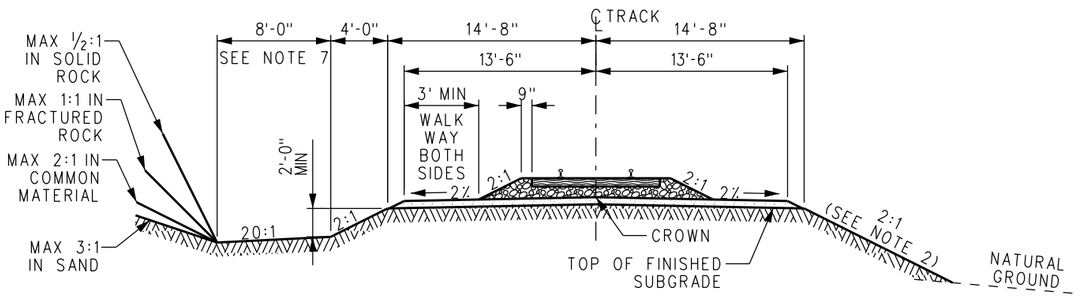
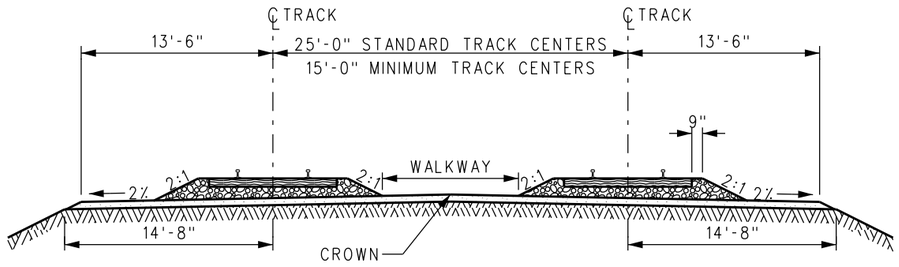
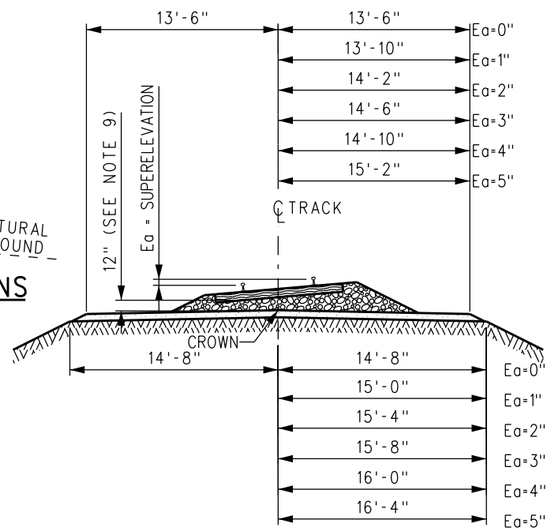


CUT SECTIONS MAINLINE ROADBED SECTION FILL SECTIONS



ROADBED SECTION FOR TWO MAINLINE TRACKS OR ADJACENT MAINLINE & SIDING

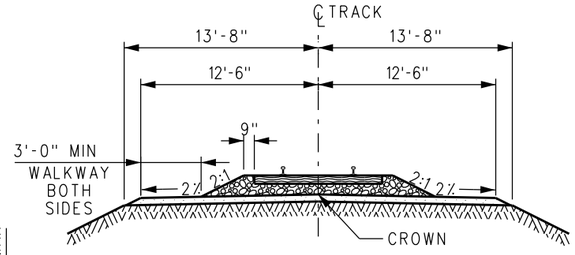


ROADBED SECTION AT CURVED TRACK

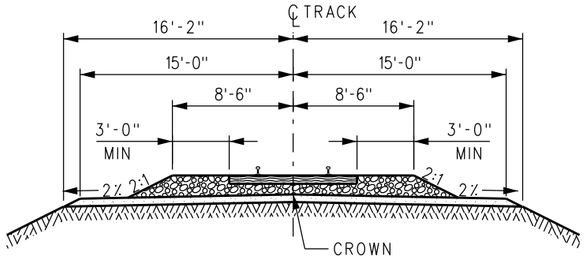
FOR DETAILS NOT SHOWN,
SEE CUT AND FILL SECTIONS ELSEWHERE ON THIS SHEET

NOTES:

1. THE DEPTH OF BALLAST AND DEPTH OF SELECT MATERIAL SHALL BE DECIDED ON THE BASIS OF VOLUME OF TRAFFIC AND ON THE QUALITY OF SELECTED MATERIAL AND SUBGRADE AS DETERMINED BY SCRRA.
2. SLOPES SHOWN FOR BANKS IN CUTS AND ON FILLS SHALL BE CONSIDERED STANDARD AND GENERALLY USED, BUT MAY BE MODIFIED AS REQUIRED BY LOCAL CONDITIONS AND CHARACTER OF MATERIAL, IF APPROVED BY SCRRA.
3. BALLAST MUST BE REGULATED IN ADVANCE OF DRESSING SO THAT FINAL SECTION WILL CONFORM TO SLOPE REQUIREMENTS AND CHARACTER OF MATERIAL.
4. WHERE OFF-TRACK ROADWAY IS TO BE PROVIDED, EXTEND THE ROADBED SECTION BY 8'-0" AND MAINTAIN 2% SLOPE AWAY FROM TRACK.
5. ALL FILL SLOPES SHALL BE FACED WITH COVER OF MATERIAL SUITABLE FOR GROWING GRASS AND HAVING A THICKNESS OF APPROXIMATELY 6". THE OUTER SURFACE OF THIS COVER SHALL COINCIDE WITH THE DESIGN SLOPE OF THE EMBANKMENT. MATERIAL FOR THIS COVER MAY BE OBTAINED FROM STRIPPINGS.
6. DEPTH OF DITCHES WILL VARY IN ORDER TO PROVIDE FLOW LINE OF 0.2% MINIMUM GRADE IN DITCHES AND IN BENCHES.
7. SLOPED BOTTOM DITCHES ARE REQUIRED FOR MAIN LINES. A "V" DITCH IS ACCEPTABLE FOR INDUSTRY TRACKS WHEN RIGHT-OF-WAY IS LIMITED AND WHERE LOCAL CONDITIONS AND CHARACTER OF MATERIAL SO REQUIRE. WIDTH OF SLOPED BOTTOM DITCHES MAY EXCEED 8' DEPENDING ON LOCAL CONDITIONS AND HYDRAULIC REQUIREMENTS. SEE SCRRA DESIGN CRITERIA MANUAL FOR MINIMUM HYDRAULIC DITCH CAPACITY DESIGN REQUIREMENTS.
8. ALL MINIMUM DIMENSIONS SHALL BE MET UNLESS OTHERWISE APPROVED BY SCRRA ASSISTANT DIRECTOR, DESIGN.
9. THE PROFILE GRADE LINE ON SUPERELEVATED TRACK APPLIES TO THE LOW RAIL. MAINTAIN 12" DEPTH OF BALLAST BENEATH TIE.
10. ALL SECTIONS ON THIS STANDARD APPLY TO NEW TRACK CONSTRUCTION, AND WHERE PRACTICAL, TRACK RECONSTRUCTION.
11. SEE SCRRA ES1201 FOR ABBREVIATIONS AND SYMBOLS.
12. WHERE TOPOGRAPHY AND RIGHT-OF-WAY ALLOWS, DITCHES SHOULD BE PLACED AS FAR AWAY FROM THE TRACK AS POSSIBLE.

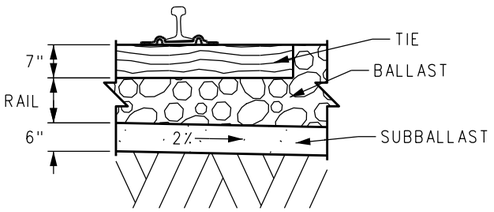


ROADBED SECTION FOR YARD TRACKS

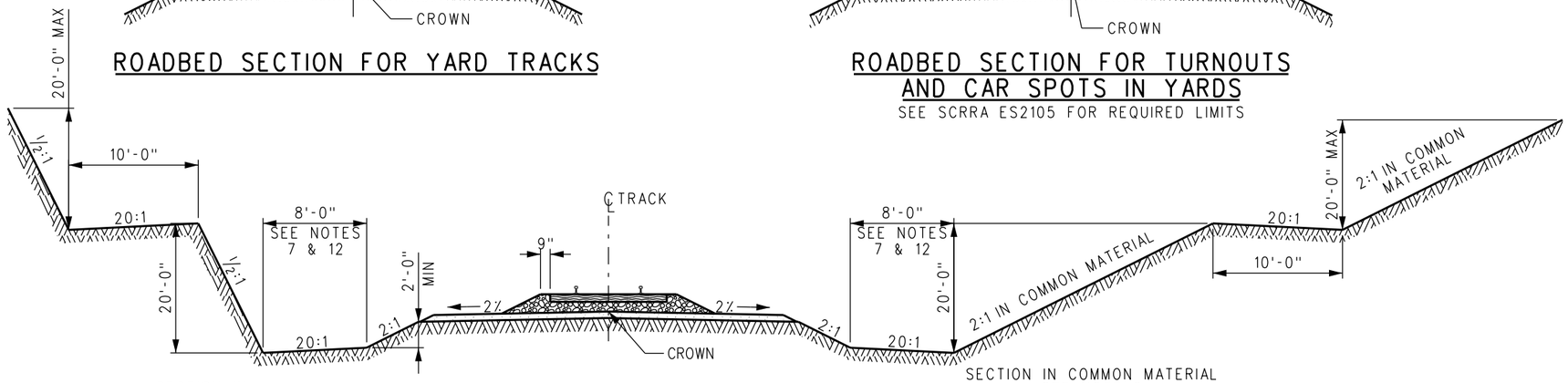


ROADBED SECTION FOR TURNOUTS AND CAR SPOTS IN YARDS

SEE SCRRA ES2105 FOR REQUIRED LIMITS

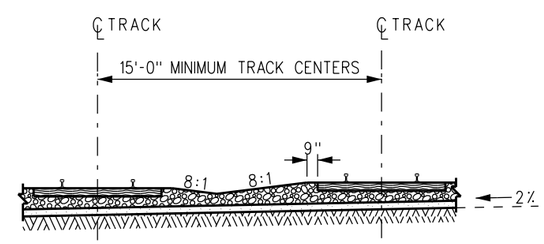


ROADBED SECTION DETAIL FOR MAINLINE, SIDING TRACKS, & YARD TRACKS



DEEP CUT SECTIONS

10' WIDE BENCH SECTION SHALL BE PROVIDED AT EACH
20' INCREMENT OF HEIGHT ABOVE DITCH BOTTOM
REPEAT BENCHING PATTERN UNTIL CUT LINE INTERCEPTS EXISTING GROUND



ROADBED SECTION FOR ADJACENT YARD TRACKS

REV.	DATE	DESCRIPTION	DES.	ENG.
B	04/17/20	REVISED NOTE 8, ADD NOTE 12	AC	JMM
A	04/23/19	REVISED BALLAST DEPTH	JK	AT

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

ROADBED SECTIONS FOR TRACK CONSTRUCTED USING WOOD TIES

STANDARD 2001
SCALE: NTS
REVISION B SHEET 1 OF 1
CADD FILE: ES2001

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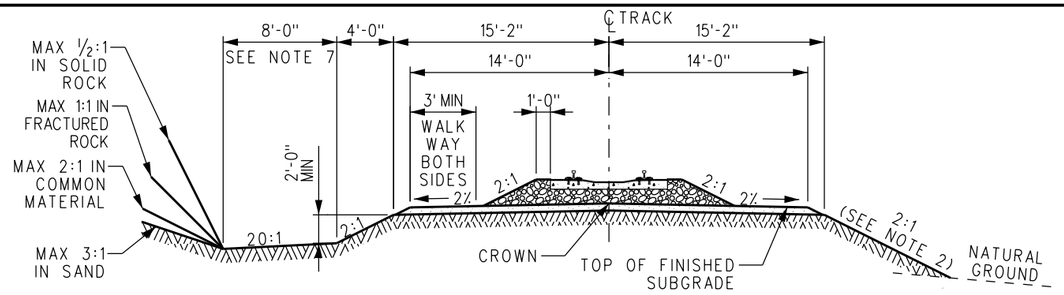
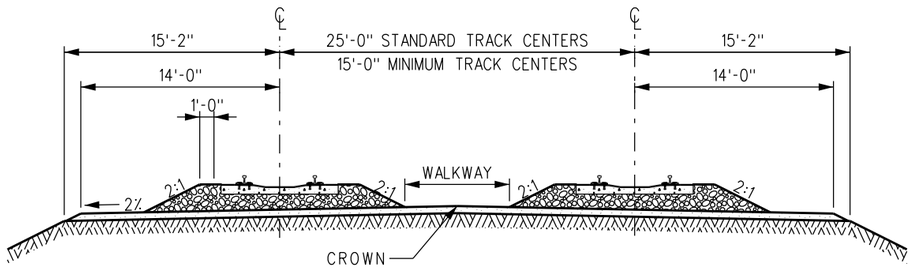
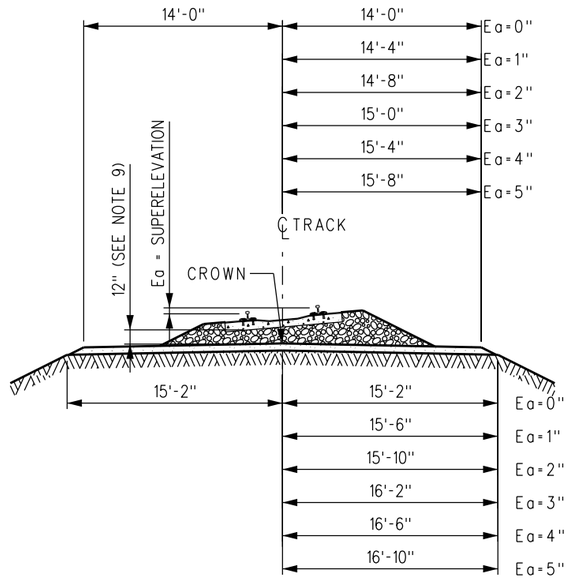


CUT SECTIONS MAINLINE ROADBED SECTION FILL SECTIONS



ROADBED SECTION FOR TWO MAINLINE TRACKS OR ADJACENT MAINLINE & SIDING

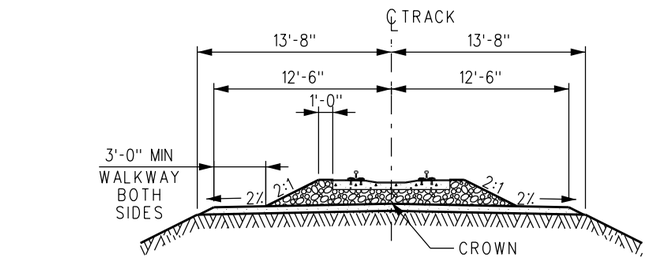


ROADBED SECTION AT CURVED TRACK

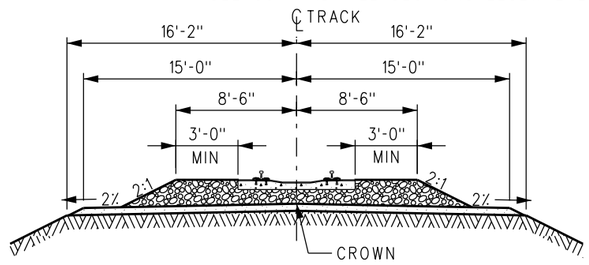
FOR DETAILS NOT SHOWN,
SEE CUT AND FILL SECTIONS ELSEWHERE ON THIS SHEET

NOTES:

1. THE DEPTH OF BALLAST AND DEPTH OF SELECT MATERIAL SHALL BE DECIDED ON THE BASIS OF VOLUME OF TRAFFIC AND ON THE QUALITY OF SELECTED MATERIAL AND SUBGRADE AS DETERMINED BY SCRRA.
2. SLOPES SHOWN FOR BANKS IN CUTS AND ON FILLS SHALL BE CONSIDERED STANDARD AND GENERALLY USED, BUT MAY BE MODIFIED AS REQUIRED BY LOCAL CONDITIONS AND CHARACTER OF MATERIAL IF APPROVED BY SCRRA.
3. BALLAST MUST BE REGULATED IN ADVANCE OF DRESSING SO THAT FINAL SECTION WILL CONFORM TO SLOPE REQUIREMENTS AND CHARACTER OF MATERIAL, IF APPROVED BY SCRRA.
4. WHERE OFF-TRACK ROADWAY IS TO BE PROVIDED, EXTEND THE ROADBED SECTION BY 8'-0" AND MAINTAIN 2% SLOPE AWAY FROM TRACK.
5. ALL FILL SLOPES SHALL BE FACED WITH COVER OF MATERIAL SUITABLE FOR GROWING GRASS AND HAVING A THICKNESS OF APPROXIMATELY 6". THE OUTER SURFACE OF THIS COVER SHALL COINCIDE WITH THE DESIGN SLOPE OF THE EMBANKMENT. MATERIAL FOR THIS COVER MAY BE OBTAINED FROM STRIPPINGS.
6. DEPTH OF DITCHES WILL VARY IN ORDER TO PROVIDE FLOW LINE OF 0.2% MINIMUM GRADE IN DITCHES AND IN BENCHES.
7. SLOPED BOTTOM DITCHES ARE REQUIRED FOR MAIN LINES. A "V" DITCH IS ACCEPTABLE FOR INDUSTRY TRACKS WHEN RIGHT-OF-WAY IS LIMITED AND WHERE LOCAL CONDITIONS AND CHARACTER OF MATERIAL SO REQUIRE. WIDTH OF SLOPED BOTTOM DITCHES MAY EXCEED 8' DEPENDING ON LOCAL CONDITIONS AND HYDRAULIC REQUIREMENTS. SEE SCRRA DESIGN CRITERIA MANUAL FOR MINIMUM HYDRAULIC DITCH CAPACITY DESIGN REQUIREMENTS.
8. ALL MINIMUM DIMENSIONS SHALL BE MET UNLESS OTHERWISE APPROVED BY SCRRA ASSISTANT DIRECTOR, DESIGN.
9. THE PROFILE GRADE LINE ON SUPERELEVATED TRACK APPLIES TO THE LOW RAIL. MAINTAIN 12" DEPTH OF BALLAST BENEATH TIE.
10. ALL SECTIONS ON THIS STANDARD APPLY TO NEW TRACK CONSTRUCTION AND, WHERE PRACTICAL, TRACK RECONSTRUCTION.
11. SEE SCRRA ES1201 FOR ABBREVIATIONS AND SYMBOLS.
12. WHERE TOPOGRAPHY AND RIGHT-OF-WAY ALLOWS, DITCHES SHOULD BE PLACED AS FAR AWAY FROM THE TRACK AS POSSIBLE.

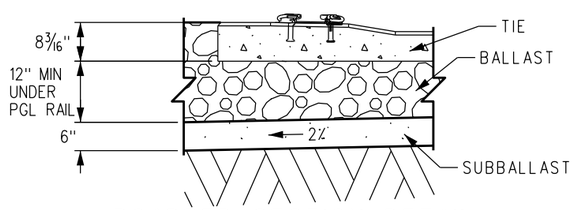


ROADBED SECTION FOR YARD TRACKS

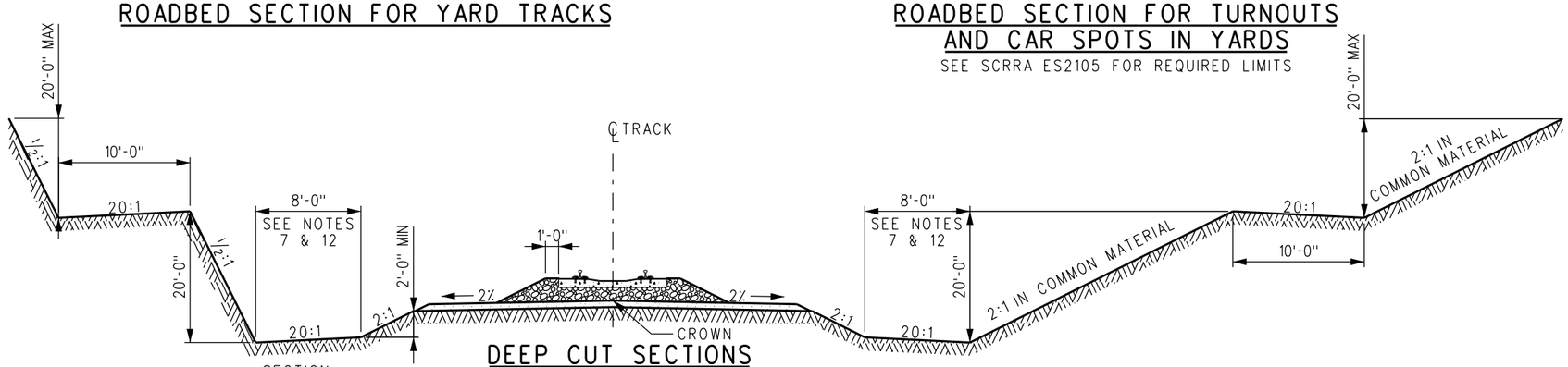


ROADBED SECTION FOR TURNOUTS AND CAR SPOTS IN YARDS

SEE SCRRA ES2105 FOR REQUIRED LIMITS



ROADBED SECTION DETAIL FOR MAINLINE, SIDING TRACKS, & YARD TRACKS

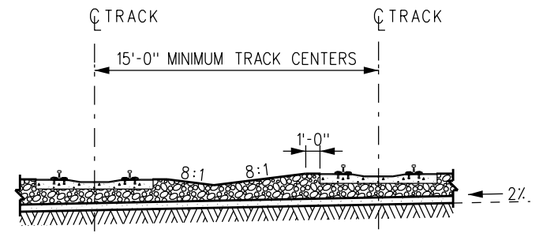


DEEP CUT SECTIONS

SECTION IN SOLID ROCK

10' WIDE BENCH SECTION TO BE PROVIDED AT EACH 20' INCREMENT OF HEIGHT ABOVE DITCH BOTTOM
REPEAT BENCHING PATTERN UNTIL CUT LINE INTERCEPTS EXISTING GROUND

SECTION IN COMMON MATERIAL, SEE NOTE 2



ROADBED SECTION FOR ADJACENT YARD TRACKS

REV.	DATE	DESCRIPTION	DES.	ENG.
B	06-12-20	REVISED NOTE 8, ADD NOTE 12	AC	JMM
A	04-18-19	REVISED BALLAST DEPTH	JK	AT

DRAWN BY: A. CARLOS DATE: 10/01/03

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

ROADBED SECTIONS FOR TRACK CONSTRUCTED USING CONCRETE TIES

STANDARD 2002
SCALE: NTS
REVISION B SHEET 1 OF 1
CADD FILE: ES2002

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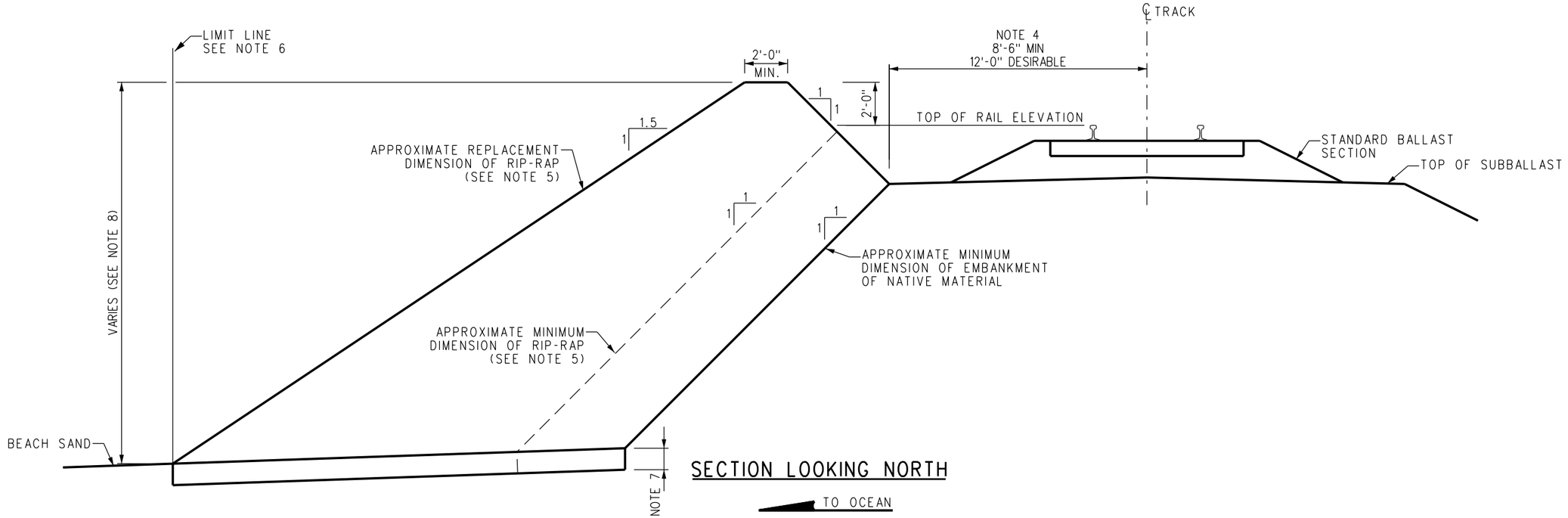

SECTION LOOKING NORTH

NOTES:

1. APPLICATION: THIS STANDARD SHALL BE USED FOR RAILROAD EMBANKMENTS EXPOSED TO OCEAN WAVES. THE RIP-RAP IS USED TO SECURE THE TRACK BALLAST FROM EROSION DUE TO WAVES, AS REQUIRED BY FEDERAL RAILROAD ADMINISTRATION TRACK SAFETY STANDARDS PART 213.103, PROTECTION OF THE BALLAST AND EMBANKMENT BEING FUNDAMENTAL IN SUPPORTING THE TRACK STRUCTURE.
2. DIMENSION LINES: DIMENSIONS FOR STONE RIP-RAP ARE THE AVERAGE OF THE EXPOSED SURFACE OF ROCK. DUE TO THE IRREGULAR SIZE AND SHAPE OF NATURALLY BROKEN ROCK, ANY SPECIFIC POINT MAY VARY TWO FEET FROM THE AVERAGE DIMENSION SHOWN.
3. RIP-RAP MATERIAL: GRANITE, BASALT OR SIMILAR IGNEOUS OR METAMORPHIC ROCK NATIVE TO ORANGE OR RIVERSIDE COUNTIES, BROKEN INTO SIZE DISTRIBUTION MEETING ASTM D5519 GRADATION WILL BE USED TO REPLACE ERODED RIP-RAP AREAS, HOWEVER EXISTING INVENTORIES OF LARGER ROCK MAY BE USED UNTIL EXHAUSTED. CONCRETE, ASPHALT, TIMBER OR METAL IS NOT PERMITTED IN THE RIP-RAP.
4. A WALKWAY GENERALLY CONFORMING TO SCRRA ES2001 AND ES2002 WILL BE PROVIDED ON THE OCEAN SIDE OF THE TRACKS. THE MINIMUM WIDTH OF THE WALKWAY IN SURF AREAS IS EIGHT FEET AND SIX INCHES (8'-6") FROM THE CENTERLINE OF THE TRACK, WITH TWELVE FEET (12'-0") TO BE PROVIDED WHERE FIELD CONDITIONS PERMIT. WALKWAY SURFACE SHALL BE SUBBALLAST.
5. MINIMUM AND MAXIMUM REPLACEMENT DIMENSIONS: THE GENERAL CRITERIA FOR INITIATING REPLACEMENT OF RIP-RAP IS WHEN EROSION OR SETTLEMENT HAS DEGRADED THE RIP-RAP SUCH THAT THE TOP OF THE RIP-RAP HAS BECOME LOWER THAN THE TOP OF RAIL ELEVATION (AND THEREFORE DOES NOT SHIELD THE TRACK FROM WAVES), WHEN THE THICKNESS OF THE RIP-RAP HAS DETERIORATED SUCH THAT THE NATURAL EMBANKMENT IS EXPOSED TO WAVE ACTION, OR WHEN THE LOWER PORTIONS OF THE RIP-RAP HAVE BECOME ERODED LEAVING AN UNSTABLE (STEEPER THAN 1:1) SLOPE RATIO. RIP-RAP WILL BE REPLENISHED TO THE "REPLACEMENT LINE" SHOWN, GENERALLY TO A 1.5:1 SLOPE RATIO. (AT LOCATIONS WITH WELL-ESTABLISHED LARGE DIMENSION RIP-RAP AT A STEEPER SLOPE, LOCALIZED SEGMENTS OF NEW RIP-RAP MAY BE INSTALLED AT 1:1 SLOPE RATIO). THE NORMAL STATE OF MAINTENANCE WILL BE GRADUALLY ERODING COVER OF RIP-RAP BETWEEN THE "MINIMUM" AND "REPLACEMENT" DIMENSION LINES.
6. THE SCRRA AND LOCAL AGENCIES HAVE ESTABLISHED A "LIMIT LINE" TO DEFINE THE MAXIMUM WIDTH OF THE RIP-RAP. THIS LINE IS LOCATED BY REFERENCE TO GPS MEASURED COORDINATES, TO OFFSETS FROM TRACK CENTERLINE, OR BOTH. PLACEMENT OF RIP-RAP SHALL CONFORM TO THE LIMIT LINE UNLESS UNPRECEDENTED EROSION OF THE BEACH LOWERS THE LEVEL OF THE SAND, IN WHICH CASE THE LIMIT LINE WILL BE ADJUSTED SEAWARD AT A 1.5:1 (OR 1:1 AT LOCALIZED SITES) SLOPE RATIO FOR THE ADDED HEIGHT OF THE EMBANKMENT. AFTER RIP-RAP REPLACEMENT OPERATIONS ARE COMPLETE SCRRA WILL MAKE A SURVEY OF THE LIMIT LINE TO DETECT ANY DEVIATIONS FROM THE LIMIT LINE.

NOTES: (continued)

7. THE BOTTOM OF THE RIP-RAP SHALL BE KEYED INTO THE BEACH SAND BY APPROXIMATELY THE SIZE OF THE RIP-RAP ROCK NOMINAL DIMENSION. EXISTING RIP-RAP OR NATIVE ROCK SHALL NOT BE EXCAVATED TO ESTABLISH A NEW KEY UNLESS REQUIRED TO ACHIEVE A STABLE STRUCTURE.
8. THE ELEVATION OF THE RIP-RAP SHALL REMAIN AS DIMENSIONED ON THIS STANDARD. IF THE ELEVATION OF THE BEACH SAND RISES OR FALLS, THE EFFECTIVE HEIGHT OF THE RIP-RAP SHALL BE ADJUSTED AT THE 1.5:1 OR 1:1 SLOPE RATIO SHOWN.
9. RIP-RAP WILL BE PLACED BY GRAVITY DUMP FROM RAILROAD EQUIPMENT, FOLLOWED BY RE-STACKING WITH EQUIPMENT WORKING FROM THE BEACH THAT IS CAPABLE OF MOVING THE LARGEST ROCKS BEING USED. THE RE-STACKING IS TO PLACE ALL ROCKS IN A STABLE MATRIX, TO RECOVER ANY ROCKS BEYOND THE LIMIT LINE, AND TO FILL VOIDS BETWEEN LARGE ROCKS WITH SMALLER ROCK ELEMENTS. EXISTING RIP-RAP MAY BE MOVED PRIOR TO ADDITION OF REPLENISHMENT ROCK IN ORDER TO FACILITATE DUMPING.
10. FOR EMBANKMENT DETAILS NOT SHOWN, REFER TO SCRRA ES2001 AND ES2002.
11. AT LOCATIONS WHERE SAND MOVES TO COVER UP THE RIP-RAP, RIP-RAP SHALL BE LEFT IN PLACE.
12. SCRRA MAINTENANCE MANAGER WILL INFORM THE GOVERNING AGENCIES ONE MONTH IN ADVANCE OF PLANNED PLACEMENT OF REPLENISHMENT RIP-RAP. IF RAPID EROSION REQUIRES PLACEMENT IN LESS THAN THE FULL MONTH NOTIFICATION PERIOD, NOTICE WILL BE GIVEN AS PROMPTLY AS PRACTICABLE.
13. INSTALLATION AND RE-STACKING OF ROCK SHAILL CONFORM TO PERMIT GUIDELINES AND SHALL BE PERFORMED ONLY AFTER PROVIDING PROTECTION FOR MEMBERS OF THE PUBLIC WHO MAY BE USING THE BEACH.
14. ROUTINE REPLENISHMENT AND MAINTENANCE OF THE RIP-RAP SHALL BE SCHEDULED TO AVOID PEAK BEACH RECREATIONAL USE TIMES.
15. LOCALIZED EXCEPTIONS TO THIS STANDARD SHALL BE MADE IN ORDER TO FIT RIP-RAP TO CONFORM TO DRAINAGE STRUCTURES, PUBLIC CROSSINGS, SIGNAL FACILITIES AND OTHER STRUCTURES.

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	REVISE NOTE 8	AC	JMM

DRAWN BY: A. CARLOS DATE: 10/01/03

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

ROADBED SECTIONS FOR EXPOSURE TO OCEAN SURF

STANDARD 2003
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2003

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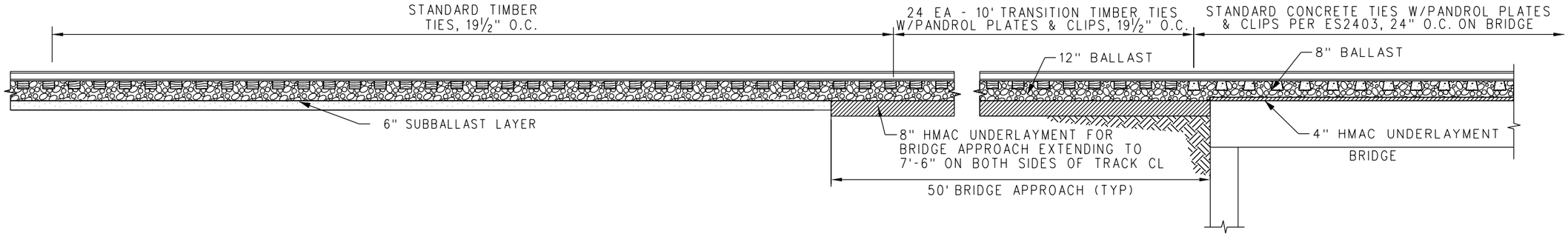
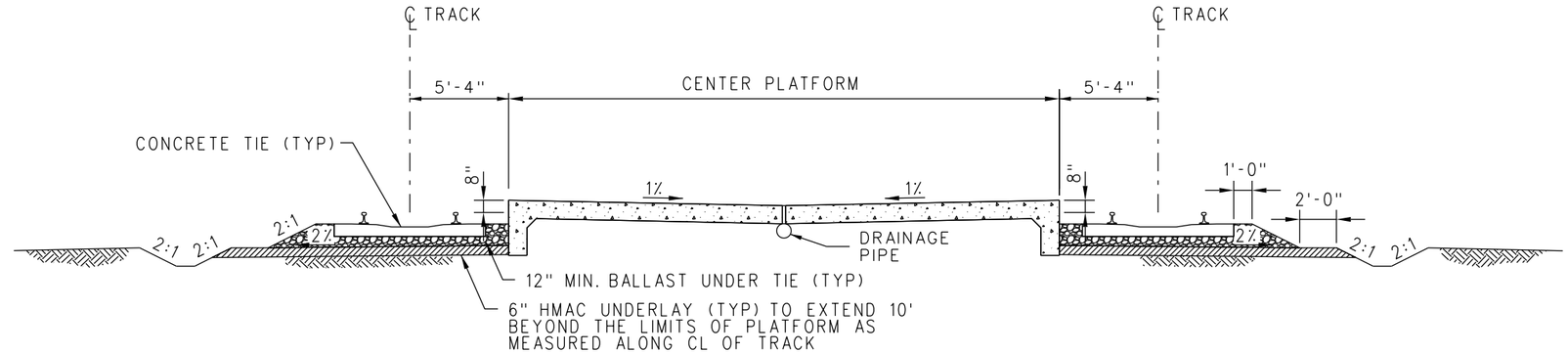
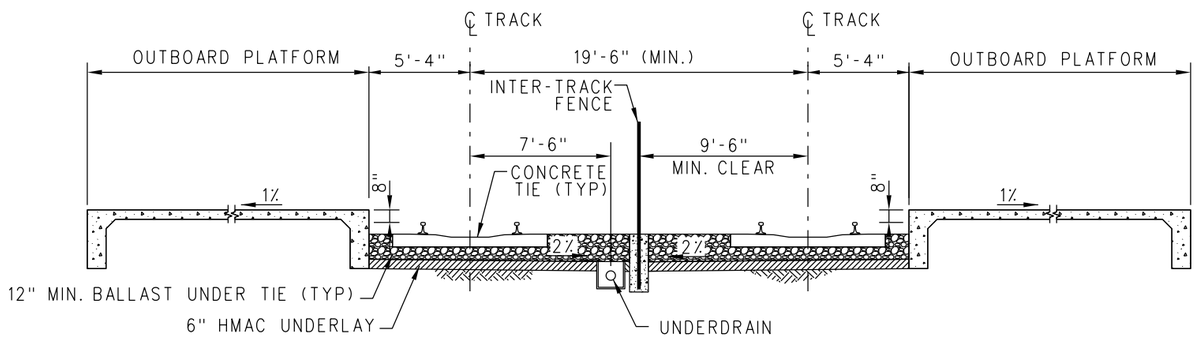


ON BRIDGES
(TYPICAL FOR BOTH ENDS)



AT STATIONS
(CENTER ISLAND PLATFORM)



AT STATIONS
(OUTBOARD PLATFORMS)

REV.	DATE	DESCRIPTION	DES.	ENG.
D	03-22-21	REVISED CONCRETE TIE NOTE ON BRIDGES	AC	JMM
C	06-12-20	REVISED NOTES AND DIMENSIONS	AC	JMM
B	09-28-15	REVISED NOTES	AC	NDP
A	03-29-13	REVISED HMAC UNDERLAYMENT	AC	NDP

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

HMAC UNDERLAYMENT
FOR SELECT CRITICAL LOCATIONS
(NEW CONSTRUCTION ONLY)

STANDARD 2004
SCALE: NTS
REVISION D SHEET 1 OF 1
CADD FILE: ES2004

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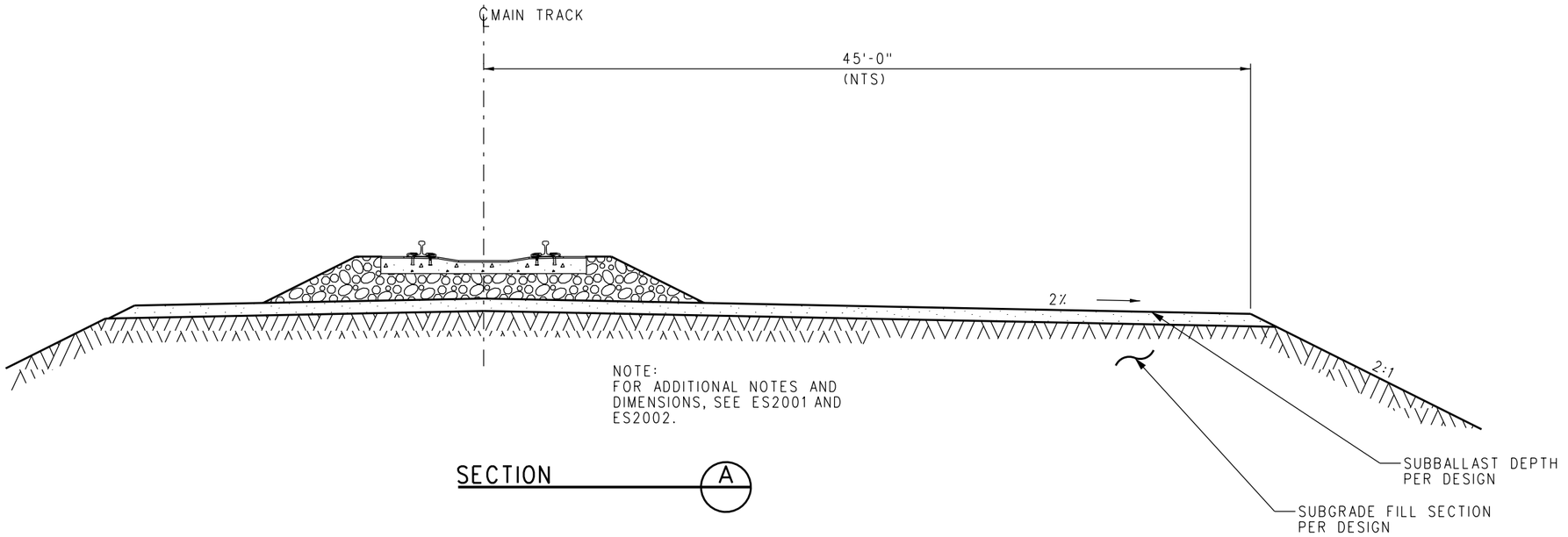
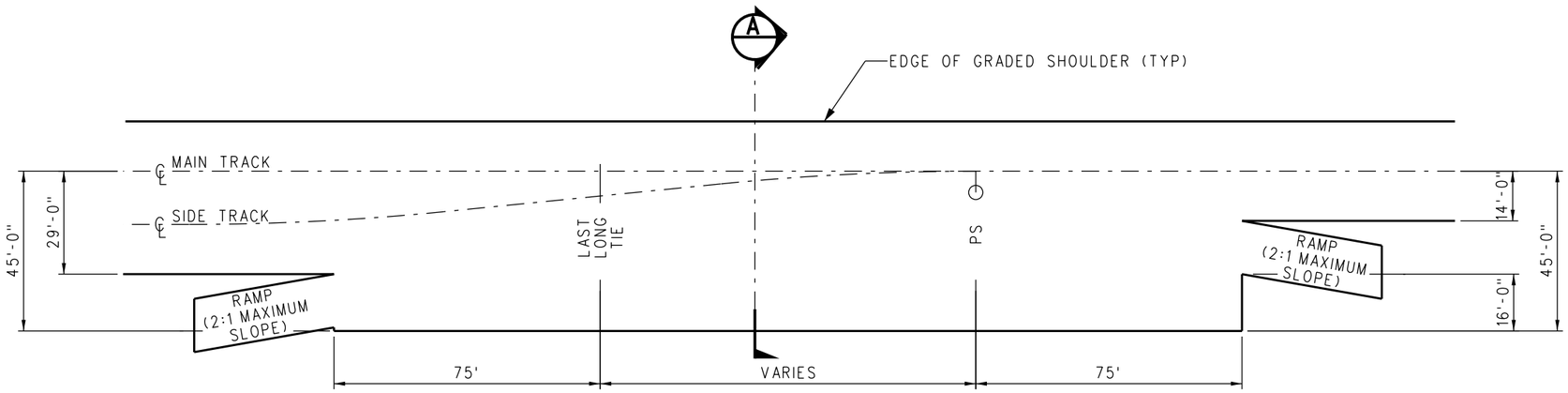


SECTION A



REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	REVISE PLAN, ADD SECTION A	AC	JMM

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TURNOUT CONSTRUCTION PADS

STANDARD: 2005
SCALE: NTS
REVISION: A
SHEET: 1 OF 1
CADD FILE: ES2005

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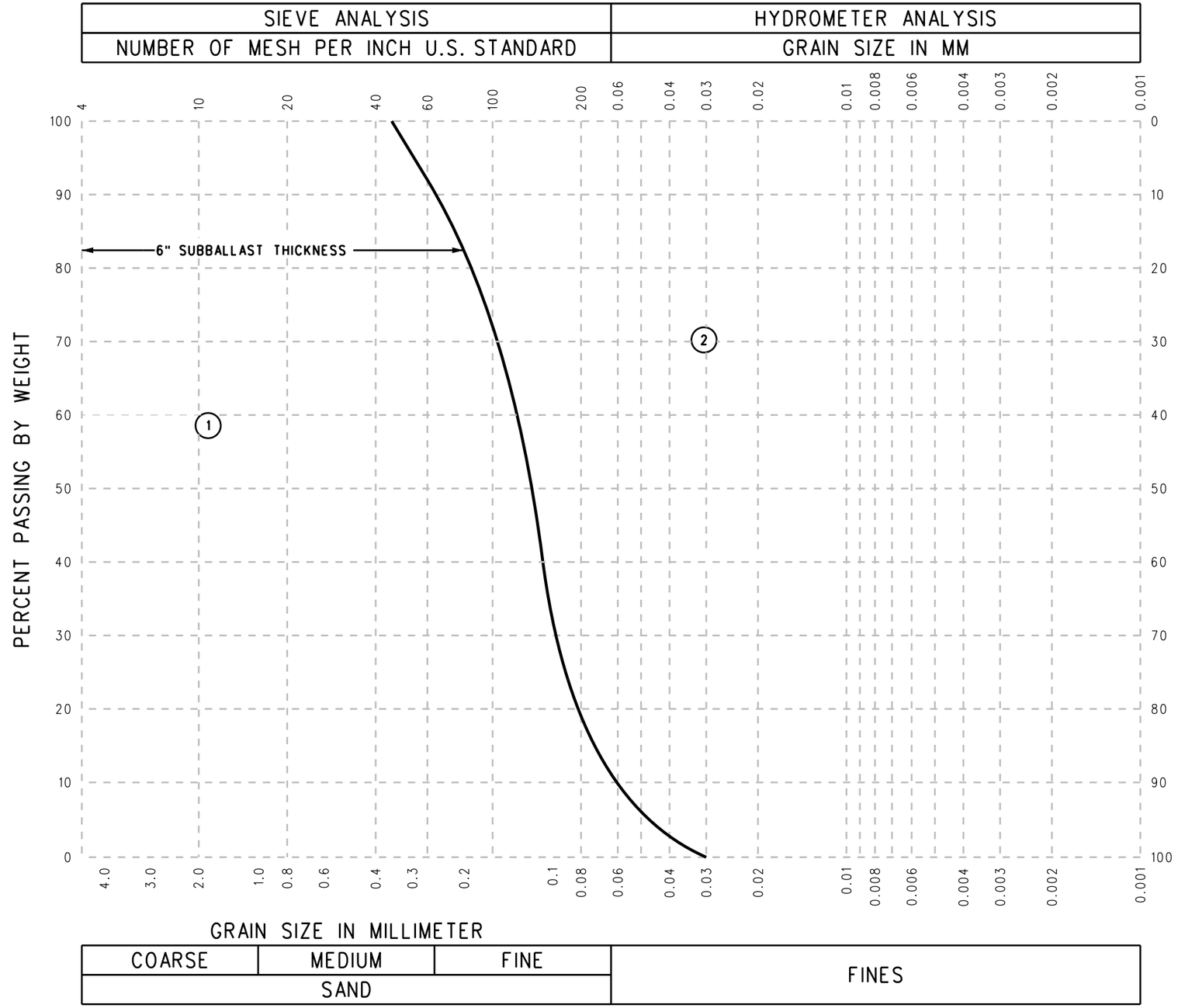


	GRADATION CURVE
SIEVE SIZE	6" LIMIT
NO 40	100
NO 60	92
NO 100	72
NO 200	19
0.015	-
0.006	-
0.004	-
0.001	-

PERCENT PASSING (BY WEIGHT)
[ALL AGGREGATE SAMPLING AND TESTING PER ASTM LATEST REVISION.]

NOTES:

1. SOILS ENGINEER WILL USE THESE REQUIREMENTS AS A MINIMUM. ADDITIONAL SUBGRADE SUPPORT MEASURES MAY BE NECESSARY AS DIRECTED BY SOIL ENGINEER'S ANALYSIS.

(1) ZONE OF SUBGRADE MATERIALS REQUIRING 6" OF SUBBALLAST.

(2) ADDITIONAL MEASURES MAY BE REQUIRED PER RECOMMENDATIONS OF AN ENGINEERING SOILS ANALYSIS.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

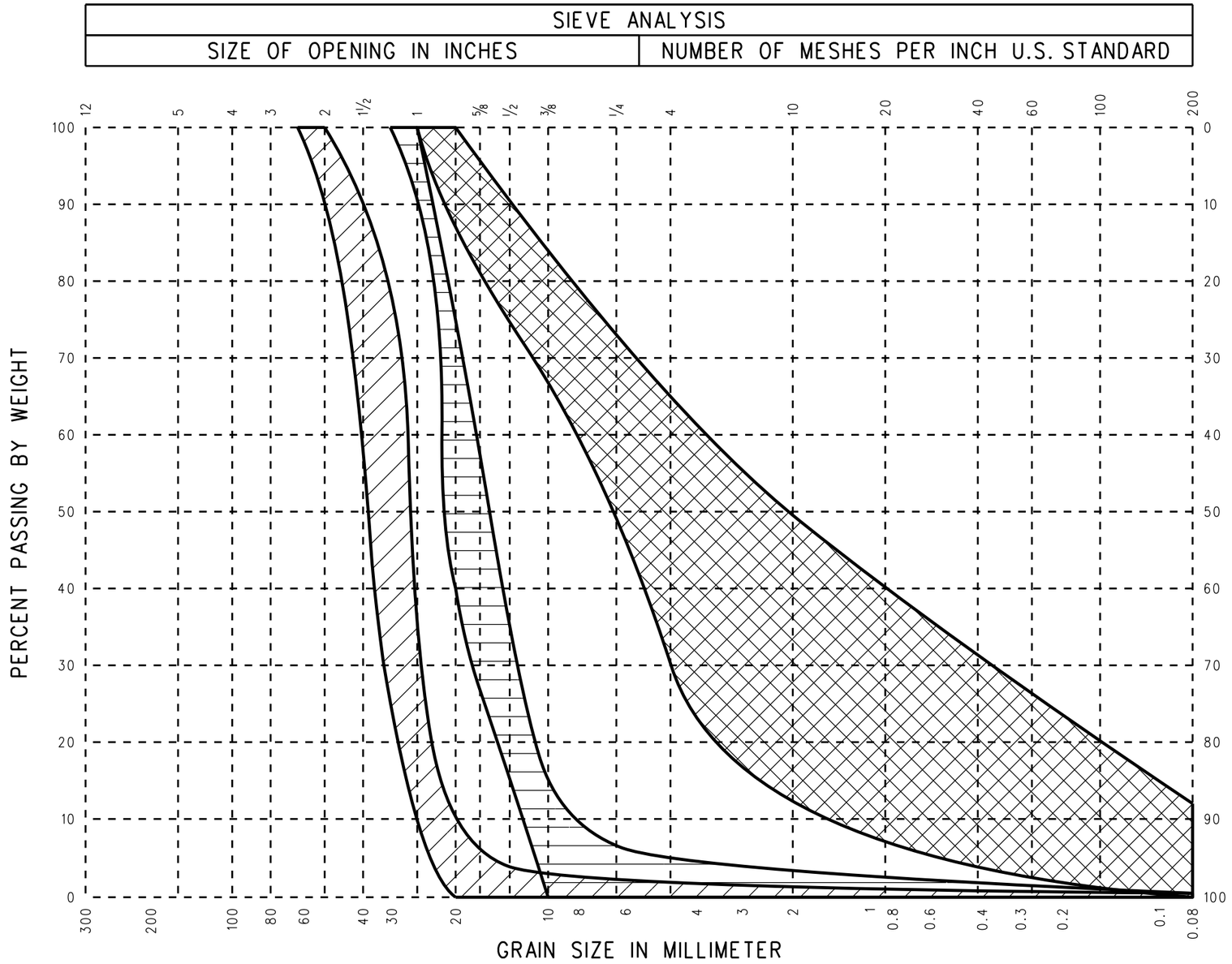
METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

GRAIN SIZE DISTRIBUTION FOR SUBGRADE SOILS

STANDARD 2007
SCALE: NTS
REVISION - SHEET 1 OF 2
CADD FILE: ES2007-01

UserName•› scrrapw11ics01$ Date Plotted: 3/27/2023 3:06:30 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
FileName•› \\scrrapw11ics01\iCS_pdf_work_dir\87\482_6\ES2007-01.dgn



SQUARE OPENING	•4A	•5	SUBBALLAST
	2"-¾"	1"-⅜"	¾"-0"
2½"	100	-	-
2"	90-100	-	-
1¾"	-	-	-
1½"	60-90	-	-
1¼"	-	100	-
1"	10-35	90-100	100
¾"	0-10	40-75	87-100
½"	-	15-35	-
⅜"	0-3	0-15	-
NO 4	-	0-5	30-65
NO 8	-	-	-
NO 10	-	-	-
NO 30	-	-	5-35
NO 200	0-0.5	0-0.5	0-12

PERCENT PASSING (BY WEIGHT)
[ALL AGGREGATE SAMPLING AND TESTING PER ASTM LATEST REVISION.]

NOTES:

1. FOR STANDARD CROSS SECTIONS, SEE SCRRA ES2001 & ES2002.

*4A BALLAST FOR MAIN TRACK

*5 BALLAST FOR WALKWAY AND YARD TRACK

SUBBALLAST CALTRANS 26-102A

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	REVISE SUBBALLAST PATTERN	AC	JMM

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

BALLAST & SUBBALLAST GRADATION TABLE

STANDARD: 2007
SCALE: NTS
REVISION: A
SHEET: 2 OF 2
CADD FILE: ES2007-02

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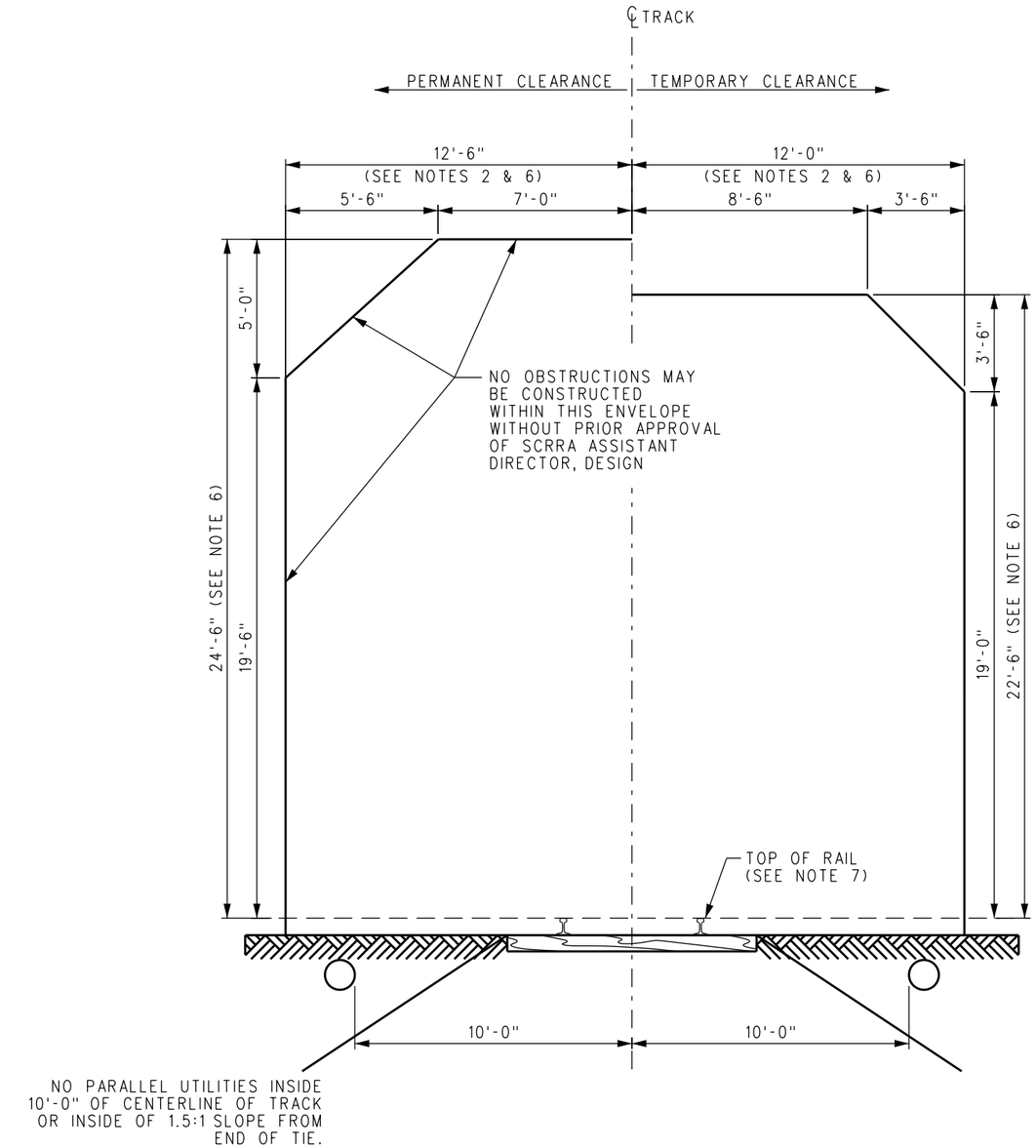


NOTES:

1. STANDARD PERMANENT AND TEMPORARY CLEARANCES SHOWN ON THIS SHEET SHALL BE USED FOR NEW DESIGN AND CONSTRUCTION WHEREVER PRACTICAL. ANY PERMANENT OR TEMPORARY CONSTRUCTION PROPOSED WITHIN THE DIMENSIONS SHOWN SHALL REQUIRE THE PRIOR APPROVAL OF THE SCRRA ASSISTANT DIRECTOR, DESIGN.
2. STANDARD PERMANENT CLEARANCE FOR STAIRWAYS AND SUPPORT COLUMNS SHALL BE A MINIMUM OF 14'-0" FROM CENTERLINE OF TRACK. PROPOSED CLEARANCES LESS THAN THIS DISTANCE SHALL CONFORM TO THOSE SHOWN ON SCRRA ES2102 AND WILL REQUIRE THE PRIOR APPROVAL OF THE SCRRA ASSISTANT DIRECTOR, DESIGN.
3. SEE SCRRA ES2104 FOR MINIMUM VERTICAL CLEARANCES FOR OVERHEAD WIRES.
4. SEE SCRRA ES3101, ES3201 AND ES3202 FOR REQUIRED PASSENGER PLATFORM CLEARANCES.
5. RAIL/HIGHWAY GRADE SEPARATIONS MAY REQUIRE PROVISIONS FOR A MAINTENANCE ROAD AND/OR FUTURE ADDITIONAL TRACK(S).
6. HIGHER AND WIDER CLEARANCES MAY BE REQUIRED TO PROVIDE VISIBILITY FOR WAYSIDE SIGNALS.
7. IN A CURVE ON SUPERELEVATED TRACK THE HORIZONTAL CLEARANCES SHALL BE MEASURED PERPENDICULAR TO THE PLANE ACROSS THE TOP OF BOTH RAILS AND THE VERTICAL CLEARANCE SHALL BE MEASURED FROM THE HIGH RAIL.

CLEARANCE REQUIREMENTS FOR NEW CONSTRUCTION OR DESIGN

REV.	DATE	DESCRIPTION	DES.	ENG.
B	06-12-20	REVISED NOTES 1 AND 2	AC	JMM
A	01-15-20	REVISED TEMPORARY CLEARANCE DIMENSIONS AND NOTES	AC	JMM

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

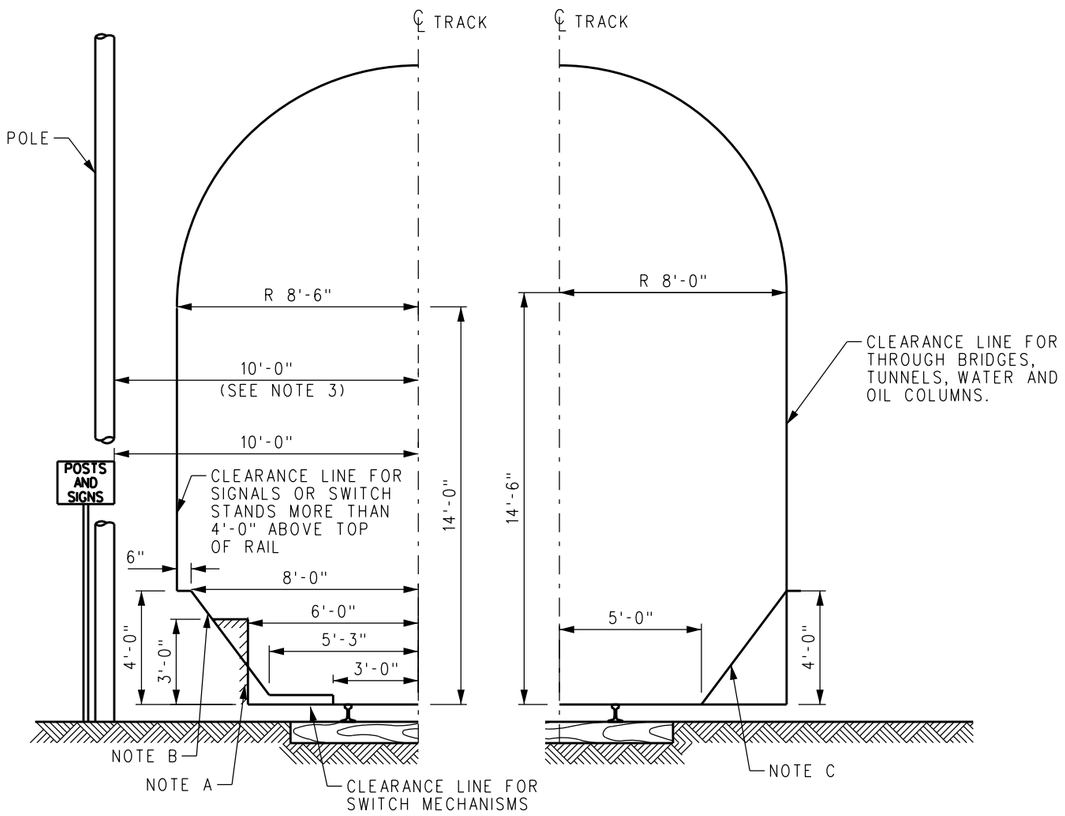
STANDARD CLEARANCE OF STRUCTURES

STANDARD 2101
SCALE: NTS
REVISION B SHEET 1 OF 1
CADD FILE: ES2101

UserName•> scrrapw11ics01$ Date Plotted: 3/27/2023 3:06:42 PM Plot Driver•> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
FileName•> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_8\ES2101.dgn

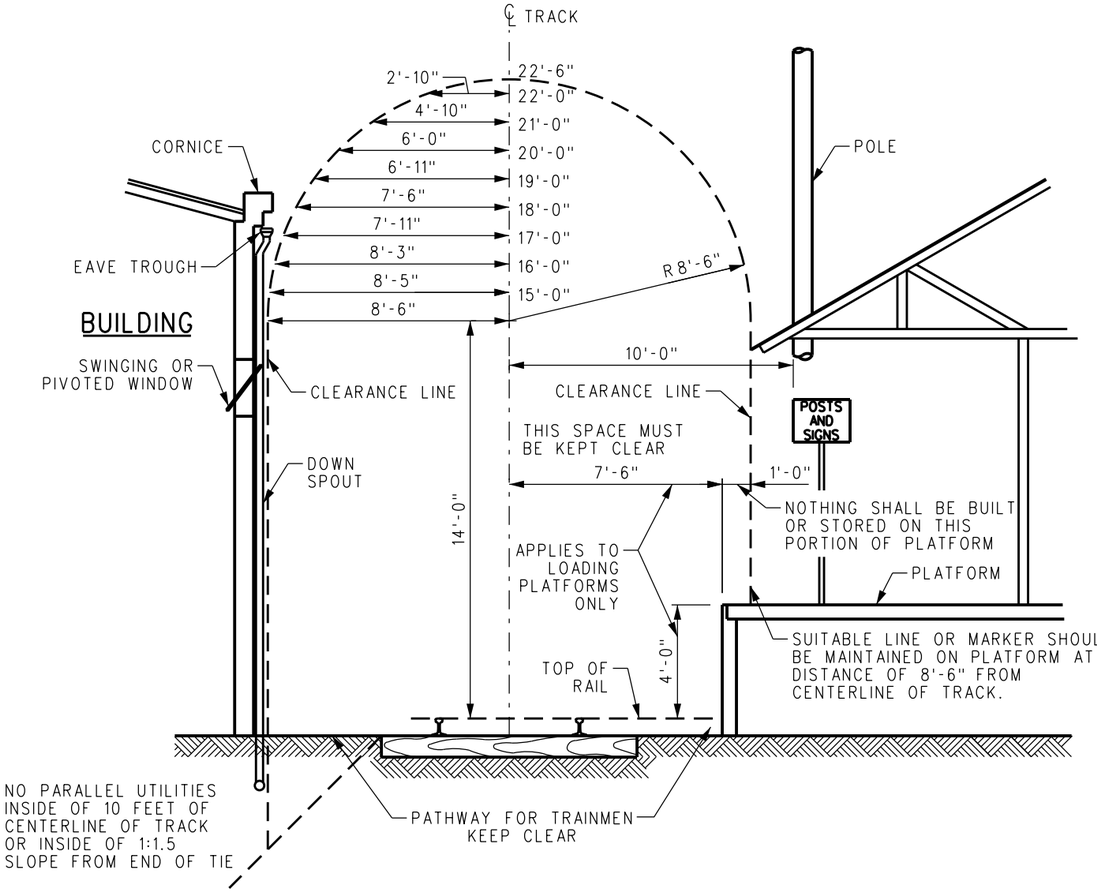
NOTES:

A. CLEARANCE LINE SHOWN BELOW IS FOR SIGNALS OR SWITCH STANDS 3'-0" OR LESS ABOVE TOP OF RAIL AND LOCATED BETWEEN TRACKS WHERE NOT PRACTICABLE TO MAINTAIN CLEARANCES OTHERWISE PRESCRIBED.
B. CLEARANCE LINE SHOWN BELOW IS FOR PORTIONS OF BLOCK SIGNALS 4'-0" OR LESS ABOVE TOP OF RAIL.
C. DECREASED CLEARANCES SHOWN BELOW ARE FOR:
   1) REFUGE PLATFORMS ON BRIDGES AND TRESTLES NOT PROVIDED WITH WALKWAYS
   2) HANDRAILS
   MINIMUM CLEARANCES FOR HANDRAILS ON BRIDGES WITH WALKWAYS SHALL BE 8'-6". DECREASED CLEARANCES, EXCEPT AS PROVIDED FOR HANDRAILS ARE NOT PERMITTED ON THROUGH BRIDGES WHERE WORK OF TRAINMEN OR YARDMEN REQUIRE THEM TO BE ON DECK OF BRIDGE FOR PURPOSE OF COUPLING OR UNCOUPLING CARS IN PERFORMING SWITCHING SERVICE ON A SWITCHING LEAD.



NOTES:

1. SEE SCRRA ES2104 FOR MINIMUM VERTICAL CLEARANCES FOR OVERHEAD WIRES.
2. ALL CLEARANCES LISTED ON THIS SHEET ARE MINIMUM REQUIREMENTS. USE STANDARD CLEARANCES SHOWN ON SCRRA ES2101 FOR NEW CONSTRUCTION.
3. POSTS, POLES, SIGNS AND SIMILAR FACILITIES MAY HAVE MINIMUM CLEARANCE OF 8'-6", BUT CLEARANCE OF 10'-0" IS RECOMMENDED WHERE PRACTICABLE
4. ALL SIDE CLEARANCE DIMENSIONS ARE FOR TANGENT TRACK. IN GENERAL, SIDE CLEARANCE FOR CURVED TRACK SHALL BE 1'-0" GREATER THAN THAT FOR TANGENT TRACK.
5. PLATFORMS 4'-0" OR LESS IN HEIGHT WITH MINIMUM CLEARANCE OF 7'-3" MAY BE EXTENDED AT EXISTING CLEARANCES IF SUCH EXTENSION IS NOT IN CONNECTION WITH RECONSTRUCTION OF ORIGINAL PLATFORM.



TYPICAL
CLEARANCE OF STRUCTURES FROM RAILROAD TRACKS AS GENERALLY PRESCRIBED BY PUBLIC UTILITIES COMMISSION - STATE OF CALIFORNIA GENERAL ORDER NO 26-D

(EFFECTIVE FEBRUARY 1, 1948)
FOR NEW WORK AND RECONSTRUCTION OF EXISTING FACILITIES ADJACENT TO STANDARD GAUGE RAILROAD TRACKS TRANSPORTING FREIGHT CARS.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

MINIMUM CLEARANCE OF STRUCTURES

STANDARD 2102
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2102

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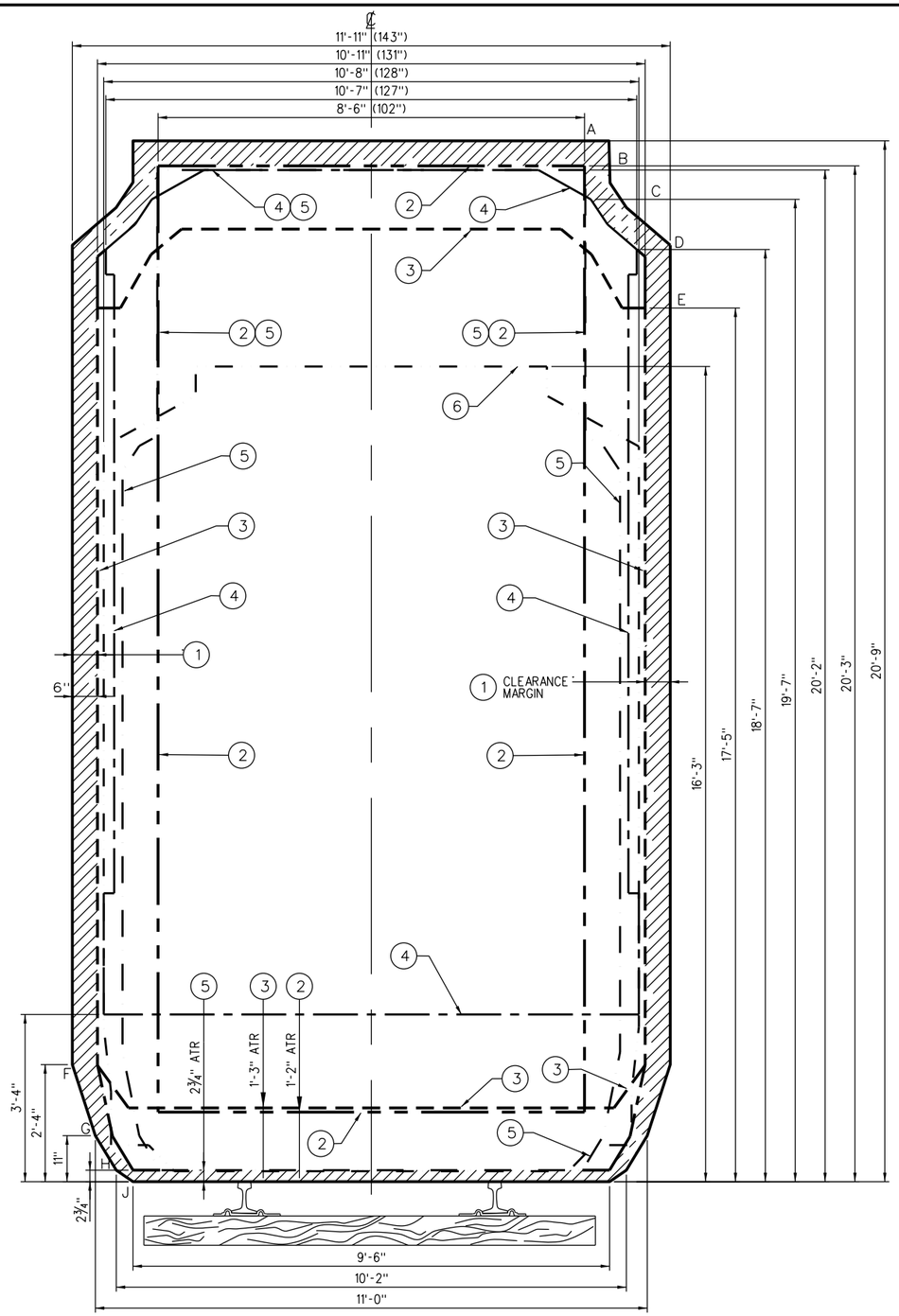
FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_9\ES2102.dgn



CLEARANCE ENVELOPE

LEGEND FOR CLEARANCE ENVELOPE

1. CLEARANCE MARGIN FOR MAXIMUM DOUBLESTACK CONTAINERS, BI-LEVEL AND TRI-LEVEL CARRIERS. THIS AREA TO BE KEPT FREE AND CLEAR OF ANY PLATFORMS, TUNNELS, BRIDGE OVERHEADS, PASSENGER PLATFORMS, POLES, UTILITY LINES, WAYSIDE SIGNAL DEVICES, AND ALL OTHER NATURAL OR MAN-MADE STRUCTURES AND OBJECTS.
2. MAXIMUM COMBINATION DOUBLESTACK CARS (8'-6" WIDE BY 9'-6½" HIGH CONTAINERS STACKED TWO HIGH, 1'-2" ATR).
3. ARTICULATED BI-LEVEL AUTO CARRIER CAR.
4. TRI-LEVEL AUTO CARRIER CAR (CHRYSLER TYPE).
5. AAR PLATE H CLEARANCE ENVELOPE (FOR DOUBLESTACK CARS WITHOUT CONTAINERS).
6. AAR PLATE L.

NOTES:

1. ALL NEW CONSTRUCTION, RECONSTRUCTION, ALTERATIONS AND MODIFICATIONS MUST BE IN COMPLIANCE WITH THE CLEARANCE ENVELOPE REQUIREMENTS FOR UNOBSTRUCTED TRANSPORT OF THIS RAIL EQUIPMENT.
2. HORIZONTAL CLEARANCE DISTANCES SHALL BE INCREASED ON CURVES AT RATE OF 1.07" ON INSIDE OF CURVES AND 1.05" ON OUTSIDE OF CURVES PER DEGREE OF CURVE.
3. WHEN TRACK SUPERELEVATION IS SET APPROPRIATELY FOR THE AUTHORIZED TRAIN SPEED, ALL CLEARANCE MEASUREMENTS ARE TO BE MADE PARALLEL TO THE PLANE OF THE TOP OF RAIL AND PERPENDICULAR TO THE CENTERLINE OF TRACK.
4. DIMENSIONS SHOWN ARE FOR INFORMATION ONLY AND NOT TO BE USED TO ESTABLISH LEGAL CLEARANCE REQUIREMENTS OR FOR HIGH-WIDE LOAD CLEARANCES.
5. IN MANY INSTANCES, STATE LAW MAY REQUIRE GREATER CLEARANCE THAN PROVIDED FOR IN THE COMBINED CLEARANCE ENVELOPE, IN WHICH CASE THE GREATER CLEARANCE SHALL GOVERN.
6. CLEARANCE DIMENSION REQUIREMENTS INDICATED EXCEED MOST STATES PERMISSIVE CLEARANCES FOR LOW PLATFORMS HOWEVER, THESE CLEARANCE STANDARDS SHALL GOVERN FOR 8 INCHES OR LOWER PLATFORMS.
7. THE PRESCRIBED CLEARANCE MARGIN ENVELOPE MAY BE MODIFIED WHEN APPROVED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN.

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	ADDED PLATE "L", REVISED NOTE 7	AC	JMM

DRAWN BY: A. CARLOS DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

CAR (EQUIPMENT)
CLEARANCE ENVELOPE

STANDARD 2103
SCALE: NONE
REVISION A SHEET 1 OF 1
CADD FILE: ES2103

UserName•› scrrapw11ics01$ Date Plotted: 3/27/2023 3:06:18 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•› \\scrrapw11ics01\iCS_pdf_work_dir\87\482_10\ES2103.dgn

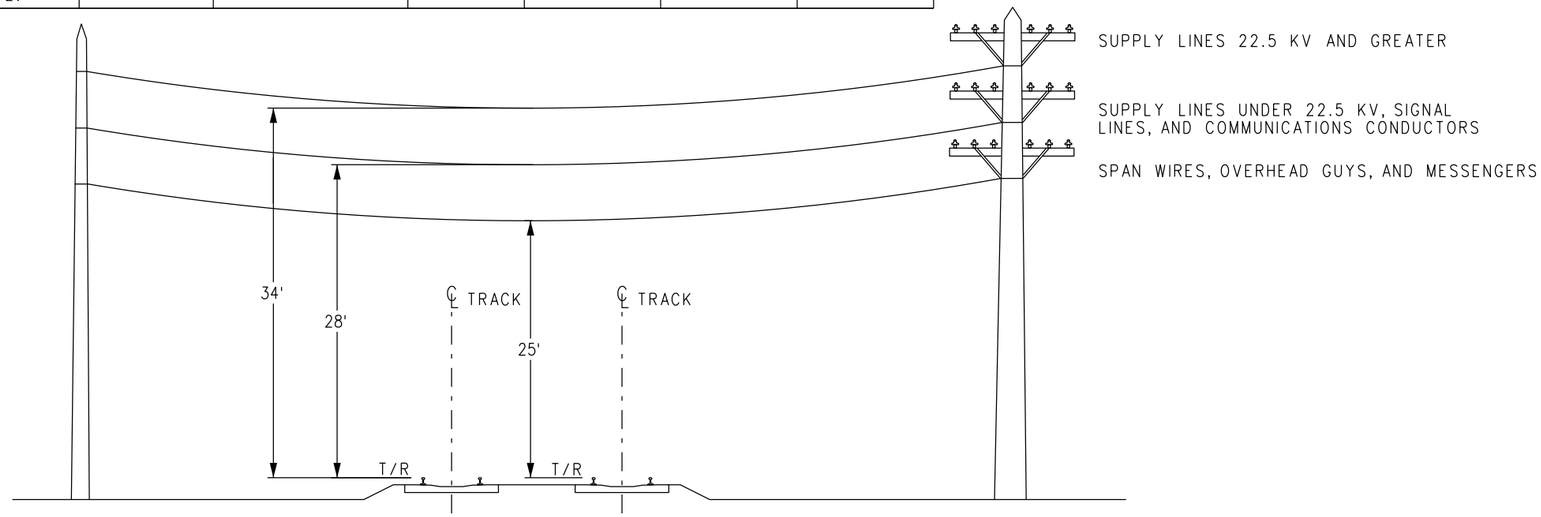
TABLE 1: CPUC GENERAL ORDER 95 BASIC MINIMUM ALLOWABLE VERTICAL CLEARANCE OF WIRES ABOVE RAILROADS, ROADWAYS, POLES, BUILDINGS, STRUCTURES OR OTHER OBJECTS

CASE NO	NATURE OF CLEARANCE	A SPAN WIRES (OTHER THAN TROLLEY SPAN WIRES) OVERHEAD GUYS AND MESSENGERS	B COMMUNICATION CONDUCTORS (INCLUDING OPEN WIRE, CABLES & SERVICE DROPS)	C TROLLEY CONTACT, FEEDER AND SPAN WIRES, UNDER 5 KV	D SUPPLY CONDUCTORS & SUPPLY CABLES UNDER 22.5 KV, SIGNAL WIRES	E SUPPLY CONDUCTORS & SUPPLY CABLES, 22.5 KV TO UNDER 300 KV	F SUPPLY CONDUCTORS & SUPPLY CABLES, 300 KV AND GREATER
1	CROSSING ABOVE TRACKS OF RAILROADS WHICH TRANSPORT OR PROPOSE TO TRANSPORT FREIGHT CARS (MAXIMUM HEIGHT 20'-9" WHERE NOT OPERATED BY OVERHEAD CONTACT WIRES.	25-FT	28-FT•	22.5-FT	28-FT	34-FT	34-FT
2	CROSSING OR PARALLELING ABOVE TRACKS OF RAILROAD OPERATED BY OVERHEAD TROLLEYS.	26-FT	26-FT	22.5-FT	30-FT•	34-FT•	34-FT•
3	CROSSING OR ALONG ROADWAYS IN URBAN DISTRICTS OR CROSSING ROADWAYS IN RURAL DISTRICTS.	18-FT	18-FT	19-FT	25-FT	30-FT	30-FT
4	ABOVE GROUND ALONG ROADWAYS IN RURAL DISTRICTS OR ACROSS OTHER AREAS CAPABLE OF BEING TRAVERSED BY VEHICLES OR AGRICULTURAL EQUIPMENT.	18-FT•	18-FT•	19-FT	25-FT	30-FT	30-FT
5	ABOVE GROUND IN AREAS ACCESSIBLE TO PEDESTRIANS ONLY.	8-FT	10-FT	19-FT	17-FT	25-FT	25-FT
6	VERTICAL CLEARANCE ABOVE WALKABLE SURFACES ON BUILDINGS, (EXCEPT GENERATING PLANTS OR SUBSTATIONS) BRIDGES OR OTHER STRUCTURES WHICH DO NOT ORDINARILY SUPPORT CONDUCTORS, WHETHER ATTACHED OR UNATTACHED.	8-FT	8-FT	8-FT	12-FT	12-FT	20-FT
6A	VERTICAL CLEARANCE ABOVE NON-WALKABLE SURFACES ON BUILDINGS, (EXCEPT GENERATING PLANTS OR SUBSTATIONS) BRIDGES OR OTHER STRUCTURES, WHICH DO NOT ORDINARILY SUPPORT CONDUCTORS, WHETHER ATTACHED OR UNATTACHED.	2-FT	8-FT	8-FT	8-FT	8-FT	20-FT
7	HORIZONTAL CLEARANCE OF CONDUCTOR AT REST FROM BUILDINGS (EXCEPT GENERATING PLANTS AND SUBSTATIONS), BRIDGES OR OTHER STRUCTURES (UPON WHICH WORKERS MAY WORK) WHERE SUCH CONDUCTOR IS NOT ATTACHED THERETO.	-	3-FT	3-FT	6-FT	6-FT	15-FT
8	DISTANCE OF CONDUCTOR FROM CENTER LINE OF POLE, WHETHER ATTACHED OR UNATTACHED.	-	15-IN	15-IN	18-IN	18-IN	NOT APPLICABLE
9	DISTANCE OF CONDUCTOR FROM SURFACE OF POLE CROSS ARM OR OTHER OVERHEAD LINE STRUCTURE UPON WHICH IT IS SUPPORTED, PROVIDING IT COMPLIES WITH CASE 8 ABOVE.	-	3-IN	3-IN	3-IN	3-IN	NOT APPLICABLE

•EXCEEDS CPUC GENERAL ORDER 95 BASIC MINIMUM ALLOWABLE VERTICAL CLEARANCE.

MINIMUM CLEARANCES OF WIRES ABOVE RAILROADS, ROADWAYS, ETC.

1. CLEARANCES BETWEEN OVERHEAD CONDUCTORS, GUYS, MESSENGERS OR TROLLEY SPAN WIRES AND TOPS OF RAILS, SURFACES OF ROADWAYS OR OTHER GENERALLY ACCESSIBLE AREAS ACROSS, ALONG OR ABOVE WHICH ANY OF THE FORMER PASS; ALSO THE CLEARANCES BETWEEN CONDUCTORS, GUYS, MESSENGERS OR TROLLEY SPAN WIRES AND BUILDINGS, POLES, STRUCTURES, OR OTHER OBJECTS, SHALL NOT BE LESS THAN THOSE SET FORTH IN TABLE 1, AT A TEMPERATURE OF 60°F AND NO WIND.
2. THE CLEARANCES SPECIFIED IN TABLE 1, CASE 1, COLUMNS A, B, D, E AND F, SHALL IN NO CASE BE REDUCED MORE THAN 5% BELOW THE TABULAR VALUES BECAUSE OF TEMPERATURE AND LOADING AS SPECIFIED IN CPUC G.O. 95 RULE 43. THE CLEARANCES SPECIFIED IN TABLE 1, CASES 2 TO 6 INCLUSIVE, SHALL IN NO CASE BE REDUCED MORE THAN 10% BELOW THE TABULAR VALUES BECAUSE OF TEMPERATURE AND LOADING AS SPECIFIED IN CPUC G.O. 95 RULE 43.
3. THE CLEARANCE SPECIFIED IN TABLE 1, CASE 1, COLUMN C (22.5 FEET), SHALL IN NO CASE BE REDUCED BELOW THE TABULAR VALUE BECAUSE OF TEMPERATURE AND LOADING AS SPECIFIED IN RULE 43.
4. WHERE SUPPLY CONDUCTORS ARE SUPPORTED BY SUSPENSION INSULATORS AT CROSSINGS OVER RAILROADS WHICH TRANSPORT FREIGHT CARS, THE INITIAL CLEARANCES SHALL BE SUFFICIENT TO PREVENT REDUCTION TO CLEARANCES LESS THAN 95% OF THE CLEARANCES SPECIFIED IN TABLE 1, CASE 1, THROUGH THE BREAKING OF A CONDUCTOR IN EITHER OF THE ADJOINING SPANS.



MINIMUM CLEARANCES OF WIRES ABOVE RAILROADS - CASE 1

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 06/08/07

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

MINIMUM VERTICAL CLEARANCE FOR WIRES

STANDARD 2104
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2104

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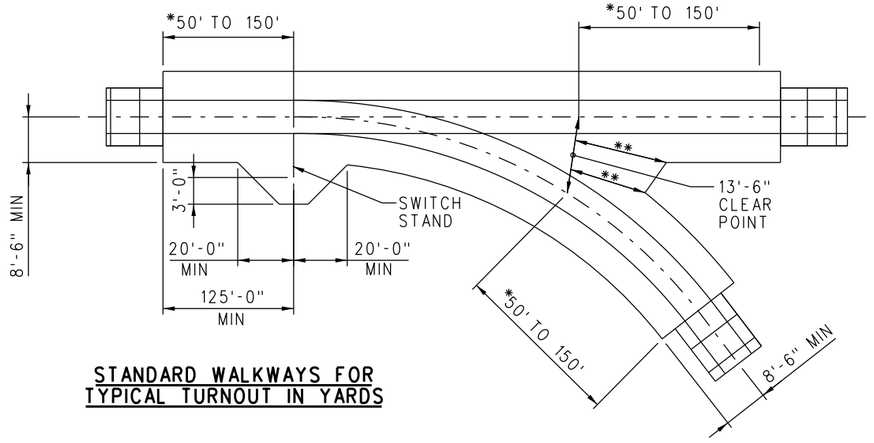
*SEE SCRRA ES2001 AND ES2002 FOR ROADBED SECTIONS. WALKWAYS AT TURNOUTS AND AT CAR SPOTS WILL EXTEND BEYOND THE POINT OF SWITCH AND ITS CLEAR POINT AND ON EACH SIDE OF THE CAR SPOT, WHERE APPLICABLE, A DISTANCE EQUAL:
1 CAR SPOT - 50'-0" MINIMUM
2 CAR SPOT - 100'-0" MINIMUM
3 OR MORE CAR SPOTS - 150'-0"

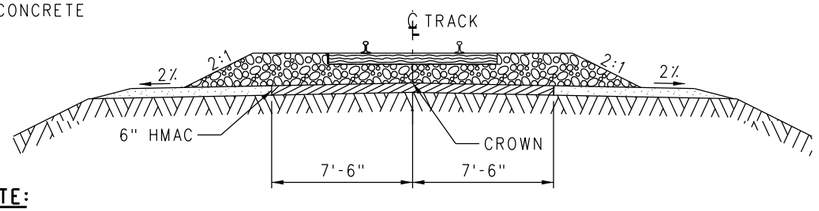
**25'-0" MIN.



STANDARD WALKWAYS FOR TYPICAL TURNOUT IN YARDS

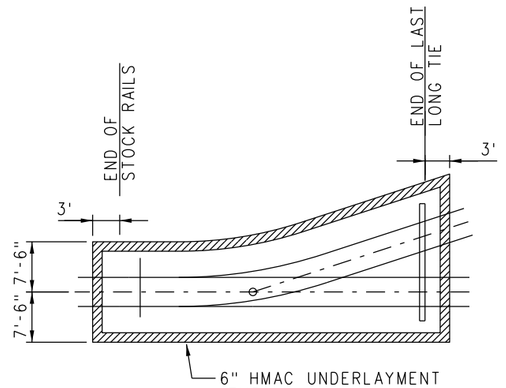
LEGEND

- HOT MIX ASPHALT CONCRETE
- BALLAST
- SUBBALLAST
- SUBGRADE

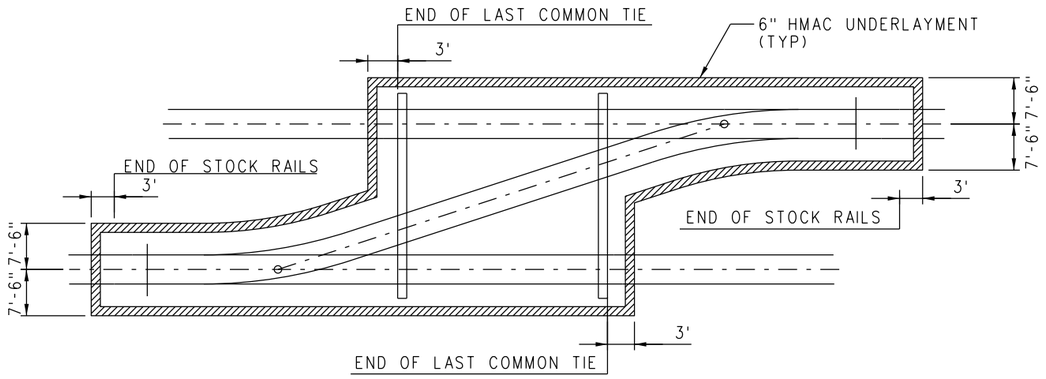


NOTE:
FOR ADDITIONAL INFORMATION SEE ES2001 & ES2002.

TYPICAL HMAC UNDERLAYMENT



TYPICAL HMAC UNDERLAYMENT AT TURNOUTS



TYPICAL HMAC UNDERLAYMENT AT CROSSOVERS

NOTES:

THE VOLUME NOTED IN THE TABLES ARE ASSUMED TO BE FINAL COMPACTED VOLUME.

VOLUMES SHOWN ARE FOR 15' TRACK CENTERS. IF TRACK CENTERS VARY FROM 15' THEN THE VALUES NEED TO BE ADJUSTED ACCORDINGLY.

