NOTES:
1. The depth of ballast and depth of select material shall be
   decided on the basis of volume of traffic and on the quality
   of selected material and subgrade as determined by SCRRA.
2. Slopes shown for banks in cuts and on fills shall be considered
   standard and generally used but may be modified as required by
   local conditions and character of material if approved by SCRRA.
3. Ballast must be placed in advance of grading so that final
   section will conform to slope requirements and character of
   material if approved by SCRRA.
4. Where off-track roadway is to be provided, extend the roadbed
   section by 8'-0" and maintain 2'-0" slope away from track.
5. All fill slopes shall be faced with cover of material suitable for
   growing grass and having a thickness of approximately 6". The
   outer surface of this cover shall coincide with the design slope
   of the embankment. Material for this cover may be obtained from
   stonemasons.
6. Depth of ditches will vary in order to provide flow line of 0.2%
   minimum grade in ditches and in benches.
7. Sloped bottom ditches are required for main lines. A 3:1 ditch
   is acceptable for industry tracks when right-of-way is limited and
   where local conditions and character of material so require.
   Where right-of-way is limited and where local conditions and
   character of material so require.
8. All minimum dimensions shall be met unless otherwise approved by
   SCRRA assistant director, design.
9. The profile grade line on super-elevated tracks applies to the low
   rail. Maintain 12" depth of ballast beneath the rail.
10. All sections on the mainline are subject to new track construction
    and whose practical track reconstruction.
11. Where topography and right-of-way allows, ditches should be
    placed as far away from the track as possible.
12. Where topography and right-of-way allows, ditches should be
    placed as far away from the track as possible.

CROWN:

ROADBED SECTION FOR TWO MAINLINE TRACKS
OR ADJACENT MAINLINE & SIDING

ROADBED SECTION AT CURVED TRACK
FOR DETAILS NOT SHOWN
SEE CUT AND FILL SECTIONS ELSEWHERE ON THIS SHEET

ROADBED SECTION FOR YARD TRACKS

ROADBED SECTION FOR TURNOUTS
AND CAR SPOTS IN YARDS
SEE SCRRA ES002 FOR REQUIRED LIMITS

DEEP CUT SECTIONS
IN SOIL ROCK
1/8" WEBCROWN SECTION TO BE PROVIDED AT EACH
20' INTERVAL OF HEIGHT ABOVE DITCH BOTTOM
REPEAT BENCHING PATTERN UNTIL CUT LINE INTERSECTS EXISTING GROUND

SECTION IN COMMON MATERIAL
SEE NOTE 2

SECTION IN SOIL ROCK
SEE NOTE 7

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

ENGINEERING STANDARDS
ROADBED SECTIONS FOR TRACK
CONSTRUCTED USING CONCRETE TIES

FILENAME: \scrrapw01app02\iCS_pdf_work_dir\67\482_2\ES2002.dgn
5:13:57 PM
UserName=> scrrapw01app02$
NOTES:

1. APPLICATION: THE STANDARD SHALL BE USED FOR RAILROAD EMBANKMENTS EXPOSED TO OCEAN WAVES. THE RIP-RAP IS USED TO SECURE THE BALLAST FROM EXCURSION DUE TO WAVES AS REQUIRED BY FEDERAL RAILROAD ADMINISTRATION TRACK SAFETY STANDARDS PART 213.035 PROTECTION OF THE BALLAST AND EMBANKMENT BEING FUNDAMENTAL IN SUPPORTING THE TRACK STRUCTURE.

2. DIMENSIONAL DEVIATIONS: DIMENSIONS FOR STONE RIP-RAP ARE THE AVERAGE OF THE EXPOSED SURFACE OF ROCK. DUE TO THE ROUGH SURFACE OF NATURALLY BROKEN ROCK, ANY SPECIFIC POINT MAY VARY TWO FEET FROM THE AVERAGE DIMENSIONS SHOWN.

3. RIP-RAP MATERIAL: MATERIALS SUCH AS GRANITE, BASALT OR SIMILAR IDENTITY OR METAMORPHIC ROCK NATIVE TO ORANGE OR RIVERSIDE COUNTIES, BROKEN INTO SIZE DISTRIBUTION MEETING ASTM D5519 GRADATION WILL BE USED. EXISTING INVENTORIES OF LARGE ROCK MAY BE USED UNTIL EXHAUSTED. CONCRETE, ASPHALT, TIMBER OR METAL IS NOT PERMITTED IN THE RIP-RAP.

4. DIMENSIONAL DEVIATIONS: THEcce, CENTRAL LINE OF THE TRACK, WITH TWELVE FEET (12'-0") TO PROVIDE WHERE FIELD CONDITIONS PERMIT. THE EMBANKMENT SURFACE SHALL BE SUBBALLAST.


7. THE LIMIT LINE SHOULD BE USED FOR RAILROAD EMBANKMENTS EXPOSED TO OCEAN WAVES. THE RIP-RAP IS USED TO SECURE THE BALLAST FROM EXCURSION DUE TO WAVES AS REQUIRED BY FEDERAL RAILROAD ADMINISTRATION TRACK SAFETY STANDARDS PART 213.035 PROTECTION OF THE BALLAST AND EMBANKMENT BEING FUNDAMENTAL IN SUPPORTING THE TRACK STRUCTURE.


9. THE LIMIT LINE MUST BE USED FOR RAILROAD EMBANKMENTS EXPOSED TO OCEAN WAVES. THE RIP-RAP IS USED TO SECURE THE BALLAST FROM EXCURSION DUE TO WAVES AS REQUIRED BY FEDERAL RAILROAD ADMINISTRATION TRACK SAFETY STANDARDS PART 213.035 PROTECTION OF THE BALLAST AND EMBANKMENT BEING FUNDAMENTAL IN SUPPORTING THE TRACK STRUCTURE.


11. AT LOCATIONS WHERE SAND MOVES TO COVER THE RIP-RAP, RIP-RAP SHALL BE LEFT IN PLACE.

12. SCARR MAINTENANCE MANAGER WILL PROVIDE THE GOVERNING AGENCIES ONE MONTH IN ADVANCE OF PLANNED PLACEMENT OF REPLACEMENT RIP-RAP. IF SAND MOVES, THE REPLACEMENT RIP-RAP SHALL BE PLANNED IN LESS THAN THE FULL MONTH NOTIFICATION PERIOD. NOTICE WILL BE GIVEN AS PRIMARY TO PRODUCTIVITY.

13. INSTALLATION AND REPLACEMENT OF ROCK SHALL CONFORM TO FEDERAL GUIDELINES AND SHALL BE PERFORMED PRIOR TO PROVIDING PROTECTION FOR MEMBERS OF THE PUBLIC WHO MAY BE USING THE BEACH.

14. REPLACEMENT OPERATIONS ARE COMPLETE SCRRA WILL MAKE A SURVEY OF THE LIMIT LINE TO DETECT ANY DEVIATIONS FROM THE LIMIT LINE.
5'-4" 12" MIN. BALLAST UNDER TIE (TYP) 6" HMAC UNDERLAY (TYP) TO EXTEND 10' BEYOND THE LIMITS OF PLATFORM AS MEASURED ALONG CL OF TRACK

ON BRIDGES (TYPICAL FOR BOTH ENDS)

CENTER PLATFORM

CONCRETE TIE (TYP)

5'-4" 12"

OUTBOARD PLATFORM 5'-4"

INTER-TRACK FENCE

15'-6" (MIN.) 12"

AT STATIONS (CENTER ISLAND PLATFORM)

AT STATIONS (OUTBOARD PLATFORMS)

6" HMAC UNDERLAY

CONCRETE TIE (TYP)

6" HMAC UNDERLAY (TYP) TO EXTEND 10' BEYOND THE LIMITS OF PLATFORM AS MEASURED ALONG CL OF TRACK

OUTBOARD PLATFORM 5'-4"

INTER-TRACK FENCE

7'-6" 9'-6"

MIN. CLEAR

12" MIN. BALLAST UNDER TIE (TYP) 6" HMAC UNDERLAY

UNDERDRAIN
NOTE:
FOR ADDITIONAL NOTES AND
UNEVENING, SEE ES2001 AND
ES2002.

SECTION

EDGE OF GRADED SHOULDER (TYP)

SUBBALLAST DEPTH
PER DESIGN

SUBGRADE FILL SECTION
PER DESIGN

MAIN TRACK

SIDE TRACK

5'-0" (NTS)

2'-0"

VARIES

75'

75'

MAIN TRACK

SIDE TRACK

BANK
(2:1 MAXIMUM SLOPE)

BANK
(2:1 MAXIMUM SLOPE)

TIE LINE

NOTE:
FOR ADDITIONAL NOTES AND
UNEVENING, SEE ES2001 AND
ES2002.

SECTION

EDGE OF GRADED SHOULDER (TYP)

SUBBALLAST DEPTH
PER DESIGN

SUBGRADE FILL SECTION
PER DESIGN

MAIN TRACK

SIDE TRACK

5'-0" (NTS)

2'-0"

VARIES

75'

75'

MAIN TRACK

SIDE TRACK

BANK
(2:1 MAXIMUM SLOPE)

BANK
(2:1 MAXIMUM SLOPE)

TIE LINE
### 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 10</td>
<td>200</td>
</tr>
<tr>
<td>NO 20</td>
<td>100</td>
</tr>
<tr>
<td>NO 30</td>
<td>72</td>
</tr>
<tr>
<td>NO 40</td>
<td>42</td>
</tr>
<tr>
<td>NO 60</td>
<td>29</td>
</tr>
<tr>
<td>NO 80</td>
<td>19</td>
</tr>
<tr>
<td>NO 100</td>
<td>19</td>
</tr>
<tr>
<td>NO 200</td>
<td>19</td>
</tr>
<tr>
<td>NO 300</td>
<td>0.006</td>
</tr>
<tr>
<td>NO 400</td>
<td>0.004</td>
</tr>
<tr>
<td>NO 500</td>
<td>0.001</td>
</tr>
</tbody>
</table>

### Hydrometer Analysis

- **Percent Passing (by weight)**
- **Percent Retained by Weight**

### Notes:
- Soils engineer will use these requirements as a minimum. Additional subgrade support measures may be necessary as directed by soil engineer's analysis.
- Additional measures may be required per recommendations of an engineering soils analysis.
- Zone of subgrade materials requiring 6" of subballast.

---

**Engineering Standards**

- **SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY**
- **80 WILSHIRE BLVD., SUITE 1500, L.A., CA 90017**

---

**Grain Size Distribution for Subgrade Soils**

- **Coarse**
- **Medium**
- **Fine**
- **Fines**
NOTES:

1. STANDARD PERMANENT AND TEMPORARY CLEARANCES SHOWN ON THIS SHEET SHALL BE USED FOR NEW DESIGN AND CONSTRUCTION WHEREVER PRACTICAL. ANY PERMANENT OR TEMPORARY CONSTRUCTION PROPOSED WITHIN THE DIMENSIONS SHOWN SHALL REQUIRE THE PRIOR APPROVAL OF THE SCRRA ASSISTANT DIRECTOR, DESIGN.

2. STANDARD PERMANENT CLEARANCE FOR STAIRWAYS AND SUPPORT COLUMNS SHALL BE A MINIMUM OF 10'-0" FROM CENTERLINE OF TRACK PROPOSED CLEARANCES LESS THAN THIS DISTANCE SHALL CONFORM TO THOSE SHOWN ON SCRRA ES202 AND WILL REQUIRE THE PRIOR APPROVAL OF THE SCRRA ASSISTANT DIRECTOR, DESIGN.

3. SEE SCRRA ES2104 FOR MINIMUM VERTICAL CLEARANCES FOR OVERHEAD WIRES.

4. SEE SCRRA ES3001, ES3201 AND ES3202 FOR REQUIRED PASSENGER PLATFORM CLEARANCES.

5. RAIL/HIGHWAY GRADE SEPARATIONS MAY REQUIRE PROVISIONS FOR A MAINTENANCE ROAD AND/OR FUTURE ADDITIONAL TRACKS.

6. HIGHER AND WIDER CLEARANCES MAY BE REQUIRED TO PROVIDE VIGILANCE FOR WAYSIDE SIGNALS.

7. NO PARALLEL UTILITIES INSIDE 10'-0" OR INSIDE OF 1.5:1 SLOPE FROM CENTERLINE OF TRACK PROPOSED CLEARANCES LESS THAN THIS DISTANCE SHALL CONFORM TO THOSE SHOWN ON SCRRA ES202 AND WILL REQUIRE THE PRIOR APPROVAL OF THE SCRRA ASSISTANT DIRECTOR, DESIGN.

8. CLEARANCES SHALL BE MEASURED PERPENDICULAR TO THE PLANE CROSSING THE TOP OF BOTH RAILS AND THE VERTICAL CLEARANCE SHALL BE MEASURED FROM THE HIGH RAIL.

CLEARANCE REQUIREMENTS FOR NEW CONSTRUCTION OR DESIGN
BELT 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"
3'-0"
R8'-6"

NOTE B
NOTE A
SWITCH MECHANISMS CLEARANCE LINE FOR

NOTE C

SIDE CLEARANCE DIMENSIONS ARE FOR TANGENT TRACK. IN GENERAL, SIDE CLEARANCE FOR CURVED TRACK SHALL BE 1'-0" GREATER THAN THAT FOR TANGENT TRACK.

PLAT FORMS 4'-0" OR LESS IN HEIGHT WITH MINIMUM CLEARANCE OF 7'-3" MAY BE EXTENDED AT EXISTING CLEARANCES IF SUCH EXTENSION IS NOT IN CONNECTION WITH RECONSTRUCTION OF ORIGINAL PLATFORM.

MINIMUM CLEARANCES SHOWN BELOW ARE FOR:

4) HANDRAILS ON BRIDGES WITH WALKWAYS SHALL BE 8'-6". DECREASED CLEARANCES SHOWN BELOW ARE FOR:

CLEARANCE LINE SHOWN BELOW IS FOR PORTIONS OF BLOCK SIGNALS 4'-0" OR LESS ABOVE TOP OF RAIL.

AND LOCATED BETWEEN TRACKS WHERE NOT PRACTICABLE TO MAINTAIN CLEARANCES OTHERWISE PRESCRIBED.

A. CLEARANCE LINE SHOWN BELOW IS FOR SIGNALS OR SWITCH STANDS 3'-0" OR LESS ABOVE TOP OF RAIL.

C. DECREASED CLEARANCES SHOWN BELOW ARE FOR:

5) PLATFORMS 4'-0" OR LESS IN HEIGHT WITH MINIMUM CLEARANCE OF 7'-3" MAY BE EXTENDED AT EXISTING CLEARANCES IF SUCH EXTENSION IS NOT IN CONNECTION WITH RECONSTRUCTION OF ORIGINAL PLATFORM.
LEGEND FOR CLEARANCE ENVELOPE

1. CLEARANCE MARGIN FOR MAXIMUM DOUBLESTACK CONTAINERS, BRAKE AND TRAVEL CARRIERS. THIS AREA TO BE KEPT CLEAR OF ANY PLATFORMS, TUNNELS, BRIDGE OVERHEADS, PASSENGER PLATFORMS, POLES, UTILITY LINES, INSTALLATION DEVICES, AND ALL OTHER NATURAL OR MAN-MADE STRUCTURES AND OBJECTS.

2. MAXIMUM COMBINATION DOUBLESTACK CARS (8'-6" wide by 9'-8" high. Containers stacked two high, 1'-2" above."

3. ARTICULATED BRAKE LEVEL AUTO CARRIER CAR.

4. TRIPLE LEVEL AUTO CARRIER CAR (CHRYSLER TYPE).

5. AAR PLATE H CLEARANCE ENVELOPE (FOR DOUBLESTACK CARS WITHOUT CONTAINERS).

6. AIR PLATE L CLEARANCE ENVELOPE FOR DOUBLESTACK CARS WITH CONTAINERS.

7. AIR PLATE M CLEARANCE ENVELOPE FOR DOUBLESTACK CARS WITH CONTAINERS.

NOTES:

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

2. MINORITIZED CLEARANCE REQUIREMENTS SHALL BE INCREASED ON CURVES AT RATE OF 0.77" PER DEGREE OF CURVE.

3. WHEN TRACK SUPERELEVATION IS SET APPROPRIATELY FOR THE RAILWAY, CLEARANCE REQUIREMENTS ARE TO BE MAINTAINED PARALLEL TO THE CENTERLINE OF TRACK.

4. DIMENSIONS SHOWN ARE FOR INFORMATION ONLY AND NOT TO BE USED TO ESTABLISH MAXIMUM CLEARANCE REQUIREMENTS OR FOR MAXIMUM LOAD CLEARANCES.

5. IN MANY INSTANCES, STATE LAW MAY REQUIRE GREATER CLEARANCE THAN PROVIDED FOR IN THE COMBINED CLEARANCE ENVELOPE. IN SUCH CASES, THE GREATER CLEARANCE SHALL GOVERN.

6. CLEARANCE ENVELOPE REQUIREMENTS ADOPTED EXCEED MOST STATES PERMISSIVE CLEARANCES FOR LOW PLATFORMS; HOWEVER, THESE CLEARANCE REQUIREMENTS SHALL COVER FOR 8 INCHES OF LOW PLATFORMS.

