SCRRRA
GRADE SEPARATION GUIDELINES

APRIL 2016
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1.0 INTRODUCTION

1.1 Purpose

The purpose of these SCRRAGrade Separation Guidelines ("Guidelines") is to inform and provide current criteria for the design and construction of, or modifications to, Grade Separation Structures that affect the track and Right-of-Way of the Southern California Regional Rail Authority (SCRRAG). The grade separation design firm(s) and their Engineer in Responsible Charge shall use these Guidelines in union with the additional guidelines listed in Section 1.6, and referenced standards, codes, specifications, and manuals listed in the Appendices as the basis for preliminary and final design. Most of these Guidelines and referenced standards, codes, specifications, and manuals are available on the SCRRAG website: www.metrolinktrains.com.

Strict compliance with these Guidelines is required in order to facilitate completion of the design and construction reviews in a timely manner.

1.2 Limitations and Disclaimers

These Guidelines shall not be used as a substitute for engineering knowledge, experience, or judgment. The criteria, referenced criteria, and information presented in these Guidelines have been developed in accordance with recognized engineering principles and railroad industry practice. SCRRAG does not warrant the accuracy of these Guidelines, or that these Guidelines are free from errors and omissions. Users of these Guidelines shall independently validate and verify the information referenced and contained herein, and should promptly notify SCRRAG of any discrepancies or inconsistencies discovered in the course of their use.

Design of Grade Separation Structures and related facilities shall be prepared by a licensed California professional engineer who shall be solely responsible for verifying the accuracy, suitability, and applicability of the information contained in these Guidelines and referenced material.

Review and acceptance of submittals by SCRRAG shall not relieve the Public Agency, Contractor, and Engineer in Responsible Charge of responsibility for the design and construction of the Grade Separation project, including responsibility for errors and omissions in submittals, and construction deviations from accepted design plans. Construction safety shall be the responsibility of the Contractor and Engineer in Responsible Charge.

1.3 Changes, Updates, and Effective Date

The most recent date shown in the lower right hand footer of each page is the effective date of these Guidelines. The most recent effective date shall supersede all previous versions. Users of these Guidelines shall be solely responsible for checking the web site and utilizing the latest version. Forward any suggested changes or updates to these Guidelines to the SCRRAG Director of Engineering and Construction for consideration. The current effective date of these Guidelines shall be April 2016.
1.4 References

The following is a general listing of specific design criteria, which shall be adhered to. This list is by no means comprehensive and other standards may apply.

The design shall meet all applicable parts of the State of California general laws, California Public Utilities Commission (CPUC) requirements, FRA safety requirements, and the specific project requirements. Where any conflict in criteria exists, the stricter criteria shall govern.

Unless specifically noted otherwise in these criteria, the latest edition of the standard, code, or guideline that is applicable at the time the design is initiated shall be used. If a new edition of or amendment to a standard, code, or guideline is issued before the design is completed, the design shall conform to the new requirements to the extent approved or required by the agency enforcing the standard, code, or guideline changed.

1.4.1 Industry Standards

The most recent editions of the following publications and documents were used:

A. AASHTO - American Association of State Highway and Transportation Officials
B. ADA - Americans with Disabilities Act
C. AREMA - American Railway Engineering and Maintenance-of-Way Association (AREMA) Recommended Practice
D. Cal/OSHA - State of California Division of Occupational Safety and Health safety orders
E. Caltrans - Caltrans Highway Design Manual (HDM)
F. CBC - California Building Code
G. CPUC - California Public Utilities Commission General Orders
H. FRA - Federal Railroad Administration, Track Safety Standards, particularly 49 Code of Federal Regulations (CFR) 213, 214, 234, and 236
I. FTA - Federal Transit Administration, Federal Highway Administration (FHWA)
K. Government Codes of the State of California
L. UBC - Uniform Building Code, including seismic requirements
M. 49 CFR 195, Transportation of Hazardous Liquids by Pipeline

1.4.2 SCRRA Standards

SCRRA has developed a number of standard plans, specifications, and manuals that shall be applied to this project. In particular, standard plans and specifications shall be used wherever possible to reduce engineering and construction costs. All standards and manuals shall be adhered to throughout this project unless waived in writing by SCRRA Director of Engineering and Construction.

A. SCRRA Engineering Standards
B. SCRRA Standard Specifications
C. SCRRA Design Criteria Manual
D. SCRRA Design Procedures Manual
E. SCRRA Design Quality Assurance Manual
1.4.3 **SCRRRA Guidelines**

The following SCRRRA documents will also be referenced and revised as appropriate:

A. SCRRRA Highway-Rail Grade Crossings Recommended Design Practices and Standards Manual
B. Grade Separation Guidelines
C. Excavation Support Guidelines
D. Landscape Design Guidelines
E. Rails-with-trails Design Guidelines
F. Quiet Zone Implementation Guidelines and Procedures
G. SCRRRA Temporary Traffic Control Guidelines

1.4.4 **SCRRRA Design Procedures Manual**

The overall design process will follow the steps defined in the SCRRRA Design Procedures Manual, which defines the required submittals, deliverables, and reviews. The manual also defines the development of specifications and estimates. As previously noted, the design shall incorporate existing SCRRRA standards, plans, and specifications.

1.5 **Definitions**

**Contractor**
The individual, firm, partnership, corporation, joint venture, or combination thereof that has entered into a construction contract with the legal entity for which the work is being performed. For purpose of these Guidelines, Contractor also includes any sub-contractor, supplier, agent, or other individual entering the SCRRRA Right-of-Way during performance of the work.

**Engineer in Responsible Charge**
The licensed professional engineer in responsible charge of grade separation design, whose seal and signature shall be affixed to the drawings, specifications, calculations, and other documents used in the design and construction of grade separation. For the purpose of these Guidelines, the Engineer in Responsible Charge also includes other people designated by the licensed professional engineer in responsible charge and working at his/her direction.

**Highway-Rail Grade Crossing**
The general area where a highway and a railroad’s Right-of-Way cross at the same level, within which are included the railroad tracks, highway, and traffic control devices for highway traffic traversing that area.
Grade Separation  A crossing of a traveled way (pedestrian pathway, highway or other roadway) and a railroad at different levels.

Member Agency  A specific county transportation agency(s), whose Right-of-Way or property is directly affected by this project. The SCRRA Member Agencies are the Los Angeles County Metropolitan Transportation Authority (MTA), the Orange County Transportation Authority (OCTA), the Riverside County Transportation Commission (RCTC), the San Bernardino Associated Governments (SANBAG), and the Ventura County Transportation Commission (VCTC).

Operating System  Includes, but is not limited to the tracks on which trains and “on-track” equipment operate or may potentially operate, and in addition, any facilities closely related to the operation of the railroad system including signal and communications masts, bridges, poles, cables, houses, tunnels, culverts, bridges, Grade Crossings, and station platforms.

Overhead Structure  A grade separated structure crossing over a railroad.

Public Agency  The Federal government and any agencies, departments, or subdivisions thereof; the State of California; and any county, city, city and county district, public authority, joint powers agency, municipal corporation, or any other political subdivision or public corporation therein, requesting and sponsoring the projects.

Right-of-Way  A strip of land, real estate, or property of interest, which is under the ownership or operating jurisdiction of SCRRA or Member Agency on which railroad tracks, other structures, and facilities are constructed.

SCRRA  A five-county joint powers authority, created pursuant to State of California Public Utilities Code Section 130255 and California Government Code Section 6500 et seq., to build, maintain, and operate the “Metrolink” commuter train system. The five-county member agencies are comprised of the following: Los Angeles County Metropolitan Transportation Authority (MTA), Ventura County Transportation Commission (VCTC), Orange County Transportation Authority (OCTA), San Bernardino Associated Governments (SANBAG), and Riverside County Transportation Commission (RCTC). SCRRA builds, operates, and maintains commuter rail system in the five-county area on rail Right-of-Way owned by the member agencies.

SCRRA Standards  The SCRRA Engineering Standards, Standard Specifications, Design Criteria, and Guidelines for any of several elements of track, roadbed, structure, signal, or related facilities.

Shoofly Track  A temporary railroad track to bypass an obstruction or construction site.
Substructure  The portions of the bridge below the bridge seats including piers, abutments, retaining walls, roadway illumination, drainage, roadway pavement, curb, gutter, striping, signage, aesthetic and cosmetic design elements, soffits, and facades.

Superstructure  The portion of the bridge above bridge seats including bearing assemblies, bridge members, deck, track, and drainage system.

Underpass Structure  A grade separated structure crossing under a railroad.

1.6 Abbreviations

<table>
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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AASHTO</td>
<td>American Association of State Highways and Transportation Officials</td>
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<td>AAR</td>
<td>Association of American Railroads</td>
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<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
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<td>ADA</td>
<td>Americans with Disabilities Act</td>
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<td>AISC</td>
<td>American Institute of Steel Construction</td>
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<td>ANSI</td>
<td>American National Standards Institute</td>
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<td>APWA</td>
<td>American Public Works Association</td>
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<td>AREMA</td>
<td>American Railway Engineering and Maintenance of Way Association</td>
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<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>Caltrans</td>
<td>California Department of Transportation</td>
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<td>CPUC</td>
<td>California Public Utilities Commission</td>
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<td>DSA</td>
<td>Design Services Agreement</td>
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<td>FHWA</td>
<td>Federal Highway Administration</td>
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<td>FRA</td>
<td>Federal Railroad Administration</td>
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<tr>
<td>HMA</td>
<td>Hot Mixed Asphalt</td>
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<tr>
<td>MSE</td>
<td>Mechanically Stabilized Embankment</td>
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<tr>
<td>MTA</td>
<td>Los Angeles County Metropolitan Transportation Authority</td>
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<tr>
<td>MUTCD</td>
<td>Manual of Uniform Traffic Control Devices</td>
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<tr>
<td>OCTA</td>
<td>Orange County Transportation Authority</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PCI</td>
<td>Precast/Pre-stressed Concrete Institute</td>
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<tr>
<td>RCTC</td>
<td>Riverside County Transportation Commission</td>
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<tr>
<td>SANBAG</td>
<td>San Bernardino Associated Governments</td>
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<tr>
<td>SCRRRA</td>
<td>Southern California Regional Rail Authority</td>
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<tr>
<td>SSPC</td>
<td>Steel Structures Painting Council</td>
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<tr>
<td>SSPWC</td>
<td>Standard Specifications for Public Works Construction</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratories Inc.</td>
</tr>
<tr>
<td>VCTC</td>
<td>Ventura County Transportation Commission</td>
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1.7 Scope

These Guidelines establish the design criteria for structures used in Grade Separation projects that support SCRRRA tracks and other railroad related facilities. Where special design cases are encountered that are not specifically covered in these Guidelines, a project-specific design criteria shall be formally submitted to SCRRRA for review and acceptance. These Guidelines do not include criteria or steps necessary to evaluate
the need for a Grade Separated Structure to replace an existing Highway-Rail Grade Crossing.

The design of a structure owned or maintained by a Public Agency other than the SCRRA and not supporting SCRRA tracks or trains shall be in accordance with the standards used by that Public Agency, and shall be consistent with SCRRA operating and maintenance requirements as contained in these Guidelines. Structures owned or maintained by Caltrans, or by any jurisdiction adopting the standards of that Public Agency, shall be designed in accordance with Caltrans criteria and SCRRA operating and maintenance requirements as contained in these Guidelines.

1.8 Design Phase

The Public Agency shall provide the following submittals during the design phase of a Grade Separation Structure to SCRRA for review and consideration for acceptance:

A. Concept and Design Criteria (5% Design)
B. Preliminary Design (30% Design)
C. Interim Design (60% Design)
D. Pre-Final Design (90% Design)
E. Final Design (100% Design)

A project meeting is required with key members of the Grade Separation design team and SCRRA when submittals are made at each design phase. The meeting shall discuss resolution of comments as necessary from previous submittals and review features of the current submittal. The meeting shall be formally requested three (3) weeks in advance from the SCRRA Manager of Rail Corridor Crossings and Encroachments. (Refer to Section 5 of these guidelines for further submittal requirements.)

At the concept level meeting the project designer will need to discuss SCRRA’s allowable construction track windows.

At the 60% level meeting a discussion will need to take place regarding any changes to the allowable track windows and any necessary refinements to the design and construction phasing shall be made prior to the next submittal.

At the 90% level meeting final track windows will be agreed upon and any further refinements to the design and construction phasing shall be made prior to the final submittal.

The final agreed upon track windows shall be annotated on the final contract drawings.

SCRRA reserves the right to modify the agreed upon allowable track windows at anytime during design and construction due to unforeseen changes in operating requirements. Any additional project costs incurred due to modified track windows will be the sole responsibility of the sponsoring Public Agency. Complete final designs and agreed upon construction track windows that have been accepted for projects that do not immediately, or within two (2) years of the final acceptance date, proceed to construction, shall be resubmitted to SCRRA for review for conformance to current standards and criteria. This review shall be considered a Pre-Final Design (90%
Design) submittal. Upon acceptance and resolution of comments, the Final Design (100% Design) can be submitted. These reviews shall be solely at the project sponsor’s expense.

1.9 Construction Phase

The submittals made during construction shall meet SCRRRA requirements contained in SCRRRA Standard Specifications. (Refer to Section 5 of these guidelines for further submittal requirements.) All submittals during construction must be submitted to and approved by the Engineer in Responsible Charge prior to forwarding by the Public Agency Resident Engineer for SCRRRA’s review and acceptance. All documents that comprise the submittal shall show valid approval by the Engineer in Responsible Charge.

SCRRRA will review material data sheets to determine compliance with the specifications. It is required that product information for steel and concrete members, bearings, concrete mix designs, rebar and strand certifications, 28-day concrete strength, waterproofing material certification, structural steel certification, test reports, and foundation reports be submitted to SCRRRA for review and acceptance. Procurement, manufacture, fabrication, and construction shall not begin until notified by SCRRRA that such submittal has been accepted.

The Site Specific Work Plan (SSWP) submittal and electronic “.PDF” drawings showing details of construction affecting the tracks and property, specifications, and plans and procedures for excavation, demolition, falsework, sheeting and shoring, drainage, temporary traffic control, and any other proposed work that may infringe on SCRRRA Right-of-Way or affect operations of train traffic, shall be submitted to SCRRRA for review and acceptance prior to procurement, manufacture, fabrication, and construction.

1.10 As-Built Phase

The Public Agency shall submit electronic “.PDF” As-Built documents and MicroStation (Version 8 or newer) As-Built drawings, as noted in Tables 5.1 and 5.2, to SCRRRA upon completion and prior to closing out the project. Submitted drawings shall conform to standards contained in SCRRRA’s CADD Drafting Standards, Guidelines, and Criteria.

