DEVIATIONS FROM THE LIMIT LINE.

REPLACEMENT OPERATIONS ARE COMPLETE SCRRA WILL MAKE A SURVEY OF THE LIMIT LINE TO DETECT ANY A 1.5:1 (OR 1:1 AT LOCALIZED SITES) SLOPE RATIO FOR THE ADDED HEIGHT OF THE EMBANKMENT. AFTER RIP-RAP OF THE BEACH LOWERS THE LEVEL OF THE SAND, IN WHICH CASE THE LIMIT LINE WILL BE ADJUSTED SEAWARD AT THE RIP-RAP. THIS LINE IS LOCATED BY REFERENCE TO GPS MEASURED COORDINATES, TO OFFSETS FROM TRACK THE SCRRA AND LOCAL AGENCIES HAVE ESTABLISHED A "LIMIT LINE" TO DEFINE THE MAXIMUM WIDTH OF "REPLACEMENT" DIMENSION LINES.

NORMAL STATE OF MAINTENANCE WILL BE GRADUALLY ERODING COVER OF RIP-RAP BETWEEN THE "MINIMUM" AND "MAXIMUM REPLACEMENT DIMENSIONS: THE GENERAL CRITERIA FOR INITIATING REPLACEMENT CONDITIONS PERMIT. WALKWAY SURFACE SHALL BE SUBBALLAST.

DUE TO THE IRREGULAR SIZE AND SHAPE OF NATURALLY BROKEN ROCK, ANY SPECIFIC POINT MAY VARY TWO FEET FROM THE AVERAGE DIMENSIONS SHOWN.

BEACH SAND INCORPORATED PASSING THROUGH 8" SCREEN, WITH GOOD WEATHERING CHARACTERISTICS AND SUBSTANTIAL RESISTANCE TO COMPRESSIONAL WEAR ARE TO BE USED. MACHINERY OR EQUIPMENT WORKING FROM THE BEACH THAT IS CAPABLE OF MOVING THE LARGEST ROCKS BEING USED.

THE BOTTOM OF THE RIP-RAP SHALL BE KEYED INTO THE BEACH SAND BY APPROXIMATELY THE SIZE OF THE RIP-RAP OR NATIVE ROCK SHALL NOT BE EXCAVATED TO ESTABLISH A NEW KEY DEPTH. EXISTING RIP-RAP OR NATIVE ROCK SHALL NOT BE EXCAVATED TO ESTABLISH A NEW KEY DEPTH.

THE ELEVATION OF THE RIP-RAP MUST BE LOCATED WITHIN A 1.5:1 SLOPE RATIO SHOWN. THE EFFECTIVE HEIGHT OF THE RIP-RAP SHALL BE ADJUSTED AT THE 1.5:1 SLOPE RATIO SHOWN. A 1.5:1 SLOPE RATIO SHALL BE USED FOR NON-SCRRA APPROVED USES:

AMOUNT AND SPECIES OF RIP-RAP TO BE USED ARE TO BE DETERMINED BY SCRRA CONSULTANT OR HISTORIC ARCHITECT.

THE TOP OF RIP-RAP SHALL BE KEYED INTO THE BEACH SAND BY APPROXIMATELY THE SIZE OF THE RIP-RAP OR NATIVE ROCK SHALL NOT BE EXCAVATED TO ESTABLISH A NEW KEY DEPTH. EXISTING RIP-RAP OR NATIVE ROCK SHALL NOT BE EXCAVATED TO ESTABLISH A NEW KEY DEPTH.

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AMOUNT AND SPECIES OF RIP-RAP TO BE USED ARE TO BE DETERMINED BY SCRRA CONSULTANT OR HISTORIC ARCHITECT.
6" SUBBALLAST THICKNESS

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.
2. ZONE OF SUBGRADE MATERIALS REQUIRING 6" OF SUBBALLAST.
3. ADDITIONAL MEASURES MAY BE REQUIRED PER RECOMMENDATIONS OF AN ENGINEERING SOILS ANALYSIS.

SIEVE ANALYSIS

<table>
<thead>
<tr>
<th>NUMBER OF MESH PER INCH U.S. STANDARD</th>
<th>GRAIN SIZE IN MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO 40</td>
<td>0.006</td>
</tr>
<tr>
<td>NO 60</td>
<td>0.001</td>
</tr>
<tr>
<td>NO 100</td>
<td>-</td>
</tr>
<tr>
<td>NO 200</td>
<td>-</td>
</tr>
</tbody>
</table>

HYDROMETER ANALYSIS

GRAIN SIZE DISTRIBUTION FOR SUBGRADE SOILS

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA 90012
### Sieve Analysis

<table>
<thead>
<tr>
<th>SIZE OF OPENING IN INCHES</th>
<th>NUMBER OF MESHES PER INCH U.S. STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5&quot;</td>
<td>0.002</td>
</tr>
<tr>
<td>1.0&quot;</td>
<td>0.004</td>
</tr>
<tr>
<td>1.25&quot;</td>
<td>0.005</td>
</tr>
<tr>
<td>1.5&quot;</td>
<td>0.006</td>
</tr>
<tr>
<td>2.0&quot;</td>
<td>0.008</td>
</tr>
<tr>
<td>2.5&quot;</td>
<td>0.010</td>
</tr>
<tr>
<td>3.0&quot;</td>
<td>0.013</td>
</tr>
<tr>
<td>3.5&quot;</td>
<td>0.015</td>
</tr>
<tr>
<td>4.0&quot;</td>
<td>0.017</td>
</tr>
<tr>
<td>4.5&quot;</td>
<td>0.019</td>
</tr>
<tr>
<td>5.0&quot;</td>
<td>0.020</td>
</tr>
</tbody>
</table>

#### Notes:

1. For standard cross sections, see SCRRA ES2001 & ES2002.

---

**SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY**

**ENGINEERING STANDARDS**

**METROLINK**

**BALLAST & SUBBALLAST GRADATION TABLE**

---

**PERCENT PASSING (BY WEIGHT)**

[All aggregate sampling and testing per ASTM latest revision.]

---

**COBBLES**

- COARSE
- FINE

**GRAVEL**

- COARSE
- MEDIUM
- FINE

**SAND**

---

**BALLAST & SUBBALLAST**

- #4A BALLAST FOR MAIN TRACK
- #5 BALLAST FOR WALKWAY AND YARD TRACK
- SUBBALLAST CALTRANS 26-102A

---

**PERCENT RETAINED BY WEIGHT**

---

**GRAN SIZE IN MILLIMETER**

---

**DATE**

- 03/31/2011

---

**DRAWN BY**: 

- ENG.

---

**FOR NON-SCRRA APPROVED USES**: 

- ALL RIGHTS RESERVED. ANY FORM OR BY ANY MEANS WITHOUT THE PRIOR WRITTEN PERMISSION OF SCRRA.

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**NOTES**

[1. For standard cross sections, see SCRRA ES2001 & ES2002.]

---

**ENGINEERING STANDARDS**

- ASSISTANT DIRECTOR: STANDARDS & DESIGN
- ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012
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 Director of Engineering and Construction.

2. Standard permanent clearance shall be 14'-0" from CL of track for Canopies, Stairways and Support Columns. Proposed clearances less than this distance shall conform to those shown on SCRRA ES2102 and will require the prior approval of the SCRRA Director of Engineering and Construction.

3. See SCRRA ES2104 for minimum vertical clearances for overhead wires.

4. See SCRRA ES3101, ES3201 and ES3202 for required permanent clearances.

5. Rail-highway grade separations may require provisions for a Maintenance Road and/or future additional track(s).

6. Water clearances may be required to provide visibility for roadway signals.

7. In a curve on super-elevated 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 top of rail.

CLEARANCE REQUIREMENTS FOR NEW CONSTRUCTION OR DESIGN

NO OBSTRUCTIONS MAY BE CONSTRUCTED WITHIN THIS ENVELOPE WITHOUT PRIOR APPROVAL OF SCRRA DIRECTOR OF ENGINEERING & CONSTRUCTION

NO PARALLEL UTILITIES INSIDE 10'-0" OF CENTERLINE OF TRACK OR INSIDE OF 15:1 SLOPE FROM END OF HE

TOP OF RAIL
OIL COLUMNS. TUNNELS, WATER AND THROUGH BRIDGES, CLEARANCE LINE FOR OF RAIL 4'-0" ABOVE TOP STANDS MORE THAN SIGNALS OR SWITCH CLEARANCE LINE FOR 10'-0"

8'-0"  6'-0"  5'-3"

NOTE A
SWITCH MECHANISMS CLEARANCE LINE FOR NOTE B
NOTE C
SWINGING OR ONLY PLATFORMS LOADING APPLIES TO RAIL TOP OF SPOUT DOWN

KEEP CLEAR PATHWAY FOR TRAINMEN

_4'-0"
_3'-0"
_2'-0"
_1'-0"

C.
B.
A.

TO STANDARD GAUGE RAILROAD TRACKS TRANSPORTING FREIGHT CARS.

FOR NEW WORK AND RECONSTRUCTION OF EXISTING FACILITIES ADJACENT (EFFECTIVE FEBRUARY 1, 1948)

(SEE NOTE 3)

DECREASED CLEARANCES SHOWN BELOW ARE FOR:

CLEARANCE LINE SHOWN BELOW IS FOR PORTIONS OF BLOCK SIGNALS 4'-0" OR LESS ABOVE TOP OF RAIL. CLEARANCE LINE SHOWN BELOW IS FOR SIGNALS OR SWITCH STANDS 3'-0" OR LESS ABOVE TOP OF RAIL. DECREASED CLEARANCES SHOWN BELOW ARE FOR:

MINIMUM CLEARANCES FOR HANDRAILS ON BRIDGES WITH WALKWAYS SHALL BE 8'-6". DECREASED CLEARANCES, EXCEPT AS PROVIDED FOR HANDRAILS ARE NOT PERMITTED ON MANUAL 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.

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

MINIMUM CLEARANCE OF STRUCTURES FROM RAILROAD TRACKS (EFFECTIVE FEBRUARY 1, 1948)

FOR CURVED TRACK SHALL BE 1'-0" GREATER THAN THAT FOR TANGENT TRACK.

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LEGEND FOR CLEARANCE ENVELOPE

1. CLEARANCE MARGIN FOR MAXIMUM DOUBLESTACK CARRIERS, BI-LEVEL AND TRI-LEVEL CARRIERS. THIS AREA TO BE KEPT FREE AND CLEAR OF ANY PLATFORMS, TUNNELS, STRUCTURES, OVERHEADS, PASSENGER PLATFORMS, Poles, Utility lines, Manholes, Signal Devices, and All Other Material or Man-made structures and objects.

2. MAXIMUM COMBINATION DOUBLESTACK CARS (8'-6" WIDE BY 9'-6" TALL) 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).

NOTES:

1. ALL NEW CONSTRUCTION, RECONSTRUCTION, ALTERATIONS AND MODIFICATIONS MUST BE IN COMPLIANCE WITH THE CLEARANCE ENVELOPE REQUIREMENTS FOR UNOBSTRUCTED TRANSPORT OF THE RAIL EQUIPMENT.

2. HORIZONTAL CLEARANCE DISTANCES SHALL BE INCREASED ON CURVES AT RATE OF 10"/M ON RADIUS OF CURVES AND 100" 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 STATED 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 DIRECTOR OF ENGINEERING AND CONSTRUCTION.
### TABLE 1: CPUC GENERAL ORDER 95 BASIC MINIMUM ALLOWABLE VERTICAL CLEARANCE OF WIRES ABOVE RAILROADS, ROADWAYS, POLES, BUILDINGS, STRUCTURES OR OTHER OBJECTS

<table>
<thead>
<tr>
<th>CASE NO</th>
<th>NATURE OF CLEARANCE</th>
<th>A: SPAN WIRES OTHER THAN TROLLEY SPAN WIRES OVERHEAD GUYS AND W الدرش</th>
<th>B: COMMUNICATION CONDUCTORS (INCLUDING OPEN WIRE, CABLES &amp; SERVICE DROPS)</th>
<th>C: TROLLEY CONTACT, FEDERATION &amp; SPAN WIRES UNDER 5 KV</th>
<th>D: SUPPLY WIRES &amp; SUPPLY CABLES UNDER 22.5 KV, 345 KV</th>
<th>E: SUPPLY WIRES &amp; SUPPLY CABLES, 22.5 KV TO UNDER 300 KV</th>
<th>F: SUPPLY WIRES &amp; SUPPLY CABLES, 300 KV AND GREATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CROSSES ABOVE TRACKS OF RAILROADS WHICH TRANSPORT OR PROPOSE TO TRANSPORT FREIGHT CARS (MAXIMUM WEIGHT 20'-9&quot; WHERE NOT OPERATED BY OVERHEAD CONTACT WIRES</td>
<td>25-FT</td>
<td>25-FT</td>
<td>22.5-FT</td>
<td>25-FT</td>
<td>34-F</td>
<td>34-F</td>
</tr>
<tr>
<td>2</td>
<td>CROSSING OR PARALLEL TO RAILROAD OPERATED BY OVERHEAD TROLLEYS</td>
<td>20-FT</td>
<td>18-FT</td>
<td>22-3/4-FT</td>
<td>30-F</td>
<td>34-F</td>
<td>34-F</td>
</tr>
<tr>
<td>3</td>
<td>CROSSING OR ALONG ROADWAYS IN URBAN OR SUBURBAN DISTRICTS</td>
<td>10-FT</td>
<td>18-FT</td>
<td>25-FT</td>
<td>30-F</td>
<td>30-F</td>
<td>30-F</td>
</tr>
<tr>
<td>4</td>
<td>ABOVE GROUND ON ROADWAYS OR ACROSS OTHER AREAS CAPABLE OF BEING TRAVELED BY VEHICLES OR AGRICULTURAL EQUIPMENT</td>
<td>8-FT</td>
<td>10-FT</td>
<td>19-FT</td>
<td>25-FT</td>
<td>25-FT</td>
<td>25-FT</td>
</tr>
<tr>
<td>5</td>
<td>A: VERTICAL CLEARANCE ABOVE WALKABLE SURFACES ON BUILDINGS, EXCEPT LINES, AND COMMUNICATIONS CONDUCTORS ON BUILDINGS</td>
<td>8-FT</td>
<td>8-FT</td>
<td>8-FT</td>
<td>12-FT</td>
<td>12-FT</td>
<td>20-FT</td>
</tr>
<tr>
<td>6</td>
<td>B: SUPPORT WIRES OTHER THAN TROLLEY SPAN WIRES OVERHEAD GUYS AND W الدرش</td>
<td>2-FT</td>
<td>8-FT</td>
<td>8-FT</td>
<td>8-FT</td>
<td>8-FT</td>
<td>20-FT</td>
</tr>
<tr>
<td>7</td>
<td>C: HORIZONTAL CLEARANCE OF CONDUCTOR AT FEET OR ROOF TOPS OF BUILDINGS, EXCEPT LINES, AND COMMUNICATIONS CONDUCTORS ON BUILDINGS</td>
<td>-</td>
<td>3-FT</td>
<td>3-FT</td>
<td>6-FT</td>
<td>6-FT</td>
<td>15-FT</td>
</tr>
<tr>
<td>8</td>
<td>D: DISTANCE OF CONDUCTOR FROM CENTER LINE OF POLE, WHETHER ATTACHED OR UNATTACHED</td>
<td>-</td>
<td>15-IN</td>
<td>15-IN</td>
<td>18-IN</td>
<td>18-IN</td>
<td>NOT APPLICABLE</td>
</tr>
<tr>
<td>9</td>
<td>E: DISTANCE OF CONDUCTOR FROM SURFACE OF POLE CROSS ARMS OR OTHER OVERHEAD LINE STRUCTURE UPON WHICH IT IS SUPPORTED, PROVIDING IT COMPLIES WITH CASE 8 ABOVE</td>
<td>-</td>
<td>3-IN</td>
<td>3-IN</td>
<td>3-IN</td>
<td>3-IN</td>
<td>NOT APPLICABLE</td>
</tr>
</tbody>
</table>

