



Chapter 5: Design Considerations

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5-1 Introduction

A protective cover is a temporary structure used to control and contain debris from bridge removal operations. Protective covers can be used to control debris from falling vertically or projected laterally from the bridge removal operation. Sometimes protective covers are installed by the Contractor for the Contractor's convenience as part of their means and methods. Most often, however, protective covers are required by the contract with the intent of providing specific protection to life, property, or the environment. A protective cover can also serve a multi-purpose function as part of a temporary support, work platform, and/or falsework. A protective cover must be designed to support all loads imposed on it, including assumed horizontal loads.

Protective covers can be self-supporting or, as often the case in partial removal operations, be attached to the existing structure. Often, protective covers use common building materials and sometimes use manufactured proprietary devices such as overhang brackets.

5-2 Protected Facilities

All traffic is to be protected, including pedestrian, railroad, waterway, and highway. All transportation facilities and other improvements which remain in place are to be protected. All utilities are to be protected, including underground, overhead, or on the structure. The [Contract Specifications](#), Section 15-1.03A, *Existing Facilities – Construction – General*, makes the Contractor responsible to repair or replace any damaged facility. Protection from falling debris includes fine dust. Before a protective cover is removed, it should first be cleaned of debris and fine dust.

All environmental resources are to be protected, including [Waters of the State](#).

The *Contract Specifications*, Section 12-4.04C, *Temporary Traffic Control – Maintaining Traffic – Temporary Pedestrian Access Routes – Construction*, requires protective overhead covering for a pedestrian route. *Contract Specifications*, Section 16-2, *Temporary Facilities – Miscellaneous Temporary Facilities*, requires the minimum pedestrian overhead covering protection to be ¾-inch plywood or solid wood planking with a nominal thickness of 2 inches.

5-3 Types of Protective Covers

During roadway closures when traffic is detoured, debris from bridge removal activities may fall directly onto the roadway provided the pavement is protected with a minimum of 2-foot-thick earthen pad or a 1-inch-thick steel plate, per the *Contract Specifications*, Section 60-2.02, *Existing Structures – Structure Removal – Bridge Removal*. See

illustration of an earthen pad in Figure 5-1. These are minimum requirements and the Contractor may use a more robust system, as authorized by the Structure Representative. This minimum protective cover intended to protect pavement may need to be more robust for sensitive facilities or utilities.

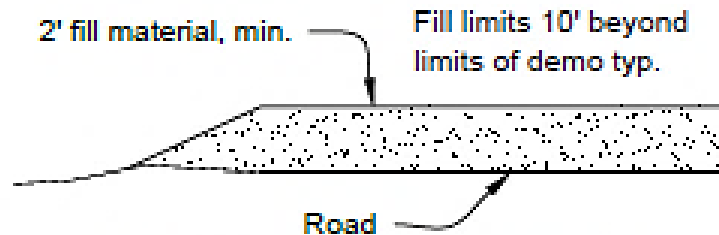


Figure 5-1. Typical Roadway Protective Cover Detail with 2-foot Fill Option

Often the bridge itself provides an adequate protective cover, as is the case of a box girder bridge, where the demolished deck is allowed to fall onto the enclosed soffit, as illustrated in Figure 5-2.



Figure 5-2. Box Girder Soffit Used as a Protective Cover, Santa Anita

Protective covers may be supported from the bottom flange of concrete and steel girders during concrete deck removal for bridges without an enclosed soffit.

Suspended scaffolding, as illustrated in Figure 5-3 and 5-4, can also be employed for bridge removal operations. Suspended scaffolding is frequently used for bridge painting and retrofit work but has also been used for partial bridge removal work. Suspended scaffolding is usually proprietary, and the engineered design is provided by the manufacturer.