Electronic copies (in “.PDF” format) of certificates, equipment, product data, shop drawings, pile driving records, and miscellaneous submittals (warranties, guarantees, agreements, testing reports, and record drawings) shall be submitted to SCRRRA for all Underpass structures.
2.0 JURISDICTION

California Public Utilities Commission (CPUC) Code Sections 1201-1220 have rules and regulations regarding railroad crossings. Section 1201 requires that no public road, highway, or street shall be constructed across the track of any railroad corporation at-grade without having first secured the permission of the Commission. Section 1202 says that the CPUC has the exclusive power (a) to determine and prescribe the manner, including the particular point of crossing, and terms of installation, operation, maintenance, use, and protection of each Grade Crossing, (b) to alter, relocate, or abolish by physical closing any such crossing, and (c) to require, where in its judgment it would be practical, a separation of grades at any crossing and prescribe the terms upon which such separation shall be made and the proportions in which the expenses shall be divided.

2.1 Approval

CPUC application for authority to construct a new public Highway-Rail Grade Crossing, major alteration to an existing crossing, or a Grade Separation is necessary per CPUC Code Sections 1201-1205. However, CPUC General Order No. 88-B provides for an informal process for authorizing Grade Separations that closes one or more Highway-Rail Grade Crossings. Refer to the CPUC website for CPUC application procedures at http://www.cpuc.ca.gov.

An evidence of agreement is required to be submitted with the application to construct or modify a Highway-Rail Grade Crossing from the owner of the railroad Right-of-Way and any and all operating railroads, per CPUC General Orders.
3.0 FUNDING

The Public Agency interested in developing a Grade Separation is responsible for financing of a Grade Separation.

Federal and State funding (partial) is available for Grade Separation projects that eliminate one or more Highway-Rail Grade Crossings. CPUC is responsible for establishing priority lists of projects that are in need of funding for separation. These lists are determined on the basis of criteria established by the CPUC. California Streets and Highways (S&H) Code Section 2450-2461 has rules and regulations regarding funding for Grade Separations. Refer to S&H website www.leginfo.ca.gov for further information on codes.

For a State funded project, and per CPUC Section 1202.5 requirements, the railroad shall pay 10 percent of the cost of Grade Separation project where a Grade Separation project initiated by a Public Agency will directly result in the elimination of one or more existing Highway-Rail Grade Crossings, located at or within a reasonable distance from the point of crossing of the Grade Separation. For a Federally funded project, and as per U. S. Department of Transportation, Federal Highway Administration, Code of Federal Regulations, Title 23, Part 646, Section 646.210, the railroad shall pay five (5) percent of the cost of the Grade Separation project. The railroad’s share of the cost shall be based on the costs for preliminary engineering; Right-of-Way and construction within the limits where a Grade Crossing is eliminated by a Grade Separation; and the structure and approaches required to transition to a theoretical highway profile which would have been constructed if there were no railroad present, and for the number of lanes on the existing highway in accordance with current design standards of the State highway agency (Caltrans).
4.0 AGREEMENTS

Design Services Agreement (DSA), Right-of-Way, Construction and Maintenance (C&M), and Right of Entry agreements consistent with SCRRA policy may be required depending on the type of project, responsible Public Agency, and to establish the responsibilities of all parties.

4.1 Design Services Agreement (DSA)

An executed Design Services Agreement (DSA) with SCRRA is required to initiate and start the coordination and review processes for each Grade Separation project. A DSA shall be executed by the Public Agency and SCRRA for the delineation of responsibilities and responsible party for payment of the costs incurred by SCRRA for the review process and all other activities required during the design and construction phases of the project.

4.2 Right-of-Way Agreements

The Right-of-Way, in many cases, is maintained by SCRRA and owned in fee by the Member Agencies. Public Agency or third party projects that affect the Right-of-Way must be coordinated with SCRRA’s Engineering and Construction Department.

The construction or modification to Grade Separations will often have an effect on the existing Right-of-Way. The Public Agency shall determine the status of the Right-of-Way within the limits of the project at the earliest stages of the project in order to properly identify the encumbrances and issues. In cases where additional Right-of-Way are required, the appropriate mapping and Right-of-Way definition shall be developed in accordance with SCRRA or Public Agency standards.

In most cases, the Public Agency takes the lead for land acquisition. The Public Agency shall properly define the necessary Right-of-Way, provide legal descriptions, and work with SCRRA’s Right-of-Way administrator and the Member Agency’s real estate department, as needed, to forward the process of property acquisition, easement, or preparing a license agreement.

4.3 Construction and Maintenance (C&M) Agreements

The construction or modification of a Grade Separation within the SCRRA Operating System shall be defined in a Construction and Maintenance (C&M) Agreement. The C&M Agreement will be preceded by a Design Services Agreement (DSA) to initiate the review process.

Before any designs can be finalized and before any construction work can begin, an agreement that includes a detailed work description; specifies the method of payment; assigns responsibility for design, construction, funding, and maintenance; provides cost estimates of the SCRRA work; and specifies the form, duration, and amount of insurances and liability must be executed by SCRRA and the Public Agency and any other outside parties participating in the funding. The CPUC must also approve the final design of changes and modifications to existing Grade Separations before any construction can begin. It is important that the development of documents outlining the responsibilities of the parties and by SCRRA begin early, as the design is established in order to properly define the scope of work and the project cost. A new C&M Agreement
will typically supersede any existing SCRRA/Public Agency agreement. SCRRA will require that the funding for SCRRA services associated with Grade Separation agreements, including DSA and C&M Agreements, be deposited with SCRRA upon execution of the Agreement and in advance of SCRRA incurring any costs.

SCRRA has developed rules, requirements, and standard specifications that define the responsibilities of Contractors working within Right-of-Way operated and maintained by SCRRA. The Public Agency should be familiar with these rules, requirements, and specifications, and include them with any bid documents associated with the work at the Grade Separation. Rules and requirements are found in Form 37: Rules and Requirements for Construction on Railway Property. A list of standard specifications can be found in Appendix A.

All project maintenance shall be conducted in accordance with the C&M Agreement. The Public Agency shall maintain and keep in a state of good repair the traveled way, fence, gates, signs, traffic signals, landscaping, and any other improvements that are within the jurisdiction and ownership (or easement, or licensed traveled-way) of the Public Agency.

As part of the C&M Agreement, the Public Agency shall notify SCRRA within five (5) working days in advance of any maintenance activity, and within thirty (30) days in advance of any construction activity, that will occur within the Right-of-Way. The Public Agency shall be required to reimburse SCRRA the actual cost and expense incurred and a computed surcharge representing SCRRA's costs for administration and management.

4.4 Right-of-Entry Agreements

In order to perform work on Right-of-Way that is operated and maintained by SCRRA, Right-of-Entry Agreements are required. For temporary or short-term uses of Right-of-Way, such as surveying activities and geotechnical investigations, the Public Agency, or Contractor, is required to submit SCRRA Form 5 – Indemnification and Assumption of Liability Agreement. For a project involving construction on SCRRA Right-of-Way, the Public Agency or Contractor is required to enter into SCRRA Form 6 – Temporary Right-of-Entry Agreement. This agreement defines the nature of the work, the flagging requirements, and the appropriate safety measures that must be in place during the work. This includes all work within the Right-of-Way, from initial design through the completion of construction. Additionally, the movement of oversize vehicles over SCRRA maintained and operated crossings requires a fully executed Form 4 – Agreement for Moving Oversized Loads over Highway-Rail Grade Crossings. These agreements are available on the SCRRA website at www.metrolinktrains.com.

In some cases, SCRRA also shares the Right-of-Way with the BNSF Railway Company (BNSF) and the Union Pacific (UPRR) Railroads. In such cases, in order to perform work on their Right-of-Way, approval shall be obtained directly from BNSF and UPRR.

The procedures for applying for Right-of-Way encroachment are found in Form 36: Right-of-Way Encroachment Approval Procedures.

SCRRA has specific non-arbitrary safety regulations that include required training, personal protective equipment requirements, and other standards and regulations that require compliance prior to entering SCRRA Right-of-Way. Failure to comply with these requirements shall result in immediate expulsion from SCRRA Right-of-Way.
5.0 SUBMITTALS

All project submittals shall be formally submitted to the SCRRRA’s Engineering and Construction Department with a completed checklist for each design and construction submittal phase. All design plan submittals shall include an affidavit that the plans have been checked and received a Quality Control review. The Final Plan submittal for all Underpass Structures shall have an independent check by an engineer who was not a member of the original design team. All design plan sets shall be annotated with the percentage complete. Plans, installation procedures and calculations for all submittals shall be signed and sealed by a registered Professional Engineer licensed to practice in the State of California. Checklists are provided in Appendix B.

As part of the submittal process, a project meeting is required with key members of the Grade Separation design team and SCRRRA when submittals are made for each design phase. The meeting shall discuss resolution of comments as necessary from previous submittals and review features of the current submittal. The meeting shall be formally requested three (3) weeks in advance from the SCRRRA.

Prior to each subsequent design submittal the previous submittal must be accepted by the SCRRRA Engineering and Maintenance, Operating, and Construction departments. The SCRRRA Signal department shall review and accept the plans of the Pre-Final Design (90% Design) submittal.

SCRRRA will review submittals as deemed necessary to reject or provide acceptance of the submittal. Acceptance of the submittal by SCRRRA does not mean that Public Agency, manufacturer, or Contractor are not responsible for: full compliance with contract requirements; correctness of structural calculations, dimensions, clearances and material quantities; proper design of details; proper fabrication and construction techniques; proper coordination with other trades; and providing all devices required for safe and satisfactory construction and operation.

All submittals during construction must be approved by the Engineer in Responsible Charge, prior to forwarding by the Agency Resident Engineer for SCRRRA’s review and acceptance. All documents that comprise the submittal shall show valid approval by the Engineer in Responsible Charge.

All submittals to the SCRRRA during design and construction shall be Adobe “.PDF” files compatible with Version 6. Plans, specifications, calculations, permits, construction documents, shoring, etc. shall be separate “.PDF” files. The construction documents shall be searchable “.PDF’s”. The final As-Built documentation shall be submitted upon completion and prior to closing out the project. CADD drawings shall conform to standards contained in SCRRRA’s CADD Drafting Standards, Guidelines and Criteria.

Each file name shall include a letter indicating the project phase, abbreviated operating line name, bridge number and a short name of what is included in the “.PDF” file name (i.e., “p_olnbridgeno._name.pdf”).

All “.PDF” files shall be placed on a DVD-R for submittal to SCRRRA. Each DVD-R shall be labeled with the information listed above and the firm’s name making the submittal.
5.1 Submittal Schedule

To allow adequate time for review, the Public Agency shall schedule submittals per Table 5-1 Overhead Structures, or structures carrying non-SCRRA loads over SCRRA tracks; or Table 5-2 Underpass Structures, or those structures carrying SCRRA tracks and loading over the crossing. The Public Agency should not expect a lesser time for review than what is indicated in the tables, nor shall SCRRA be responsible for delays of design or construction. Partial, incomplete, or inadequate submittals will be rejected, thus delaying the acceptance process. Revised submittals will follow the same procedure as the initial submittal until all issues are resolved. Submittals approved by the SCRRA but not acted on (advanced to the next submittal stage or construction) within 24 months of the SCRRA approval date will be required to be resubmitted for re-approval.

5.2 Geotechnical Report

A geotechnical report shall be provided for the design of all bridges and retaining walls. The preliminary geotechnical report shall include enough information to support foundation design calculations and backfill design requirements. The final geotechnical report shall have recommendations consistent with those used in the final structural design.

5.3 Drainage Report

A drainage report is required if the Grade Separation necessitates changes in existing drainage patterns or increases drainage flow on SCRRA Right-of-Way. Refer to SCRRA Design Criteria Manual, Chapter 8, for hydraulic criteria to be used.

5.4 Units

All controlling dimensions, elevations, design criteria, assumptions, and material stresses shall be expressed in English units. Dual units with English units in parenthesis are acceptable for projects that require the use of Metric units per Federal, State, and/or Local government requirements. Refer to Section 6.0 for additional requirements.

5.5 Design and Construction Submittals

The Public Agency or their representative shall submit all applicable design and construction submittals defined in Table 5.1 Overhead Structures, or Table 5.2 Underpass Structures, to the SCRRRA for review and acceptance following their own internal review and approval of the submittal. Shoring and falsework designs shall be submitted as shown in the design phase. Design of shoring shall be performed in accordance with SCRRRA's Excavation Support Guidelines. The Engineer in Responsible Charge's review comments must be submitted to the SCRRRA along with the construction submittal.
Table 5.1  Overhead Structures

<table>
<thead>
<tr>
<th>Phase</th>
<th>Type of Submittal</th>
<th>Format</th>
<th>SCERRA Review Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td><strong>A</strong>  Concept and Design Criteria (5% Design) [Plans and Site Pictures]</td>
<td>PDF</td>
<td>4 weeks</td>
</tr>
<tr>
<td></td>
<td><strong>E</strong>  Final Design (100% Design) [Applicant response, Design Plans, Project Specifications, Drainage Report, Shoofly Design, Construction Phasing Plans, Shoring and Falsework Designs]</td>
<td>PDF</td>
<td>4 weeks</td>
</tr>
</tbody>
</table>
| Construction | Shoring  
Falsework erection and removal  
Demolition  
Erection  
Erosion Control  
Construction Phasing Plans  
Site Specific Work Plan (SSWP) | PDF    | 4 weeks            |
| As-Built | As-Built Plans                                                                                             | PDF    | N/A               |
The Concept and Design Criteria (5% Design) submittal shall compare alternative design solutions and shall be based on field inspection to identify critical clearances and evaluate existing conditions, including track alignment, evidence of utilities, location of other SCRRA structures and facilities, and identification of potential Right-of-Way conflicts. The Concept and Design Criteria (5% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists, design submittal report, and a list of reports and analyses that should be prepared as a part of conceptual design.

B. Conceptual roadway alignments and layouts complete with existing track locations and alignments, and critical Overhead and clearance dimensions.

C. Plan, Elevation, and Typical Section of proposed Grade Separation.

D. Identification of ownership for all project Right-of-Way needed for the Grade Separation.

E. An initial assembly of utility information affecting the project location using the SCRRA Utilities Matrix. SCRRA is not a member of the Underground Service Alert (USA), and the Agency shall request location of SCRRA utilities from SCRRA.

F. Photo log with pictures of the proposed project location. Site pictures shall be in all controlling directions including, but not limited to North, East, South, and West. The plan view should show a reference location and direction for each picture.

The Preliminary Design (30% Design) submittal shall advance the engineering and technical work to 30% of final design. The design criteria will continue to be refined progressively as the design advances. The Preliminary Design (30% Design) submittal shall determine the constructability and functional feasibility of the Grade Separation and provide preliminary critical dimensions and elevations. The Preliminary Design (30% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists and applicant responses to SCRRA review comments on the concept submittal. The Preliminary Design (30% Design) submittal shall reflect concept review comments.

B. Identification of all stakeholders and incorporation of their input into the Grade Separation plans.

C. Preliminary Design Plans showing a Plan View, Elevation View, Typical Section, and Top-of-Rail Profile Grade Diagram for existing track(s) 1000 feet each way from the proposed Overhead Structure centerline. Plans to include general notes and indicate structure design criteria and construction methods. Include existing Grade Crossing locations with roadway elevations, and other Grade Separations, with existing vertical clearance dimension over existing track(s), within one (1) mile of the proposed Overhead structure.

