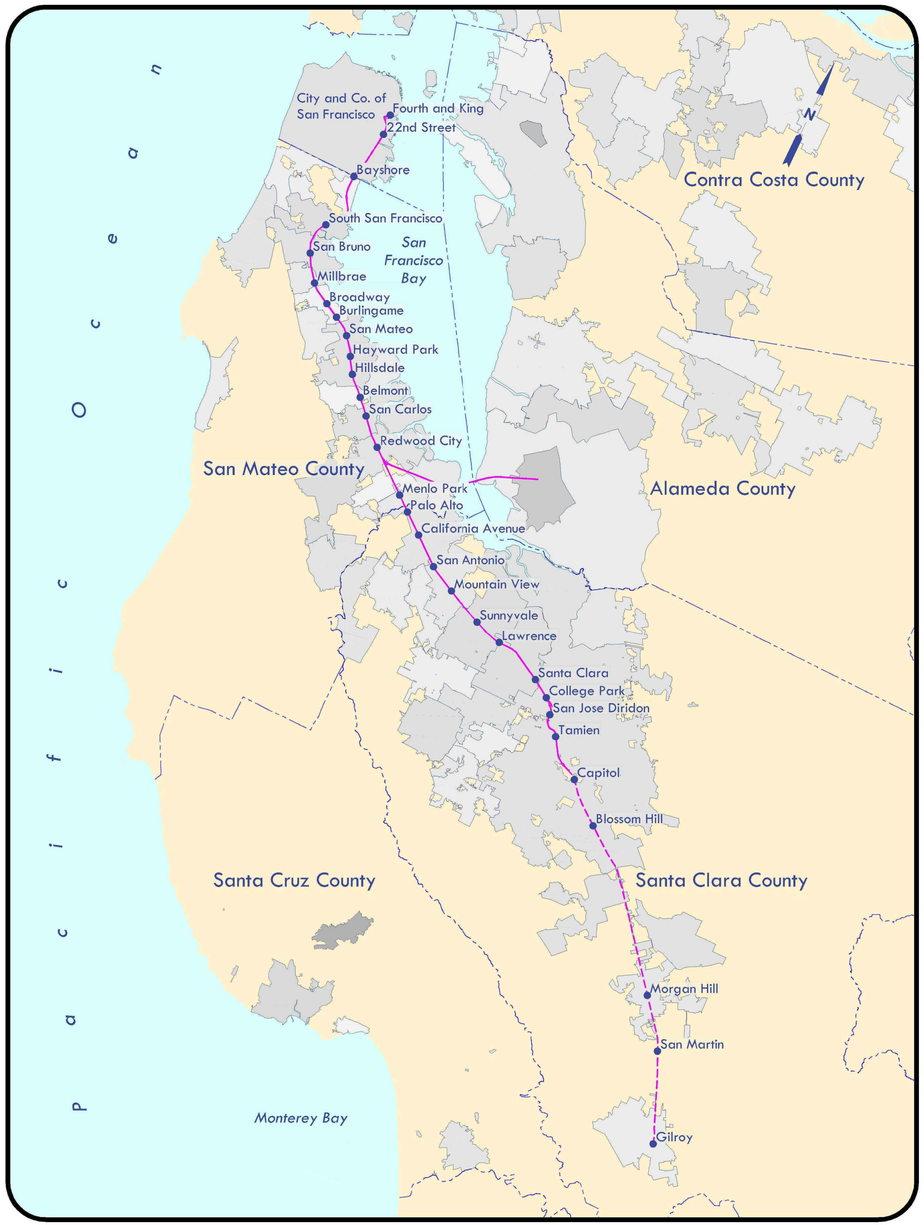
CALTRAIN CORRIDOR



ELECTRIFICATION STANDARD DRAWINGS

PENINSULA CORRIDOR JOINT POWERS BOARD

OVERHEAD CONTACT SYSTEM
BASIC DESIGN: GROUNDING AND BONDING

JANUARY 01, 2026

INDEX OF DRAWINGS

REV	DATE	BY	CHK	APP	DESCRIPTION
	010126				SECOND EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DIRECTOR, ENGINEERING

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

DRAWING INDEX

CADD FILE NAME: SD–E5001

REV: | EDITION: SECOND

SCALE: NONE

STANDARD DRAWING NO.: SD–E5001

ABBREVIATIONS

ACSR	ALUMINUM CONDUCTOR STEEL REINFORCED CABLE
ATF	AUTOTRANSFORMER FEEDER
ATFZ	AUTOTRANSFORMER FEEDER ZONE
AVE	AVENUE
AWG	AMERICAN WIRE GAUGE
CCZ	CURRENT COLLECTOR ZONE
CL	CABLE LENGTH
CEMOF	CENTRALIZED EQUIPMENT MAINTENANCE AND OPERATIONS FACILITY
CONC	CONCRETE
CP	COUNTERPOISE
CU	COPPER
CW	CONTACT WIRE
DWG. NO.	DRAWING NUMBER
EXIST	EXISTING
EGC	EQUIPMENT GROUNDING CONDUCTOR
EOR	ENGINEER OF RECORD
FDN	FOUNDATION
FG	FINISHED/FINAL GRADE
HP	HIGHEST POINT OF CONTACT WIRE
LV	LOW VOLTAGE (120V NOMINAL VOLTAGE)
MF	MAINTENANCE FACILITY
MGB	MAIN GROUNDING BUS BAR
MV	MEDIUM VOLTAGE
MW	MESSENGER WIRE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NTS	NOT TO SCALE
OCLZ	OVERHEAD CONTACT LINE ZONE
OCS	OVERHEAD CONTACT SYSTEM
PS	PARALLELING STATION
ROW	RIGHT-OF-WAY
SD	STANDARD DRAWING
SPD	SURGE PROTECTION DEVICE
SRG	SIGNAL REFERENCE GROUND
SW	STATIC WIRE
SWS	SWITCHING STATION
THHN	THERMOPLASTIC, HIGH HEAT, NYLON INSULATION
TPS	TRACTION POWER SUBSTATION
TVM	TICKET VENDING MACHINE
VLD	VOLTAGE LIMITING DEVICE
VMS	VISUAL MESSAGE SIGN
WWM	WELDED WIRE MESH

SYMBOLS

- PASSENGER SHELTER
- OCS POLE
- VISUAL MESSAGE SIGN
- LIGHT POLE
- GROUND
- CENTER LINE
- GROUND ROD
- CABLE CONNECTION/JOINT
- DRAIN BOND OR IMPEDANCE BOND

LINESTYLES

- CENTERLINE
- METALLIC RIGHT-OF-WAY FENCE (BY OTHERS)
- INTERTRACK FENCE, WELDED WIRE MESH (WWM) (BY OTHERS)
- OVERHEAD CONTACT LINE ZONE (OCLZ)
- COUNTERPOISE OR GROUND CABLE #4/0 AWG, UNLESS OTHERWISE INDICATED
- TRACTION BONDING CABLE ($\geq$ #4/0 AWG CU), UNLESS OTHERWISE INDICATED
- AUTOTRANSFORMER FEEDER (ATF) (BY OTHERS)
- STATIC WIRE ACSR (BY OTHERS)

GENERAL NOTES:

1. THIS PACKAGE IS THE STANDARD DESIGN FOR GROUNDING AND BONDING AND DOES NOT APPLY TO NEUTRAL RETURN SYSTEM.
2. FOR SYSTEM WIDE GROUNDING AND BONDING SPECIFICATIONS, REFER TO SPECIFICATION 26 05 26.
3. THE STANDARD GROUNDING AND BONDING DESIGN OF THE FOLLOWING IS NOT IN THE SCOPE OF THIS SET:
   - A. GENERAL FACILITY GROUNDING.
   - B. LIGHTNING PROTECTION AND SURGE ARRESTERS.
   - C. GROUNDING AND BONDING PROTECTION SYSTEMS FOR THE COMMUNICATIONS SYSTEM EQUIPMENT AND STRUCTURES.
   - D. GROUNDING AND BONDING REQUIREMENTS FOR FACILITY POWER SYSTEMS AND LIGHTING SYSTEMS.
   - E. GROUNDING REQUIREMENTS FOR RACEWAY, CABLE TRAY, UNDERGROUND DUCT BANKS AND STRUCTURES.
   - F. GROUNDING AND BONDING REQUIREMENTS FOR UTILITIES.
   - G. GROUNDING DESIGN OF FACILITIES/BUILDINGS, RAISED FLOOR SYSTEMS, EQUIPMENT ROOMS AND PRE-ENGINEERED ENCLOSURES, SUCH AS: TRACTION POWER FACILITY (TPF) EQUIPMENT HOUSES, COMMUNICATIONS ROOMS, CBOSS/PTC/SIGNAL HOUSES AND WAYSIDE POWER CONTROL CUBICLES.
   - H. STRAY CURRENT, CORROSION CONTROL AND EMI.
4. REFER TO OTHER DISCIPLINES FOR THE FOLLOWING:
   - A. BRIDGE STRUCTURE PLAN AND ELEVATION BACKGROUNDS.
   - B. OCS BACKGROUNDS FOR STATIC WIRE, CONTACT WIRE, AUTOTRANSFORMER FEEDER WIRE AND MESSENGER WIRE.
   - C. STATION BACKGROUNDS FOR THE EXTENT OF PLATFORM, WHICH DETERMINES THE EXTENT OF COUNTERPOISE WIRE.
5. FOR ALL DRAWINGS: STATIC WIRE, ELECTRIFIED WIRE, OCS POLE AND SUPPORT, PROTECTION BARRIER, BRIDGE STRUCTURE LAYOUT, SECTION AND ELEVATION PLAN, STATION AND PLATFORM PLAN ARE PROVIDED AS BACKGROUND BY OTHERS (SEE NOTE 4 ABOVE) AND ARE PROVIDED FOR REFERENCE ONLY. APPLY PROJECT SPECIFIC BACKGROUND FOR OCS, BRIDGE STRUCTURE, STATION PLATFORM AND SIGNALS.
6. FOR THIRD PARTY UTILITY GROUNDING AND BONDING:
   - A. CONTRACTOR SHALL IDENTIFY ALL THIRD PARTY METALLIC FENCES, THIRD PARTY PIPELINES, THIRD PARTY STRUCTURES AND THIRD PARTY PURPOSELY ELECTRIFIED FENCES.
   - B. FOR REQUIREMENTS, SEE NOTES 8 AND 9 ON DRAWING SD-E5011.
   - C. CONTRACTOR SHALL SUBMIT THE DESIGN, PRIOR TO INSTALLATION, TO THE ENGINEER FOR APPROVAL.
7. CONDUCTORS USED FOR GROUNDING AND BONDING SHALL BE 4/0 AWG COPPER, ANNEALED AND SOFT DRAWN, OR APPROVED EQUAL. IN EASILY ACCESSIBLE AREAS, THE CONDUCTOR SHALL BE ERICO OR ANTITHEFT EQUAL APPROVED, WITH EQUIVALENT ELECTRICAL PROPERTIES.
8. BONDING TO PRESTRESSED STEEL TENDONS, WITHIN STRUCTURES, IS PROHIBITED.
9. FOR THE PURPOSE OF CALTRAIN ELECTRIFICATION STANDARD DRAWINGS, THE FOLLOWING NOMENCLATURE IS USED:
   - A. A BARE CONDUCTOR, ALSO REFERRED TO AS WIRE, IS A METALLIC CONDUCTOR WITHOUT INSULATION OR COVERING.
   - B. A CABLE IS A METALLIC CONDUCTOR WITH INSULATION OR COVERING.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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Bin Zhang

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Caltrain

ENGINEERING STANDARD DRAWINGS

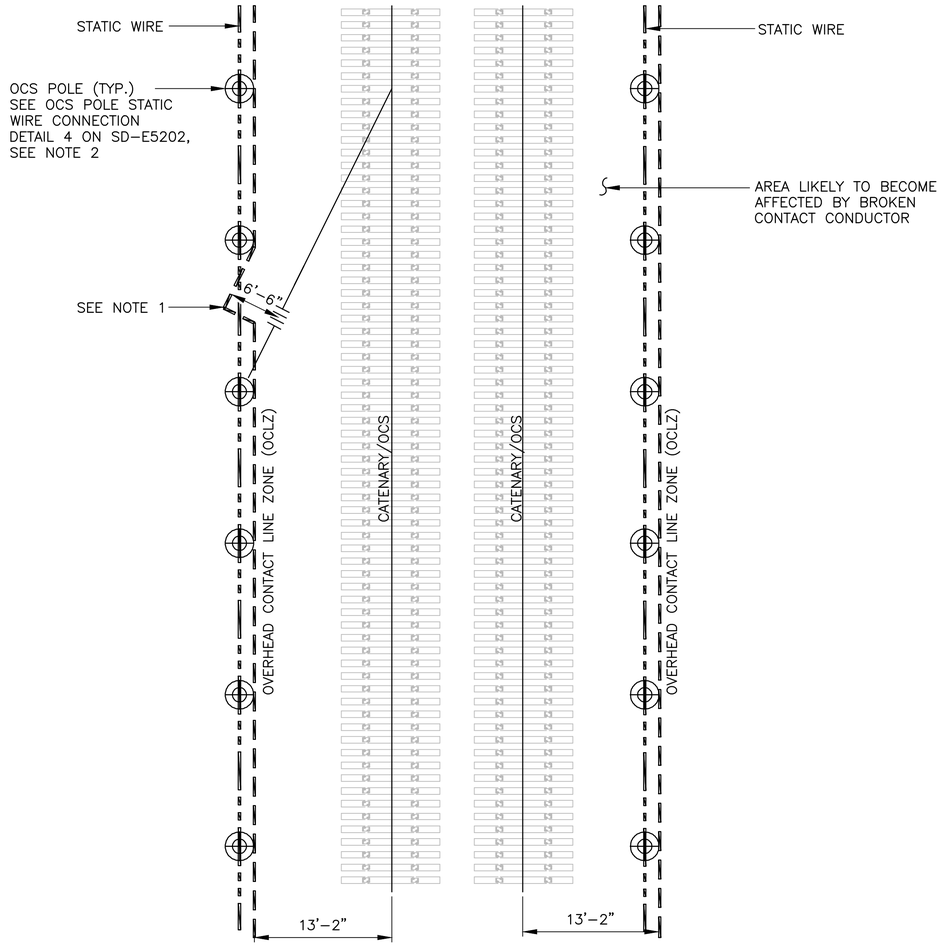
GROUNDING AND BONDING
BASIC DESIGN
ABBREVIATIONS, SYMBOLS,
GENERAL NOTES AND ASSUMPTIONS

CADD FILE NAME: SD-E5002

REV: | EDITION: SECOND

SCALE: NONE

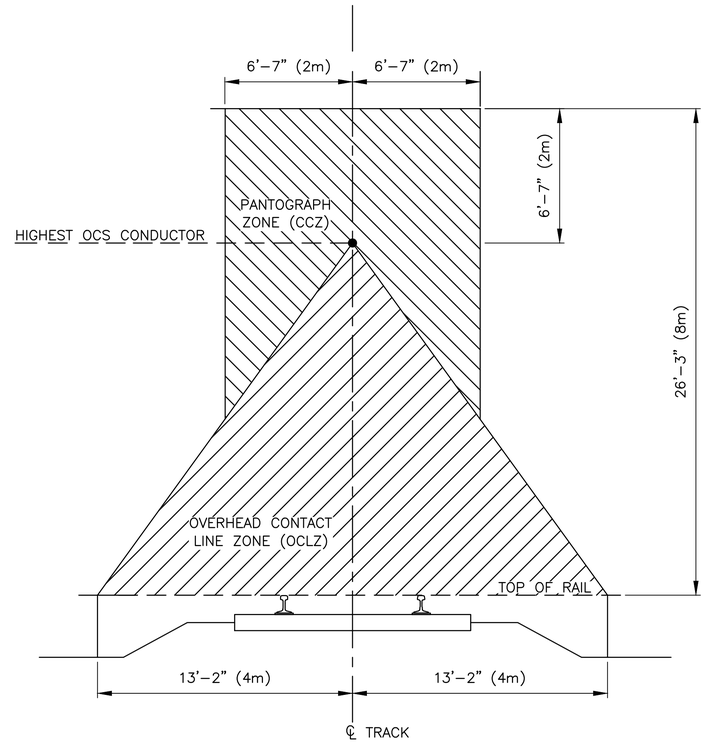
STANDARD DRAWING NO.: SD-E5002



OVERHEAD CONTACT LINE ZONE
PLAN VIEW

1 / – PLAN

SCALE: NOT TO SCALE



OVERHEAD CONTACT LINE ZONE
AND PANTOGRAPH ZONE

2 / – SECTION

SCALE: NOT TO SCALE

NOTES:

1. THE OCLZ IS EXTENDED LATERALLY TO A DISTANCE OF 6'–7" FROM OUTERMOST LIVE TERMINATION WIRE.
2. FOR OCLZ GROUNDING DETAILS TO THE NEAREST OCS POLE, AND GROUNDING LOCATIONS OF SIGNAL ELEMENTS, INCLUDING CROSS BONDS GROUNDING WITHIN OCLZ, REFER TO SIGNALS AND COMMUNICATIONS DUCTBANK DRAWINGS.

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ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

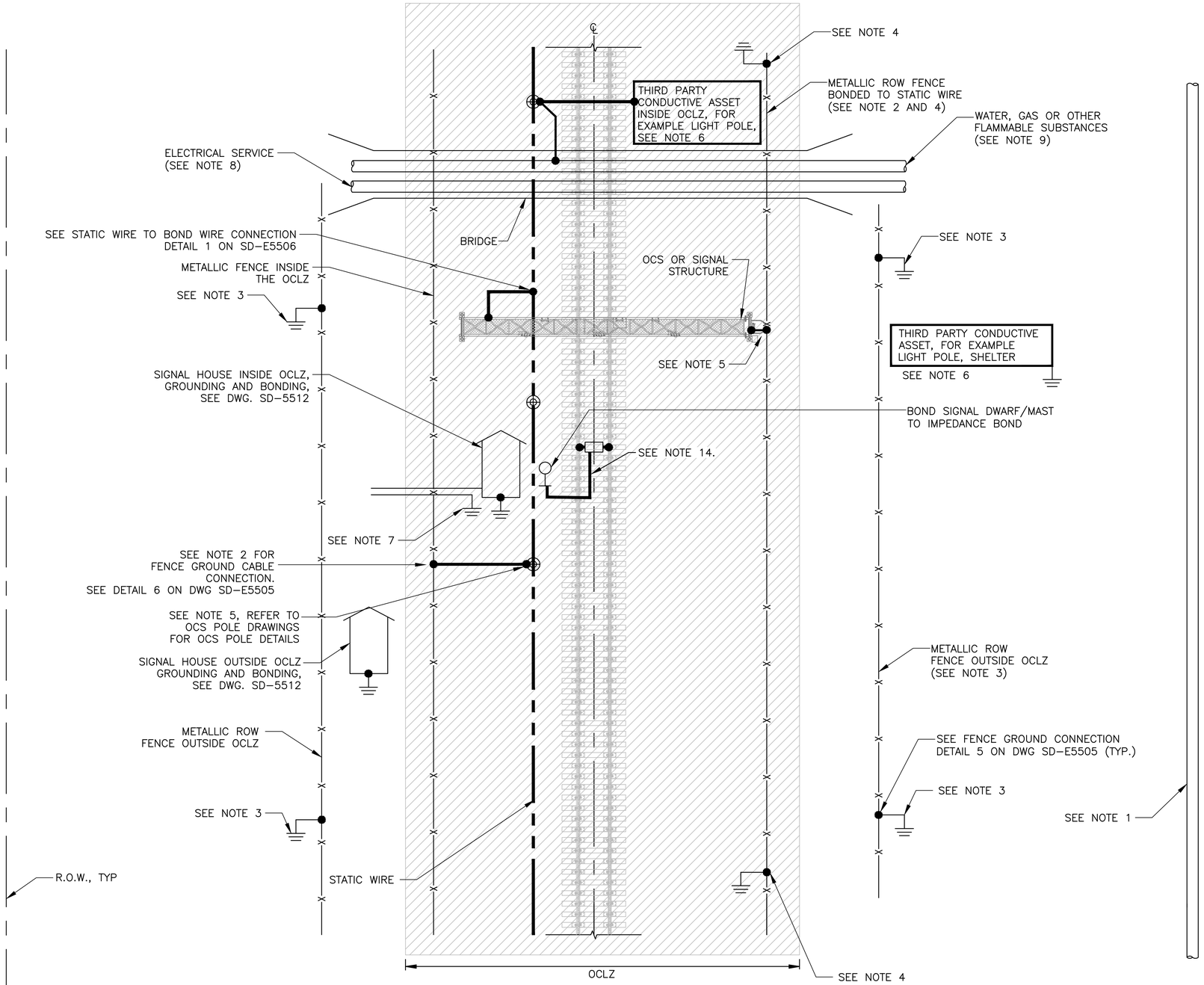
OVERHEAD CONTACT LINE ZONE

CADD FILE NAME: SD–E5010

REV: | EDITION: SECOND

SCALE: NTS

STANDARD DRAWING NO.: SD–E5010



TYPICAL ROW GROUNDING AND BONDING

1 – PLAN

SCALE: NOT TO SCALE

NOTES:

