US Army Corps
of Engineers
Huntsville Center

# EARTH-COVERED MAGAZINE, CONCRETE OVAL-ARCH 421-80-09 WITH 8'-0" OR 10'-0" DOOR

US Army Corps
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Huntsville Center

| No. | Description | Revisions | Date | Appr. |
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Designed by: RWB & MER
Drawn by: MER
Checked by: RSW
Project Engineer/Architect: Jeff Coulston
Date: SEPT 2013
Scale: AS SHOWN
Drawing code:
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U. S. ARMY CORPS OF ENGINEERS
ENGINEERING AND
SUPPORT CENTER,
HUNTSVILLE, ALABAMA

CONCRETE OVAL-ARCH.
EARTH COVERED MAGAZINE
STD 421-80-09

COVER SHEET

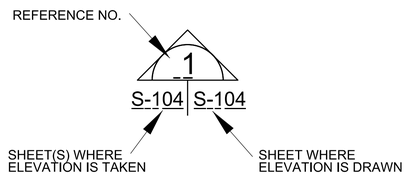
Sheet reference number:
G-001
Sheet 1 of 23

STANDARD DESIGN DRAWINGS - FINAL

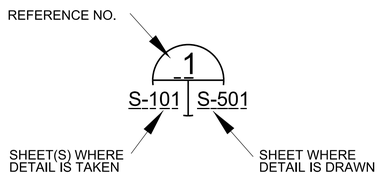
## GENERAL ABBREVIATIONS

| | |
|---|---|
| AFF | ABOVE FINISHED FLOOR |
| ALUM | ALUMINUM |
| APPROX | APPROXIMATELY |
| BLDG | BUILDING |
| BOTT | BOTTOM |
| BRG | BEARING |
| CIP | CAST-IN-PLACE |
| CJ | CONTROL JOINT |
| CL | CENTER LINE |
| CMU | CONCRETE MASONRY UNIT |
| CP | CENTER POINT |
| COL | COLUMN |
| COORD | COORDINATE |
| CONC | CONCRETE |
| CONT | CONTINUE, CONTINUOUS |
| DIA | DIAMETER |
| DIAG | DIAGONAL |
| DIM | DIMENSION |
| EA | EACH |
| ELEV | ELEVATION |
| EF | EACH FACE |
| EJ | EXPANSION JOINT |
| EQ | EQUAL |
| E.W. | EACH WAY |
| (E) OR EXIST | EXISTING |
| EXT | EXTERIOR |
| FTG | FOOTING |
| FV | FIELD VERIFY |
| GALV | GALVANIZED |
| HD | HEADED |
| HT | HEIGHT |
| INT | INTERIOR |
| ID | INSIDE DIAMETER |
| LLH | LONG-LEG HORIZONTAL |
| LLV | LONG-LEG VERTICAL |
| MIN | MINIMUM |
| MANF | MANUFACTURER |
| NTS | NOT TO SCALE |
| O.C. | ON CENTER |
| OD | OUTSIDE DIAMETER |
| OH | OPPOSITE HAND |
| R | RADIUS |
| REINF | REINFORCEMENT |
| REQ'D | REQUIRED |
| SF | SQUARE FEET |
| SHT | SHEET |
| SIM | SIMILAR |
| SOG | SLAB-ON-GRADE |
| STIFF | STIFFENER |
| TYP | TYPICAL |
| UNO | UNLESS NOTED OTHERWISE |
| VIF | VERIFY IN FIELD |
| WWF | WELDED WIRE FABRIC |
| WWR | WELDED WIRE REINFORCEMENT |
| W/ | WITH |
| WP | WORKING POINT |

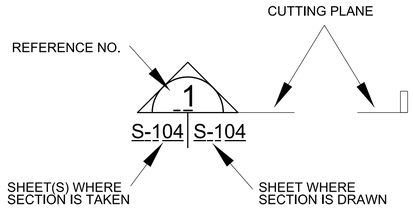
## DRAWING SYMBOLS




### ELEVATION REFERENCE




### DETAIL REFERENCE




### SECTION CUT

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INDEX, SYMBOLS,
& ABBREVIATIONS

Sheet reference number:
G-002
Sheet 2 of 23

1.0 DESIGN CRITERIA:

A. BUILDING CODES AND SPECIFICATIONS:

1. INTERNATIONAL BUILDING CODE 2009 (IBC) AS MODIFIED BY UFC 1-200-01
2. AMERICAN CONCRETE INSTITUTE (ACI 318)
3. AMERICAN INSTITUTE OF STEEL CONSTRUCTION
4. AMERICAN WELDING SOCIETY, A.W.S.

B. LIVE LOADS

ROOF----------100 PSF
FLOOR----------100 PSF

SNOW LOAD:

GROUND SNOW LOAD (Pg) = 60 PSF
IMPORTANCE FACTOR (I) = 1.1
EXPOSURE CATEGORY (Ce) = 1.0
THERMAL CATEGORY (Ct) = 1.0

C. WIND LOAD:

BASIC WIND SPEED: 130 MPH
IMPORTANCE FACTOR (I): 1.15
EXPOSURE CATEGORY: C
ENCLOSURE CLASSIFICATION: ENCLOSED

D. EARTHQUAKE:

OCCUPANCY CATEGORY=III
Ie= 1.25
Ss= 1.0
Sds= 0.67
S1= 0.4
Sd1= 0.37
SITE CLASS: C
BASIC SEISMIC-FORCE RESISTING SYSTEM:
SPECIAL REINFORCED CONCRETE SHEARWALLS
SEISMIC DESIGN CATEGORY= D
ANALYSIS PROCEDURE = EQUIVALENT LATERAL FORCE PROCEDURE

E. SOILS

SOIL DENSITY (γ): 120 PCF
ANGLE OF INTERNAL FRICTION OF THE SOIL (ϕ) : 30 DEGREES
AT-REST PRESSURE (EFP): 60 PSF PER FOOT OF DEPTH
ACTIVE PRESSURE (EFP): 40 PSF PER FOOT OF DEPTH

2.0 GENERAL

2.1 CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND SITE CONDITIONS PRIOR TO CONSTRUCTION/FABRICATION. CONTRACTOR SHALL NOTIFY CONTRACTING OFFICER OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

2.2 THE STRUCTURE (MEMBERS AND CONNECTIONS) HAS BEEN DESIGNED TO SUPPORT IN-PLACE DESIGN LOADS ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LIMITING CONSTRUCTION LOADS SUCH THAT THESE LOADS DO NOT EXCEED THE DESIGN LOADS NOTED ABOVE.

2.3 IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE CONSTRUCTION METHODS, PROCEDURES, AND SEQUENCES TO ENSURE STABILITY AND SAFETY DURING CONSTRUCTION. THE CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO PROTECT AND MAINTAIN THE STRUCTURAL INTEGRITY OF ALL NEW AND EXISTING CONSTRUCTION AT ALL STAGES.

2.4 SECTIONS AND DETAILS SHOWN ON THE STRUCTURAL DRAWINGS SHALL BE CONSIDERED TYPICAL FOR SIMILAR CONDITIONS THAT DO NOT HAVE A SPECIFIC SECTION INDICATED.

2.5 THE CONTRACTOR SHALL COORDINATE STANDARD DRAWINGS WITH THE VENDOR/MANF. SHOP DRAWINGS TO VERIFY SIZES AND LOCATIONS OF OPENINGS, SLEEVES, INSERTS, DEPRESSIONS, FINISHES, SLOPES, ETC. ANY DISCREPANCY SHALL BE BROUGHT TO THE ATTENTION OF THE CONTRACTING OFFICER.

2.6 SEE CIVIL SITE LAYOUT DRAWINGS (PART OF SITE ADAPTION) FOR ACTUAL FINISHED FLOOR ELEVATIONS (F.F.E.) FOR ALL BUILDINGS. ELEVATIONS SHOWN IN STRUCTURAL DOCUMENTS WILL BE BASED ON REFERENCED F.F.E. EQUAL TO 100'-0", U.O.N.

2.7 ANY DISCREPANCIES BETWEEN DRAWINGS, SPECIFICATIONS, REFERENCE STANDARDS, OR GOVERNING CODE, THE MORE STRINGENT REQUIREMENTS SHALL GOVERN. CONTRACTOR SHALL NOTIFY THE CONTRACTING OFFICER OF DISCREPANCIES AND OBTAIN DIRECTION PRIOR TO PROCEEDING.

2.8 CONTRACTOR SHALL PROVIDE TEMPORARY SHORING AND BRACING OF ALL STRUCTURAL WORK, AND SOIL EXCAVATION AS REQUIRED. SHORING AND BRACING SHALL NOT BE REMOVED UNTIL ALL FINAL CONNECTIONS HAVE BEEN COMPLETED IN ACCORDANCE WITH THE DRAWINGS, AND MATERIALS HAVE ACHIEVED DESIGN STRENGTH.

2.9 HEAVY COMPACTION AND OPERATION EQUIPMENT SHALL BE KEPT A MINIMUM DISTANCE EQUAL TO THE HEIGHT OF THE BACKFILL ABOVE THE FOUNDATION FROM THE BACK FACE OF THE REINFORCED CONCRETE WINGWALLS. THE CONTRACTOR SHOULD TAKE CARE NOT TO OVERCOMPACT THE BACKFILL DIRECTLY BEHIND THESE RETAINING WALLS.

3.0 FOUNDATIONS

3.1 SEE CIVIL DRAWINGS AND SPECIFICATIONS (PART OF SITE ADAPTION) FOR EARTHWORK PREPARATION OF FOUNDATIONS INCLUDING THE REMOVAL OF ORGANIC MATERIALS, COMPACTING SOILS BENEATH STRUCTURES, BACK FILL REQUIREMENTS FOR OVER EXCAVATION AND REMOVAL OF UNSUITABLE MATERIALS.

3.2 MAXIMUM ASSUMED NET SOIL BEARING PRESSURE USED FOR DESIGN: 3000 PSF .

3.3 ASSUMED UNIT WEIGHT OF SOIL USED FOR DESIGN: 120 PCF

3.4 ALL FOUNDATION BEARING SURFACES SHALL BE REVIEWED BY THE GEOTECHNICAL ENGINEER PRIOR TO PLACING CONCRETE TO ENSURE THEIR COMPLIANCE WITH THE PRESSURES NOTE ABOVE.

3.5 ALL FOOTINGS SHALL PROJECT AT LEAST 1'-6" INTO UNDISTURBED NATURAL SOIL OR COMPACTED ENGINEERED FILL HAVING A SOIL BEARING PRESSURE THAT MEETS OR EXCEEDS THAT SPECIFIED ABOVE.

3.6 ALL DISTURBED EARTH UNDER FOOTINGS SHALL BE REPLACED WITH LEAN CONCRETE.

3.7 CONCRETE SHALL NOT BE PLACED OVER FROZEN SOIL OR FOOTING EXCAVATIONS SUBJECTED TO WATER.

4.0 CONCRETE

4.1 ALL CONCRETE WORK INCLUDING DETAILING, FABRICATION, PLACEMENT OF REINFORCING, MIXING, HANDLING, PLACING, FINISHING, AND CURING SHALL CONFORM TO THE FOLLOWING DOCUMENTS:

ACI 301----------"STANDARD SPECIFICATIONS FOR STRUCTURAL CONCRETE"
ACI 315----------"MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES"
ACI 318----------"BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE"

4.2 ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS, U.O.N. ALL CONCRETE SHALL CONFORM TO ASTM C94.

4.3 REINFORCING BARS SHALL BE DEFORMED TYPE CONFORMING TO ASTM A615 GRADE 60 U.O.N.

4.4 WELDED WIRE REINFORCEMENT SHALL CONFORM TO ASTM A185. MINIMUM LAP AND EMBEDMENT TO BE THE GREATER OF ONE CROSS WIRE SPACING PLUS 2" OR 6", WHICHEVER IS GREATER.

4.5 FABRICATE AND PROVIDE BAR SUPPORTING ACCESSORIES IN ACCORDANCE WITH ACI MANUAL OF STANDARD PRACTICE AND C.R.S.I. SPECIFICATIONS. REINFORCING SHALL NOT BE WELDED IN ANY MANNER U.O.N. IN CONSTRUCTION DOCUMENTS.

4.6 REINFORCING SPLICES SHALL BE CONFORM WITH ACI 318 CLASS "B" TENSION LAP SPLICES, U.O.N. NO SPLICES ARE PERMITTED IN THE PILASTERS AND DOOR HEADER. SPLICES IN THE 12" HEADWALL, IF NECESSARY, SHALL BE STAGGERED ON OPPOSITE FACES AND SPLICES OF ADJACENT PARALLEL BARS WITHIN THE SAME LAYER SHALL BE STAGGERED. STAGGER 12" HEADWALL SPLICES BY THE SPLICE LENGTH INDICATED IN THE DRAWINGS.

4.7 CONCRETE COVERAGE OF REINFORCEMENT FOR CAST-IN-PLACE CONSTRUCTION U.O.N.:

CONCRETE CAST AGAINST EARTH:.....3 INCHES
FORMED CONCRETE EXPOSED TO EARTH OR WEATHER:
NO. 6 BAR AND LARGER.....2 INCHES
NO. 5 BAR AND SMALLER.....1 1/2 INCHES
CONCRETE NOT EXPOSED TO WEATHER:
SLABS, WALLS, JOISTS.....1 INCHES
BEAMS AND COLUMNS.....1 1/2 INCHES
SLAB ON GRADE.....MID-DEPTH OF SLAB

4.8 PROVIDE REINFORCING BARS IN CONCRETE FOOTINGS TO MATCH THE SIZE AND SPACING OF THE HORIZONTAL REINFORCING AT ALL CORNERS AND INTERSECTIONS OF STRIP FOOTINGS. PROVIDE LEG LENGTH EQUIVALENT TO CLASS "A" TENSION LAP SPLICE U.O.N.

4.9 PROVIDE DOWEL TO FOUNDATION WITH 90 DEGREE HOOK TO MATCH SIZE AND SPACING OF VERTICAL REINFORCING AT ALL PEDESTALS, WALLS, AND COLUMNS.

4.10 FOOTINGS AND SLABS SHALL HAVE NO HORIZONTAL JOINTS (POURED TO THEIR FULL DEPTHS IN ONE OPERATION). ANY STOP IN CONCRETE WORK SHALL BE BULKHEAD AND KEYED, U.O.N.

4.11 REINFORCEMENT SHALL NOT BE BENT OR STRAIGHTENED IN A MANNER THAT WILL DAMAGE THE MATERIAL. BARS WITH WITH KINKS OR IMPROPER BENDS SHALL NOT BE USED.

4.12 REINFORCEMENT SHALL BE CONTINUOUS THROUGH ALL CONSTRUCTION JOINTS, BUT DISCONTINUOUS THROUGH ALL CONTROL JOINTS, U.O.N..

4.13 REFER TO GEOTECHNICAL REPORT FOR RECOMMENDATIONS RELATIVE TO SUBGRADE PREPARATION FOR SLAB ON GRADE WORK.

5.0 STRUCTURAL STEEL

5.1 STRUCTURAL STEEL FABRICATION, ERECTION, AND CONNECTION DESIGN SHALL CONFORM TO A.I.S.C.'S "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS."

5.2 STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING ASTM DESIGNATIONS:

W AND S SHAPES.....ASTM A36
STEEL CHANNELS, ANGLES, PLATES AND BARS: .....ASTM A36
RECTANGULAR, SQUARE, AND ROUND HSS.....ASTM A500, GRADE B
STEEL PIPE (HSS).....ASTM A53, GRADE B

5.3 STRUCTURAL FASTENERS SHALL CONFORM TO THE FOLLOWING ASTM DESIGNATIONS:

THREADED RODS.....ASTM A36
HEADED STUDS.....ASTM A108, GRADES 1015 TO 1020 (60 KSI TENSILE STRENGTH)

5.4 BOLTED CONNECTIONS SHALL CONFORM TO RCSC'S "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS". ALL BOLTS SHALL BE 3/4" DIAMETER UNLESS OTHERWISE NOTED.

5.5 WELDED CONNECTIONS SHALL CONFORM TO AWS D1.1 "STRUCTURAL WELDING CODE-STEEL". MINIMUM SIZE FILLET WELDS SHALL BE 3/16" UNLESS OTHERWISE NOTED AND ELECTRODES SHALL BE E70xx. WELDERS SHALL BE QUALIFIED IN ACCORDANCE WITH AWS.

5.6 UNLESS SPECIFICALLY DETAILED ON THE CONTRACT DRAWINGS, ALL FRAMED BEAM CONNECTIONS SHALL BE DESIGNED BY A QUALIFIED PROFESSIONAL ENGINEER EMPLOYED BY THE FABRICATOR. STANDARD BEAM CONNECTIONS (NON-COMPOSITE) SHALL BE DESIGNED BASED ON A REACTION EQUAL TO ONE-HALF THE MAXIMUM TOTAL UNIFORM LOAD CAPACITY FROM AISC'S "MAXIMUM TOTAL UNIFORM LOAD" TABLE MULTIPLIED BY A FACTOR OF 1.2, UNLESS REACTIONS ARE SHOWN ON STRUCTURAL DRAWINGS. MINIMUM REACTION TO DESIGN FOR SHALL BE (12.0 KIPS).

5.7 ALL EXTERIOR STEEL EXPOSED TO THE WEATHER SHALL BE HOT DIPPED GALVANIZED, UON. MEMBERS NOT REQUIRED FOR CORROSION PROTECTION SHALL RECEIVE ONE COAT OF STANDARD PRIMER PAINT. DO NOT PRIME OR PAINT SURFACES WHICH ARE TO RECEIVE FIELD WELDED HEADED SHEAR STUDS. PROVIDE 3" MINIMUM CONCRETE COVER FOR ALL STEEL BELOW GRADE AND PAINT WITH 2 COATS OF COAL TAR EPOXY. EPOXY SHALL MEET THE REQUIREMENTS OF PAINT SPECIFICATION SSPC-PAINT 16.

5.8 ALL STIFFENERS AND GUSSETS PLATES SHALL BE MINIMUM 3/8" THICK, UNLESS OTHERWISE NOTED.

6.0 LIGHTNING PROTECTION SYSTEM (LPS)

6.1 ALL METAL PARTS, TO INCLUDE REINFORCEMENT IN FLOOR, WALLS/ARCH, LOUVERS, VENTILATOR, DOOR AND DOOR FRAME, ETC., SHALL BE MADE ELECTRICALLY CONTINUOUS BY BONDING PER NFPA 780 APPROVED METHOD(S) AT 5 LINEAR FEET INTERVALS. ELECTRICAL CONTINUITY SHALL BE PROVIDED ACROSS FLOOR EXPANSION AND ISOLATION JOINTS TO ARCH/WALL REINFORCEMENT AND SHALL BE PROVIDED DURING CONSTRUCTION. SEE ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION REGARDING LPS.

DESIGNER NOTES: TO BE REMOVED WHEN PREPARING CONSTRUCTION DRAWINGS FOR SITE ADAPTION OF THIS DESIGN.