D. Preliminary Project Specifications and/or Special Provisions, including SCRRA coordination requirements.

E. Preliminary Drainage Report.
F. Preliminary Shoofly Design, if required. The general plan shall show the location of the Shoofly, if a Shoofly is required, and indicate the footprint of the proposed Overhead Structure in relation to the centerline of Shoofly and existing track(s).

G. Preliminary Construction Phasing Plans. Construction Phasing Plans must show all required phasing, track windows, and construction procedures.

H. Identify any potential conflicts with existing signal system.

I. Preliminary Shoring and Falsework Designs.

The Interim Design (60% Design) submittal will require an additional 30% of the overall design effort to bring the design level to 60% design completion. The Interim Design (60% Design) submittal shall address drainage layout and design, identify additional geotechnical investigations to be used for final design, and provide critical elevations and dimensions. The Interim Design (60% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists and applicant responses to SCRRRA review comments on the Preliminary Design (30% Design) submittal. The Interim Design (60% Design) submittal shall reflect the Preliminary Design (30% Design) submittal review comments.

B. Revisions to Design Plans.

C. Revisions to Project Specifications and/or Special Provisions, including SCRRRA coordination requirements.

D. Revisions to Drainage Report.

E. Revisions to Shoofly Design, if a shoofly is required.

F. Revisions to Construction Phasing Plans including track windows.

G. Revisions to Shoring and Falsework Designs.

The Pre-Final Design (90% Design) submittal will require the design to be advanced to at least 90% of the overall design effort. Some of the components of the design may be progressed to 100% design. The Pre-Final Design (90% Design) submittal shall address quality of the design and design documents, identify all required utility protections or relocations and finalize agreements with utility companies, and obtain required approvals from regulatory agencies. The Pre-Final Design (90% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists and applicant responses to SCRRRA review comments on the Interim Design (60% Design) submittal. The Pre-Final Design (90% Design) submittal shall reflect the Interim Design (60% Design) submittal review comments.

B. Revisions to Design Plans.

C. Revisions to Project Specifications and/or Special Provisions, including SCRRRA coordination requirements.

D. Revisions to Drainage Report.

E. Revisions to Shoofly Design, if a shoofly is required.

F. Revisions to Construction Phasing Plans including track windows.
G. Revisions to Shoring and Falsework Designs.

The Final Design (100% Design) submittal will progress work to 100%. The Final Design (100% Design) submittal shall confirm quality completeness and adequacy of design. Final Specifications, Special Conditions and bid ready plans will be provided for acceptance. The Final Design (100% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists and applicant responses to SCRRA review comments on the Pre-Final Design (90% Design) submittal. The Final Design (100% Design) submittal shall reflect the Pre-Final Design (90% Design) submittal review comments.

B. Final Design Plans with agreed upon track windows annotated on the contract drawings.

C. Final Project Specifications and/or Special Provisions, including SCRRA coordination requirements.

D. Final Drainage Report.

E. Final Shoofly Design, if a Shoofly is required.

F. Final Construction Phasing Plans including agreed upon track windows.

G. Final Shoring and Falsework Designs.
Table 5.2  Underpass Structures

<table>
<thead>
<tr>
<th>Phase</th>
<th>Type of Submittal</th>
<th>Format</th>
<th>Railroad Review Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Concept and Design Criteria (5% Design) [Plans and Site Pictures]</td>
<td>4 hard copies and .PDF</td>
<td>4 weeks</td>
</tr>
<tr>
<td>B</td>
<td>Preliminary Design (30% Design) [Applicant response, Type Selection Report, Design Plan, Shoofly, Construction phasing, Conceptual Shoring Design]</td>
<td>4 hard copies and .PDF</td>
<td>8 weeks</td>
</tr>
<tr>
<td>Construction</td>
<td>Shoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Falsework erection and removal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demolition</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Erection</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Erosion Control</td>
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<td></td>
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<tr>
<td></td>
<td>Construction Phasing Plans</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Site Specific Work Plan (SSWP)</td>
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<tr>
<td></td>
<td>Shop Drawings</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Bearing Shop Drawings and Material Certifications</td>
<td></td>
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<tr>
<td></td>
<td>Concrete Mix Design</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Structural Steel, Rebar and Strand Certifications</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28-day Cylinder Test of Concrete Strength</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Waterproofing Material Certification</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Test Reports for Fracture Critical Members</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Foundation Construction Reports (e.g.: Pile Driving Records, Caisson Drilling, and/or Crosshole Sonic Log Testing for Drilled Shafts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>As-Built</td>
<td>As-Built Plans and Construction Documents, Shop Plans, Pile Driving Records, and Misc Submittals</td>
<td>PDF MicroStation</td>
<td>N/A</td>
</tr>
</tbody>
</table>
The Concept and Design Criteria (5% Design) submittal shall compare alternative design solutions and shall be based on field inspection to identify critical clearances and evaluate existing conditions, including: track alignment; evidence of utilities; location of other SCRRRA structures and facilities; and identification of potential Right-of-Way conflicts. The Concept and Design Criteria (5% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists, design submittal report, and a list of reports and analyses that should be prepared as a part of conceptual design.

B. Conceptual track and roadway alignments and layouts complete with critical dimensions.

C. Plan, Elevation, and Typical Section of proposed Grade Separation.

D. Identification of ownership for all project Right-of-Way needed for the Grade Separation project and initial assembly of utility information affecting the project location using the SCRRRA Utilities Matrix. SCRRRA is not a member of the Underground Service Alert (USA), and the Agency shall request location of SCRRRA utilities from SCRRRA.

E. Photo log with pictures of the proposed project location. Site pictures shall be in all controlling directions including, but not limited to North, East, South, and West. The plan view should show a reference location and direction for each picture.

The Preliminary Design (30% Design) submittal shall advance the engineering and technical work to 30% of final design. The design criteria will continue to be refined progressively as the design advances. The Preliminary Design (30% Design) submittal shall determine the constructability and functional feasibility of the Grade Separation and provide preliminary critical dimensions and elevations. The Preliminary Design (30% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists and applicant responses to SCRRRA review comments on the concept submittal. The Preliminary Design (30% Design) submittal shall reflect concept review comments.

B. Identification of all stakeholders and incorporation of their input into the Grade Separation plans.

C. Preliminary Design Plans showing a Plan View, Elevation View, Typical Section, and Top-of-Rail Profile Grade Diagram for existing track(s) 1000 feet from each end of the proposed Underpass structure. Plans to include general notes and indicate structure design criteria and construction methods.

D. Preliminary Project Specifications and/or Special Provisions, including SCRRRA coordination requirements.

E. Preliminary Geotechnical Report.

F. Preliminary Drainage Report.

G. Preliminary Shoofly Design. The general plan shall show the location of the Shoofly and indicate the footprint of the proposed Underpass structure in relation to centerline of proposed Shoofly and any other existing track(s).
H. Preliminary Construction Phasing Plans. Construction Phasing Plans must show all required phasing, track windows, construction procedures, and conceptual shoring designs.

The Interim Design (60% Design) submittal will require an additional 30% of the overall design effort to bring the design level to 60% design completion. The Interim Design (60% Design) submittal shall address drainage layout and design, identify additional geotechnical investigations to be used for final design, and provide critical elevations and dimensions. The Interim Design (60% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists and applicant responses to SCRRA review comments on the Preliminary Design (30% Design) submittal. The Interim Design (60% Design) submittal shall reflect the Preliminary Design (30% Design) submittal review comments.

B. Design Plans and calculations, including: Superstructure and Substructure details; bearing details; deck and waterproofing details; miscellaneous bridge details; and a complete set of structural calculations.

C. Revisions to Geotechnical Report/recommendations.

D. Revisions to Project Specifications and/or Special Provisions, including SCRRA coordination requirements.

E. Revisions to Drainage Report.

F. Revisions to Shoofly Design.

G. Revisions to Construction Phasing Plans including track windows.

H. Revisions to Excavation Shoring Design and details.

The Pre-Final Design (90% Design) submittal will require the design to be advanced to at least 90% of the overall design effort. Some of the components of the design may be progressed to 100% design. The Pre-Final Design (90% Design) submittal shall address quality of the design and design documents, identify all required utility protections or relocations and finalize agreements with utility companies, and obtain required approvals from regulatory agencies. The Pre-Final Design (90% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists and applicant responses to SCRRA review comments on the Interim Design (60% Design) submittal. The Pre-Final Design (90% Design) submittal shall reflect Interim Design (60% Design) review comments. Revisions to plans and calculations as dictated by review of the Interim Design (60% Design) submittal.

B. Revisions to plans and calculations.

C. Revisions to Geotechnical Report/recommendations.

D. Revisions to Project Specifications and/or Special Provisions, including railroad coordination requirements.

E. Revisions to Drainage Report.

F. Revisions to Shoofly Design.

G. Revisions to Construction Phasing Plans including track windows.
H. Revisions to Excavation Shoring Design and details

The Final Design (100% Design) submittal will progress work to 100%. The Final Design (100% Design) submittal shall confirm quality completeness and adequacy of design. The Final Design (100% Design) submittal shall provide final Project Specifications, Special Conditions and bid ready plans to SCRRA for final acceptance. The Final Design (100% Design) submittal shall, at a minimum, include the following:

A. Submittal checklists and applicant responses to SCRRA review comments on the Pre-Final Design (90% Design) submittal.

B. Final Plans and design calculations with agreed upon track windows annotated on the contract drawings.

C. Final Geotechnical Report/recommendations.

D. Final Project Specifications and/or Special Provisions, including Railroad coordination requirements.

E. Final Drainage Report.

F. Final Shoofly Design plans and alignment data.

G. Final and detailed Construction Phasing Plans including agreed upon track windows.

H. Final Excavation Shoring Design and details.
6.0 GENERAL DESIGN GUIDELINES

The design of Grade Separation projects shall be performed by the Public Agency. SCRRA Signal and Communications Engineering Section prepares, at Public Agency’s cost, the design for the active railroad control system including the train detection circuits. The railroad signal and communications design may be done by SCRRA approved consultants if requested by the Public Agency and approved by SCRRA.

The policy of the SCRRA is that the construction and removal of a Grade Separation shall not temporarily or permanently reduce the utility of the Operating System. Aspects of utility to be preserved include: future track expansion of at least one additional track; opportunity to build additional track(s) identified in future plans including but not limited to SCRRA’s Strategic Plan; clearances, and sight lines for signals and road crossings; maintenance access to track and/or signals; drainage of the track; speed of train operations; reliability of train operations; and economy and reliability of operation and maintenance of the Operating System. SCRRA’s reviews of Grade Separation submittals for design and work plans shall be guided by this policy of not diminishing the utility of the Operating System. The Public Agency’s design documents and design and construction submittals shall demonstrate that the utility of the Operating System is not diminished.

Grade Separation projects are undertaken based on schedule and funding that may change in the course of implementation. It is possible that the design will be completed ahead of the funding, and the actual construction will start at a later date with considerable (one year or more) gap between the design and the construction. If this happens to any project, the design shall be revised to meet current standards, requirements, and guidelines of SCRRA and other agencies mentioned in Section 1.4, References.

Design of Grade Separation Structures shall be reviewed by SCRRA and/or SCRRA’s outside consultant at the expense of the Public Agency. Prior to any review, a DSA shall be executed by the Public Agency agreeing to pay all review costs for the design and construction phases of the project. Review expenses shall include all costs for in-house personnel and/or consultants retained by SCRRA. The original estimated costs would not be the upper limit of the costs but provide a guideline for budgeting purposes. Regardless, all costs incurred by SCRRA during plan review process and construction-monitoring phase of the work shall be fully recoverable from the Public Agency.

Engineer in Responsible Charge shall prepare design calculations for Underpass bridge structures. These calculations shall be checked by another independent consultant who is not part of the original design team. SCRRA may engage the services of an outside consultant at the expense of the Public Agency for the independent check of the calculations.

For Overhead Structures, a demolition plan indicating the method of track protection, the sequence of demolition, and a description of the procedure and equipment to be used during demolition shall be submitted to SCRRA for review and acceptance.

All Overhead Structures shall provide horizontal and vertical clearances for: anticipated future track(s); changes in track alignments; raising track(s) for maintenance purposes; location of access roads; location and size of drainage facilities; and location of existing or relocated utilities. SCRRA shall be contacted prior to finalizing the clearances. All requests for information regarding future track requirements shall be formally submitted
to the SCRRRA Director of Engineering and Construction. At all times, minimum CPUC and SCRRRA clearances shall be maintained. If the facility is on another railroad, the clearances specified by the specific railroad at that location shall be followed, if greater. At clearance locations where super elevation is present, vertical clearances shall be measured from the high rail.

Construction activities that impact SCRRRA trains must be coordinated with SCRRRA. The proposed staging and phasing must be reviewed and accepted by SCRRRA at the concept stage and re-reviewed during development of detailed plans. See Section 1.9 of these Guidelines for construction track window discussion requirements. A proposed construction sequence for all aspects of the work for Grade Separations affecting SCRRRA operations, including agreed upon construction track windows, shall be incorporated into the construction documents and annotated on the Contract drawings. Special Provisions shall include SCRRRA coordination requirements in order to make the Contractor aware prior to letting of the proposed Grade Separation. During construction, the Contractor shall submit a final Site Specific Work Plan (SSWP) incorporating the construction sequences, phasing, including track windows accepted during the design phase.

Grade separation projects required coordination with different stakeholders and their design, construction, safety, material, acceptance, accounting, submittal, reporting, funding, and scheduling procedures. During the design and prior to construction, the Consultant will outline all applicable requirements and then select the most applicable one in concurrence with all stakeholders. During construction, the design and construction team will carry out advance planning and constant communications among the stakeholders to prevent surprises and delays.

### 6.1 Dimensions and Units

All dimensions and calculations of interest to SCRRRA shall be in English units. Dual dimensions with English units in parenthesis are acceptable for projects that require the use of Metric units as per State or Federal requirements. SCRRRA shall reject any and all drawings and reports if dual dimensions are not shown or not shown properly.

Dual dimensions shall be shown as a minimum for the following:

A. Horizontal and Vertical clearances.
B. Underground and Surface utilities.
C. Drainage patterns and Drainage facilities.
D. Track spacing, SCRRRA and other Railroad Right-of-Way, and track stationing.
E. Span length, width and depth of Superstructure elements.
F. Size and limits for barrier rails or splashboards and fences.
G. Location and elevation of underground or aerial utilities and their relocation adjustments if required.
H. Size, elevation, and location of pier or abutment footings for spans adjacent to track(s).
I. Size of structure supports.
J. Size and elevations of pier protection wall.
K. Shoring and Falsework locations and their limits, if required.
L. Top-of-Rail elevation under structure and grade profile.
M. Size and location of drainage structures and ditches.
N. Temporary construction vertical or horizontal clearances.
6.2 **Operational Requirements**

The proposed construction be performed without interference to railroad operations. The most effective method for reducing interference to SCRRRA operations for construction of grade separation projects is to use an Overhead structure and avoid an Underpass structure.

