

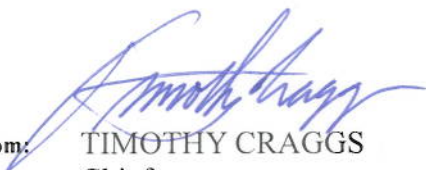
# Memorandum

*Serious drought.  
Help save water!*

To: DEPUTY DIRECTORS  
DISTRICT DIRECTORS  
DIVISION CHIEFS

Date: January 22, 2016

File:

  
From: TIMOTHY CRAGGS  
Chief  
Division of Design

Subject: **DESIGN INFORMATION BULLETIN (DIB) 88**

DIB 88, "Wall Structure Aesthetic Guidelines" is now available on the Division of Design website: [www.dot.ca.gov/hq/oppd/dib/dib88.pdf](http://www.dot.ca.gov/hq/oppd/dib/dib88.pdf) and is effective as of the date of this memorandum. Projects, where project development efforts have started, shall comply with Highway Design Manual (HDM) Index 82.5 "Effective Date for Implementing Design Revisions to Design Standards."

DIB 88 provides design guidance and procedures to improve the quality and constructability of aesthetic treatments for wall structures on the State Highway System. It was developed in collaboration with the construction industry to minimize constructability issues and meet the aesthetic expectations of stakeholders.

If you have any questions on the Division of Design related guidance in this DIB, or if training is desired in the Region or District, contact Keith Robinson, Principle Landscape Architect, Division of Design, at (916) 654-6200. If you have any questions on the Division of Engineering Services related guidance in this DIB, contact Bob Travis, Division of Engineering Services at (916) 227-3962. Project specific application and questions should be referred to the Division of Design Landscape Architecture District Coordinators.

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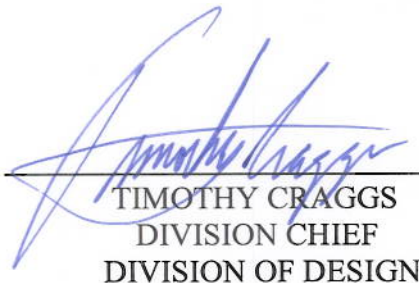
# DESIGN INFORMATION BULLETIN (DIB) 88

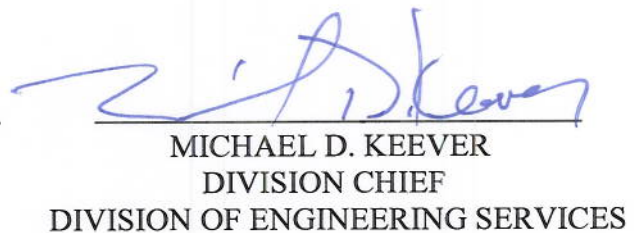
## WALL STRUCTURE AESTHETIC GUIDELINES

Department of Transportation  
Division of Design – Landscape Architecture Program  
Division of Engineering Services, Structures Design – Office of Transportation Architecture



APPROVED BY:

  
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January 22, 2016

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## 1.0 INTRODUCTION

### 1.1 Background

Wall structures are prominent and high cost components of the highway system and their aesthetic treatments can have a strong influence on the visual character of a highway corridor. It is likely that wall structures will be seen by millions of viewers, both from the highway and toward the highway, and therefore their aesthetic treatments must be carefully considered in the context of comprehensive corridor aesthetic planning as well as local community planning.

Constructability issues with aesthetic treatments, such as misaligned patterns, staggered top of wall profile, or placement of expansion joints at locations that conflict with the aesthetic treatment, can compromise the wall structure appearance and create construction challenges. Remediation of design related constructability issues may not be easily or cost effectively accomplished, and may result in poorly considered treatments becoming permanent features of the wall.

Caltrans, in collaboration with the construction industry, identified wall structure aesthetic treatment constructability issues and design solutions that may be used to reduce conflicts between construction and design. This Design Information Bulletin (DIB) 88 establishes design guidance resulting from this collaborative effort and is intended to satisfy the expectations of designers, contractors, the local community, and other stakeholders.



The staggered appearance and misaligned pattern of this wall structure are the result of inadequate coordination of the aesthetic design, wall design, and construction methods.

### 1.2 Definitions

**Wall Structure** – Concrete walls including Concrete Cantilever Walls and Soil Reinforcement Systems (e.g. Mechanically Stabilized Earth (MSE)) including walls which are independent of other structures and walls which are part of other structure systems.

**Aesthetic Treatment** – For the purpose of this DIB, aesthetic treatment, also commonly referred to as “architectural treatment”, refers to the overall form of the wall and its elements such as columns,

end treatments, caps, and concrete barriers. It also refers to the incorporation of color, texture, pattern, and/or imagery to the surfaces of concrete wall structures (referred to as “concrete surface textures” in Caltrans Standard Specifications) and elements incorporated to improve the appearance and integration of walls into their surrounding environment.