HMAC VOLUME QUANTITIES

TURNOUT NO	AREA OF HMAC (SF)	VOLUME OF 6" HMAC (CY)
10	2400	45
14	3340	62
20	4640	86
24	6100	113

CROSSOVER NO	TRACK CENTER DISTANCE (FT)	AREA OF HMAC (SF)	VOLUME OF 6" HMAC (CY)
10	15	4490	84
14	15	6210	115
20	15	8760	163
24	15	11,780	218

REV.	DATE	DESCRIPTION	DES.	ENG.
B	06-12-20	REVISED TABLES AND DETAILS	AC	JMM
A	11-11-16	REVISED TABLES	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

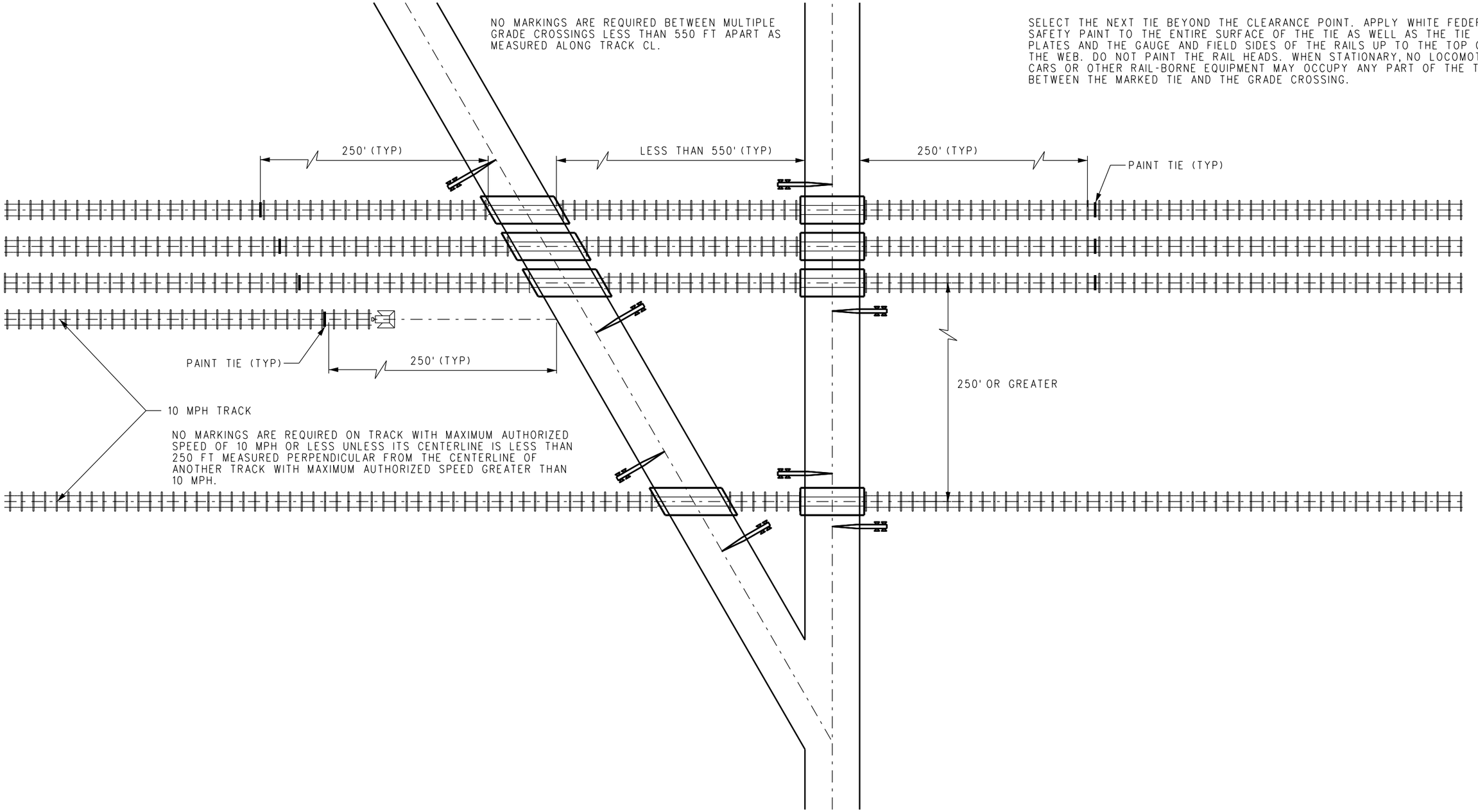
TURNOUT WALKWAYS AND HMAC UNDERLAYMENT

STANDARD 2105
SCALE: NTS
REVISION B SHEET 1 OF 1
CADD FILE: ES2105

UserName•> scrrapw11ics01$ Date Plotted: 3/27/2023 3:07:13 PM Plot Driver•> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_12\ES2105.dgn

NO MARKINGS ARE REQUIRED BETWEEN MULTIPLE GRADE CROSSINGS LESS THAN 550 FT APART AS MEASURED ALONG TRACK CL.

SELECT THE NEXT TIE BEYOND THE CLEARANCE POINT. APPLY WHITE FEDERAL SAFETY PAINT TO THE ENTIRE SURFACE OF THE TIE AS WELL AS THE TIE PLATES AND THE GAUGE AND FIELD SIDES OF THE RAILS UP TO THE TOP OF THE WEB. DO NOT PAINT THE RAIL HEADS. WHEN STATIONARY, NO LOCOMOTIVES, CARS OR OTHER RAIL-BORNE EQUIPMENT MAY OCCUPY ANY PART OF THE TRACK BETWEEN THE MARKED TIE AND THE GRADE CROSSING.



NO MARKINGS ARE REQUIRED ON TRACK WITH MAXIMUM AUTHORIZED SPEED OF 10 MPH OR LESS UNLESS ITS CENTERLINE IS LESS THAN 250 FT MEASURED PERPENDICULAR FROM THE CENTERLINE OF ANOTHER TRACK WITH MAXIMUM AUTHORIZED SPEED GREATER THAN 10 MPH.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TRACK CLEARANCE POINTS AT GRADE CROSSINGS

STANDARD: 2106
SCALE: NTS
REVISION: -
SHEET: 1 OF 1
CADD FILE: ES2106

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INSTRUCTIONS FOR MARKING NO RIDE ZONE FOR SIDE AND SECONDARY TRACKS (BASED ON 13'-6" CLEARANCE POINT)

CASE 1 DIVERGING TRACKS

WHERE A TRACK TURNS OUT AND CONTINUES TO DIVERGE FROM THE PARENT TRACK, THE 13'-6" CLEARANCE POINT SHALL BE WHERE THE DISTANCE BETWEEN THE FIELD SIDES OF THE TWO CLOSEST RAILHEADS IS 8'-4" MEASURED PERPENDICULAR TO THE CENTERLINE OF THE PARENT TRACK.

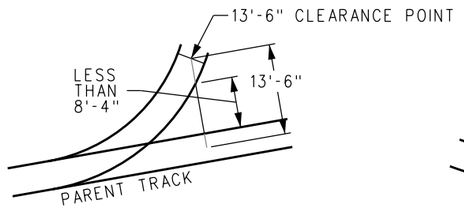


FIGURE 1A

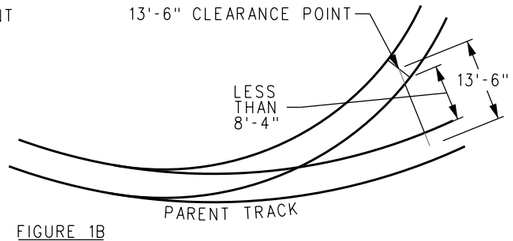


FIGURE 1B

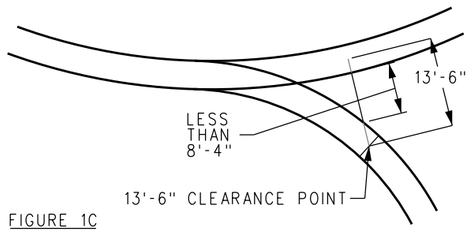


FIGURE 1C

CASE 2 PARALLEL TRACKS - TANGENT OR CURVED

WHERE A TRACK TURNS OUT AND BECOMES PARALLEL TO THE PARENT TRACK, THE 13'-6" CLEARANCE POINT SHALL BE WHERE THE DISTANCE BETWEEN THE FIELD SIDES OF THE TWO CLOSEST RAILHEADS IS 8'-4" MEASURED PERPENDICULAR TO THE CL OF THE PARENT TRACK. SEE FIGURES 2A AND 2C.

WHERE TRACKS ARE PARALLEL, BUT THE FIELD SIDES OF THE TWO CLOSEST RAILS ARE LESS THAN 8'-4" APART, THE CLEARANCE POINT SHALL BE WHERE THE TRACKS BECOME PARALLEL. SEE FIGURES 2B AND 2D.

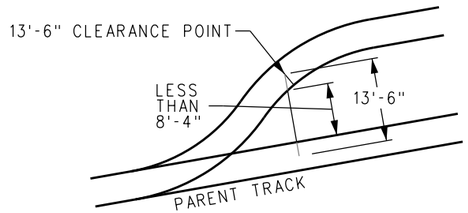


FIGURE 2A

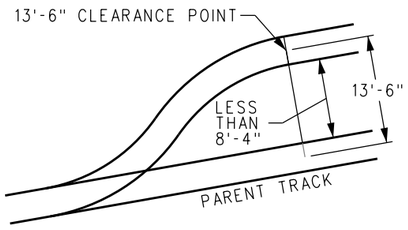


FIGURE 2B

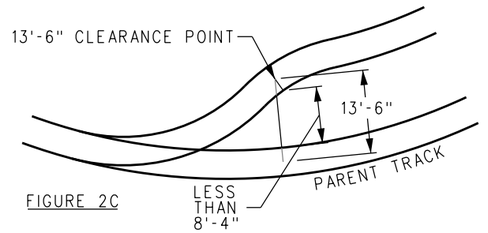


FIGURE 2C

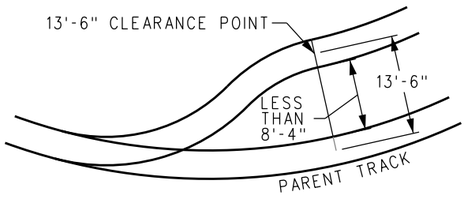
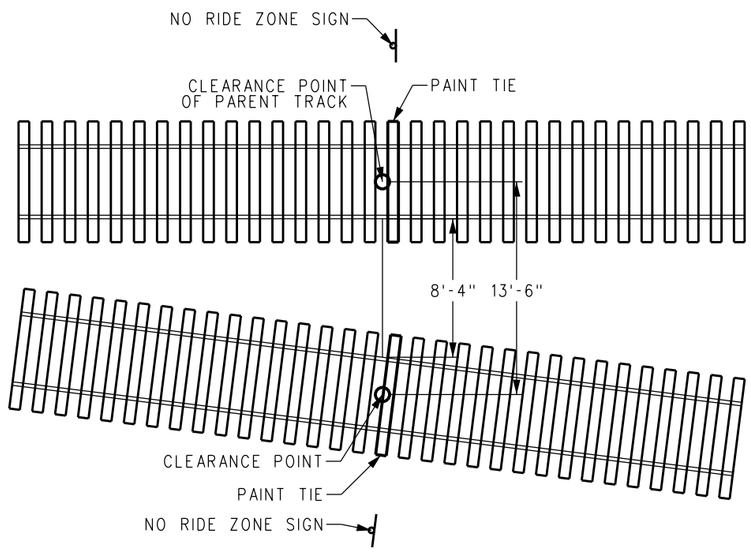


FIGURE 2D

SELECTING AND MARKING NO RIDE ZONE

SELECT THE NEXT TIES BEYOND THE NO RIDE POINT AS DETERMINED BY CASE 1 OR 2. APPLY WHITE PAINT TO THE ENTIRE TOP SURFACE OF THE TIES AS WELL AS THE TIE PLATES AND THE GAUGE AND FIELD SIDES OF THE RAILS UP TO THE TOP OF THE WEB. DO NOT PAINT THE RAIL HEADS.



REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	REVISED DRAWING TITLE	AC	JMM

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

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SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TRACK CLEARANCE POINTS AT TURNOUTS (NO RIDE ZONE)

STANDARD 2107
SCALE: NTS
REVISION A | SHEET 1 OF 1
CADD FILE: ES2107

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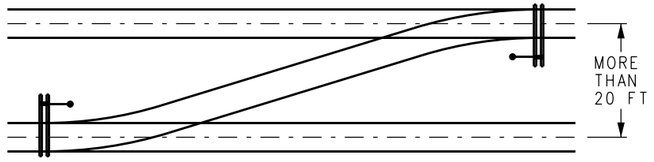
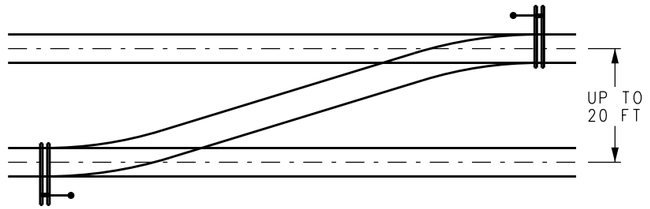


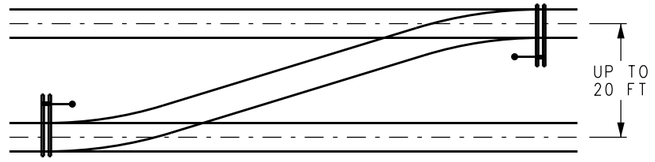
TRACKS MORE THAN 20 FT ON CENTER
(INSIDE PLACEMENT)

	SWITCH STANDS	ROD LENGTH	HEADBLOCK TIE LENGTH
MAIN LINE	112E, 36EH	7'-0"	17'-0"
YARD	22E, 36E	5'-0"	15'-0"



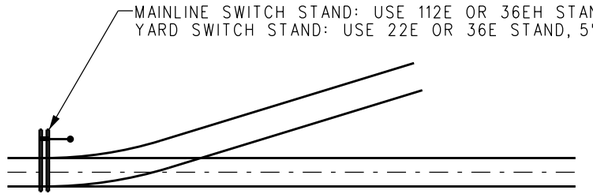
TRACKS 13 FT TO 20 FT ON CENTER
(OUTSIDE PLACEMENT)

	SWITCH STANDS	ROD LENGTH	HEADBLOCK TIE LENGTH
MAIN LINE	112E, 36EH	7'-0"	17'-0"
YARD	22E, 36E	5'-0"	15'-0"



TRACKS 13 FT TO 20 FT ON CENTER
(INSIDE PLACEMENT)

	SWITCH STANDS	ROD LENGTH	HEADBLOCK TIE LENGTH
MAIN LINE	36E WITH SWITCH HANDLE	3'-4"	14'-0"
YARD	22E, 36E WITH SWITCH HANDLE	3'-4"	14'-0"



TYPICAL ALIGNMENT WITH
NO CLEARANCE RESTRICTIONS

NOTES:

1. SWITCH STANDS SHALL BE:
   A. WHERE SPACE PERMITS, MOUNTED ON THE CLOSED POINT SIDE OF THE SWITCH WHEN LINED FOR THE MAIN TRACK.
   B. NO LESS THAN 8'-6" (HIGH STANDS) OR 6'-0" (LOW STANDS) FROM THE CENTER OF ANY TRACK TO ANY PART OF THE STAND OR TARGET IN ITS MOST RESTRICTIVE POSITION.
   C. POSITIONED WITH THE HANDLE POINTING TOWARD THE FROG WHEN THE SWITCH IS LINED FOR THE MAIN TRACK.
   D. FIRMLY ATTACHED TO THE HEADBLOCK TIES.
2. WHERE TRACKS ARE 20 FT OR LESS ON CENTER, OUTSIDE PLACEMENT OF SWITCH STANDS IS PREFERRED. INSIDE PLACEMENT SHALL BE USED ONLY WHERE FIELD CONDITIONS MAKE OUTSIDE PLACEMENT IMPRACTICAL.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

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ENGINEERING STANDARDS

SWITCH STAND PLACEMENT

STANDARD 2108
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2108

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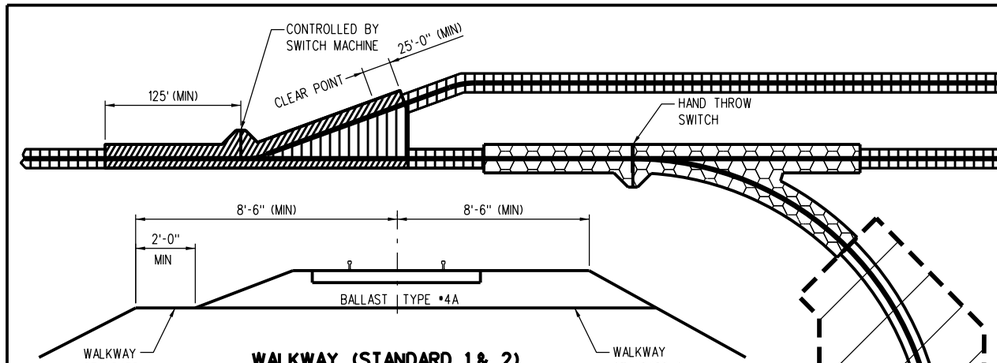
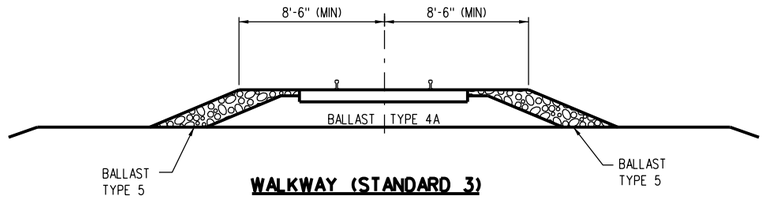
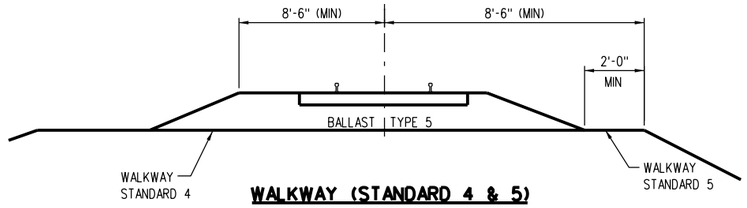


WALKWAY (STANDARD 1 & 2)



WALKWAY (STANDARD 3)



WALKWAY (STANDARD 4 & 5)

LEGEND

	STANDARD NO 1		STANDARD NO 3		STANDARD NO 5
	STANDARD NO 2		STANDARD NO 4		YARD, LAYOVER AREA, OR INDUSTRY TRACK

NOTE:

1. THE WALKWAY DIMENSIONS SHOWN ABOVE REFLECT PUC MINIMUM REQUIREMENTS, PLEASE SEE SCRRA STANDARDS ES2001 AND ES2002 FOR DIMENSION GUIDELINES FOR EMBANKMENT AND WALKWAYS REQUIRED FOR NEW CONSTRUCTION.

2. BALLAST TYPE •4A AND TYPE •5 GRADATIONS ARE DEPICTED ON SCRRA STANDARD ES2007-02. TYPE 4A BALLAST IS REQUIRED FOR MAIN LINE OPERATIONS, TYPE 5 IS YARD BALLAST AND MAXIMIZED FOR WALKWAY BENEFITS.

3. DIMENSIONS FOR TURNOUT WALKWAYS ARE DEPICTED AND DETAILED ON ES2105.

4. NO REQUESTS FOR DESIGN EXCEPTION INDICATING LESS THAN THE REQUIREMENTS OF CALIFORNIA PUBLIC UTILITIES COMMISSION GENERAL ORDERS 26D AND 118 WILL BE CONSIDERED.

5. WALKWAY STANDARD REQUIREMENTS FOR NEW CONSTRUCTION:
   - A. FOR MAIN TRACK, WALKWAY STANDARD 1 WILL BE REQUIRED ON ALL SCRRA MAIN TRACK, FOR MULTIPLE MAIN TRACKS WITH LESS THAN 20 FOOT CENTERS WALKWAYS ARE REQUIRED ON OUTSIDE SHOULDERS ONLY.
   - B. FOR MAIN TRACK TURNOUTS CONTROLLED WITH A SWITCH MACHINE WALKWAYS STANDARD 2 WILL BE REQUIRED.
   - C. FOR MAIN TRACK TURNOUTS WITH HAND THROW OR MANUAL CONTROL ONLY, WALKWAY STANDARD 3 WILL BE REQUIRED, THIS INCLUDES ALL MANUALLY CONTROLLED INDUSTRY TRACKS.
   - D. FOR MAIN TRACK CONTROLLED WITH A SWITCH MACHINE BUT ACCESSING A YARD OR LAYOVER TRACK WALKWAY STANDARD 3 WILL BE REQUIRED.
   - E. FOR YARD OR LAYOVER TRACK AREAS INCLUDING ALL INTERIOR TURNOUTS WALKWAY STANDARD 4 OR WALKWAY STANDARD 5 WILL BE REQUIRED.
   - F. TRACKS FREQUENTLY USED BY ENGINEERS AND CONDUCTOR TO GET ON AND OFF THE TRAINS FOR MAIN LINE USE WALKWAY STANDARD 3 ON OTHER THAN MAIN LINE TRACK WALKWAY STANDARD 4 OR 5 WILL BE REQUIRED.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

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ENGINEERING STANDARDS

CPUC MINIMUM WALKWAY STANDARDS

STANDARD: 2109
SCALE: NTS
REVISION: -
SHEET: 1 OF 1
CADD FILE: ES2109

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STANDARD VERTICAL CURVES (AREMA SECTION 3.6)

1. VERTICAL CURVES AS CALCULATED IN ITEM 6 BELOW SHALL BE USED TO CONNECT ALL CHANGES IN GRADIENTS.
2. THE LENGTH OF VERTICAL CURVES IS DETERMINED BY CHANGES IN GRADIENT, VERTICAL ACCELERATION AND THE SPEED OF THE TRAIN.
3. THE PURPOSE OF VERTICAL CURVES IS TO EASE THE CHANGE OF THE GRADIENTS IN ORDER TO REDUCE COUPLER AND DIAPHRAGM BINDING AND ELIMINATE THE DANGER OF BREAKING THE TRAIN IN TWO AS A DIRECT RESULT OF TRAIN ACTION. PROPERLY DESIGNED VERTICAL CURVES WILL PROVIDE FOR PASSENGER COMFORT. VERTICAL CURVES SHALL BE DESIGNED LONG ENOUGH TO MATCH THE HIGHEST SPEEDS CONTEMPLATED FOR THE LINES.
4. A VERTICAL CURVE WHICH IS CONCAVE UPWARD SHALL BE DENOTED AS A SAG. A VERTICAL CURVE WHICH IS CONCAVE DOWNWARD SHALL BE DENOTED AS A SUMMIT (SEE DIAGRAMS BELOW).
5. VERTICAL CURVES SHALL BE PARABOLIC.
6. THE MINIMUM LENGTH OF VERTICAL CURVES FOR BOTH SAGS AND SUMMITS IS DETERMINED BY THE FOLLOWING FORMULA:

$$LVC = \frac{D \times V^2 \times K}{A}$$

WHERE: A = VERTICAL ACCELERATION IN FEET/SEC/SEC (FT/SEC^2)
D = ABSOLUTE VALUE OF THE DIFFERENCE IN RATES OF GRADES EXPRESSED AS A DECIMAL
K = 2.15 CONVERSION FACTOR TO GIVE LVC IN FEET
V = DESIGN SPEED IN MILES PER HOUR

IT IS RECOMMENDED PRACTICE TO ROUND THE CALCULATED MINIMUM LVC UP TO A CONVENIENT WHOLE NUMBER. ON TRACKS WITH DESIGN SPEEDS GREATER THAN OR EQUAL TO 25 MPH, ANY CALCULATED MINIMUM LVC OF LESS THAN 100 FT SHALL BE ROUNDED UP TO AT LEAST 100 FT.

7. THE RECOMMENDED VERTICAL ACCELERATION (A) SHALL BE SELECTED BASED ON THE TYPE OF OPERATIONS AND IS THE SAME FOR BOTH SAGS AND SUMMITS. DEVIATIONS FROM THESE ACCELERATION CRITERIA MAY BE AUTHORIZED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN. THE LONGEST VERTICAL CURVE COMPUTED BY THESE METHODS WITH EACH CRITERIA WILL GOVERN.

FREIGHT OPERATIONS:
A=0.10 FEET/SEC/SEC

PASSENGER OPERATIONS:
A=0.60 FEET/SEC/SEC

MIXED PASSENGER WITH FREIGHT TRAFFIC NOT EXCEEDING 4000 TON TRAINS OR 8 MILLION GROSS TONS ANNUAL FREIGHT TRAFFIC
A=0.30 FEET/SEC/SEC FREIGHT SPEED
A=0.60 FEET/SEC/SEC PASSENGER SPEED

WHEN DESIGNING VERTICAL CURVES ON MIXED USE FREIGHT AND PASSENGER OPERATIONS, THE DESIGNER SHALL CALCULATE MINIMUM LVC'S USING THE APPLICABLE VALUES OF "A" AND "V" AND SELECT THE LONGEST VALUE YIELDED.

8. THE MINIMUM DISTANCE BETWEEN VERTICAL CURVES SHALL BE 3V OR 100 FT, WHICHEVER IS GREATER. (V=DESIGN SPEED IN MPH.)
9. TURNOUTS SHALL NOT BE PLACED WITHIN THE LIMITS OF ANY VERTICAL CURVE.
10. THE DESIRABLE LENGTH OF VERTICAL CURVES IN YARD TRACKS SHALL BE NOT LESS THAN 100 FT. THE MINIMUM LENGTH OF VERTICAL CURVES IN YARD TRACKS SHALL BE 30 FT.
11. THE GOAL OF DESIGN OF THE VERTICAL ALIGNMENT IS TO REDUCE THE NUMBER OF VERTICAL CURVES, CONSISTENT WITH ENGINEERING ECONOMY AND SITE CONSTRAINTS.
12. VERTICAL CURVES SHALL BE DESIGNED USING THE FUTURE MAXIMUM DESIGN SPEED FOR PASSENGER AND FREIGHT TRAINS EXPECTED ON A GIVEN SUBDIVISION. FUTURE MAXIMUM SPEEDS FOR PASSENGER TRAINS MAY EXCEED SPEEDS CURRENTLY IN EFFECT. DESIGNERS SHALL CONSULT WITH THE SCRRA ASSISTANT DIRECTOR, DESIGN FOR THE FUTURE MAXIMUM PASSENGER SPEED AT EACH LOCATION.
13. SPEED RESTRICTIONS DUE TO SIGNAL/STOPPING DISTANCE WILL NOT BE CONSIDERED.
14. PLANS FOR NEW CONSTRUCTION, REHABILITATION, AND TEMPORARY TRACK SHALL CLEARLY SHOW THE PERCENT GRADE CHANGE, DESIGN SPEED, BEGINNING AND ENDS, AND LENGTH OF EACH VERTICAL CURVE, AND MUST SHOW CONSTRAINTS TO VERTICAL PROFILE SUCH AS EXISTING OR FUTURE BRIDGES, TURNOUTS OR STATION PLATFORMS.
15. VERTICAL CURVES WITHIN 100 FEET OF A STATION PLATFORM SHALL BE AVOIDED.
16. VERTICAL CURVES SHALL BE PLACED OUTSIDE THE LIMITS OF A HORIZONTAL CURVE WHERE PRACTICABLE.

EXAMPLE CALCULATION FOR FREIGHT OPERATIONS

CREST CURVE WITH +0.50% APPROACHING GRADE MEETING A -0.50% DEPARTING GRADE. MAXIMUM DESIGN SPEED IS 50 MPH.

A=0.10 FEET/SEC/SEC VERTICAL ACCELERATION (FREIGHT)
D=ABSOLUTE VALUE OF ((+0.005)-(-0.005))=0.01
K=2.15 CONVERSION FACTOR TO GIVE LVC IN FEET
V=50 MPH DESIGN SPEED

$LVC = \frac{D \times V^2 \times K}{A}$ = MINIMUM LENGTH OF VERTICAL CURVE IN FEET

$LVC = \frac{(0.01) \times (50MPH)^2 \times 2.15}{0.10\ FEET/SEC/SEC}$ = 537.50 FEET SAY 540 FEET

EXAMPLE CALCULATION FOR PASSENGER OPERATIONS

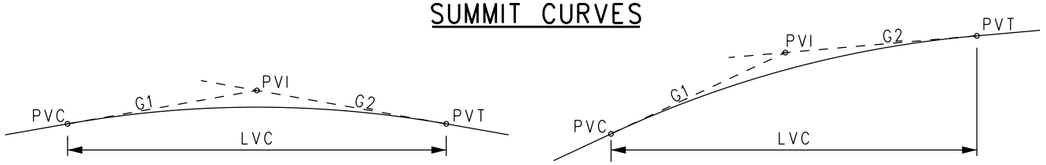
CREST CURVE WITH +0.50% APPROACHING GRADE MEETING A -0.50% DEPARTING GRADE. MAXIMUM DESIGN SPEED IS 75 MPH.

A=0.60 FEET/SEC/SEC VERTICAL ACCELERATION (PASSENGER)
D=ABSOLUTE VALUE OF ((+0.005)-(-0.005))=0.01
K=2.15 CONVERSION FACTOR TO GIVE LVC IN FEET
V=75 MPH DESIGN SPEED

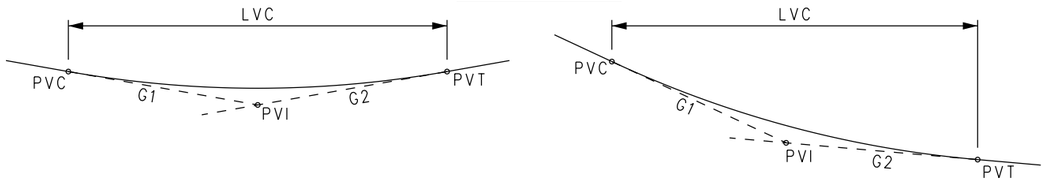
$LVC = \frac{D \times V^2 \times K}{A}$ = MINIMUM LENGTH OF VERTICAL CURVE IN FEET

$LVC = \frac{(0.01) \times (75MPH)^2 \times 2.15}{0.60\ FEET/SEC/SEC}$ = 201.56 FEET SAY 205 FEET

SUMMIT CURVES



SAG CURVES



ABBREVIATIONS

G1	APPROACHING GRADE
G2	DEPARTING GRADE
LVC	LENGTH OF VERTICAL CURVE
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
VC	VERTICAL CURVE

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	ADDED NOTE 16, REVISE NOTE 7 & 12	AC	JMM

DRAWN BY: HDR DATE: 05/28/2010

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ENGINEERING STANDARDS

VERTICAL CURVE GEOMETRY

STANDARD: 2201
SCALE: NTS
REVISION: A
SHEET: 1 OF 1
CADD FILE: ES2201

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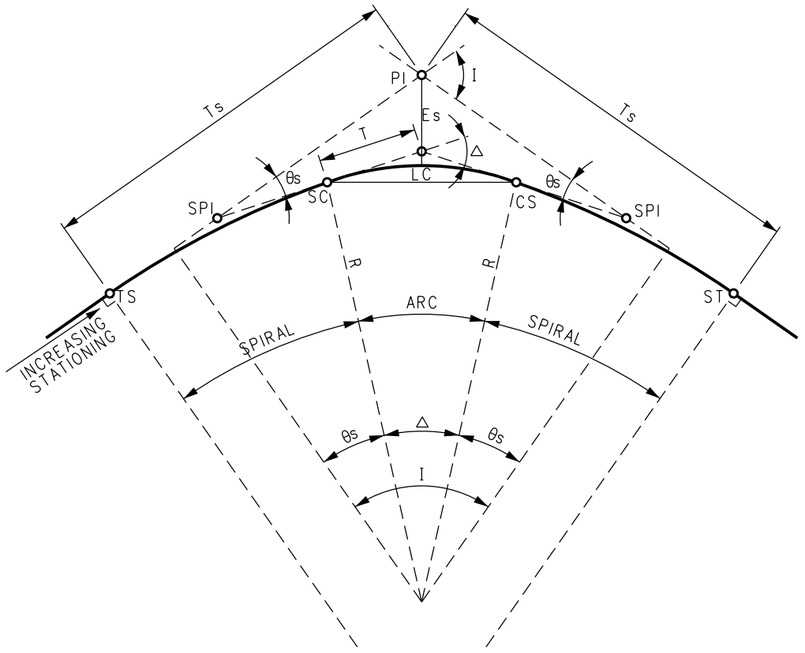

FIGURE A
CIRCULAR CURVE
WITH SPIRAL TRANSITIONS

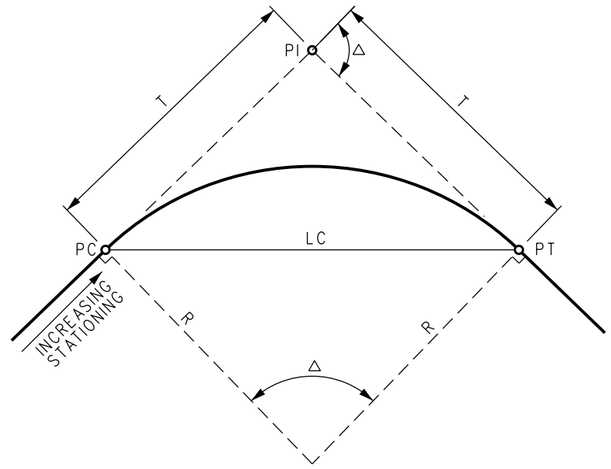

FIGURE B
SIMPLE CIRCULAR CURVE

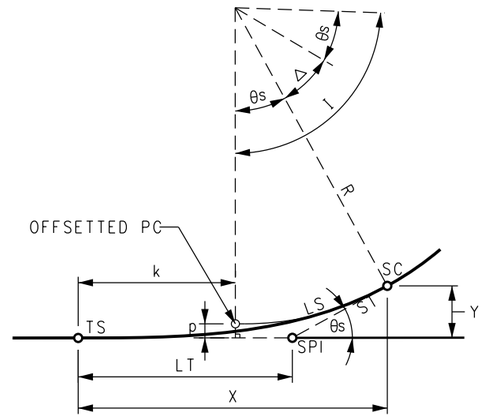

FIGURE C
SPIRAL TRANSITION CURVE

NOTES:

1. CIRCULAR CURVES ARE DEFINED BY THE CHORD DEFINITION (CENTRAL ANGLE SUBTENDED BY A CHORD OF 100 FEET) OF CURVATURE AND SPECIFIED BY DEGREE.
2. SPIRALS ARE DEFINED BY THE CLOTHOID DEFINITION. AUTHORIZATION FROM SCRRA SHALL BE OBTAINED IF ANY DIFFERENT METHOD OR PARAMETERS ARE UTILIZED FOR SPIRAL TRANSITION CURVES. THE REQUEST SHALL BE FULLY DOCUMENTED WITH DESIGN DATA, CALCULATIONS AND OTHER PERTINENT INFORMATION.
3. THE TRACK GEOMETRY DATA TABLE, SHOWN IN ES2202-2, SHALL BE COMPLETED AND SUBMITTED TO SCRRA FOR REVIEW, COMMENT AND APPROVAL FOR ALL CURVES.
4. ALL ANGLES ARE IN DEGREES, DISTANCES AND LENGTHS ARE IN FEET, EXCEPT SUPERELEVATIONS ARE IN INCHES AND SPEEDS ARE IN MILES PER HOUR (MPH).

ABBREVIATIONS AND SYMBOLS

CC	COMPOUND CURVE
CS	CURVE TO SPIRAL
Δ	CENTRAL ANGLE OF CIRCULAR CURVE
Dc	DEGREE OF CURVATURE (CHORD DEFINITION)
E	EQUILIBRIUM ELEVATION (Ea + Eu)
Ea	ACTUAL ELEVATION
Es	EXTERNAL DISTANCE FROM PI TO CIRCULAR CURVE
Eu	UNBALANCED ELEVATION (CANT DEFICIENCY)
I	TOTAL INTERSECTION ANGLE (DEFLECTION ANGLE AT THE PI)
K	INCREASE IN DEGREES OF CURVATURE PER 100 FT STATIONS ALONG SPIRAL
k	TANGENT DISTANCE FROM THE TS TO THE OFFSETTED PC
l	LENGTH FROM THE TS OR ST TO ANY POINT ON THE SPIRAL HAVING COORDINATES X AND Y
L	CHORDED LENGTH OF CIRCULAR CURVE
LC	LONG CHORD
LS	LENGTH OF SPIRAL
LT	LONG TANGENT (DISTANCE FROM THE TS TO THE SPI)
p	ORDINATE OF THE OFFSETTED PC
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PI	POINT OF INTERSECTION
PRC	POINT OF REVERSE CURVATURE
PT	POINT OF TANGENCY
R	RADIUS
s	LENGTH l IN 100 FT STATIONS
S	LENGTH OF SPIRAL (LS) IN 100 FT STATIONS
SC	SPIRAL TO CURVE
SPI	POINT OF INTERSECTION BETWEEN TS AND SC
SS	SPIRAL TO SPIRAL
ST	SPIRAL TO TANGENT
ST	SHORT TANGENT (DISTANCE FROM SPI TO SC)
θs	TANGENT LENGTH OF CIRCULAR CURVE
TS	TANGENT TO SPIRAL
Ts	TOTAL TANGENT DISTANCE OF A SPIRALED CURVE
	SPIRAL ANGLE
X	TANGENT DISTANCE FROM TS TO SC
Y	TANGENT OFFSET TO THE SC

KEY FORMULAE

$R = \frac{50'}{\sin\left(\frac{Dc}{2}\right)}$

$\Delta = I - 2\theta s$

$L = \frac{\Delta}{Dc} \times 100$

$T = R \tan\left(\frac{\Delta}{2}\right)$

$LC = 2R \sin\left(\frac{\Delta}{2}\right)$

$LS = \frac{200\theta s}{Dc}$

$S = \frac{LS}{100}$

$\theta s = \frac{LS\ Dc}{200}$

$K = \frac{100\ Dc}{LS}$

$LT = X - \frac{Y}{\tan\theta s}$

$ST = \frac{Y}{\sin\theta s}$

$Ts = (R+p)\tan\left(\frac{I}{2}\right)+k$

$Es = (R+p)\mathrm{EX}\sec\left(\frac{I}{2}\right)+p$

$X = l - 0.00304806\theta s^{2}s$

$Y = 0.5820\theta s\,s - 0.00001264\,\theta s^{3}s$

$k = \frac{LS}{2} - 0.000508\Delta^{2}S$

$p = 0.1454\,\theta s\,S$

REV.	DATE	DESCRIPTION	DES.	ENG.
A	02/26/16	REVISED ABBREVIATIONS & SYMBOLS & KEY FORMULAE	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

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ENGINEERING STANDARDS

HORIZONTAL CURVE GEOMETRY

STANDARD 2202
SCALE: NTS
REVISION A SHEET 1 OF 2
CADD FILE: ES2202-01

UserName•> scrrapw11ics01$ Date Plotted: 3/27/2023 3:06:51 PM Plot Driver•> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_18\ES2202-01.dgn

TRACK GEOMETRY DATA TABLE

	CURVE OR TURNOUT NO	DESC	BEARING	DISTANCE	STATION	NORTHING	EASTING	Dc	Ea	Eu	V (PAS)	V (FRT)	LS	I	R	Δ	L	T	θs	X	Y	k	p	LT	ST	Ts
			STATIONING DATA					INPUT DATA							CURVE DATA				SPIRAL DATA							
								DEGREES	INCHES	INCHES	MPH	MPH	FEET	DEGREES	FEET	DEGREES	FEET	FEET	FEET	FEET	FEET	FEET	FEET	FEET	FEET	FEET
		POB			X	X	X																			
		TS	X	X	X	X	X																			
		SC			X	X	X						X						X	X	X	X	X	X	X	X
CIRCULAR CURVE WITH SPIRAL TRANSITIONS	M1	PI			X	X	X	X	X	X	X	X		X	X	X	X	X								
		CS			X	X	X																			
		ST			X	X	X						X						X	X	X	X	X	X	X	X
		PITO	X	X	X	X	X																			
TURNOUT	C33	PS	X	X	X	X	X																			
		TS	X	X	X	X	X																			
		SC			X	X	X						X						X	X	X	X	X	X	X	X
		PI			X	X	X	X	X	X	X	X		X	X	X	X	X								
COMPOUND CIRCULAR CURVE WITH SPIRAL TRANSITIONS	M2	CS			X	X	X																			
		SC			X	X	X						X						X	X	X	X	X	X	X	X
		PI			X	X	X	X	X	X	X	X		X	X	X	X	X								
		CS			X	X	X																			
		ST			X	X	X						X						X	X	X	X	X	X	X	X
		PC	X	X	X	X	X																			
SIMPLE CIRCULAR CURVE	M3	PI			X	X	X	X	X	X	X	X		X	X	X	X	X								
		PT			X	X	X																			
		PC	X	X	X	X	X																			
		PI			X	X	X	X	X	X	X	X		X	X	X	X	X								
COMPOUND CIRCULAR CURVE	M4	PCC			X	X	X																			
		PI			X	X	X	X	X	X	X	X		X	X	X	X	X								
		PT			X	X	X																			
		POE	X	X	X	X	X																			

NOTES:

1. TRACK GEOMETRY DATA TABLES SHALL BE COMPLETED AND INCLUDED WITH DESIGN DRAWINGS SUBMITTED TO SCRRA FOR REVIEW, COMMENT, AND APPROVAL. EACH PROPOSED OR REALIGNED TRACK SHALL REQUIRE A SEPARATE TABLE.
2. CELLS MARKED WITH AN "X" WILL NORMALLY CONTAIN DATA.
3. IN PRACTICE, COMPOUND CURVES WITH MORE THAN TWO CIRCULAR ARCS ARE RARE. IN THEORY, A COMPOUND CURVE CAN HAVE AN INFINITE NUMBER OF CIRCULAR ARCS.
4. FOR FREIGHT-ONLY OPERATIONS, COLUMN "V (PAS)" WILL REMAIN BLANK. FOR PASSENGER-ONLY OPERATIONS, COLUMN "V (FRT)" WILL REMAIN BLANK.
5. IN THE EVENT A DESIGNER MUST PROPOSE A CURVE THAT DOES NOT MEET DESIGN REQUIREMENTS PER SCRRA ES2203 AND ES2204, THE DESIGNER SHALL CLEARLY INDICATE IT ON THE GEOMETRY TABLE. THE DESIGNER SHALL, FOR EACH PROPOSED SUBSTANDARD CURVE, SUBMIT TO SCRRA A WRITTEN REQUEST AND JUSTIFICATION FOR A DESIGN WAIVER.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR | DATE: 5/28/2010

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ENGINEERING STANDARDS

TRACK GEOMETRY DATA TABLE

STANDARD 2202
SCALE: NTS
REVISION - | SHEET 2 OF 2
CADD FILE: ES2202-02

UserName=> scrrapw11ics01$ Date Plotted: 3/27/2023 3:06:58 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_19\ES2202-02.dgn

GENERAL

1. THERE ARE SIX TABLES OF DESIGN AND MAINTENANCE STANDARDS FOR SCRRA TRACK ALIGNMENT:
   - TABLE P3.5: 3.5 - INCH UNBALANCED ELEVATION - STANDARD SPIRAL LENGTH TABLE FOR PASSENGER OPERATIONS
   - TABLE F2.0: 2.0 - INCH UNBALANCED ELEVATION - STANDARD SPIRAL LENGTH TABLE FOR FREIGHT OPERATIONS
   - TABLE P3.5M: 3.5 - INCH UNBALANCED ELEVATION - MINIMUM SPIRAL LENGTH TABLE FOR PASSENGER OPERATIONS
   - TABLE F2.0M: 2.0 - INCH UNBALANCED ELEVATION - MINIMUM SPIRAL LENGTH TABLE FOR FREIGHT OPERATIONS
   - TABLE PML: 4.0 - INCH UNBALANCED ELEVATION - MAINTENANCE LIMIT FOR PASSENGER OPERATIONS
   - TABLE FML: 3.0 - INCH UNBALANCED ELEVATION - MAINTENANCE LIMIT FOR FREIGHT OPERATIONS

2. FOR THE OPERATION OF PASSENGER EQUIPMENT NORMALLY USED IN SCRRA AND AMTRAK TRAINS;

   THE DESIGN AND MAINTENANCE OF CURVE GEOMETRY IS CONTROLLED BY FRA TRACK SAFETY STANDARDS (49CFR213.57), WHICH ESTABLISHES THE MAXIMUM SPEED FOR ANY COMBINATION OF CURVATURE AND SUPERELEVATION FOR PASSENGER TRAINS AS RESULTING IN 4 INCHES OF UNDERBALANCE. TO ASSURE THAT NORMAL MAINTENANCE VARIATIONS DO NOT INADVERTENTLY RESULT IN CURVE GEOMETRY THAT CAUSES MORE THAN 4 INCHES OF UNBALANCED ELEVATION, THE DESIGN UNDERBALANCE IS SET AT 3.5 INCHES FOR TABLES P3.5 AND P3.5M. THE FRA TABLES AND FORMULAS DEFINE 4 INCHES OF UNBALANCED ELEVATION AS THE THRESHOLD OF FAILURE; THESE SCRRA TABLES DESIGNATE DESIGN PRACTICE THAT FITS WITHIN THE FRA LIMITS. DESIGNERS AND MAINTENANCE PERSONNEL WILL CONSTRUCT AND MAINTAIN TRACK TO THOSE VALUES EXCEPT AS AUTHORIZED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN, OR AS EXCEPTED BELOW.

   FREIGHT TRAIN SPEEDS ARE GOVERNED BY 49CFR213.57 TO NOT RESULT IN MORE THAN 3 INCHES OF UNDERBALANCE. FREIGHT TRAIN SPEEDS FOR NEW CURVES WILL BE DESIGNED PER TABLES F2.0 AND F2.0M, WHICH HAVE 2 INCHES UNDERBALANCE; EXISTING CURVES MAY BE MAINTAINED WITH UP TO 3 INCHES OF UNDERBALANCE AND REMEDIAL ACTION MUST BE TAKEN FOR ANY CURVE FOUND TO EXCEED 3 INCHES OF UNDERBALANCE FOR FREIGHT TRAIN SPEED.

   THE SPIRAL IS A HORIZONTAL ALIGNMENT ELEMENT OF GRADUALLY DECREASING RADIUS, WHICH MATCHES THE RADIUS OF THE CIRCULAR CURVE ELEMENT AT THE POINT IT MEETS THE CURVE. CURVE TRANSITION SPIRALS WILL BE USED TO CONNECT CURVES TO TANGENT TRACK WHENEVER THERE IS SUPERELEVATION IN THE CURVE. THE SUPERELEVATION IS TO BE UNIFORMLY INCREASED FROM THE TANGENT TO THE CURVE THROUGHOUT THE LENGTH OF THE SPIRAL.

   THE LENGTH OF THE SPIRALS IN THE TABLES HAS BEEN CALCULATED BASED UPON THE SPEED OF THE TRAIN AND ON THE MAXIMUM TWIST THAT ROLLING STOCK CAN SAFELY NEGOTIATE. LONG CARS THAT TRAVERSE SPIRALS THAT HAVE MORE THAN 1 INCH OF ELEVATION CHANGE IN 62 FEET BEGIN TO UNLOAD SOME OF THE VERTICAL LOAD ON WHEELS IF THEIR SIDE BEARING CLEARANCE IS AT MINIMUMS. THEREFORE STANDARD LENGTH SPIRALS DO NOT EXCEED THIS RATE OF CHANGE. A MAXIMUM CHANGE OF 1 INCH PER 50 FEET IS PERMITTED UNDER THE "MINIMUM" TABLES, BECAUSE SPIRALS WITH THESE PARAMETERS ARE FOUND ON SOME LINES AND CANNOT BE CHANGED DUE TO GEOGRAPHIC LIMITATIONS. THE MINIMUM SPIRAL LENGTHS FOUND IN TABLES P3.5M AND F2.0M MAY ONLY BE USED ON THE VENTURA AND ANTELOPE VALLEY SUBDIVISION. AT SPEEDS IN EXCESS OF 50 MPH, THE LENGTH OF SPIRALS IS INCREASED TO MINIMIZE TRANSIENT DYNAMIC LOADS AND PASSENGER DISCOMFORT.

   SPIRALS MAY BE LONGER THAN THE STANDARD LENGTHS SHOWN. LONGER SPIRALS THAT EXIST FROM ORIGINAL CONSTRUCTION WILL NOT BE SHORTENED UNLESS NECESSARY TO OBTAIN REVERSING TANGENT LENGTH. SPIRALS FOR CURVES, WHICH MAY BE DESIGNED FOR HIGHER SPEED IN THE FUTURE (E.G. NEAR PRESENT SPEED RESTRICTIONS SUCH AS TUNNELS) SHOULD BE DESIGNED WITH SPIRAL LENGTHS FOR FUTURE HIGHER SPEED AND SUPERELEVATION; AND PRESENTLY NEEDED SUPERELEVATION RUNOFF OVER THE LENGTH OF THE SPIRAL.

   NEW CONSTRUCTION WILL BE DESIGNED WITH STANDARD LENGTH SPIRALS PER THE EXAMPLE SHOWN ON THIS SHEET FOR THE MAXIMUM FUTURE DESIGN SPEED FOR THE LOCATION.

CURVE DESIGN PROCEDURE

1. REFER TO AREMA CHAPTER 5.3 FOR A COMPLETE DISCUSSION OF CURVE DESIGN.

2. IN ORDER TO SELECT THE SUPERELEVATION AND SPIRAL LENGTHS FOR CURVES, THE DESIGN SPEEDS FOR FREIGHT AND PASSENGER TRAINS MUST BE DEVELOPED. A SERIES OF TRIAL SOLUTIONS IS USUALLY NECESSARY. EVERY CURVE MUST MEET THE STANDARDS OF SPIRAL LENGTH AND SUPERELEVATION FOR THE SPEED CHOSEN. THE GOAL IS TO OBTAIN THE MAXIMUM SPEED FOR PASSENGER TRAINS CONSISTENT WITH GOOD TRAIN HANDLING, SIGNAL SPACING AND PRACTICAL LIMITS OF EQUIPMENT PERFORMANCE AND TO HAVE THE RESULTING DESIGN PROVIDE AN ACCEPTABLE FREIGHT TRAIN OPERATION AND MAINTENANCE ENVIRONMENT.

3. HORIZONTAL CURVES SHALL BE DESIGNED USING THE FUTURE MAXIMUM DESIGN SPEED FOR PASSENGER AND FREIGHT TRAINS EXPECTED ON A GIVEN SUBDIVISION. FUTURE MAXIMUM SPEEDS FOR PASSENGER TRAINS MAY EXCEED SPEEDS CURRENTLY IN EFFECT. THIS MAY RESULT IN SPIRAL LENGTHS THAT ARE LONGER THAN REQUIRED TO PROVIDE FOR PROPOSED SUPERELEVATION RUNOFF FOR NEW CONSTRUCTION. DESIGNERS WILL CONSULT WITH THE SCRRA ASSISTANT DIRECTOR, DESIGN FOR THE FUTURE PASSENGER SPEED AT EACH LOCATION. THE SPIRAL LENGTH DESIGN SHALL BE SUFFICIENT TO ALLOW SUPERELEVATION RUNOFF FOR THE FUTURE MAXIMUM DESIGN SPEED EVEN IF THE ACTUAL DESIGN OPERATING SPEED IS LESS THAN THE FUTURE MAXIMUM DESIGN SPEED.

4. THE MAXIMUM SPEED FOR FREIGHT TRAINS IS 60 MILES PER HOUR.

5. ALL NEW WORK SHOULD USE TABLES P3.5 AND F2.0 TO SPECIFY STANDARD LENGTH SPIRALS. TABLES WITH SUFFIX "M" ARE TO BE USED ONLY ON THE VENTURA AND ANTELOPE VALLEY SUBDIVISIONS AND ONLY AT LOCATIONS CONSTRAINED BY EXISTING TRACK GEOMETRY. CURVES WHICH DO NOT MEET THE STANDARDS OF TABLES P3.5, F2.0, P3.5M AND F2.0M MUST BE CORRECTED THROUGH REDUCTION OF TRAIN SPEED AND ALTERATION TO THE TRACK CHARACTERISTICS.

6. TANGENTS BETWEEN CURVES SHALL BE EQUAL TO 3 TIMES THE MAXIMUM DESIGN SPEED, IN MILES PER HOUR, OR 100 FEET, WHICHEVER IS GREATER. FOR EXAMPLE, A DESIGN SPEED OF 50 MPH WILL REQUIRE A TANGENT WITH A MINIMUM LENGTH OF 150' (3 TIMES 50). EXCEPTIONS WILL REQUIRE THE APPROVAL OF THE SCRRA ASSISTANT DIRECTOR, DESIGN.

7. ALL DESIGN SPEEDS MUST BE APPROVED BY BOTH THE SCRRA ASSISTANT DIRECTOR, DESIGN AND THE SCRRA MANAGER OF SIGNAL AND COMMUNICATIONS.

8. SPEEDS SHOULD BE ESTABLISHED IN CONSIDERATION OF PLACEMENT OF SPEED SIGNS PER SCRRA ES5213, SUCH THAT THERE IS NO OVERLAP BETWEEN SIGNS FOR REDUCTION AND INCREASE OF SPEED IN THE SAME DIRECTION.

9. SPEED AND SUPERELEVATION WILL BE CONSISTENT THROUGH CURVES UNLESS AUTHORIZED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN. ALL COMPOUND CURVES WILL BE SEPARATED WITH A SPIRAL OF AT LEAST 31 FEET. IN COMPOUND CURVES WHERE SUPERELEVATION DIFFERS IN EACH CURVE, A SPIRAL OF APPROPRIATE LENGTH WILL BE REQUIRED AT THE POINT OF COMPOUND CURVATURE. THE SPIRAL LENGTH WILL BE DESIGNED TO ACCOMMODATE THE DIFFERENCE OF THE COMPOUND CURVE'S SUPERELEVATIONS. A COMPOUND SPIRAL IS NOT REQUIRED WHERE THE SPIRAL OFFSET IS LESS THAN 0.25".

10. ACTUAL ELEVATION GREATER THAN 5 INCHES IS NOT PERMITTED WITHOUT PRIOR APPROVAL OF THE SCRRA ASSISTANT DIRECTOR, DESIGN.

11. SUPERELEVATION THROUGH GRADE CROSSINGS WILL BE DESIGNED WITH CONSIDERATION OF THE STREET PROFILE, WHICH MAY CONSTRAIN THE SUPERELEVATION AND THEREFORE THE CURVE SPEED. THE STREET PROFILE SHOULD BE CONSIDERED TO BE CHANGED IF PRACTICAL TO ACCOMODATE SUPERELEVATION FOR THE PROPOSED MAXIMUM SPEED.

12. SPEEDS FOR FREIGHT TRAINS SHOULD BE AS UNIFORM AS PRACTICABLE. FREIGHT TRAINS GENERALLY CANNOT UTILIZE HIGHER SPEEDS THAT ARE LESS THAN 2 MILES IN LENGTH. DUE TO BRAKING DISTANCES AND SIGNAL SPACING, FREIGHT TRAIN SPEEDS MAY BE SET WHICH ARE SUBSTANTIALLY LESS THAN PASSENGER TRAIN SPEEDS. OPERATION OF FREIGHT TRAINS AT SPEEDS LESS THAN EQUILIBRIUM (NO UNDERBALANCE) RESULTS IN HEAVY WEAR ON THE LOW RAIL AND LOW VERTICAL LOADS TO THE HIGH WHEELS.

CURVE DESIGN PROCEDURE (CONT)

13. DESIGNERS SHOULD AVOID SUPERELEVATIONS IN EXCESS OF 4 INCHES WHERE GRADES OR OTHER RESTRICTIONS CAUSE TRAINS TO RUN A SPEED LESS THAN 25 MILES PER HOUR.

14. FREIGHT TRAIN MAXIMUM AUTHORIZED SPEED SHALL BE BASED ON A STANDARD UNBALANCED ELEVATION BETWEEN 1 AND 2 INCHES. SCRRA ASSISTANT DIRECTOR, DESIGN MUST APPROVE ANY COMBINATION OF FREIGHT SPEED AND CURVE SUPERELEVATION OUTSIDE THESE LIMITS.

15. THE PRIORITIES FOR DESIGNERS ARE:
   - SET MAXIMUM DESIGN SPEED AND DEGREE OF CURVATURE FOR PASSENGER AND FREIGHT TRAINS ON A GIVEN SUBDIVISION AFTER CONSULTATION WITH SCRRA.
   - ASSURE ADEQUATE REVERSING TANGENTS AND SPIRAL LENGTHS.
   - ASSURE ACTUAL ELEVATIONS AND STANDARD SPIRAL LENGTHS FOR HIGHEST PASSENGER AND FREIGHT TRAIN SPEEDS.
   - ASSURE UNIFORM FREIGHT TRAIN SPEED THAT CAN BE SUSTAINED FOR AT LEAST TWO (2) MILES.
   - ASSURE MAXIMUM FREIGHT TRAIN SPEED IS 60 MPH.
   - SET ACTUAL ELEVATION AND SPIRAL LENGTHS FOR FASTEST PRACTICABLE PASSENGER TRAIN OPERATION CONSISTENT WITH SCRRA AND FRA STANDARDS.

16. THESE DESIGN STANDARDS DO NOT REPLACE FRA TRACK SAFETY STANDARDS PART 49CFR213.57. IN ADDITION TO COMPLYING WITH THE OVERALL PARAMETERS OF SUPERELEVATION AND SPIRAL LENGTH, CURVES MUST ALSO COMPLY WITH ALL PARTS OF 213.5 THRU 213.63. IN PRACTICE, DESIGNERS SET THE OVERALL PARAMETERS AND MAINTENANCE PERSONNEL PREVENT ANY IRREGULARITIES WHICH COULD BECOME EXCEPTIONS TO THE FRA STANDARDS.
17. THE HORIZONTAL ALIGNMENT OF SPIRAL CURVES MAY BE DESIGNED BY:
   - TEN CHORD SPIRAL
   - AREMA CHAPTER 5.3.1.2
   - CLOTHOID SPIRAL GENERATED UNDER CADD DESIGN, WHICH MEETS AREMA CRITERIA
18. WHEN THE CURVE CHARACTERISTICS ARE CHANGED AND APPROVED, THE NEW DATA SHOULD BE ENTERED ONTO THE TRACK CHARTS AND THE FIELD MARKING WILL BE UPDATED.
19. RUNOFF OF SUPERELEVATION ON TANGENT TRACK IS NOT PERMITTED.

SAMPLE CURVE DESIGN PROBLEM

A CURRENT RAIL LINE OPERATES PASSENGER SERVICE AT 70 MPH AND FREIGHT AT 50 MPH. A 2°-0'-0" HORIZONTAL CURVE HAS BEEN PROPOSED. WHAT SUPERELEVATION AND SPIRAL LENGTHS DO YOU USE? WILL PASSENGER AND FREIGHT BE ABLE TO MAINTAIN THEIR CURRENT SPEEDS?

1. LOOK UP THE Ea AND Ls FOR A 2°-0'-0" CURVE AT 70 MPH IN THE STANDARD SPIRAL LENGTH TABLE FOR PASSENGER OPERATIONS, TABLE P3.5.

   Ea = 3.50", Ls = 300'

2. NOW CHECK CURVE FREIGHT SPEED AND ACTUAL ELEVATION FOR A 2°-0'-0" CURVE IN THE STANDARD SPIRAL LENGTH TABLE FOR FREIGHT OPERATIONS, TABLE F2.0.

   FOR 65 MPH: Ea = 4.00" AND Ls = 320'
   FOR 60 MPH: Ea = 3.25" AND Ls = 240'
   FOR 50 MPH: Ea = 1.50" AND Ls = 100'

3. THE CURVE WILL NEED TO HAVE 3.50 INCHES OF SUPERELEVATION AND THE SPIRALS WILL NEED TO BE 300 FEET BECAUSE THE PASSENGER REQUIREMENTS GOVERN IN THIS SITUATION. FREIGHT CAN CONTINUE TO OPERATE AT 50 MPH OR MAY BE INCREASED TO 60 MPH IF THIS SPEED CAN BE SUSTAINED FOR AT LEAST 2 MILES (CURVE DESIGN PROCEDURE NO. 13).

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	REVISED NOTES	AC	JMM

DRAWN BY: A. CARLOS DATE: 04/12/2002

PRINCIPAL ENGINEER, DESIGN & STANDARDS

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ENGINEERING STANDARDS

CURVE SPEED, SUPERELEVATION AND SPIRAL LENGTH NOTES

STANDARD 2203
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2203

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TABLE P3.5 - 3.5 INCH UNBALANCED ELEVATION FOR PASSENGER OPERATIONS - STANDARD SPIRAL LENGTHS

ABBREVIATIONS	
E = EQUILIBRIUM ELEVATION OF OUTSIDE RAIL (IN)	Vmax = MAXIMUM ALLOWABLE OPERATING SPEED (MPH)
Eu = UNBALANCED ELEVATION OF OUTSIDE RAIL (IN)	Ls = SPIRAL LENGTH (FT)
Ea = ACTUAL ELEVATION OF OUTSIDE RAIL (IN)	D = DEGREE OF CURVATURE (DECIMAL DEGREES)

FORMULAS	
$E = 0.0007DV_{max}^2$	SPIRAL LENGTH; THE LONGEST OF: $L_s = 1.2V_{max}E_a$
$E_a = E - E_u$	$L_s = 62E_a$
	$L_{s_{MIN}} = 40'$

CURVATURE - DEGREES AND MINUTES	MAXIMUM ALLOWABLE PASSENGER OPERATING SPEED - MILES PER HOUR																							
	20		25		30		35		40		45		50		60		70		80		90		100		110	
	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls
0° 15'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	50'	0.00"	50'	0.00"	60'	0.00"	60'	0.00"	70'
0° 30'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	50'	0.00"	50'	0.00"	60'	0.00"	60'	0.75"	100'
0° 45'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	50'	0.00"	50'	1.00"	110'	1.75"	210'	3.00"	400'
1° 00'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	50'	1.00"	100'	2.25"	250'	3.50"	420'	5.00"	660'
1° 15'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	1.00"	90'	2.25"	220'	3.75"	410'	5.25"	630'		
1° 30'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.50"	40'	1.75"	150'	3.25"	320'	5.25"	570'				
1° 45'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	1.00"	80'	2.75"	240'	4.50"	440'						
2° 00'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	1.75"	130'	3.50"	300'	5.50"	530'						
2° 15'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.50"	40'	2.25"	170'	4.25"	360'								
2° 30'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	1.00"	70'	3.00"	220'	5.25"	450'								
2° 45'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.50"	40'	1.50"	100'	3.50"	260'	6.00"	510'								
3° 00'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	1.00"	70'	1.75"	110'	4.25"	310'										
3° 15'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	1.25"	80'	2.25"	140'	4.75"	350'										
3° 30'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.50"	40'	1.50"	100'	2.75"	180'	5.50"	400'										
3° 45'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.75"	50'	2.00"	130'	3.25"	210'	6.00"	440'										
4° 00'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	1.00"	70'	2.25"	140'	3.50"	220'												
4° 15'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	1.50"	100'	2.75"	180'	4.00"	250'												
4° 30'	0.00"	40'	0.00"	40'	0.00"	40'	0.50"	40'	1.75"	110'	3.00"	190'	4.50"	280'												
4° 45'	0.00"	40'	0.00"	40'	0.00"	40'	0.75"	50'	2.00"	130'	3.25"	210'	5.00"	310'												
5° 00'	0.00"	40'	0.00"	40'	0.00"	40'	1.00"	70'	2.25"	140'	3.75"	240'	5.25"	330'												
5° 15'	0.00"	40'	0.00"	40'	0.00"	40'	1.25"	80'	2.50"	160'	4.00"	250'	5.75"	360'												
5° 30'	0.00"	40'	0.00"	40'	0.00"	40'	1.25"	80'	2.75"	180'	4.50"	280'														
5° 45'	0.00"	40'	0.00"	40'	0.25"	40'	1.50"	100'	3.00"	190'	4.75"	300'														
6° 00'	0.00"	40'	0.00"	40'	0.50"	40'	1.75"	110'	3.25"	210'	5.25"	330'														
6° 15'	0.00"	40'	0.00"	40'	0.50"	40'	2.00"	130'	3.50"	220'	5.50"	350'														
6° 30'	0.00"	40'	0.00"	40'	0.75"	50'	2.25"	140'	4.00"	250'	5.75"	360'														
6° 45'	0.00"	40'	0.00"	40'	1.00"	70'	2.50"	160'	4.25"	270'																
7° 00'	0.00"	40'	0.00"	40'	1.00"	70'	2.75"	180'	4.50"	280'																
7° 15'	0.00"	40'	0.00"	40'	1.25"	80'	2.75"	180'	4.75"	300'																
7° 30'	0.00"	40'	0.00"	40'	1.25"	80'	3.00"	190'	5.00"	310'																
7° 45'	0.00"	40'	0.00"	40'	1.50"	100'	3.25"	210'	5.25"	330'																
8° 00'	0.00"	40'	0.00"	40'	1.75"	110'	3.50"	220'	5.50"	350'																
8° 15'	0.00"	40'	0.25"	40'	1.75"	110'	3.75"	240'	5.75"	360'																
8° 30'	0.00"	40'	0.25"	40'	2.00"	130'	4.00"	250'																		
8° 45'	0.00"	40'	0.50"	40'	2.25"	140'	4.25"	270'																		
9° 00'	0.00"	40'	0.50"	40'	2.25"	140'	4.25"	270'																		
9° 15'	0.00"	40'	0.75"	50'	2.50"	160'	4.50"	280'																		
9° 30'	0.00"	40'	0.75"	50'	2.50"	160'	4.75"	300'																		
9° 45'	0.00"	40'	1.00"	70'	2.75"	180'	5.00"	310'																		
10° 00'	0.00"	40'	1.00"	70'	3.00"	190'	5.25"	330'																		
10° 15'	0.00"	40'	1.00"	70'	3.00"	190'	5.50"	350'																		
10° 30'	0.00"	40'	1.25"	80'	3.25"	210'	5.75"	360'																		
10° 45'	0.00"	40'	1.25"	80'	3.50"	220'	5.75"	360'																		
11° 00'	0.00"	40'	1.50"	100'	3.50"	220'	6.00"	380'																		
11° 15'	0.00"	40'	1.50"	100'	3.75"	240'																				
11° 30'	0.00"	40'	1.75"	110'	3.75"	240'																				
11° 45'	0.00"	40'	1.75"	110'	4.00"	250'																				
12° 00'	0.00"	40'	1.75"	110'	4.25"	270'																				

NOTES:

1. NO SPIRALS OR SUPERELEVATIONS WILL BE PERMITTED TO THE RIGHT OF HEAVY LINE WITHOUT PRIOR APPROVAL FROM THE SCRRA ASSISTANT DIRECTOR, DESIGN.
2. WHERE CURVATURE IS MORE THAN 5 MINUTES MORE THAN A LISTED FIGURE, THE NEXT HIGHER ELEVATION AND RESULTING SPIRAL LENGTH WILL BE USED.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TABLE P3.5 - 3.5 INCH UNBALANCED ELEVATION STANDARD SPIRAL LENGTH TABLE FOR PASSENGER OPERATIONS

STANDARD: 2204
SCALE: NTS
REVISION: - SHEET: 1 OF 6
CADD FILE: ES2204-01

TABLE F2.0 - 2.0 INCH UNBALANCED ELEVATION FOR FREIGHT OPERATIONS - STANDARD SPIRAL LENGTHS

ABBREVIATIONS	
E = EQUILIBRIUM ELEVATION OF OUTSIDE RAIL (IN)	Vmax = MAXIMUM ALLOWABLE OPERATING SPEED (MPH)
Eu = UNBALANCED ELEVATION OF OUTSIDE RAIL (IN)	Ls = SPIRAL LENGTH (FT)
Ea = ACTUAL ELEVATION OF OUTSIDE RAIL (IN)	D = DEGREE OF CURVATURE (DECIMAL DEGREES)

FORMULAS	
$E = 0.0007DVmax^2$	SPIRAL LENGTH; THE LONGEST OF: Ls = 1.2VmaxEa
Ea = E - Eu	Ls = 62Ea
	Ls_{MIN} = 40'

CURVATURE - DEGREES AND MINUTES	MAXIMUM ALLOWABLE FREIGHT OPERATING SPEED - MILES PER HOUR																							
	20		25		30		35		40		45		50		55		60		65		70		75		80	
	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls
0° 15'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	50'	0.00"	50'	0.00"	50'
0° 30'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	50'	0.00"	50'	0.25"	50'
0° 45'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	0.75"	70'	1.00"	90'	1.50"	150'
1° 00'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	0.75"	60'	1.00"	80'	1.50"	130'	2.00"	180'	2.50"	240'
1° 15'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	0.75"	50'	1.25"	90'	1.75"	140'	2.50"	210'	3.00"	270'	3.75"	360'
1° 30'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	0.75"	50'	1.25"	90'	2.00"	150'	2.50"	200'	3.25"	280'	4.00"	360'	4.75"	460'
1° 45'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.50"	40'	1.25"	80'	1.75"	120'	2.50"	180'	3.25"	260'	4.25"	360'	5.00"	450'	6.00"	580'
2° 00'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	1.00"	70'	1.50"	100'	2.25"	150'	3.25"	240'	4.00"	320'	5.00"	420'	6.00"	540'		
2° 15'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'	0.75"	50'	1.25"	80'	2.00"	130'	3.00"	200'	3.75"	270'	4.75"	380'	5.75"	490'				
2° 30'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'	1.00"	70'	1.75"	110'	2.50"	160'	3.50"	240'	4.50"	330'	5.50"	430'						
2° 45'	0.00"	40'	0.00"	40'	0.00"	40'	0.50"	40'	1.25"	80'	2.00"	130'	3.00"	190'	4.00"	270'	5.00"	360'								
3° 00'	0.00"	40'	0.00"	40'	0.00"	40'	0.75"	50'	1.50"	100'	2.50"	160'	3.25"	210'	4.50"	300'	5.75"	420'								
3° 15'	0.00"	40'	0.00"	40'	0.25"	40'	1.00"	70'	1.75"	110'	2.75"	180'	3.75"	240'	5.00"	330'										
3° 30'	0.00"	40'	0.00"	40'	0.25"	40'	1.25"	80'	2.00"	130'	3.00"	190'	4.25"	270'	5.50"	370'										
3° 45'	0.00"	40'	0.00"	40'	0.50"	40'	1.25"	80'	2.25"	140'	3.50"	220'	4.75"	300'	6.00"	400'										
4° 00'	0.00"	40'	0.00"	40'	0.75"	50'	1.50"	100'	2.50"	160'	3.75"	240'	5.00"	310'												
4° 15'	0.00"	40'	0.00"	40'	0.75"	50'	1.75"	110'	3.00"	190'	4.25"	270'	5.50"	350'												
4° 30'	0.00"	40'	0.00"	40'	1.00"	70'	2.00"	130'	3.25"	210'	4.50"	280'	6.00"	380'												
4° 45'	0.00"	40'	0.25"	40'	1.00"	70'	2.25"	140'	3.50"	220'	4.75"	300'														
5° 00'	0.00"	40'	0.25"	40'	1.25"	80'	2.50"	160'	3.75"	240'	5.25"	330'														
5° 15'	0.00"	40'	0.50"	40'	1.50"	100'	2.75"	180'	4.00"	250'	5.50"	350'														
5° 30'	0.00"	40'	0.50"	40'	1.50"	100'	2.75"	180'	4.25"	270'	6.00"	380'														
5° 45'	0.00"	40'	0.75"	50'	1.75"	110'	3.00"	190'	4.50"	280'																
6° 00'	0.00"	40'	0.75"	50'	2.00"	130'	3.25"	210'	4.75"	300'																
6° 15'	0.00"	40'	0.75"	50'	2.00"	130'	3.50"	220'	5.00"	310'																
6° 30'	0.00"	40'	1.00"	70'	2.25"	140'	3.75"	240'	5.50"	350'																
6° 45'	0.00"	40'	1.00"	70'	2.50"	160'	4.00"	250'	5.75"	360'																
7° 00'	0.00"	40'	1.25"	80'	2.50"	160'	4.25"	270'	6.00"	380'																
7° 15'	0.25"	40'	1.25"	80'	2.75"	180'	4.25"	270'																		
7° 30'	0.25"	40'	1.50"	100'	2.75"	180'	4.50"	280'																		
7° 45'	0.25"	40'	1.50"	100'	3.00"	190'	4.75"	300'																		
8° 00'	0.25"	40'	1.50"	100'	3.25"	210'	5.00"	310'																		
8° 15'	0.50"	40'	1.75"	110'	3.25"	210'	5.25"	330'																		
8° 30'	0.50"	40'	1.75"	110'	3.50"	220'	5.50"	350'																		
8° 45'	0.50"	40'	2.00"	130'	3.75"	240'	5.75"	360'																		
9° 00'	0.75"	50'	2.00"	130'	3.75"	240'	5.75"	360'																		
9° 15'	0.75"	50'	2.25"	140'	4.00"	250'	6.00"	380'																		
9° 30'	0.75"	50'	2.25"	140'	4.00"	250'																				
9° 45'	0.75"	50'	2.50"	160'	4.25"	270'																				
10° 00'	1.00"	70'	2.50"	160'	4.50"	280'																				
10° 15'	1.00"	70'	2.50"	160'	4.50"	280'																				
10° 30'	1.00"	70'	2.75"	180'	4.75"	300'																				
10° 45'	1.25"	80'	2.75"	180'	5.00"	310'																				
11° 00'	1.25"	80'	3.00"	190'	5.00"	310'																				
11° 15'	1.25"	80'	3.00"	190'	5.25"	330'																				
11° 30'	1.25"	80'	3.25"	210'	5.25"	330'																				
11° 45'	1.50"	100'	3.25"	210'	5.50"	350'																				
12° 00'	1.50"	100'	3.25"	210'	5.75"	360'																				

NOTES:

1. NO SPIRALS OR SUPERELEVATIONS WILL BE PERMITTED TO THE RIGHT OF HEAVY LINE WITHOUT PRIOR APPROVAL FROM THE SCRRA ASSISTANT DIRECTOR, DESIGN.
2. WHERE CURVATURE IS MORE THAN 5 MINUTES MORE THAN A LISTED FIGURE, THE NEXT HIGHER ELEVATION AND RESULTING SPIRAL LENGTH WILL BE USED.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TABLE F2.0 - 2.0 INCH UNBALANCED ELEVATION
STANDARD SPIRAL LENGTH TABLE
FOR FREIGHT OPERATIONS

STANDARD: 2204
SCALE: NTS
REVISION: - SHEET: 2 OF 6
CADD FILE: ES2204-02

UserName=> scrrapw11ics01$ Date Plotted: 3/27/2023 3:07:22 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_22\ES2204-02.dgn

TABLE P3.5M - 3.5 INCH UNBALANCED ELEVATION FOR PASSENGER OPERATIONS - MINIMUM SPIRAL LENGTHS

ABBREVIATIONS	
E = EQUILIBRIUM ELEVATION OF OUTSIDE RAIL (IN)	Vmax = MAXIMUM ALLOWABLE OPERATING SPEED (MPH)
Eu = UNBALANCED ELEVATION OF OUTSIDE RAIL (IN)	Ls = SPIRAL LENGTH (FT)
Ea = ACTUAL ELEVATION OF OUTSIDE RAIL (IN)	D = DEGREE OF CURVATURE (DECIMAL DEGREES)

FORMULAS	
$E = 0.0007DV_{max}^2$	SPIRAL LENGTH; THE LONGEST OF: Ls = 1.0VmaxEa
Ea = E - Eu	Ls = 50Ea
	Ls_{MIN} = 30'

CURVATURE - DEGREES AND MINUTES	MAXIMUM ALLOWABLE PASSENGER OPERATING SPEED - MILES PER HOUR																							
	20		25		30		35		40		45		50		60		70		80		90		100		110	
	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls
0° 15'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	40'	0.00"	40'	0.00"	50'	0.00"	50'	0.00"	60'
0° 30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	40'	0.00"	40'	0.00"	50'	0.00"	50'	0.75"	90'
0° 45'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	40'	0.00"	40'	1.00"	90'	1.75"	180'	3.00"	330'
1° 00'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	40'	1.00"	80'	2.25"	210'	3.50"	350'	5.00"	550'
1° 15'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	1.00"	70'	2.25"	180'	3.75"	340'	5.25"	530'		
1° 30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.50"	30'	1.75"	130'	3.25"	260'	5.25"	480'				
1° 45'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	1.00"	60'	2.75"	200'	4.50"	360'						
2° 00'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	1.75"	110'	3.50"	250'	5.50"	440'						
2° 15'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.50"	30'	2.25"	140'	4.25"	300'								
2° 30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	30'	1.00"	50'	3.00"	180'	5.25"	370'								
2° 45'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.50"	30'	1.50"	80'	3.50"	210'	6.00"	420'								
3° 00'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	1.00"	50'	1.75"	90'	4.25"	260'										
3° 15'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	30'	1.25"	70'	2.25"	120'	4.75"	290'										
3° 30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.50"	30'	1.50"	80'	2.75"	140'	5.50"	330'										
3° 45'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.75"	40'	2.00"	100'	3.25"	170'	6.00"	360'										
4° 00'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	1.00"	50'	2.25"	120'	3.50"	180'												
4° 15'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	30'	1.50"	80'	2.75"	140'	4.00"	200'												
4° 30'	0.00"	30'	0.00"	30'	0.00"	30'	0.50"	30'	1.75"	90'	3.00"	150'	4.50"	230'												
4° 45'	0.00"	30'	0.00"	30'	0.00"	30'	0.75"	40'	2.00"	100'	3.25"	170'	5.00"	250'												
5° 00'	0.00"	30'	0.00"	30'	0.00"	30'	1.00"	50'	2.25"	120'	3.75"	190'	5.25"	270'												
5° 15'	0.00"	30'	0.00"	30'	0.00"	30'	1.25"	70'	2.50"	130'	4.00"	200'	5.75"	290'												
5° 30'	0.00"	30'	0.00"	30'	0.00"	30'	1.25"	70'	2.75"	140'	4.50"	230'														
5° 45'	0.00"	30'	0.00"	30'	0.25"	30'	1.50"	80'	3.00"	150'	4.75"	240'														
6° 00'	0.00"	30'	0.00"	30'	0.50"	30'	1.75"	90'	3.25"	170'	5.25"	270'														
6° 15'	0.00"	30'	0.00"	30'	0.50"	30'	2.00"	100'	3.50"	180'	5.50"	280'														
6° 30'	0.00"	30'	0.00"	30'	0.75"	40'	2.25"	120'	4.00"	200'	5.75"	290'														
6° 45'	0.00"	30'	0.00"	30'	1.00"	50'	2.50"	130'	4.25"	220'																
7° 00'	0.00"	30'	0.00"	30'	1.00"	50'	2.75"	140'	4.50"	230'																
7° 15'	0.00"	30'	0.00"	30'	1.25"	70'	2.75"	140'	4.75"	240'																
7° 30'	0.00"	30'	0.00"	30'	1.25"	70'	3.00"	150'	5.00"	250'																
7° 45'	0.00"	30'	0.00"	30'	1.50"	80'	3.25"	170'	5.25"	270'																
8° 00'	0.00"	30'	0.00"	30'	1.75"	90'	3.50"	180'	5.50"	280'																
8° 15'	0.00"	30'	0.25"	30'	1.75"	90'	3.75"	190'	5.75"	290'																
8° 30'	0.00"	30'	0.25"	30'	2.00"	100'	4.00"	200'																		
8° 45'	0.00"	30'	0.50"	30'	2.25"	120'	4.25"	220'																		
9° 00'	0.00"	30'	0.50"	30'	2.25"	120'	4.25"	220'																		
9° 15'	0.00"	30'	0.75"	40'	2.50"	130'	4.50"	230'																		
9° 30'	0.00"	30'	0.75"	40'	2.50"	130'	4.75"	240'																		
9° 45'	0.00"	30'	1.00"	50'	2.75"	140'	5.00"	250'																		
10° 00'	0.00"	30'	1.00"	50'	3.00"	150'	5.25"	270'																		
10° 15'	0.00"	30'	1.00"	50'	3.00"	150'	5.50"	280'																		
10° 30'	0.00"	30'	1.25"	70'	3.25"	170'	5.75"	290'																		
10° 45'	0.00"	30'	1.25"	70'	3.50"	180'	5.75"	290'																		
11° 00'	0.00"	30'	1.50"	80'	3.50"	180'	6.00"	300'																		
11° 15'	0.00"	30'	1.50"	80'	3.75"	190'																				
11° 30'	0.00"	30'	1.75"	90'	3.75"	190'																				
11° 45'	0.00"	30'	1.75"	90'	4.00"	200'																				
12° 00'	0.00"	30'	1.75"	90'	4.25"	220'																				

NOTES:

1. NO SPIRALS OR SUPERELEVATIONS WILL BE PERMITTED TO THE RIGHT OF HEAVY LINE WITHOUT PRIOR APPROVAL FROM THE SCRRA ASSISTANT DIRECTOR, DESIGN.
2. THIS TABLE MAY ONLY BE USED ON THE VENTURA AND ANTELOPE VALLEY SUBDIVISIONS AT LOCATIONS WHERE STANDARD SPIRAL LENGTHS CAN NOT BE OBTAINED DUE TO EXISTING FIELD CONDITIONS.
3. WHERE CURVATURE IS MORE THAN 5 MINUTES MORE THAN A LISTED FIGURE, THE NEXT HIGHER ELEVATION AND RESULTING SPIRAL LENGTH WILL BE USED.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TABLE P3.5M - 3.5 INCH UNBALANCED ELEVATION MINIMUM SPIRAL LENGTH TABLE FOR PASSENGER OPERATIONS

STANDARD: 2204
SCALE: NTS
REVISION: -
SHEET: 3 OF 6
CADD FILE: ES2204-03

TABLE F2.0M - 2.0 INCH UNBALANCED ELEVATION FOR FREIGHT OPERATIONS - MINIMUM SPIRAL LENGTHS

ABBREVIATIONS	
E = EQUILIBRIUM ELEVATION OF OUTSIDE RAIL (IN)	Vmax = MAXIMUM ALLOWABLE OPERATING SPEED (MPH)
Eu = UNBALANCED ELEVATION OF OUTSIDE RAIL (IN)	Ls = SPIRAL LENGTH (FT)
Ea = ACTUAL ELEVATION OF OUTSIDE RAIL (IN)	D = DEGREE OF CURVATURE (DECIMAL DEGREES)

FORMULAS		
$E = 0.0007DVmax^2$	SPIRAL LENGTH; THE LONGEST OF:	Ls = 1.0VmaxEa
Ea = E - Eu		Ls = 50Ea
		Ls_{MIN} = 30'

CURVATURE - DEGREES AND MINUTES	MAXIMUM ALLOWABLE FREIGHT OPERATING SPEED - MILES PER HOUR																							
	20		25		30		35		40		45		50		55		60		65		70		75		80	
	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls	Ea	Ls
0° 15'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	40'	0.00"	40'	0.00"	40'	0.00"	40'
0° 30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	40'	0.00"	40'	0.00"	40'	0.25"	40'
0° 45'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	40'	0.75"	60'	1.00"	80'	1.50"	120'
1° 00'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	30'	0.75"	50'	1.00"	70'	1.50"	110'	2.00"	150'	2.50"	200'
1° 15'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	30'	0.75"	50'	1.25"	80'	1.75"	120'	2.50"	180'	3.00"	230'	3.75"	300'
1° 30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	30'	0.75"	40'	1.25"	70'	2.00"	120'	2.50"	170'	3.25"	230'	4.00"	300'	4.75"	380'
1° 45'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.50"	30'	1.25"	70'	1.75"	100'	2.50"	150'	3.25"	220'	4.25"	300'	5.00"	380'	6.00"	480'
2° 00'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	30'	1.00"	50'	1.50"	80'	2.25"	130'	3.25"	200'	4.00"	260'	5.00"	350'	6.00"	450'		
2° 15'	0.00"	30'	0.00"	30'	0.00"	30'	0.00"	30'	0.75"	40'	1.25"	70'	2.00"	100'	3.00"	170'	3.75"	230'	4.75"	310'	5.75"	410'				
2° 30'	0.00"	30'	0.00"	30'	0.00"	30'	0.25"	30'	1.00"	50'	1.75"	90'	2.50"	130'	3.50"	200'	4.50"	270'	5.50"	360'						
2° 45'	0.00"	30'	0.00"	30'	0.00"	30'	0.50"	30'	1.25"	70'	2.00"	100'	3.00"	150'	4.00"	220'	5.00"	300'								
3° 00'	0.00"	30'	0.00"	30'	0.00"	30'	0.75"	40'	1.50"	80'	2.50"	130'	3.25"	170'	4.50"	250'	5.75"	350'								
3° 15'	0.00"	30'	0.00"	30'	0.25"	30'	1.00"	50'	1.75"	90'	2.75"	140'	3.75"	190'	5.00"	280'										
3° 30'	0.00"	30'	0.00"	30'	0.25"	30'	1.25"	70'	2.00"	100'	3.00"	150'	4.25"	220'	5.50"	310'										
3° 45'	0.00"	30'	0.00"	30'	0.50"	30'	1.25"	70'	2.25"	120'	3.50"	180'	4.75"	240'	6.00"	330'										
4° 00'	0.00"	30'	0.00"	30'	0.75"	40'	1.50"	80'	2.50"	130'	3.75"	190'	5.00"	250'												
4° 15'	0.00"	30'	0.00"	30'	0.75"	40'	1.75"	90'	3.00"	150'	4.25"	220'	5.50"	280'												
4° 30'	0.00"	30'	0.00"	30'	1.00"	50'	2.00"	100'	3.25"	170'	4.50"	230'	6.00"	300'												
4° 45'	0.00"	30'	0.25"	30'	1.00"	50'	2.25"	120'	3.50"	180'	4.75"	240'														
5° 00'	0.00"	30'	0.25"	30'	1.25"	70'	2.50"	130'	3.75"	190'	5.25"	270'														
5° 15'	0.00"	30'	0.50"	30'	1.50"	80'	2.75"	140'	4.00"	200'	5.50"	280'														
5° 30'	0.00"	30'	0.50"	30'	1.50"	80'	2.75"	140'	4.25"	220'	6.00"	300'														
5° 45'	0.00"	30'	0.75"	40'	1.75"	90'	3.00"	150'	4.50"	230'																
6° 00'	0.00"	30'	0.75"	40'	2.00"	100'	3.25"	170'	4.75"	240'																
6° 15'	0.00"	30'	0.75"	40'	2.00"	100'	3.50"	180'	5.00"	250'																
6° 30'	0.00"	30'	1.00"	50'	2.25"	120'	3.75"	190'	5.50"	280'																
6° 45'	0.00"	30'	1.00"	50'	2.50"	130'	4.00"	200'	5.75"	290'																
7° 00'	0.00"	30'	1.25"	70'	2.50"	130'	4.25"	220'	6.00"	300'																
7° 15'	0.25"	30'	1.25"	70'	2.75"	140'	4.25"	220'																		
7° 30'	0.25"	30'	1.50"	80'	2.75"	140'	4.50"	230'																		
7° 45'	0.25"	30'	1.50"	80'	3.00"	150'	4.75"	240'																		
8° 00'	0.25"	30'	1.50"	80'	3.25"	170'	5.00"	250'																		
8° 15'	0.50"	30'	1.75"	90'	3.25"	170'	5.25"	270'																		
8° 30'	0.50"	30'	1.75"	90'	3.50"	180'	5.50"	280'																		
8° 45'	0.50"	30'	2.00"	100'	3.75"	190'	5.75"	290'																		
9° 00'	0.75"	40'	2.00"	100'	3.75"	190'	5.75"	290'																		
9° 15'	0.75"	40'	2.25"	120'	4.00"	200'	6.00"	300'																		
9° 30'	0.75"	40'	2.25"	120'	4.00"	200'																				
9° 45'	0.75"	40'	2.50"	130'	4.25"	220'																				
10° 00'	1.00"	50'	2.50"	130'	4.50"	230'																				
10° 15'	1.00"	50'	2.50"	130'	4.50"	230'																				
10° 30'	1.00"	50'	2.75"	140'	4.75"	240'																				
10° 45'	1.25"	70'	2.75"	140'	5.00"	250'																				
11° 00'	1.25"	70'	3.00"	150'	5.00"	250'																				
11° 15'	1.25"	70'	3.00"	150'	5.25"	270'																				
11° 30'	1.25"	70'	3.25"	170'	5.25"	270'																				
11° 45'	1.50"	80'	3.25"	170'	5.50"	280'																				
12° 00'	1.50"	80'	3.25"	170'	5.75"	290'																				

NOTES:

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2. THIS TABLE MAY ONLY BE USED ON THE VENTURA AND ANTELOPE VALLEY SUBDIVISIONS AT LOCATIONS WHERE STANDARD SPIRAL LENGTHS CAN NOT BE OBTAINED DUE TO EXISTING FIELD CONDITIONS.
3. WHERE CURVATURE IS MORE THAN 5 MINUTES MORE THAN A LISTED FIGURE, THE NEXT HIGHER ELEVATION AND RESULTING SPIRAL LENGTH WILL BE USED.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TABLE F2.0M - 2.0 INCH UNBALANCED ELEVATION
MINIMUM SPIRAL LENGTH TABLE
FOR FREIGHT OPERATIONS

STANDARD: 2204
SCALE: NTS
REVISION: -
SHEET: 4 OF 6
CADD FILE: ES2204-04

TABLE PML - 4.0 INCH UNBALANCED ELEVATION FOR PASSENGER OPERATIONS - MAINTENANCE LIMIT

ABBREVIATIONS	
E = EQUILIBRIUM ELEVATION OF OUTSIDE RAIL (IN)	Vmax = MAXIMUM ALLOWABLE OPERATING SPEED (MPH)
Eu = UNBALANCED ELEVATION OF OUTSIDE RAIL (IN)	Ls = SPIRAL LENGTH (FT)
Ea = ACTUAL ELEVATION OF OUTSIDE RAIL (IN)	D = DEGREE OF CURVATURE (DECIMAL DEGREES)