6.3 **Access Road**

The design shall include adequate access to existing railroad facilities along and/or within the Right-of-Way. Access road, access road bridge, or access road turnaround with a minimum of 50 feet radius is to be provided. Access road requirements and location shall be verified at the concept stage of the proposed grade separation project. Minimum access road width shall be 12 feet and the centerline of the access road shall be located a minimum of 20 feet from the centerline of the nearest existing or future track.

Refer to Section 8.7 for more information on access road for Underpass Structures.

6.4 **Excavation Support**

All temporary excavation required for construction or demolition of a Grade Separation and other facilities shall comply with SCRRRA Excavation Support Guidelines. The design of permanent retaining walls and other systems of permanent earth retention adjacent to SCRRRA track(s) is addressed in the SCRRRA Design Criteria Manual and applicable reference materials. Shored excavations within 15 feet of a track (including both a shoofly or permanent track) will typically require the track structure include a hot mix asphalt (HMA) sub-ballast, eight (8) inches thick for temporary track and 12 inches thick for permanent track, 12 feet wide (centered about the track centerline) and extending 20 feet past the shored excavation. Refer to Section 8.15 for permanent track and structure HMA requirements.

6.5 **Exception and Waiver Requests**

Requests for exceptions and waivers to these Guidelines must be formally submitted to SCRRRA on the SCRRRA Request for Special Design Consideration form. This form is available on SCRRRA’s website at [www.metrolinktrains.com](http://www.metrolinktrains.com).

Only fully completed Design Exception Forms that provide adequate justification for the requested exception or waiver will be considered for approval. Each separate request shall require a completed Design Exception Form.
7.0 OVERHEAD

The design and construction of Overhead Structures shall be in compliance with the criteria shown on standard drawing, Figure GSG-07 in Appendix C.

The structure, at a minimum, shall meet the specifications and design standards of AASHTO and Caltrans, and shall comply with all applicable Federal, State, and Local laws.

Expansion or hinge joints for the Overhead Structures shall not be located over any track(s) or within the SCRRA Right-of-Way.

7.1 Loading

Overhead Structures shall be designed to carry dead, live, impact or dynamic, wind, seismic, and other loads and forces. All new and replacement highway bridges shall be designed to carry not less than AASHTO HL-93 live load.

7.2 Clearances

The Overhead Structure clearances shall comply with the applicable requirements shown on Drawing GSG-07 - Overhead Structure Clearances, found in Appendix C.

7.2.1 Horizontal

Design for the Overhead Structure shall have all piers and abutments located outside of the SCRRA Right-of-Way. If this is not feasible and an exception is granted by SCRRA, then all piers and abutments shall be located a minimum of 25'-0" from the face of pier to the centerline of the nearest track or identified future track.

Horizontal clearances are for tangent track(s) and correspond to the perpendicular distance from the centerline of the track to the face of support or pier protection wall. The horizontal clearances shall be increased per AREMA and CPUC requirements when any part of the Overhead is located within 80 feet of curved track.

7.2.2 Vertical

A permanent minimum vertical clearance of 24'-0" shall be provided for all Overhead Structures, measured from the top of the high rail to the lowest point of the structure.

Additional vertical clearances may be required for features beyond those shown in the Engineering Standards, such as: correction of sag in the track(s); track raise; construction requirements; and future track raises [within the next five (5) years]. The elevation of the existing top of rail shall be verified prior to beginning construction. All discrepancies shall be brought to the attention of SCRRA prior to construction.

7.2.3 Temporary

A temporary minimum horizontal clearance of 15'-0" from the centerline of track(s) (including temporary falsework) shall be provided for all Overhead Structures.

A temporary minimum vertical clearance of 22'-6" above the top of the rail shall be provided for all Overhead Structures.
7.3 Safety Barriers

Safety barriers for Overhead Structures shall be provided to retain and redirect errant vehicles. Concrete barrier (Type 742) as per Caltrans Standard Plan B11-57 with a height of 42 inches shall be provided on both sides of all Overhead Structures.

7.4 Safety Fences

Overhead Structures shall provide means of protecting SCRRA facilities and the safety of their employees below from objects being thrown from above by pedestrians or passing motorists.

Chain link railing (fencing) (Type 7) as per Caltrans Standard Plan B11-52 shall be provided on both sides of all Overhead Structures. The limits of protective fence shall extend to the full length of the SCRRA Right-of-Way or a minimum of 25 feet beyond the centerline of the outermost track, identified future track or access road. Ornamental fencing with a maximum gap of four (4) inches may be considered by SCRRA.

Parallel structures, which are up to two (2) feet apart, shall not require safety fence at their interface, but the gap shall be covered with a 3/16” minimum thickness galvanized steel plate. Overhead Structures, which are more than two (2) feet apart, shall be treated as individual structures and the required safety protective fence shall be provided.

7.5 Abutment Slopes

To prevent embankment material from sloughing and drainage waters from undermining track subgrade, end slopes of abutments adjacent to tracks shall be protected with paved slopes.

Paved slopes should extend two (2) feet past the outside face of abutment wall and terminate with either a curb or gutter to divert runoff. Paving shall consist of a prepared sub-base and filter fabric with a minimum of four (4) inches thick reinforced concrete or grouted rip-rap placed on prepared sub-base and filter fabric. Toe of slopes should terminate at the bottom of drainage ditches and shall have a cut-off wall as required to protect slope from drainage erosion. The toe of slope shall be below the finished track or roadway subgrade and provide a ditch for positive drainage.

If the layout of the abutment interferes with the existing drainage ditches, suitable means of handling the longitudinal drainage shall be provided with drainage modification plans and supporting calculations to SCRRA.

7.6 Piers

Piers and abutments shall be located outside of the SCRRA Right-of-Way. All piers or columns shall be located so that they do not interfere with the drainage ditches or the natural drainage features of the area. If the layout of piers or columns interferes with the drainage ditches, suitable means of handling the longitudinal drainage shall be provided along with drainage modification plans and supporting calculations to SCRRA.

Tops of pier footings within 25 feet of track centerlines shall be a minimum of six (6) feet below the base of rail. Pier footings shall not restrict SCRRA from modifying the
longitudinal drainage system in the future or from providing unobstructed area for placing signal, fiber optic lines, or other buried utilities.

7.7 Pier Protection

All new, replacement, or modified Overhead Structures will comply with the AREMA manual recommended practices for pier protection.

To limit damage by the redirection and deflection of railroad equipment, piers supporting Overhead Structures over SCRRA track(s) and with a clear distance of less than 25 feet from track centerlines shall be of heavy construction.

The necessity of pier protection wall shall be discussed with SCRRA prior to design and construction. Design of pier protection shall comply with the recommended practices outlined in AREMA Chapter 8, Part 2, and Section 2.1.5.1. Examples of protection walls are shown in the AREMA Manual Figure 8-C-2-1. In locations where pier columns and protection walls interfere with drainage, openings must be provided in the wall for drainage to ditches, or drainage facilities must be provided to collect and dispose water to the drainage system. Opening in the pier protection wall must be lower than the track subgrade elevation and must drain away from the track(s).

7.8 Foundation

Drilled piles and piers/shafts within the influence line shown on the SCRRA Excavation Support Guidelines shall be designed with temporary casing to protect track against cave-in, subsidence, and/or displacement of surrounding ground. Casing shall be designed for live load due to the railroad surcharge in addition to all other loads. Drilled shafts or piling shall be designed to allow the drilling or pile driving to proceed without impacting the SCRRA Operating System.

Drilling of piles, piers/shafts, or shoring construction for footings within influence of railroad surcharge shall not proceed without acceptance from SCRRA. For limits of the Railroad Zone of Influence, refer to the SCRRA Excavation Support Guidelines.

7.9 Drainage

Drainage plans and hydrology report prepared as per local city, county, and SCRRA criteria (Design Criteria Manual, Chapter 8), shall be submitted for SCRRA review and acceptance.

Drainage from the structure shall be diverted away from the SCRRA Right-of-Way at all times. Scuppers from structure deck shall not be permitted to discharge water onto the track or roadway areas at any time. If drainage of deck uses downspouts in the columns, then they shall be connected to the storm drain system or allowed to drain into drainage ditches away from SCRRA Right-of-Way. Concrete splash block or aggregate ditch lining shall be provided at the discharge area of downspouts. Downspouts shall be behind the face of the piers.

Lateral clearances shall provide sufficient space for construction of the required standard ditches parallel to the standard roadbed section. When the proposed construction shall change the quantity and/or characteristic of flow in the existing ditches, the ditches shall
be modified as required to handle the increased runoff. The size of the ditches should vary depending upon the flow and terrain and should be designed accordingly.

7.10 Lights

All Overhead Structures exceeding 80 feet of Superstructure width shall be provided with a lighting system, except if such structure is located in a rural area. Lighting shall also be provided for structures of less than 80 feet width in areas where switching is performed, where high vandalism or trespassing has been experienced, or as directed by SCRRRA.

An average of one (1) foot-candle of power shall be provided under the structure. Fixtures shall be installed on column walls or caps of the Overhead Structure without reducing the minimum clearances. The maintenance of lights shall be the responsibility of the Public Agency.

7.11 Falsework

For Overhead Structures, those carrying traffic over SCRRRA track, the falsework design and construction shall meet the rules and requirements of Caltrans Falsework Manual and Caltrans Standard Specifications Section 51-1.06. Falsework installation and removal methods and procedures shall be submitted for SCRRRA review and acceptance. Temporary collision posts set in six (6) feet of concrete and extending not less than 16 feet above the top of the rail shall be installed on both sides of the falsework bents and located 10 feet clear of the centerline of the nearest track and approximately 100 feet in advance of the falsework. Collision posts shall preferably be steel I-girders with web parallel to the track. Falsework shall be sheathed solid on the side adjacent to track between three (3) and 17 feet above the top of the rail. Sheathing shall consist of plywood not less than 5/8” thick or lumber not less than one (1) inch thick. Collision posts and sheathing shall not be required if horizontal clearances to falsework are 25 feet or greater.

Falsework design and construction shall not obstruct the clear view of SCRRRA’s wayside train signals that may be located on either side of the falsework. If it is necessary to temporarily or permanently relocate the wayside signals, the cost of the relocation shall be the responsibility of the Public Agency requesting the falsework installation.

7.12 Maintenance

The Public Agency is responsible to maintain, repair, and renew the entire Overhead Structure, including piers and abutments, retaining walls, lighting, drainage system, roadway pavement, roadway facilities, curb and gutter, striping, signage, and appurtenances. The Public Agency is responsible for removal of graffiti from the Superstructure, piers, abutments, and retaining walls on a regular basis or as requested by SCRRRA.
8.0 UNDERPASS

The Public Agency responsible for funding and designing the Underpass Structure, structure carrying SCRRA track and other facilities over the road or feature being crossed shall comply with SCRRA Design Criteria, Standard Specifications, and other reference standards listed in these Guidelines.

For other project elements that are not integral components of the Underpass Structure or other SCRRA facilities, and not specifically referenced in these Guidelines, their design shall comply with the applicable codes approved by the Public Agency.


8.1 Loading

The primary design criteria to be used in the design of SCRRA Underpass Structures shall be the American Railway Engineering and Maintenance-of-Way Association (AREMA) – Manual of Railway Engineering (latest edition) and SCRRA Design Criteria Manual. Final determination of the appropriate use and application of the AREMA Manual, SCRRA Design Criteria Manual, or other applicable codes and standards shall be discussed with and accepted by SCRRA.

For multiple track structures, live load, as described by the AREMA Manual, shall be calculated based on the assumption that the track(s) can be located anywhere on the bridge and at a minimum spacing of 13 feet.

Live load distribution for precast/prestressed concrete slab or double box beams shall be in accordance with Chapter 8, Part 2, Reinforced Concrete Design, and Article 2.2.3.c of AREMA. This means that it shall not be assumed that the live load is necessarily equally distributed to the slab or box beams supporting the track(s).

Underpass Structures shall be designed for all applicable loads and loading conditions specified in Chapters 8, 9, or 15 of the AREMA Manual.

8.2 Materials

Materials used in the construction of Underpass Structures shall comply with AREMA, SCRRA Reference Standards, Standard Specifications, and Sections 8.2.1, 8.2.2, and 8.2.3 of these Guidelines.

8.2.1 Concrete Requirements

Minimum Compressive Strength – 4000 lb. per square inch at 28 days.

Concrete shall be proportioned such that the water-cementitious material ratio (by weight) does not exceed the values in AREMA Table 8-1-9. Precast concrete shall contain a minimum of 610 pounds of cementitious material per cubic yard of concrete. Cast-in-place concrete shall contain a minimum of 565 pounds of cementitious material per cubic yard. If fly ash is used with cement it shall be limited to 15% of the cementitious material.

Cement shall be Type I, II, or III Portland Cement per ASTM C150.
Course Aggregate shall be size No. 67.

Fine Aggregate shall be fine sand.

Admixtures shall not be used without SCRRRA acceptance.

Membrane curing compound shall conform to ASTM C309 Type 2.

Apply an approved epoxy adhesive before placing new concrete against hardened concrete surfaces.

For precast elements, the fabricator shall stencil the fabricator’s name, date of fabrication, the bridge number, lifting weight, and piece mark on each component.

The production facility shall be pre-certified. Production procedures for the manufacture of precast members shall be in accordance with AREMA and the current edition of the Precast Concrete Institute's Manual MNL 116 for Quality Control.

Dimensional tolerances governing the manufacture of precast members shall conform to Division VI, Section 6.4.6 of the Precast Concrete Institute’s Manual MNL 116 for Quality Control. Tolerance for location of lifting devices shall be $=/- \frac{1}{2}$".

All concrete components shall be made available, at SCRRRA’s discretion, for inspection by the Engineer in Responsible Charge and SCRRRA at the fabricator’s plant prior to shipment.

8.2.2 Reinforcing Steel Requirements

Reinforcing steel shall be deformed, new billet bars per current ASTM A615 Specifications and meet Grade 60 requirements.

Reinforcing steel requiring field welding or bending shall conform to ASTM A706 Specifications, Grade 60 requirements.

Fabrication of reinforcing steel shall be per Chapter 7 of the CRSI Manual of Standard Practice. Dimensions of bending details shall be out to out of bars.

Reinforcing steel is to be blocked to proper location and securely wired against displacement. Tack welding of reinforcing is prohibited. Minimum concrete cover not otherwise noted shall meet current AREMA criteria.

Prestressing Strand Requirements:

Prestressing strand shall be seven-wire, uncoated and low relaxation which is in accordance with the requirements specified in ASTM A416, ACI 318 and AREMA Chapter 8.

The strand shall have an ultimate tensile strength of 270 ksi.

8.2.3 Structural Steel Requirements

All major elements subjected to track live loads shall conform to the following minimum specifications, except as otherwise noted:

Painted structures: ASTM A709 Grade 50
Unpainted structures: ASTM A709 Grade 50W

All bolted connections shall be made with high strength bolts.

8.3 Track Geometry

In the design of Underpass Structures, the top of rail elevation and alignment are generally preferred to remain at the existing location. An existing top of rail survey covering a distance that includes an additional 1,000 feet at 100 foot stations from each end of the proposed Underpass shall be provided to the SCRRA for review and direction for establishing final track grade. All existing Overheads and Highway-Rail Grade Crossings within ½ mile of the proposed Underpass structure shall be shown on the survey, with Overhead’s low chord and Highway-Rail Grade Crossing top of roadway elevations clearly noted.