1. WHERE EXPOSED METAL PIPE AND/OR CONDUIT IS WITHIN ROW, LOCATED NO MORE THAN 45' FROM TRACK, THE PIPE AND/OR CONDUIT GROUNDING SHALL BE COORDINATED WITH THE ASSET OWNER.
2. METALLIC RIGHT–OF–WAY FENCE LESS THAN 1000FT LONG AND INSIDE THE OCLZ SHALL BE BONDED TO THE STATIC WIRE OR COUNTERPOISE WIRE. IF THE FENCE EXCEEDS 1000FT IN LENGTH IT SHALL BE DIVIDED INTO MAXIMUM 1000FT SECTIONS WITH INSULATED INSERTS. SEE INSULATED FENCE INSERTS DETAIL 1 ON DWG SD–E5508.
3. METALLIC RIGHT–OF–WAY FENCE OUTSIDE THE OCLZ AND LESS THAN 45' FROM CENTERLINE OF TRACK SHALL BE GROUNDED IN ACCORDANCE WITH NFPA 70. GROUND RODS SHALL BE SPACED AT MAXIMUM 500FT INTERVALS.
4. FOR FENCE, DISTANCE BETWEEN GROUNDS, WHETHER STATIC WIRE/COUNTERPOISE CONNECTION OR EARTH, SHALL NOT EXCEED 500FT.
5. CONNECTION OF FENCES OR OTHER WAYSIDE DEVICES TO THE STATIC WIRE SHALL BE MADE BY BONDING TO THE BASE OF THE NEAREST OCS POLE OR ANOTHER STATIC WIRE BONDED STRUCTURE.
6. EXPOSED THIRD PARTY CONDUCTIVE ASSETS INSIDE OCLZ SHALL BE BONDED TO STATIC WIRE THROUGH THE NEAREST OCS POLE, EXPOSED THIRD PARTY CONDUCTIVE ASSETS OUTSIDE OCLZ AND WITHIN 45' FROM CENTERLINE OF NEAR ELECTRIFIED TRACK SHALL BE GROUNDED LOCALLY, COORDINATE WITH ASSET OWNER AND OBTAIN APPROVAL.
7. UTILITY GROUND IS EXISTING AND SHALL BE SEPARATE FROM TRACTION POWER RETURN SO THAT THERE ARE NO PHYSICAL ELECTRICAL CONNECTIONS BETWEEN UTILITY GROUND AND FACILITY GROUND.
8. METALLIC CONDUIT IN OVER–HEAD OR UNDER–GRADE BRIDGES SHALL BE BONDED TO TRACTION RETURN OR INSULATED. IF CHOSEN, INSULATION SHALL WRAP METALLIC CONDUIT TO REMOVE ANY POTENTIAL OR EXCESSIVE TOUCH VOLTAGE OR RETURN CURRENT IN THAT CONDUIT. WRAP METALLIC CONDUIT WITH INSULATION MATERIAL EXTENDING 10 FT ON EACH SIDE OF OVERHEAD BRIDGE. COORDINATE WITH ASSET OWNER AND OBTAIN APPROVAL.
9. FOR EXPOSED WATER LINES, GAS LINES AND OTHER FLAMMABLE SUBSTANCES IN OVER–HEAD BRIDGES, ALL EXPOSED METALLIC CARRIER PIPES SHALL BE ISOLATED IN ACCORDANCE WITH NOTE 8. FOR PRESSURIZED WATER LINES, EXPOSED METAL PIPE SHALL BE ENCASED (BY OTHERS NOT IN GROUNDING AND BONDING DRAWINGS) IN A METAL CASING THAT IS ISOLATED FROM THE CARRIER PIPE BY APPROVED INSULATORS. METAL CASING SHALL BE BONDED TO THE RAILROAD STATIC WIRE. COORDINATE WITH ASSET OWNER TO OBTAIN APPROVAL. NOTIFY EOR IF AN ALTERNATIVE ISOLATION METHOD IS REQUIRED.
10. FOR FENCE GATES SEE DETAIL 2 AND 3 ON DWG SD–E5505.
11. IF THIRD PARTY ELECTRIFIED FENCES FOR LIVE STOCK CONTROL ARE ENCOUNTERED ALONG THE WAY, CONTRACTOR SHALL CONFIRM WITH ENGINEER FOR SITE SPECIFIC GROUNDING AND INSULATING REQUIREMENTS. CONNECTIONS TO THIRD PARTY INFRASTRUCTURE SHALL BE COORDINATED AND APPROVED BY THIRD PARTY.
12. CONTRACTOR SHALL IDENTIFY THE THIRD PARTY FENCES OUTSIDE OCLZ BUT LESS THAN 45 FEET FROM CENTERLINE OF ELECTRIFIED TRACK, AND BOND LOCALLY USING GROUND RODS. CONTRACTOR SHALL COORDINATE WITH ASSET OWNER AND OBTAIN APPROVAL.
13. FOR OCLZ GROUNDING DETAILS TO THE NEAREST OCS POLE, AND GROUNDING LOCATIONS OF SIGNAL ELEMENTS, INCLUDING CROSS BONDS GROUNDING WITHIN OCLZ, REFER TO SIGNALS AND COMMUNICATIONS DUCTBANK DRAWINGS.
14. REFER TO CALTRAIN SIGNAL STANDARD DRAWINGS FOR BONDING DETAILS.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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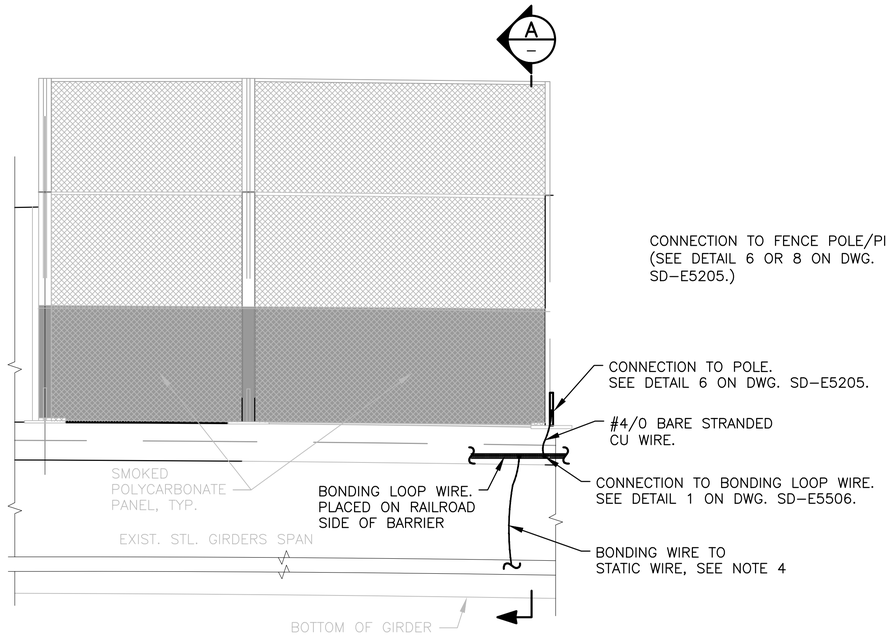
ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN
GROUNDING, BONDING AND
SEPARATION REQUIREMENTS

CADD FILE NAME:	SD–E5011
REV:	EDITION: SECOND
SCALE:	NTS
STANDARD DRAWING NO.:	SD–E5011



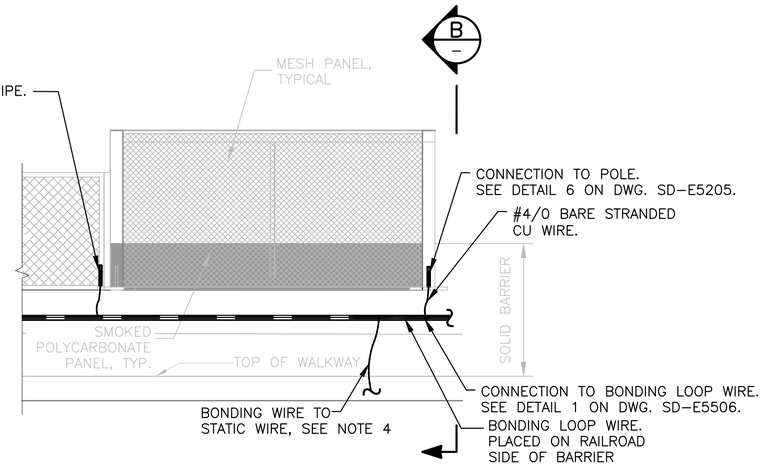
ELEVATION VIEW
OF CURVED FENCE

1 – ELEVATION

SCALE: NOT TO SCALE

NOTE:

FOR FENCE AND BARRIER DIMENSIONS, SEE NOTE 1.



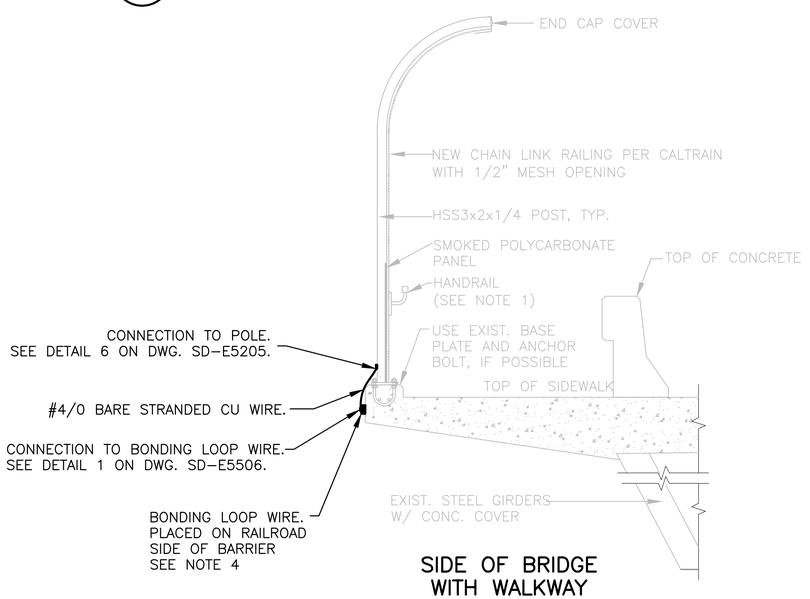
ELEVATION VIEW
OF STRAIGHT FENCE

2 – ELEVATION

SCALE: NOT TO SCALE

NOTES:

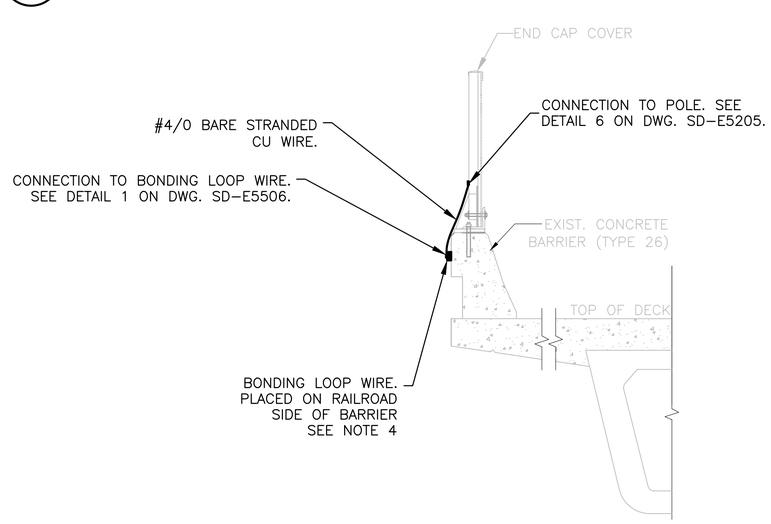
1. FOR PROTECTION BARRIER REQUIREMENTS, HEIGHT AND LENGTH, REFER TO BRIDGE ATTACHMENT DRAWINGS.
2. PROVIDE BONDING LOOP WIRE ON BOTH SIDES OF THE BRIDGE FACING THE RAILROAD, AND SUPPORT FROM THE BRIDGE.
3. PROVIDE BONDING CONDUCTOR TO BOND METALLIC POLE OF THE PROTECTION BARRIER TO THE BONDING LOOP WIRE.
4. PROVIDE BONDING CONDUCTOR TO BOND THE BONDING LOOP WIRE TO STATIC WIRE, AND SUPPORT THE BONDING CONDUCTOR FROM THE BRIDGE.
5. SEE DWGS SD–E5202 AND SD–E5203 FOR TYPICAL GROUNDING AND BONDING FOR CONCRETE BRIDGE AND STEEL BRIDGE.
6. AN ADDITIONAL STAINLESS STEEL CABLE SHALL BE INSTALLED TO PROVIDE AN EXPOSED GROUND WHERE PVC COATED MESH FABRIC IS UTILIZED. REFER TO PROTECTION BARRIER DETAILS FOR CONSTRUCTION DETAIL.



SIDE OF BRIDGE
WITH WALKWAY

A – SECTION

SCALE: NOT TO SCALE



SIDE OF BRIDGE
WITHOUT WALKWAY

B – SECTION

SCALE: NOT TO SCALE

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ENGINEERING STANDARD DRAWINGS

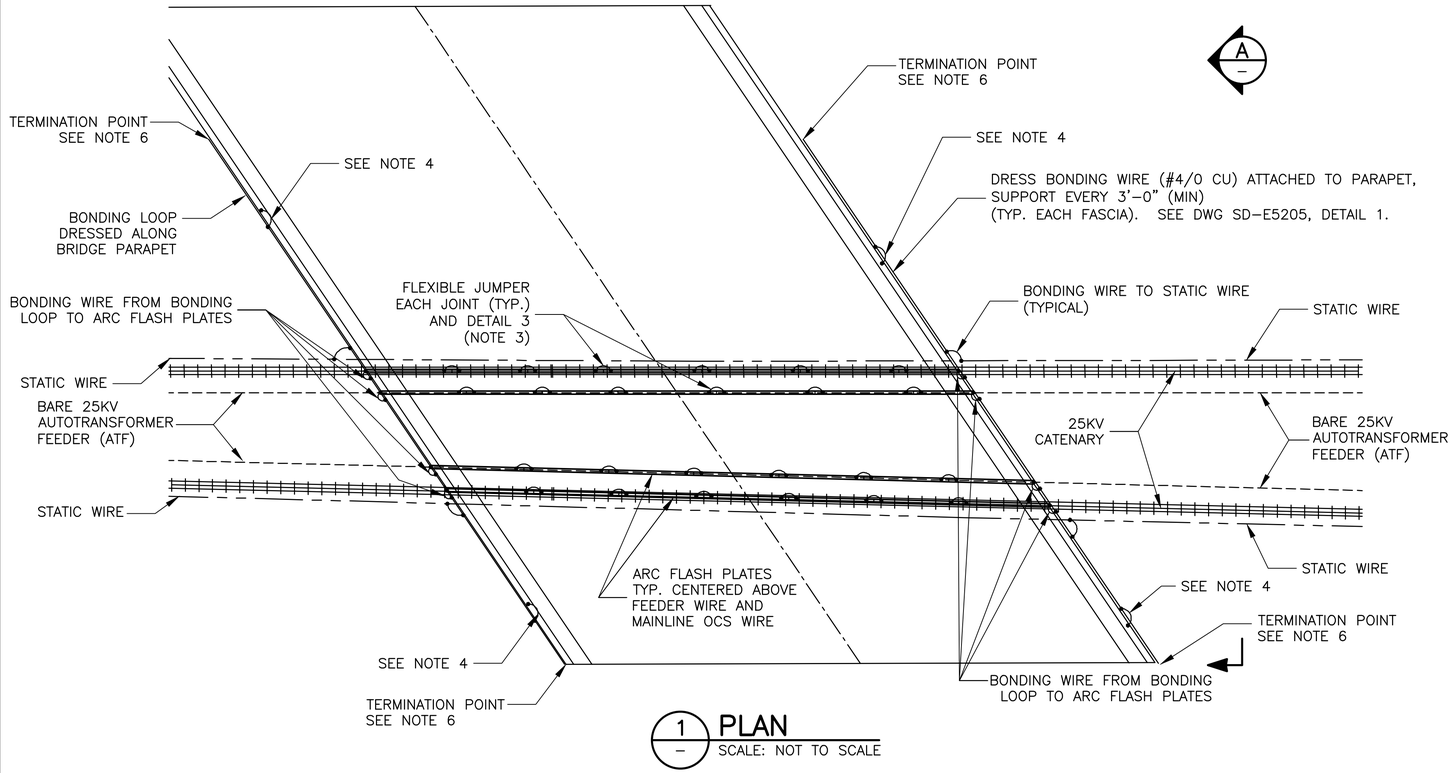
GROUNDING AND BONDING
BASIC DESIGN
TYPICAL BONDING LOOP
FOR PROTECTION BARRIER

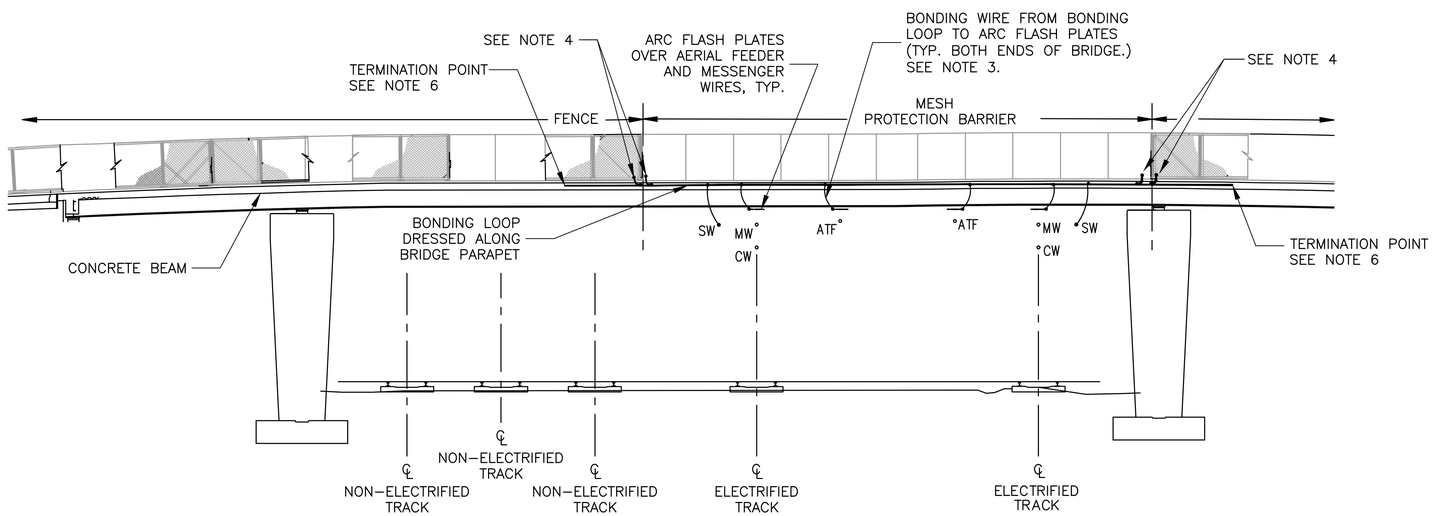
CADD FILE NAME: SD-E5201

REV: | EDITION: SECOND

SCALE: NTS

STANDARD DRAWING NO.: SD–E5201



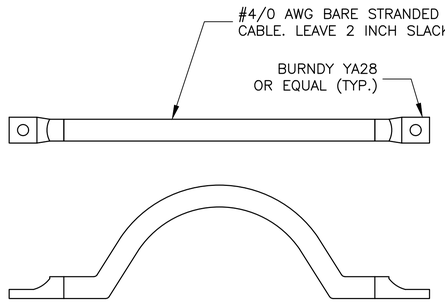


SQUARE LONGITUDINAL SECTION

A SECTION
SCALE: NOT TO SCALE

NOTES:

1. FOR LOCATION OF ARC FLASH PLATES AND FOR LOCATION AND DETAIL OF PROTECTION BARRIERS, REFER TO BRIDGE ATTACHMENT DRAWINGS.
2. THE LOCATION OF OCS WIRES (CW, MW, ATF AND SW) ARE SHOWN FOR REFERENCE ONLY, FOR EXACT LOCATION REFER TO OCS PLANS.
3. EACH ARC FLASH PLATE TO BE JUMPERED TO THE NEXT ARC FLASH PLATE (SEE DWG SD-E5205 DETAIL 3). EACH END ARC FLASH PLATE TO BE JUMPERED TO THE BONDING LOOP USING A BOND CABLE CRIMP (SEE DWG SD-E5506 DETAIL1). SEE DWG SD-E5507 FOR BONDING OF ARC FLASH PLATE DETAILS.
4. BOND PROTECTION BARRIER TO BONDING LOOP, REFER TO DWG. SD-E5201 FOR DETAILS.
5. BRIDGE AND OCS STRUCTURES ARE FOR REFERENCE ONLY TO SHOW GROUNDING AND BONDING; AND DO NOT PORTRAY EXISTING BRIDGE CONDITIONS OR PROPOSED OCS STRUCTURE ASSEMBLY.
6. TERMINATE CROSS-CONNECT JUMPER CABLE A MINIMUM OF 20 FEET NORMAL TO THE CATENARY WIRE AND A MINIMUM OF 10 FEET NORMAL TO THE AUTOTRANSFORMER FEED (ATF).
7. AT EXPANSION JOINTS, PROVIDE SUFFICIENT SLACK IN THE BONDING CONDUCTOR TO ALLOW FOR BRIDGE EXPANSION JOINT MOVEMENT.