**MINIMUM CLEARANCES OF WIRES ABOVE RAILROADS - CASE 1**

- **SUPPLY LINES 22.5 KV AND GREATER**
- **SUPPLY LINES UNDER 22.5 KV, SIGNAL LINES, AND COMMUNICATIONS CONDUCTORS**
- **SPAN WIRES, OVERHEAD GUYS, AND W الدرش**

---

**MINIMUM VERTICAL CLEARANCE FOR WIRES ABOVE RAILROADS, ROADWAYS, POLES, BUILDINGS, STRUCTURES OR OTHER OBJECTS**

**ENGINEERING STANDARDS**

- **SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY**
- **ONE GATEWAY PLAZA, 13TH FLOOR, L.A., CA 90001**

---

**TABLE 1**

<table>
<thead>
<tr>
<th>CASE NO</th>
<th>NATURE OF CLEARANCE</th>
<th>MINIMUM CLEARANCES OF WIRES ABOVE RAILROADS, ROADWAYS, POLES, BUILDINGS, STRUCTURES OR OTHER OBJECTS</th>
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<tbody>
<tr>
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<td>25-FT</td>
</tr>
<tr>
<td>2</td>
<td>CROSSING OR PARALLEL TO RAILROAD OPERATED BY OVERHEAD TROLLEYS</td>
<td>20-FT</td>
</tr>
<tr>
<td>3</td>
<td>CROSSING OR ALONG ROADWAYS IN URBAN OR SUBURBAN DISTRICTS</td>
<td>10-FT</td>
</tr>
<tr>
<td>4</td>
<td>ABOVE GROUND ON ROADWAYS OR ACROSS OTHER AREAS CAPABLE OF BEING TRAVELED BY VEHICLES OR AGRICULTURAL EQUIPMENT</td>
<td>8-FT</td>
</tr>
<tr>
<td>5</td>
<td>A: VERTICAL CLEARANCE ABOVE WALKABLE SURFACES ON BUILDINGS, EXCEPT LINES, AND COMMUNICATIONS CONDUCTORS ON BUILDINGS</td>
<td>8-FT</td>
</tr>
<tr>
<td>6</td>
<td>B: SUPPORT WIRES OTHER THAN TROLLEY SPAN WIRES OVERHEAD GUYS AND W الدرش</td>
<td>2-FT</td>
</tr>
<tr>
<td>7</td>
<td>C: HORIZONTAL CLEARANCE OF CONDUCTOR AT FEET OR ROOF TOPS OF BUILDINGS, EXCEPT LINES, AND COMMUNICATIONS CONDUCTORS ON BUILDINGS</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
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<td>-</td>
</tr>
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<td>E: DISTANCE OF CONDUCTOR FROM SURFACE OF POLE CROSS ARMS OR OTHER OVERHEAD LINE STRUCTURE UPON WHICH IT IS SUPPORTED, PROVIDING IT COMPLIES WITH CASE 8 ABOVE</td>
<td>-</td>
</tr>
</tbody>
</table>

10 MPH TRACK

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

LESS THAN 550' (TYP)

PAINT TIE (TYP)

250' (TYP)

250' OR GREATER

PAINT TIE (TYP)

10 MPH TRACK

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


10 MPH TRACK

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

LESS THAN 550' (TYP)

PAINT TIE (TYP)

250' (TYP)

250' OR GREATER

PAINT TIE (TYP)

10 MPH TRACK

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

CASE 2: PARALLEL TRACKS - TANGENT OR CURVED

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.

SELECTING AND MARKING NO RIDE ZONE

FIGURE 1A
FIGURE 1B
FIGURE 1C
FIGURE 1D
FIGURE 2A
FIGURE 2B
FIGURE 2C
FIGURE 2D
FIGURE 3A
FIGURE 3B
FIGURE 3C
FIGURE 3D
TRAINS MORE THAN 20 FT ON CENTER
(INSIDE PLACEMENT)

<table>
<thead>
<tr>
<th>SWITCH STANDS</th>
<th>ROD LENGTH</th>
<th>HEADBLOCK TIE LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN LINE</td>
<td>22E, 36E</td>
<td>5'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>112E, 36E</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>YARD</td>
<td>22E, 36E</td>
<td>5'-0&quot;</td>
</tr>
</tbody>
</table>

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 8'-0" LOW STANDS FROM THE CENTER OF ANY TRACK TO ANY PART OF THE STAND ON TARGET IN ITS MOST RESTRICTIVE POSITION.
   C. POSITIONED WITH THE HANDLE POINTING TOWARD THE FROG OR TARGET IN ITS MOST RESTRICTIVE POSITION.
   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.

MAIN LINE SWITCH STAND: USE 22E OR 36E STAND, 7'-0" ROD, 17'-0" HEADBLOCK TIES
YARD SWITCH STAND: USE 22E OR 36E STAND, 5'-0" ROD, 15'-0" HEADBLOCK TIES

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

<table>
<thead>
<tr>
<th>SWITCH STANDS</th>
<th>ROD LENGTH</th>
<th>HEADBLOCK TIE LENGTH</th>
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</thead>
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<tr>
<td>MAIN LINE</td>
<td>22E, 36E</td>
<td>5'-0&quot;</td>
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<tr>
<td></td>
<td>112E, 36E</td>
<td>7'-0&quot;</td>
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<tr>
<td>YARD</td>
<td>22E, 36E</td>
<td>5'-0&quot;</td>
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TRACKS 13 FT TO 20 FT ON CENTER
(INSIDE PLACEMENT)

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<td>MAIN LINE</td>
<td>36E</td>
<td>14'-0&quot;</td>
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<tr>
<td>YARD</td>
<td>36E</td>
<td>14'-0&quot;</td>
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</tbody>
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 Metrolink
Southern California Regional Rail Authority

Engineering Standards

Switch Stand Placement

American Civil Engineering Standards.
NOTE:

1. The railway dimensions shown above reflect CPUC minimum requirements. Please see SCRRA Standards ES2001 and ES2002 for dimension guidelines for embankment and railways required for new construction.

2. Ballast Type 4 and Type 5 gradations are depicted on SCRRA Standard ES2007-02. Type 4 ballast is required for main line operations, Type 5 for yard ballast and yards for railway yards.

3. Dimensions for turnout railways are depicted and detailed on ES2010.

4. No requests for design exception adopting less than the requirements of California Public Utilities Commission (CPUC) orders 203 and 118 will be considered.

5. Ballast standards requirements for new construction:
   a. For main track, standard ballast will be required on all SCRRA main tracks. For multiple main tracks with less than 20-foot centers, standard ballast will be required. For 20-foot centers, standard ballast will be required. For tracks controlled with a switch machine, trackway standard 5 will be required. For 100-foot centers or more, trackway standard 5 will be required. This includes all manually controlled industry tracks.
   b. For main track, standard trackways will be required. For main track, standard trackways will be required. For 100-foot centers or more, trackway standard 5 will be required. For main track, standard trackways will be required. For 100-foot centers or more, trackway standard 5 will be required.
   c. For main track, standard trackways will be required. For main track, standard trackways will be required. For 100-foot centers or more, trackway standard 5 will be required. For main track, standard trackways will be required. For 100-foot centers or more, trackway standard 5 will be required.

6. WALKWAY 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, standard ballast will be required. For 20-foot centers, standard ballast will be required. For tracks controlled with a switch machine, trackway standard 5 will be required. For 100-foot centers or more, trackway standard 5 will be required. This includes all manually controlled industry tracks.
   b. For main track, standard trackways will be required. For main track, standard trackways will be required. For 100-foot centers or more, trackway standard 5 will be required. For main track, standard trackways will be required. For 100-foot centers or more, trackway standard 5 will be required.
   c. For main track, standard trackways will be required. For main track, standard trackways will be required. For 100-foot centers or more, trackway standard 5 will be required. For main track, standard trackways will be required. For 100-foot centers or more, trackway standard 5 will be required.

---

LEGEND

- **STANDARD NO 1**
- **STANDARD NO 2**
- **STANDARD NO 3**
- **STANDARD NO 4**
- **STANDARD NO 5**

- **BALLAST TYPE 4A**
- **BALLAST TYPE 5**

- **WALKWAY (STANDARD 1 & 2)**
- **WALKWAY (STANDARD 3)**
- **WALKWAY (STANDARD 4 & 5)**

- **CLEAR POINT**
- **PASSING TRACK**
- **MAIN LINE**
- **YARD, LAYOVER AREA, OR INDUSTRY TRACK**
- **SWITCH MACHINE**
- **CONTROLLED BY**
- **SWITCH**
- **HAND THROW**

---

CPUC MINIMUM WALKWAY STANDARDS

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 19TH FLOOR, L.A., CA 90012

DIGITAL FILE:
- **ENG. DES.**
- **DATE**
- **REV.**
- **DESCRIPTION**

DRAWN BY:
- **DATE**
- **FOR NON-SCRRA APPROVED USES:**

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DIRECTOR OF ENGINEERING AND CONSTRUCTION

ASSISTANT DIRECTOR: STANDARDS & DESIGN

ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
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 AIRPOLLING WINNING AND ELIMINATE THE TANGS OF DRIVING THE TRAIN IN TWO AS A DIRECT RESULT OF TRANSITION. PROPERLY DESIGNED VERTICAL CURVES WILL PROVIDE FOR PASSENGER COMFORT.

4. VERTICAL CURVES SHALL BE DESIGNED LONG ENOUGH TO MATCH THE HIGHEST SPEEDS CONTEMPLATED FOR THE LINES.

5. VERTICAL CURVES SHALL BE PARABOLIC.

6. THE MINIMUM LENGTH OF VERTICAL CURVES FOR BOTH SAGS AND SUMMITS IS DETERMINED BY THE FOLLOWING FORMULAS:

   \[ LVC = D \times V \times K = \text{MINIMUM LENGTH OF VERTICAL CURVE IN FEET} \]

   \[ V = \text{DESIGN SPEED IN MPH} \]

   \[ K = 2.15 \text{ CONVERSION FACTOR TO GIVE LVC IN FEET} \]

   \[ D = \text{ABSOLUTE VALUE OF THE DIFFERENCE IN RATES OF GRADES EXPRESSED AS A DECIMAL} \]

   \[ A = \text{VERTICAL ACCELERATION IN FEET/SEC/SEC} \]

   \[ P = \text{PASSenger OPERATIONS: A=0.30 FEET/SEC/SEC FREIGHT OPERATIONS: A=0.10 FEET/SEC/SEC} \]

   \[ T = \text{TON TRAINS OR 8 MILLION GROSS TONS ANNUAL FREIGHT TRAFFIC} \]

   \[ M = \text{MIXED PASSENGER WITH FREIGHT TRAFFIC NOT EXCEEDING 4000} \]

   \[ C = \text{PASSENGER OPERATIONS: A=0.30 FEET/SEC/SEC FREIGHT OPERATIONS: A=0.10 FEET/SEC/SEC} \]

   \[ V = \text{DESIGN SPEED IN MPH} \]

   \[ K = 2.15 \text{ CONVERSION FACTOR TO GIVE LVC IN FEET} \]

   \[ D = \text{ABSOLUTE VALUE OF ((+0.005)-(-0.005))=0.01} \]

   \[ A = \text{0.60 FEET/SEC/SEC VERTICAL ACCELERATION (PASSENGER)} \]

   \[ 0.10 \text{ FEET/SEC/SEC VERTICAL ACCELERATION (FREIGHT)} \]

   \[ 25 \text{ MPH DESIGN SPEED} \]

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INCREASING SUPERELEVATIONS ARE IN INCHES AND SPEEDS ARE IN MILES PER HOUR (MPH).

ALL ANGLES ARE IN DEGREES, DISTANCES AND LENGTHS ARE IN FEET, EXCEPT SUBTENDED BY A CHORD OF 100 FEET) OF CURVATURE AND SPECIFIED BY DEGREE.

CIRCULAR CURVES ARE DEFINED BY THE CHORD DEFINITION (CENTRAL ANGLE)

SPRILS ARE DEFINED BY THE CLOTHOID DEFINITION. AUTHORIZATION FROM SCRRA SHALL BE OBTAINED IF ANY DIFFERENT METHOD OR PARAMETERS ARE UTILIZED FOR SPIRALS.

THE TRACK GEOMETRY DATA TABLE, SHOWN IN ES2202-2, SHALL BE COMPLETED WITH DESIGN DATA, CALCULATIONS AND OTHER PERTINENT INFORMATION.

THE REQUEST SHALL BE FULLY DOCUMENTED SUBMITTED TO SCRRA FOR REVIEW, COMMENT AND APPROVAL FOR ALL CURVES.

IN CR EASING

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. THEY SHALL BE OBTAINED IF ANY DIFFERENT METHOD OR PARAMETERS ARE UTILIZED FOR SPIRAL TRANSITIONS CURVE. THE REQUEST SHALL BE FULLY DOCUMENTED SUBMITTED TO SCRRA FOR REVIEW, COMMENT AND APPROVAL FOR ALL CURVES.
2. SPIRALS ARE DEFINED BY THE CLOTHOID DEFINITION. AUTHORIZATION FROM SCRRA SHALL BE OBTAINED IF ANY DIFFERENT METHOD OR PARAMETERS ARE UTILIZED FOR SPIRAL TRANSITIONS.
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 SUBTENDED BY A CHORD OF 100 FEET) OF CURVATURE AND SPECIFIED BY DEGREE.
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### 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 (PAS)" WILL REMAIN BLANK.
5. IF 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 SUB-STANDARD CURVE, SUBMIT TO SCRRA A WRITTEN REQUEST AND JUSTIFICATION FOR A DESIGN WAIVER.
2:19:08 PM

DATE:

CURVE DESIGN PROCEDURE

GENERAL

1. There are six tables of design and maintenance standards for SCRRA track alignment. Table P.2.0 gives standard spiral length tables for passenger and freight operations. Table P.2.26 provides standard spiral length tables for passenger operations. Table P.2.24 gives standard spiral length tables for freight operations. Table P.2.28 provides standard spiral length tables for maintenance of way.