1. THE MAGAZINE HAS BEEN ANALYZED FOR THE LOADS LISTED ON THIS SHEET AND DETERMINED TO BE ADEQUATE UNDER THESE LOADINGS. HOWEVER, THE DESIGNER SHOULD VERIFY THE STRUCTURE FOR THE SITE-SPECIFIC LOADING CRITERIA. IF SITE-SPECIFIC LOADS EXCEED THESE LISTED ON THIS SHEET, THE DESIGNER SHOULD ADDRESS ALL DEFICIENCIES THAT DO NOT MEET CURRENT BUILDING CODES.
2. FOUNDATIONS SHALL BE REVISED TO REFLECT SPECIFIC SITE SOIL CONDITIONS INCLUDING LOCAL SITING, TOPOGRAPHIC CONDITIONS, AND FROST PENETRATION DEPTHS. FINAL DESIGN OF DRAINAGE SYSTEM AND WATERPROOFING AROUND MAGAZINE IS THE RESPONSIBILITY OF THE SITE -ADAPT DESIGNER OF RECORD.
3. STRUCTURAL COMPONENTS, WITH THE EXCEPTION OF THE FOUNDATION (FOOTINGS), SLAB-ON-GRADE, AND WING WALLS SHALL NOT BE MODIFIED WITHOUT THE APPROVAL OF THE CONTRACTING OFFICER, WHO SHOULD CONSULT WITH THE U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE (STRUCTURAL BRANCH). STRUCTURE HAS BEEN DETERMINED TO BE ADEQUATE FOR THE DESIGN CRITERIA LISTED ON THIS SHEET.
4. SHEETS S701 - S705 (HIGH SECURITY HASP) AND S701(A) - S705(A) (ILD) IDENTIFY TWO DIFFERENT LOCKING SYSTEMS. THE DESIGNER SHALL VERIFY WITH THE CONTRACTING OFFICER THE CORRECT LOCKING SYSTEM REQUIRED AND REMOVE THE REDUNDANT SHEETS FROM THE CONSTRUCTION CONTRACT DOCUMENTS FOR THE SYSTEM NOT USED.

STRUCTURAL DESIGNATION (7-BAR) NOTES:

1. ANY DEVIATION FROM THE STANDARD APPROVED DESIGN DRAWINGS FOR THE CONCRETE HEADWALL, STEEL DOOR, CONCRETE ROOF OR THEIR SUPPORTS WITHOUT WRITTEN APPROVAL FROM THE DEPARTMENT OF DEFENSE EXPLOSIVE SAFETY BOARD (DDESB) MAY REQUIRE THE MAGAZINE TO BE CONSIDERED AN UNDEFINED MAGAZINE AND MAY SEVERELY RESTRICT THE ALLOWABLE STORAGE CAPACITY.
2. IF CONSTRUCTED PER THESE DRAWINGS, FACILITY MEETS BLAST-RESISTANT DESIGN CRITERIA FOR A 7-BAR STRUCTURAL DESIGNATION PER DOD 6055.09-M. THIS DESIGNATION IN NO WAY IMPLIES VALIDATION OF THE DESIGN AGAINST OTHER LOAD CASES.

1. THIS STANDARD DESIGN DRAWING DATED SEPTEMBER 2013, STD 421-80-09 SHEETS 1-23, UPDATE AND SUPERSEDE THE STANDARD DESIGN OF MAGAZINE, CONCRETE OVAL-ARCH EARTH-COVERED, STD 33-15-74.

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GENERAL NOTES

Sheet reference number:
S-001
Sheet 3 of 23

STANDARD DESIGN DRAWINGS - FINAL

## SPECIAL INSPECTION SCHEDULE/VERIFICATION

| ITEM | EXTENT OF INSPECTION [1] | REFERENCE | COMMENTS/SCOPE |
|---|---|---|---|
| **CONCRETE CONSTRUCTION** | | | |
| REINFORCING STEEL PLACEMENT | P | ACI 318: 3.5, 7.1-7.7 | INSPECT SIZE, SPACING, COVER, POSITIONING AND GRADE OF REINFORCING STEEL. VERIFY THAT REINFORCING BARS ARE FREE OF FORM OIL OR OTHER DELETERIOUS MATERIALS. INSPECT BAR LAPS AND MECHANICAL SPLICES. VERIFY THAT BARS ARE ADEQUATELLY TIED AND SUPPORTED ON CHAIRS OR BOLSTERS |
| WELDING OF RIENFORCEMENT | C, P | AWS D1.4, ACI 318:3.5.2 | VISUALLY INSPECT ALL REINFORCING STEEL WELDS. VERIFY WELDABILITY OF REINFORCING STEEL. INSPECT PREHEATING OF STEEL WHEN REQUIRED. |
| CONCRETE PLACEMENT | C | ACI 318: 5.9, 5.10 | INSPECT PLACEMENT OF CONCRETE. VERIFY THAT CONCRETE CONVEYANCE AND DEPOSITING AVOIDS SEGREGATION OR CONTAMINATION. VERIFY THAT CONCRETE IS PROPERLY CONSOLIDATED |
| SAMPLING AND TESTING OF CONCRETE | C | ASTM C 172<br>ASTM C 31<br>ACI 318: 5.6, 5.8 | TEST CONCRETE COMPRESSIVE STRENGTH, SLUMP, AIR-CONTENT AND TEMPERATURE |
| CURING AND PROTECTION | P | ACI 318: 5.11-5.13 | INSPECT CURING, COLD WEATHER PROTECTION AND HOT WEATHER PROTECTION PROCEDURES |
| FORMWORK | P | ACI 318: 6.1.1 | INSPECT FORWORK FOR SHAPE, LOCATION, AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED |
| | | | |
| **DOOR CONSTRUCTION** | | | |
| FABRICATOR CERTIFICATION/QUALITY CONTROL PROCEDURES | S | | REVIEW OF FABRICATOR'S QUALITY CONTROL PROCEDURES OR AISC CERTIFICATION |
| FABRICATOR INSPECTION | | | INSPECT IN-PLANT FABRICATION, OR REVIEW FABRICATOR'S APPROVED INDEPENDENT INSPECTION AGENCY'S REPORTS |
| | | | |
| **SPECIAL ITEMS RELATED TO THE BLAST STRUCTURAL STRENGTH DESIGNATION** | | | |
| REBAR FARADAY-SHIELD | P | DWGS E-101; E-102 | INSPECT REINFORCING STEEL TO ENSURE ELECTRICAL CONTINUITY BETWEEN THE ARCHED ROOF, WALLS, SLAB AND FOUNDATION THROUGH BONDING WELDS. DOCUMENT BONDS WITH PHOTOS AND CONTINUITY TEST. |
| ECM GROUNDNG | P | DWGS E-101; E-102 | VISUALLY INSPECT TO ENSURE ECM DOOR AND FOUNDATION IS BONDED TO THE GROUNDING SYSTEM. DOCUMENT WITH PHOTOS. |
| GROUNDING SYSTEM | P | DWGS E-101; E-102, NFPA 780, DA PAM 385-64, 17-27. | VISUALLY INSPECT GROUNDING SYSEM CONDUCTORS TO ENSURE NO DAMAGE, BREAKAGE, OR CORROSION HAS OCCURRED TO THE CONDUCTORS DURING INSTALL AND BEFORE EARTH BURIAL. |
| INDIVIDUAL BONDS | P | DWGS E-101, E-102, NFPA 780, 8.9 DA PAM 385-64, 17.27. | INSPECT ALL BONDS FOR LOOSE CONNECTIONS THAT MIGHT RESULT IN HIGH-RESISTANCE CONNECTIONS. |
| LPS COMPONENTS | P | NFPA 780, 8.9 DA PAM 385-64, 17-27. | INSPECT LPS COMPONENTS FOR SECURE MOUNTING AND PROTECTION AGAINST ACCIDENTAL MECHANICAL DISPLACEMENT. |
| LPS TESTING | S | NFPA 780, 8.9 DA PAM 385-64, 17-28. | PERFORM BONDING TEST ACROSS EACH BOND, AND AN EARTH ELECTRODE TEST OF THE LPS. |
| EARTH COVER | P | DWGS S-301-302 | INSPECT DEPTH GAUGES ON ROOF PRIOR TO EARTH COVER PLACEMENT FOR SIZE AND STABILITY. INSPECT EARTH COVER DEPTH AND SLOPE TO ENSURE A 2' MIN. IS PROVIDED ABOVE STRUCTURE |
| | | | |

**SPECIAL INSPECTION NOTES:**

1 INSPECTION INTERVALS ARE AS FOLLOWS:
**C** - Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed
**P** - Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.
**S** - Submittal
2 STRUCTURAL TEST AND SPECIAL INSPECTIONS ARE BASED ON CHAPTER 17 OF THE IBC 2009 EDITION
3 CONTRACTOR SHALL HIRE A QUALIFIED INSPECTION AND TESTING AGENCY TO PERFORM SPECIAL INSPECTIONS AND TESTING IN ACCORDANCE WITH THE IBC. SUBMIT INSPECTION REPORTS TO THE CONTRACTING OFFICER FOR EACH DAY SPECIAL INSPECTIONS AND TESTING IS PERFORMED.

DESIGNER NOTES: TO BE REMOVED WHEN PREPARING CONSTRUCTION DRAWINGS FOR SITE ADAPTION OF THIS DESIGN.

1. SPECIAL INSPECTION SCHEDULE SHALL BE REVISED TO REFLECT SPECIFIC PROJECT REQUIREMENTS IN ACCORDANCE WITH CHAPTER 17 OF THE INTERNATIONAL BUILDING CODE; HOWEVER, AT A MINIMUM THE SPECIAL ITEMS RELATED TO THE 'OTHER EXPLOSIVES SAFETY RELATED ITEMS' SHALL BE INSPECTED AS SHOWN ON THIS SCHEDULE.

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Project Engineer/Architect: Jeff Coulston
Date:

U. S. ARMY CORPS OF ENGINEERS
ENGINEERING AND
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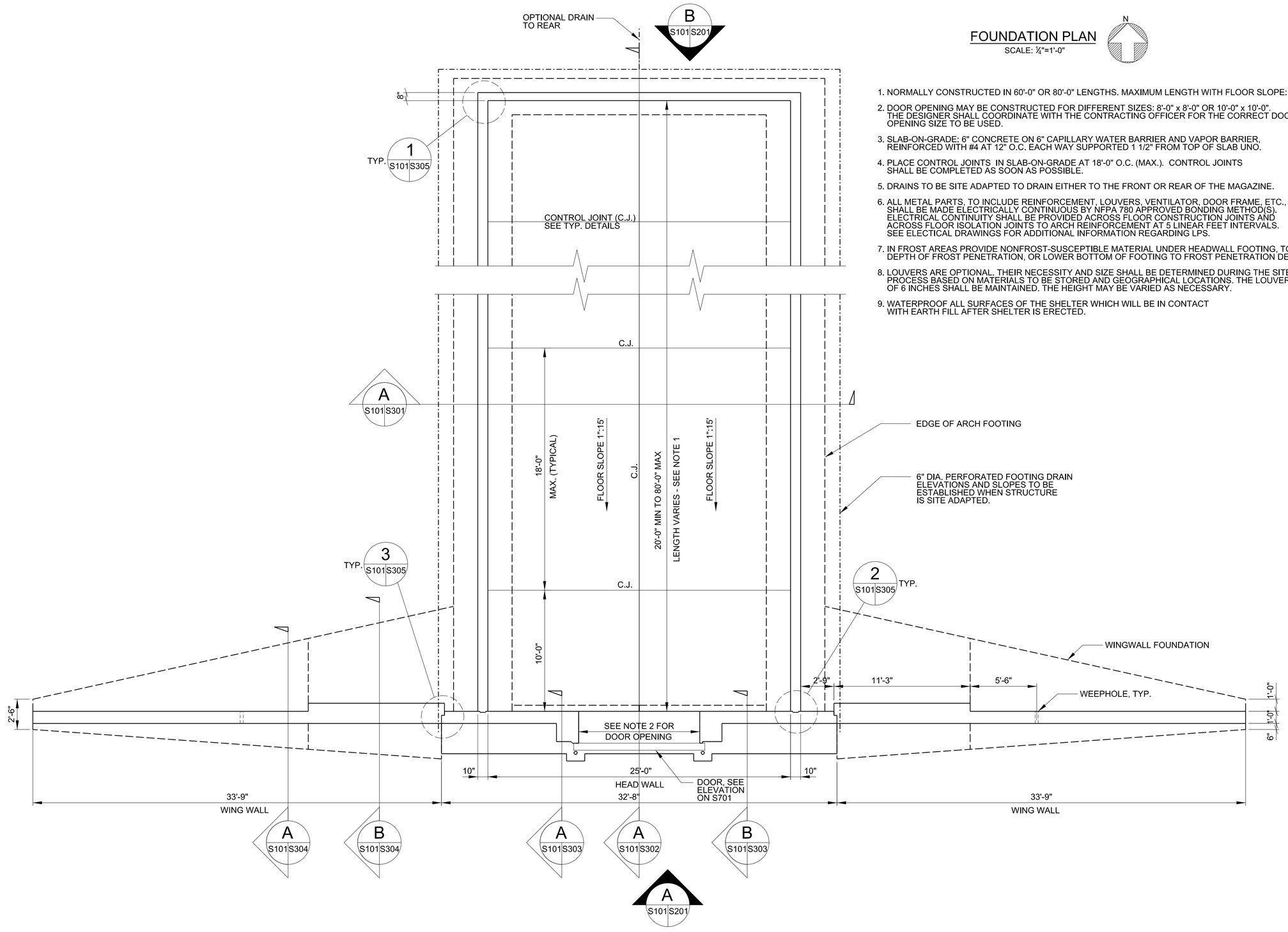
HUNTSVILLE, ALABAMA

CONCRETE OVAL-ARCH,
EARTH COVERED MAGAZINE
STD 421-80-09

SPECIAL INSPECTIONS

Sheet reference number:
S-002
Sheet 4 of 23

STANDARD DESIGN DRAWINGS - FINAL




## FOUNDATION PLAN

SCALE: ¼"=1'-0"

N

1. NORMALLY CONSTRUCTED IN 60'-0" OR 80'-0" LENGTHS. MAXIMUM LENGTH WITH FLOOR SLOPE: 90'-0".
2. DOOR OPENING MAY BE CONSTRUCTED FOR DIFFERENT SIZES: 8'-0" x 8'-0" OR 10'-0" x 10'-0". THE DESIGNER SHALL COORDINATE WITH THE CONTRACTING OFFICER FOR THE CORRECT DOOR OPENING SIZE TO BE USED.
3. SLAB-ON-GRADE: 6" CONCRETE ON 6" CAPILLARY WATER BARRIER AND VAPOR BARRIER, REINFORCED WITH #4 AT 12" O.C. EACH WAY SUPPORTED 1 1/2" FROM TOP OF SLAB UNO.
4. PLACE CONTROL JOINTS IN SLAB-ON-GRADE AT 18'-0" O.C. (MAX.). CONTROL JOINTS SHALL BE COMPLETED AS SOON AS POSSIBLE.
5. DRAINS TO BE SITE ADAPTED TO DRAIN EITHER TO THE FRONT OR REAR OF THE MAGAZINE.
6. ALL METAL PARTS, TO INCLUDE REINFORCEMENT, LOUVERS, VENTILATOR, DOOR FRAME, ETC., SHALL BE MADE ELECTRICALLY CONTINUOUS BY NFPA 780 APPROVED BONDING METHOD(S). ELECTRICAL CONTINUITY SHALL BE PROVIDED ACROSS FLOOR CONSTRUCTION JOINTS AND ACROSS FLOOR ISOLATION JOINTS TO ARCH REINFORCEMENT AT 5 LINEAR FEET INTERVALS. SEE ELECTICAL DRAWINGS FOR ADDITIONAL INFORMATION REGARDING LPS.
7. IN FROST AREAS PROVIDE NONFROST-SUSCEPTIBLE MATERIAL UNDER HEADWALL FOOTING, TO FULL DEPTH OF FROST PENETRATION, OR LOWER BOTTOM OF FOOTING TO FROST PENETRATION DEPTH.
8. LOUVERS ARE OPTIONAL. THEIR NECESSITY AND SIZE SHALL BE DETERMINED DURING THE SITE-ADAPTION PROCESS BASED ON MATERIALS TO BE STORED AND GEOGRAPHICAL LOCATIONS. THE LOUVER WIDTH OF 6 INCHES SHALL BE MAINTAINED. THE HEIGHT MAY BE VARIED AS NECESSARY.
9. WATERPROOF ALL SURFACES OF THE SHELTER WHICH WILL BE IN CONTACT WITH EARTH FILL AFTER SHELTER IS ERECTED.

