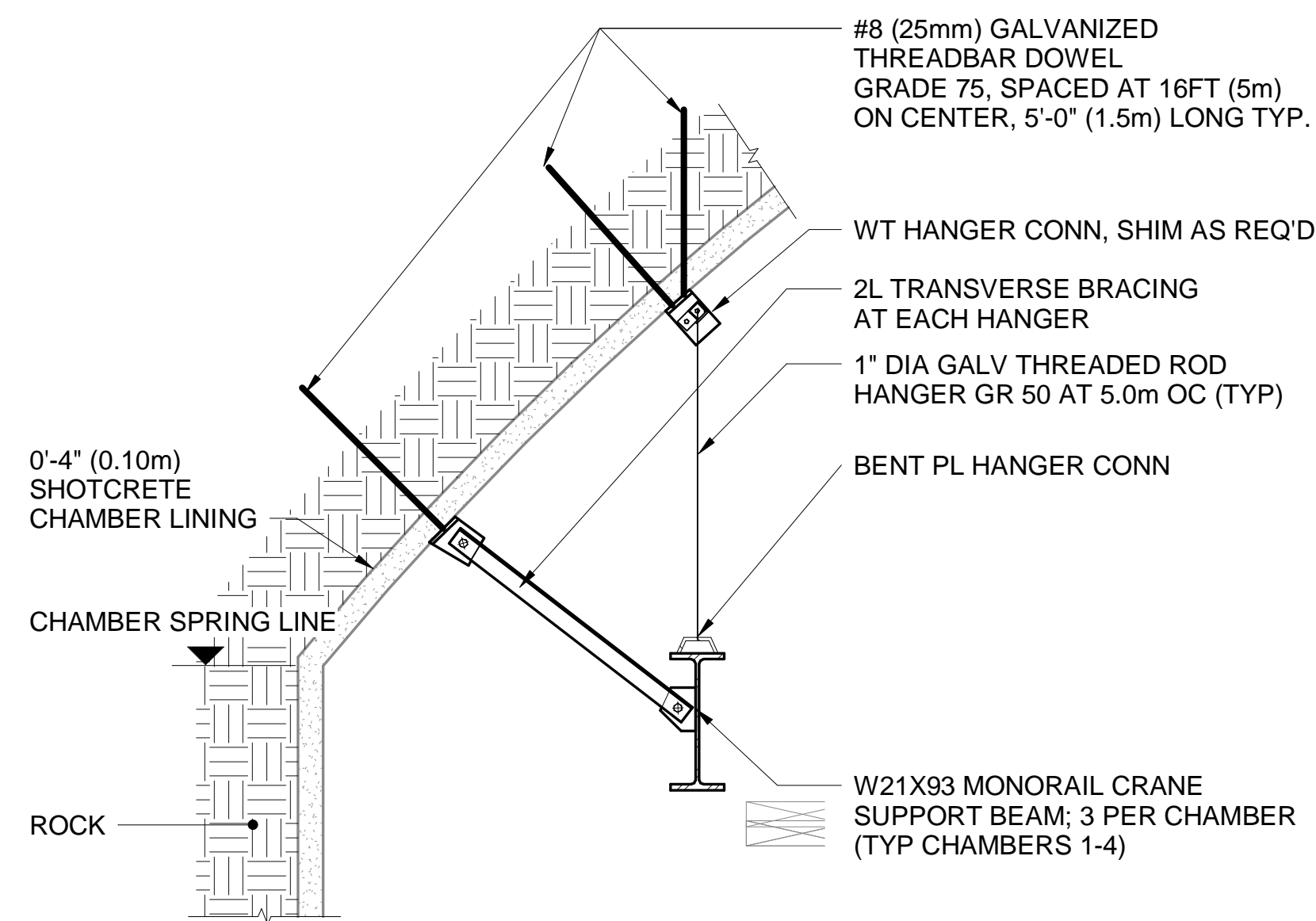
CHAMBERS 1-4 TYPICAL MONORAIL PLAN

SCALE: 1" = 20'-0"