FORMULAS
$E = 0.0007DVmax^2$
Ea = E - Eu

CURVATURE - DEGREES AND MINUTES	MAXIMUM ALLOWABLE PASSENGER OPERATING SPEED - MILES PER HOUR																		
	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110
0° 15'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"
0° 30'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.25"
0° 45'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	0.75"	1.25"	2.00"	2.50"
1° 00'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	1.25"	1.75"	2.50"	3.00"	3.75"	4.50"
1° 15'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	1.00"	1.75"	2.50"	3.25"	4.00"	4.75"	5.75"	
1° 30'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	1.25"	2.00"	2.75"	3.75"	4.75"	5.50"			
1° 45'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	1.25"	2.25"	3.00"	4.00"	5.00"	6.00"				
2° 00'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.25"	1.25"	2.00"	3.00"	4.00"	5.00"						
2° 15'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	1.00"	1.75"	2.75"	3.75"	5.00"							
2° 30'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	1.50"	2.50"	3.50"	4.75"	6.00"							
2° 45'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	1.00"	2.00"	3.00"	4.25"	5.50"								
3° 00'	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	1.25"	2.50"	3.75"	5.00"									
3° 15'	0.00"	0.00"	0.00"	0.00"	0.00"	0.75"	1.75"	3.00"	4.25"	5.75"									
3° 30'	0.00"	0.00"	0.00"	0.00"	0.00"	1.00"	2.25"	3.50"	5.00"										
3° 45'	0.00"	0.00"	0.00"	0.00"	0.25"	1.50"	2.75"	4.00"	5.50"										
4° 00'	0.00"	0.00"	0.00"	0.00"	0.50"	1.75"	3.00"	4.50"											
4° 15'	0.00"	0.00"	0.00"	0.00"	1.00"	2.25"	3.50"	5.00"											
4° 30'	0.00"	0.00"	0.00"	0.00"	1.25"	2.50"	4.00"	5.75"											
4° 45'	0.00"	0.00"	0.00"	0.25"	1.50"	2.75"	4.50"												
5° 00'	0.00"	0.00"	0.00"	0.50"	1.75"	3.25"	4.75"												
5° 15'	0.00"	0.00"	0.00"	0.75"	2.00"	3.50"	5.25"												
5° 30'	0.00"	0.00"	0.00"	0.75"	2.25"	4.00"	5.75"												
5° 45'	0.00"	0.00"	0.00"	1.00"	2.50"	4.25"													
6° 00'	0.00"	0.00"	0.00"	1.25"	2.75"	4.75"													
6° 15'	0.00"	0.00"	0.00"	1.50"	3.00"	5.00"													
6° 30'	0.00"	0.00"	0.00"	0.25"	1.75"	3.50"	5.25"												
6° 45'	0.00"	0.00"	0.50"	2.00"	3.75"	5.75"													
7° 00'	0.00"	0.00"	0.50"	2.25"	4.00"	6.00"													
7° 15'	0.00"	0.00"	0.75"	2.25"	4.25"														
7° 30'	0.00"	0.00"	0.75"	2.50"	4.50"														
7° 45'	0.00"	0.00"	1.00"	2.75"	4.75"														
8° 00'	0.00"	0.00"	1.25"	3.00"	5.00"														
8° 15'	0.00"	0.00"	1.25"	3.25"	5.25"														
8° 30'	0.00"	0.00"	1.50"	3.50"	5.75"														
8° 45'	0.00"	0.00"	1.75"	3.75"	6.00"														
9° 00'	0.00"	0.00"	1.75"	3.75"															
9° 15'	0.00"	0.25"	2.00"	4.00"															
9° 30'	0.00"	0.25"	2.00"	4.25"															
9° 45'	0.00"	0.50"	2.25"	4.50"															
10° 00'	0.00"	0.50"	2.50"	4.75"															
10° 15'	0.00"	0.50"	2.50"	5.00"															
10° 30'	0.00"	0.75"	2.75"	5.25"															
10° 45'	0.00"	0.75"	3.00"	5.25"															
11° 00'	0.00"	1.00"	3.00"	5.50"															
11° 15'	0.00"	1.00"	3.25"	5.75"															
11° 30'	0.00"	1.25"	3.25"	6.00"															
11° 45'	0.00"	1.25"	3.50"																
12° 00'	0.00"	1.25"	3.75"																

NOTES:

1. AT ALL TIMES THE TRACK MUST BE IN CONFORMANCE WITH 49CFR213. TABLES P3.5 AND P3.5M DEFINE THE LIMITING DESIGN SPEED FOR PASSENGER TRAINS. TABLES F2.0 AND F2.0M DEFINE THE LIMITING DESIGN SPEED FOR FREIGHT TRAINS. OPERATION AT SPEEDS RESULTING IN 4 INCHES UNDERBALANCE IS PERMITTED FOR SCRRA AND AMTRAK PASSENGER TRAINS EXCEPT WHEN ADVISED THAT SEVERE WIND CONDITIONS EXIST. 3 INCHES UNDERBALANCE IS THE LIMITING CONDITION FOR ALL FREIGHT TRAINS AND FOR PASSENGER TRAINS UNDER SEVERE WIND CONDITIONS. ANY COMBINATION OF CURVATURE OR ACTUAL ELEVATION THAT IS DISCOVERED OR CREATED THAT RESULTS IN THE OPERATING SPEED TO EXCEED THE SPEED PERMITTED BY THESE TABLES REQUIRES IMMEDIATE REMEDIAL ACTION.
2. SOME CURVES WERE CONSTRUCTED AND SPEEDS ESTABLISHED WITH UNDERBALANCE FOR PASSENGER SPEEDS BETWEEN THE 3.5 INCH DESIGN VALUE OF TABLES P3.5 AND P3.5M AND THE 4 INCH LIMITING VALUE PER THE FRA. CURVES WITH THESE CHARACTERISTICS WILL BE MAINTAINED AS DESIGNED.
3. SUPERELEVATION AND SPIRAL LENGTHS WILL BE MAINTAINED TO THE VALUES RECORDED IN THE SCRRA TRACK CHARTS. SOME OF THESE DO NOT MEET THE LENGTH REQUIREMENTS FOR THE TABLES FOR NEW DESIGN, P3.5 AND F2.0. HOWEVER, THEY DO MEET THE REQUIREMENTS FOR THE P3.5M AND P2.0M TABLES.
4. SPIRAL LENGTHS MUST NOT BE INCREASED EXCEPT AS PART OF AN ENGINEERED REALIGNMENT OF A CURVE. THE SHARPNESS OF THE CURVE IN THE CENTRAL BODY WILL BE INCREASED IF THE SPIRALS ARE EXTENDED INTO THE BODY OF THE CURVE.
5. CONTRACT TRACK INSPECTORS WILL FIELD VERIFY THE CHARACTERISTICS OF AT LEAST TWO CURVES EACH MONTH, USING TRACK LEVEL AND STRING LINE, REPORTING THE OBSERVED 62-FOOT CHORD MID-ORDINATE AND SUPERELEVATION AT 15.5-FOOT INTERVALS FOR THE LENGTH OF THE CURVE. THE MANAGERS OF TRACK MAINTENANCE AND THE CONTRACT PROJECT MANAGER WILL REVIEW AND COMPARE THE PRECEDING TWO YEARS OF TRACK GEOMETRY DATA TO THE TRACK CHART DATA, AND WILL ARRANGE FOR FIELD VERIFICATION OF ALIGNMENT BASED UPON THESE REVIEWS.
6. MANAGERS OF TRACK MAINTENANCE MUST RIDE WITH EACH OPERATION OF TRACK GEOMETRY CARS. THEY MUST MONITOR AND ENSURE THAT THE MAINTENANCE CONTRACTOR INVESTIGATES ANY NOTED REPORTS OF WARP OR UNDERBALANCE EXCEPTIONS AND TAKES THE REQUIRED REMEDIAL ACTIONS (SPOT REPAIRS OR REDUCTION IN SPEED). THEY MUST ALSO PROMPTLY REVIEW THE CURVE DATA GENERATED BY THE TRACK GEOMETRY CAR AND COMPARE THE AVERAGE CURVATURE, AVERAGE ELEVATION, LIMITING CURVATURE AND LIMITING ELEVATION FOR EACH CURVE TO THE RECORDS IN THE TRACK CHARTS WHETHER AN EXCEPTION IS NOTED OR NOT.
7. COMPOUND CURVES DESCRIBED IN THE TRACK CHARTS THAT HAVE DIFFERING TRAIN SPEED, SUPERELEVATION, AND/OR CURVATURE NOTED FOR TWO OR MORE SEGMENTS OF ONE CURVE HAVE BEEN APPROVED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN.
8. IF THE ACTUAL SUPERELEVATION AND CURVATURE MEASURED IN THE FIELD BY GEOMETRY CARS OR BY MANUAL INSPECTION PER NOTE 5 ABOVE ARE FOUND TO RESULT IN AN ALLOWABLE SPEED LESS THAN PERMITTED BY TABLES PML AND FML, A TEMPORARY SPEED REDUCTION MUST BE IMPOSED TO THE NEXT LOWER SPEED THAT WILL ACCOMMODATE THE ACTUAL MEASURED SUPERELEVATION. THE TEMPORARY SPEED REDUCTION MUST REMAIN UNTIL THE SUPERELEVATION LIMITS ARE RAISED TO THE VALUES SHOWN IN TABLES P3.5, F2.0, P3.5M AND F2.0M FOR THE DESIGN SPEED.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TABLE PML - 4.0 INCH UNBALANCED ELEVATION MAINTENANCE LIMIT FOR PASSENGER OPERATIONS

STANDARD 2204
SCALE: NTS
REVISION - SHEET 5 OF 6
CADD FILE: ES2204-05

TABLE FML - 3.0 INCH UNBALANCED ELEVATION FOR FREIGHT OPERATIONS - MAINTENANCE LIMIT

ABBREVIATIONS	
E = EQUILIBRIUM ELEVATION OF OUTSIDE RAIL (IN)	Vmax = MAXIMUM ALLOWABLE OPERATING SPEED (MPH)
Eu = UNBALANCED ELEVATION OF OUTSIDE RAIL (IN)	Ls = SPIRAL LENGTH (FT)
Ea = ACTUAL ELEVATION OF OUTSIDE RAIL (IN)	D = DEGREE OF CURVATURE (DECIMAL DEGREES)

FORMULAS
$E = 0.0007DVmax^2$
Ea = E - Eu

CURVATURE - DEGREES AND MINUTES

	MAXIMUM ALLOWABLE FREIGHT OPERATING SPEED - MILES PER HOUR												
	20	25	30	35	40	45	50	55	60	65	70	75	80
0° 15'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"
0° 30'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"
0° 45'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"
1° 00'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	1.00"	1.50"
1° 15'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.25"	0.75"	1.50"	2.00"	2.75"
1° 30'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.25"	1.00"	1.50"	2.25"	3.00"	3.75"
1° 45'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.25"	0.75"	1.50"	2.25"	3.25"	4.00"	5.00"
2° 00'	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.50"	1.25"	2.25"	3.00"	4.00"	5.00"	6.00"
2° 15'	0.00"	0.00"	0.00"	0.00"	0.00"	0.25"	1.00"	2.00"	2.75"	3.75"	4.75"	6.00"	
2° 30'	0.00"	0.00"	0.00"	0.00"	0.00"	0.75"	1.50"	2.50"	3.50"	4.50"	5.75"		
2° 45'	0.00"	0.00"	0.00"	0.00"	0.25"	1.00"	2.00"	3.00"	4.00"	5.25"			
3° 00'	0.00"	0.00"	0.00"	0.00"	0.50"	1.50"	2.25"	3.50"	4.75"	6.00"			
3° 15'	0.00"	0.00"	0.00"	0.00"	0.75"	1.75"	2.75"	4.00"	5.25"				
3° 30'	0.00"	0.00"	0.00"	0.25"	1.00"	2.00"	3.25"	4.50"	6.00"				
3° 45'	0.00"	0.00"	0.00"	0.25"	1.25"	2.50"	3.75"	5.00"					
4° 00'	0.00"	0.00"	0.00"	0.50"	1.50"	2.75"	4.00"	5.50"					
4° 15'	0.00"	0.00"	0.00"	0.75"	2.00"	3.25"	4.50"	6.00"					
4° 30'	0.00"	0.00"	0.00"	1.00"	2.25"	3.50"	5.00"						
4° 45'	0.00"	0.00"	0.00"	1.25"	2.50"	3.75"	5.50"						
5° 00'	0.00"	0.00"	0.25"	1.50"	2.75"	4.25"	5.75"						
5° 15'	0.00"	0.00"	0.50"	1.75"	3.00"	4.50"							
5° 30'	0.00"	0.00"	0.50"	1.75"	3.25"	5.00"							
5° 45'	0.00"	0.00"	0.75"	2.00"	3.50"	5.25"							
6° 00'	0.00"	0.00"	1.00"	2.25"	3.75"	5.75"							
6° 15'	0.00"	0.00"	1.00"	2.50"	4.00"	6.00"							
6° 30'	0.00"	0.00"	1.25"	2.75"	4.50"								
6° 45'	0.00"	0.00"	1.50"	3.00"	4.75"								
7° 00'	0.00"	0.25"	1.50"	3.25"	5.00"								
7° 15'	0.00"	0.25"	1.75"	3.25"	5.25"								
7° 30'	0.00"	0.50"	1.75"	3.50"	5.50"								
7° 45'	0.00"	0.50"	2.00"	3.75"	5.75"								
8° 00'	0.00"	0.50"	2.25"	4.00"	6.00"								
8° 15'	0.00"	0.75"	2.25"	4.25"									
8° 30'	0.00"	0.75"	2.50"	4.50"									
8° 45'	0.00"	1.00"	2.75"	4.75"									
9° 00'	0.00"	1.00"	2.75"	4.75"									
9° 15'	0.00"	1.25"	3.00"	5.00"									
9° 30'	0.00"	1.25"	3.00"	5.25"									
9° 45'	0.00"	1.50"	3.25"	5.50"									
10° 00'	0.00"	1.50"	3.50"	5.75"									
10° 15'	0.00"	1.50"	3.50"	6.00"									
10° 30'	0.00"	1.75"	3.75"										
10° 45'	0.25"	1.75"	4.00"										
11° 00'	0.25"	2.00"	4.00"										
11° 15'	0.25"	2.00"	4.25"										
11° 30'	0.25"	2.25"	4.25"										
11° 45'	0.50"	2.25"	4.50"										
12° 00'	0.50"	2.25"	4.75"										

NOTES:

1. AT ALL TIMES THE TRACK MUST BE IN CONFORMANCE WITH 49CFR213. TABLES P3.5 AND P3.5M DEFINE THE LIMITING DESIGN SPEED FOR PASSENGER TRAINS. TABLES F2.0 AND F2.0M DEFINE THE LIMITING DESIGN SPEED FOR FREIGHT TRAINS. OPERATION AT SPEEDS RESULTING IN 4 INCHES UNDERBALANCE IS PERMITTED FOR SCRRA AND AMTRAK PASSENGER TRAINS EXCEPT WHEN ADVISED THAT SEVERE WIND CONDITIONS EXIST. 3 INCHES UNDERBALANCE IS THE LIMITING CONDITION FOR ALL FREIGHT TRAINS AND FOR PASSENGER TRAINS UNDER SEVERE WIND CONDITIONS. ANY COMBINATION OF CURVATURE OR ACTUAL ELEVATION THAT IS DISCOVERED OR CREATED THAT RESULTS IN THE OPERATING SPEED TO EXCEED THE SPEED PERMITTED BY THESE TABLES REQUIRES IMMEDIATE REMEDIAL ACTION.
2. SOME CURVES WERE CONSTRUCTED AND SPEEDS ESTABLISHED WITH UNDERBALANCE FOR PASSENGER SPEEDS BETWEEN THE 3.5 INCH DESIGN VALUE OF TABLES P3.5 AND P3.5M AND THE 4 INCH LIMITING VALUE PER THE FRA. CURVES WITH THESE CHARACTERISTICS WILL BE MAINTAINED AS DESIGNED.
3. SUPERELEVATION AND SPIRAL LENGTHS WILL BE MAINTAINED TO THE VALUES RECORDED IN THE SCRRA TRACK CHARTS. SOME OF THESE DO NOT MEET THE LENGTH REQUIREMENTS FOR THE TABLES FOR NEW DESIGN, P3.5 AND F2.0. HOWEVER, THEY DO MEET THE REQUIREMENTS FOR THE P3.5M AND P2.0M TABLES.
4. SPIRAL LENGTHS MUST NOT BE INCREASED EXCEPT AS PART OF AN ENGINEERED REALIGNMENT OF A CURVE. THE SHARPNESS OF THE CURVE IN THE CENTRAL BODY WILL BE INCREASED IF THE SPIRALS ARE EXTENDED INTO THE BODY OF THE CURVE.
5. CONTRACT TRACK INSPECTORS WILL FIELD VERIFY THE CHARACTERISTICS OF AT LEAST TWO CURVES EACH MONTH, USING TRACK LEVEL AND STRING LINE, REPORTING THE OBSERVED 62-FOOT CHORD MID-ORDINATE AND SUPERELEVATION AT 15.5-FOOT INTERVALS FOR THE LENGTH OF THE CURVE. THE MANAGERS OF TRACK MAINTENANCE AND THE CONTRACT PROJECT MANAGER WILL REVIEW AND COMPARE THE PRECEDING TWO YEARS OF TRACK GEOMETRY DATA TO THE TRACK CHART DATA, AND WILL ARRANGE FOR FIELD VERIFICATION OF ALIGNMENT BASED UPON THESE REVIEWS.
6. MANAGERS OF TRACK MAINTENANCE MUST RIDE WITH EACH OPERATION OF TRACK GEOMETRY CARS. THEY MUST MONITOR AND ENSURE THAT THE MAINTENANCE CONTRACTOR INVESTIGATES ANY NOTED REPORTS OF WARP OR UNDERBALANCE EXCEPTIONS AND TAKES THE REQUIRED REMEDIAL ACTIONS (SPOT REPAIRS OR REDUCTION IN SPEED). THEY MUST ALSO PROMPTLY REVIEW THE CURVE DATA GENERATED BY THE TRACK GEOMETRY CAR AND COMPARE THE AVERAGE CURVATURE, AVERAGE ELEVATION, LIMITING CURVATURE AND LIMITING ELEVATION FOR EACH CURVE TO THE RECORDS IN THE TRACK CHARTS WHETHER AN EXCEPTION IS NOTED OR NOT.
7. COMPOUND CURVES DESCRIBED IN THE TRACK CHARTS THAT HAVE DIFFERING TRAIN SPEED, SUPERELEVATION, AND/OR CURVATURE NOTED FOR TWO OR MORE SEGMENTS OF ONE CURVE HAVE BEEN APPROVED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN.
8. IF THE ACTUAL SUPERELEVATION AND CURVATURE MEASURED IN THE FIELD BY GEOMETRY CARS OR BY MANUAL INSPECTION PER NOTE 5 ABOVE ARE FOUND TO RESULT IN AN ALLOWABLE SPEED LESS THAN PERMITTED BY TABLES PML AND FML, A TEMPORARY SPEED REDUCTION MUST BE IMPOSED TO THE NEXT LOWER SPEED THAT WILL ACCOMMODATE THE ACTUAL MEASURED SUPERELEVATION. THE TEMPORARY SPEED REDUCTION MUST REMAIN UNTIL THE SUPERELEVATION LIMITS ARE RAISED TO THE VALUES SHOWN IN TABLES P3.5, F2.0, P3.5M AND F2.0M FOR THE DESIGN SPEED.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

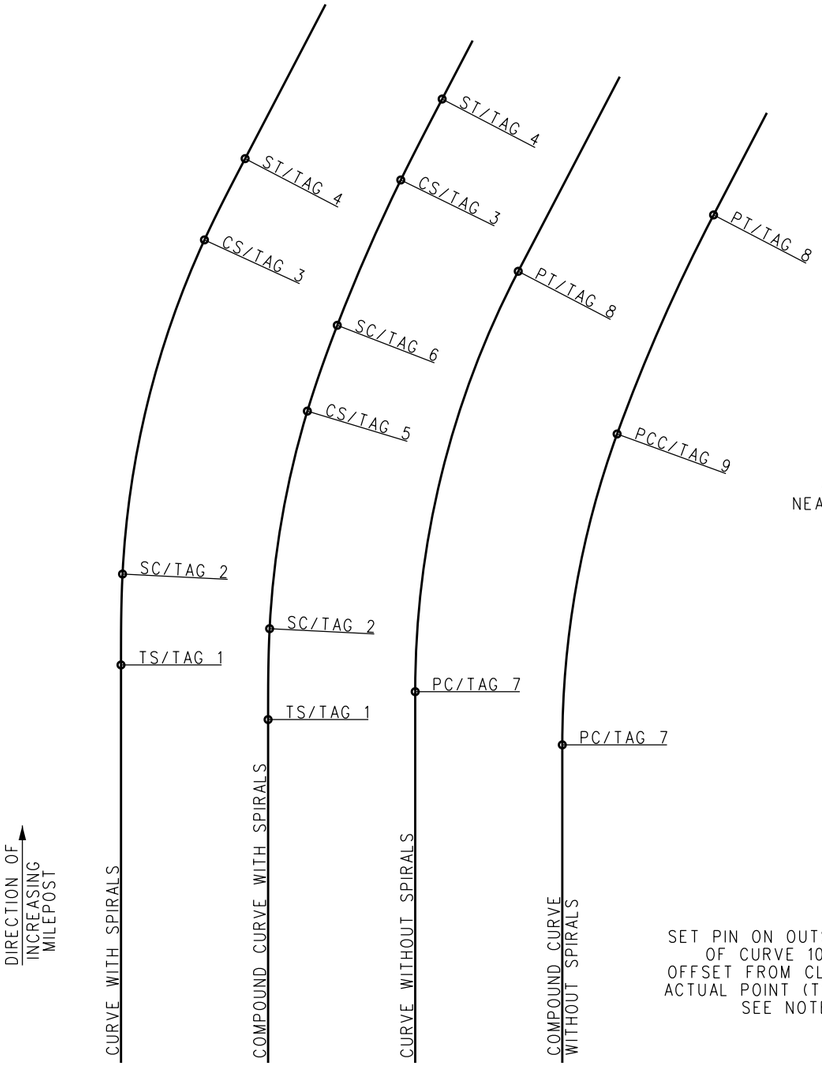
ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

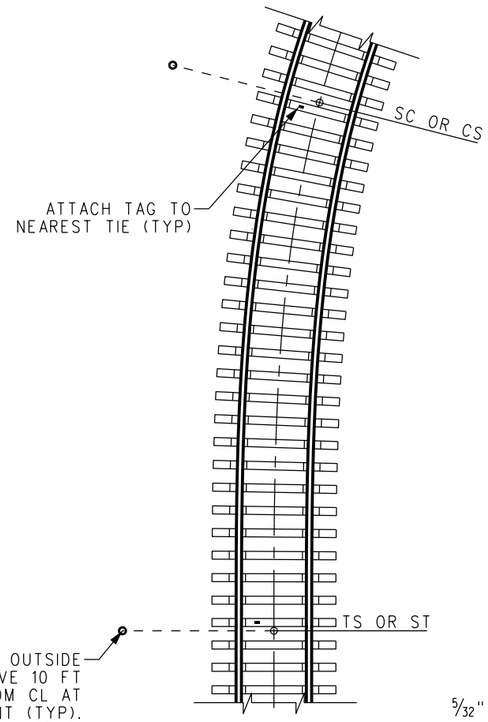
ENGINEERING STANDARDS

TABLE FML - 3.0 INCH UNBALANCED ELEVATION MAINTENANCE LIMIT FOR FREIGHT OPERATIONS

STANDARD 2204
SCALE: NTS
REVISION - SHEET 6 OF 6
CADD FILE: ES2204-06



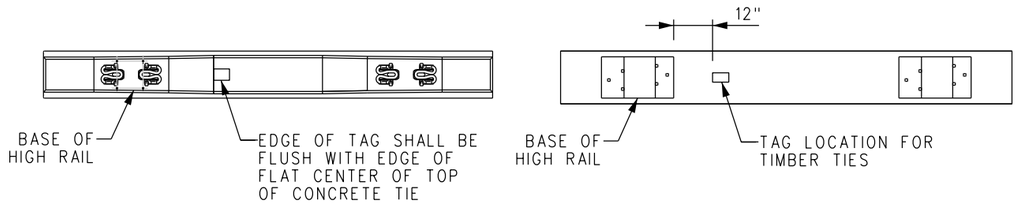
PLAN - LOCATIONS TO BE TAGGED

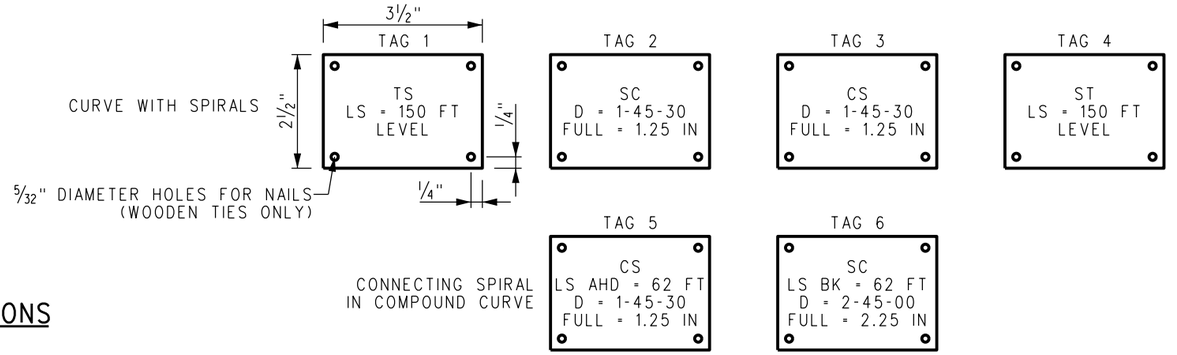


PLAN - TAG AND PIN LOCATIONS

NOTES: (RH CURVE AS SHOWN, LH OPPOSITE)

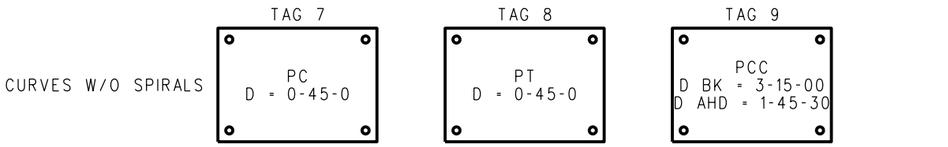
1. TAGS SHALL BE CLEAR ANODIZED ALUMINUM, 16 GAUGE, WITH EMBOSSED LETTERING, AS SHOWN.
2. TAGS SHALL INDICATE NO SUPERELEVATION OF OUTSIDE RAIL AT THE TS AND THE ST AND FULL SUPERELEVATION OF OUTSIDE RAIL IN INCHES AT ALL SC AND CS POINTS.
3. ORIENT TAGS TO BE READ WHILE WALKING IN THE DIRECTION OF INCREASING MILE POSTS.
4. ATTACH TAGS TO CONCRETE TIES WITH MANUS-PRENE 65-A ADHESIVE; TO WOOD TIES WITH GALVANIZED 10 PENNY NAILS OR APPROVED EQUAL.
5. TAGS ATTACHED TO ANY TIE BEING REPLACED SHALL BE REMOVED AND ATTACHED TO THE REPLACEMENT TIE BY THE CONTRACTOR.
6. CURVE INFORMATION WRITTEN ON RAIL BEING REPLACED SHALL BE WRITTEN IN THE SAME LOCATION ON THE REPLACEMENT RAIL BY THE CONTRACTOR.
7. SUPERELEVATED CURVES MUST INCLUDE SPIRALS. CURVES WITHOUT SPIRALS SHALL NOT BE SUPERELEVATED.
8. OFFSET PINS SHALL BE #5 REBAR, AT LEAST 24 IN LONG, DRIVEN VERTICALLY INTO GROUND WITH 1-2 IN REMAINING EXPOSED. PIN SHALL BE MADE HIGHLY VISIBLE WITH BRIGHT ORANGE PAINT AND ORANGE SURVEYOR TAPE. WITH APPROVAL OF SCRRA, THE DESIRED 10 FT OFFSET MAY VARY BASED ON FIELD CONDITIONS OR TO AVOID HAVING THE PIN BE A TRIPPING OR TIRE-PUNCTURE HAZARD.





	TS	SC	CS	ST
HIGH RAIL	LEVEL	FULL = 1.50 IN	FULL = 1.50 IN	LEVEL
LOW RAIL	TS LS = 150 FT	SC D = 1-45-30	D = 1-45-30 CS	LS = 150 FT ST

INFORMATION TO BE PLACED IN WRITING ON GAUGE SIDE WEB OF RAIL WITH PERMANENT METAL MARKER OR PAINT STICK



TAG DETAIL

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 03/31/11

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

SUPERELEVATION TAGS

STANDARD 2206
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2206

UserName•› scrrapw11ics01$ Date Plotted: 3/27/2023 3:07:36 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
FileName•› \\scrrapw11ics01\iCS_pdf_work_dir\87\482_27\ES2206.dgn

SPACING OF TRACKS ON CURVES			
DEGREE OF CURVE	DISTANCE BETWEEN TRACK CENTERS- SUPERELEVATION SAME ON EACH TRACK- SEE NOTE 2		
	MAIN OR RUNNING AND ADJACENT TRACKS		INDUSTRY AND YARD TRACKS
TANGENT	15'-0"	16'-0"	15'-0"
1°	15'-2"	16'-2"	15'-0"
2°	15'-4"	16'-4"	15'-0"
3°	15'-6"	16'-6"	15'-0"
4°	15'-8"	16'-8"	15'-0"
5°	15'-10"	16'-10"	15'-0"
6°	16'-0"	17'-0"	15'-0"
7°	16'-2"	17'-2"	15'-2"
8°	16'-4"	17'-4"	15'-4"
9°	16'-6"	17'-6"	15'-6"
10°	16'-8"	17'-8"	15'-8"
11°	16'-10"	17'-10"	15'-10"
12°	17'-0"	18'-0"	16'-0"
13°	17'-2"	18'-2"	16'-2"
14°	17'-4"	18'-4"	16'-4"
15°	17'-6"	18'-6"	16'-6"
OVER 15°	INCREASE BY ½ INCH PER 15 MINUTES OF CURVE		

NOTES:

1. MINIMUM DISTANCE BETWEEN CENTER LINES OF ADJACENT TRACKS ON ALL NEW CONSTRUCTION SHALL BE AS FOLLOWS: (THIS MINIMUM DISTANCE WILL ALSO APPLY TO EXISTING TRACKS WHEN RESPACING IS AUTHORIZED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN.)
   - A. MAIN TRACKS ——— 15'-0" MINIMUM, 25'-0" WHERE SPACE PERMITS
   - B. MAIN SIDING, RUNNING AND DRILL TRACKS AND ADJACENT TRACK (EXCEPT YARD TRACK) ——— 15'-0"
   - C. LADDER TRACK AND ADJACENT TRACK ——— 20'-0"
   - D. INDUSTRY, YARD AND HOUSE TRACKS ——— 15'-0"
   - E. YARD TRACK AND ADJACENT MAIN OR RUNNING TRACK — 25'-0"
   - F. ON CURVES, TRACK CENTERS AS SHOWN ABOVE SHALL BE INCREASED AS FOLLOWS (ALSO SEE TABLE ON THIS SHEET):
     - a. TRACKS PER NOTES A, B AND E - INCREASE BY ½ INCH PER EACH 15 MINUTES OF CURVE.
     - b. TRACKS PER NOTE D (YARD TRACKS) - INCREASE BY ½ INCH PER EACH 15 MINUTES OF CURVE IN EXCESS OF 6 DEGREES.
2. INCREASED DISTANCES BETWEEN TRACK CENTERS SHALL BE APPLIED IN ½ INCH INCREMENTS. DEGREES OF CURVATURE THAT ARE NOT EXACT 15 MINUTE INCREMENTS SHALL BE ROUNDED UP TO THE NEXT GREATER 15 MINUTE INCREMENT. FOR EXAMPLE, IF TWO CURVED TRACKS ARE TO BE PARALLEL AND THE INNER TRACK IS D=8°15' 10", THEY SHALL BE SEPARATED BASED ON THE ASSUMPTION THAT ITS CURVATURE IS D=8°30'.
3. WHERE ADJACENT TRACK IS ON THE OUTSIDE OF A CURVE AND ITS SUPERELEVATION IS MORE THAN ON THE INSIDE TRACK, DISTANCE BETWEEN THE TRACKS SHALL BE INCREASED THREE INCHES FOR EACH INCH DIFFERENCE IN SUPERELEVATION. THE INCREASE SHALL BE ADDED TO THE AMOUNT SHOWN IN TABLE AT LEFT. WHERE SUCH TRACK HAS THE SAME OR LESS AMOUNT OF SUPERELEVATION, USE SPACING AS SHOWN IN THE TABLE.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 03/31/11

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TRACK CENTER SPACING

STANDARD: 2207
SCALE: NTS
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2207

UserName=> scrrapw11ics01$ Date Plotted: 3/27/2023 3:08:19 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_28\ES2207.dgn

MAXIMUM SPEEDS THROUGH TURNOUTS, SPRING SWITCHES AND SLIP SWITCHES

SUBJECT TO SPEED RESTRICTIONS IMPOSED BY LOCAL CONDITIONS, OTHER THAN THE NUMBER OF THE TURNOUT OR TYPE OF SWITCH, THE FOLLOWING WILL GOVERN THE MAXIMUM SPEEDS PERMITTED THROUGH TURNOUTS AND OVER SPRING SWITCHES AND SLIP SWITCHES:

FREIGHT						
TURNOUT NO	TANGENTIAL		STANDARD		EQUILATERAL (MPH)	DOUBLE SLIP (MPH)
-	SWITCH LENGTH (POINTS)	MPH	SWITCH LENGTH (POINTS)	MPH	-	-
8	-	-	16'-6"	10	N/A	10
9	-	-	16'-6"	10	N/A	N/A
10	21'-6"	15	19'-6"	15	N/A	10
11	-	-	19'-6"	15	N/A	N/A
14	29'-0"	25	26'-0"	20	N/A	N/A
15	-	-	26'-0"	20	N/A	N/A
20	47'-0"	40	39'-0"	35	50	N/A
24	61'-6"	50	39'-0"	40	60	N/A
30	82'-0"	60	-	N/A	80	N/A

PASSENGER						
TURNOUT NO	TANGENTIAL		STANDARD		EQUILATERAL (MPH)	DOUBLE SLIP (MPH)
-	SWITCH LENGTH (POINTS)	MPH	SWITCH LENGTH (POINTS)	MPH	-	-
8	-	-	16'-6"	12	N/A	12
9	-	-	16'-6"	12	N/A	N/A
10	21'-6"	25	16'-6"	20	N/A	15
11	-	-	19'-6"	20	N/A	N/A
14	29'-0"	35	26'-0"	30	N/A	N/A
15	-	-	26'-0"	30	N/A	N/A
20	47'-0"	50	39'-0"	45	70	N/A
24	61'-6"	60	39'-0"	55	85	N/A
30	82'-0"	75	-	N/A	110	N/A

NOTE:

1. MAXIMUM SPEEDS WERE CALCULATED BASED ON TURNOUT GEOMETRY WITH Ea = 0" AND ASSUMED Eu = 3.5" FOR PASSENGER TRAINS AND Eu = 2.0" FOR FREIGHT TRAINS.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

SPEED THROUGH TURNOUTS

STANDARD 2208
SCALE: NTS
REVISION -
SHEET 1 OF 1
CADD FILE: ES2208

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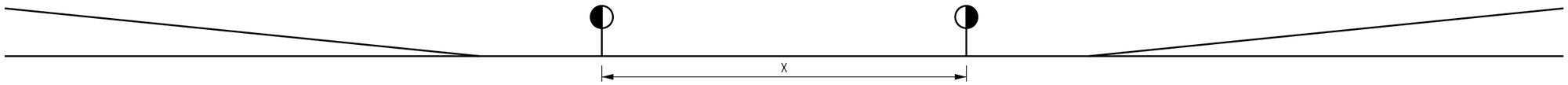
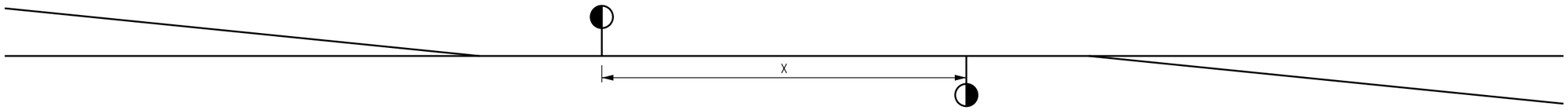
FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_29\ES2208.dgn

FACING TURNOUTS OF OPPOSITE HAND



FROG NO	DESIRABLE X (FT)	MINIMUM X (FT)
8, 10	82	46
14	122	86
20	N/A	118
24	N/A	150

FACING TURNOUTS OF LIKE HAND



FROG NO	DESIRABLE X (FT)	MINIMUM X (FT)
8, 10	82	52
14	125	90
20	N/A	122
24	N/A	150

NOTES:

1. DESIGN SPEED, SIGNAL SPACING AND CIRCUITS WILL GOVERN AT LOCATIONS WHERE INSULATED JOINTS ARE REQUIRED.
2. ANY DISTANCE BETWEEN FACING POINTS OF SWITCH LESS THAN THE MINIMUMS GIVEN SHALL REQUIRE THE APPROVAL OF THE SCRRA ASSISTANT DIRECTOR, DESIGN.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

FACING POINT TURNOUT ARRANGEMENT AND SPACING

STANDARD 2209
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2209

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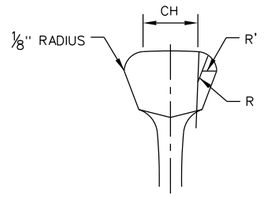
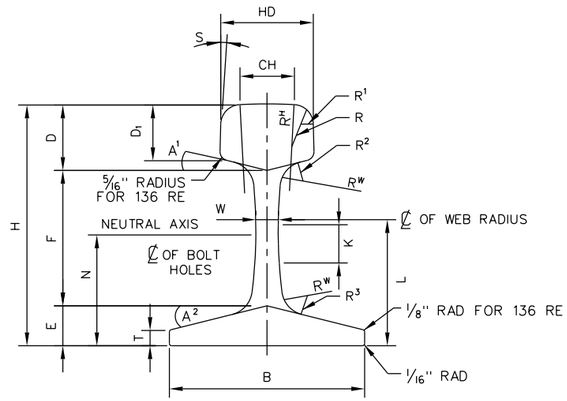
DIMENSIONS	RAIL SECTION	HEIGHT OF RAIL	WIDTH OF BASE	WIDTH OF HEAD	WEB THICK-NESS	DEPTH OF HEAD		FISHING DEPTH	DEPTH OF BASE	THICKNESS AT EDGE OF BASE	HEAD ANGLE	BASE ANGLE	SLOPE OF HEAD	HEAD RADIUS	CHORD OF HEAD RADIUS	HEAD CORNER RADIUS		HEAD & WEB FILLET	WEB & BASE FILLET	WEB RADIUS	BOTTOM OF RAIL TO			DIAM. OF BOLT HOLES	RAIL END DRILLING	
						AT CENTER	AT CORNER														℄ OF WEB RADIUS	NEUT. AXIS	℄ OF BOLT HOLES			
		INCHES H	INCHES B	INCHES HD	INCHES W	INCHES D	INCHES D^1	INCHES F	INCHES E	INCHES T	INCHES A^1	INCHES A^2	INCHES S	INCHES R^H	INCHES CH	INCHES R	INCHES R^1	INCHES R^2	INCHES R^3	INCHES R^W	INCHES L	INCHES N	INCHES C	INCHES K	INCHES X	INCHES Y
	132-LB. HEAD FREE (MAINTENANCE ONLY)	7 5/16	6	2 3/32	2/32	1 15/16	25/32	4 3/16	1 3/16	7/16	60½°	1:4	1:40	14	1 13/16	1	3/8	½	¾	10-TOP 23-BOT.	4 1/4	3.30	3 9/32"	1 1/8"	6½"	2½"
	136-LB. RE	7 5/16	6	2 15/16	1 1/16	1 15/16	1 9/16	4 3/16	1 3/16	7/16	1:4	1:4	1:40	8	1 13/32	1 1/4	9/16	5/16 & ¾	¾	8-TOP 20-BOT.	3 7/8	3.35	3 3/32	1 1/8"	6"	3½"

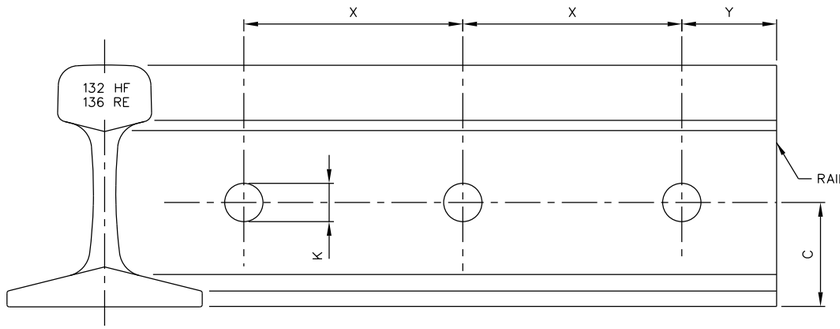
PROPERTIES	RAIL SECTION	WEIGHT PER YARD	NET TONS PER MILE OF TRACK	TRACK MILES PER 1000 NET TONS	AREA OF				MOMENT OF INERTIA	SECTION MODULUS		RATIOS	
					SECTION	HEAD	WEB	BASE		HEAD	BASE	MOM. OF INERTIA TO AREA	SEC. MOD. OF HEAD TO AREA
		POUNDS			SQ. IN.	SQ. IN.	SQ. IN.	SQ. IN.	$INCHES^4$	$INCHES^3$	$INCHES^3$		
	136-LB. RE	135.88	239.15	4.18	13.32	4.81	3.63	4.86	94.21	23.73	28.18	7.07	1.78



HEAD FREE SECTION



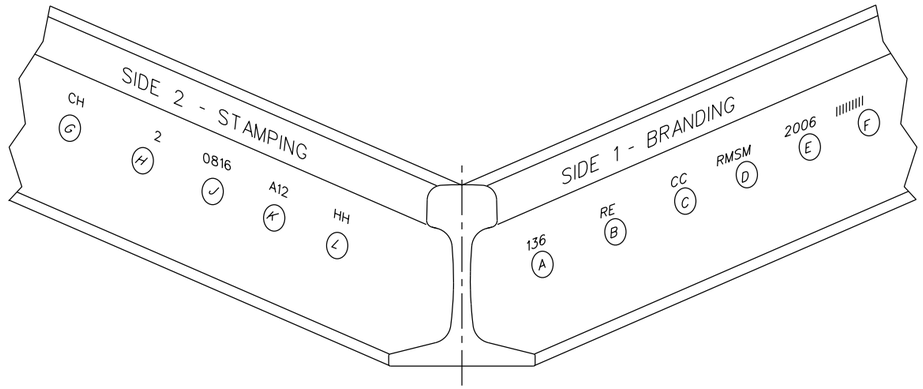
RAIL SECTION



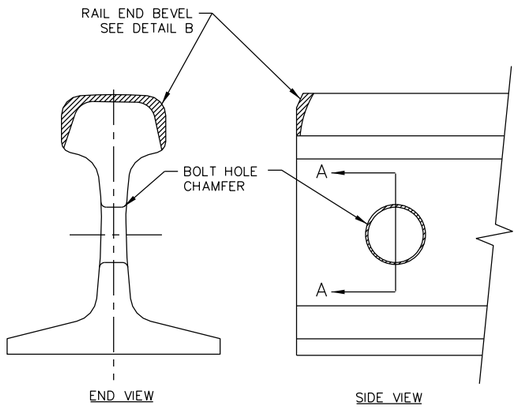
RAIL DRILLING FOR JOINTS

NOTE:

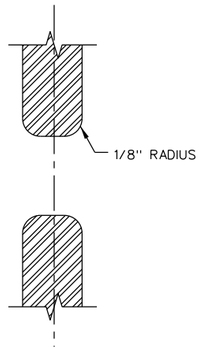
END OF RAIL DRILLING SHOWN FOR INFORMATION ONLY. END HOLE IS NOT TYPICALLY DRILLED TO FACILITATE RAIL WELDING.



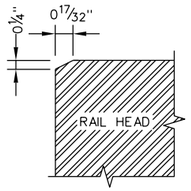
RAIL MARKINGS



RAIL CHAMFERING AND BEVELING



BOLT HOLE CHAMFER SECTION A-A



RAIL END BEVEL DETAIL B

RAIL MARKING NOTES

SIDE 1: BRANDING SHALL BE ROLLED IN RAISED CHARACTERS ON THE SIDE OF THE WEB OF EACH RAIL IN ACCORDANCE TO AREMA.

- A = WEIGHT OF RAIL
- B = SECTION
- C = HYDROGEN REDUCTION METHOD (CC = CONTROL COOLED, VT = VACUUM TREATED)
- D = MANUFACTURER (EG, RMSM = ROCKY MOUNTAIN STEEL MILLS)
- E = YEAR ROLLED
- F = MONTH ROLLED

SIDE 2: THE WEB OF OPPOSITE SIDE OF THE RAIL SHALL BE HOT STAMPED IN ACCORDANCE TO AREMA.

- G = END HARDENED
- H = HEARTH NUMBER
- J = HEAT NUMBER
- K = INGOT NUMBER
- L = HEAD HARDENED, MAY BE DESIGNATED ON STAMP OR BRAND SIDE

REV.	DATE	DESCRIPTION	DES.	ENG.
A	04-18-19	REVISED RAIL MARKINGS, PROPERTIES & DIMENSION TABLE	JK	AT

DRAWN BY: A. CARLOS DATE: 06/08/07

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

DATA FOR STANDARD RAIL SECTIONS

STANDARD 2301
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2301

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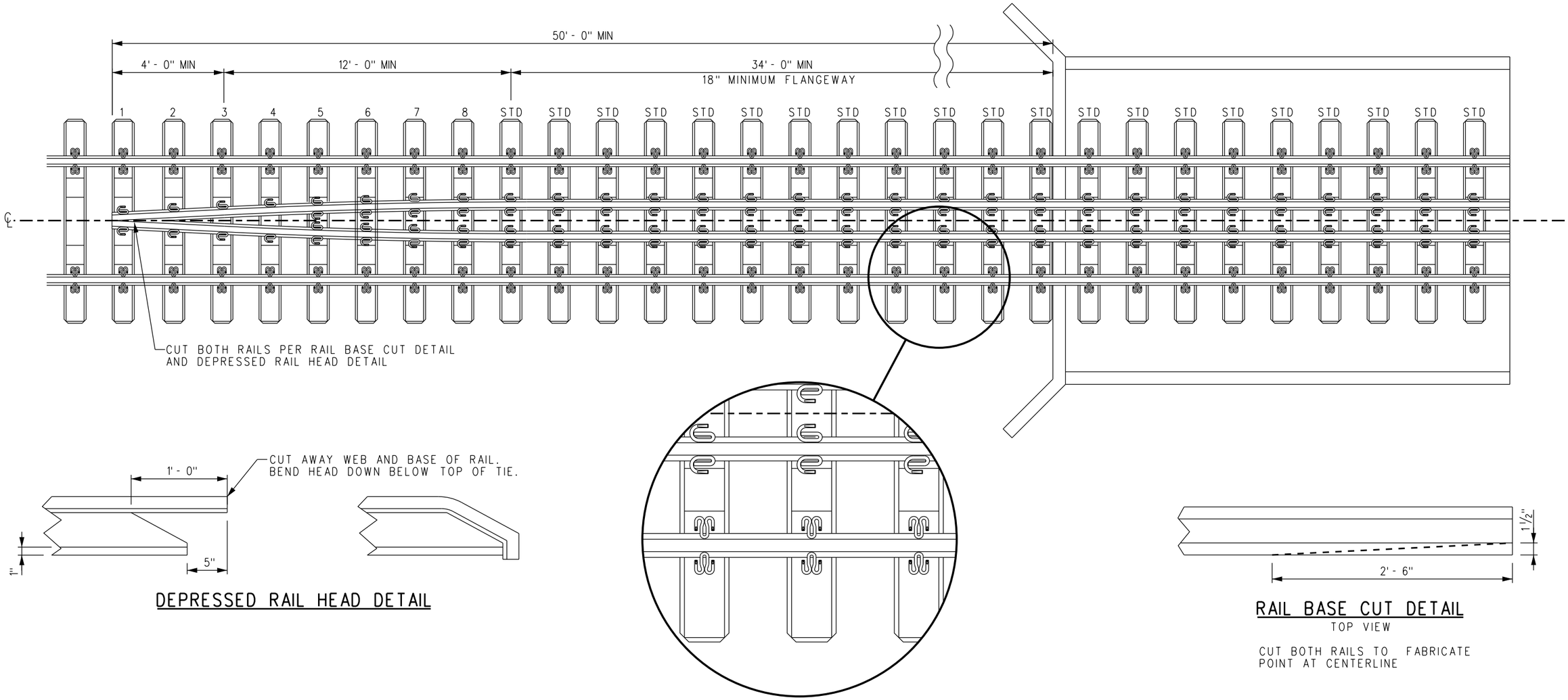

DEPRESSED RAIL HEAD DETAIL

RAIL BASE CUT DETAIL

TOP VIEW

CUT BOTH RAILS TO FABRICATE
POINT AT CENTERLINE

NOTES:

1. INNER GUARD RAILS ON BRIDGES SHALL BE REQUIRED FOR ALL SPANS WHERE EXPOSED STRUCTURAL STEEL IS PRESENT ABOVE T/R AND IS SUBJECTED TO STRUCTURAL DAMAGE BY DERAILED EQUIPMENT. INNER GUARD RAILS SHALL BE INSTALLED ON BRIDGES WHERE INDIVIDUAL SPANS ARE OVER 100 FEET IN LENGTH OR WHERE THE ENTIRE STRUCTURE IS OVER 800 FEET IN LENGTH AND AT LEAST ONE SPAN CROSSES OVER A WATERWAY THAT NORMALLY CONTAINS WATER AT LEAST 15 FEET DEEP. INNER GUARD RAILS SHALL EXTEND 50 FEET BEYOND THE SPAN OR SPANS TO BE PROTECTED.
2. INNER GUARD RAILS SHALL BE INSTALLED ON ANY OTHER BRIDGE AS DIRECTED BY SCRRA.
3. INSIDE GUARDRAILS ARE NOT REQUIRED ON BRIDGES UNTIL BRIDGE OR BRIDGE DECK IS REPLACED OR RUNNING RAIL IS REPLACED ACROSS BRIDGE UNLESS DIRECTED BY SCRRA.
4. INSIDE GUARD RAILS MAY BE CONSTRUCTED USING RAIL NOT LESS THAN 23 LBS LIGHTER OR NO LARGER THAN RUNNING RAILS. IF GUARD RAIL HAS 5½" BASE, USE MODIFIED PLATES FOR 5½" BASE SCRRA ES2371.
5. ON CONCRETE TIES, GUARD RAILS SHALL BE FASTENED TO EACH TIE.
6. GUARD RAIL JOINTS, IF PRESENT, SHALL BE FULLY BOLTED USING JOINT BARS.
7. THE QUANTITY OF STD PLATES ON CONCRETE TIES WILL VARY DEPENDING ON THE NUMBER OF TIES. THEY ARE TO BE ORDERED AS NEEDED. PLATES 1 THROUGH 8 COME AS TWO SETS AND ARE TO BE ROTATED 180° ON OPPOSITE ENDS.

REFERENCE DRAWINGS:
FOR PLATES SEE SCRRA ES2371
FOR CONCRETE TIE SEE SCRRA ES2406 OR ES2407
FOR SCREW AND WASHER SEE SCRRA ES2356

REV.	DATE	DESCRIPTION	DES.	ENG.
A	04-18-19	REVISED NOTES	JK	AT

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

INSIDE GUARD RAILS FOR CONCRETE TIES

STANDARD 2302
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2302

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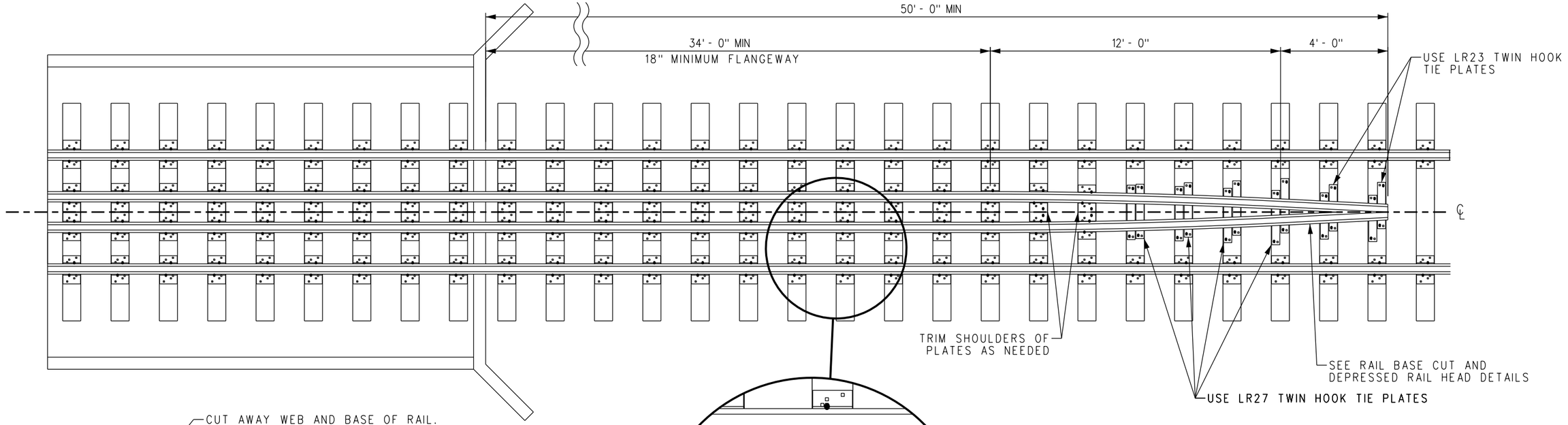
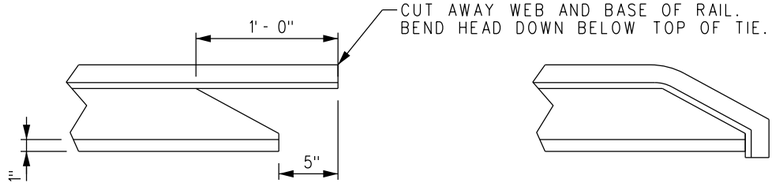
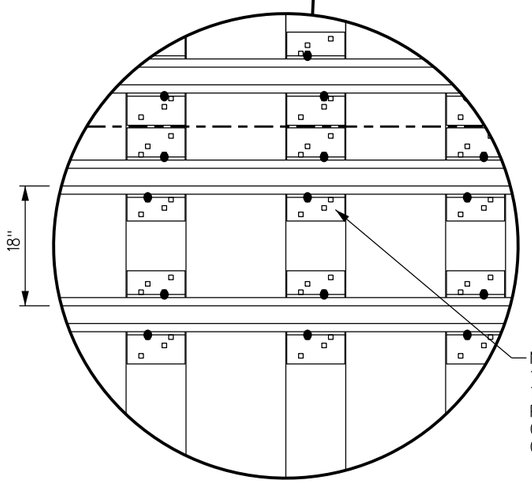
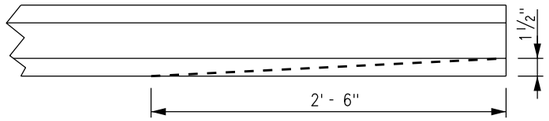




DEPRESSED RAIL HEAD DETAIL





RAIL BASE CUT DETAIL
TOP VIEW

NOTES:

1. INNER GUARD RAILS ON BRIDGES SHALL BE REQUIRED FOR ALL SPANS WHERE EXPOSED STRUCTURAL STEEL IS PRESENT ABOVE T/R AND IS SUBJECTED TO STRUCTURAL DAMAGE BY DERAILED EQUIPMENT. INNER GUARD RAILS SHALL BE INSTALLED ON BRIDGES WHERE INDIVIDUAL SPANS ARE OVER 100 FEET IN LENGTH OR WHERE THE ENTIRE STRUCTURE IS OVER 800 FEET IN LENGTH AND AT LEAST ONE SPAN CROSSES OVER A WATERWAY THAT NORMALLY CONTAINS WATER AT LEAST 15 FEET DEEP. INNER GUARD RAILS SHALL EXTEND 50 FEET BEYOND THE SPAN OR SPANS TO BE PROTECTED.
2. INNER GUARD RAILS SHALL BE INSTALLED ON ANY OTHER BRIDGE AS DIRECTED BY SCRRA.
3. INSIDE GUARDRAILS ARE NOT REQUIRED ON BRIDGES UNTIL BRIDGE OR BRIDGE DECK IS REPLACED OR RUNNING RAIL IS REPLACED ACROSS BRIDGE
4. INSIDE GUARD RAILS MAY BE CONSTRUCTED USING RAIL NOT LESS THAN 23 LBS LIGHTER OR NO LARGER THAN RUNNING RAILS. IF GUARD RAIL HAS 5½" BASE, USE MODIFIED PLATES FOR 5½" BASE SCRRA ES2371.
5. ON WOOD TIES, GUARD RAILS SHALL BE FULLY PLATED AND SPIKED.
6. GUARD RAIL JOINTS, IF PRESENT, SHALL BE FULLY BOLTED USING JOINT BARS.
7. ON TANGENT TRACK, SPIKE THE INSIDE GUARD RAIL WITH TWO SPIKES PER PLATE ON EACH RAIL OF THE TANGENT PORTION AND THREE SPIKES ON EACH RAIL OF THE CURVED PORTION. ON CURVED TRACK, SPIKE THE ENTIRE GUARD RAIL WITH THREE SPIKES PER PLATE ON EACH RAIL.
8. ON WOOD TIES, BOX ANCHOR TWO TIES NEAR THE CENTER OF BRIDGE TO RESTRICT LONGITUDINAL MOVEMENT OF GUARD RAIL.

REFERENCE DRAWINGS:
FOR PLATES SEE SCRRA ES2451 & ES2452
FOR SCREW SPIKE SEE SCRRA ES2355

REV.	DATE	DESCRIPTION	DES.	ENG.
A	04-18-19	REVISED NOTES	JK	AT

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

INSIDE GUARD RAIL FOR WOOD TIES

STANDARD 2304
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2304

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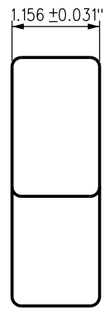
RAIL BASE SIZE	A
5½"	5.625"
6"	6.125"

ANCHOR NOTES:

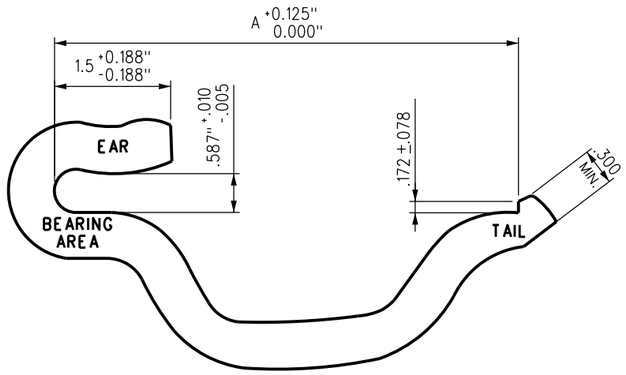
1. MATERIAL FOR RAIL ANCHOR TO BE HIGH CARBON STEEL.
2. MATERIAL FOR RAIL ANCHOR TO BE HEAT TREATED TO RC 34-47, TARGET RANGE RC 39-44.
3. ALL DIMENSIONS ARE MINIMUM UNLESS OTHERWISE SPECIFIED.
4. TYPICAL CHEMISTRY, CARBON .58-.90, MANGANESE .7-1.1, SILICON .5 MAXIMUM.
5. RAIL ANCHORS SHALL CONFORM TO AREMA MANUAL, CHAPTER 5, PART 7, SECTION 7.1.

NOTES:

1. RAIL ANCHORS SHALL NOT BE PLACED AGAINST JOINT TIES, INCLUDING INSULATED JOINTS.
2. WHILE THE NUMBER OF ANCHORS REQUIRED MAY VARY WITH LOCAL CONDITIONS, STANDARD IS 16 ANCHORS PER RAIL LENGTH OF 39 FT OR 24 TIES.
3. AT LOCATIONS WHERE ADDITIONAL ANCHORS ARE REQUIRED, SCRRA ENGINEER WILL DETERMINE THE NUMBER OF ANCHORS REQUIRED.
4. RAIL ANCHOR SHALL BE DRIVEN ON BASE OF RAIL UNTIL LOCKING NOTCH ENGAGES EDGE OF OPPOSITE FLANGE. ANCHORS MUST NOT BE DRIVEN ALONG THE RAIL. IF ADJUSTMENTS ARE NECESSARY, REMOVE AND RE-APPLY.
5. FOR CONTINUOUS WELDED RAIL, APPLICATION OF ANCHORS SHALL BE IN ACCORDANCE WITH SCRRA ES2351-02.
6. TURNOUTS THAT ARE NOT FASTENED WITH ELASTIC CLIPS ARE TO BE FULLY BOX ANCHORED EXCEPT AT JOINTS OR LOCATIONS WHERE ANCHOR WILL INTERFERE WITH SWITCH OPERATION.
7. ELASTIC FASTENERS WILL SATISFY RAIL ANCHORAGE NEEDS. USE OF ANCHORS IN COMBINATION WITH ELASTIC FASTENERS SHALL BE DONE ONLY AS DIRECTED BY SCRRA ENGINEER.
8. FOR JOINTED RAIL IN LENGTHS IN EXCESS OF 39 FT, CONTINUE THE PATTERN OF BOX ANCHORS APPLIED TO EACH RAIL ON EVERY THIRD TIE, SKIPPING AND ADJUSTING FOR JOINT TIES.
9. ANCHOR PATTERN IS EVERY THIRD TIE TO BE BOX ANCHORED SKIPPING TIES WHERE JOINT BAR IS PRESENT. TIES NUMBER 2, 11, 14, AND 23 MAY BE IMPACTED BY JOINT BAR. IF THIS OCCURS, ANCHOR ADJACENT TIE INSTEAD TO MAINTAIN 8 BOX ANCHORED TIES PER 39 FT.
10. EPOXY BONDED INSULATED JOINTS ARE TO BE CONSIDERED AS CONTINUOUS LENGTHS OF RAIL AND NOT AS "JOINTS" FOR THE PURPOSES OF SELECTING ANCHOR PATTERNS.

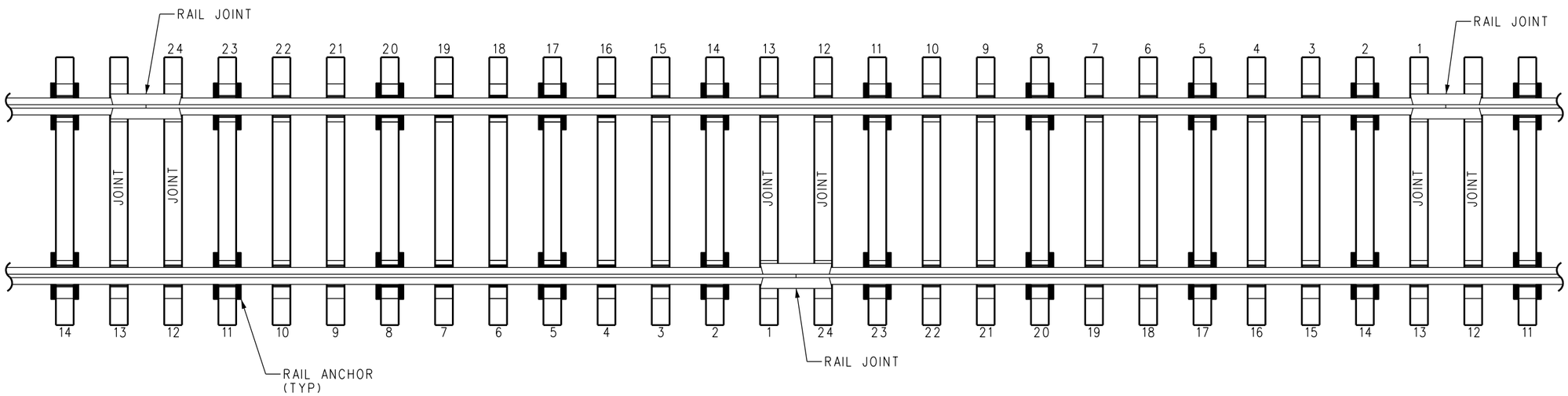


FRONT VIEW



SIDE VIEW

RAIL ANCHOR



16 ANCHORS PER 39 FT RAIL

REV.	DATE	DESCRIPTION	DES.	ENG.
A	02-28-13	ADDED RAIL ANCHOR DETAILS	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

RAIL ANCHOR APPLICATIONS TO JOINTED RAIL

STANDARD: 2351
SCALE: NTS
REVISION: A
SHEET: 1 OF 5
CADD FILE: ES2351-01

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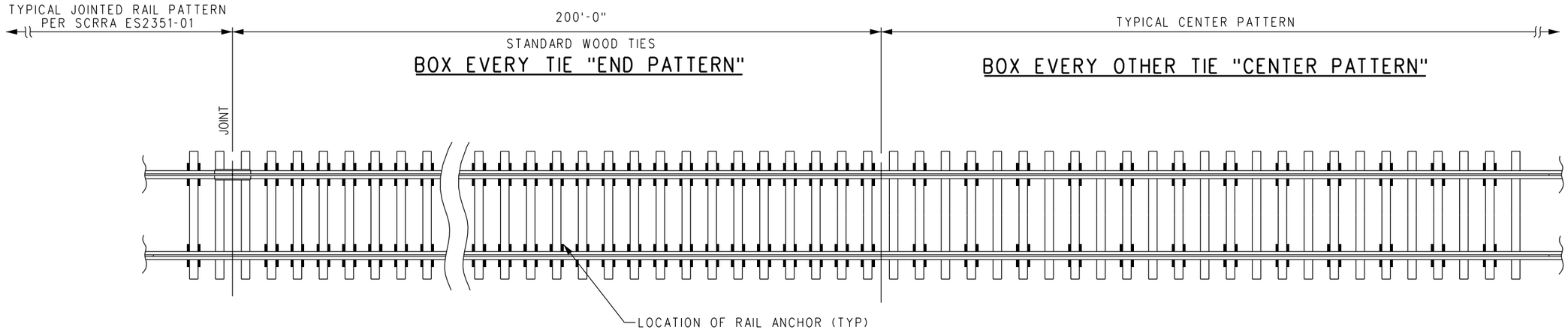
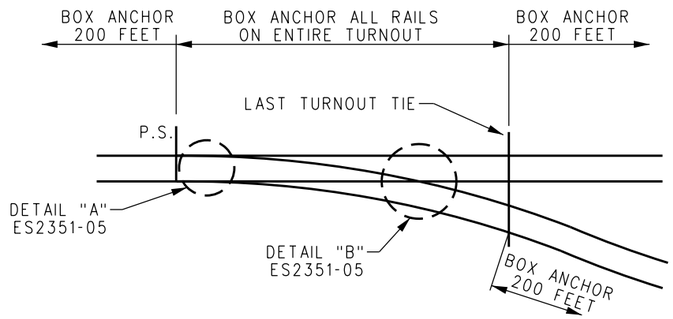




CONTINUOUS WELDED RAIL TURNOUTS ON WOOD TIES

NOTES:

1. END PATTERN IS TO BE APPLIED TO BOTH RAILS WHEN JOINT IS ON ONLY ONE RAIL.
2. FOR JOINTED RAIL, APPLICATION OF ANCHORS SHALL BE IN ACCORDANCE WITH DRAWING ES2351-01.
3. BOX ANCHOR EVERY TIE FOR A DISTANCE OF 200 FT AHEAD AND BEHIND TURNOUTS, ROAD CROSSINGS, BRIDGES, AND RAILROAD DIAMOND CROSSINGS.
4. FULLY BOX ANCHOR HOT BOX OR DRAGGING EQUIPMENT DETECTORS FOR 200 FT IN EACH DIRECTION.
5. EPOXY BONDED INSULATED JOINTS DO NOT REQUIRE END PATTERNS.
6. RAIL ANCHORS MUST NOT BE PLACED AGAINST JOINT TIES, INCLUDING INSULATED JOINTS.
7. AT LOCATIONS WHERE ADDITIONAL ANCHORS ARE REQUIRED, SCRRA WILL DETERMINE THE NUMBER OF ANCHORS REQUIRED.
8. RAIL ANCHOR SHALL BE DRIVEN ON BASE OF RAIL UNTIL LOCKING NOTCH ENGAGES EDGE OF OPPOSITE FLANGE. ANCHORS MUST NOT BE DRIVEN ALONG THE RAIL. IF ADJUSTMENTS ARE NECESSARY, REMOVE AND RE-APPLY.
9. ELASTIC FASTENERS WILL SATISFY RAIL ANCHORAGE NEEDS. USE OF ANCHORS IN COMBINATION WITH ELASTIC FASTENERS SHALL BE DONE ONLY AS DIRECTED BY SCRRA.
10. IF FIELD WELD INTERFERES WITH TYPICAL END PATTERN, ANCHOR MAY BE OMITTED. IF ANCHOR IS OMITTED, DO NOT APPLY ANCHOR TO SAME SIDE OF TIE ON OPPOSITE RAIL, AS ANCHOR PATTERN MUST BE A MIRROR PATTERN TO AVOID SKEWING TIES.
11. APPLIES TO ALL TRACKS-ML, SIDING, AND YARD WITH CONTINUOUS WELDED RAIL.

REV.	DATE	DESCRIPTION	DES.	ENG.
A	04/18/19	REVISED PLAN & NOTES	JK	AT

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

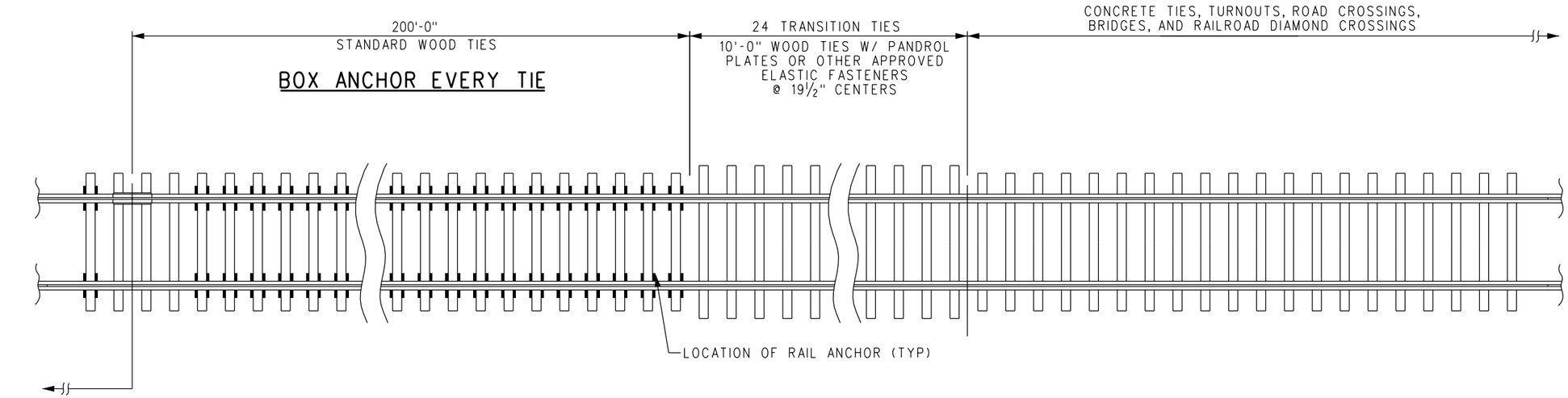
RAIL ANCHOR APPLICATIONS
FOR CONTINUOUS WELDED RAIL
WITH WOOD CROSS TIES

STANDARD: 2351
SCALE: NTS
REVISION: A
SHEET: 2 OF 5
CADD FILE: ES2351-02

UserName-> scrrapw1ics01$ Date Plotted: 3/27/2023 3:08:49 PM Plot Driver-> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName-> \\scrrapw1ics01\iCS_pdf_work_dir\87\482_35\ES2351-02.dgn

NOTES:

1. TRANSITION TIES TO CONSIST OF 24, 10'-0" LONG, WOOD TIES WITH PANDROL TYPE, GALVANIZED CLIPS OR EQUAL.
2. BOX ANCHORS ARE REQUIRED FOR 200 FT IN THE WOOD TIES AFTER TRANSITION TIES.
3. RAIL ANCHORS MUST NOT BE PLACED AGAINST JOINT TIES, INCLUDING INSULATED JOINTS. GLUE LAMINATED INSULATED JOINTS ARE NOT CONSIDERED AS JOINTS AND WILL BE FULLY ANCHORED.
4. AT LOCATIONS WHERE ADDITIONAL ANCHORS ARE REQUIRED, SCRRA WILL DETERMINE THE NUMBER OF ANCHORS REQUIRED.
5. RAIL ANCHOR SHALL BE DRIVEN ON BASE OF RAIL UNTIL LOCKING NOTCH ENGAGES EDGE OF OPPOSITE FLANGE. ANCHORS MUST NOT BE DRIVEN ALONG THE RAIL. IF ADJUSTMENTS ARE NECESSARY, REMOVE AND RE-APPLY.
6. ELASTIC FASTENERS IN WOOD TIE ZONE WILL SATISFY RAIL ANCHORAGE NEEDS. USE OF ANCHORS IN COMBINATION WITH ELASTIC FASTENERS SHALL BE DONE ONLY AS DIRECTED BY SCRRA.
7. APPLIES TO ALL TRANSITIONS FROM FIXED POINTS SUCH AS, TURNOUTS, ROAD CROSSINGS, BRIDGES, RAILROAD DIAMOND CROSSINGS, AND CONCRETE TO WOOD TIE TRANSITIONS ON MAINLINE, AND SIDING TRACKS.



REV.	DATE	DESCRIPTION	DES.	ENG.
A	04/18/19	REVISED NOTES & TITLE	JK	AT

DRAWN BY: A. CARLOS DATE: 10/01/03

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

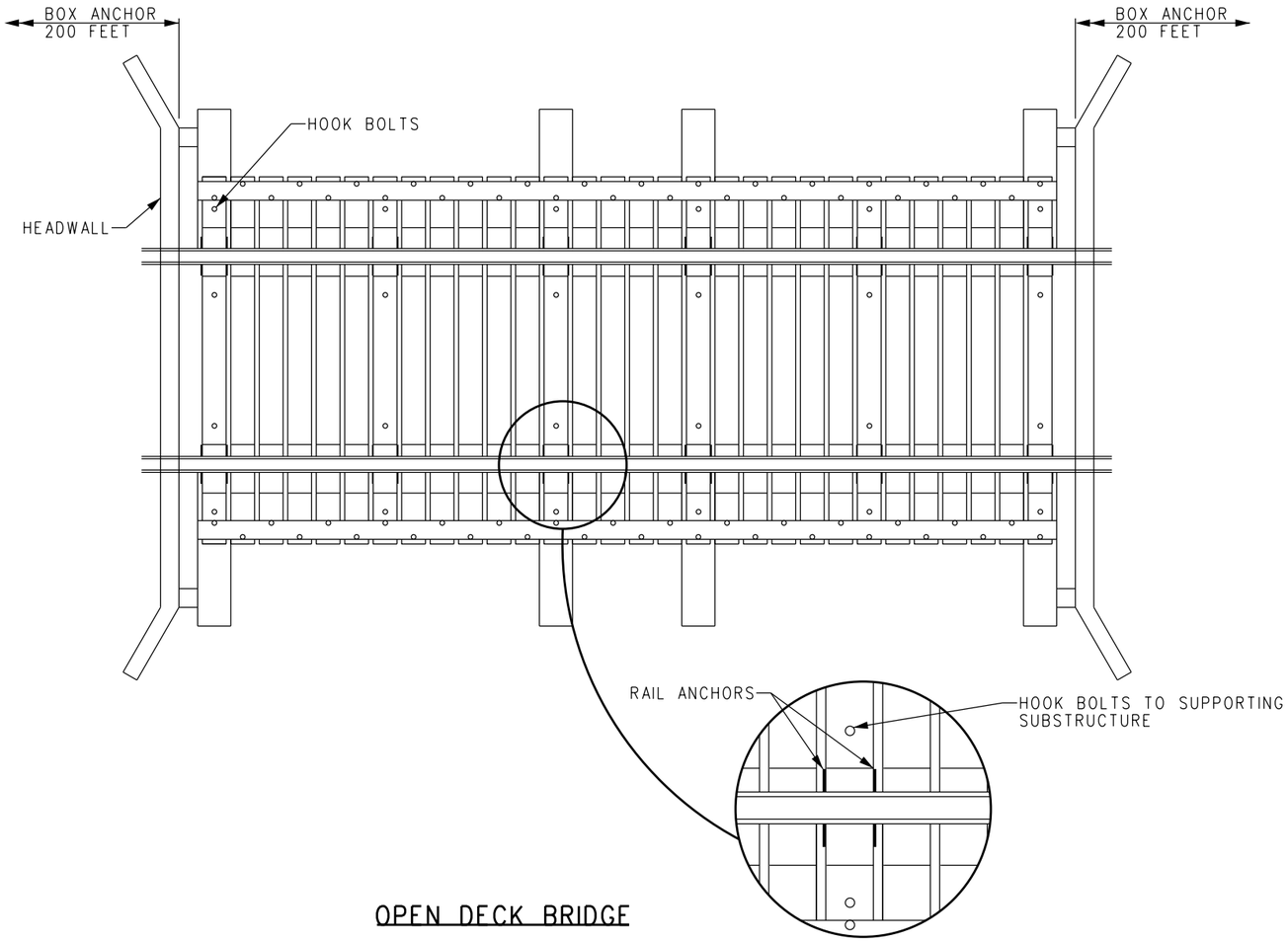
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

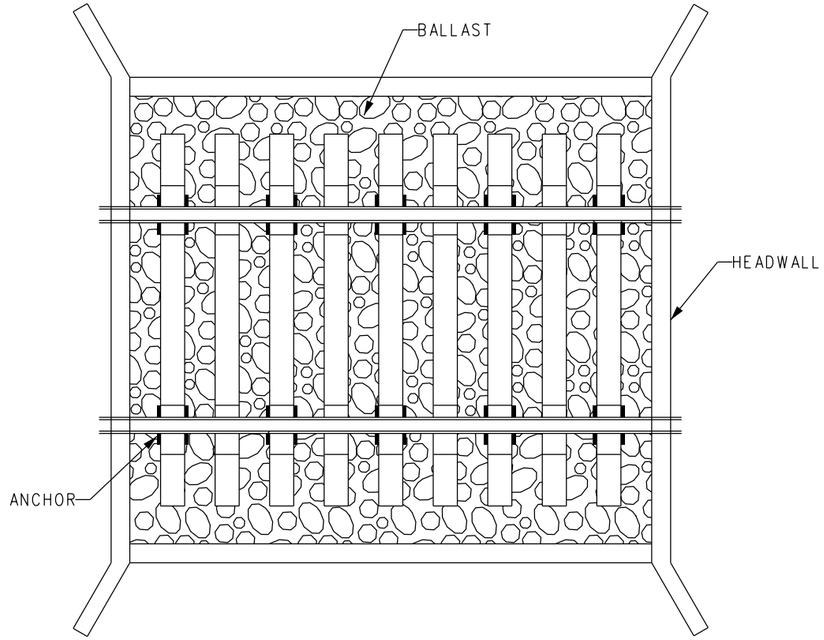
RAIL ANCHOR APPLICATIONS FOR CONTINUOUS WELDED RAIL - TRANSITION FROM WOOD TO CONCRETE CROSS TIES OR A FIXED POINT

STANDARD: 2351
SCALE: NTS
REVISION: A
SHEET: 3 OF 5
CADD FILE: ES2351-03

UserName=> scrrapw1ics01$ Date Plotted: 3/27/2023 3:09:15 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName=> \\scrrapw1ics01\iCS_pdf_work_dir\87\482_36\ES2351-03.dgn



OPEN DECK BRIDGE



BALLAST DECK BRIDGE

FOR ANCHORING RAIL ON BALLAST DECK BRIDGES, BRIDGE HAS NO IMPACT ON PATTERN, USE PATTERN REVISIONS IN ES2351-02.

OPEN DECK BRIDGES:

1. BOX ANCHOR EVERY TIE FOR 200 FEET AWAY FROM HEADWALL ON ALL OPEN DECK BRIDGE APPROACHES. USE ANCHOR PATTERN ON SCRRA ES2351-02.
2. ALL TIES ACROSS OPEN DECK BRIDGES WHICH ARE ANCHORED TO SUBSTRUCTURE WILL BE BOX ANCHORED.
3. ONLY APPLIES TO BRIDGE 200' OR LONGER.

NOTES:

1. EXISTING ANCHOR PATTERNS MAY REMAIN UNTIL RAIL RELAY IS COMPLETE.
2. SECOND HAND ANCHORS MAY BE USED ON ALL INDUSTRY AND YARD TRACKS.
3. AS A GENERAL RULE, TRACK WITH ELASTIC FASTENERS DOES NOT REQUIRE ANCHORING. HOWEVER, IF THE SCRRA ENGINEER DEEMS IT NECESSARY TO PROPERLY RESTRAIN THE RAIL FROM MOVING LONGITUDINALLY, RAIL ANCHORS SHALL BE INSTALLED.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

RAIL ANCHOR PATTERNS FOR CWR ON BRIDGES

STANDARD: 2351
SCALE: NTS
REVISION: - SHEET: 4 OF 5
CADD FILE: ES2351-04

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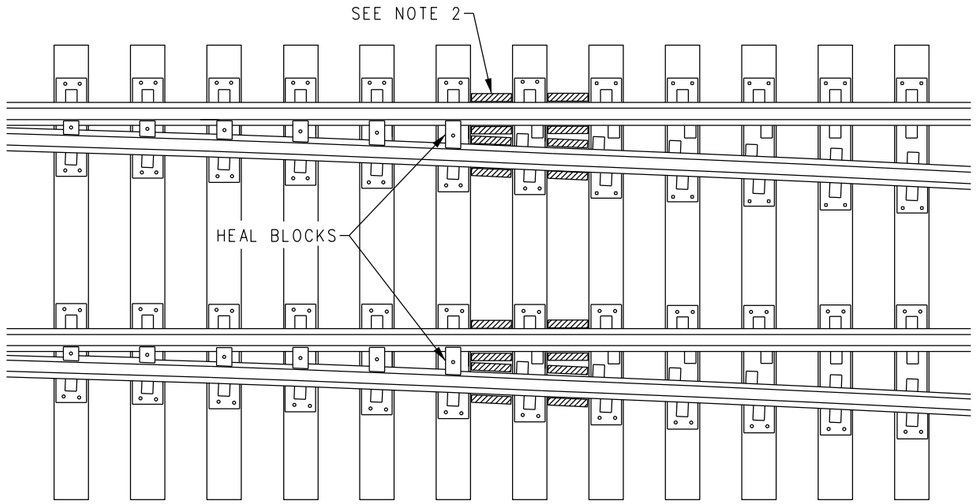
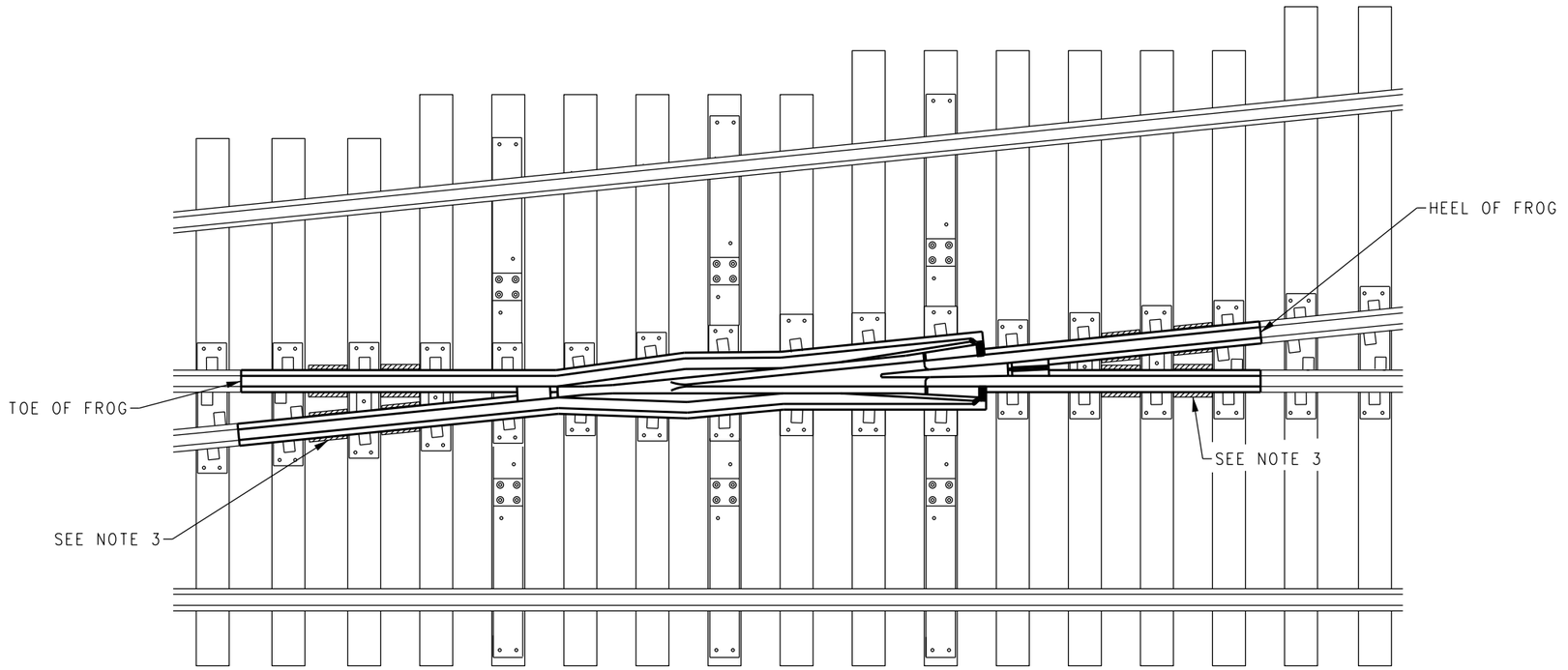


DETAIL "A"

NOTES:

1. BOX ANCHOR EVERY TIE FOR A DISTANCE OF 200 FEET AHEAD OF AND BEHIND TURNOUTS ON MAIN TRACK AND TO THE CLEARANCE POINT ON SIDE TRACK OF TURNOUT FOR ALL SWITCHES IN CWR TERRITORY. ALSO BOX ANCHOR EVERY TIE AS ABOVE FOR RAILROAD DIAMOND CROSSINGS.
2. BOX ANCHOR TWO CRIBS AFTER HEEL BLOCKS. PLACE SUFFICIENT NUMBER OF BOX ANCHORS TO FILL CRIB FROM TIE TO TIE.
3. BOX ANCHOR TWO CRIBS AT TOE AND HEEL OF FROGS. PLACE SUFFICIENT NUMBER OF BOX ANCHORS TO FILL CRIB FROM TIE TO TIE.



DETAIL "B"

X	XX/XX/XX	REVISION	XX	XX
REV.	DATE	DESCRIPTION	DES.	ENG.

DRAWN BY: A. CARLOS DATE: 02/28/2019

PRINCIPAL ENGINEER, DESIGN & STANDARDS

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SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

DETAILS FOR CONTINUOUS WELDED RAIL TURNOUTS ON WOOD TIES

STANDARD 2351
SCALE: NTS
REVISION | SHEET 5 OF 5
CADD FILE: ES2351-05

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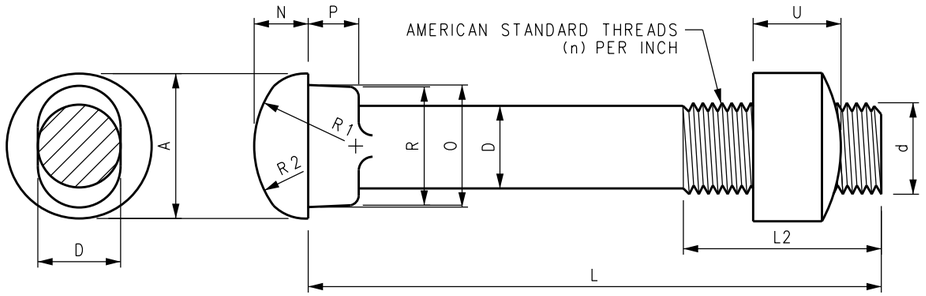
FileName•› \\scrrapw11ics01\iCS_pdf_work_dir\87\482_109\ES2351-05.dgn

NOTES:

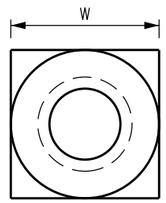
1. BOLTS AND NUTS TO BE MADE OF CLASS B STEEL.
2. NOMINAL SIZE OF BOLT IS THE THREAD DIAMETER (d).
3. WASHERS TO CONFORM TO AREMA SPECIFICATIONS.