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| | | | |

Designed by: MER & RWB
Drawn by: MER
Checked by: RSW
Date: SEPT 2013
Scale: AS SHOWN
Drawing code:
Date:
Project Engineer/Architect: Jeff Coulston

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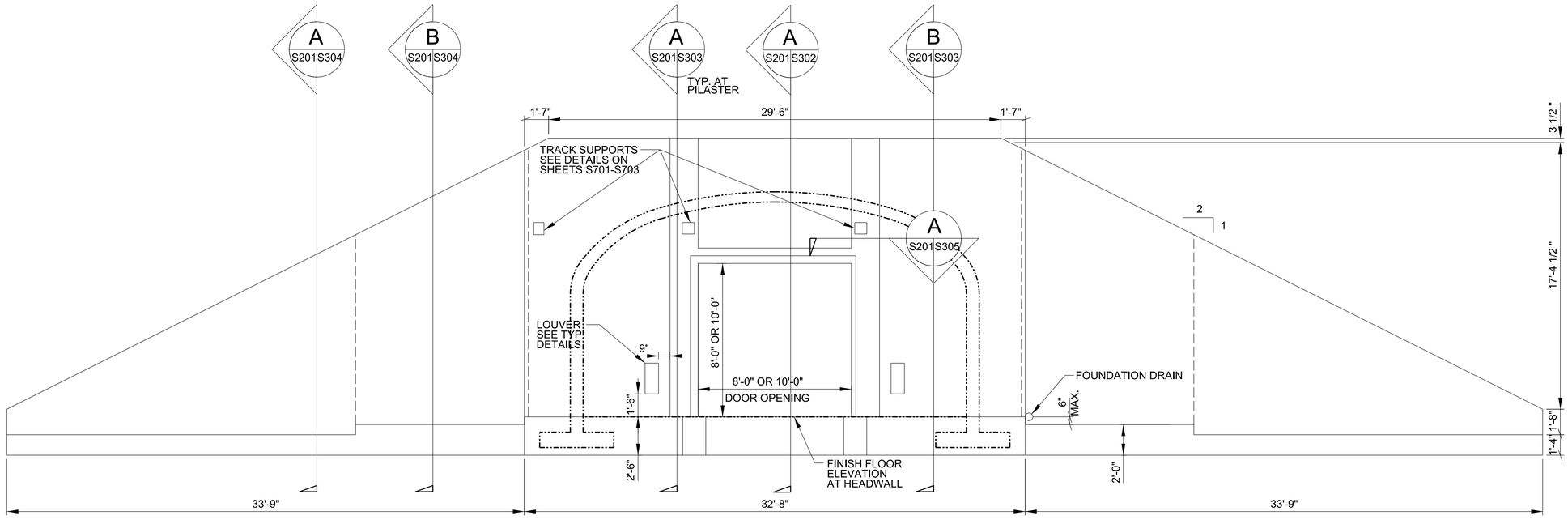
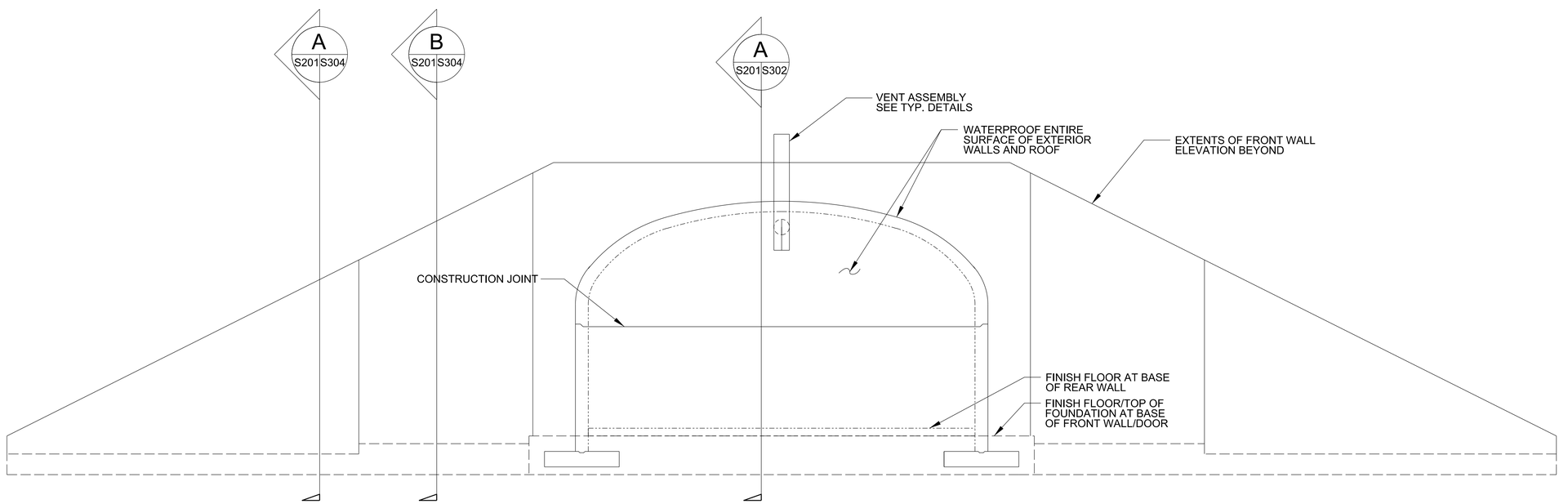
FOUNDATION PLAN

Sheet reference number:
S-101
Sheet 5 of 23

STANDARD DESIGN DRAWINGS - FINAL




WALL ELEVATION A
SCALE: ¼"=1'-0"
S101 S201 S302




WALL ELEVATION B
SCALE: ¼"=1'-0"
S101 S201 S302

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|---|---|---|---|
| | Revisions | | |

Date: SEPT 2013
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Designed by: RWB & MER
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Checked by: RSW
Project Engineer/Architect: Jeff Coulston

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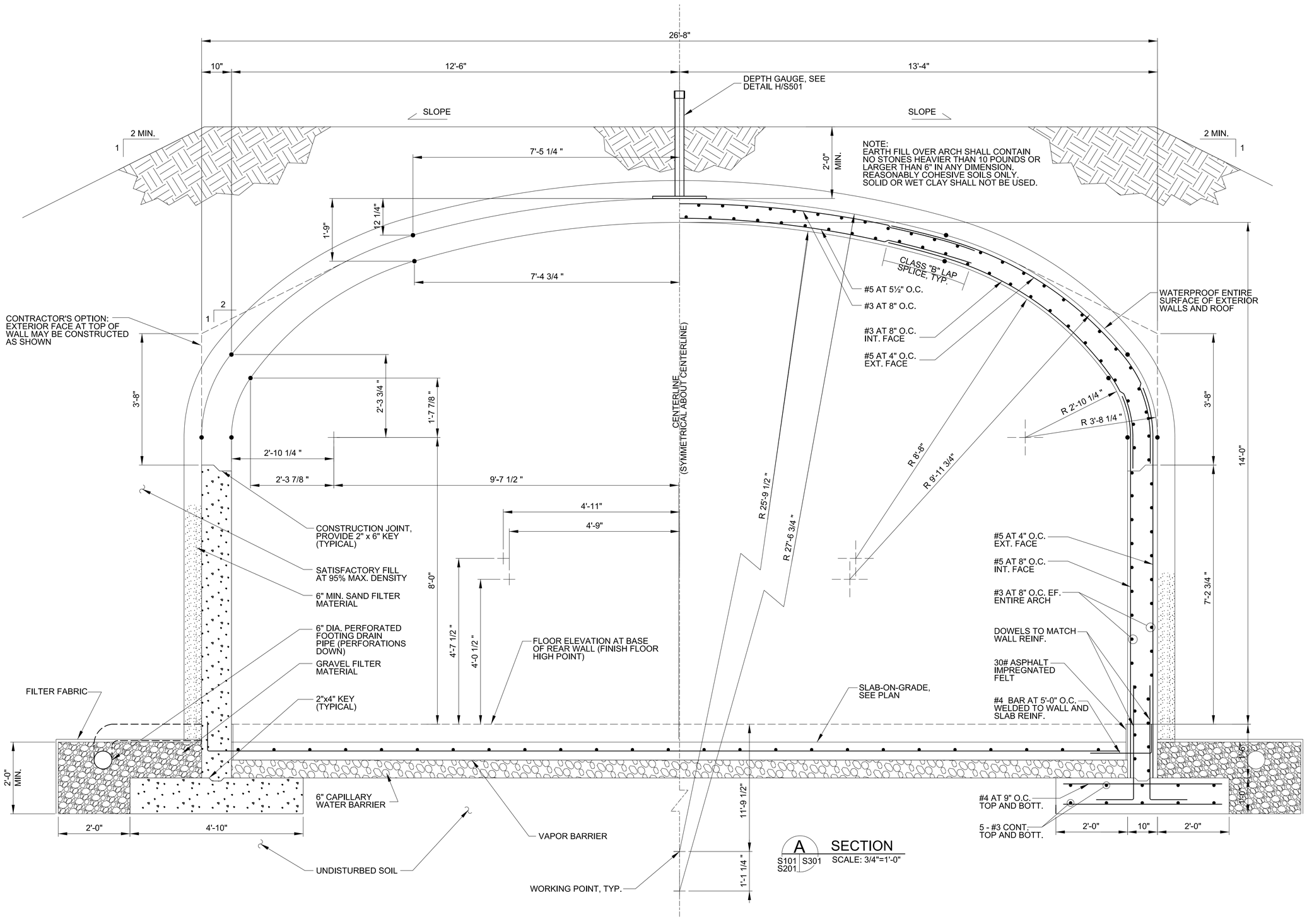
ELEVATIONS

Sheet reference number:
S-201
Sheet 6 of 23

STANDARD DESIGN DRAWINGS - FINAL




A SECTION
S101 S301 S201
SCALE: 3/4"=1'-0"

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|---|---|---|---|---|

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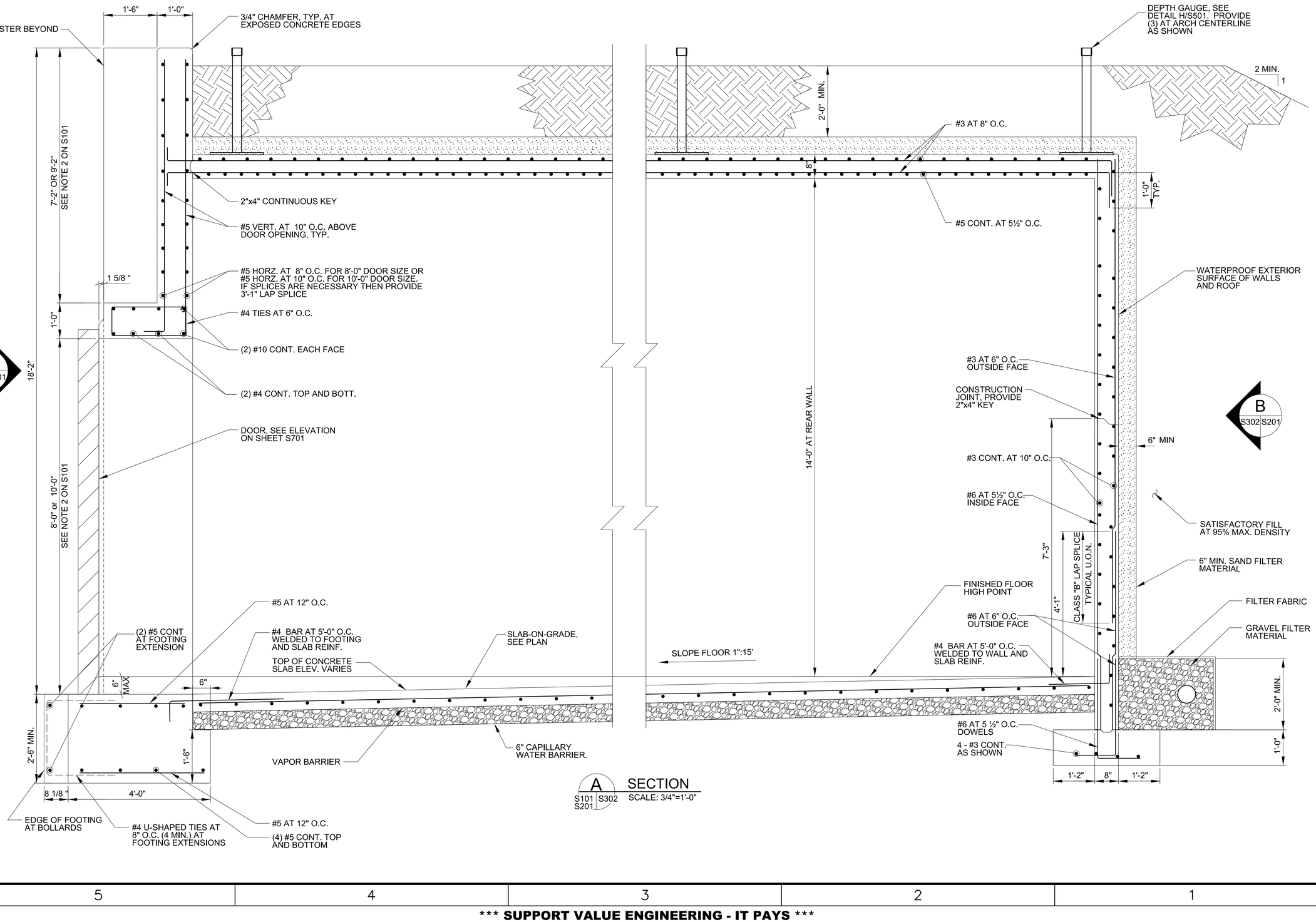
BUILDING SECTION

Sheet reference number:
S-301
Sheet 7 of 23

STANDARD DESIGN DRAWINGS - FINAL

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Revisions

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Checked by: RSW
Project Engineer/Architect: Jeff Coulston
Date: SEPT 2013
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CONCRETE OVAL-ARCH, EARTH COVERED MAGAZINE STD 421-80-09

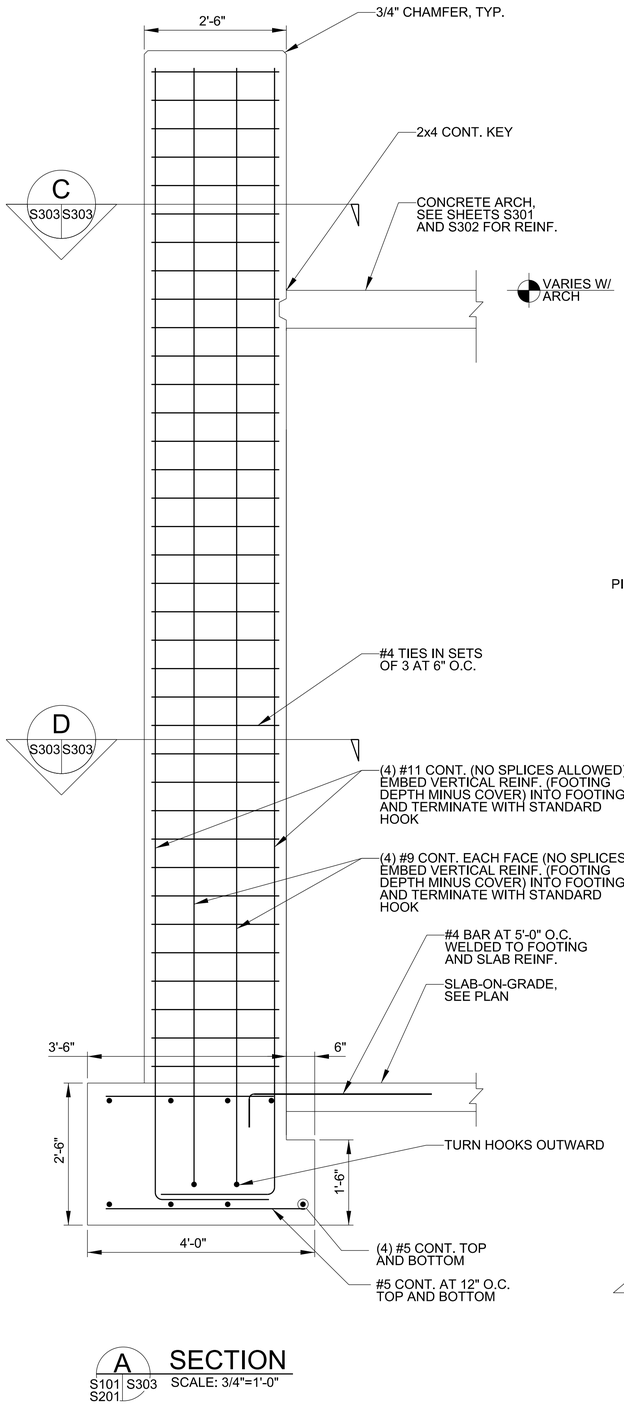
BUILDING SECTION

Sheet reference number:

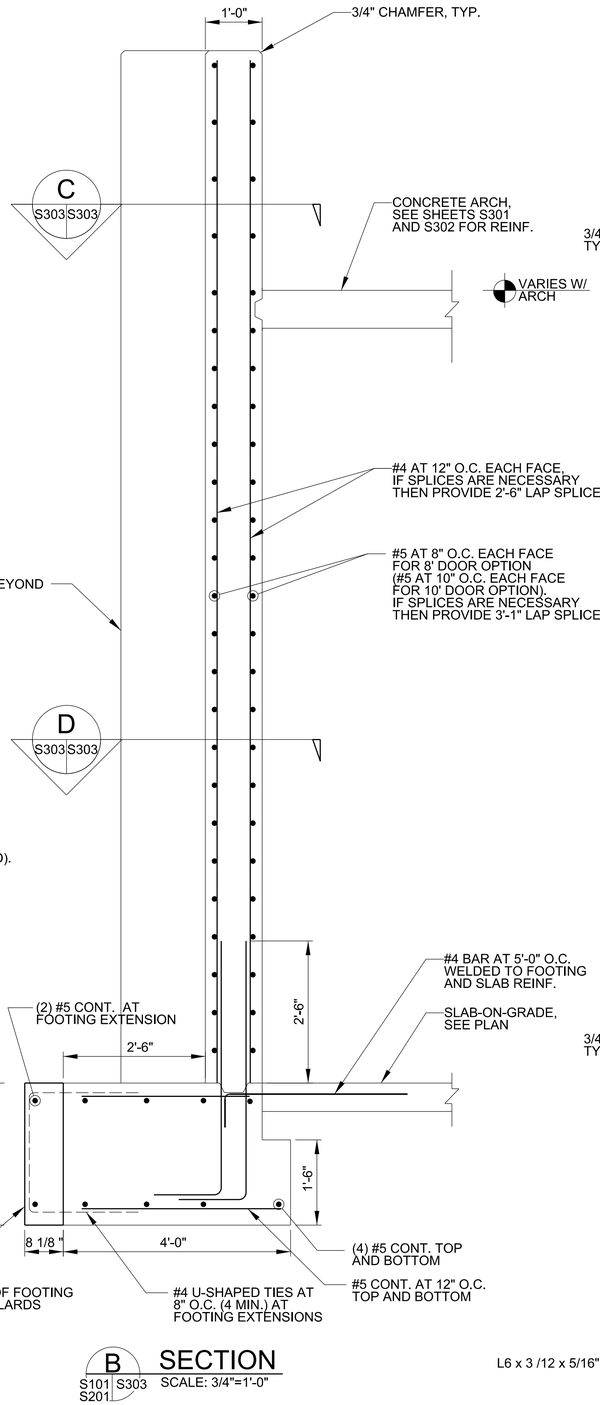
S-302

Sheet 8 of 23

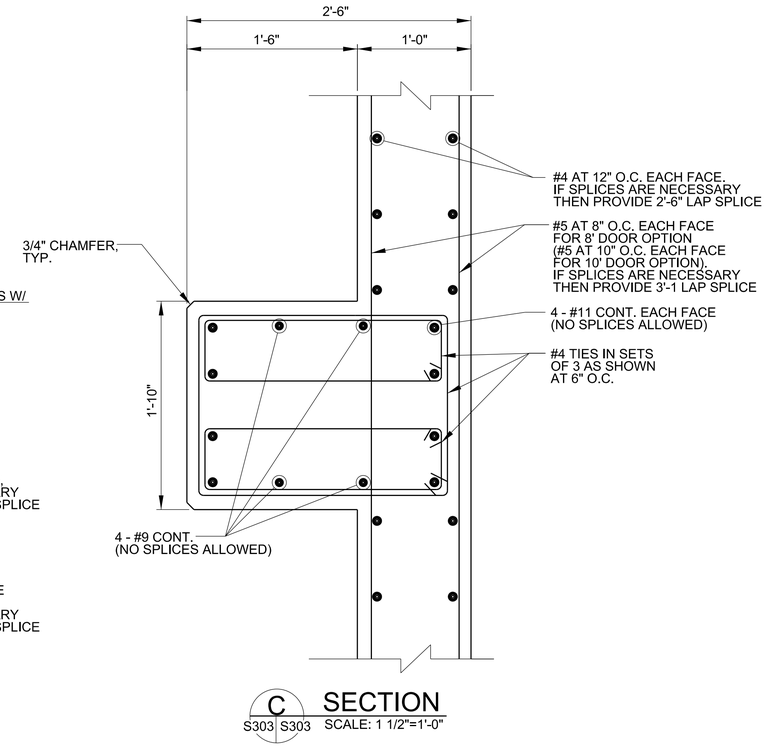
STANDARD DESIGN DRAWINGS - FINAL



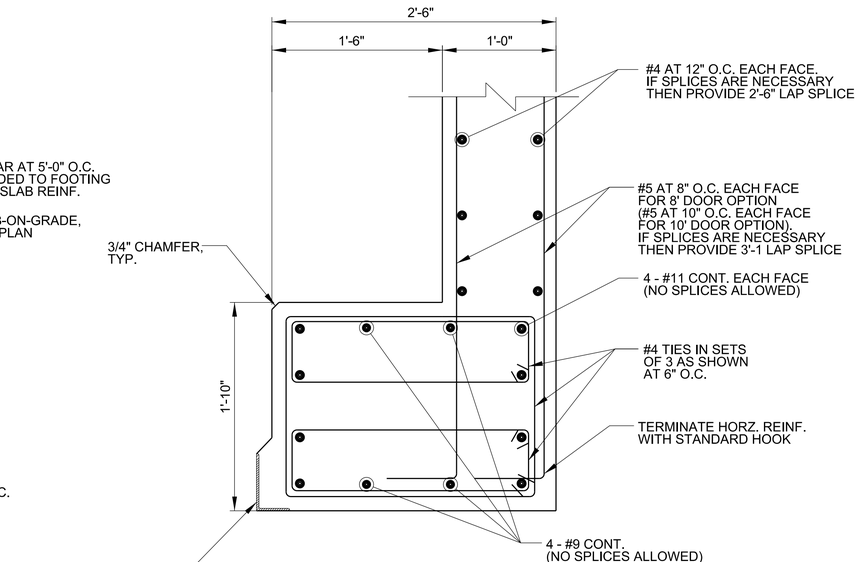

A SECTION
S101 S303 S201 SCALE: 3/4"=1'-0"