7. THE PRESCRIBED CLEARANCE MARGIN ENVELOPE MAY BE MODIFIED WHEN APPROVED BY THE SCRRA ASSISTANT DIRECTOR DESIGN.
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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A SPAN WIRE OTHER THAN TROLLEY, SPAN WIRE OVERHEAD GUARD WIRES AND MESSENGERS</td>
</tr>
<tr>
<td>1</td>
<td>CROSSING ABOVE TRACKS OF RAILROADS WHICH TRANSPORT OR PROPOSE TO TRANSPORT FREIGHT CARS (MAXIMUM HEIGHT 20'-9&quot; WHERE NOT OPERATED BY OVERHEAD CONTACT WIRES)</td>
</tr>
<tr>
<td>2</td>
<td>CROSSING OR PARALLEL TO RAILS OR RAILROAD OPERATED BY OVERHEAD TROLLEYS</td>
</tr>
<tr>
<td>3</td>
<td>CROSSING OR ALONG ROADWAYS IN URBAN DISTRICTS OR CROSSING ROADWAYS IN RURAL DISTRICTS</td>
</tr>
<tr>
<td>4</td>
<td>ABOVE GROUND ALONG ROADWAYS IN RURAL DISTRICTS OR ACROSS OTHER AREAS CAPABLE OF BEING TRAVERSED BY VEHICLES OR AGRICULTURAL EQUIPMENT</td>
</tr>
<tr>
<td>5</td>
<td>ABOVE GROUND IN AREAS ACCESSIBLE TO PEDESTRIANS ONLY</td>
</tr>
<tr>
<td>6</td>
<td>VERTICAL CLEARANCE ABOVE WALKABLE SURFACES OR BUILDINGS, (EXCEPT GENERATING PLANTS OR SUBSTATIONS) BRIDGES OR OTHER STRUCTURES WHICH DO NOT ORDINARILY SUPPORT CONDUCTORS, WHETHER ATTACHED OR UNATTACHED</td>
</tr>
<tr>
<td>7</td>
<td>VERTICAL CLEARANCE ABOVE NON-WALKABLE SURFACES OR BUILDINGS, (EXCEPT GENERATING PLANTS OR SUBSTATIONS) BRIDGES OR OTHER STRUCTURES WHICH DO NOT ORDINARILY SUPPORT CONDUCTORS, WHETHER ATTACHED OR UNATTACHED</td>
</tr>
<tr>
<td>8</td>
<td>HORIZONTAL CLEARANCE OF CONDUCTOR AT FEET FROM BUILDINGS (EXCEPT GENERATING PLANTS AND SUBSTATIONS), BRIDGES OR OTHER STRUCTURES UPON WHICH WORKERS MAY WORK WHERE SUCH CONDUCTOR IS NOT ATTACHED THEREON</td>
</tr>
<tr>
<td>9</td>
<td>DISTANCE OF CONDUCTOR FROM CENTER LINE OF POLE, WHETHER ATTACHED OR UNATTACHED</td>
</tr>
</tbody>
</table>

MINIMUM CLEARANCES OF WIRES ABOVE RAILROADS - CASE 1

- CLEARANCES BETWEEN OVERHEAD CONDUCTORS, GUYS, MESSENGERS OR TROLLEY SPAN WIRES AND TOPS OF BUILDINGS, SURFACES OF ROADWAYS OR OTHER GENERALLY ACCESSIBLE AREAS ACROSS, ALONG OR ABOVE WHICH ANY OF THE FORMER PASS; ALSO THE CLEARANCES BETWEEN CONDUCTORS, GUYS, MESSENGERS OR TROLLEY SPAN WIRES AND BUILDINGS, POLES, STRUCTURES, OR OTHER OBJECTS, SHALL NOT BE LESS THAN THOSE SET FORTH IN TABLE 1, AT A TEMPERATURE OF 60°F AND NO WIND.

- THE CLEARANCES SPECIFIED IN TABLE 1, CASES 2 TO 6 INCLUSIVE, SHALL IN NO CASE BE REDUCED MORE THAN 5% BELOW THE TABULAR VALUES BECAUSE OF TEMPERATURE AND LOADING AS SPECIFIED IN CPUC G.O. 95 RULE 43.

- THE CLEARANCES SPECIFIED IN TABLE 1, CASE 1, COLUMNS A, B, D AND E, SHALL IN NO CASE BE REDUCED MORE THAN 10% BECAUSE OF TEMPERATURE AND LOADING AS SPECIFIED IN CPUC G.O. 95 RULE 43.

- CLEARANCES BETWEEN OVERHEAD CONDUCTORS, GUYS, MESSENGERS OR TROLLEY SPAN WIRES AND BUILDINGS, POLES, STRUCTURES, OR OTHER OBJECTS, SHALL NOT BE LESS THAN THOSE SET FORTH IN TABLE 1, CASE 1, THROUGH THE BREAKING OF A CONDUCTOR IN EITHER OF THE ADJOINING SPANS.

- CLEARANCES BETWEEN OVERHEAD CONDUCTORS, GUYS, MESSENGERS OR TROLLEY SPAN WIRES AND BUILDINGS, POLES, STRUCTURES, OR OTHER OBJECTS, SHALL NOT BE LESS THAN THOSE SET FORTH IN TABLE 1, CASE 1, AT A TEMPERATURE OF 60°F AND NO WIND.

- THE CLEARANCES SPECIFIED IN TABLE 1, CASES 2 TO 6 INCLUSIVE, SHALL IN NO CASE BE REDUCED MORE THAN 5% BELOW THE TABULAR VALUES BECAUSE OF TEMPERATURE AND LOADING AS SPECIFIED IN CPUC G.O. 95 RULE 43.

- THE CLEARANCES SPECIFIED IN TABLE 1, CASE 1, COLUMNS A, B, D AND E, SHALL IN NO CASE BE REDUCED MORE THAN 10% BECAUSE OF TEMPERATURE AND LOADING AS SPECIFIED IN CPUC G.O. 95 RULE 43.

- CLEARANCES BETWEEN OVERHEAD CONDUCTORS, GUYS, MESSENGERS OR TROLLEY SPAN WIRES AND BUILDINGS, POLES, STRUCTURES, OR OTHER OBJECTS, SHALL NOT BE LESS THAN THOSE SET FORTH IN TABLE 1, CASE 1, THROUGH THE BREAKING OF A CONDUCTOR IN EITHER OF THE ADJOINING SPANS.
**NOTES:**

*The volume noted in the tables are assumed to be final compacted volume. Volumes shown are for 15' track centers. If track centers vary from 15' then the values need to be adjusted accordingly.*

### HMAC Volume Quantities

<table>
<thead>
<tr>
<th>Turnout No</th>
<th>Area of HMAC</th>
<th>Volume of 6&quot; HMAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2400</td>
<td>42</td>
</tr>
<tr>
<td>14</td>
<td>3340</td>
<td>67</td>
</tr>
<tr>
<td>20</td>
<td>4340</td>
<td>85</td>
</tr>
<tr>
<td>24</td>
<td>5100</td>
<td>113</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crossover</th>
<th>Track Center</th>
<th>Area of HMAC</th>
<th>Volume of 6&quot; HMAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>15</td>
<td>4490</td>
<td>77</td>
</tr>
<tr>
<td>14</td>
<td>15</td>
<td>2430</td>
<td>105</td>
</tr>
<tr>
<td>20</td>
<td>15</td>
<td>9700</td>
<td>165</td>
</tr>
<tr>
<td>24</td>
<td>15</td>
<td>11,780</td>
<td>218</td>
</tr>
</tbody>
</table>

**Legend:**

- `NOT MIX ASPHALT CONCRETE`
- `BALLAST`
- `SUBBALLAST`
- `SUBGRADE`
No markings are required on track with maximum authorized speed of 10 MPH or less unless its centerline is less than 250 ft measured perpendicular from the centerline of another track with maximum authorized speed greater than 10 MPH.

At grade crossings, no markings are required between multiple grade crossings less than 550 ft apart as measured along track CL.

Select the next tie beyond the clearance point. Apply white federal safety paint to the entire surface of the tie as well as the tie plates and the gauge and field sides of the rails up to the top of the web. Do not paint the rail heads.

Cars or other rail-borne equipment may occupy any part of the track between the marked tie and the grade crossing.

250' (Typ)

10 MPH Track

Paint tie (Typ)

250' (Typ)

250' or greater

Paint tie (Typ)

250' (Typ)

250' (Typ)

LESS THAN 550' (Typ)
INSTRUCTIONS FOR MARKING NO RIDE ZONE
FOR SIDE AND SECONDARY TRACKS
(BASED ON 13'-6" CLEARANCE POINT)

CASE 1: DIVERGING TRACKS
WHERE A TRACK TURNS OUT AND CONTINUES TO DIVERGE FROM THE PARENT TRACK, THE 13'-6" CLEARANCE POINT SHALL BE WHERE THE DISTANCE BETWEEN THE FIELD SIDES OF THE TWO CLOSEST RAILHEADS IS 8'-4" MEASURED PERPENDICULAR TO THE CENTERLINE OF THE PARENT TRACK.

SELECTING AND MARKING NO RIDE ZONE

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.

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

ENGINEERING STANDARDS
TRACK CLEARANCE POINTS
(NO RIDE ZONE)
SWITCH STAND PLACEMENT

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'-4" high stands or 6'-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 when the switch is lined for the main track.

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.

TYPICAL ALIGNMENT WITH NO CLEARANCE RESTRICTIONS
ENGINEERING STANDARDS

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

ASSISTANT DIRECTOR, DESIGN
PRINCIPAL ENGINEER, DESIGN & STANDARDS

NOTE:
1. THE WALKWAY DIMENSIONS SHOWN BELOW ARE IN COMPLIANCE WITH CPUC MINIMUM WALKWAY STANDARDS. PLEASE SEE SCRR STANDARDS ES2001 AND ES2002 FOR DIMENSION GUIDELINES FOR PERIMETER AND WALKWAYS REQUIRED FOR NEW CONSTRUCTION.

2. BALLAST TYPE 4A AND TYPE 5 GRADATIONS ARE DEPICTED ON SCRR STANDARD ES2007-02. TYPE 4A BALLAST IS REQUIRED FOR MAIN LINE OPERATIONS, TYPE 5 BALLAST IS REQUIRED FOR MAIN LINE OPERATIONS.

3. DIMENSIONS FOR TURNOUT WALKWAYS ARE DEPICTED AND DEPEND ON CERTAIN FACTORS.

4. NO REQUESTS FOR DESIGN EXCEPTIONS IN EXCESS OF THE REQUIREMENTS OF CALIFORNIA PUBLIC UTILITIES COMMISSION GENERAL ORDERS 26D AND 118 WILL BE CONSIDERED.

5. WALKWAY STANDARDS REQUIREMENTS FOR NEW CONSTRUCTION:
   A. FOR MAIN TRACK WALKWAYS, STANDARD 2 WILL BE REQUIRED ON ALL SCRR MAIN TRACKS WITH LESS THAN 20 FOOT CENTERS.
   B. FOR MAIN TRACK TURNOUTS CONTROLLED WITH A SWITCH MACHINE WALKWAY STANDARD 2 WILL BE REQUIRED.
   C. FOR MAIN TRACK TURNOUTS WITH HAND THROW OR MANUAL CONTROL ONLY, WALKWAY STANDARD 3 WILL BE REQUIRED FOR HAND CONTROLLED INDUSTRY TRACKS.
   D. FOR MAIN TRACK CONTROLLED WITH A SWITCH MACHINE WALKWAY STANDARD 4 OR 5 WILL BE REQUIRED FOR YARD OR LAYOUT TRACK TURNOUTS WITH BALLAST. WALKWAY STANDARD 5 WILL BE REQUIRED FOR BALLAST TYPE #4A AND #5 GRADATIONS.
   E. FOR YARD OR LAYOUT TRACK TURNOUTS WITH BALLAST WALKWAY STANDARD 4 OR 5 WILL BE REQUIRED. BALLAST TYPE #4A BALLAST IS REQUIRED FOR BALLAST TYPE #5.
   F. FOR YARD OR LAYOUT TRACK TURNOUTS IN LAYOVER OR INDUSTRY TRACKS WALKWAY STANDARD 4 OR 5 WILL BE REQUIRED.

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

2. BALLAST TYPE #4A AND TYPE #5 GRADATIONS ARE DEPICTED ON SCRR STANDARD ES2007-02. TYPE 4A BALLAST IS REQUIRED FOR MAIN LINE OPERATIONS, TYPE 5 BALLAST IS REQUIRED FOR EMBANKMENT AND WALKWAYS REQUIRED FOR NEW CONSTRUCTION.

3. DIMENSIONS FOR TURNOUT WALKWAYS ARE DEPICTED AND DEPEND ON CERTAIN FACTORS.

4. NO REQUESTS FOR DESIGN EXCEPTIONS IN EXCESS OF THE REQUIREMENTS OF CALIFORNIA PUBLIC UTILITIES COMMISSION GENERAL ORDERS 26D AND 118 WILL BE CONSIDERED.

5. WALKWAY STANDARDS REQUIREMENTS FOR NEW CONSTRUCTION:
   A. FOR MAIN TRACK WALKWAYS, STANDARD 2 WILL BE REQUIRED ON ALL SCRR MAIN TRACKS WITH LESS THAN 20 FOOT CENTERS.
   B. FOR MAIN TRACK TURNOUTS CONTROLLED WITH A SWITCH MACHINE WALKWAY STANDARD 2 WILL BE REQUIRED.
   C. FOR MAIN TRACK TURNOUTS WITH HAND THROW OR MANUAL CONTROL ONLY, WALKWAY STANDARD 3 WILL BE REQUIRED FOR HAND CONTROLLED INDUSTRY TRACKS.
   D. FOR MAIN TRACK CONTROLLED WITH A SWITCH MACHINE WALKWAY STANDARD 4 OR 5 WILL BE REQUIRED FOR YARD OR LAYOUT TRACK TURNOUTS WITH BALLAST. WALKWAY STANDARD 5 WILL BE REQUIRED FOR BALLAST TYPE #4A AND #5 GRADATIONS.
   E. FOR YARD OR LAYOUT TRACK TURNOUTS IN LAYOVER OR INDUSTRY TRACKS WALKWAY STANDARD 4 OR 5 WILL BE REQUIRED. BALLAST TYPE #4A BALLAST IS REQUIRED FOR BALLAST TYPE #5.
1. Vertical curves as calculated in item 6 below shall be used to connect all changes in grades.
2. The length of vertical curves is determined by changes in grade, vertical acceleration and the speed of the train.
3. The purpose of vertical curves is to ease the change of the grades in order to reduce coupler and derailment forces and eliminate the danger of breaking the train in two as a direct result of transitory movement. Properly designed vertical curves will provide for passenger comfort and safety.
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 formula:
   \[ \text{LVC} = D \times V \times K \]
   Where:
   - \( A \) = Vertical acceleration in feet/sec/seg in \( \text{ft}^2/\text{sec}^2 \)
   - \( D \) = Absolute value of the difference in rates of grades expressed as a decimal
   - \( V \) = Design speed in miles per hour
   - \( K \) = Conversion factor to give \( \text{LVC} \) in feet

   It is recommended practice to round the calculated minimum \( \text{LVC} \) to a convenient whole number.

   The recommended vertical acceleration \( A \) shall be selected based on the type of operations and is the same for both sags and summits. Deviations from these acceleration criteria may be authorized by the SCRRA assistant director/design. The longest vertical curve computed by these methods with each criteria will govern.

   Example calculation for freight operations:
   \[ \text{LVC} = 0.01 \times 75 \times 2.15 = 205 \text{ feet} \]
   Example calculation for passenger operations:
   \[ \text{LVC} = 0.01 \times 50 \times 2.15 = 540 \text{ feet} \]

Summit curves:

Sag curves:

Abbreviations:
- G1: Approaching Grade
- G2: Departing Grade
- PVC: Point of Vertical Curve
- LVC: Length of Vertical Curve
- PVI: Point of Vertical Intersection
- PVC: Point of Vertical Tangency
- VC: Vertical Curve

Example calculation for passenger operations:

- \( A \) = 0.10 \text{ ft/seg/seg} (freight)
- \( D = 0.01 \text{ (+.005)-(-.005)} \)
- \( K = 2.15 \text{ conversion factor to give LVC in feet} \)
- \( PVI = 0.50\% \text{ approach grade meeting } -0.50\% \text{ departure grade. Maximum design speed is 75 mph.} \)
- \( \text{LVC} = (0.01) \times 25 \times 2.15 = 57.5 \text{ feet} \)

Example calculation for freight operations:

- \( A \) = 0.50 \text{ ft/seg/seg} (vertical acceleration (freight))
- \( D = 0.01 \text{ (+.005)-(-.005)} \)
- \( K = 2.15 \text{ conversion factor to give LVC in feet} \)
- \( \text{LVC} = (0.01) \times 75 \times 2.15 = 205 \text{ feet} \)
<table>
<thead>
<tr>
<th>CURVE OR TOWING NO</th>
<th>DESCR</th>
<th>HEADING DISTANCE</th>
<th>STATION</th>
<th>NORTING</th>
<th>EASTING</th>
<th>UC</th>
<th>E0</th>
<th>E1</th>
<th>V (PAS)</th>
<th>V (FRT)</th>
<th>LS</th>
<th>L</th>
<th>T</th>
<th>H</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>p</th>
<th>L1</th>
<th>S1</th>
<th>L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>POB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIRCULAR CURVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH TRANSITIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>TS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>SS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>TURNOUT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C33</td>
<td>FT3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PI3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>CS3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>SS3</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>COMPOUND CIRCULAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CURVE WITH TRANSI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>TS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>CS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>SIMPLE CIRCULAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CURVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M3</td>
<td>TS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>COMPOUND CIRCULAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CURVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M4</td>
<td>TS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**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 MAKE AN INFINITE NUMBER OF CIRCULAR ARCS.
4. FOR FREIGHT-ONLY OPERATIONS, COLUMN "V (FRT)" WILL REMAIN BLANK. FOR PASSENGER-ONLY OPERATIONS, COLUMN "V (FRT)" WILL REMAIN BLANK.
5. IN THE EVENT A DESIGNER MUST PROPOSE A CURVE THAT DOES NOT MEET DESIGN REQUIREMENTS PER SCRRA ES2203 AND ES2204, THE DESIGNER SHALL CLEARLY INDICATE IT ON THE GEOMETRY TABLE. THE DESIGNER SHALL, FOR EACH PROPOSED SUBSTANDARD CURVE, SUBMIT TO SCRRA A WRITTEN REQUEST AND JUSTIFICATION FOR A DESIGN WAIVER.
**GENERAL**

1. There are six tables of design and maintenance standards for SCRR
2. Chart alignment.
3. Table P.5.5 - Inclination Elevation - Standard Spiral Length Table for Passenger Operations
4. Table P.3.5 - Inclination Elevation - Standard Spiral Length Table for Freight Operations
5. Table F.3.5 - Inclination Elevation - Standard Spiral Length Table for Freight Operations
6. Table P.3.5M - Inclination Elevation - Maintenance Limit for Freight Operations
7. Table F.3.5M - Inclination Elevation - Maintenance Limit for Freight Operations
8. Table P.4.0 - Inclination Elevation - Maintenance Limit for Passenger Operations
9. Table F.4.0 - Inclination Elevation - Maintenance Limit for Passenger Operations