2. For the operation of passenger equipment normally used in SCRRA and Amtrak trains, the design and maintenance of curve geometry is controlled by the SCRRA track safety standards (49CFR213.57). These standards are based on AREMA standards and are intended to minimize transient dynamic loads and passenger discomfort. The standards are aimed at ensuring a smooth and safe ride for passengers and freight trains.

3. New construction will be designed with standard length spirals per AREMA standards. Future maximum design speeds for passenger trains may exceed current speeds. For example, the maximum speed for freight trains is 60 mph, while the maximum speed for passenger trains is 70 mph. The standards for new construction are designed to provide a safe and comfortable ride for passengers and freight trains.

4. Standards for existing curves may be maintained with up to 3 inches of underbalance. However, if there is less than 1 inch of super elevation in both curves, reversing tangents may be reduced to half of the above length. The new data should be entered on the track charts and the new data shown on the next sheet for the maximum future design speed for the location.

5. The new construction will be designed with standard length spirals per AREMA standards. The new construction will be designed for passenger and freight trains. The new construction will be designed for the passenger train that is expected to travel on the line. The new construction will be designed for the passenger train that is expected to travel on the line. The new construction will be designed for the passenger train that is expected to travel on the line. The new construction will be designed for the passenger train that is expected to travel on the line. The new construction will be designed for the passenger train that is expected to travel on the line. The new construction will be designed for the passenger train that is expected to travel on the line. The new construction will be designed for the passenger train that is expected to travel on the line. The new construction will be designed for the passenger train that is expected to travel on the line. The new construction will be designed for the passenger train that is expected to travel on the line.

6. The priorities for designers are: - Set maximum design speed and degree of curvature for passenger and freight trains on a given subdivision after considering all factors. - Avoid an excessive number of tangents and spiral lengths. - Maintain continuous super elevation. - Provide for adequate super elevation runoff. - Avoid excessive spalling or other irregularities that could cause damage to the track. - Provide for adequate super elevation runoff. - Avoid excessive spalling or other irregularities that could cause damage to the track.

7. The SCRRA engineering standards are intended for SCRRA approved uses only. All design speeds must be approved by both the SCRRA director of engineering and construction and the SCRRA manager of signaling and communications.

8. The priorities for designers are: - Set maximum design speed and degree of curvature for passenger and freight trains on a given subdivision after considering all factors. - Avoid an excessive number of tangents and spiral lengths. - Maintain continuous super elevation. - Provide for adequate super elevation runoff. - Avoid excessive spalling or other irregularities that could cause damage to the track. - Provide for adequate super elevation runoff. - Avoid excessive spalling or other irregularities that could cause damage to the track.

9. A current rail line operates passenger service at 70 mph and freight service at 60 mph. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains. The surface has been proposed for a design speed of 80 mph for passenger and 60 mph for freight trains.

10. The new data should be entered on the track charts and the new data shown on the next sheet for the maximum future design speed for the location.
<table>
<thead>
<tr>
<th><strong>MAXIMUM ALLOWABLE PASSENGER OPERATING SPEED - MILES PER HOUR</strong></th>
<th><strong>E</strong></th>
<th><strong>Ls</strong></th>
<th><strong>Es</strong></th>
<th><strong>Vmax</strong></th>
<th><strong>Li</strong></th>
<th><strong>Spiral Length</strong></th>
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<tbody>
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<td>0° 15'</td>
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**NOTES:**

1. NO SPIRALS OR SUPER ELEVATIONS WILL BE PERMITTED TO THE RIGHT OF HORIZONTAL LINES WITHOUT PRIOR APPROVAL FROM THE SCRRA DIRECTOR OF ENGINEERING AND CONSTRUCTION.

2. WHERE CURVATURE IS MORE THAN 5 MILES PER HOUR, A HIGHER ELEVATION AND RESULTING SPIRAL LENGTH WILL BE USED.
### Table P2.0 - 2.0 Inch UnBalanced Elevation for Freight Operations - Standard Spiral Lengths

<table>
<thead>
<tr>
<th>Degree of Curvature (Degrees and Minutes)</th>
<th>Actual Elevation of Outside Rail (In)</th>
<th>UnBalanced Elevation of Outside Rail (In)</th>
<th>Equilibrium Elevation of Outside Rail (In)</th>
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</table>

**Notes:**
1. No spirals or super Elevations will be located to the right of the proposed alignment.
2. Where necessary for later stages, the control line will be offset.
3. The spiral lengths will be the longest of:
   - 1.2VmaxEa
   - 0.0007DVmaxE = 0.0007DVmaxEa
   - 1.2VmaxEa

**Formulas:**
- D: Degree of Curvature (Decimal Degrees)
- Vmax: Maximum Allowable Operating Speed (Miles Per Hour)
- Ea: Actual Elevation of Outside Rail (Inches)
- Ls: Spiral Length;

**Equations:**
- Ls = MAXIMUM ALLOWABLE FREIGHT OPERATING SPEED - MILES PER HOUR
- Ls = MAXIMUM ALLOWABLE OPERATING SPEED - MILES PER HOUR
- Ls = MAXIMUM ALLOWABLE OPERATING SPEED - MILES PER HOUR

**Calculations:**
- Ls = MAXIMUM ALLOWABLE FREIGHT OPERATING SPEED - MILES PER HOUR
- Ls = MAXIMUM ALLOWABLE OPERATING SPEED - MILES PER HOUR
- Ls = MAXIMUM ALLOWABLE OPERATING SPEED - MILES PER HOUR

**Tables:**
- Table P2.0: 2.0 Inch UnBalanced Elevation for Freight Operations - Standard Spiral Lengths
- Table P2.0: 2.0 Inch UnBalanced Elevation for Freight Operations - Standard Spiral Lengths
- Table P2.0: 2.0 Inch UnBalanced Elevation for Freight Operations - Standard Spiral Lengths

**References:**
- Table 2.0 - 2.0 Inch UnBalanced Elevation for Freight Operations - Standard Spiral Lengths
- Table 2.0 - 2.0 Inch UnBalanced Elevation for Freight Operations - Standard Spiral Lengths
- Table 2.0 - 2.0 Inch UnBalanced Elevation for Freight Operations - Standard Spiral Lengths
**TABLE P3.5M - 3.5 INCH UNBALANCED ELEVATION FOR PASSENGER OPERATIONS - MINIMUM SPIRAL LENGTHS**

**ABBREVIATIONS**
- $E_o$: External Elevation at Length
- $E_u$: Internal Elevation at Length
- $V_{ma}$: Maximum Allowable Operating Speed (mph)
- $S$: Grade of Curvature (percent degrees)

**FORMULAS**
- $S = \frac{V_{ma} \times \sqrt{1000}}{E_o - E_u} $  

**MAXIMUM ALLOWABLE PASSENGER OPERATING SPEED - MILES PER HOUR**

<table>
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<th>$S$</th>
<th>$L_s$</th>
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**NOTES:**
1. **NO SPIRALS OR SUPER ELEVATIONS WILL BE PERMITTED TO THE RIGHT OF HEAVY LINE WITHOUT PRIOR APPROVAL FROM THE SUPERINTENDENT OF ENGINEERING AND CONSTRUCTION.**
2. **THE 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. **THREE SPIRAL ELEVATIONS MUST BE MORE THAN 5 DEGREES MORE THAN A LISTED FIGURE. THE NEAREST higher ELEVATION AND RESULTING SPIRAL LENGTH WILL BE USED.**

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**ENGINEERING STANDARDS**

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY  
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA 90012

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**METROLINK**
### Table F2.0M - 2.0 Inch Unbalanced Elevation for Freight Operations - Minimum Spiral Lengths

<table>
<thead>
<tr>
<th>Eo</th>
<th>Ls</th>
<th>20'</th>
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#### Notes:
1. No spirals or super elevations will be permitted to the right of heavy line without prior approval from the SCRA director of Engineering and Construction.
2. This table may only be used on the Ventura and Antelope Valley subdivisions at locations where standard spiral lengths cannot be obtained due to existing field conditions.
3. Where curvature is 500 ft. or more than a listed figure, the next higher elevation and resulting spiral length will be used.
### TABLE PML - 4.0 INCH UNBALANCED ELEVATION FOR PASSENGER OPERATIONS - MAINTENANCE LIMIT

#### ABBREVIATIONS
- **E**: EQUIVALENT ELEVATION OF OUTSIDE RAIL (IN)
- **Vmax**: MAXIMUM ALLOWABLE OPERATING SPEED (MPH)
- **E1**: UNBALANCED ELEVATION OF OUTSIDE RAIL (IN)
- **G**: ACTUAL ELEVATION OF OUTSIDE RAIL (IN)
- **O**: DEGREE OF CURVATURE (DEGREES)

#### FORMULAS
- \( E = 0.0007DV_{\text{max}} \)
- \( E_1 = E \)

#### TABLE

<table>
<thead>
<tr>
<th>E1</th>
<th>E</th>
<th>Vmax</th>
<th>O</th>
<th>MAXIMUM ALLOWABLE PASSENGER OPERATING SPEED - MILES PER HOUR</th>
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#### NOTES:
1. AT ANY TIMES THE TRACK MUST BE IN CONFORMITY WITH 49CFR213. TABLES P3.5 AND P5.5M DEFINE THE LIMITING DESIGN SIZES FOR PASSENGER TRACKS. TABLES P2.0 AND P2.0M DEFINE THE LIMITING DESIGN SIZES FOR FREIGHT TRACKS. OPERATION AT SPEEDS RESULTING IN 4 INCHES IN UNBALANCE IS PERMITTED ONLY WHEN DETERMINED BY THE SCRRA TO BE SAFE. 4 INCHES UNDER BALANCE IS THE LIMITING CONDITION FOR ALL FREIGHT TRACKS. 3 INCHES UNDER BALANCE IS THE LIMITING CONDITION FOR ALL PASSENGER TRACKS. 2 INCHES UNDER BALANCE IS THE LIMITING CONDITION FOR ALL TRAINS UNDER 50 MPH CONDITIONS. ANY COMBINATION OF CURVATURE, OR CONDITION IS NOTED OR NOTED FROM THE INSTRUCTIONS FOR THE OPERATIONAL SPEEDS TO THE DESIGN SCHEDULES.テーレーズ REQUIRES IMMEDIATE REMOVAL ACTION.

2. SOME CURVES WERE CONSTRUCTED WITH SCALES ESTIMATED TO UNDER BALANCE. THE CURVES WERE ESTIMATED TO UNDER BALANCE FOR PASSENGER OPERATIONS AND TO UNDER BALANCE FOR PASSENGER OPERATIONS AT 3.5 INCHES UNDER BALANCE. TABLES P2.0 AND P2.0M AND THE 4 INCH LIMITING DESIGN SIZES WERE MAINTAINED AS DESIGNED.

3. SUPER-ELEVATION AND Spiral LENGTHS WILL BE MAINTAINED TO THE VALUES RECORDED IN THE SCKRRA TRACK CHARTS. THIS IS NOT MEETING THE LIMITS FOR THE DESIGN SCHEDULES, P2.0 AND P2.0M. HOWEVER, IT DOES MEET THE REQUIREMENTS FOR THE PASSENGER DESIGN SCHEDULES, P2.0 AND P2.0M. THEY DO NOT MEET THE REQUIREMENTS FOR ALL PASSENGER OPERATIONS. THE SHARPNESS OF THE CURVE IN THE CENTRAL PORTION OF THE TRACK WILL BE INCREASED IF THE SCALES ARE EXTENDED FROM THE RECORDS.

4. CONTRACT TRACK INSPECTORS WILL FIELD VERIFY THE CHARACTERISTICS OF AT LEAST TWO CURVES EACH MONTH OR AS REQUIRED OR AS RECOMMENDED BY THE SCKRRA TRACK CHARTS. THE MANUFACTURER CONTRACTOR WILL FIELD VERIFY THE DESIGN CURVES AND MEASURE THEIR CURVES ONCE PER YEAR OR AS REQUIRED OR AS RECOMMENDED BY THE SCKRRA TRACK CHARTS. THE MANUFACTURER CONTRACTOR WILL FIELD VERIFY THE DESIGN CURVES AND MEASURE THEIR CURVES ONCE PER YEAR OR AS REQUIRED OR AS RECOMMENDED BY THE SCKRRA TRACK CHARTS.

5. MANUFACTURER CONTRACTOR WILL FIELD VERIFY THE CHARACTERISTICS OF AT LEAST TWO CURVES EACH MONTH OR AS REQUIRED OR AS RECOMMENDED BY THE SCKRRA TRACK CHARTS. THE MANUFACTURER CONTRACTOR WILL FIELD VERIFY THE DESIGN CURVES AND MEASURE THEIR CURVES ONCE PER YEAR OR AS REQUIRED OR AS RECOMMENDED BY THE SCKRRA TRACK CHARTS.
### TABLE FML - 3.0 INCH UNBALANCED ELEVATION FOR FREIGHT OPERATIONS - MAINTENANCE LIMIT

<table>
<thead>
<tr>
<th>Degrees</th>
<th>0° 00'</th>
<th>0° 30'</th>
<th>1° 00'</th>
<th>1° 30'</th>
<th>2° 00'</th>
<th>2° 30'</th>
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<th>5° 00'</th>
<th>5° 30'</th>
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<td>0° 00'</td>
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**Formulas:**
- \( E = 0.0007DV_{max} \)
- \( D = \text{Degree of Curvature (Decimal Degrees)} \)
- \( L_s = \text{Spiral Length (FT)} \)
- \( \text{MAXIMUM ALLOWABLE OPERATING SPEED (MPH)} \)

**Notes:**
1. At all times the track must be in conformity with 49CFR213. Tables P3.5 and P3.5M define the limiting design speed for passenger trains. Tables P3.5 and P3.5M define the limiting design speed for freight trains. Operation at speeds exceeding the limiting condition for 4 inches unbalance is permitted for SCRRA and AMTRAK passenger trains except when advised that severe wind conditions exist. 3 inches unbalance is the limiting condition for all passenger trains under severe wind conditions. Any combination of curvature, elevation, or spiral length will be considered only if the computed result exceeds the speed defined by these tables and results in an unbalance in the field of 6 inches or more between the values recorded in the SCRRA tables for the same curve. No unbalance will be maintained on the values recorded in the SCRRA tables for the same curve. No unbalance will be maintained on the values recorded in the SCRRA tables for the same curve.
2. On curves where construction and speeds established with unbalance will be maintained as designed.
3. Super-elevation and spiral lengths will be maintained to the values recorded in the SCRRA tables for the same curve. No unbalance will be maintained on the values recorded in the SCRRA tables for the same curve. No unbalance will be maintained on the values recorded in the SCRRA tables for the same curve.
4. The sharpness of the curve in the central body will be increased if the spirals are extended faster than the body.
5. Contract track inspectors will verify the characteristics of at least two curves each month to ensure that the spirals and string line maintain the observed 3-foot chord mid-chord and super-elevation at 3-foot intervals for the length of the curve. The management of SCRRA will also review and compare the preceding two years of track geometry data to the track chart data, and will arrange for field verification of alignments based upon these reviews.
6. Managers of track maintenance must note with each operation of track geometry cars, the sharpness of the curve in the central body will be increased if the spirals are extended faster than the body.
7. Contract track inspectors will verify the characteristics of at least two curves each month to ensure that the spirals and string line maintain the observed 3-foot chord mid-chord and super-elevation at 3-foot intervals for the length of the curve. The management of SCRRA will also review and compare the preceding two years of track geometry data to the track chart data, and will arrange for field verification of alignments based upon these reviews.
8. If the actual super-elevation and curvature measured in the field by geometry cars or by manual inspection per Note 5 above are found to result in an unbalance speed less than permitted by Tables P3.5 and P3.5M, temporary speed reductions must be imposed to the next lower level. The maximum allowable speed must remain until the maximum allowable speed is imposed to the next lower level. The maximum allowable speed must remain until the maximum allowable speed is imposed to the next lower level.
## Spacing of Tracks on Curves