Where it is proposed for other reasons that the track grade or alignment be changed due to the circumstances of design, the SCRRA requests that it be consulted and the following considerations be given:

A. The change in track grade for both temporary and permanent alignment shall minimize the impact on train operations, adjacent station platforms, parking lots, and SCRRA maintenance access.

B. The change in track grade shall minimize any undulating effect on the track profile relative to existing Underpass Structures, future Underpass Structures, or nearby Grade Crossings.

C. The affects of a track grade change that will require any adjustments or relocations to the fiber optic line along the corridor shall be identified and solutions investigated.

8.4 Structure Selection Criteria

Refer to Drawing numbers GSG-02 to GSG-06, Appendix C, for different types of bridge structures acceptable to SCRRA. Refer to SCRRA Engineering Standards 6001 and 6002 for details of precast/prestressed concrete beam bridges. Cast-in-place bridge Superstructure for Underpasses is not approved for construction on the SCRRA Operating System. Materials used in the design of SCRRA facilities shall conform to SCRRA standard specifications and the AREMA Manual unless otherwise specified in this Section.

A. Bridge Structures shall be of simple span construction. Monolithic, continuous span bridge structures are not permitted.

B. Superstructure shall have a ballasted deck; open deck type Superstructures are not permitted.

C. Structures are to be designed to be redundant and to remain serviceable after damage by accidents and earthquakes.

D. All concrete bridge structures shall be protected by collision impact devices over the traveled lanes of traffic.
E. Retaining walls are similarly based on simple designs.

F. Structures shall be designed for a service life of at least 100 years.

The Underpass Engineer in Responsible Charge shall address construction sequencing during the early phases of the design and structure selection process. The Engineer in Responsible Charge shall incorporate sequencing of construction in their design that will minimize SCRRA signal changes for the existing track(s) and Shoofly. The preferred sequence is to close the highway, or relocate traffic to another location rather than providing a temporary highway crossing at the site.

The SCRRA preferred construction method for Underpass Structures incorporates “top-down” construction. This method minimizes the amount of excavation and shoring, and allows for the majority of excavation for the highway after the structure is constructed and the track back in service.

The track on an Underpass Structure may require the addition of inner guard rail ties and inner guard rails to extend across the bridge and to include 50 feet from each end of the bridge. If existing rail and ties are used for this work, all welds shall be tested ultrasonically. Refer to SCRRA Engineering Standards for inner guard rail details and to determine if the proposed bridge will require inner guard ties and inner guard rails.

The following is a list in order of preference of bridge structure types acceptable to SCRRA:

<table>
<thead>
<tr>
<th>Table 8.1 Underpass Bridge Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bridge Structure Type</strong></td>
</tr>
<tr>
<td>Precast (pre-stressed) Concrete Slab Beam</td>
</tr>
<tr>
<td>Precast (pre-stressed) Concrete Double Cell Box Beam</td>
</tr>
<tr>
<td>Steel Beam</td>
</tr>
<tr>
<td>Steel Deck Plate Girder</td>
</tr>
<tr>
<td>Steel Through Plate Girder</td>
</tr>
</tbody>
</table>

SCRRRA acceptance shall be obtained prior to final selection of the type of Superstructure for the Underpass.

8.5 Future Expansion

The Underpass Structure(s) shall account for future track expansion of at least one additional track. For example, if there are currently two existing tracks at the project location, the bridge and other facilities shall be provided for three (3) tracks. When
allowing for future track, consideration shall be given to limitations due to track alignment and location on the existing Right-of-Way, Right-of-Way availability, adjacent Overhead Structures, and drainage provisions.

Future expansion can be accommodated by providing a single bridge wide enough for all tracks or multiple bridges with one or more tracks per bridge as long as provision is provided for one additional track and additional facilities.

The Designer shall take into consideration the manner in which the bridge could be widened when adding future additional track(s). The substructure shall accommodate future superstructure widening without requiring significant modifications to the seats, backwalls, and wing walls. The superstructure shall accommodate future expansion taking into account minimizing modifications to the superstructure and disruption of SCRR&A operations.

Coordinate with the SCRR&A Director of Engineering and Construction to determine which side of existing track to provide provision for expansion and for required track spacing. SCRR&A may require the Public Agency to prepare a short report showing the feasibility of a future expansion on both sides of the Grade Separation.

8.6 Skew of Bridge

The preferred angle of roadway crossing and bridge structure relative to the centerline of track is 90°. Prior acceptance from SCRR&A is required in cases where a 90° crossing cannot be obtained. In cases where a 90° crossing cannot be obtained, the maximum skew of bridge structure from 90° degrees shall not exceed the following for various types of structures:

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Skew in Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel span</td>
<td>30° Max.</td>
</tr>
<tr>
<td>Pre-stressed concrete beams</td>
<td>15° Max.</td>
</tr>
</tbody>
</table>

Roadway, bridge piers, and abutments shall be aligned as required to comply with the above maximum skew limitations.

Where conditions preclude any other solution, the skew proposal shall require special consideration and proof of adequacy.

At the end of skewed bridge, approach slabs shall be provided for each track. The length of approach slab shall be of sufficient length to square off the track(s) approach to a minimum 12-foot width symmetrical to centerline of track.

8.7 Access to Underpass Structure

An access roadway with access from adjacent public roads to each end of the bridge, or an access roadway with bridge maintenance structure on one side of the track(s) with access to adjacent public roads, shall be provided for SCRR&A off-track maintenance equipment.
Access roadway with turnaround pads shall be designed and constructed in conjunction with the Grade Separation project when a bridge maintenance structure is not provided. Turnaround pad shall start no further than 30 feet from the end of the bridge structure and with embankment shoulder 60 feet minimum from the centerline of the track. Roadway grade should not exceed 10% and should terminate at the sub-ballast elevation. Roadway shall have sufficient width to provide for one 12 feet wide road, drainage ditch, and shoulder. Roadway and turnaround pad shall be constructed on compacted material and have a 12 inch thick minimum base and six (6) inch thick hot mixed asphalt (HMA) pavement. Turnaround pad and roadway shall be sloped to drain away from the track sub-grade and dispose water to drainage system. All down slopes of turnaround pad and roadway shall be protected with asphalt concrete curbs to prevent embankment erosion.

The bridge maintenance structure may be part of the track supporting structure or a completely separate structure. If bridge maintenance structure is part of the main track structure, the structure shall be designed for railroad E-80 loading to accommodate any future track needs and modifications. If the bridge maintenance structure is a totally separate structure, it shall be designed for HL-93 live load. The separate bridge maintenance structure width shall accommodate one (1) 12-foot paved lane with curbs and railing. The deck of bridge structure shall be Portland cement concrete deck pavement or steel plate deck with six (6) inch thick HMA pavement. Bridge deck shall include curbs, railing, and drainage and joint seals as required. HMA pavement shall extend 12 feet past the end of the structure and be placed over a 12 inch thick minimum base. The access roadway with a bridge maintenance structure shall meet the same criteria as an access roadway with turnarounds.

### 8.8 Clearances

The Underpass clearances shall comply with the applicable requirements shown on Drawing GSG-08 - Underpass Structure Clearances, found in Appendix C.

#### 8.8.1 Vertical

A minimum vertical clearance of 16’-6” shall be provided for all Underpass Structures, measured from the lowest point of the Superstructure to the highest point of the roadway pavement. A minimum vertical clearance less than 16’-6” may be provided if prior approvals were obtained on an Exception Request form from SCRRA and if sacrificial beams not carrying any track loads are provided over the traveled roadway.

Exceptions for minimum vertical clearance shall only be granted if it is uneconomical to provide the stated minimum vertical clearance over the roadway or geometry won’t allow minimum vertical clearance to be achieved. A thorough and complete analysis must be provided with the exception request that documents why the minimum vertical clearance cannot be provided. The exception request along with any supporting documentation shall be submitted on the SCRRA Request for Special Design Consideration form. Exception and waiver requests shall be submitted at the Concept and Design Criteria (5% Design) or Preliminary Design (30% Design) review levels for consideration by SCRRA. Concept and Design Criteria (5% Design) exception and waiver requests are preferred. Design should not be advanced to the Interim Design (60% Design) level prior to receiving a decision on an exception or waiver request.
The Public Agency shall assume the repair costs for damage to the bridge by highway traffic. In the event of damage to the bridge or the girders by highway traffic, the extent and method of repair shall be agreed upon by the Public Agency and SCRRA. If the Public Agency fails, refuses or neglects to perform the repair to the structure, SCRRA shall perform any work necessary to place the highway and appurtenances in such condition as shall not endanger or interfere with SCRRA facilities or operations, or jeopardize SCRRA employees. The Public Agency shall reimburse SCRRA for all the expenses.

If resurfacing or any other activity is to be performed below the Underpass structure, the Public Agency of the roadway shall submit a written request five (5) working days in advance of the activity for acceptance from SCRRA. This request must provide the existing measured and posted clearances of the structure and the proposed configuration after work is completed. The Public Agency shall be responsible for posting and maintaining signed structure clearances and any advance street notifications in accordance with CALTRANS and the AASHTO MUTCD, as required.

8.9 **Superstructure**

The minimum depth of ballast for the design of the structure under the ties at the lowest rail shall be eight (8) inches. In addition, a four (4) inch layer of Hot Mixed Asphalt (HMA) underlayment shall be provided for all structure types and eight (8) inch on the approaches for 50 feet past the bridge abutments. A steel cover plate and membrane waterproofing shall be provided at the Underpass deck joints. All structures shall be designed for an additional six (6) inches of ballast to accommodate a future track raise. Direct fixation of rail to Superstructure is not acceptable.

Minimum longitudinal structure grade of 0.2% shall be provided for drainage purposes. Drainage towards one end of the structure may be provided. When the structure is excessively long, adequate deck grades to drain the structure to both ends of bridge, or to pier locations, shall be provided. If the top of rail grade remains constant over the length of structure, the depth of ballast may be increased from the minimum depth but should be taken into account in the design.

Parallel structures shall have a minimum separation of five (5) feet to provide room for maintenance work and inspection.

Bird screens may be provided below the Superstructure; however, the screens shall be designed to allow periodic inspections and maintenance by SCRRA. If attached to the Superstructure, the attachments need to provide stability when exposed to frequent vibratory loads and span deflection under live load.

8.9.1 **Steel and Precast/Prestressed Concrete Beams and Girders**

All steel and precast members shall be constructed from approved shop drawings and only after acceptance of the shop drawings is received from SCRRA. No materials should be ordered until SCRRA acceptance of the shop drawings is received. Structural members shall be constructed in accordance with the current AREMA Manual and methods accepted by SCRRA and as shown on the SCRRA accepted shop drawings. Structural members, drawings, and submittals that do not meet the project specifications shall be rejected. The Contractor at no additional expense to SCRRA shall replace
reJECTED STRUCTURAL MEMBERS. MEMBERS THAT HAVE BEEN DELIVERED AND ARE THEN REJECTED MUST BE REMOVED FROM THE RIGHT-OF-WAY WITH NO ADDITIONAL COST TO SCRRA.

8.10 DECK WIDTH

FOR A SINGLE-TRACK BRIDGE STRUCTURE, THE WIDTH OF THE DECK SHALL BE AS SHOWN ON THE SCRRA STANDARD DRAWINGS GSG-02 TO GSG-06, 6001, AND 6002, AND SHALL NOT BE LESS THAN 13 FEET INSIDE FACE TO INSIDE FACE OF CURB AT TOP OF THE HOT MIX ASPHALT OVERLAY.

8.11 CURB HEIGHT

THE TOP OF BALLAST CURB SHALL BE 24 INCHES ABOVE THE BRIDGE DECK TO ALLOW FOR FUTURE TRACK RAISES.

8.12 WALKWAY

THE CLEAR DISTANCE FROM CENTERLINE OF TRACK TO INSIDE FACE OF THE BALLAST RETAINER FOR BRIDGES WITH WALKWAY SHALL BE 6'-6" MINIMUM. TO PREVENT CRACKING UNDER LIVE LOADS, PROVIDE ¼ INCH WIDE JOINTS AT 10 FEET MAXIMUM SPACING ON CONCRETE CURBS, WALKWAYS, AND BALLAST RETAINERS.

WALKWAYS AND HANDRAILS SHALL BE PROVIDED ON BOTH SIDES OF THE DECK. WALKWAYS SHALL NOT BE LESS THAN 2'-0" WIDE WITH THE TOP OF WALKWAY 24 INCHES ABOVE THE BRIDGE DECK. THAT PORTION OF THE BRIDGE WALKWAY THAT SPANS OVER THE HIGHWAY AND/OR PEDESTRIAN WALKWAY SHALL BE CONSTRUCTED OF SOLID MATERIAL AND A CURB OR TOE BOARD SHALL BE PROVIDED.

8.13 HANDRAIL

HANDRAILS OR CHAIN LINK RAILING (FENCING) SHALL BE PROVIDED ON BOTH SIDES OF THE STRUCTURE AND SHALL MEET FRA, AREMA, AND OSHA REQUIREMENTS. THE DESIGN OF HANDRAIL OR THE CHAIN LINK RAILING SHALL BE PROJECT SPECIFIC DESIGN AND WILL PROVIDE ARCHITECTURALLY PLEASANT APPEARANCE SINCE IT WILL BE VISIBLE FROM THE ROADWAY. THE DESIGN WILL BE APPROVED BY SCRRA AND BY THE LOCAL JURISDICTION.

8.14 DECK DRAINAGE

THE HMA OVERLAY ON TOP OF THE DECK FOR STEEL BEAM/GIRDERS AND CONCRETE BOX OR SLAB BEAMS SHALL BE SLOPED TRANSVERSLY NOT LESS THAN 1% TO THE LONGITUDINAL DRAINAGE COLLECTION SYSTEM.

A LONGITUDINAL DRAINAGE COLLECTION SYSTEM SHALL BE PROVIDED TO DISPOSE OF DRAINAGE WITHOUT PERMITTING IT TO ENTER THE BALLAST SECTION AND BACKFILL BEYOND THE LIMITS OF THE BRIDGE STRUCTURE. LONGITUDINAL DRAINS SHALL BE CONNECTED TO THE STORM DRAIN SYSTEM OR PROPERLY DISCHARGED AT THE TOE OF EMBANKMENT SLOPES OR AT THE BOTTOM OF PIERS INTO NEW OR EXISTING DRAINAGE DITCHES.

IF AN APPROACH GRADE DESCENDS TOWARD THE BRIDGE, DRAINAGE FROM THE APPROACH SHALL BE INTERCEPTED BY APPROPRIATE MEANS SO THAT IT SHALL NOT DRAIN ONTO THE BRIDGE.
8.15 **Hot Mixed Asphalt (HMA) Overlay**

HMA overlay shall comply with Caltrans Standard Specification, Section 39 “Hot Mixed Asphalt”. The HMA shall be four (4) inches in thickness at the crown on top of the bridge deck. A 12 inch layer of HMA, 15 feet in width and symmetrical to the track, shall be placed for the bridge approach on top of the embankment and extend 50 feet from each end of the bridge. When there is more than one track the HMA layer shall extend between tracks and 7’-6” inches outward on field side of each track. HMA layer shall be crowned at centerline of single track or at the centerline between two tracks and slope away from tracks at a 1% slope toward the field side of each track.

