

Exhibit 7.4: Historic Bridges and Tunnels No Adverse Effects with Standard Conditions

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Exhibit 7.4:

Historic Bridges and Tunnels

No Adverse Effects with Standard Conditions

A Finding of No Adverse Effect with Standard Conditions is appropriate when Other activities, or undertakings that involve historic bridges and tunnels¹, are completed in a manner consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties (SOIS)* in accordance with the Stipulation X.1.b of both the 2014 First Amended Section 106 Programmatic Agreement ([106 PA](#)²) and the 2015 Public Resources Code 5024 Memorandum of Understanding ([5024 MOU](#)³) for state-owned bridges and tunnels. Such findings must be reviewed by a Caltrans Professionally Qualified Staff (PQS) Principal Architectural Historian.⁴

The *No Adverse Effect with Standard Conditions* through use of the SOIS (FNAE-SC-SOIS) is appropriate for the activities listed below. The affected character-defining features (CDFs) need to be identified in order to assess the effects to the historic bridge or tunnel and a Standard Conditions Action Plan must be developed; see [Exhibit 7.5](#): SOIS Action Plan. If the project includes many of these activities, is

¹ Historic bridges and tunnels are those that are listed on or eligible for listing on the National Register of Historic Places (Category 1 or 2 of the Caltrans Historic Bridge Inventory). For purposes of CEQA this includes bridges and tunnels listed in the California Register of Historical Resources or that meet the California Register criteria, registered California Historic Landmarks (CHL) and locally designated bridges and tunnels. For PRC 5024 purposes, this also includes state-owned historic bridges and tunnels that are registered or eligible as CHLs, in addition to National Register listing and eligibility.

² *First Amended Programmatic Agreement Among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California*, January 1, 2014.

³ *Memorandum of Understanding Between the California Department of Transportation and the California State Historic Preservation Officer Regarding Compliance with Public Resources Code Section 5024 and Governor's Executive Order W-26-92*, effective January 1, 2015.

⁴ See Attachment 1 of the [106 PA](#) and the [5024 MOU](#) for a description of Professionally Qualified Staff, including Principal Architectural Historian

a full rehabilitation or involves complex bridges or tunnels, it may be necessary to identify the CDFs of a historic bridge or tunnel. [Exhibit 7.1, Ranking Character-Defining Features](#), in the Caltrans [Standard Environmental Reference Volume 2-Cultural Resource \(SERv2\)](#) provides guidance. This ranking process identifies the CDFs most important to preserve, helps prioritize which CDFs to protect when considering project alternatives, and provides guidance in distinguishing between CDFs and historic fabric. To reach an FNAE-SC-SOIS, an action plan as described in Attachment 5.2 of the [106 PA](#) and the [5024 MOU](#) for state-owned historic bridges and tunnels must be completed and then approved by Caltrans PQS in order to identify who will monitor the work to ensure it meets the SOIS.⁵

In cases where actions are determined to be an FNAE-SC-SOIS, Caltrans shall concurrently provide the Caltrans Division of Environmental Analysis Cultural Studies Office and any consulting parties, as appropriate, with documented notification of the finding, as outlined in the Stipulation X.B.1 of the [106 PA](#) and the [5024 MOU](#) for state-owned historic bridges and tunnels.

Proposed activities that are required for compliance with the Americans with Disabilities Act (ADA) are subject to the alternative provisions of the California Historical Building Code and require consultation with the State Historical Building Safety Board in addition to individual review by Caltrans PQS Principal Architectural Historian(s). This type of federal undertaking may or may not be considered an FNAE-SC-SOIS. If conditions other than the SOIS are proposed, it is possible that either a Finding of No Adverse Effect without Standard Conditions or a Finding of Adverse Effect is appropriate; see Stipulation X.B.2 of the [106 PA](#) or the [5024 MOU](#) for state-owned historic bridges and tunnels; see [Exhibits 2.8](#) and [2.9](#).

Seismic retrofit activities receiving Federal-Aid for individual projects under the Local Bridge Seismic Safety Retrofit Program (Program) are subject to [106 PA](#) Stipulation XVII and Attachment 7.