FLEXIBLE JUMPERS

3 DETAIL
SCALE: NOT TO SCALE

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ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

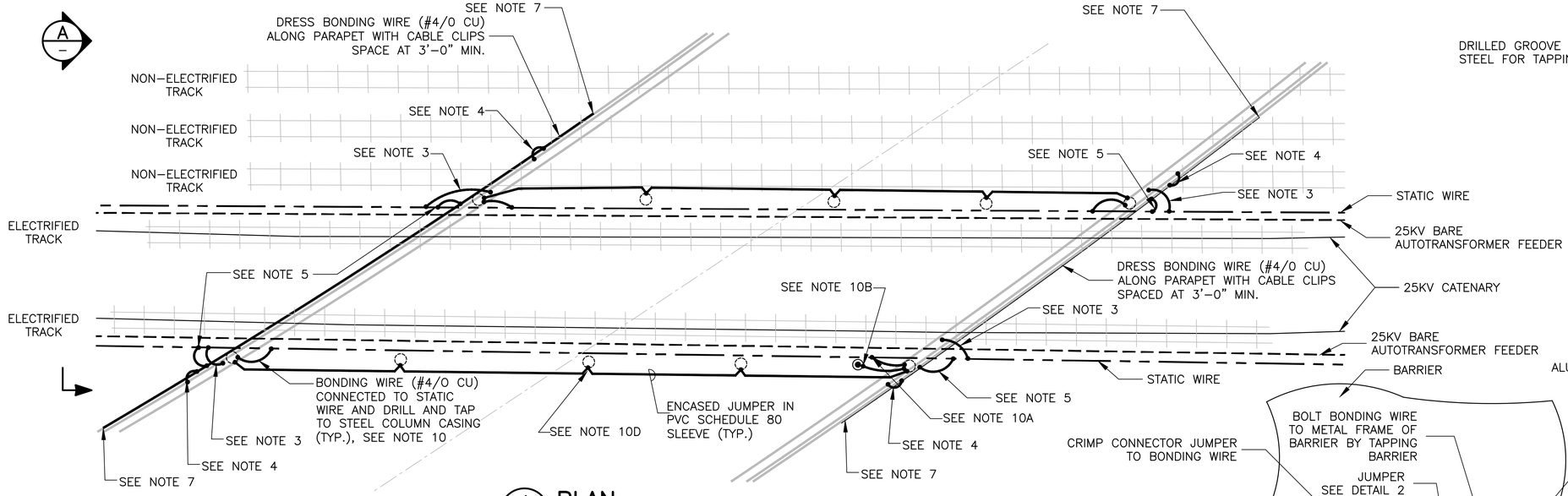
TYPICAL CONCRETE BRIDGE

CADD FILE NAME: SD-E5202

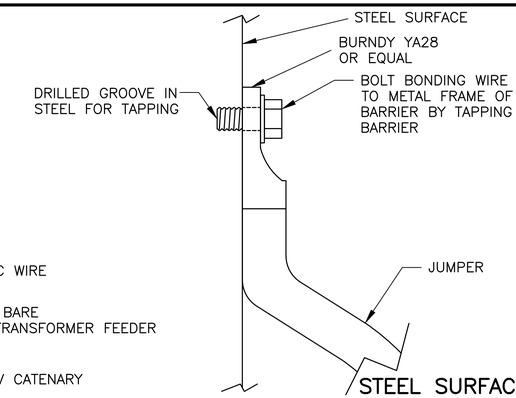
REV: | EDITION: SECOND

SCALE: NTS

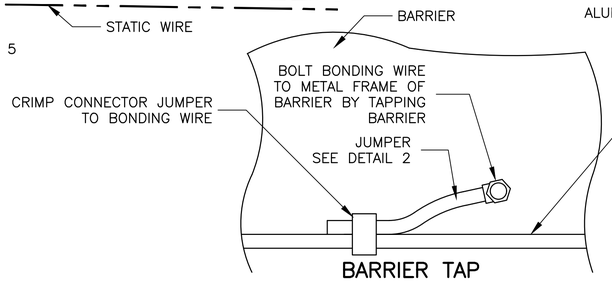
STANDARD DRAWING NO.: SD-E5202



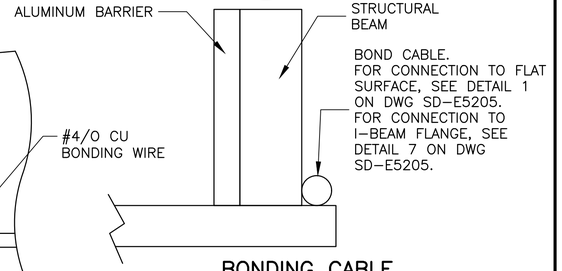
1 PLAN
SCALE: NOT TO SCALE



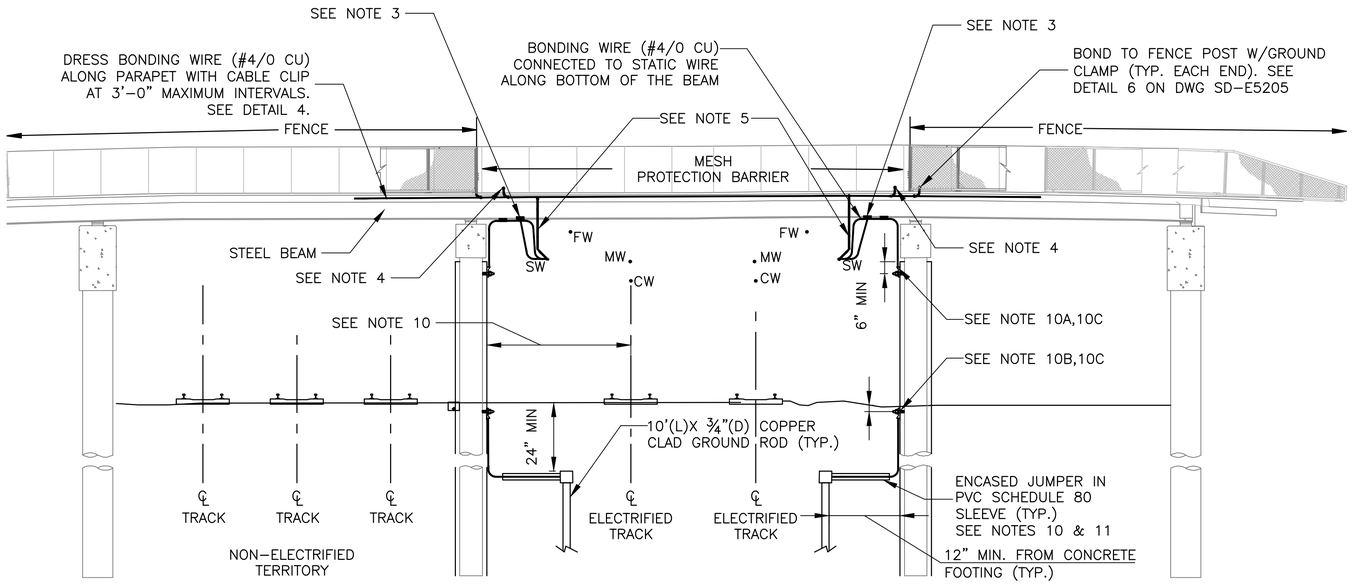
STEEL SURFACE BOND
2 DETAIL
SCALE: NOT TO SCALE



BARRIER TAP TO BOND CABLE
3 DETAIL
SCALE: NOT TO SCALE



BONDING CABLE TO PARAPET CLAMPS
4 DETAIL
SCALE: NOT TO SCALE



SQUARE LONGITUDINAL SECTION
A SECTION
SCALE: NOT TO SCALE

NOTES:

1. BRIDGE AND OCS STRUCTURES ARE FOR REFERENCE ONLY TO SHOW GROUNDING AND BONDING AND DO NOT PORTRAY EXISTING BRIDGE CONDITIONS OR PROPOSED OCS STRUCTURE ASSEMBLY.
2. THE LOCATION OF OCS WIRE (CW, MW, ATF AND SW) ARE SHOWN FOR REFERENCE ONLY. REFER TO OCS DRAWINGS AND TROUGH OR DUCT BANKS AS SHOWN ON OTHER SYSTEM WIDE DUCT BANK DRAWINGS.
3. WELDING WILL NOT BE ALLOWED ON THE STEEL GIRDER BUT WILL BE ALLOWED ON SECONDARY MEMBERS, SUCH AS CROSS BRACES. FOR STATIC WIRE CONNECTION TO GIRDER, SEE DETAIL 7 ON DWG. SD–E5205.
4. TAP TO METALLIC FRAME OF MESH BARRIER. SEE DETAIL 3.
5. PROVIDE BONDING CABLE #4/0 CU TO BOND THE BONDING LOOP WIRE TO STATIC WIRE. SUPPORT THE BONDING CABLE FROM THE BRIDGE. SEE DETAIL 4.
6. FOR GROUNDING AND BONDING OF UTILITIES, REFER TO NOTES 6, 8 AND 9 ON DWG. SD–E5011.
7. TERMINATE BONDING LOOP CABLE AT STEEL BRIDGE 20 FEET FROM ELECTRIFIED OCS WIRE WITH GROUND CLAMP. SEE DETAIL 7 ON DWG. SD–E5205. SEE ALSO DETAIL 2.
8. BONDING CABLES TO EXPOSED CONDUCTIVE PARTS, UTILITIES AND ELECTRICAL SERVICES SHALL BE MINIMUM #4/0 AWG STRANDED CU WIRE.
9. CONTRACTOR SHALL VERIFY IN FIELD WHERE COLUMN CASING IS ADJACENT TO ELECTRIFIED TRACK. LIMIT OF CASING SHALL ALSO BE VERIFIED IN FIELD.
10. CONTRACTOR SHALL VERIFY THAT THE DISTANCE FROM STEEL CASING TO THE ENERGIZED FEEDER IS LESS THAN 10 FEET AND/OR WHETHER THE STEEL CASING IS WITHIN OCLZ. CONTRACTOR TO OBTAIN APPROVAL FROM THE BRIDGE OWNER PRIOR TO DRILL AND TAP TO COLUMN STEEL CASING.
    A. IF THE DISTANCE TO THE ENERGIZED FEEDER WIRE, OUT OF RUNNING OCS WIRE, OR ATF WIRE, IS LESS THAN 10 FEET, DRILL AND TAP TO THE COLUMN STEEL CASING AND BOND TO THE STATIC WIRE.
    B. IF THE DISTANCE TO THE ENERGIZED FEEDER WIRE, OUT OF RUNNING OCS WIRE, OR ATF WIRE, IS MORE THAN 10 FEET, BUT THE STEEL CASING IS WITHIN OCLZ, DRILL AND TAP TO THE STEEL CASING AND BOND TO GROUND ROD. CONTRACTOR TO PROVIDE AS MANY GROUND RODS AS NEEDED AND TO IMPROVE THE QUALITY OF GROUNDING AS NEEDED FOR RESISTANCE TO GROUND TO BE LESS THAN 25 OHM.
    C. SEE DETAIL 2 FOR STEEL SURFACE BOND.
    D. BOND INTERMEDIATE STEEL CASING TO THE STEEL CASING NEAR THE FACE OF THE BRIDGE THAT IS BONDING TO STATIC WIRE OR GROUND ROD. DRILL AND TAP TO THE STEEL CASING.
11. CONTRACTOR TO VERIFY EXISTING FOUNDATION LOCATION AND CONFIRM CLEARANCE IS MET TO GROUND ROD BEYOND FOOTING.

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ENGINEERING STANDARD DRAWINGS

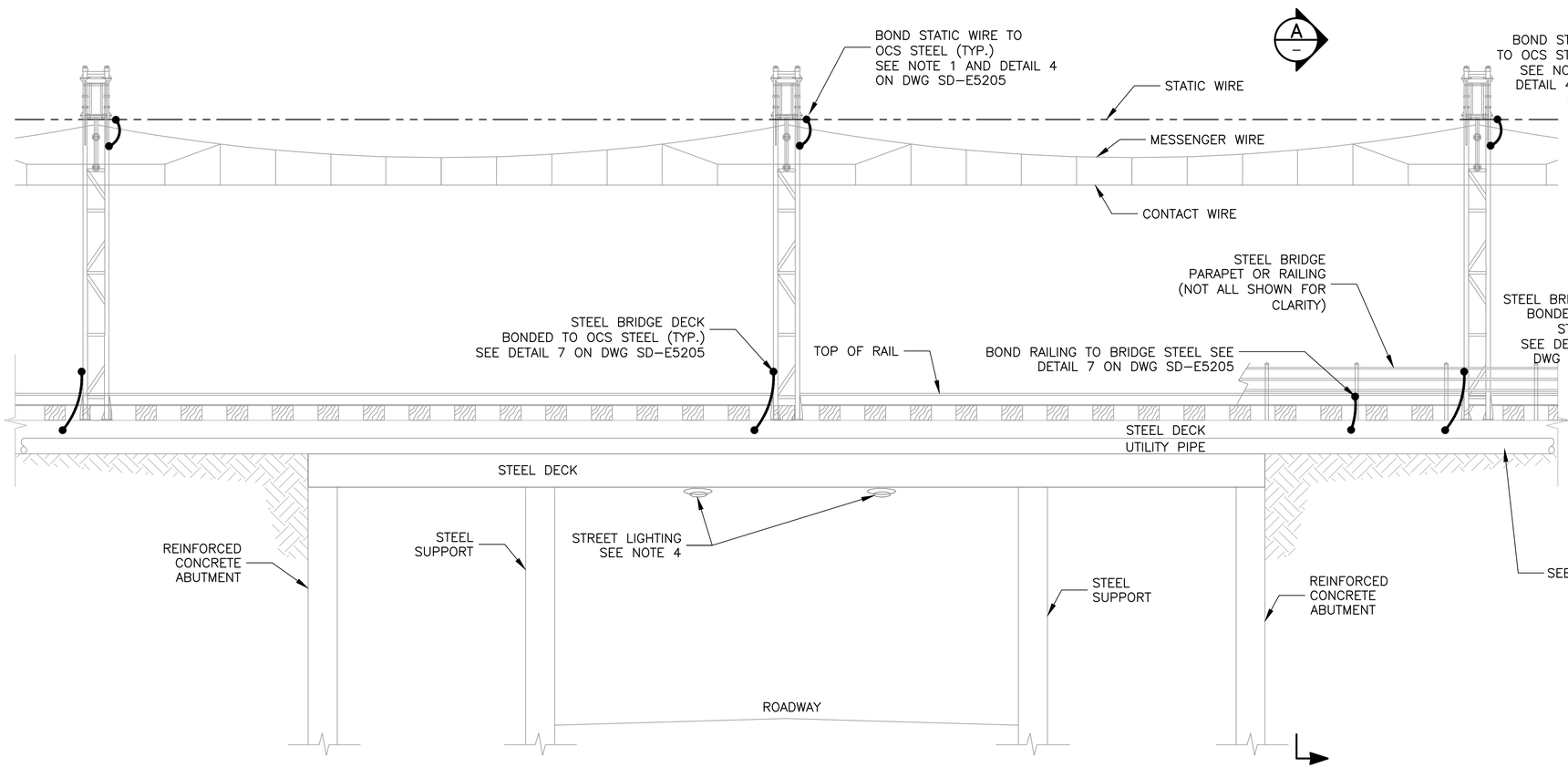
GROUNDING AND BONDING
BASIC DESIGN

TYPICAL STEEL BRIDGE

CADD FILE NAME: SD–E5203
REV: EDITION: SECOND
SCALE: NTS
STANDARD DRAWING NO.: SD–E5203

NOTES:

1. BOND BRIDGE STRUCTURE TO STATIC WIRE AT EACH END OF AND ON OPPOSITE SIDES OF BRIDGE.
2. ALL BRIDGE METALLIC STRUCTURES MUST BE BONDED (STEEL PARAPET, STEEL HANDRAILS, STEEL DECK, STEEL BRIDGE SUPPORT, UTILITY PIPES) SEE NOTES 6, 8 AND 9 ON DWG SD–E5011.
3. BRIDGE AND OCS STRUCTURES ARE FOR REFERENCE ONLY TO SHOW GROUNDING AND BONDING AND DO NOT PORTRAY EXISTING BRIDGE CONDITIONS OR PROPOSED STRUCTURE ASSEMBLY.
4. FOR GROUNDING AND BONDING OF UTILITIES, REFER TO NOTES 6, 8 AND 9 ON DWG SD–E5011.
5. ALL BONDING CABLES SHALL BE #4/0 AWG CU. AT TRACK LEVEL OR IN EASILY ACCESSIBLE AREAS, BONDING CABLES SHALL BE ERICO OR ANTITHEFT EQUAL APPROVED CABLE WITH EQUIVALENT ELECTRICAL PROPERTIES.
6. FOR STATIC WIRE CONNECTION TO WIDE FLANGE, SEE DETAILS ON DRAWING SD–E5205. USE STATIC WIRE SUPPORT AS SHOWN ON DRAWING SD–W5112, EXCEPT AT STATIONS.



1 – ELEVATION
SCALE: NOT TO SCALE

A – SECTION
SCALE: NOT TO SCALE

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	010126				SECOND EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DIRECTOR, ENGINEERING

Caltrain

ENGINEERING STANDARD DRAWINGS

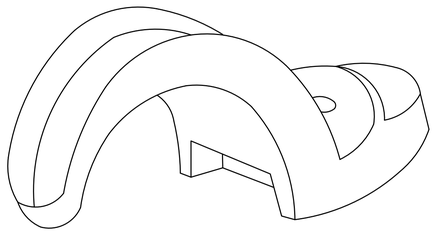
GROUNDING AND BONDING
BASIC DESIGN
TYPICAL UNDERPASS
STEEL DECK BRIDGE

CADD FILE NAME: SD–E5204

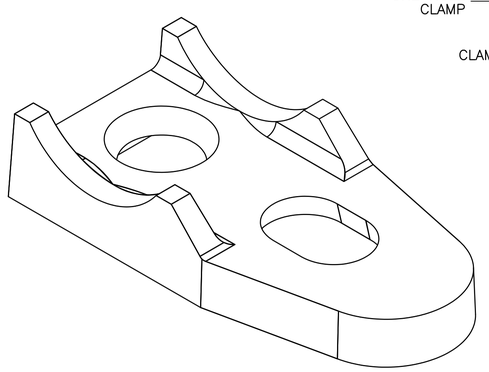
REV: | EDITION: SECOND

SCALE: NTS

STANDARD DRAWING NO.: SD–E5204



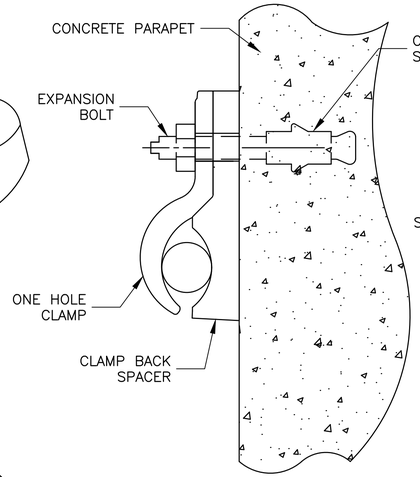
ONE HOLE CLAMP

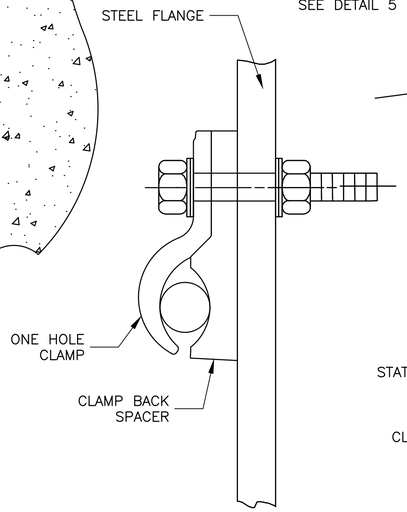


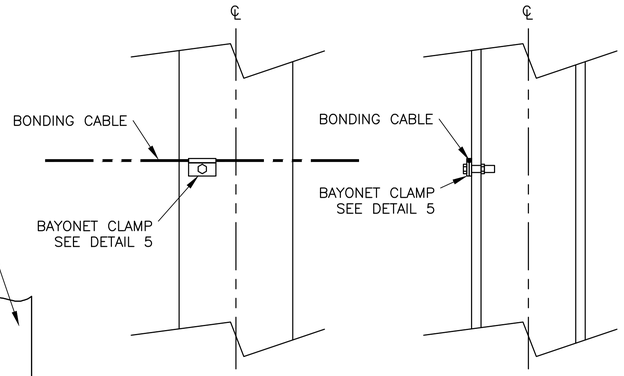
CLAMP BACK SPACER

CROSS CONNECT CABLE JUMPER SUPPORT
(FROM CONCRETE OR STEEL)

1 DETAIL
– SCALE: NOT TO SCALE

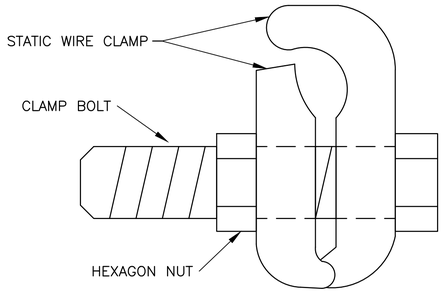






BONDING CABLE CONNECTION
TO STANDARD WIDE FLANGE

4 DETAIL
– SCALE: NOT TO SCALE

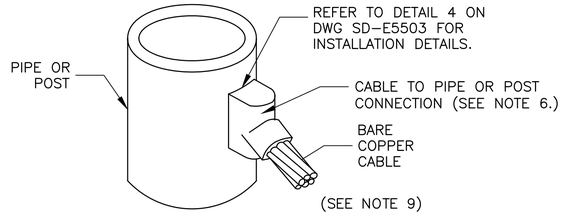


BAYONET CLAMP

5 DETAIL
– SCALE: NOT TO SCALE

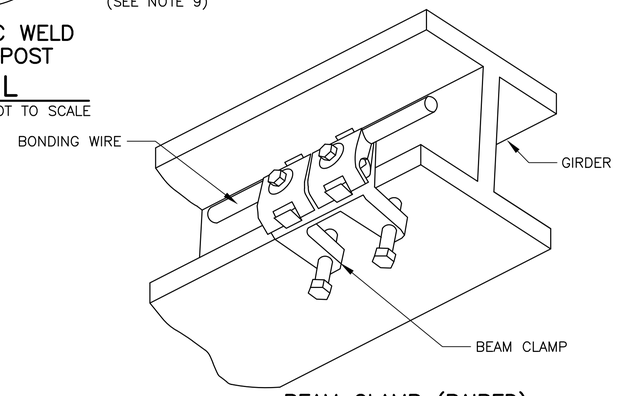
NOTES:

1. USE DETAIL 1 TO SUPPORT CROSS–CONNECT WIRES AT BRIDGE OVERPASSES.
2. FURNISH BONDING AND CROSS–CONNECT JUMPERS AS #4/0 AWG BARE CU WIRE UNLESS NOTED OTHERWISE. AT TRACK LEVEL OR IN EASILY ACCESSIBLE AREAS, BONDING SHALL BE ERICO OR ANTITHEFT EQUAL APPROVED CABLE WITH EQUIVALENT ELECTRICAL PROPERTIES.
3. ALL BURIED OR CONCRETE ENCASED GROUND CLAMPS TO BE RATED FOR DIRECT BURIAL.
4. GROUND CLAMPS TO BE BURNDY 22C037, 22C034, 22C041 (BASED ON POST DIAMETER) OR APPROVED EQUAL.
5. REFER TO OCS POLE DRAWINGS FOR OCS POLE DETAILS.
6. REFER TO DWG SD–E5503 DETAIL 1 FOR MORE EXOTHERMIC WELD CONNECTIONS.
7. FOR STATIC WIRE CONNECTION TO OCS POLE REFER TO DWG SD–W5110 DETAIL 2.
8. DO NOT DRILL OR INSTALL CONCRETE ANCHORS IN PRE–STRESSED OR POST TENSIONED MEMBERS.
9. MECHANICAL CLAMPS ARE APPROVED FOR USE IN LIEU OF EXOTHERMIC WELDS. SEE DETAIL 8 FOR MECHANICAL CLAMP.