8.16 **Fire Protection**

SCRRA structures and facilities shall be designed to provide a minimum fire rating as specified in the applicable local code, in accordance with the “UL List”.

8.17 **Substructures**

The Substructure elements shall be designed in accordance with Chapter 8 of the current AREMA Manual and SCRRA Design Criteria Manual.

Cross-hole Sonic Log (CSL) testing shall be required by SCRRA to evaluate the integrity of drilled shafts/caissons if used for foundation support. The Plans and Specifications shall include provisions for this testing.

Drilled shafts within the influence of track live load surcharge shall be designed with temporary casing for protection against cave-in, subsidence, and/or displacement of surrounding ground. Casing shall be designed for live load due to the track surcharge in addition to all other loads. Design of casing as shoring shall be in accordance with SCRRA’s Excavation Support Guidelines. Drilled shafts and piling shall be designed to allow the drilling or pile driving operation to proceed without stopping trains.

8.18 **Soil and Geotechnical Data**

Soil properties shall be established by subsurface investigations and laboratory testing. A Geologic Hazard Assessment shall be provided.

Soils and geologic data shall be prepared in accordance with the appropriate AREMA practices. These data should consist of boring location plans, boring logs, and test results and geologic sections and profiles.

8.19 **Earth Retaining Structures**

Earth retaining structures shall be designed in accordance with Chapter 8, Part 5 of AREMA Manual. Refer to Section 10.12, Permanent Retaining Walls of SCRRA’s Design Criteria Manual for more information on design and construction of retaining walls.

SCRRA will consider acceptance of MSE walls, provided design and construction protocols address quality and lifespan issues, including: control of surface water; control of tendon corrosion; quality and compaction of backfill; and transition sections. MSE walls shall be designed and constructed in accordance with recommendations of

8.20  Abutments

The abutments shall be designed in accordance with the recommendations of Chapter 8, Part 5 of the AREMA Manual and SCRRAs Design Criteria Manual (non spill-through type abutments shall be at least 0.2H in thickness at the base). The abutments shall be wide enough to satisfy SCRRAs standard roadbed shown on Engineering Standards No. 2001 and No. 2002.

For multiple track bridges, the abutments shall be sufficient to provide standard shoulders, plus 20 feet for each existing or future track. Wing walls shall be designed to support 2:1 embankment slopes. Handrails shall be returned on the backwall and/or wing walls.

Abutment seats shall be sloped to drain away from bearing locations. When weathering steel is used for the Superstructure, details on top of abutment seat shall indicate method of collecting and disposing of water without staining the vertical concrete surfaces.

At certain locations, where the face of an abutment or retaining wall stem is exposed to public view, it may be desirable to treat the face architecturally. Such treatment may include the use of textured form liner, sandblasting, or bush-hammering. Such architectural treatment will not reduce the minimum clearances for reinforcing steel shown in Chapter 8 of the AREMA Manual nor shall it be allowed to reduce the effective wall section.

Sloping embankments in front of abutments shall be landscaped and/or paved as per SCRRAs input and acceptance. Landscaping shall be as per SCRRAs Landscaping Guidelines and/or SCRRAs Specifications Section 31 35 00 - Slope Protection.

8.21  Piers

Single column piers will not be accepted for Underpass Structures. Solid wall piers or a minimum of two columns shall be provided.

Bridge piers adjacent to roadways shall be protected from vehicular traffic by use of concrete barrier or other type of guard rail. The type, design, and detailing of the concrete barrier or guard rail that is used shall comply with AASHTO and Caltrans standards.

8.22  Bearings

Refer to the SCRRAs Design Criteria Manual for guidance on selection and design of acceptable end bearing provisions for steel and concrete spans for Underpass Structures.
8.23 Painting

All steel bridge Underpass Structures shall be fabricated with weathering steel for exposed members unless located within one (1) mile from the ocean, in which case the structure shall be painted. Painting shall conform to the requirements of current AASHTO specifications and recommendations of Steel Structures painting Council Manual (SSPC). Paint shall be applied in accordance with manufacturer’s recommendations and in compliance with SSPC recommendations. Paint shall be submitted by the painting agency for review and acceptance by SCRRA prior to application of any of the coatings.

All accessible concrete, masonry, and porous surfaces from finish grade or floor to 10 feet above finish grade or floor shall be painted with clear graffiti-resistant coating. Refer to SCRRA specifications 34 80 61 – Painting and Protective Coating for Bridges for material and construction requirements.

8.24 Signal and Communications Conduits

Provisions shall be made for all Underpass Structures to carry SCRRA signal and communications conduits and cables for either active and future expansions or additions to communications systems, if required. Attachment points of SCRRA signal and communications conduits to cut-and-cover structures shall be positively located to avoid all reinforcement. This may be accomplished by casting inserts directly into the concrete, or by casting block-outs into which attachments can be secured.

No public or private utility attachments are allowed on Underpass Structures. Lighting conduit and lights are allowed to be attached to Substructure units, but shall not be attached to Superstructure components. Existing or future public and private fiber optic lines should be placed underground and away from the structure. Relocation of existing utilities interfering with construction of the project shall be the responsibility of the Public Agency.

8.25 Drainage

Drainage plans and hydrology report shall be prepared per the SCRRA Design Criteria Manual, Chapter 8, and shall be submitted for SCRRA review and acceptance.

8.26 Maintenance

The C&M Agreement assigns SCRRA responsibility for the inspection and maintenance of the Superstructure of the Underpass Structure above the bridge seats, including bearing assemblies, spans, roadbed, tracks, railroad drainage, and all other related SCRRA facilities.

The C&M Agreement assigns the Public Agency responsibility to maintain the structure and appurtenances below the bridge seats, including: piers and abutments; retaining walls; roadway illumination and electrical appurtenances; drainage system; roadway pavement; roadway facilities; curb and gutter; striping; signage; and aesthetic or cosmetic design elements or painting added to the Superstructure soffits or facades and appurtenances. The Public Agency is responsible for removal of graffiti from the entire project, including retaining walls, Substructure and Superstructure (above and below the bridge seats) of the Grade Separation structure.
The Public Agency shall be responsible for maintaining facades and fascia girders including removing fascia girders or facades prior to SCRRRA scheduled maintenance or repair to the structure. SCRRRA can remove the fascia girders or facades during emergencies and then be reimbursed by the Agency.

The Public Agency shall be responsible for all roadway work and closures that occur during structure inspection, maintenance, or repair. The Public Agency shall also be responsible to obtain written acceptance in advance of performing any work that could affect the structural integrity of the structure or interfere with SCRRRA operations.
9.0 PEDESTRIAN GRADE SEPARATIONS

Pedestrian grade separations shall comply with all applicable Federal, State, and Local laws, and shall provide an accessible facility under the Americans with Disabilities Act of 1990 (ADA) and the Rehabilitation Act of 1973 (Section 504). The FHWA is responsible for ensuring access for persons with disabilities and it is recommended the designer refers to the best practices design guidelines publications on the FHWA website.

The design of Pedestrian grade separations shall consider and balance initial project capital costs and life-cycle costs including maintenance. Selection of an Underpass Structure will minimize interference with train operations and reduce maintenance and is, therefore, preferred by SCRRA.

9.1 Pedestrian Overhead

The Pedestrian Overhead Structure, as a minimum, shall meet the specifications and design standards of AASHTO and Caltrans. The structure shall also meet all general requirements for Overhead Structures outlined in Section 7 of these Guidelines.

The Pedestrian Overhead Structure shall be designed to span the entire width of SCRRA Right-of-Way and if practical at 90 degrees to the track(s).

The Pedestrian Overhead Structure shall be of sufficient length to allow for future track(s) and access road(s) as directed by SCRRA. Refer to Section 8 of these Guidelines for future expansion requirements.

9.1.1 Protection of SCRRA Operations

The Pedestrian Overhead Structure shall provide protection for the entire width of the SCRRA Right-of-Way to prevent the throwing of objects from the structure onto the Right-of-Way. The structure shall be totally enclosed or provided with a fence on both sides that extends a minimum of 8 feet above the deck as depicted on Drawing GSA-09, Overhead Structure Clearances, in Appendix C.

The Pedestrian Overhead Structure and approaches shall be adequately lighted, however; lighting must be designed and installed in a manner that will not interfere with the train crew’s ability to clearly observe track signals.

The Pedestrian Overhead Structure shall not interfere with train crew’s unobstructed line of sight to the wayside or at-grade crossing signal systems.

The Pedestrian Overhead Structure shall be designed to prevent the structure from fouling the track(s) during a seismic event.

9.1.2 Minimum Width

The minimum traveled width for Pedestrian Overhead Structures shall be 10 feet.

9.1.3 Clearances

The Pedestrian Overhead Structure final minimum clearances shall comply with the applicable requirements shown on Drawing GSG-07, Overhead Structure Clearances, refer to Appendix C.
A temporary minimum horizontal clearance of 15'-0" from the centerline of track(s) (including temporary falsework) shall be provided during erection of the Pedestrian Overhead Structure.

A temporary minimum vertical clearance of 22'-6" above top of the rail shall be provided during erection of the Pedestrian Overhead Structure.

9.1.4 **Access**

The Pedestrian Overhead Structure shall be designed and constructed with stairways, approach ramps, and elevators as necessary to comply with sponsoring Public Agency codes and requirements and the ADA.

SCRRA Right-of-Way shall be protected against unauthorized access by pedestrians by providing railings or fences. Railings or fences shall be a minimum of 6 feet in height and constructed to discourage climbing over the railing or fence to gain access to the SCRRA Right-of-Way.

9.1.5 **Construction**

The Pedestrian Overhead Structure design shall include consideration of construction and erection methods in order to minimize disruption to SCRRA operations. Construction track windows where train traffic can be stopped to allow uninterrupted construction are generally limited to 8 to 12 hours during the week with maximum weekend windows of 48 hours.

The Site Specific Work Plan (SSWP) submittal and electronic “.PDF” drawings showing details of construction affecting tracks and property, specifications, and plans and procedures for excavation, demolition, falsework, sheeting and shoring, drainage, and other proposed work that may infringe on SCRRA Right-of-Way or affect operations shall be submitted to SCRRA for review and acceptance prior to procurement, manufacture, fabrication, and construction.

9.1.6 **Submittals**

Refer to Section 5.0 Submittals of these Guidelines.

A submittal checklist included in Appendix B of these Guidelines shall be provided with each Pedestrian Overhead Structure review submittal for design and construction.

9.1.7 **Maintenance**

The Pedestrian Overhead Structure shall be maintained by and at the expense of the sponsoring Public Agency.

9.2 **Pedestrian Underpass**

The Design of precast and cast-in-place concrete box sections used for Pedestrian Underpass Structures shall comply with the current edition of the AREMA Manual, Chapter 8, Part 16 – Design and Construction of Reinforced Concrete Box Culverts, and the SCRRA Design Criteria Manual. When other structure types are proposed the
design shall comply with appropriate Chapters and Parts of AREMA and SCERRA Design Criteria Manual. The structure shall be designed to cross the Right-of-Way at 90 degrees to the track(s).

Concrete box structures are preferred for Pedestrian Underpass Structures. Where concrete box structures are used, precast box sections shall be utilized to minimize construction track windows. The length of precast box sections shall be at least of sufficient overall length that any cast-in-place section(s) can be installed after the track(s) is put back in service and shoring installed per Excavation Support Guidelines.

Precast box sections shall be positively connected to provide closure of the joints, engage the gasket seals, and prevent possibility of future separation of the box sections. The connections shall be provided on the top (two minimum), and on each side (one minimum) of the box sections. The connections may be bolted, welded, or a combination of both. Any open holes left after erection shall be grouted closed.

The Pedestrian Underpass Structure shall be of sufficient length to allow for future track(s) as directed by SCERRA. Refer to Section 8 for future track expansion criteria.

9.2.1 Width and Height

The minimum inside clear dimensions of the Pedestrian Underpass Structure shall not be less than 9 feet wide by 9 feet high prior to installing the floor. The maximum inside clear dimensions of the structure shall not be more than 16 feet wide by 10.5 feet high. The width and height of the structure shall be determined based on individual analysis to provide adequate visibility through the structure.

The Pedestrian Underpass Structure shall be designed to minimize the “tunnel” perception. The structure architecture should consider an arc shaped inside roof line that is six to twelve inches lower at the walls.

9.2.2 Depth of Cover

The depth of cover from the top of tie to the top of the Pedestrian Underpass Structure crown shall be sufficient to provide for the structure waterproofing system, HMA overlay, ballast, and type of tie. The depth of cover shall be kept to the minimum to facilitate construction and maintenance of the structure, and reduce the length of approach ramps and number of stairs.

9.2.3 Ballast Depth

The ballast depth over the Pedestrian Underpass Structure and for the 30 foot approach lengths shall be a minimum of 8 inches over the HMA layer. Provide a minimum total HMA plus ballast depth of 16 inches.

9.2.4 Hot Mix Asphalt (HMA) Overlay

HMA shall be applied directly over the Pedestrian Underpass Structure’s waterproofing system. The HMA width shall provide for existing and future track(s). The HMA shall be continuous between existing and proposed track(s) and extend out a minimum of 7’-6” on the field side of track(s). The HMA shall extend 30 feet along the approaches measured from the outside faces of the structure’s walls.
The HMA shall have a minimum layer depth of 8 inches over the crown at the centerline of the Pedestrian Underpass Structure and slope to 6 inches at the ends of the 30 foot approaches. The HMA layer shall slope away from the track(s) to the field side at 1% slope. Refer to Appendix C, Drawing GSG-09.

9.2.5 **Waterproofing**

The Pedestrian Underpass Structure shall be waterproofed such that it remains watertight.

A waterproofing system shall be provided to protect the Pedestrian Underpass Structure in addition to the HMA overlay. The waterproofing system used shall be of a quality that will prevent any leakage into the structure over its useful lifespan. A warranty shall be provided to SCERRA by the Contractor that will cover repairs for material and labor for 20 years after construction is complete if the structure develops leaks. The waterproofing system shall be protected from damage during installation of the HMA overlay.

Precast box section joints shall be of watertight construction incorporating a rubberized gasket installed between the tongue and groove sections of the sections.

Cast-in-place box sections shall incorporate water stops at all construction joints.

Other type structures used for Pedestrian Underpass Structures shall be suitably designed to provide watertight construction.

The waterproofing system details for the structural type of Pedestrian Underpass Structure to be used shall be submitted to SCERRA for acceptance prior to fabrication and construction.

9.2.6 **Drainage**

The Pedestrian Underpass Structure shall include an inside drainage collection system to allow for water removal due to maintenance cleaning and any storm runoff from adjacent approach ramps and stairways. It is preferred that a drainage collection system be installed on each side of the floor along the full length of the structure and then routed to an existing storm drainage system. A sump with pump and lift station should only be considered if connecting to an existing storm drain by gravity flow is not practical. The inside structure’s floor shall be sloped as required to facilitate draining to the drainage collection system.