⁵ [Exhibit 7.5](#) of the SERv2; and Attachment 5.2 of the [106 PA](#) and the [5024 MOU](#) Attachment 5.2 state who is qualified to be monitors for this type of finding..

The list below is organized first by activities specific to bridges and tunnels, regardless of type or material, followed by activities involving specific materials and structure types. Definitions and references to further information on items in bold text (such as bridge components and bridge-related activities) are provided at the end of this document. These definitions are drawn from the American Association of State Highway and Transportation Officials (AASHTO); design, construction, and maintenance standards from Caltrans and/or the Federal Highway Administration (FHWA); the National Park Service (NPS); and the California Office of Historic Preservation.

**ACTIVITIES AND UNDERTAKINGS THAT MAY BE
FINDINGS OF NO ADVERSE EFFECT WITH STANDARD CONDITIONS**

Bridge Approach and Adjacent Roadway

- Refer to *Specific Activities by Material* (see below) for additional information.
 - In-kind repair, replacement of contributing wingwalls, approach railings and spans.
-

Deck

- Refer to *Specific Activities by Material* (see below) for additional information.
 - Application of waterproof sealant or overlay (e.g., polyester concrete overlay, methacrylate, silane, or polymer).
 - Installation of **cathodic protection**.
 - **In-kind replacement** of the deck.
 - Installing **skid resistant** devices (such as anti-skid studs) to concrete or metal.
 - Repair – **patching, bonding, and filling voids** in timber or metal decks (**pot holes** and cracks).
-

Abutments, Bents, Piles, and Piers

- Refer to *Specific Activities by Material* (see below) for additional information.
 - **In-kind replacement** of bent, pile, pier, girder or **column** and associated **bent cap**.
 - Repair of **footing** or implementation of measures to address settlement and **scour**, such as providing a **pile, deadman, or shoring**.
 - Application of waterproof sealant or painting (refer to *Specific Activities by Structure Type or Materials* below for further guidance).
 - In-kind **patching, bonding, and filling voids in concrete** caused by cracks, **spalling**, or deterioration.
 - In-kind repair of steel or timber components.
-

**ACTIVITIES AND UNDERTAKINGS THAT MAY BE
FINDINGS OF NO ADVERSE EFFECT WITH STANDARD CONDITIONS**

Sidewalks, Curbs, and Gutters

- Refer to *Specific Activities by Material* (see below) for additional information.
 - **In-kind repair or replacement sidewalks, curbs, and gutters.**
-

Railings

- Refer to *Specific Activities by Material* (see below) for additional information.
 - **In-kind repair or replacement** of contributing railings.
 - Replacement applying the California State Historical Building Code.
 - On a case-by-case basis, installation of visually compatible **safety devices** (guardrails, barriers) between roadway and historic railings.
-

Drainage

- Refer to *Specific Activities by Material* (see below) for additional information.
 - **In-kind repair or in-kind replacement of drainage system** including drains and **conduit**.
-

Expansion Joints

- None identified.
-

Other

- Refer to *Specific Activities by Material* (see below) for additional information.
 - Testing or sampling of bridge components.
 - **In-kind repair or in-kind replacement of utility facilities.**
 - **In-kind repair or in-kind replacement** of safety walks and railing, exit stairs, and ladder structures.
 - **In-kind repair, in-kind replacement, or installation** of visually compatible **traffic control devices**, such as markings (delineators, object markers, colored pavement, temporary barricades, channelizing devices, and island), signs, and traffic signals.
-

**ACTIVITIES AND UNDERTAKINGS THAT MAY BE
FINDINGS OF NO ADVERSE EFFECT WITH STANDARD CONDITIONS**

In-kind repair, in-kind replacement, or installation of visually compatible signs, and safety devices (overhead and changeable message signs).