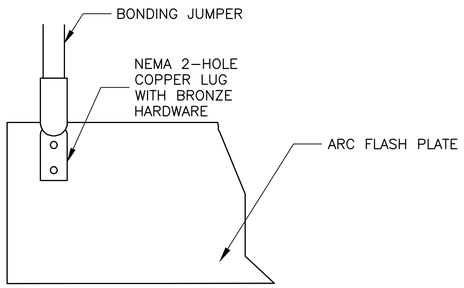
EXOTHERMIC WELD
TO PIPE/POST

6 DETAIL
– SCALE: NOT TO SCALE



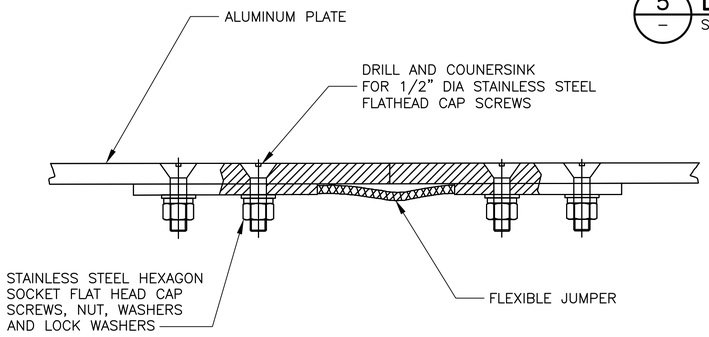
BEAM CLAMP (PAIRED)

7 DETAIL
– SCALE: NOT TO SCALE



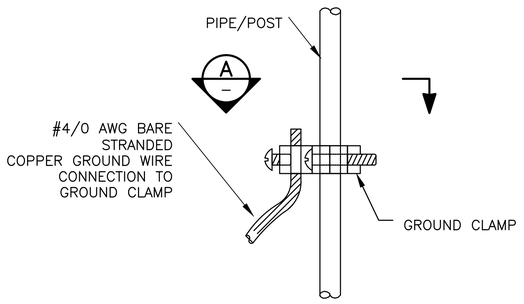
BONDING JUMPER TO ARC–FLASH
PLATE CONNECTION DETAIL

2 DETAIL
– SCALE: NOT TO SCALE



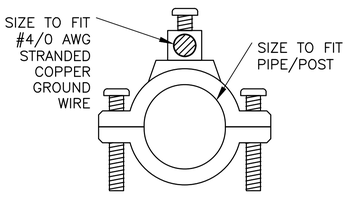
ARC–FLASH SCREEN PLATE
CONNECTION DETAIL

3 DETAIL
– SCALE: NOT TO SCALE



GROUND CLAMP CONNECTION

8 DETAIL
– SCALE: NOT TO SCALE



COPPER CLAMP

A SECTION
– SCALE: NOT TO SCALE

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	010126				SECOND EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

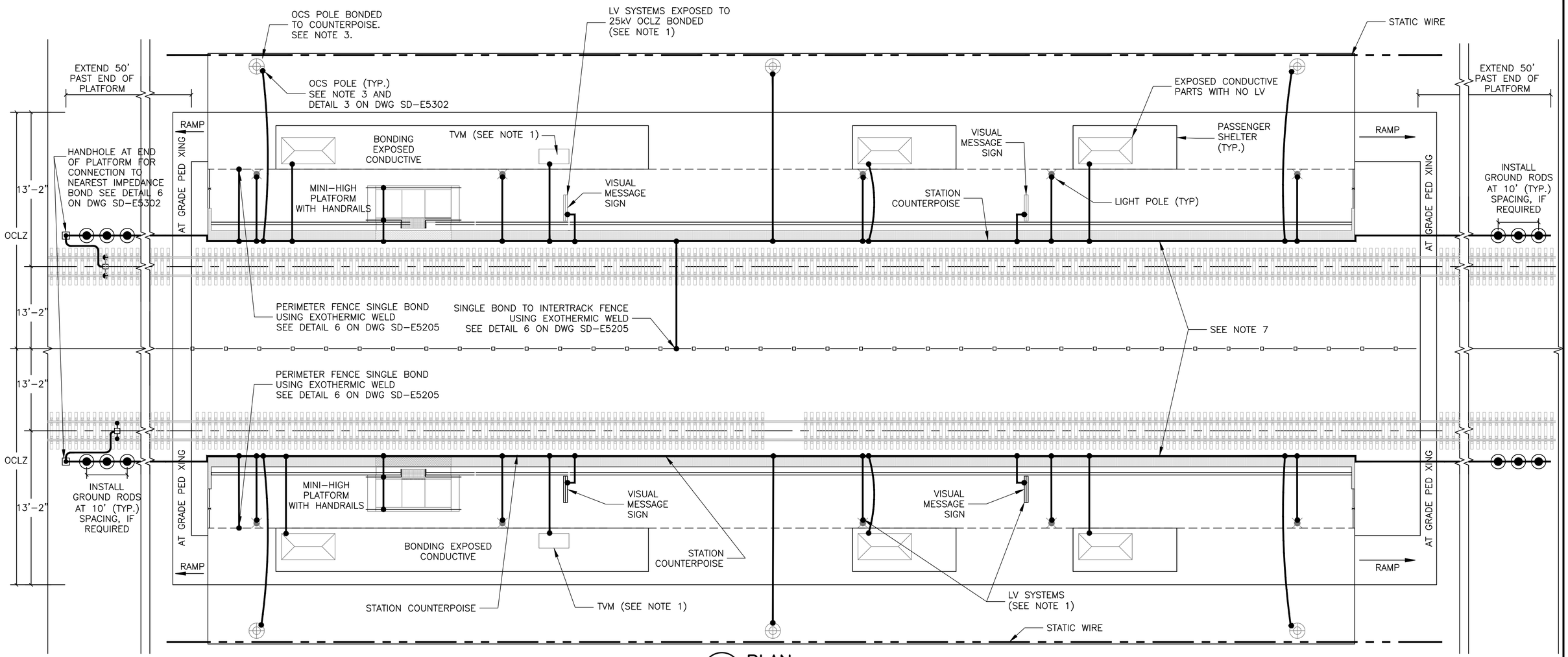
Bin Zhang

DIRECTOR, ENGINEERING

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN
TYPICAL BRIDGE GROUNDING AND
BONDING CONNECTION DETAILS

CADD FILE NAME:	SD–E5205
REV:	EDITION: SECOND
SCALE:	NTS
STANDARD DRAWING NO.:	SD–E5205



1 — PLAN
SCALE: NOT TO SCALE

NOTES:

1. BONDING OF ALL METALLIC OBJECTS, STRUCTURES, RAILINGS, RAMPS, ENCLOSURES, AND MISCELLANEOUS ITEMS SHALL COMPLY WITH THE CURRENT CALTRAIN DESIGN CRITERIA CHAPTER 4, AREMA MANUAL FOR RAILWAY ENGINEERING CHAPTER 33, CPUC GENERAL ORDER 95, AND EN 50122, TOGETHER WITH ALL OTHER APPLICABLE LAWS, CODES, AND STANDARDS, WITH THE MOST STRINGENT REQUIREMENT GOVERNING WHERE CRITERIA DIFFER.
2. METALLIC DRAIN COVERS IN THE OCLZ SHALL BE REPLACED WITH NON-CONDUCTING COVERS OR BONDED TO THE COUNTERPOISE.
3. OCS POLES, WITHIN THE LIMIT OF PLATFORMS, SHALL BE BONDED TO THE COUNTERPOISE AND ISOLATED FROM STATIC WIRE. FOR PORTAL TYPE OCS POLE, ONLY ONE SIDE SHALL BE BONDED TO THE COUNTERPOISE, AND ISOLATED FROM STATIC WIRE. THE POLE SYMBOL IS FOR REFERENCE ONLY, REFER TO OCS PLANS FOR OCS WIDE FLANGE POLE, ROUND POLE AND STRUCTURAL TUBE POLE.
4. THIS DIAGRAM IS SCHEMATIC FOR TYPICAL OUTBOARD PLATFORMS STATIONS ONLY, AND IS NOT APPLICABLE TO OTHER STATION CONFIGURATIONS.
5. ALL FENCES IN OCLZ TO BE MADE ELECTRICALLY CONTINUOUS.
6. METALLIC STRUCTURES AND MISCELLANEOUS METALLIC ITEMS WITHIN 8 FEET FROM THE EDGE OF THE PLATFORM, ON PLATFORM, INCLUDING ANY OCS POLES, SHALL BE ISOLATED FROM THE STATIC WIRE AND SHALL BE BONDED DIRECTLY OR INDIRECTLY TO THE COUNTERPOISE OR GROUNDING CONDUCTOR. PLATFORM REINFORCEMENT STEEL SHALL BE ISOLATED FROM THE STATIC WIRE.
7. COUNTERPOISE SHALL BE GROUNDED BY BONDING TO DRIVING MULTIPLE GROUND RODS AT THE END OF THE PLATFORMS AND IF POSSIBLE ADDITIONAL RODS NEXT TO STRUCTURE COLUMNS, AS PER ENGINEER'S APPROVAL. IF INSTALLATION OF COUNTERPOISE ON STATION EDGE IS NOT FEASIBLE, CONSIDER ALTERNATIVE RUN SUCH AS EMBEDDED IN SAW-CUT CLOSE TO PLATFORM EDGE ALONG YELLOW LINE AND BACKFILL SIMILAR TO PLATFORM CABLE CROSSING AS SHOWN IN DRAWING SD-E5302, DETAIL 1.
8. NUMBER OF GROUND RODS SHALL PROVIDE A COUNTERPOISE TO EARTH RESISTANCE OF 5 OHMS AND PROVIDE SAFE TOUCH AND STEP POTENTIALS.
9. FOR BONDING CABLE CROSSING THE PLATFORM, SEE DETAIL 1 ON DWG SD-E5302.
10. THE COUNTERPOISE OR GROUNDING-CONDUCTOR-BONDED METALLIC ITEMS SHALL BE ISOLATED FROM STEEL BUILDING GROUNDS AND FROM UTILITY GROUNDS.
11. STATION PLATFORM LOCATIONS REQUIRING CONDUIT FOR GROUNDING WORK, ARE PER SIGNALS AND COMMUNICATIONS DUCTBANK DRAWINGS.
12. BONDS SHALL BE SIZED 4/0 AWG. COPPER BARE WIRE UNLESS FAULT CURRENT CALCULATIONS YIELD OTHERWISE. ALL CONDUCTORS SHALL BE PROTECTED TO PREVENT THEFT AS MUCH AS POSSIBLE.

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DIRECTOR, ENGINEERING

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

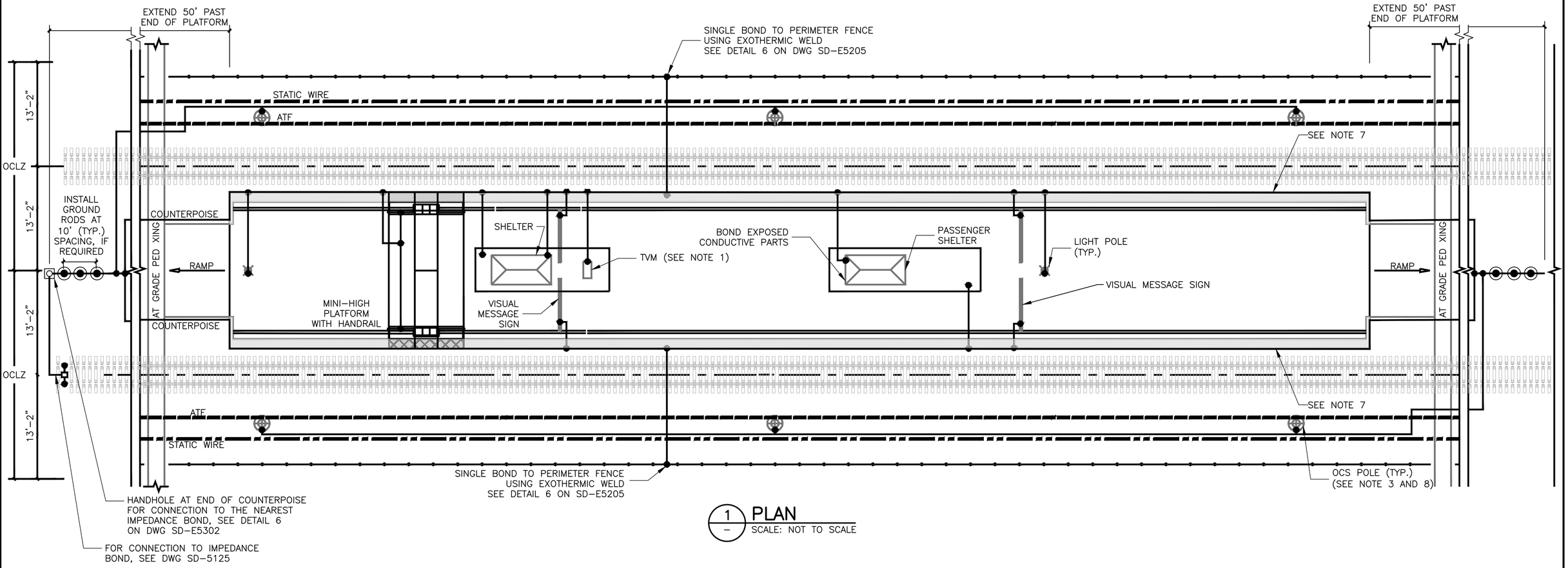
TYPICAL OUTBOARD PLATFORMS

CADD FILE NAME: SD-E5300

REV: | EDITION: SECOND

SCALE: NTS

STANDARD DRAWING NO.: SD-E5300



1 — PLAN
SCALE: NOT TO SCALE

NOTES:

1. BONDING OF ALL METALLIC OBJECTS, STRUCTURES, RAILINGS, RAMPS, ENCLOSURES, AND MISCELLANEOUS ITEMS SHALL COMPLY WITH THE CURRENT CALTRAIN DESIGN CRITERIA CHAPTER 4, AREMA MANUAL FOR RAILWAY ENGINEERING CHAPTER 33, CPUC GENERAL ORDER 95, AND EN 50122, TOGETHER WITH ALL OTHER APPLICABLE LAWS, CODES, AND STANDARDS, WITH THE MOST STRINGENT REQUIREMENT GOVERNING WHERE CRITERIA DIFFER.
2. METALLIC DRAIN COVERS IN THE OCLZ SHALL BE REPLACED WITH NON-CONDUCTING COVERS OR BONDED TO THE COUNTERPOISE.
3. OCS POLES, WITHIN THE LIMIT OF PLATFORMS, SHALL BE BONDED TO THE COUNTERPOISE AND ISOLATED FROM STATIC WIRE. FOR PORTAL TYPE OCS POLE, ONLY ONE SIDE SHALL BE BONDED TO THE COUNTERPOISE, AND ISOLATED FROM STATIC WIRE. THE POLE SYMBOL IS FOR REFERENCE ONLY, REFER TO OCS PLANS FOR OCS WIDE FLANGE POLE, ROUND POLE AND STRUCTURAL TUBE POLE.
4. THIS DIAGRAM IS SCHEMATIC FOR TYPICAL CENTER ISLAND PLATFORMS STATIONS ONLY, AND IS NOT APPLICABLE TO OTHER STATION CONFIGURATIONS.
5. ALL FENCES IN OCLZ TO BE MADE ELECTRICALLY CONTINUOUS.
6. METALLIC STRUCTURES AND MISCELLANEOUS METALLIC ITEMS WITHIN 8 FEET FROM THE EDGE OF THE PLATFORM, ON PLATFORM, INCLUDING ANY OCS POLES, SHALL BE ISOLATED FROM THE STATIC WIRE AND SHALL BE BONDED DIRECTLY OR INDIRECTLY TO THE COUNTERPOISE OR GROUNDING CONDUCTOR. PLATFORM REINFORCEMENT STEEL SHALL BE ISOLATED FROM THE STATIC WIRE.
7. COUNTERPOISE SHALL BE GROUNDED BY BONDING TO DRIVING MULTIPLE GROUND RODS AT THE END OF THE PLATFORMS AND IF POSSIBLE ADDITIONAL RODS NEXT TO STRUCTURE COLUMNS, AS PER ENGINEER'S APPROVAL. IF INSTALLATION OF COUNTERPOISE ON STATION EDGE IS NOT FEASIBLE, CONSIDER ALTERNATIVE RUN SUCH AS EMBEDDED IN SAW-CUT CLOSE TO PLATFORM EDGE ALONG YELLOW LINE AND BACKFILL SIMILAR TO PLATFORM CABLE CROSSING AS SHOWN IN DRAWING SD-E5302, DETAIL 1.
8. NUMBER OF GROUND RODS SHALL PROVIDE A COUNTERPOISE TO EARTH RESISTANCE OF 5 OHMS AND PROVIDE SAFE TOUCH AND STEP POTENTIALS.
9. FOR BONDING CABLE CROSSING THE PLATFORM, SEE DETAIL 1 ON DWG SD-E5302.
10. THE COUNTERPOISE OR GROUNDING-CONDUCTOR-BONDED METALLIC ITEMS SHALL BE ISOLATED FROM STEEL BUILDING GROUNDS AND FROM UTILITY GROUNDS.
11. STATION PLATFORM LOCATIONS REQUIRING CONDUIT FOR GROUNDING WORK, ARE PER SIGNALS AND COMMUNICATIONS DUCTBANK DRAWINGS.
12. BONDS SHALL BE SIZED 4/0 AWG. COPPER BARE WIRE UNLESS FAULT CURRENT CALCULATIONS YIELD OTHERWISE. ALL CONDUCTORS SHALL BE PROTECTED TO PREVENT THEFT AS MUCH AS POSSIBLE.

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

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Caltrain

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

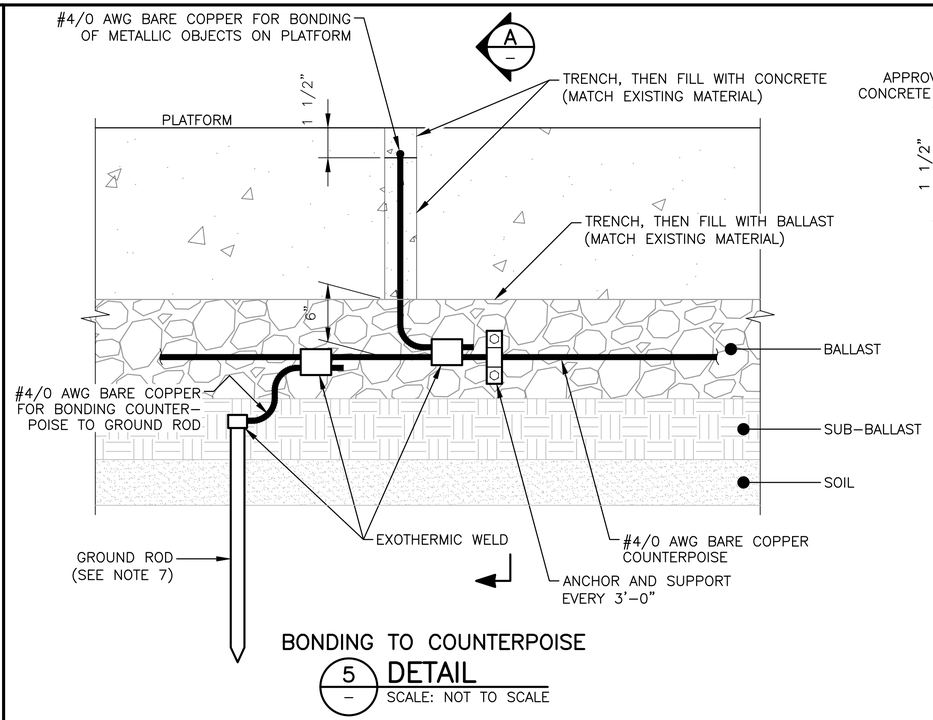
TYPICAL CENTER ISLAND PLATFORM

CADD FILE NAME: SD-E5301

REV: | EDITION: SECOND

SCALE: NTS

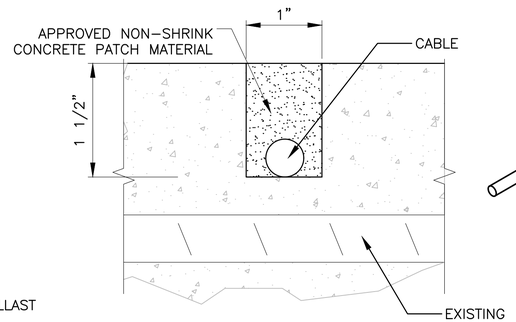
STANDARD DRAWING NO.: SD-E5301



BONDING TO COUNTERPOISE

5 DETAIL

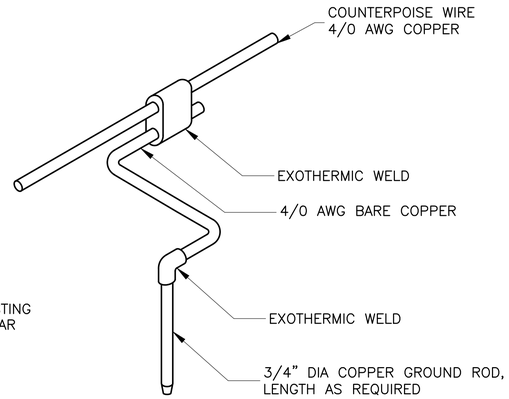
SCALE: NOT TO SCALE



PLATFORM CABLE CROSSING

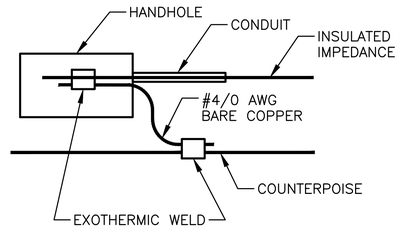
1 DETAIL

SCALE: NOT TO SCALE



NOTES:

1. EXOTHERMIC WELD BURIED CONNECTIONS TO BE COATED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
2. PREPARE SURFACE FOR EXOTHERMIC WELD IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
3. EMBEDDED STEEL ITEMS TO BE BONDED TO GROUNDING SYSTEM WITH BELOW SURFACE CONNECTIONS WHEREVER POSSIBLE
4. WHERE ORNAMENTAL COVERS ARE USED OVER ANCHOR RODS, GROUND CONNECTIONS SHALL BE MADE WITHIN COVERS.
5. FOR OCS POLE TO GROUND ROD CONNECTION, REFER TO DWG SD-W5162, SD-W5163, SD-W5164 AND SD-W5165
6. FOR TYPES OF POLE BASE IN I BEAM, CIRCULAR, SQUARE POLES, REFER TO OCS STRUCTURES BASIC DESIGN DRAWINGS.
7. CONTRACTOR MAY USE IRREVERSIBLE COMPRESSION GROUNDING CONNECTORS IN LIEU OF EXOTHERMIC WELDS WHERE WELDS ARE INDICATED ON THE DESIGN.