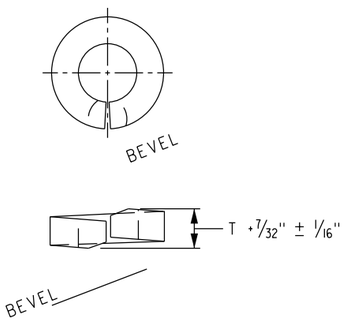
DIMENSION TABLE (INCHES)

WEIGHT AND SECTION OF RAIL	BOLT												NUT		WEIGHT EACH (BOLT AND NUT)	NUMBER OF BOLTS PER 200 LB KEG	SPRING WASHER		
	THREADS			BODY		HEAD				NECK									
	OUTSIDE DIAMETER	LENGTH	NUMBER PER INCH	SHANK DIAMETER	LENGTH UNDER HEAD	DIAMETER	THICKNESS	LONG RADIUS	SHORT RADIUS	MAXIMUM WIDTH	MINIMUM WIDTH	DEPTH	THICKNESS	WIDTH			INSIDE DIAMETER	OUTSIDE DIAMETER	THICKNESS
	d	L2	n	D	L	A	N	R1	R2	O	R	P	U	W	LBS		ID	OD	T
80 LB ASCE	13/16	1 1/2	10	3/4	4 3/8	1 7/16	9/16			1 1/16	1 1/32	7/16	3/4	1 3/8	1.09	184	7/8	1 3/4	7/16
75 LB CS & CS REV 80 LB ASCE	15/16	1 7/8	9	7/8	4 3/4	1 9/16	11/16			1 7/32	1 3/16	1/2	1 1/8	1 1/2	1.56	128	1 1/16	2 1/16	9/16
90 LB AREA	"	"	"	7/8	5 1/8	"	"			"	"	"	"	"	1.62	123	1 1/16	2 1/16	9/16
110 LB RE	1 1/16	2 1/8	8	1	5 3/8	1 11/16	3/4			1 11/32	1 5/16	5/8	1 1/4	1 5/8	2.22	90	1 1/8	2 1/8	9/16
130 LB PS, 130 LB RE	"	"	"	1	6 3/8	"	"			"	"	"	"	"	2.45	82	1 1/8	2 1/8	9/16
112 LB, 115 LB, 131 LB RE 113 LB HF, 132 LB HF 119 LB CF&I, 136 LB RE 141 LB RE	1 1/8	2 1/2	7	1 1/16	6 1/2	1 57/64	45/64	1 55/64	43/64	1 17/32	1 1/2	5/8	1 1/8	1 11/16	2.62	76	1 3/16	2 7/32	9/16



TRACK BOLT AND NUT





SPRING WASHER
(NO TENSION)

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TRACK BOLTS, NUTS AND WASHER

STANDARD 2352
SCALE: NTS
REVISION -
SHEET 1 OF 1
CADD FILE: ES2352

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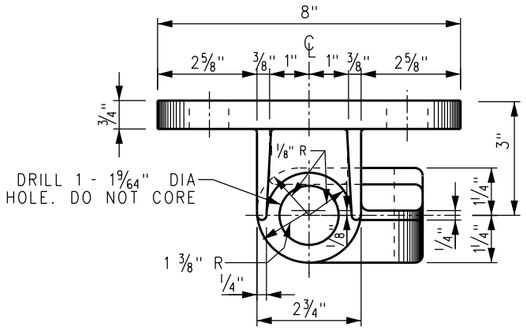
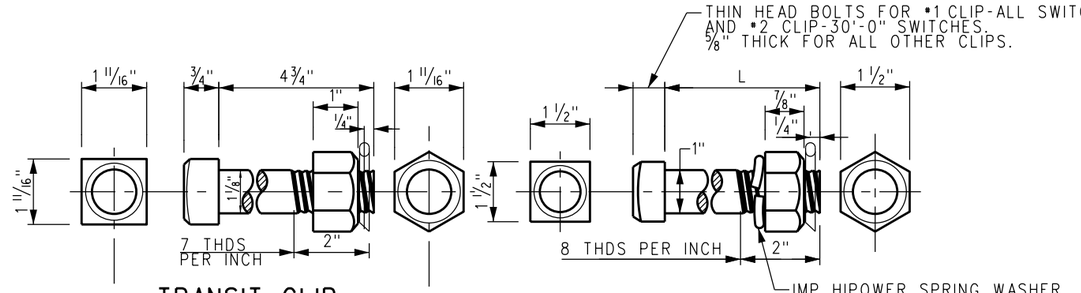


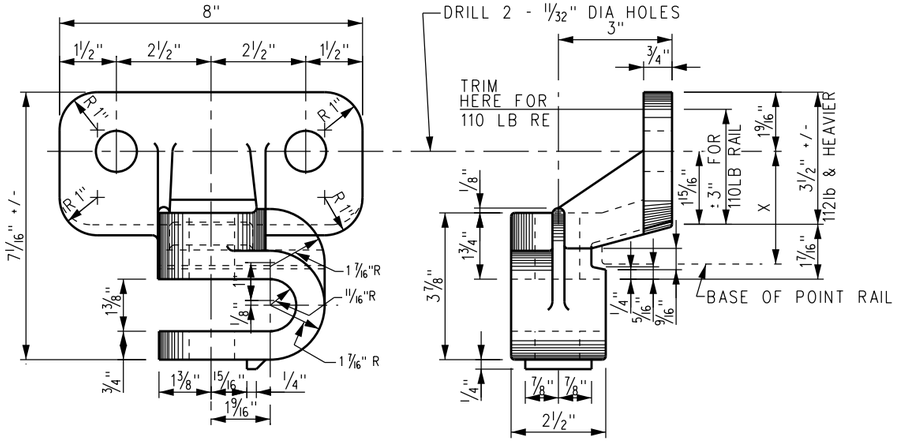
"X" HEIGHT ABOVE BASE		
WEIGHT OF RAIL	1/2" REINFORCING	1 1/4" REINFORCING
110 LB TO 119 LB	2 7/8"	2 11/16"
130 LB TO 136 LB	2 15/16"	2 3/4"

SPECIFICATIONS:

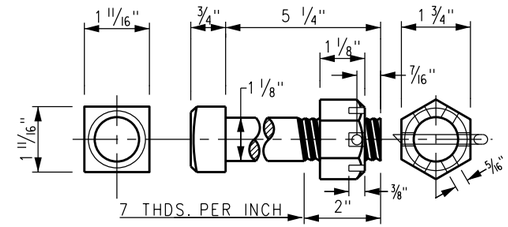
CAST STEEL CLIPS
RIGHT AND LEFT HAND
RIGHT HAND SHOWN



TRANSIT CLIP



OPEN SIDE JAW CLIP

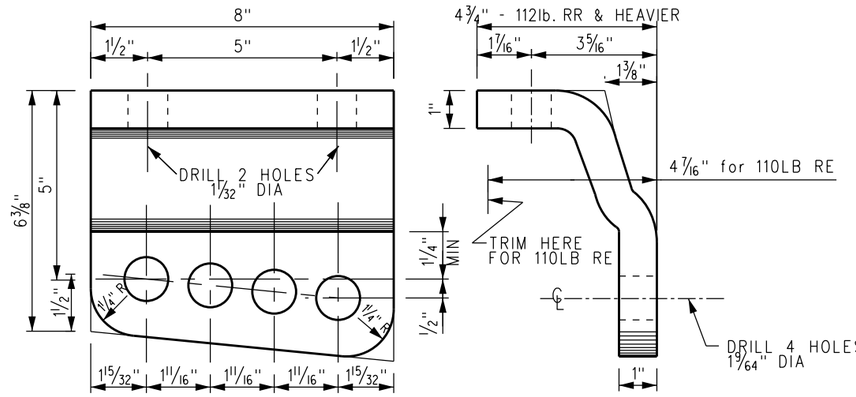


SWITCH LENGTH	ROD NO.	TYPE CLIP	LENGTH OF BOLTS "L"	
			SPLIT SWT	SPRING SWT
16'-6"	1	TRANSIT	4"	
		OSJ	*4"	4"
	2	TRANSIT	4"	4 1/2"
	3	OSJ		+4 3/4"
24'-0" AND 30'-0"	1	TRANSIT	4 1/2"	
		OSJ	*4"	4 3/4"
	2-5IN	TRANSIT	4 1/2"	5 1/4"
	4	OSJ		+5 1/2"
*FOR MACHINE OPERATED SWITCHES +FOR FACING POINT LOCK OPERATION				

OPEN SIDE JAW CLIP

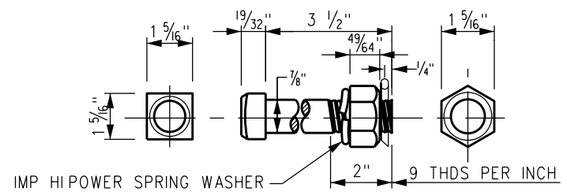
BOLTS FOR SWITCH RODS AND CLIPS BOLTS FOR SWITCH POINTS AND CLIPS

OPEN SIDE JAW & TRANSIT CLIP



TRANSIT CLIP

RIGHT AND LEFT HAND REQUIRED
RIGHT HAND SHOWN



BOLT FOR REPLACING LOOSE RIVETS

NOTES:

1. ALL BOLTS TO BE TURNED BOLTS WITH CUT THREADS.
2. DRILL 9/32" DIA HOLE FOR 1/4" SPRING COTTERS AS SHOWN.
3. SLOTTED NUT SHOWN TO BE AMERICAN STANDARD HEAVY SEMI-FINISHED.

NOTE:

THIS BOLT TO BE USED FOR REPLACING LOOSE RIVETS ON SWITCHES FORMERLY FURNISHED WITH TRANSIT CLIPS RIVETED TO SWITCH POINTS.

FOR MAINTENANCE ONLY

REV.	DATE	DESCRIPTION	DES.	ENG.
A	05/01/12	REVISED "AS MAINTENANCE ONLY"	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

SWITCH ROD CLIPS AND BOLTS

STANDARD 2353
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2353

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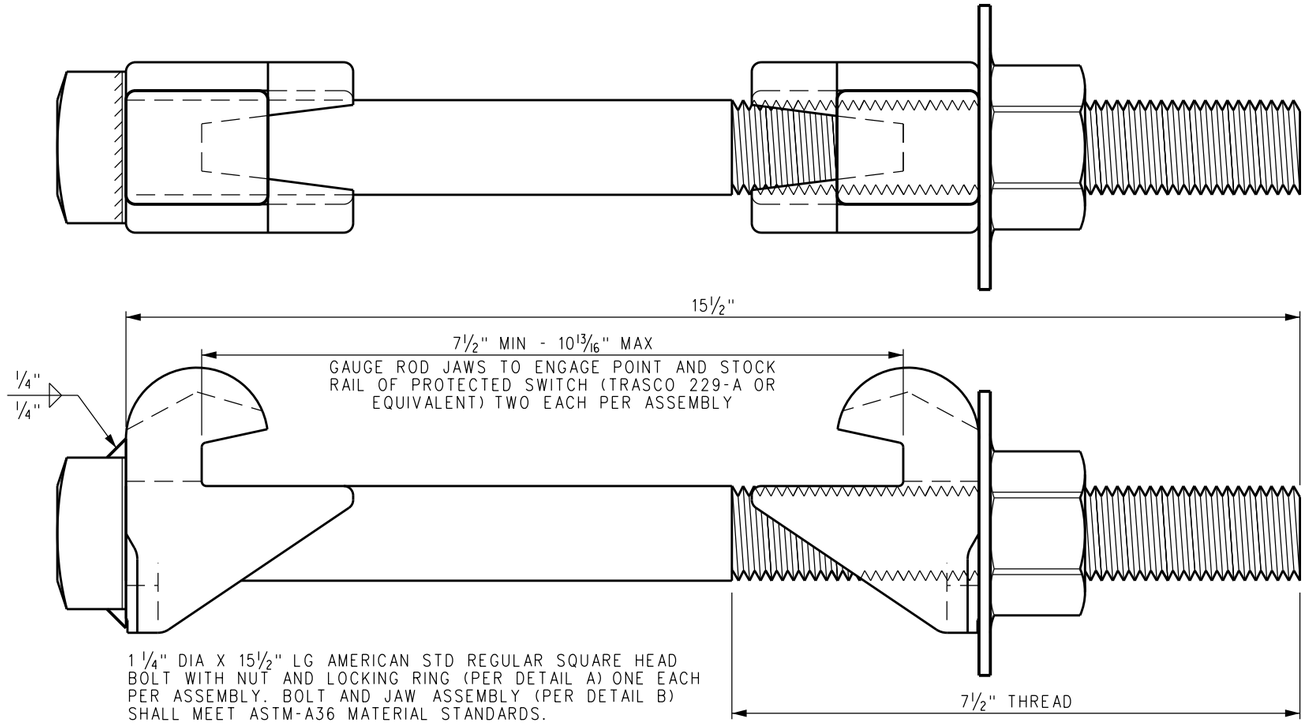
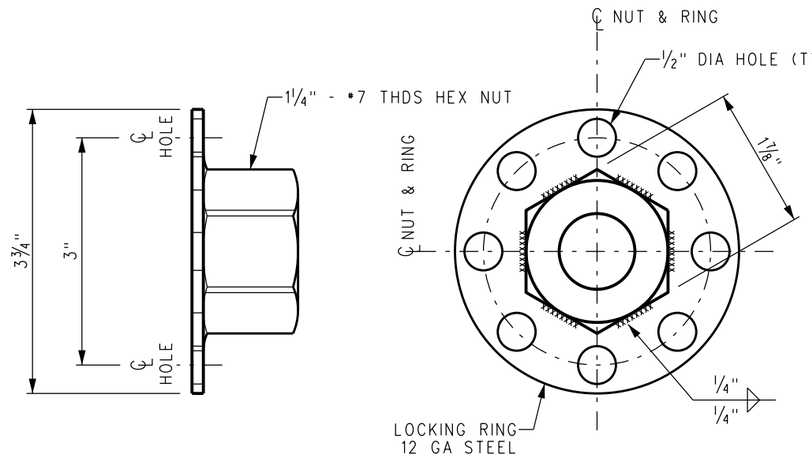
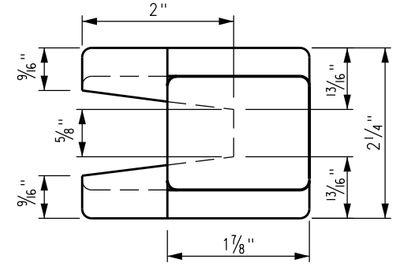
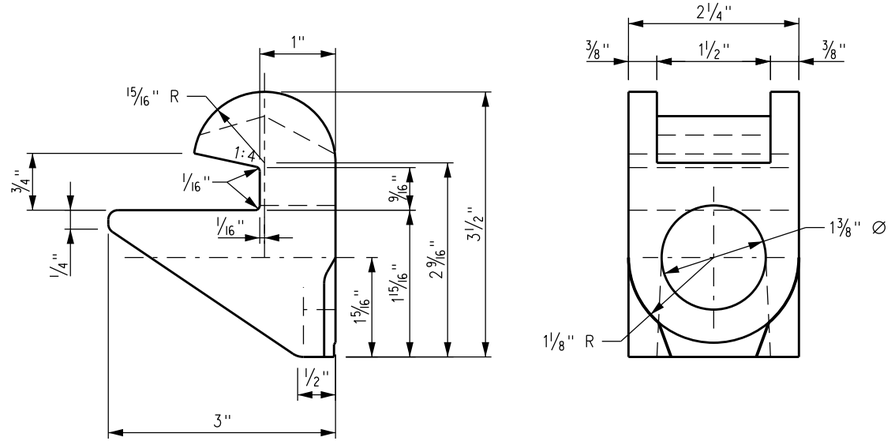


SWITCH POINT CLAMP



DETAIL A - NUT AND LOCKING RING





DETAIL B - CLAMP CASTING

NOTES:

1. TO BE INSTALLED ALONG SWITCH POINT BETWEEN POINT OF SWITCH AND NO 2 ROD.
2. PAINT ASSEMBLY DARK BLUE-EXCEPT THREADS. USE SCRRA MAINTENANCE PADLOCK.
3. WHEN CLAMP IS APPLIED ON SWITCH WITH HAND THROW SWITCH STAND, STANDARD SWITCH LOCK WILL BE REPLACED WITH SCRRA MAINTENANCE PADLOCK, AND TAGGED "OUT OF SERVICE".

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

SWITCH POINT CLAMP

STANDARD 2354
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2354

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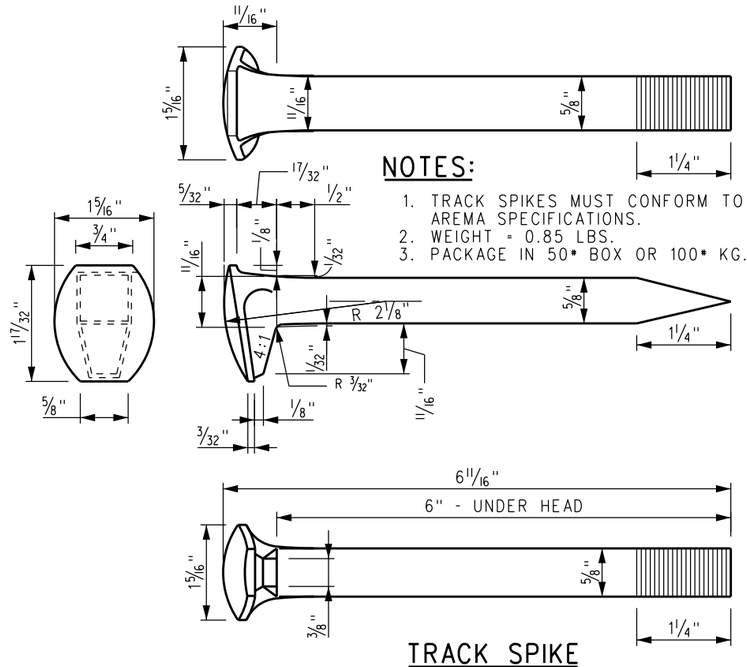
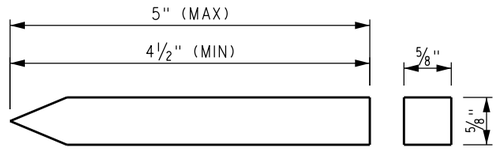


TRACK SPIKE



TIE PLUG

NOTES:

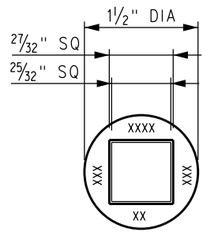
1. TIE PLUG TO CONFORM TO AREMA STANDARDS.
2. TIE PLUG TO BE FABRICATED FROM HARDWOOD TREATED WITH CREOSOTE, CCA, OR BORATE.
3. MAY BE BUNDLED OR BAGGED.
4. PLUG MUST BE FULLY INSERTED INTO EMPTY SPIKE HOLE AND TAMPED INTO PLACE. REMOVE EXCESS PLUG WITH ADZE.

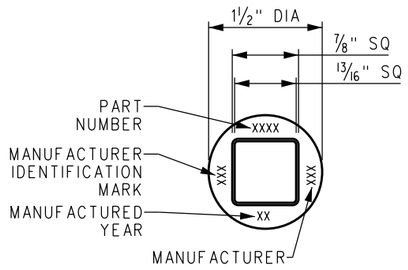
TIGHT SPIKE

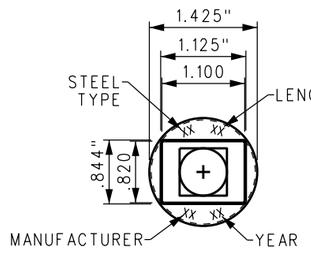
OR APPROVED EQUAL, SPIKE HOLE FINISHING COMPOUND

NOTES:

1. CONSISTS OF A 2-PART FILLER MATERIAL-PART A (ISOCYANATE) AND PART B (POLYOL).
2. OPERATORS MUST BE PROPERLY TRAINED AND USE APPROPRIATE EQUIPMENT FOR INSTALLATION OF MATERIAL.
3. MATERIAL IS SUPPLIED IN SEVERAL SIZES INCLUDING SMALL CAULK GUN TUBES FOR MINOR INSTALLATION REQUIREMENTS.
4. MUST ADHERE TO REQUIREMENTS OF MATERIAL SAFETY DATA SHEET WHEN HANDLING MATERIAL.







SCREW SPIKE INSTALLATION INSTRUCTIONS:

1. PRE-DRILL WOOD TIES WITH 11/16" DIA DRILL BIT TO DEPTH OF 5 1/2".
2. PRE-DRILLED HOLES MUST BE PERPENDICULAR WITH BASE PLATE.
3. USING A 7/8" SQUARE DRIVE SOCKET AND AN IMPACT WRENCH, SCREW IN UNTIL SNUG.

"EVERGRIP" OR EQUAL SCREW SPIKES INSTALLATION INSTRUCTIONS:

1. PRE-DRILL WOOD TIES WITH 11/16" DIA DRILL BIT TO DEPTH OF 6".
2. PRE-DRILLED HOLES MUST BE PERPENDICULAR WITH BASE PLATE.
3. MAY BE DRIVEN IN (SPIKE DRIVER, SLEDGE ETC) OR WITH ROTATING MACHINERY.

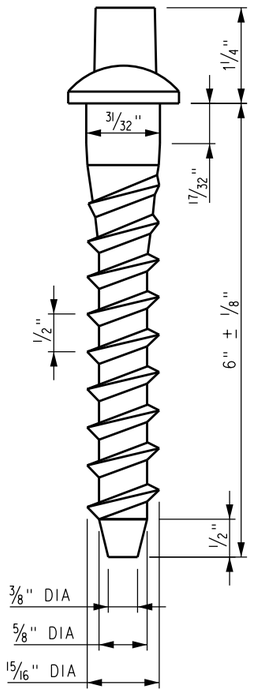
MATERIAL SPECIFICATIONS:

1. ALL SCREW SPIKES TO BE HOT FORGED.
2. SCREW SPIKES TO BE MADE FROM MEDIUM CARBON STEEL TO MEET ASTM A-66 SPECIFICATIONS AND AREMA CHAPTER 5 SPECIFICATIONS.
3. SCREW SPIKES TO BE COATED TO RESIST CORROSION.
4. SCREW SPIKES TO BE PACKED 100 TO A BAG.

PROPERTIES:

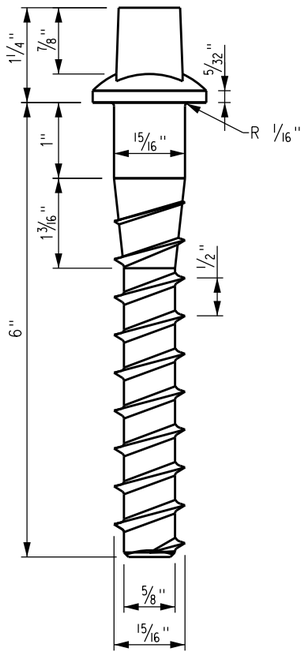
TENSILE (EVERGRIP):	85,000 PSI MIN
TENSILE:	74,000 PSI MIN
YIELD:	37,000 PSI MIN
ELONGATION:	18% MIN

PLAN



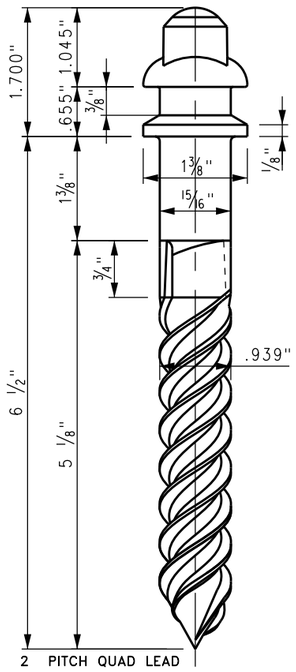
ELEVATION
SCREW SPIKE

PLAN



ELEVATION
SCREW SPIKE

PLAN



ELEVATION
"EVERGRIP" OR EQUAL
SCREW SPIKE

NOTE:

1. DESIGNED FOR USE WITH 13/16" SQUARE SOCKET

DRILL BIT SIZE REQUIRED BY WOOD TYPE		
FASTENER SIZE AND TYPE	SOFTWOOD	HARDWOOD
15/16 x 6 1/2 INCH SCREW	11/16 INCH	3/4 INCH
5/8 INCH TORX HEAD ROAD XING SCREW	3/8 INCH	3/8 INCH

FOR MAINTENANCE ONLY OR AS APPROVED

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	REVISED SCREW SPIKE DETAILS AND DRAWING TITLE	AC	JMM

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

6" TRACK SPIKES, SCREW SPIKE, TIE PLUGS AND TIGHT SPIKE FILLER

STANDARD 2355
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2355

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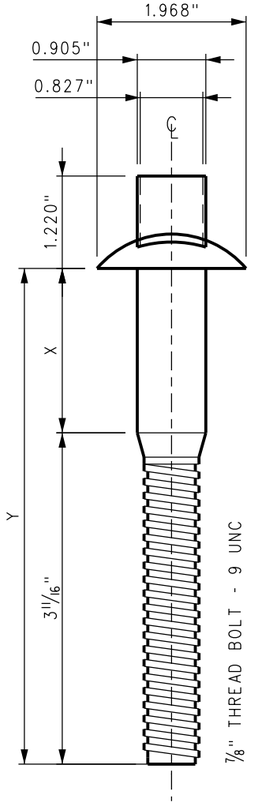
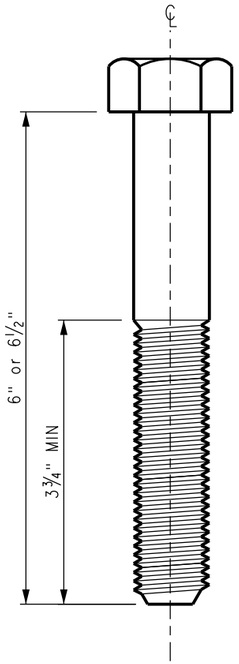
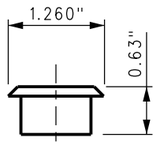


VAPE BOLT

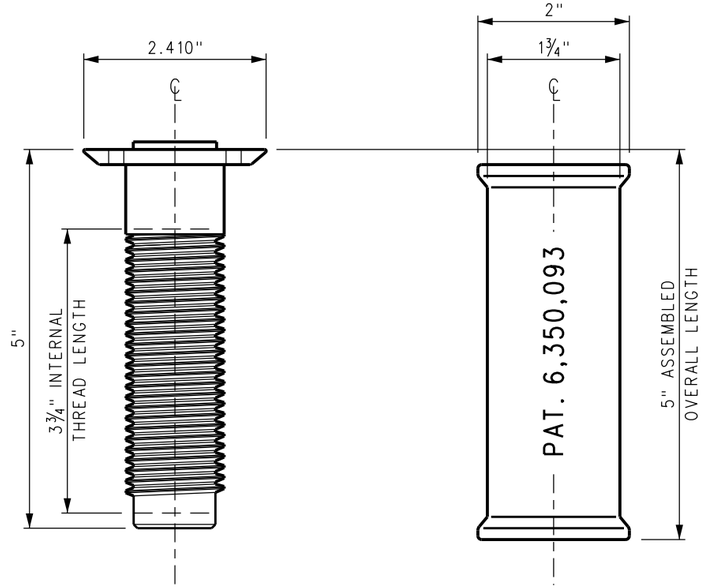


6" OR 6-1/2" LONG
7/8" UNC BOLT
GR A-325
YELLOW ZINC BICHROMATE



DEBRIS CAP LUG
(CCF 1-14.20)

NYLON 66
THREAD INSERT
COLOR-WHITE
REMOVABLE/REPLACEABLE



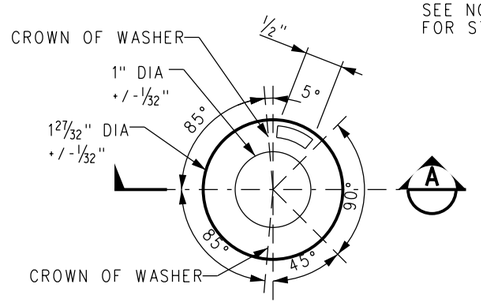
DUCTILE IRON HOUSING
INTERNALLY THREADED

VAPE BOLT DIMENSIONS

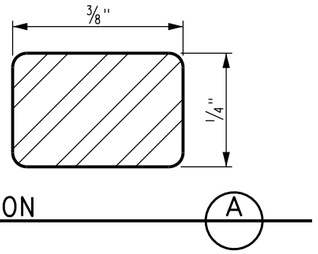
X GRIP LENGTH	Y SHANK LENGTH	FOR USE THROUGH
2 3/16"	5 7/8"	3/4" PLATING
2 5/8"	6 3/8"	1" PLATING

NOTES:

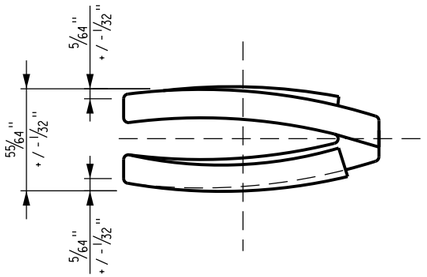
1. 6" OR 6-1/2" LONG 7/8" UNC BOLT GR A-325 YELLOW ZINC BICHROMATE.
2. TO AVOID DAMAGE TO THE TIE, ENSURE THAT PROPER SCREW SIZE IS USED FOR VARIOUS PLATE THICKNESSES. (SEE TABLE)
3. VAPE SCREW TO BE TORQUED TO 150 FT-LBS. THIS TORQUE CORRESPONDS TO A 1mm CLEARANCE BETWEEN COILS ON THE SPRING WASHER.
4. FOR CONCRETE GUARD RAIL TIE SEE SCRRA ES2406 OR ES2407. FOR CONCRETE SWITCH TIE SEE CORRESPONDING TIE PLAN.
5. SPRING WASHERS SHALL CONFORM TO UIC CODE 864-3. DIMENSIONS AS DELIVERED (UNLOADED). STAMPING IS TO BE DONE IN AREA INDICATED ON CURRENT YEAR AND SUPPLIER'S LOGO.

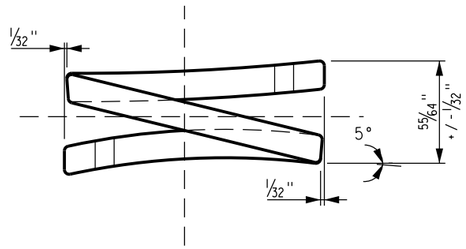


SEE NOTE
FOR STAMPING



SECTION A





HELICAL SPRING WASHER

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PIM 532 SCREW, INSERT AND
HELICAL WASHER FOR CONCRETE TIES

STANDARD: 2356
SCALE: NTS
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2356

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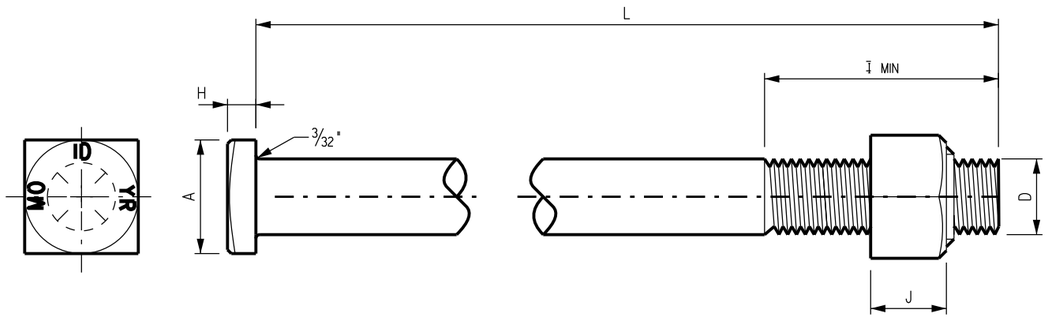
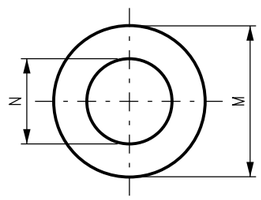
FileName=> \\scrrapw1ics01\iCS_pdf_work_dir\87\482_42\ES2356.dgn

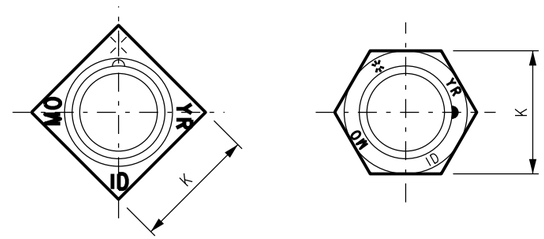
FROG BOLTS, NUTS, AND WASHERS TABLE OF DIMENSIONS								
D	L	A	H	I	J	K	M	N
1"	3 1/2"	1 1/2"	3/8"	2"	-	-	-	-
"	4"	"	"	"	-	-	-	-
"	4 1/2"	"	"	"	-	-	-	-
"	5"	"	"	2 1/2"	-	-	-	-
"	5 1/2"	"	"	"	-	-	-	-
"	6"	"	"	"	-	-	-	-
"	6 1/2"	"	"	"	-	-	-	-
"	7"	"	"	"	-	-	-	-
1"	3 1/2"	1 1/2"	21/32"	"	-	-	-	-
"	4"	"	"	"	-	-	-	-
"	4 1/2"	"	"	"	-	-	-	-
"	5"	"	"	"	-	-	-	-
"	5 1/2"	"	"	"	-	-	-	-
"	6"	"	"	"	-	-	-	-
"	6 1/2"	"	"	"	-	-	-	-
"	7"	"	"	"	-	-	-	-
WASHER							2"	1 1/8"
SQ NUT					1"	1 5/8"		
HEX NUT					1"	1 5/8"		
1 3/8"	4"	2 1/16"	29/32"	2 3/4"	-	-	-	-
"	4 1/2"	"	"	"	-	-	-	-
"	5"	"	"	"	-	-	-	-
"	5 1/2"	"	"	"	-	-	-	-
"	6"	"	"	3 1/4"	-	-	-	-
"	6 1/2"	"	"	"	-	-	-	-
"	7"	"	"	"	-	-	-	-
"	8"	"	"	"	-	-	-	-
"	9"	"	"	"	-	-	-	-
"	10"	"	"	"	-	-	-	-
"	11"	"	"	"	-	-	-	-
"	12"	"	"	"	-	-	-	-
"	13"	"	"	"	-	-	-	-
"	14"	"	"	"	-	-	-	-
"	15"	"	"	"	-	-	-	-
"	16"	"	"	"	-	-	-	-
"	17"	"	"	"	-	-	-	-
"	18"	"	"	"	-	-	-	-
"	19"	"	"	"	-	-	-	-
"	20"	"	"	"	-	-	-	-
"	21"	"	"	"	-	-	-	-
"	22"	"	"	"	-	-	-	-
"	23"	"	"	"	-	-	-	-
"	24"	"	"	"	-	-	-	-
WASHER							2 3/4"	1 1/2"
SQ NUT					1 3/8"	2 3/16"		
HEX NUT					1 3/8"	2 3/16"		



SQUARE HEAD FROG BOLTS



WASHER



SQ NUT OR HEX NUT

NOTES:

1. BOLT SHALL CONFORM TO THE CURRENT VERSION OF SAE J429 GRADE 8. HEAT TREATED TO 150,000 PSI TENSILE STRENGTH, 130,000 PSI YIELD, OIL QUENCHED FROM 4140 STEEL. HEAD MARKINGS SHALL INCLUDE GRADE 8 GRADE MARKINGS, MANUFACTURER ID, MONTH AND YEAR OF MANUFACTURE. THREADS TO BE ROLLED AND CONFORM TO ANSI/ASME B1.1 UNC-2A THREAD FORM.
2. NUTS SHALL CONFORM TO HARDNESS AND MATERIAL REQUIREMENTS OF SAE J995 GRADE 8 OR ASTM A-563 GRADE 'DH', AND DIMENSIONAL REQUIREMENTS OF ANSI/ASME B18.2.2 HEAVY HEX OR SQUARE NUTS, PLAIN FINISH. HEAVY HEX OR SQUARE LOCK NUT THREADS SHALL CONFORM TO ANSI/ASME B1.1 UNC-2B THREAD FORM, FREE FIT.
3. FLAT WASHERS SHALL CONFORM TO HARDNESS REQUIREMENTS OF THE CURRENT VERSION OF ASTM F-436 AND BE 5/32" THICK.
4. WORKMANSHIP: BOLTS, NUTS, AND WASHERS SHALL BE FREE FROM BURRS, SEAMS, LAPS, AND SCALE.
5. BOLT TIGHTENING SEQUENCE SHALL START WITH THE BOLT NEAREST THE CENTER OF FROG. WORK IN A CIRCULAR PATTERN IN A CLOCKWISE DIRECTION, PROGRESSING OUTWARD TO THE NEXT NEAREST FROG BOLT UNTIL ALL BOLTS ARE TIGHTENED TO PROPER TORQUE, OR AS DIRECTED BY MANUFACTURER. ALL BOLTS AND NUTS WILL BE SUPPLIED WITH SELF-CENTERING WASHERS OR EQUIVALENT FOR PROPER LOAD DISTRIBUTION. SEE SCRRA ES2359.

X	XX-XX-XX	REVISION	XX	XX
REV.	DATE	DESCRIPTION	DES.	ENG.

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

SQUARE HEAD FROG BOLTS, SQUARE AND HEX NUTS AND HARDENED FLAT WASHERS

STANDARD 2357
SCALE: NTS
REVISION -
SHEET 1 OF 1
CADD FILE: ES2357

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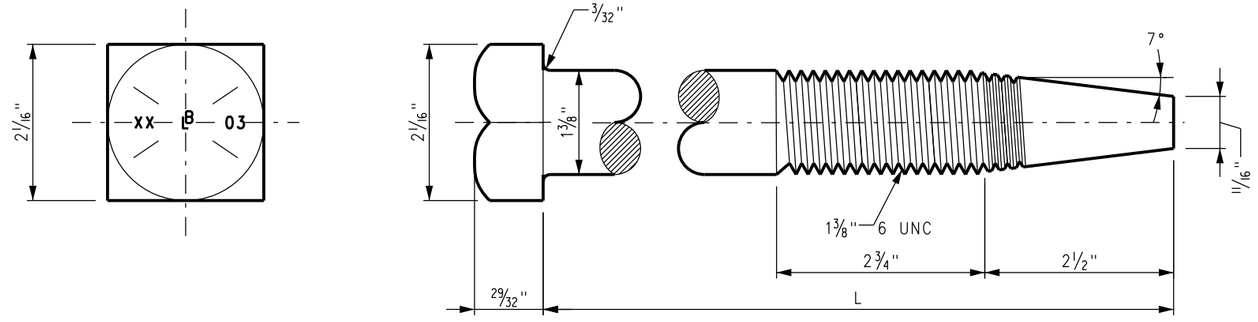
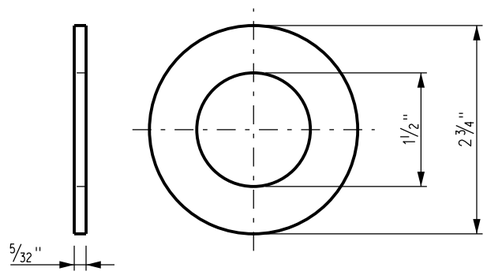


LENGTH = L
19 1/2"
20"
20 1/2"
21"
21 1/2"

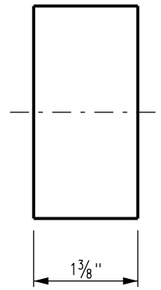
TAPERED FROG BOLTS

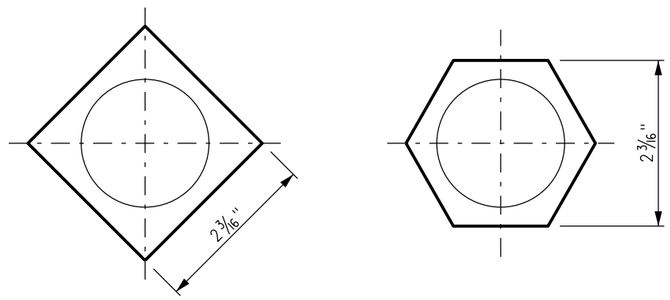
NOTES:

1. WHEN USING/ORDERING TAPERED BOLTS, ADD 2½" TO OLD BOLT LENGTH.
2. BOLT SHALL CONFORM TO THE CURRENT VERSION OF SAE J429 GRADE 8. HEAT TREATED TO 150,000 PSI TENSILE STRENGTH, 130,000 PSI YIELD, OIL QUENCHED FROM 4140 STEEL. HEAD MARKINGS SHALL INCLUDE GRADE 8 GRADE MARKINGS, MANUFACTURER ID, MONTH AND YEAR OF MANUFACTURE. THREADS TO BE ROLLED AND CONFORM TO ANSI/ASME B1.1 UNC-2A THREAD FORM.
3. NUTS SHALL CONFORM TO HARDNESS AND MATERIAL REQUIREMENTS OF SAE J995 GRADE 8 OR ASTM A-563 GRADE 'DH' AND DIMENSIONAL REQUIREMENTS OF ANSI/ASME B18.2.2 HEAVY HEX OR SQUARE NUTS, PLAIN FINISH. HEAVY HEX OR SQUARE LOCK NUT THREADS SHALL CONFORM TO ANSI/ASME B1.1 UNC-2B THREAD FORM, FREE FIT.
4. FLAT WASHERS SHALL CONFORM TO HARDNESS REQUIREMENTS OF THE CURRENT VERSION OF ASTM F-436 AND BE 5/32" THICK.
5. WORKMANSHIP: BOLTS, NUTS, AND WASHERS SHALL BE FREE FROM BURRS, SEAMS, LAPS, AND SCALE.



WASHER





SQ NUT OR HEX NUT

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TAPERED FROG BOLT ASSEMBLY

STANDARD 2358
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2358

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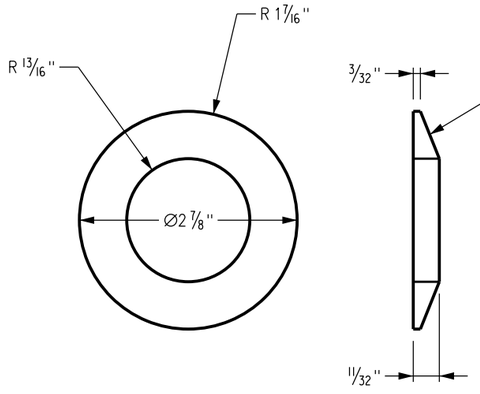
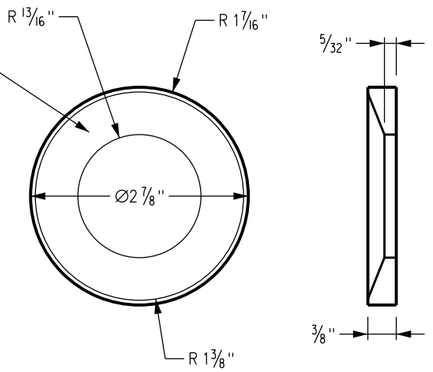


PLAN VIEW SECTION VIEW

TOP WASHER

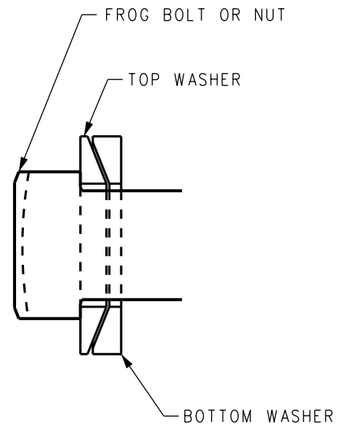
INSTALL UNDER BOLT HEAD OR NUT



PLAN VIEW SECTION VIEW

BOTTOM WASHER

INSTALL AGAINST ITEM BEING BOLTED BELOW TOP WASHER



SECTION VIEW

ASSEMBLED WASHER SET

INSTALLATION NOTES:

1. INSTALL TOP WASHER UNDER BOLT HEAD OR NUT.
2. INSTALL BOTTOM WASHER BELOW TOP WASHER AND AGAINST FROG OR OBJECT BEING CLAMPED.
3. USE OF D-WASHER OR BEVELED WASHERS ARE REQUIRED WHEN INSTALLING SPHERICAL (SELF-ALIGNING) WASHERS ON RAIL AND ON FROGS, WHERE APPLICABLE.
4. BOLT HEAD LOCKS WILL NOT WORK WITH SPHERICAL WASHERS, AND NEED TO BE REPLACED WITH D-WASHERS, BEVELED WASHERS, OR REMOVED BY GRINDING.

MANUFACTURING SPECIFICATION:

1. SURFACE FINISH COEFFICIENT OF FRICTION SHALL BE 0.05-0.10.
2. FINISHED SURFACES MUST PROVIDE LONG-TERM (NOT TEMPORAL) LUBRICATION EFFECTS UNDER EXTREME PRESSURE: 150,000 PSI (10,500 KG/CM SQUARED).
3. FINISHED WASHERS MUST WITHSTAND 1000 HOURS OF ASTM B-117 SALT FOG TEST, WITH LESS THAN 15% RED RUST.
4. FINISHED WASHERS SHALL HAVE THE MINIMUM HARDNESS APPROPRIATE AND SUFFICIENT FOR USE WITH HIGH STRENGTH FASTENERS.
5. MINIMUM COMPENSATING ANGLE SHALL BE 10 DEGREES IN ALL DIRECTIONS.
6. PARTS SHALL BE MARKED WITH MANUFACTURERS IDENTIFYING CHARACTERISTICS.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

SPHERICAL (SELF - CENTERING) WASHER SET

STANDARD 2359
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2359

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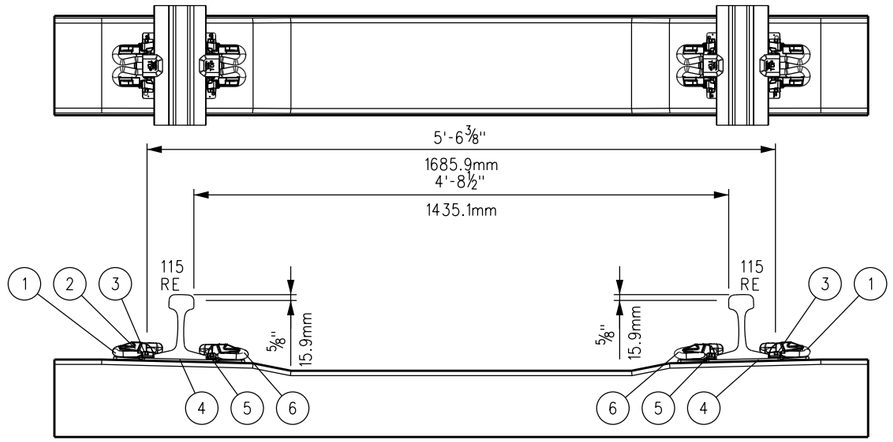
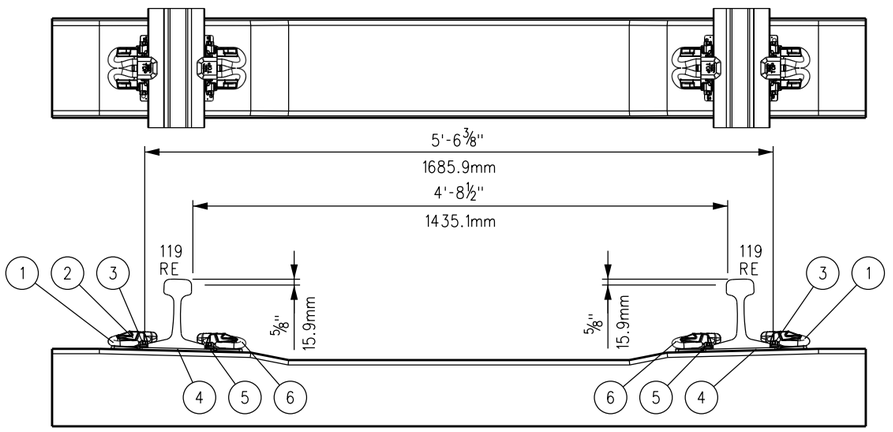
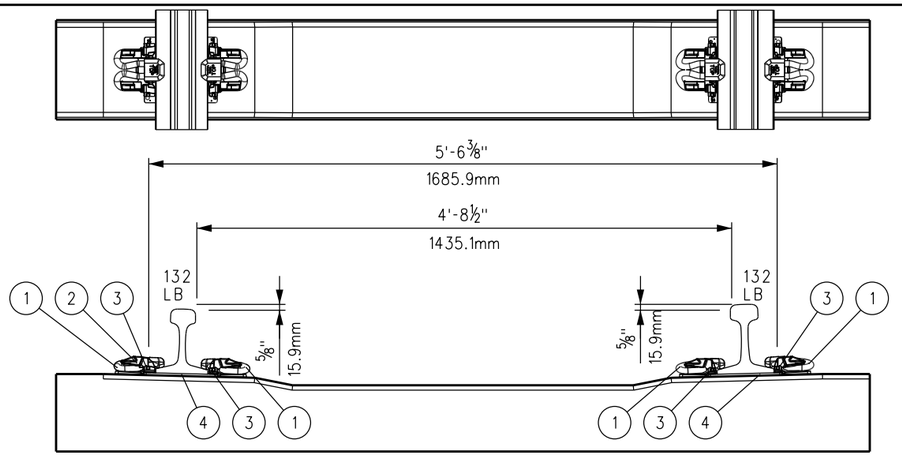


115 RE RAIL AND 136 LB RAIL CONCRETE TIE				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10218	RAIL CLIP ASSY - FC1603 CLIP / 7695 TOE INSULATOR	BLUE	2
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	11458	SIDE POST INSULATOR - 0.726" THICK POST	BLUE	2
4	11549	RAIL PAD		2
5	11459	SIDE POST INSULATOR - 0.430" THICK POST	GREEN	2
6	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NEUTRAL	2



119 RE RAIL AND 136 LB RAIL CONCRETE TIE				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10218	RAIL CLIP ASSY - FC1603 CLIP / 7695 TOE INSULATOR	BLUE	2
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	11458	SIDE POST INSULATOR - 0.726" THICK POST	BLUE	2
4	11549	RAIL PAD		2
5	11459	SIDE POST INSULATOR - 0.430" THICK POST	GREEN	2
6	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NEUTRAL	2



132 LB RAIL AND 136 LB RAIL CONCRETE TIE				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NEUTRAL	4
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	7692	STANDARD SIDE POST INSULATOR - 0.326" THICK POST	NUETRAL	4
4	7083	RAIL PAD ASSEMBLY		2

NOTES:

1. FOR RAIL PAD DETAILS, SEE SCRRA ES2364.
2. FOR SIDE POST INSULATOR DETAILS, SEE SCRRA ES2365.
3. FOR RAIL CLIP DETAILS, SEE SCRRA ES2366.
4. FOR TOE INSULATORS DETAILS, SEE SCRRA ES2367.
5. ALL COMPONENTS FOR TIE ASSEMBLIES TO BE PANDROL TYPE OR EQUIVALENT AS APPROVED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN.
6. ALL PART NUMBERS LISTED ON THIS DRAWING CORRESPOND TO PANDROL BRAND COMPONENTS AND ARE SUBJECT TO CHANGE.
7. FOR CONCRETE TIE DETAILS AND FRICTION PATTERN, SEE SCRRA ES2402.

REV.	DATE	DESCRIPTION	DES.	ENG.
A	05-16-16	REVISED RAIL PAD ASSEMBLY NUMBER	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PANDROL FASTCLIP CONCRETE TIE ASSEMBLIES FOR VARIOUS RAIL COMBINATIONS

STANDARD 2360
SCALE: NTS
REVISION A SHEET 1 OF 3
CADD FILE: ES2360-01

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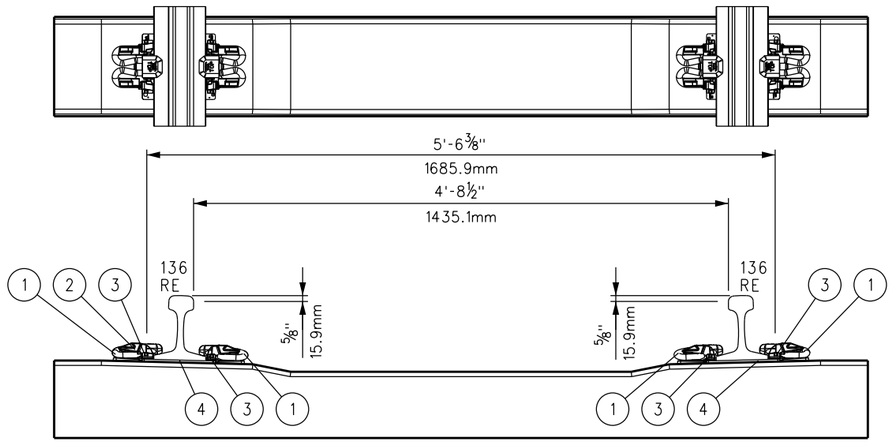
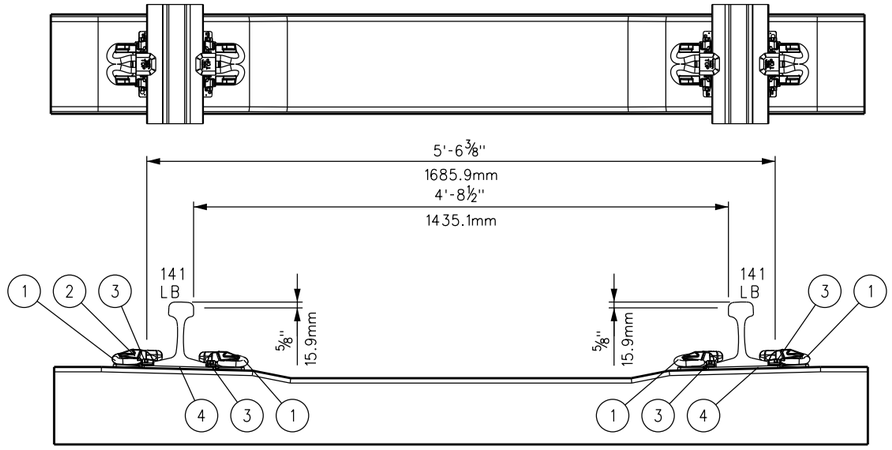
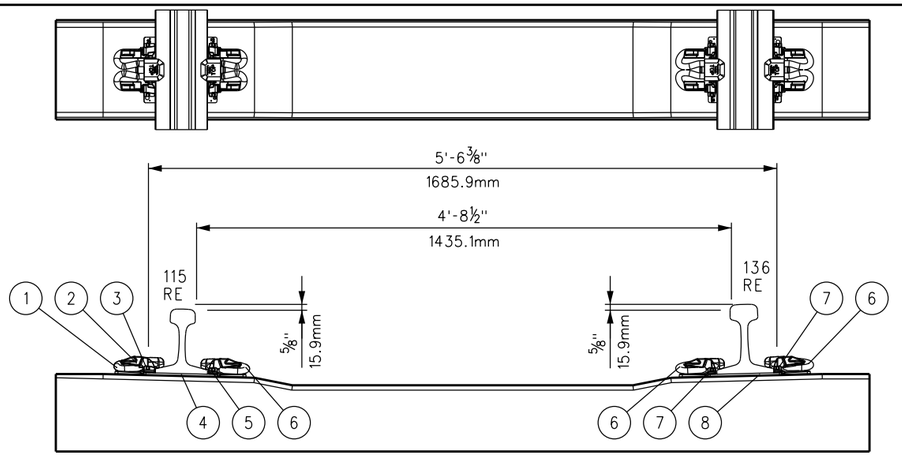


136 RE RAIL AND 136 LB RAIL CONCRETE TIE				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NUETRAL	4
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	7692	STANDARD SIDE POST INSULATOR FOR TWIN-STEM SHOULDER	NUETRAL	4
4	7083	RAIL PAD ASSEMBLY		2



141 LB RAIL AND 136 LB RAIL CONCRETE TIE				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NUETRAL	4
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	7692	STANDARD SIDE POST INSULATOR FOR TWIN-STEM SHOULDER	NUETRAL	4
4	7083	RAIL PAD ASSEMBLY		2



COMBINATION 115 RE RAIL AND 136 RE RAIL				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10218	RAIL CLIP ASSY - FC1603 CLIP / 7695 TOE INSULATOR	BLUE	1
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	11458	SIDE POST INSULATOR - 0.726" THICK POST	BLUE	1
4	11549	RAIL PAD		1
5	11459	SIDE POST INSULATOR - 0.430" THICK POST	GREEN	1
6	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NUETRAL	3
7	7692	STANDARD SIDE POST INSULATOR	NUETRAL	2
8	7083	RAIL PAD ASSEMBLY		1

NOTES:

1. FOR RAIL PAD DETAILS, SEE SCRRA ES2364.
2. FOR SIDE POST INSULATOR DETAILS, SEE SCRRA ES2365.
3. FOR RAIL CLIP DETAILS, SEE SCRRA ES2366.
4. FOR TOE INSULATORS DETAILS, SEE SCRRA ES2367.
5. ALL COMPONENTS FOR TIE ASSEMBLIES TO BE PANDROL TYPE OR EQUIVALENT AS APPROVED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN.
6. ALL PART NUMBERS LISTED ON THIS DRAWING CORRESPOND TO PANDROL BRAND COMPONENTS AND ARE SUBJECT TO CHANGE.
7. FOR CONCRETE TIE DETAILS AND FRICTION PATTERN, SEE SCRRA ES2402.

REV.	DATE	DESCRIPTION	DES.	ENG.
A	05-16-16	REVISED RAIL PAD ASSEMBLY NUMBER	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PANDROL FASTCLIP CONCRETE TIE ASSEMBLIES FOR VARIOUS RAIL COMBINATIONS

STANDARD 2360
SCALE: NTS
REVISION A SHEET 2 OF 3
CADD FILE: ES2360-02

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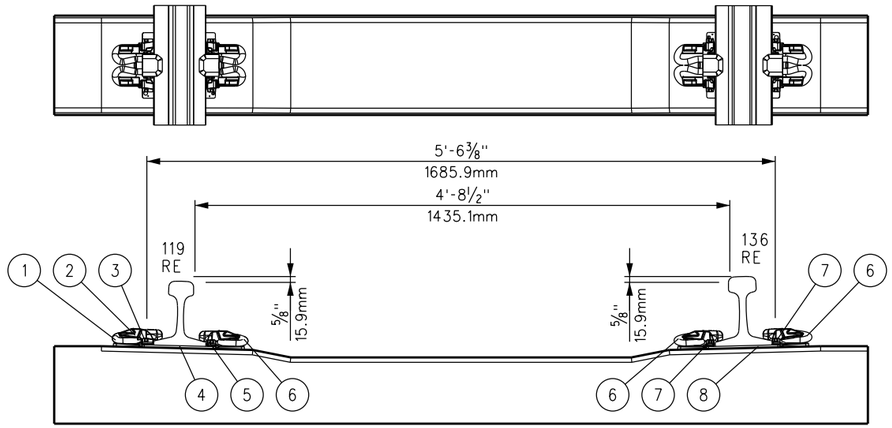
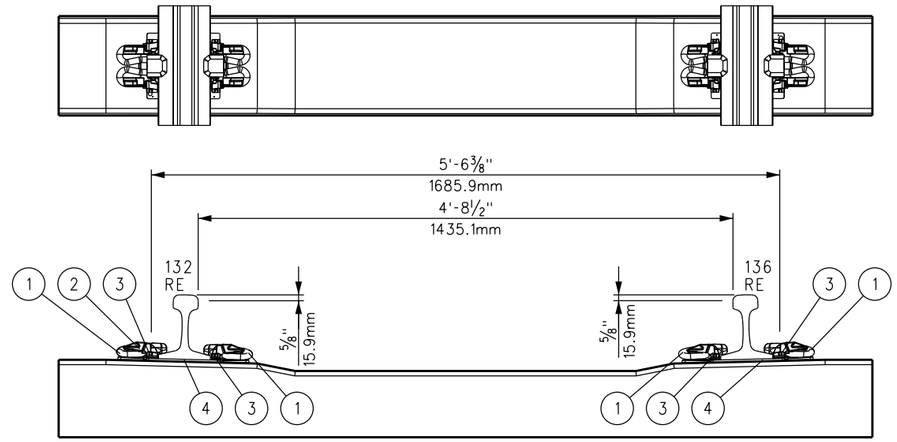


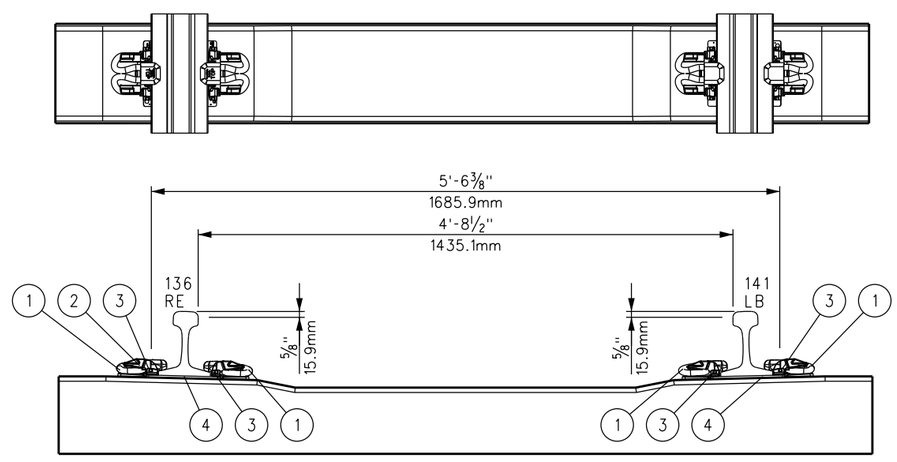
COMBINATION 119 RE RAIL AND 136 LB RAIL				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10218	RAIL CLIP ASSY - FC1603 CLIP / 7695 TOE INSULATOR	BLUE	1
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	11458	SIDE POST INSULATOR - 0.726" THICK POST	BLUE	1
4	11549	RAIL PAD		1
5	11459	SIDE POST INSULATOR - 0.430" THICK POST	GREEN	1
6	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NUETRAL	3
7	7692	STANDARD SIDE POST INSULATOR	NUETRAL	2
8	7083	RAIL PAD ASSEMBLY		1

NOTES:

1. FOR RAIL PAD DETAILS, SEE SCRRA ES2364.
2. FOR SIDE POST INSULATOR DETAILS, SEE SCRRA ES2365.
3. FOR RAIL CLIP DETAILS, SEE SCRRA ES2366.
4. FOR TOE INSULATORS DETAILS, SEE SCRRA ES2367.
5. ALL COMPONENTS FOR TIE ASSEMBLIES TO BE PANDROL TYPE OR EQUIVALENT AS APPROVED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN.
6. ALL PART NUMBERS LISTED ON THIS DRAWING CORRESPOND TO PANDROL BRAND COMPONENTS AND ARE SUBJECT TO CHANGE.
7. FOR CONCRETE TIE DETAILS AND FRICTION PATTERN, SEE SCRRA ES2402.



136 RE RAIL AND 136 LB RAIL CONCRETE TIE				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NUETRAL	4
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	7692	STANDARD SIDE POST INSULATOR FOR TWIN-STEM SHOULDER	NUETRAL	4
4	7083	RAIL PAD ASSEMBLY		2



141 LB RAIL AND 136 LB RAIL CONCRETE TIE				
ITEM NO	PART NO	DESCRIPTION	COLOR	QTY
1	10216	RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR	NUETRAL	4
2	9086	FASTCLIP TWIN-STEM SHOULDER		4
3	7692	STANDARD SIDE POST INSULATOR	NUETRAL	4
4	7083	RAIL PAD ASSEMBLY		2

REV.	DATE	DESCRIPTION	DES.	ENG.
A	05-16-16	REVISED RAIL PAD ASSEMBLY NUMBER	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PANDROL FASTCLIP CONCRETE TIE ASSEMBLIES FOR VARIOUS RAIL COMBINATIONS

STANDARD 2360
SCALE: NTS
REVISION A SHEET 3 OF 3
CADD FILE: ES2360-03

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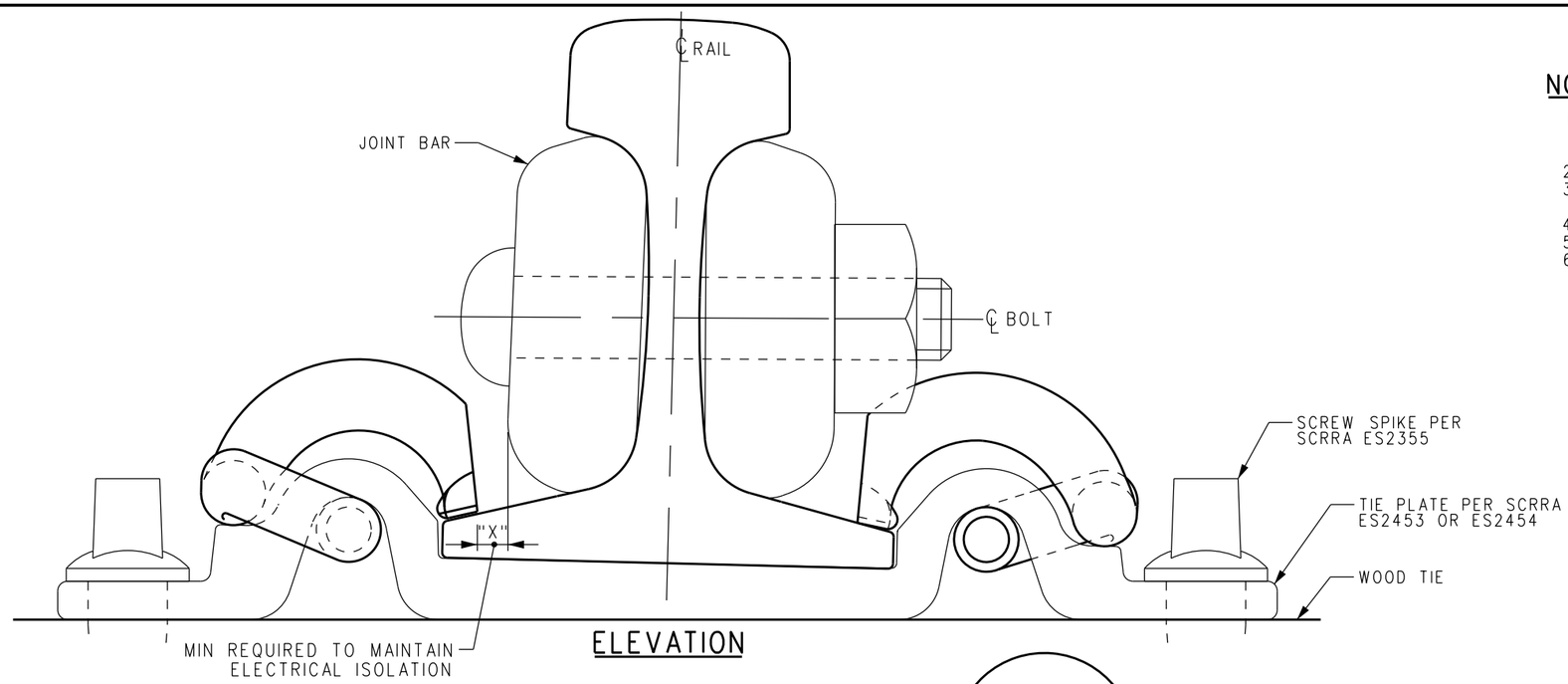
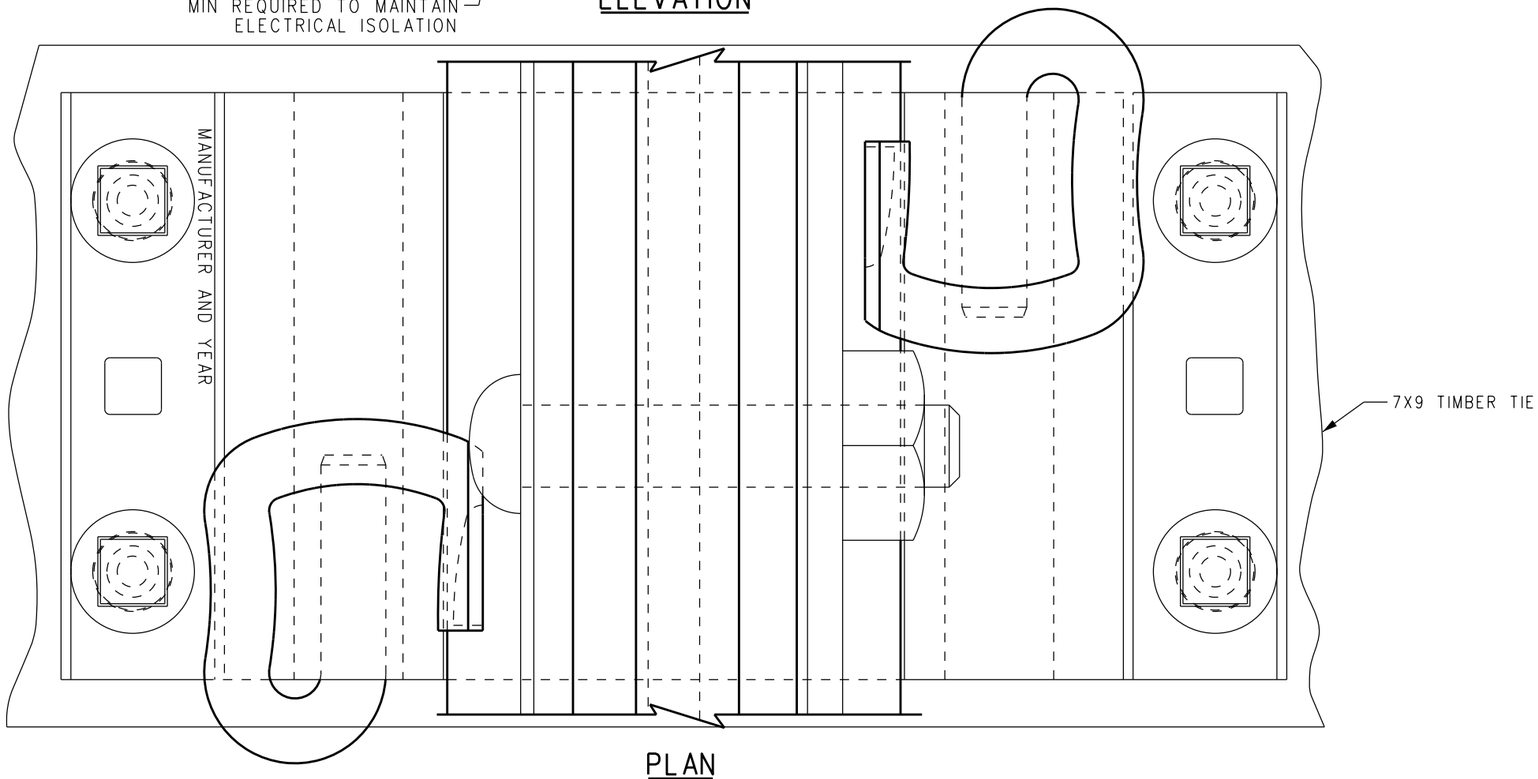


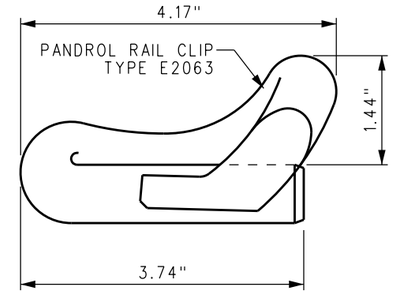
ELEVATION

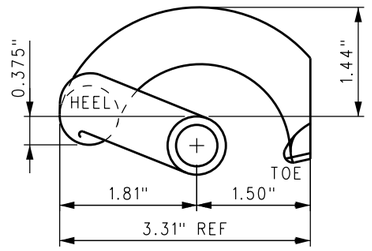


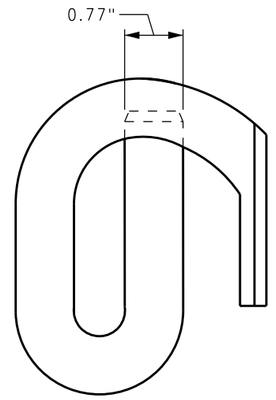
PLAN

NOTES:

1. PANDROL RAIL CLIP TYPE e2063, AS SHOWN, IS USED WITH PANDROL TYPE OR EQUIVALENT ROLLED STEEL BASE PLATES FOR RAIL WITH 5½" OR 6" INSIDE BASE.
2. TWO CLIPS REQUIRED FOR EACH BASE PLATE.
3. CLIPS SHALL BE DRIVEN TO FULLY INSERT STRAIGHT PART OF ANCHOR INTO PLATE, AND CURVED TO BE FULLY OUTSIDE PLATE.
4. THIS CLIP IS TO BE USED FOR BOLTED OR INSULATED JOINTS.
5. BEARING AREA OF TOE = 0.7 IN.
6. APPROX WEIGHT = 1.69 LBS.







REV.	DATE	DESCRIPTION	DES.	ENG.
A	01-13-21	REVISED DRAWING NUMBER	AC	JMM

DRAWN BY: A. CARLOS DATE: 10/01/03

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PANDROL JOINT "E"-CLIP TYPE E2063

STANDARD 2361
SCALE: NTS
REVISION A SHEET 1 OF 2
CADD FILE: ES2361-01

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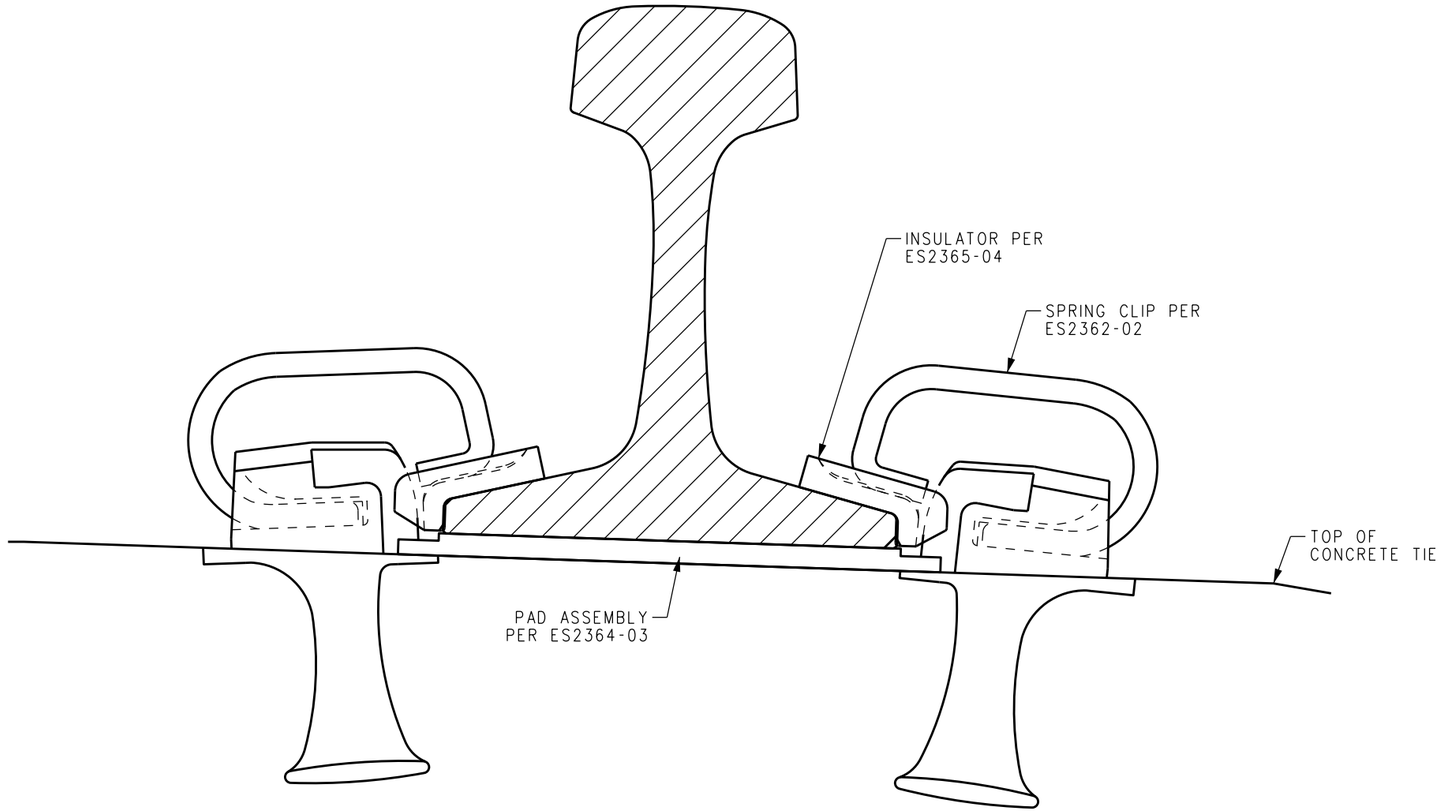

FOR MAINTENANCE ONLY

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 10/28/20

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

CONCRETE TIE SAFELOK 1
CLIP ASSEMBLY

STANDARD: 2361
SCALE: NTS
REVISION: - SHEET: 2 OF 2
CADD FILE: ES2361-02

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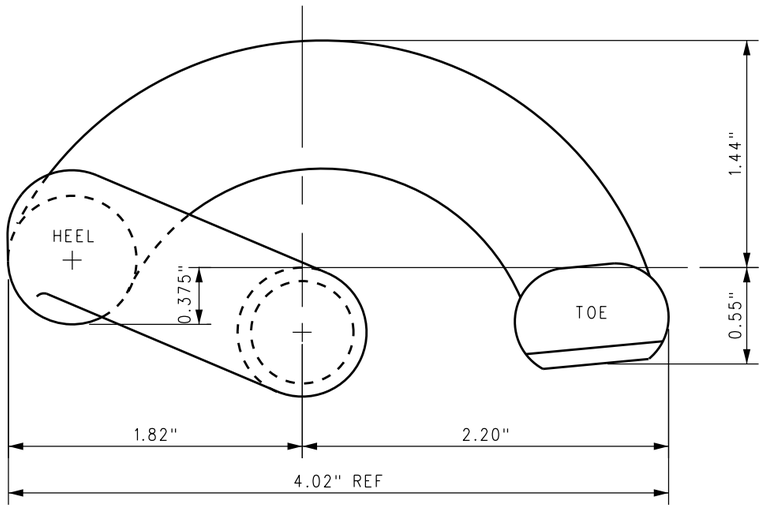
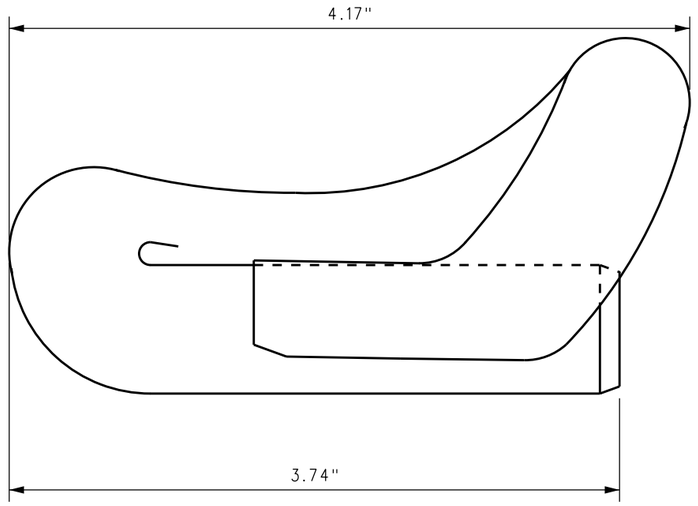
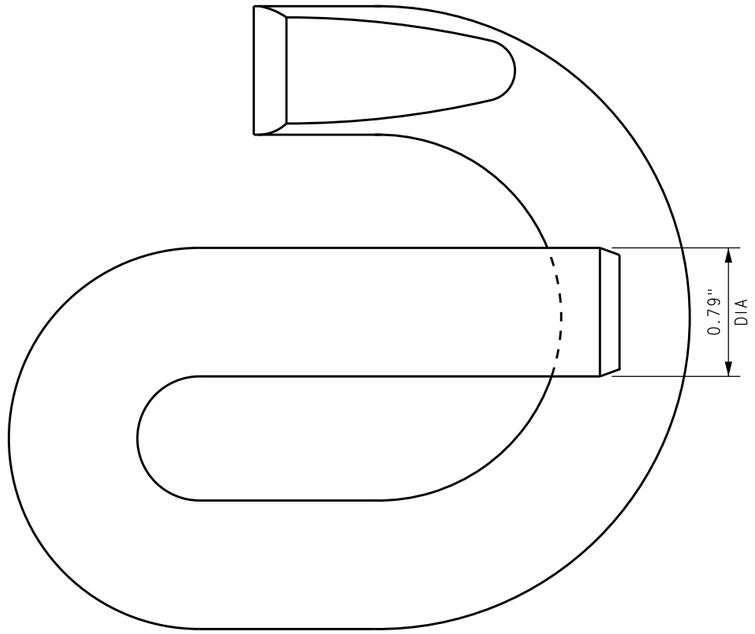


FRONT



SIDE

(RH CLIP SHOWN, LH OPPOSITE)



BOTTOM

NOTES:

1. E2055 OR RPS-01-8700 OR EQUIVALENT (E2055 SHOWN)
2. GALVANIZED CLIPS ARE REQUIRED IN THE FOLLOWING LOCATIONS:
   - A. IN ALL AT-GRADE CROSSING APPLICATIONS INCLUDING THE TRANSITION TIES.
   - B. WITHIN A ½ MILE RADIUS TO SALT WATER OR IF CORROSIVE SOIL CONDITIONS EXIST.
   - C. IN ALL TUNNELS GREATER THAN 500 FEET IN LENGTH.

REV.	DATE	DESCRIPTION	DES.	ENG.
B	02-28-23	REVISED NOTES & DRAWING TITLE	AC	RG
A	10-02-20	REVISED NOTES AND DRAWING NUMBER	AC	JMM

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

STANDARD "E"-CLIP

STANDARD 2362
SCALE: NTS
REVISION B SHEET 1 OF 2
CADD FILE: ES2362-01

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FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_50\ES2362-01.dgn

NOTES:

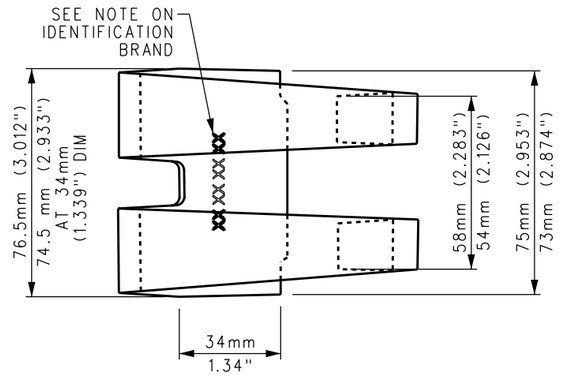
1. "A": CLIPS ARE SET WITHIN THIS RANGE TO GIVE SPECIFIED TOE LOAD.
2. HARDNESS: HARDENED AND TEMPERED TO 43-47 ROCKWELL "C".
3. PAINT STANDARD CLIP: RED OXIDE PRIMER, BLACK OR BROWN PAINT GALVANIZED CLIP: SILVER.

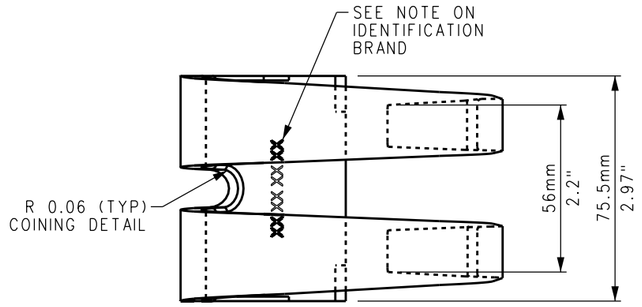
NOTES: (CONT.)

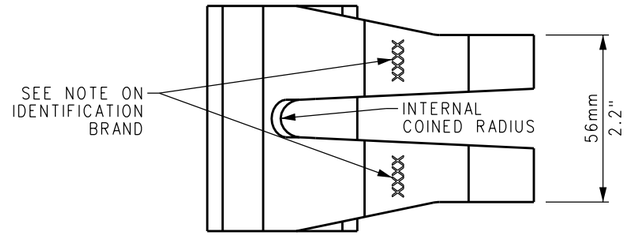
4. GALVANIZED CLIPS ARE REQUIRED IN THE FOLLOWING LOCATIONS:
   - A. IN ALL AT-GRADE CROSSING APPLICATIONS.
   - B. WITHIN A ½ MILE RADIUS TO SALT WATER OR IF CORROSIVE SOIL CONDITIONS EXIST.
   - C. IN ALL TUNNELS GREATER THAN 500 FEET IN LENGTH.

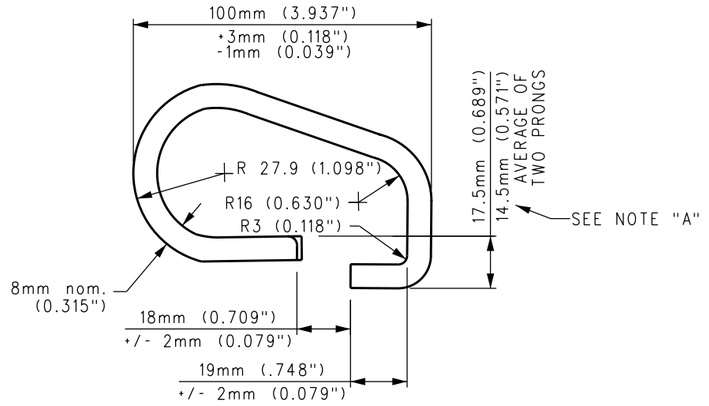
IDENTIFICATION FOR SAFELOK BRAND

PART NO. SAFELOK EMBLEM AND BATCH CODE.
BATCH CODE FORMAT: 20 03 20
DAY
MONTH
YEAR
PC1 36800
SHIFT
PART NO.

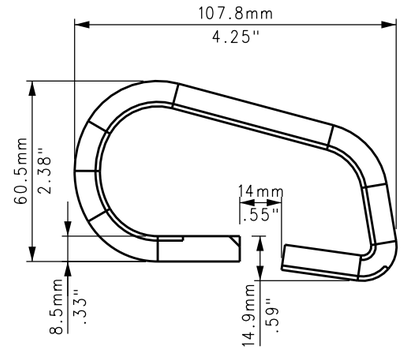




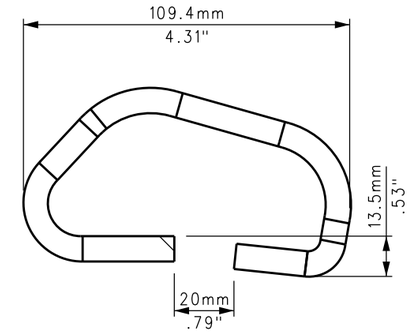




STANDARD SPRING CLIP
(PANDROL 36800 SHOWN)



LONG REACH SPRING CLIP
(NT2060 SHOWN)



ALTERNATIVE LONG REACH SPRING CLIP
(U6030 SHOWN)

FOR MAINTENANCE ONLY

REV.	DATE	DESCRIPTION	DES.	ENG.
A	02-28-23	REVISED LONG REACH SPRING CLIP DETAILS	AC	RG

DRAWN BY: A. CARLOS DATE: 10/28/2020

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

SPRING CLIPS FOR SAFELOK I FASTENING SYSTEM

STANDARD 2362
SCALE: NTS
REVISION A SHEET 2 OF 2
CADD FILE: ES2362-02

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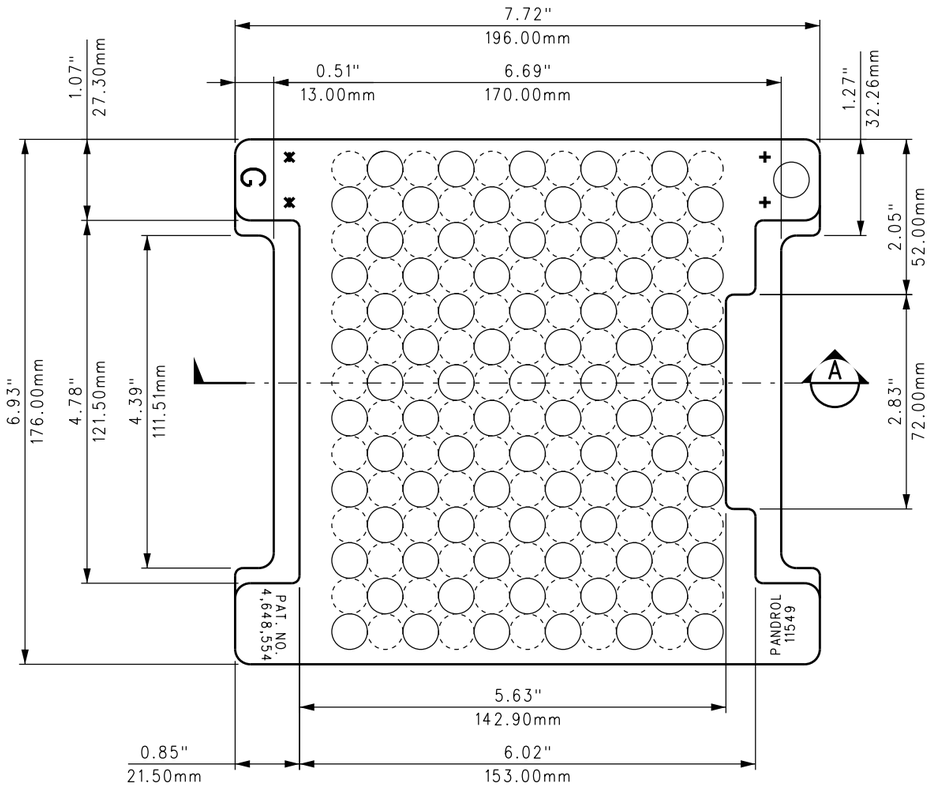
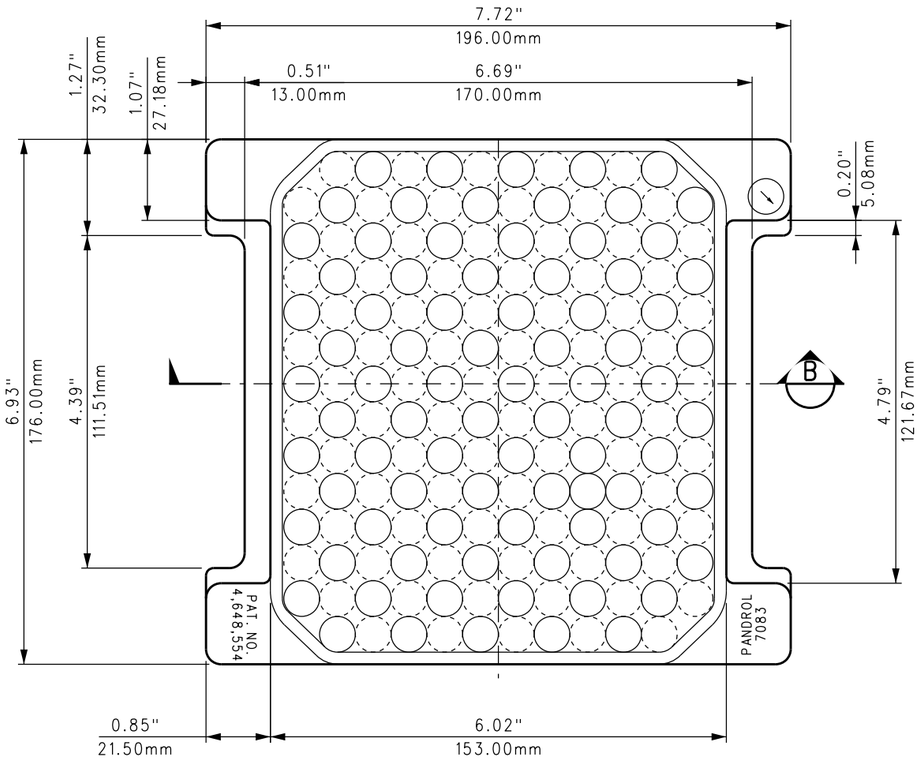


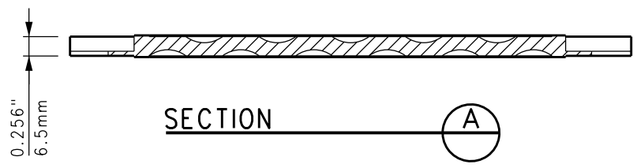
FASTCLIP TIE PAD
FOR 5½" RAIL

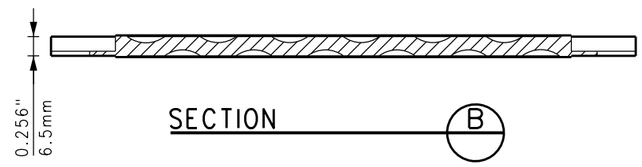
USING SCRRA STANDARD
6" BASE CONCRETE TIE
(PART #11549)



FASTCLIP TIE PAD
FOR 6" RAIL

PANDROL RAIL PAD ASSEMBLY
(PART #7083)





REV.	DATE	DESCRIPTION	DES.	ENG.
A	05-16-16	REVISED TIE PAD FOR 6" RAIL AND DRAWING NUMBER	AC	NDP

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PANDROL CONCRETE TIE PADS
FOR 5½" & 6" RAIL BASE

STANDARD: 2364
SCALE: NTS
REVISION: A
SHEET: 1 OF 3
CADD FILE: ES2364-01

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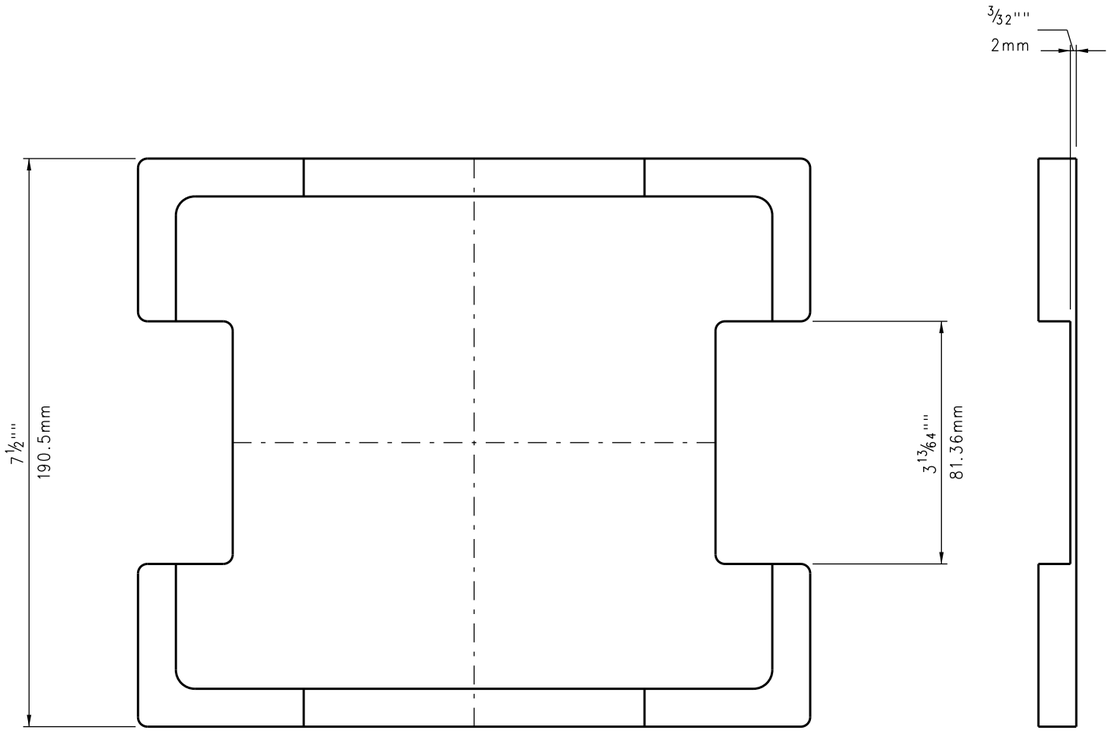

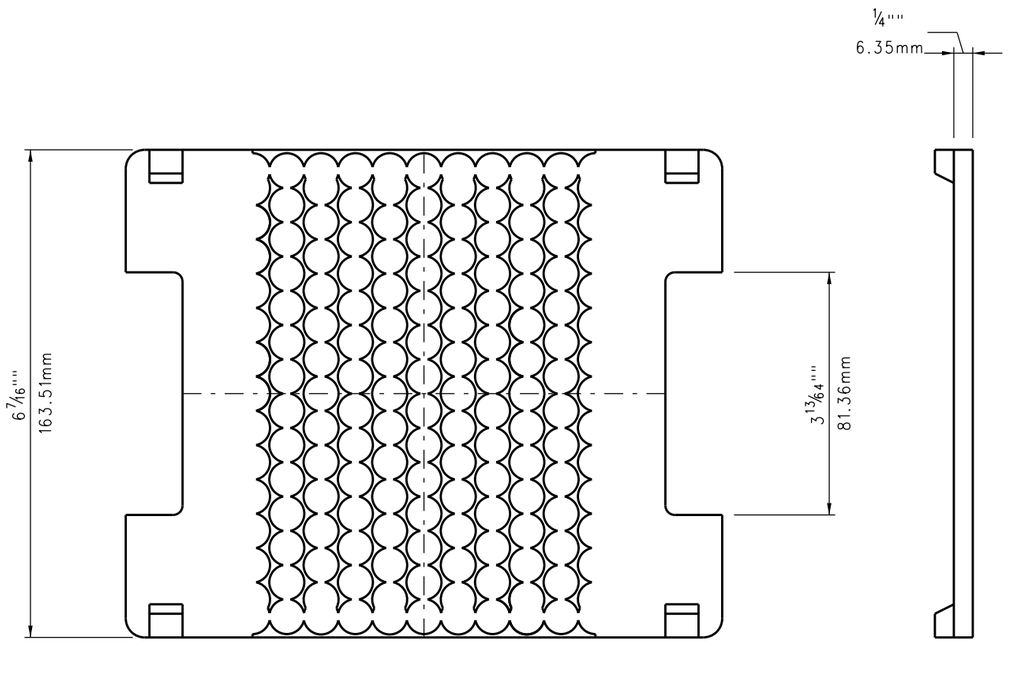

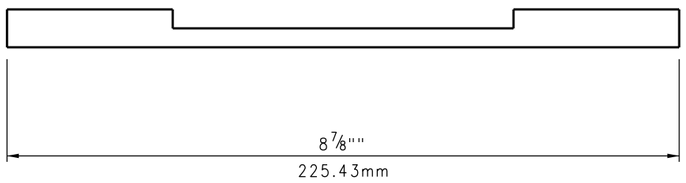

NOTES:

1. PAD MATERIAL: POLYURETHANE ETHER BASE. PAD HARDNESS: 95 DURO A/45 DURO D, WITH 30 YEAR UV PROTECTION.
2. ABRASION PLATE MATERIAL: TO BE 13% GLASS FILLED NYLON OR EQUIVILANT WITH 30 YEAR UV PROTECTION.