SPECIFIC ACTIVITIES BY MATERIAL

Concrete

- Cleaning with water or compressed air with non-destructive method following testing on small area.⁶
- **In-kind repair (patching, bonding, and filling voids in concrete)** after first testing the repair method on a small area to ensure compatible texture and color.
- Removing water stains or residues with non-destructive method following testing on small area.⁴
- Non-destructive graffiti removal.^{4,6}

⁶ Use the gentlest possible treatment that will be effective. Consider the existing condition, appearance, color, and texture of the concrete in determining the best cleaning method; the goal of cleaning is not to return the structure to a like-new appearance. Low-pressure water or compressed air can be effective in removing surface soil. Power washing with high-pressure water can be used to clean or remove coatings from high-strength concrete, but is generally not appropriate for concrete on historic structures. Water and compressed air are not typically effective in removing stains and residue. Detergent cleaners or mild, diluted acid cleaners may be appropriate in this case. Micro-abrasive and chemical surface treatments can be effective but may damage the concrete and alter its appearance, texture, and surface reflectivity. Perform trial samples or testing on small, inconspicuous areas prior to full-scale cleaning. Refer to *NPS Preservation Brief 15: Preservation of Historic Concrete* at <http://www.nps.gov/history/hps/tps/briefs/brief15.htm> for further guidance on appropriate cleaning methods for concrete on historic structures.

**ACTIVITIES AND UNDERTAKINGS THAT MAY BE
FINDINGS OF NO ADVERSE EFFECT WITH STANDARD CONDITIONS**

- **In-kind repair or in-kind replacement of anchor bolt.**
 - Application of sealant or coating to reduce water penetration.⁷
 - Application of paint.⁸
-

Steel

- Repainting bridge with historically compatible color.
- Major or full replacement of deteriorated or missing **bolts or rivets.**⁹
- **In-kind replacement of members (girders, beams, diagonals, and/or stringers).**
- **In-kind replacement of floor beams and systems.**
- Installation of **braces** to replace or strengthen connections.
- **In-kind repair or in-kind replacement of rivet heads.**

⁷ Sealants and coatings include clear penetrating sealers and clear or pigmented film-forming coatings to reduce water penetration into the substrate. The effects of most sealers and coatings are not reversible and may result in a change in the color, surface texture, surface reflectivity and finish of the original concrete. The effects of sealants and coatings may also reduce breathability overtime, trapping water in the substrate and resulting in damage. The Caltrans Historic Bridge Inventory website provides several studies discussing the use of sealers and coatings on concrete under Technical Guidance. If the application of a sealant or coating is necessary, perform trial samples or testing on small, inconspicuous areas. Samples or tests should be reviewed by Caltrans PQS to confirm that the proposed measures are appropriate and consistent with the Standards.

⁸ Generally, concrete should not be painted; however, for graffiti removal it may be appropriate to apply paint in areas immediately adjacent to the roadway that are not subject to excessive moisture. *Preservation Brief 38: Removing Graffiti from Historic Masonry* provides guidance for removing graffiti from stone, masonry, and concrete. Samples or tests should be reviewed by Caltrans PQS to confirm that the proposed measures are appropriate and comply with the Standards.

⁹ Deteriorated bolts or rivets should be replaced in-kind when possible. Deteriorated or missing rivets can be replaced with bolts due to the savings in labor and cost. However, rivets have a distinctly different look than bolts and maintaining this appearance can be paramount to retaining the character-defining features of a bridge. As a result, round “button-head” bolts should be used to replicate the appearance of rivets when appropriate. Button-head ends should face the most visible direction. Locations on the structure with restricted access, including the gusset plate connections, may inhibit use of the tool that installs the specialized button head bolts; in these cases, the button-head bolts should be installed and tightened without the tool to avoid reverse installations that hide the button head. Shop rivets should be used for in-kind replacement members that are being fabricated off-site.

**ACTIVITIES AND UNDERTAKINGS THAT MAY BE
FINDINGS OF NO ADVERSE EFFECT WITH STANDARD CONDITIONS**

Timber

- Application of non-destructive **wood preservatives, fire retardants, and protective finish treatments** to existing components.¹⁰
 - Non-destructive graffiti removal.¹¹
 - **In-kind repair or in-kind replacement** of deteriorated or damaged members (siding, **pile, beam, girder, stringer**), connections, and **braces**.
-

Masonry

- **In-kind repair** of decorative features.
 - Re-pointing mortar joints to same depth, including the arch barrel.
 - **In-kind replacement** of damaged or deteriorated brick or stone.
 - Installation of tie rods.
 - Removing water stains or residues with non-destructive method following testing on small area.¹²
 - Filling of openings or cracks with grout.
 - Non-destructive **graffiti** removal.^{6, 12}
-

¹⁰ Work should follow FHWA's *Covered Bridge Manual: Publication No. FHWA-HRT-04-098* and *Guide for In-Place Treatment of Wood in Historic Covered and Modern Bridges* – see Caltrans Historic Bridge Inventory website.