<table>
<thead>
<tr>
<th>Degree of Curve</th>
<th>Main or Running and Adjacent Tracks</th>
<th>Industry and Yard Tracks</th>
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</thead>
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<td>Tangent</td>
<td>15'-0&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>1°</td>
<td>15'-2&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>2°</td>
<td>15'-4&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>3°</td>
<td>15'-6&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>4°</td>
<td>15'-8&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>5°</td>
<td>15'-10&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>6°</td>
<td>15'-12&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>7°</td>
<td>15'-14&quot;</td>
<td>15'-0&quot;</td>
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<tr>
<td>8°</td>
<td>15'-16&quot;</td>
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<td>9°</td>
<td>15'-18&quot;</td>
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<td>15'-20&quot;</td>
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<td>15'-0&quot;</td>
</tr>
<tr>
<td>Over 15°</td>
<td>Increase by ½ inch per 15 minutes of curve</td>
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</tbody>
</table>

### Notes:
1. Minimum distance between center lines of adjacent tracks on all new construction shall be as follows: (See Table on this sheet for existing tracks)
   - Yard tracks on curves, track centers as shown above shall be increased three inches for each inch difference in super-elevation. The increase shall be added to the amount shown in Table at left where such track has the same or less amount of super-elevation, use spacing as shown in the table.
   - Increased distances between track centers shall be applied in ½ inch increments.
   - Increased distances between track centers shall be rounded off to the next greater 15 minute increment. For example, if two curved tracks are not 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'.
   - Track spacing for main, side, and yard tracks is the same as for main tracks.
   - Minimum distance between center lines of adjacent tracks on all new construction shall be as follows:
     - Main tracks: 15'-0" minimum, 25'-0" where space permits
     - Main siding, running and drill tracks and adjacent track (except yard tracks): 15'-0"
     - Yard track and adjacent track: 25'-0"

2. Increased distances between track centers shall be applied in ½ inch increments.

3. Increased distances between track centers shall be rounded off to the next greater 15 minute increment. For example, if two curved tracks are not 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'.
### 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

<table>
<thead>
<tr>
<th>Turnout No</th>
<th>TANGENTIAL</th>
<th>STANDARD</th>
<th>EQUILATERAL</th>
<th>DOUBLE SLIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SWITCH LENGTH (POINTS)</td>
<td>MPH</td>
<td>SWITCH LENGTH (POINTS)</td>
<td>MPH</td>
</tr>
<tr>
<td>1</td>
<td>8 19'-6&quot;</td>
<td>18 19'-6&quot;</td>
<td>10 19'-6&quot;</td>
<td>15 29'-0&quot;</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>10 19'-6&quot;</td>
<td>15 29'-0&quot;</td>
<td>25 29'-0&quot;</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>N/A 50</td>
<td>N/A 60</td>
<td>N/A 80</td>
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</table>

#### Passenger

<table>
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<tr>
<th>Turnout No</th>
<th>TANGENTIAL</th>
<th>STANDARD</th>
<th>EQUILATERAL</th>
<th>DOUBLE SLIP</th>
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<tbody>
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<td></td>
<td>SWITCH LENGTH (POINTS)</td>
<td>MPH</td>
<td>SWITCH LENGTH (POINTS)</td>
<td>MPH</td>
</tr>
<tr>
<td>1</td>
<td>8 19'-6&quot;</td>
<td>18 19'-6&quot;</td>
<td>10 19'-6&quot;</td>
<td>15 29'-0&quot;</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>10 19'-6&quot;</td>
<td>15 29'-0&quot;</td>
<td>25 29'-0&quot;</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>N/A 50</td>
<td>N/A 60</td>
<td>N/A 80</td>
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**Note:**

1. Maximum speeds were calculated based on turnout geometry with Eu = 0" and assumed Eu = 3.5" for passenger trains and Eu = 2.0" for freight trains.
FACING TURNOUTS OF OPPOSITE HAND

<table>
<thead>
<tr>
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<th>MINIMUM X (FT)</th>
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<tbody>
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<td>14</td>
<td>122</td>
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<td>24</td>
<td>N/A</td>
<td>150</td>
</tr>
</tbody>
</table>

FACING TURNOUTS OF LIKE HAND

<table>
<thead>
<tr>
<th>FROG NO</th>
<th>DESIRABLE X (FT)</th>
<th>MINIMUM X (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8, 10</td>
<td>82</td>
<td>52</td>
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<tr>
<td>14</td>
<td>125</td>
<td>90</td>
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<tr>
<td>20</td>
<td>N/A</td>
<td>122</td>
</tr>
<tr>
<td>24</td>
<td>N/A</td>
<td>150</td>
</tr>
</tbody>
</table>

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 DIRECTOR OF ENGINEERING AND CONSTRUCTION.
1. **Inner Guard Rails on Bridges** shall be required for all spans where exposed structural steel is present above the rail and is subjected to structural damage by derailled 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 400 feet in length and where 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 the SCRRA Director of Engineering and Construction.**

3. **Inner Guard Rails are not required on bridges until bridge on bridge deck is replaced or running rail is replaced across bridge unless directed by SCRRA Director of Engineering.**

4. **Inside Guard Rails** may be constructed using second-hand rail not less than 23 lbs lighter or no larger than running rails. Inside guard rails may be base cut to modified plates for 5" base SCRRA ES2371.

5. On concrete ties, inside guard rails shall be fastened to each tie with one screw and washer. Guard rail joints, if present, shall be fully bolted using second-hand joint bars.

6. The quantity of 50d plates on concrete ties will vary depending on the number of ties. They are to be spaced as needed. Plates 1 through 8 come as sets and are to be rotated 180° on opposite ends.

7. Inside guard rails on bridges shall extend 50 feet beyond the span or spans to be protected.

**NOTES:**

- Inside guard rails on bridges shall be required for all spans where exposed structural steel is present above the rail and is subjected to structural damage by derailled 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 400 feet in length and where 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.

- Inside guard rails shall be installed on any other bridge as directed by the SCRRA Director of Engineering and Construction.

- Inside guard rails are not required on bridges until bridge on bridge deck is replaced or running rail is replaced across bridge unless directed by SCRRA Director of Engineering.

- Inside guard rails may be constructed using second-hand rail not less than 23 lbs lighter or no larger than running rails. Inside guard rails may be base cut to modified plates for 5" base SCRRA ES2371.

- On concrete ties, inside guard rails shall be fastened to each tie with one screw and washer. Guard rail joints, if present, shall be fully bolted using second-hand joint bars.

- The quantity of 50d plates on concrete ties will vary depending on the number of ties. They are to be spaced as needed. Plates 1 through 8 come as sets and are to be rotated 180° on opposite ends.

**REFERENCE DRAWINGS:**

- For plates see SCRRA ES2357
- For concrete tie see SCRRA ES2406 or ES2407
- For screw and washer see SCRRA ES2356
1. Inside guard rails on bridges shall be required for all spans where exposed structural steel is present above 18" and is subjected to structural damage by derailment equipment. Inside guard rails shall be installed on bridges where individual spans are over 100 feet in length or where the entire structure is over 100 feet in length and at least one span crosses over a waterway that normally contains water at least 15 feet deep. Inside guard rails shall extend 50 feet beyond the span or spans to be protected.

2. Inside guard rails shall be installed on any other bridge as directed by the SCRRA director of engineering and construction.

3. Inside guard rails are not required on bridges until bridge or bridge deck is replaced or running rail is relocated across bridge.

4. Inside guard rails may be constructed using second-hand 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 second-hand 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 member two ties near the center of bridge to restrict longitudinal movement of guard rail.

NOTES:

- Inside guard rails shall be reversed under guard rail with smart end of plate toward running rail.

- Use LR27 twin hook tie plates.

- Trim shoulders of plates as needed.

- Inside guard rails on bridges shall be required for all spans where exposed structural steel is present above 18" and is subjected to structural damage by derailment equipment. Inside guard rails shall be installed on bridges where individual spans are over 100 feet in length or where the entire structure is over 100 feet in length and at least one span crosses over a waterway that normally contains water at least 15 feet deep. Inside guard rails shall extend 50 feet beyond the span or spans to be protected.

- Inside guard rails shall be installed on any other bridge as directed by the SCRRA director of engineering and construction.

- Inside guard rails are not required on bridges until bridge or bridge deck is replaced or running rail is relocated across bridge.

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RAIL ANCHOR APPLICATIONS TO JOINTED RAIL

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 east 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 box anchored; skipping ties where joint bar is present. The 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 purpose of selecting anchor patterns.

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 35-44.
3. All dimensions are minimum unless otherwise specified.
4. Typical chemistry: carbon .5-1.1, manganese 7-11.
5. Rail anchors shall conform to AREMA Manual, Chapter 5, Part 7, Section 7.1.

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5. Rail anchors shall conform to AREMA Manual, Chapter 5, Part 7, Section 7.1.
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 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.
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 ENGINEER
   WILL DETERMINE THE NUMBER OF ANCHORS REQUIRED.
8. RAIL ANCHOR SHALL BE DRIVEN ON BASE OF RAIL UNTIL LOCKING NOTCH ENGAGES
   EDGE OF OPPOSITE PLANCE. 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 ENGINEER.
10. IF FIELD WELD INTERSECTIONS WITH TYPICAL END PATTERN, ANCHOR MAY BE OMITTED.
    DO NOT APPLY ANCHOR TO SAME SIDE OF THE OPPOSITE RAIL, AS ANCHOR
    PATTERN MUST BE A MIRROR PATTERN TO AVOID EXCESSIVE TIES.
11. APPLIES TO ALL TRACKS-ML, SIDING, AND YARD WITH CONTINUOUS WELDED RAIL.

TYPICAL JOINTED RAIL PATTERN

TYPICAL END PATTERN

TYPICAL CENTER PATTERN

LOCATION OF RAIL ANCHOR (TYP)

END PATTERN ANCHORING REQUIRED AT EACH END OF CWR

<table>
<thead>
<tr>
<th>LENGTH OF CWR</th>
<th>MIN DISTANCE OF END PATTERN (FT)</th>
<th>EQUIVALENT NUMBER OF TIES</th>
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<tbody>
<tr>
<td>1000' OR MORE</td>
<td>200</td>
<td>120</td>
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<tr>
<td>800' TO 1000'</td>
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<tr>
<td>400' TO 800'</td>
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<td>48</td>
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<tr>
<td>200' TO 400'</td>
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</table>

PER SCRRA ES2351-01
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, AND MORE ON BOTH RAILS MAY BE OMITTED IF JOINTS ARE PRESENT.
3. RAIL ANCHORS MUST NOT BE PLACED AGAINST JOINT TIES, INCLUDING INSULATED JOINTS. INSULATED JOINTS ARE NOT CONSIDERED AS JOINTS AND WILL BE FULLY ANCHORED.
4. AT LOCATIONS WHERE ADDITIONAL ANCHORS ARE REQUIRED, SCRRA ENGINEER WILL DETERMINE THE NUMBER OF ANCHORS REQUIRED.
5. RAIL ANCHORS 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 ENGINEER.
7. APPLIES TO ALL CONCRETE TIE TRACKS - ML, SIDING, AND YARD.

---

STANDARD RAIL ANCHOR PATTERN PER SCRRA ES2351-02 H OWR,
AND SCRRA ES2355-01 H JOINTED RAIL.

**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, AND MORE ON BOTH RAILS MAY BE OMITTED IF JOINTS ARE PRESENT.
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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 ENGINEER.
7. APPLIES TO ALL CONCRETE TIE TRACKS - ML, SIDING, AND YARD.
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 non-anchor tracks may also 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 feels it necessary to properly restrain the rail from moving longitudinally, rail anchors shall be installed.
**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)

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</table>
SPECIFICATIONS:
CAST STEEL CLIPS
RIGHT AND LEFT HAND
HEAVY zeigt shown

Table: Weight of Rail vs Reinforcing

<table>
<thead>
<tr>
<th>Weight of Rail</th>
<th>Reinforcing</th>
<th>Reinforcing</th>
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<tr>
<td>110 LB</td>
<td>2 1/2&quot;</td>
<td>2 5/8&quot;</td>
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<td>112 LB</td>
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<tr>
<td>130 LB</td>
<td>2 5/8&quot;</td>
<td>2 7/8&quot;</td>
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</table>

TRANSIT CLIP

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
HEAVY zeigt shown

BOLT FOR REPLACING LOOSE RIVETS

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

FOR MAINTENANCE ONLY

FOR MACHINE OPERATED SWITCHES
FOR FACING POINT LOCK OPERATION

SWITCH ROD CLIPS AND BOLTS

NOTES:
1. ALL BOLTS TO BE TURNED BOLTS WITH CUT THREADS.
2. DRILL 5/16" DIA HOLE FOR 1/4" SPRING COTTERS AS SHOWN.
3. SLOTTED NUT SHOWN TO BE AMERICAN STANDARD HEAVY SEMI-FINISHED.
SWITCH POINT CLAMP

NOTES:

1. TO BE INSTALLED ALONG SWITCH POINT BETWEEN POINT OF SWITCH AND NO. 2 ROD.
2. PAINT ASSEMBLY DARK BLUE-EXCEPT THREADS.
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".

1 1/4" DIA X 1 1/2" LG AMERICAN STD REGULAR SQUARE HEAD BOLT WITH NUT AND LOCKING RING (PER DETAIL A) ONE EACH PER ASSEMBLY. BOLT AND JAW ASSEMBLY (PER DETAIL B) SHALL MEET ASTM-A36 MATERIAL STANDARDS.

DETAIL A - NUT AND LOCKING RING

DETAIL B - CLAMP CASTING
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 SMALL TUBES FOR MINOR INSTALLATION REQUIREMENTS.
4. MUST ADHERE TO REQUIREMENTS OF MATERIAL SAFETY DATA SHEET WHEN HANDLING MATERIAL.

NOTES:
1. THE PLUG TO CONFORM TO AREMA STANDARDS.
2. THE PLUG TO BE FABRICATED FROM HARDWOOD TREATED WITH CREOSOTE.
3. MAY BE BUNDLED OR BAGGED.
4. PLUG MUST BE FULLY INSERTED INTO EMPTY SPIKE HOLE AND TAMPERED INTO PLACE. REMOVE EXCESS PLUG WITH ADZE.