### 1.3 Purpose of Wall Structure Aesthetics

Wall structures are an essential and integral component of the State Highway System (SHS). They are generally massive in scale and can dominate the surrounding context and the views to and from the highway corridor and adjacent community. A principle objective of highway corridor aesthetics is for the physical elements of the highway, including the wall structures, to visually relate to one another as a unified whole and be integrated into the surrounding context of the corridor. Aesthetic treatments and other techniques such as slope terracing, can reduce the apparent scale of a wall structure and help to integrate it into the surrounding natural and cultural context.



Aesthetic treatments on wall structures can reflect an image of the surrounding community and create visual interest for motorists.

Aesthetic treatments are incorporated into wall structures to achieve various objectives. Environmental analysis of transportation improvement projects often requires that wall structures incorporate aesthetic treatments to improve their appearance and reduce their visual impact on viewers. Aesthetic treatments can help compensate for a loss of visual quality in the corridor due to the removal of vegetation or other existing aesthetic features by a transportation project, or for their potential urbanizing effect in rural areas.

Aesthetic treatments on wall structures also provide functional benefits, such as reduction of surface glare and providing visual interest to stimulate driver alertness. Walls are prone to vandalism which is an aesthetic and maintenance problem and must be considered when making aesthetic design decisions. For example, aesthetic surface treatments incorporating rough textures and varied patterns tend to discourage graffiti and improve worker safety by reducing the need for graffiti removal.



Wall structure aesthetic treatments should be coordinated with other highway elements in a well-considered corridor design. In Orange County, repeating the orange motif aesthetic treatment from the MSE wall (left) to the sound wall columns and adjacent slope paving is one technique used to help provide unity to the appearance of the highway corridor.

Implementation of a Context Sensitive Solutions (CSS) process, which balances transportation goals with other stakeholder goals, can lead to the selection of aesthetic treatments that reinforce overall corridor aesthetic themes and reflect local community aesthetic, scenic, cultural, and historic values and reinforce community identity. Highways can be a major component of community image, having a significant impact on the local economy and quality of life. Therefore, identifying wall aesthetic treatments that meet stakeholder desires is often crucial to obtaining project approval from local agencies, community members and other stakeholders. Deploying an effective stakeholder involvement process and incorporating well designed aesthetic treatments into transportation projects can reduce the risk of project delay and foster public trust, which can lead to a streamlined approval process in subsequent projects, saving both time and dollar resources.

#### **1.4 How to Use this DIB**

This DIB is to be used in conjunction with the Highway Design Manual, including but not limited to, Topic 81 – Project Development Overview; Topic 109 – Scenic Values in Planning and Design; Topic 210 – Reinforced Earth Slopes and Earth Retaining Systems; and Topic 1102 – Design Criteria; as the current state of the practice for the planning, design, and construction of aesthetic treatments for certain wall structures on the SHS.

## **2.0 DESIGN GUIDANCE**

### **2.1 Collaboration and Coordination**

The architectural design of aesthetic treatments must be compatible with the structural design of the wall and design efforts must be coordinated so that the constructed wall structure satisfies the design intent. All members of the Project Development Team (PDT), including but not limited to, Division of Engineering Services (DES) Structures Design (Structures) engineers and architects, district transportation and environmental planners, landscape architects and engineers, design consultants, and partners, must collaborate on critical aesthetic design decisions throughout wall structure design development, beginning in the planning phase and continuing through construction. The involvement of individual PDT members will fluctuate throughout the project development process and the landscape architect or structures architect will coordinate

communication of aesthetic issues with all PDT members throughout the project development phases.

The PDT, including key community stakeholders, should develop a clear and concise aesthetic design intent statement for the wall aesthetics early in project development. The PDT determines the format and content of the aesthetic design intent statement to fit project specific needs. At a minimum the aesthetic design intent statement should account for requirements of the environmental document, in particular the visual impact assessment, and should reference applicable corridor master plans or community planning goals and objectives. It should provide guidance to the PDT throughout planning and design to ensure that the wall structure and related corridor features are coordinated aesthetically and can be constructed and maintained to fulfill the design intent. It should also be used to provide aesthetic continuity on the project if changes in project personnel or community partners occur. The aesthetic design intent statement should provide the flexibility to be updated if changes to the aesthetic design, agreed upon by the PDT, must be accommodated.