**CURVE DESIGN PROCEDURE**

1. Refer to AREMA Chapter 5.5 for a complete discussion of curve design.
2. In order to select the interchange and spiral layout for curves, the design speeds for freight and passenger trains must be determined. A shape is selected that will fit the standard of the spiral length and super-elevation for the selected speed. The speed will be shown to the design engineer for approval with good train handling, spiral spacing and practical limits of equipment performance and design in acceptable freight train operation and maintenance environment.
3. The curves shall be designed using the future maximum design speed for freight and passenger trains expected on a given subdivision. Future maximum speeds for passenger and freight trains may exceed speeds currently in effect. That may result in spiral lengths that are longer than required to preserve the proposed super-elevation runout for the case of curve. The spiral length design for passenger and freight trains at each location, the spiral length design should be used for all trains unless the actual design operating speeds are below the future maximum design speed.
4. The maximum speed for future design is 600 miles per hour.
5. All new works shall use Tables P.5.5 and F.3.5 to select standard spiral length spirals. Tables with elliptical are to be used only on the ventura and anticipate valley subdivisions and only at locations constrained by the existing track profile. These tables are for new works. Table tables P.5.5, F.3.5, P.3.5 and F.3.5 must be connected through reduction of train speed and alignment to the track characteristics.
6. Tangents between curves shall be equal to 3 times the maximum design speed, in miles per hour, or 100 feet, whichever is greater. For example, a design speed of 30 miles per hour will require a tangent with a minimum length of 150 feet. If the position, exceptions will require the approval of the engineer. If so, the tangent shall be specified.
7. All design speeds must be approved by the SCRA assistant director, design and the SCRA manager of signal and communications.
8. Speeds should be estimated in consideration of placement of the speed sign for a passenger route whenever there is superelevation in the line.
9. Speed and super-elevation will be consistent in consideration of the speed and super-elevation on the line. The minimum spiral length at the start of the super-elevation is at the tangent to the curve. Therefore, standard design spiral lengths are not exceed the tangent. Therefore, standard design spiral lengths are not exceed the tangent. Therefore, standard design spiral lengths are not exceed the tangent. Therefore, standard design spiral lengths are not exceed the tangent.
10. Actual elevation greater than 5 inches is not permitted without prior approval of the super-elevation. The super-elevation is to be considered at the tangent to the curve. The super-elevation is to be considered at the tangent to the curve. The super-elevation is to be considered at the tangent to the curve.
11. Superelevation through grade crossings will be considered with consideration of a compound curve. A compound of spiral is not required where the super-elevation is less than 2 inches. A compound of spiral is not required where the super-elevation is less than 2 inches. A compound of spiral is not required where the super-elevation is less than 2 inches. A compound of spiral is not required where the super-elevation is less than 2 inches.
12. Superelevation for freight trains should be in uniformity with the super-elevation of passenger trains. The super-elevation for freight trains should be in uniformity with the super-elevation of passenger trains. The super-elevation for freight trains should be in uniformity with the super-elevation of passenger trains. The super-elevation for freight trains should be in uniformity with the super-elevation of passenger trains.
13. The curve will have to meet the 3.0 - inch unbalanced elevation at the crest of the spiral. The curve will have to meet the 3.0 - inch unbalanced elevation at the crest of the spiral. The curve will have to meet the 3.0 - inch unbalanced elevation at the crest of the spiral. The curve will have to meet the 3.0 - inch unbalanced elevation at the crest of the spiral.
14. Freight train maximum authorized speed shall be based on a standard unbalanced elevation between 1 and 2.0 inches. Freight train maximum authorized speed shall be based on a standard unbalanced elevation between 1 and 2.0 inches. Freight train maximum authorized speed shall be based on a standard unbalanced elevation between 1 and 2.0 inches. Freight train maximum authorized speed shall be based on a standard unbalanced elevation between 1 and 2.0 inches.
15. The criteria for design are:
   - Maximum speed for passenger trains is 100 miles per hour.
   - Assume the same super-elevation as that of the passenger trains.
   - Engage both the passenger and freight trains from the super-elevation runout for the case of curve. The spiral length design should be used for all trains unless the actual design operating speeds are below the future maximum design speed.
16. These design standards do not replace FRA track safety standards FAR 18.1231.3. In addition, it is required to comply with the overall parameters of super-elevation and spiral length curves and must also comply with all parts of 181.3. When selecting the super-elevation and spiral length, maintenance personnel must ensure that the new design criteria will be matched with the FRA limits. Maintenance personnel must ensure that the new design criteria will be matched with the FRA limits.
17. The horizontal alignment of spiral curves may be designed by:
   - Ten chord spiral - AREMA chapter 5.3.12
   - Clothoid spiral generated under CAD design, which meets AREMA chapter 5.3.1.2
   - Ten chord spiral - AREMA chapter 5.3.1.2
   - Ten chord spiral - AREMA chapter 5.3.1.2
18. This data should be entered on the track charts and as updates to the field marking will be updated.
19. Runoff of super-elevation on tangent track is not permitted.

**SAMPLE CURVE DESIGN PROBLEM**

Set maximum design speed and degree of curvature for freight and passenger trains expected on a given subdivision. The design and maintenance of curve geometry is controlled by FRA. The overall parameters of super-elevation and spiral length, maintenance personnel must ensure that the new design criteria will be matched with the FRA limits.

- Maximum speed for passenger trains is 100 miles per hour.
- Assume the same super-elevation as that of the passenger trains.
- Engage both the passenger and freight trains from the super-elevation runout for the case of curve. The spiral length design should be used for all trains unless the actual design operating speeds are below the future maximum design speed.

1. Look up the "L" and "D" for a 2.0 - 0.5' curve at 70 mph in the standard spiral length table for passenger operations. Table P.5.5.
2. Now check curve freight speed and actual elevation of the 2.0 - 0.5' curve in the standard spiral length table for freight operations. Table F.5.3.
3. The curve will need to have 3.0 - inch unbalanced elevation and the spiral will need to be 300 feet because the passenger train maximum speed is 100 miles per hour.
## Table P3.5 - 3.5 Inch Unbalanced Elevation for Passenger Operations - Standard Spiral Lengths

### Abbreviations
- E: Equilibrium Elevation of Outside Rail (ft)
- V: Maximum Allowable Operating Speed (mph)
- Ls: Spiral Length (ft)
- Es: Actual Elevation of Outside Rail (ft)
- D: Degree of Curvature (Decimal Degrees)

### Formulas
- \( E_s = E \times \frac{V}{12000} \)
- \( L_s = E \times D \)

### Standard Spiral Length Table

| 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 0°15' | 0.00' | 40' | 0.00' | 40' | 0.00' | 40' | 0.00' | 40' | 0.00' | 40' | 0.00' | 40' | 0.00' | 40' | 0.00' | 40' | 0.00' | 40' | 0.00' |

### Notes:
1. No spirals or super-elevations will be permitted to the right of heavy line without prior approval from the SCRRA Assistant Director, Design.
2. Where curvature is more than 4 minutes, more than a listed figure, the next higher elevation and resulting spiral length will be used.
### TABLE F2.0 - 2.0 INCH UNBALANCED ELEVATION FOR FREIGHT OPERATIONS - STANDARD SPIRAL LENGTHS

<table>
<thead>
<tr>
<th>( L_s )</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
<th>75</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 0.00 )</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>( 0.25 )</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>( 0.50 )</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>( 1.00 )</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### FORMULAS

- \( L_s = \text{SPIRAL LENGTH (FT)} \)
- \( E_t = \text{DEGREE OF CURVATURE (DECIMAL DEGREES)} \)

### EMERSON STANDARDS

- **ENGINEERING STANDARDS:**
  - TABLE F2.0 - 2.0 INCH UNBALANCED ELEVATION STANDARD SPIRAL LENGTH TABLE FOR FREIGHT OPERATIONS

### NOTES:

1. No spirals or super elevations will be permitted to the right of heavy line without prior approval from the SCERA Assistant Director of Design.
2. Where curvature is more than 5 minutes more than a listed figure, the next higher elevation and resulting spiral length will be used.

---

**ABBREVIATIONS**

- \( E_t \) = Actual Elevation of Outside Rail (in)
- \( V_{\text{max}} \) = Maximum Allowable Operating Speed (mph)
- \( D \) = Degree of Curvature (decimal degrees)
- \( L_s \) = Spiral Length (ft)
- \( \Delta \) = Unbalanced Elevation (in)
- \( D = \) Maximum Allowable Operating Speed (mph)
- \( L_s = \) Spiral Length (ft)
- \( E_t = \) Degree of Curvature (decimal degrees)
### TABLE P3.5M - 3.5 INCH UNBALANCED ELEVATION FOR PASSENGER OPERATIONS - MINIMUM SPIRAL LENGTHS

#### ABBREVIATIONS
- $E_0$ = Equilibrium Elevation of Outside Rail (in)
- $V_{m0}$ = Maximum Allowable Operating Speed (mph)
- $E_u$ = Unbalanced Elevation of Outside Rail (in)
- $L_s$ = Spiral Length (ft)
- $D$ = Degree of Curvature (degrees)

#### FORMULAS
- $E = 0.0007DV_{m0}$
- $E_u = E - E_0$

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

<table>
<thead>
<tr>
<th>$D$</th>
<th>$L_s$</th>
<th>$E_0$</th>
<th>$E$</th>
<th>$E_u$</th>
<th>$V_{m0}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>0.00</td>
<td>35°</td>
<td>50°</td>
<td>0.00</td>
<td>60°</td>
</tr>
<tr>
<td>1°</td>
<td>0.00</td>
<td>50°</td>
<td>60°</td>
<td>0.00</td>
<td>80°</td>
</tr>
<tr>
<td>2°</td>
<td>0.00</td>
<td>70°</td>
<td>170</td>
<td>0.00</td>
<td>100°</td>
</tr>
<tr>
<td>3°</td>
<td>0.00</td>
<td>120°</td>
<td>270</td>
<td>0.00</td>
<td>120°</td>
</tr>
<tr>
<td>4°</td>
<td>0.00</td>
<td>180°</td>
<td>330</td>
<td>0.00</td>
<td>180°</td>
</tr>
<tr>
<td>5°</td>
<td>0.00</td>
<td>230°</td>
<td>420</td>
<td>0.00</td>
<td>230°</td>
</tr>
<tr>
<td>6°</td>
<td>0.00</td>
<td>270°</td>
<td>520</td>
<td>0.00</td>
<td>270°</td>
</tr>
<tr>
<td>7°</td>
<td>0.00</td>
<td>320°</td>
<td>630</td>
<td>0.00</td>
<td>320°</td>
</tr>
<tr>
<td>8°</td>
<td>0.00</td>
<td>370°</td>
<td>750</td>
<td>0.00</td>
<td>370°</td>
</tr>
<tr>
<td>9°</td>
<td>0.00</td>
<td>420°</td>
<td>870</td>
<td>0.00</td>
<td>420°</td>
</tr>
</tbody>
</table>

**NOTES:**
1. **No spirals or super elevations will be permitted to the right of heavy line without prior approval from the SOPRA assistant superintendent design.**
2. This table may only be used on the Antelope and San Bernardino Valley Substations at locations where standard spiral lengths can not be obtained due to existing field conditions.
3. Where说道: "is" is more than a listed figure, the next higher elevation and resulting spiral length will be used.
### TABLE F2.0M - 2.0 INCH UNBALANCED ELEVATION FOR FREIGHT OPERATIONS - MINIMUM SPIRAL LENGTHS

#### MAXIMUM ALLOWABLE FREIGHT OPERATING SPEED - MILES PER HOUR

<table>
<thead>
<tr>
<th>En</th>
<th>Ls</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
<th>75</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>0.00</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>1°</td>
<td>0.02</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>2°</td>
<td>0.04</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>3°</td>
<td>0.06</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>4°</td>
<td>0.08</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>5°</td>
<td>0.10</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>6°</td>
<td>0.12</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>7°</td>
<td>0.14</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>8°</td>
<td>0.16</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>9°</td>
<td>0.18</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>10°</td>
<td>0.20</td>
<td>300</td>
<td>150</td>
<td>75</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

**NOTES:**

1. No spirals or superellipses will be permitted to the right of heavy line without prior approval from the SCRRA Assistant Director of Engineering.
2. This table may only be used on the Ventura and Antelope Valley Subdivisions at locations where standard spiral lengths cannot be determined due to existing field conditions.
3. Where 2° 30' is more than 3 minutes 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

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Formulas</th>
</tr>
</thead>
<tbody>
<tr>
<td>PML</td>
<td>Equilibrium Elevation of Outside Rail (in)</td>
<td>Vmax = Maximum Allowable Operating Speed (mph)</td>
</tr>
<tr>
<td>PML</td>
<td>Actual Elevation of Outside Rail (in)</td>
<td>( \theta ) = Degree of Curvature (Normal Degrees)</td>
</tr>
</tbody>
</table>

#### Abbreviations
- Vmax: Maximum Allowable Operating Speed (mph)
- \( \theta \): Degree of Curvature (Normal Degrees)
- E: Equilibrium Elevation of Outside Rail
- \( \Delta E \): Actual Elevation of Outside Rail

#### Maximum Allowable Passenger Operating Speed - Miles Per Hour

<table>
<thead>
<tr>
<th>Elevation (in)</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
<th>75</th>
<th>80</th>
<th>85</th>
<th>90</th>
<th>95</th>
<th>100</th>
<th>105</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00*</td>
<td>1.00</td>
<td>2.25</td>
<td>2.75</td>
<td>3.50</td>
<td>4.00</td>
<td>4.50</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>7.00</td>
<td>7.50</td>
<td>8.00</td>
<td>8.50</td>
<td>9.00</td>
<td>9.50</td>
<td>10.00</td>
<td>10.50</td>
<td>11.00</td>
</tr>
<tr>
<td>0.06*</td>
<td>1.00</td>
<td>2.25</td>
<td>2.75</td>
<td>3.50</td>
<td>4.00</td>
<td>4.50</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>7.00</td>
<td>7.50</td>
<td>8.00</td>
<td>8.50</td>
<td>9.00</td>
<td>9.50</td>
<td>10.00</td>
<td>10.50</td>
<td>11.00</td>
</tr>
<tr>
<td>0.12*</td>
<td>1.00</td>
<td>2.25</td>
<td>2.75</td>
<td>3.50</td>
<td>4.00</td>
<td>4.50</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>7.00</td>
<td>7.50</td>
<td>8.00</td>
<td>8.50</td>
<td>9.00</td>
<td>9.50</td>
<td>10.00</td>
<td>10.50</td>
<td>11.00</td>
</tr>
<tr>
<td>0.18*</td>
<td>1.00</td>
<td>2.25</td>
<td>2.75</td>
<td>3.50</td>
<td>4.00</td>
<td>4.50</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>7.00</td>
<td>7.50</td>
<td>8.00</td>
<td>8.50</td>
<td>9.00</td>
<td>9.50</td>
<td>10.00</td>
<td>10.50</td>
<td>11.00</td>
</tr>
<tr>
<td>0.24*</td>
<td>1.00</td>
<td>2.25</td>
<td>2.75</td>
<td>3.50</td>
<td>4.00</td>
<td>4.50</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>7.00</td>
<td>7.50</td>
<td>8.00</td>
<td>8.50</td>
<td>9.00</td>
<td>9.50</td>
<td>10.00</td>
<td>10.50</td>
<td>11.00</td>
</tr>
<tr>
<td>0.30*</td>
<td>1.00</td>
<td>2.25</td>
<td>2.75</td>
<td>3.50</td>
<td>4.00</td>
<td>4.50</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>7.00</td>
<td>7.50</td>
<td>8.00</td>
<td>8.50</td>
<td>9.00</td>
<td>9.50</td>
<td>10.00</td>
<td>10.50</td>
<td>11.00</td>
</tr>
<tr>
<td>0.36*</td>
<td>1.00</td>
<td>2.25</td>
<td>2.75</td>
<td>3.50</td>
<td>4.00</td>
<td>4.50</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>7.00</td>
<td>7.50</td>
<td>8.00</td>
<td>8.50</td>
<td>9.00</td>
<td>9.50</td>
<td>10.00</td>
<td>10.50</td>
<td>11.00</td>
</tr>
<tr>
<td>0.42*</td>
<td>1.00</td>
<td>2.25</td>
<td>2.75</td>
<td>3.50</td>
<td>4.00</td>
<td>4.50</td>
<td>5.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.50</td>
<td>7.00</td>
<td>7.50</td>
<td>8.00</td>
<td>8.50</td>
<td>9.00</td>
<td>9.50</td>
<td>10.00</td>
<td>10.50</td>
<td>11.00</td>
</tr>
</tbody>
</table>

#### Notes:
1. **Equilibrium Elevation**
   - I: 0.00005 V^2 \( \text{V} \) mph
   - E: \( \theta \) (Normal Degrees)
   - S: 2.00

2. **Actual Elevation**
   - 2.00
   - 0.75
   - 0.50
   - 0.25

3. **Spiral Lengths**
   - 2.00
   - 1.50
   - 1.25

4. **Design, P3.5 and F2.0**
   - However, they do meet the requirements for the P3.5M and P2.0M tables.

5. **Temporary Speed Reduction**
   - Must remain until the super-elevation limits are raised to the values shown in Tables P3.5, P3.0 and P3.0M for the design speed.
### TABLE FML - 3.0 INCH UNBALANCED ELEVATION FOR FREIGHT OPERATIONS - MAINTENANCE LIMIT

<table>
<thead>
<tr>
<th><strong>ABBREVIATIONS</strong></th>
<th><strong>FORMULAS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E</strong></td>
<td>Equilibrium Elevation of Outside Rail (In) (°)</td>
</tr>
<tr>
<td><strong>Vmax</strong></td>
<td>Maximum Allowable Operating Speed (M.P.H)</td>
</tr>
<tr>
<td><strong>Eu</strong></td>
<td>Unbalanced Elevation of Outside Rail (In) (°)</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>Degree of Curvature (Decimal Degrees)</td>
</tr>
</tbody>
</table>

### MAXIMUM ALLOWABLE FREIGHT OPERATING SPEED - MILES PER HOUR

<table>
<thead>
<tr>
<th><strong>Angle (°)</strong></th>
<th><strong>Speed Reduction</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00°</td>
<td>0.00°</td>
</tr>
<tr>
<td>0.25°</td>
<td>0.25°</td>
</tr>
<tr>
<td>0.50°</td>
<td>0.50°</td>
</tr>
<tr>
<td>1.00°</td>
<td>1.00°</td>
</tr>
<tr>
<td>2.00°</td>
<td>2.00°</td>
</tr>
<tr>
<td>4.00°</td>
<td>4.00°</td>
</tr>
</tbody>
</table>

### NOTES:

1. **At all times the track must be in conformity with AAR Manual 250.** Tables P3.5 and P3.5M define the limiting design speed for passenger trains. Tables P3.0 and P3.0M define the limiting design speed for freight trains. Operation at speeds resulting in 4 inches UNBALANCE or 3 inches UNDERBALANCE is the limiting condition for all freight trains and for passenger trains under severe wind conditions. Any combination of curvature or elevation exceeding the specified limits results in the operating speed to exceed the speed permitted by these tables requiring immediate remedial action. **Spares and spiral lengths will be maintained to the values recorded in the table.**

2. **Spares in unspiraled segments will be maintained at the end of the segment.**

3. **Super-elevation and spiral lengths will be maintained to the values recorded in the table.**

4. **Contract Track Inspectors will verify the characteristics of at least two curves in each segment.**

5. **Track Geometry Data will be collected and analyzed at 5-foot intervals for the length of the curve. The managers of the maintenance contractors will review and compare the preceding two years of track geometry data to the track geometry data and will arrange for field verification of alignment based upon these reviews.**

6. **Any elevated segments that are not corrected will be immediately remedied.**

7. **Track maintenance work will be performed by the maintenance contractor.**

8. **If the actual super-elevation and curvature measured in the field by geometry cars or by survey notes are not within the limits specified in the table, the actual speed reduction must be determined.**

9. **The temporary speed restriction is to be imposed on the next occurring curve until the actual speed reduction is determined.**

10. **The temporary speed restriction must be maintained until the actual super-elevation and curvature are within the limits specified in the table.**

### ENGINEERING STANDARDS

- **SOUTHERN CALIFORNIA RAILWAY AUTHORITY 150 WILSHIRE BLVD, SUITE 1500 L.A., CA 90000**

---

**FILENAME:** scrrapw01app02$  **USERNAME:** scrrapw01app02$
### Spacing of Tracks on Curves

<table>
<thead>
<tr>
<th>Degree of Curve</th>
<th>Distance Between Track Centers: Superelavation Same on Each Track</th>
<th>Tangent</th>
<th>1°</th>
<th>2°</th>
<th>3°</th>
<th>4°</th>
<th>5°</th>
<th>6°</th>
<th>7°</th>
<th>8°</th>
<th>9°</th>
<th>10°</th>
<th>11°</th>
<th>12°</th>
<th>13°</th>
<th>14°</th>
<th>15°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main or Running and Adjacent Tracks</td>
<td>Industry and Yard Tracks</td>
<td>15'-0&quot;</td>
<td>15'-2&quot;</td>
<td>15'-4&quot;</td>
<td>15'-6&quot;</td>
<td>15'-8&quot;</td>
<td>15'-10&quot;</td>
<td>15'-0&quot;</td>
<td>15'-2&quot;</td>
<td>15'-4&quot;</td>
<td>15'-6&quot;</td>
<td>15'-8&quot;</td>
<td>15'-10&quot;</td>
<td>15'-0&quot;</td>
<td>15'-2&quot;</td>
<td>15'-0&quot;</td>
<td></td>
</tr>
<tr>
<td>Over 15°</td>
<td>Increase by ½ inch per 15 minutes of curve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes:

1. Minimum distance between center lines of adjacent tracks on all new construction shall be as follows: 10′ minimum distance shall also apply to electric tracks when replacing is authorized by the SCRRA Assistant Director/Design.
2. Tracks not less than 10′ on the inside track shall be increased to the next greater 10′ increment. The increase shall be applied in ½ inch increments.
3. Trains left in a curve shall be spaced as shown above.