B SECTION
S101 S303 S201 SCALE: 3/4"=1'-0"




C SECTION
S303 S303 SCALE: 1 1/2"=1'-0"




D SECTION
S303 S303 SCALE: 1 1/2"=1'-0"

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|---|---|---|---|
| | Revisions | | |

Date: SEPT 2013
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Date:
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Project Engineer/Architect: Jeff Coulston

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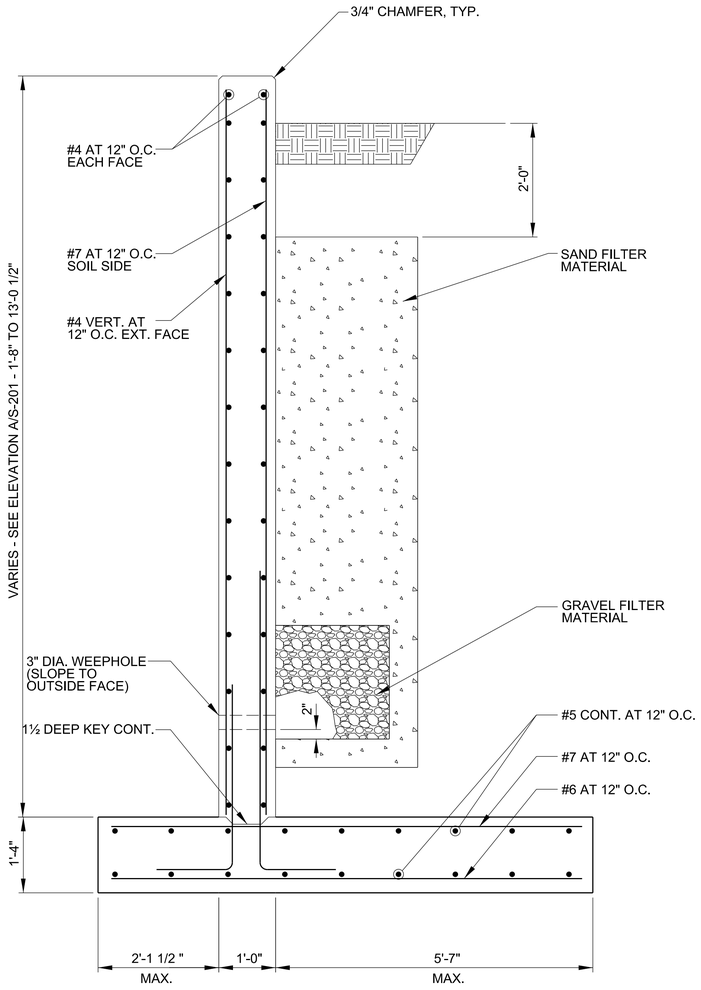
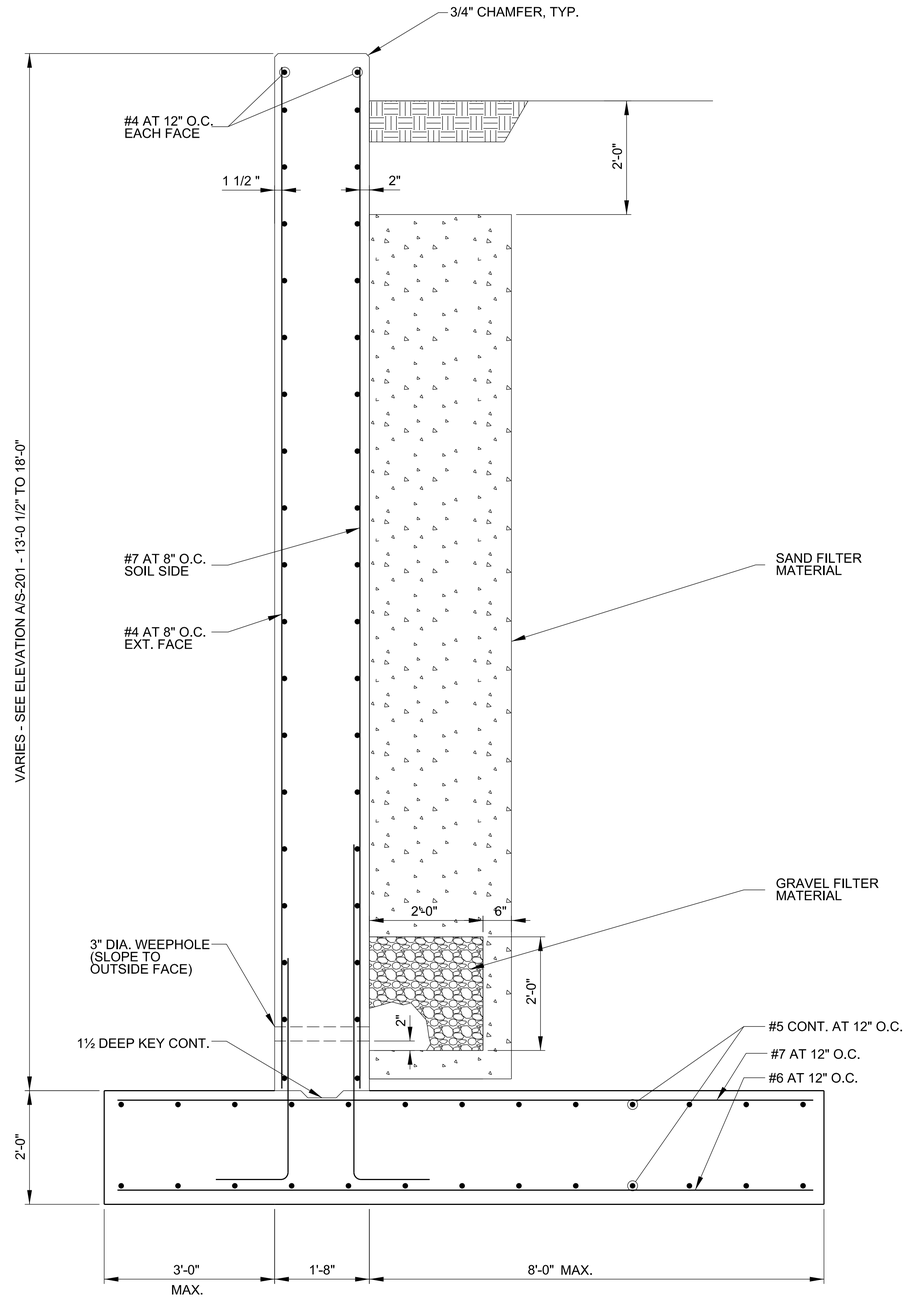
PILASTER SECTIONS

Sheet reference number:
S-303
Sheet 9 of 23

STANDARD DESIGN DRAWINGS - FINAL




A SECTION
S101 S304 S201
SCALE: 3/4"=1'-0"




B SECTION
S101 S304 S201
SCALE: 3/4"=1'-0"

NOTE:
AS AN OPTION, DEPENDING ON SITE-SPECIFIC CONDITIONS, THE WEEPHOLES THROUGH THE WINGWALLS MAY BE REPLACED WITH PERFORATED PIPE DRAINS PLACED IN THE GRAVEL FILTER MATERIAL RUNNING LATERALLY BEHIND THE WINGWALL AND CONNECTED TO THE PERIMETER FOOTING DRAINS FOR THE MAGAZINE.

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Date: SEPT 2013
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Project Engineer/Architect: Jeff Coulston
Date:

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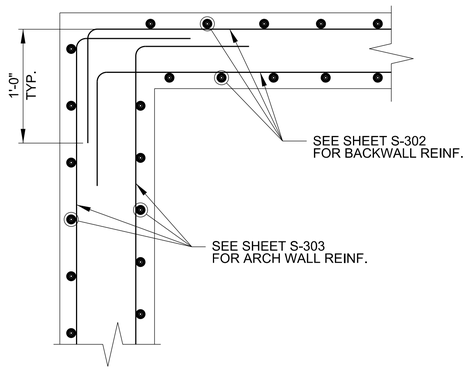
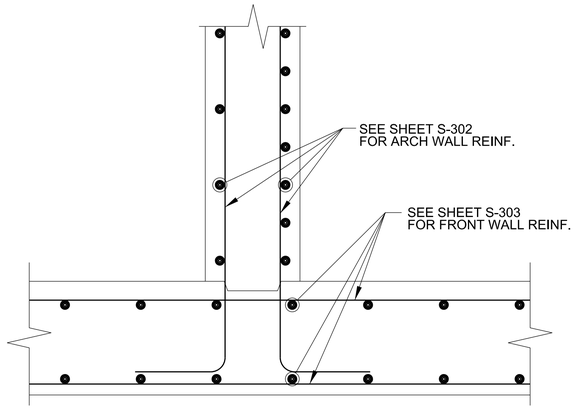
WINGWALL SECTIONS

Sheet reference number:
S-304
Sheet 10 of 23

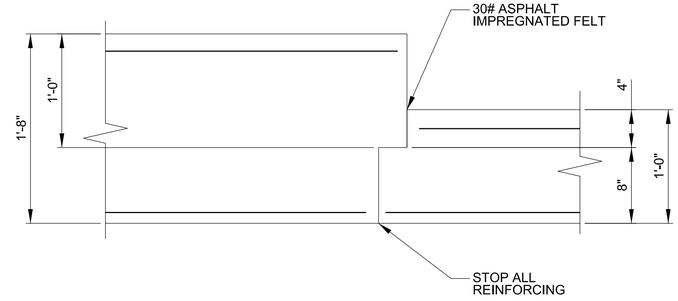
STANDARD DESIGN DRAWINGS - FINAL



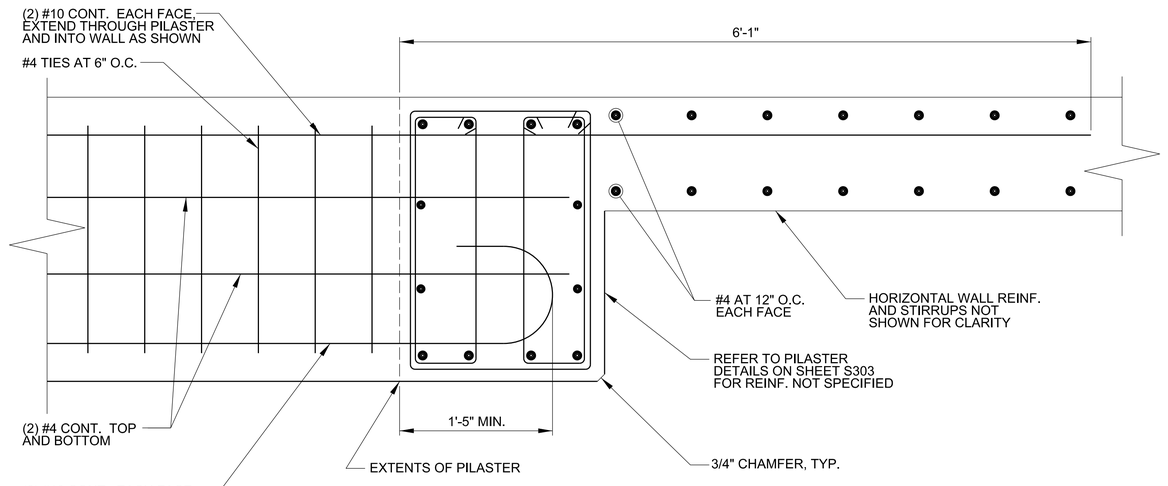

1 DETAIL
S101 | S305 SCALE: 1 1/2"=1'-0"




2 DETAIL
S101 | S305 SCALE: 1 1/2"=1'-0"




3 DETAIL
S101 | S305 SCALE: 1 1/2"=1'-0"




A SECTION
S201 | S305 SCALE: 1 1/2"=1'-0"

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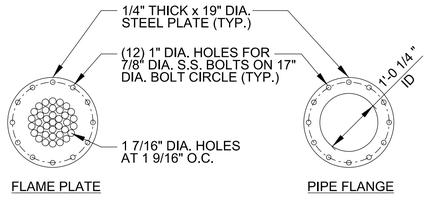
WALL DETAILS

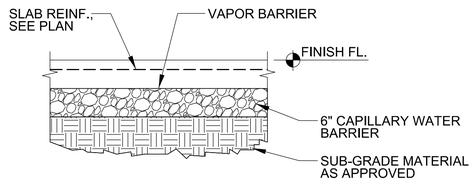
Sheet reference number:
S-305
Sheet 11 of 23

STANDARD DESIGN DRAWINGS - FINAL



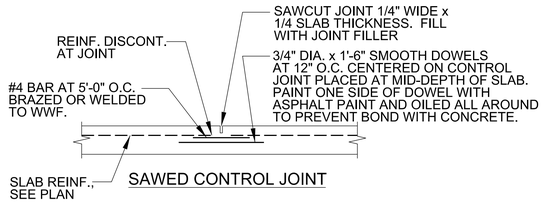

NOTE:
CLASS 150 FORGED FLANGES MAY BE SUBSTITUTED FOR FABRICATED PLATE FLANGES

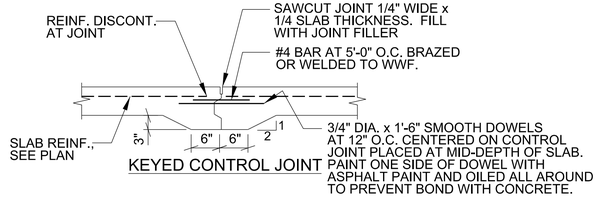
## VENTILATOR FLAME PLATE DETAIL A
SCALE: 3/4"=1'-0" — S501




## SLAB-ON-GRADE DETAIL B
SCALE: 3/4"=1'-0" — S501

NOTES:
REFER TO GEOTECHNICAL REPORT FOR THE SUBGRADE PREPARATION AND EARTHWORK RECOMMENDATIONS.




## SLAB CONTROL JOINT DETAIL C
SCALE: 3/4"=1'-0" — S501

USE EITHER AT CONTRACTOR'S OPTION
SAWCUT JOINTS AS EARLY AS ALLOWED
HAND- TOOL AREAS INACCESSIBLE BY SAW

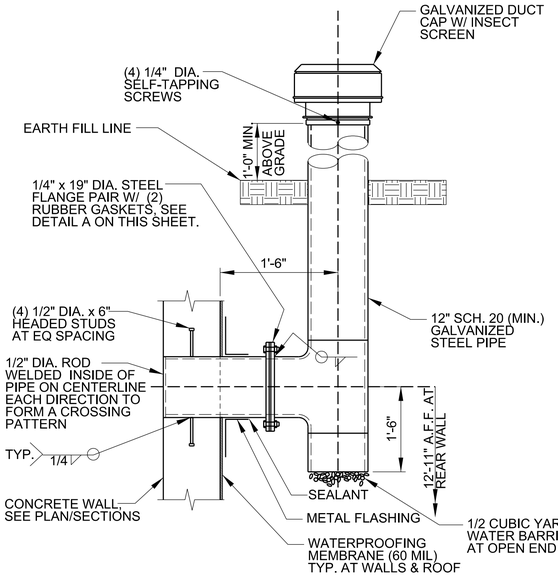
| SPLICE LENGTHS | | | | | DEVELOPMENT LENGTHS | |
|---|---|---|---|---|---|---|
| BAR SIZE | $f_c$= 4000 PSI | | | | $f_c$= 4000 PSI | |
| | TOP BARS | | OTHER BARS | | TOP BARS | OTHER BARS |
| NO. | A | B | A | B | | |
| #3 | 19" | 24" | 15" | 19" | 19" | 15" |
| #4 | 25" | 32" | 19" | 25" | 25" | 19" |
| #5 | 31" | 40" | 24" | 31" | 31" | 24" |
| #6 | 37" | 48" | 29" | 37" | 37" | 29" |
| #7 | 54" | 70" | 42" | 54" | 54" | 42" |
| #8 | 62" | 80" | 48" | 60" | 62" | 48" |
| #9 | 78" | 101" | 60" | 78" | 70" | 54" |
| #10 | 85" | 111" | 66" | 85" | 79" | 61" |

TOP BARS ARE HORIZONTAL REINF. WITH MORE THAN 12" ON CONCRETE CAST BELOW THE REINF.

CONCRETE LAP LENGTHS SHALL BE INCREASED 20 PERCENT WHERE EPOXY COATING IS USED.