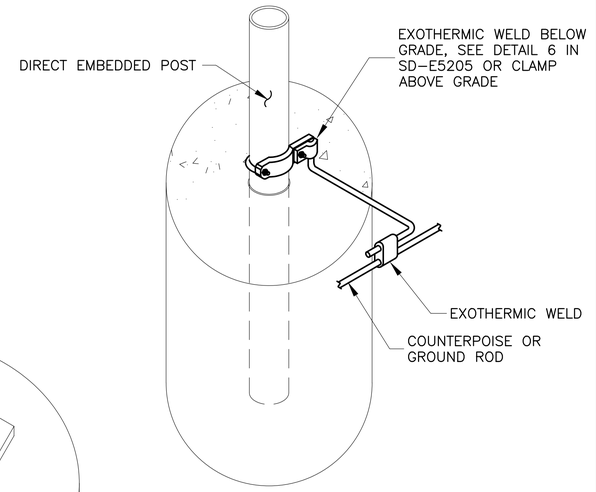
6 DETAIL

SCALE: NOT TO SCALE

COUNTERPOISE OR REBAR TO GROUND ROD

2 DETAIL

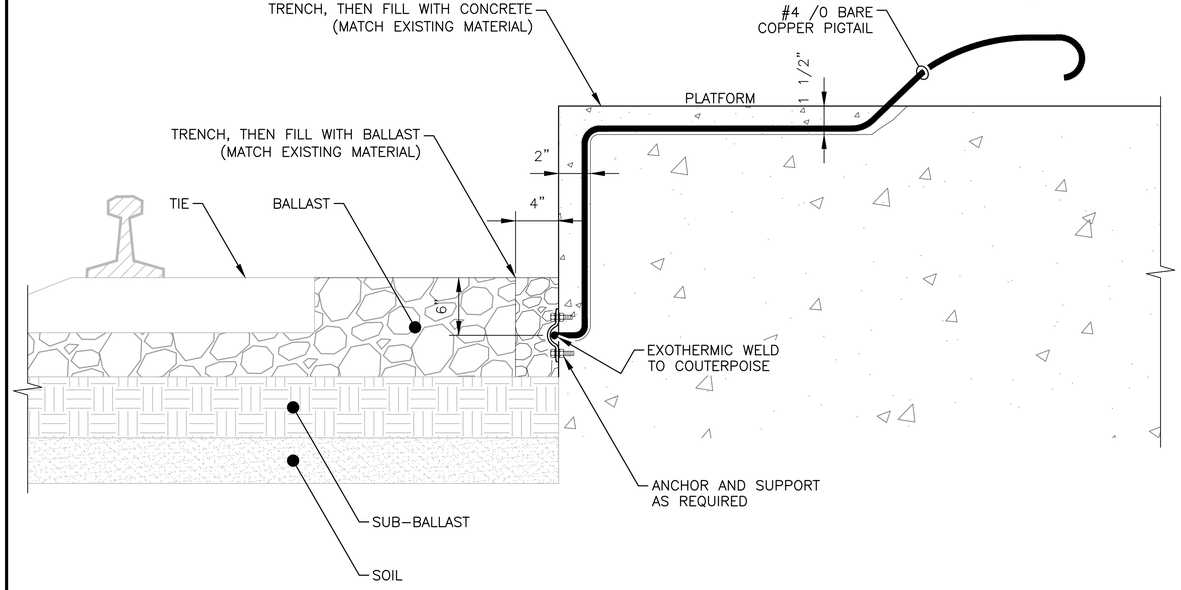
SCALE: NOT TO SCALE



DIRECT EMBEDDED POST TO COUNTERPOISE OR GROUND ROD

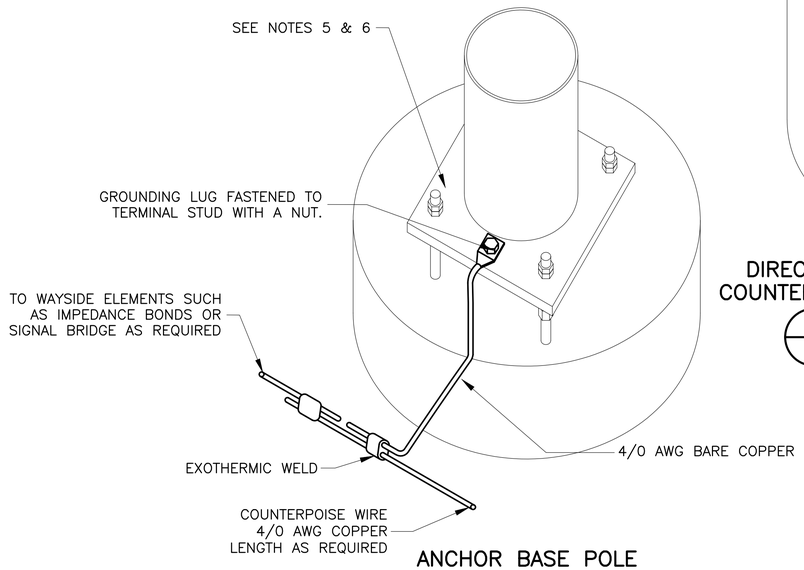
4 DETAIL

SCALE: NOT TO SCALE



A SECTION

SCALE: NOT TO SCALE



ANCHOR BASE POLE TO COUNTERPOISE

3 DETAIL

SCALE: NOT TO SCALE

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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

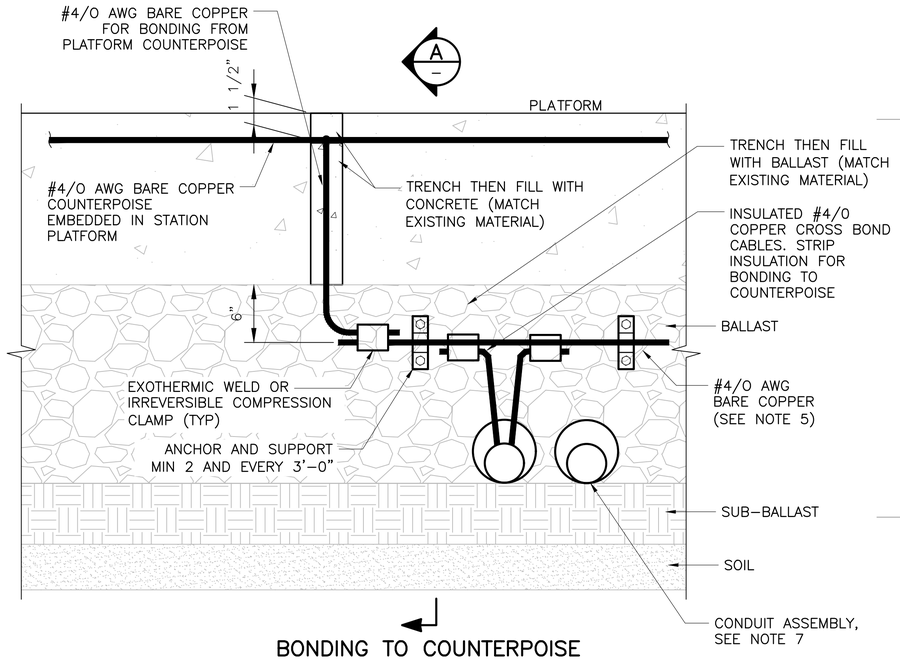
DIRECTOR, ENGINEERING

Caltrain

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN
TYPICAL STATION PLATFORM
COUNTERPOISE GROUNDING AND BONDING CONNECTIONS

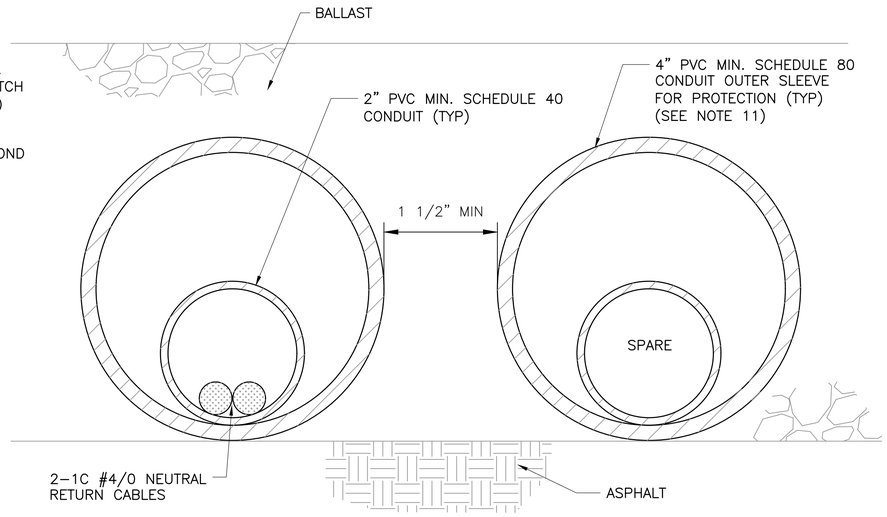
CADD FILE NAME:	SD-E5302
REV:	EDITION: SECOND
SCALE:	NTS
STANDARD DRAWING NO.:	SD-E5302



BONDING TO COUNTERPOISE

1 DETAIL

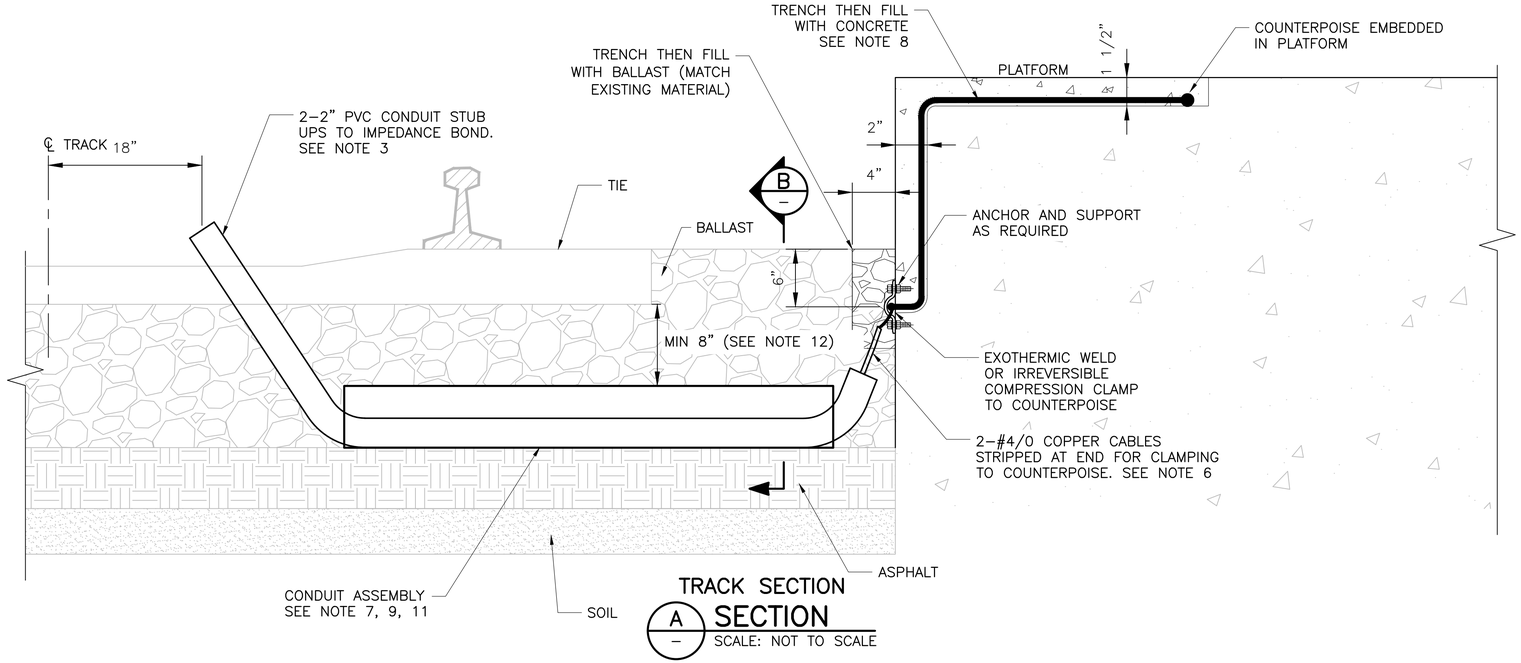
SCALE: NOT TO SCALE



CONDUIT ASSEMBLY SECTION

B SECTION

SCALE: NOT TO SCALE



TRACK SECTION

A SECTION

SCALE: NOT TO SCALE

NOTES:

1. DETAIL DEVELOPED FOR STATION PLATFORMS WITH COUNTERPOISE EMBEDDED IN PLATFORM AND STATION CROSS BOND LOCATED WITHIN STATION LIMITS.
2. PROTECT STATION SUB-BALLAST HMAC OR ASPHALT LAYER IN PLACE.
3. REFER TO SIGNAL STANDARD DRAWINGS FOR ADDITIONAL DETAILS AND REQUIREMENTS ON IMPEDANCE BOND CONNECTION AND CROSS BONDING.
4. INSTALLATION OF A HANDHOLE ON THE STATION COUNTERPOISE WILL BE REQUIRED AT ONE END OF EACH COUNTERPOISE TO ALLOW FOR FUTURE EXPANSION AND STATION GROUND TESTING.
5. A COPPER PLATE (1/4"D X 4"W X 36"L) MAY ALSO BE INSTALLED ANCHORED TO THE PLATFORM FACE IN LIEU OF A COPPER JUMPER.
6. REFER TO CABLE MANUFACTURER RECOMMENDED PROCEDURES FOR STRIPPING OF CABLE INSULATION AT CABLE BOND TO COUNTERPOISE.
7. WHERE USE OF TYPICAL NEUTRAL RETURN DUCTBANK WITHIN STATION PLATFORM LIMITS CANNOT BE ACHIEVED DUE TO EXISTING HMAC LAYER AT A SHALLOW DEPTH, AN OUTER CONDUIT SLEEVE, MINIMUM SCHEDULE 80 PVC INSTALLATION SHALL BE USED. DO NOT USE GRS CONDUIT FOR NEUTRAL RETURN DUCTBANKS.
8. MATCH EXISTING CONCRETE AND REPLACE ANY TACTILE WARNING STRIPS OR STATION MARKINGS IN KIND.
9. INSTALLATION OF REDUCED DEPTH TRACK CROSSING DUE TO EXISTING HMAC OR CONCRETE SUB-BALLAST CONDITIONS WITHIN STATIONS SHALL REQUIRE CALTRAIN APPROVAL.
10. USE EQUIVALENT DETAIL FOR CROSS BOND CONNECTION BETWEEN TRACKS WITHIN PASSENGER STATION LIMITS WHERE SHALLOW ASPHALT SUB-BALLAST IS PRESENT.
11. ADD DUCT SEAL AROUND 2-IN CONDUIT AT ENTRY AND EXIT OF 4-IN CONDUIT OUTER SLEEVE SUFFICIENT TO HOLD 2-IN CONDUIT IN PLACE.
12. MINIMUM CLEARANCE FROM BOTTOM OF TIE TO TOP OF CONDUIT INSTALLATION SHALL BE 8" TO ALLOW PROPER CLEARANCE FOR JPB MAINTENANCE. IF 8" MINIMUM CLEARANCE CANNOT BE MAINTAINED, CONDUITS WILL NEED TO BE EMBEDDED BELOW THE STATION ASPHALT. REFER TO DRAWING SD-E5304.

REV	DATE	BY	CHK	APP	DESCRIPTION
	010126				SECOND EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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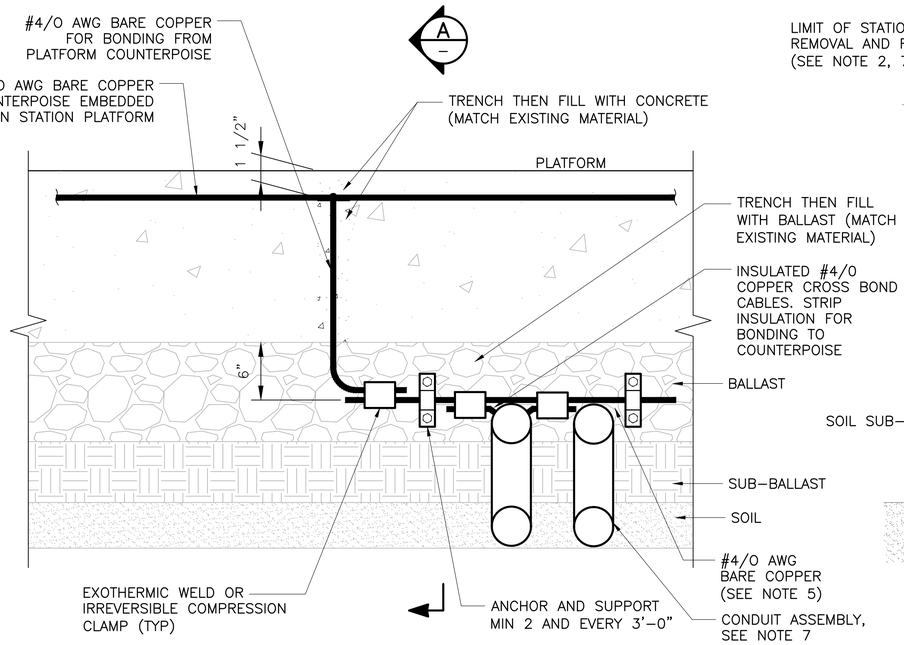
DIRECTOR, ENGINEERING

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN
TYPICAL STATION PLATFORM
COUNTERPOISE TO IMPEDANCE BOND
CONNECTION WITHIN PLATFORM LIMITS

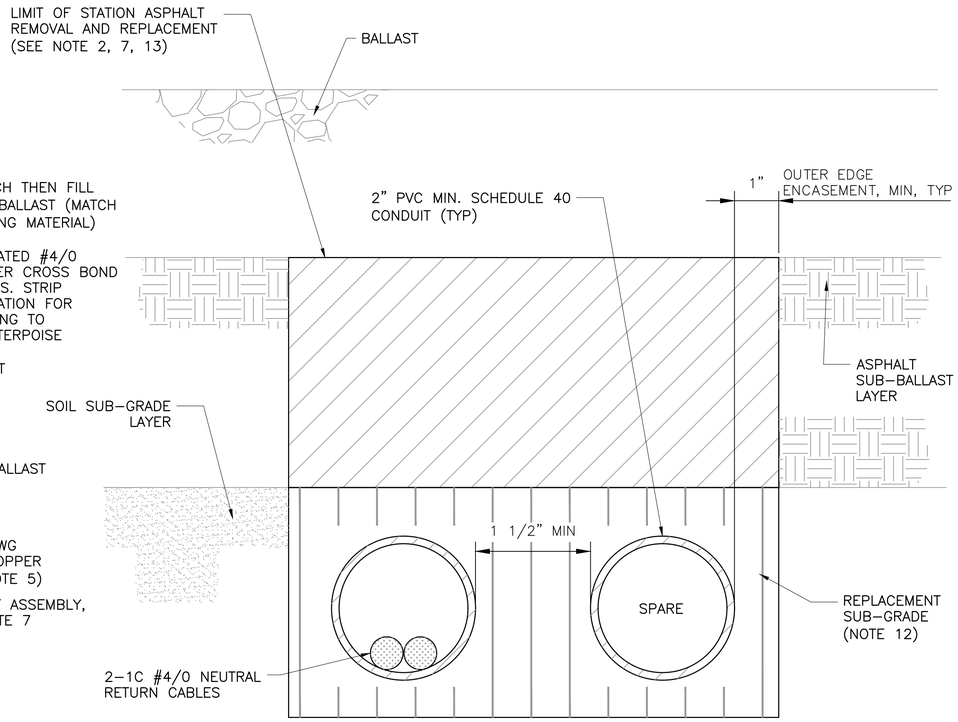
CADD FILE NAME:	SD-E5303
REV:	EDITION: SECOND
SCALE:	NTS
STANDARD DRAWING NO.:	SD-E5303