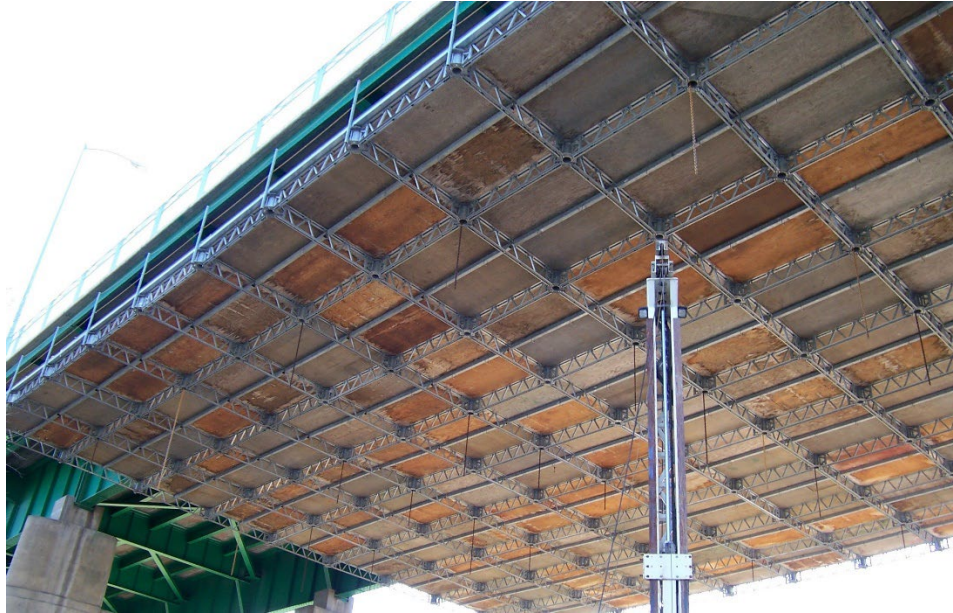


Figure 5-3. Suspended Scaffolding over River Span, Marysville



Figure 5-4. Suspended Scaffolding on Overhang for Debris Containment, Marysville

Temporary overhang brackets are sometimes used for bridge rail replacement or widening work. Overhang brackets can be a proprietary design that is bolted to the exterior girder or a contractor designed job-specific system. Drilling holes for these systems requires permission from the Structure Representative. Holes must not damage the post-tensioning system or critical tension reinforcement in the case of concrete bridges, nor damage tension flanges and zones in the case of steel girder bridges. When holes are drilled or fasteners embedded in the existing bridge, the bridge removal work plan must include a plan to repair the holes and provide resistance to corrosion. See Figure 5-5 for an example of a protective cover suspended from the overhang, supported by threaded rod.



Figure 5-5. Four-Foot-Wide Protective Cover for Rail Removal, Sacramento

The *Contract Specifications* requires the protective cover to extend at least 4 feet from the face of the rail in locations where only railing is removed, and to extend at least 10 feet beyond the face of the railing at locations where entire girders are removed, as illustrated in Figure 5-6.