¹¹ No specific guidance is developed for the proper removal of graffiti on historic timber. Protective Finish Treatments are generally addressed in Chapter 10, Issues Related to Wood, in FHWA's *Covered Bridge Manual: Publication No. FHWA-HRT-04-098* in Chapter 10 at www.fhwa.dot.gov/publications/research/infrastructure/structures/04098/10.cfm#Toc99789846. Non-destructive measures to remove graffiti on historic timber bridges should be tested. Measures should consider the existing condition and appearance of the timber in determining the best removal method. Perform trial samples or testing on small, inconspicuous areas prior to full-scale removal. Samples or tests should be reviewed by Caltrans PQS to confirm that the proposed measures are appropriate and consistent with the Standards.

¹² Use the gentlest possible treatment that will be effective. Consider the existing condition and appearance of the masonry and mortar in determining the best cleaning method. Perform trial samples or testing on small, inconspicuous areas prior to full-scale cleaning. Samples or tests should be reviewed by Caltrans PQS to confirm that the proposed measures are appropriate and consistent with the Standards. Although not specific to historic bridges, *NPS Preservation Brief 1: Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings* at <http://www.nps.gov/hps/tps/briefs/brief01.htm> provides further guidance on cleaning historic masonry structures.

**ACTIVITIES AND UNDERTAKINGS THAT MAY BE
FINDINGS OF NO ADVERSE EFFECT WITH STANDARD CONDITIONS**

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- Application of sealant or coating to reduce water penetration.¹³
 - Application of paint.¹⁴
-

Specific Activities by Structure Type

Movable

- **In-kind repair or in-kind replacement** of interior cabinetry and instruments within interior of operational control room.
 - **In-kind repair or in-kind replacement** of deteriorated or damaged mechanical equipment, brakes, cables, and electrical equipment.
 - **In-kind repair or in-kind replacement** of lighting for navigational aids and roadway light fixtures.
 - Installation of visually compatible navigational lighting aids and roadway light fixtures.
-

Tunnels

- Installation of visually compatible lighting, ventilation, mechanical, and communication systems.
 - **In-kind repair or in-kind replacement** of existing safety walks, railings, exit stairs, and ladder structures.
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¹³ Sealants and coatings include clear penetrating sealers and clear or pigmented film-forming coatings to reduce water penetration into the substrate. The effects of most sealers and coatings are not reversible and may result in a change in the color, surface texture, surface reflectivity, and finish of the original concrete. The effects of sealants and coatings may also reduce breathability overtime, trapping water in the substrate and resulting in damage. The Caltrans Historic Bridge Inventory website provides several studies discussing the use of sealers and coatings on masonry. If the application of a sealant or coating is necessary, perform trial samples or testing on small, inconspicuous areas. Samples or tests should be reviewed by Caltrans PQS to confirm that the proposed measures are appropriate and consistent with the Standards.

¹⁴ Generally, masonry should not be painted; however, to address ongoing problems areas that are repeated targets of graffiti, it may be appropriate to apply paint in areas immediately adjacent to the roadway. *Preservation Brief 38: Removing Graffiti from Historic Masonry* provides guidance for removing graffiti from stone, masonry, and concrete. Samples or tests should be reviewed by Caltrans PQS to confirm that the proposed measures are appropriate and comply with the Standards.

Definitions and References

Approach Slab: Approach slabs provide a smooth transition between a pavement that is generally supported on a yielding medium (soil that is subject to consolidation and settlement) and a structure, which is supported on a relatively unyielding foundation (bridge). See *Caltrans Highway Design Manual*, Chapter 670 at http://www.dot.ca.gov/hq/oppd/hdm/HDM_050712.pdf for details.