MATERIAL SPECIFICATIONS:
1. ALL SCREW SPIKES TO BE NOT FORGED.
2. SCREW SPIKES TO BE MADE FROM MEDIUM CARBON STEEL TO MEET ASTM A-36 SPECIFICATIONS.
3. SCREW SPIKES TO BE COATED TO RESIST CORROSION.
4. APPROXIMATE SHIPPING WEIGHT OF EACH SCREW SPIKE 1.1 LBS.
5. SCREW SPIKES TO BE PACKED 100 TO A BAG.

INSTALLATION INSTRUCTIONS:
1. PRE-DRILL WOOD TIES WITH ¼" DIA DRILL BIT TO DEPTH OF 5 ¼".
2. PRE-DRILED HOLES MUST BE PERPENDICULAR WITH BASE PLATE.
3. USING A ¼" SQUARE DRIVE SOCKET AND AN IMPACT WRENCH, SCREW IN UNTIL SNUG.
4. IMPACT WRENCH, SCREW IN UNTIL SNUG.

NOTES:
1. TRACK SPIKES MUST CONFORM TO AREMA SPECIFICATIONS.
2. WEIGHT = 0.85 LBS.
3. PACKAGE IN 50# BOX OR 100# KG.

NOTES:
1. SCREW SPIKES TO BE PACKED 100 TO A BAG.
2. APPROXIMATE SHIPPING WEIGHT OF EACH SCREW SPIKE 1.1 LBS.
FROG BOLTS, NUTS, AND WASHERS

TABLE OF DIMENSIONS

<table>
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NOTES:

1. ALL BOLTS SHALL BE FROG BOLTS, SQAURE HEAD FROG BOLTS, SQUARE AND HEX NUTS, AND WASHERS WILL BE SUPPLIED WITH SELF-CENTERING WASHERS OR EQUIVALENT.

2. NUTS SHALL CONFORM TO HARDNESS AND MATERIAL REQUIREMENTS OF SAE J429 GRADE 8 OR ASTM A-563 GRADE 'DH' AND DIMENSIONAL REQUIREMENTS OF SAE J995 GRADE 8 OR ASTM A-449 GRADE 8, AND AS DIRECTED BY MANUFACTURER. WORK IN A CIRCULAR PATTERN IN A CLOCKWISE DIRECTION.

3. FLAT WASHERS SHALL CONFORM TO HARDNESS REQUIREMENTS OF THE CURRENT VERSION OF ASTM F-436 AND BE 1/8" THICK.

4. BOLT TIGHTENING SEQUENCE SHALL START WITH THE BOLT NEAREST THE CENTER OF THE FROG, WORK IN A CIRCULAR PATTERN IN A CLOCKWISE DIRECTION.

5. BOLT TIGHTENING SEQUENCE SHALL START WITH THE BOLT NEAREST THE CENTER OF THE FROG, WORK IN A CIRCULAR PATTERN IN A CLOCKWISE DIRECTION.

6. NUTS SHALL CONFORM TO HARDNESS AND MATERIAL REQUIREMENTS OF SAE J429 GRADE 8 OR ASTM A-563 GRADE 'DH', AND DIMENSIONAL REQUIREMENTS OF SAE J995 GRADE 8 OR ASTM A-449 GRADE 8, AND AS DIRECTED BY MANUFACTURER. WORK IN A CIRCULAR PATTERN IN A CLOCKWISE DIRECTION.

NOTE:

- WASHERS SHALL CONFORM TO HARDNESS REQUIREMENTS OF THE CURRENT VERSION OF ASTM F-436 AND BE 1/8" THICK.

- WORK IN A CIRCULAR PATTERN IN A CLOCKWISE DIRECTION.

- BOLT TIGHTENING SEQUENCE SHALL START WITH THE BOLT NEAREST THE CENTER OF THE FROG, WORK IN A CIRCULAR PATTERN IN A CLOCKWISE DIRECTION.

- ALL BOLTS SHALL BE FROG BOLTS, SQUARE HEAD FROG BOLTS, SQUARE AND HEX NUTS, AND WASHERS WILL BE SUPPLIED WITH SELF-CENTERING WASHERS OR EQUIVALENT.

- GAP BETWEEN BOLTS, NUTS, AND WASHERS SHALL BE FREE FROM BURRS, FLAT WASHERS SHALL CONFORM TO HARDNESS REQUIREMENTS OF THE CURRENT VERSION OF ASTM F-436 AND BE 1/8" THICK.

- HEAD MARKINGS SHALL INCLUDE GRADE 8 GRADE MARKINGS, MANUFACTURER ID, MONTH AND YEAR OF MANUFACTURE. THREADS TO BE ROLLED FROM 4140 STEEL. HEAD MARKINGS SHALL INCLUDE GRADE 8 GRADE MARKINGS, MANUFACTURER ID, MONTH AND YEAR OF MANUFACTURE. THREADS TO BE ROLLED FROM 4140 STEEL.

- ALL BOLTS SHALL BE FROG BOLTS, SQUARE HEAD FROG BOLTS, SQUARE AND HEX NUTS, AND WASHERS WILL BE SUPPLIED WITH SELF-CENTERING WASHERS OR EQUIVALENT.

- THREADS TO BE ROLLED FROM 4140 STEEL. HEAD MARKINGS SHALL INCLUDE GRADE 8 GRADE MARKINGS, MANUFACTURER ID, MONTH AND YEAR OF MANUFACTURE. THREADS TO BE ROLLED FROM 4140 STEEL.

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- THREADS TO BE ROLLED FROM 4140 STEEL. HEAD MARKINGS SHALL INCLUDE GRADE 8 GRADE MARKINGS, MANUFACTURER ID, MONTH AND YEAR OF MANUFACTURE. THREADS TO BE ROLLED FROM 4140 STEEL.

- ALL BOLTS SHALL BE FROG BOLTS, SQUARE HEAD FROG BOLTS, SQUARE AND HEX NUTS, AND WASHERS WILL BE SUPPLIED WITH SELF-CENTERING WASHERS OR EQUIVALENT.
TAPERED FROG BOLTS

NOTES:

1. WHEN USING/ORDERING TAPERED BOLTS, ADD 2½" TO OLD BOLT LENGTH
2. BOLT SHOULD CONFORM TO THE CURRENT VERSION OF SAE J429 GRADE 8. HEAT TREATED TO 100,000 PSEUDOMA STRONGY. OIL QUENCHED FROM 980° F. HEAD MARKINGS SHALL INCLUDE GRADE 8 GRADE MARKINGS. MANUFACTURER, MOUTH AND YEAR OF MANUFACTURE. THREADS TO BE ROLL AND CONFORM TO THE CURRENT VERSION OF ASTM F-436 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 B1.2 HEAVY HEX OR SQUARE NUTS, FLAT FINISH. HEAVY HEX OR SQUARE LOCK NUT THREADS SHALL CONFORM TO ANSI/ASME B1.1 UNC-2A THREAD FORM, FREE FIT.
4. FLAT WASHERS SHALL CONFORM TO HARDNESS REQUIREMENTS OF THE CURRENT VERSION OF ASTM F-436 AND BE "" THICK.
5. WORKMANSHIP BOLTS, NUTS, AND WASHERS SHALL BE FREE FROM BURRS, SEAMS, LAPS, AND SCALE.

WASHER

LENGTH - L

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SO NUT OR HEX NUT
NO LUBRICATION REQUIRED

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 FRICITION 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/CMS 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. WASHING COMPENSATING ANGLE SMALL BE 10 DEGREES IN ALL DIRECTION.
6. PARTS SHALL BE MARKED WITH MANUFACTURERS IDENTIFYING CHARACTERISTICS.

DIRECTOR OF ENGINEERING AND CONSTRUCTION

ENGINEERING STANDARDS

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ENGINEERING STANDARDS

SPHERICAL (SELF - CENTERING) WASHER SET
NOTES:
1. FOR RAIL PAD DETAILS, SEE SCRRA ES2364.
2. FOR SIDE POST INSULATOR DETAILS, SEE SCRRA ES2363.
3. FOR RAIL CLIP DETAILS, SEE SCRRA ES2366.
4. FOR TOE INSULATORS DETAILS, SEE SCRRA ES2367.
5. ALL COMPONENTS FOR THE ASSEMBLIES TO BE PANDROL TYPE OR EQUIVALENT AS APPROVED BY THE SCRRA DIRECTOR OF ENGINEERING AND CONSTRUCTION.
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.

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FOR VARIOUS RAIL COMBINATIONS
PANDROL FASTCLIP CONCRETE TIE ASSEMBLIES
FOR RAIL CLIP DETAILS, SEE SCRRA ES2366.
FOR SIDE POST INSULATOR DETAILS, SEE SCRRA ES2363.
FOR TOE INSULATORS DETAILS, SEE SCRRA ES2367.
FOR CONCRETE TIE DETAILS AND FRICTION PATTERN, SEE SCRRA ES2402.

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012

ENGINEERING STANDARDS
PANDROL FASTCLIP CONCRETE TIE ASSEMBLIES
FOR VARIOUS RAIL COMBINATIONS

METROLINK
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
NOTES:
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2. FOR SIDE POST INSULATOR DETAILS, SEE SCRRA ES2367.
3. FOR RAIL CLIP DETAILS, SEE SCRRA ES2366.
4. FOR SIDE POST INSULATOR DETAILS, SEE SCRRA ES2367.
5. ALL COMPONENTS FOR THE ASSEMBLIES TO BE PANDROL TYPE OR EQUIVALENT AS APPROVED BY THE SCRRA DIRECTOR OF ENGINEERING AND CONSTRUCTION.
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

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141 LB RAIL AND 136 LB RAIL CONCRETE TIE

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COMBINATION 115 RE RAIL AND 136 RE RAIL

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COMBINATION 100 RE RAIL AND 136 LB RAIL

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136 RE RAIL AND 136 LB RAIL CONCRETE TIE

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</table>
APPROX WEIGHT = 1.69 LBS.

BEARING AREA OF TOE = 0.7 IN.

THIS CLIP IS TO BE USED FOR BOLTED OR INSULATED JOINTS.

PLATE, AND CURVED TO BE FULLY OUTSIDE PLATE.

CLIPS SHALL BE DRIVEN TO FULLY INSERT STRAIGHT PART OF ANCHOR INTO TWIN CLIPS REQUIRED FOR EACH BASE PLATE.

6" INSIDE BASE.

TYPE OR EQUIVALENT ROLLED STEEL BASE PLATES FOR RAIL WITH 5½" OR PANDROL RAIL CLIP TYPE e2063, AS SHOWN, IS USED WITH PANDROL RAIL.

ELEVATION

MIN REQUIRED TO MAINTAIN ELECTRICAL ISOLATION

PLATE PER SCRRB 321358

Screw Spike Per SCRRB E52453 or E52454

TIE PLATE PER SCRRB 32423 or 32424

WOOD TIE

ELEVATION

MIN REQUIRED TO MAINTAIN ELECTRICAL ISOLATION

PLAN

ELEVATION

MIN REQUIRED TO MAINTAIN ELECTRICAL ISOLATION

NOTE:

1. PANDROL RAIL CLIP TYPE E2063, AS SHOWN, IS USED WITH PANDROL TYPE 2 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.
NOTES:

1. PANDROL PART NO 2055.
2. CLIP IS STANDARD TYPE. GALVANIZED CLIP IS NOT REQUIRED TO COMPLY WITH THIS STANDARD.
FASTCLIP TIE PAD FOR 5 1/2" RAIL

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

FASTCLIP TIE PAD FOR 6" RAIL

PANDROL RAIL PAD ASSEMBLY
(PART #7083)

SECTION A

SECTION B

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012

ENGINEERING STANDARDS
PANDROL CONCRETE TIE PADS
FOR 5 1/2" & 6" RAIL BASE

DIRECTOR OF ENGINEERING AND CONSTRUCTION

REVISION

STANDARD SHEET

SCALE:

CADD FILE:

ENG.

DES.

DATE

REV.

DESCRIPTION

DRAWN BY:

DATE:

FOR NON-SCRRA APPROVED USES:

ALL RIGHTS RESERVED.

ANY FORM OR BY ANY MEANS WITHOUT THE PRIOR WRITTEN PERMISSION OF SCRRA.

USE. NO PART OF THESE STANDARDS SHOULD BE REPRODUCED OR DISTRIBUTED IN

THIS INFORMATION AGREES THAT IT ASSUMES ALL LIABILITY ARISING FROM SUCH

AND REPRESENTATIONS OF ANY KIND ARE DISCLAIMED. ANYONE MAKING USE OF

SCRRA SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF

SCRRA ENGINEERING STANDARDS ARE INTENDED FOR SCRRA APPROVED USES ONLY.
NOTE:
1. COLOR: NATURAL (OFF-WHITE) OR AS SPECIFIED ON PURCHASE ORDER.

STANDARD SIDE POST INSULATOR
(PART #: 7692)

1. Color: Natural (off-white) or as specified on purchase order.
NOTES:
1. PANDROL RAIL CLIP TYPE FC1601 AND FC1603 AS SHOWN ARE USED WITH PANDROL TYPE OR EQUIVALENT FASTCLIP CONCRETE TIE ASSEMBLIES FOR 3/8" BASE AND 5/8" BASE RAIL RESPECTIVELY.
2. TWO CLIPS ARE REQUIRED PER ASSEMBLY. SEE SCRRA ES2360-01 THROUGH ES2360-03.

DIMENSION TABLE

<table>
<thead>
<tr>
<th>DIM</th>
<th>INCHES</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>126</td>
<td>316</td>
</tr>
<tr>
<td>B</td>
<td>80</td>
<td>203</td>
</tr>
<tr>
<td>C</td>
<td>45</td>
<td>114</td>
</tr>
<tr>
<td>D</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>E</td>
<td>192</td>
<td>488</td>
</tr>
<tr>
<td>F</td>
<td>29</td>
<td>73.7</td>
</tr>
</tbody>
</table>

NOTES:
1. TWO CLIPS ARE REQUIRED PER ASSEMBLY. SEE SCRRA ES2366-01 THROUGH ES2366-03.
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.
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.
WELD-ON SHOULDER PANDROL P/N 7299-1

NOTES:
1. ALL WELDS TO BE IN ACCORDANCE WITH AREMA WELDING SPECIFICATIONS, 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. SHOULDER 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.