The layout of the aesthetic treatment and the wall structure must be carefully considered if the desired aesthetic results are to be achieved. Appropriate grading, location, and dimensioning of footing steps, footing heights, expansion joints, weakened joints, horizontal wall angle points, and horizontal curve layout are critical for aesthetic treatments to align correctly to create a continuous and unified appearance. When architectural and engineering design are not coordinated, constructability issues such as misaligned patterns, staggered profiles, or poor placement of expansion joints, drainage features, and weep holes are more likely to occur, compromising the design intent and the final appearance of the wall.



The design of aesthetic treatments must be well coordinated with the engineering design of the wall structure. Aesthetic treatments must be compatible with footing steps, footing heights, and expansion joints to avoid misalignment issues in construction.

To contribute to a uniform corridor concept, wall structures require aesthetic coordination with related corridor features such as fencing, safety cable railing, concrete barriers, lighting, landscaping, transportation art, and community identifiers. Aesthetic treatment may also be influenced by other corridor features such as bicycle and transit elements, utilities, signage, hydraulics, grading, erosion control, adjacent paving including vegetation control, slope paving, and paving beyond the gore; and adjacent corridor visual elements such as buildings and bridges outside the right of way.

## 2.2 Concrete Cantilever Walls

### 2.2.1 Wall Layout and Profile

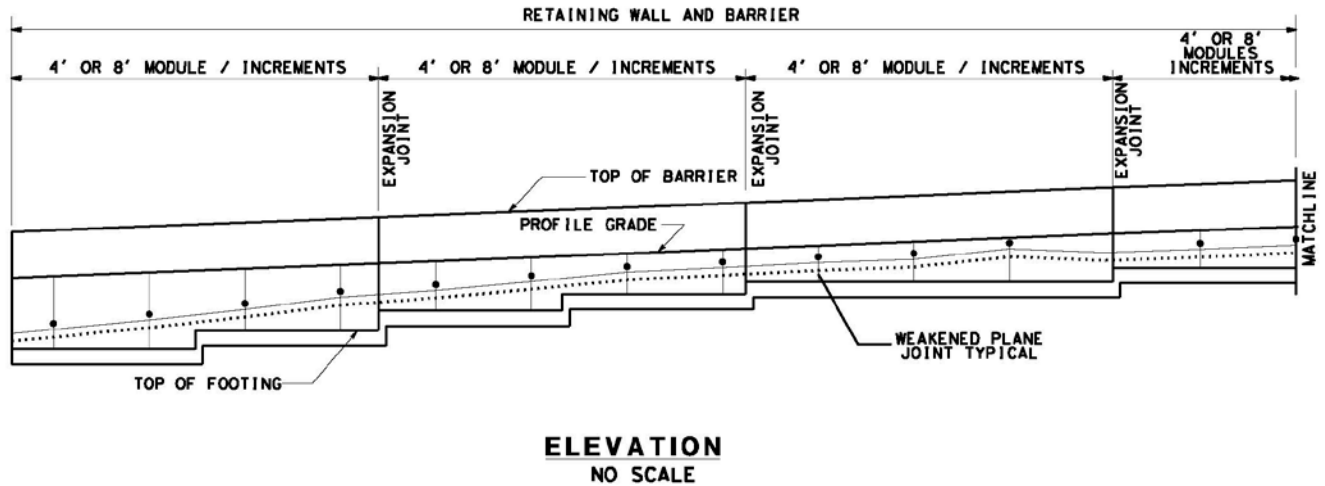
In general, the top elevation of a retaining wall should smoothly follow the profile of the slope, which follows the contour of the existing landscape. On occasion, the aesthetic design or other functional needs may dictate extending the top of the wall beyond what is required to retain the soil. However, the main purpose of the retaining wall is to retain the soil mass behind it. Adding height where it is not required to retain the soil or for other functional purposes increases cost and may not be technically feasible to accomplish. DES Structures should be consulted to determine the feasibility of extending the wall height beyond what is required to retain the soil.



Gang form systems are the common methodology for wall structure construction.