Approach Span: The span or spans connecting the abutment with the main span or spans.

Beam: A horizontal structure member supporting vertical loads by resisting bending. A girder is a larger beam, especially when made of multiple plates. Deeper, longer members are created by using trusses.

Bent: Part of a bridge substructure comprised of a rigid frame commonly made of reinforced concrete or steel that supports a vertical load and is placed transverse to the length of a structure. Bents are commonly used to support beams and girders. Each vertical member of a bent may be called a column, pier, or pile. The bent stands on top of some type of foundation or footer that is usually hidden below grade. A bent commonly has at least two vertical supports. Another term used to describe a bent is capped pile pier. A support having a single column with bent cap is sometimes called a "hammerhead" pier.

Bent Cap: The horizontal member resting on top of the columns.

Bolt: A fastener fitted with threads and a nut to connect bridge components. Bolts can include "button head," which describes the style of the bolt head, to replicate the appearance of rivets when appropriate.

Brace: A structural support or member to strengthen and stiffen a structure to resist loads.

Bridge Approach: The part of the bridge that may include portions adjacent roadway along with the approach slab and approach spans, that carries traffic from the land to the main parts of the bridge.

Cathodic Protection: A type of corrosion protection, including cathodic protection measures, are described in Caltrans' *Bridge Memo to Designers, 10-5, [Protection of Reinforcement Against Corrosion Due to Chlorides, Acids Sulfates](http://www.dot.ca.gov/hq/esc/techpubs/manual/bridgemanuals/bridge-memo-to-designer/bmd.html)* at <http://www.dot.ca.gov/hq/esc/techpubs/manual/bridgemanuals/bridge-memo-to-designer/bmd.html>.

Column: Part of a bridge substructure comprised of a vertical, structural element, strong in compression. The column stands on top of some type of foundation or footer that is usually hidden below grade.

Conduit: Any pipe, arch, box, or drain tile through which water is conveyed.

Deadman: A buried object, serving as an anchor, such as cable guard rail guy anchors.

Deck: The roadway portion of a bridge including shoulders. Most bridge decks are constructed as reinforced concrete slabs, but timber decks are still seen in rural areas, and open-grid steel decks are used in some movable bridge designs.

Diagonal: A sloping structural member of a truss or bracing system.

Drainage: Features to remove runoff from the roadway and to convey surface and stream waters originating upstream of the highway to the downstream side. Drainage features are designed to accomplish these functions without causing objectionable backwater, excessive velocities, erosion, or unduly affecting traffic safety. See Chapter 800 in *Caltrans Highway Design Manual* at <http://www.dot.ca.gov/hq/oppd/hdm/pdf/chp0800.pdf> for details.

Drainage System: A system of underground conduits and collector structures which flow to a single point of discharge.

Fire Protection: Installation of fire extinguishers in the operational control room and machinery room of movable bridges or a fire suppression system on a timber covered bridge. See Chapter H – Bridges in *Caltrans Maintenance Manual, Volume 1* at www.dot.ca.gov/hq/maint/manual/ChH.pdf for details on fire protection on movable bridges. Fire suppression systems for covered timber bridges are addressed in

FHWA's *Covered Bridge Manual* in Chapter 17 at

www.fhwa.dot.gov/publications/research/infrastructure/structures/04098/17.cfm#Toc99789937

Floor Beam: Horizontal members that are placed transversely to the major beams, girders, or trusses; used to support the deck.

Footing: The enlarged lower portion of the substructure or foundation that rests directly on the soil, bedrock, or piles; usually below grade and not visible.

Girder: A horizontal structure member supporting vertical loads by resisting bending. A girder is a larger beam, especially when made of multiple metal plates. The plates are usually riveted or welded together.

Graffiti: Caltrans graffiti removal guidance is addressed in Maintenance Manual Volume 1, Chapter D1 - Litter, Debris, and Graffiti at http://www.dot.ca.gov/hq/maint/manual/Ch_D1.pdf and in *California Department of Transportation, DD-39-R1, Deputy Directive for Graffiti Prevention and Removal.*

In-kind Repair: See definition and guidance below.