WELDING DETAIL OF 7299-1 SHOULDER

POSITIONING SHOULDER
<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>POLY INSULATED JOINT BAR 36½&quot; LONG</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>STEEL BACKUP PLATE ½&quot; THICK X 15½&quot; LONG</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>STEEL BACKUP PLATE ½&quot; THICK X 15½&quot; LONG</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>OVAL NECK BOLT 1¾&quot; X 1½&quot; LONG</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>1&quot; LOCK WASHER</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>1&quot; SQUARE NUT</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>PEWTER NUT</td>
</tr>
</tbody>
</table>

**POLY - INSULATED JOINT**

141-136-132 LB. RE RAIL

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA 90012

ENTIRE DRAWING FORMATTED TO 1"=1'-0" ON 1/4"=1'-0" SCALE.
PLATES 1 - 4

A 6\"  
B 6\"  
C 6\"  
D 4\"  

WELDED WEDGE ON PLATES 3 AND 4 ONLY

PLATES 5-8 AND STANDARD

A 6\"  
B 6\"  
C 6\"  
D 4\"

STEEL BLOCK (WEDGE) FOR PLATES 3 & 4

1/2" X 4" A36

ENTRY PLATES

<table>
<thead>
<tr>
<th>PLATE</th>
<th>C (IN)</th>
<th>D (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2.65</td>
<td>3.14</td>
</tr>
<tr>
<td>4</td>
<td>5.34</td>
<td>5.74</td>
</tr>
</tbody>
</table>

STANDARD PLATE

<table>
<thead>
<tr>
<th>PLATE</th>
<th>A (IN)</th>
<th>B (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>10.05</td>
<td>10.05</td>
</tr>
</tbody>
</table>

NOTES:

1. NO INSIDE CLIPS FOR PLATES 1, 2, 3, & 4. STEEL WEDGE ON PLATES 5 & 4.
2. IF 5\" 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\" TO 5\".
3. ALTERNATE (EQUIVALENT TO PANDROL 7229-1)
1. TO DETERMINE HAND OF TRANSITION RAIL:
   A. FACE GAUGE SIDE OF TRANSITION RAIL. IF TRANSITION RAIL IS INSTALL TO EDGE OF TRACK, STAND IN CENTER OF TRACK.
   B. MANUFACTURER'S TAG SHOULD BE VISIBLE IN WEB AREA.
   C. TAG SHOULD READ "GAUGE SIDE".
   D. WHEN HEAVY OR HIGH RAIL IS ON THE RIGHT, IT IS A RIGHT HAND TRANSITION RAIL.

2. TRANSITION RAIL LENGTHS WERE CALCULATED USING 0.75" TO 1" SPACING FOR WOOD AND 0.75" TO 1" SPACING FOR CONCRETE.

3. ALWAYS MEASURE TRANSITION RAIL LENGTH BEFORE CUTTING OLD RAIL.

4. BOX ANCHOR 1-4" SIDE OF TRANSITION RAIL. BOX ANCHOR EACH SIDE OF THE RAIL LENGTH, AS SHOWN.

5. OTHERWISE, ANCHOR PER SCAN 1325-8.

6. HEAD HARDENED RAIL TO BE USED UNLESS OTHERWISE SPECIFIED.

7. MANUFACTURER TO PAINT WEB OF RAIL, 10 FEET CENTERED ON WELD AND 5 FEET LEFT AND RIGHT OF RAIL.

8. MANUFACTURER TO MARK LIFT/BALANCE POINT FOR EACH RAIL LENGTH MANUFACTURED AND ACTUAL WEIGHT OF RAIL, STENCIL ON HEAD OF RAIL.

9. MANUFACTURER TO PAINT WEB OF RAIL 10 FEET CENTERED ON WELD AND 5 FEET LEFT AND RIGHT OF RAIL.

10. MANUFACTURER TO PLACE NON-SCRRA APPROVED USES:

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TRANSITION RAIL 141 LB NEW TO 132 LB 1/2" HEAD LOSS
1 EA TRANSITION RAIL 141 LB NEW TO 132 LB 1/2" HEAD LOSS

BILL OF MATERIALS

RAIL WEIGHT

<table>
<thead>
<tr>
<th>SECTION</th>
<th>141 LB</th>
<th>136 LB</th>
<th>132 LB</th>
</tr>
</thead>
<tbody>
<tr>
<td>136 LB</td>
<td>1/2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>132 LB</td>
<td>6 1/2&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TRANSITION RAIL 141 LB NEW TO 132 LB 1/2" HEAD LOSS
1 EA TRANSITION RAIL 136 LB NEW TO 132 LB 1/2" 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. MANUFACTURED SURFACES MUST BE FREE OF SEAMS AND RIDGES.
4. MANUFACTURER TO MARK LIFT/BALANCE POINT FOR EACH RAIL LENGTH AND ACTUAL WEIGHT OF RAIL, STENCILED ON HEAD OF RAIL.
5. STENCIL IN BLACK THE MFG NAME AND S/N BETWEEN MARKING RAIL TRANSITIONS, i.e. 141-NEW AND 132-1/2" HEAD LOSS AT EACH END OF THE WHITE PAINTING.
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 132-1/2" LOSS AT EACH END OF THE WHITE PAINTING, STENCIL IN BLACK THE WGT 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 1/2" HEAD LOSS.
8. TRANSITION RAIL IS UNIVERSAL AND CAN BE USED AS RIGHT HAND OR LEFT HAND RAIL.
EVERGRIP SCREW SPIKE ¾" X 6½"
PART NUMBER SSEP2094-0650P
PART NUMBER SSEP2094-0650P
PART NUMBER SSEP2094-0650P

NOTES:
1. EASILY DRIVEN WITH CONVERTED AUTOMATIC SPIKE DRIVER, PORTABLE SPIKER OR MAUL.
2. FINS LOCK THE SPIKE INTO THE WOOD PREVENTING BACKWARD ROTATION.
3. CANNOT BE OVERDRIVEN.
NOTES:

1. TRACK PANELS TO BE CONSTRUCTED AS ABOVE.
2. NEW OR SECOND HAND RAIL TO BE DRILLED SECOND AND THIRD HOLES ONLY. HOLES NEAREST END NOT DRILLED. RAIL TO COMPLY TO CURRENT SPECIFICATIONS. RAIL TRANSPOSED SO THAT WORN RAIL IS ON FIELD SIDE OF PANELS. MEASURED ON BOTH ENDS, SHOULD NOT BE MORE THAN ±1/8" GAUGE IS TO BE WITHIN ±1/8" TO PROPER GAUGE OF 56" AT 136 LB. RAIL TO COMPLY TO CURRENT SPECIFICATIONS. RAIL TRANSPOSED SO THAT WORN RAIL IS ON FIELD SIDE OF PANELS.
3. PANEL WEIGHTS

<table>
<thead>
<tr>
<th>PANEL WEIGHTS IN LBS</th>
<th>39'-0&quot; PANEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,300±</td>
<td>10,800±</td>
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</tbody>
</table>

4. ANCHOR PATTERN OF MAIN LINE PANELS ADJUSTED IN THE FIELD DURING INSTALLATION.
5. ANCHOR PATTERN OF MAIN LINE PANELS ADJUSTED IN THE FIELD DURING INSTALLATION.
6. ANCHOR PATTERN OF MAIN LINE PANELS ADJUSTED IN THE FIELD DURING INSTALLATION.

ALLOWABLE SECOND HAND RAIL WEAR

<table>
<thead>
<tr>
<th>RAIL WEIGHT</th>
<th>ALLOWABLE WEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>136 LB</td>
<td>1/8&quot; 1/8&quot;</td>
</tr>
<tr>
<td>115 LB</td>
<td>1/8&quot; 1/8&quot;</td>
</tr>
</tbody>
</table>

7. USE NEW 2" X 8" 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. ANCHOR PATTERN OF MAIN LINE PANELS ADJUSTED IN THE FIELD DURING INSTALLATION.
10. PANEL TO BE MARKED TO INDICATE NEW OR SECOND HAND RAIL WITH INDELIBLE MARKER ON TOP OF RAIL AT CENTER OF PANEL.
NOTES:

1. CONCRETE COMPRESSIVE STRENGTH USING 4" CYLINDERS: 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 LIMITED TO 5.5% IN THE HARDENED CONCRETE

3. THE RAIL SEAT SHALL BE A FLAT SMOOTH SURFACE 

4. GAUGING POINTS FOR FLATNESS AND WIND WIND BETWEEN RAIL SEATS NOT TO EXCEED 3/16" [4.8 mm] BETWEEN THESE POINTS.

5. SEE APPROPRIATE RAIL PATTERN DRAWING FOR WIRE AND STRESSING DETAILS (SCRA ES2405)

6. END OF PRESTRESSING WIRE TO BE CUT OFF WITHIN 3/8" [10 mm] FROM SURROUNDING CONCRETE AT TIE ENDS.

7. THIS CONCRETE IS DESIGNED TO PROVIDE TRACK GAUGE USING TIES AND THE FASTENING COMPONENTS LISTED PER METER. THE OUT-TO-OUT SHOULDER DIMENSION IS CALculated TO PROVIDE THE GAUGE INDICATED ASUMING NOMINAL DIMENSIONS FOR RAIL PADS, INSULATORS, AND RAIL TO PROVIDE THE GAUGE INDICATED 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.

8. RAIL FASTENING INFORMATION:

9. CAST IN COMPONENTS:

10. RAIL SEAT CAST: 0.164" @ 5/8" GAUGING POINT:

11. APPROXIMATE WEIGHT OF TIE = 600 LBS.

12. THIS TIE IS DESIGNED TO PROVIDE TRACK GAUGE USING TIES AND THE FASTENING COMPONENTS LISTED PER METER. THE OUT-TO-OUT SHOULDER DIMENSION IS CALculated TO PROVIDE THE GAUGE INDICATED ASUMING NOMINAL DIMENSIONS FOR RAIL PADS, INSULATORS, AND RAIL TO PROVIDE THE GAUGE INDICATED 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.

13. RAIL FASTENING INFORMATION:

14. CAST IN COMPONENTS:

15. RAIL SEAT CAST: 0.164" @ 5/8" GAUGING POINT:

16. APPROXIMATE WEIGHT OF TIE = 600 LBS.

17. THIS TIE IS DESIGNED TO PROVIDE TRACK GAUGE USING TIES AND THE FASTENING COMPONENTS LISTED PER METER. THE OUT-TO-OUT SHOULDER DIMENSION IS CALculated TO PROVIDE THE GAUGE INDICATED ASUMING NOMINAL DIMENSIONS FOR RAIL PADS, INSULATORS, AND RAIL TO PROVIDE THE GAUGE INDICATED 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.
NOTES:
1. CONCRETE STRENGTH USING CYLINDER STRENGTHS, 28 DAY SPECIFIED = 7000 PSI (USING AIR ENTRAINED CONCRETE).
2. GAUGE INDICATES NOMINAL DIMENSIONS FOR RAIL, RAIL SEAT, AND RAIL SEAT WALL.
3. RAIL SEAT CANT = 1:40 ± 5.
4. APPROXIMATE WEIGHS OF 39000 LB USING AIR ENTRAINED CONCRETE.
5. FOR DIMENSIONAL ACCEPTANCE PURPOSES THE GAUGING DIMENSION BETWEEN OUTER SHOULDERS IS CHECKED WITH GAUGE CHEEKS TO BE WITHIN 1⁄6" OF CALCULATED DIMENSION, AT A HEIGHT OF 0.4" ABOVE THE RAIL SEAT SURFACE. GAUGE CHEEK IS 66.42" ± 0.063."
NOTE:

1. CONCRETE STRENGTH (USING CYLINDER STRENGTHS), 28 DAY SPECIFIED = 7000 PSI
   CONCRETE STRENGTH (USING CYLINDER STRENGTHS), 28 DAY SPECIFIED = 7000 PSI

2. RAIL SEAT CANT = 1:40 ± 5

3. THE RAIL SEAT SHALL BE A FLAT SMOOTH SURFACE 60.04° (1.0mm).

4. APPROXIMATE WEIGHT OF TIE = 600 LBS USING AIR ENTRAINED CONCRETE

5. FOR DIMENSIONAL ACCEPTANCE PURPOSES, THE GAUGING DIMENSION BETWEEN OUTER SHOULDER IS CHECKED WITH GO/NO GAUGES TO BE WITHIN ±7/16" OF NOMINAL DIMENSIONS AT A HEIGHT OF 0.4" ABOVE THE RAIL SEAT SURFACE. GO/NO GAUGE DIMENSION IN 60.42° ± 0.063°.

6. THIS TIE IS DESIGNED FOR USE WITH 136 LB RE RAIL. THIS TIE WILL ALLOWS ACCOMODATE 115, 119, 132, AND 141 LB RAIL WITH MINOR CHANGE IN THIS TIE 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.

7. END VIEW OF TIE WITH A BLACK DIAMOND AS SHOWN.

8. END OF PRESTRESSING WIRE TO BE CUT OFF WITHIN 0.4" OF SURROUNDING CONCRETE AT THE END, AIR ENTRAINED CONCRETE TO BE USED, AIR CONTENT TO BE 5±% ± 1% IN PLASTIC CONCRETE.

9. 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.

10. TIES TO BE MANUFACTURED IN ACCORDANCE WITH ACCEPTED PCI CONSTRUCTION PRACTICE OR SCRRA APPROVED CONSTRUCTION.

11. FASTENING SYSTEM TO BE APPROVED BY SCRRA DIRECTOR OF ENGINEERING AND CONSTRUCTION.

12. FASTENING SYSTEM TO BE APPROVED BY SCRRA DIRECTOR OF ENGINEERING AND CONSTRUCTION.

13. GUARD RAIL FASTENINGS:

14. GUARD RAIL MUST BE SMALLER THAN OR EQUAL IN HEIGHT TO RUNNING RAIL. GUARD RAIL MUST BE SMALLER THAN OR EQUAL IN HEIGHT TO RUNNING RAIL. GUARD RAIL MUST BE SMALLER THAN OR EQUAL IN HEIGHT TO RUNNING RAIL.

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20. GUARD RAIL MUST BE SMALLER THAN OR EQUAL IN HEIGHT TO RUNNING RAIL. GUARD RAIL MUST BE SMALLER THAN OR EQUAL IN HEIGHT TO RUNNING RAIL. GUARD RAIL MUST BE SMALLER THAN OR EQUAL IN HEIGHT TO RUNNING RAIL.
NOTES:
1. ALL SQUARE SPIKE HOLES SHALL HAVE 1/4" FILLETS IN CORNERS.
2. ESTIMATED WEIGHT 10-50 LBS EACH.
3. MUST MEET AREMA SPECIFICATIONS.

ELEVATION

PLAN

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012

DIRECTOR OF ENGINEERING AND CONSTRUCTION

ENGINEERING STANDARDS

REV.

DATE

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A. CARLOS

XX

XX

XX-XX-XX
X
MUST MEET AREMA SPECIFICATIONS.

ESTIMATED WEIGHT: 21.47 LBS EACH.

1. ALL SQUARE SPIKE HOLES SHALL HAVE 1/4" FILLETS IN CORNERS.

2. SQUARE SPIKE HOLES SHALL HAVE 90° NOT TO EXCEED 92°.

3. 1 TO 40±.
NOTES:
1. ALL HOLE MEASUREMENTS TO BE TAKEN FROM BOTTOM OF PLATE.
2. PLATE TO BE STANDARD PANDROL TYPE OR APPROVED
   Equa Ti plate modified for 1" DIAM HOLES
3. PLATE TO BE INSTALLED WITH 4 EACH PANDROL
   RAIL FASTENING "E" CLIP PER SORRA E2355
4. PLATE TO BE INSTALLED WITH 4 EACH SCREW SPIKES
   PER PLATE PER SORRA E2355.

NAME OR BRAND OF MANUFACTURER AND
LAST TWO DIGITS OF YEAR MANUFACTURED
TO BE ROLLED IN RAISED LETTERS

PLAN

SECTION

METROLINK.
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA 90012

ENGINEERING STANDARDS
ROLLED STEEL TIE PLATE
TO SUIT 56" BASE AREMA RAIL
AND PANDROL RAIL CLIPS E2055

A. CARLOS

DIRECTOR OF ENGINEERING AND CONSTRUCTION

ENG. DES.