Pedestrian Underpass Structures shall also have a sub-drainage system installed along the external walls below floor level in conjunction with pervious backfill material and/or geo-composite drainage board to collect water from groundwater fluctuations and surface infiltration. When the structure is also located in an area with a high ground water table a permanent dewatering system should be considered in addition to the sub-drainage system.

The drainage system details shall be submitted to SCERRA for acceptance prior to construction.
9.2.7 **Access**

The Pedestrian Underpass Structure shall provide access that includes stairways and approach ramps that provide adequate site distances to the pedestrian. The structure shall provide access that is ADA compliant.

SCRRA Right-of-Way shall be adequately protected against unauthorized access by providing railings or fences. Railings or fences shall be a minimum 6 feet in height and of a construction type that will discourage climbing over the railing or fence to gain access to the SCRRA Right-of-Way.

9.2.8 **Lighting**

The Pedestrian Underpass Structure, stairways, and approach ramps shall be lighted for security of the pedestrian. Lighting in underpasses requires addressing pedestrians’ personal safety. Lighting on the approaches and within the underpass should appear bright while avoiding glare and shadows. This can be accomplished by carefully selecting surface textures and colors.

When the ratio of the Pedestrian Underpass length to height exceeds 10:1, lighting should operate continuously.

During the day, the Pedestrian Underpass lighting should be bright enough to allow pedestrians to see into the underpass. At night, pedestrians in the underpass should be able to see the areas surrounding the exits. This can be accomplished by reducing the lighting intensity at each entrance to the underpass.

Avoid using recessed lamps that could create pools of light. Since Pedestrian Underpass lamps are generally located at a relatively low level, they should be made of polycarbonate or of some other type that is resistant to vandalism.

Consider installing an emergency lighting system to provide illumination if the main power supply fails.

9.2.9 **Construction**

The Pedestrian Underpass Structure design shall include consideration of construction and erection methods previously successfully used on SCRRRA projects of similar type in order to minimize disruption to SCRRRA operations. Construction track windows where train traffic can be stopped to allow uninterrupted construction are generally limited to 8 to 12 hours during the week with maximum weekend windows of 48 hours. Include one and one half hour to remove each track and the same timeframe to replace each track in the allowable track window timeframes.

The Site Specific Work Plan (SSWP) submittal and electronic “.PDF” drawings showing details of construction affecting tracks and property, specifications, and plans and procedures for excavation, demolition, falsework, sheeting and shoring, drainage, and any other proposed work that may infringe on SCRRRA Right-of-Way or affect operations shall be submitted to SCRRRA for review and acceptance prior to procurement, manufacture, fabrication, and construction.

9.2.10 **Submittals**

Refer to Section 5.0 Submittals of these Guidelines.
A submittal checklist included in Appendix B of these Guidelines shall be provided with each Pedestrian Underpass Structure review submittal for design and construction.

9.2.11 Maintenance

The Pedestrian Underpass Structure shall be designed considering ease of maintenance. Lighting fixtures, signage, aesthetic treatments, and other materials proposed for use in the structure shall be included in the design considerations to reduce maintenance frequency and requirements.

For example, lighting fixtures should be recessed with unbreakable lenses or provided with lens protection. Signage should be adequately fastened to supports and out of reach to the extent possible. Aesthetic treatments should be inlaid or anchored and protected by other means from vandalism damage. Concrete should have graffiti protection if warranted, and handrails and exposed metals should be protected from corrosion (galvanized steel is preferred).

The Pedestrian Underpass Structure shall be maintained by and at the expense of the sponsoring Public Agency.
10.0 SHOOFLY TRACK

The most effective method of maintaining traffic is to temporarily reroute railroad traffic around the construction site using Shoofly Tracks. The Shoofly shall be designed to comply with current rail operations and existing conditions. The Shoofly design shall be submitted for review in the early stages of project design. The Shoofly for construction of the permanent structure shall be designed for construction staging to minimize the traffic interference with the Operating System. SCRRRA requires that the track remain fully operational at all times, except for “track outage window”, during which a track is shut down to train traffic for certain periods of time. It shall be the Public Agency’s or the Contractor’s responsibility to secure permission for any such track outage window from SCRRRA. The Public Agency or the Contractor shall make a request for such track outage window to SCRRRA at least sixty (60) working days in advance. The Public Agency’s or the Contractor’s request shall be subject to SCRRRA approval for each outage. The Public Agency or the Contractor shall not regard track outage window as routine events.

If the Shoofly track centerline will be located within 15 feet of the face of a shored excavation, then the Shoofly track must be constructed with a hot mix asphalt (HMA) sub-ballast, eight (8) inches thick, 12 feet wide (centered about the track centerline), and extending 20 feet in both directions past the shored excavation.

The Shoofly Track design shall conform to all applicable Federal, State, Local, and SCRRRA Design Criteria Manual standards and regulations. The Shoofly shall be designed for maximum authorized speed for passenger and freight trains shown in SCRRRA Timetable and Track Charts. SCRRRA approval shall be obtained if the Shoofly is to be designed for lower speeds to meet existing site conditions. The track curve speed, super-elevation and spiral length shall meet the requirements shown in SCRRRA Engineering Standards ES2202 and ES2203.

If existing track is removed temporarily during Shoofly construction, the existing rail shall be put up on blocks and not on the ground, ties shall be stacked with space dunnage boards so that the ties are not resting on the shoulders of the lower ties, and clips are put in containers protected from weather.

The Shoofly Track crossings shall meet the requirements of the SCRRRA Highway-Rail Grade Crossings Recommended Design and Procedures Manual.

When Shoofly construction is performed by the Agency Contractor, SCRRRA shall perform a field review and accept the track(s) prior to cut-over. Contractor shall coordinate cut-over with SCRRRA forces.
11.0 CONSTRUCTION

The construction shall meet requirements stated in SCRRA's Standard Specifications, SCRRA Reference Standards and Guidelines, Form 37: Rules and Requirements for Construction on Railway Property, and shall also comply with the AREMA Manual unless the SCRRA requirements are more restrictive.

During construction of Underpass Structures, the Public Agency shall provide an independent qualified Resident Engineer to be onsite during all construction activities. The Resident Engineer will be the coordinator of project correspondence and construction questions between the Agency and SCRRRA.

SCRRA or designated Engineering Consultant shall have the option to conduct site observations of the work anytime during construction of the project. Site observations will be required for those activities outlined in the Agreements for SCRRA to provide acceptance or approvals of the work performed.

All work on, over, or adjacent to the tracks must be coordinated with SCRRA, and the work is subject to SCRRA operating rules for work on all tracks. Project Specific Work Windows shall be obtained from SCRRA. The Project Specific Work Window hours and days will be included in the specifications by the Public Agency. If work windows are not included in the project specifications, they will be provided based on SCRRA safety requirements and SCRRRA operating rules.

Any damage to rails, ties, structures, embankment, third party property, signal and communications equipment, or any other facilities shall be repaired, at Public Agency or Contractor expense, to a condition equal or better to the condition prior to entry and as accepted by SCRRA. The Public Agency or the Contractor agrees to reimburse SCRRA and/or any operating railroads for any and all cost and expense incurred as a result of Contractor's work which may result in: (i) unscheduled delay to the trains or interference in any manner with the operation of trains; (ii) unscheduled disruption to normal train operation; (iii) unreasonable inconvenience to the public or private user of the system; (iv) loss of revenue; and (v) alternative method of transportation for passengers.

During operations adjacent to live track, all work within 25 feet of the live track or within 50 feet of any main track(s) switch shall be stopped when trains are approaching, and equipment and employees moved to a safe distance from the tracks.

The Public Agency and its Contractors shall comply with the rules and regulations contained in the current editions of the following SCRRA documents during the construction of the project:

A. Temporary Right-of-Entry Agreement (SCRRA Form No. 6)

B. Rules and Requirements for Construction on Railroad Property (SCRRA Form No. 37)

C. General Safety Regulations for Third Party Construction and Utility Workers on SCRRA Property

D. Applicable SCRRA Engineering Standards.

The Public Agency shall notify SCRRA five (5) working days prior to beginning work on the Right-of-Way and secure any protection SCRRA deems necessary.
11.1 Excavation and Backfill

The excavation and backfill shall meet all the requirements shown in SCARRA Standard Specification 31 20 00 - Earthwork. Excavation for construction of footings, piers, columns, walls, or other facilities that require shoring to support active tracks shall comply with the SCARRA Excavation Support Guidelines. Shoring shall be designed, signed, and sealed by the Engineer in Responsible Charge licensed in the State of California. The Contractor shall perform excavation and grading so that the finished surfaces are in uniform planes with no abrupt breaks in surface and having positive drainage on the Right-of-Way away from the track structure.

The Contractor shall compact all backfill to 95% relative density as determined by ASTM D1557. Where it becomes necessary to excavate beyond the normal lines of excavation to remove boulders or other interfering objects, the voids remaining after such materials are removed shall be back-filled with suitable material accepted by SCARRA. The material obtained from the project excavation may be suitable for use as fill or backfill at the discretion of SCARRA. Any excess material must be disposed of by hauling off-site. The excess material must not be piled-up or scattered on the Right-of-Way.

11.2 Erosion Control

The general plans for the Grade Separation shall indicate the proposed methods of erosion control and must specifically address means to prevent silt accumulation in the ditches and culverts and to prevent fouling the track ballast, sub-ballast, and existing drainage system. Existing track ditches shall be maintained at all times throughout the construction period. All erosion control shall meet current California and County requirements for SWPPP and shall have Agency approval prior to construction. After the construction has been completed, all erosion control devices shall be removed, all deposits of silt removed, and the ditches restored. Acceptance of the erosion control plan does not relieve the submitting agency, consultant, and/or Contractor of the ultimate responsibility and liability for a satisfactory erosion control plan.

11.3 Temporary Traffic Control

SCARRA’s Temporary Traffic Control Guidelines for Highway-Rail Grade Crossings shall be referenced for further information on definitions, referenced standards, traffic control plans, submittals, traffic control elements, and responsibility/authority for temporary traffic control at Highway-Rail Grade Crossings. The guidelines provide acceptable alternatives and procedures to prescribe the appropriate temporary traffic control measures at Highway-Rail Grade Crossings.

The construction of a new Grade Separation, or the modification of an existing Grade Separation, may require temporary traffic control. A temporary traffic control plan, including traffic detours, shall be prepared in accordance with Part 6 of the CA MUTCD, the WATCH Manual, and the Public Agency’s requirements. When a Highway-Rail Grade Crossing exists either within or in the vicinity of a temporary traffic control zone, lane restrictions, flagging, or other operations shall not be performed in a manner that would cause vehicles to stop on the tracks unless a law enforcement office or flagger is provided at the Highway-Rail Grade Crossing to minimize the possibility of vehicles stopping on the tracks. This applies even if automatic warning devices are in place.
SCRRRA shall be contacted when the initial planning begins for any temporary traffic control zone that may directly or indirectly influence the flow of traffic at Highway-Rail crossings. Responsible Public Agency(s), along with others affected, such as emergency services and businesses, should meet to plan appropriate traffic detours and the necessary signing, marking, and flagging requirements for operations during traffic control activities. Consideration should be given to the length of time that the Highway-Rail Grade Crossing is to be closed; highway classification; type of vehicle and traffic affected; the time of day; and the materials and techniques of repair. Temporary traffic control operations should minimize the inconvenience, delay, and crash potential to affected traffic. Temporary traffic control activities should not be permitted to extensively prolong the closing of a crossing.

Temporary traffic control shall be used when a maintenance or construction activity is located on the SCRRRA Right-of-Way, or when activity in the vicinity of a Highway-Rail Grade Crossing could result in queuing of vehicles across the railroad tracks. The issue of temporary traffic control shall be addressed within the specifications for the crossing.

11.4 Utility Adjustments

The existing utilities shall be located prior to commencing any excavations. Approval of the project by SCRRRA does not constitute a representation as to the accuracy or completeness of location or the existence or non-existence of any utilities or structures within the limits of this project. The appropriate regional notification center [Underground Service Alert (USA) at (800) 227-2600], railway companies, and utility companies shall be notified prior to performing any excavation close to any underground pipeline, conduit, wire, or other structure. Refer to SCRRRA's website www.metrlinktrains.com to ensure proper contracts and phone numbers. Also, refer to Rules and Requirements for Construction on SCRRRA Right-of-Way (Form No. 37), Section 6.1 for additional requirements on utilities.

SCRRRA is not a member of USA and the Agency shall request locations of SCRRRA utilities from SCRRRA. It is therefore necessary to call SCRRRA’s signal department phone number (refer to SCRRRA’s website) to mark, at the Public Agency(s) or Contractor’s expense, signal and communication cables and conduits; in case of signal emergencies or Highway-Rail Grade Crossing problems, the Contractor shall call SCRRRA’s 24-hour signal emergency number. If utilities cannot be located, potholing shall be done to locate the utilities. SCRRRA and appropriate utility owners shall be notified immediately when utility lines not known or indicated on the drawings are encountered. No service shall be disrupted until the utility owner and SCRRRA have determined the required action on such lines.

Relocated utilities on SCRRRA Right-of-Way shall each have new separate crossing permits developed and approved in accordance with SCRRRA’s Right-of-Way Encroachment Application. The Public Agency sponsoring the project shall be responsible for ensuring these permits are obtained and pay all costs associated with obtaining such permits.

Note: Fiber optic cables may be presently buried on the SCRRRA Right-of-Way, or such installations may be scheduled. The presence of such facilities shall be considered in the project design, and appropriate measures for the installation and protection of the fiber optic cables shall be addressed in the plans and contract documents.
APPENDIX A

Standard Specifications

The latest edition of the following SCRRA specifications shall be used in the design and construction of bridge structures. This list does not include all SCRRA standard specifications and SCRRA should be contacted to obtain other sections of the specifications.

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APPENDIX B

Submittal Checklists
## SCRRRA UNDERPASS OR OVERHEAD DESIGN SUBMITTAL CHECKLIST

**Project Name/Location:**

**Submittal Date:**

**Design Firm:**

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<td>2. If this is first submittal has meeting been scheduled with SCRRRA?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. If not, was previous submittal accepted by SCRRRA?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Plans are signed and sealed by a Professional Engineer licensed in the State of California?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Affidavit included confirming plans have been checked and received a quality control review?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Previous review comments addressed and included with submittal?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. SCRRRA Director of Engineering and Construction contacted regarding future track and maintenance access requirements?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. If yes, have SCRRRA requirements been incorporated into the plans?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Final horizontal and vertical clearances are compliant with the Guidelines?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. If not, has an exception or waiver been formally approved?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Temporary minimum horizontal and vertical clearances are compliant with the Guidelines?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. If not, has an exception or waiver been formally approved?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Are shoofly plans compliant with SCRRRA requirements?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Proposed construction phasing including construction track windows has been discussed or accepted by SCRRRA?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. If yes, has the proposed phasing including accepted track windows have been incorporated into the review or final contract plan set?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Construction demolition plan provided, including sequence and description of procedures and equipment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Structure compliant with applicable SCRRRA standard grade separation drawing?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. If not, has an exception or waiver been formally approved?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Project documents include SCRRRA Coordination requirements?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Geotechnical report provided?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. All dimensions and calculations of interest to SCRRRA provided in English units?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Utilities have been located and shown on the plans?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
17. Are there any SCRRA utilities or signals that need to be accounted for in the design of the structure or falsework?  
   A. If yes, have they been accounted for in the design and coordinated with and approved by SCRRA?  