---

**NOTES:**

25'-0"  
15'-0"  
20'-0"  
15'-0"  
MINIMUM, 25'-0" WHERE SPACE PERMITS  
PER EACH 15 MINUTES OF CURVE IN EXCESS OF 6 DEGREES.  
TRACKS PER NOTE D (YARD TRACKS) - INCREASE BY ½ INCH PER 3.  
TRACKS PER NOTES A, B AND E - INCREASE BY ½ INCH PER 3.

---

**TANGENT**

- 15'-0"
- 16'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
- 15'-0"
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.

<table>
<thead>
<tr>
<th>TURNOUT NO</th>
<th>TANGENTIAL</th>
<th>STANDARD (MPH)</th>
<th>EQUILATERAL (MPH)</th>
<th>DOUBLE SLIP (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TURNOUT NO</th>
<th>TANGENTIAL</th>
<th>STANDARD (MPH)</th>
<th>EQUILATERAL (MPH)</th>
<th>DOUBLE SLIP (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:

1. Maximum speeds were calculated based on turnout geometry with $E_a = 3.5''$ for passenger trains and $E_a = 2.0''$ for freight trains.
FACING TURNOUTS OF OPPOSITE HAND

FACING TURNOUTS OF LIKE HAND

NOTES:
1. Design speed, signal spacing and circuits will govern at locations where insulated joints are required.
2. Any distance between facing points of switch less than the minimums given shall require the approval of the SCRRA assistant director, design.

<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>46</td>
</tr>
<tr>
<td>14</td>
<td>122</td>
<td>86</td>
</tr>
<tr>
<td>20</td>
<td>N/A</td>
<td>118</td>
</tr>
<tr>
<td>24</td>
<td>N/A</td>
<td>150</td>
</tr>
</tbody>
</table>

<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>
</tr>
<tr>
<td>14</td>
<td>125</td>
<td>90</td>
</tr>
<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>
**Rail Markings**

**Rail Marking Notes**

<table>
<thead>
<tr>
<th>Size</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Shall be in raised characters on the head of each rail in accordance to AREMA.</td>
</tr>
<tr>
<td>4</td>
<td><strong>A</strong>: Size of Rail.</td>
</tr>
<tr>
<td>3</td>
<td><strong>B</strong>: Section.</td>
</tr>
<tr>
<td>2</td>
<td><strong>C</strong>: Manufacturer (ELMAY/ROCKY MOUNTAIN STEEL MFG).</td>
</tr>
<tr>
<td>1</td>
<td><strong>D</strong>: Year Rolled.</td>
</tr>
<tr>
<td>0.75</td>
<td><strong>E</strong>: Month Rolled.</td>
</tr>
</tbody>
</table>

**End of Rail Markings Shown**

*Note: End of rail markings shown for Information Only. End hole is not typically drilled to facilitate rail handling.*

---

**Rail Drilling for Joints**

**Rail Chamfering and Rebling**

**Bolt Hole Chamfer**

**Rail End Bevel**

---

**Engineering Standards**

**Data for Standard Rail Sections**

---

**Metrolink**

**Southern California Regional Rail Authority**

180 Wilshire Blvd., Suite 1500, L.A., CA 90017
1. 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 from dropped 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 at least one span crosses over a waterway that normally contains water at least 15 feet deep. Inner guard rails shall extend 30 feet beyond the span or spans to be protected.

2. Inside guard rails shall be installed on any other bridge as directed by SCRRA.

3. Inside guard rails are not required on bridges where a running rail is replaced under bridge or where the running rail is replaced across bridge unless directed by SCRRA.

4. Inside guard rails may be constructed using rail, not less than 1½ inches in diameter, than running rails. If guard rail has 5½" base, use modified holes for 5½" base. Guard rails shall be fastened to each tie.

5. On concrete ties, guard rails shall be fastened to guard rail joints, if present, shall be fully bolted using joint base.

6. Inside guard rails, if present, shall be fully bolted using joint base.

7. The quantity of STD plates on concrete ties will vary depending on the number of ties. They are to be provided as needed, plates 1 through 8 come as two sets and are to be rotated 180° on opposite ends.

NOTES:
1. Inside guard rails on bridges shall be required for all spans where exposed structural steel is present above 10' and is subjected to structural damage by debris. Inside guard rails shall be installed on bridges where individual spans are over 100 feet in length or where the entire structure is over 500 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 SCRRA.

3. Inside guardrails are not required on bridges unless the bridge or bridge deck is replaced or running rail is replaced across bridge.

4. Inside guard rails may be constructed using rail not less than 23 lbs lighter or no larger than running rails. If guard rail has a 5½" base, use modified plates for 5½" base SCRRA ES2371.

5. On wood ties, guard rails shall be fully plated and spiked.

6. Guard rail joints, if present, shall be fully bolted using joint bars.

7. On tangent track, spike the inside guard rail with two spikes per plate on each rail of the tangent portion and three spikes on each rail of the curved portion. On curved track, spike the entire guard rail with single spikes per plate on each rail.

8. On wood ties, box anchor two ties near the center of bridge to restrict longitudinal movement of guard rail.

NOTES:

1. Inside guard rails on bridges shall be required for all spans where exposed structural steel is present above 10' and is subjected to structural damage by debris. Inside guard rails shall be installed on bridges where individual spans are over 100 feet in length or where the entire structure is over 500 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 SCRRA.

3. Inside guardrails are not required on bridges unless the bridge or bridge deck is replaced or running rail is replaced across bridge.

4. Inside guard rails may be constructed using rail not less than 23 lbs lighter or no larger than running rails. If guard rail has a 5½" base, use modified plates for 5½" base SCRRA ES2371.

5. On wood ties, guard rails shall be fully plated and spiked.

6. Guard rail joints, if present, shall be fully bolted using joint bars.

7. On tangent track, spike the inside guard rail with two spikes per plate on each rail of the tangent portion and three spikes on each rail of the curved portion. On curved track, spike the entire guard rail with single spikes per plate on each rail.

8. On wood ties, box anchor two ties near the center of bridge to restrict longitudinal movement of guard rail.
RAIL BASE SIZE

<table>
<thead>
<tr>
<th>Scale</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>5½&quot;</td>
<td>5.625&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>6.125&quot;</td>
</tr>
</tbody>
</table>

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 .58-.90, MANGANESE .7-1.1.
5. RAIL ANCHORS SMALL CONFORM TO AREMA MANUAL, CHAPTER 5.

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

NOTES:

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

RAIL ANCHOR APPLICATIONS TO JOINTED RAIL

ENGINEERING STANDARDS
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
50 WILSHIRE BLVD, SUITE 1500, L.A., CA 90017

NOTES:

16 ANCHORS PER 39 FT RAIL

RAIL ANCHOR
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 ES2351-02.
3. Box anchor every tie for a distance of 200 ft ahead and behind turnouts, road crossings, bridges, and railroad diamond crossings.
4. Fully box anchor hot box or dragging equipment sensors for 200 ft in each direction.
5. Epoxy bonded insulated joints do not require end patterns.
6. Rail anchors must not be placed against joint ties, including insulated joints.
7. At locations where additional anchors are required, SCRRA will determine the number of anchors required.
8. Rail anchors shall be driven on base of rail until locking notch engages edge of opposite flange. Anchors must not be driven along the rail.
9. Adjustments are necessary. Remove and re-apply.
10. Field welds interfere with typical end pattern. Anchor may be omitted.
11. If anchor is omitted, do not apply anchor to same side of tie on opposite rail. Anchor pattern must be a mirror pattern to avoid shearing ties.
12. Applies to all tracks-ml, siding, and yard with continuous welded rail.

RAIL ANCHOR APPLICATIONS
FOR CONTINUOUS WELDED RAIL
WITH WOOD CROSS TIES

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

ASSISTANT DIRECTOR, DESIGN
PRINCIPAL ENGINEER, DESIGN & STANDARDS
NOTES:

1. Transition ties to consist of 24, 10'-0" long, wood ties with Pandrol type.
2. Box anchors are required for 200 ft in the wood ties after transition ties.
3. Rail anchors must not be placed against joint ties, including insulated joints. Self-laminated insulated joints are not considered as joints and will be fully anchored.
4. At locations where additional anchors are required, SCRRA will determine the number of anchors required.
5. Rail anchor shall be driven on base of rail until locking notch engages edge of opposite flange. Anchors shall not be driven along the rail. If adjustments are necessary, remove and re-drive.
6. Elastic fasteners in wood tie zone will satisfy rail anchorage needs. Use of anchors in combination with elastic fasteners shall be done only as directed by SCRRA.
7. Applies to all transitions from fixed points such as, turnouts, road crossings, bridges, railroa diamond crossings, and concrete to wood tie transitions on mainline and siding tracks.

Box anchor every tie

200'-0" standard wood ties

24 transition ties

Concrete ties, turnouts, road crossings, bridges, and railroad diamond crossings

10'-0" wood ties with Pandrol plates or other approved elastic fasteners @ 19½" centers

Location of rail anchor (typ)
OPEN DECK BRIDGES:

1. Box anchor every tie for 200 feet away from headwall on all open deck bridge approaches. Use anchor pattern on SCRRA ES2351-02.
2. All ties across open deck bridges which are anchored to substructure will be box anchored.
3. Only applies to bridge 200' or longer.

NOTES:

1. Existing anchor patterns may remain until rail relay is complete.
2. Second hand anchors may be used on all industry and yard tracks.
3. As a general rule, track with elastic fasteners does not require anchoring. However, if the SCRRA engineer deems it necessary to properly restrain the rail from moving longitudinally, rail anchors shall be installed.

BALLAST DECK BRIDGE

For anchoring rail on ballast deck bridges, bridge has no impact on pattern, use pattern revisions in ES2351-02.
NOTES:

1. Box anchor every tie for a distance of 200 feet ahead of and behind turnouts on main track and
to the clearance point on side track of turnout.

2. Box anchor two crbs after heel blocks, place sufficient number of box anchors to fill crib
from tie to tie.

3. Box anchor two crbs at toe and heel of frogs, place sufficient number of box anchors to fill
crib from tie to tie.
### Dimension Table (Inches)

<table>
<thead>
<tr>
<th>Weight and Section of Rail</th>
<th>Threads</th>
<th>Body</th>
<th>Head</th>
<th>Neck</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outline Diameters</td>
<td>Length</td>
<td>Diameters</td>
<td>Length</td>
</tr>
<tr>
<td></td>
<td>O.D.</td>
<td>P.L</td>
<td>L</td>
<td>A</td>
</tr>
<tr>
<td>80 lb ASC</td>
<td>$\frac{3}{8}$</td>
<td>10</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>75 lb CS &amp; CS Rev</td>
<td>$\frac{3}{8}$</td>
<td>9</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>80 lb ASC</td>
<td>$\frac{1}{2}$</td>
<td>10</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>90 lb AREA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>110 lb RE</td>
<td>$\frac{3}{8}$</td>
<td>10</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>130 lb FS, 130 lb RE</td>
<td>$\frac{3}{8}$</td>
<td>10</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>112 lb, 175 lb, 131 lb RE</td>
<td>$\frac{3}{8}$</td>
<td>10</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>113 lb HF, 132 lb HF</td>
<td>$\frac{3}{8}$</td>
<td>10</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>119 lb CFM, 138 lb</td>
<td>$\frac{3}{8}$</td>
<td>10</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

### 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.
FOR MAINTENANCE ONLY

SWITCH ROD CLIPS AND BOLTS

NOTES:
1. ALL BOLTS TO BE TAPPED BOLTS WITH CUT THREADS.
2. DRILL 1½" DIA HOLE FOR 5/8" SPRING COTTER AS SHOWN.
3. SLIGHTLY INSIDE SHOWN TO BE AMERICAN STANDARD HEAVY SELF-FINISHED.

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

SWITCH POINT CLAMP

DETAIL A - NUT AND LOCKING RING

DETAIL B - CLAMP CASTING
Screws Spike

**Installation Instructions:**

1. Pre-drill wood ties with \( \frac{1}{8} \) "dia drill bit to depth of 5 ".
2. Pre-drilled holes must be perpendicular with base plate.
3. Use a \( \frac{1}{8} \) " square drive socket and an impact wrench, screw in until snug.

**EVERGRIP** or equal Screw Spikes

**Installation Instructions:**

1. Pre-drill wood ties with \( \frac{1}{8} \) " dia drill bit to depth of 6 ".
2. Pre-drilled holes must be perpendicular with base plate.
3. May be driven in (spike driver, sledge etc) or with rotating machinery.

**Material Specifications:**

1. All screw spikes to be not forged.
2. Screw spikes to be made from medium carbon steel to meet ASTM A-66 specifications and AREMA Chapter 5 specifications.
3. Screw spikes to be coated to resist corrosion.
4. Screw spikes to be packed 100 to 1 A bag.

**Properties:**

- Tensile (EVERGRIP): 85,000 PSI min
- Tensile: 74,000 PSI min
- Tensile: 53,000 PSI min
- Elongation: 18% min

**Drill Bit Size Required by Wood Type**

<table>
<thead>
<tr>
<th>Fastener Size and Type</th>
<th>Softwood</th>
<th>Hardwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{1}{8} ) &quot; x ( \frac{1}{8} ) &quot; Inch Screw</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
</tr>
<tr>
<td>( \frac{1}{8} ) &quot; Inch 10X Head</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
</tr>
</tbody>
</table>

**For Maintenance Only or as Approved**

SDS:

- 6" Track Spikes, Screw Spike, Tie Plugs and Tight Spike Filler

**Engineering Standards**

- 2031
- NTS

**Tool Specifications:**

- For use with \( \frac{1}{8} \) " square socket

**Notes:**

1. Designed for use with \( \frac{1}{8} \) " square socket

**For Maintenance Only or as Approved**

- "EVERGRIP" or equal Screw Spikes

- Tie plugs and tight spike filler

**For Maintenance Only or as Approved**

- Screw spike

**Installation Instructions:**

1. Pre-drill wood ties with \( \frac{1}{8} \) " dia drill bit to depth of 5 ".
2. Pre-drilled holes must be perpendicular with base plate.
3. Using a \( \frac{1}{8} \) " square drive socket and an impact wrench, screw in until snug.

**EVERGRIP** or equal Screw Spikes

**Installation Instructions:**

1. Pre-drill wood ties with \( \frac{1}{8} \) " dia drill bit to depth of 6 ".
2. Pre-drilled holes must be perpendicular with base plate.
3. May be driven in (spike driver, sledge etc) or with rotating machinery.

**Material Specifications:**

1. All screw spikes to be not forged.
2. Screw spikes to be made from medium carbon steel to meet ASTM A-66 specifications and AREMA Chapter 5 specifications.
3. Screw spikes to be coated to resist corrosion.
4. Screw spikes to be packed 100 to 1 A bag.

**Properties:**

- Tensile (EVERGRIP): 85,000 PSI min
- Tensile: 74,000 PSI min
- Tensile: 53,000 PSI min
- Elongation: 18% min

**Drill Bit Size Required by Wood Type**

<table>
<thead>
<tr>
<th>Fastener Size and Type</th>
<th>Softwood</th>
<th>Hardwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{1}{8} ) &quot; x ( \frac{1}{8} ) &quot; Inch Screw</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
</tr>
<tr>
<td>( \frac{1}{8} ) &quot; Inch 10X Head</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
</tr>
</tbody>
</table>

**For Maintenance Only or as Approved**

- "EVERGRIP" or equal Screw Spikes

- Tie plugs and tight spike filler

**Installation Instructions:**

1. Pre-drill wood ties with \( \frac{1}{8} \) " dia drill bit to depth of 5 ".
2. Pre-drilled holes must be perpendicular with base plate.
3. Using a \( \frac{1}{8} \) " square drive socket and an impact wrench, screw in until snug.

**EVERGRIP** or equal Screw Spikes

**Installation Instructions:**

1. Pre-drill wood ties with \( \frac{1}{8} \) " dia drill bit to depth of 6 ".
2. Pre-drilled holes must be perpendicular with base plate.
3. May be driven in (spike driver, sledge etc) or with rotating machinery.

**Material Specifications:**

1. All screw spikes to be not forged.
2. Screw spikes to be made from medium carbon steel to meet ASTM A-66 specifications and AREMA Chapter 5 specifications.
3. Screw spikes to be coated to resist corrosion.
4. Screw spikes to be packed 100 to 1 A bag.

**Properties:**

- Tensile (EVERGRIP): 85,000 PSI min
- Tensile: 74,000 PSI min
- Tensile: 53,000 PSI min
- Elongation: 18% min

**Drill Bit Size Required by Wood Type**

<table>
<thead>
<tr>
<th>Fastener Size and Type</th>
<th>Softwood</th>
<th>Hardwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{1}{8} ) &quot; x ( \frac{1}{8} ) &quot; Inch Screw</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
</tr>
<tr>
<td>( \frac{1}{8} ) &quot; Inch 10X Head</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
<td>( \frac{1}{8} ) &quot; Inch</td>
</tr>
</tbody>
</table>
NOTES:
1. 5/8" or 6-1/2" long 3/8" UNC BOLT OR A-375 YELLOW ZINC RICHROMATE.
2. TO AVOID DAMAGE TO THE TIE, ENSURE THAT PROPER SCREW SIZE IS USED FOR VARIOUS PLATE THICKNESSES (SEE TABLE).
3. VAPE SCREW TO BE TORQUED TO 150 FT-LBS. THIS TORQUE CORRESPONDS TO A 1mm CLEARANCE BETWEEN COILS ON THE SPRING WASHER.
4. FOR CONCRETE GUARD RAIL SEE SCRRA ES2406 OR ES2407.
5. SPRING WASHERS SHALL CONFORM TO UIC CODE B64-1. DIMENSIONS AS DELIVERED (UNLOADED). STAMPING IS TO BE DONE IN AREA INDICATED ON CURRENT YEAR AND SUPPLIER'S LOGO.