DATE: 03/31/2011

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ASSISTANT DIRECTOR: STANDARDS & DESIGN
ONE GATEWAY PLAZA, 12TH FLOOR, L. A., CA. 90012
NOTES:
1. ALL HOLE MEASUREMENTS TO BE TAKEN FROM BOTTOM OF PLATE.
2. PLATE TO BE Standard PANDROL TYPE OR APPROVED EQUAL.
3. PLATE TO BE INSTALLED WITH 2 EACH PANDROL RAIL FASTENING "e" CLIP PER SCRRA ES2355.
4. PLATE TO BE INSTALLED WITH 4 EACH SCREW SPIRES PER SCRRA ES2355.

NAME OF BRAND OF MANUFACTURER AND LAST TWO DIGITS OF YEAR MANUFACTURED TO BE ROLLED IN RAISED LETTERS.

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NAME OF BRAND OF MANUFACTURER AND
LAST TWO DIGITS OF YEAR MANUFACTURED
TO BE ROLLED IN RAISED LETTERS.
TIE PLATE SPIKING PATTERNS

NOTES:

1. TIE PLATE SPIKING FOR PLATES WITH HOLD-DOWN SPIKE HOLES:
   - Figure A - Tangent and Curves to 3°00' - 4 Spikes Required, 2 Line and 2 Hold-Down.
   - Figure B - Curves 2°00' 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 - 4 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 the SCRRA Director of Engineering and Construction.

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.

FIGURE A
TANGENT AND CURVES TO 2°00' - 4 SPIKES REQUIRED, 2 LINE AND 2 HOLD-DOWN.

FIGURE B
CURVES 2°01' TO 4° - 5 SPIKES REQUIRED, 3 LINE AND 2 HOLD-DOWN.

FIGURE C
CURVES > 4° - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN.

FIGURE D
TANGENT TRACK WHERE SPEED IS 25 MPH FREIGHT OR 30 MPH PASSENGER OR LESS - 4 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.

FIGURE G
TIE PLATE SPIKING FOR PANDROL TYPE FASTENING SYSTEMS.

FIGURE H
TIE PLATE SPIKING FOR PANDROL TYPE FASTENING SYSTEMS.

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FIGURE F
CURVES OVER 4°00' - 4 LINE SPIKES REQUIRED.

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TIE PLATE SPIKING FOR PANDROL TYPE FASTENING SYSTEMS.

TIE PLATE SPIKING PATTERNS

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   - Figure A - Tangent and Curves to 3°00' - 4 Spikes Required, 2 Line and 2 Hold-Down.
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   - Figure C - Curves over 4°00' - 6 Spikes Required, 4 Line and 2 Hold-Down.

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TIE PLATE SPIKING PATTERNS
FOR "SP" PLATES

1. TIE PLATE SPIKING FOR PLATES WITH HOLD-DOWN SPIKE HOLES
2. FIGURE A - TANGENT TO 2°00' - 4 SPIKES REQUIRED, 2 LINES AND 2 HOLD-DOWN
3. FIGURE B - CURVES OVER 2°00' TO 4°00' INCLUSIVE - 5 SPIKES REQUIRED, 3 LINE AND 2 HOLD-DOWN
4. FIGURE C - OVER 4°00' - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN

NOTE:

TANGENT AND CURVES TO 2°
(FIGURE A)

YARD AND INDUSTRY TRACK
MIN SPIKES PER PLATE

CURVES OVER 2° TO 4°
(FIGURE B)

CURVES > 4°
(FIGURE C)

NOT TO BE USED
THESE HOLES ARE
NOT TO BE USED
THESE HOLES ARE
NOT TO BE USED
THESE HOLES ARE
NOT TO BE USED
THESE HOLES ARE
NOT TO BE USED

NOTE:

OVERSIZED JOINTS
EXCEPT TO CLEAR

TIE PLATE SPIKING PATTERNS
FOR "SP" PLATES

TIE PLATE

ES2460-02
02/07/12
REVISED FIELD AND GAUGE DESIGNATIONS

FOR "SP" PLATES

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012

NOT TO BE USED
THESE HOLES ARE
NOT TO BE USED
THESE HOLES ARE
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02/07/12
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FOR "SP" PLATES

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012
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 non-worked, high carbon steel tie plates.

DIMENSION TABLE

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</table>

DETAIL 1

DETAIL 2

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 non-worked, high carbon steel tie plates.
NOTES:
1. BOLT HOLES SHALL BE CHAMFERED.
2. SPRING WASHERS UP TO APPROXIMATELY 0.78" THICK.
3. ALL BOLT HOLES SHALL BE CHAMFERED.
4. THIS PLAN IS FOR USE IN NEW RAIL INSTALLATION (SEE SCRRA ES2352 FOR EXISTING 115 LB. 5¾" BAR).
5. ALL BOLT HOLES SHALL BE CHAMFERED.

RAIL AND JOINT ASSEMBLY
FOR 115 LB. RE RAIL

SPRING WASHER
UP TO APPROXIMATELY 0.78" THICK.

DETAIL OF HEAD EASEMENT

EASEMENT:
0.031" TO 0.062"

RAIL

LONGITUDINAL SECTION
OF JOINT BAR

BOLT HOLES

ASSEMBLY

JOINT BAR

RAIL END DRILLING

ENGINEERING STANDARDS

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
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JOINT BAR PUNCHING

SIZE OF BOLT HOLES

RAIL AND JOINT ASSEMBLY
FOR 115 LB. RE RAIL

METROLINK.
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA 90012

NOTES:
1. RAILS, JOINT BARS AND TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.
2. DECALIZATIONS AND DIVERS FOR TRACK BOLTS SHALL DESIGNATE DIAMETER OF BOLT PER SCRRA ES2352.
3. LENGTH OF TRACK BOLT WILL PERMIT USE OF SPRING WASHERS UP TO APPROXIMATELY 0.04" THICK.
4. ALL BOLT HOLES SHALL BE CHAMFERED.

115 RE RAIL

JOINT BAR

ASSEMBLY

LONGITUDINAL SECTION
OF JOINT BAR

DETAIL OF HEAD EASEMENT

SIZE OF BOLT HOLES
(IN JOINT BAR)

RAIL END DRILLING

METROLINK.
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA 90012

ENGINEERING STANDARDS
RAIL AND JOINT ASSEMBLY FOR 115 LB RE RAIL
FOR MAINTENANCE USE WITH FORMER "SP"
PUNCH 2½" x 6½" x 6"
1. THIRD HOLE IN 110 LB RAIL TO BE DRILLED IN THE FIELD.
2. USE STANDARD JOINT BAR PER ES2302, MACRISIZED & LABELED TO INDICATE RAIL SIZE AND GAUGE AND FIELD SIDES.
3. USE STANDARD JOINT BAR PER ES2302, MACRISIZED & LABELED TO INDICATE RAIL SIZE AND GAUGE AND FIELD SIDES.

NOTES
1. THE PLAN SHOWS GENERAL INFORMATION FOR COMPROMISE JOINTS.
2. USE STANDARD JOINT BAR PER ES2302, MACRISIZED & LABELED TO INDICATE RAIL SIZE AND GAUGE AND FIELD SIDES.
3. USE STANDARD JOINT BAR PER ES2302, MACRISIZED & LABELED TO INDICATE RAIL SIZE AND GAUGE AND FIELD SIDES.
4. BOLTS FOR COMPROMISE JOINTS ARE SAME AS FOR CORRESPONDING HEAVIER RAIL AND D, G, M AND P FOR THE LIGHTER RAIL.
5. BOLTS FOR COMPROMISE JOINTS ARE SAME AS FOR CORRESPONDING STANDARDS JOINTS.
6. THE TYPE OF HOLES IN COMPROMISE BARS ARE AS SHOWN BELOW. *H* DENOTES HOLLOW HOLES AND *O* DENOTES OVAL HOLES.

HEAVIER RAIL: LIGHTER RAIL

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

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR, L.A., CA. 90012

ENGINEERING STANDARDS
COMPROMISE JOINTS FOR VARIOUS WEIGHTS OF RAILS

CADD FILE:
SCALE:
STANDARD
SHEET

ES2303
NOTES:
1. INSULATED JOINT PLUGS SHALL NOT EXCEED CURRENT AREMA SPECIFICATION CHAPTER 4.
2. INSULATED JOINT PLUGS MUST BE MANUFACTURED FROM NEW HEAD HARDENED RAIL.
3. INSULATED JOINTS SHALL BE INSTALLED AS SHOWN IN PLANS OR AS DIRECTED.
4. GOOD PRACTICE IS TO INSTALL RAIL WITH 6" HEAVY SECTIONS AT JOINTS MANUFACTURED FOR 5'' HEADWEAR.
5. INSULATED JOINTS FOR USE IN TURNOUTS, RAIL WILL BE BENT TO ALLOW FOR CLOSURE OR TURNOUT USE.
6. INSULATED JOINTS TO BE MANUFACTURED AND CURVED IN A CONTROLLED ENVIRONMENT.
7. MANUFACTURER SHALL MARK A BALANCE POINT ON THE HEAD OF RAIL FOR HANDLING.
8. INSULATED JOINT PLUGS SHALL BE CENTERED BETWEEN TIE CRIBS WHEN INSTALLED.
9. SUPPLIERS OF MATERIAL SHOWN ON TRACK STANDARD DRAWINGS SHALL SUBMIT THEIR SHOP DRAWINGS TO SCRRA DIRECTOR OF ENGINEERING AND CONSTRUCTION FOR APPROVAL. MATERIAL SHIPPED WITHOUT WRITTEN APPROVAL FROM SCRRA DIRECTOR OF ENGINEERING AND CONSTRUCTION WILL NOT BE ACCEPTED.
10. PREFABRICATED JOINTS OF OTHER LENGTHS AS SPECIFIED MAY BE REQUIRED IN TURNOUTS.
11. ONLY TURNOUT SIDE JOINTS MANUFACTURED FOR 5'' HEADWEAR.

NOTES: (CONT)
10. PREFABRICATED JOINTS OF OTHER LENGTHS AS SPECIFIED MAY BE REQUIRED IN TURNOUTS.
11. ONLY TURNOUT SIDE JOINTS MANUFACTURED FOR 5'' HEADWEAR.
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 track is hazard to 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 the main track or siding, except where track grade ascends toward main track or siding at a steeper rate.
   d. Any track, regardless of grade that is used for the storage of live cars 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. All new installations of derails as outlined above shall be the double switch point type SCRRA ES2604. Existing sliding or hinged type derails currently applied are authorized except where indicated.

2. On inside of curves over 5 degrees:
   a. On tracks where an uncontrolled car could reach a speed in excess of four (4) mph.
   b. 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 protected by blue flag rules and procedures.
   c. At any other locations 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 figured as noted below. At other locations requiring a derail, a sliding or hinged derail, SCRRA ES2611 or ES2614 will be used.
   a. Locations where uncontrolled movements can exceed 20 mph.
   b. Locations protecting tracks leading to office cars.
   c. Operating track ascends toward main track at grade less than 0.5% or descends toward the main track at any grade.
   d. At other locations designated by SCRRA Director of Engineering and Construction.

4. For details of connecting rods for sliding and hinged derails see SCRRA ES2602.

5. See SCRRA ES2607, ES2611 and ES2614 for derail support and anchors 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.
NOTE:

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

SECTION A-A

POSITION OF CONNECTING ROD WHEN DERAIL IS IN THE OPEN POSITION

POSITION OF CONNECTING ROD WHEN DERAIL IS IN THE CLOSED POSITION

GENERAL PLAN FOR CONNECTING ROD WITH HAYES SLIDING DERAIL
ENGINEERING STANDARDS
16'-6" DOUBLE POINT DERAIL
(LEFT HAND SHOWN)

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 STANDARDS SPECIFICATIONS 54:11.24
5. RH SWITCH POINT DETAIL IS MIRROR IMAGE OF THIS LAYOUT. SEE BILL OF MATERIALS FOR REFERENCES TO SPECIFIC PARTS.

DEPRESSED RAIL HEAD DETAIL

LEGEND
WELDED JOINTS

TURNOUT DATA

SWITCH GEOMETRY:
CENTRAL ANGLE OF TURNOUT CURVE: 5°36'18"

SWITCH SPREAD:
SWITCH ANGLE: 6°41'11"
CENTRAL ANGLE OF CL CURVE: 7°46'58"

ENTRY DISTANCE:
VERTEX DISTANCE: 60'-6"

DEGREE OF CL CURVE:
RADIUS OF CL CURVE: 738'-5½"

SWITCH ANGLE:
CENTRAL ANGLE OF TURNOUT CURVE: 5°36'18"

VERTEX DISTANCE:
SWITCH GEOMETRY:

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

FOR REFERENCE TO SPECIFIC PARTS.

DATE:
S-9P 136
P-14-L 136
P-19-L 136
P-11-L 136
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1 OF 1
P-13-L 136
3 - 13' TIES
P-17-L 136
DESCRIPTION
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8 - 12' TIES
P-10-L 136
16 - 10' TIES
P-15-L 136
11 - 11' TIES
P-18-L 136
8 - 12' TIES
P-11-L 136
9" VERTEX
P-19-L 136
P-21-L 136
S-5P 136
S-9P 136
P-15-L 136
P-18-L 136
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P-18-L 136
S-8P 136
P-11-L 2:19:43 PM
1 OF 1
P-13-L 136
3 - 13' TIES
P-17-L 136
DESCRIPTION
P-18-L 136
8 - 12' TIES
P-10-L 136
16 - 10' TIES
P-15-L 136
11 - 11' TIES
P-18-L 136
8 - 12' TIES
P-11-L 9" VERTEX
P-19-L 136
P-21-L 136
S-5P 136
S-9P 136
P-15-L 136
P-18-L 136
S-8P 136
P-11-L 2:19:43 PM
1 OF 1
P-13-L 136
3 - 13' TIES
P-17-L 136
DESCRIPTION
P-18-L 136
8 - 12' TIES
10'-0"

One Gateway Plaza, 12th Floor, L.A., CA 90012

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY

16'-6" DOUBLE POINT DERAIL
(LEFT HAND SHOWN)
<table>
<thead>
<tr>
<th>ITEM</th>
<th>LH QTY</th>
<th>RH QTY</th>
<th>DESCRIPTION</th>
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<td>CURVED RAIL 4'-7/8&quot; LONG</td>
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<td>TIE PLATE, ROLLED PANDROL, 6&quot; RAIL BASE, CANTED, 1&quot; DIA HOLES</td>
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<td>SERRATED WASHER FOR BOLTLESS BRACE</td>
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<td>SCREW SPIKE, 1/4&quot; DIA X 6&quot; LONG</td>
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<td>PANDROL SPRING CLIP (E2055)</td>
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<td>PANDROL SPRING CLIP (E2056), FOR JOIN BARS</td>
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<td>TIE PLATE, TPE-0, NO CANT</td>
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**MATERIAL SPECIFICATIONS**

**PRODUCT SYSTEM**

<table>
<thead>
<tr>
<th>MANUFACTURER AND PRODUCT</th>
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<tbody>
<tr>
<td>1. 3M SCOTCHLITE HIGH INTENSITY PRISMATIC WHITE GRADE 3930 SHEETING</td>
</tr>
<tr>
<td>2. NIPPON CARBIDE RETRO-REFLECTIVE SHEETING TYPE VIII CRYSTAL GRADE</td>
</tr>
<tr>
<td>3. AVERY DENNISON OMNIPERF 1-9900 PRISMATIC HIGH INTENSITY SHEETING</td>
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<tr>
<td>4. 3M PROCESS COLOR SERIES BL55 INK</td>
</tr>
<tr>
<td>5. NIPPON CARBIDE RETRO-REFLECTIVE SHEETING 3803 INK</td>
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<tr>
<td>6. AVERY DENNISON 4930 INK</td>
</tr>
<tr>
<td>7. NIPPON CARBIDE RETRO-REFLECTIVE SHEETING TYPE VIII CRYSTAL GRADE</td>
</tr>
<tr>
<td>8. AVERY DENNISON OL - 1000 PREMIUM ANTI-GRAFFITI FILM</td>
</tr>
</tbody>
</table>

**INSTALLATION NOTES**

TYPE "B" DERAIL SIGNS SHALL BE USED AT ALL DERAILS PER SCRRA ES2611. SIGNS SHALL BE LOCATED AS PER LOCATION PLAN AND FACING SO AS TO BE READ FROM ENGINE PULLING OUT OF THE SIDE TRACK SELECT OFFICE FROM FIELD SIDE OF NEAREST RAIL SUCH THAT UNDERGROUND UTILITIES SHALL NOT BE DAMAGED WHEN SETTING ANCHOR.