In-kind Replacement: See definition and guidance below.

Load: Weight distribution throughout a structure.

Patching, Bonding, and Filling Voids in Concrete: Repair materials and procedures are addressed in Chapter H – Bridges in *Caltrans Maintenance Manual, Volume 1*, Section H.08.1 at www.dot.ca.gov/hq/maint/manual/ChH.pdf.

Pavement Delineation, Signs, and Safety Devices: This may include raised pavement markers, guardrails, permanent signs, and barriers, but only on the traveled way, shoulders, ramps, and auxiliary lanes. This does not include markings or delineation of legends or parking stalls, markings at roadside rest areas, weigh stations, or other public service locations. See Chapter M, Pavement Delineation, Signs, and Safety Devices in *Caltrans Maintenance Manual, Volume 1* at <http://www.dot.ca.gov/hq/maint/manual/maintman.htm> for details.

Pier: A vertical structure that supports the ends of a multi-span superstructure at a location between abutments. Also see *Column* and *Pile*.

Pile: A long column driven deep into the ground to form part of a foundation or substructure. Also see *Column* and *Pier*.

Pot Hole: A pit or hole extending into the wearing surface.

Rivet: A metal fastener used in pre-1970 construction; made with a rounded preformed head at one end and installed hot into a predrilled or punched hole; the other end was hammered into a similar shaped head thereby clamping the adjoining parts together.

Scour: Erosion

Shoring: Shoring is generally considered temporary work to provide earth retaining structures or systems. See Caltrans Technical Manual, *Trenching and Shoring Manual 2011* at

<http://www.dot.ca.gov/hq/esc/construction/manuals/OSCCCompleteManuals/TrenchingandShoringManual2011.pdf> for details.

Spalling: Chipping along the edges, as at joints in concrete pavements and structures.

Stiffener: On plate girders, structural steel shapes, such as an angle, are attached to the web to add intermediate strength.

Stringer: A beam aligned with the length of a span that supports the deck.

Traffic Control Devices: Markings include pavement and curb markings, object markers, delineators, colored pavements, barricades, channelizing devices, and islands used to convey regulations, guidance, or warning to road users. Signs include traffic control devices intended to communicate specific information to road users through a word or symbol. Traffic signals include power-operated control devices by which traffic is warned or directed to take a specific action. See *Caltrans Highway*

Design Manual, Chapter 60, Topic 62 – Definitions, 62.8 Traffic (13), at <http://www.dot.ca.gov/hq/oppd/hdm/pdf/chp0060.pdf> for details.

Utility Facilities: Pipeline and electrical and communication conduits, which are further described in *Caltrans Memo to Designers, 18-2*, and *Caltrans Memo to Designers, 18-2, Attachment* at <http://www.dot.ca.gov/hq/esc/techpubs/manual/bridgemanuals/bridge-memo-to-designer/bmd.html#sec1>

Wood Preservatives, Fire Retardants, and Protective Finish Treatments: Issues to consider related to protective treatments are outlined in FHWA's *Covered Bridge Manual: Publication No. FHWA-HRT-04-098* in Chapter 10 at www.fhwa.dot.gov/publications/research/infrastructure/structures/04098/10.cfm#ToC99789846

In-Kind Repair and In-Kind Replacement Definition and Guidance¹⁵

Repair

Repair¹⁶ of historic materials begins with the least degree of intervention possible, such as patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading them according to recognized preservation methods.

Repair may include the limited replacement in kind, or with compatible substitute materials, of extensively deteriorated or missing parts of features when there are surviving prototypes. Although using the same kind of material is always the preferred option, substitute material is acceptable if the form and design as well as the substitute material itself convey the visual appearance of the remaining parts of the feature and finish.

Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive [character-defining] feature, the new feature will match the old in design, color, texture, and where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.¹⁷

Replacement

Following repair in the hierarchy is replacement of an entire feature with new material because the level of deterioration or damage of materials precludes repair. If the essential form and detailing are still evident so that the physical evidence can be used to re-establish the feature as an integral part of the rehabilitation project, then its replacement is appropriate.