18. All foundation elements are compliant with SCRRA Excavation Support Guidelines?  
   A. If not, has an exception or waiver been formally approved?  

19. Does drainage impact SCRRA Right-of-Way?  
   A. If yes, is drainage plan and hydrology report included with submittal?  

20. Plans indicate proposed methods of erosion control?  

21. Will temporary highway traffic control be required?  
   A. If yes, is SCRRA’s Temporary Traffic Control Guidelines referenced?
**SCERRA UNDERPASS OR OVERHEAD CONSTRUCTION SUBMITTAL CHECKLIST**

Project Name/Location: ____________________________________________
Submittal Date: _________________________________________________
Design Firm: ___________________________________________________

<table>
<thead>
<tr>
<th>Item</th>
<th>Yes/No/NA</th>
<th>Explain if No or NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Submittal signed and sealed by a Professional Engineer licensed in the State of California?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Submittal has been approved by Engineer-of-Record?</td>
<td></td>
<td></td>
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<tr>
<td>3. Affidavit included confirming submittal has been checked and received a quality control review?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Submittal meets SCERRA requirements shown on relative SCERRA Standard Specification Sections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. All dimensions and calculations of interest to SCERRA provided in English units?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SCRRRA FALSEWORK SUBMITTAL CHECKLIST

Project Name/Location: ____________________________________________________________
Submittal Date: __________________________________________________________________
Design Firm: ____________________________________________________________________

<table>
<thead>
<tr>
<th></th>
<th>Yes/No/NA</th>
<th>Explain if No or NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are the falsework details and the method and procedure for installation and removal clearly shown and described on the plans?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Are the designed horizontal and vertical clearance dimensions provided on the plans?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. If the SCRRRA train signals are within ½ mile of the falsework have provisions been made to verify that there is clear sight distance for train operations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Are collision posts to protect falsework provided on the plans when falsework is located within 25 feet to the centerline of any adjacent track(s)?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C

Drawings

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSG-01</td>
<td>Bridge Glossary</td>
</tr>
<tr>
<td>GSG-02</td>
<td>Steel Beam Bridge with Sacrificial Beam</td>
</tr>
<tr>
<td>GSG-03</td>
<td>Steel Deck Plate Girder Bridge</td>
</tr>
<tr>
<td>GSG-04</td>
<td>Steel Through Plate Girder Bridge</td>
</tr>
<tr>
<td>GSG-05</td>
<td>Precast (Pre-stressed) Concrete Slab Beam Bridge</td>
</tr>
<tr>
<td>GSG-06</td>
<td>Precast (Pre-stressed) Concrete Box Beam Bridge</td>
</tr>
<tr>
<td>GSG-07</td>
<td>Overhead Structure Clearances</td>
</tr>
<tr>
<td>GSG-08</td>
<td>Underpass Structure Clearances</td>
</tr>
<tr>
<td>GSG-09</td>
<td>Pedestrian Underpass</td>
</tr>
</tbody>
</table>

SCERRA Engineering Standards

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>2001</td>
<td>Roadbed Sections for Track Constructed Using Wood Ties</td>
</tr>
<tr>
<td>2002</td>
<td>Roadbed Sections for Track Constructed Using Concrete Ties</td>
</tr>
<tr>
<td>2101</td>
<td>Standard Clearance of Structures</td>
</tr>
<tr>
<td>2102</td>
<td>Minimum Clearance of Structures</td>
</tr>
<tr>
<td>2004</td>
<td>HMAC Underlayment for Selected Critical Structures (New Construction Only)</td>
</tr>
<tr>
<td>2207</td>
<td>Track Center Spacing</td>
</tr>
<tr>
<td>6001</td>
<td>Precast/Prestressed Concrete Double Box Beam Bridges (Not attached in these Guidelines)</td>
</tr>
<tr>
<td>6002</td>
<td>Precast/Prestressed Concrete Slab Beam Bridges (Not attached in these Guidelines)</td>
</tr>
</tbody>
</table>
1. RAIL
2. TIE
3. BALLAST
4. TOEBOARD
5. HANDRAIL
6. WALKWAY
7. HOT MIXED ASPHALT (HMA)
8. DRAIN
9. SUPERSTRUCTURE—PARTS OF A BRIDGE WHICH SPAN AN AREA AND CARRY TRAFFIC LOADS
10. BENT—A LINE PERPENDICULAR TO THE LENGTH OF THE BRIDGE CONTAINING MULTIPLE COLUMNS
11. CURB AND GUTTER—ROAD DRAINAGE
12. ROADWAY—DRIVING SURFACE
13. PILE—CONCRETE OR STEEL SUPPORTS DRILLED OR HAMMERED INTO THE GROUND TO SUPPORT THE WEIGHT OF BRIDGE AND TRAFFIC
14. COLUMN—A VERTICAL SUPPORT FOR THE BRIDGE SUPERSTRUCTURE TYPICALLY CAST IN CONCRETE
15. SOFFIT—BOTTOM OF SUPERSTRUCTURE
16. SLOPE PROTECTION—SLOPED SURFACE AT THE ABUTMENT
17. ABUTMENT—THE PERMANENT CONCRETE SEAT (SUBSTRUCTURE) AT THE ENDS OF THE BRIDGE WHICH SUPPORTS THE SUPERSTRUCTURE
18. SUBSTRUCTURE—THE PARTS OF A BRIDGE WHICH COME INTO CONTACT WITH THE GROUND AND SUPPORT LOADS FROM ABOVE
19. FOOTING—THE BASE OF A STRUCTURE WHICH TRANSfers LOADS TO BEDROCK OR PILING
20. CONCRETE COLLAR
1. RAIL
2. TIE
3. BALLAST
4. DRAIN
5. CURB
6. WALKWAY
7. HOT MIX ASPHALT (HMA)
8. HANDRAIL
9. WATERPROOFING
10. STEEL PLATE DECK
11. BRACKET
12. STEEL BEAM
13. SACRIFICIAL BEAM

STEEL BEAM BRIDGE WITH SACRIFICIAL BEAM
*12" MIN. BALLAST CONCRETE TIE
8" MIN. BALLAST TIMBER TIE

1) RAIL
2) TIE
3) BALLAST
4) DRAIN
5) WALKWAY
6) HANDRAIL
7) HOT MIX ASPHALT (HMA)
8) STEEL PLATE DECK
9) DIAPHRAGM
10) STEEL GIRDER
11) INSPECTION WALKWAY
12) BRACKET
**12" MIN. BALLAST CONCRETE TIE**

8" MIN. BALLAST TIMBER TIE

1) RAIL  
2) INNER GUARD RAIL  
3) TIE  
4) BALLAST  
5) DRAIN  
6) CURB PLATE  
7) WALKWAY  
8) KNEE BRACE  
9) WATERPROOFING  
10) STEEL PLATE DECK  
11) TRANSVERSE FLOOR BEAM  
12) STEEL GIRDER
* 8" MIN. BALLAST CONCRETE TIE
8" MIN. BALLAST TIMBER TIE

1) RAIL
2) TIE
3) BALLAST
4) DRAIN
5) CONCRETE CURB AND WALKWAY
6) HANDRAIL

7) CONCRETE CURB
8) WALKWAY
9) TOEBOARD
10) HOT MIXED ASPHALT (HMA)
11) PRECAST CONCRETE SLAB BEAM
12) BEARING PAD
* 8" MIN. BALLAST CONCRETE TIE
8" MIN. BALLAST TIMBER TIE

1) RAIL
2) TIE
3) BALLAST
4) DRAIN
5) CONCRETE CURB AND WALKWAY
6) HANDRAIL

7) CONCRETE CURB
8) WALKWAY
9) TOEBOARD
10) HOT MIX ASPHALT (HMA)
11) PRECAST CONCRETE DOUBLE BOX BEAM
12) BEARING PAD
CROSS SECTION THRU OVERHEAD

SCALE: NONE

1. FENCE
2. PEDESTRIAN/BICYCLE PATHWAY
3. SCRRA MAINTENANCE ROAD
4. SLOPE PROTECTION
5. SCRRA R.O.W. LINE
6. CLEARANCE
7. FOOTING

OVERHEAD STRUCTURE CLEARANCES
1. Top of Rail
2. Handrail
3. Steel Superstructure
4. Bent
5. Bent Protection
6. Abutment
7. Footing
8. Roadway

Underpass Structure Clearances

Span as Required

16'-6" Min. Vertical Clearance

GSG - 08
**HMAC UNDERLAYMENT FOR SELECT CRITICAL LOCATIONS (NEW CONSTRUCTION ONLY)**

**CONCRETE TIE (TYP)**

- **12" MIN. BALLAST UNDER TIE (TYP)**
- **6" HMAC UNDERLAY (TYP)** to extend 10' beyond the limits of platform as measured along CL of track

**AT STATIONS (CENTER ISLAND PLATFORM)**

- **OUTBOARD PLATFORM**
- **CENTER PLATFORM**
- **OUTBOARD PLATFORM**

**AT STATIONS (OUTBOARD PLATFORMS)**

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

**CONCRETE TIE (TYP)**

- **6" PVC UNDERDRAIN**

---

**Standards and Specifications**

- Standard Timber Ties, 19½" O.C.
- 24 EA. 10" Transition Timber Ties W/Pandrol Plates & Clips, 19½" O.C. On Bridge
- Standard Concrete Ties W/Pandrol Plates & Clips, 24" O.C. On Bridge
- 12" Ballast
- 6" Ballast
- 8" HMAC Underlayment for Bridge Approach extending to 7'6" on both sides of track CL
- 6" Subballast Layer
- 30' Transition from 9" to 12" of Ballast
- 30' Bridge Approach (Typ)

---

**Drawing Information**

- **Plot Driver:** S:\Plot Drivers\practice_pdf.plt
- **Plot Driver Path:** S:\V8EngStds\Revisions in progress\ES2004_revB.dgn
- **UserName:** carlosa
- **Date Plotted:** 11/24/2015 10:15:32 AM
- **Plot Driver:** S:\Plot Drivers\practice_pdf.plt
- **FileName:** S:\V8EngStds\Revisions in progress\ES2004_revB.dgn

---

**Supplementary Notes**

- **Engineer: NGP
  Date: 09-28-15**

---

**Revision History**

- **03-29-13:** NDP
  Revised HMAC Underlayment
- **03/31/2011:** NDP
  Rev E-3.01
- **ES2004:**
  sayılı metik sayfada yer alan metinle işbirliği yapmak, metinin okunabilmesini sağlar. Metinin doğal okunması üretildi.
NOTES:

1. Standard permanent and temporary clearances shown on this sheet shall be used for new design and construction wherever practical. Any permanent or temporary construction proposed within the dimensions shown shall require the prior approval of the SCRRA Director of Engineering and Construction.

2. Standard permanent clearance shall be 14'-6" from CL of track for canopies, stairways and support columns. Proposed clearances less than this distance shall conform to those shown on SCRRA ES2102 and will require the prior approval of the SCRRA Director of Engineering and Construction.

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

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

5. Rail-highway grade separations may require provisions for a maintenance road and/or future additional tracks.

6. Clearances may be required to provide visibility for wayside signals.

7. In a curve on super-elevated track the horizontal clearances shall be measured perpendicular to the plane across the top of both rails and the vertical clearance shall be measured from the high rail.

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

5'-3"
3'-0"

R 8'-0"
4'-0"
3'-0"

R 8'-6"
4'-0"
3'-0"

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

TYPICAL CLEARANCE OF STRUCTURES FROM RAILROAD TRACKS
AS GENERALLY PRESCRIBED BY PUBLIC UTILITIES COMMISSION - STATE OF CALIFORNIA
GENERAL ORDER NO 26-D
(EFFECTIVE FEBRUARY 1, 1946)

FOR NEW WORK AND RECONSTRUCTION OF EXISTING FACILITIES ADJACENT TO STANDARD GAUGE RAILROAD TRACKS TRANSPORTING FREIGHT CARS.

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

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

PUBLIC UTILITIES COMMISSION - STATE OF CALIFORNIA
GENERAL ORDER NO 26-D
(EFFECTIVE FEBRUARY 1, 1946)

FOR NEW WORK AND RECONSTRUCTION OF EXISTING FACILITIES ADJACENT TO STANDARD GAUGE RAILROAD TRACKS TRANSPORTING FREIGHT CARS.
<table>
<thead>
<tr>
<th>Degree of Curve</th>
<th>Main or Running and Adjacent Tracks</th>
<th>Industry and Yard Tracks</th>
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</thead>
<tbody>
<tr>
<td>TANGENT</td>
<td>15'-0&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>1°</td>
<td>15'-2&quot;</td>
<td>15'-2&quot;</td>
</tr>
<tr>
<td>3°</td>
<td>15'-4&quot;</td>
<td>15'-4&quot;</td>
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<tr>
<td>5°</td>
<td>15'-6&quot;</td>
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<td>7°</td>
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<td>15'-10&quot;</td>
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<td>15°</td>
<td>15'-16&quot;</td>
<td>17'-4&quot;</td>
</tr>
<tr>
<td>17°</td>
<td>15'-18&quot;</td>
<td>17'-6&quot;</td>
</tr>
<tr>
<td>OVER 15°</td>
<td>INCREASE BY 1/2 INCH PER 15 MINUTES OF CURVE</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Minimum distance between center lines of adjacent tracks on all new construction shall be as follows: the minimum distance shall also apply to existing tracks when resurfacing is authorized by the SCRRA Director of Engineering and Construction.
   a. Main tracks - 15'-0" minimum, 25'-0" where space permits
   b. Main Siding, running and shunt tracks and adjacent track (except yard tracks) - 15'-0"
   c. Lumber yard track and adjacent track - 15'-0"
   d. Industry, two and three tracks - 15'-0"
   e. Yard track and adjacent main or running track - 25'-0"
   f. On curves, track centers as shown above shall be increased as follows (also see table on this sheet):
      - Tracks per notes A, B and C - increase by 1/2 inch per each 15 minutes of curve.
      - Tracks per note D (Yard tracks) - increase by 1/2 inch per each 15 minutes of curve in excess of E degrees.
2. Increased distances between track centers shall be applied in 1/2 inch increments. Degrees of curvature that are not exact 15 minute increments shall be rounded up to the next greater 15 minute increment. For example, if two curved tracks are to be parallel and the inner track is D=8°30', they shall be separated based on the assumption that its curvature is D=8°30'.
3. Where adjacent track is on the outside of a curve and its super elevation is more than on the inside track, distance between the tracks shall be increased three inches for each inch difference in super elevation. The increase shall be added to the amount shown in Table at left. Where such track has the same or less amount of super elevation, use spacing as shown in the table.

AMOUNT OF SUPERELEVATION, USE SPACING AS SHOWN IN THE TABLE.