**MATERIAL NOTES:**

1. PANEL SHALL INCLUDE ALUMINUM PANEL, RETROREFLECTIVE SHEETING, POLYURETHANE PAINT, SCREEN-PROCESS COLORS OR FILM, UV PROTECTION OVERLAY, ANTI-GRAFFITI OVERLAY, POSTS, ANCHORS AND HARDWARE.
2. PANEL SHALL BE ALCOA 6061-T6 OR EQUAL.
3. TEXT Font SHALL BE "" Arial Bold "" AS PER SCRRA ES1212.
4. POSTS, ANCHORS, AND HARDWARE SHALL BE AS PER SCRRA ES5520.
5. PANEL SHALL BE PAINTED ON ALL SIDES WITH UV 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.
Installation Requirement Notes:

1. CROWDER WITH SLIDING DERAIL TRENCH.

2. PLACE THE RAIL CONTACTS WITH WHEEL CROWDER POINTS.

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 DERRAILING 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 TO THE MANUAL OR ELECTRIC SWITCH STAND TO THE TURNBUCKET OR 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 5" 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.

6. MAKE SURE THAT YOUR SWITCH STAND (HEAD BLOCK) TIES THAT HOLD THE DERAIL ARE HIGH QUALITY.

7. MAKE SURE THAT YOUR SWITCH STAND (HEAD BLOCK) TIES THAT HOLD THE DERAIL ARE HIGH QUALITY.

8. PLACE COTTER KEYS TO SECURE THE NUTS.

9. INSTALL A SWITCH LOCK.

Installation of Crowder Notes:

1. PLACE THE WHEEL CROWDER TIGHTLY AGAINST THE WEB OF THE RAIL.

2. INSTALL A SWITCH LOCK.

Bill of Material:

<table>
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<th>ITEM</th>
<th>QTY</th>
<th>DESCRIPTION</th>
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<tr>
<td>1</td>
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<td>BI-DIRECTIONAL DERAIL WITH CROWDER</td>
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<td>NORTHERN DERRAIL M-55 C/W CROWDER</td>
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<tr>
<td>10</td>
<td>2</td>
<td>NORTHERN DERRAIL M-55 C/W CROWDER</td>
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</tbody>
</table>

Part No: SCRRA00016

Product No: SCRRA00016
### INSTALLATION REQUIREMENT NOTES:

1. **CROWDER WITH SLIDING DEAIL**:
   - Wheel crowder stroke is 5/8" with 3/8" diameter pins.
   - Paint safety yellow.
   - For proper throw of switch stand to derail/crowder, adjust switch stand crank eye for 5/8" throw.

2. **MAKE SURE THAT YOUR SWITCH STAND HEAD BLOCK CONVENTIONAL TIES**
   - That hold the derail are high quality.

3. **READ THE MANUFACTURERS INSTRUCTIONS**

4. **PLACE THE CROWDER TIGHTLY AGAINST THE RAIL**
   - Smooth both rails to the ties at the proper cause.

5. **FASTEN THE DEAIL AND CROWDER THROUGH ALL THE SCREW**
   - Use the web set screws to adjust and maintain proper wheel contact with the ties.

6. **SPRINE BOTH RAILS TO THE TIES AT THE PROPER GAUGE**
   - Secure the derail and crownder with sliding derail shown.

7. **ATTACH THE SWITC STAND CONNECTING ROD TO THE LEFT LUG ON THE CROWDER**
   - The opposite end of the connecting rod connects to the back of the derail.

8. **ATTACH THE SWITCH STAND CONNECTING ROD TO THE MANUAL OR ELECTRIC**
   - Press the connecting rod to the back of the derail,

9. **INSTALL A SWITCH LOCK**
   - Pre-drill holes to prevent the ties from splitting.

### INSTALLATION OF CROWDER NOTES:

1. **PLACE THE WHEEL CROWDER TIGHTLY AGAINST THE WEB OF THE RAIL**
   - The opposite end of the connecting rod connects to the derail.

2. **RAIL CROWDER MOUNTING BOLT MILE TO BE MATCHED FOR WHEEL CROWDER MOUNTING BOLT HOLE TO BE MATCHED FROM THE WEB OF THE RAIL**
   - With both rails and wheel crowder secured and in derail 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 back of the wheel crowder.

3. **ATTACH THE SWITCH STAND CONNECTING ROD TO THE MANUAL OR ELECTRIC**
   - The opposite end of the connecting rod connects to the back of the derail.

4. **ATTACH THE SWITCH STAND CONNECTING ROD TO THE MANUAL OR ELECTRIC**
   - Press the connecting rod to the back of the derail, then connect the opposite end of the connecting rod with the turnbuckle into the reversing crank mechanism on the back of the wheel crowder.

5. **INSTALL A SWITCH LOCK**
   - Pressure on the connecting rod or switch stand eye with a 5/8" throw, a shorter throw will give you pressure on the connecting rod or switch stand eye with 5/8" throw, pressure on the eye and connecting rod can result in a failure of that component, adjust as necessary.

### BILL OF MATERIAL

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<td>SEE SWITCH STAND WITH TARGET B/W BALL HANDLE SCRRA STANDARD TARGET</td>
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<td>THE MANHOLE COVER, 9&quot; X 12&quot; X 14-1/2&quot;</td>
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<td>THE PLATE HDR-136</td>
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<td>THE PLATE HDR-136</td>
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<td>2</td>
<td>BOLT HEX 1&quot; X 4&quot; OR 5</td>
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<td>2</td>
<td>NUT HEX 1&quot; OR 5</td>
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**PRODUCT NO**

- X56-00000
- X56-00000
- X56-00000
- X56-00000
- X56-00000
- X56-00000
- X56-00000
- X56-00000
- X25-00000

**PART NO**

- SCRRA
- ES2614
- D-XXXX

**BILL OF MATERIAL**

- BI-DIRECTIONAL DERAIL WITH CROWDER
- 36E SWITCH STAND

---

**SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY**

**ONE GATEWAY PLAZA, 12TH FLOOR, L. A., CA. 90012**

**ENGINEERING STANDARDS**

**BIDIRECTIONAL DERAIL WITH CROWDER WITH 36E SWITCH STAND**
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.
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.

Hex head frog bolts supplied with bumping post.

-w 6" x 6" cross angle

HEADING PLATE

Steel bumping post details
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 THE POSTS OF INSULATED JOINTS SHALL BE A MINIMUM OF 6'-6" AND A MAXIMUM OF 10'-0" (FRA REGULATIONS ALLOW 10'-0" STAGGER BUT ABOVE STANDARD SHALL BE APPLIED TO ALL NEW CONSTRUCTION).
4. DISTANCE FROM CLEARANCE POINT TO INSULATED JOINT SHALL BE A MINIMUM OF 6'-6".
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.

SEE CHART
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) siding and yard track switch stands at connections with ctc sidings.
3. All other switch stands on side tracks in yards and on other inside tracks will have yellow targets on both sides.

TARGET SYMBOLS

TARGET PARALLEL WITH TRACK
(NORMAL POSITION OF SWITCH)

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

"SCOTCHLITE" 3" NO 3290 WHITE CUT-OUT NUMBERS TO BE APPLIED IN THE FIELD ON THE FACE SIDE OF SWITCH TARGET ONLY.

TRACK DESCRIPTIONS FOR SPRING SWITCH

18" DIA "S" TARGET FOR SPRING SWITCH

36E TARGET

22E TARGET

COLOR INDICATORS OF TARGETS ON SWITCH STANDS

ENGINEERING STANDARDS

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 12TH FLOOR L.A., CA 90012

METROLINK
COLORS OF SWITCH LIGHTS, THE LONGER SIDE OF TP SHOULD BE PARALLEL TO THE RAIL WHEN THE SWITCH IS LINED FOR THE NORMAL POSITION.

NOTES:
1. USE THE ES2708 STANDS FOR NEW INSTALLATION WORK.
2. THIS LOW STAR SWITCH STAND IS TO BE USED ONLY UNTIL THE STYLE STANDS ARE REPLACED IN THE NORMAL COURSE OF MAINTENANCE OR CAPITAL PROJECT RENEWALS.
3. ONE GATEWAY PLAZA, 12TH FLOOR, L. A., CA. 90012
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.

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY

ENGINEERING STANDARDS

LOW STAR SWITCH STAND
DOUBLE CRANK - DOUBLE HEADBLOCK

METROLINK.
NOTES:
1. ROD SHALL BE SAE1045. THREADS SHALL BE 1/4" 7 UNC-2B.
2. RAIL ENGAGEMENT FITTINGS (SF-21) SHALL BE OF 80,000 PSI TENSILE, 45,000 P cdYIELD, AND 12% ELONGATION PROPERTIES WITH STANDARD MILL TOLERANCES.
3. AFTER ASSEMBLING THE RA125, Buff smooth ALL WRENCH MARKS.
4. PA-6 INSULATORS ARE POLYIMIDE 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".
NOTE:

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

36-EH & 36-E

STAND WITH OPTIONAL STRAIGHT HANDLE

CAP

ROLL PIN 3/8" X 2"

USE SCREW SPIKES ES2355 TO ATTACH STAND TO MEDISLACK TIES (10 SCREW SPIKES REQUIRED)
OPTIONAL 36" STRAIGHT HANDLE
(USE FOR TIGHT CLEARANCE ONLY)

TIE STRAP LOCATION

TIE STRAP

HEADBLOCK TIES

TIE MOUNTING KIT

NOTES:
1. SEE ES2708-01 FOR REST OF THE DRAWING.
2. ES-36 RECOMMENDED USE MAIN TRACK CROSSOVERS AND YARD TRACKS OR OTHER THEN MAIN LINE TRACKS.
3. ES-36H RECOMMENDED USE MAIN TRACK CROSSOVERS AND YARD TRACKS OR OTHER THEN MAIN LINE TRACKS.
4. FOR MAIN LINE INSTALLATION USE MOUNTING KIT, APPLY THE STRAP ON HEADBLOCK TIES OR HEADBLOCK TIES ON THE OPPOSITE SIDE OF TRACK FROM SWITCH STANDS.
5. LUBRICATE INTERNALLY AT LEAST ONCE A YEAR.
6. REFERENCE THE FOLLOWING DRAWINGS:
   - SCREW KIT - ES2455
   - CONNECTING KIT ASSEMBLY - ES2090
   - CONNECTING KIT ASSEMBLY - ES2090
7. STRAIGHT HANDLE TO BE PAINTED SAFETY YELLOW.

BILL OF MATERIAL

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TIE MOUNTING KIT

1/2" SCREW SPACES ES2555
1/2" SPACERS FOR STAND AND 2" FOR STRAP

1/2" X 2" X 2" STEEL STRAP

METROLINK.
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
ONE GATEWAY PLAZA, 10TH FLOOR, L.A., CA. 90012

ENGINEERING STANDARDS

36E & 36EH SWITCH STANDS

03/31/2011
10/5/2011

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TIE STRAP MOUNTING KIT
(10 3/8” X 2” X 2’ STEEL STRAP)

112E HIGH SWITCH STAND

BASE

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’-0”.

BILL OF MATERIALS

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<td>15</td>
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<td>TIE STRAP MOUNTING KIT</td>
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TARGET SPINDLE EXTENSION

1/8” INSIDE, 1 1/8” OUTSIDE SQUARE TUBING
1. Turnbuckle (tighten jam nut) threads showing on connecting rod or adjustment. Start with about 1" of thread engaged on connecting rod.

2. Measure throw between switch point & stock rail at first rod.

3. Set crankeye setting at distance "A" for measured opening and correct stand.

4. Move switch points to half-thrown position (opening equal on both sides) and stand lever in vertical position. Center stand on headblock eye 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 1⁄4" to 1⁄2" above final positions on top of lever.

Pipe 2".

**NOTES:**

1. Use 3⁄4" screw spikes or appropriate PB screws when installing new switch stands on timber or concrete ties.

2. Field inspection of stand is recommended at least annually or when whole stand is used frequently.

3. Oil or grease hole 1⁄4" and add on frequently.

4. Grease should be LG312 lithium grade 2. Reoaming of all internal parts is recommended before use so as to prevent loss of motion in connecting rod/stock rail connections.

5. Differences between crankeye measurements on this drawing and final adjustments are probably due to tolerances (lost motion) in connecting rod/stock rail connections.

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**RACOR 22E & 36E**

Standard side for crankeye.
CONNECTING ROD ASSEMBLY FOR ALL SWITCH STANDS WITH ADJUSTABLE CRANK EYE
(22E, 36E-EH, 112E, etc.)

Includes: HT turned shoulder bolt 1½" dia with 7½" heavy hex jam nut and ⅝" x 1½" cotter

And "Y" dia with 1½" heavy hex jam nut and ⅝" x 1½" cotter

CASTLE NUT
COTTER PIN

JAWS ARE ¾" THICK
Includes: HT machine bolt, heavy hex nut ½" cotter and washer

Rail Size | "X" | Head Rod Thickness
---------|-----|---------------------
90-115 LB | 1½" | 1½" for ⅜" head rods
132-136 LB | 1½" | 1½" for ⅝" head rods
132-136 LB | 1½" | ⅝" for 1" head rods
132-136 LB | 1½" | ⅝" for 1½" head rods

Rail size | "X" | Head Rod Thickness
---------|-----|---------------------
90-115 LB | 1½" | 1½" for ⅜" head rods
132-136 LB | 1½" | 1½" for ⅝" head rods
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