CHAMBERS 1-4 LONGITUDINAL SECTION

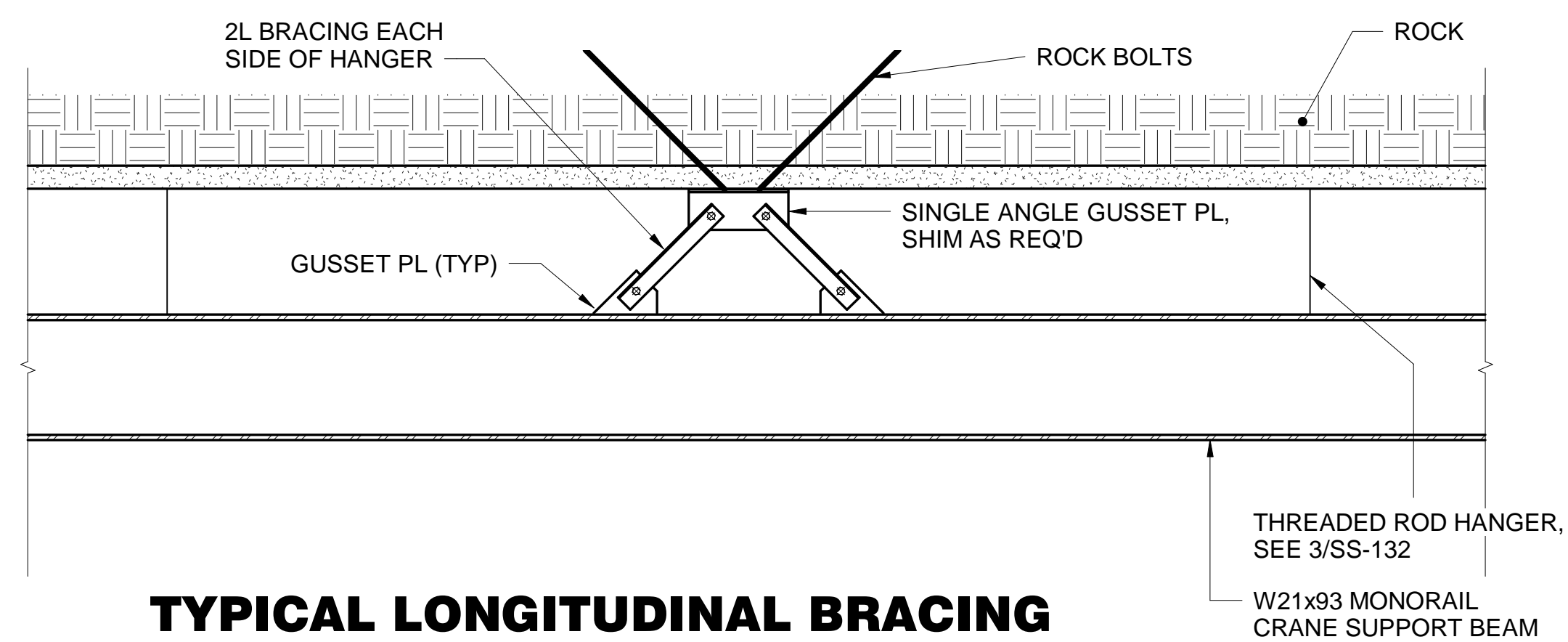
SCALE: 1" = 20'-0"



TYPICAL MONORAIL CRANE BEAM SUPPORT

SCALE: 1/2" = 1'-0"