VAPE BOLT DIMENSIONS

<table>
<thead>
<tr>
<th>X SM</th>
<th>X SHAKE</th>
<th>FOR USE THROUGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/8&quot;</td>
<td>3/4&quot;</td>
<td>1&quot; PLATING</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>5/8&quot;</td>
<td>1&quot; PLATING</td>
</tr>
</tbody>
</table>

SECTION A

HELIICAL SPRING WASHER

YELLOW ZINC RICHROMATE

REMOVABLE/REPLACEABLE

FOR STAMPING

SEE NOTE

CROWN OF WASHER

VAPE BOLT

6" OR 6-1/2" LONG 3/8" UNC BOLT OR A-375 YELLOW ZINC RICHROMATE

NYLON 66 THREAD INSERT

COLOR-WHITE

DUCTILE IRON HOUSING

INTERALLY THREADED

K würmer
**Frog Bolts, Nuts, and Washers**

**Table of Dimensions**

<table>
<thead>
<tr>
<th>D</th>
<th>L</th>
<th>A</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>W</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>3 3/8&quot;</td>
<td>1 1/2&quot;</td>
<td>1 3/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Square Head Frog Bolts**

**Washer**

**So Nut or Hex Nut**

**Notes:**

1. Bolt shall conform to the current version of SAE J429 Grade 8. Heat treated to 150,000 psi tensile strength. 120,000 psi yield. Oil quenched from 1500 °F. Head markings shall include grade and hardness markings. Manufacturer's name, weight and year of manufacture, threads to be rolled and conform to ASTM B1 UNC-2B thread form.

2. Nuts shall conform to hardness and material requirements of SAE J429 Grade 8 or ASTM A490 Grade 7 bolt and dimensional requirements of ASTM B1.3 Heavy Hex or Square Nuts. Plain finish heavy hex or square lock nut threads shall conform to ASTM B1 UNC-2B thread form. Free fit.

3. Flat washers shall conform to hardness requirements of the current version of ASTM A465 and be 1/8" thick.

4. Workmanship, bolts, nuts, and washers shall be free from burns, seams, laps, and scale.

5. Bolt tightening sequence shall start with the bolt nearest the center of frog. Work in a circular pattern in a clockwise direction. Proceeding outward to the next nearest frog bolt until all bolts are tightened to proper torque as directed by manufacturer. All bolts and nuts will be supplied with self-centering washers or equivalent for proper load distribution. See SCRRA ES2359.
NOTES:

1. WHEN USING/ORDERING TAPERED BOLTS, ADD 2½" TO OLD BOLT LENGTH.
2. BOLTS SMALL CONFORM TO THE CURRENT VERSION OF SAE J429 GRADE 8. HEAT TREATED TO 100,000 PSYIELD. DIL QUENCHED FROM 1500 STEEL. HEAD MARKINGS SMALL INCLUDE GRADE 8 GRADE MARKINGS. MANUFACTURER'S NAME, MONTH AND YEAR OF MANUFACTURE, THREADS TO BE ROLLING AND CONFORM TO ANSIB/ASME A1.9-3 THREAD FORM.
3. NUTS SMALL CONFORM TO HARDNESS AND MATERIAL REQUIREMENTS OF SAE J995 GRADE B OR ASTM A-325 GRADE 75 AND DIMENSIONAL REQUIREMENTS OF SAE J429 BOLT. SEVEN-SQUARE LOCKNUT THREADS SHALL BE CLEAR FINISH. HEAVY HEX OR SQUARE LOCK NUT THREADS SMALL TO CONFORM TO ANSIB/ASME A1.9-3 THREAD FORM, FREE FIT.
4. HEX WASHERS SMALL CONFORM TO HARDNESS REQUIREMENTS OF THE CURRENT VERSION OF ASTM F-436 AND BE 7/64" THICK.
5. USE MANUFACTURER ID, MONTH AND YEAR OF MANUFACTURE. THREADS TO BE ROLLED FROM 4140 STAINLESS. HEAD MARKINGS SHALL INCLUDE GRADE 8 GRADE MARKINGS, TREATED TO 150,000 PSI TENSILE STRENGTH, 130,000 PSI YIELD, OIL QUENCHED, HEAD TREATED TO 150,000 PSI TENSILE STRENGTH, 130,000 PSI YIELD, OIL QUENCHED.

TAPERED FROG BOLTS

WASHER

SQ 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
3. FINISHED WASHERS MUST WITHSTAND 1000 HOURS OF ASTM B-117 SALT FOG TEST WITH LESS THAN 15% RED RUST
4. FINISHED WASHERS MUST HAVE THE MINIMUM HARDNESS APPROPRIATE AND SUFFICIENT FOR USE WITH HIGH STRENGTH FASTENERS
5. MINIMUM COMPENSATING ANGLE SHALL BE 10 DEGREES IN ALL DIRECTIONS
6. PARTS SHALL BE MARKED WITH MANUFACTURERS IDENTIFYING CHARACTERISTICS.
### Notes:

1. For rail pad details, see SCRRA ES2363.
2. For side post insulator details, see SCRRA ES2366.
3. For rail clip details, see SCRRA ES2367.
4. For tie insulator details, see SCRRA ES2368.
5. All components for tie assemblies to be PANDROL type or equivalent as approved by the SCRRA Assistant Director, Design.
6. All part numbers listed on this drawing correspond to PANDROL brand components and are subject to change.
7. For concrete tie details and friction pattern, see SCRRA ES2402.

### 136 Re rail and 136 lb rail concrete tie

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Color</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10216</td>
<td>Rail clip assy - FC1601 clip / 7695 tie insulator</td>
<td>Neutral</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>9086</td>
<td>Fastclip twin-stem shoulder</td>
<td>Neutral</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>7692</td>
<td>Standard side post insulator for twin-stem shoulder</td>
<td>Neutral</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>7083</td>
<td>Rail pad assembly</td>
<td>Neutral</td>
<td>2</td>
</tr>
</tbody>
</table>

### 141 lb rail and 136 lb rail concrete tie

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Color</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10216</td>
<td>Rail clip assy - FC1601 clip / 7695 tie insulator</td>
<td>Neutral</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>9086</td>
<td>Fastclip twin-stem shoulder</td>
<td>Neutral</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>7692</td>
<td>Standard side post insulator for twin-stem shoulder</td>
<td>Neutral</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>7083</td>
<td>Rail pad assembly</td>
<td>Neutral</td>
<td>2</td>
</tr>
</tbody>
</table>

### Combination 115 re rail and 136 re rail

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Color</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10216</td>
<td>Rail clip assy - FC1603 clip / 7695 tie insulator</td>
<td>Blue</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>9086</td>
<td>Fastclip twin-stem shoulder</td>
<td>Blue</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>11459</td>
<td>Side post insulator - 0.400&quot; thick post</td>
<td>Green</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>11457</td>
<td>Rail pad</td>
<td>Blue</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>11459</td>
<td>Side post insulator - 0.400&quot; thick post</td>
<td>Green</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>10216</td>
<td>Rail clip assy - FC1601 clip / 7695 tie insulator</td>
<td>Neutral</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>7692</td>
<td>Standard side post insulator</td>
<td>Neutral</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>7083</td>
<td>Rail pad assembly</td>
<td>Neutral</td>
<td>1</td>
</tr>
</tbody>
</table>
### COMBINATION 106 RE RAIL AND 136 LB RAIL

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>PART NO</th>
<th>DESCRIPTION</th>
<th>COLOR</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10216</td>
<td>RAIL CLIP ASSY - FC1603 CLIP / 7695 TOE INSULATOR</td>
<td>BLUE</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>9086</td>
<td>FASTCLIP TWIN-STEM SHOULDER</td>
<td>NUETRAL</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>11458</td>
<td>SIDE POST INSULATOR - 0.726&quot; THICK POST</td>
<td>BLUE</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>11549</td>
<td>RAIL PAD</td>
<td>NUETRAL</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>11459</td>
<td>SIDE POST INSULATOR - 0.430&quot; THICK POST</td>
<td>GREEN</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>10216</td>
<td>RAIL CLIP ASSY - FC1603 CLIP / 7695 TOE INSULATOR</td>
<td>NUETRAL</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>7692</td>
<td>STANDARD SIDE POST INSULATOR</td>
<td>NUETRAL</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>7083</td>
<td>RAIL PAD ASSEMBLY</td>
<td>NUETRAL</td>
<td>1</td>
</tr>
</tbody>
</table>

### 136 RE RAIL AND 136 LB RAIL CONCRETE TIE

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>PART NO</th>
<th>DESCRIPTION</th>
<th>COLOR</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10216</td>
<td>RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR</td>
<td>NUETRAL</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>9086</td>
<td>FASTCLIP TWIN-STEM SHOULDER</td>
<td>NUETRAL</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>7692</td>
<td>STANDARD SIDE POST INSULATOR</td>
<td>NUETRAL</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>7083</td>
<td>RAIL PAD ASSEMBLY</td>
<td>NUETRAL</td>
<td>2</td>
</tr>
</tbody>
</table>

### 143 LB RAIL AND 136 LB RAIL CONCRETE TIE

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>PART NO</th>
<th>DESCRIPTION</th>
<th>COLOR</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10216</td>
<td>RAIL CLIP ASSY - FC1601 CLIP / 7695 TOE INSULATOR</td>
<td>NUETRAL</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>9086</td>
<td>FASTCLIP TWIN-STEM SHOULDER</td>
<td>NUETRAL</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>7692</td>
<td>STANDARD SIDE POST INSULATOR</td>
<td>NUETRAL</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>7083</td>
<td>RAIL PAD ASSEMBLY</td>
<td>NUETRAL</td>
<td>2</td>
</tr>
</tbody>
</table>
NOTES:
1. PANORAL RAIL CLIP TYPE E2063, AS SHOWN, IS USED WITH PANORAL TYPE E 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. CLEARING AREA OF TOE = 0.7".
6. APPROXIMATE WEIGHT = 1.69 LBS.

ES2355
SCRRA

ESP2361-01
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
200 WILSHIRE BLVD., SUITE 1500, L.A., CA 90017

ASSISTANT DIRECTOR, DESIGN
PRINCIPAL ENGINEER, DESIGN & STANDARDS
CONCRETE TIE

TOP OF 

ES2362-02

SPRING CLIP PER  

ES2362-02

INSULATOR PER 

ES2365-04

PAD ASSEMBLY 

PER ES2364-03

FOR MAINTENANCE ONLY
NOTES:
1. PANDROL PART NO 2055
2. CLIP IS STANDARD TYPE
3. GALVANIZED CLIPS ARE REQUIRED IN ALL ROAD CROSSING APPLICATIONS INCLUDING THE TRANSITION TIES.
4. GALVANIZED CLIPS ARE REQUIRED IF APPLICATION IS WITHIN A ½ MILE HARDS TO SALT WATER OR IF CORROSIVE SOIL CONDITIONS EXIST.
LONG REACH SPRING CLIP

STANDARD SPRING CLIP

FOR MAINTENANCE ONLY

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

SEE NOTE "A"

SEE NOTE ON IDENTIFICATION BRAND FOR SAFELOK BRAND

PART NO. SAFELOK EMBLEM AND BATCH CODE.

DATE
MONTH
DAY

PART NO.

BATCH CODE FORMAT: 20 03 20

NOTES:
1. A: CLIPS ARE SET WITHIN THIS RANGE TO GIVE SPECIFIED TOE LOAD.
2. HARDNESS: HARDENED AND TEMPERED TO 43-47 ROCKWELL "C".
3. PAINT STANDARD CLIP RED OXIDE PRIMER BLACK OR BROWN PAINT GALVANIZED CLIP SILVER.
FASTCLIP TIE PAD
FOR 5½" RAIL
USING SCRRERA STANDARD
6" BASE CONCRETE TIE
(PART #11549)

FASTCLIP TIE PAD
FOR 6" RAIL
PANDROL RAIL PAD ASSEMBLY
(PART #7083)

SECTION A

SECTION B

FOR 6" RAIL BASE
6" BASE CONCRETE TIE
(PART #7083)

FOR 5½" & 6" RAIL BASE
6" BASE CONCRETE TIE
(PART #11549)
NOTES:

1. PAD MATERIAL: POLYURETHANE ETHER BASE
   PAD HARDNESS 95 DURO A/45 DURO D,
   WITH 30 YEAR UV PROTECTION.

2. ABRASION PLATE MATERIAL: TO BE 15% GLASS
   FILLED NYLON OR EQUIVALENT WITH 30 YEAR
   UV PROTECTION.

FOR MAINTENANCE ONLY
NOTES:

1. PAD MATERIAL POLYURETHANE ETHER BASE
   PAD HARDNESS: 95 DURO A/45 DURO D,
   WITH 30 YEAR UV PROTECTION.

2. ABRASION PLATE MATERIAL: TO BE 13% GLASS
   FILLED NYLON OR EQUIVALENT WITH 30 YEAR
   UV PROTECTION.

3. FOR ASSEMBLY, SEE ESxxxx.

FOR MAINTENANCE ONLY
NOTES:

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

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

STANDARD SIDE POST INSULATOR
(PART #: 7692)
<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>FIELD/GAGE SIDE OF RAIL</th>
<th>COLOR</th>
<th>POST WIDTH</th>
<th>CONCRETE TIE APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD</td>
<td>BOTH</td>
<td>NATURAL</td>
<td>8mm</td>
<td>USE IN TANGENT TRACK AND CURVES LESS THAN 1 DEGREE 30 MINUTES</td>
</tr>
<tr>
<td>NARROW</td>
<td>GAGE</td>
<td>NATURAL</td>
<td>5.4mm</td>
<td>USE IN CURVED TRACK TO CORRECT WIDE GAGE. REQUIRES INSTALLATION OF NARROW POST INSULATOR</td>
</tr>
<tr>
<td>HEAVY DUTY</td>
<td>FIELD</td>
<td>NATURAL</td>
<td>8mm</td>
<td>USE ON FIELD SIDES OF CURVED TRACK GREATER THAN 1 DEGREE 30 MINUTES. USE WITH NARROW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W/ CAST</td>
<td>12mm</td>
<td>POST INSULATOR ON GAGE SIDE. USE ON FIELD SIDES OF CURVED TRACK GREATER THAN 1 DEGREE</td>
</tr>
</tbody>
</table>

**NARROW POST INSULATOR**

**HEAVY DUTY WIDE POST INSULATOR**

**STANDARD INSULATOR**

**HEAVY DUTY INSULATOR**

---

**FOR MAINTENANCE ONLY**

**ENGINEERING STANDARDS**

**INSULATORS FOR E CLIP FASTENING SYSTEM ON CONCRETE TIES**

---

**Southern California Regional Rail Authority**

**900 Wilshire Blvd., Suite 1500, L.A., CA 90017**

---

**Metrolink**

---

---
<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>FIELD/GAGE SIDE OF RAIL</th>
<th>COLOR</th>
<th>POST WIDTH</th>
<th>CONCRETE TIE APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD</td>
<td>BOTH</td>
<td>WHITE/NATURAL</td>
<td>7mm</td>
<td>USE IN TANGENT TRACK AND CURVES LESS THAN 1 DEGREE 30 MINUTES</td>
</tr>
<tr>
<td>STANDARD NARROW</td>
<td>GAGE</td>
<td>BLUE</td>
<td>4mm</td>
<td>USE IN CURVED TRACK TO CORRECT WIDE GAGE, REQUIRES INSTALLATION OF WIDE POST INSULATOR ON FIELD SIDE</td>
</tr>
<tr>
<td>STANDARD</td>
<td>GAGE</td>
<td>WHITE/NATURAL</td>
<td>9.5mm</td>
<td>USE IN TRACK WHERE 5½&quot; BASE RAIL IS USED ON 6&quot; BASE RAIL SEAT TIES, LONG REACH SAFELOK 1 INSULATOR TO BE UTILIZED ON FIELD SIDE</td>
</tr>
<tr>
<td>CONVERSION</td>
<td>FIELD</td>
<td>WHITE/NATURAL</td>
<td>17mm</td>
<td>USE ON FIELD SIDE ONLY OF CURVED TRACK GREATER THAN 1 DEGREE 30 MINUTES</td>
</tr>
<tr>
<td>HEAVY DUTY</td>
<td>FIELD</td>
<td>WHITE/NATURAL</td>
<td>7mm</td>
<td>USE IN CURVED TRACK TO CORRECT WIDE GAGE, REQUIRES INSTALLATION OF NARROW POINT INSULATOR ON GAGE SIDE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GRAY</td>
<td>10mm</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE SEE SECTION 10° FROM FINISH TO HAVE ROUGH BOTTOM SURFACE 10 mm**

**FOR MAINTENANCE ONLY**
NOTES:
1. PANDROL RAIL CLIP TYPE FC1601 AND FC1603 AS SHOWN ARE USED WITH PANDROL TYPE OR EQUIVALENT FASTCLIP CONCRETE TIE ASSEMBLIES FOR 1/2" BASE AND 8" BASE RAIL RESPECTIVELY.
2. TWO CLIPS ARE REQUIRED PER ASSEMBLY. SEE SCRRA ES2360-01 THROUGH ES2360-03.

DIMENSION TABLE

<table>
<thead>
<tr>
<th>NOT</th>
<th>PANDROL FAST CLIP TYPE</th>
<th>RAIL CLIPS (OR EQUAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4 1/8&quot;</td>
<td>126</td>
</tr>
<tr>
<td>B</td>
<td>3 1/8&quot;</td>
<td>80</td>
</tr>
<tr>
<td>C</td>
<td>1 5/8&quot;</td>
<td>45</td>
</tr>
<tr>
<td>D</td>
<td>1 1/8&quot;</td>
<td>12</td>
</tr>
<tr>
<td>E</td>
<td>4 1/8&quot;</td>
<td>112</td>
</tr>
<tr>
<td>F</td>
<td>1/2&quot;</td>
<td>29</td>
</tr>
</tbody>
</table>

NO CLIPS FC1501 (136 LB) FC1603 (115-119 LB)
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.