FOR MAINTENANCE ONLY

REV.	DATE	DESCRIPTION	DES.	ENG.
-	XX-XX-XX	-	-	-

DRAWN BY: A. CARLOS DATE: 10/28/2020

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

CONCRETE TIE 2-PART
PAD ASSEMBLY FOR
E-CLIP FASTENING SYSTEM

STANDARD: 2364
SCALE: NTS
REVISION: -
SHEET: 2 OF 3
CADD FILE: ES2364-02

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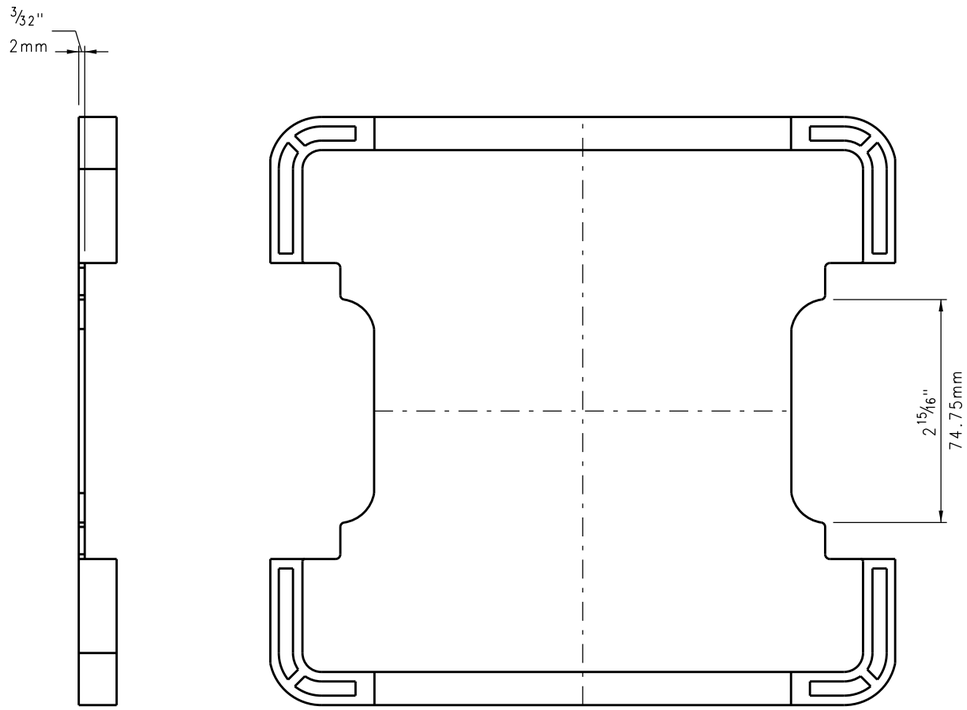

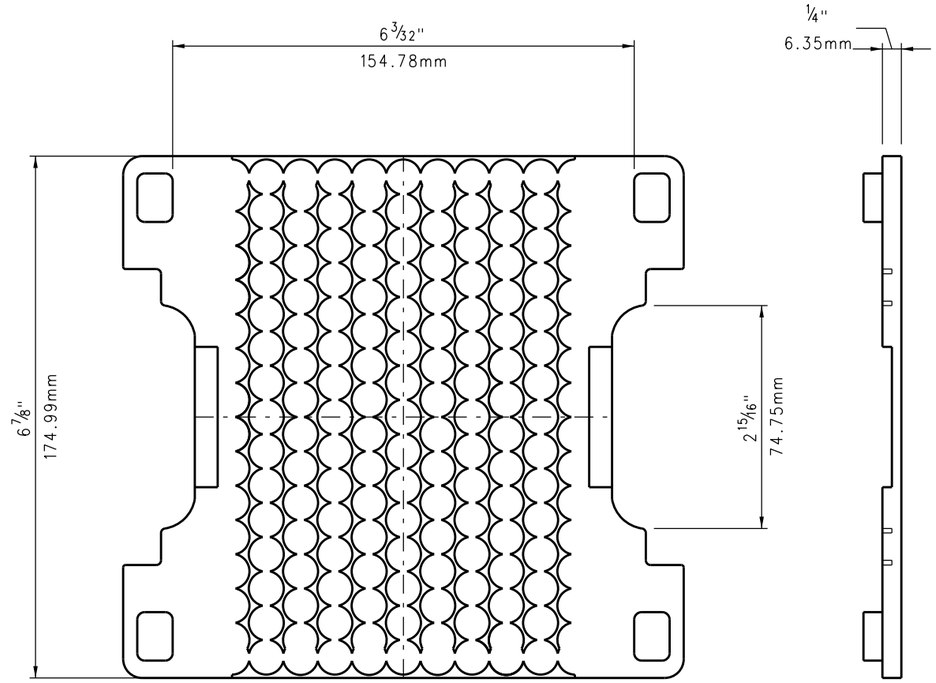

NOTES:

1. PAD MATERIAL: POLYURETHANE ETHER BASE. PAD HARDNESS: 95 DURO A/45 DURO D, WITH 30 YEAR UV PROTECTION.
2. ABRASION PLATE MATERIAL: TO BE 13% GLASS FILLED NYLON OR EQUIVILANT WITH 30 YEAR UV PROTECTION.
3. FOR ASSEMBLY, SEE ESXXXX.

FOR MAINTENANCE ONLY

REV.	DATE	DESCRIPTION	DES.	ENG.
-	XX-XX-XX	-	-	-

DRAWN BY: A. CARLOS DATE: 10/28/2020

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

ABRASION PAD ASSEMBLY
FOR SAFELOK 1

STANDARD 2364
SCALE: NTS
REVISION - SHEET 3 OF 3
CADD FILE: ES2364-03

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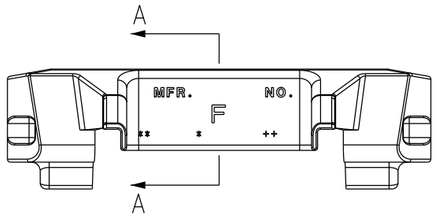
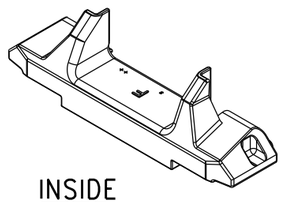
FileName-> \\scrrapw11ics01\iCS_pdf_work_dir\94\482_128\ES2364-03.dgn



TOP VIEW



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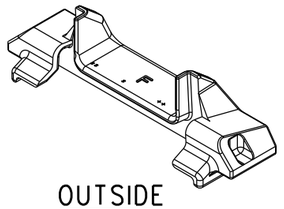

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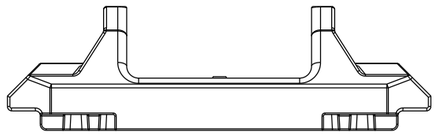
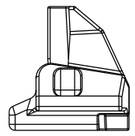
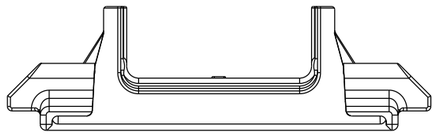


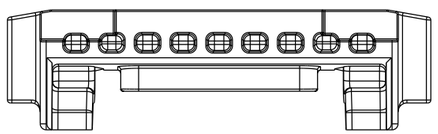
INSIDE VIEW



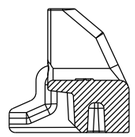
SIDE VIEW



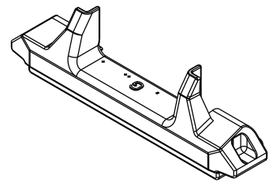
OUTSIDE VIEW



FIELD SIDE POST INSULATOR
(PART #11458)



SECTION A - A



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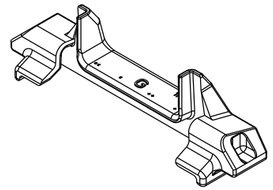

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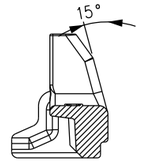
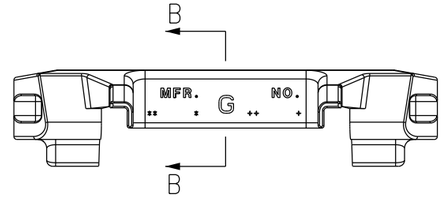
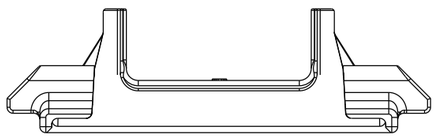


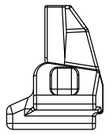
SECTION B - B



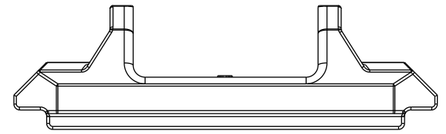
PLAN VIEW



OUTSIDE VIEW



SIDE VIEW



INSIDE VIEW

GAUGE SIDE POST INSULATOR
(PART #11459)

NOTES:

1. INSULATORS TO BE PANDROL TYPE OR EQUIVALENT.
2. APPROXIMATE WEIGHT OF GAUGE SIDE INSULATOR, 1.6 OZ COLOR, GREEN.
3. APPROXIMATE WEIGHT OF FIELD SIDE INSULATOR, 2.3 OZ COLOR, BLUE.
4. STANDARD SIDE POST INSULATOR (PART #7692) (SEE SCRRA ES2365-02).

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 07/14/05

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

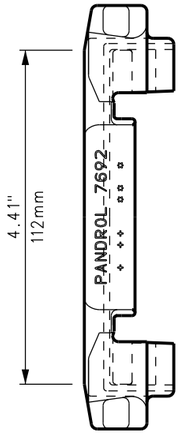
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

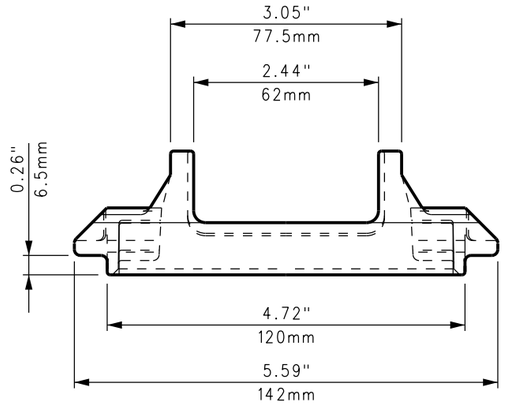
ENGINEERING STANDARDS

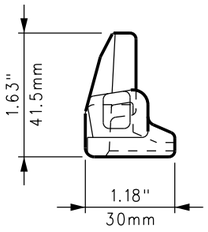
PANDROL FASTCLIP TYPE SIDE POST INSULATORS

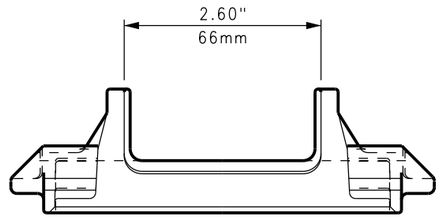
STANDARD: 2365
SCALE: NTS
REVISION: - SHEET: 1 OF 4
CADD FILE: ES2365-01

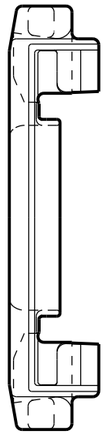
UserName=> scrrapw11ics01$ Date Plotted: 3/27/2023 3:03:25 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_52\ES2365-01.dgn

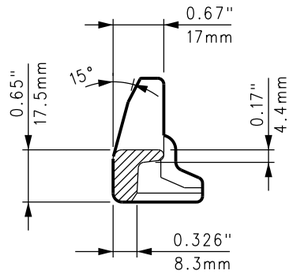












NOTE:

1. COLOR: NATURAL (OFF-WHITE) OR AS SPECIFIED ON PURCHASE ORDER.

STANDARD SIDE POST INSULATOR (PART #7692)

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

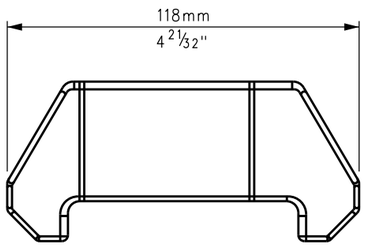
ENGINEERING STANDARDS

INSULATOR SIDE POST
FOR FC1600 SERIES PANDROL FASTCLIP

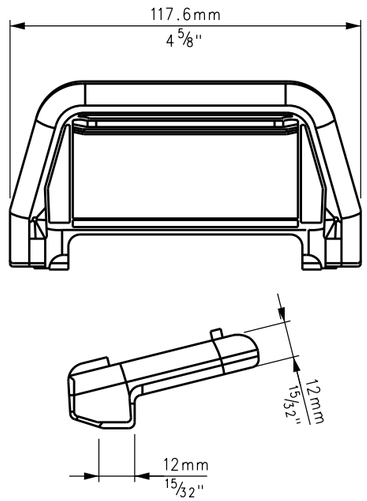
STANDARD: 2365
SCALE: NTS
REVISION: - SHEET: 2 OF 4
CADD FILE: ES2365-02

UserName•› scrrapw11ics01$ Date Plotted: 3/27/2023 3:03:20 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
FileName•› \\scrrapw11ics01\iCS_pdf_work_dir\87\482_53\ES2365-02.dgn

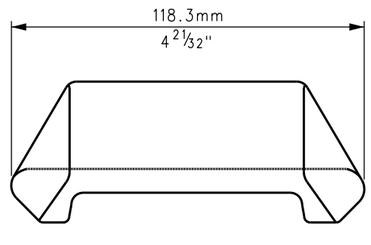
CLASSIFICATION	FIELD/GAGE SIDE OF RAIL	COLOR	POST WIDTH	CONCRETE TIE APPLICATION
STANDARD	BOTH	NATURAL	8MM	USE IN TANGENT TRACK AND CURVES LESS THAN 1 DEGREE 30 MINUTES
NARROW	GAGE	NATURAL	5.4MM	USE IN CURVED TRACK TO CORRECT WIDE GAGE. REQUIRES INSTALLATION OF WIDE POST INSULATOR ON FIELD SIDE.
HEAVY DUTY	FIELD	NATURAL	8MM	USE ON FIELD SIDES OF CURVED TRACK GREATER THAN 1 DEGREE 30 MINUTES. UTILIZE WITH STANDARD INSULATOR ON GAGE SHOULDERS.
		NATURAL W/ CAST BACK	12MM	USE IN CURVED TRACK TO CORRECT WIDE GAGE. REQUIRES INSTALLATION OF NARROW POINT INSULATOR ON GAGE SIDE.



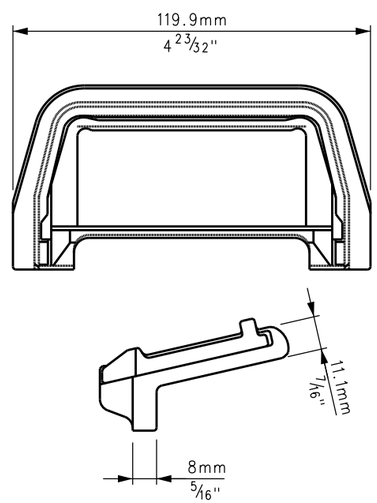
NARROW POST INSULATOR



HEAVY DUTY WIDE POST INSULATOR



STANDARD INSULATOR



HEAVY DUTY INSULATOR

FOR MAINTENANCE ONLY

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 10/28/20

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

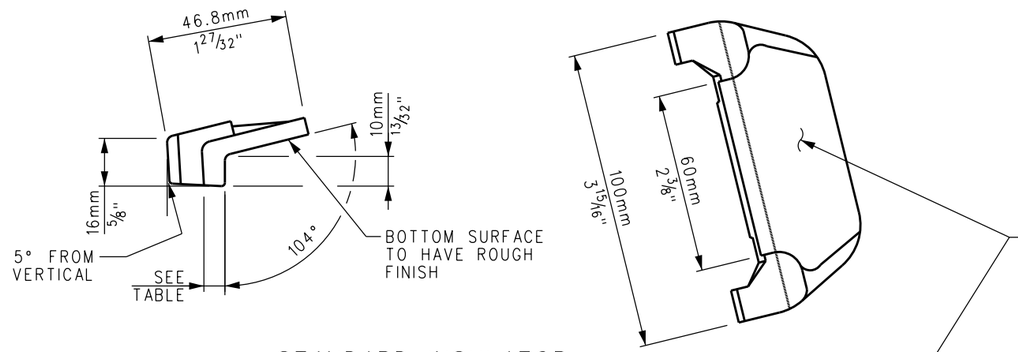
ENGINEERING STANDARDS

INSULATORS FOR E CLIP FASTENING SYSTEM ON CONCRETE TIES

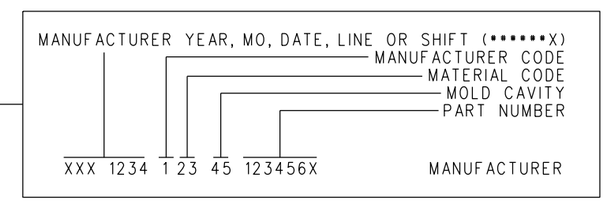
STANDARD: 2365
SCALE: NTS
REVISION: -
SHEET: 3 OF 4
CADD FILE: ES2365-03

UserName•› scrrapw11ics01$ Date Plotted: 3/27/2023 3:06:18 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•› \\scrrapw11ics01\iCS_pdf_work_dir\87\482_131\ES2365-03.dgn

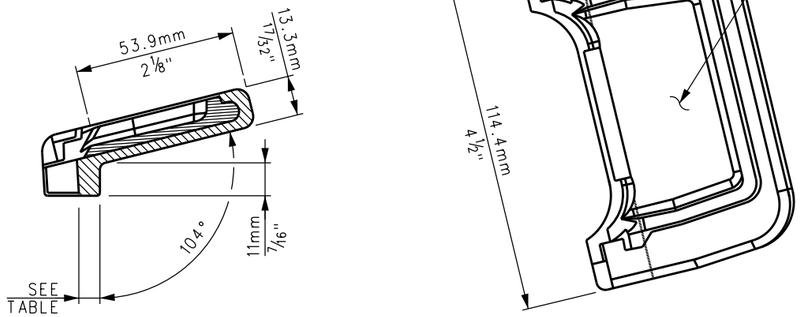
CLASSIFICATION	FIELD/GAGE SIDE OF RAIL	COLOR	POST WIDTH	CONCRETE TIE APPLICATION
STANDARD	BOTH	WHITE/NATURAL	7MM	USE IN TANGENT TRACK AND CURVES LESS THAN 1 DEGREE 30 MINUTES
STANDARD NARROW	GAGE	BLUE	4MM	USE IN CURVED TRACK TO CORRECT WIDE GAGE. REQUIRES INSTALLATION OF WIDE POST INSULATOR ON FIELD SIDE.
STANDARD CONVERSION	GAGE	WHITE/NATURAL	9.5MM	USE IN TRACK WHERE 5½" BASE RAIL IS USED ON 6" BASE RAIL SEAT TIES. LONG REACH SAFELOK 1 CLILP TO BE UTILIZED ON FIELD SIDE.
	FIELD	WHITE/NATURAL	17MM	
HEAVY DUTY	FIELD	WHITE/NATURAL	7MM	USE ON FIELD SIDE ONLY OF CURVED TRACK GREATER THAN 1 DEGREE 30 MINUTES.
		GRAY	10MM	USE IN CURVED TRACK TO CORRECT WIDE GAGE. REQUIRES INSTALLATION OF NARROW POINT INSULATOR ON GAGE SIDE.



STANDARD INSULATOR



MANUFACTURER I.D.



HEAVY DUTY INSULATOR

FOR MAINTENANCE ONLY

X	XX-XX-XX	REVISION	XX	XX
REV.	DATE	DESCRIPTION	DES.	ENG.

DRAWN BY: A. CARLOS DATE: 10/28/20

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

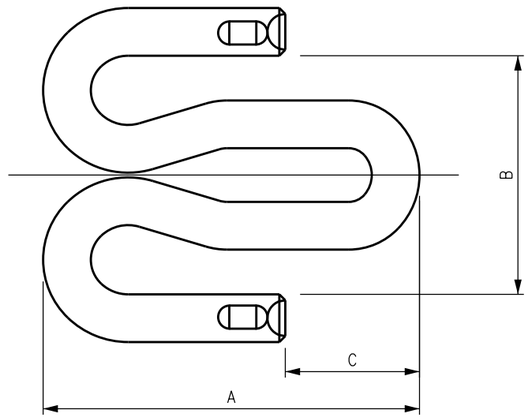
INSULATORS FOR SAFELOK 1 FASTENING SYSTEM

STANDARD: 2365
SCALE: NTS
REVISION: - SHEET: 4 OF 4
CADD FILE: ES2365-04

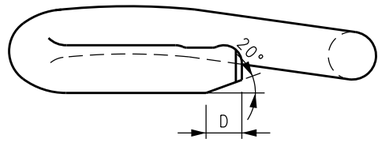
UserName•› scrrapw1ics01$ Date Plotted: 3/27/2023 3:06:42 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•› \\scrrapw1ics01\iCS_pdf_work_dir\87\482_130\ES2365-04.dgn

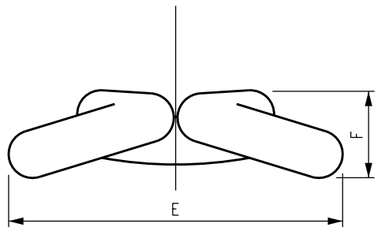
NOTES:

1. PANDROL RAIL CLIP TYPE FC1601 AND FC1603 AS SHOWN ARE USED WITH PANDROL TYPE OR EQUIVALENT FASTCLIP CONCRETE TIE ASSEMBLIES FOR 5½" BASE AND 6" BASE RAIL RESPECTIVELY.
2. TWO CLIPS ARE REQUIRED PER ASSEMBLY. SEE SCRRA ES2360-01 THROUGH ES2360-03.



DIMENSION TABLE				
PANDROL FAST CLIP TYPE RAIL CLIPS (OR EQUAL)				
DIM	INCHES	mm	INCHES	mm
A	4 31/32"	126	5 5/32"	131
B	3 5/32"	80	3 5/32"	80
C	1 25/32"	45	2 3/32"	53
D	15/32"	12	15/32"	12
E	4 13/32"	112	4 13/32"	112
F	1 1/8"	29	1 1/16"	27
NO	FC1601 (136 LB)		FC1603 (115-119 LB)	





REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 07/14/05

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PANDROL TYPE FASTCLIP
136LB. FC1601 AND 115-119LB. FC1603

STANDARD: 2366
SCALE: NTS
REVISION: -
SHEET: 1 OF 1
CADD FILE: ES2366

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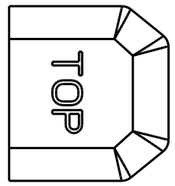
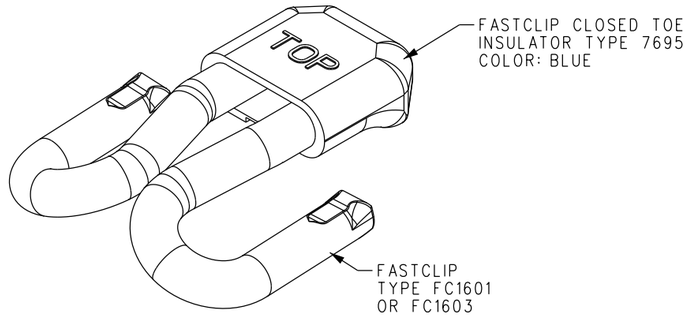
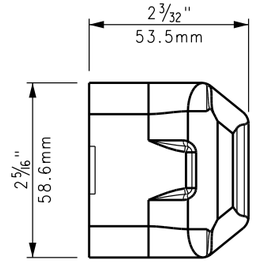


TOP VIEW

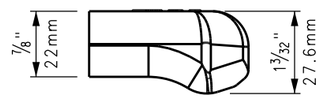


ISOMETRIC
(ASSEMBLED)

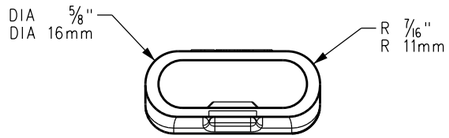


BOTTOM

ISOMETRIC



SIDE VIEW



END VIEW

NOTE:

1. TOE INSULATOR TO BE PANDROL TYPE 7695 OR EQUIVALENT. INSULATOR COLOR: BLUE
2. FOR USE WITH PANDROL FASTCLIP TYPE FC1601, FC1603, OR EQUIVALENT.
3. TYPE 7695 TOE INSULATOR IS A HEAVY DUTY PART NUMBER.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 07/14/05

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PANDROL TYPE TOE INSULATOR
TO SUIT PANDROL FASTCLIP
1600 SERIES RAIL CLIPS

STANDARD: 2367
SCALE: NTS
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2367

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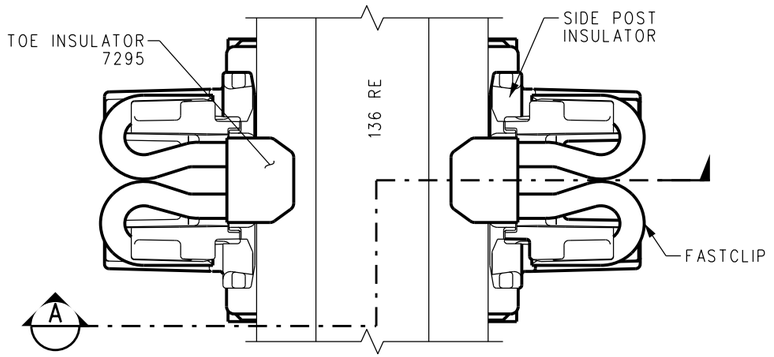
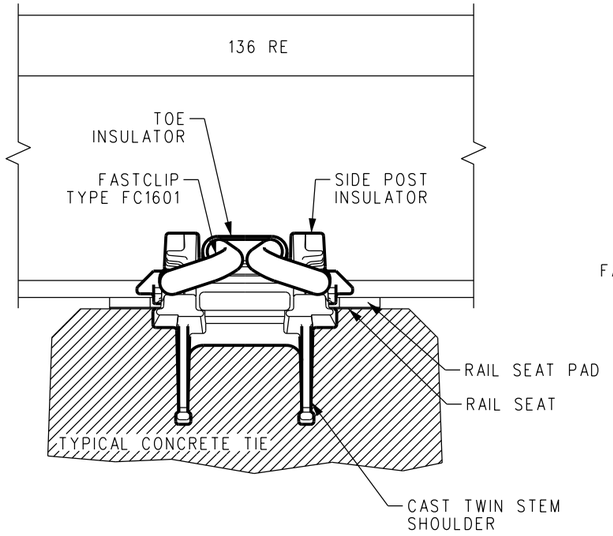
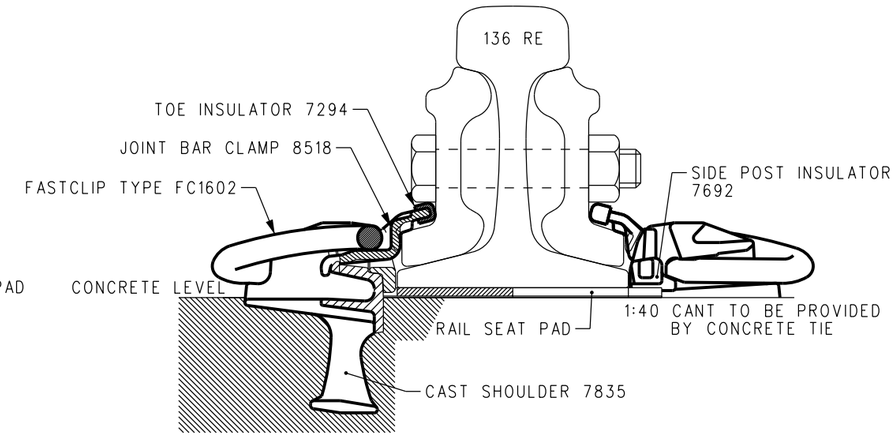


STANDARD FASTCLIP
ON CONRETE TIE



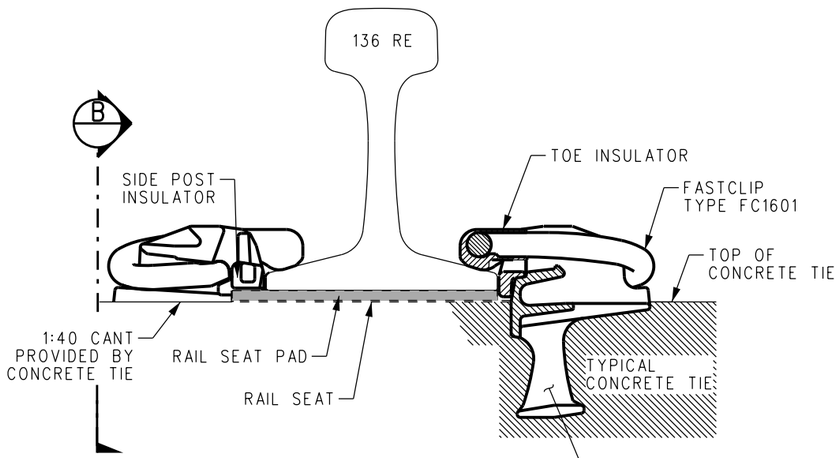
SECTION B



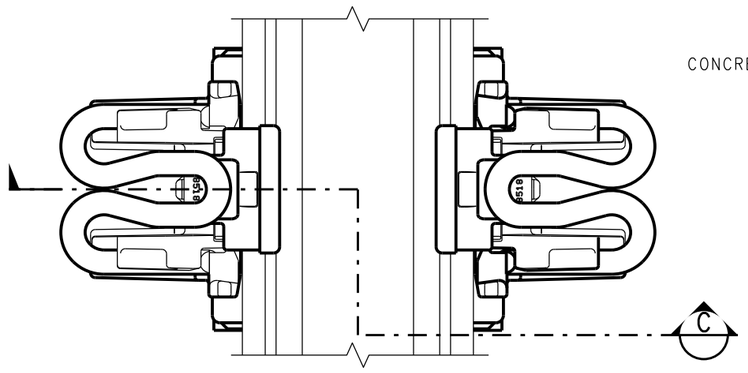
MODIFIED FASTCLIP
FOR STANDARD JOINTS
ON CONCRETE TIE

NOTES:

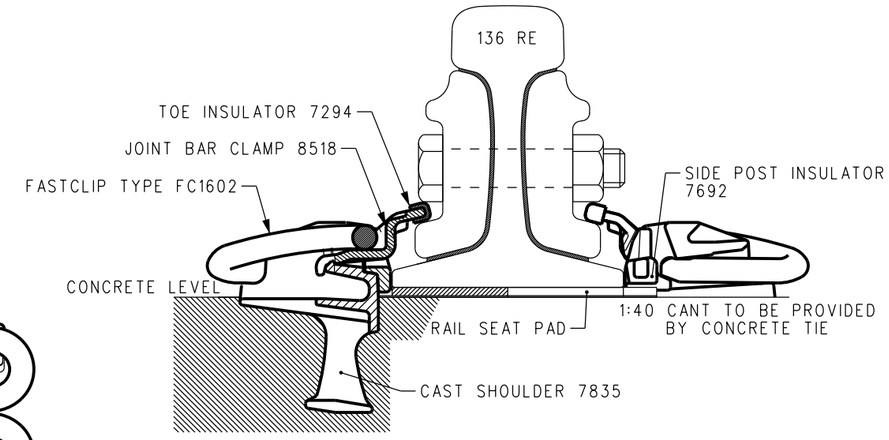
1. FASTCLIP FC1601 SHALL BE USED AT ALL LOCATIONS OTHER THAN JOINTS.
2. A MODIFIED FASTCLIP FC1602 SHALL BE USED ONLY AT JOINT BAR LOCATIONS.
3. FASTCLIP ASSEMBLIES FOR JOINTS (FC1602, FC8518, & FC7294) ARE PAINTED YELLOW FOR SIMPLE IDENTIFICATION.



SECTION A



MODIFIED FASTCLIP FOR JOINTS



NOTE:

1. SECTION C PROVIDES A VIEW OF A MODIFIED FASTCLIP FOR EITHER A STANDARD JOINT OR AN INSULATED JOINT ON A CONCRETE TIE.

MODIFIED FASTCLIP
FOR INSULATEDJOINTS
ON CONCRETE TIE C

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PANDROL TYPE TOE INSULATOR TO SUIT
PANDROL FASTCLIP 1600 SERIES RAIL CLIPS
FOR STANDARD RAIL & JOINT APPLICATIONS

STANDARD 2368
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2368

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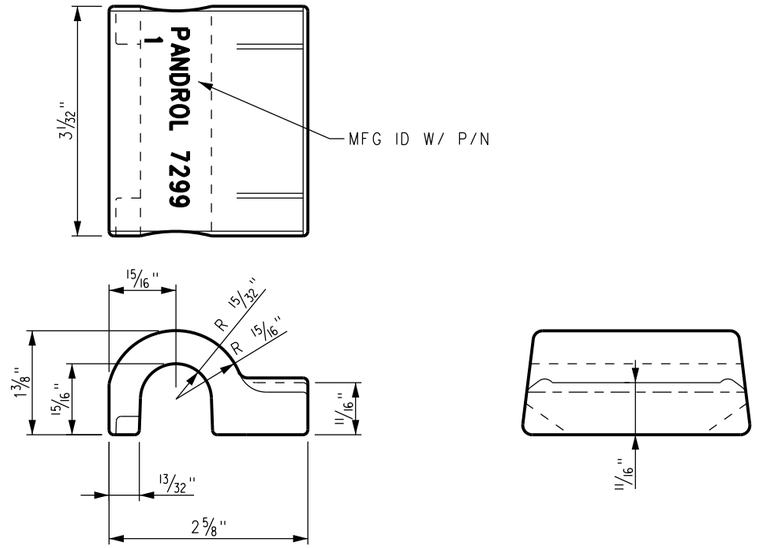
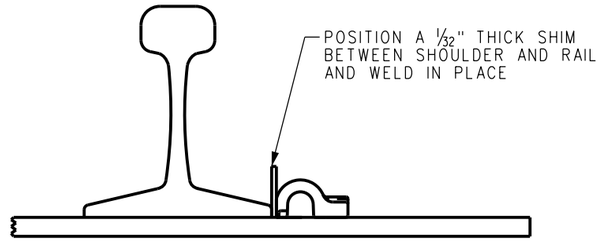
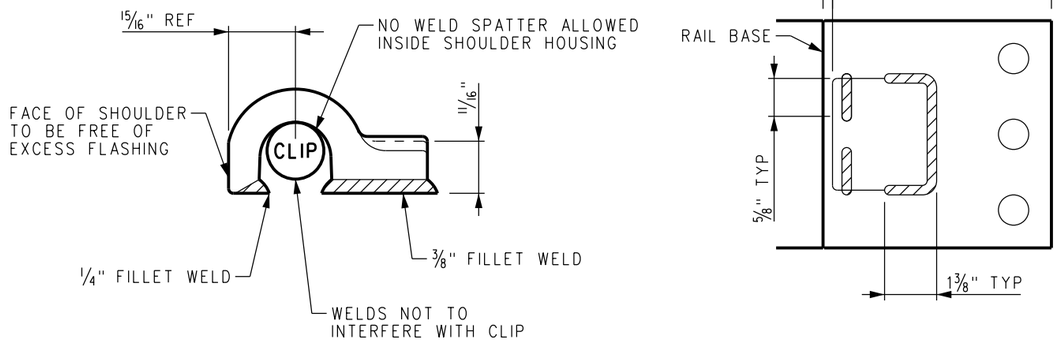


WELD-ON SHOULDER PANDROL P/N 7299-1



POSITIONING SHOULDER



WELDING DETAIL OF 7299-1 SHOULDER

NOTES:

1. ALL WELDS TO BE IN ACCORDANCE WITH AREMA WELDING SPECIFICATIONS, 1/8" 7018 WELDING ROD, 3-PASSES.
2. ALL WELDS TO HAVE FULL PENETRATION TO BOTH PLATE AND SHOULDER.
3. WELD MUST NOT INTERFERE WITH EITHER THE RAIL OR THE CLIP.
4. RAIL SEATS AND INSIDE SHOULDER HOUSING TO BE FREE OF EXCESS WELD, SLAG, AND SPATTER.
5. SHOULDERS TO BE TACKED (OR CLAMPED) DOWN PRIOR TO FINAL WELDING, TO PREVENT THE CLIP FROM RISING DURING THE FINAL WELDS.
6. SHOULDER TO BE GENERALLY CENTERED ON THE PLATE, IF POSSIBLE.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

WELD-ON SHOULDER
FOR PANDROL "E" - CLIPS

STANDARD: 2369
SCALE: NTS
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2369

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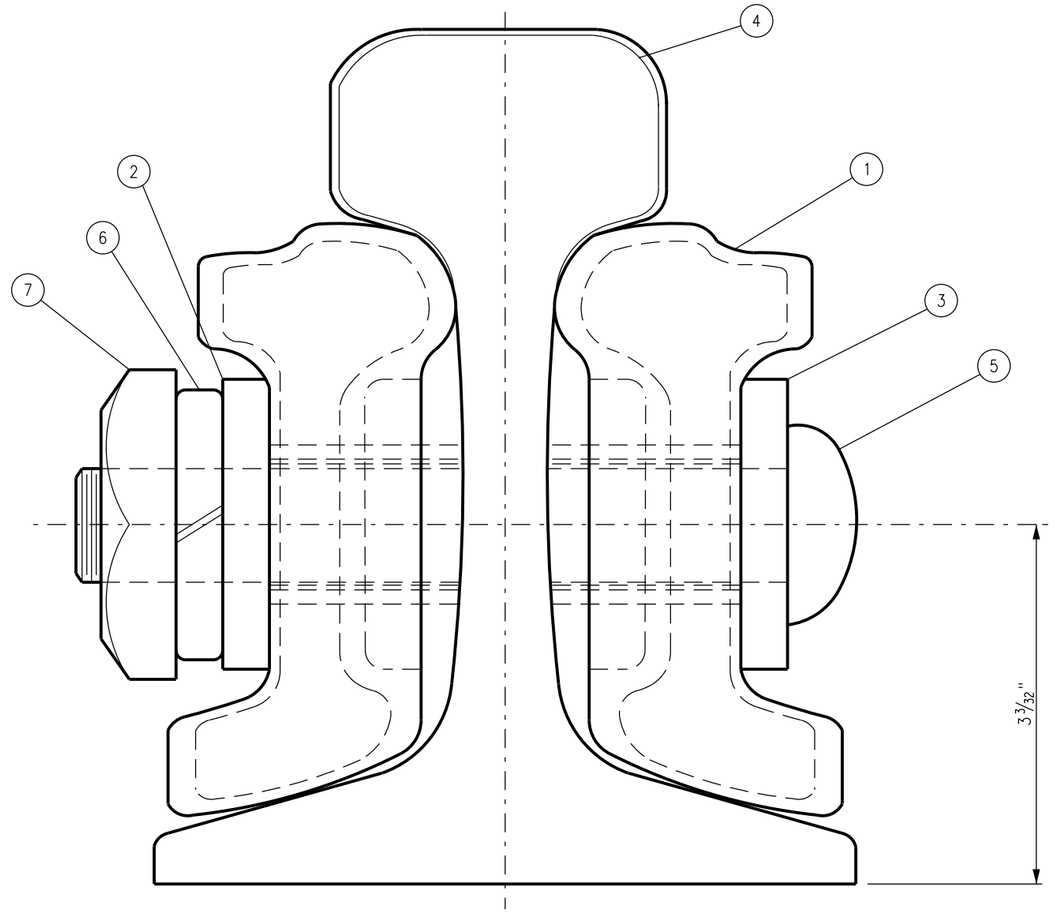
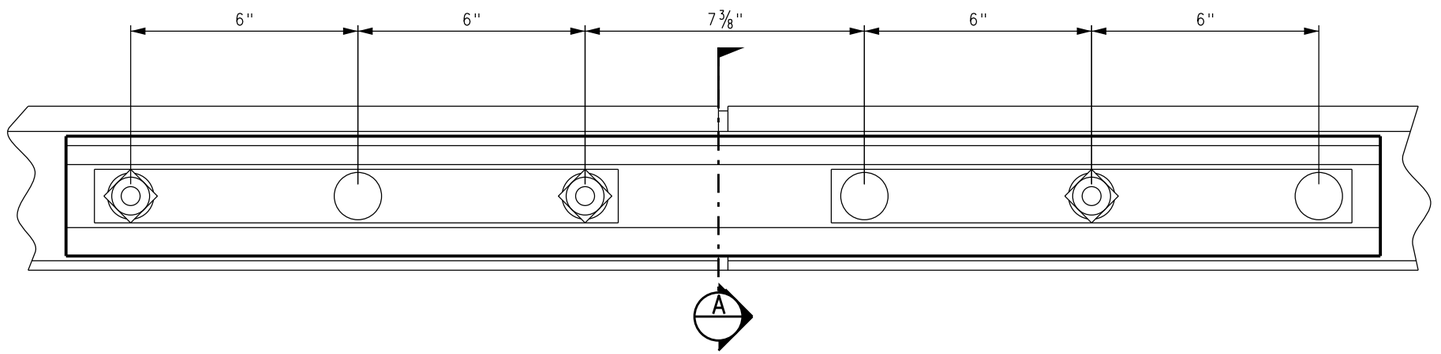
ITEM	QTY	DESCRIPTION
1	2	POLY INSULATED JOINT BAR 36½" LONG
2	2	STEEL BACKUP PLATE ½" THICK X 15¼" LONG
3	2	STEEL BACKUP PLATE ½" THICK X 15¼" LONG
4	1	SCOTCHPLY END POST ⅜" THICK
5	6	OVAL NECK BOLT 1" X 7½" LONG
6	6	1" LOCKWASHER
7	6	1" SQUARE NUT



SECTION A



REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

POLY - INSULATED JOINT
141-136-132 LB. RE RAIL

STANDARD 2370
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2370

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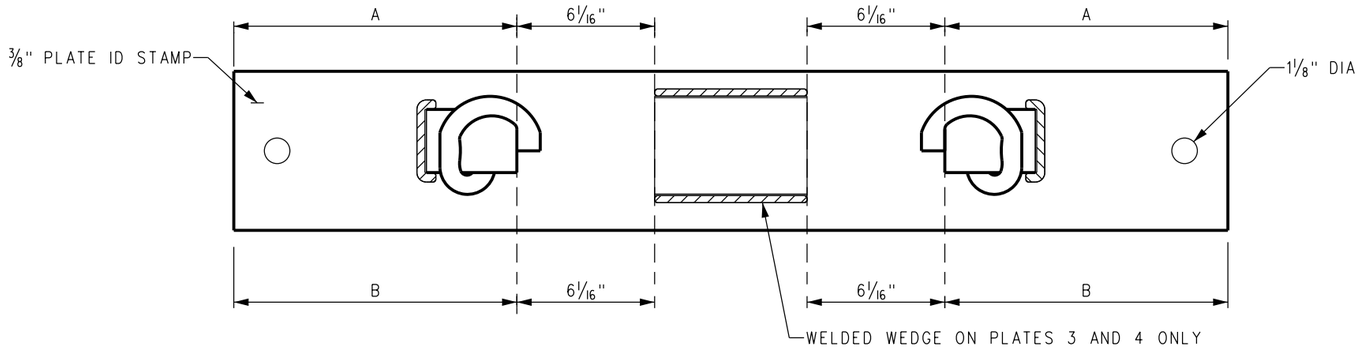
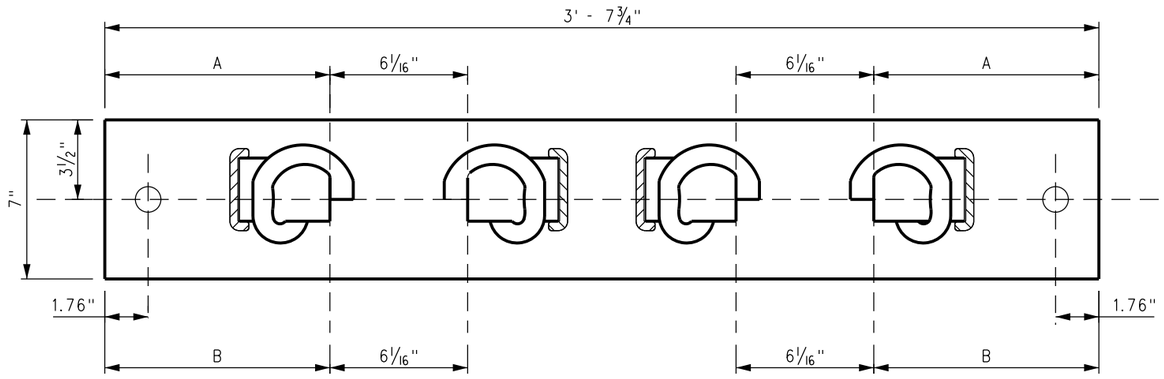
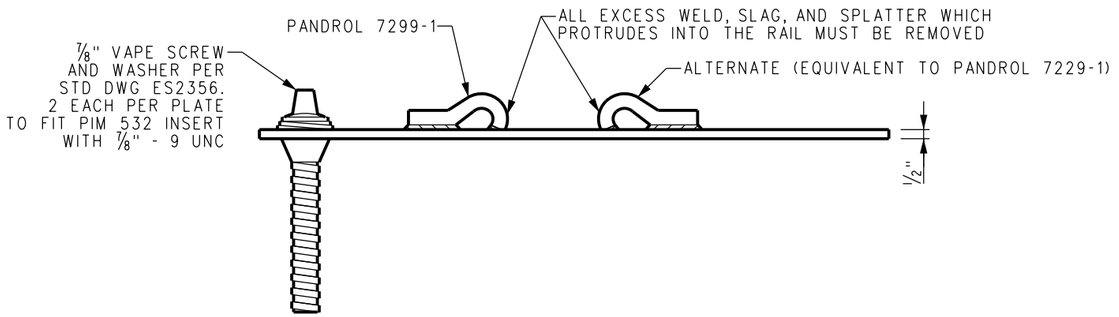


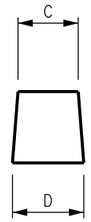
PLATES 1 - 4



PLATES 5-8 AND STANDARD



DOUBLE INSIDE GUARD RAIL PLATE DETAILS



1/2" X 4" A36 STEEL BLOCK (WEDGE) FOR PLATES 3 & 4

PLATE ID	C (IN)	D (IN)
3	2.65	3.14
4	5.34	5.74

ENTRY PLATES

PLATE ID	A (IN)	B (IN)
1	17.12	16.75
2	15.85	15.69
3	14.59	14.15
4	13.21	12.87
5	12.11	11.83
6	11.24	11.03
7	10.60	10.47
8	10.21	10.14

STANDARD PLATE

PLATE ID	A (IN)	B (IN)
STD	10.05	10.05

DOUBLE INSIDE GUARD RAIL ITEM NUMBERS SET INCLUDES ALL ENTRY PLATES (2 OF EACH)	
STD PLATE (EACH)	ENTRY PLATES 1-8 (SET)

NOTES:

1. NO INSIDE CLIPS FOR PLATES 1, 2, 3, & 4. REQUIRES STEEL WEDGE ON PLATES 3 & 4.
2. IF 5 1/2" BASE RAIL WILL BE USED FOR GUARD RAIL, THEN DIMENSIONS A & B ARE TO BE INCREASED BY 0.50 (IN), AND THE RAIL SEAT DIMENSION WILL CHANGE FROM 6 1/16" TO 5 9/16".

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

INSIDE GUARD RAIL PLATES FOR CONCRETE TIES

STANDARD 2371
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2371

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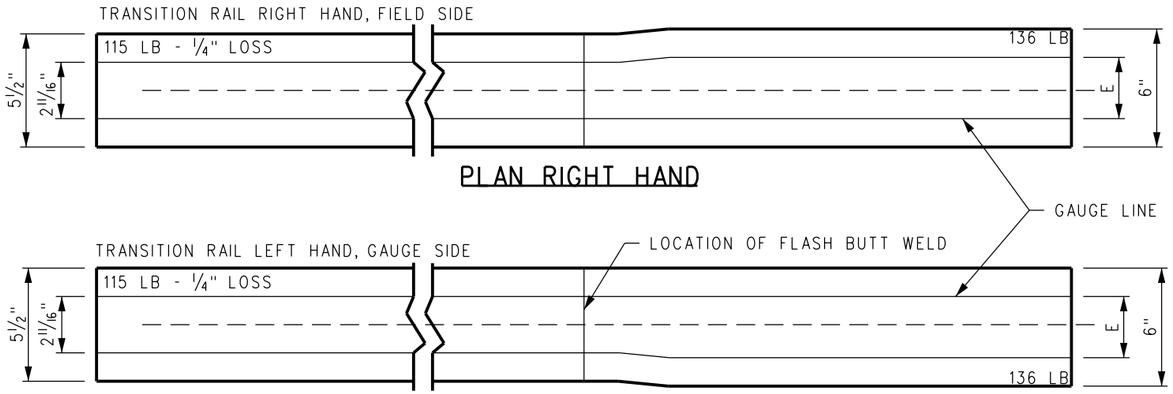
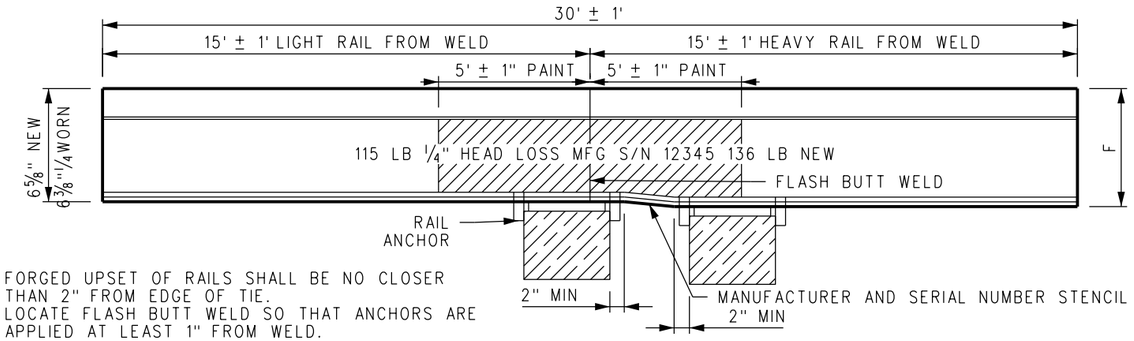


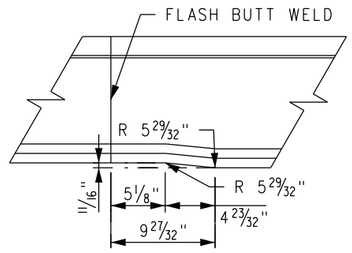
TRANSITION RAIL HAND IDENTIFICATION



FORGED UPSET OF RAILS SHALL BE NO CLOSER THAN 2" FROM EDGE OF TIE. LOCATE FLASH BUTT WELD SO THAT ANCHORS ARE APPLIED AT LEAST 1" FROM WELD.

ELEVATION

FACING GAUGE SIDE OF RAIL



TRANSITION DETAIL

RAIL	E	F
132 LB 1/4" WORN	2 31/32"	6 7/8"
136 LB NEW	2 29/32"	7 5/16"
136 LB 1/4" WORN	2 29/32"	7 1/16"
141 LB NEW	2 29/32"	7 1/16"

BILL OF MATERIALS

TRANSITION RAIL ASSEMBLIES - LEFT HAND AND RIGHT HAND

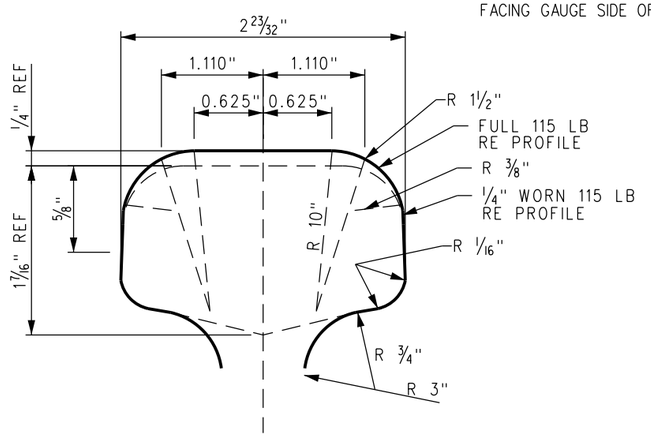
141 LB NEW TO 115 LB NEW
141 LB NEW TO 115 LB 1/4" HEAD LOSS
136 LB NEW TO 115 LB NEW
136 LB NEW TO 115 LB 1/4" HEAD LOSS
136 LB 1/4" HEAD LOSS TO 115 LB 1/4" HEAD LOSS
132 LB 1/4" HEAD LOSS TO 115 LB 1/4" HEAD LOSS

NOTES:

1. TO DETERMINE HAND OF TRANSITION RAIL:
   A. FACE GAUGE SIDE OF TRANSITION RAIL. IF TRANSITION RAIL IS INSTALLED IN TRACK, STAND IN CENTER OF TRACK.
   B. MANUFACTURER'S TAG SHOULD BE VISIBLE IN WEB AREA, GAUGE SIDE.
   C. TAG SHOULD READ "GAUGE SIDE".
   D. WHEN HEAVY OR HIGH RAIL IS ON THE RIGHT, IT IS A RIGHT HAND TRANSITION RAIL. WHEN HEAVY OR HIGH RAIL IS ON THE LEFT, IT IS A LEFT HAND TRANSITION RAIL.
2. TRANSITION RAIL LENGTHS WERE CALCULATED USING 19 1/2" TIE SPACING FOR WOOD AND 24" TIE SPACING FOR CONCRETE.
3. ALWAYS MEASURE TRANSITION RAIL LENGTH BEFORE CUTTING OUT OLD RAIL.
4. BOX ANCHOR TIE EACH SIDE OF TRANSITION. BOX ANCHOR TIE EACH SIDE OF THERMITE WELDS, AS SHOWN. OTHERWISE, ANCHOR PER SCRRA ES2351-02.

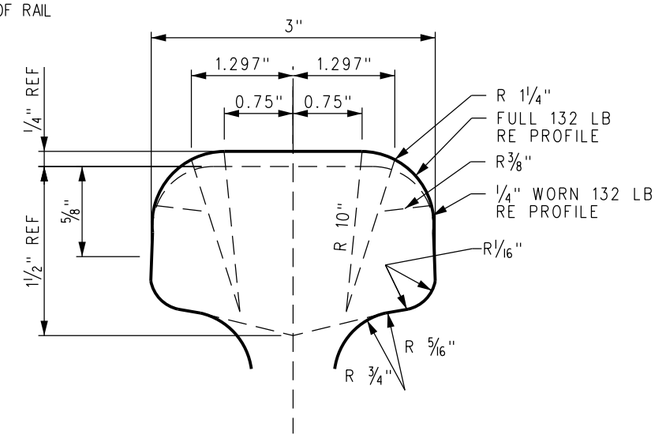
NOTES FOR MANUFACTURERS:

1. TRANSITION RAILS ARE FURNISHED AS PAIRS AND ARE RIGHT OR LEFT HANDED.
2. MANUFACTURER TO PLACE ID TAG READING "GAUGE SIDE" ON WEB OF RAIL GAUGE SIDE AND OTHER APPROPRIATE INFORMATION AS SHOWN.
3. MACHINED SURFACES MUST BE FREE OF SEAMS AND RIDGES.
4. FLASH BUTT WELD TO BE GROUND FLUSH WITH PARENT RAILS ON BASE AND SIDES OF BASE, +0.000" TO -0.010".
5. TEMPLATES MUST BE USED TO CHECK FINISHED GAUGE CORNER AND TOP RADII.
6. HEAD HARDENED RAIL TO BE USED UNLESS OTHERWISE SPECIFIED.
7. MANUFACTURER TO MARK LIFT/BALANCE POINT FOR EACH RAIL LENGTH MANUFACTURED AND ACTUAL WEIGHT OF RAIL, STENCILED ON HEAD OF RAIL.
8. MANUFACTURER TO PAINT WEB OF RAIL, 10 FEET CENTERED ON WELD AND SOLID WHITE BOTH SIDES. USING 2 1/2" BLOCK STENCIL AND BLACK PAINT, MARK RAIL TRANSITIONS, I.E. 136 LB NEW AND 132 LB 1/4" HEAD LOSS AT APPROPRIATE END OF THE WHITE PAINTING. STENCIL IN BLACK THE MFG NAME AND S/N BETWEEN MARKING RAIL TRANSITIONS USING 2" BLOCK STENCIL.



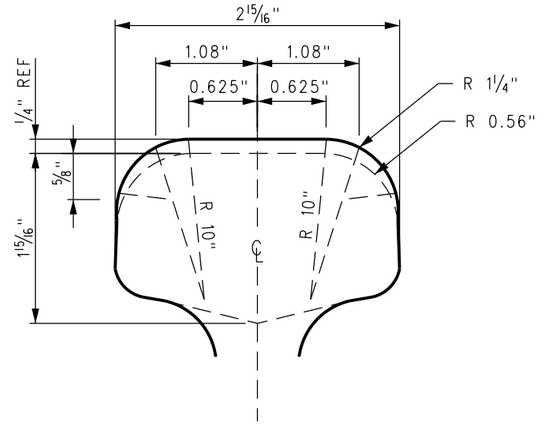
TOP RADII DETAIL

115 LB



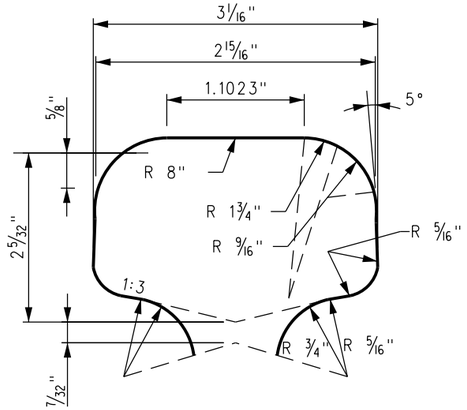
TOP RADII DETAIL

132 LB



TOP RADII DETAIL

136 LB



TOP RADII DETAIL

141 LB

X	XX-XX-XX	REVISION	XX	XX
REV.	DATE	DESCRIPTION	DES.	ENG.

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

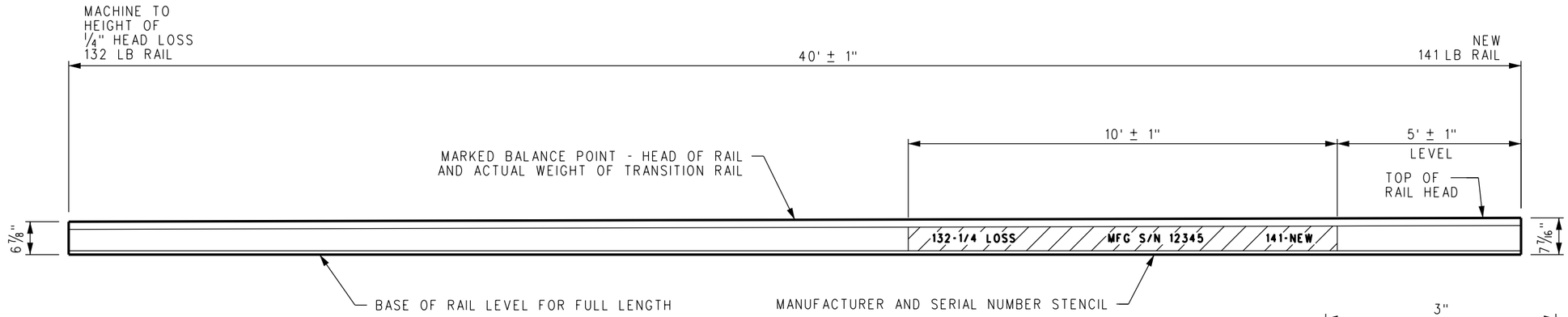
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

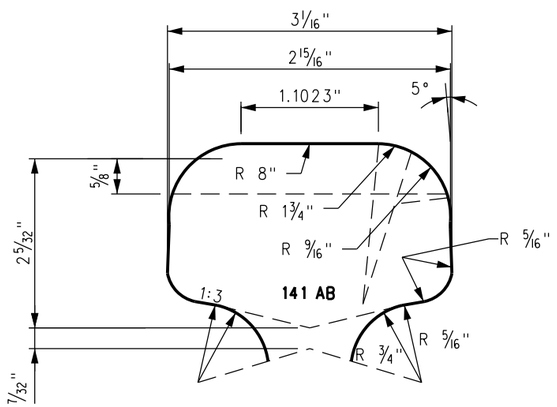
ENGINEERING STANDARDS

FORGED TRANSITION RAILS FOR NEW 141 / 136LB. TO 115LB. NEW AND 1/4" HEAD LOSS RAIL

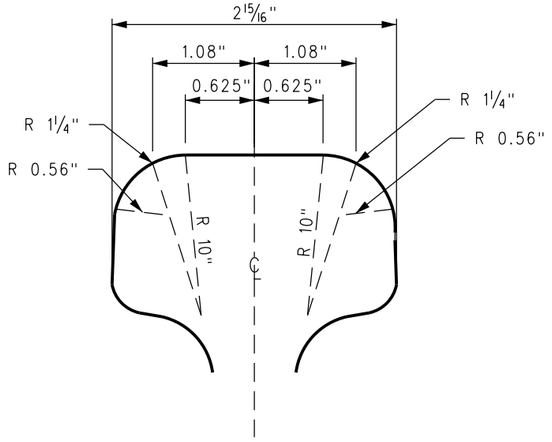
STANDARD 2372
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2372

UserName→ scrrapw11ics01$ Date Plotted: 3/27/2023 3:03:43 PM Plot Driver→ C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName→ \\scrrapw11ics01\iCS_pdf_work_dir\87\482_60\ES2372.dgn

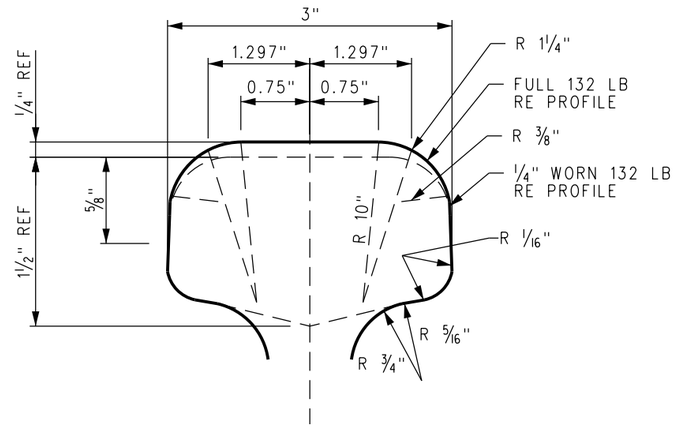




TOP RADII DETAIL
141 LB



TOP RADII DETAIL
136 LB



TOP RADII DETAIL
132 LB

RAIL HEIGHT		
SECTION	NEW	1/4" HEAD LOSS
141 LB	7 7/16"	-
136 LB	7 5/16"	-
132 LB	-	6 7/8"

BILL OF MATERIALS

QUANTITY TRANSITION RAIL
1 EA TRANSITION RAIL, 141 LB NEW TO 132 LB 1/4" HEAD LOSS
1 EA TRANSITION RAIL, 136 LB NEW TO 132 LB 1/4" HEAD LOSS

NOTES:

1. RAIL TO BE PURCHASED AND MANUFACTURED TO CURRENT "SCRRA SPECIFICATIONS FOR HEAD HARDENED RAIL".
2. TRANSITION RAIL TO BE MANUFACTURED FROM HEAD HARDENED RAIL.
3. MACHINED SURFACES MUST BE FREE OF SEAMS AND RIDGES.
4. TEMPLATES MUST BE USED TO CHECK FINISHED GAUGE CORNER AND TOP RADII.
5. MANUFACTURER TO MARK LIFT/BALANCE POINT FOR EACH RAIL LENGTH AND ACTUAL WEIGHT OF RAIL, STENCILED ON HEAD OF RAIL.
6. MANUFACTURER SHALL PAINT WEB OF RAIL, 10 FEET AS SHOWN ON RAIL, SOLID WHITE, BOTH SIDES. USING 2 1/2" BLOCK STENCIL AND BLACK PAINT, MARK RAIL TRANSITIONS, I.E. 141-NEW AND 132 1/4" LOSS AT EACH END OF THE WHITE PAINTING. STENCIL IN BLACK THE MFG NAME AND S/N BETWEEN MARKING RAIL TRANSITIONS USING 2" BLOCK STENCIL.
7. THE 141 LB TRANSITION RAIL CAN BE USED WITH 136 LB AND 132 LB RAIL SECTIONS NEW TO 1/4" HEAD LOSS.
8. TRANSITION RAIL IS UNIVERSAL AND CAN BE USED AS RIGHT HAND OR LEFT HAND RAIL.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TRANSITION RAILS (PLANED)
FOR NEW 141LB. AND 136LB.
TO 132LB. 1/4" HEAD LOSS

STANDARD 2373
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2373

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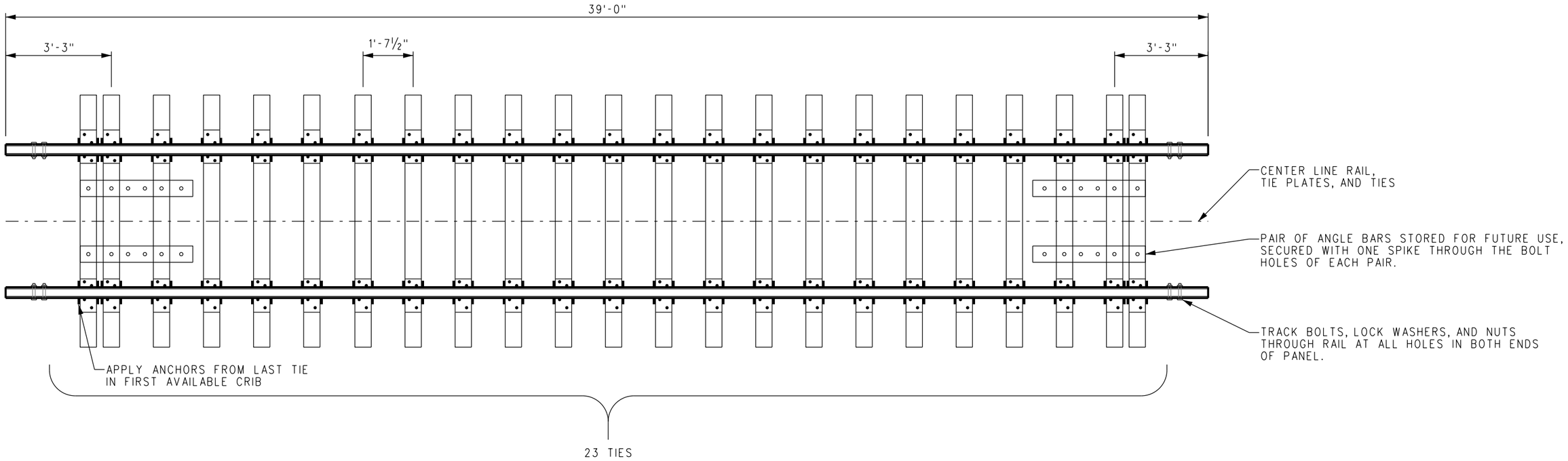

EMERGENCY TRACK PANEL

PANEL WEIGHTS

PANEL WEIGHTS IN LBS	
39' PANEL	
115 LB	136 LB
10,300±	10,800±

ALLOWABLE SECOND HAND RAIL WEAR

RAIL WEIGHT	ALLOWABLE WEAR	
	TOP	GAUGE
136 LB	3/8"	1/4"
115 LB	1/8"	1/4"

NOTES:

1. TRACK PANELS TO BE CONSTRUCTED AS ABOVE.
2. NEW OR SECOND HAND RAIL. NEW RAIL TO BE DRILLED SECOND AND THIRD HOLES ONLY (HOLE NEAREST END NOT DRILLED). RAIL TO COMPLY TO CURRENT SPECIFICATIONS. RAIL TRANSPOSED SO THAT WORN RAIL IS ON FIELD SIDE OF PANELS. THE HEAD LOSS AND GAUGE FACE LOSS BETWEEN ANY TWO PANELS ON A SHIPMENT, MEASURED ON BOTH ENDS, SHOULD NOT BE MORE THAN ±1/8". GAUGE IS TO BE WITHIN ±1/8" TO PROPER GAUGE OF 56½" AT 5/8" BELOW TOP OF BALL OF RAIL.
3. NEW OR SECOND HAND TIE PLATES TO MATCH NEW OR SECOND HAND RAIL.
4. USE NEW ANCHORS.
5. DERAILMENT PANELS TO BE BOX ANCHORED EVERY TIE.
6. ANCHOR PATTERN OF MAIN LINE PANELS ADJUSTED IN THE FIELD DURING INSTALLATION TO COMPLY WITH SCRRA ES2351-02.
7. USE NEW 7" X 9" X 8'-6" HARDWOOD TREATED TIES SPIKING PATTERN TO COMPLY WITH SCRRA ES2460-01, FIGURE A.
8. APPROPRIATE NUMBER OF TRACK BOLTS, LOCK WASHERS AND NUTS FASTENED IN ALL BOLT HOLES IN RAILS. WRAP BOLT ENDS WITH DUCT TAPE TO PREVENT BOLT LOOSENING.
9. ANGLE BARS ARE TO BE PLACED ON THE END TIES AS SHOWN ABOVE AND SPIKED TO THE TIE THROUGH THE BOLT HOLE WITH ONE SPIKE PER PAIR OF BARS.
10. TIES ARE PERPENDICULAR TO RAIL AND SPACING IS ±1". RAIL ENDS TO MATCH WITHIN 1/4".
11. PANELS TO BE MARKED TO INDICATE WEIGHT WITH INDELIBLE MARKER ON TOP OF RAIL AT CENTER OF PANEL.
12. PANEL TO BE MARKED TO INDICATE NEW OR SECOND HAND RAIL WITH INDELIBLE MARKER ON SIDE OF RAIL NEAR CENTER OF PANEL.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TYPICAL TRACK PANELS
115 LB. AND 136 LB. TIMBER TIES

STANDARD 2380
SCALE: NTS
REVISION -
SHEET 1 OF 1
CADD FILE: ES2380

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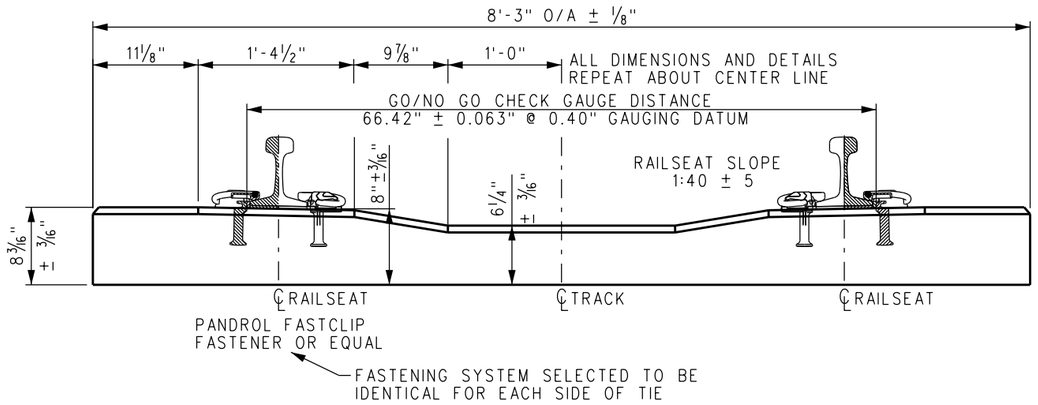
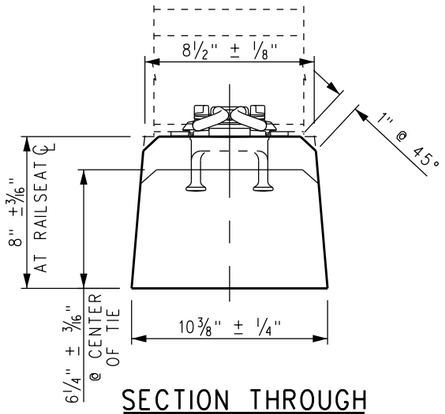


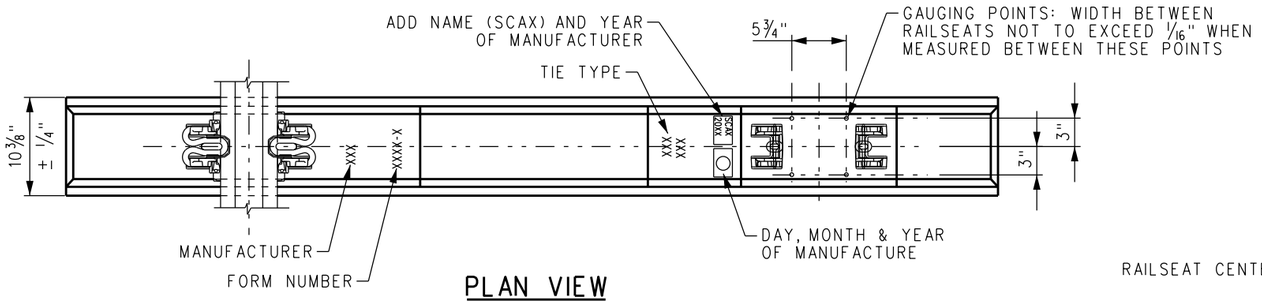
ELEVATION

(FRICTION PATTERN
NOT SHOWN FOR CLARITY)

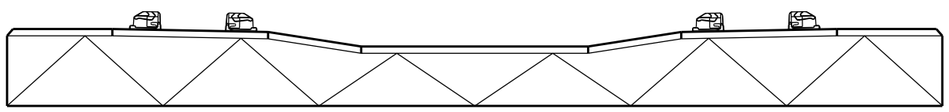


SECTION THROUGH RAILSEAT CENTERLINE

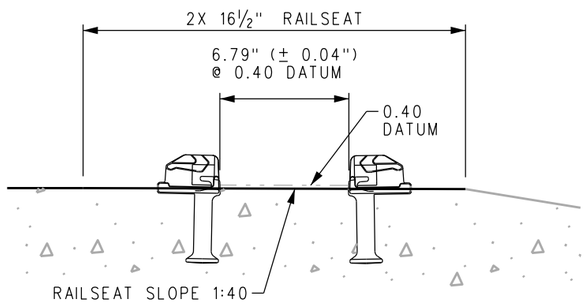
(PRESTRESSING WIRE NOT SHOWN)



PLAN VIEW



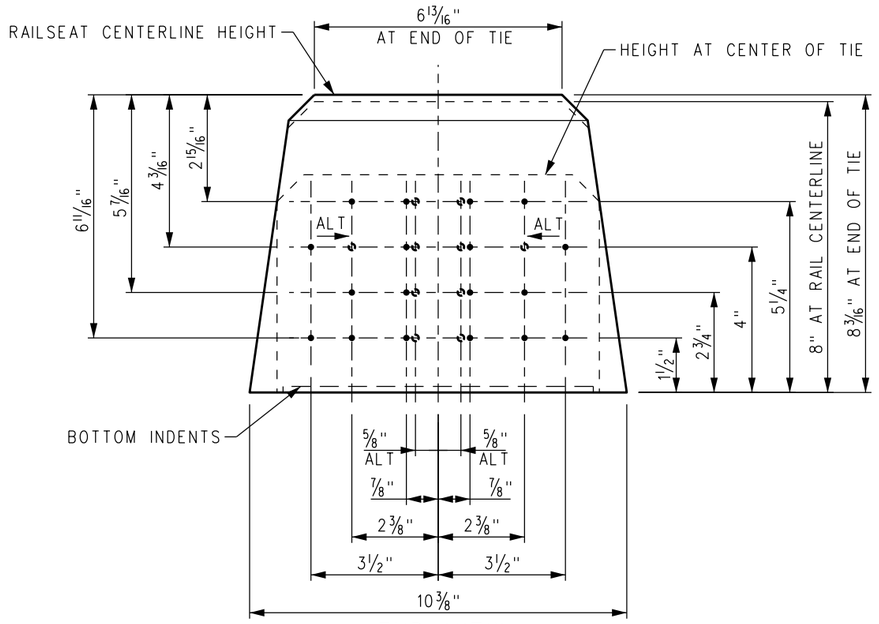
FRICTION PATTERN



SHOULDER LOCATION DETAIL

NOTES:

1. CONCRETE COMPRESSIVE STRENGTH (USING ▫4" CYLINDER):
   28 DAY SPECIFIED ▫ 7000 PSI [48.3 MPa]
   TRANSFER MINIMUM ▫ 4500 PSI [31 MPa]
2. AIR ENTRAINED CONCRETE TO BE USED. AIR CONTENT TO BE A MINIMUM OF 3.5% IN THE HARDENED CONCRETE.
3. THE RAILSEAT SHALL BE A FLAT SMOOTH SURFACE ± 0.04" [1.0mm].
4. GAUGING POINTS FOR FLATNESS AND WIND. WIND BETWEEN RAILSEATS NOT TO EXCEED 1/16" [1.6mm] BETWEEN THESE POINTS.
5. ENDS OF PRESTRESSING WIRE TO BE CUT OFF TO WITHIN 1/8" [3.2mm] FROM SURROUNDING CONCRETE AT TIE ENDS.
6. TIES TO BE MANUFACTURED IN ACCORDANCE WITH SPECIFICATIONS AND ACCEPTED PCI PRACTICE FOR PRESTRESSED CONCRETE.
7. THIS TIE IS DESIGNED FOR USE WITH 136 RE, RAIL. THIS TIE WILL ALSO ACCOMMODATE 115 LB, 119 LB, 132 LB, AND 141 LB RAIL WITH MINOR CHANGE IN SIDE POST TO ACHIEVE CORRECT GAUGE. SEE SCRRA ES2360 FOR DETAILS CONCERNING SIDE POST AND RAIL SIZE.
8. FOR DIMENSIONAL ACCEPTANCE PURPOSES, THE GAUGING DIMENSION BETWEEN OUTER SHOULDERS IS CHECKED WITH GO/NO GO GAUGES TO BE WITHIN 1/16" OF CALCULATED DIMENSION, AT A HEIGHT OF 0.4" ABOVE THE RAIL SEAT SURFACE WHICH IS 66.42" ± 0.63".
9. PRESTRESSING WIRE IS 5.32mm DIAMETER CONFORMING WITH ASTM A-881 STEEL WIRE, DEFORMED, STRESS RELIEVED FOR PRESTRESSED CONCRETE RAILROAD TIES. ULTIMATE STRENGTH IS 9200 LB-FORCE MINIMUM.
10. WIRES ARE TENSIONED TO 7000 LB-FORCE/WIRE.
11. THE TOLERANCE ON WIRE SHALL BE ± 1/4". ANY SINGLE WIRE MAY BE OUT OF POSITION BY MORE THAN 1/4" SO LONG AS 3/4" MINIMUM COVER AND ELECTRICAL REQUIREMENTS ARE SATISFIED.
12. ○ ▫ ALTERNATE WIRE LOCATION
13. FASTENING SYSTEM TO BE FASTCLIP OR AS APPROVED BY THE SCRRA ASSISTANT DIRECTOR, DESIGN.
14. AN SCRRA APPROVED FRICTION PATTERN SHALL BE CAST INTO SIDES OF TIES AND EMBOSSED INTO BOTTOM OF TIES.
15. RAILSEAT CANT: 1:40 (0.144 @ 5 3/4" GAUGING POINT)
    MAX ▫ 0.164" @ 5 3/4" GAUGING POINT
    MIN ▫ 0.128" @ 5 3/4" GAUGING POINT
16. APPROXIMATE WEIGHT OF TIE ▫ 610 LBS
    (USING AIR ENTRAINED CONCRETE)



END VIEW

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06/27/2011	REVISED NOTE AND STAMP, PLAN VIEW	AC	NDP

DRAWN BY: A. CARLOS DATE: 10/01/03

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

CONCRETE TIE AND FASTCLIP FASTENING STANDARD

STANDARD 2402
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2402

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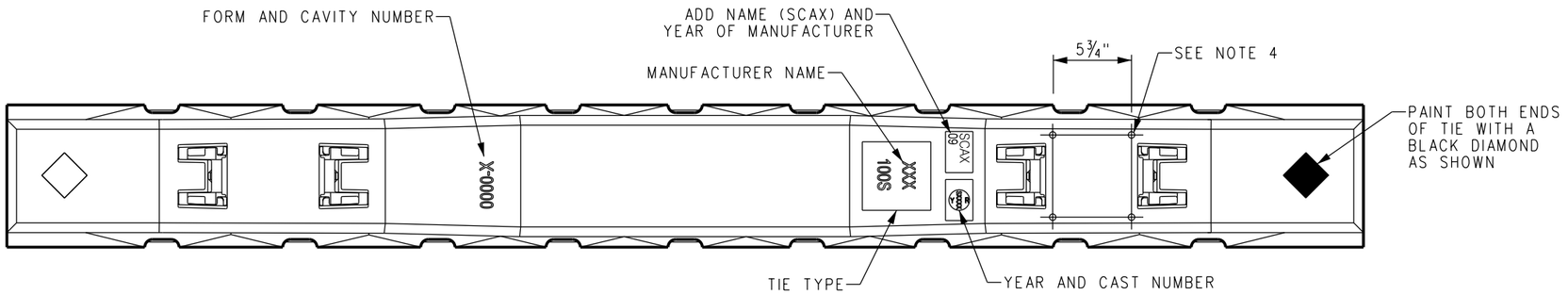
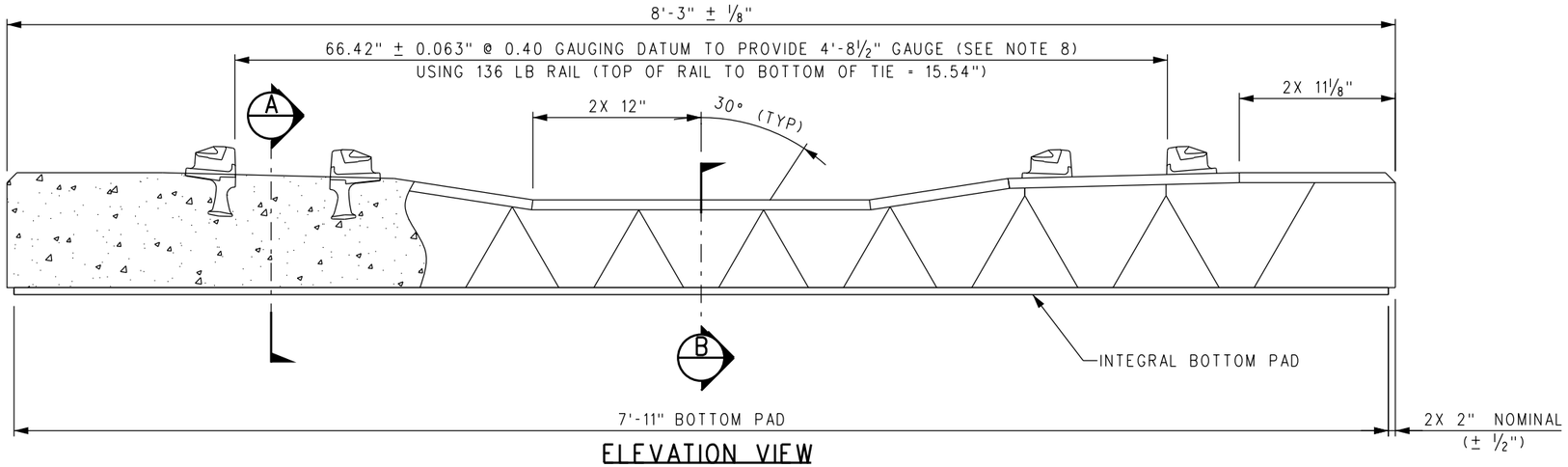


PLAN VIEW

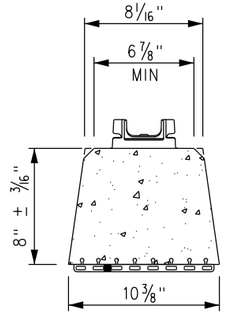


ELEVATION VIEW

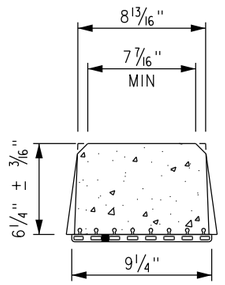
NOTES:

1. CONCRETE COMPRESSIVE STRENGTH (USING x 4" CYLINDER):
   28 DAY SPECIFIED = 7000 PSI[48.3 MPA]
   TRANSFER MINIMUM = 4500 PSI[31 MPA]
2. AIR ENTRAINED CONCRETE TO BE USED. AIR CONTENT TO BE MINIMUM OF 3.5% IN THE HARDENED CONCRETE.
3. THE RAIL SEAT SHALL BE A FLAT SMOOTH SURFACE ± 0.04" [1.0mm].
4. GAUGING POINTS FOR FLATNESS AND WIND. WIND BETWEEN RAIL SEATS NOT TO EXCEED 1/16" [1.6mm] BETWEEN THESE POINTS.
5. SEE APPROPRIATE WIRE PATTERN DRAWING FOR WIRE AND STRESSING DETAILS. (SCRRA ES2402)
6. ENDS OF PRESTRESSING WIRE TO BE CUT OFF WITHIN 1/8" [3.2mm] FROM SURROUNDING CONCRETE AT TIE ENDS.
7. TIES TO BE MANUFACTURED IN ACCORDANCE WITH CUSTOMER SUPPLIED SPECIFICATIONS AND/OR ACCEPTED PCI PRACTICE FOR PRESTRESSED CONCRETE.
8. THIS TIE IS DESIGNED TO PROVIDE TRACK GAUGE USING RAIL AND THE FASTENING COMPONENTS LISTED HEREON. THE OUT-TO-OUT SHOULDER DIMENSION IS CALCULATED TO PROVIDE THE GAUGE INDICATED ASSUMING NOMINAL DIMENSIONS FOR RAIL PADS, INSULATORS, AND RAIL TOLERANCE ON SHOULDER POSITION AND RAIL SEAT INCLINATION ARE THOSE FOUND BY EXPERIENCE TO BE ACHIEVABLE AND SATISFACTORY IN PRACTICE. SEE SCRRA ES2360-01 THROUGH ES2360-03 FOR SIDE POSTS AND CLIPS FOR VARIOUS OTHER RAIL WEIGHTS.
9. RAIL FASTENING INFORMATION:
   CAST IN COMPONENTS:
   - DUCTILE IRON SHOULDER — PANDROL 9086
   - SHOULDER FACE ANGLE — 3°

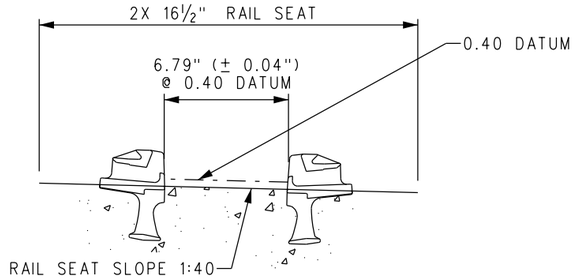
   LOOSE COMPONENTS:
   - INSULATOR:
     - SIDE POST THICKNESS: — AS SPECIFIED
     - TOE INSULATOR THICKNESS: — AS SPECIFIED
   - CLIP: — AS SPECIFIED
   - PAD THICKNESS: — AS SPECIFIED
10. RAIL SEAT CANT: 1:40 (0.144" @ 5¾" GAUGING POINT)
    MAX = 0.164" @ 5¾" GAUGING POINT
    MIN = 0.128" @ 5¾" GAUGING POINT
11. APPROXIMATE WEIGHT OF TIE = 610 LBS. (USING AIR ENTRAINED CONCRETE).
12. THIS TIE TO ONLY BE USED ON BRIDGE DECKS WITH LESS THAN 12" OF BALLAST UNDER TIES, REGARDLESS IF HMAC UNDERLAYMENT IS REQUIRED OR NOT, OR AS DIRECTED BY SCRRA ENGINEER.