BONDING TO COUNTERPOISE

1 DETAIL

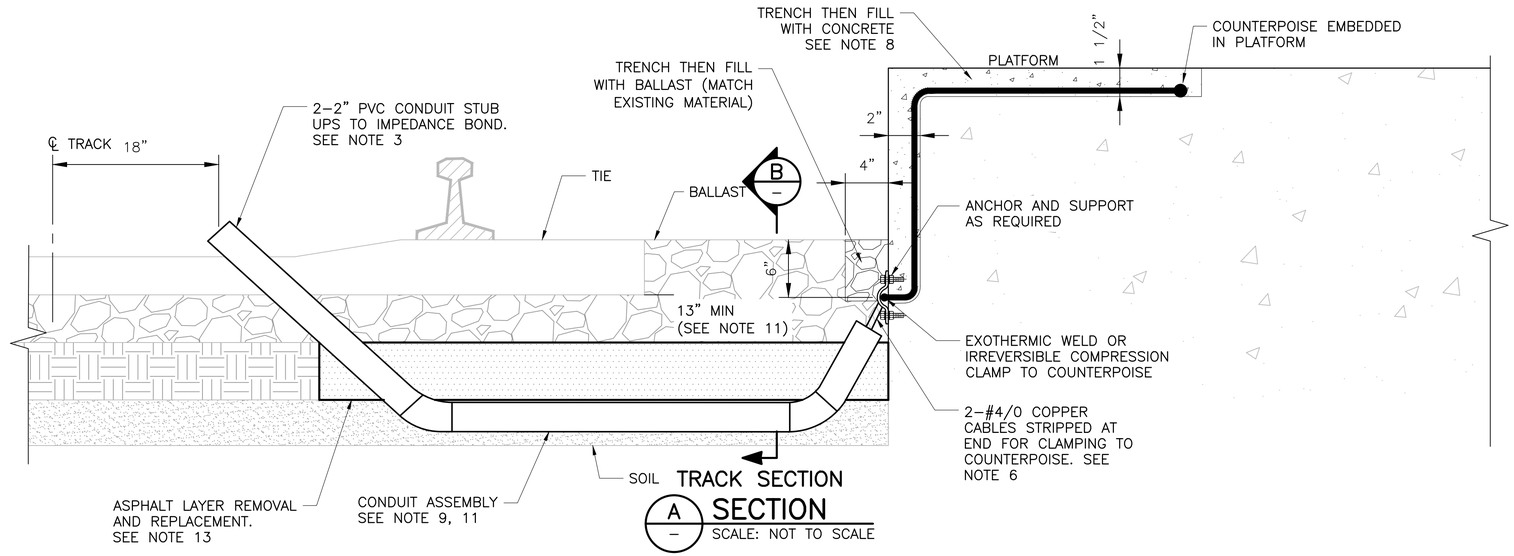
SCALE: NOT TO SCALE



CONDUIT ASSEMBLY

B SECTION

SCALE: NOT TO SCALE



TRACK SECTION

A SECTION

SCALE: NOT TO SCALE

NOTES:

1. DETAIL DEVELOPED FOR STATION PLATFORMS WITH COUNTERPOISE EMBEDDED IN PLATFORM AND STATION CROSS BOND LOCATED WITHIN STATION LIMITS.
2. SAW CUT LIMITS SHOWN ARE APPROXIMATE. IF ADDITONAL ASPHALT PAVEMENT IS REMOVED DURING CONSTRUCTION, THE SECTION WILL BE REPLACED IN KIND.
3. REFER TO SIGNAL STANDARD DRAWINGS FOR ADDITIONAL DETAILS AND REQUIREMENTS ON IMPEDANCE BOND CONNECTION AND CROSS BONDING.
4. INSTALLATION OF A HANDHOLE ON THE STATION COUNTERPOISE WILL BE REQUIRED AT ONE END OF EACH COUNTERPOISE TO ALLOW FOR FUTURE EXPANSION AND STATION GROUND TESTING.
5. A COPPER PLATE (1/4"D X 4"W X 36"L) MAY ALSO BE INSTALLED ANCHORED TO THE PLATFORM FACE IN LIEU OF A COPPER JUMPER.
6. REFER TO CABLE MANUFACTURER RECOMMENDED PROCEDURES FOR STRIPPING OF CABLE INSULATION AT CABLE BOND TO COUNTERPOISE.
7. ENSURE CUTS INTO ASPHALT ARE CLEAN AND COMPLETED PROPERLY USING APPROPRIATE SAWS AND TOOLS.
8. MATCH EXISTING CONCRETE AND REPLACE ANY TACTILE WARNING STRIPS OR STATION MARKINGS IN KIND.
9. INSTALLATION OF REDUCED DEPTH TRACK CROSSING DUE TO EXISTING HMAC OR CONCRETE SUB-BALLAST CONDITIONS WITHIN STATIONS SHALL REQUIRE CALTRAIN APPROVAL.
10. USE EQUIVALENT DETAIL FOR CROSS BOND CONNECTION BETWEEN TRACKS WITHIN PASSENGER STATION LIMITS WHERE SHALLOW ASPHALT SUB-BALLAST ARE PRESENT.
11. WHERE CLEARANCE FROM BOTTOM OF TIE TO TOP OF ASPHALT IS GREATER THAN 13" EMBEDMENT OF CONDUITS BELOW STATION ASPHALT SUB-BALLAST IS NOT REQUIRED. REFER TO DRAWING SD-E5303 FOR DETAILS OF INSTALLATION.
12. BACKFILL MATERIAL BELOW SUB-BALLAST PER SPECIFICATION 34 32 66. PROTECT NEIGHBORING SUB-GRADE DURING DUCTBANK INSTALLATION AND PLACEMENT.
13. PATCH REMOVED ASPHALT SUB-BALLAST LAYER WITH QUICKCRETE FASTSET CONCRETE OR APPROVED EQUIVALENT BACKFILL MATERIAL. TYPICAL THICKNESS OF ASPHALT LAYER VARIES FROM 6 TO 8 INCHES IN THE FIELD.

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	010126				SECOND EDITION

REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

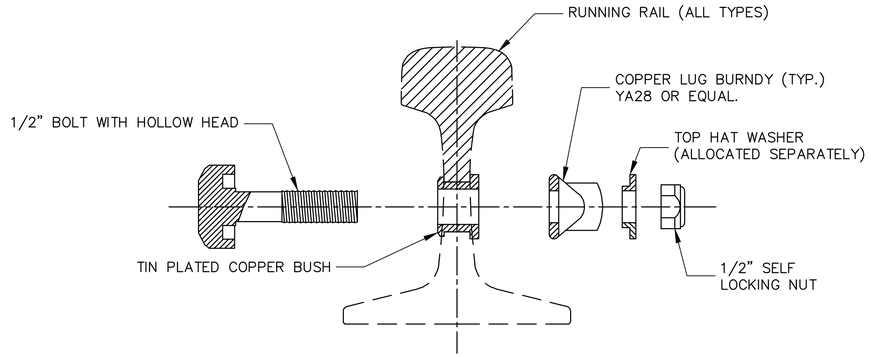
Bin Zhang

DIRECTOR, ENGINEERING

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN
TYPICAL STATION PLATFORM COUNTERPOISE TO IMPEDANCE BOND CONNECTION WITHIN PLATFORM LIMITS WITH LIMITED CLEARANCE

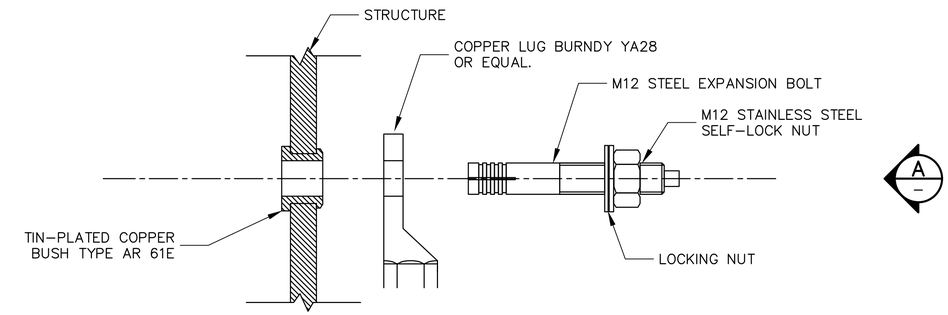
CADD FILE NAME:	SD-E5304
REV:	EDITION: SECOND
SCALE:	NTS
STANDARD DRAWING NO.:	SD-E5304



CEMBRE CONNECTION TO RAIL

3 – SECTION

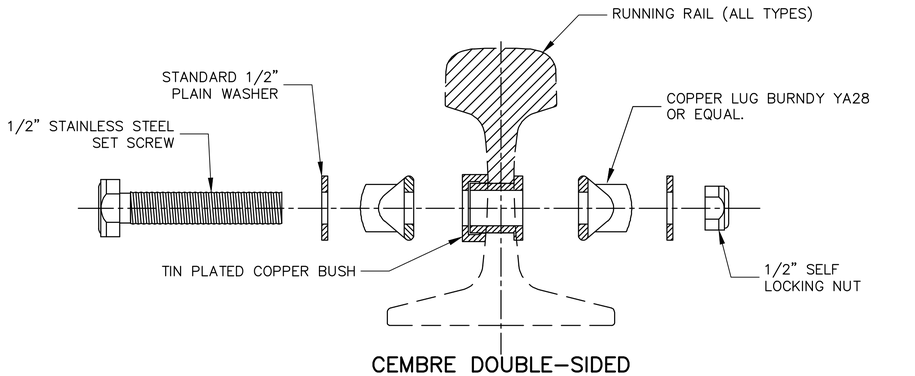
SCALE: NOT TO SCALE



CEMBRE SINGLE–SIDE BONDING
CONNECTION TO STRUCTURE

1 – SECTION

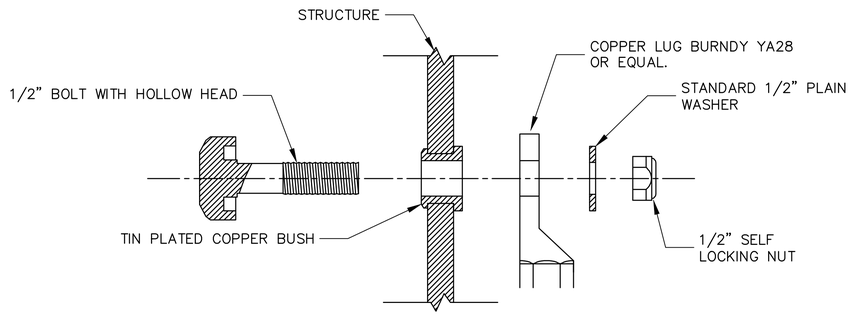
SCALE: NOT TO SCALE



CEMBRE DOUBLE–SIDED
CONNECTION TO RAIL

2 – SECTION

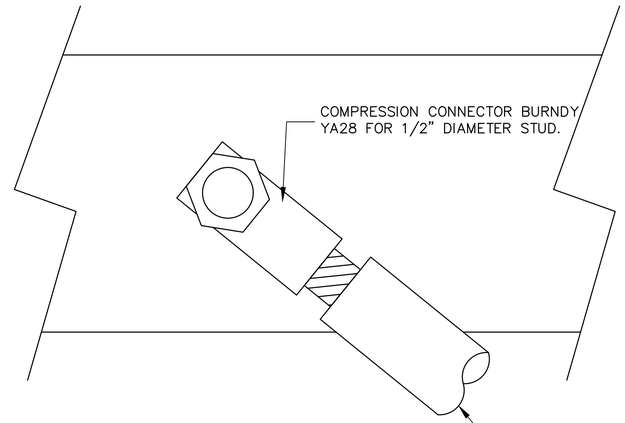
SCALE: NOT TO SCALE



CEMBRE CONNECTION TO STRUCTURE

1 – SECTION

SCALE: NOT TO SCALE



GENERAL VIEW FROM
BACK SIDE OF CONNECTION

A – DETAIL

SCALE: NOT TO SCALE

NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED.
2. FOR INSTALLATION OF TIN PLATED COPPER BUSH REFER TO MANUFACTURER'S INSTALLATION INSTRUCTIONS.

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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

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Caltrain

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

RAIL BONDING CONNECTIONS

CADD FILE NAME: SD–E5500

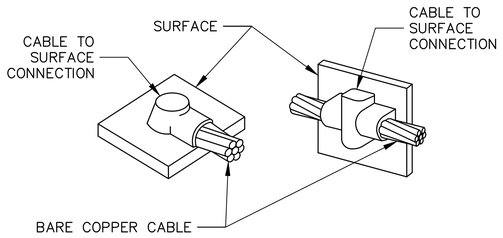
REV: | EDITION: SECOND

SCALE: NTS

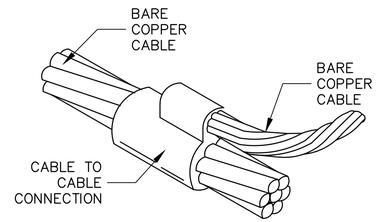
STANDARD DRAWING NO.: SD–E5500

NOTES:

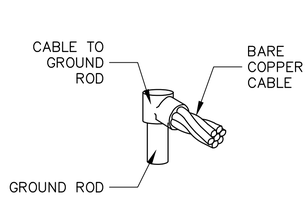
1. PREPARE SURFACE FOR WELD IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
2. TEST WELDS ON SURFACE WITH A 2 POUND HAMMER TEST.
3. COAT WELD LOCATIONS AS REQUIRED ON SURFACE WITH AN EPOXY COATING COMPATIBLE WITH THE SURFACE COATING SYSTEM.
4. COAT ALL AREAS OF STEEL AND COPPER AFTER WELDING.
5. APPROVED MECHANICAL CLAMPS SHALL BE USED FOR BONDING CONNECTIONS. WELDED CONNECTIONS, HOWEVER, SHALL BE USED FOR UNDERGROUND CONNECTIONS.



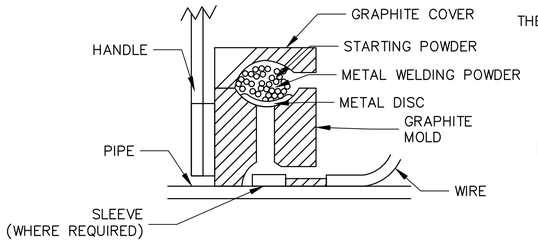
SURFACE CONNECTIONS



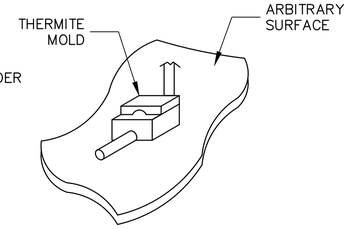
PARALLEL TAP CONNECTION



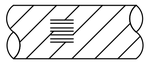
CABLE TO GROUND ROD CONNECTION



EXPLODED VIEW OF MOLD

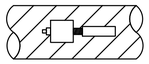


THERMITE MOLD PLACEMENT

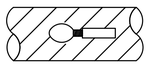


STEP 1 — REMOVE 3"X3" COATING, FILE OR GRIND STRUCTURE CONNECTION AREA (3"X3") TO BARE SHINY METAL AND CLEAN.

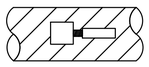
STEP 2 — STRIP INSULATION FROM WIRE. ATTACH SLEEVE (REQUIRED ON #8 AWG WIRE OR SMALLER).



STEP 3 — HOLD MOLD FIRMLY WITH OPENING AWAY FROM OPERATOR AND IGNITE WITH FLINT GUN.



STEP 4 — REMOVE SLAG FROM CONNECTION AND PEEN WELD FOR SOUNDNESS.



STEP 5 — COAT WELD AREA AS REQUIRED PER SPECIFICATIONS.

EXOTHERMIC WELDS
1 DETAIL
SCALE: NOT TO SCALE

THERMITE WELD DETAIL
2 DETAIL
SCALE: NOT TO SCALE

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
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Caltrain

ENGINEERING STANDARD DRAWINGS

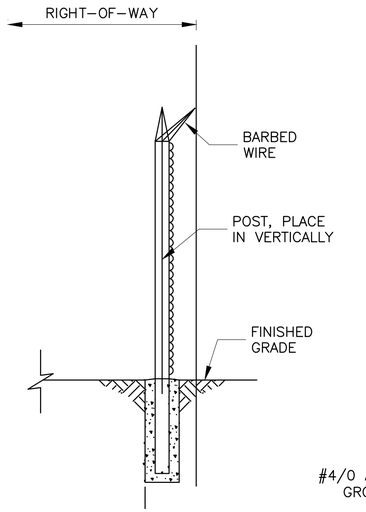
GROUNDING AND BONDING
BASIC DESIGN

WELD DETAILS

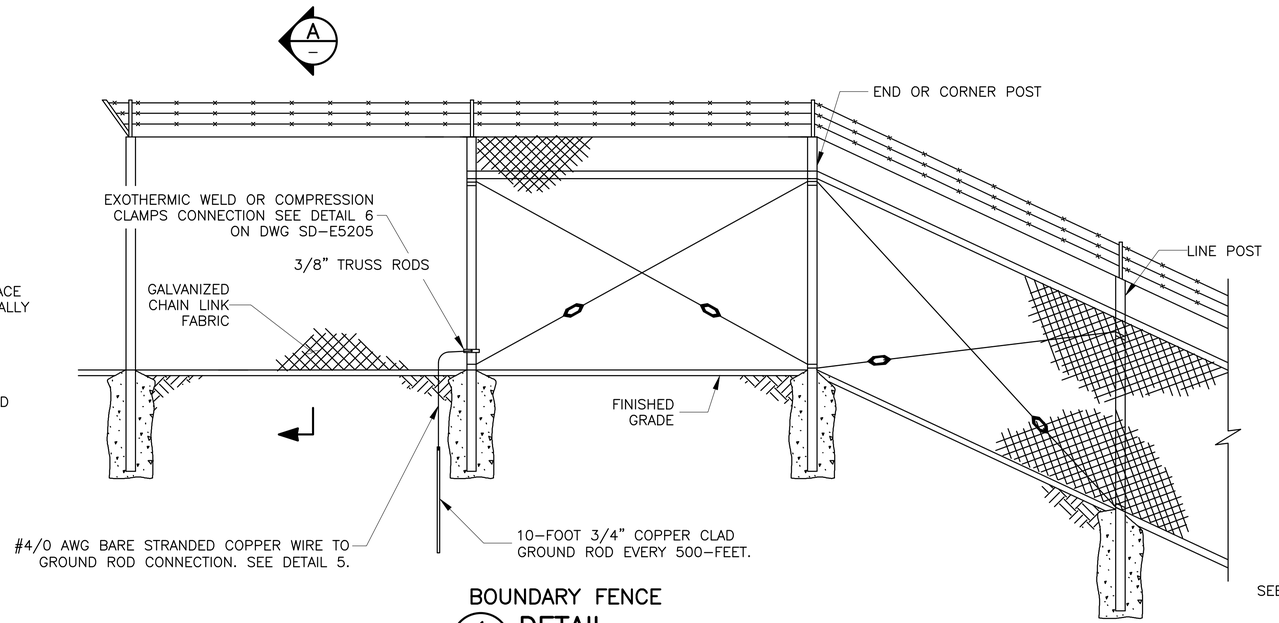
CADD FILE NAME: SD-E5503
REV:
EDITION: SECOND
SCALE: NTS
STANDARD DRAWING NO.: SD-E5503

NOTES:

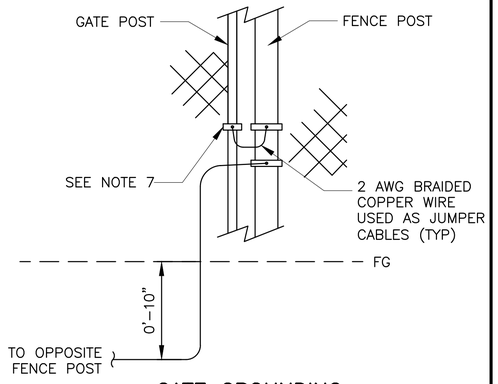
1. ALL PERMANENT FENCING AND GATES SHALL BE BONDED, GROUNDED AND INSULATED TO PREVENT ELECTRIC SHOCK.
2. WHEN THE FENCE IS WITHIN OCLZ THE FENCE WILL BE BONDED TO STATIC WIRE/COUNTERPOISE.
3. WHEN THE FENCE IS MORE THAN 45 FEET FROM CENTERLINE OF TRACK, GROUNDING AND BONDING OF THE FENCE IS NOT IN SCOPE OF WORK.
4. BAR FENCE INSIDE OCLZ SHALL BE BONDED TO NEAREST OCS POLE STATIC WIRE/COUNTERPOISE.
5. RAILING INSIDE OCLZ SHALL BE BONDED TO NEAREST OCS POLE STATIC WIRE/COUNTERPOISE.
6. DESIGN OF FENCES AND GATES IS NOT IN THIS SET OF DRAWINGS.
7. MECHANICAL CLAMPS ARE APPROVED FOR USE AS AN ALTERNATE TO EXOTHERMIC WELDS.