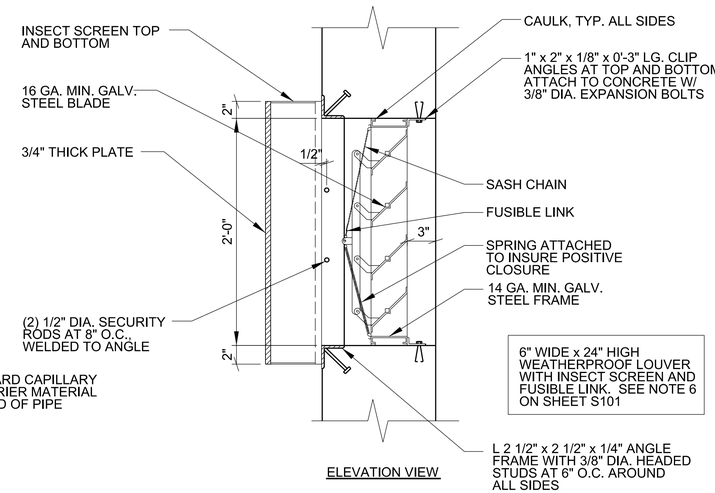
WHEN LAPPING TWO DIFFERENT SIZE BARS, USE THE LARGER OF THE LAP SPLICE DIMENSION OF THE SMALLER BAR OR THE DEVELOPMENT LENGTH OF THE LARGER BARS

INCREASED SPLICE LENGTHS ARE REQUIRED IN THE 12" THICK HEADWALL. THESE INCREASED LAPS ARE SHOWN ON THE DETAILS/SECTIONS AND INCLUDE A 20% INCREASE FACTOR. NO SPLICES ARE ALLOWED IN THE PILASTERS OR DOOR HEADER




## TYPICAL VENT DETAIL D
SCALE: 3/4"=1'-0" — S501

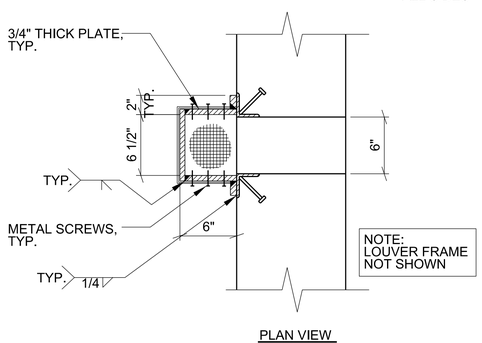
NOTE:
PROVIDE ELECTRICAL CONTINUITY BY WELDING VERTICAL AND HORZ. REINFORCEMENT TO VENT PIPE




ELEVATION VIEW

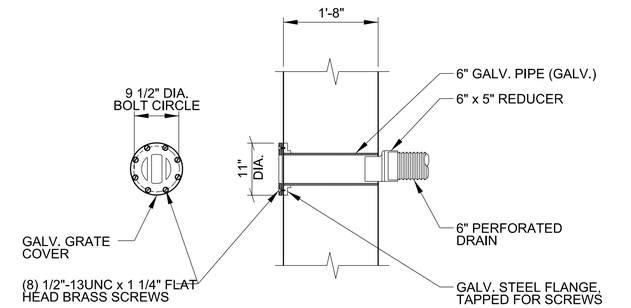



## TYPICAL REINFORCING AROUND WALL OPENING J
SCALE: 3/4"=1'-0" — S501

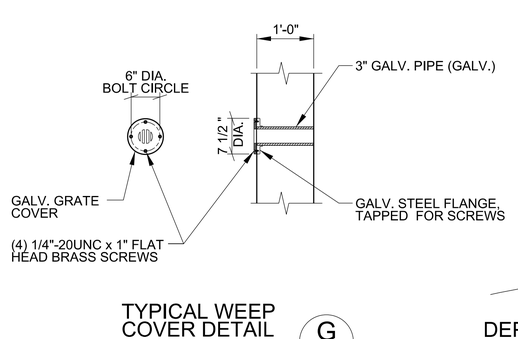



PLAN VIEW

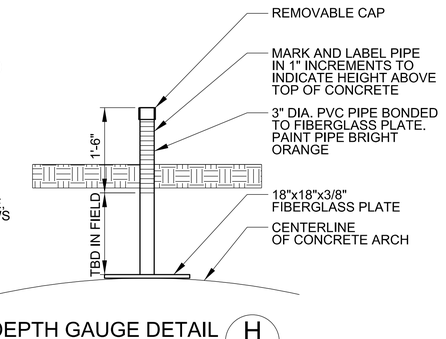
## TYPICAL LOUVER DETAIL E
SCALE: 1 1/2"=1'-0" — S501




## TYPICAL DRAIN COVER DETAIL F
SCALE: 3/4"=1'-0" — S501




## TYPICAL WEEP COVER DETAIL G
SCALE: 3/4"=1'-0" — S501




## DEPTH GAUGE DETAIL H
SCALE: 3/4"=1'-0" — S501

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| No. | Description | Date | Appr. |
|---|---|---|---|
| | | | |

Revisions

Date: SEPT 2013
Scale: AS SHOWN
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Date:

Designed by:
Drawn by: JMU
Checked by: RSW
Project Engineer/Architect: Jeff Coulston

U. S. ARMY CORPS OF ENGINEERS
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HUNTSVILLE, ALABAMA

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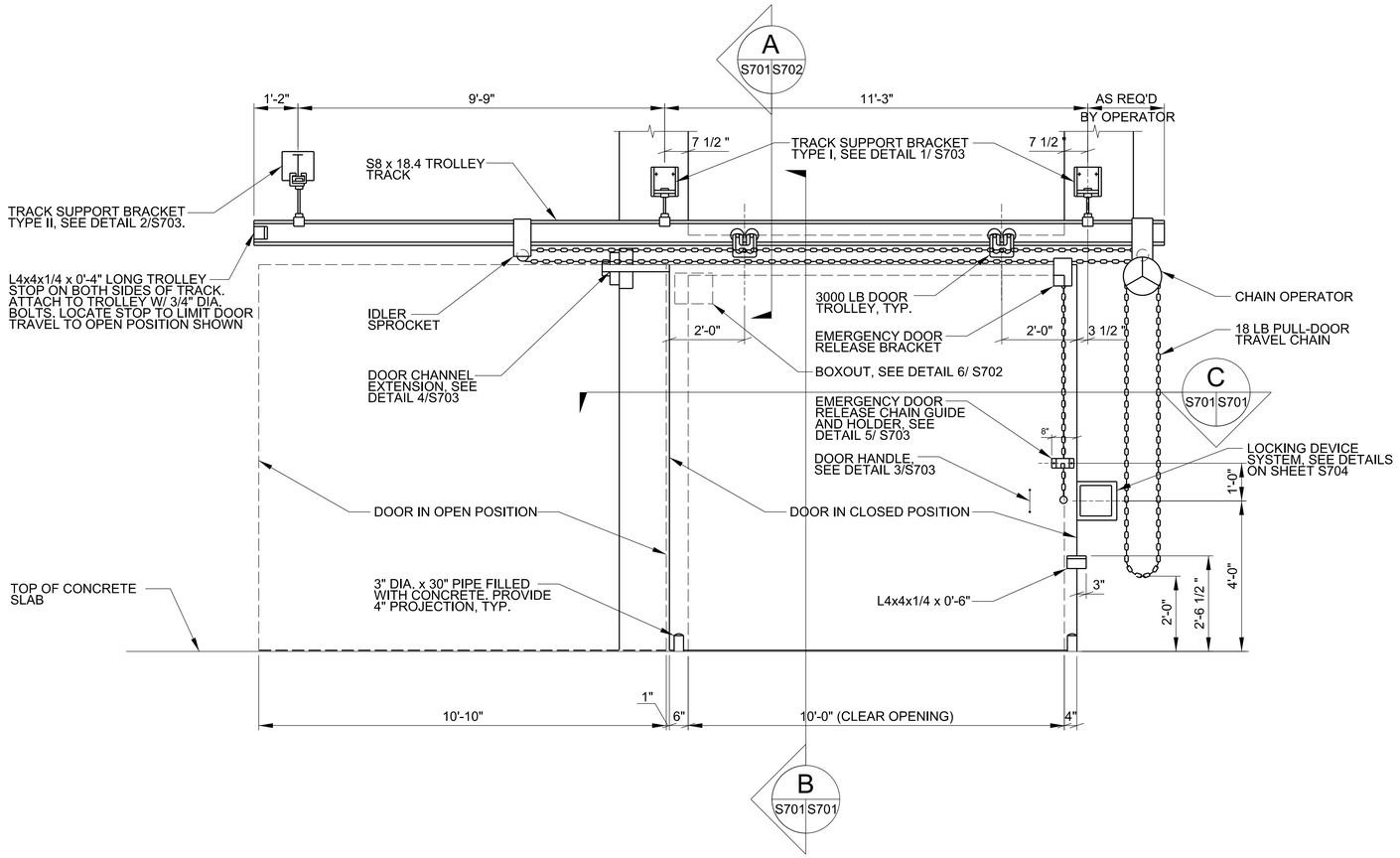
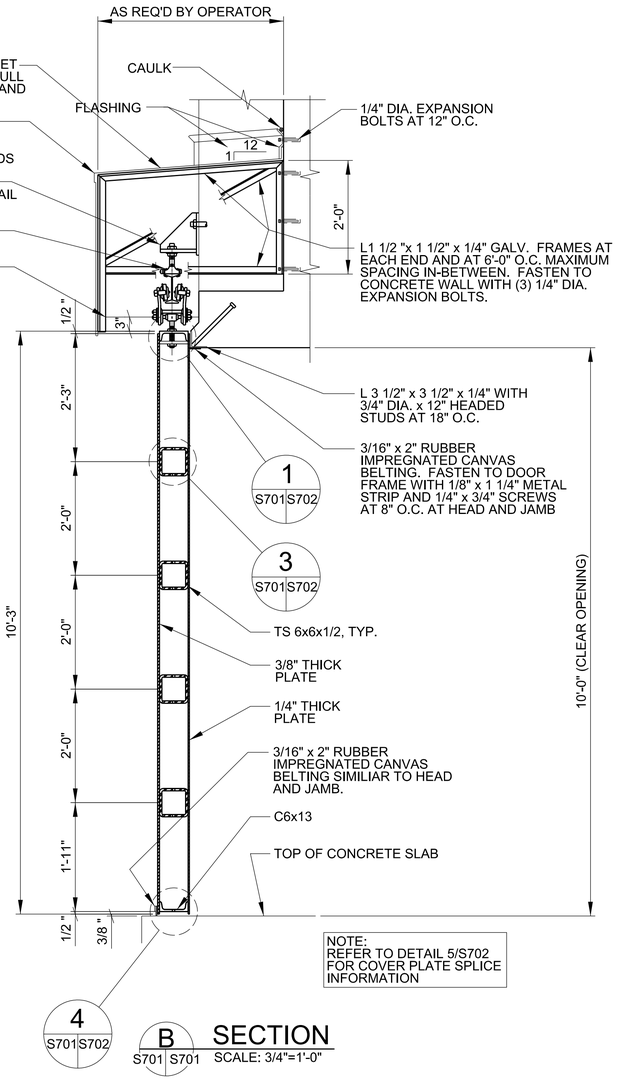
TYPICAL DETAILS

Sheet reference number:
S-501
Sheet 12 of 23

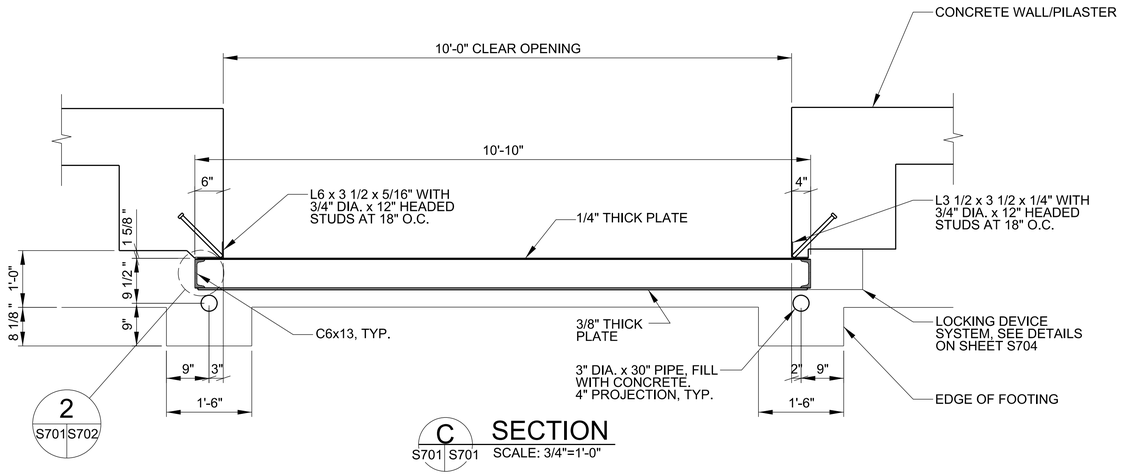
STANDARD DESIGN DRAWINGS - FINAL




A ELEVATION
S101 S701 S102 SCALE: 1/2"=1'-0"




B SECTION
S701 S701 SCALE: 3/4"=1'-0"




C SECTION
S701 S701 SCALE: 3/4"=1'-0"

DESIGNER NOTE: TO BE REMOVED WHEN PREPARING CONSTRUCTION DRAWINGS FOR SITE ADAPTION DESIGN

SHEETS S701 - S702 (10'-0" x 10'-0" DOOR) AND S701(A) - S702(A) (8'-0" x 8'-0" DOOR) IDENTIFY TWO DIFFERENT DOOR OPENING SIZES. THE DESIGNER SHALL VERIFY WITH THE CONTRACTING OFFICER THE CORRECT DOOR SIZE REQUIRED AND REMOVE THE REDUNDANT SHEETS FROM THE CONSTRUCTION CONTRACT DOCUMENTS FOR THE DOOR SIZE NOT USED.

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| No. | Description | Revisions | Date | Appr. |
|---|---|---|---|---|

Designed by:
Drawn by: JMU
Checked by: RSW
Date: SEPT 2013
Scale: AS SHOWN
Drawing code:
Project Engineer/Architect: Jeff Coulston
Date:

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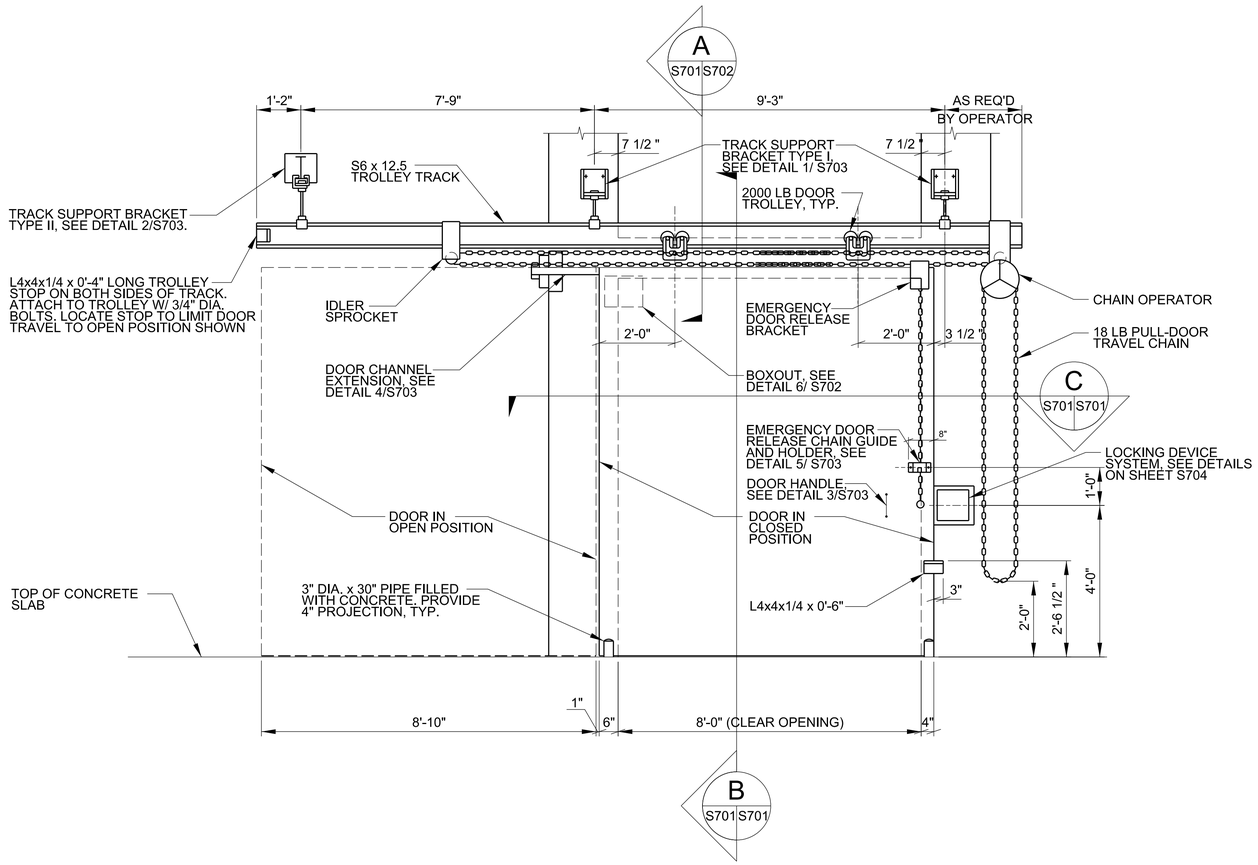
CONCRETE OVAL-ARCH, EARTH COVERED MAGAZINE STD 421-80-09

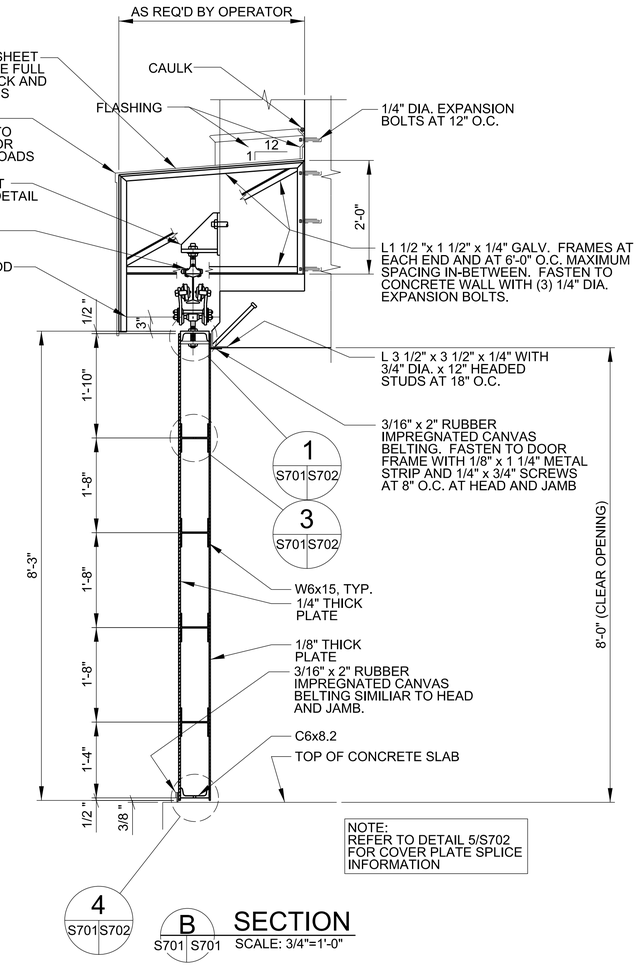
DOOR DETAILS

Sheet reference number:
S-701
Sheet 13 of 23

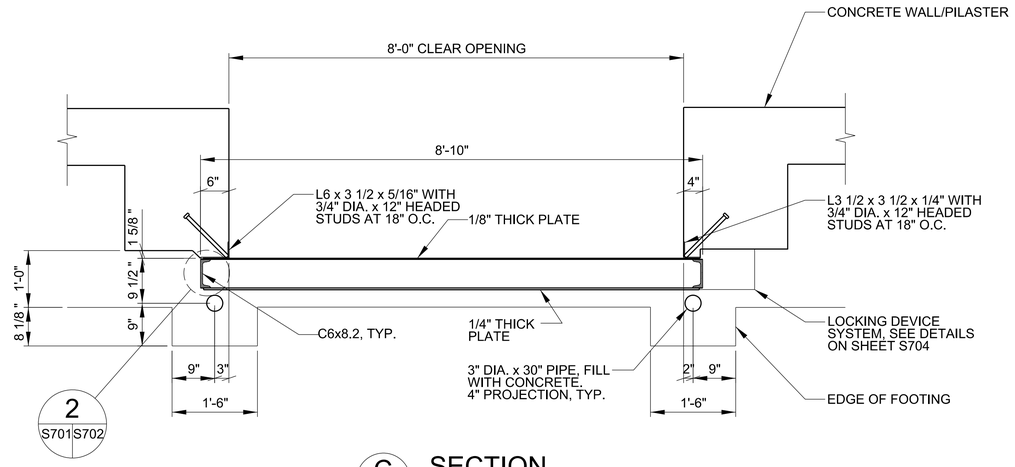
STANDARD DESIGN DRAWINGS - FINAL




A ELEVATION
S101 S701 S102
SCALE: 1/2"=1'-0"




B SECTION
S701 S701
SCALE: 3/4"=1'-0"




C SECTION
S701 S701
SCALE: 3/4"=1'-0"

DESIGNER NOTE: TO BE REMOVED WHEN PREPARING CONSTRUCTION DRAWINGS FOR SITE ADAPTION DESIGN

SHEETS S701 - S702 (10'-0" x 10'-0" DOOR) AND S701(A) - S702(A) (8'-0" x 8'-0" DOOR) IDENTIFY TWO DIFFERENT DOOR OPENING SIZES. THE DESIGNER SHALL VERIFY WITH THE CONTRACTING OFFICER THE CORRECT DOOR SIZE REQUIRED AND REMOVE THE REDUNDANT SHEETS FROM THE CONSTRUCTION CONTRACT DOCUMENTS FOR THE DOOR SIZE NOT USED.