NOTE:
WELD-ON SHOULDER PANDROL P/N 7299-1

NOTES:
1. ALL WELDS TO BE IN ACCORDANCE WITH AREMA WELDING SPECIFICATIONS, AWS D1.5 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
<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 36 1/2&quot; LONG</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>STEEL BACKUP PLATE 1/2&quot; THICK X 10 1/2&quot; LONG</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>STEEL BACKUP PLATE 1/2&quot; THICK X 10 1/2&quot; LONG</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>SCOTCHPLY END 20&quot;31/2&quot; THICK</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>OVAL NECK BOLT 1&quot; X 7/5&quot; LONG</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>1&quot; LOCK WASHER</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>1&quot; SQUARE NUT</td>
</tr>
</tbody>
</table>

SECTION A

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

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

ENGINEERING STANDARDS

METROLINK.

ASSISTANT DIRECTOR, DESIGN
PRINCIPAL ENGINEER, DESIGN & STANDARDS

PRINTED BY: SCRRAPW01APP02$ DATE: 1/13/2021
PRINT DRIVER: C:\Program Files (x86)\Common Files\InterPlot\IPLOT\bin\iplotdrvn.plt
FILENAME: \scrrapw01app02\iCS_pdf_work_dir\67\482_58\ES2370.dgn

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.
**PLATES 1 - 4**

- Plate ID: C (IN)
- Plate ID: D (IN)
- Plate ID: A (IN)
- Plate ID: B (IN)

**STEEL BLOCK (WEDGE) FOR PLATES 3 & 4**

- Plate ID: C (IN)
- Plate ID: D (IN)

**ENTRY PLATES**

- Plate ID: C (IN)
- Plate ID: D (IN)

**STANDARD PLATE**

- Plate ID: C (IN)
- Plate ID: D (IN)

**NOTES:**

1. No inside clips for plates 1, 2, 3, & 4.
2. Requires steel wedge on plates 3 & 4.
3. If 5½" 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 6¼" to 5¾".
4. All excess weld, slag, and splatter which protrudes into the rail must be removed.
5. Steel block (wedge) must be removed.
6. Alternate (equivalent to Pandrol 7229-1)

**DOUBLE INSIDE GUARD RAIL PLATE DETAILS**

- Pandrol 7229-1
- All excess weld, slag, and splatter which protrudes into the rail must be removed.
- Alternate (equivalent to Pandrol 7229-1)

**DOUBLE INSIDE GUARD RAIL PLATE ITEM NUMBERS**

- Entry plates 1 & 2 of each
- STD plate (each)
- Entry plates 1-8 (set)

**STEEL BLOCK (WEDGE)**

- ½" X 4" A36

**ENTRY PLATES**

- Plate ID: C (IN)
- Plate ID: D (IN)

**PLATE ID DETAILS**

- Plate ID: 1
- Plate ID: 2
- Plate ID: 3
- Plate ID: 4
- Plate ID: 5
- Plate ID: 6
- Plate ID: 7
- Plate ID: 8
TRANSITION RAIL IS UNIVERSAL AND CAN BE USED AS RIGHT HAND OR LEFT HAND NEW TO ¼" HEAD LOSS.

THE 141 LB TRANSITION RAIL CAN BE USED WITH 136 LB AND 132 LB RAIL SECTIONS USING 2" BLOCK STENCIL.

STENCIL IN BLACK THE MFG NAME AND S/N BETWEEN MARKING RAIL TRANSITIONS, I.E. 141-NEW AND 132 ¼" LOSS AT EACH END OF THE WHITE PAINTING. WHITE, BOTH SIDES. USING 2½" BLOCK STENCIL AND BLACK PAINT, MARK RAIL MANUFACTURER SHALL PAINT WEB OF RAIL, 10 FEET AS SHOWN ON RAIL, SOLID ACTUAL WEIGHT OF RAIL, STENCILED ON HEAD OF RAIL.

MANUFACTURER TO MARK LIFT/BALANCE POINT FOR EACH RAIL LENGTH AND TEMPLATES MUST BE USED TO CHECK FINISHED GAUGE CORNER AND TOP RADII.

MACHINED SURFACES MUST BE FREE OF SEAMS AND RIDGES.

TRANSITION RAIL TO BE MANUFACTURED FROM HEAD HARDENED RAIL.

FOR HEAD HARDENED RAIL".

RAIL TO BE PURCHASED AND MANUFACTURED TO CURRENT "SCRRA SPECIFICATIONS FOR HEAD HARDENED RAIL".

1. TRANSITION RAIL TO BE MANUFACTURED FROM HEAD HARDENED RAIL.
2. TRANSITION RAIL MUST BE FREE OF SEAMS AND RIDGES.
3. TEMPLATES MUST BE USED TO CHECK FINISHED GAUGE CORNER AND TOP RADII.
4. MANUFACTURER TO MARK LIFT/BALANCE POINT FOR EACH RAIL LENGTH AND ACTUAL WEIGHT OF RAIL STENCILED ON HEAD OF RAIL.
5. MANUFACTURED SHALL PAINT WEB OF RAIL 10 FEET AS SHOWN ON RAIL, SOLID WHITE, BOTH SIDES. USING 2½" BLOCK STENCIL AND BLACK PAINT, MARK RAIL TRANSITIONS, I.E. 141-NEW AND 132 ¼" LOSS AT EACH END OF THE WHITE PAINTING. STENCIL IN BLACK THE MFG NAME AND S/N BETWEEN MARKING RAIL TRANSITIONS USING 2½" BLOCK STENCIL.
6. THE 141 LB TRANSITION RAIL CAN BE USED WITH 136 LB AND 132 LB RAIL SECTIONS NEW TO ¼" HEAD LOSS.
7. TRANSITION RAIL IS UNIVERSAL AND CAN BE USED AS RIGHT HAND OR LEFT HAND RAIL.

BILL OF MATERIALS

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TRANSITION RAIL, 136 LB NEW TO 132 LB ¼&quot; HEAD LOSS</td>
</tr>
<tr>
<td>1</td>
<td>TRANSITION RAIL, 133 LB NEW TO 132 LB ¼&quot; HEAD LOSS</td>
</tr>
</tbody>
</table>

NOTES:
1. TRANSITION RAIL TO BE MANUFACTURED FROM HEAD HARDENED RAIL.
2. TRANSITION RAIL MUST BE FREE OF SEAMS AND RIDGES.
3. TEMPLATES MUST BE USED TO CHECK FINISHED GAUGE CORNER AND TOP RADII.
4. MANUFACTURER TO MARK LIFT/BALANCE POINT FOR EACH RAIL LENGTH AND ACTUAL WEIGHT OF RAIL STENCILED ON HEAD OF RAIL.
5. MANUFACTURED SHALL PAINT WEB OF RAIL 10 FEET AS SHOWN ON RAIL, SOLID WHITE, BOTH SIDES. USING 2½" BLOCK STENCIL AND BLACK PAINT, MARK RAIL TRANSITIONS, I.E. 141-NEW AND 132 ¼" LOSS AT EACH END OF THE WHITE PAINTING. STENCIL IN BLACK THE MFG NAME AND S/N BETWEEN MARKING RAIL TRANSITIONS USING 2½" BLOCK STENCIL.
6. TRANSITION RAIL IS UNIVERSAL AND CAN BE USED AS RIGHT HAND OR LEFT HAND RAIL.
EMERGENCY TRACK PANEL

PANEL WEIGHTS

<table>
<thead>
<tr>
<th>PANEL WEIGHTS IN LBS</th>
<th>PANEL LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 LB</td>
<td>3'-3&quot;</td>
</tr>
<tr>
<td>136 LB</td>
<td>3'-3&quot;</td>
</tr>
<tr>
<td>10,300 lbs</td>
<td>3'-3&quot;</td>
</tr>
</tbody>
</table>

ALLOWABLE SECOND HAND RAIL WEAR

<table>
<thead>
<tr>
<th>RAIL WEIGHT</th>
<th>ALLOWABLE RAIL WEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 LB</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>115 LB</td>
<td>3/8&quot;</td>
</tr>
</tbody>
</table>

NOTES:

1. TRACK PANELS TO BE CONSTRUCTED AS ABOVE.
2. NEW OR SECOND HAND RAIL OR TIE RAIL TO BE DRILLED SECOND AND THIRD HOLES ONLY. HEAD HEAT AND END HOLE AND BOLTED TO CURRENT SPECIFICATIONS. RAIL TRANSPOD TO CLARIFY WORN RAIL ON THE SIDE OF PANELS. THE HEAD LOSS AND GAUGE FACE LOSS BETWEEN ANY TWO PANELS OR A SIMILAR PANEL, MEASURED ON BOTH ENDS, SHOULD NOT BE MORE THAN ¼" GAUGE IS TO BE WITHIN 5/32" TO 3/32" TO PROPER GAUGE OF 56½" AT 3/8" BELOW TOP OF RAIL OF RAIL.
3. NEW OR SECOND BAND RAIL PLATES TO MATCH NEW OR SECOND HAND RAIL.
4. ANCHOR PATTERN OF MAIN LINE PANELS ADJUSTED IN THE FIELD DURING INSTALLATION TO COMPLY WITH SCRRA ES2351-02.
5. ANCHOR PATTERN OF MAIN PANELS ADJUSTED IN THE FIELD DURING INSTALLATION TO COMPLY WITH SCRRA ES2351-02.
6. USE NEW 7" X 9" X 8'-6" HARDWOOD TREATED TIES SPIKING PATTERN TO COMPLY WITH SCRRA ES2460-01, FIGURE A.
7. 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.
8. ANCHOR PATTERN OF MAIN PANELS ADJUSTED IN THE FIELD DURING INSTALLATION TO COMPLY WITH SCRRA ES2351-02.
9. ANCHOR PATTERN OF MAIN PANELS ADJUSTED IN THE FIELD DURING INSTALLATION TO COMPLY WITH SCRRA ES2351-02.
10. PANELS TO BE MARKED TO INDICATE WEIGHT WITH INDELIBLE MARKER ON TOP OF RAIL AT CENTER OF PANEL.
11. PANEL TO BE MARKED TO INDICATE NEW OR SECOND HAND RAIL WITH INDELIBLE MARKER ON SIDE OF RAIL NEAR CENTER OF PANEL.
NOTES:
1. ALL SQUARE SPIKE HOLES SHALL HAVE ⅛" FILLETS IN CORNERS.
2. ESTIMATED WEIGHT: 10-35 LB EACH.
3. MUST MEET AREMA SPECIFICATIONS.
NOTES:
1. ALL SQUARE SPIKE HOLES SHALL HAVE 2" FILLETS IN CORNERS.
2. ESTIMATED WEIGHT: 21.47 LBS EACH.
3. MUST MEET AREMA SPECIFICATIONS.

14" TIE PLATE FOR 6" BASE RAIL

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

ENGINEERING STANDARDS
SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
860 WILSHIRE BLVD., SUITE 1500, L.A., CA 90017

ASSISTANT DIRECTOR, DESIGN
PRINCIPAL ENGINEER, DESIGN & STANDARDS
NOTES:
1. ALL HOLE MEASUREMENTS TO BE TAKEN FROM BOTTOM OF PLATE.
2. PLATE TO BE STANDARD PANDROL TYPE OR APPROVED EQUIL TIE PLATE MODIFIED FOR 1” DIA HOLES
3. PLATE TO BE INSTALLED WITH 6 EACH PANDROL RAIL FASTENING "C" CLIP PER SCRRA ES2362
4. PLATE TO BE INSTALLED WITH 4 EACH SCREW SPIKES PER PLATE PER SCRRA ES2353.

PLAN

SECTION

MANUFACTURER AND YEAR

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

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

PRINCIPAL ENGINEER, DESIGN & STANDARDS
ASSISTANT DIRECTOR, DESIGN
NOTES:
1. ALL HOLE MEASUREMENTS TO BE TAKEN FROM BOTTOM OF PLATE
2. PLATE TO BE STANDARD PANDROL TYPE OR APPROVED EQUAL TO PLATE MODIFIED FOR 1 1/4" HOLES
3. PLATE TO BE INSTALLED WITH 2 EACH PANDROL RAIL FASTENING "e" CLIP PER SCRRA E2362
4. PLATE TO BE INSTALLED WITH 4 EACH SCREW SPIKES PER SCRRA E2355

SECTION

PLAN

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

1. TIE PLATE SPIKING FOR PLATES WITH HOLD-DOWN SPIKE HOLES:
   - **Figure A**: Tangent and curves to 2°00' - 4' SPIKES REQUIRED, 2 LINE AND 2 HOLD-DOWN.
   - **Figure B**: Curves over 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 A**: Tangent and curves to 2°00' - 4' SPIKES REQUIRED, 2 LINE AND 2 HOLD-DOWN.
   - **Figure B**: Curves over 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.

REFERENCES:

- **Figure A**: Tangent and curves to 2°00' - 4' SPIKES REQUIRED, 2 LINE AND 2 HOLD-DOWN.
- **Figure B**: Curves over 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.
- **Figure D**: Tangent and curves to 4°00' inclusive - 5 SPIKES REQUIRED, 3 LINE AND 2 HOLD-DOWN.
- **Figure E**: Curves over 4°00' inclusive - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN.
- **Figure F**: Tangent and curves to 4°00' - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN.
- **Figure G**: Tangent and curves over 4°00' inclusive - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN.
- **Figure H**: Tangent and curves over 4°00' - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN.
TIE PLATE SPIKING PATTERNS FOR "SP" PLATES

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

2. SPACING PATTERNS TO BE ADJUSTED DURING RAIL AND TIE INSTALLATION.

3. IF EXISTING SPACING PATTERNS HAVE MORE SPIKES THAN REQUIRED PER THIS STANDARD, THEN THE ADDITIONAL SPIKES SHALL REMAIN IN PLACE.

NOTE:

- FIGURE A - OVER 4°00' - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN.
- FIGURE B - CURVES OVER 2°00' TO 4°00' INCLUSIVE - 5 SPIKES REQUIRED, 2 HOLD-DOWN.
- FIGURE A - TANGENT TO 2°00' - 4 SPIKES REQUIRED, 2 LINES AND 2 HOLD-DOWN.

TIE PLATE SPIKING PATTERNS FOR PLATES WITH HOLD-DOWN SPIKE HOLES.

- FIGURE A - TANGENT TO 2°00' - 4 SPIKES REQUIRED, 2 LINES AND 2 HOLD-DOWN.
- FIGURE B - CURVES OVER 2°00' TO 4°00' INCLUSIVE - 5 SPIKES REQUIRED, 2 LINES AND 2 HOLD-DOWN.
- FIGURE C - OVER 4°00' - 6 SPIKES REQUIRED, 4 LINES AND 2 HOLD-DOWN.

SPACING PATTERNS TO BE ADJUSTED DURING RAIL AND TIE INSTALLATION.

- FIGURE A - OVER 4°00' - 6 SPIKES REQUIRED, 4 LINE AND 2 HOLD-DOWN.
- FIGURE B - CURVES OVER 2°00' TO 4°00' INCLUSIVE - 5 SPIKES REQUIRED, 2 HOLD-DOWN.
- FIGURE A - TANGENT TO 2°00' - 4 SPIKES REQUIRED, 2 LINES AND 2 HOLD-DOWN.
NOTES:
1. MANUFACTURER NAME RAIL SECTION YEAR AND DIMENSION BASE SIZE TO BE ROLLED IN RAISED LETTERS AND FIGURES ON THE OUTSIDE SHOULDER.
2. SPECIFICATIONS AND WORKMANSHIP TO BE IN ACCORDANCE WITH CURRENT AREMA MANUAL REQUIREMENTS FOR HOT-WORKED HIGH CARBON STEEL TIE PLATES.

DIMENSION TABLE

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>5½&quot;</th>
<th>6&quot;</th>
<th>6&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>554-9010</td>
<td>13&quot;</td>
<td>14&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>554-9015</td>
<td>3½&quot;</td>
<td>3½&quot;</td>
<td>3½&quot;</td>
</tr>
<tr>
<td>554-9020</td>
<td>5½&quot;</td>
<td>6&quot;</td>
<td>6½&quot;</td>
</tr>
<tr>
<td>554-9025</td>
<td>4½&quot;</td>
<td>4½&quot;</td>
<td>6½&quot;</td>
</tr>
<tr>
<td>554-9030</td>
<td>1&quot;</td>
<td>1½&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>554-9035</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>2½&quot;</td>
</tr>
<tr>
<td>554-9040</td>
<td>1&quot;</td>
<td>1½&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>554-9045</td>
<td>3½&quot;</td>
<td>3½&quot;</td>
<td>3½&quot;</td>
</tr>
<tr>
<td>554-9050</td>
<td>3½&quot;</td>
<td>3½&quot;</td>
<td>3½&quot;</td>
</tr>
<tr>
<td>554-9055</td>
<td>½&quot;</td>
<td>½&quot;</td>
<td>½&quot;</td>
</tr>
<tr>
<td>554-9060</td>
<td>¾&quot;</td>
<td>¾&quot;</td>
<td>¾&quot;</td>
</tr>
</tbody>
</table>

DETAIL 1

DETAIL 2
**NOTES:**

1. RAILS, JOINT BARS AND TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.

2. DESIGNING AND ORDERING FOR TRACK BOLTS SHALL DESIGNATE DIAMETER OF BOLT PER SCRRA [ES2352].

3. LENGTH OF TRACK BOLT WILL PERMIT USE OF SPRING WASHER UP TO APPROXIMATELY 0.78" THICK.

4. ALL BOLT HOLES SHALL BE CHAMFERED.

5. THIS PLAN FOR USE IN NEW RAIL INSTALLATION (SEE SCRRA ES2350-02) FOR EXISTING 115 LB 9"X6½" RAIL (OLD SP PUNCH).

---

**DETAIL OF HEAD EASEMENT**

**RAIL END DRILLING**

**SIZE OF BOLT HOLES**

**RAIL END DRILLING**

**ENGINEERING STANDARDS**

**SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY**

**FOR 115 LB. RE RAIL**

---

**METROLINK**

---

**NOTES:**

1. RAILS, JOINT BARS AND TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.

2. DESIGNING AND ORDERING FOR TRACK BOLTS SHALL DESIGNATE DIAMETER OF BOLT PER SCRRA [ES2352].

3. LENGTH OF TRACK BOLT WILL PERMIT USE OF SPRING WASHER UP TO APPROXIMATELY 0.78" THICK.

4. ALL BOLT HOLES SHALL BE CHAMFERED.

5. THIS PLAN FOR USE IN NEW RAIL INSTALLATION (SEE SCRRA ES2350-02) FOR EXISTING 115 LB 9"X6½" RAIL (OLD SP PUNCH).
NOTES:

1. RAILS, JOINT BARS AND TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.
2. DESIGNATIONS AND DESIGNATIONS FOR TRACK BOLTS SHALL BE DETERMINED BY SCRRA ES2501.
3. LENGTH OF TRACK BOLT HOLE FORM AND USE OF SPRING WASHER UP TO APPROXIMATELY 0.78" THICK.
4. ALL BOLT HOLES SHALL BE CHAMFERED.