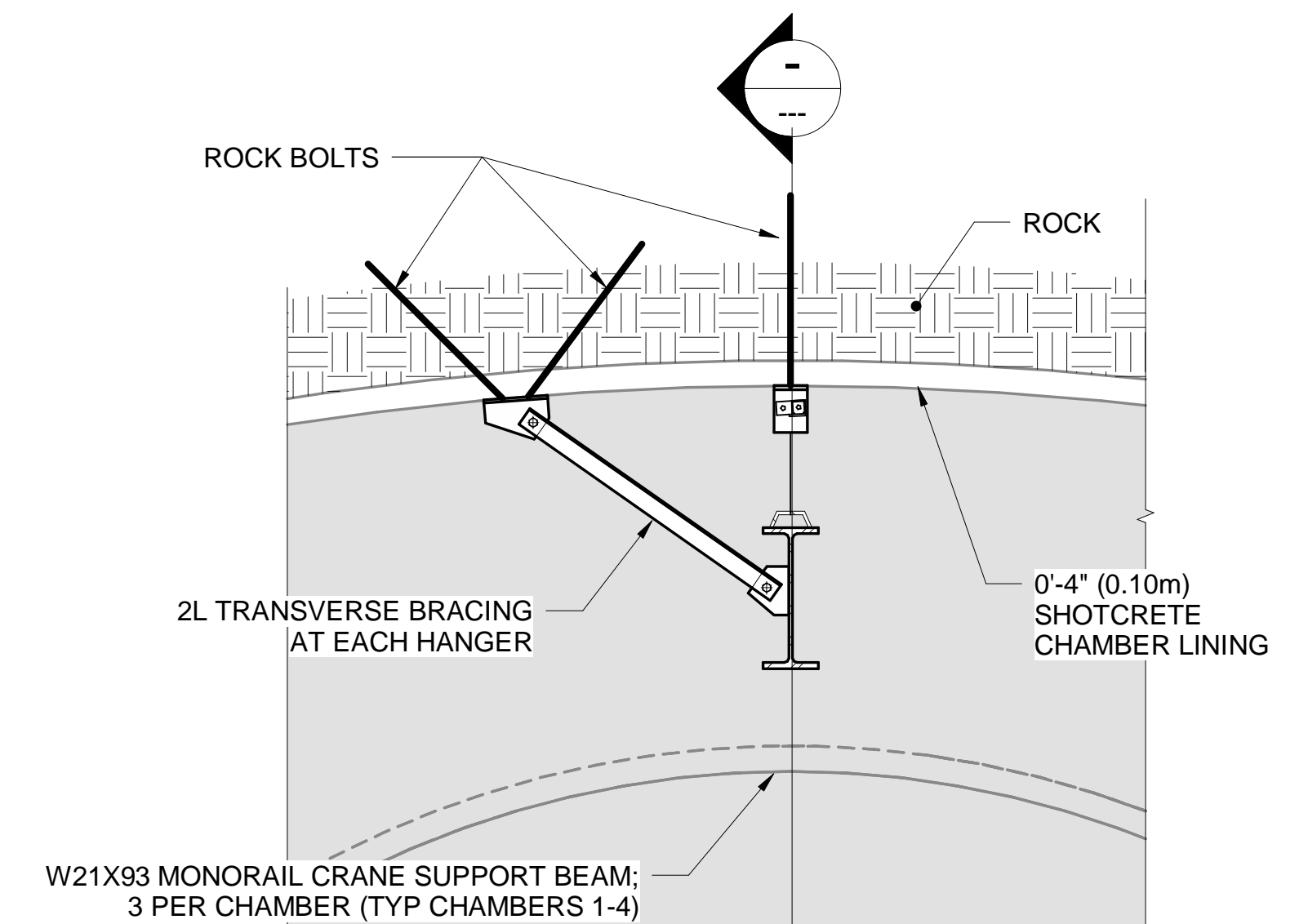
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TYPICAL LONGITUDINAL BRACING DETAIL

SCALE: 1/2" = 1'-0"

3



CENTRAL MONORAIL CRANE BEAM SUPPORT

SCALE: 1/2" = 1'-0"