US Army Corps of Engineers
Huntsville Center

| No. | Description | Revisions | Date | Appr. |
|---|---|---|---|---|

Designed by:
Drawn by: JMU
Checked by: RSW
Date: SEPT 2013
Scale: AS SHOWN
Drawing code:
Project Engineer/Architect: Jeff Coulston
Date:

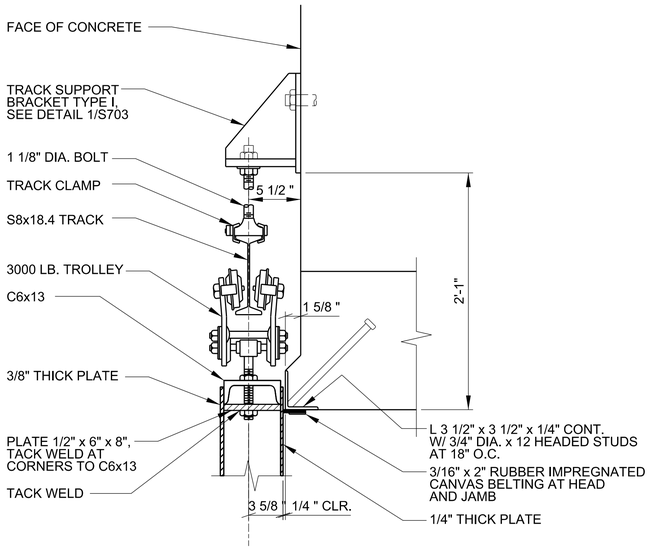
U. S. ARMY CORPS OF ENGINEERS
ENGINEERING AND SUPPORT CENTER,
HUNTSVILLE, ALABAMA

CONCRETE OVAL-ARCH, EARTH COVERED MAGAZINE STD 421-80-09

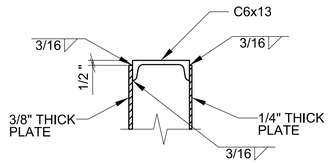
DOOR DETAILS

Sheet reference number:
S-701 (A)
Sheet 14 of 23

STANDARD DESIGN DRAWINGS - FINAL

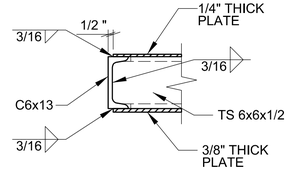



A SECTION
S701 S702 SCALE: 1 1/2"=1'-0"

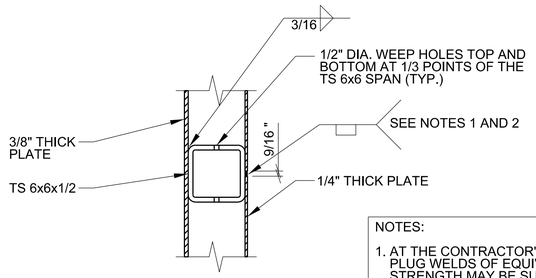



NOTE:
REFER TO A/S702 FOR INFORMATION NOT SHOWN

1 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"



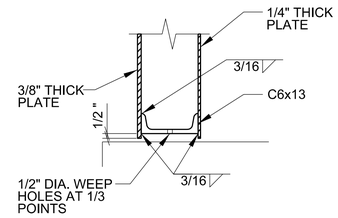

2 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"



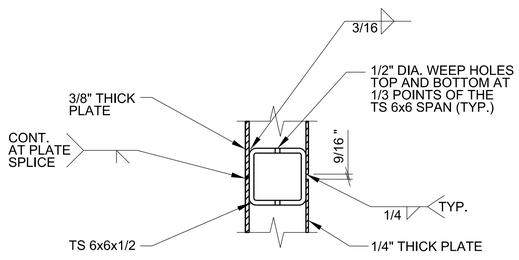

NOTES:

1. AT THE CONTRACTOR'S OPTION, PLUG WELDS OF EQUIVALENT STRENGTH MAY BE SUBSTITUTED FOR THE SLOT WELDS.
2. 9/16" x 2 1/2" SLOT WELD. 3 AT 5" O.C., 2 AT 7" O.C., 2 AT 9 1/2" O.C., AND 1 AT 17" FROM EACH EDGE OF DOOR. START CENTERLINE OF FIRST WELD 5" FROM EDGE OF DOOR.

3 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"



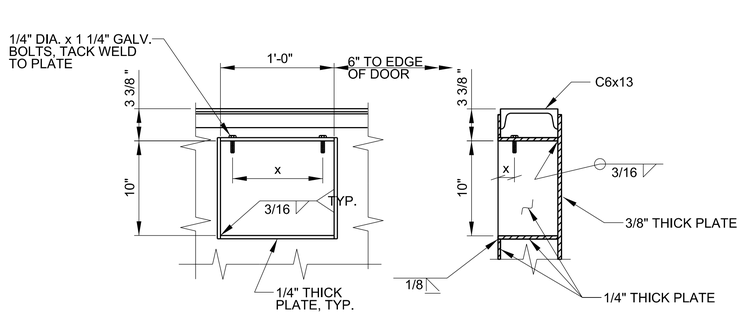

4 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"




NOTE:

COVER PLATES SHALL BE SPLICED ONLY AS REQUIRED BY THE SIZE OF PLATES AVAILABLE. LOCATION OF SPLICE(S) SHALL BE DETERMINED BY THE CONTRACTOR AND THE SPLICE SHALL CONFORM TO THIS DETAIL.

5 COVER PLATE SPLICE DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"




"x" DIMENSION TO FIT MAGNETIC SWITCH PURCHASED

6 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"

DESIGNER NOTE: TO BE REMOVED WHEN PREPARING CONSTRUCTION DRAWINGS FOR SITE ADAPTION DESIGN

SHEETS S701 - S702 (10'-0" x 10'-0" DOOR) AND S701(A) - S702(A) (8'-0" x 8'-0" DOOR) IDENTIFY TWO DIFFERENT DOOR OPENING SIZES. THE DESIGNER SHALL VERIFY WITH THE CONTRACTING OFFICER THE CORRECT DOOR SIZE REQUIRED AND REMOVE THE REDUNDANT SHEETS FROM THE CONSTRUCTION CONTRACT DOCUMENTS FOR THE DOOR SIZE NOT USED.

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Revisions

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Drawn by: JMU
Checked by: RSW
Project Engineer/Architect: Jeff Coulston
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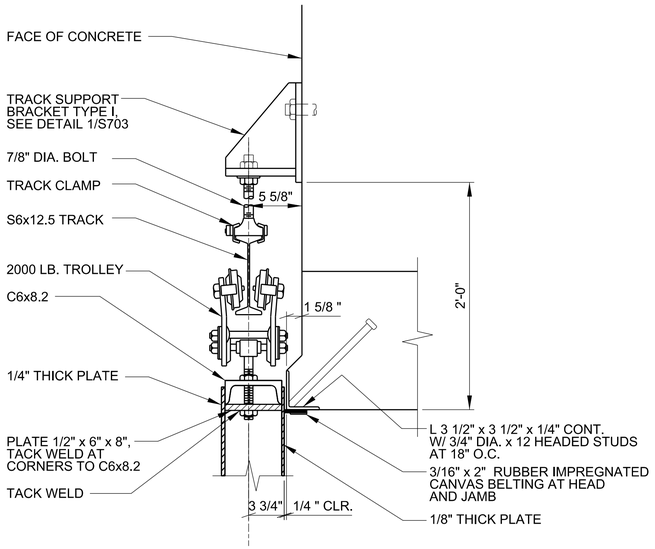
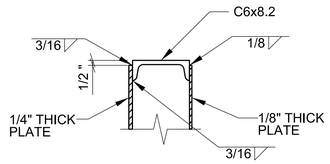
DOOR DETAILS

Sheet reference number:
S-702
Sheet 15 of 23

STANDARD DESIGN DRAWINGS - FINAL




A SECTION
S701 S702 SCALE: 1 1/2"=1'-0"




NOTE:
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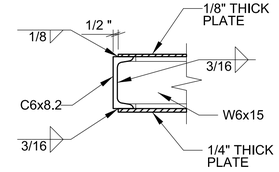
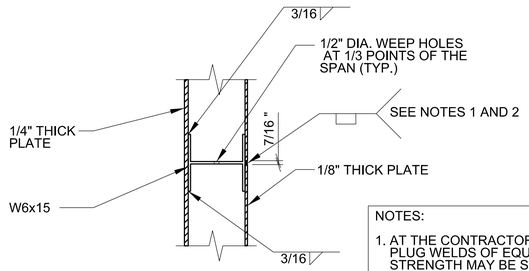
1 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"




2 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"

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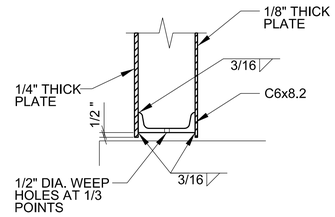
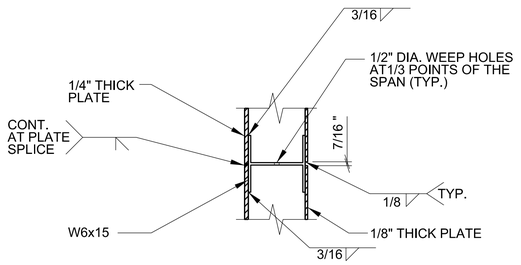
3 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"




4 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"

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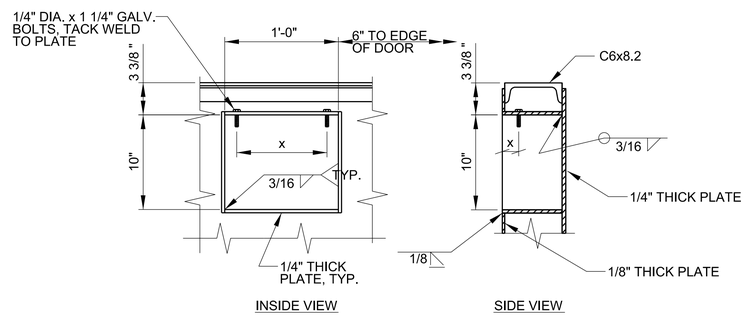


"x" DIMENSION TO FIT MAGNETIC SWITCH PURCHASED

6 DETAIL
S701 S702 SCALE: 1 1/2"=1'-0"

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Huntsville Center

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Revisions

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Drawn by: JMU
Checked by: RSW
Date: SEPT 2013
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Drawing code:
Project Engineer/Architect: Jeff Coulston
Date:

U. S. ARMY CORPS OF ENGINEERS
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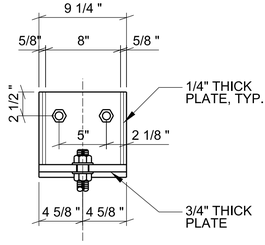
HUNTSVILLE, ALABAMA

CONCRETE OVAL-ARCH, EARTH COVERED MAGAZINE STD 421-80-09

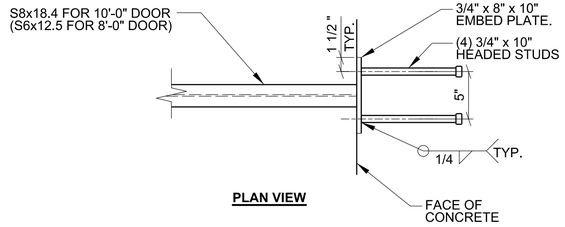
DOOR DETAILS

Sheet reference number:
S-702(A)
Sheet 16 of 23

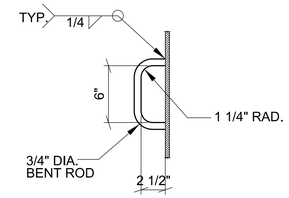
STANDARD DESIGN DRAWINGS - FINAL



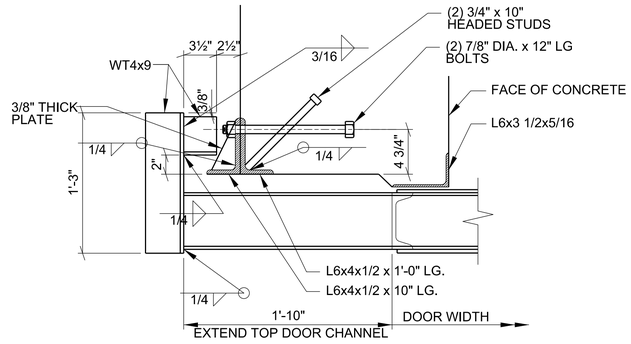

**ELEVATION VIEW**



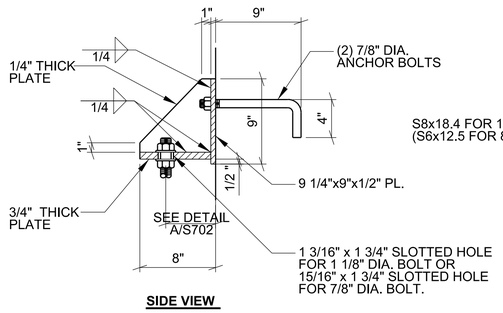

**PLAN VIEW**



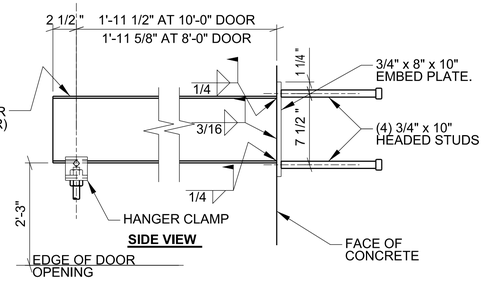

3 S701 S703 DOOR HANDLE DETAIL
SCALE: 1 1/2"=1'-0"



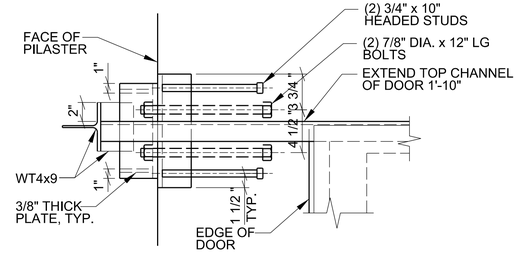

**PLAN VIEW**




**SIDE VIEW**




**SIDE VIEW**

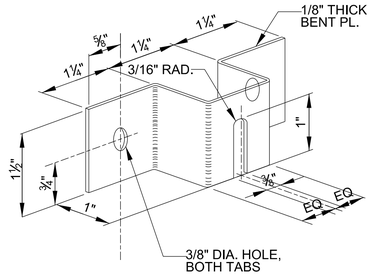



**ELEVATION VIEW**

1 S701 S702 S703 TYPE I TRACK SUPPORT BRACKET DETAIL
SCALE: 1 1/2"=1'-0"

2 S701 S703 TYPE II TRACK SUPPORT BRACKET DETAIL
SCALE: 1 1/2"=1'-0"

4 S701 S703 DETAIL
SCALE: 1 1/2"=1'-0"




5 S701 S703 CHAIN GUIDE AND HOLDER DETAIL
SCALE: N.T.S.

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Huntsville Center

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|---|---|---|---|---|
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Drawn by: JMU
Checked by: RSW
Project Engineer/Architect: Jeff Coulston

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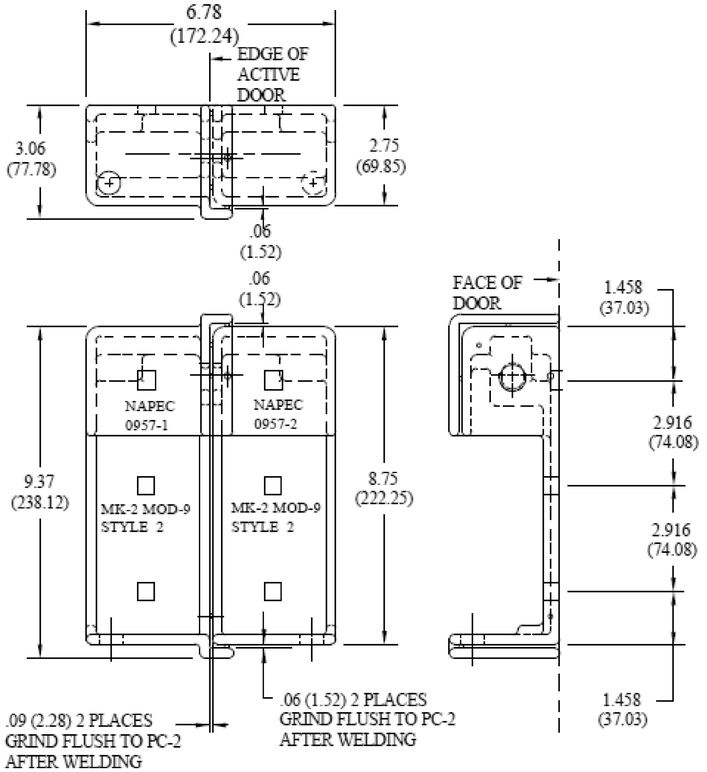
CONCRETE OVAL-ARCH,
EARTH COVERED MAGAZINE
STD 421-80-09