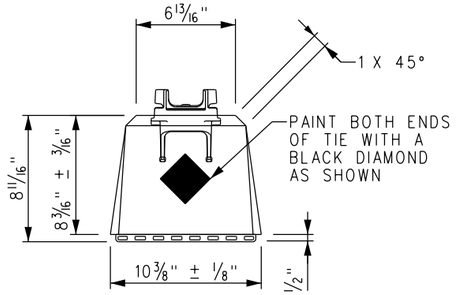
MIDWAY BETWEEN SHOULDERS — A



CENTER OF TIE — B



SHOULDER LOCATION DETAIL



END VIEW

REV.	DATE	DESCRIPTION	DES.	ENG.
B	03/22/21	REVISED NOTE 12	AC	JMM
A	06/27/2011	REVISED NOTE AND STAMP, PLAN VIEW	AC	NDP

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

8'-3" BOTTOM PAD TIE (FASTCLIP) FOR USE ON BRIDGE DECKS

STANDARD: 2403
SCALE: NTS
REVISION: B
SHEET: 1 OF 1
CADD FILE: ES2403

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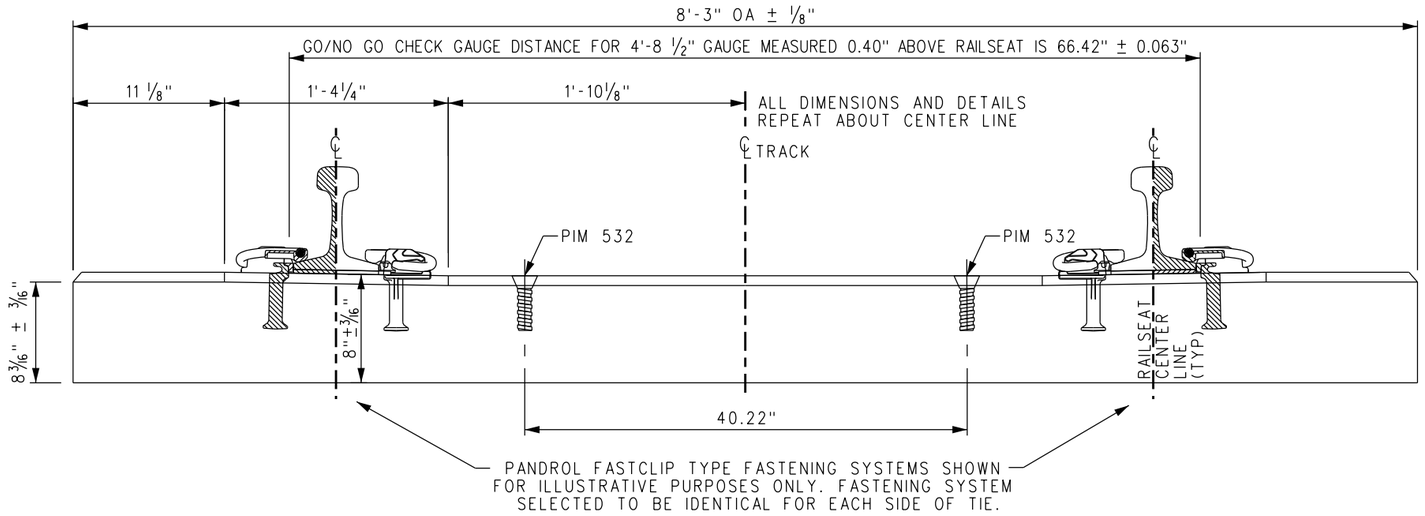
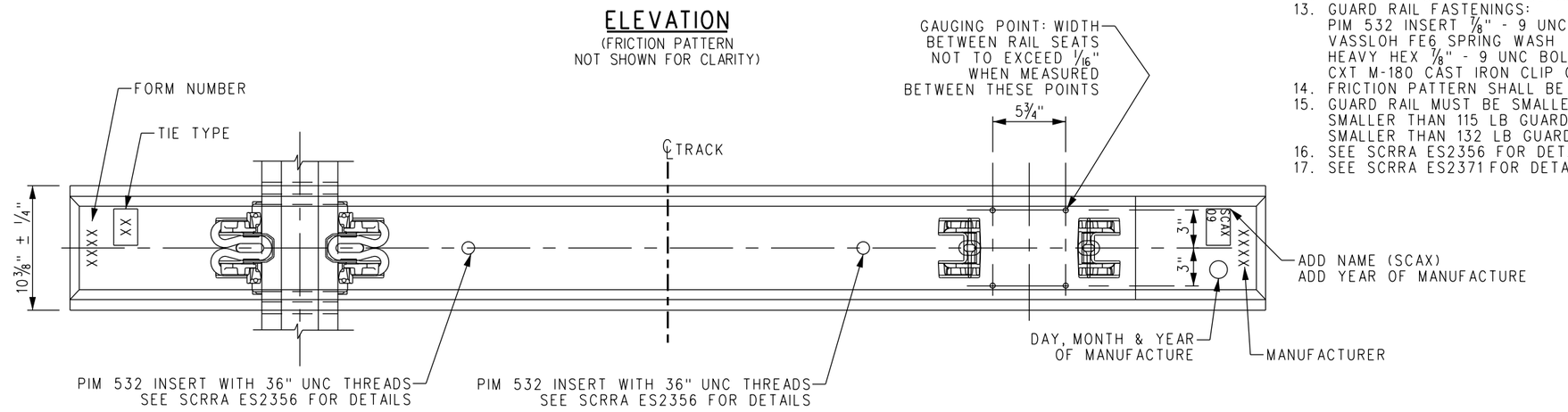


ELEVATION

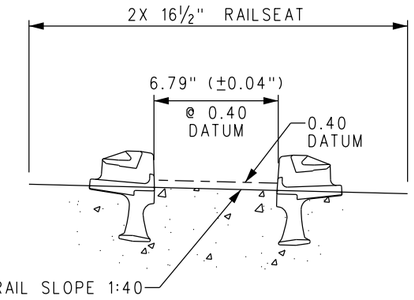
(FRICTION PATTERN NOT SHOWN FOR CLARITY)



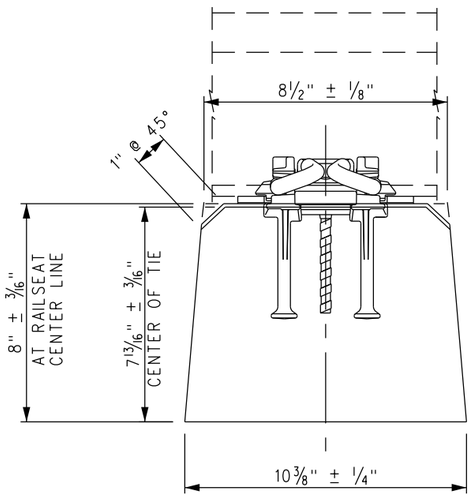
PLAN VIEW

NOTES:

1. CONCRETE STRENGTH (USING CYLINDER STRENGTHS), 28 DAY SPECIFIED = 7000 PSI TRANSFER MINIMUM = 4500 PSI.
2. RAILSEAT CANT = 1:40 ± 5.
3. THE RAILSEAT SHALL BE A FLAT, SMOOTH SURFACE ±0.04" (1.0mm).
4. APPROXIMATE WEIGHT OF TIE = 600 LBS (USING AIR ENTRAINED CONCRETE).
5. FOR DIMENSIONAL ACCEPTANCE PURPOSES, THE GAUGING DIMENSION BETWEEN OUTER SHOULDERS IS CHECKED WITH GO/NO GO GAUGES TO BE WITHIN 1/16" OF CALCULATED DIMENSION, AT A HEIGHT OF 0.4" ABOVE THE RAIL SEAT SURFACE. GO/NO GO DIMENSION IS 66.42" ± 0.063".
6. THIS TIE IS DESIGNED FOR USE WITH 136 LB RE RAIL. THIS TIE WILL ALSO ACCOMMODATE 115 LB, 119 LB, 132 LB, AND 141 LB RAIL WITH MINOR CHANGE IN SIDE POST TO ACHIEVE CORRECT GAUGE. SEE SCRRA ES2360 FOR DETAILS CONCERNING SIDE POST AND RAIL SIZE.
7. PRESTRESSING WIRE IS 5.32mm DIAMETER DEFORMED WIRE STRESS RELIEVED WITH A MINIMUM BREAKING LOAD OF 9200 LBS AND WITH OTHER REQUIREMENTS CONFORMING WITH ASTM A-881, "STEEL WIRE DEFORMED FOR PRESTRESSED CONCRETE RAILROAD TIES".
8. ENDS OF PRESTRESSING WIRE TO BE CUT OFF TO WITHIN 1/8" OF SURROUNDING CONCRETE AT TIE ENDS.
9. AIR ENTRAINED CONCRETE TO BE USED, AIR CONTENT TO BE 5 1/2% ± 1% IN PLASTIC CONCRETE.
10. THE OUT TO OUT SHOULDER SPACING DIMENSION FOR THIS TIE IS CALCULATED TO PROVIDE THE GAUGE INDICATED ASSUMING NOMINAL DIMENSIONS FOR RAIL PADS, INSULATORS AND RAIL. TOLERANCE ON SHOULDER POSITIONS AND RAILSEAT INCLINATION ARE THOSE FOUND BY EXPERIENCE TO BE ACHIEVABLE AND SATISFACTORY IN PRACTICE.
11. TIES TO BE MANUFACTURED IN ACCORDANCE WITH ACCEPTED PCI CONSTRUCTION PRACTICE FOR PRESTRESSED CONCRETE.
12. FASTENING SYSTEM TO BE APPROVED BY SCRRA ASSISTANT DIRECTOR, DESIGN.
13. GUARD RAIL FASTENINGS:
    PIM 532 INSERT 7/8" - 9 UNC THREAD
    VASSLOH FE6 SPRING WASH
    HEAVY HEX 7/8" - 9 UNC BOLT
    CXT M-180 CAST IRON CLIP OR EQUIVALENT.
14. FRICTION PATTERN SHALL BE CAST INTO SIDES OF TIES AND EMBOSSED INTO BOTTOM OF TIES.
15. GUARD RAIL MUST BE SMALLER THAN OR EQUAL IN HEIGHT TO RUNNING RAIL. DO NOT USE SMALLER THAN 115 LB GUARD RAIL SECTION WITH 132 LB - 136 LB RUNNING RAIL. DO NOT USE SMALLER THAN 132 LB GUARD RAIL SECTION WITH 141 LB RUNNING RAIL.
16. SEE SCRRA ES2356 FOR DETAILS ON COACH SCREW, INSERT, AND WASHER.
17. SEE SCRRA ES2371 FOR DETAILS ON INSIDE GUARD RAIL PLATES FOR CONCRETE TIES.



SHOULDER LOCATION DETAIL



SECTION THROUGH RAILSEAT CENTERLINE

(PRESTRESSING WIRE NOT SHOWN)

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06/27/2011	REVISED NOTE AND STAMP, PLAN VIEW	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

CONCRETE TIE - GUARD RAIL

STANDARD 2406
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2406

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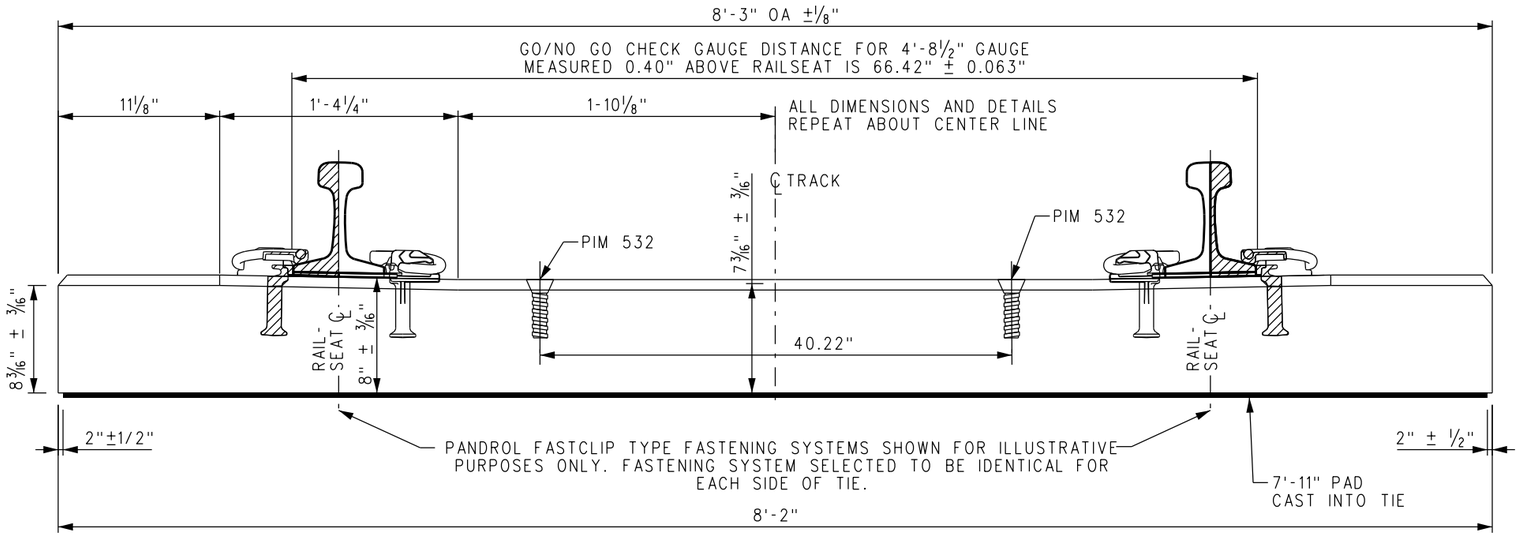
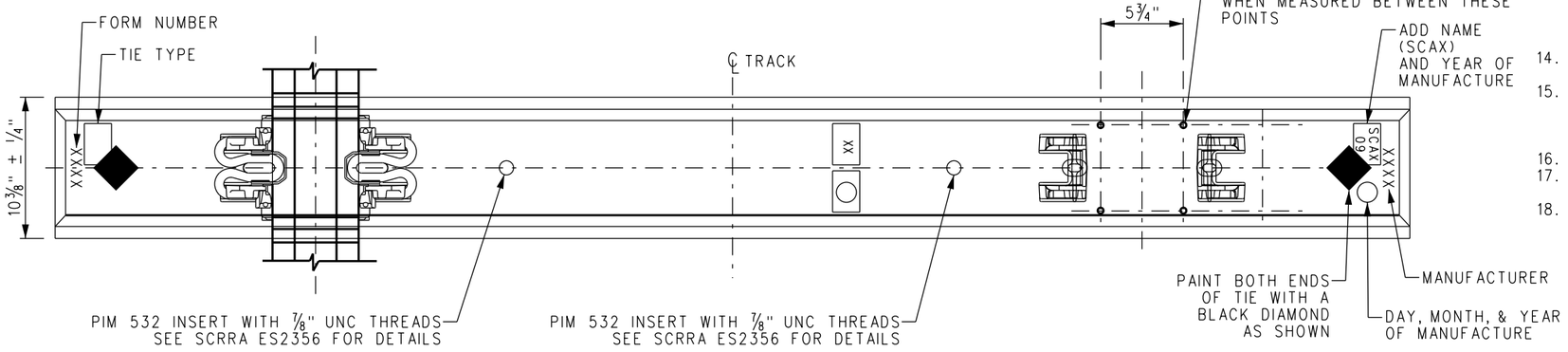
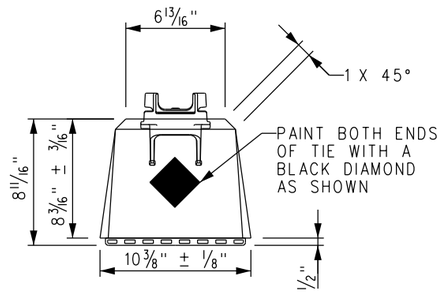


ELEVATION

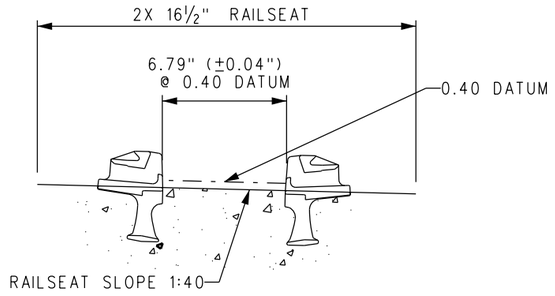
(FRICTION PATTERN NOT SHOWN FOR CLARITY)



PLAN VIEW



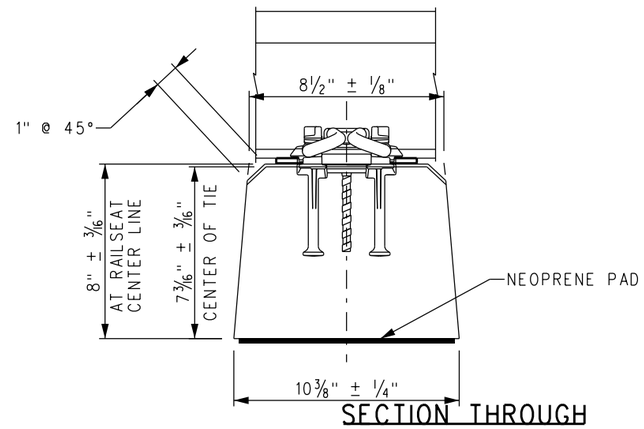
END VIEW



SHOULDER LOCATION DETAIL

NOTES:

1. CONCRETE STRENGTH (USING CYLINDER STRENGTHS),
   28 DAY SPECIFIED = 7000 PSI
   TRANSFER MINIMUM = 4500 PSI.
2. RAIL SEAT CANT = 1:40 ± 5.
3. THE RAIL SEAT SHALL BE A FLAT, SMOOTH SURFACE ±0.04" (1.0mm).
4. APPROXIMATE WEIGHT OF TIE = 600 LBS (USING AIR ENTRAINED CONCRETE).
5. FOR DIMENSIONAL ACCEPTANCE PURPOSES, THE GAUGING DIMENSION BETWEEN OUTER SHOULDERS IS CHECKED WITH GO/NO GO GAUGES TO BE WITHIN 1/16" OF CALCULATED DIMENSION, AT A HEIGHT OF 0.4" ABOVE THE RAIL SEAT SURFACE. GO/NO GO DIMENSION IS 66.42" ± 0.063".
6. THIS TIE IS DESIGNED FOR USE WITH 136 LB RE RAIL. THIS TIE WILL ALSO ACCOMMODATE 115, 119, 132, AND 141 LB RAIL WITH MINOR CHANGE IN SIDE POST TO ACHIEVE CORRECT GAUGE. SEE SCRRA ES2360 FOR DETAILS CONCERNING SIDE POST AND RAIL SIZE.
7. PRESTRESSING WIRE IS 5.32mm DIAMETER DEFORMED WIRE STRESS RELIEVED WITH A MINIMUM BREAKING LOAD OF 9200 LBS AND WITH OTHER REQUIREMENTS CONFORMING WITH ASTM A-881, "STEEL WIRE DEFORMED FOR PRESTRESSED CONCRETE RAILROAD TIES".
8. ENDS OF PRESTRESSING WIRE TO BE CUT OFF WITHIN 1/8" OF SURROUNDING CONCRETE AT TIE ENDS.
9. AIR ENTRAINED CONCRETE TO BE USED, AIR CONTENT TO BE 5½% ± 1% IN PLASTIC CONCRETE.
10. THE OUT TO OUT SHOULDER SPACING DIMENSION FOR THIS TIE IS CALCULATED TO PROVIDE THE GAUGE INDICATED ASSUMING NOMINAL DIMENSIONS FOR RAIL PADS, INSULATORS AND RAIL. TOLERANCE ON SHOULDER POSITIONS AND RAILSEAT INCLINATION ARE THOSE FOUND BY EXPERIENCE TO BE ACHIEVABLE AND SATISFACTORY IN PRACTICE.
11. TIES TO BE MANUFACTURED IN ACCORDANCE WITH ACCEPTED PCI CONSTRUCTION PRACTICE FOR PRESTRESSED CONCRETE.
12. FASTENING SYSTEM TO BE APPROVED BY SCRRA ASSISTANT DIRECTOR, DESIGN.
13. GUARD RAIL FASTENINGS:
    PIM 532 INSERT 7/8" - 9 UNC THREAD
    VASSLOH FE6 SPRING WASHER
    HEAVY HEX 7/8" - 9 UNC BOLT
    CXT M180 CAST IRON CLIP OR EQUIVALANT
14. FRICTION PATTERN SHALL BE CAST INTO SIDES OF TIES AND EMBOSSED INTO BOTTOM OF TIES.
15. GUARD RAIL MUST BE SMALLER THAN OR EQUAL IN HEIGHT TO RUNNING RAIL. DO NOT USE SMALLER THAN 115 LB GUARD RAIL SECTION WITH 132 - 136 LB RUNNING RAIL. DO NOT USE SMALLER THAN 132 LB GUARD RAIL SECTION WITH 141 LB RUNNING RAIL.
16. SEE SCRRA ES2356 FOR DETAILS ON COACH SCREW, INSERT, AND WASHER.
17. SEE SCRRA ES2371 FOR DETAILS ON INSIDE GUARD RAIL PLATES FOR CONCRETE TIES.
18. THIS TIE TO ONLY BE USED ON BRIDGE DECKS WITH LESS THAN 12" OF BALLAST UNDER TIES OR AS DIRECTED BY SCRRA ENGINEER.



SECTION THROUGH RAILSEAT CENTERLINE

(PRESTRESSING WIRE NOT SHOWN)

REV.	DATE	DESCRIPTION	DES.	ENG.
A	06/27/2011	REVISED NOTE AND STAMP, PLAN VIEW	AC	NDP

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

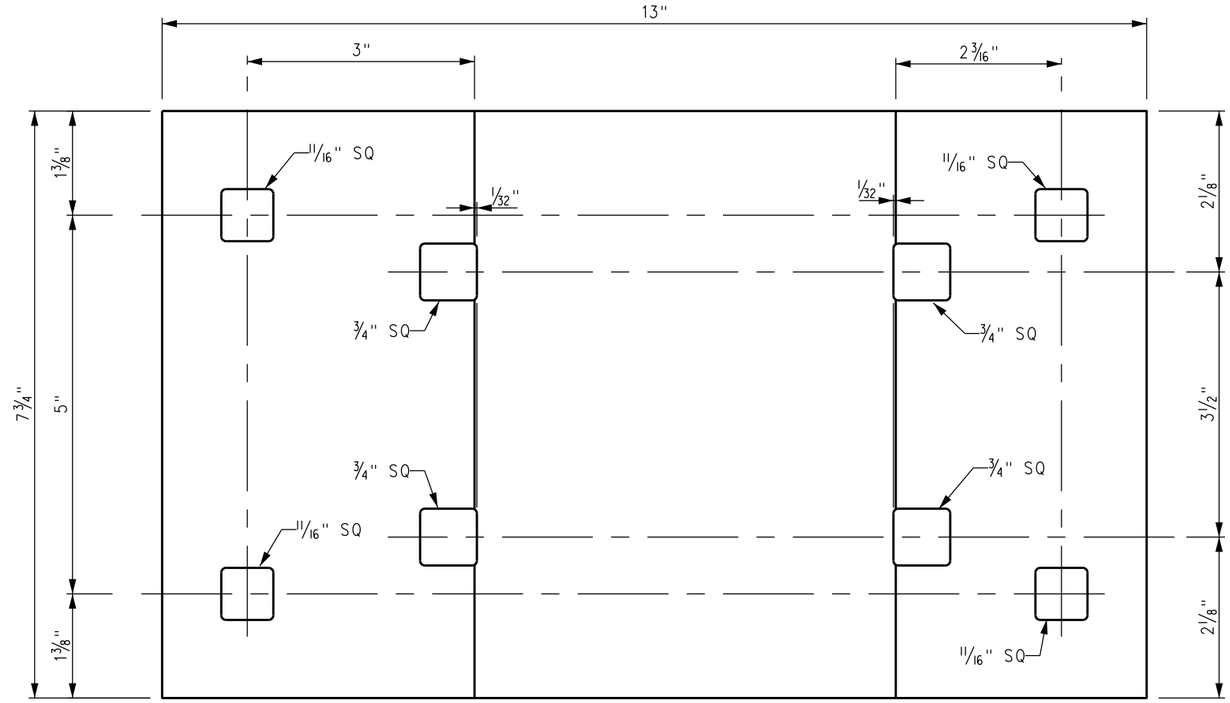
CONCRETE TIE - GUARD RAIL
WITH NEOPRENE PAD

STANDARD 2407
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2407

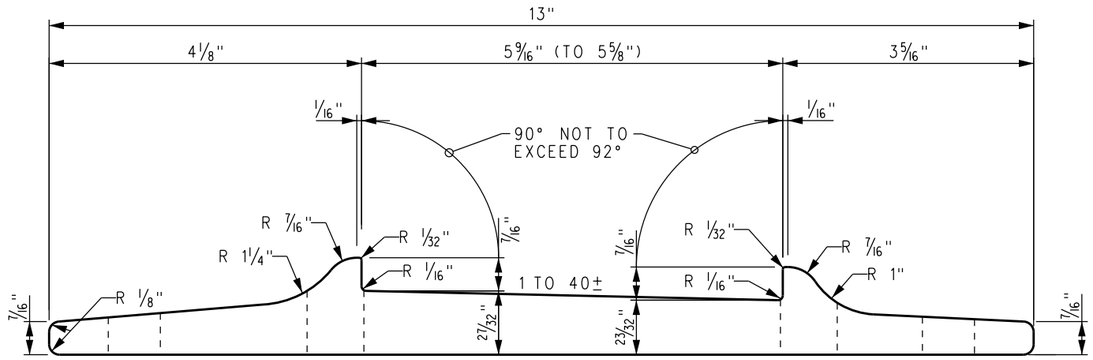
UserName•> scrrapw1ics01$ Date Plotted: 3/27/2023 3:04:02 PM Plot Driver•> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•> \\scrrapw1ics01\iCS_pdf_work_dir\87\482_67\ES2407.dgn

NOTES:

1. ALL SQUARE SPIKE HOLES SHALL HAVE 1/16" FILLETS IN CORNERS.
2. ESTIMATED WEIGHT: 19.60 LBS EACH.
3. MUST MEET AREMA SPECIFICATIONS.



PLAN



ELEVATION

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

STANDARD 13" TIE PLATE
FOR 5½" BASE RAIL

STANDARD: 2451
SCALE: NTS
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2451

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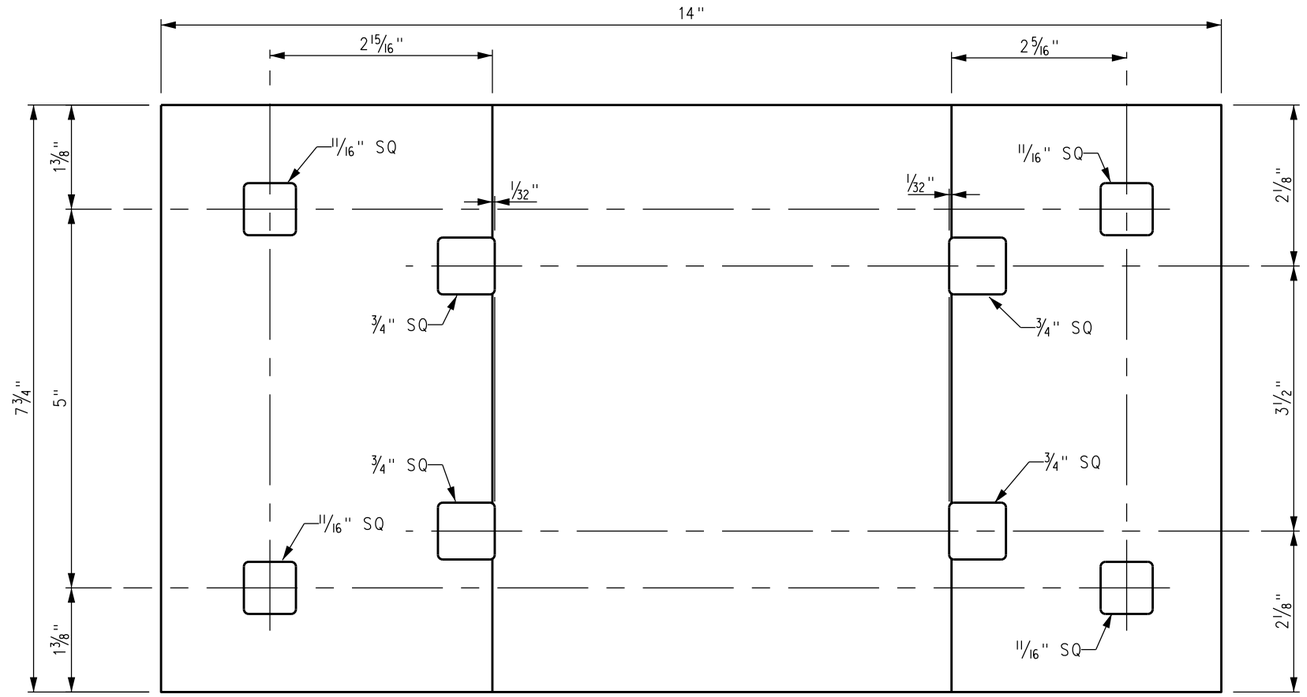
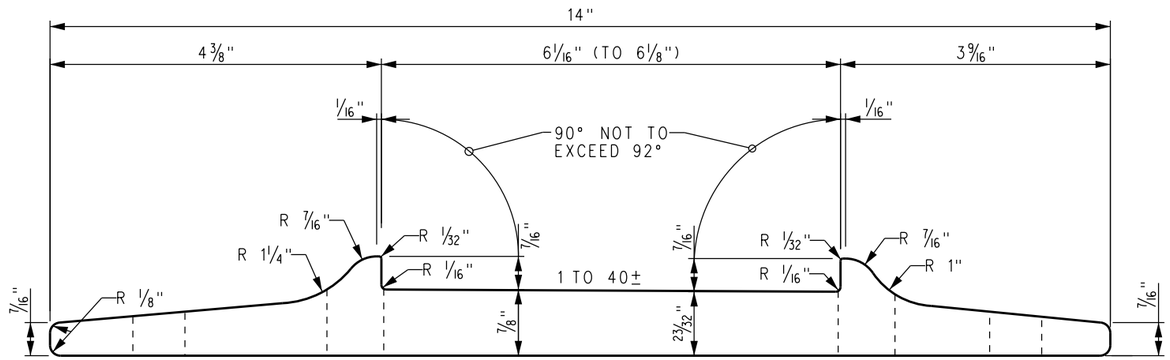


PLAN



ELEVATION

NOTES:

1. ALL SQUARE SPIKE HOLES SHALL HAVE 1/16" FILLETS IN CORNERS.
2. ESTIMATED WEIGHT: 21.47 LBS EACH.
3. MUST MEET AREMA SPECIFICATIONS.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

14" TIE PLATE FOR 6" BASE RAIL

STANDARD: 2452
SCALE: NTS
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2452

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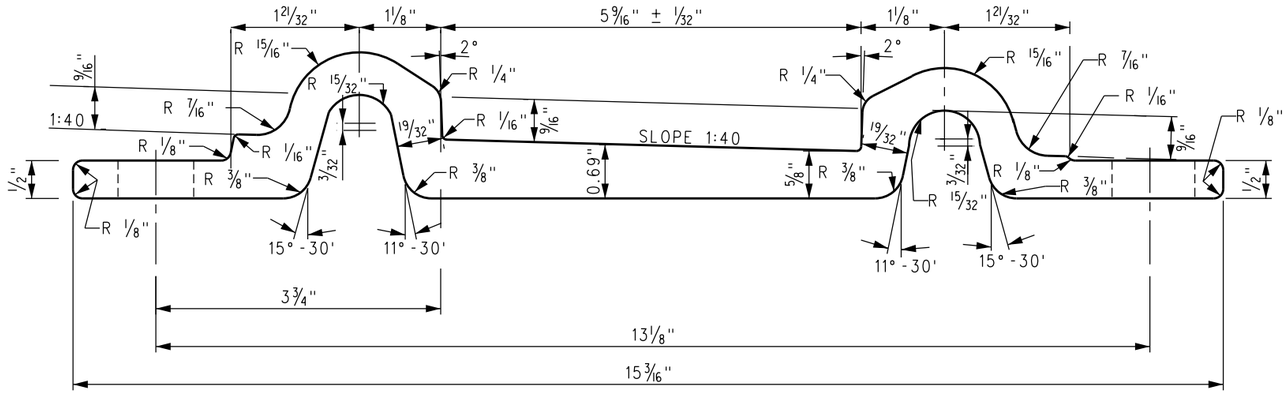
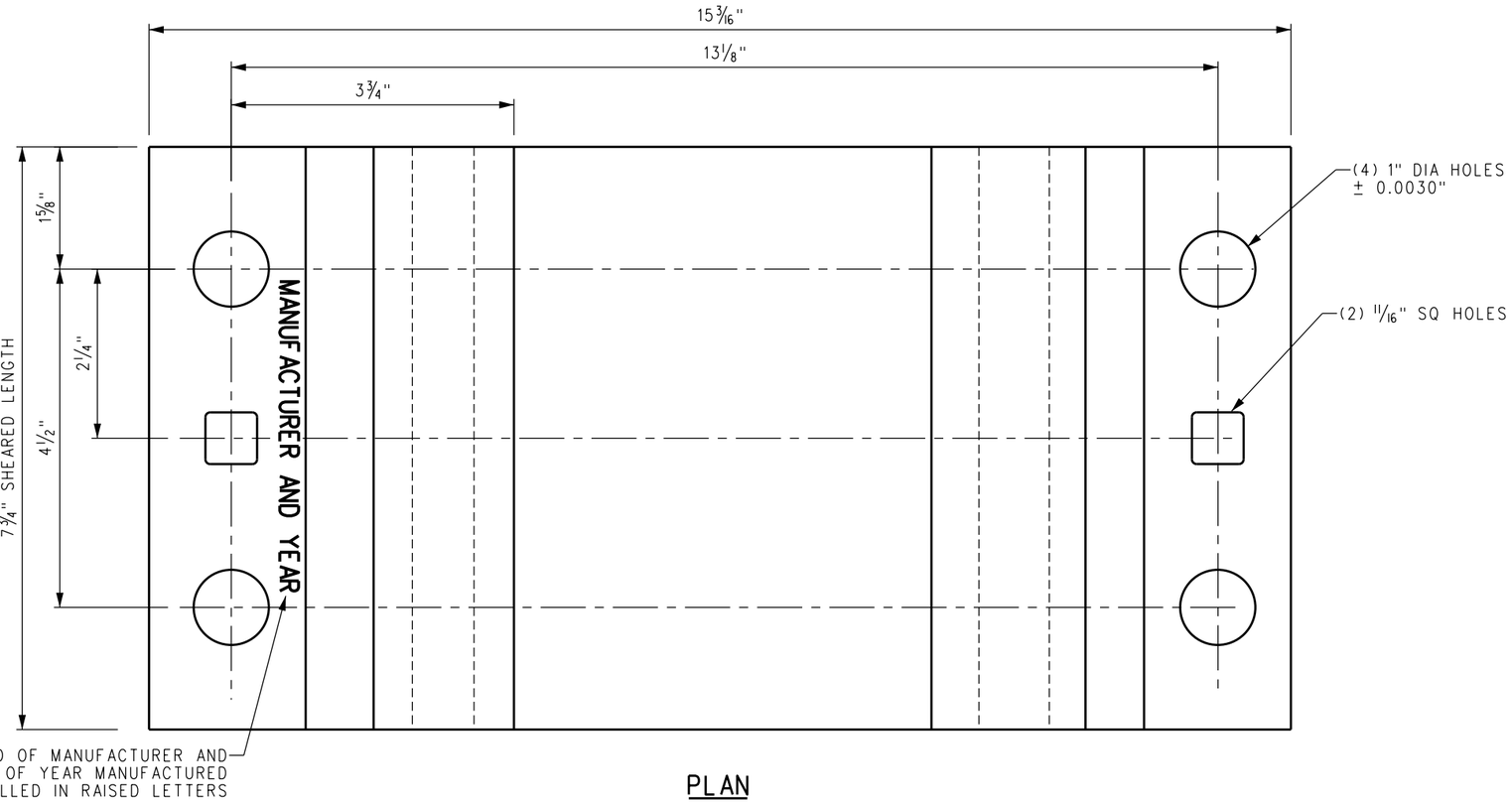


SECTION



PLAN

NOTES:

1. ALL HOLE MEASUREMENTS TO BE TAKEN FROM BOTTOM OF PLATE.
2. PLATE TO BE STANDARD PANDROL TYPE OR APPROVED EQUAL TIE PLATE MODIFIED FOR 1" DIA HOLES.
3. PLATE TO BE INSTALLED WITH 2 EACH PANDROL RAIL FASTENING "e" CLIP PER SCRRA ES2362.
4. PLATE TO BE INSTALLED WITH 4 EACH SCREW SPIKES PER PLATE PER SCRRA ES2355.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

ROLLED STEEL TIE PLATE TO SUIT 5½" BASE AREMA RAIL AND PANDROL RAIL CLIPS E2055

STANDARD: 2453
SCALE: NTS
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2453

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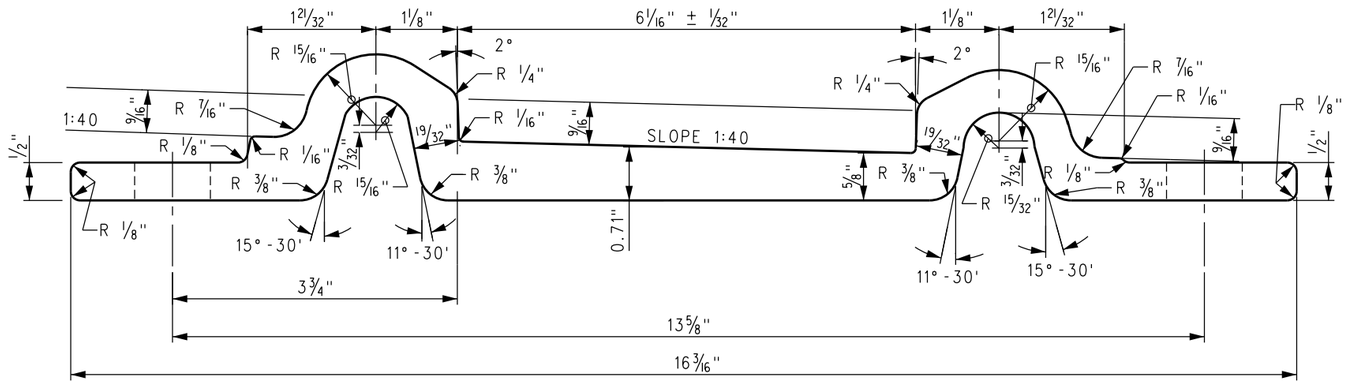
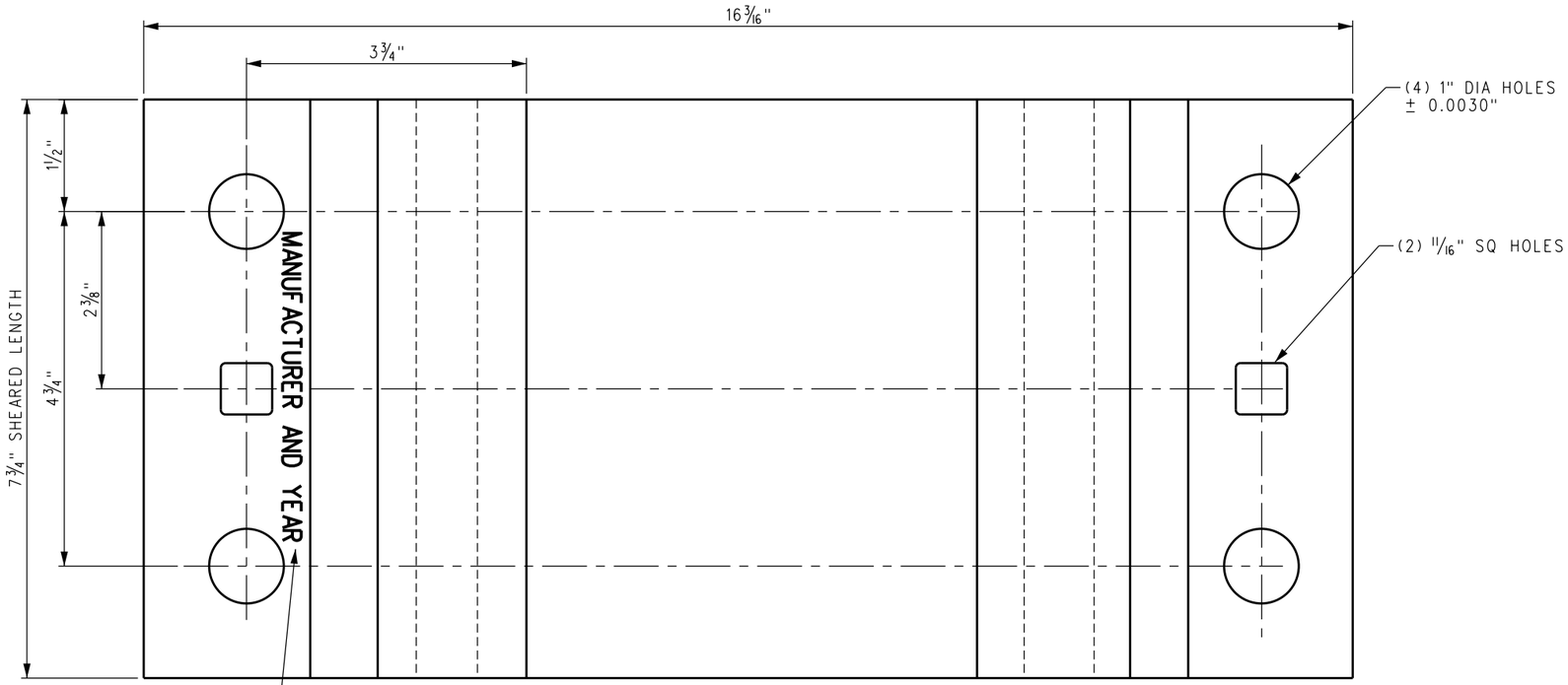
NOTES:

1. ALL HOLE MEASUREMENTS TO BE TAKEN FROM BOTTOM OF PLATE.
2. PLATE TO BE STANDARD PANDROL TYPE OR APPROVED EQUAL TIE PLATE MODIFIED FOR 1" DIA HOLES.
3. PLATE TO BE INSTALLED WITH 2 EACH PANDROL RAIL FASTENING "e" CLIP PER SCRRA ES2362.
4. PLATE TO BE INSTALLED WITH 4 EACH SCREW SPIKES PER SCRRA ES2355.



SECTION



PLAN

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

ROLLED STEEL TIE PLATE
TO SUIT 132 LB. RE - 141 LB. RE RAIL
AND PANDROL RAIL CLIPS E2055

STANDARD: 2454
SCALE: NTS
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2454

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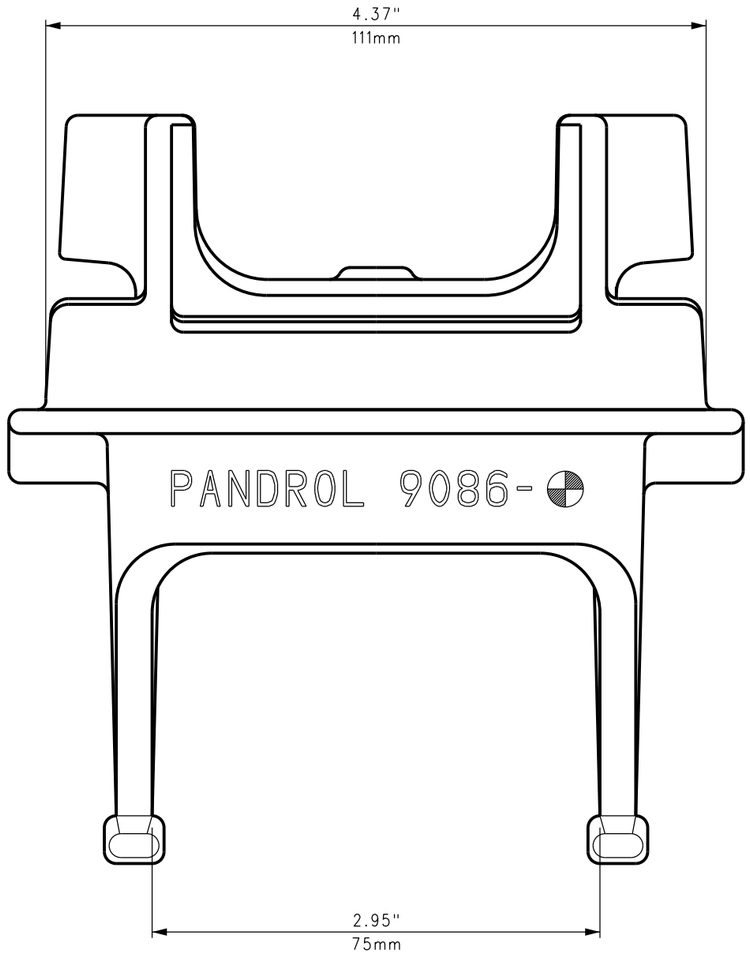

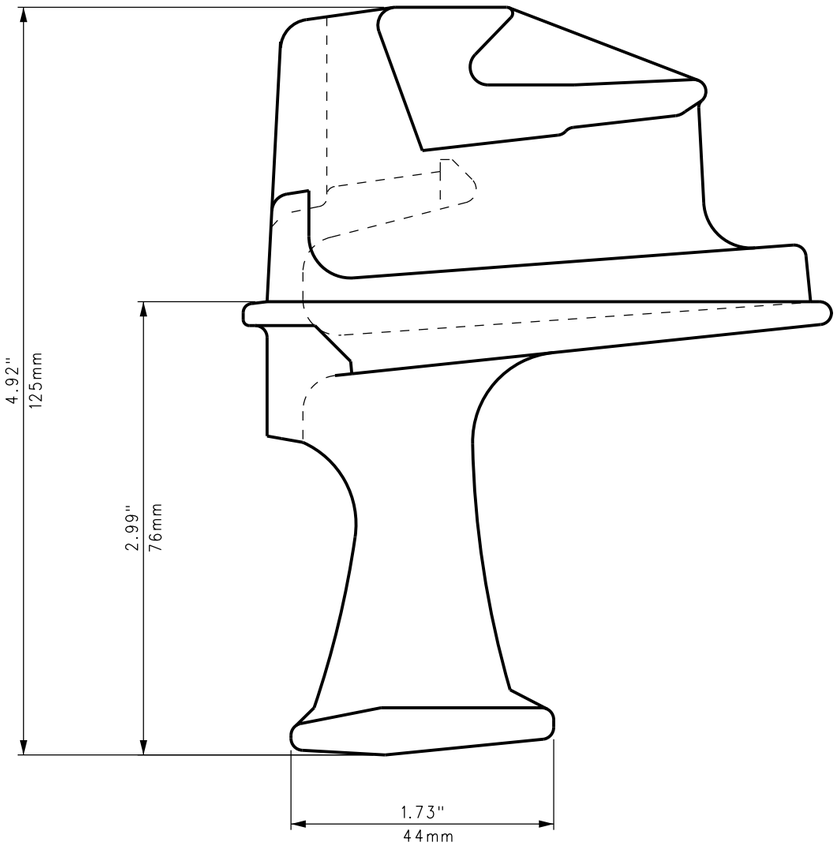

PART #9086

					DRAWN BY: HDR	DATE: 03/31/2011
					PRINCIPAL ENGINEER, DESIGN & STANDARDS	
					ASSISTANT DIRECTOR, DESIGN	
X	XX-XX-XX	REVISION	XX	XX		
REV.	DATE	DESCRIPTION	DES.	ENG.		

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

CAST SHOULDER TO SUIT
SERIES FC1600 FASTCLIP

STANDARD	2455
SCALE:	NTS
REVISION	-
SHEET	1 OF 1
CADD FILE:	ES2455

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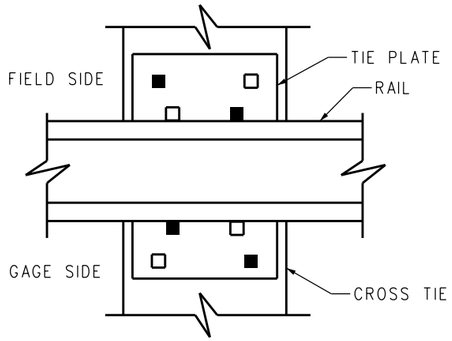
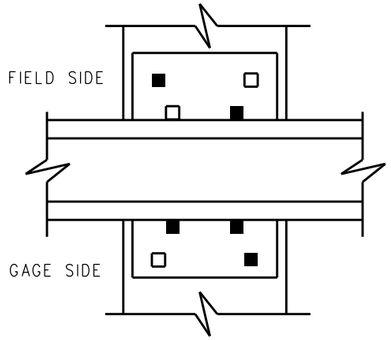


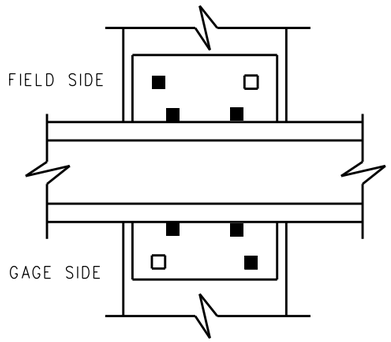
TANGENT AND CURVES 2° AND LESS

FIGURE A



CURVES 2°01' TO 4°

FIGURE B

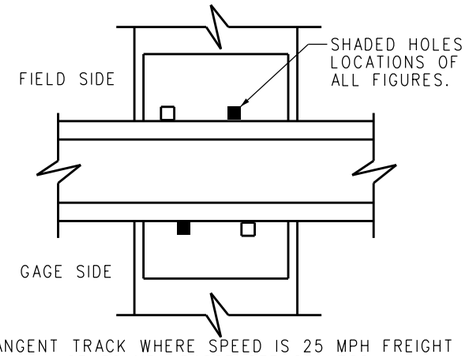


CURVES > 4°

FIGURE C

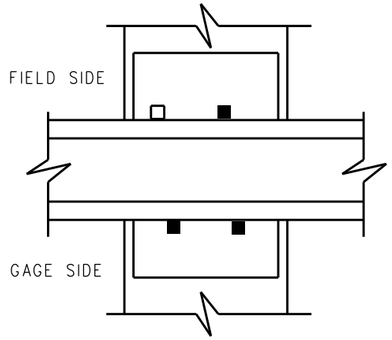
TIE PLATE WITH HOLD-DOWN SPIKE HOLES

"NEW CONSTRUCTION"



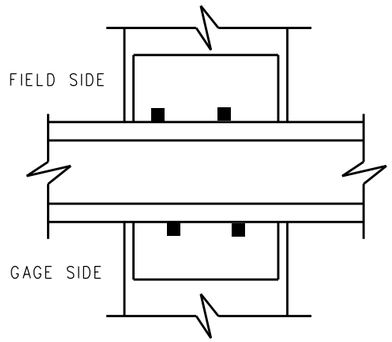
TANGENT TRACK WHERE SPEED IS 25 MPH FREIGHT OR 30 MPH PASSENGER OR LESS
YARD AND INDUSTRY TRACK < 6° CURVES

FIGURE D



TANGENT AND CURVES TO 4°
YARD AND INDUSTRY TRACK > 6° CURVES

FIGURE E

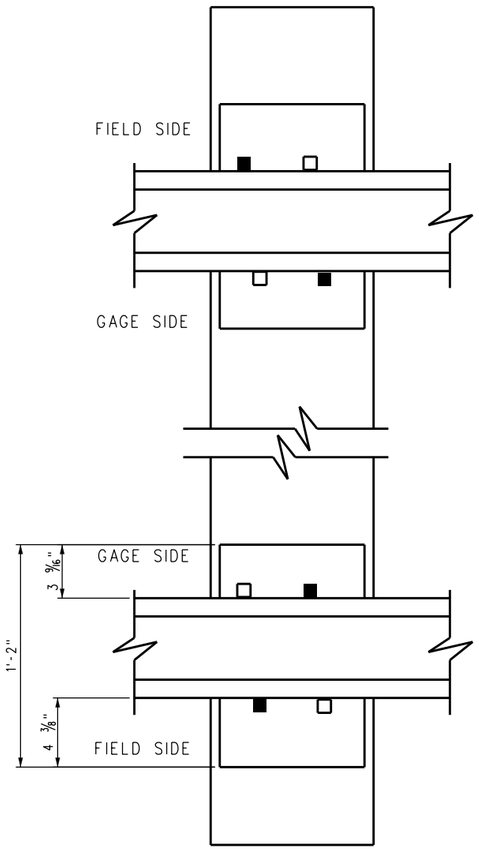


CURVES > 4°

FIGURE F

TIE PLATE WITHOUT HOLD-DOWN SPIKE HOLES

"MAINTENANCE ONLY"

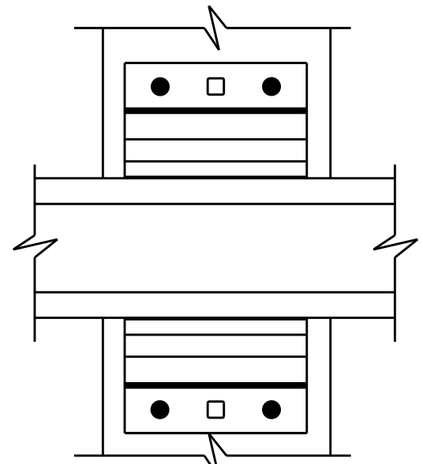


TANGENT AND CURVES TO 4°
YARD AND INDUSTRY TRACK > 6° CURVES

FIGURE H

NOTES:

1. TIE PLATE SPIKING FOR PLATES WITH HOLD-DOWN SPIKE HOLES.
   - FIGURE A - TANGENT AND CURVES TO 2°00' - 4 SPIKES REQUIRED, 2 LINE AND 2 HOLD-DOWN.
   - FIGURE B - CURVES 2°01' TO 4°00' INCLUSIVE - 5 SPIKES REQUIRED, 3 LINE AND 2 HOLD-DOWN.
   - FIGURE C - CURVES OVER 4°00' - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN.
2. TIE PLATE SPIKING FOR PLATES WITHOUT HOLD-DOWN SPIKE HOLES.
   - FIGURE D - TANGENT TRACK WHERE THE MAXIMUM OPERATING SPEED DOES NOT EXCEED 25 MPH FOR FREIGHT AND 30 MPH FOR PASSENGER TRAINS, 2 LINE SPIKES REQUIRED.
   - FIGURE E - TANGENT AND CURVES TO 4°00' INCLUSIVE, 3 LINE SPIKES REQUIRED.
   - FIGURE F - CURVES OVER 4°00' - 4 LINE SPIKES REQUIRED.
3. TIE PLATE SPIKING FOR PANDROL TYPE FASTENING SYSTEMS FIGURE G, 4 SCREW SPIKES REQUIRED.
4. FIGURE H - THIS PATTERN TO BE USED ONLY ON EXISTING TRACK SO SPIKED.
5. ANY VARIATIONS IN THE SPIKING PATTERNS ILLUSTRATED IN FIGURES A THRU F MUST BE APPROVED BY SCRRA.
6. YARD AND INDUSTRY TRACK TO BE SPIKED WITH NOT LESS THAN TWO SPIKES TO EACH TIE PLATE.
7. REFER TO SCRRA ES2460-02 FOR "SP" PLATES.
8. CUT SPIKES MAY BE USED ON PANDROL PLATE SQUARE HOLES FOR TEMPORARY ASSEMBLY OF TRACK. THEY WILL NOT BE REMOVED AFTER INSTALLATION OF SCREW SPIKES.
9. SPIKING PATTERNS TO BE ADJUSTED DURING RAIL AND TIE INSTALLATION.
10. IF EXISTING SPIKING PATTERNS HAVE MORE SPIKES THAN REQUIRED PER THIS STANDARD, THEN THE ADDITIONAL SPIKES SHALL REMAIN IN PLACE.



PANDROL PLATE
4- SCREW SPIKES REQUIRED
TANGENT AND CURVES

FIGURE G

REV.	DATE	DESCRIPTION	DES.	ENG.
B	04/18/19	REVISED FIGURE H	JK	AT
A	05/01/12	ADDED FIGURE H	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TIE PLATE SPIKING PATTERNS

STANDARD: 2460
SCALE: NTS
REVISION: B
SHEET: 1 OF 2
CADD FILE: ES2460-01

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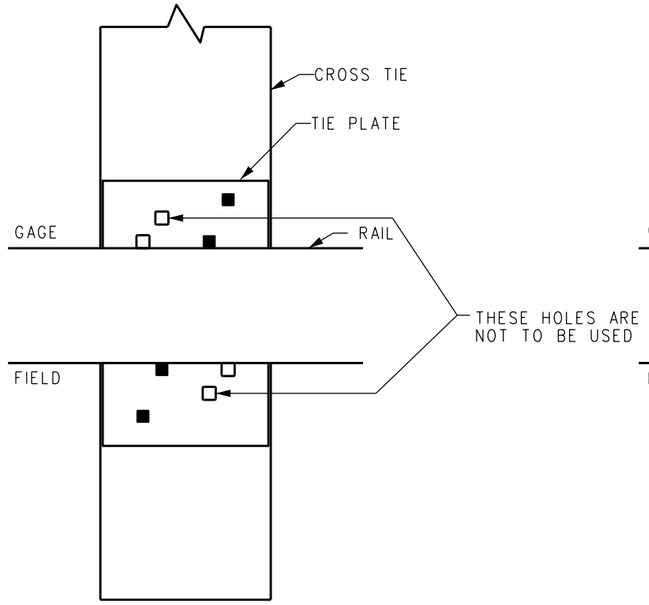
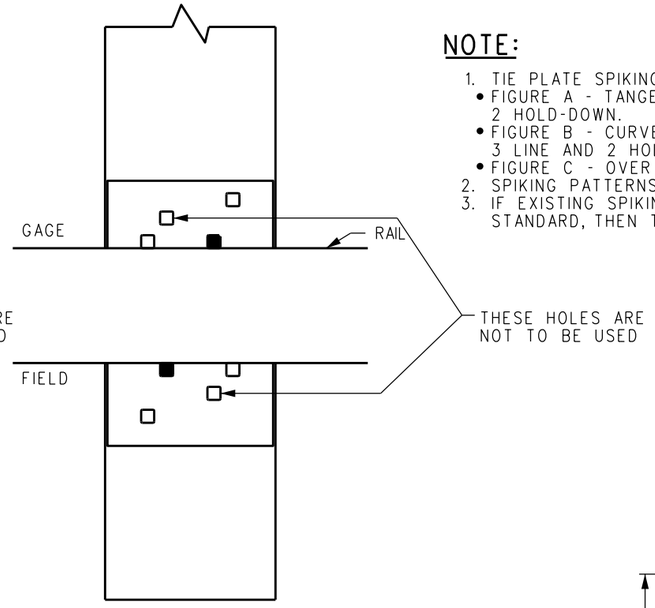


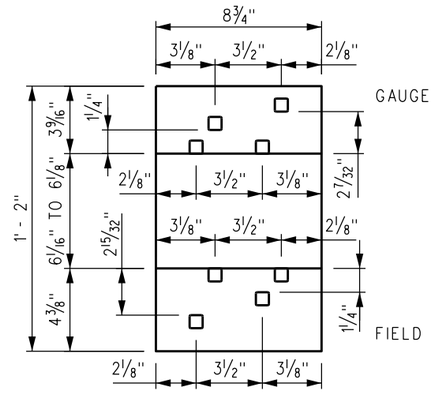
TANGENT AND CURVES TO 2°
(FIGURE A)



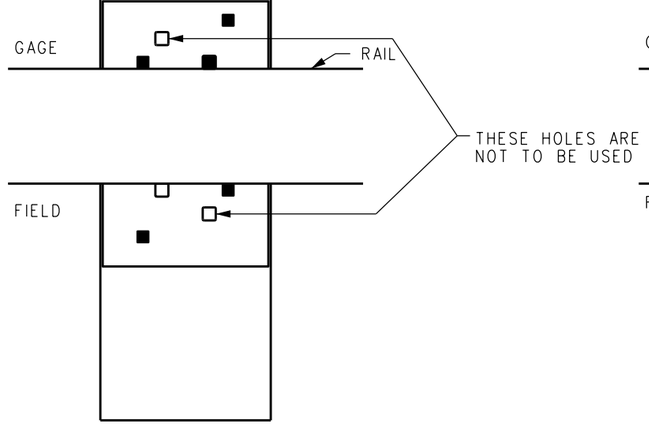
YARD AND INDUSTRY TRACK
MIN SPIKES PER PLATE

NOTE:

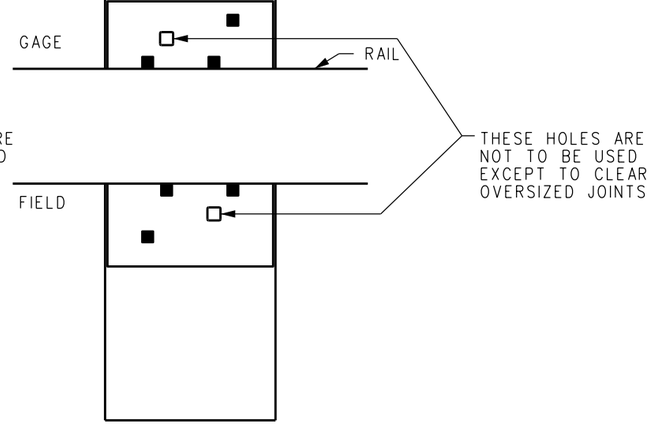
1. TIE PLATE SPIKING FOR PLATES WITH HOLD-DOWN SPIKE HOLES.
   - FIGURE A - TANGENT TO 2°00' - 4 SPIKES REQUIRED, 2 LINES AND 2 HOLD-DOWN.
   - FIGURE B - CURVES OVER 2°00' TO 4°00' INCLUSIVE - 5 SPIKES REQUIRED, 3 LINE AND 2 HOLD-DOWN
   - FIGURE C - OVER 4°00' - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN
2. SPIKING PATTERNS TO BE ADJUSTED DURING RAIL AND TIE INSTALLATION.
3. IF EXISTING SPIKING PATTERNS HAVE MORE SPIKES THAN REQUIRED PER THIS STANDARD, THEN THE ADDITIONAL SPIKES SHALL REMAIN IN PLACE.



TIE PLATE



CURVES OVER 2° TO 4°
(FIGURE B)



CURVES > 4°
(FIGURE C)

REV.	DATE	DESCRIPTION	DES.	ENG.
B	04/18/19	REVISED FIELD AND GAUGE DESIGNATIONS	JK	AT
A	02/07/12	REVISED FIELD AND GAUGE DESIGNATIONS	AC	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TIE PLATE SPIKING PATTERNS
FOR "SP" PLATES

STANDARD: 2460
SCALE: NTS
REVISION: B
SHEET: 2 OF 2
CADD FILE: ES2460-02

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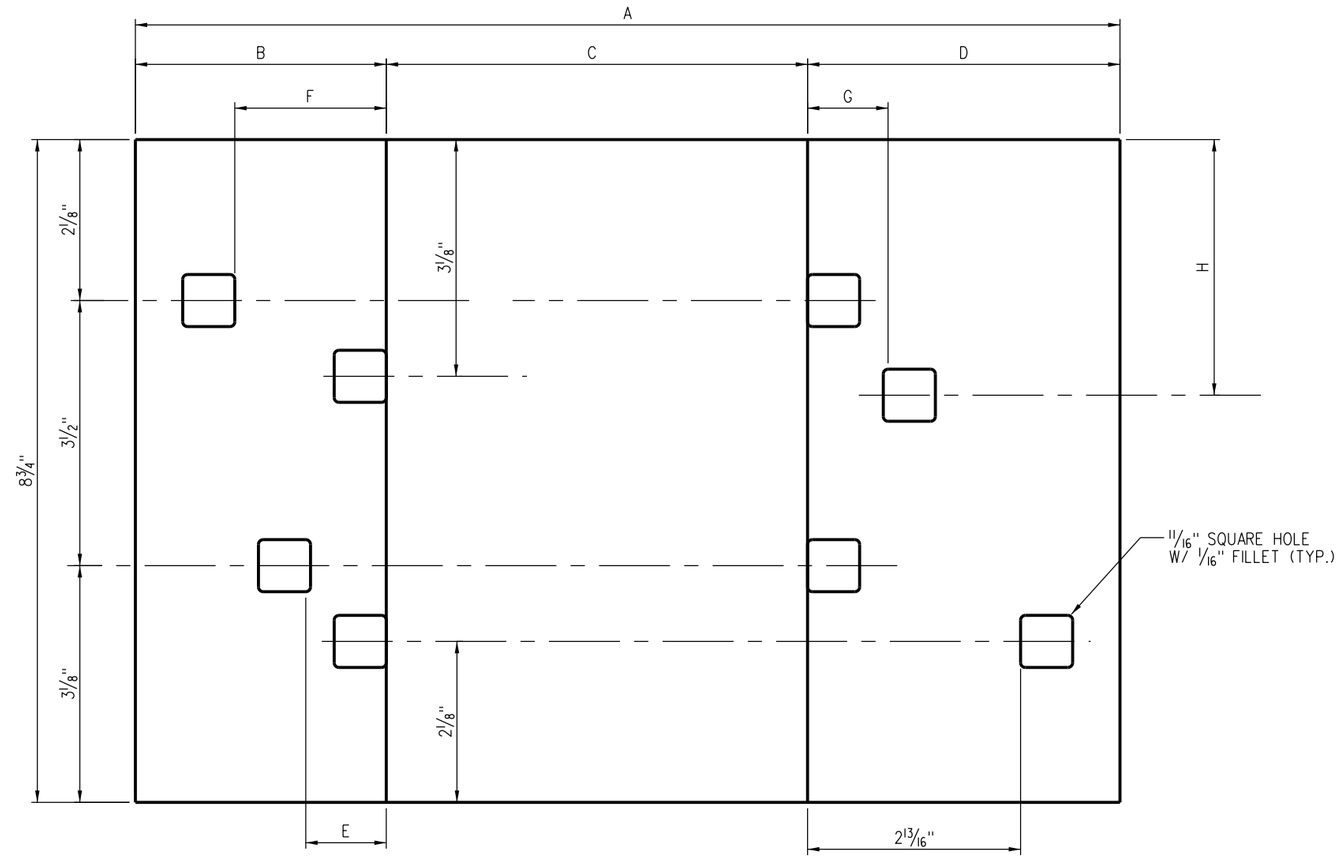
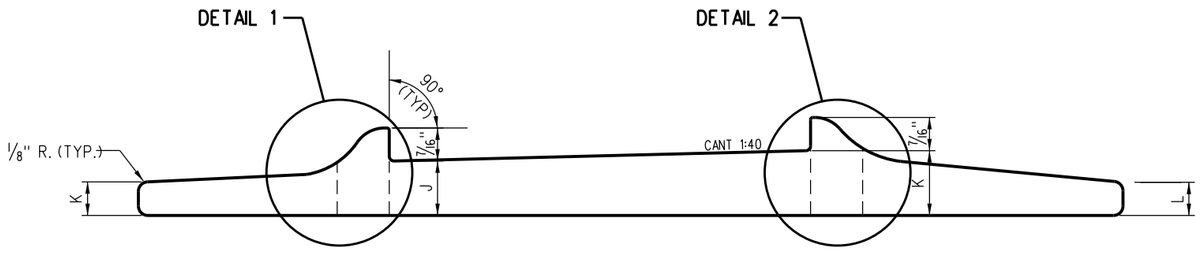
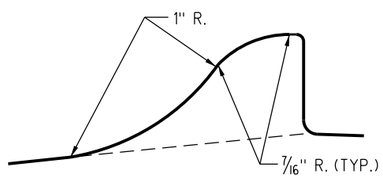


NOTES:

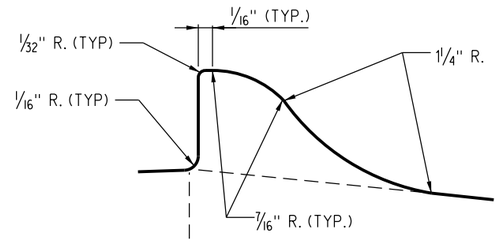
1. MANUFACTURER NAME, RAIL SECTION, YEAR AND DIMENSION BASE SIZE TO BE ROLLED IN RAISED LETTERS AND FIGURES ON THE OUTSIDE SHOULDER.
2. SPECIFICATIONS AND WORKMANSHIP TO BE IN ACCORDANCE WITH CURRENT AREMA MANUAL REQUIREMENTS FOR HOT-WORKED, HIGH CARBON STEEL TIE PLATES.

DIMENSION TABLE			
RAIL BASE	5½"	6"	6"
ITEM NO.	554-9010	554-9015	554-9020
A	13"	14"	16"
B	3 5/16"	3 9/16"	3 11/16"
C	5 9/16"	6 1/16"	6 1/16"
D	4 1/8"	4 3/8"	6 1/4"
E	1"	1 1/4"	1 1/4"
E	2"	2 7/32"	2 7/32"
G	1"	1 1/4"	1 1/4"
H	3 3/8"	3 1/8"	3 1/8"
J	23/32"	23/32"	31/32"
K	27/32"	7/8"	1 1/8"
L	7/16"	7/16"	3/8"





DETAIL 1



DETAIL 2

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

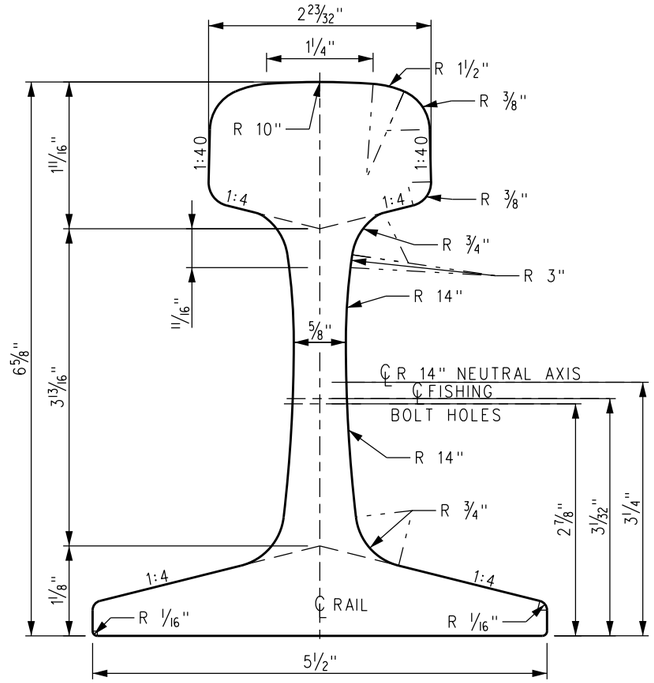
DOUBLE SHOULDER TIE PLATES
5½" AND 6" BASE RAIL

STANDARD: 2463
SCALE: FULL
REVISION: - SHEET: 1 OF 1
CADD FILE: ES2463

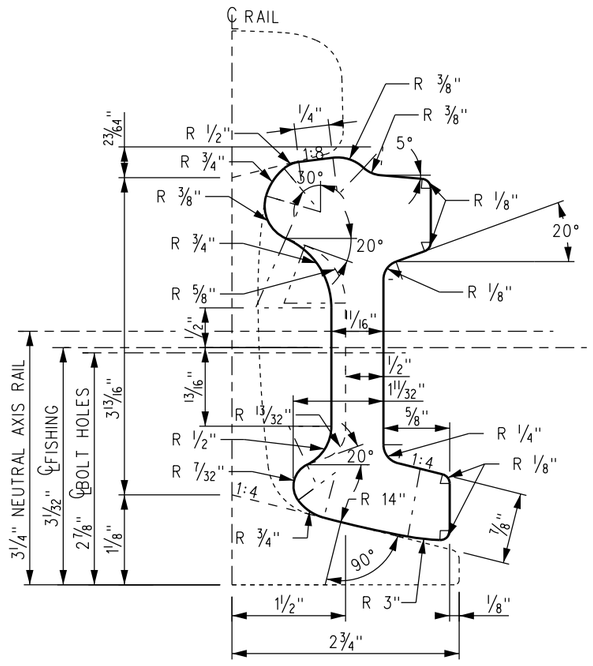
UserName=> scrrapw11ics01$ Date Plotted: 3/27/2023 3:04:22 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_75\ES2463.dgn

NOTES:

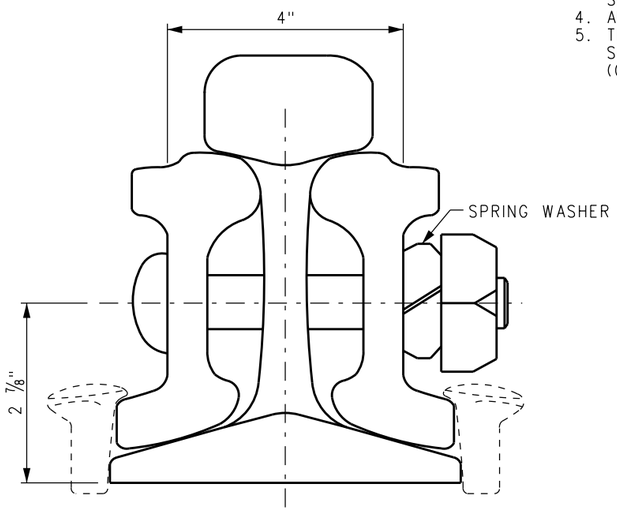
1. RAILS, JOINT BARS AND TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.
2. REQUISITIONS AND ORDERS FOR TRACK BOLTS SHALL DESIGNATE DIAMETER OF BOLT PER SCRRA ES2352.
3. LENGTH OF TRACK BOLT WILL PERMIT USE OF SPRING WASHER UP TO APPROXIMATELY 0.78" THICK.
4. ALL BOLT HOLES SHALL BE CHAMFERED.
5. THIS PLAN FOR USE IN NEW RAIL INSTALLATION (SEE SCRRA ES2501-02) FOR EXISTING 115 LB 5"X6½" (OLD SP PUNCH).



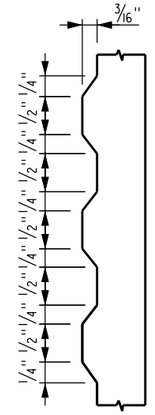
115 RE RAIL



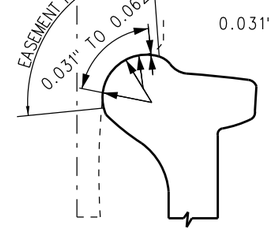
JOINT BAR



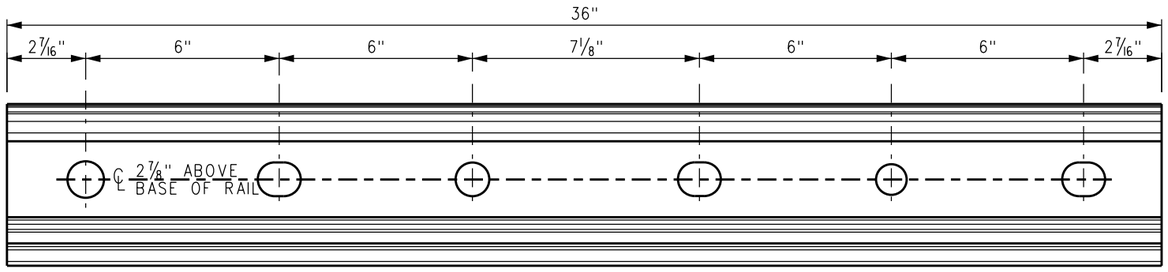
ASSEMBLY



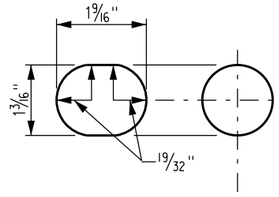
LONGITUDINAL SECTION OF JOINT BAR



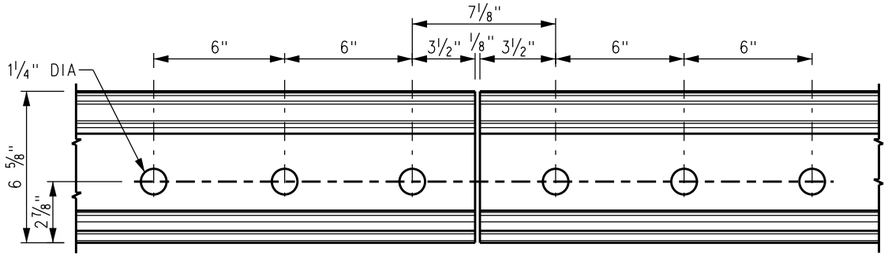
DETAIL OF HEAD EASEMENT



JOINT BAR PUNCHING
(FRONT VIEW)



SIZE OF BOLT HOLES
(INJOINT BAR)



RAIL END DRILLING

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

RAIL AND JOINT ASSEMBLY
FOR 115 LB. RE RAIL

STANDARD 2501
SCALE: NTS
REVISION - SHEET 1 OF 2
CADD FILE: ES2501-01

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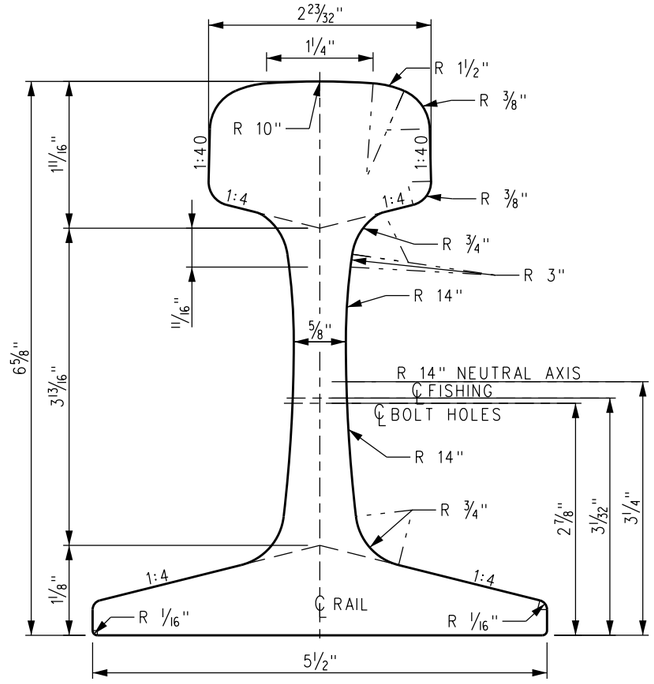
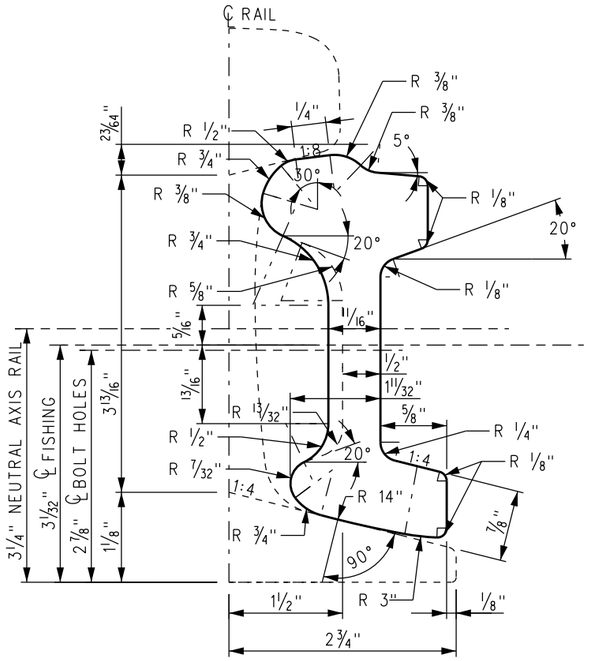
FileName=> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_76\ES2501-01.dgn

NOTES:

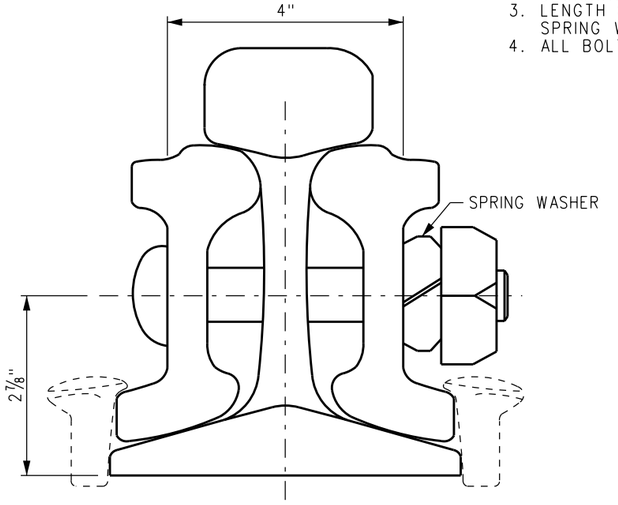
1. RAILS, JOINT BARS AND TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.
2. REQUISITIONS AND ORDERS FOR TRACK BOLTS SHALL DESIGNATE DIAMETER OF BOLT PER SCRRA ES2352.
3. LENGTH OF TRACK BOLT WILL PERMIT USE OF SPRING WASHER UP TO APPROXIMATELY 0.78" THICK.
4. ALL BOLT HOLES SHALL BE CHAMFERED.



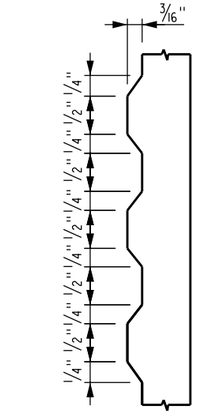
115 RE RAIL



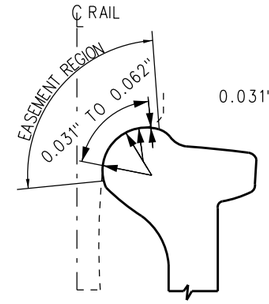
JOINT BAR

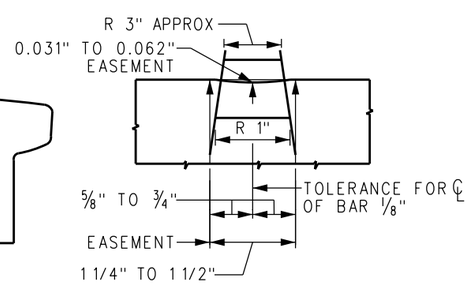


ASSEMBLY

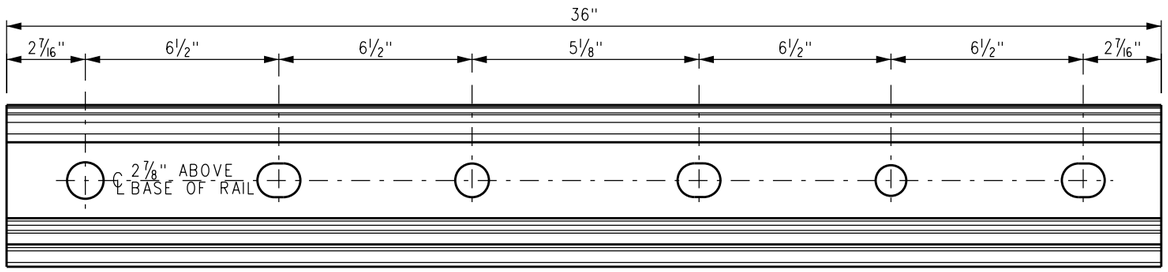


LONGITUDINAL SECTION OF JOINT BAR

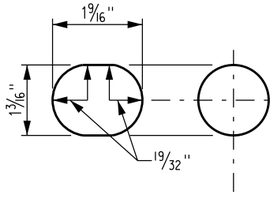




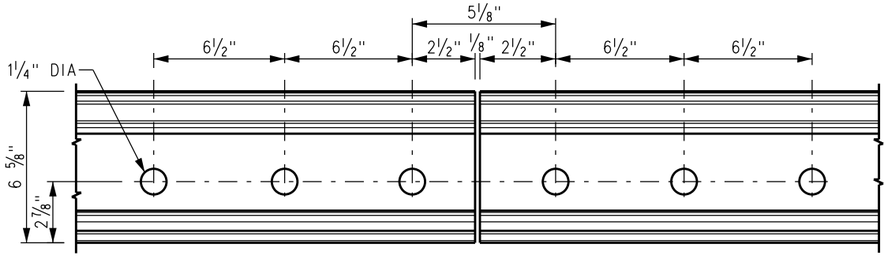
DETAIL OF HEAD EASEMENT



JOINT BAR PUNCHING
(FRONT VIEW)



SIZE OF BOLT HOLES
(INJOINT BAR)



RAIL END DRILLING

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

RAIL AND JOINT ASSEMBLY FOR 115 LB. RE RAIL
FOR MAINTENANCE USE WITH FORMER "SP"
PUNCH 2½" x 6½" x 6½"

STANDARD	2501
SCALE:	NTS
REVISION	-
SHEET	2 OF 2
CADD FILE:	ES2501-02

UserName=> scrrapw11ics01$ Date Plotted: 3/27/2023 3:04:36 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
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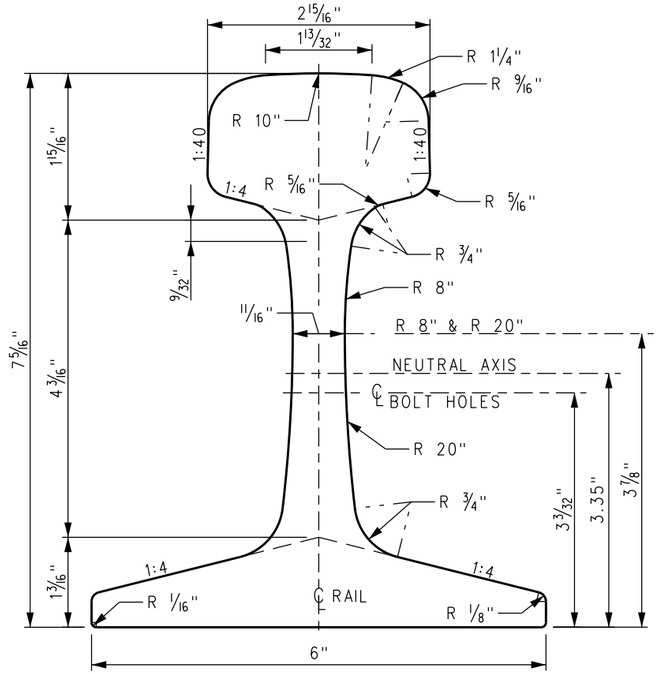
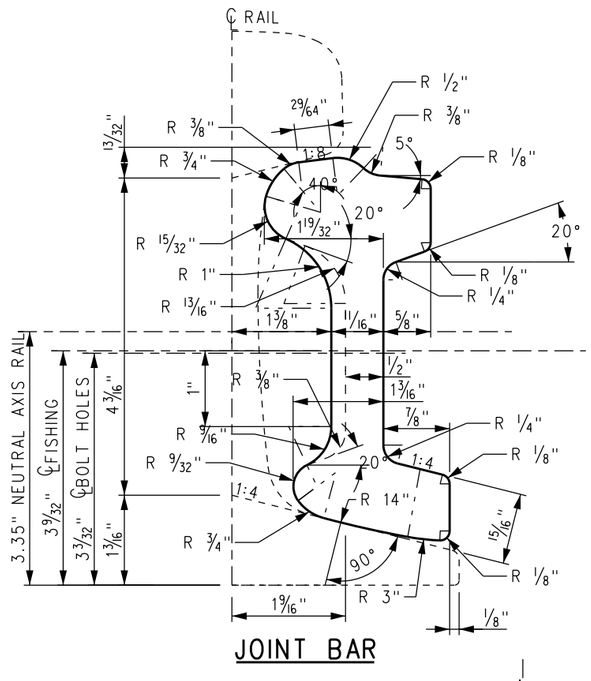
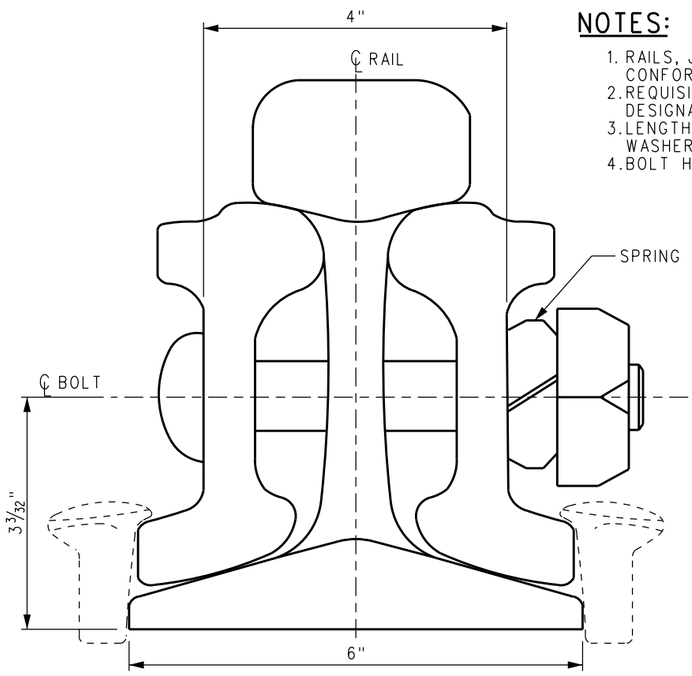


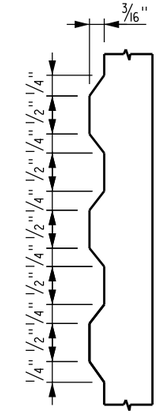
136 RE RAIL



JOINT BAR



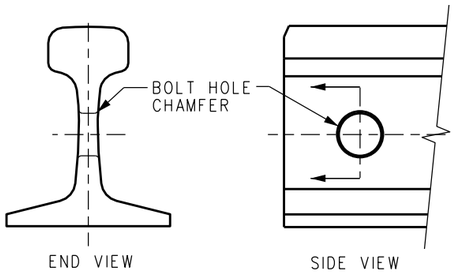
ASSEMBLY



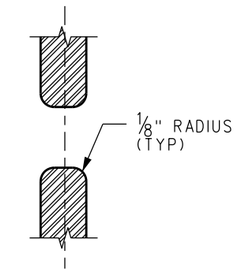
LONGITUDINAL SECTION OF JOINT BAR

NOTES:

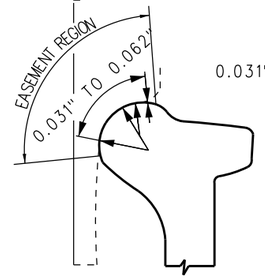
1. RAILS, JOINT BARS AND TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.
2. REQUISITIONS AND ORDERS FOR TRACK BOLTS SHALL DESIGNATE DIAMETER OF BOLT PER SCRRA ES2352.
3. LENGTH OF TRACK BOLT WILL PERMIT USE OF SPRING WASHER UP TO APPROXIMATELY 0.76" THICK. ALL
4. BOLT HOLES SHALL BE CHAMFERED.