4

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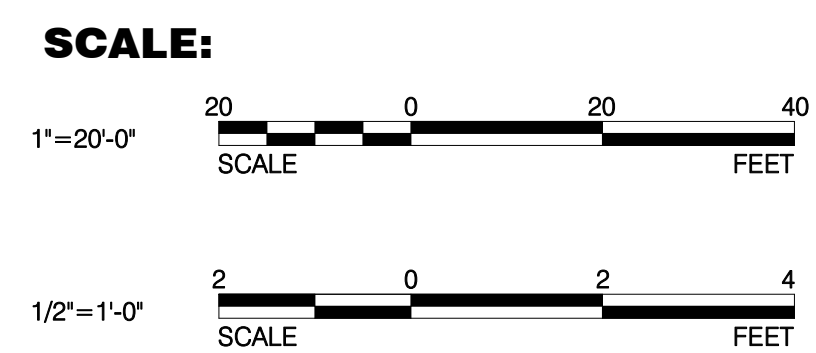
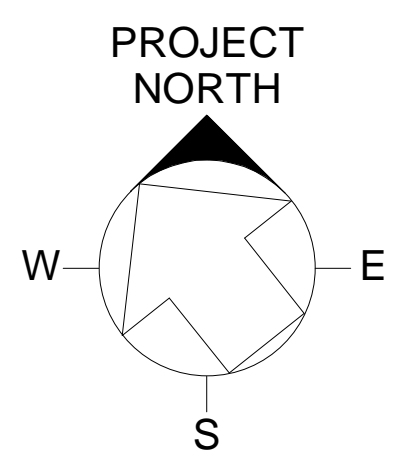
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