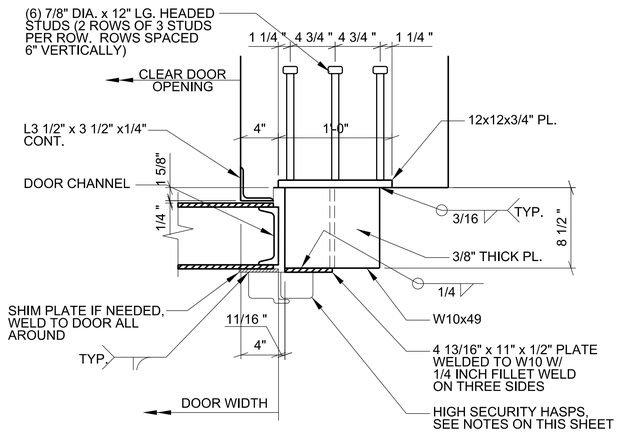
DOOR DETAILS

Sheet reference number:
S-703
Sheet 17 of 23

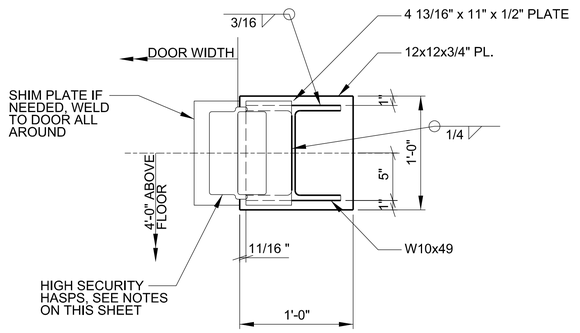
STANDARD DESIGN DRAWINGS - FINAL




HIGH SECURITY HASP
STYLE 2, MK 2 MOD 9
A S704




**PLAN VIEW**




**ELEVATION VIEW**

1 S701 | S704 HIGH SECURITY HASPS DETAIL
SCALE: 1 1/2"=1'-0"

HIGH SECURITY HASP NOTES:

1. HIGH SECURITY HASPS SHALL CONFORM TO MILITARY SPECIFICATION MIL-DTL-29181C, STYLE 2-HASP (M29181-02) FOR LEFT HAND SWINGING DOOR. HIGH SECURITY PADLOCKS SHALL CONFORM TO MILITARY SPECIFICATION MIL-DTL-43607J.
2. NO MODIFICATIONS AND/OR DEVIATIONS TO THE DOOR CONSTRUCTION SHOWN IN THE STANDARD DRAWINGS IS PERMITTED TO ACCOMMODATE THE HIGH SECURITY HASP UNLESS APPROVED BY THE U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE (STRUCTURAL BRANCH).
3. DOOR MANUFACTURER WILL COORDINATE WITH THE GOVERNMENT ON INSTALLATION AND ATTACHMENT DETAILS OF THE HASPS AND PROVIDE THE NECESSARY STIFFENERS AND ADDITIONAL FRAMING (IF REQUIRED) TO ACCOMMODATE THE HIGH SECURITY HASPS.
4. SEE DOOR FRAME AND DOOR DETAILS ON SHEETS S701 - S703.

DESIGNER NOTE: TO BE REMOVED WHEN PREPARING CONSTRUCTION DRAWINGS FOR SITE ADAPTION DESIGN

SHEET S704 (HIGH SECURITY HASPS) AND S704 (A) (ILD) IDENTIFY TWO DIFFERENT LOCKING SYSTEMS. THE DESIGNER SHALL VERIFY WITH THE CONTRACTING OFFICER THE CORRECT LOCKING SYSTEM REQUIRED AND REMOVE THE REDUNDANT SHEETS FROM THE CONSTRUCTION CONTRACT DOCUMENTS FOR THE SYSTEM NOT USED.

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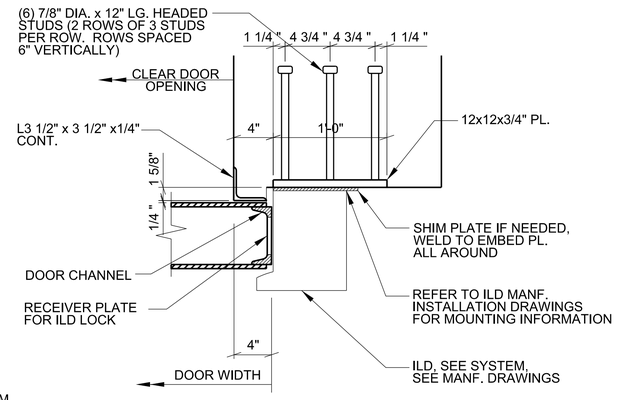
HIGH SECURITY HASP

Sheet reference number:
S-704
Sheet 18 of 23

STANDARD DESIGN DRAWINGS - FINAL


INTERNAL LOCKING DEVICE (ILD) A S704




1 ILD DETAIL
S701 S704 SCALE: 1 1/2"=1'-0"

INTERNAL LOCKING DEVICE (ILD) NOTES:

1. INTERNAL LOCKING DEVICE IS A U.S. GOVERNMENT DESIGNED AND PATENTED LOCKING SYSTEM. THE ILD SYSTEM SHALL BE PURCHASED FROM A GOVERNMENT APPROVED ILD MANUFACTURER WITH COORDINATION OF NAVAL FACILITIES ENGINEERING SERVICE CENTER (NAVFAC ESC) SECURITY ENGINEERING DIVISION. CONTACT CAN BE MADE VIA PHONE BY CALLING 805-982-1212 OR THEIR WEBSITE (https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_nfesc_pp/locks/) FOR ORDERING INFORMATION.
2. NO MODIFICATIONS AND/OR DEVIATIONS TO THE DOOR CONSTRUCTION SHOWN IN THE STANDARD DRAWINGS ARE PERMITTED TO ACCOMMODATE THE ILD UNLESS APPROVED BY THE U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE (STRUCTURAL BRANCH).
3. DOOR MANUFACTURER WILL COORDINATE WITH THE GOVERNMENT ON INSTALLATION AND ATTACHMENT DETAILS OF THE ILD AND PROVIDE THE NECESSARY STIFFENERS AND ADDITIONAL FRAMING (IF REQUIRED) TO ACCOMMODATE THE ILD.
4. SEE ILD MANUFACTURERS INSTALLATION DRAWINGS FOR ADDITIONAL INFORMATION NOT SHOWN IN THESE DRAWINGS.
5. SEE DOOR FRAME AND DOOR DETAILS ON SHEETS S701-S703.

DESIGNER NOTE: TO BE REMOVED WHEN PREPARING CONSTRUCTION DRAWINGS FOR SITE ADAPTION DESIGN

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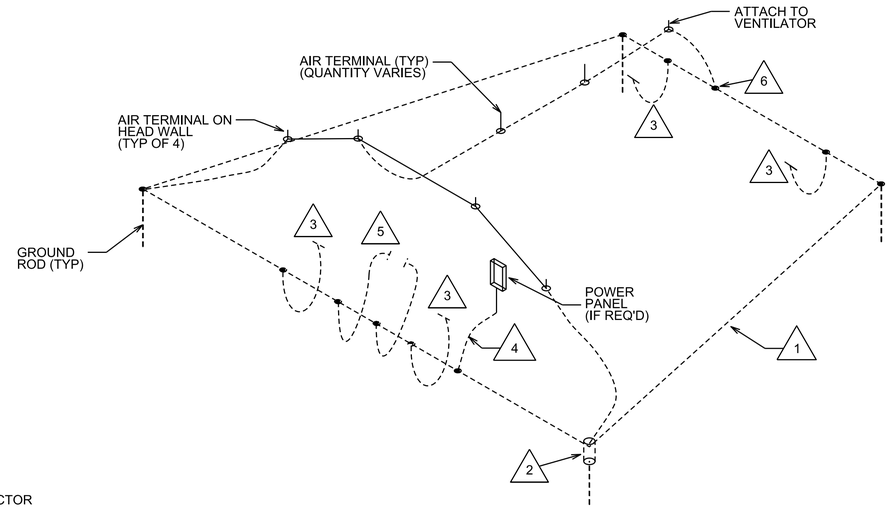
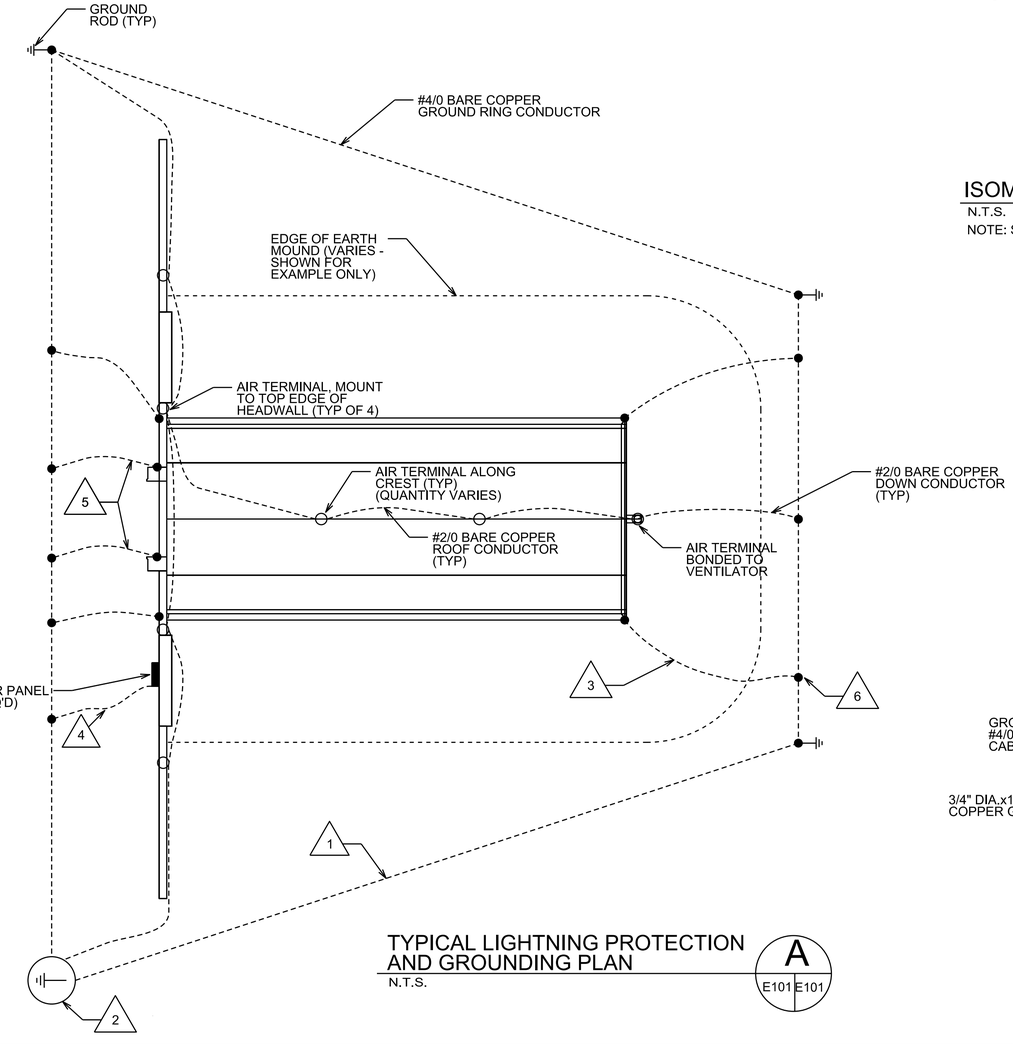
INTERNAL LOCKING DEVICES

Sheet reference number:
S-704(A)
Sheet 19 of 23

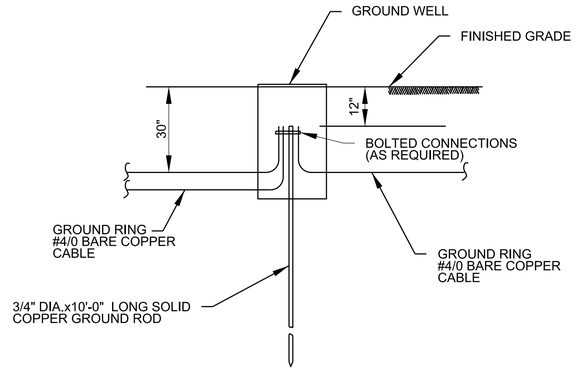
STANDARD DESIGN DRAWINGS - FINAL




ISOMETRIC VIEW OF LPS
N.T.S.
NOTE: STRUCTURE NOT SHOWN FOR CLARITY
B E101 E101




TYPICAL LIGHTNING PROTECTION AND GROUNDING PLAN
N.T.S.
A E101 E101




GROUND ROD TEST WELL DETAIL
N.T.S.
C E101 E101

## NOTES: (APPLICABLE TO DRAWINGS E-101, E-102, E-103, E-104)

1. DRAWINGS E-101, E-102, E-103, AND E-104 ARE US ARMY CORPS OF ENGINEERS (USACE) STANDARD GUIDANCE FOR LIGHTNING PROTECTION SYSTEM (LPS) DESIGN APPLICABLE TO EARTH COVERED MAGAZINES (ECM). THESE DRAWINGS DO NOT CONSTITUTE A COMPLETE LPS DESIGN. DESIGNER SHALL ADAPT THE STANDARDS TO UNIQUE SITE CONDITIONS, AND CONSULT THE BELOW LISTED CRITERIA TO ENSURE A COMPLETE AND FUNCTIONAL DESIGN. THE COMPLETED LPS INSTALLATION SHALL RECEIVE A UL MASTER LABEL CERTIFICATE OR EQUIVALENT.
2. THE LPS MUST PROVIDE A ZONE OF PROTECTION BASED ON A 100FT. RADIUS STRIKING DISTANCE (ds). THE ZONE OF PROTECTION MUST BE DOCUMENTED USING THE ROLLING SPHERE METHOD (RSM) ANALYSIS OF 100FT. RADIUS. SEE DRAWING E-103 AND E-104 FOR TYPICAL RSM ANALYSIS.
3. THE LPS SHALL BE MADE OF MATERIALS ACCEPTABLY PROTECTED AGAINST CORROSION AS SPECIFIED IN UL 96.
4. MINIMUM AIR TERMINAL HEIGHT IS AS INDICATED ABOVE THE PROTECTED OBJECT. AIR TERMINALS GREATER THAN 2 FT MUST BE SUPPORTED PER NFPA 780.
5. REINFORCING STEEL IN WALLS, FLOOR SLAB, AND ARCH OR BOX STRUCTURE MUST ALL BE INTERCONNECTED THRU BONDING, AND MUST HAVE A CONTINUOUS PATH TO THE PRIMARY GROUNDING SYSTEM. METAL VENTILATORS, STEEL DOORS AND DOOR FRAMES SHALL BE BONDED TO THE PRIMARY GROUNDING SYSTEM. PHOTO DOCUMENTATION OF THE REINFORCING STEEL BONDING AND PRIMARY GROUND BONDING IS MANDATORY.
6. INCOMING POWER AND COMM. MUST ENTER THE GROUND AT LEAST 50FT FROM THE FACILITY. CABLES AND WIRE MUST BE SHIELDED OR BE INSTALLED IN METALLIC PIPING THAT IS BONDED TO THE PRIMARY GROUNDING SYSTEM AT THE POINT OF ENTRY.
7. INTERIOR ELECTRICAL SYSTEMS SHALL BE DESIGNED BY USER ACCORDING TO SITE CONDITIONS AND USER REQUIREMENTS. USER SHALL DEFINE HAZARDOUS CLASSIFICATION WHEN REQ'D.
8. PROVIDE SURGE PROTECTIVE DEVICES (SPD) FOR POWER, COMM, AND INSTRUMENTATION PER NFPA 780.
9. CONSIDER ALL MASSES FOR SIDEFLASH POTENTIAL. METAL MASSES WITHIN THE SIDEFLASH DISTANCE SHALL BE BONDED TO THE LPS, OR BE MOVED OUTSIDE THE SIDEFLASH SEPARATION DISTANCE.
10. THE LPS SHALL BE TESTED PER THE BELOW LISTED CRITERIA.
11. EXOTHERMIC WELD ALL GROUNDING CONDUCTOR BONDS AND TERMINATIONS, EXCEPT IN TEST WELLS WHICH REQUIRE BOLTED CONNECTIONS.
12. GROUNDING AND BONDING CABLES SHALL BE COPPER.
13. WHERE CONFLICTS EXISTS BETWEEN THESE DRAWINGS AND THE BELOW CRITERIA, THE MOST STRINGENT REQUIREMENT SHALL APPLY.
14. DESIGN/INSTALLATION CRITERIA (LATEST EDITIONS):
    a. DA PAM 385-64 AMMUNITION AND EXPLOSIVES SAFETY STANDARDS
    b. DOD 6055.09 - M, VOL.2 - AMMUNITION AND EXPLOSIVES SAFETY STANDARDS
    c. NFPA 780 STANDARD FOR THE INSTALLATION OF LIGHTNING PROTECTION SYSTEMS
    d. UL 96A INSTALLATION REQUIREMENTS FOR LIGHTNING PROTECTION SYSTEMS
    e. UL 96 STANDARD FOR LIGHTNING PROTECTION COMPONENTS
    f. NFPA 70 NATIONAL ELECTRICAL CODE (NEC)

## KEYED NOTES

1. #4/0 BARE COPPER CONDUCTOR (BCC) GROUND RING ENCIRCLING STRUCTURE'S PERIMETER. INSTALL IN DIRECT CONTACT WITH EARTH, 30"MIN. BELOW GRADE AND 3' FROM EDGE OF EARTH MOUND.
2. GROUND TEST WELL WITH GROUND ROD. ALL BONDS WITHIN THE TEST WELL SHALL BE BOLTED-TYPE CONNECTIONS. SEE DETAIL C, THIS SHEET.
3. BOND FOUNDATION REBAR TO GROUNDING SYSTEM WITH #4/0 BCC. INSTALL CABLE IN PLASTIC CONDUIT WHERE IT PASSES THROUGH CONCRETE (TYP EACH CORNER AND DISTANCES NOT TO EXCEED 60 FT). SEE DETAIL C, DWG E-102.
4. WHEN POWER IS REQUIRED, PROVIDE GROUNDING ELECTRODE CONDUCTOR SIZED PER NEC IN PVC CONDUIT.
5. BOND TROLLEY BEAM TO GROUNDING SYSTEM (2 PLACES). SEE DETAIL B, SHEET E-102 FOR DOOR GROUNDING DETAIL.
6. EXOTHERMIC BOND (TYP).