The preferred option is always replacement of the feature in-kind (with the same material). Because this approach may not always be technically or economically feasible, provisions are made to consider the use of a compatible substitute material.

¹⁵ Adapted from information provided by the California Office of Historic Preservation, Incentives and Architectural Review Unit, based on the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

¹⁶ For repairs, replacement of material is limited to up to 30% of the original feature or material.

¹⁷ *Secretary of the Interior's Standards for the Treatment of Historic Properties*, Standard No. 6

In the event that replacement is necessary, the new material should match the material being replaced in composition, design, color, texture, and other visual properties. Substitute materials should be used only on a limited basis and only when they will match the appearance and general properties of the historic material and will not damage the historic structure.

When deteriorated, damaged, or lost features of a historic structure need repair or replacement, it is almost always best to use historic materials. Great care must be taken if substitute materials are used on the exteriors of historic structures. Light, moisture, and temperature changes can greatly impair the performance of substitute materials over time. Only after consideration of all options, in consultation with qualified professionals¹⁸ and development of carefully written specifications should this work be undertaken.

Substitute materials

Because the overzealous use of substitute materials can greatly impair the historic character of a historic structure, all preservation options should be explored before substitute materials are used. It is important to remember that the purpose of repairing damaged features and of replacing lost and irreparably damaged ones is both to match visually what was there and to cause no further deterioration. For these reasons it is not appropriate to cover up historic materials with synthetic materials that will alter the appearance, proportions and details of a historic structure and that will conceal future deterioration. In general, four circumstances warrant the consideration of substitute materials:

- 1) Unavailability of historic materials
- 2) Unavailability of skilled craftsmen
- 3) Inherent flaws in the original materials
- 4) Code required changes

¹⁸ Caltrans Professionally Qualified Staff at the Principal Architectural Historian level, experienced fabricators and contractors

In order to provide an appearance that is compatible with the historic materials, the new material should match the details and craftsmanship of the original as well as the color, surface texture, surface reflectivity and finish of the original material. The closer an element is to the view, the more closely the material and craftsmanship must match the original.¹⁹

¹⁹ NPS Technical Preservation Services *Preservation Brief 16: The Use of Substitute Materials on Historic Building Exteriors*.

Sources

AASHTO

Historic Bridges Glossary, AASHTO Center for Environmental Excellence (Historic Bridges Community of Practice

(http://environment.transportation.org/cop/groups/historic_bridges/pages/glossary.aspx)

Caltrans

Caltrans Highway Design Manual (<http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm>)

- Chapter 60, Nomenclature, Topic 62 - Definitions
- Chapter 800 - General Aspects (Drainage)
- Chapter 870 – Channel and Shore Protection Erosion Control
- Chapter 670 – Structure Approach Slabs

Bridge Memo to Designers, Caltrans, Division of Engineering Services

(<http://www.dot.ca.gov/hq/esc/techpubs/manual/bridgemanuals/bridge-memo-to-designer/bmd.html#sec1>)

Caltrans Maintenance Manual, Volume 1

(<http://www.dot.ca.gov/hq/maint/manual/maintman.htm>)

- Chapter H – Bridges
- Chapter M – Pavement Delineation, Signs, and Safety Devices
- Appendix, Section 1 – Definition of Terms

Caltrans Technical Manuals (<http://www.dot.ca.gov/hq/esc/construction/manuals/>)

- Trenching and Shoring Manual 2011

National Park Service

National Park Service, *Secretary of the Interior's Standards for the Treatment of Historic Properties* (<http://www.nps.gov/hps/tps/standguide/>)

National Park Service, *Preservation Brief 1: Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings* (<http://www.nps.gov/tps/how-to-preserve/briefs/1-cleaning-water-repellent.htm>)

National Park Service, *Preservation Brief 15: Preservation of Historic Concrete* (<http://www.nps.gov/tps/how-to-preserve/briefs/15-concrete.htm>)

FHWA

Covered Bridge Manual: Publication No. FHWA-HRT-04-098

(<http://www.fhwa.dot.gov/publications/research/infrastructure/structures/04098/10.cfm#Toc99789846>)