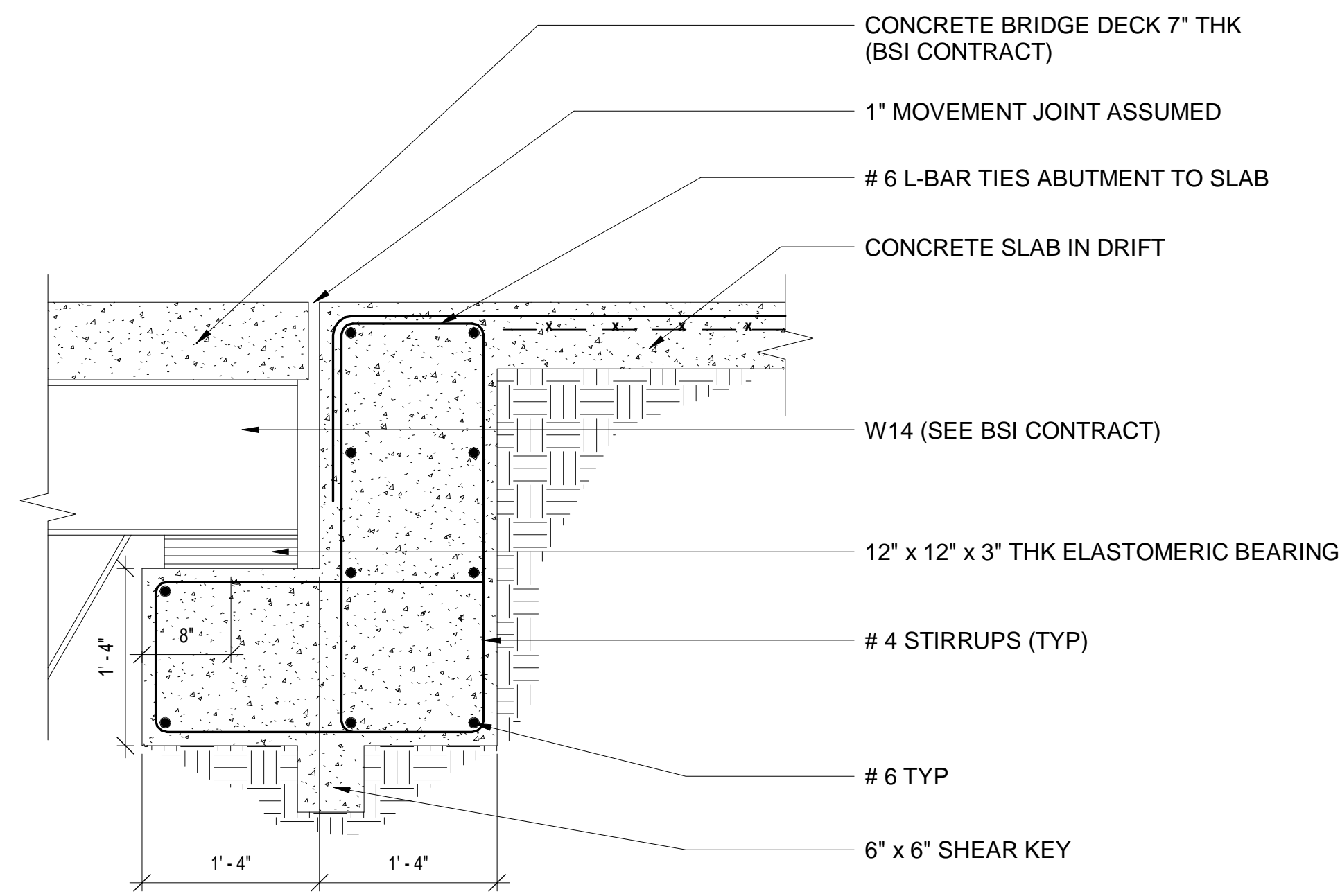
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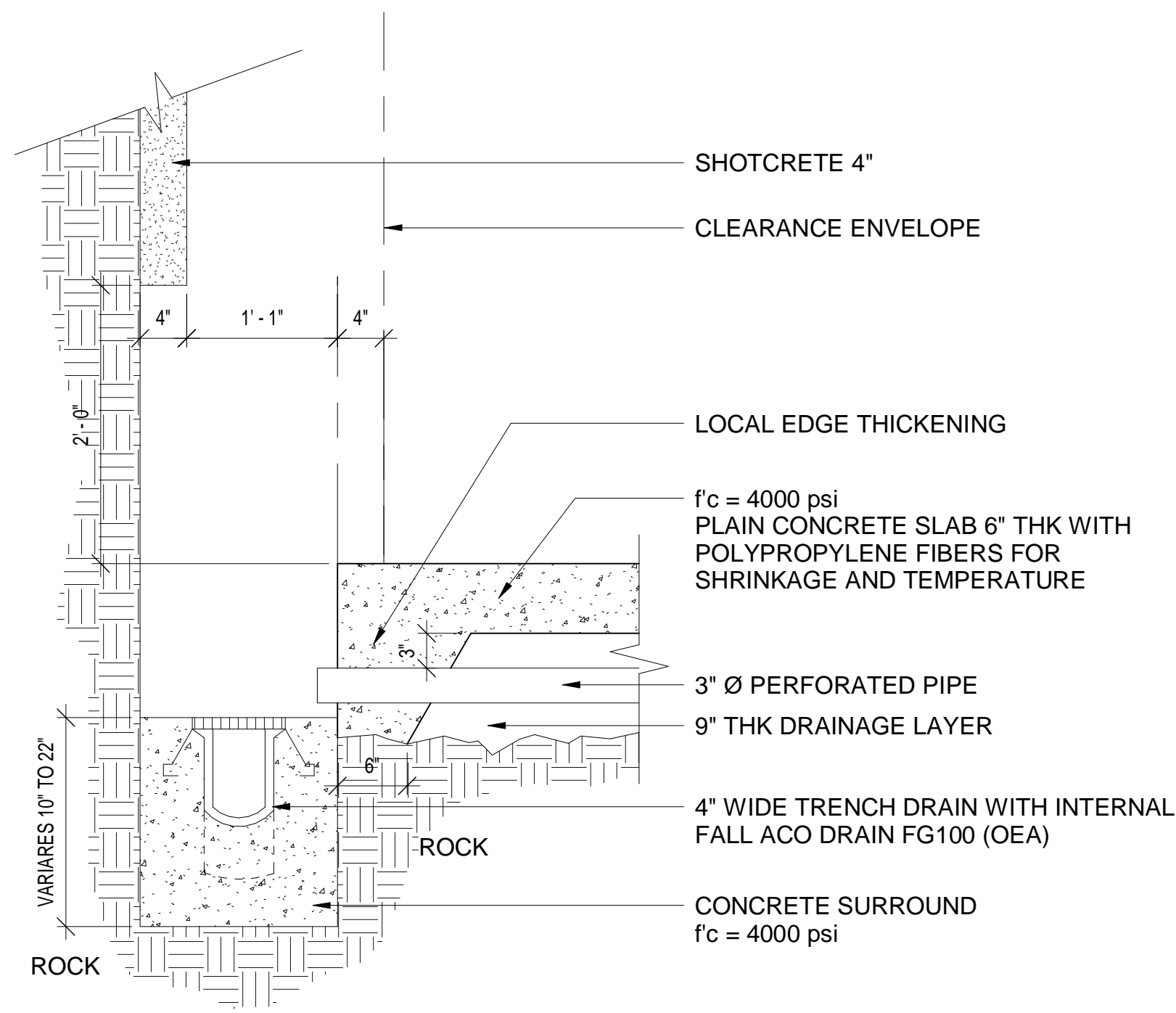
**EXC 4850 LEVEL
TYPICAL CHAMBER MONORAIL
PLAN AND SECTIONS**