**ASSEMBLY**

- **DETAIL OF HEAD EASEMENT**
- **RAIL END DRILLING**
- **LONGITUDINAL SECTION OF JOINT BAR**
- **JOINT BAR PUNCHING**
- **SIZE OF BOLT HOLES**

**ENGINEERING STANDARDS**

**RAIL AND JOINT ASSEMBLY FOR 115 LB. RE RAIL**

FOR MAINTENANCE USE WITH FORMER "SP" RAIL AND JOINT ASSEMBLY FOR 115 LB. RE RAIL

PUNCH 2½" x 6½" x 6½"
NOTES:
1. RAILS, JOINT BARS AND TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.
2. SPECIFICATIONS AND ORDERS FOR TRACK BOLTS SHALL DESIGNATE DIAMETER OF BOLT PER SCRRA ES2352.
3. LENGTH OF TRACK BOLT SHALL PERMIT USE OF SPRING WASHER UP TO APPROXIMATELY 0.67" THICK.
4. BOLT HOLES SHALL BE CHAMFERED.

RAIL END DRILLING

JOINT BAR PUNCHING

BOLT HOLE CHAMFERING

SECTION A-A

DETAIL OF HEAD EASEMENT

LONGITUDINAL SECTION OF JOINT BAR

BOLT HOLES SHALL BE CHAMFERED. WASHER UP TO APPROXIMATELY 0.76" THICK. ALL LENGTH OF TRACK BOLT WILL PERMIT USE OF SPRING DESIGNATE DIAMETER OF BOLT PER SCRRA ES2352.

REQUISITIONS AND ORDERS FOR TRACK BOLTS SHALL CONFORM TO THE SCRRA CURRENT SPECIFICATION.

RAILS, JOINT BARS AND TRACK BOLTS SHALL

FOR 136 LB. RE RAIL AND JOINT ASSEMBLY

RADIUS 8"

1¾" DIA (TYP)

0.031" TO 0.062"

EASEMENT 1¼" TO 1½"

ENGINEERING STANDARDS

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY
1200 WILSHIRE BLVD., SUITE 1500, L. A., CA. 90017

ASSISTANT DIRECTOR, DESIGN
PRINCIPAL ENGINEER, DESIGN & STANDARDS

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
THE SELECTION AND USE OF THESE
SCRRA SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF
SCRRA ENGINEERING STANDARDS ARE INTENDED FOR SCRRA APPROVED USES ONLY.
The plan shows general information for compromise joints.

1. Use standard joint bar per ES2501, machined & labeled to indicate rail size and gauge and field sides.
2. Use standard joint bar per ES2502, machined & labeled to indicate rail size and gauge and field sides.
3. Use standard joint bar per ES2503, machined & labeled to indicate rail size and gauge and field sides.
4. Use standard joint bar per ES2504, machined & labeled to indicate rail size and gauge and field sides.
5. Use standard joint bar per ES2505, machined & labeled to indicate rail size and gauge and field sides.
6. Use standard joint bar per ES2506, machined & labeled to indicate rail size and gauge and field sides.

Compromise joint dimensions and lengths:

<table>
<thead>
<tr>
<th>Heavy Rail: Lighter Rail</th>
<th>Length</th>
<th>Rail Height</th>
<th>Bolt Dia</th>
<th>Diameter of Holes in Rail</th>
<th>Diameter of Holes in Bar</th>
<th>Rail End to 1st Hole</th>
<th>Rail End to 2nd Hole</th>
<th>Rail End to 3rd Hole</th>
<th>Rail End to 4th Hole</th>
<th>Rail End to 5th Hole</th>
<th>Amount of Heat</th>
<th>Cap Between Rail Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 HE &amp; 135 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>14 HE &amp; 135 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>14 HE &amp; 170 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>14 HE &amp; 170 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>14 HE &amp; 170 HE (HARD ONLY)</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>14 HE &amp; 170 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>15 HE &amp; 175 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>15 HE &amp; 175 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>15 HE &amp; 175 HE (HARD ONLY)</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>15 HE &amp; 175 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>16 HE &amp; 180 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>16 HE &amp; 180 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>16 HE &amp; 180 HE (HARD ONLY)</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>16 HE &amp; 180 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>16 HE &amp; 180 HE (HARD ONLY)</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
<tr>
<td>16 HE &amp; 180 HE</td>
<td>36 ⁴⁄₅</td>
<td>⁷⁄₈&quot;</td>
<td>⁷⁄₈&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
<td>1 ³⁄₈&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>3&quot;</td>
<td>3½&quot;</td>
<td>4&quot;</td>
<td>4 ⁴⁄₅&quot;</td>
<td>1 ⁵⁄₈&quot;</td>
</tr>
</tbody>
</table>

Notes:
1. Use standard joint bar per ES2501, machined & labeled to indicate rail size and gauge and field sides.
2. Use standard joint bar per ES2502, machined & labeled to indicate rail size and gauge and field sides.
3. Use standard joint bar per ES2503, machined & labeled to indicate rail size and gauge and field sides.
4. Use standard joint bar per ES2504, machined & labeled to indicate rail size and gauge and field sides.
5. Use standard joint bar per ES2505, machined & labeled to indicate rail size and gauge and field sides.
6. Use standard joint bar per ES2506, machined & labeled to indicate rail size and gauge and field sides.
NOTES:
1. Insulated joint plugs shall have a design, size, and shape that will ensure a secure and proper fit. The plugs shall be manufactured with a hardened surface, and the manufacturer shall provide a certification of the hardness of the rail used in the manufacture of the plugs. The plugs shall be designed to ensure a tight fit when installed on the rail, and shall be marked with a manufacturer's identification tag. The tag shall include the manufacturer's name, control number, location, identification number, and the month and year of manufacture.

2. Insulated joint plugs shall be manufactured in accordance with the latest revision of the AREMA specifications. The manufacturer shall provide a copy of the latest revision of the AREMA specifications with each shipment of insulated joint plugs.

3. Insulated joint plugs shall be tested for hardness and durability. The tests shall be conducted in accordance with the latest revision of the AREMA specifications. The manufacturer shall provide a certificate of conformity with the AREMA specifications with each shipment of insulated joint plugs.

4. Insulated joint plugs shall be installed in accordance with the latest revision of the AREMA specifications. The manufacturer shall provide instructions for the installation of insulated joint plugs with each shipment of insulated joint plugs.

5. Insulated joint plugs shall be marked with a balance point for centering the plugs on the rail. The balance point shall be marked on the manufacturer's identification tag. The balance point shall be marked with a pencil or a similar marking tool.

6. Insulated joint plugs shall be marked with a grade number for centering the plugs on the rail. The grade number shall be marked on the manufacturer's identification tag. The grade number shall be marked with a pencil or a similar marking tool.

7. Insulated joint plugs shall be marked with a manufacturer's name and address for centering the plugs on the rail. The name and address shall be marked on the manufacturer's identification tag. The name and address shall be marked with a pencil or a similar marking tool.

8. Insulated joint plugs shall be marked with a manufacturer's date of manufacture for centering the plugs on the rail. The date of manufacture shall be marked on the manufacturer's identification tag. The date of manufacture shall be marked with a pencil or a similar marking tool.

9. Insulated joint plugs shall be marked with a manufacturer's lot number for centering the plugs on the rail. The lot number shall be marked on the manufacturer's identification tag. The lot number shall be marked with a pencil or a similar marking tool.

10. Insulated joint plugs shall be marked with a manufacturer's certification of conformity for centering the plugs on the rail. The certification of conformity shall be marked on the manufacturer's identification tag. The certification of conformity shall be marked with a pencil or a similar marking tool.

11. Insulated joint plugs shall be marked with a manufacturer's signature for centering the plugs on the rail. The signature shall be marked on the manufacturer's identification tag. The signature shall be marked with a pencil or a similar marking tool.
REQUIRED DERAIL NOTES:

1. Except at the interlockings, derails are required at the following locations unless otherwise authorized:
   a. Interchange tracks, regardless of grade conditions, where there is hazard of foreign line operation causing engines or cars to move foul of main track, siding, or other tracks.
   b. Industry tracks, where an industry can move cars to create a hazard by fouling the main track, siding, or any industry tracks or other tracks where cars are left unattended.
   c. Spur and other tracks on which cars are left unattended and the unauthorized movement of such cars may foul main track or siding, except where track grade ascends toward main track or siding at greater than or equal to 1.5% gradient.
   d. Any track, regardless of grade that is used for the storage of live engines and where an unauthorized movement of the engines could foul main track.
   e. Other locations, regardless of grade, where special conditions require derail protection and such protection is authorized by SCRRA.

2. 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 specified:
   a. On inside of curves over 5 degrees.
   b. On tracks where an uncontrolled car could reach a speed in excess of four (4) mph.
   c. At locations where a derail is installed to protect against the movement of engines or trains. Sliding or hinged derails are authorized for protection at locomotive and car repair facilities when also protected by blue flag rules and procedures.
   d. At any other location where conditions are such that the switch point derail should be installed to eliminate a potentially hazardous situation.

3. Double point derails for SCRRA ES2604 are required as noted below. At other locations requiring a derail, a sliding or hinged derail, SCRRA ES2613 or ES2614 will be used:
   a. Locations where uncontrolled movements can exceed 20 mph.
   b. Locations protecting tracks holding 15 or more cars.
   c. Operating track ascends toward main track at grade less than 0.5% or descends toward the main track at any gradient.
   d. By other locations designated by SCRRA assistant director for design.

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

5. See SCRRA ES2610, ES2611 and ES2612 for derail usage 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.
GENERAL PLAN FOR CONNECTING ROD WITH HAYES SLIDING DERAIL

NOTE:

SINCE THE THROW OF SWITCH STAND IS ONLY 5", THE SLOTTED HOLE IN ROD IS PRODUCED TO RESIST MOVEMENT OF 6¼" REQUIRED FOR PROPER FUNCTIONING OF HAYES SLIDING DERAIL.

SECTION A-A

POSITION OF CONNECTING ROD WHEN DERAIL IS IN THE OPEN POSITION

TOP OF THE

SECTION A-A

(CLOSED)

POSITION OF CONNECTING ROD WHEN DERAIL IS IN THE CLOSED POSITION

TOP OF THE
## BILL OF MATERIAL

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Ln No</th>
<th>Mfr</th>
<th>Description</th>
<th>Qty</th>
<th>PART NO</th>
<th>DWG NO</th>
<th>SCRRAP PART NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
<td>SAMSON POINT, 16&quot;-8&quot; x 45&quot;-8&quot; LONG, FLOATING MELL MANGANESE TP, LM</td>
<td>35</td>
<td>ES2921-08</td>
<td>ES2921-08</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td></td>
<td>SAMSON POINT, 16&quot;-8&quot; x 45&quot;-8&quot; LONG, FLOATING MELL MANGANESE TP, BM</td>
<td>34</td>
<td>ES2921-08</td>
<td>ES2921-08</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td></td>
<td>STOCK RAIL SAMSON UNDERCUT, HEnt &amp; CURVED, 28'-10&quot; LONG LW/HTO</td>
<td>35</td>
<td>ES2921-09</td>
<td>ES2921-09</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td></td>
<td>STOCK RAIL SAMSON UNDERCUT, STRAIGHT, 42'-0&quot; LONG HM/WHTO</td>
<td>37</td>
<td>ES2921-09</td>
<td>ES2921-09</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td></td>
<td>CURVE RAIL 4' x 4'-6&quot; LONG</td>
<td>39</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td></td>
<td>CURVE RAIL 30'-4&quot;/5&quot; LONG</td>
<td>40</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td></td>
<td>SWITCH ROD “ASSEMBLY”, HM/vertical C/W BASKET ASSEMBLY</td>
<td>41</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td></td>
<td>SWITCH ROD “ASSEMBLY”, HM/vertical</td>
<td>42</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td></td>
<td>GAUGE PLATE INSULATED (P=1+)</td>
<td>43</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td></td>
<td>GAUGE PLATE INSULATED (G=1+)</td>
<td>44</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td></td>
<td>GAUGE PLATE INSULATED (G=1+)</td>
<td>45</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td></td>
<td>GAUGE PLATE INSULATED (G=2+)</td>
<td>46</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td></td>
<td>GAUGE PLATE INSULATED (G=2+)</td>
<td>47</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>7</td>
<td></td>
<td>BRACE SLIDE PLATE (G=2+)</td>
<td>48</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>4</td>
<td></td>
<td>BRACE SLIDE PLATE (G=2+)</td>
<td>49</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>2</td>
<td></td>
<td>BRACE SLIDE PLATE (G=2+)</td>
<td>50</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td></td>
<td>SWITCH MEAT PLATE (G=2+)</td>
<td>51</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td></td>
<td>SWITCH MEAT PLATE (G=2+)</td>
<td>52</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>6</td>
<td></td>
<td>SLIDE PLATE (S=2+) 6&quot; - Premier</td>
<td>53</td>
<td>ES2921-08</td>
<td>ES2921-08</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>4</td>
<td></td>
<td>SLIDE PLATE (S=2+) 6&quot; - Premier</td>
<td>54</td>
<td>ES2921-08</td>
<td>ES2921-08</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>55</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>56</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>57</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>58</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>59</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>60</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>61</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>62</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>63</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>2</td>
<td></td>
<td>SWITCH PLATE (T=10+)</td>
<td>64</td>
<td>ES2921-13</td>
<td>ES2921-13</td>
<td></td>
</tr>
</tbody>
</table>
**MATERIAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>SYSTEM</th>
<th>MANUFACTURER AND PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HIGH INTENSITY SHEETING</td>
<td>3M SCOTCHLITE HIGH INTENSITY PRISMATIC WHITE GRADE 3930 SHEETING</td>
</tr>
<tr>
<td>2</td>
<td>TYPE VIII CRYSTAL GRADE</td>
<td>NIPPON CARBIDE RETRO-REFLECTIVE SHEETING TYPE VIII CRYSTAL GRADE</td>
</tr>
<tr>
<td>3</td>
<td>PHOTOSTATIC HIGH INTENSITY SHEETING</td>
<td>AVERY DENNISON OPP-100 PREMIUM PHOTOSTATIC HIGH INTENSITY SHEETING</td>
</tr>
<tr>
<td>4</td>
<td>GRAPHICS</td>
<td>3M PROCESS COLOR SERIES 8801 INK</td>
</tr>
<tr>
<td>5</td>
<td>ANTI-REFLECTIVE SHEETING</td>
<td>NIPPON CARBIDE RETRO-REFLECTIVE SHEETING TYPE XI CRYSTAL GRADE</td>
</tr>
<tr>
<td>6</td>
<td>ANTI-REFLECTIVE OVERLAY FILM</td>
<td>AVERY DENNISON OMNI-VIEW T-9500 PRISMATIC SHEETING</td>
</tr>
<tr>
<td>7</td>
<td>OVERLAY</td>
<td>3M PREMIUM ELECTROSTATIC FILM 1160</td>
</tr>
<tr>
<td>8</td>
<td>ANTI-GRAFFITI OVERLAY</td>
<td>NIPPON CARBIDE GRAFT RESISTANT 3803 INK</td>
</tr>
<tr>
<td>9</td>
<td>ANTI-GRAFFITI PASTE</td>
<td>AVERY DENNISON 4930 INK</td>
</tr>
<tr>
<td>10</td>
<td>OVERLAY</td>
<td>3M PREMIUM PROTECTIVE OVERLAY 1160</td>
</tr>
<tr>
<td>11</td>
<td>PANEL</td>
<td>1/8&quot; THICK ALUMINUM, ALCOA 6061-T6 OR EQUAL</td>
</tr>
<tr>
<td>12</td>
<td>HARDWARE</td>
<td>POSTS, ANCHORS, &amp; HARDWARE</td>
</tr>
</tbody>
</table>

**INSTALLATION NOTES**

1. ALL SIGNS SHALL BE LOCATED AS PER LOCATION PLAN AND FACING WEB AS TO BE READ FROM ENGINE PULLING OUT OF THE SIDE TRACK. SELECT OFFSET FROM FIELD SIDE OF NEAREST RAIL, SUCH THAT UNDERGROUND UTILITIES SHALL NOT BE DAMAGED WHEN SITTING ANCHOR.

2. MATERIALS INCLUDE: ALUMINUM PANEL, RETROREFLECTIVE SHEETING, POLYURETHANE PAINT, SCREENED-PROCESS COLORS OR FILM, UV PROTECTION OVERLAY, ANTI-GRAFFITI OVERLAY, POSTS, ANCHORS AND HARDWARE.

3. PANEL SHALL BE ALUMINUM PANEL, RETROREFLECTIVE SHEETING, POLYURETHANE PAINT, SCREENED-PROCESS COLORS OR FILM, UV PROTECTION OVERLAY, ANTI-GRAFFITI OVERLAY, POSTS, ANCHORS AND HARDWARE.

4. PANEL SHALL BE PAINTED ON ALL SIDES WITH TWO PART ACRYLIC POLYURETHANE PAINT COATING.

5. RETROREFLECTIVE SHEETING SHALL CONFORM TO THE REQUIREMENTS OF ASTM E8455, CLASS B OR GREATER.

6. SCREENED-PROCESS COLORS OR FILM, UV PROTECTION OVERLAY, ANTI-GRAFFITI OVERLAY, POSTS, ANCHORS AND HARDWARE SHALL HAVE EQUIVALENT OUTDOOR WEATHERABILITY CHARACTERISTICS AS THE RETROREFLECTIVE SHEETING.

**ENGINEERING STANDARDS**

**TYPE "B" DERAIL SIGN**

**SIGN**

**LOCATION PLAN**

**TYPE "B" SIGNS CONFORM TO CALIFORNIA STATE LAW**

**METROLINK**

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

**ENGINEERING STANDARDS**

**TYPE "B" DERAIL SIGN**
### INSTALLATION NOTES

Where derail is provided to prevent fouling of any track, derail switch notice shall be placed on stand of that particular switch through which the fouling movement would be made.

### MATERIAL NOTES:

1. Signs shall include aluminum panel retroreflective sheeting, polyurethane paint, screened-process colors, or film for protection overlay, anti-graffiti overlay, posts, anchors and hardware.
2. Panel shall be aluminum 6061-T6 or equal.
3. Panel shall be painted on all sides with two-pass acrylic polyurethane paint coating.
4. Retroreflective sheeting shall conform to the requirements of ASTM D4956 Class IX or greater. Retroreflective sheeting shall have Class 1, 2, or 3 adhesive backing which shall be pressure sensitive and fungus resistant.
5. Screened-process colors and nonreflective opaque black film shall have equivalent outdoor weatherability characteristics as the retroreflective sheeting.

### MATERIAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>MANUFACTURER AND PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3M ScotchLite High Intensity Prismatic White Grade 3930 Sheeting</td>
</tr>
<tr>
<td>2</td>
<td>Nippon Carbide Retro-Reflective Sheeting Type Vincristale Grade</td>
</tr>
<tr>
<td>3</td>
<td>Avery Dennison Own-View 1-9300 Prismatic High Intensity Sheeting</td>
</tr>
</tbody>
</table>

### INSTALLATION NOTES

Where derail is provided to prevent fouling of any track, derail switch notice shall be placed on stand of that particular switch through which the fouling movement would be made.
INSTALLATION REQUIREMENT NOTES:
1. CROWDER WITH EYE OF DEERL THROWN.
2. WHEEL CROWDER STROKE TO 3/4" WITH 1/2" DIAMETER PINS.
3. PAINT SAFETY YELLOW.
4. FOR PROPER THROW OF SWITCH STAND TO DEERL/CROWDER, ADJUST SWITCH STAND CRANK EYE FOR 3 1/2" THROW.
5. MAKE SURE THAT YOUR SWITCH STAND HEAD BLOCK TIES THAT HOLD THE DEERL ARE HIGH QUALITY.
6. READ THE MANUFACTURER’S INSTRUCTIONS.
7. PLACE THE DEERL VISUALLY TO THE GAUGE.
8. SPACER BOTH RAILS TO THE TIES AT THE PROPER GAUGE.
9. INSERT THE CROWDER THROUGH THE GAUGE HOLES TO PREVENT THE TIES FROM SPREADING.
10. HAVE GOOD DRAINAGE AND BALLAST. THE AREA UNDER THE DEERL MUST BE POCKETED TO PREVENT BINDING IN ADVERSE WEATHER CONDITIONS.

INSTALLATION OF CROWDER NOTES:
1. PLACE THE WHEEL CROWDER TIGHTLY AGAINST THE WEB OF THE RAIL.
2. RAIL CROWDER MOUNTING BOLT HOLE TO BE MATCHED MARKED FROM THE RAIL CROWDER AND DRILLED IN THE FIELD.
3. USE THE RAIL SET SCREWS TO ADJUST AND MAINTAIN PROPER RAIL CROWDER POINT CONTACTS WITH THE RAIL.
4. WITH BOTH RAIL AND RAIL CROWDER SECURED AND IN DERAILING POSITION, ATTACH THE CONNECTING ROD TO THE LEFT LUG ON THE DEERL THEN CONNECT THE OPPOSITE END OF THE CONNECTING RODS 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 TURNBUCKLE ON THE SWITCH STAND OR ELECTRIC SWITCH STAND. THE OPPOSITE END OF THE CONNECTING ROD CONNECTS TO THE RIGHT HAND LUG ON THE DEERL. ADJUST THE THROWN OR YOUR SWITCH STAND TO A 5/8" THROW. A SHORTER THROW WILL GIVE YOU PRESSURE ON THE CONNECTING ROD ON SWITCH STAND EYE. PRESSURE ON THE EYE AND CONNECTING ROD CAN RESULT IN A FAILURE OF THAT COMPONENT ADJUST AS NECESSARY.
6. PLACE COTTER KEYS TO SECURE THE NUTS.
7. INSTALL A SWITCH LOCK.

BILL OF MATERIAL

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>WHEEL DEERL M5X55 C/W CROWDER</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>RAIL DEERL KIT FOR WCH DEERL FOR USE WITH US&amp;S M23E MACH/ MACHINE</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>BOLT HEX 1&quot; X 4&quot; GR5</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>NUT HEAVY HEX 1&quot; GR5</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>WASHER SPRING HEAVY 1&quot;</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>CLIP PANDROL E2055G RH GALVANIZED</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>DR-136</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>TIE PLATE DR1-136</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>TIE PLATE DR2-136</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>TIE HARDWOOD TREATED 8&quot; X 10&quot; X 9'-0&quot;</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>TIE HARDWOOD TREATED 8&quot; X 10&quot; X 12'-0&quot;</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
<td>SCREW SPIKE 1/2&quot; X 6&quot;</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>BOLT HEX 1/2&quot; X 4&quot; GR5</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>WASHER SPRING HEAVY 1/2&quot;</td>
</tr>
<tr>
<td>15</td>
<td>8</td>
<td>CLIP PANDROL E2055G RH GALVANIZED</td>
</tr>
</tbody>
</table>

ENGINEERING STANDARDS
BI-DIRECTIONAL DEERL WITH CROWDER
INSTALLATION REQUIREMENT NOTES:

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

INSTALLATION OF CROWDER NOTES:

1. PLACE THE WHEEL CROWDER TIGHTLY AGAINST THE WEB OF THE RAIL.
2. ONE CROWDER MOUNTING BOLT MIST BE PAIN WORKED FROM THE RAIL AND WHEELED IN THE FIELDS.
3. USE THE WHEEL HOLE SCREWS TO ADJUST AND MAINTAIN PROPER WHEEL CROWDER POINT CONTACTS WITH THE RAIL.
4. WITH BOTH RAIL AND WHEEL CROWDER SECURED AND IN DETAILING POSITION, ATTACH THE CONNECTING ROD TO THE LEFT LUG ON THE DERAIL, THEN CONNECT THE OPPOSITE END OF THE CONNECTING ROD WITH THE CROWDER AND SLIDING DERAIL CROWDER MECHANISM ON THE BASE OF THE WHEEL CROWDER.
5. ATTACH THE SWITCH STAND CONNECTING ROD OF THE MANUAL OR ELECTRIC SWITCH STAND TO THE TURNBUCKLE ON THE RAIL DERAIL OR ELECTRIC SWITCH STAND. THE OPPOSITE END OF THE CONNECTING ROD CONNECTS TO THE TURNBUCKLE ON THE CROWN DERAIL OR ELECTRIC SWITCH STAND. THE BURGLARY END OF THE CONNECTING ROD CONNECTS TO THE RIGHT HAND LUG ON THE DERAIL, ADJUST THE THROW ON YOUR SWITCH STAND TO 5/8" THROW. A SHORTER THROW WILL GIVE YOU PRESSURE ON THE CONNECTING ROD ON SWITCH STAND EYE. PRESSURE ON THE EYE AND CONNECTING ROD CAN RESULT IN A FAILURE OF THAT COMPONENT, ADJUST AS NECESSARY.
6. PLACE COTTER KEYS TO SECURE THE NUTS.
7. INSTALL A SWITCH LOCK.
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 manufacturer's recommendation.
**NOTES:**

1. TURNOUT - DERAIL CONNECTED TO SIGNAL SYSTEM

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

<table>
<thead>
<tr>
<th>TYPE OF DERAIL</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEND ON SLOPING</td>
<td>15°</td>
<td>35°</td>
</tr>
<tr>
<td>DOUBLE POINT</td>
<td>25°</td>
<td>90°</td>
</tr>
</tbody>
</table>

3. DERAIL SET BACK

4. MAX 10'-0"

5. MIN 6'-6"

6. TURNOUT - DERAIL CONNECTED TO SIGNAL SYSTEM

7. DERAIL SET BACK

8. MAX 10'-0"

9. MIN 6'-6"

10. POINT OF DERAIL (SEE CHART)

11. CLEARANCE POINT

12. POINT OF DERAIL

13. CLEARANCE POINT

14. MIN 6'-6"

15. MAX 10'-0"

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

17. NOTE 7

18. SEE CHART

19. 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
   - WITHOUT CONSULTING A REGISTERED PROFESSIONAL ENGINEER. ALL WARRANTIES
   - SCRRA SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF
   - SCRRA ENGINEERING STANDARDS ARE INTENDED FOR SCRRA APPROVED USES ONLY.

20. SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY


22. ASSISTANT DIRECTOR, DESIGN

23. PRINCIPAL ENGINEER, DESIGN & STANDARDS
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 (CROSSING AND YARD TRACK SWITCH STANDS AT CROSSEVERS LEADING TO MAIN TRACK, OR SENDING AND YARD TRACK SWITCH STANDS WHICH ACTUATE MAIN LINE SIGNALS). YARD AND OTHER INSIDE 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)

TARGET SYMBOLS
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.

 TRACK DESCRIPTIONS

FOR SPRING SWITCH

TRACK NUMBER

EAST LEAD

36E TARGET

18" dia. "E" target for spring switch

"SCOTCHLITE" 3" NO 3290 WHITE CUT-OUT

NUMBERS TO BE APPLIED IN THE FIELD ON THE FACE SIDE OF SWITCH TARGET ONLY

22E TARGET

COLOR INDICATORS OF TARGETS

ON SWITCH STANDS

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.
FOR MAINTENANCE ONLY

NOTES:

1. USE THE (ES2708) STANDS FOR NEW INSTALLATION.
2. THIS LOW STAR SWITCH STAND IS TO BE USED ONLY UNTIL THE STYLE STAND IS REPLACED IN THE NORMAL COURSE OF MAINTENANCE OR CAPITAL PROJECT RENEWALS.
3. MAIN TRACK SWITCH STANDS SHALL BE PLACED ON THE TURNOUT SIDE TO THE TRACK WHEREVER STRUCTURES OR OTHER TRACKS POINT.
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
800 WILSHIRE BLVD., SUITE 1500, L.A., CA. 90017

ALL RIGHTS RESERVED.

ENGINEERING STANDARDS

LOW STAR SWITCH STAND
DOUBLE CRANK - DOUBLE HEADBLOCK
NOTES:
1. ROD SHALL BE SAE1045. THREADS SHALL BE 1/4" 7 UNC-2B.
2. RAIL ENGAGEMENT FITTINGS (SF-21) SHALL BE OF 60,000 PSI TENSILE, 45,000 PSI YIELD, AND 12% ELONGATION PROPERTIES WITH STANDARD MILL TOLERANCES.
3. AFTER ASSEMBLING THE RA125, Buff smooth ALL WRENCH MARKS.
4. PA-6 INSULATORS ARE 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".
22E SWITCH STAND

NOTES:
1. 22E RECOMMENDED USE: YARD AND OTHER THAN MAIN TRACK
2. IT IS RECOMMENDED THAT SWITCH STANDS BE INSPECTED AND LUBRICATED AT LEAST ONCE A YEAR. USE GRAPHITE LUBE IN "OIL CUPS" WITH ANY GOOD GRADE ENGINE OIL.
3. IF SWITCH STAND IS DISASSEMBLED, REGREASING OF ALL INTERNAL PARTS IS REQUIRED. APPLY GREASE LIBERALLY IN "THRUST BUSHING" CAVITY, BOTH END "SPRING BASE", "TJANGLES" SLOT, AND ALL BEARING SURFACES.
4. SWITCH STAND TO BE INSTALLED USING SCREW SPIKES (SCRRA ES2355).
5. FOR SWITCH TARGET DETAILS SEE SCRRA ES2703-01
6. STRAIGHT HANDLE TO BE PAINTED SAFETY YELLOW.

STAND WITH OPTIONAL 36" STRAIGHT HANDLE

OPTIONAL 36" STRAIGHT HANDLE
(USE FOR TIGHT CLEARANCE ONLY)
NOTES:
1. FOR BILL OF MATERIALS SEE SHEET ES2708, SHEET 2 OF 2

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

TIE STRAP LOCATION

TIE MOUNTING KIT

NOTES:
1. SEE ES2708-01 FOR REST OF THE DRAWING.
2. 36-E RECOMMENDED USE: MAIN TRACK CROSS-OVERS AND YARD TRACKS OR OTHER THEN MAIN LINE TRACKS.
3. 36-EH RECOMMENDED USE: MAIN TRACK.
4. FOR MAIN LINE INSTALLATION USE MOUNTING KIT. APPLY THE STRAP ON HEAD BLOCK TIES ON OPPOSITE SIDE OF TRACK FROM SWITCH STANDS.
5. LUBRICATE INTERNALLY AT LEAST ONCE A YEAR.
6. REFERENCE THE FOLLOWING DRAWINGS:
   - SCREW SPACES - ES2158
   - SWITCH TARGET DETAILS - ES2703-01 & 02
   - CONNECTING ROD ASSEMBLY - ES2108
7. STRAIGHT HANDLE TO BE PAINTED SAFETY YELLOW.

CATALOG NO | QTY | DESCRIPTION
-------------|-----|-------------------
3674         | 1   | COVER (S-4790)
3669         | 1   | BASE (S-34678)
3601         | 1   | PIVOT
c3602         | 1   | CRANK (C-3469)
3668         | 1   | THRU-HANDLE LEVER
3618         | 2   | SQ HD BOLT ½" x 3¼" LONG
3615         | 2   | SQ HD BOLT ½" x 4¾" LONG
3671         | 1   | NUT (S-34629)
3665         | 1   | TUBE (S-34676)
3666         | 2   | ⅜" BUTTON HEADS
3672         | 2   | FOOT LATCH
3663         | 1   | CRANK BUSHING
3654         | 1   | CRANK WASHER
3652         | 1   | CRANK C-34698
3606         | 1   | PLATE
3677         | 2   | ⅜" x ⅝" HEX CAP SCREW
3678         | 1   | WRENCH H-5480
3667         | 2   | ½" x 2¼" HEX CAP SCREW
3677         | 1   | SWIVEL SCREW 6-480
3678         | 1   | ADAPTOR S-479

TIE STRAP LOCATION

HEAD BLOCK TIES

TIE STRAP

TIE STRAP MOUNTING KIT

1/2" X 2" X 2' STEEL STRAP
10 FOR STAND AND 2 FOR STRAP
1/2" X 3" X 2' STEEL STRAP

BASE (D-34678)
SPINDLE
CRANK EYE (GL-1889)
TRI-HANDLE LEVER
SQ HD BOLT ¾" X 3¼" LONG
SQ HD BOLT ¾" X 4¾" LONG
HUB (D-34629)
YOKE (D-34679)
¾" BUTTON RIVETS
FOOT LATCH
CRANK BUSHING
CRANK WASHER
CRANK GL-1908
COTTER
½" X 2¼" HEX CAP SCREW
STIFFENER S-480
ADAPTER S-481
SPINDLE EXTENSION #66
SQ HEAD BOLT ½" X 2½" LONG 2" THDS
HEX NUT ½"
SPRING WASHER - ½"
ANCO HEX NUT - ½"
HEX SECURITY NUT ½" - 10
SPRING WASHER ½"
MEX NUT HEAVY 1½" - SLOTTED
2" - SLOTTED
MEX SECURITY NUT ½" - 10
FLAT WASHER 1½"
GREASE FITTING
GREASE FITTING
ROLL PIN ½" X 2"
HEX SECURITY NUT - ½"
HEX NUT HEAVY WFI ½" - SLOTTED
FLAT WASHER 1½"
GREASE FITTING
FLAT WASHER 1½"
GREASE FITTING
FLAT WASHER 1½"
GREASE FITTING
FLAT WASHER 1½"
GREASE FITTING
FLAT WASHER 1½"
GREASE FITTING
112E HIGH SWITCH STAND

### BILL OF MATERIALS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>OTY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>MAIN CASTING (MODIFIED AS SHOWN)</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>SPINDLE</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>CRANK EYE</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>SPINDLE EXTENSION</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>COLLAR</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>SPINDLE BRACKET</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>SPINDLE EXTENSION</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>TARGET</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>TARGET</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>¾&quot; X 2&quot; BOLT SQUARE HD/NUT B FLAT WASHER</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>¼&quot; X 2½&quot; MACH BOLTS/SQUARE HD NUTS 8&quot; X 1/2&quot; COUPLING SPRING WASHER</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
<td>¾&quot; X 2½&quot; MACH BOLTS/SQUARE HD 8&quot; HEX ANCO NUTS</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>TIE STRAP MOUNTING KIT</td>
</tr>
</tbody>
</table>

### NOTES:

1. RECOMMENDED USE, MAIN TRACK FOR SWITCH STAND MOUNTING KIT.
2. APPLY TIE STRAP ON HEADBLOCK TIES ON OPPOSITE SIDE OF TRACK FROM SWITCH STANDS.
3. MINIMUM CONNECTING ROD LENGTH IS 6'-0¾".
4. FOR SWITCH TARGET DETAILS: SCRRA ES2701-01
5. FOR TRACK IDENTIFICATION: SCRRA ES2701-02
6. FOR CONNECTING ROD ASSEMBLY: SCRRA ES2708

### BASE

- 1" DIA (TYP)
- 2½" (TYP)

### TARGET SPINDLE EXTENSION

- 3½" DIA (TYP)
- 1½" INSIDE, 1½" OUTSIDE SQUARE TUBING

---

**ENGINEERING STANDARDS**

112E HIGH SWITCH STAND

---

**METROLINK**

SOUTHERN CALIFORNIA REGIONAL RAIL AUTHORITY

800 WILSHIRE BLVD., SUITE 1500, L.A., CA 90017

---

**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 THE DATA OR INFORMATION CONTAINED HEREIN. THE SELECTION AND USE OF THESE SCRRA SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCRRA ENGINEERING STANDARDS ARE INTENDED FOR SCRRA APPROVED USES ONLY.
1. CRANKEYE AND CONNECTING ROD CLEVIS SHOULD BE GREASED PRIOR TO INSTALLATION.

2. MEASURE THROW BETWEEN SWITCH POINT & STOCK RAIL AT FIRST RODThread showing on connecting rod should be greased prior to installation.

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 TIES AND SPINE OR LAG TO YES.

5. HAND THROW SWITCH TO BOTH SIDES SEVERAL TIMES. WHEN POINT CONTACTS STOCK RAIL, LEVER SHOULDN'T BE MORE THAN 0.5" TO 1" ABOVE FINAL POSITIONS ON TOP OF LEVER REST FOR BOTH POSITIONS.

---

**NOTES:**

1. USE #6 SCREW SPIKES OR APPROPRIATE PH SCREWS WHEN INSTALLING NEW SWITCH STANDS ON TIMBER OR CONCRETE TIES.

2. FIELD INSPECTION OF STAND IS RECOMMENDED AT LEAST ANNUALLY OR MORE WHERE STAND IS USED FREQUENTLY.

3. OIL CONROD AT LEAST 60 DEGREES ABOVE FREE ENTER.

4. CRANKEYE MEASUREMENTS ON THIS DRAWING AND FINAL ADJUSTMENTS ARE PROBABLY DUE TO TOLERANCES (LOST MOTION) IN CONNECTING ROD/HEADBLOCK TIES.

5. DIFFERENCES BETWEEN CRANKEYE MEASUREMENTS ON THIS DRAWING AND FINAL ADJUSTMENTS ARE PROBABLY DUE TO TOLERANCES (LOST MOTION) IN CONNECTING ROD/HEADBLOCK TIES AND INSTALLATION INSTRUCTIONS.
Connecting Rod Assembly for All Switch Stands with Adjustable Crank Eye

(22E, 36E-EH, 112E, etc.)

<table>
<thead>
<tr>
<th>Rail Size</th>
<th>&quot;X&quot;</th>
<th>Head Rod Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-115 LB</td>
<td>3&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td>132-136 LB</td>
<td>3.5&quot;</td>
<td>1.5&quot;</td>
</tr>
<tr>
<td>90-115 LB</td>
<td>5&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td>132-136 LB</td>
<td>5&quot;</td>
<td>1.5&quot;</td>
</tr>
<tr>
<td>90-115 LB</td>
<td>7&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td>132-136 LB</td>
<td>7&quot;</td>
<td>1.5&quot;</td>
</tr>
</tbody>
</table>

Includes: HT Machine Bolt, Heavy Hex Nut. 1/2" Cotter and Washer.