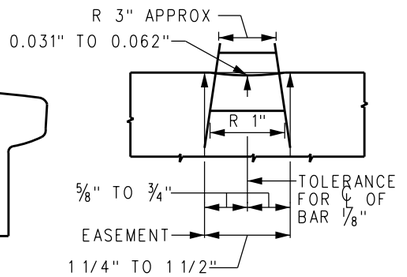


BOLT HOLE CHAMFERING

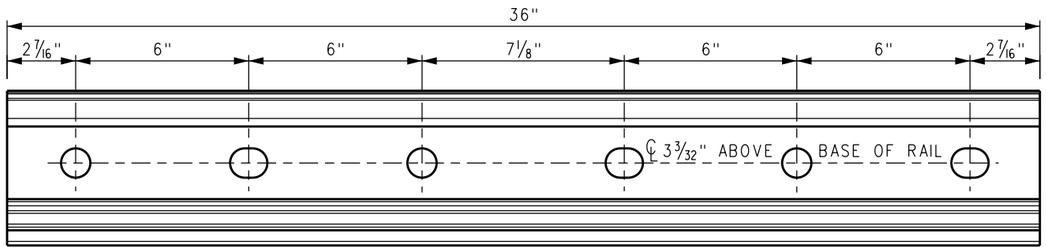


BOLT HOLE CHAMFER SECTION A-A

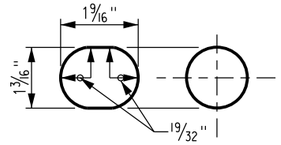




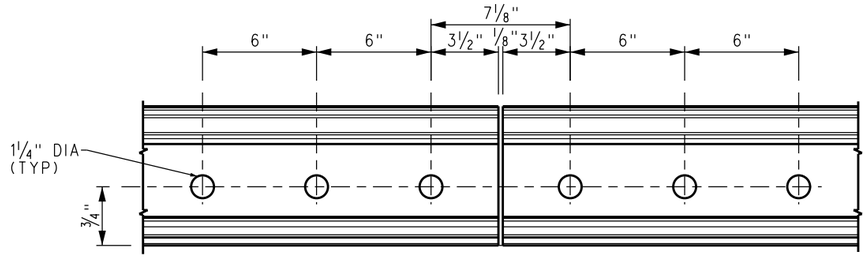
DETAIL OF HEAD EASEMENT



JOINT BAR PUNCHING
(FRONT VIEW)



SIZE OF BOLT HOLES
(IN JOINT BAR)



RAIL END DRILLING

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

RAIL AND JOINT ASSEMBLY
FOR 136 LB. RE RAIL

STANDARD 2502
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2502

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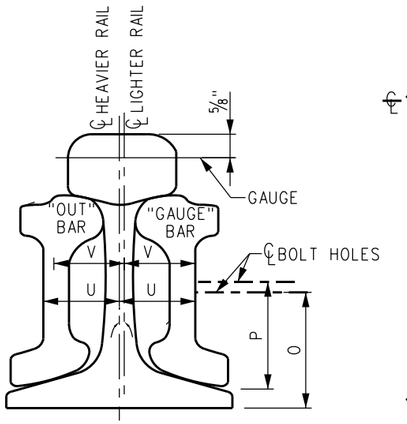
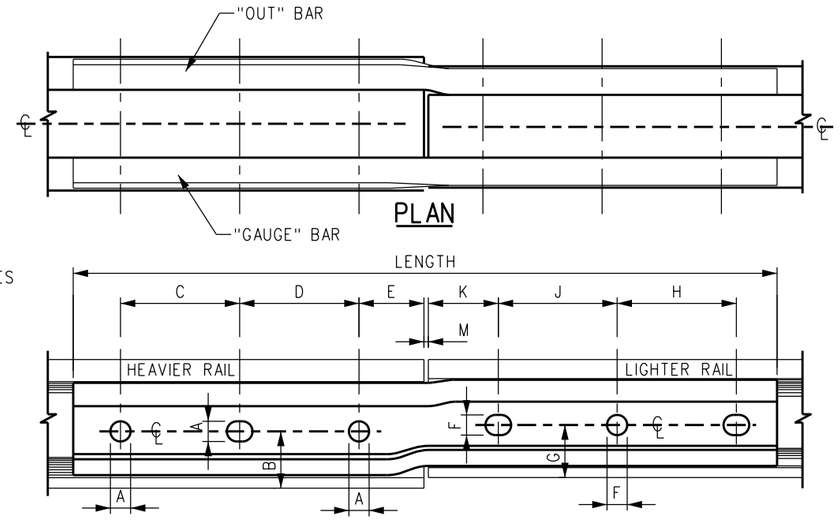
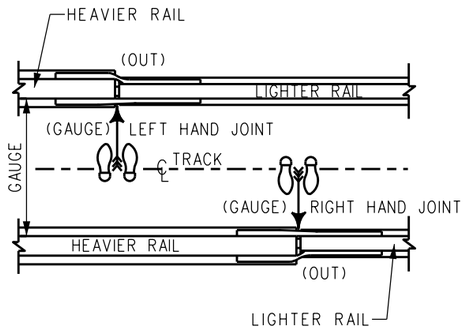


END ELEVATION



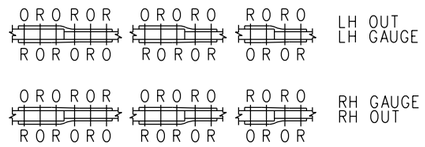
ELEVATION OF "GAUGE" BAR



IDENTIFICATION SKETCH

NOTES

1. THIS PLAN SHOWS GENERAL INFORMATION FOR COMPROMISE JOINTS. SCRRA ASSISTANT DIRECTOR, DESING WILL FURNISH DETAIL PLANS FOR THE MANUFACTURER.
2. TO DETERMINE RIGHT HAND OR LEFT HAND JOINT: STAND BETWEEN RAILS IN THE TRACK, FACING RAILS TO BE JOINED. WHEN HEAVIER RAIL IS ON THE RIGHT HAND SIDE, IT IS A RIGHT HAND JOINT AND WHEN HEAVIER RAIL IS ON THE LEFT HAND SIDE, IT IS A LEFT HAND JOINT. ONE RIGHT HAND AND ONE LEFT HAND JOINT FORM A SET (FOUR BARS).
3. EACH BAR TO BE MARKED WITH THE FOLLOWING STAMPED IN DATA:
   SECTION OF RAIL, AT EACH END,
   "RH" OR "LH", FOR RIGHT HAND OR LEFT HAND,
   "GAUGE" OR "OUT", FOR GAUGE SIDE OR OUTSIDE,
   PATTERN NUMBER,
   NAME OR TRADE MARK OF MANUFACTURER,
   YEAR MANUFACTURED.
4. ON ACCOUNT OF VARIOUS RAIL DRILLINGS FOR SECTIONS OTHER THAN SHOWN, REQUISITIONS AND ORDERS FOR COMPROMISE JOINTS FOR SUCH OTHER RAIL SHALL SHOW DIMENSIONS FOR B, F, J, K, AND O. FOR HEAVIER RAIL AND D, G, M AND P FOR THE LIGHTER RAIL.
5. BOLTS FOR COMPROMISE JOINTS ARE SAME AS FOR CORRESPONDING STANDARD JOINT BARS.
6. THE TYPE OF HOLES IN COMPROMISE BARS ARE AS SHOWN BELOW. "R" DENOTES ROUND HOLES AND "O" DENOTES OVAL HOLES.



1. THIRD HOLE IN 110 LB RAIL TO BE DRILLED IN THE FIELD.
2. USE STANDARD JOINT BAR PER ES2501, MACHINED & LABELED TO INDICATE RAIL SIZE AND GAUGE AND FIELD SIDES.
3. USE STANDARD JOINT BAR PER ES2502, MACHINED & LABELED TO INDICATE RAIL SIZE AND GAUGE AND FIELD SIDES.

COMPROMISE JOINT DIMENSIONS AND LENGTHS:

HEAVIER RAIL : LIGHTER RAIL	LENGTH	HEAVY RAIL HEIGHT	HEAVY BOLT DIA	A DIAMETER OF HOLE IN BAR	B BASE RAIL TO CL OF RAIL DRILLING	C CTR 2nd TO CTR 3rd HOLE	D CTR 1st TO CTR 2nd HOLE	E RAIL END TO CTR 1st HOLE	LIGHT RAIL HEIGHT	LIGHT BOLT DIA	F DIAMETER OF HOLE IN RAIL	G BASE RAIL TO CL OF RAIL DRILLING	H CTR 2nd TO CTR 3rd HOLE	J CTR 1st TO CTR 2nd HOLE	K RAIL END TO CTR 1st HOLE	AMOUNT OF WEAR	M GAP BETWEEN RAIL ENDS
141 RE To 136 RE	36"	7 7/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	7 5/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	--	1/8"
141 RE To 132 RE	36"	7 7/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	7 1/8"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	1/4"	1/8"
141 RE To 119 CFI	36"	7 7/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	6 13/16"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	1/4"	1/8"
141 RE To 115 RE (MAINT ONLY)	36"	7 7/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6 1/2"	6 1/2"	2 1/2"	1/4"	1/8"
141 RE To 115 RE	36"	7 7/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	1/4"	1/8"
136 RE To 132 RE	36"	7 5/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	7 1/8"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	1/4"	1/8"
136 RE To 119 CFI	36"	7 5/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	6 13/16"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	1/4"	1/8"
136 RE To 115 RE (MAINT ONLY)	36"	7 5/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6 1/2"	6 1/2"	2 1/2"	1/4"	1/8"
136 RE To 115 RE	36"	7 5/16"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	1/4"	1/8"
132 RE To 119 CFI	36"	7 1/8"	1 1/8"	1 5/16"	3 3/32"	6 1/2"	6 1/2"	2 1/2"	6 13/16"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	--	1/8"
132 RE To 115 RE	36"	7 1/8"	1 1/8"	1 5/16"	3 3/32"	6"	6"	3 1/2"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	--	1/8"
132 RE To 115 RE (MAINT ONLY)	36"	7 1/8"	1 1/8"	1 5/16"	3 3/32"	6 1/2"	6 1/2"	2 1/2"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6 1/2"	6 1/2"	2 1/2"	--	1/8"
119 RE To 115 RE	36"	6 13/16"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6 1/2"	6 1/2"	2 1/2"	--	1/8"
115 RE To 110 RE (MAINT ONLY)	30"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6 1/2"	6 1/2"	2 1/2"	6 1/4"	1"	1 3/16"	2 5/8"	--	5 1/2"	2 11/16"	--	1/8"
115 RE To 110 RE	30"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	6 1/4"	1"	1 3/16"	2 45/64"	--	5"	2 15/32"	--	1/8"
115 RE To 100 RA	30"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	6"	1"	1 3/16"	2 5/8"	--	5"	2 15/32"	--	1/8"
115 RE To 100 RE	30"	6 5/8"	1 1/8"	1 5/16"	2 7/8"	6"	6"	3 1/2"	6"	1"	1 3/16"	2 11/16"	--	5 1/2"	2 11/16"	--	1/8"
110 RE To 90 RA	24"	6 1/4"	1"	1 3/16"	2 5/8"	--	5 1/2"	2 11/16"	5 5/8"	1"	1 3/16"	2 31/64"	--	5"	2 13/32"	--	5/32"
110 RE To 85	24"	6 1/4"	1"	1 3/16"	2 5/8"	--	5 1/2"	2 11/16"	5 3/8"	1"	1 3/16"	2 29/64"	--	7"	2 7/16"	--	5/32"
90 RA To 85	24"	5 5/8"	1"	1 3/16"	2 13/16"	--	5"	2 13/32"	5 3/8"	1"	1 3/16"	2 29/64"	--	5"	2 15/32"	--	3/16"

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

COMPROMISE JOINTS FOR VARIOUS WEIGHTS OF RAILS

STANDARD 2503
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2503

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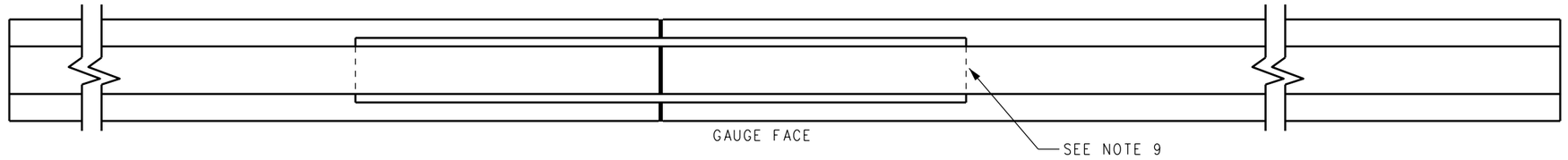
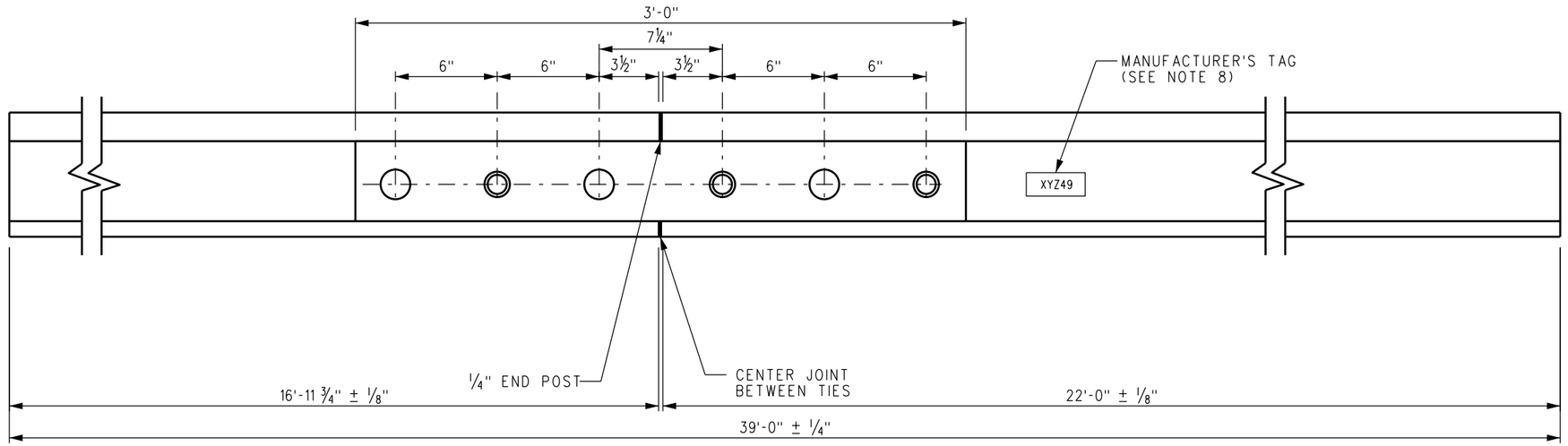
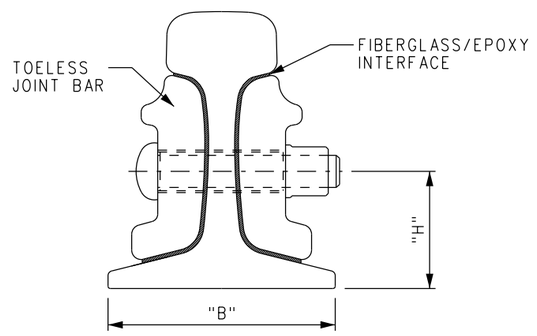


PLAN



PROFILE

RAIL SIZE	"B"	"H"
115 RE (MAINTENANCE ONLY)	5½"	2⅞"
136 RE	6"	3 3/32"



CROSS SECTION

NOTES:

1. INSULATED JOINT PLUG SHALL MEET OR EXCEED CURRENT AREMA SPECIFICATION CHAPTER 4, PART 3.8, ONLY ALLEGHENY BONDED INSULATED JOINT OR APPROVED EQUAL WILL BE ACCEPTED.
2. INSULATED JOINT PLUGS SHALL BE MANUFACTURED FROM NEW PREMIUM HEAD HARDENED RAIL. INSULATED JOINTS SHALL BE INSTALLED AS SHOWN IN PLANS OR AS DIRECTED. GOOD USABLE SECOND-HAND PREMIUM HEAD HARDENED RAIL WITH ¼" HEADWEAR MAY BE USED FOR JOINTS MANUFACTURED FOR ¼" HEADWEAR. INSULATED JOINTS FOR USE IN TURNOUTS, RAIL WILL BE BENT FOR CLOSURE OR TURNOUT SIDE.
3. ALL RAIL ENDS ARE TO BE DEBURRED ONLY; RAIL END MAY BE DRILLED UPON REQUEST.
4. ALL HOLES SHALL BE CHAMFERED.
5. FOR DRILLING OF RAIL AT JOINT: RAIL HOLE DIAMETER: 1-5/16" FOR 1" BOLTS.
6. 1" A325 HUCK "PIN" BOLTS WITH STAGGERED PATTERN SHALL BE FURNISHED. WHEN NECESSARY, A490 BOLTS WITH SECURITY LOCKNUTS, LUBRICATED AND TORQUED TO 850 FT LBS, MAY BE SUBSTITUTED FOR HUCK "PIN" BOLTS.

NOTES: (CONTINUED)

7. INSULATED JOINT PLUGS TO BE MANUFACTURED AND CURED IN A CONTROLLED ENVIRONMENT AT THE MANUFACTURER'S PLANT. NO FABRICATION OF INSULATED JOINT PLUGS IN THE FIELD WILL BE ACCEPTED.
8. AFTER HUCKING OR BOLTING, MANUFACTURER SHALL REMOVE EXCESS EPOXY FROM RAIL AND JOINT BAR. MANUFACTURER SHALL ADHERE IDENTIFICATION TAG TO THE WEB OF RAIL DEPICTING MANUFACTURER'S NAME, CONTROL NUMBER, LOCATION, MONTH (01) AND YEAR (2XXX) WHERE JOINTS WERE FABRICATED.
9. MANUFACTURER SHALL MARK A BALANCE POINT WITH A PAINTED LINE AND STENCIL "LIFT HERE" ON THE HEAD OF RAIL FOR HANDLING.
10. INSULATED JOINT PLUGS SHALL BE CENTERED BETWEEN TIE CRIBS.
11. SUPPLIERS OF MATERIAL SHOWN ON TRACK STANDARD DRAWINGS SHALL FORMALLY SUBMIT THEIR SHOP DRAWINGS TO SCRRA FOR APPROVAL. MATERIAL SHIPPED WITHOUT WRITTEN APPROVAL FROM SCRRA WILL NOT BE ACCEPTED.
12. PREFABRICATED JOINTS OF OTHER LENGTHS AS SPECIFIED MAY BE REQUIRED IN TURNOUTS.
13. REFER TO ENGINEERING STANDARDS AND SPECIFICATIONS FOR PROPER OTM USE WHEN FASTENING INSULATED JOINTS TO TRACK STRUCTURE.

REV.	DATE	DESCRIPTION	DES.	ENG.
F	10-24-24	ADDED TABLE AND REVISED CROSS SECTION	AC	RG
E	03-03-23	REVISED NOTES, DETAILS ADDED CROSS SECTION	AC	RG
D	09-22-21	REVISED NOTE 8	AC	JMM
C	03-05-21	REVISED CONCRETE TIE PROFILE	AC	JMM
B	02-27-19	ADDED CONCRETE TIE PROFILE	AC	JF
A	05-31-13	REVISED PROFILE	AC	NDP

DRAWN BY: A. CARLOS DATE: 03/22/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

PREFABRICATED BONDED INSULATED JOINT

STANDARD 2504
SCALE: NTS
REVISION F SHEET 1 OF 1
CADD FILE: ES2504

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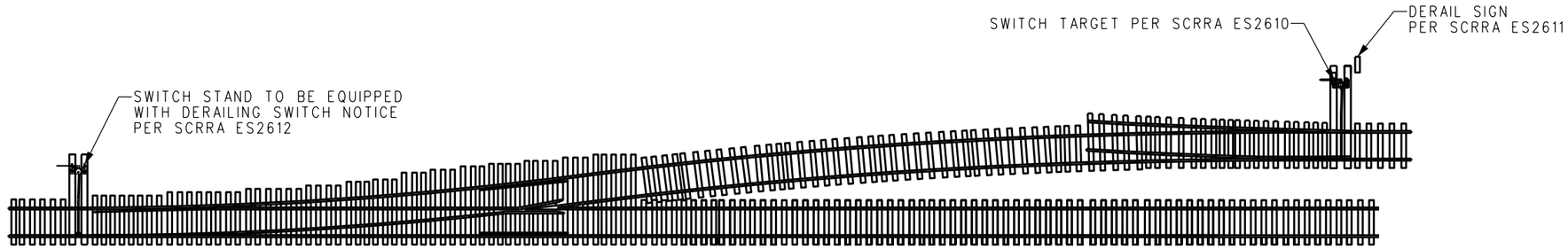
FileName-> C:\ics-for-pdf-work-dir\154\482_80\ES2504.dgn



GENERAL DERAIL LAYOUT PLAN

NOTE:

SEE SCRRA ES2702 FOR DISTANCE FROM MAIN TRACK SWITCH TO POINT OF DERAIL AND INSULATED JOINT LOCATIONS.

REQUIRED DERAIL NOTES:

1. EXCEPT AT THE INTERLOCKINGS, DERAILS ARE REQUIRED AT THE FOLLOWING LOCATIONS UNLESS OTHERWISE AUTHORIZED.
   a. INTERCHANGE TRACKS, REGARDLESS OF GRADE CONDITIONS, WHERE THERE IS HAZARD OF FOREIGN LINE OPERATION CAUSING ENGINES OR CARS TO MOVE FOUL OF MAIN TRACK, SIDING OR OTHER TRACKS.
   b. INDUSTRY TRACKS, WHERE AN INDUSTRY CAN MOVE CARS TO CREATE A HAZARD BY FOULING THE MAIN TRACK, SIDING; OR ANY INDUSTRY TRACKS OR OTHER TRACKS WHERE CARS ARE LEFT UNATTENDED.
   c. SPURS AND OTHER TRACKS ON WHICH CARS ARE LEFT UNATTENDED AND THE UNAUTHORIZED MOVEMENT OF SUCH CARS MAY FOUL MAIN TRACK OR SIDING, EXCEPT WHERE TRACK GRADE ASCENDS TOWARD MAIN TRACK OR SIDING AT GREATER THAN OR EQUAL TO 1.50% GRADIENT.
   d. ANY TRACK, REGARDLESS OF GRADE. THAT IS USED FOR THE STORAGE OF LIVE ENGINES AND WHERE AN UNAUTHORIZED MOVEMENT OF THE ENGINES COULD FOUL MAIN TRACK.
   e. OTHER LOCATIONS, REGARDLESS OF GRADE, WHERE SPECIAL CONDITIONS REQUIRE DERAIL PROTECTION AND SUCH PROTECTION IS AUTHORIZED BY SCRRA.
   f. ANY TRACK, USED FOR LOADING, UNLOADING OR STORAGE OF CARS CONTAINING HAZARDOUS MATERIAL AS LISTED IN THE HAZARDOUS MATERIALS REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION, CODE OF FEDERAL REGULATIONS. SUCH OPERATIONS SHALL BE PROTECTED AGAINST INBOUND MOVEMENTS BY DERAILS, SECURED WITH LOCKS AND LOCATED BEYOND THE CLEARANCE POINT AND NOT LESS THAN 50 FEET FROM NEAR END OF THE CAR(S).
2. ALL NEW INSTALLATIONS OF DERAILS AS OUTLINED ABOVE SHALL BE THE DOUBLE SWITCH POINT TYPE SCRRA ES2604. EXISTING SLIDING OR HINGED TYPE DERAILS CURRENYLY APPLIED ARE AUTHORIZED EXCEPT WHERE APPLIED:
   a. ON INSIDE OF CURVES OVER 5 DEGREES.
   b. ON TRACKS WHERE AN UNCONTROLLED CAR COULD REACH A SPEED IN EXCESS OF FOUR (4) MPH.
   c. AT LOCATIONS WHERE A DERAIL IS INSTALLED TO PROTECT AGAINST THE MOVEMENT OF ENGINES OR TRAINS. SLIDING OR HINGED DERAILS ARE AUTHORIZED FOR PROTECTION AT LOCOMOTIVE AND CAR REPAIR FACILITIES WHEN ALSO PROTECED BY BLUE FLAG RULES AND PROCEDURES.
   d. AT ANY OTHER LOCATION WHERE CONDITIONS ARE SUCH THAT THE SWITCH POINT DERAIL SHOULD BE INSTALLED TO ELIMINATE A POTENTIALLY HAZARDOUS SITUATION.
3. DOUBLE POINT DERAILS PER SCRRA ES2604 ARE REQUIRED AS NOTED BELOW. AT OTHER LOCATIONS REQUIRING A DERAIL, A SLIDING OR HINGED DERAIL, SCRRA ES2613 OR ES2614 WILL BE USED.
   a. LOCATIONS WHERE UNCONTROLLED MOVEMENTS CAN EXCEED 20 MPH.
   b. LOCATIONS PROTECTING TRACKS HOLDING 15 OR MORE CARS.
   c. DIVERGING TRACK ASCENDS TOWARDS MAIN TRACK AT GRADE LESS THAN 0.5% OR DESCENDS TOWARD THE MAIN TRACK AT ANY GRADIENT.
   d. AT OTHER LOCATIONS DESIGNATED BY SCRRA ASSISTANT DIRECTOR, DESIGN.
4. FOR DETAILS OF CONNECTING RODS FOR SLIDING AND HINGED DERAILS SEE SCRRA ES2602.
5. SEE SCRRA ES2610, ES2611 AND ES2612 FOR DERAIL SIGNAGE WHERE REQUIRED.
6. EXPOSED ENDS OF STOCK RAIL AND DEFLECTING RAILS SHALL BE CUT AND BENT PER DEPRESSED RAIL HEAD DETAIL PER SCRRA ES2604.
7. HAND OPERATED DERAILS ARE ILLUSTRATED, HOWEVER POWER OPERATED DERAILS WILL BE INSTALLED AS DIRECTED BY SCRRA.

REV.	DATE	DESCRIPTION	DES.	ENG.
A	08-03-20	REVISED NOTE 3, SUBPART d	AC	JMM

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

DERAIL USE REQUIREMENTS

STANDARD 2601
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2601

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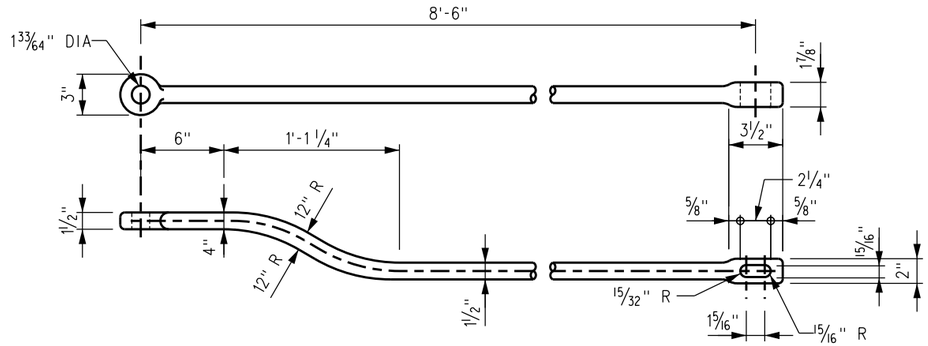
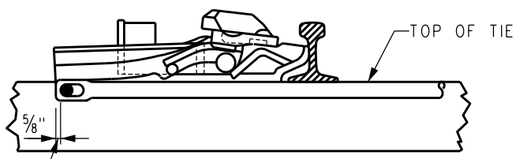


CONNECTING ROD FOR USE WITH HAYES DERAIL AND HIGH OR LOW SWITCH STANDS PER SCRRA ES2701 & ES2704

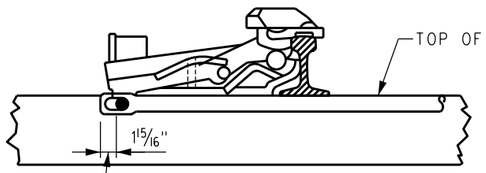
NOTE:

SINCE THE THROW OF SWITCH STAND IS ONLY 5", THE SLOTTED HOLE IN ROD IS PROVIDED TO PERMIT MOVEMENT OF 6 1/4" REQUIRED FOR PROPER FUNCTIONING OF HAYES SLIDING DERAIL.



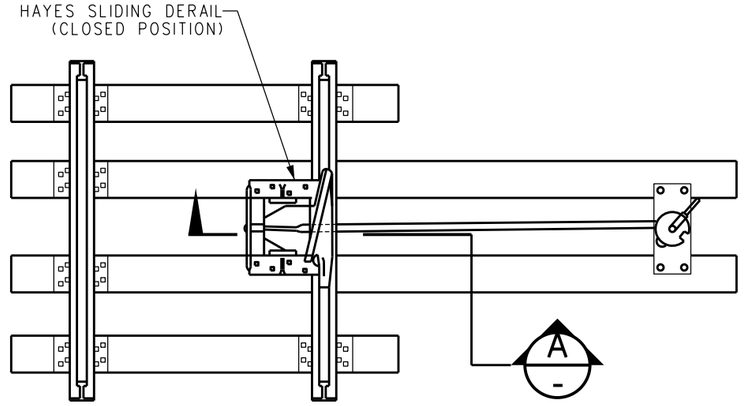
POSITION OF CONNECTING ROD WHEN DERAIL IS IN THE OPEN POSITION

SECTION A-A (OPEN)



POSITION OF CONNECTING ROD WHEN DERAIL IS IN THE CLOSED POSITION

SECTION A-A (CLOSED)



GENERAL PLAN FOR CONNECTING ROD WITH HAYES SLIDING DERAIL

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

CONNECTING ROD DETAILS FOR DERAILS

STANDARD 2602
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2602

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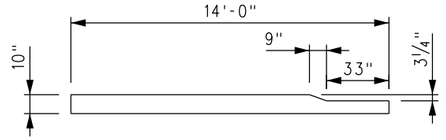
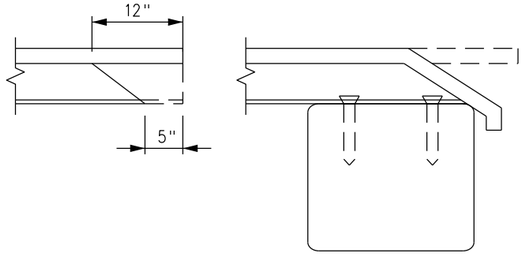


DAPPING DETAIL - HEADBLOCK TIES
(8"x10"x14'-0")



DEPRESSED RAIL HEAD DETAIL

TURNOUT DATA

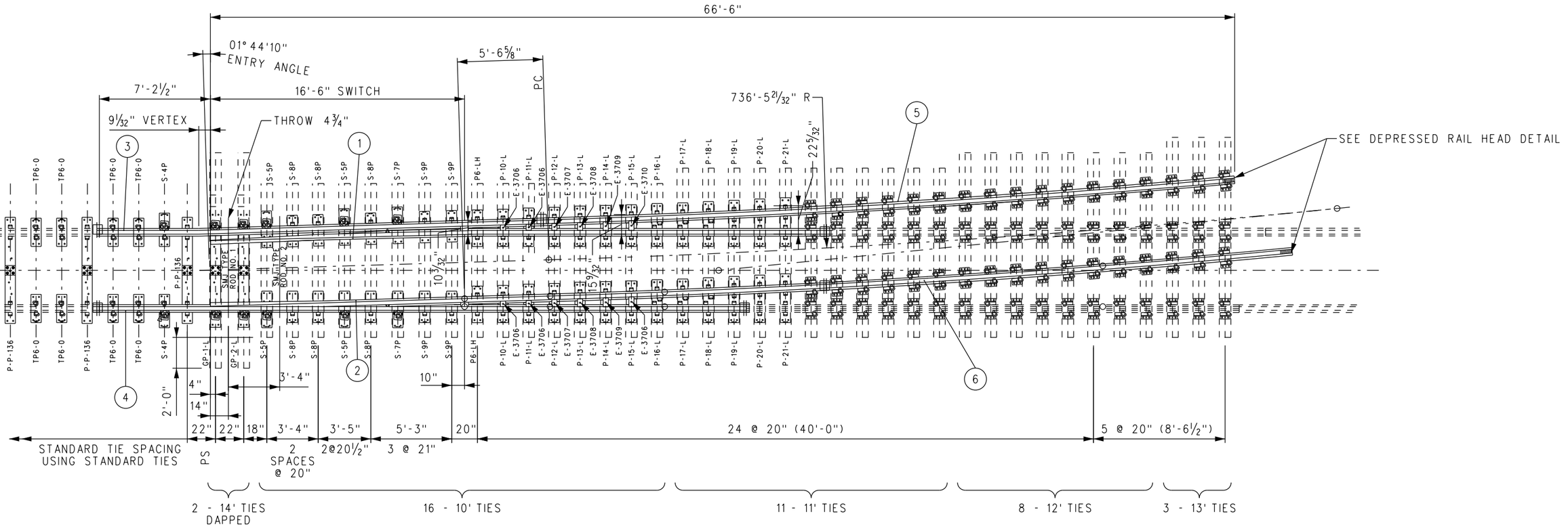
SWITCH GEOMETRY:	16'-6"
VERTEX DISTANCE:	9 1/32"
SWITCH ANGLE:	1° 44'11"
SWITCH HEEL SPREAD:	6 1/4"
RADIUS OF CL CURVE:	736'-5 21/32"
DEGREE OF CL CURVE:	7° 46'58"
CENTRAL ANGLE OF TURNOUT CURVE:	3° 59'18"

LEGEND

WELDED JOINTS

NOTES:

1. SEE ES2604-02 FOR BILL OF MATERIALS. CIRCLED ITEM NUMBERS APPLY TO BILL OF MATERIAL ITEMS.
2. ALL RAIL SHALL HAVE IDENTIFICATION COLOR CODE PAINTED ON WEB CLEAR OF JOINT AREA.
3. LH AND RH SWITCH POINTS WITH MANGANESE TIP.
4. TIMBER TIES TO CONFORM TO SCRRA STANDARD SPECIFICATIONS 34 11 34.
5. RH SWITCH POINT DERAIL IS MIRROR IMAGE OF THIS LAYOUT. SEE BILL OF MATERIALS FOR REFERENCE TO SPECIFIC PARTS.



REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

16'-6" DOUBLE POINT DERAIL
(LEFT HAND SHOWN)

STANDARD: 2604
SCALE: NTS
REVISION: - SHEET: 1 OF 2
CADD FILE: ES2604-01

UserName•› scrrapw11ics01$ Date Plotted: 3/27/2023 3:04:47 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•› \\scrrapw11ics01\iCS_pdf_work_dir\87\482_83\ES2604-01.dgn

BILL OF MATERIAL					
ITEM	LH QTY	RH QTY	DESCRIPTION	DWG NO	SCRRA PART NO
1	1	1	SAMSON POINT, 16'-6"/40'-0" LONG, FLOATING HEEL, MANGANESE TIP, LH	ES2921-08	
2	1	1	SAMSON POINT, 16'-6"/40'-0" LONG, FLOATING HEEL, MANGANESE TIP, RH	ES2921-08	
3	1	-	STOCK RAIL, SAMSON UNDERCUT, BENT & CURVED, 28'-10" LONG, LH/LHTO	ES2921-09	
3	-	1	STOCK RAIL, SAMSON UNDERCUT, BENT & CURVED, 28'-10" LONG, RH/RHTO	ES2921-09	
4	1	-	STOCK RAIL, SAMSON UNDERCUT, STRAIGHT, 42'-0" LONG, RH/LHTO	ES2921-09	
4	-	1	STOCK RAIL, SAMSON UNDERCUT, STRAIGHT, 42'-0" LONG, LH/RHTO	ES2921-09	
5	1	1	CURVED RAIL 44'-11 9/16" LONG	-	
6	1	1	CURVED RAIL 30'-4 1/8" LONG	-	
9	1	1	SWITCH ROD #1 ASSEMBLY, 'SMJ' VERTICAL C/W BASKET ASSEMBLY	-	
10	1	1	SWITCH ROD #2 ASSEMBLY, 'SMJ' VERTICAL	-	
11	3	3	GAUGE PLATE, INSULATED (P-P-136)	ES2802-80	
12	1	-	GAUGE PLATE, INS (GP-1-L)	ES2802-81	
13	-	1	GAUGE PLATE, INS (GP-1-R)	ES2802-81	
14	1	-	GAUGE PLATE, INS (GP-2-L)	ES2802-82	
15	-	1	GAUGE PLATE, INS (GP-2-R)	ES2802-82	
16	2	2	BRACE SLIDE PLATE (S-4P)	ES2802-88	
17	4	4	BRACE SLIDE PLATE (S-5P)	ES2802-85	
18	2	2	BRACE SLIDE PLATE (S-7P)	ES2802-85	
19	2	-	SWITCH HEEL PLATE (P6-LH)	ES2802-83	
20	-	2	SWITCH HEEL PLATE (P6-RH)	ES2802-84	
21	6	6	SLIDE PLATE (S-8P), 1/4" RISER	ES2802-86	
22	4	4	SLIDE PLATE (S-9P), 0" RISER	ES2802-86	
23	2	-	SWITCH PLATE (P-10-L)	ES2921-13	
24	-	2	SWITCH PLATE (P-10-R)	ES2921-13	
25	2	-	SWITCH PLATE (P-11-L)	ES2921-13	
26	-	2	SWITCH PLATE (P-11-R)	ES2921-13	
27	2	-	SWITCH PLATE (P-12-L)	ES2921-13	
28	-	2	SWITCH PLATE (P-12-R)	ES2921-13	
29	2	-	SWITCH PLATE (P-13-L)	ES2921-13	
30	-	2	SWITCH PLATE (P-13-R)	ES2921-13	
31	2	-	SWITCH PLATE (P-14-L)	ES2921-13	
32	-	2	SWITCH PLATE (P-14-R)	ES2921-13	

BILL OF MATERIAL					
ITEM	LH QTY	RH QTY	DESCRIPTION	DWG NO	SCRRA PART NO
33	2	-	SWITCH PLATE (P-15-L)	ES2921-13	
34	-	2	SWITCH PLATE (P-15-R)	ES2921-13	
35	2	-	SWITCH PLATE (P-16-L)	ES2921-13	
36	-	2	SWITCH PLATE (P-16-R)	ES2921-13	
37	2	-	SWITCH PLATE (P-17-L)	ES2921-13	
38	-	2	SWITCH PLATE (P-17-R)	ES2921-13	
39	2	-	SWITCH PLATE (P-18-L)	ES2921-13	
40	-	2	SWITCH PLATE (P-18-R)	ES2921-13	
41	2	-	SWITCH PLATE (P-19-L)	ES2921-13	
42	-	2	SWITCH PLATE (P-19-R)	ES2921-13	
43	2	-	SWITCH PLATE (P-20-L)	ES2921-13	
44	-	2	SWITCH PLATE (P-20-R)	ES2921-13	
45	2	-	SWITCH PLATE (P-21-L)	ES2921-13	
46	-	2	SWITCH PLATE (P-21-R)	ES2921-13	
47	72	72	TIE PLATE, ROLLED PANDROL, 6" RAIL BASE, CANTED, 1" DIA HOLES	ES2454	
48	4	4	HOLD-DOWN CLIP (E3706)	-	
49	2	2	HOLD-DOWN CLIP (E3707)	-	
50	2	2	HOLD-DOWN CLIP (E3708)	-	
51	2	2	HOLD-DOWN CLIP (E3709)	-	
52	2	2	HOLD-DOWN CLIP (E3710)	-	
53	264	264	PANDROL SPRING CLIP (E2055)	ES2362	
54	8	8	PANDROL SPRING CLIP, (E2063), FOR JOINT BARS	ES2361	
55	536	536	SCREW SPIKE, 15/16" DIA X 6" LONG	ES2355	
56	12	12	BOLTLESS BRACE, 136RE 'SURFIT'	-	
57	12	12	SERRATED WASHER FOR BOLTLESS BRACE	-	
58	16	16	TIE, HARDWOOD, TREATED, 7" X 9" X 10'-0" LONG	-	
59	11	11	TIE, HARDWOOD, TREATED, 7" X 9" X 11'-0" LONG	-	
60	8	8	TIE, HARDWOOD, TREATED, 7" X 9" X 12'-0" LONG	-	
61	3	3	TIE, HARDWOOD, TREATED, 7" X 9" X 13'-0" LONG	-	
62	2	2	TIE, HARDWOOD, TREATED, 10" X 8" X 14'-0" LONG, DAPPED	-	
63	8	8	TIE PLATE, TP6-0, NO CANT	-	

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

16'-6" DOUBLE POINT DERAIL
BILL OF MATERIAL LH AND RH

STANDARD 2604
SCALE: NTS
REVISION -
SHEET 2 OF 2
CADD FILE: ES2604-02

UserName=> scrrapw11ics01$ Date Plotted: 3/27/2023 3:05:07 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
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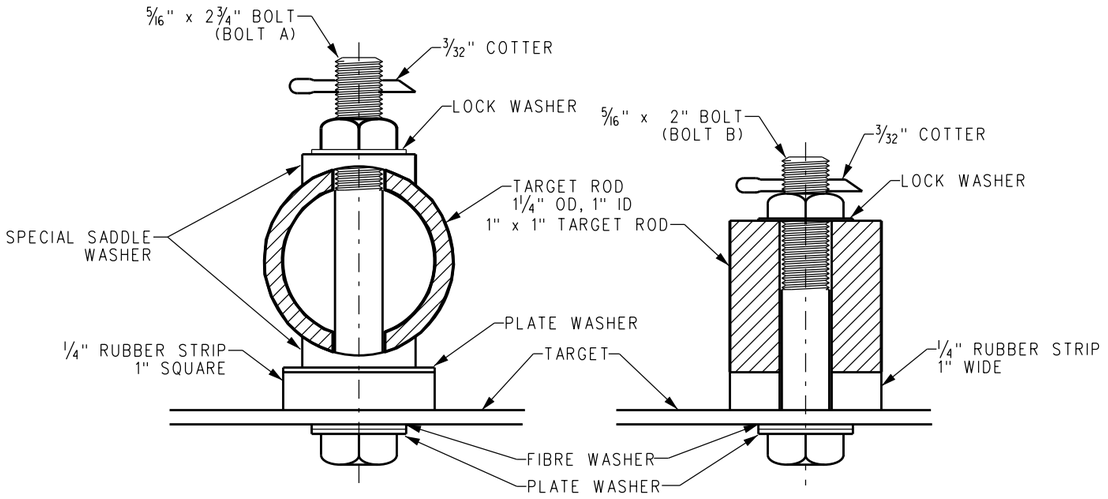


SECTION A-A

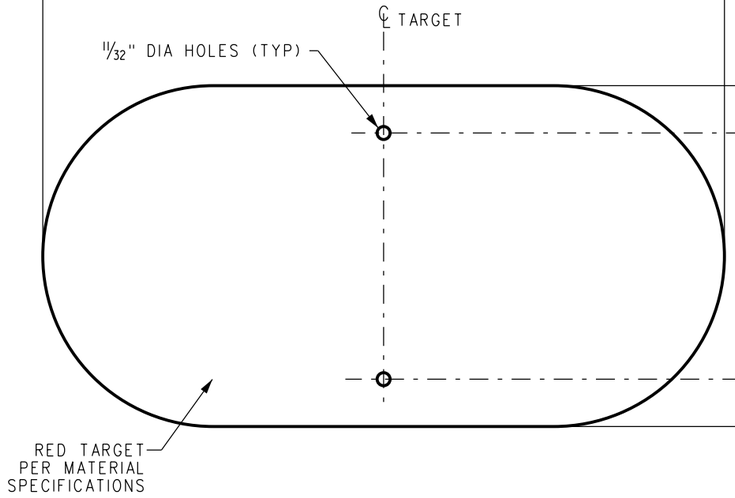
SECTION B-B

MATERIAL SPECIFICATIONS

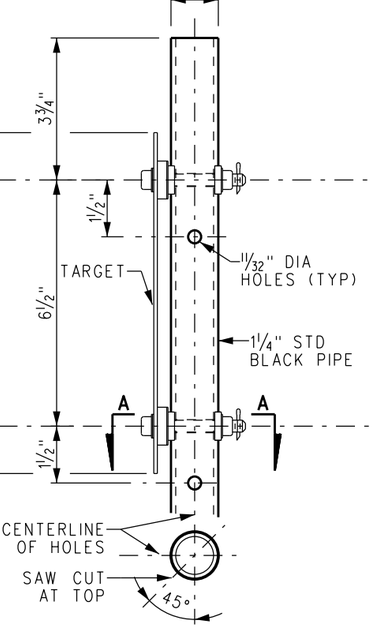
PRODUCT	SYSTEM	MANUFACTURER AND PRODUCT
HIGH INTENSITY SHEETING RED	1	3M DIAMOND GRADE DG-3-4092
	2	AVERY DENNISON OMNI-CUBE T-11508
ANTI-GRAFFITI OVERLAY	1	3M PREMIUM PROTECTIVE OVERLAY FILM 1160
	2	NIKKALITE BRAND HI-SCALE F-40801
	3	AVERY DENNISON OL-1000 PREMIUM ANTI-GRAFFITI FILM

MATERIAL NOTES:

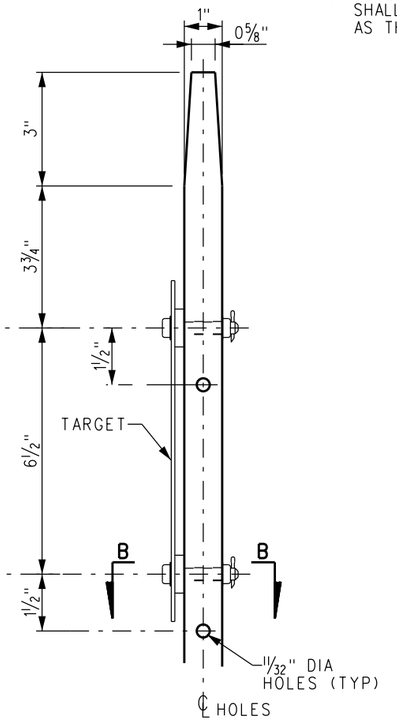
1. SIGNS SHALL INCLUDE ALUMINUM PANEL, RETROREFLECTIVE SHEETING, POLYURETHANE PAINT, SCREENED-PROCESS COLORS OR FILM, UV PROTECTION OVERLAY, ANTI-GRAFFITI OVERLAY, POSTS, ANCHORS AND HARDWARE.
2. ALUMINUM PANEL SHALL BE ALCOA 6016-T6 OR EQUAL.
3. TEXT FONT SHALL BE 7/32" ARIEL BOLD 9/32" AS PER SCRRA ES1212, SIZE AS INDICATED.
4. PANEL SHALL BE PAINTED ON ALL SIDES WITH TWO PART ACRYLIC POLYURETHANE PAINT COATING.
5. RETROREFLECTIVE SHEETING SHALL CONFORM TO THE REQUIREMENTS OF ASTM D4956, CLASS IX OR GREATER. RETROREFLECTIVE SHEETING SHALL HAVE CLASS 1, 3, OR 4 ADHESIVE BACKING WHICH SHALL BE PRESSURE SENSITIVE AND FUNGUS RESISTANT.
6. SCREENED-PROCESS COLORS AND NONREFLECTIVE, OPAQUE BLACK FILM SHALL HAVE EQUIVALENT OUTDOOR WEATHERABILITY CHARACTERISTICS AS THE RETROREFLECTIVE SHEETING.



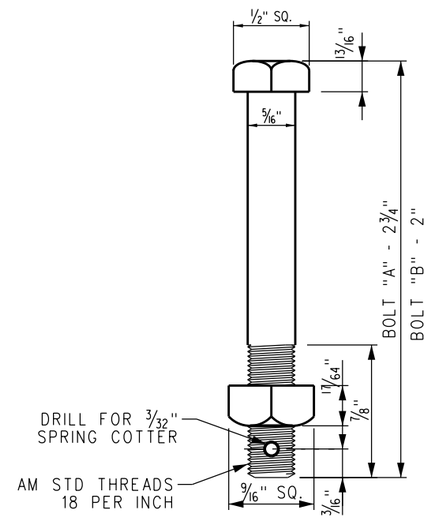
DERAILING SWITCH TARGET



TUBULAR TARGET ROD



SQUARE TARGET ROD



5/16" TARGET BOLT

REV.	DATE	DESCRIPTION	DES.	ENG.
A	3-22-13	REVISED MATERIAL SPECIFICATIONS	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

DERAILING SWITCH TARGET

STANDARD 2610
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2610

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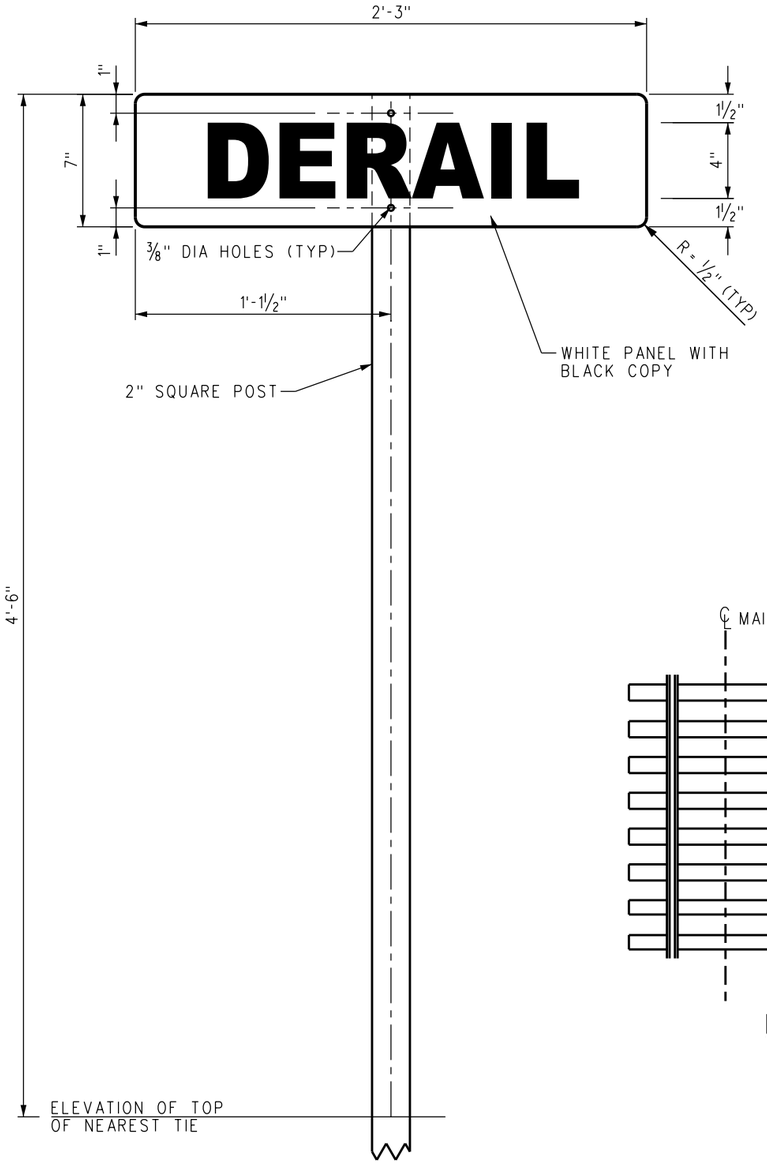
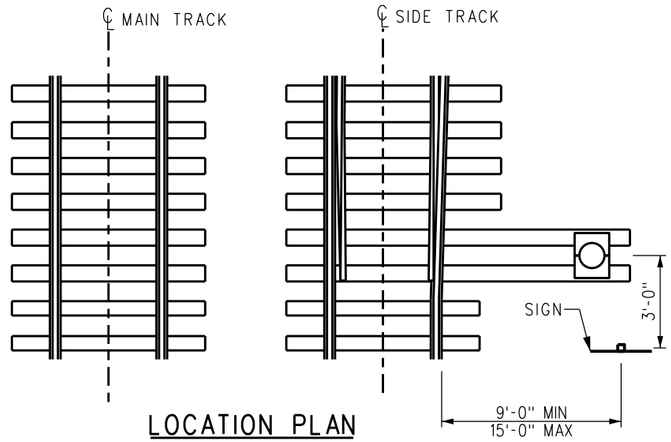


TYPE "B"



LOCATION PLAN

TYPE "B" SIGNS CONFORM TO CALIFORNIA STATE LAW

MATERIAL SPECIFICATIONS

PRODUCT	SYSTEM	MANUFACTURER AND PRODUCT
HIGH INTENSITY SHEETING (WHITE)	1	3M SCOTCHLITE HIGH INTENSITY PRISMATIC WHITE GRADE 3930 SHEETING
	2	NIPPON CARBIDE RETRO-REFLECTIVE SHEETING TYPE VIII CRYSTAL GRADE
	3	AVERY DENNISON OMNI-VIEW T-9500 PRISMATIC HIGH INTENSITY SHEETING
COPY / GRAPHICS (BLACK)	1	3M PROCESS COLOR SERIES 8851 INK
	2	NIPPON CARBIDE GRAFFITI RESISTANT 3803 INK
	3	AVERY DENNISON 4930 INK
ANTI - GRAFFITI OVERLAY	1	3M PREMIUM PROTECTIVE OVERLAY FILM 1160
	2	NIKKALITE BRAND HI - SCALE F-40801
	3	AVERY DENNISON OL - 1000 PREMIUM ANTI - GRAFFITI FILM
PANEL	1	⅛" THICK ALUMINUM, ALCOA 6016-T6 OR EQUAL
POSTS, ANCHORS & HARDWARE	1	AS PER SCRRA ES5210

INSTALLATION NOTES

TYPE "B" DERAIL SIGN SHALL BE USED AT ALL DERAILS PER SCRRA ES2601. SIGN SHALL BE LOCATED AS PER LOCATION PLAN AND FACING SO AS TO BE READ FROM ENGINE PULLING OUT OF THE SIDE TRACK. SELECT OFFSET FROM FIELD SIDE OF NEAREST RAIL SUCH THAT UNDERGROUND UTILITIES SHALL NOT BE DAMAGED WHEN SETTING ANCHOR.

MATERIAL NOTES:

1. SIGNS SHALL INCLUDE ALUMINUM PANEL, RETROREFLECTIVE SHEETING, POLYURETHANE PAINT, SCREENED-PROCESS COLORS OR FILM, UV PROTECTION OVERLAY, ANTI-GRAFFITI OVERLAY, POSTS, ANCHORS AND HARDWARE.
2. ALUMINUM PANEL SHALL BE ALCOA 6016-T6 OR EQUAL.
3. TEXT FONT SHALL BE 7/32" ARIEL BOLD 9/32" AS PER SCRRA ES1212, SIZE AS INDICATED.
4. POSTS, ANCHORS, AND HARDWARE SHALL BE AS PER SCRRA ES5210.
5. PANEL SHALL BE PAINTED ON ALL SIDES WITH TWO PART ACRYLIC POLYURETHANE PAINT COATING.
6. RETROREFLECTIVE SHEETING SHALL CONFORM TO THE REQUIREMENTS OF ASTM D4956, CLASS IX OR GREATER. RETROREFLECTIVE SHEETING SHALL HAVE CLASS 1, 3, OR 4 ADHESIVE BACKING WHICH SHALL BE PRESSURE SENSITIVE AND FUNGUS RESISTANT.
7. SCREENED-PROCESS COLORS AND NONREFLECTIVE, OPAQUE BLACK FILM SHALL HAVE EQUIVALENT OUTDOOR WEATHERABILITY CHARACTERISTICS AS THE RETROREFLECTIVE SHEETING.

REV.	DATE	DESCRIPTION	DES.	ENG.
A	03/22/13	REVISED MATERIAL SPECIFICATIONS	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

TYPE "B" DERAIL SIGN

STANDARD 2611
SCALE: NTS
REVISION A
SHEET 1 OF 1
CADD FILE: ES2611

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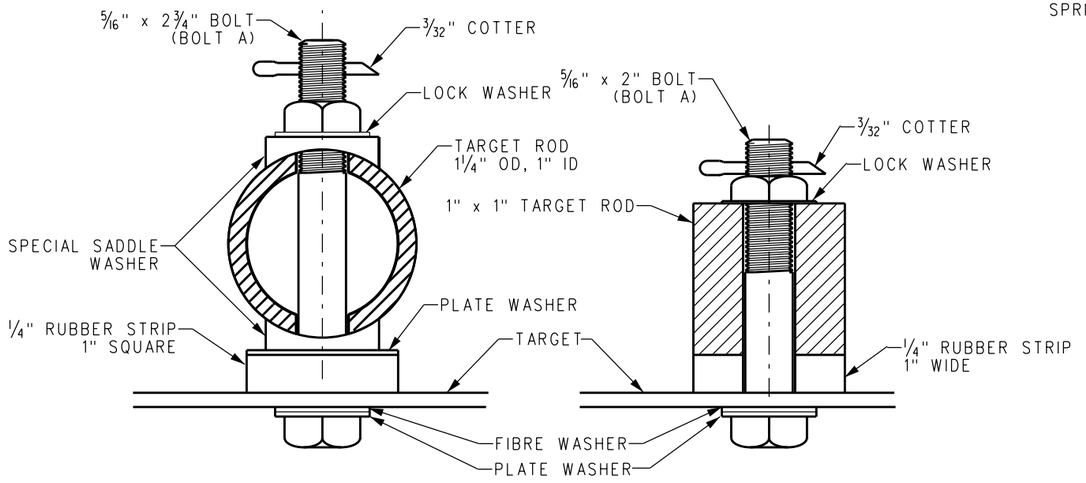
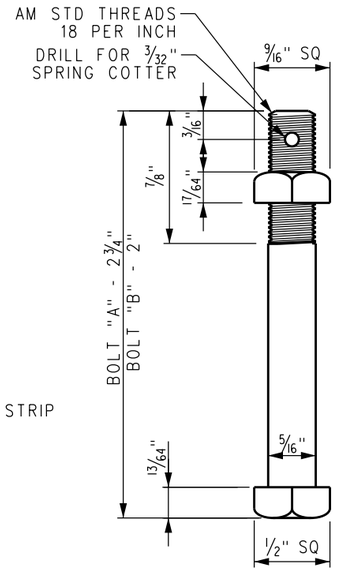


SECTION A-A SECTION B-B



5/16" TARGET BOLT

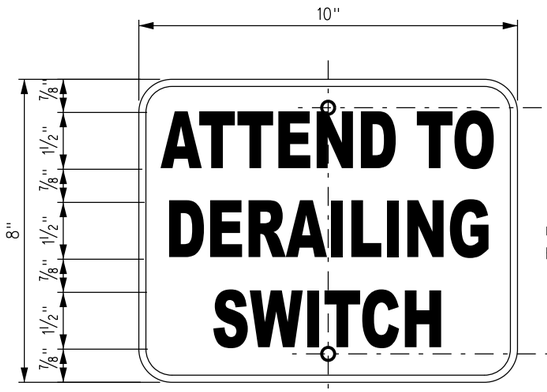
MATERIAL SPECIFICATIONS		
PRODUCT	SYSTEM	MANUFACTURER AND PRODUCT
HIGH INTENSITY SHEETING (WHITE)	1	3M SCOTCHLITE HIGH INTENSITY PRISMATIC WHITE GRADE 3930 SHEETING
	2	NIPPON CARBIDE RETRO-REFLECTIVE SHEETING TYPE VIII CRYSTAL GRADE
	3	AVERY DENNISON OMNI-VIEW T-9500 PRISMATIC HIGH INTENSITY SHEETING
COPY / GRAPHICS (BLACK)	1	3M PROCESS COLOR SERIES 8851 INK
	2	NIPPON CARBIDE GRAFFITI RESISTANT 3803 INK
	3	AVERY DENNISON 4930 INK
ANTI - GRAFFITI OVERLAY	1	3M PREMIUM PROTECTIVE OVERLAY FILM 1160
	2	NIKKALITE BRAND HI - SCALE F-40801
	3	AVERY DENNISON OL - 1000 PREMIUM ANTI - GRAFFITI FILM
PANEL	1	1/8" THICK ALUMINUM, ALCOA 6016-T6 OR EQUAL

INSTALLATION NOTES

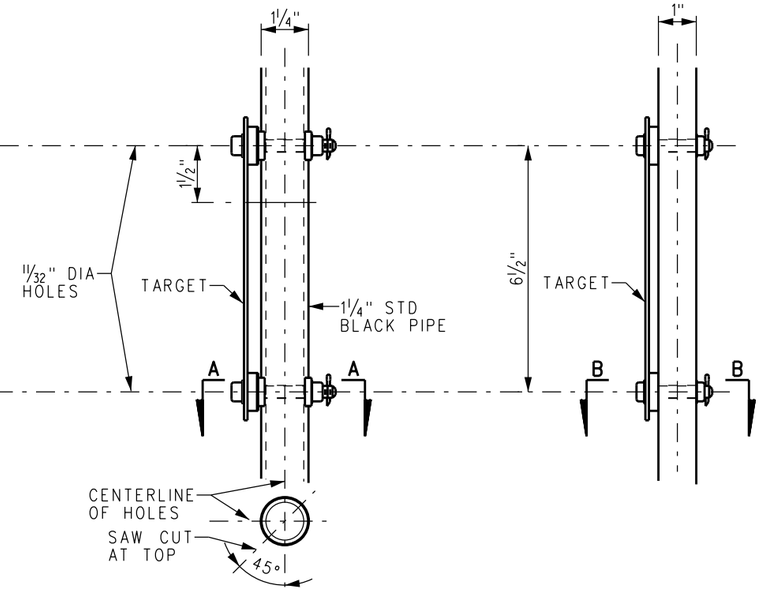
WHERE DERAIL IS PROVIDED TO PREVENT FOULING OF ANY TRACK, DERAILING SWITCH NOTICE SHALL BE PLACED ON STAND OF THAT PARTICULAR SWITCH THROUGH WHICH THE FOULING MOVEMENT WOULD BE MADE.

MATERIAL NOTES:

1. SIGNS SHALL INCLUDE ALUMINUM PANEL, RETROREFLECTIVE SHEETING, POLYURETHANE PAINT, SCREENED-PROCESS COLORS OR FILM, UV PROTECTION OVERLAY, ANTI-GRAFFITI OVERLAY, POSTS, ANCHORS AND HARDWARE.
2. ALUMINUM PANEL SHALL BE ALCOA 6016-T6 OR EQUAL.
3. TEXT FONT SHALL BE ARIAL BOLD AS PER SCRRA ES1212, SIZE AS INDICATED.
4. PANEL SHALL BE PAINTED ON ALL SIDES WITH TWO PART ACRYLIC POLYURETHANE PAINT COATING.
5. RETROREFLECTIVE SHEETING SHALL CONFORM TO THE REQUIREMENTS OF ASTM D4956, CLASS IX OR GREATER. RETROREFLECTIVE SHEETING SHALL HAVE CLASS 1, 3, OR 4 ADHESIVE BACKING WHICH SHALL BE PRESSURE SENSITIVE AND FUNGUS RESISTANT.
6. SCREENED-PROCESS COLORS AND NONREFLECTIVE, OPAQUE BLACK FILM SHALL HAVE EQUIVALENT OUTDOOR WEATHERABILITY CHARACTERISTICS AS THE RETROREFLECTIVE SHEETING.

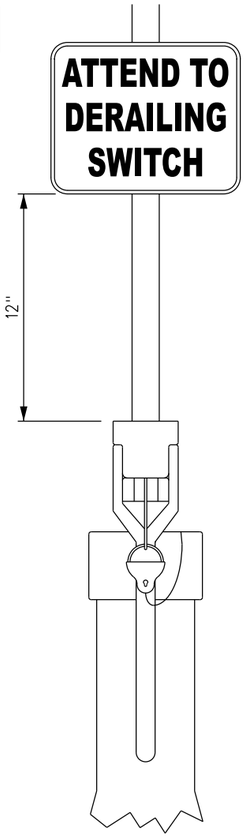


DERAILING SWITCH TARGET



TUBULAR TARGET ROD

SQUARE TARGET ROD



FULL VIEW

REV.	DATE	DESCRIPTION	DES.	ENG.
A	05-31-13	REVISED MATERIAL SPECIFICATIONS AND NOTES	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

DERAIL SWITCH NOTICE

STANDARD 2612
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2612

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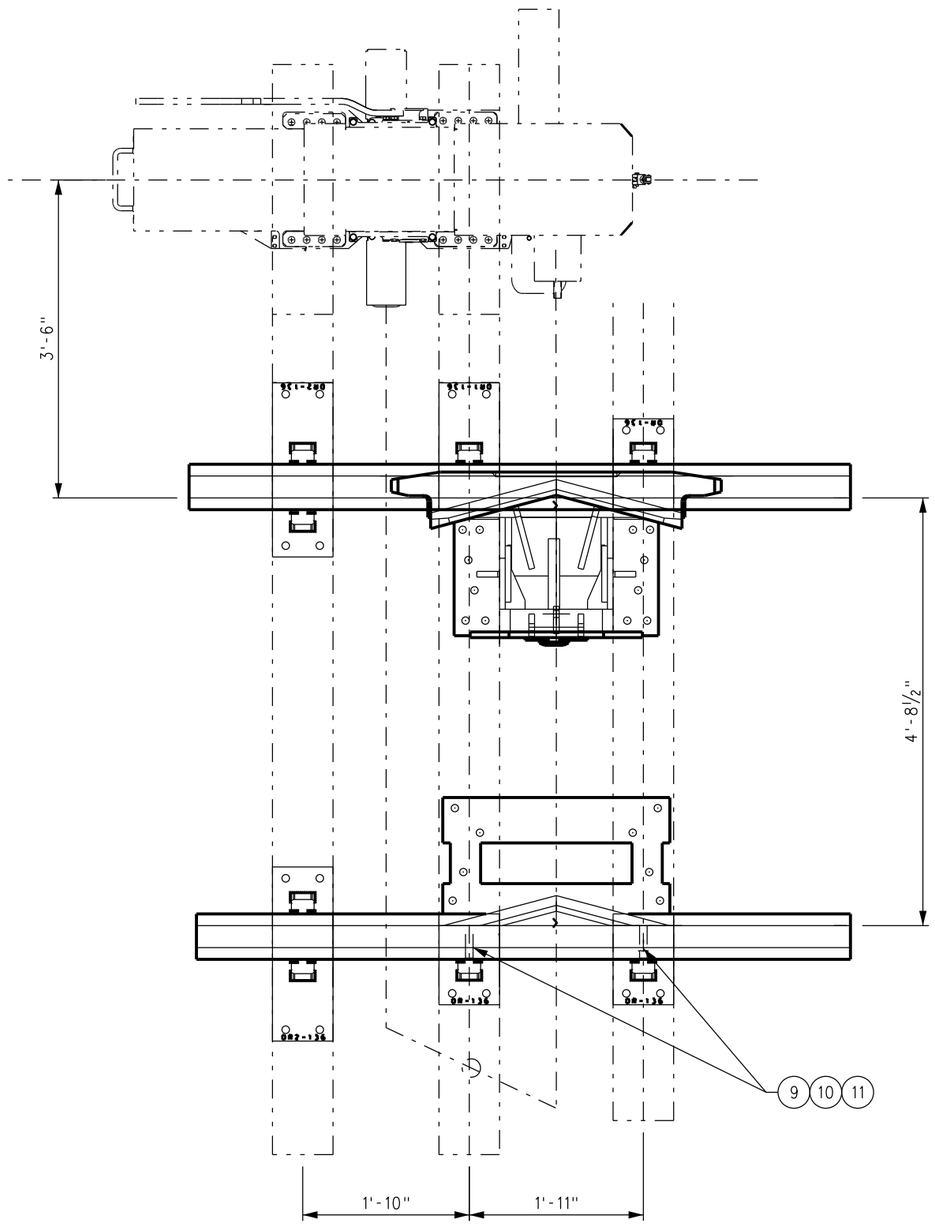


BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PRODUCT NO	SCRRA PART NO
1	1	HAYS DERAIL HBXS-8-SS C/W CROWDER	X99-02310	
2	1	RODDING KIT FOR WCH DERAIL FOR USE WITH US&S M23E SW/MACHINE	X99-02314	
3	3	TIE PLATE DR-136	G90-00630	
4	1	TIE PLATE DR1-136	G90-00631	
5	2	TIE PLATE DR2-136	G90-00632	
6	2	TIE HARDWOOD TREATED DAPPED 8" X 10" X 12'-0"	J15-00068	
7	1	TIE HARDWOOD TREATED 8" X 10" X 9'-0"	J15-00069	
8	46	SCREW SPIKE 15/16" X 6"	V50-00010	
9	2	BOLT HEX 1" X 4" GR5	V01-61010	
10	2	NUT HEVEY HEX 1" GR5	V30-60015	
11	2	WASHER SPRING HEAVY 1"	V35-60217	
12	8	CLIP PANDROL E2055G RH GALVANIZED	X25-00016	

INSTALLATION REQUIREMENT NOTES:

1. CROWDER WITH SLIDING DERAIL SHOWN. WHEEL CROWDER STROKE IS 5¼" WITH ⅞" DIAMETER PINS.
2. PAINT: SAFETY YELLOW.
3. FOR PROPER THROW OF SWITCH STAND TO DERAIL/CROWDER, ADJUST SWITCH STAND CRANK EYE FOR 5¼" THROW.
4. MAKE SURE THAT YOUR SWITCH STAND (HEAD BLOCK) TIES THAT HOLD THE DERAIL ARE HIGH QUALITY.
5. READ THE MANUFACTURER'S INSTRUCTIONS.
6. PLACE THE DERAIL TIGHTLY AGAINST THE RAIL.
7. SPIKE BOTH RAILS TO THE TIES AT THE PROPER GAUGE.
8. FASTEN THE DERAIL AND CROWDER THROUGH ALL THE SCREW SPIKE HOLES. PRE-DRILL HOLES TO PREVENT THE TIES FROM SPLITTING.
9. HAVE GOOD DRAINAGE AND BALLAST. THE AREA UNDER THE DERAIL MUST BE POCKETED TO PREVENT BINDING IN ADVERSE WEATHER CONDITIONS.

INSTALLATION OF CROWDER NOTES:

1. PLACE THE WHEEL CROWDER TIGHTLY AGAINST THE WEB OF THE RAIL.
2. RAIL CROWDER MOUNTING BOLT HOLE TO BE MATCH MARKED FROM THE RAIL CROWDER AND DRILLED IN THE FIELD.
3. USE THE WEB SET SCREWS TO ADJUST AND MAINTAIN PROPER WHEEL CROWDER POINT CONTACTS WITH THE RAIL.
4. WITH BOTH RAIL AND WHEEL CROWDER SECURED AND IN DERAILING POSITION, ATTACH THE CONNECTING ROD TO THE LEFT LUG ON THE DERAIL, THEN CONNECT THE OPPOSITE END OF THE CONNECTING ROD WITH THE TURNBUCKLE INTO THE REVERSING CRANK MECHANISM ON THE BASE OF THE WHEEL CROWDER.
5. ATTACH THE SWITCH STAND CONNECTING ROD OF THE MANUAL OR ELECTRIC SWITCH STAND TO THE TURNBUCKLE ON THE SWITCH STAND OR ELECTRIC SWITCH STAND. THE OPPOSITE END OF THE CONNECTING ROD CONNECTS TO THE RIGHT HAND LUG ON THE DERAIL. ADJUST THE THROW ON YOUR SWITCH STAND TO A 5¼" THROW. A SHORTER THROW WILL GIVE YOU PRESSURE ON THE CONNECTING ROD OR SWITCH STAND EYE. PRESSURE ON THE EYE AND CONNECTING ROD CAN RESULT IN A FAILURE OF THAT COMPONENT. ADJUST AS NECESSARY.
6. PLACE COTTER KEYS TO SECURE THE NUTS.
7. INSTALL A SWITCH LOCK.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

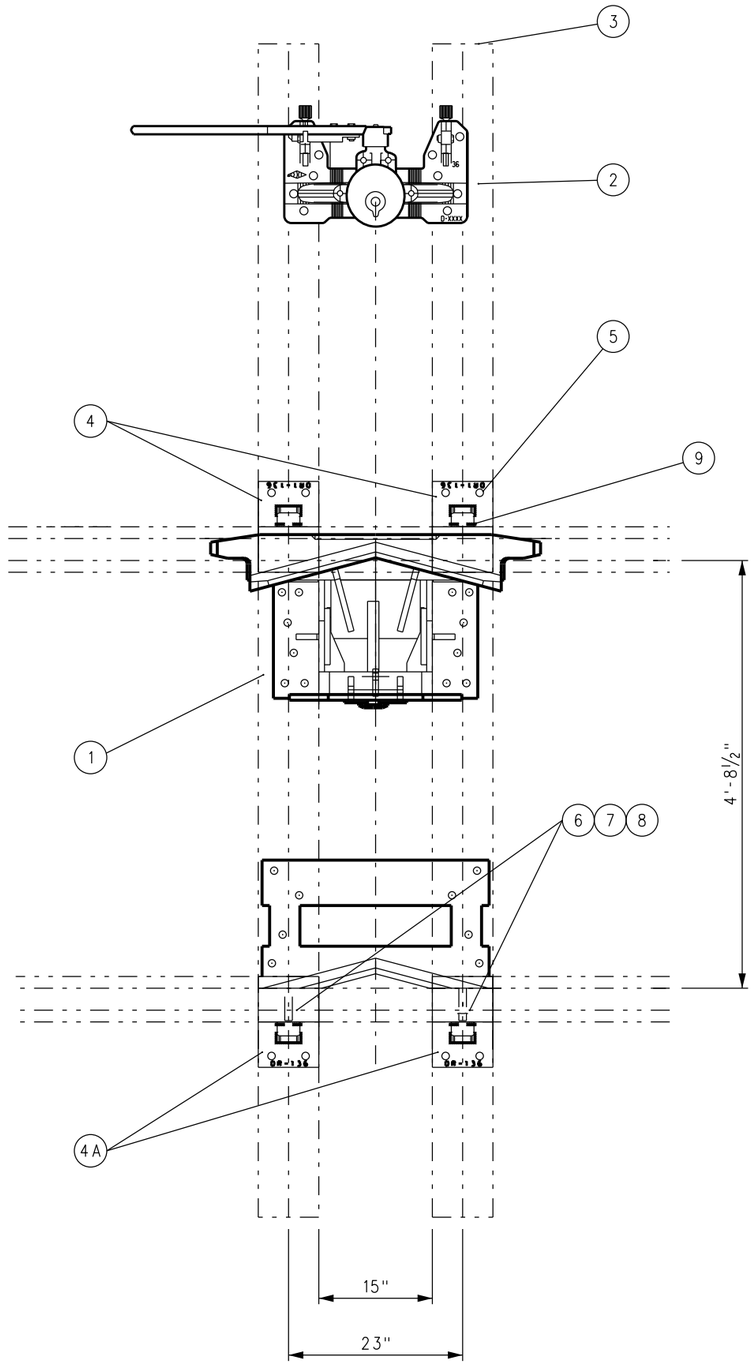
METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

BI-DIRECTIONAL DERAIL WITH CROWDER

STANDARD 2613
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2613



BILL OF MATERIAL				
ITEM	QTY	DESCRIPTION	PRODUCT NO	SCRRA PART NO
1	1	HAYS DERAIL HBXS-8-SS C/W CROWDER	X99-02310	
2	1	36E SWITCH STAND WITH TARGET & BALL HANDLE SCRRA STANDARD TARGET	R36-36094	
3	2	TIE HARDWOOD TREATED, 8" X 12" X 14'-0"	J15-00067	
4	2	TIE PLATE DR1-136		
4A	2	TIE PLATE DR-136		
5	38	SCREW SPIKE 15/16" X 6"	V50-00010	
6	2	BOLT HEX 1" X 4" GR 5	V01-61010	
7	2	NUT HEAVY HEX 1" GR 5	V30-60015	
8	2	WASHER SPRING HEAVY 1"	V35-60217	
9	4	CLIP PANDROL E2055G RH GALVANIZED	X25-00016	

INSTALLATION REQUIREMENT NOTES:

1. CROWDER WITH SLIDING DERAIL SHOWN. WHEEL CROWDER STROKE IS 5¼" WITH ⅞" DIAMETER PINS.
2. PAINT: SAFETY YELLOW.
3. FOR PROPER THROW OF SWITCH STAND TO DERAIL/CROWDER, ADJUST SWITCH STAND CRANK EYE FOR 5¼" THROW.
4. MAKE SURE THAT YOUR SWITCH STAND (HEAD BLOCK) TIES THAT HOLD THE DERAIL ARE HIGH QUALITY.
5. READ THE MANUFACTURER'S INSTRUCTIONS.
6. PLACE THE DERAIL TIGHTLY AGAINST THE RAIL.
7. SPIKE BOTH RAILS TO THE TIES AT THE PROPER GAUGE.
8. FASTEN THE DERAIL AND CROWDER THROUGH ALL THE SCREW SPIKE HOLES. PRE-DRILL HOLES TO PREVENT THE TIES FROM SPLITTING.
9. HAVE GOOD DRAINAGE AND BALLAST. THE AREA UNDER THE DERAIL MUST BE POCKETED TO PREVENT BINDING IN ADVERSE WEATHER CONDITIONS.

INSTALLATION OF CROWDER NOTES:

1. PLACE THE WHEEL CROWDER TIGHTLY AGAINST THE WEB OF THE RAIL.
2. RAIL CROWDER MOUNTING BOLT HOLE TO BE MATCH MARKED FROM THE RAIL CROWDER AND DRILLED IN THE FIELD.
3. USE THE WEB SET SCREWS TO ADJUST AND MAINTAIN PROPER WHEEL CROWDER POINT CONTACTS WITH THE RAIL.
4. WITH BOTH RAIL AND WHEEL CROWDER SECURED AND IN DERAILING POSITION, ATTACH THE CONNECTING ROD TO THE LEFT LUG ON THE DERAIL, THEN CONNECT THE OPPOSITE END OF THE CONNECTING ROD WITH THE TURNBUCKLE INTO THE REVERSING CRANK MECHANISM ON THE BASE OF THE WHEEL CROWDER.
5. ATTACH THE SWITCH STAND CONNECTING ROD OF THE MANUAL OR ELECTRIC SWITCH STAND TO THE TURNBUCKLE ON THE SWITCH STAND OR ELECTRIC SWITCH STAND. THE OPPOSITE END OF THE CONNECTING ROD CONNECTS TO THE RIGHT HAND LUG ON THE DERAIL. ADJUST THE THROW ON YOUR SWITCH STAND TO A 5¼" THROW. A SHORTER THROW WILL GIVE YOU PRESSURE ON THE CONNECTING ROD OR SWITCH STAND EYE. PRESSURE ON THE EYE AND CONNECTING ROD CAN RESULT IN A FAILURE OF THAT COMPONENT. ADJUST AS NECESSARY.
6. PLACE COTTER KEYS TO SECURE THE NUTS.
7. INSTALL A SWITCH LOCK.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

BI-DIRECTIONAL DERAIL WITH CROWDER WITH 36E SWITCH STAND

STANDARD 2614
SCALE: NTS
REVISION -
SHEET 1 OF 1
CADD FILE: ES2614

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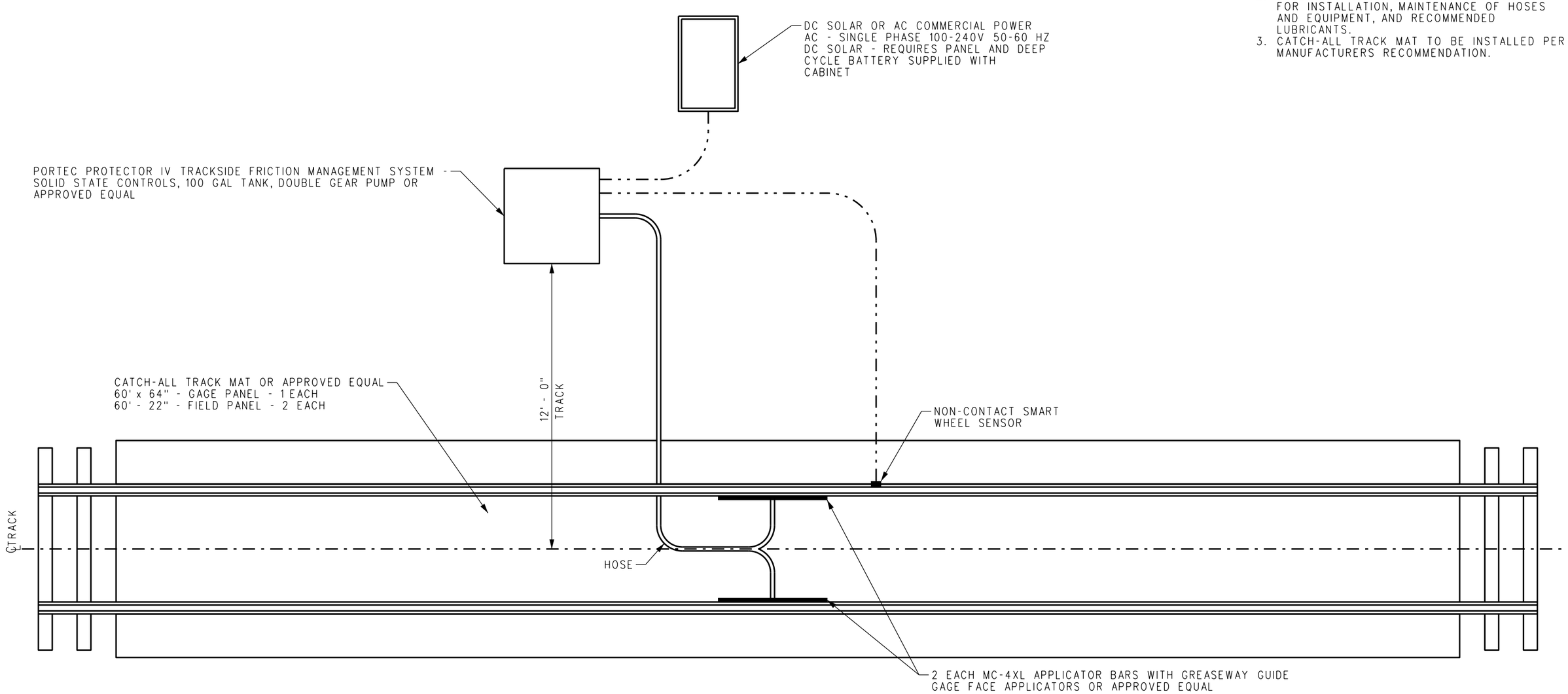
NOTES:

1. FIELD LOCATION OF RAIL LUBRICATOR TO BE DETERMINED BY SCRRA. RAIL LUBRICATOR TO BE INSTALLED ON TANGENT TRACK.
2. FOLLOW MANUFACTURER RECOMMENDATIONS FOR INSTALLATION, MAINTENANCE OF HOSES AND EQUIPMENT, AND RECOMMENDED LUBRICANTS.
3. CATCH-ALL TRACK MAT TO BE INSTALLED PER MANUFACTURERS RECOMMENDATION.



REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

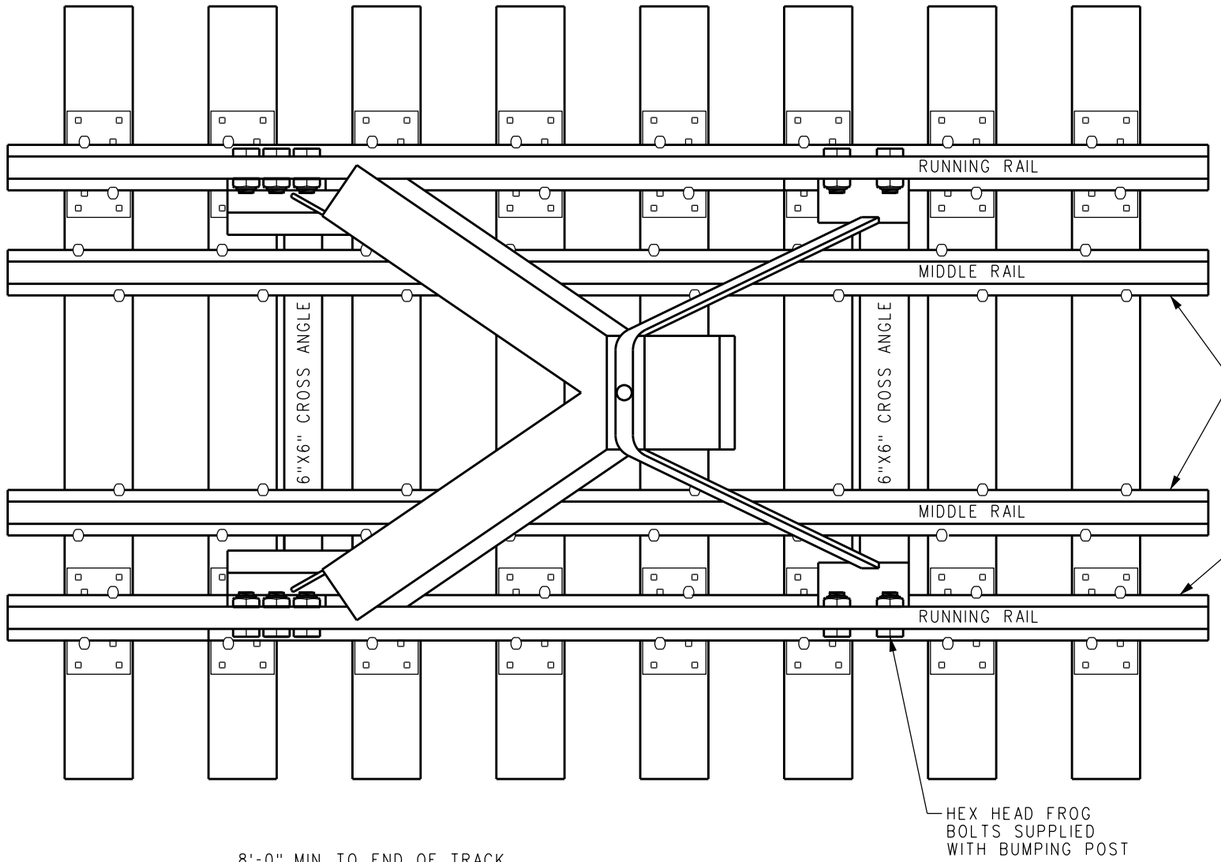
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

RAIL LUBRICATOR

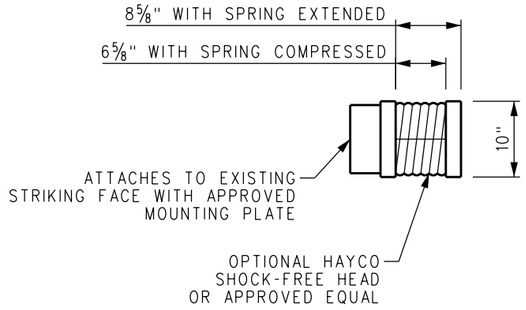
STANDARD: 2615
SCALE: NTS
REVISION: -
SHEET: 1 OF 1
CADD FILE: ES2615

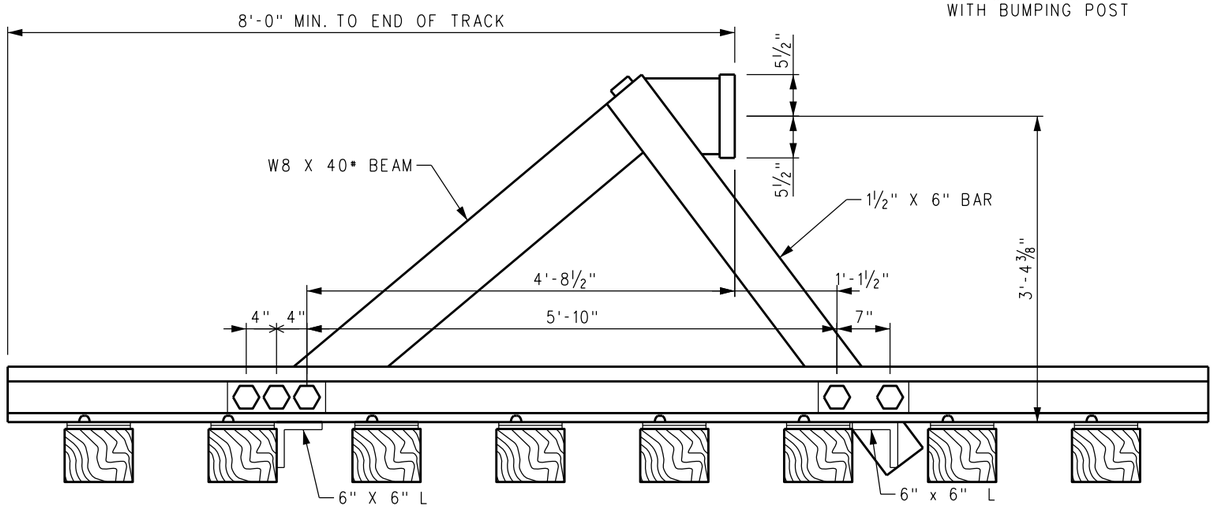
UserName•› scrrapw11ics01$ Date Plotted: 3/27/2023 3:05:23 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•› \\scrrapw11ics01\iCS_pdf_work_dir\87\482_90\ES2615.dgn

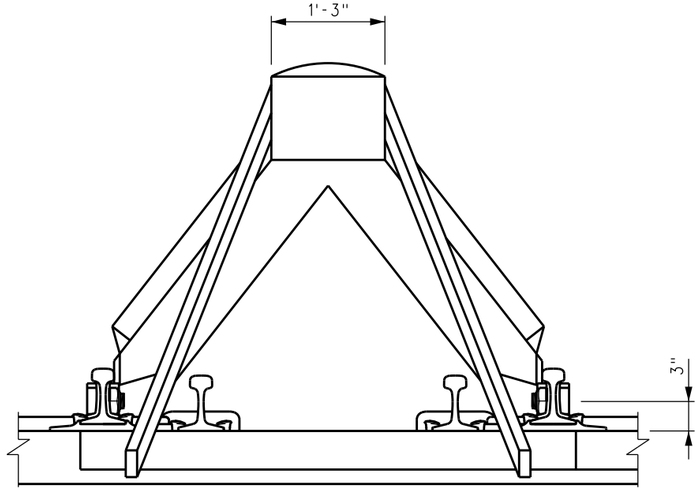


NOTES:

1. STEEL BUMPING POST TO BE WCH MODEL, WAC OR APPROVED EQUAL.
2. OPTIONAL SHOCK FREE HEAD TO BE INSTALLED IF DIRECTED BY SCRRA.