DRAWING NO. **15-1-6F UG-FD-SS-132** REV. **1**

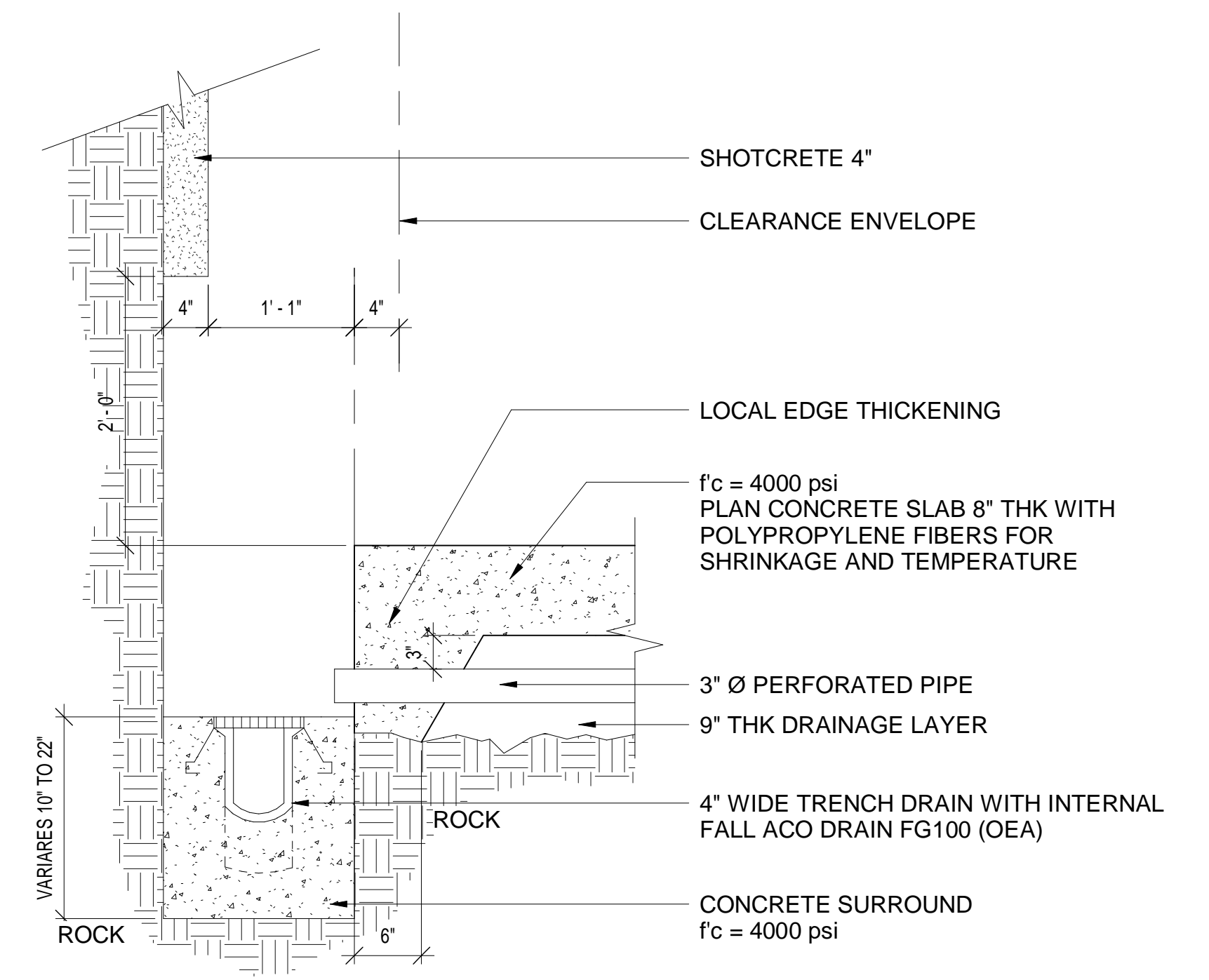
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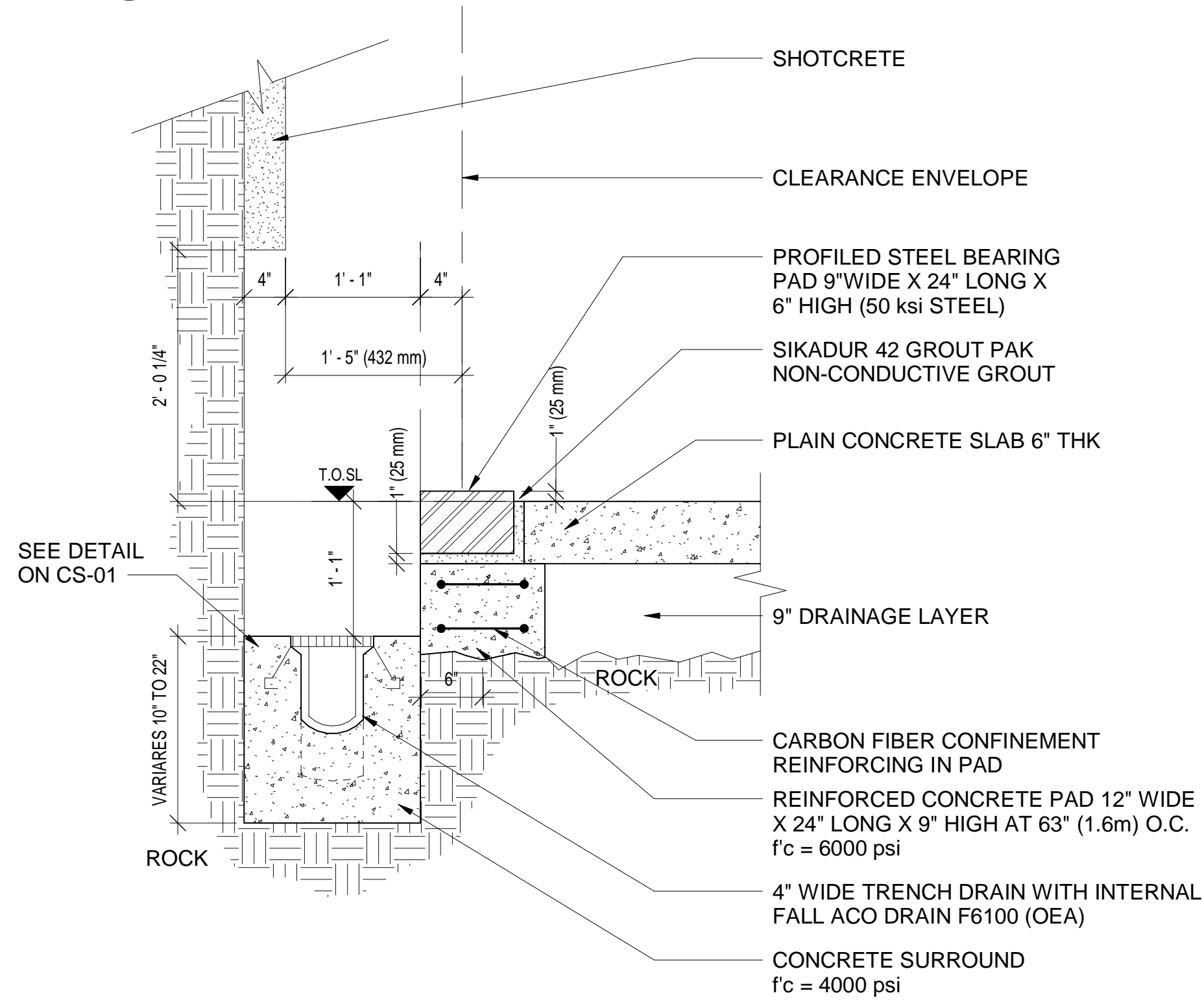
1 BRIDGE ABUTMENT SECTION AT 4500L
1" = 1'-0"



2 TYPICAL DETAIL OF EXPERIMENT CAVERN SLAB BETWEEN PADS
1" = 1'-0"



3 TYPICAL DETAIL OF CUC SLAB AND EXPERIMENT CAVERN SLAB BELOW SEPTUM BRIDGE
1" = 1'-0"



4 DETAIL AT CONCRETE PADS IN EXPERIMENT CAVERN
1" = 1'-0"

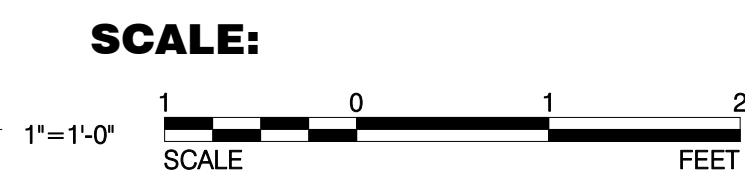
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4850 LEVEL
CONCRETE SLAB DETAILS

DRAWING NO. **15-1-6F UG-FD-SS-510** REV. **1**

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