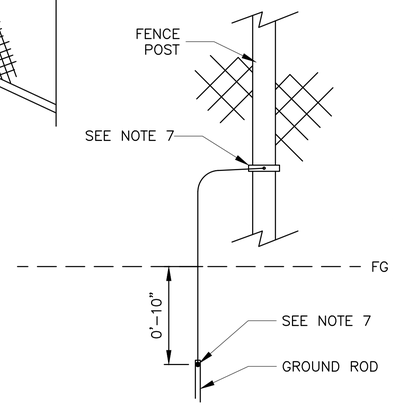
A – SECTION
SCALE: NOT TO SCALE



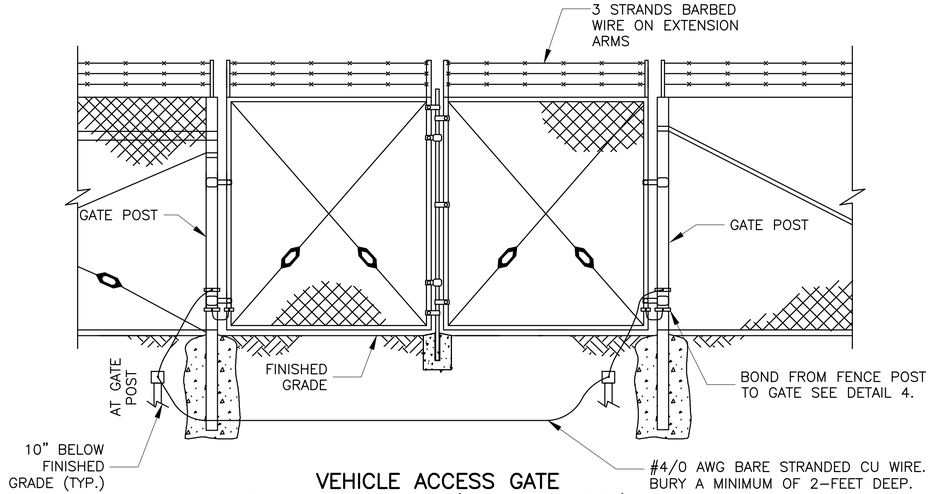
BOUNDARY FENCE
1 – DETAIL
SCALE: NOT TO SCALE



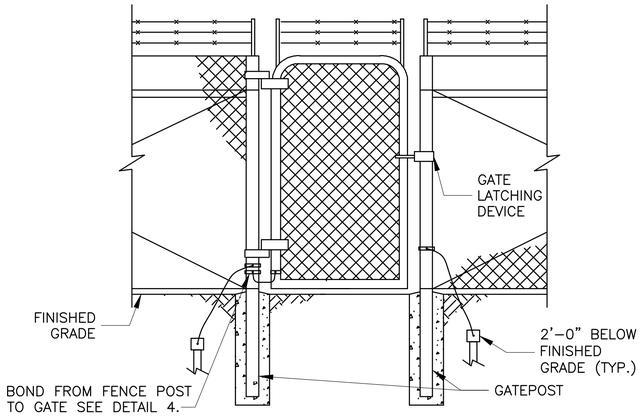
GATE GROUNDING
4 – DETAIL
SCALE: NOT TO SCALE



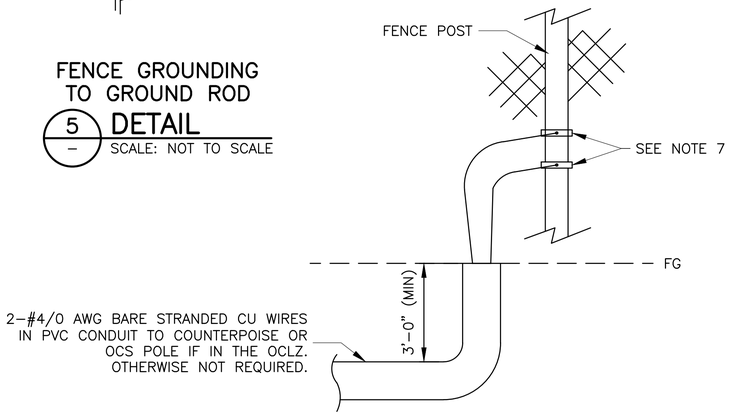
FENCE GROUNDING TO GROUND ROD
5 – DETAIL
SCALE: NOT TO SCALE



VEHICLE ACCESS GATE
BOUNDARY FENCE (DRIVING GATES)
2 – DETAIL
SCALE: NOT TO SCALE



PEDESTRIAN ACCESS GATE
BOUNDARY FENCE (WALKING GATES)
3 – DETAIL
SCALE: NOT TO SCALE



FENCE GROUNDING
TO COUNTERPOISE
6 – DETAIL
SCALE: NOT TO SCALE

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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

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Caltrain

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

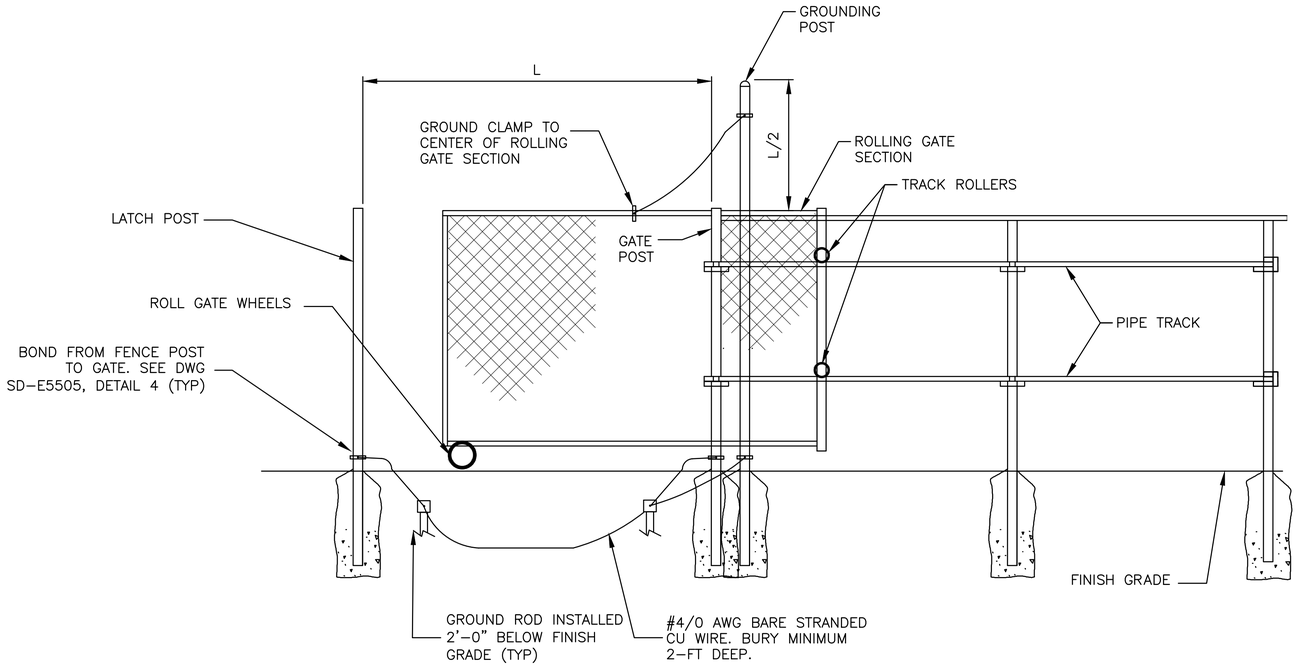
TYPICAL GATE AND FENCE

CADD FILE NAME: SD–E5505

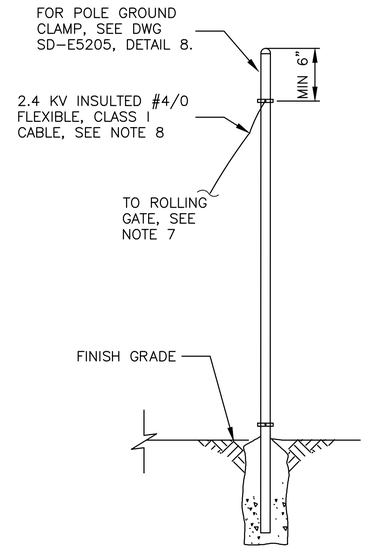
REV: | EDITION: SECOND

SCALE: NTS

STANDARD DRAWING NO.: SD–E5505



ROLLING GATE
GROUNDING AND BONDING
1 – DETAIL
SCALE: NOT TO SCALE



NEW POST
2 – SECTION
SCALE: NOT TO SCALE

NOTES:

1. THIS DETAIL IS PREPARED AS AN ALTERNATIVE TO PERMANENT FENCING WHERE ROLLING GATES CANNOT BE AVOIDED. ALL PERMANENT FENCING AND GATES SECTIONS SHALL BE BONDED, GROUNDED AND INSULATED TO PREVENT ELECTRIC SHOCK.
2. WHEN THE FENCE IS WITHIN OCLZ THE FENCE WILL BE BONDED TO STATIC WIRE/COUNTERPOISE.
3. WHEN THE FENCE IS MORE THAN 45 FEET FROM CENTERLINE OF TRACK, GROUNDING AND BONDING OF THE FENCE IS NOT IN SCOPE OF WORK.
4. DESIGN OF FENCES AND GATES IS NOT IN THIS SET OF DRAWINGS.
5. MECHANICAL CLAMPS ARE APPROVED FOR USE AS AN ALTERNATE TO EXOTHERMIC WELDS.
6. NEW FENCE POST UTILIZED FOR GROUNDING AND BONDING SHALL COMPLY WITH TYPICAL JPB REQUIREMENTS FOR MATERIAL, DIAMETER AND FOUNDATION DESIGN. REFER TO CALTRAIN SD-9002 FOR DETAILS. DO NOT BLOCK BARRIER OPENING WITH NEW FENCE INSTALLATION.
7. POSITION CABLE CONNECTION OF POST CLAMPS ON SIDE OF FENCE OPPOSITE OF TRACK ROLLERS SO THAT THE HANGING CABLE DOES NOT CATCH BETWEEN THE FENCE SECTIONS.
8. PROVIDE SUFFICIENT SLACK FOR COMPLETE MOVEMENT OF ROLL GATE SECTION WHILE ALSO AVOIDING POTENTIAL FOR SNAG OF CONDUCTOR ON TRACK ROLLERS.

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PENINSULA CORRIDOR JOINT POWERS BOARD

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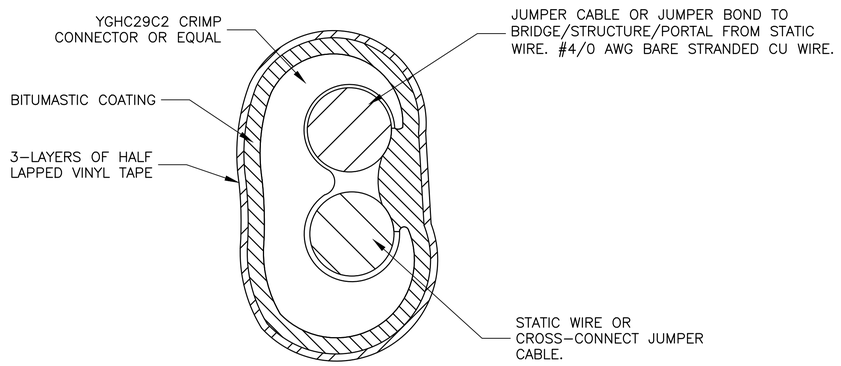
ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

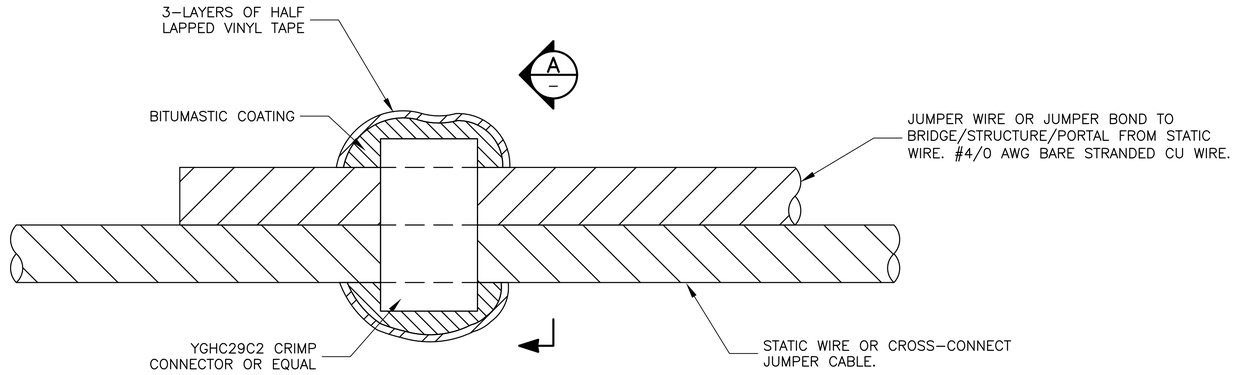
ROLLING GATE BONDING DETAILS

CADD FILE NAME: SD-E5505A
REV:
EDITION: SECOND
SCALE: NTS
STANDARD DRAWING NO.: SD-E5505A

NOTE:
IN LIEU OF BITUMASTIC COATING AN APPROVED ANTI–RUST, ANTI–CORROSION GREASE MAY BE APPLIED FOR DISSIMILAR METALS.

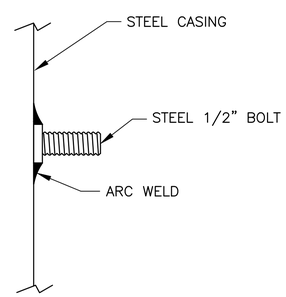


BOND CABLE CRIMP
A – SECTION
SCALE: NOT TO SCALE



CONNECTION OF JUMPER WIRE OR JUMPER BOND TO STATIC WIRE OR CROSS–CONNECT JUMPER CABLE
1 – DETAIL
SCALE: NOT TO SCALE

NOTE:
VINYL TAPE AND BITUMASTIC COATING IS NOT REQUIRED FOR CROSS–CONNECT JUMPER (COPPER TO COPPER).



GROUNDING STUD INSULATION
2 – DETAIL
SCALE: NOT TO SCALE

REV	DATE	BY	CHK	APP	DESCRIPTION
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REV	DATE	BY	CHK	APP

PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:
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DIRECTOR, ENGINEERING

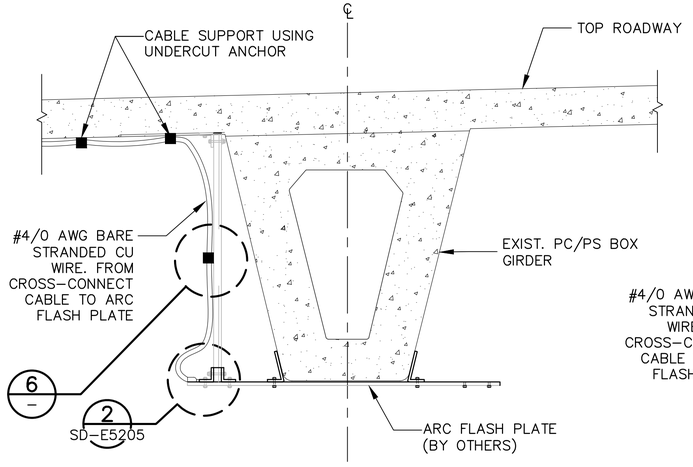
Caltrain

ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

TYPICAL COMPRESSION
GROUND TAP CONNECTIONS

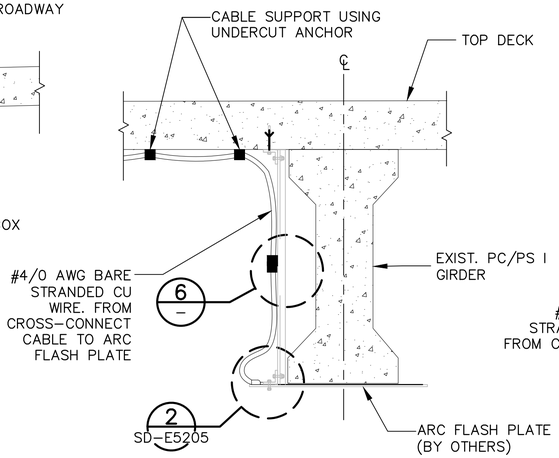
CADD FILE NAME: SD–E5506
REV:
EDITION: SECOND
SCALE: NTS
STANDARD DRAWING NO.: SD–E5506



ARC-FLASH PLATE, TYP

1 – SECTION

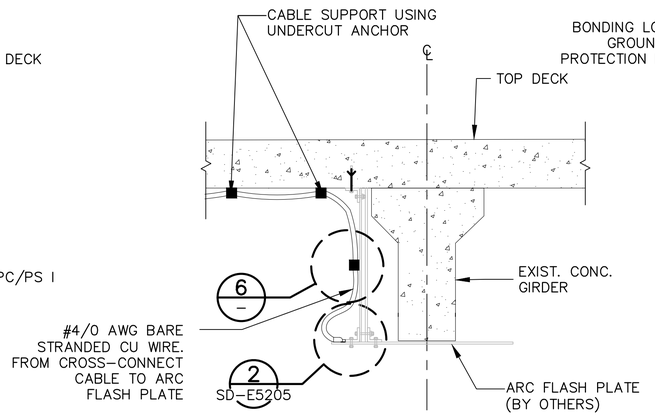
SCALE: NOT TO SCALE



ARC-FLASH PLATE, TYP

2 – SECTION

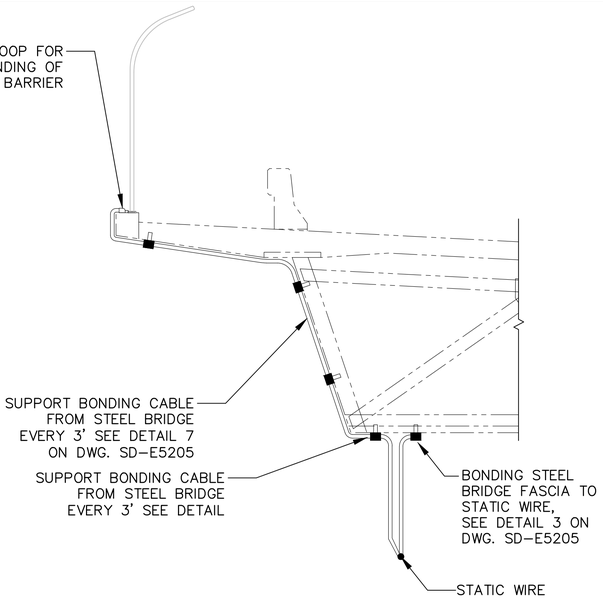
SCALE: NOT TO SCALE



ARC-FLASH PLATE, TYP

3 – SECTION

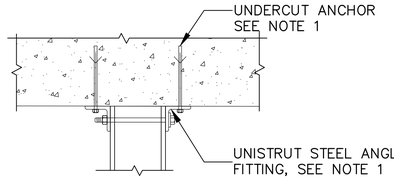
SCALE: NOT TO SCALE



STEEL BRIDGE CABLE SUPPORT

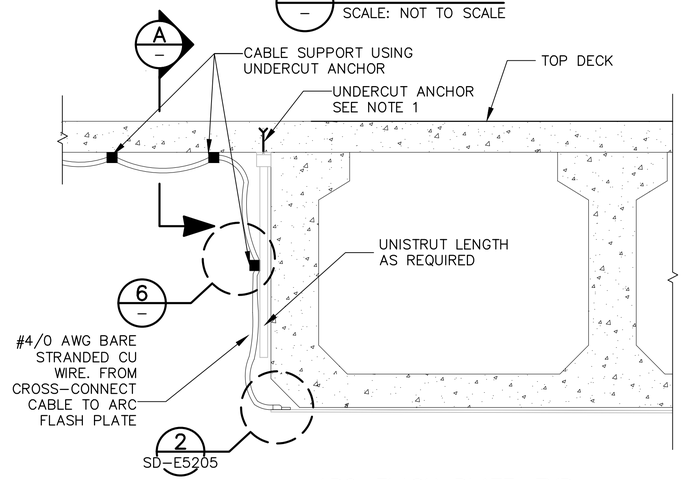
8 – DETAIL

SCALE: NOT TO SCALE



A – SECTION

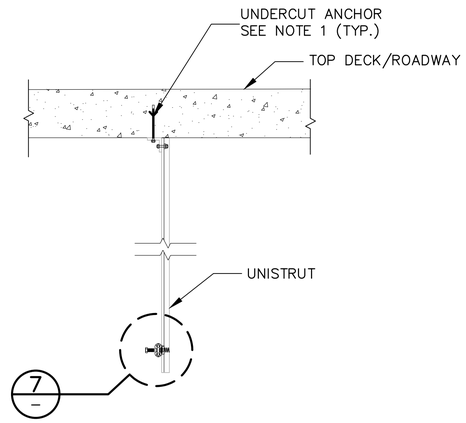
SCALE: NOT TO SCALE



ARC-FLASH PLATE, TYP

4 – SECTION

SCALE: NOT TO SCALE



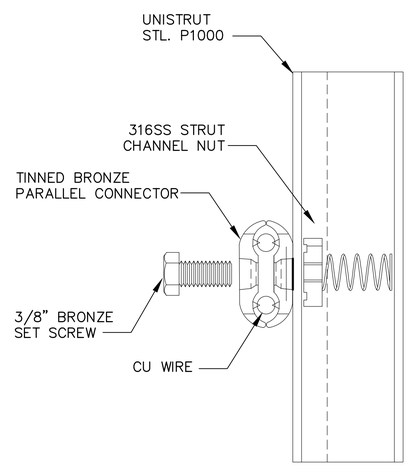
CABLE SUPPORT FOR BONDING ARC-FLASH PLATE TO ADJACENT ARC-FLASH PLATE

5 – DETAIL

SCALE: NOT TO SCALE

NOTES:

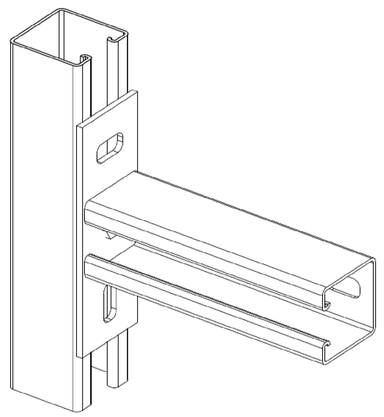
1. ALL ATTACHMENTS TO CONCRETE BRIDGE SHALL BE APPROVED BY THE BRIDGE OWNERS.
2. FOR CONDUCTOR SUPPORT IN CONCRETE OR STEEL, SEE DETAIL 1 IN DRAWING SD-E5205.