REV.	DATE	DESCRIPTION	DES.	ENG.
A	06-12-20	ADDED DIMENSION	AC	JMM

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

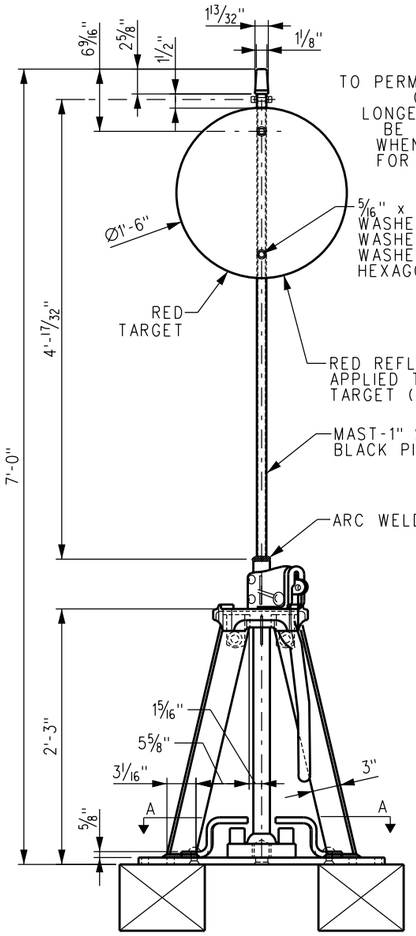
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

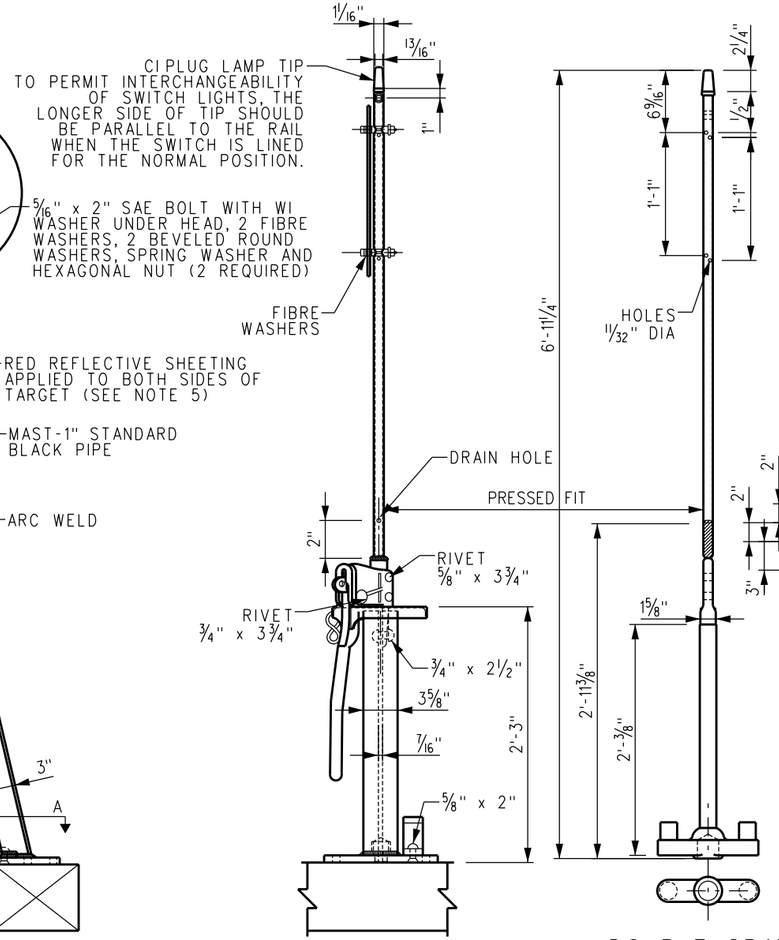
STEEL BUMPING POST DETAILS

STANDARD: 2616
SCALE: NTS
REVISION: A SHEET: 1 OF 1
CADD FILE: ES2616

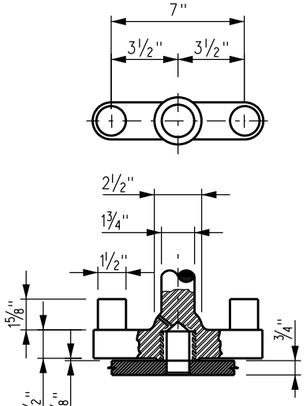
UserName=> scrrapw1ics01$ Date Plotted: 3/27/2023 3:05:23 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName=> \\scrrapw1ics01\iCS_pdf_work_dir\87\482_91\ES2616.dgn

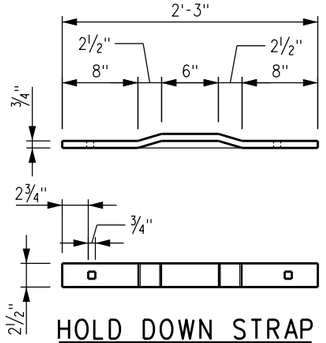


SWITCH STAND
(FRONT VIEW)



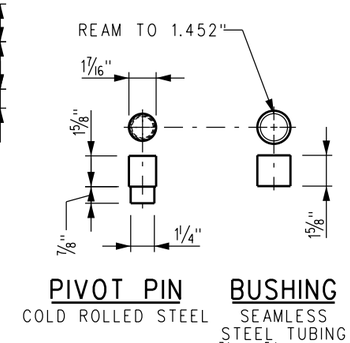
SWITCH STAND
(SIDE VIEW)

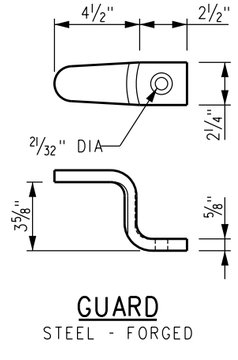


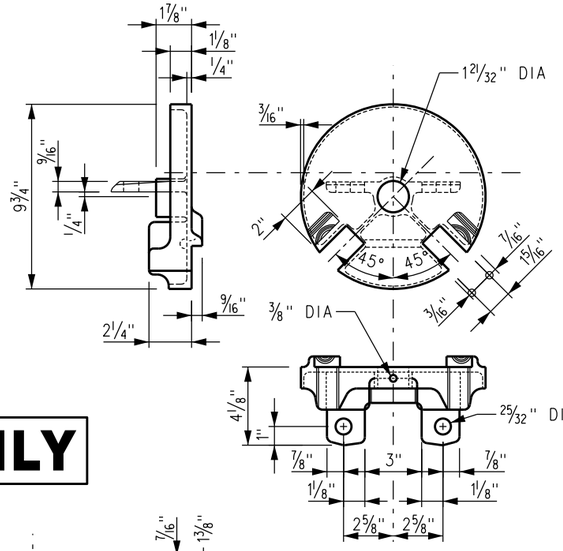


NOTES:

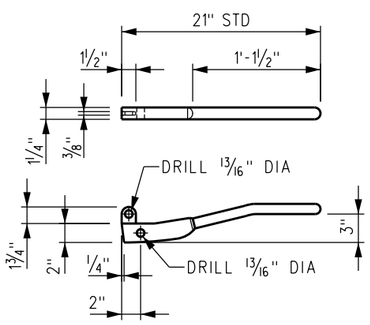
1. USE 36E (SCRRA ES2708) STANDS FOR NEW INSTALLATION MAINLINE USE. THIS HIGH STAR SWITCH STAND IS TO BE USED ONLY UNTIL THIS STYLE STAND IS REPLACED IN THE NORMAL COURSE OF MAINTENANCE OR CAPITAL PROJECT RENEWALS.
2. MAIN TRACK SWITCH STANDS SHALL BE PLACED ON THE TURNOUT SIDE TO THE TRACK WHEREVER STRUCTURES OR OTHER TRACKS PERMIT.
3. SWITCH STANDS OF THE TYPE SHOWN ON THIS PLAN SHALL BE USED FOR SINGLE AND DOUBLE SWITCH POINT DERAILS.
4. WHERE TWO HIGH STANDS COME SO CLOSE TOGETHER AS TO BLANKET EACH OTHER, USE ONE HIGH STAND AND ONE LOW STAND.
5. MANUFACTURER WILL NOT FURNISH TARGET, CONNECTING ROD AND HOLD DOWN STRAP UNLESS SPECIFIED ON ORDER.

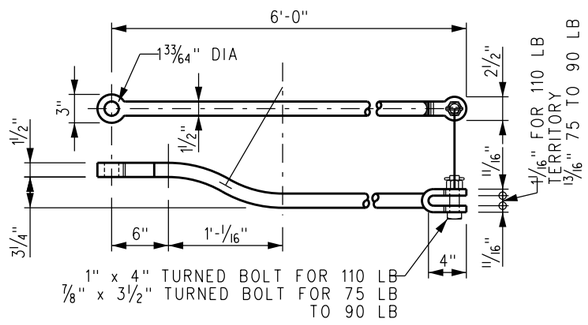


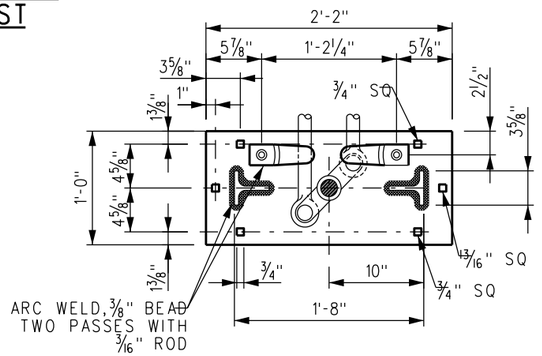




FOR MAINTENANCE ONLY







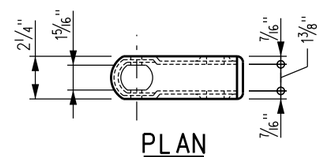
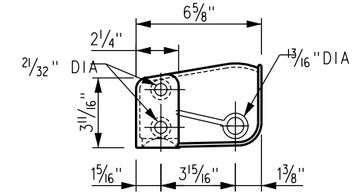
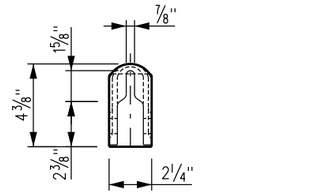


TABLE
CAST STEEL





YOKE
CAST STEEL

REV.	DATE	DESCRIPTION	DES.	ENG.
A	12/05/11	ADDED "FOR MAINTENANCE ONLY" STAMP	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

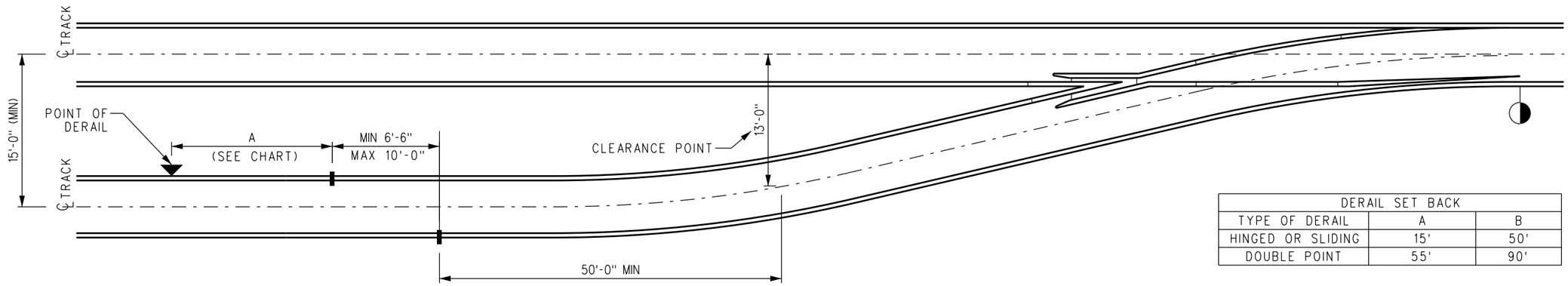
METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

HIGH STAR SWITCH STAND
DOUBLE CRANK - DOUBLE HEADBLOCK

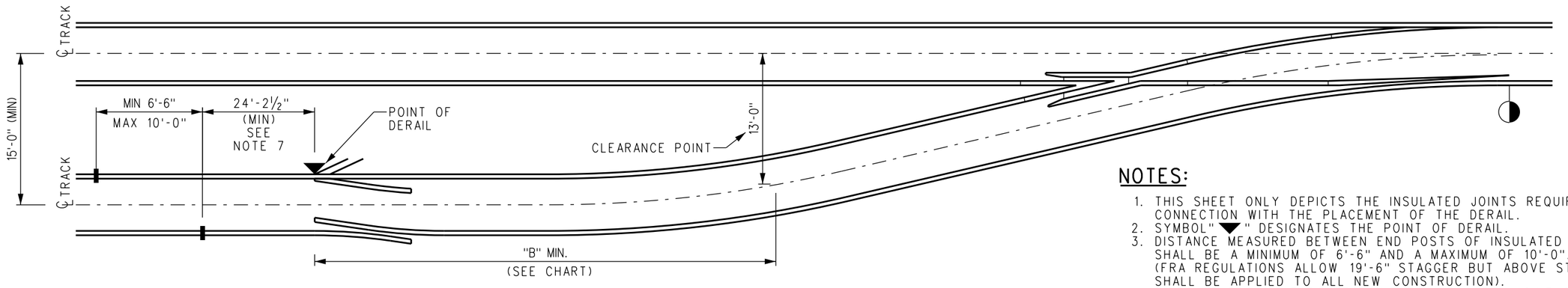
STANDARD 2701
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2701

UserName→ scrrapw1ics01$ Date Plotted: 3/27/2023 3:05:23 PM Plot Driver→ C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
FileName→ \\scrrapw1ics01\iCS_pdf_work_dir\87\482_92\ES2701.dgn



DERAIL SET BACK		
TYPE OF DERAIL	A	B
HINGED OR SLIDING	15'	50'
DOUBLE POINT	55'	90'

TURNOUT - DERAIL NOT CONNECTED TO SIGNAL SYSTEM - OUTSIDE INSULATED JOINTS



TURNOUT - DERAIL CONNECTED TO SIGNAL SYSTEM

NOTES:

1. THIS SHEET ONLY DEPICTS THE INSULATED JOINTS REQUIRED IN CONNECTION WITH THE PLACEMENT OF THE DERAIL.
2. SYMBOL "▼" DESIGNATES THE POINT OF DERAIL.
3. DISTANCE MEASURED BETWEEN END POSTS OF INSULATED JOINTS SHALL BE A MINIMUM OF 6'-6" AND A MAXIMUM OF 10'-0". (FRA REGULATIONS ALLOW 19'-6" STAGGER BUT ABOVE STANDARD SHALL BE APPLIED TO ALL NEW CONSTRUCTION).
4. DISTANCE FROM CLEARANCE POINT TO INSULATED JOINT SHALL BE A MINIMUM OF 50'-0".
5. SEE ES8220 FOR PLACEMENT OF ALL OTHER NECESSARY INSULATED JOINTS IN CONNECTION WITH TURNOUTS OR OTHER THAN MAIN TRACKS.
6. THE DOUBLE POINT DERAIL WILL BE PLACED ENTIRELY ON TANGENT TRACK (SEE ES2604-01 FOR DOUBLE SWITCH POINT DERAIL DIMENSIONS). CLOSURE CURVES MAY REQUIRE EXTENDING THE DIMENSION "B" LENGTH TO PROVIDE THE NECESSARY TANGENT TRACK LENGTH. THE DIMENSION DEPICTED IN THIS STANDARD IS THE MINIMUM PERMISSIBLE LENGTH.
7. THE DISTANCE BETWEEN THE DERAIL POINT OF SWITCH AND THE INSULATED JOINT (IJ), SHALL ALLOW FOR THE PLACEMENT OF A PREFABRICATED BONDED IJ PLUG RAIL PER ES2504 AND THE STOCK RAIL OF THE DERAIL PER ES2604 WITHOUT REDUCING THE LENGTH OF EITHER RAIL AS REQUIRED BY THE RESPECTIVE STANDARDS. IF THE LONG SIDE OF THE IJ PLUG RAIL IS USED, THE MINIMUM DISTANCE NOTED WILL NEED TO BE INCREASED TO 29'-2½".

REV.	DATE	DESCRIPTION	DES.	ENG.
A	03-05-21	REVISED INSULATED JOINT LOCATION, ADDED NOTE 7	AC	JMM

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

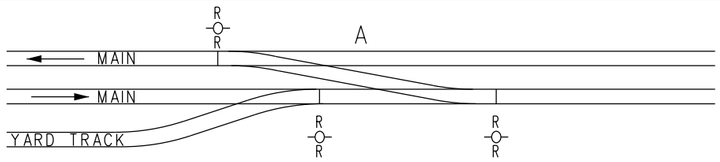
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

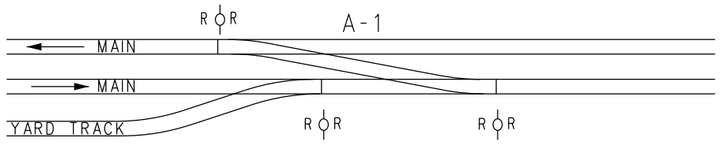
ENGINEERING STANDARDS

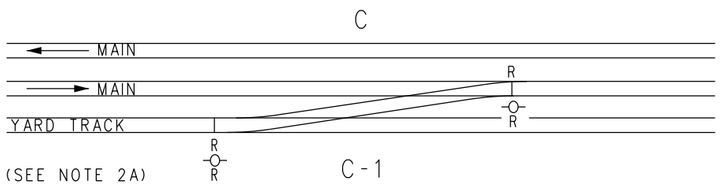
INSULATED JOINT PLACEMENT AND DERAIL LOCATION

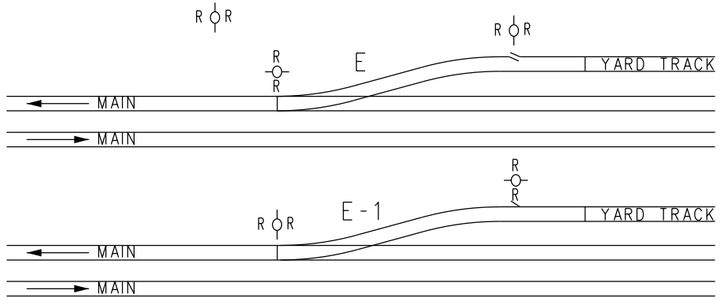
STANDARD 2702
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2702

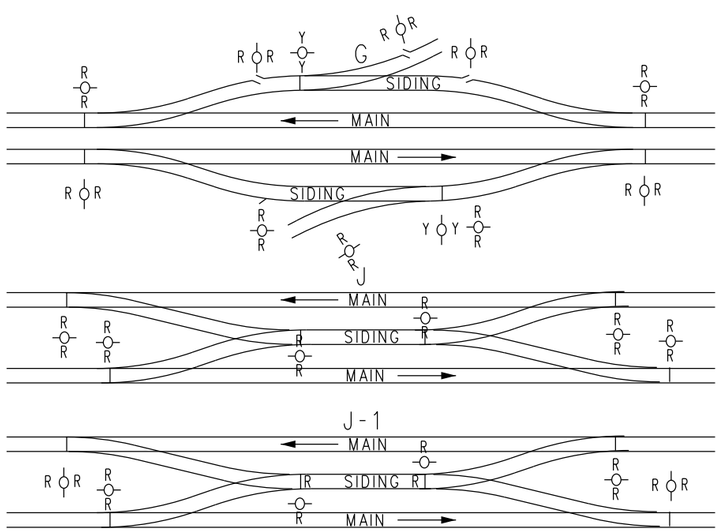
UserName•› scrrapw1ics01$ Date Plotted: 3/27/2023 3:05:06 PM Plot Driver•› C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•› \\scrrapw1ics01\iCS_pdf_work_dir\87\482_93\ES2702.dgn

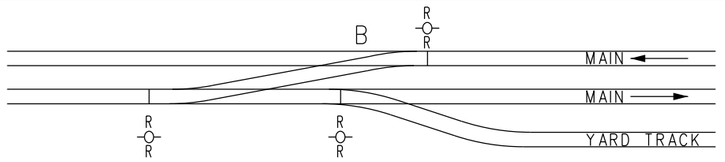


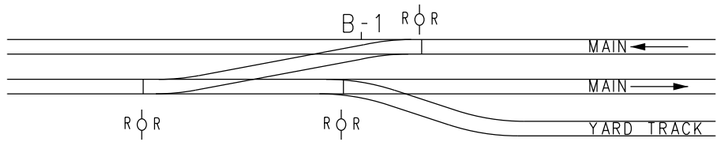


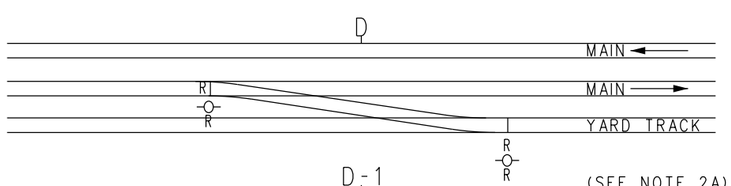


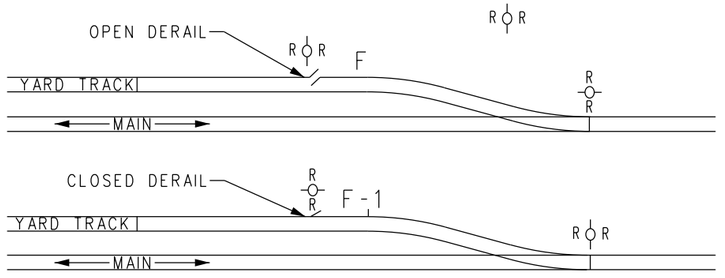


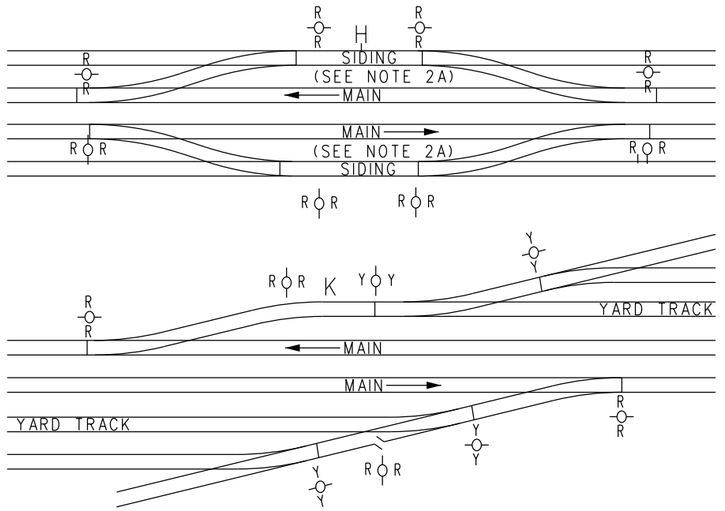


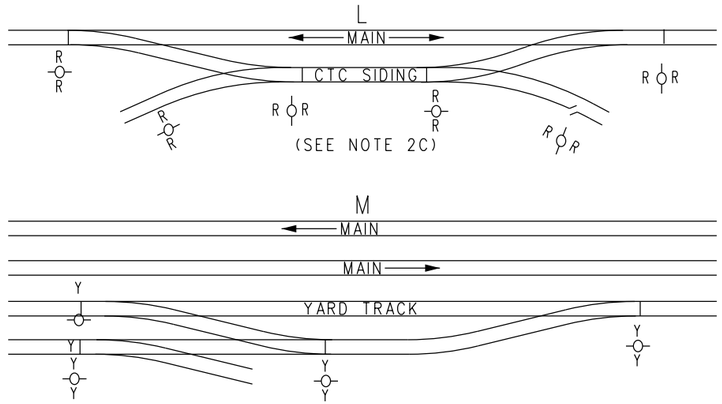












NOTES:

1. LETTERS R (RED) AND Y (YELLOW) DENOTE COLORS OF TARGETS.
2. THE FOLLOWING SWITCH STANDS WILL HAVE RED TARGETS ON BOTH SIDES, THE SAME AS FOR MAIN LINE SWITCH STANDS.
   (A) SIDING AND YARD TRACK SWITCH STANDS AT CROSSOVERS LEADING TO MAIN TRACK.
   (B) SIDING AND YARD TRACK SWITCH STANDS WHICH ACTUATE MAIN LINE SIGNALS.
   (C) YARD AND OTHER INSIDE TRACK SWITCH STANDS AT CONNECTIONS WITH CTC SIDINGS.
   (D) DERAIL SWITCH STANDS.
3. ALL OTHER SWITCH STANDS ON SIDE TRACKS IN YARDS AND ON OTHER INSIDE TRACKS WILL HAVE YELLOW TARGETS ON BOTH SIDES.

TARGET PARALLEL WITH TRACK
(NORMAL POSITION OF SWITCH)

TARGET AT RIGHT ANGLES TO TRACK
(OPEN POSITION OF SWITCH)

TARGET SYMBOLS

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

COLOR INDICATORS OF TARGETS ON SWITCH STANDS

STANDARD 2703
SCALE: NTS
REVISION - SHEET 1 OF 2
CADD FILE: ES2703-01

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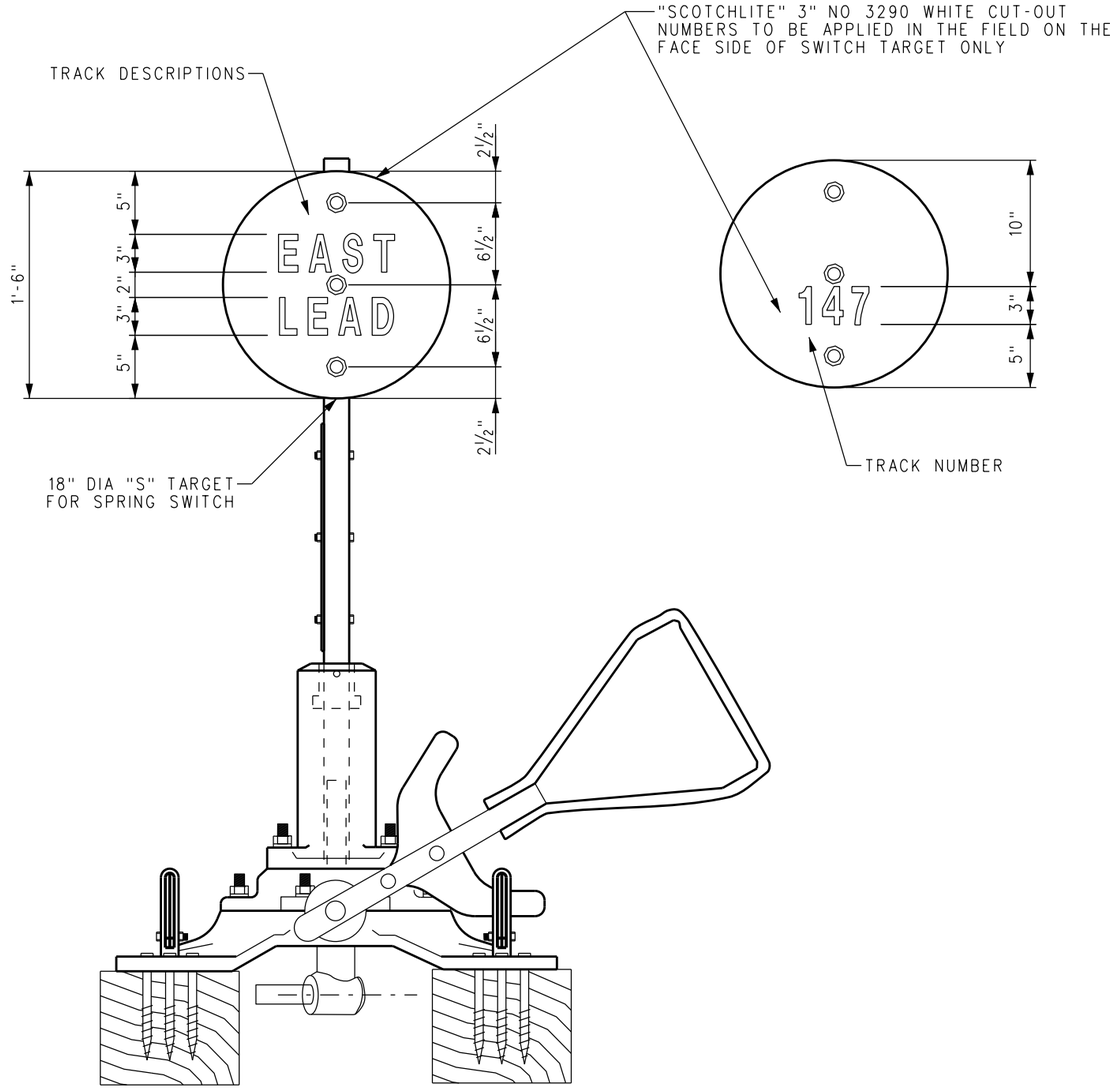
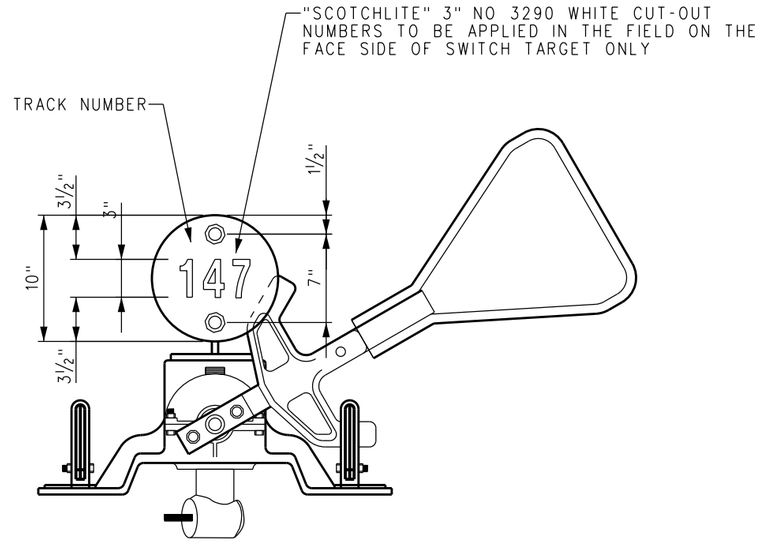
NOTES:

1. TRACK IDENTITY IS TO BE APPLIED TO SWITCH STAND TARGETS IN THE FIELD ONLY AND TARGETS MUST NOT BE ORDERED BEARING ANY TRACK I.D.



36E TARGET



22E TARGET

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

COLOR INDICATORS OF TARGETS ON SWITCH STANDS

STANDARD 2703
SCALE: NTS
REVISION - SHEET 2 OF 2
CADD FILE: ES2703-02

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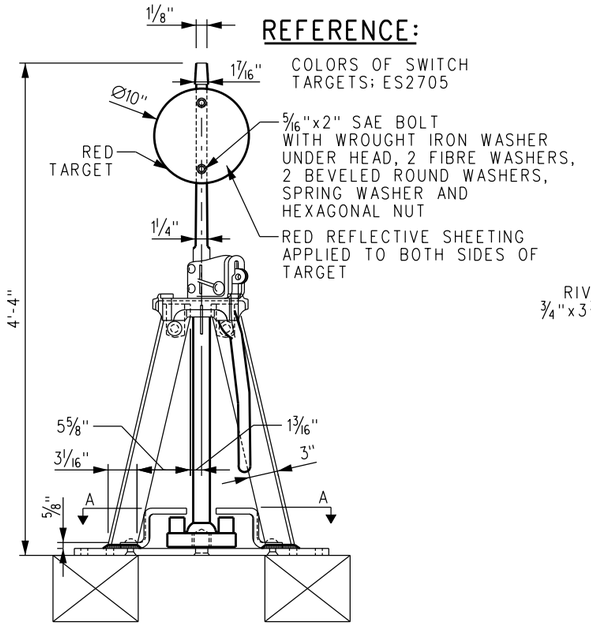
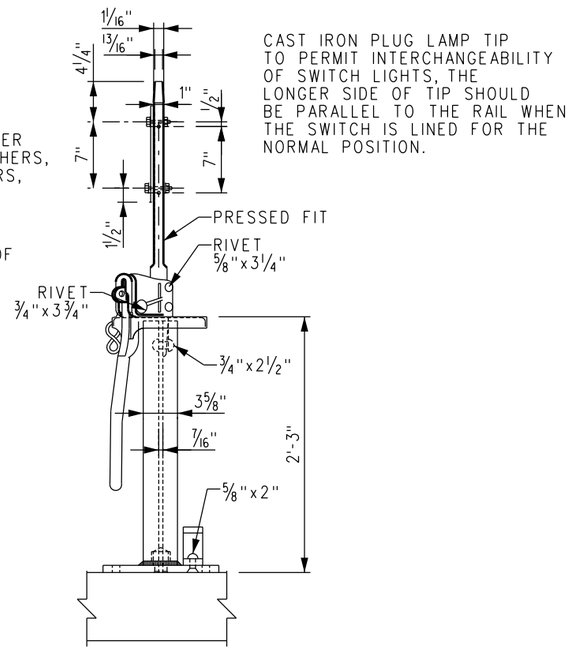
FileName•› \\scrrapw1ics01\iCS_pdf_work_dir\87\482_95\ES2703-02.dgn

REFERENCE:

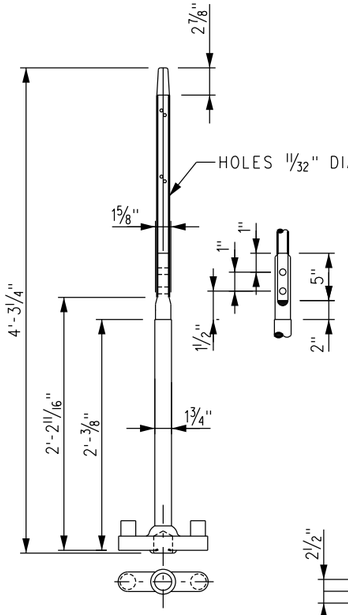
COLORS OF SWITCH TARGETS: ES2705



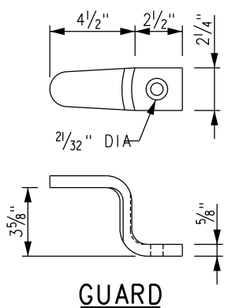
SWITCH STAND
(FRONT VIEW)



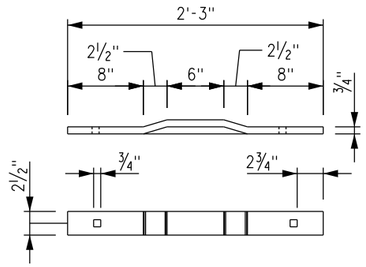
SWITCH STAND
(SIDE VIEW)



DOUBLE CRANK
AND MAST



GUARD
STEEL-FORGED



HOLD DOWN STRAP

NOTES:

1. USE 36E (ES2708) STANDS FOR NEW INSTALLATION MAINLINE USE.
   THIS LOW STAR SWITCH STAND IS TO BE USED ONLY UNTIL THIS STYLE STAND IS REPLACED IN THE NORMAL COURSE OF MAINTENANCE OR CAPITAL PROJECT RENEWALS.
2. MAIN TRACK SWITCH STANDS SHALL BE PLACED ON THE TURNOUT SIDE TO THE TRACK WHEREVER STRUCTURES OR OTHER TRACKS PERMIT.
3. SWITCH STANDS OF THE TYPE SHOWN ON THIS PLAN SHALL BE USED FOR SINGLE AND DOUBLE SWITCH POINT DERAILS.
4. WHERE TWO HIGH STANDS COME SO CLOSE TOGETHER AS TO BLANKET EACH OTHER, USE ONE HIGH STAND AND ONE LOW STAND.
5. MANUFACTURER WILL NOT FURNISH TARGET, CONNECTING ROD AND HOLD DOWN STRAP UNLESS SPECIFIED ON ORDER.

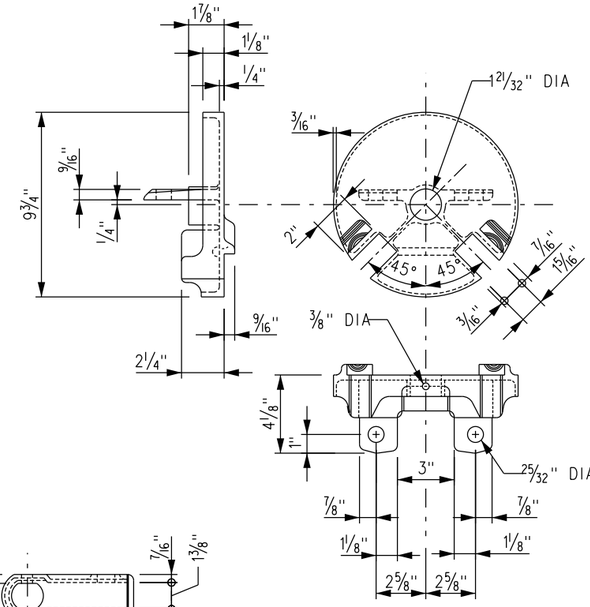
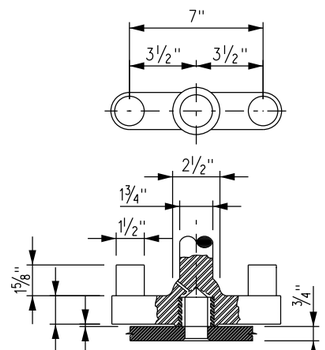
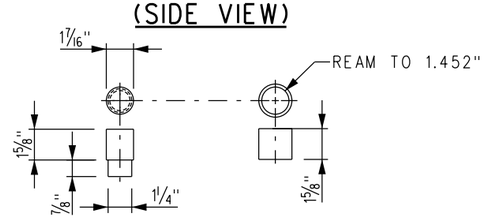


TABLE
CAST STEEL

FOR MAINTENANCE ONLY

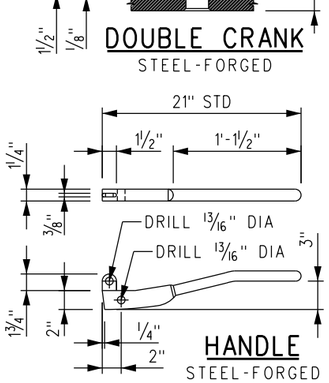


DOUBLE CRANK
STEEL-FORGED

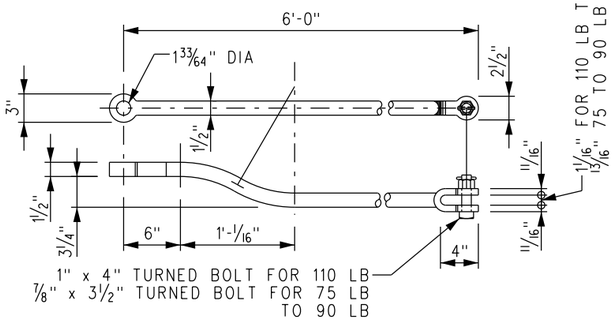


PIVOT PIN
COLD ROLLED STEEL

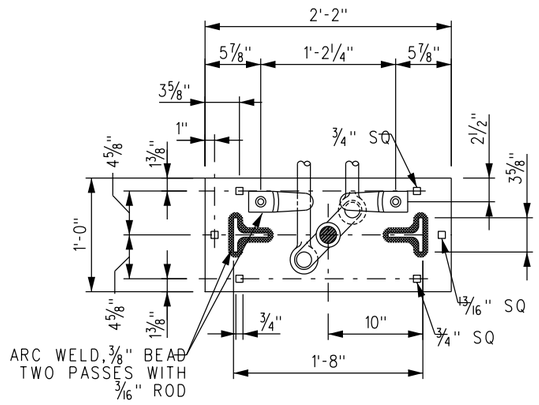
BUSHING
SEAMLESS STEEL TUBING
1¾"x⁵⁄₃₂" THICK



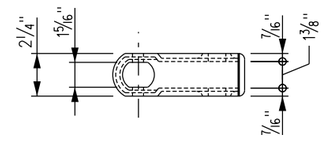
HANDLE
STEEL-FORGED



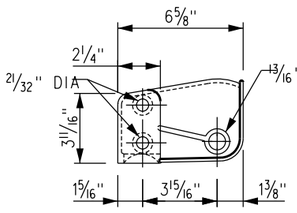
CONNECTING ROD



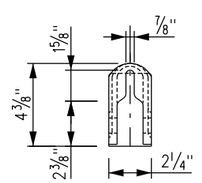
CONNECTING ROD
SECTION A-A



PLAN



ELEVATION



FRONT

YOKE
CAST STEEL

REV.	DATE	DESCRIPTION	DES.	ENG.
A	12/05/11	ADDED "FOR MAINTENANCE ONLY" STAMP	AC	NDP

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

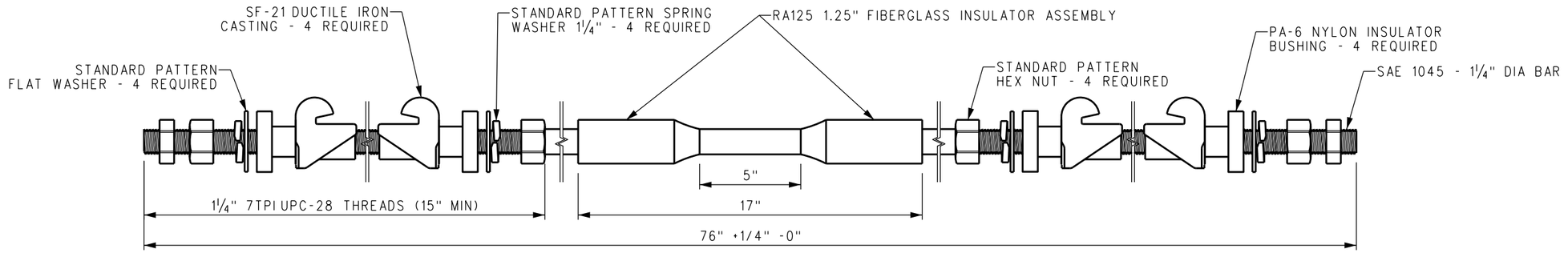
LOW STAR SWITCH STAND
DOUBLE CRANK - DOUBLE HEADBLOCK

STANDARD 2704
SCALE: NTS
REVISION A SHEET 1 OF 1
CADD FILE: ES2704

UserName→ scrrapw1ics01$ Date Plotted: 3/27/2023 3:05:38 PM Plot Driver→ C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
FileName→ \\scrrapw1ics01\iCS_pdf_work_dir\87\482_96\ES2704.dgn

NOTES:

1. ROD SHALL BE SAE1045. THREADS SHALL BE 1¼" 7 UNC-2B.
2. RAIL ENGAGEMENT FITTINGS (SF-21) SHALL BE OF 60,000 PSI TENSILE, 45,000 PSI YIELD, AND 12% ELONGATION PROPERTIES WITH STANDARD MILL TOLERANCES.
3. AFTER ASSEMBLING THE RA125, BUFF SMOOTH ALL WRENCH MARKS.
4. PA-6 INSULATORS ARE POLYMIDE TYPE 6 NYLON. ALL RODS SHALL BE SHIPPED ASSEMBLED.
5. INCLUDE JAM NUT ON EACH OF ASSEMBLY.
6. CHAMFER ENDS OF ROD BEFORE THREADING.



SPECIAL NOTE TO MANUFACTURER:
ALL THREADS TO BE COATED WITH BOSTIK "NEVER-SEIZE".

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

INSULATED GAUGE ROD

STANDARD: 2706
SCALE: NTS
REVISION: -
SHEET: 1 OF 1
CADD FILE: ES2706

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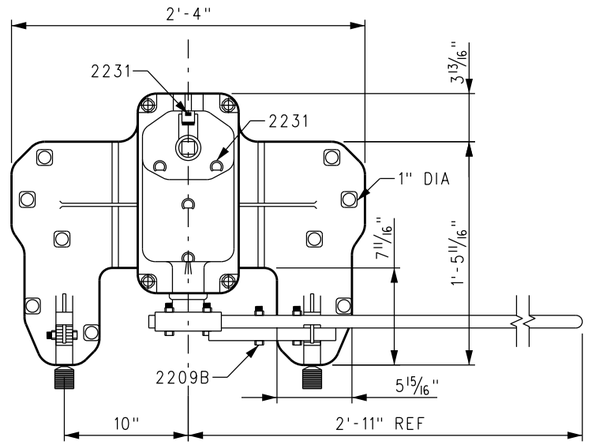
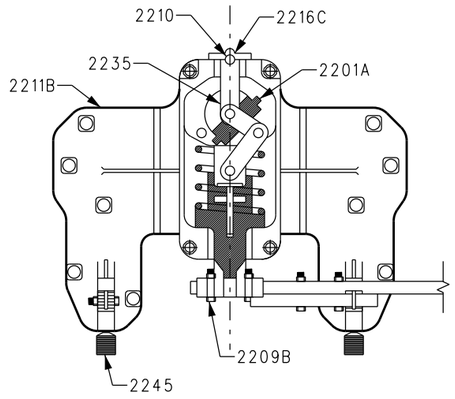
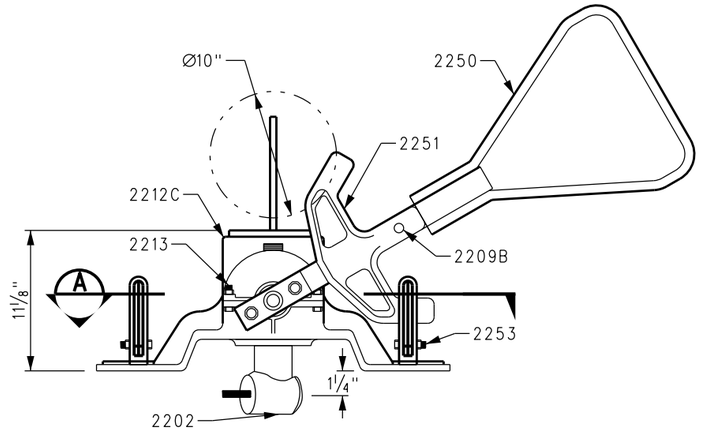


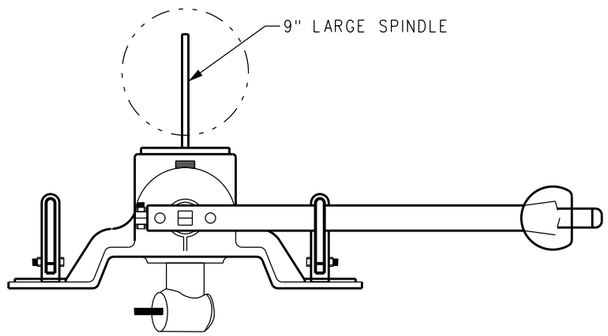
22E - TOP VIEW



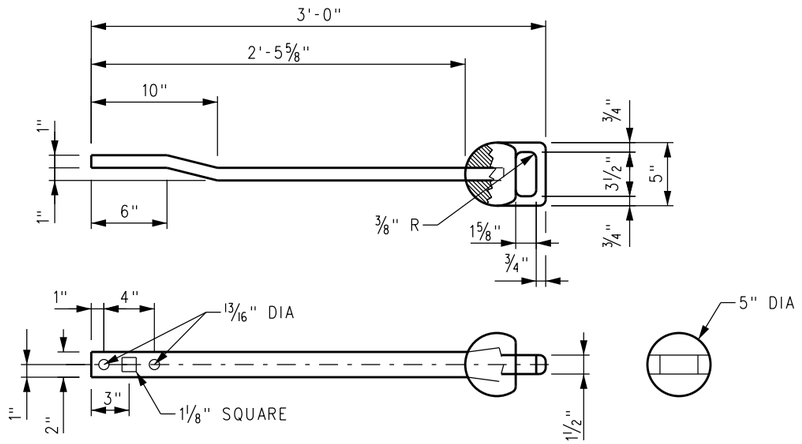
22E - DETAIL VIEW (A)



22E SWITCH STAND



STAND WITH OPTIONAL 36" STRAIGHT HANDLE



OPTIONAL 36" STRAIGHT HANDLE
(USE FOR TIGHT CLEARANCE ONLY)

BILL OF MATERIAL

CATALOG NO	QTY	DESCRIPTION	SCRRA PART NO
2235	1	LINKAGE AND SPRING CAGE ASSEMBLY (SEE ASSEMBLY DRAWING FOR PARTS DRAWINGS)	
2216C	1	THRUST BUSHING	
2210	1	THRUST BALL 1" DIA	
2212C	1	COVER (S-604-C)	
2252	1	BASE (D-34645)	
2201A	1	SPINDLE (GL-2762)	
2202	1	CRANK EYE (GL-1889)	
2250	1	TRI-HANDLE LEVER	
2213	4	SQUARE HEAD BOLT 5/8" X 3" LONG	
	4	HEX NUT 5/8" - 11	
	4	LOCK WASHER 5/8"	
2209B	4	SQUARE HEAD BOLT 3/4" X 2 3/4" LONG	
	4	SECURITY NUT 3/4" - 10	
2231	5	1608B GREASE FITTING - DRIVE TYPE	
2207	1	TARGET	
2208A	1	TARGET MAST	
	2	BOLT	
	2	NUT	
2251	1	YOKE (D-34637)	
2253	2	1/2" X 2 1/4" HEX CAP SCREW	
	2	HEX SECURITY NUT	
2254	2	FOOT LATCH	

NOTES:

1. 22-E RECOMMENDED USE: YARD AND OTHER THAN MAIN TRACK
2. IT IS RECOMMENDED THAT SWITCH STANDS BE INSPECTED AND LUBRICATED AT LEAST ONCE A YEAR. ADD OIL IN "OIL CUPS" WITH ANY GOOD GRADE ENGINE OIL. RECOMMEND OIL WITH GRAPHITE CONTENT SAE 60.
3. IF SWITCH STAND IS DISASSEMBLED, REGREASING OF ALL INTERNAL PARTS IS REQUIRED. APPLY GREASE LIBERALLY IN "THRUST BUSHING" CAVITY, BOTH ENDS "SPRING BASE", "SPINDLE" SLOT, AND ALL BEARING SURFACES (TEXACO NO 904 GREASE).
4. SWITCH STAND TO BE INSTALLED USING SCREW SPIKES (SCRRA ES2355)
5. FOR SCREW SPIKES SEE SCRRA ES2355
   FOR SWITCH TARGET DETAILS SEE SCRRA ES2703-01
   FOR TRACK IDENTIFICATION SEE SCRRA ES2703-02
   FOR CONNECTING ROD ASSEMBLY SEE SCRRA ES2108
6. STRAIGHT HANDLE TO BE PAINTED SAFETY YELLOW.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

22E SWITCH STAND

STANDARD: 2707
SCALE: NTS
REVISION: -
SHEET: 1 OF 1
CADD FILE: ES2707

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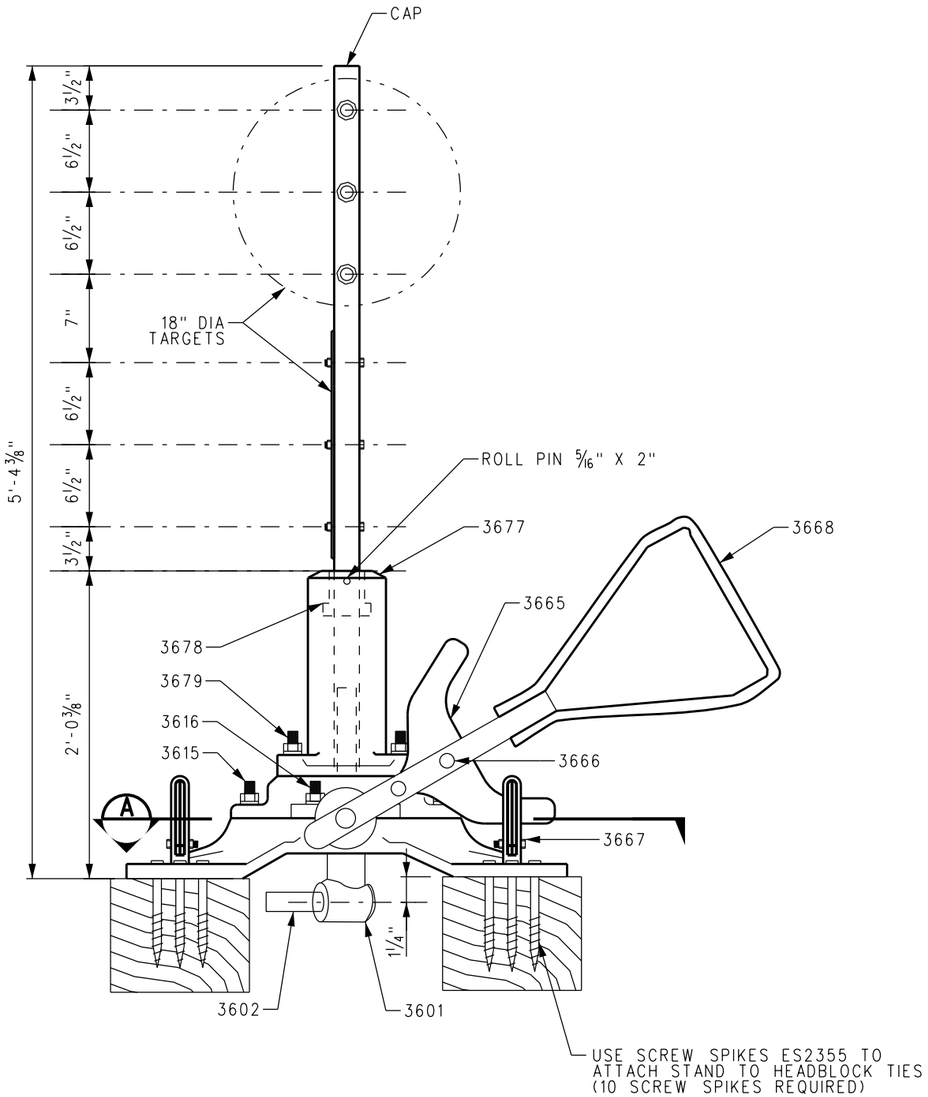
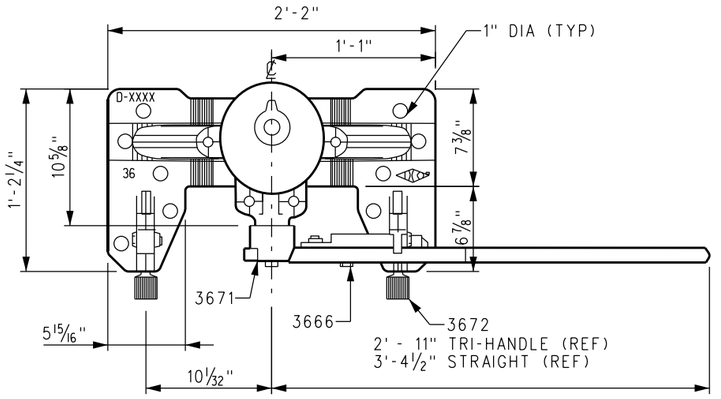
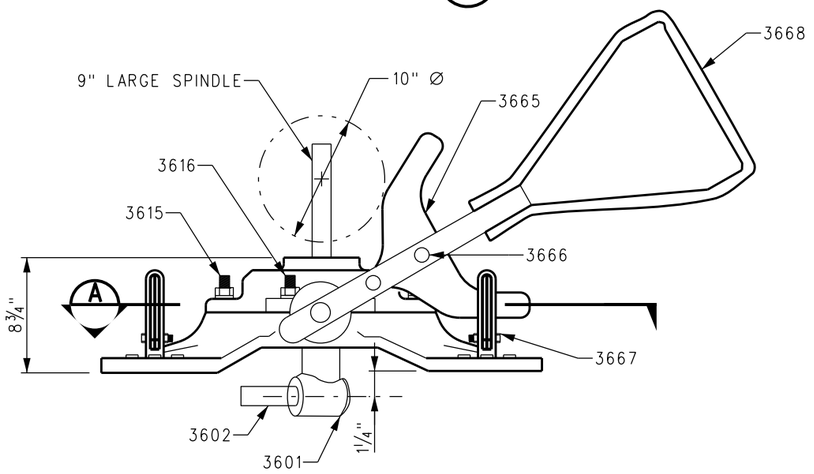


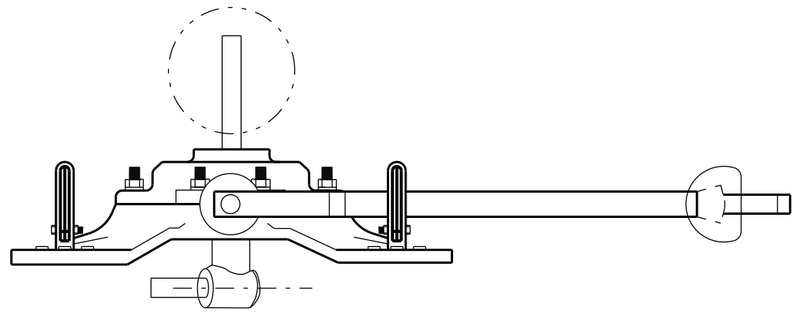
36-EH



36-EH & 36-E (A)



36-E



STAND WITH OPTIONAL STRAIGHT HANDLE

NOTES:

1. FOR BILL OF MATERIALS SEE SHEET ES2708, SHEET 2 OF 2

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

36E & 36EH SWITCH STANDS

STANDARD: 2708
SCALE: NTS
REVISION: - SHEET: 1 OF 2
CADD FILE: ES2708-01

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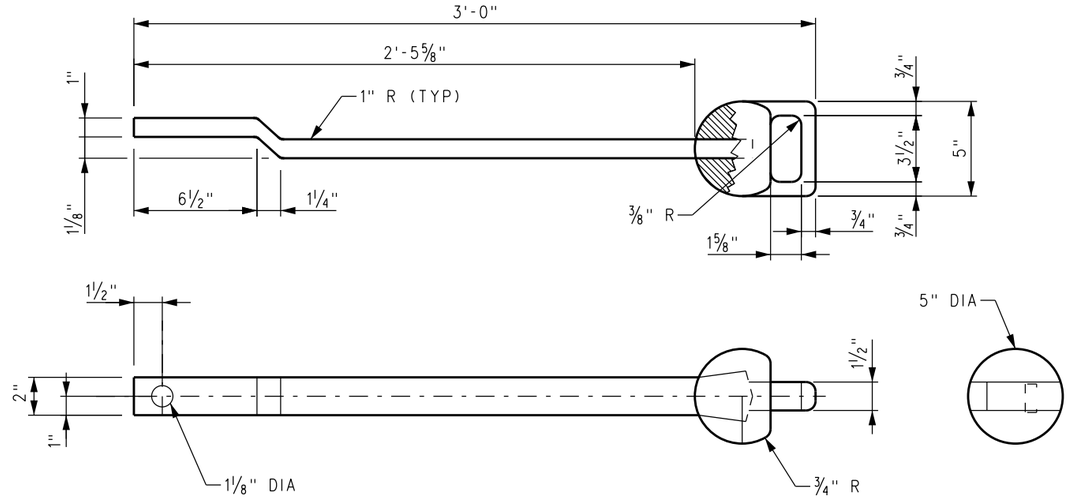
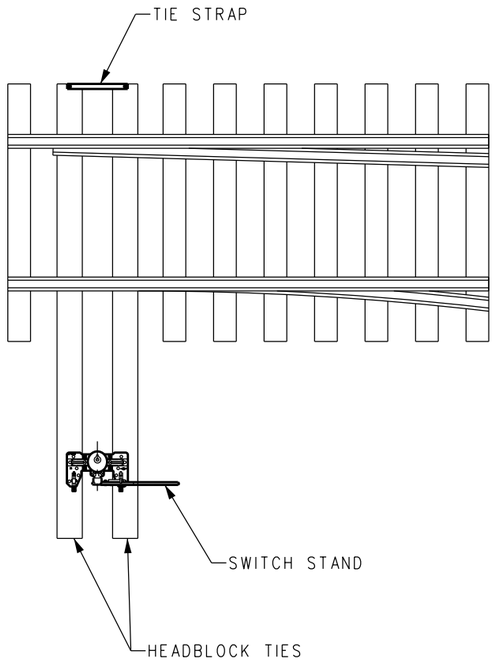
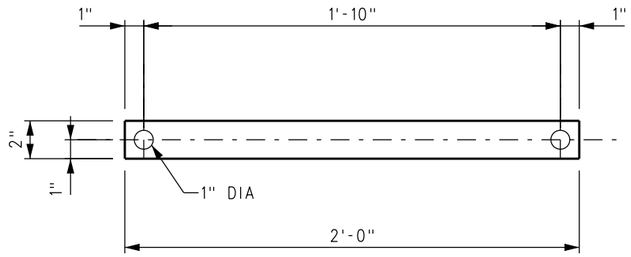


OPTIONAL 36" STRAIGHT HANDLE
(USE FOR TIGHT CLEARANCE ONLY)



TIE STRAP LOCATION



TIE STRAP
TIE MOUNTING KIT

(12) SCREW SPIKES ES2355
(10 FOR STAND AND 2 FOR STRAP)
(1) ½" X 2" X 2' STEEL STRAP

BILL OF MATERIAL

CATALOG NO	QTY	DESCRIPTION	SCRRA PART NO
3674	1	COVER (S-479)	
3669	1	BASE (D-34678)	
3601	1	SPINDLE	
3602	1	CRANKEYE (GL-1889)	
3668	1	TRI-HANDLE LEVER	
3616	2	SQ HD BOLT ¾" X 3¼" LONG	
3615	2	SQ HD BOLT ¾" X 4¾" LONG	
3671	1	HUB (D-34629)	
3665	1	YOKE (D-34679)	
3666	2	¾" BUTTON RIVETS	
3672	2	FOOT LATCH	
3653	1	CRANK BUSHING	
3654	1	CRANK WASHER	
3652	1	CRANK GL-1908	
3656	1	COTTER	
3667	2	½" X 2¼" HEX CAP SCREW	
3677	1	STIFFENER S-480	
3678	1	ADAPTER S-481	
	1	SPINDLE EXTENSION *66	
3679	2	SQ HEAD BOLT ½" X 2½" LONG 2" THDS	
	2	HEX NUT ½"	
	2	SPRING WASHER - ½"	
	2	ANCO HEX NUT - ½"	
	4	HEX SECURITY NUT ¾" - 10	
	4	SPRING WASHER ¾"	
3655	1	HEX NUT HEAVY WFI ⅛" - SLOTTED	
	2	HEX SECURITY NUT - ½"	
3673	1	FLAT WASHER 1⅛"	
	2	GREASE FITTING	
	2	GREASE FITTING	
	1	ROLL PIN 5/16" X 2"	

NOTES:

1. SEE ES2708-01 FOR REST OF THE DRAWING.
2. 36-E RECOMMENDED USE: MAIN TRACK CROSS-OVERS AND YARD TRACKS OR OTHER THEN MAIN LINE TRACKS.
3. 36-EH RECOMMENDED USE: MAIN TRACK.
4. FOR MAIN LINE INSTALLATION USE MOUNTING KIT. APPLY TIE STRAP ON HEADBLOCK TIES ON OPPOSITE SIDE OF TRACK FROM SWITCH STANDS.
5. LUBRICATE INTERNALLY AT LEAST ONCE A YEAR.
6. REFERENCE THE FOLLOWING DRAWINGS:
   - -SCREW SPIKES - ES2358
   - -SWITCH TARGET DETAILS - ES2703-01 & 02
   - -CONNECTING ROD ASSEMBLY - ES2108
7. STRAIGHT HANDLE TO BE PAINTED SAFETY YELLOW.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

36E & 36EH SWITCH STANDS

STANDARD 2708
SCALE: NTS
REVISION - SHEET 2 OF 2
CADD FILE: ES2708-02

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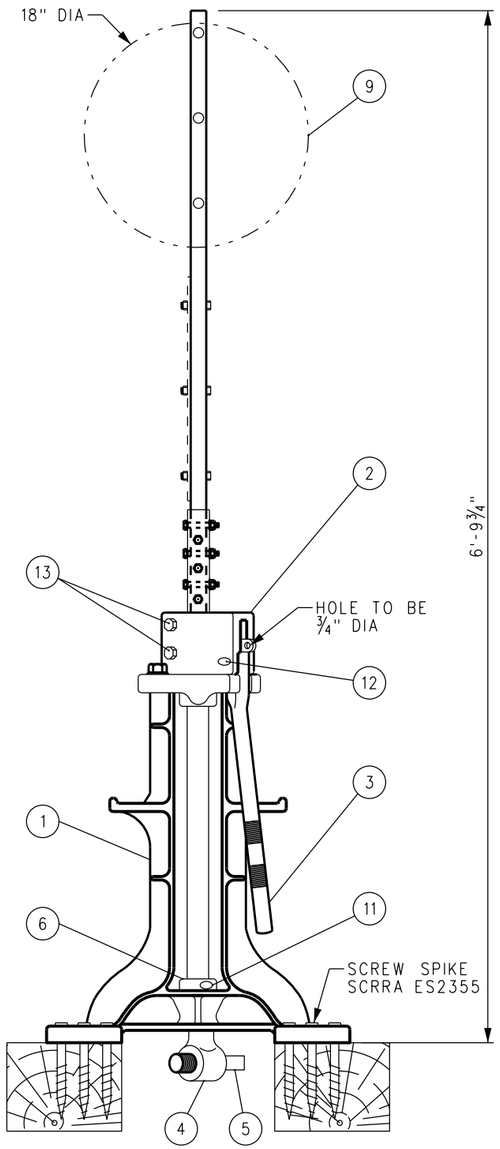
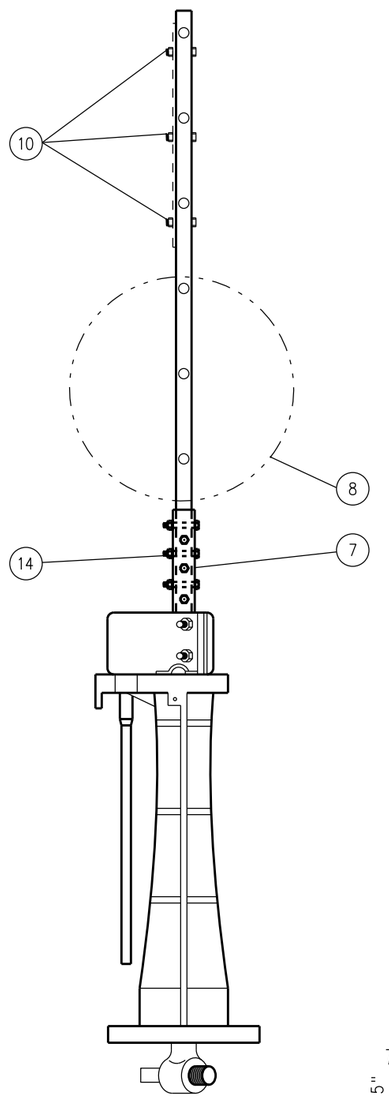
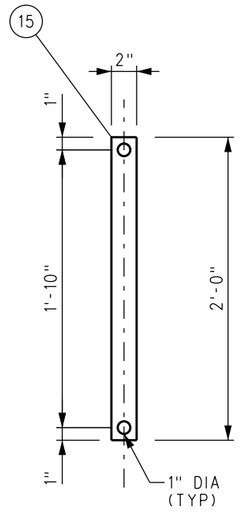


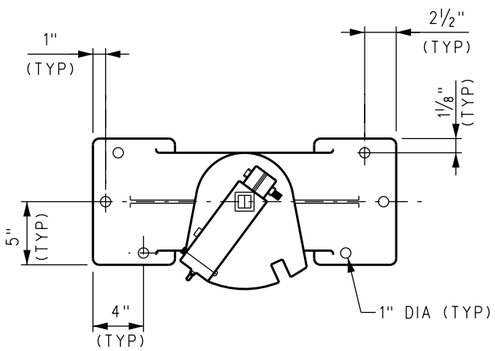


112E HIGH SWITCH STAND



TIE STRAP MOUNTING KIT

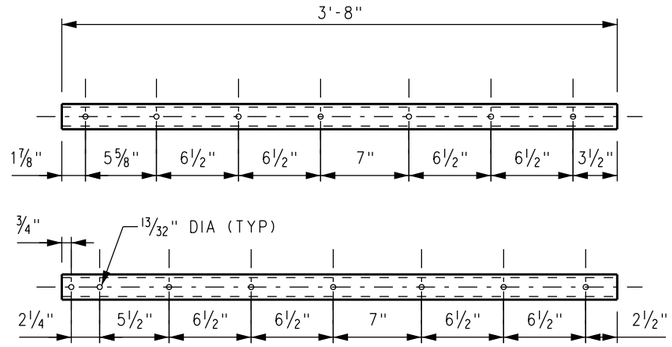
(1) ½" X 2" X 2' STEEL STRAP



BASE

BILL OF MATERIALS

ITEM	QTY	DESCRIPTION	SCRRA PART NO	PART NO
1	1	MAIN CASTING (MODIFIED AS SHOWN)		11209E
2	1	LEVER BRACKET		11212E
3	1	HAND LEVER		11213E
4	1	SPINDLE		11201E
5	1	CRANK EYE		11202E
6	1	COLLAR		11210E
7	2	SPLICE BRACKET		11216E
8	1	SPINDLE EXTENSION		962023
9	1	TARGET		
10	3	⅜" X 2" BOLT SQUARE HD/HEX HD NUT 8 FLAT WASHER		
11	1	RIVET ½" X 3¾"		11211E
12	1	RIVET ⅝" X 3¼"		11214E
13	2	⅞" X 3¾" HT MACH BOLTS/ HEX SLOTTED NUTS 8 3⁄16" X 1½" COTTER/SPRING WASHER		11215E
14	6	⅜" X 2½" MACH BOLTS/SQUARE HD 8 HEX ANCO NUTS		11217E
15	1	TIE STRAP MOUNTING KIT		



⅞" INSIDE, 1 3⁄16" OUTSIDE SQUARE TUBING

TARGET SPINDLE EXTENSION

NOTES:

1. RECOMMENDED USE, MAIN TRACK FOR SWITCH STAND MOUNTING KIT.
2. APPLY TIE STRAP ON HEADBLOCK TIES ON OPPOSITE SIDE OF TRACK FROM SWITCH STANDS.
3. MINIMUM CONNECTING ROD LENGTH IS 6'-0¾".
4. FOR SWITCH TARGET DETAILS: SCRRA ES2703-01
   FOR TRACK IDENTIFICATIONS: SCRRA ES2703-02
   FOR CONNECTING ROD ASSEMBLY: SCRRA ES2108

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

112E HIGH SWITCH STAND

STANDARD 2709
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2709

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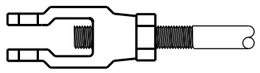
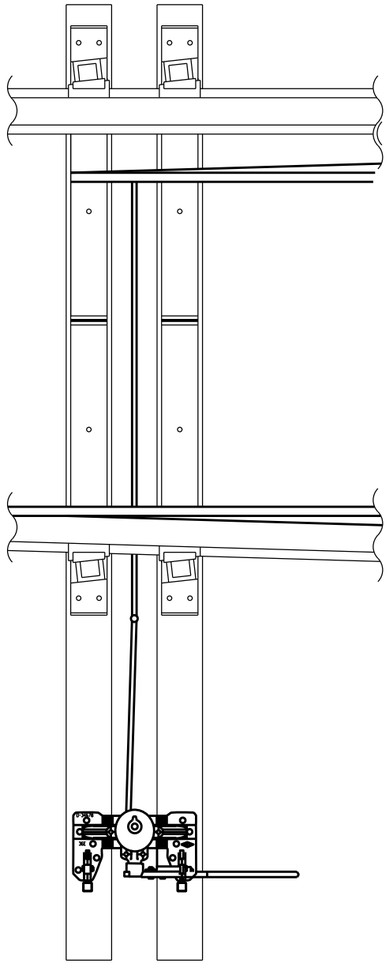
1

CRANKEYE AND CONNECTING ROD CLEVIS SHOULD BE GREASED PRIOR TO INSTALLATION OR ADJUSTMENT. START WITH ABOUT 1" OF THREADS SHOWING ON CONNECTING ROD TURNBUCKLE (TIGHTEN JAM NUT)



2

MEASURE THROW BETWEEN SWITCH POINT & STOCK RAIL AT FIRST ROD

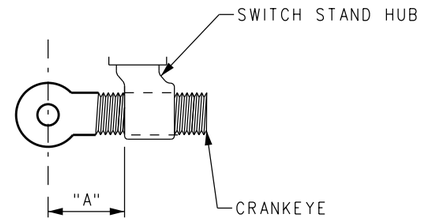


3

SET CRANKEYE SETTING AT DISTANCE "A" FOR MEASURED OPENING AND CORRECT STAND

THROW OF SWITCH	"A" RACOR 22E	"A" RACOR 36E
4 1/2"	2 1/16"	2 9/16"
4 5/8"	2 3/16"	2 11/16"
4 3/4"	2 1/4"	2 3/4"
4 7/8"	2 5/16"	2 13/16"
5"	2 7/16"	2 15/16"
5 1/8"	2 1/2"	3"
5 1/4"	2 5/8"	3 1/8"
5 3/8"	2 11/16"	3 3/16"
5 1/2"	2 13/16"	3 5/16"
5 5/8"	-	3 3/8"
5 3/4"	-	3 7/16"

"A" WORKS FOR ALL ROD LENGTHS



RACOR 22E & 36E

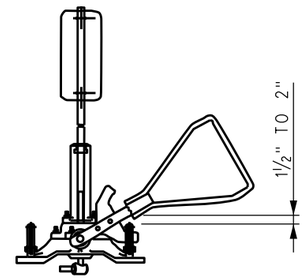
STANDARD SIDE FOR CRANKEYE

4

MOVE SWITCH POINTS TO HALF-THROWN POSITION (OPENING EQUAL ON BOTH SIDES), AND STAND LEVER IN VERTICAL POSITION. CENTER STAND ON HEADBLOCK TIES AND SPIKE OR LAG TO TIES.

5

HAND THROW SWITCH TO BOTH SIDES SEVERAL TIMES. WHEN POINT CONTACTS STOCK RAIL, LEVER SHOULD NOT BE MORE THAN 1 1/2" TO 2" ABOVE FINAL POSITIONS ON TOP OF LEVER REST FOR BOTH POSITIONS.



ELEVATION

IF NOT, ADJUST AS FOLLOWS:

WHEN NEAR POINT FITS PROPERLY AND FAR POINT IS TOO TIGHT:
SHORTEN CRANKEYE SETTING AND SHORTEN CONNECTING ROD CLEVIS.

WHEN NEAR POINT FITS PROPERLY AND FAR POINT IS LOOSE:
LENGTHEN CRANKEYE SETTING AND LENGTHEN CONNECTING ROD CLEVIS.

WHEN FAR POINT FITS PROPERLY AND NEAR POINT IS TOO TIGHT:
SHORTEN CRANKEYE SETTING AND LENGTHEN CONNECTING ROD CLEVIS.

WHEN FAR POINT FITS PROPERLY AND NEAR POINT IS LOOSE:
LENGTHEN CRANKEYE SETTING AND SHORTEN CONNECTING ROD CLEVIS.

WHEN BOTH POINTS ARE TIGHT:
SHORTEN CRANKEYE SETTING AND DO NOT CHANGE CONNECTING ROD CLEVIS.

WHEN BOTH POINTS ARE LOOSE:
LENGTHEN CRANKEYE SETTING AND DO NOT CHANGE CONNECTING ROD CLEVIS.

NOTES:

1. USE 15/16" SCREW SPIKES OR APPROPRIATE PIM SCREWS WHEN INSTALLING NEW SWITCH STANDS ON TIMBER OR CONCRETE TIES.
2. FIELD INSPECTION OF STAND IS RECOMMENDED AT LEAST ANNUALLY OR MORE WHERE STAND IS USED FREQUENTLY.
3. OIL CUPS: USE SAE 40, ADD OIL FREQUENTLY.
4. GREASE SHOULD BE LG312 LITHIUM GRADE 2. REGREASING OF ALL INTERNAL PARTS IS RECOMMENDED BEFORE REASSEMBLY AFTER INSPECTIONS.
5. DIFFERENCES BETWEEN CRANKEYE MEASUREMENTS ON THIS DRAWING AND FINAL ADJUSTMENTS ARE PROBABLY DUE TO TOLERANCES (LOST MOTION) IN CONNECTING ROD/HEAD ROD CONNECTIONS.

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

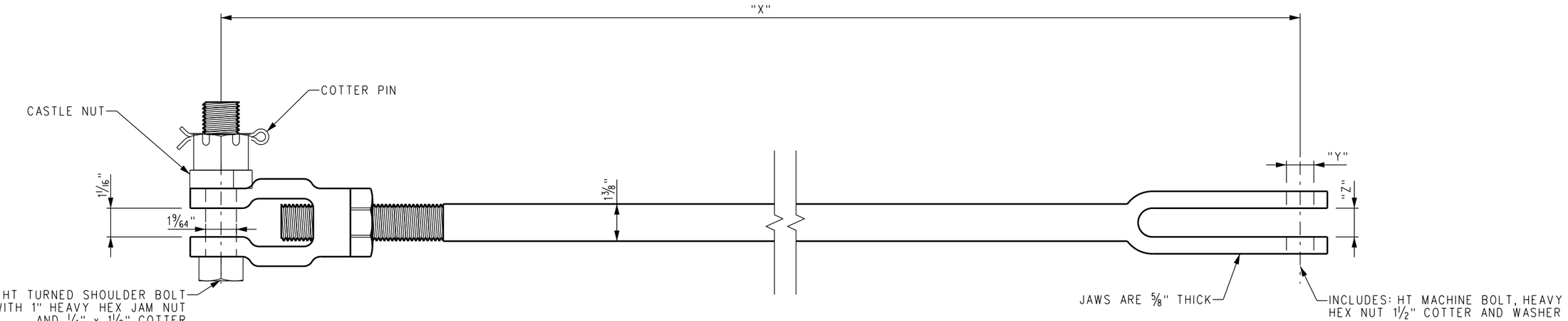
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

SWITCH STANDS HAND THROW ADJUSTMENTS AND INSTALLATION INSTRUCTIONS

STANDARD: 2710
SCALE: NTS
REVISION: -
SHEET: 1 OF 1
CADD FILE: ES2710

UserName•> scrrapw1ics01$ Date Plotted: 3/27/2023 3:05:39 PM Plot Driver•> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName•> \\scrrapw1ics01\iCS_pdf_work_dir\87\482_102\ES2710.dgn



CONNECTING ROD ASSEMBLY FOR ALL SWITCH STANDS WITH ADJUSTABLE CRANK EYE (22E, 36E-EH, 112E, ETC)

"Y" - 1 1/64" FOR 3/4" AND 1" HEAD RODS
- 1 9/64" FOR 1 1/4" HEAD RODS

"Z" - 13/16" FOR 3/4" HEAD RODS
- 1 1/16" FOR 1" HEAD RODS
- 1 5/16" FOR 1 1/4" HEAD RODS

RAIL SIZE	"X"	HEAD ROD THICKNESS
90-115 LB	3'-4"	1"
132-136 LB	3'-4"	1 1/4"
90-115 LB	5'	1"
132-136 LB	5'	1 1/4"
90-115 LB	7'	1"
132-136 LB	13'-9"	1 1/4"
132-136 LB	7'	1 1/4"

REV.	DATE	DESCRIPTION	DES.	ENG.
X	XX-XX-XX	REVISION	XX	XX

DRAWN BY: HDR DATE: 03/31/2011

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

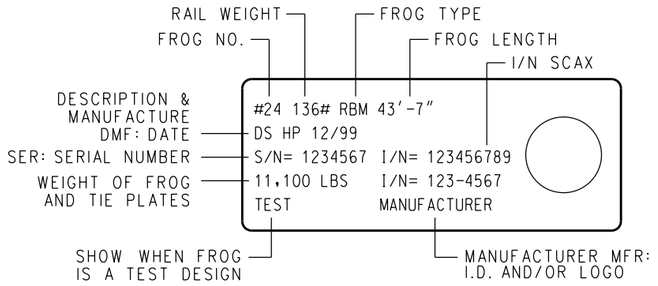
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

CONNECTING ROD ASSEMBLY

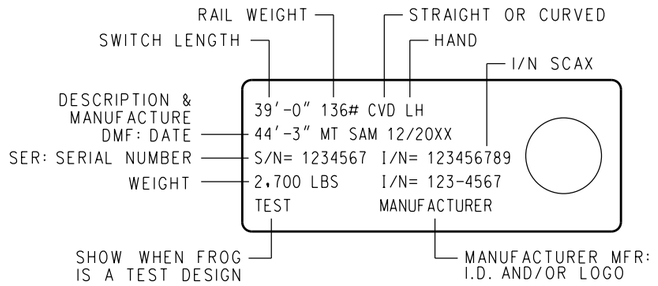
STANDARD 2712
SCALE: NTS
REVISION - SHEET 1 OF 1
CADD FILE: ES2712

UserName=> scrrapw1ics01$ Date Plotted: 3/27/2023 3:06:01 PM Plot Driver=> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt FileName=> \\scrrapw1ics01\iCS_pdf_work_dir\87\482_103\ES2712.dgn



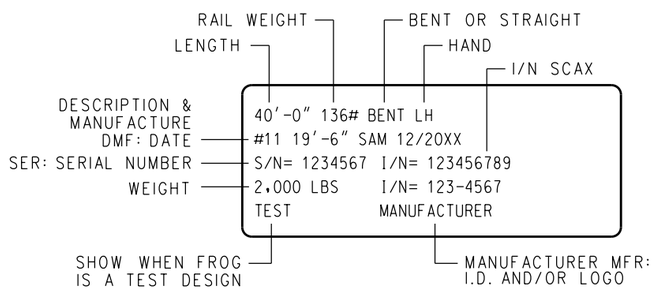
FROG TAG

ATTACH BY GLUE OR BOLT



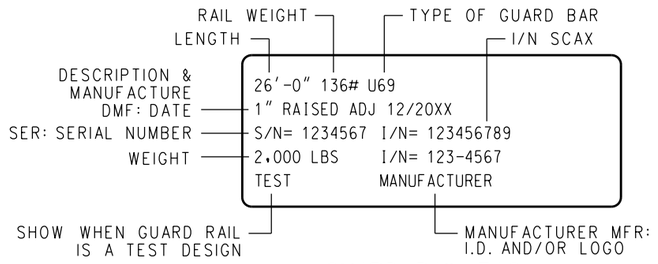
SWITCH POINT TAG

ATTACH BY GLUE OR BOLT



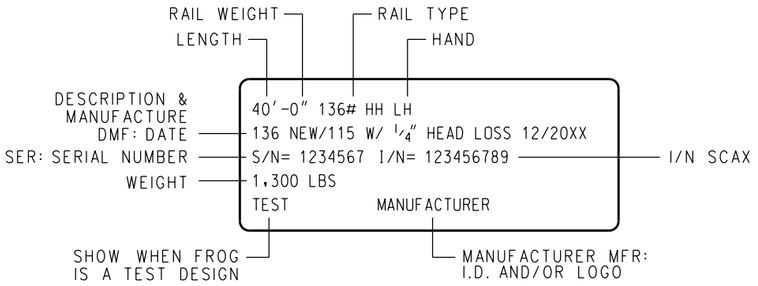
STOCK RAIL TAG

ATTACH BY GLUE ONLY



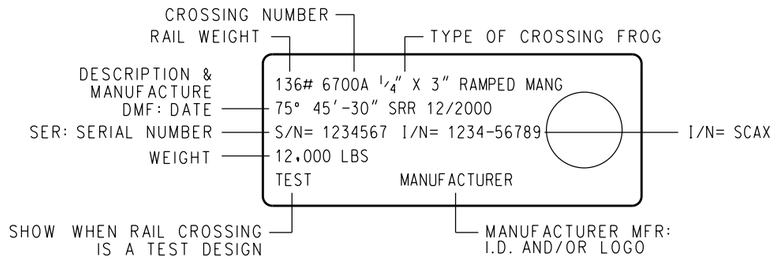
GUARD RAIL TAG

ATTACH BY GLUE ONLY



BONDED INSULATED JOINT & TRANSITION RAIL TAG

ATTACH BY GLUE ONLY



RAILROAD CROSSING TAG

ATTACH BY GLUE OR BOLT

ABBREVIATIONS:

TURNOUT FROG:

CS	= COMMON STANDARD HEEL
DS	= DIRECT SUPPORT
HP	= HEAVY POINT
MPF	= MOVEABLE POINT FROG
RBM	= RAIL BOUND MANGANESE
SAM	= SAMSON
SPR	= SPRING
SSG OR SMSG	= SOLID SELF GUARDED
WHM	= WELDED HEEL MANGANESE
TH	= TAPERED HEEL

CROSSING FROG:

1-RAIL	= 1 RAIL BOLTED
2-RAIL	= 2 RAIL BOLTED
3-RAIL	= 3 RAIL BOLTED
AM	= ARTICULATED MANGANESE
FB	= FLANGE BEARING
LBM	= LAPPED BEAM MANGANESE
OWLS	= ONE WAY LOW SPEED
MI	= MANGANESE INSERT
RM	= REVERSIBLE MANGANESE
SM	= SOLID MANGANESE
SRR	= STRAIGHT RAIL REVERSIBLE

SWITCH:

CVD OR CV	= CURVED
MT	= MANGANESE TIP
STR	= STRAIGHT
SAM	= SAMSON
SPR	= SPRING

STOCK RAIL:

CVD OR CV	= CURVED
SAM	= SAMSON
STR	= STRAIGHT

HAND:

LH	= LH
RH	= RH

MISCELLANEOUS:

ADJ	= ADJUSTABLE
DHH OR HH	= DEEP HEAD HARDENED
HF	= HOOK FLANGE
S/N	= SERIAL NUMBER
STD	= STANDARD
I/N	= ITEM NUMBER

NOTES:

1. TAGS TO BE MADE OF 0.025 THICK STAINLESS STEEL PLATE.
2. LETTERS TO BE RAISED OR INDENT PUNCH 3/8" HIGH WITH 3/16" SPACE, BAR CODE 1/2" HIGH. BETWEEN LINES AND AT TOP AND BOTTOM OF I.D. TAG. LETTERS TO BE CLEARLY LEGIBLE FROM A DISTANCE OF SIX FEET.
3. ACTUAL SIZE OF I.D. TAG MAY VARY WITH AMOUNT OF INFORMATION REQUIRED.
4. USE ABBREVIATIONS AS SHOWN ABOVE.
5. I.D. TAG TO BE APPLIED WITH PERMANENT EPOXY ADHESIVE. WIPE OFF EXCESS EPOXY.

REV.	DATE	DESCRIPTION	DES.	ENG.
0	02/29/12	INITIAL ISSUE	XX	XX

DRAWN BY: A. CARLOS DATE: 04/12/02

PRINCIPAL ENGINEER, DESIGN & STANDARDS

ASSISTANT DIRECTOR, DESIGN

METROLINK

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
900 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ENGINEERING STANDARDS

IDENTIFICATION TAGS FOR TRACK COMPONENTS

STANDARD 2715
SCALE: 1½" = 1'-0"
REVISION -
SHEET 1 OF 1
CADD FILE: ES2715

UserName•> scrrapw11ics01$ Date Plotted: 3/27/2023 3:05:52 PM Plot Driver•> C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
FileName•> \\scrrapw11ics01\iCS_pdf_work_dir\87\482_104\ES2715.dgn