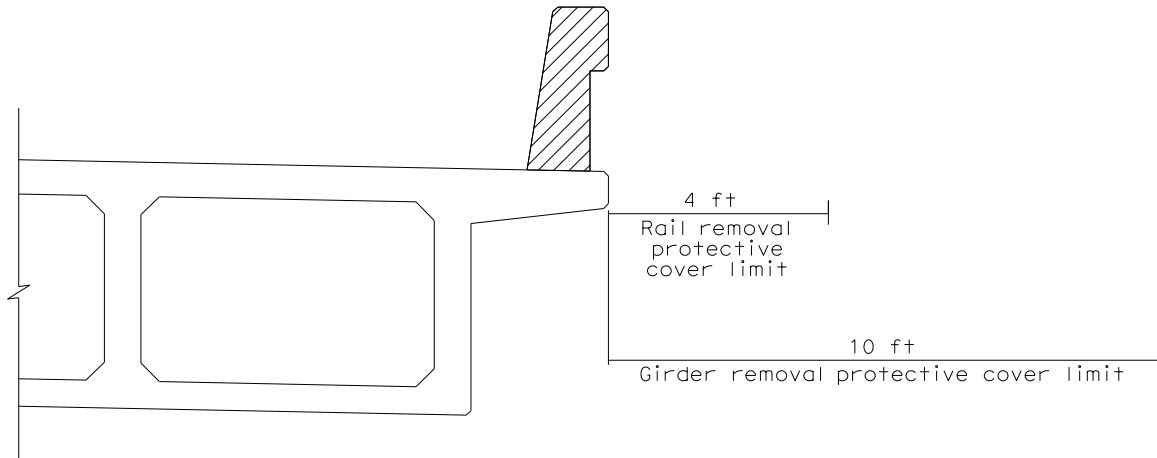


Figure 5-6. Protective Cover Minimum Limits

A protective cover can take the form of a trestle over a waterway, as illustrated in Figure 5-7, or can resemble traditional post and beam falsework used in cast-in-place concrete bridge construction.



Figure 5-7. Trestle Type Protective Cover Over Waterway, Simerly Slough

5-4 Protective Cover Design

The design and construction of protective covers must conform to the *Contract Specifications*, Section 48, *Temporary Structures*. Often, protective covers are similar to falsework and will be analyzed as such, however the loads will typically be different than the loads used in falsework. The *Falsework Manual* should be referenced for review of the protective cover design.

When protective covers are used, they must be supported by calculations and be part of the bridge removal work plans signed by an engineer registered as a civil engineer in the State. Protective covers are a vital safety component of the bridge removal work plan and require a thorough review.

Protective covers are considered an action submittal and must be submitted as part of the bridge removal work plan and conform to *Contract Specifications*, Section 5-1.23B(2), *Control of Work – Submittals – Action Submittals – Shop Drawings*.

5-5 Traffic Openings

Contract Specifications, Section 60-2.02C(2), *Existing Structures – Structure Removal – Bridge Removal – Construction – Protective Covers*, requires a protective cover over traffic to be in place prior to the beginning of bridge removal work. Traffic control must conform to *Contract Specifications*, Section 12-4, *Temporary Traffic Control – Maintaining Traffic*, and minimum clearances of 15 feet vertically and 8 feet horizontally of traffic lanes or shoulders open to the public must be maintained, unless specified otherwise in the *Special Provisions*.

Contract Specifications, Sections 16-2.02A(1), *Temporary Facilities – Miscellaneous Temporary Facilities – Temporary Pedestrian Facilities – General – Summary*, and 48-2.03E, *Temporary Structures – Falsework – Construction – Falsework Lighting*, are applicable where the safety of the public prevails, including provisions to light pedestrian openings through the work. *Contract Specifications*, Section 7-1.04, *Legal Relations and Responsibility to the Public – Public Safety*, addresses the general intent of the contract towards public safety, including the installation of temporary illumination.

5-6 Railroad Requirements at Railroad Openings

Contract Specifications, Section 5-1.20C, *Control of Work – Coordination with Other Entities – Railroad Relations*, provides a contractual link between the *Contract Specifications* and any existing agreement between the railroad and the Department. These agreements often detail specific protective cover requirements. The agreements should be included in the project *Information Handout*.

Contract Specifications, Section 5-1.36B, *Control of Work – Property and Facility Preservation – Railroad Property*, requires the prevention of any material, equipment, and debris from falling onto railroad property. As such, protective covers must be provided over railroad property as outlined in *Contract Specifications*, Section 60-2.02C(2), *Existing Structures – Structure Removal – Bridge Removal – Construction – Protective Covers*. See Figure 5-8 for an illustration of suspended scaffold over a railroad, and Figure 5-9 for an illustration of steel plates used to protect railroad tracks.

Railroad approval is required for bridge removal work plans, including protective covers. The bridge removal work plan, including the protective cover plans, must be routed through the Structure Construction (SC) Falsework Engineer for railroad review and railroad approval prior to the Structure Representative's authorization of the plan.

The railroads offer guidelines and checklists to assist in the development of demolition plans, which are available from SC Headquarters upon request.



Figure 5-8. Suspended Scaffolding Over Railroad for Edge of Deck Removal, Marysville



Figure 5-9. Protective Cover with Steel Plates Over Railroad, Dunsmuir