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Designed by: JRD
Drawn by: WJC
Checked by: WLS
Project Engineer/Architect: Jeff Coulston
Date: SEPT 2013
Scale: AS SHOWN
Drawing code:

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CONCRETE OVAL-ARCH, EARTH COVERED MAGAZINE STD 421-80-09

LIGHTNING PROTECTION SYSTEM

Sheet reference number: E-101

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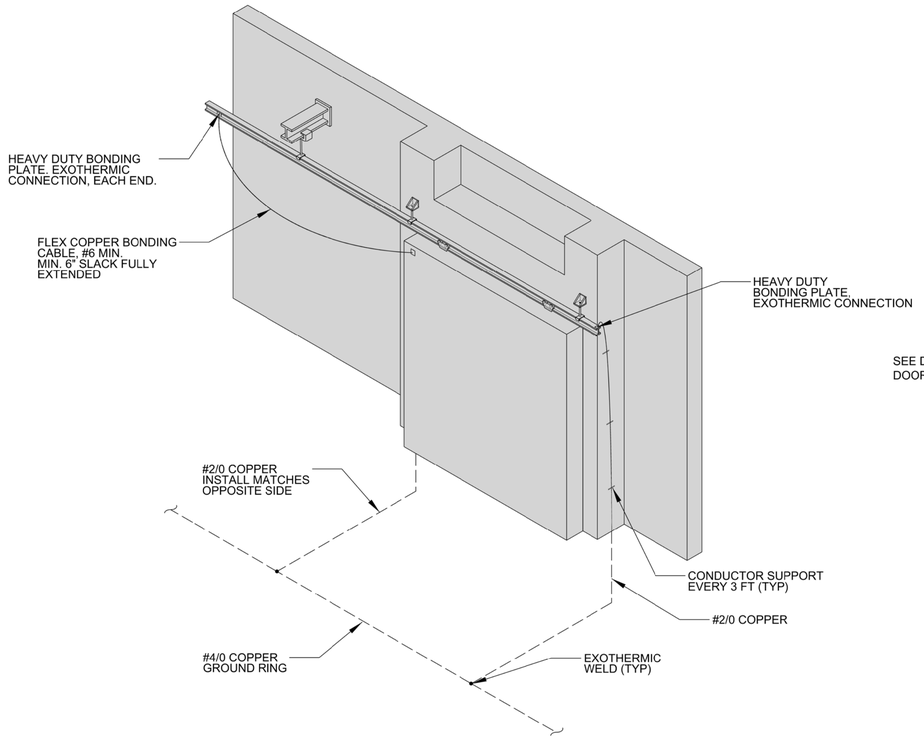
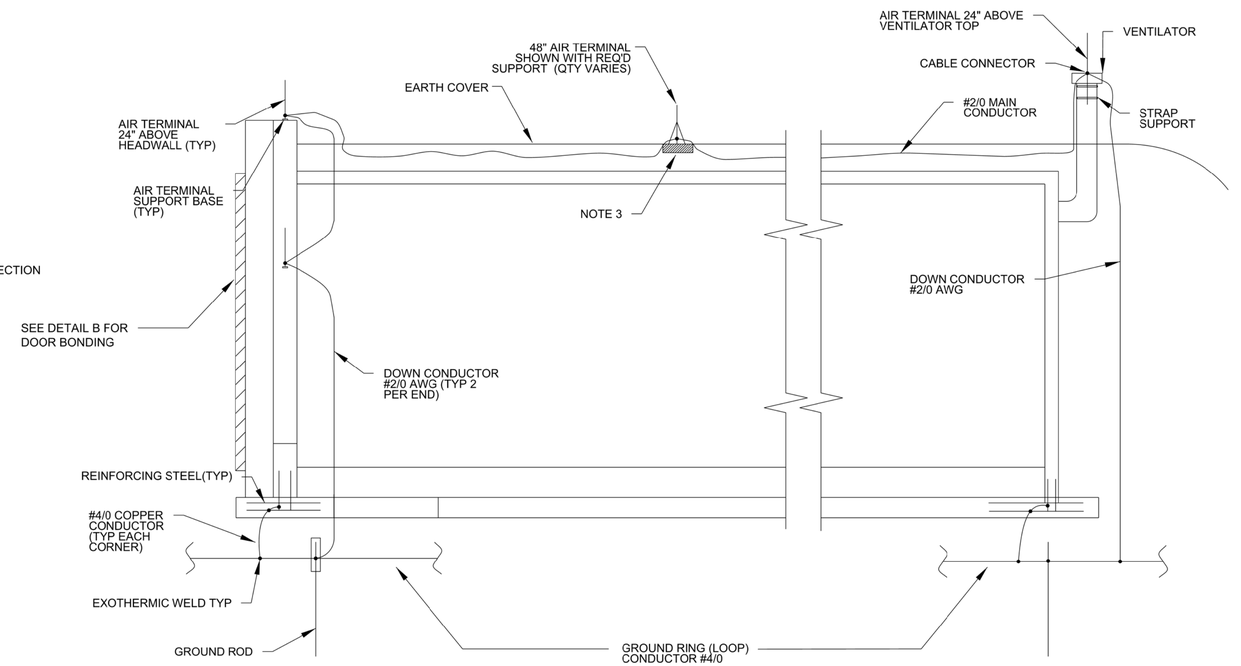
STANDARD DESIGN DRAWINGS - FINAL




## DOOR BONDING DETAIL

N.T.S.

B E102 E102



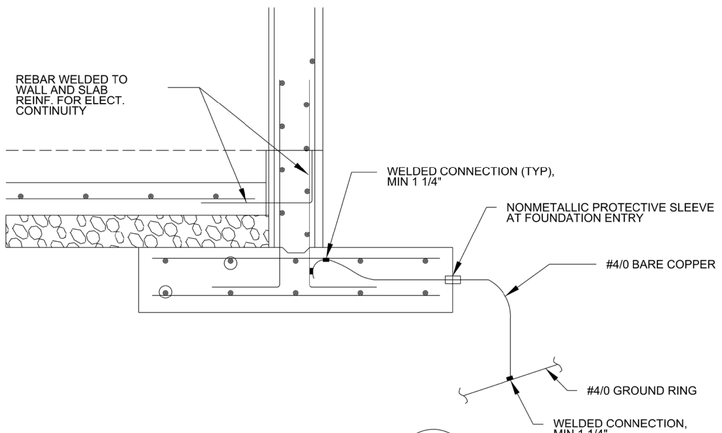

## TYPICAL ECM GROUNDING SECTION

N.T.S.

A E102 E102

NOTES:

1. ALL VENTILATORS MAY NOT BE SHOWN FOR CLARITY. ANY VENTILATORS OR OTHER METALLIC BODIES WHICH RISE ABOVE FINISHED GRADE WITHIN MUNITIONS STORAGE SHALL HAVE AN AIR TERMINAL ATOP AND BONDED TO NEAREST GROUNDING ELECTRODE SYSTEM SIMILARLY AS SHOWN.
2. CONDUCTORS SHALL BE MINIMUM #2/0 AWG UNLESS OTHERWISE NOTED.
3. PROVIDE SOLID CONCRETE PAD ON WHICH TO SECURE AIR TERMINAL BASE, AND REQUIRED SUPPORT BRACKET. PLACE PAD AT TOP OF EARTH COVER
4. SEE STRUCTURAL DRAWINGS FOR REBAR BONDING DETAILS THAT ESTABLISHES ELECTRICAL CONTINUITY THROUGHOUT ECM.




## TYPICAL FOUNDATION GROUNDING DETAIL

N.T.S.

C E102 E102

NOTE: FOUNDATION SHALL BE CONNECTED TO GROUNDING ELECTRODE SYSTEM AT EACH CORNER, AND DISTANCES NOT TO EXCEED 60 FT.

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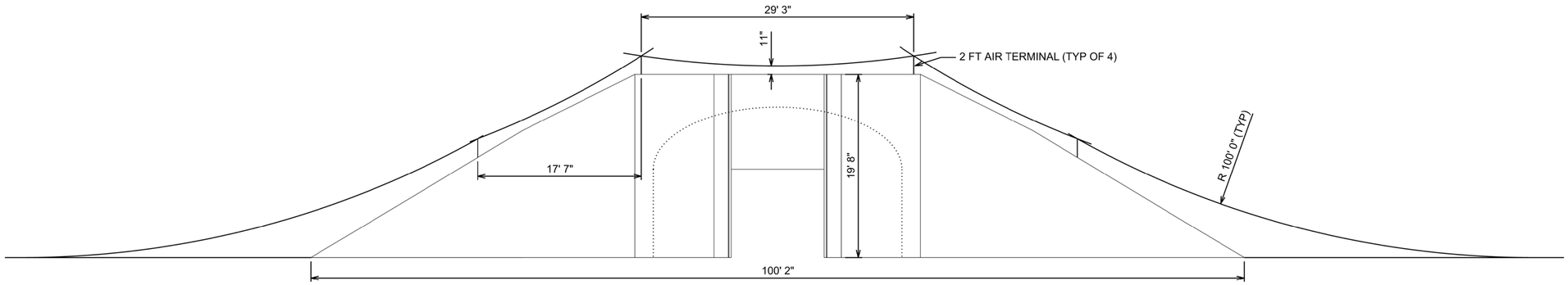
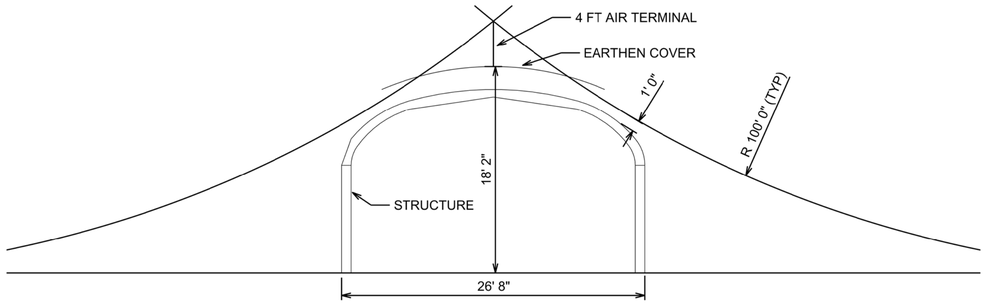



## TYPICAL FRONT HEADWALL DETAIL WITH ROLLING SPHERE ANALYSIS

A | E103 | E103

N.T.S.

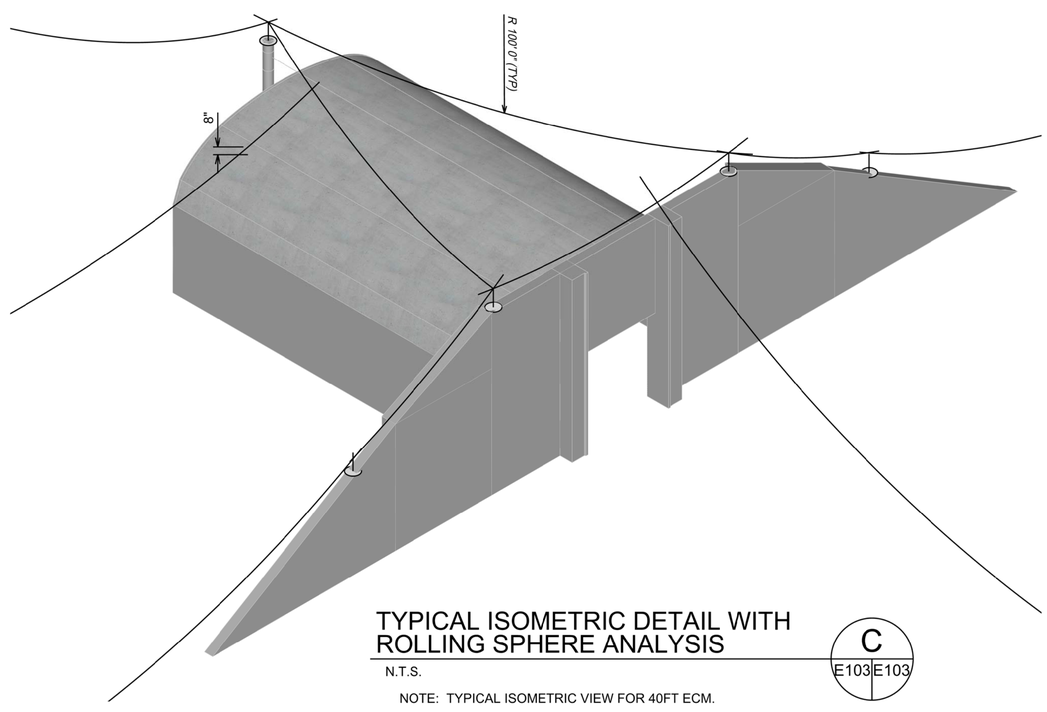



## TYPICAL CROSS-SECTION DETAIL WITH ROLLING SPHERE ANALYSIS

B | E103 | E103

N.T.S.

NOTE: TYPICAL CROSS SECTION FOR ECM'S LONGER THAN 40FT.




## TYPICAL ISOMETRIC DETAIL WITH ROLLING SPHERE ANALYSIS

C | E103 | E103

N.T.S.

NOTE: TYPICAL ISOMETRIC VIEW FOR 40FT ECM.

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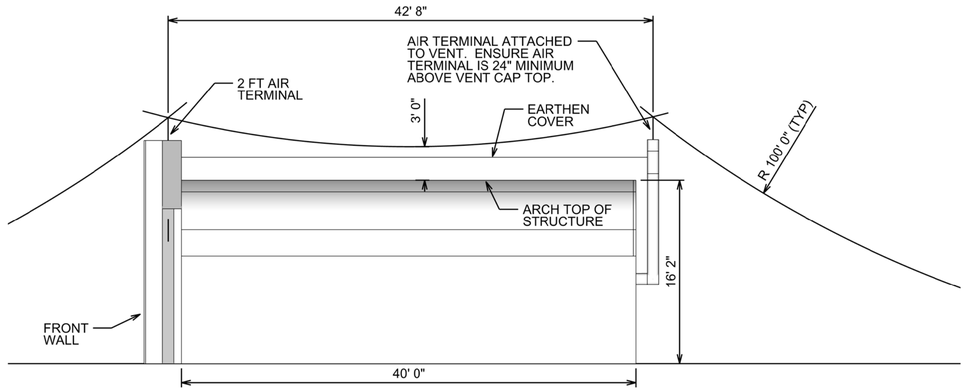
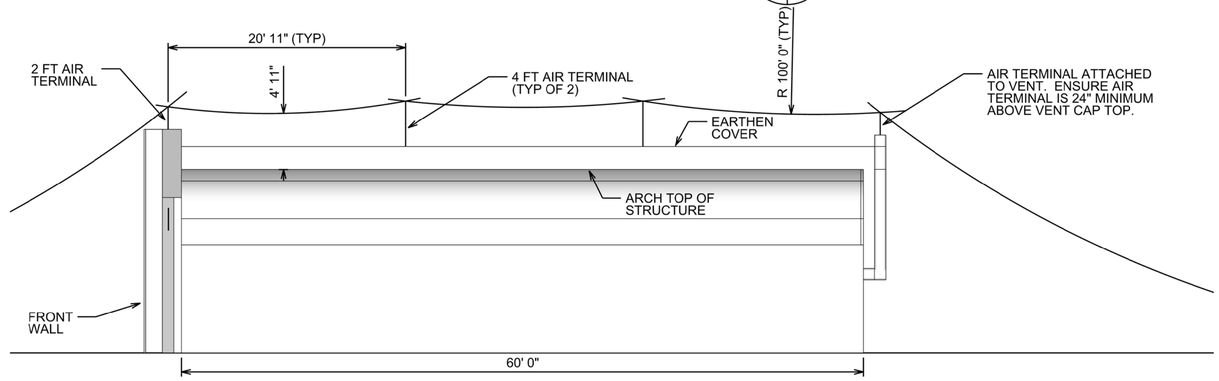



## TYPICAL RSM ANALYSIS DIAGRAM - 40 FT ECM

N.T.S

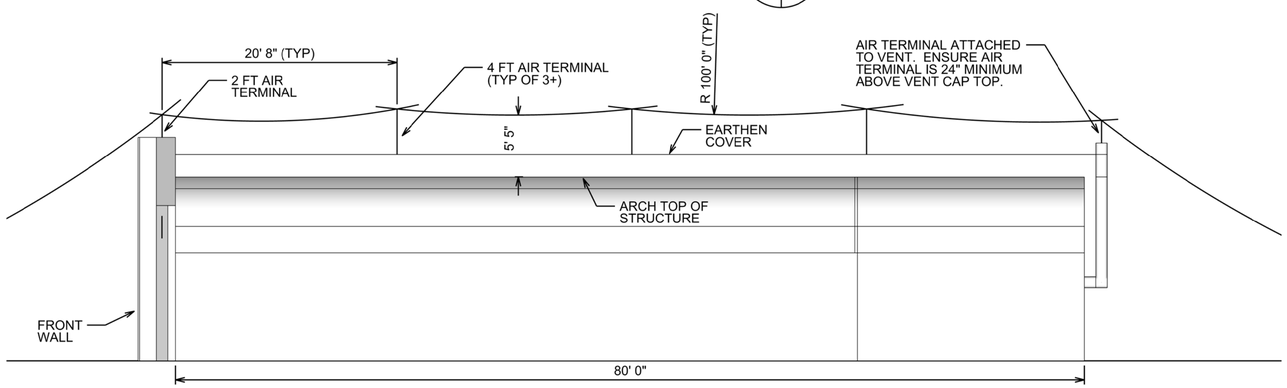
A E104 E104




## TYPICAL RSM ANALYSIS DIAGRAM - 60 FT ECM

N.T.S

B E104 E104




## TYPICAL RSM ANALYSIS DIAGRAM - 80 FT ECM

N.T.S

C E104 E104

## TYPICAL AIR TERMINAL PLACEMENT FOR EARTH COVERED MAGAZINES WITH ARCHED ROOF

| NOMINAL ECM LENGTH | HEADWALL | EQUALLY SPACED ALONG CREST | ON/NEAR REAR VENT STACK | MINIMUM AIR TERMINAL QUANTITY |
|---|---|---|---|---|
| 40 FT. OR LESS | 4 | 0 | 1 | 5 |
| MORE THAN 40 FT. LESS THAN 80 FT. | 4 | 2 | 1 | 7 |
| 80 FT. OR MORE | 4 | 3+ | 1 | 8 |

NOTES:

1. 48" AIR TERMINALS ALONG CREST UNLESS OTHERWISE NOTED (UON).
2. 24" AIR TERMINALS ON HEADWALL, UON.

NOTES:

1. ALL VENTILATORS MAY NOT BE SHOWN FOR CLARITY. ANY VENTILATORS OR OTHER METALLIC BODIES WHICH RISE ABOVE FINISHED GRADE WITHIN MUNITIONS STORAGE SHALL HAVE AN AIR TERMINAL ATOP AND BONDED TO GROUND SIMILARLY AS SHOWN.
2. GROUNDING CONNECTIONS NOT SHOWN FOR CLARITY.
3. SUPPORT BRACKETS FOR 48" AIR TERMINALS NOT SHOWN IN RSM DIAGRAMS.

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