CABLE CLAMP

7 – DETAIL

SCALE: NOT TO SCALE



6 – DETAIL

SCALE: NOT TO SCALE

FOR CLAMP ATTACHMENT SEE DETAIL 7

UNISTRUT CHANNEL	SUPPORT SINGLE CANTILEVER ARM
MANUFACTURE	COMTEC
PART NO.	P1000 & P1000T, OR APPROVED EQUAL

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PENINSULA CORRIDOR JOINT POWERS BOARD

APPROVED BY:

Bin Zhang

DIRECTOR, ENGINEERING

Caltrain

ENGINEERING STANDARD DRAWINGS

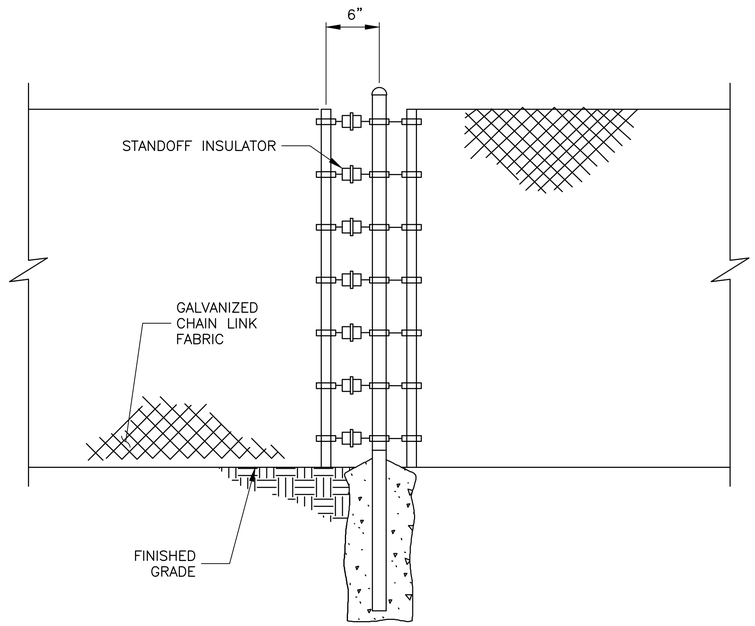
GROUNDING AND BONDING BASIC DESIGN

TYPICAL ARC FLASH PLATE BONDING

CADD FILE NAME:	SD-E5507
REV:	EDITION: SECOND
SCALE:	NTS
STANDARD DRAWING NO.:	SD-E5507

NOTES:

1. PROVIDE SHOP DRAWINGS PRIOR TO PROCUREMENT.
2. FENCE NOT SHOWN FOR CLARITY.
3. GROUND FENCE AT A MAXIMUM DISTANCE OF 500–FEET.
4. ISOLATE FENCE EVERY 1000–FEET. INSERT FENCE INSULATION AS SHOWN IN DETAIL 1.
5. FENCES LESS THAN 1000–FEET SHALL BE GROUNDED AT EACH END AND IN THE CENTER OF SECTION.
6. NEW FENCE POSTS SHALL CONFORM TO CALTRAIN STANDARD SD–9002 FOR LINE POSTS. DETAIL AS SHOWN IS USED TO ISOLATE AND EXISTING FENCE. FENCE POSTS SHALL MEET EXISTING FENCE SIZE AND HEIGHT.
7. FENCE POSTS ON EITHER END OF INSULATION/ISOLATION SHALL BE GROUNDED SEPARATELY. SEE DETAIL 5 ON DWG SD–E5505.



FENCE INSULATION
1 – ELEVATION
SCALE: NOT TO SCALE

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	010126				SECOND EDITION

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ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

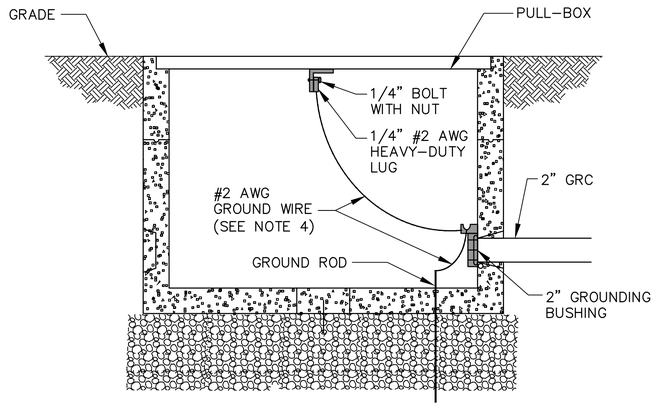
TYPICAL FENCE INSULATION DETAILS

CADD FILE NAME: SD–E5508

REV: | EDITION: SECOND

SCALE: NTS

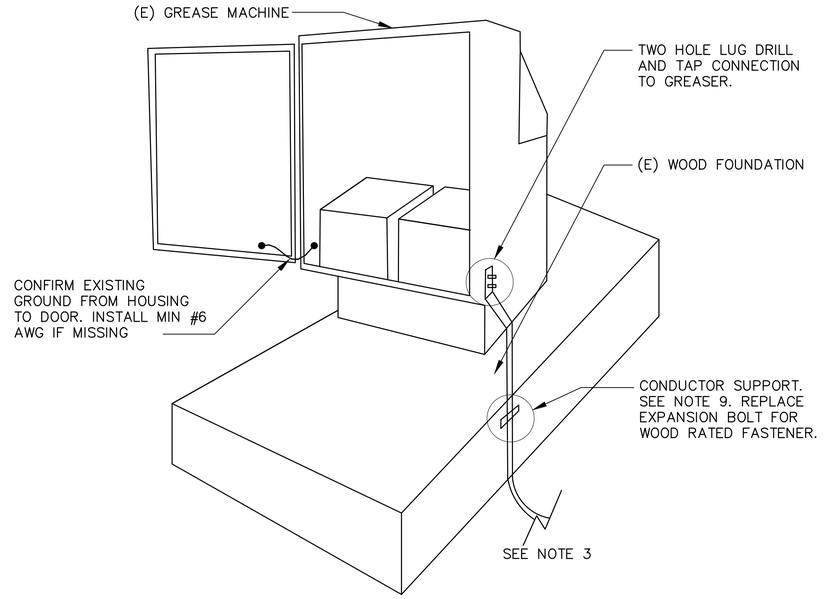
STANDARD DRAWING NO.: SD–E5508



PULLBOX GROUNDING AND BONDING

1 DETAIL

SCALE: NOT TO SCALE



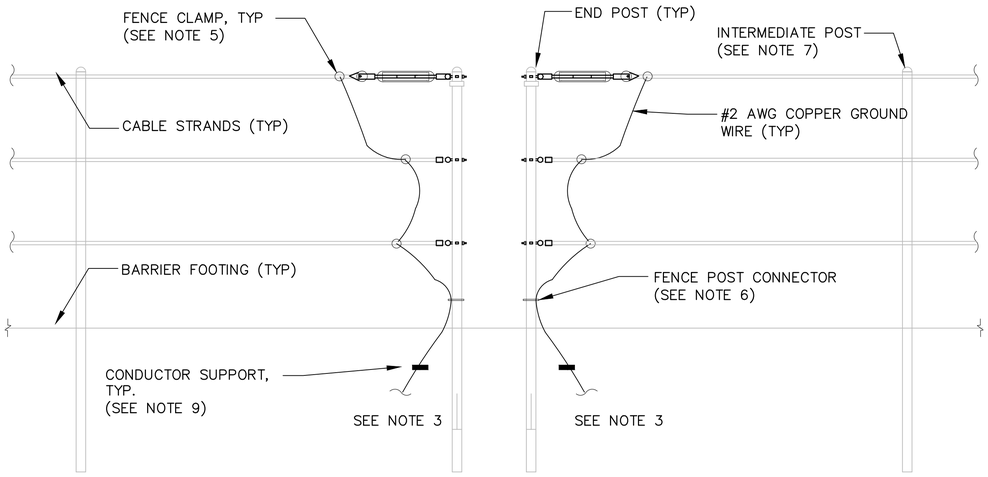
GREASE MACHINE GROUNDING AND BONDING
GROUND CONNECTOR AND ATTACHMENTS

2 DETAIL

SCALE: NOT TO SCALE SEE NOTE 1.

NOTES:

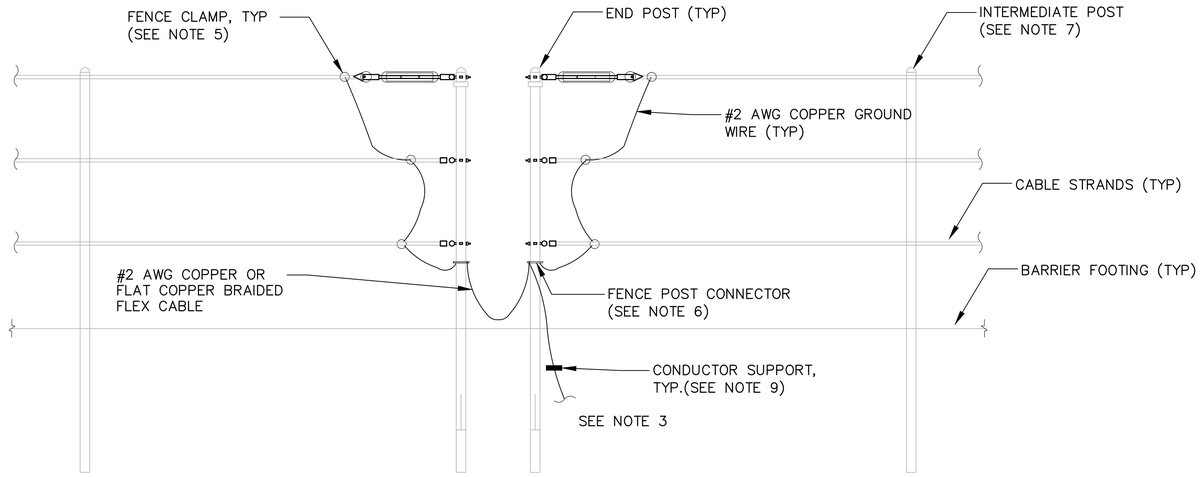
1. COORDINATE WITH ASSET OWNER TO TAG OUT ELECTRICAL EQUIPMENT PRIOR TO INSTALLATION OF GROUNDING AND BONDING.
2. OPEN GREASE MACHINE PRIOR TO DRILL AND TAP OF GROUNDING BOLT. INSTALLATION SHALL NOT INTERFERE WITH THE EXISTING EQUIPMENT WITHIN THE GREASE MACHINE.
3. CONTINUATION OF #4/0 COPPER GROUND CONDUCTOR TO LOCAL GROUND ROD OR ADJACENT OCS STRUCTURE.
4. PROVIDE SUFFICIENT SLACK TO ALLOW FOR REMOVAL OF PULL BOX LID. FOR LOCATIONS WITHOUT GRS CONDUITS, PULL BOX LID SHALL BE BONDED DIRECTLY TO GROUND ROD.
5. UTILIZE BURNDY FFGC2 FENCE FABRIC GROUND CLAMP OR APPROVED ALTERNATIVE FOR BONDING TO CABLE RAILING STANDARD.
6. UTILIZE FENCE POST CLAMP PER DWG SD–E5205, DETAIL 8. FOR A FLAT POST DRILL AND TAP OR EXOTHERMIC WELD ARE ACCEPTABLE ALTERNATIVE METHODS.
7. INTERMEDIATE POSTS FOR CABLE RAIL FENCING MAY NOT BE BONDED DIRETLY TO THE CABLE RAILING. BOND INTERMEDIATE POSTS TO MINIMUM 1 CABLE STRAND.
8. CABLE RAILINGS SHALL BE GROUNDED, BONDED AND ISOLATED CONSISTENT WITH BARRIER FENCING REQUIREMENTS DETAILED IN DWG SD–E5011, SD–E5505 AND SD–E5508.
9. SUPPORT BARE CONDUCTOR MINIMUM EVERY 3–FT ABOVE GRADE. USE APPROVED CABLE ATTACHMENT CLAMP. REFER TO DWG SD–E5205, DETAIL 1.



CABLE RAILING GROUNDING AND BONDING DETAILS
ISOLATED SECTION

4 DETAIL

SCALE: NOT TO SCALE SEE NOTE 8.



CABLE RAILING GROUNDING AND BONDING DETAILS
BONDED SECTION

4 DETAIL

SCALE: NOT TO SCALE SEE NOTE 8.

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ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

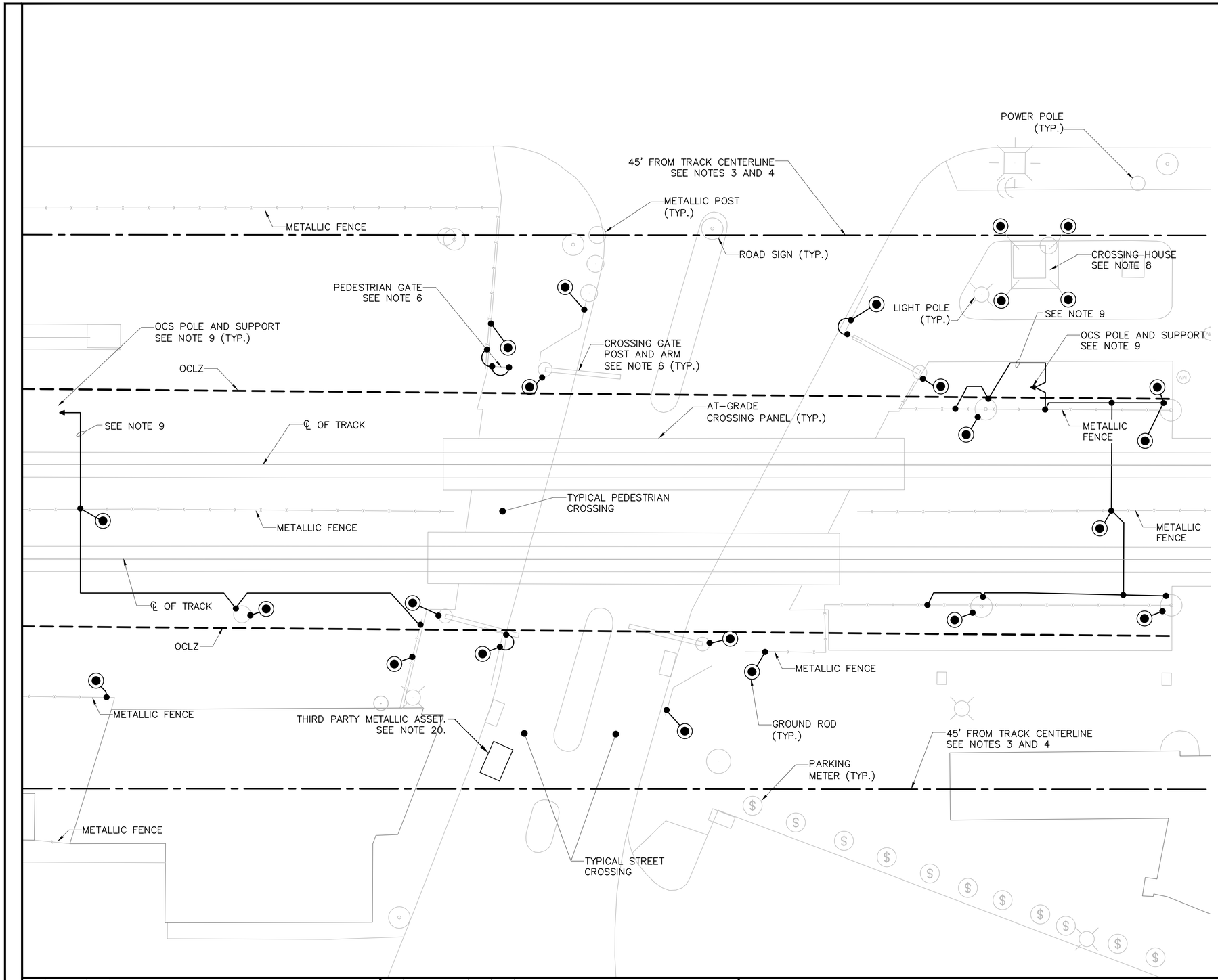
MISCELLANEOUS DETAILS

CADD FILE NAME: SD-E5508A

REV: EDITION: SECOND

SCALE: NTS

STANDARD DRAWING NO.: SD–E5508A



NOTES:

1. THE GROUNDING AND BONDING SHOWN ON THIS DRAWING IS TYPICAL AND APPLICABLE TO ALL GRADE CROSSINGS.
2. PROVIDE GROUNDING AND BONDING:
   A. FOR SIGNAL/EQUIPMENT HOUSES, TO ACHIEVE A GROUND RESISTANCE OF LESS THAN 5 OHMS.
   B. FOR OTHER METALLIC OBJECTS, TO ACHIEVE A GROUNDING RESISTANCE OF LESS THAN 25 OHMS.
3. GROUNDING AND BONDING ALONG THE TRACKS, OUTSIDE OF 45 FEET FROM THE CENTERLINE OF THE TRACKS IS NOT IN THE SCOPE OF WORK.
4. GROUNDING AND BONDING OF FENCES ALONG THE TRACKS, OUTSIDE OF OCLZ (OVERHEAD CONTACT LINE ZONE) AND WITHIN 45 FEET FROM THE CENTERLINE OF THE TRACKS SHALL BE ACCORDING TO NEC, USING #4/0 AWG (MIN.), ANNEALED AND SOFT DRAWN BARE COPPER, AT 24" BELOW GRADE, WITHOUT BONDING TO STATIC WIRE.
5. GROUNDING AND BONDING OF FENCES ALONG THE TRACKS, INSIDE OF OCLZ (OVERHEAD CONTACT LINE ZONE) SHALL BE ACCORDING TO NEC, USING #4/0 AWG (MIN.), ANNEALED AND SOFT DRAWN BARE COPPER, AT 24" BELOW GRADE, WITH BONDING TO STATIC WIRE.
6. AT GRADE CROSSING, BOND ALL METALLIC OBJECTS SUCH AS THE PEDESTRIAN GATES, SIGNAL GATE, GATE SUPPORT AND FLASHER TOGETHER AND TO A GROUND ROD OR GROUND RODS TO ACHIEVE NOT MORE THAN 5 OHMS RESISTANCE TO GROUND. DO NOT BOND TO STATIC WIRE.
7. FOR GROUNDING AND BONDING OF SIGNAL MAST AND SIGNAL BRIDGE, REFER TO SIGNAL STANDARD DRAWINGS.
8. FOR TYPICAL GROUNDING AND BONDING OF THE SIGNAL/ COMMUNICATION HOUSE/CASE, REFER TO DRAWINGS SD-E5102 AND SD-E5103. FOR EXACT LOCATION AND DESIGN, REFER TO SIGNAL AND COMMUNICATION DESIGN PACKAGES.
9. STATIC WIRE CONNECTIONS SHALL BE MADE TO THE BASE OF THE NEAREST OCS SUPPORT STRUCTURE, REFER TO DRAWING SD-E5302, DETAIL 3.
10. THIS DRAWING SHOWS THE TYPICAL ARRANGEMENT AT EACH GRADE CROSSING. THE LOCATION OF THE GROUNDING AND BONDING COMPONENTS SHALL BE INSTALLED BASED ON ACTUAL SITE CONDITIONS TO MINIMIZE THE IMPACT TO UNDERGROUND STRUCTURES.
11. ALL GROUND WIRE ROUTE SUBJECT TO VEHICULAR OR TRAIN TRAFFIC SHALL HAVE PROTECTION USING CONDUIT, PVC SCHEDULE 80, MINIMUM 24" BELOW BOTTOM OF RAILROAD TIE.
12. FOR TYPICAL NON-SIGNAL RELATED GATE, POST AND FENCE BONDING AND GROUNDING DETAILS SEE DRAWING SD-E5505.
13. FOR GROUNDING AND BONDING OF FENCES, REFER TO DWG SD-E5011, NOTES 2, 3 AND 4.
14. CONTRACTOR TO VERIFY IN THE FIELD IF FENCE IS WITHIN OCLZ.
15. FOR FENCE OUTSIDE THE OCLZ AND WITHIN 45' FROM CENTERLINE OF TRACK, SEE NOTE 3 ON DWG. SD-E5011. NO WORK IS REQUIRED IF FENCE IS MORE THAN 45' FROM CENTERLINE OF THE TRACK.
16. IF FENCE INSIDE OCLZ IS LESS THAN 1000 FEET LONG, IT SHALL BE BONDED TO NEAREST OCS POLE, STATIC WIRE OR STATION COUNTERPOISE.
17. IF FENCE INSIDE OCLZ IS MORE THAN 1000 FEET LONG IT SHALL BE DIVIDED INTO 1000 FEET OR SMALLER SECTIONS WITH INSULATED INSERTS. SEE INSULATED FENCE INSERTS DETAIL 1 ON DWG. SD-E5508A. BOND FENCE SECTIONS PER NOTE 16 ABOVE.
18. CONNECTION BETWEEN GROUNDS WHETHER STATIC WIRE/COUNTERPOISE OR GROUND ROD SHALL NOT EXCEED 500 FEET. ALSO SEE NOTES 2, 4, 5 AND 6 ON DWG. SD-E5011.
19. FOR ALL FENCES, CONTRACTOR SHALL VERIFY LENGTH OF THE FENCES IN THE FIELD. CONTRACTOR SHALL MAKE ALL METALLIC FENCES ELECTRICALLY CONTINUOUS EXCEPT AS NOTED ABOVE.
20. FOR THIRD PARTY METALLIC ASSETS GROUNDING AND BONDING, SEE SD-E5011, NOTE 6.

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ENGINEERING STANDARD DRAWINGS

GROUNDING AND BONDING
BASIC DESIGN

AT GRADE CROSSING
TYPICAL GROUNDING AND BONDING PLAN

CADD FILE NAME:	SD-E6003
REV:	EDITION: SECOND
SCALE:	NTS
STANDARD DRAWING NO.:	SD-E6003