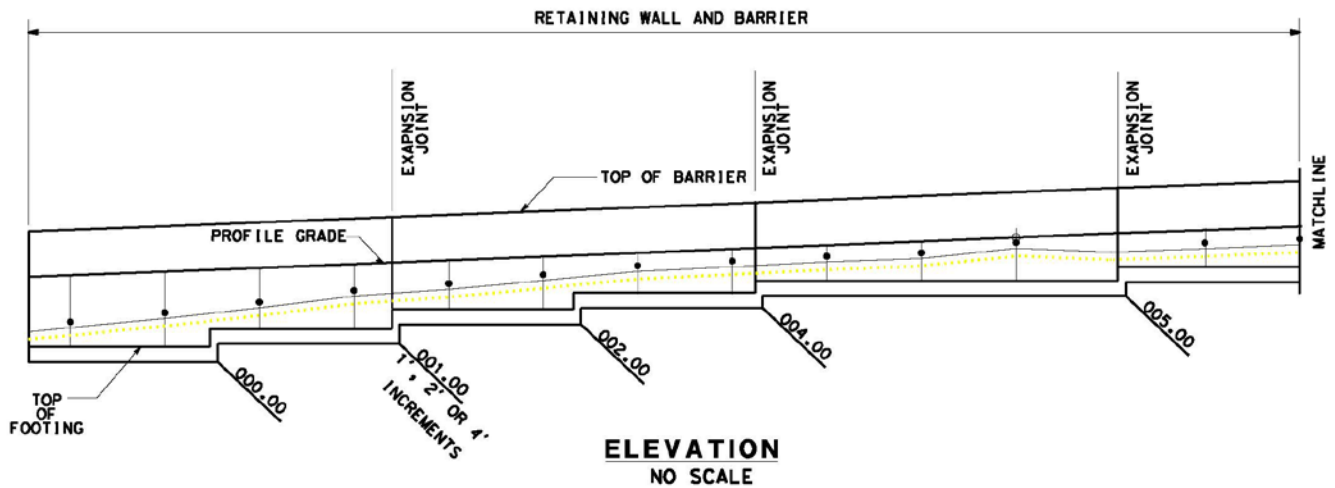
Concrete wall structures should be designed to facilitate a gang form system construction methodology. Gang form systems are based on 8-foot to 24-foot wide panels connected together to achieve the planned wall length and 8-foot panel heights to achieve the planned wall height. During construction wall panels are typically used multiple times to efficiently construct the entire length of the wall. To accommodate this construction methodology, wall layout should be based on 4-foot or 8-foot increments [Figure 1]. The design details should place all expansion joints, weakened plane joints, begin and end curves, and wall footing step lengths on 8-foot increments. This will match typical form liner dimensions to facilitate the alignment of textures and patterns and reduce labor and material costs. Expansion joints should be aligned with footing step locations in order to avoid conflicts with the aesthetic textures and patterns.





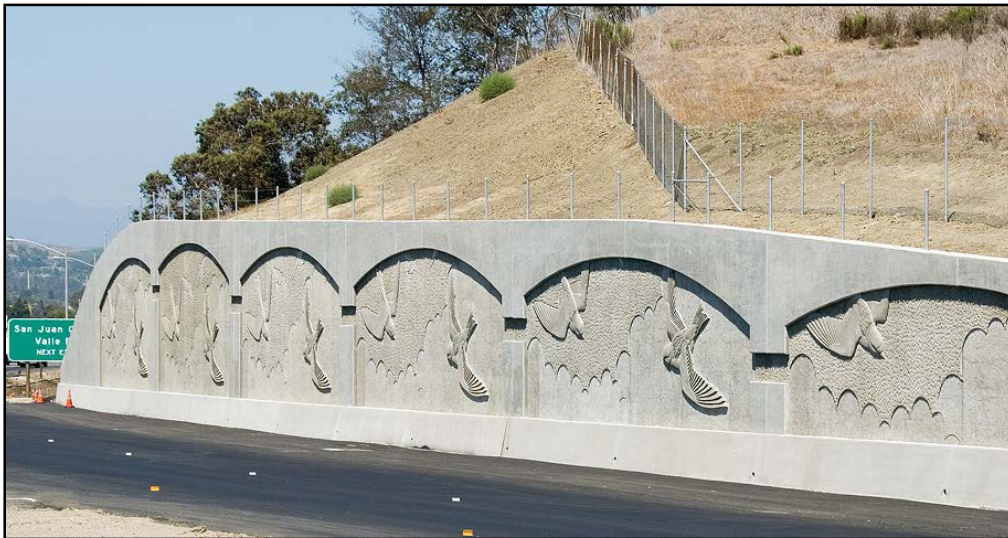
**Figure 1**

Wall footing step heights should be in 1, 2, or 4-foot increments to facilitate gang form system construction and provide for the alignment of horizontal seams [Figure 2]. When aesthetic treatments include vertical patterns, wall footing step heights should match the vertical pattern repeat dimensions to facilitate alignment of the vertical pattern. When horizontal patterns are used, footing step heights should be consistent with horizontal pattern repeat dimensions, whenever practicable, to facilitate alignment of the horizontal pattern.



**Figure 2**

Wall profiles are an important element of the overall aesthetics of wall structures and should be integrated with the aesthetic design. Top of wall profile lines that are continuous and smooth flowing are generally considered more aesthetically pleasing than those that are staggered or have abrupt changes in elevation.



Top of wall profile lines that are unbroken and smooth flowing as demonstrated in this wall in San Juan Capistrano, contribute to the aesthetics of the wall rather than detract from it.

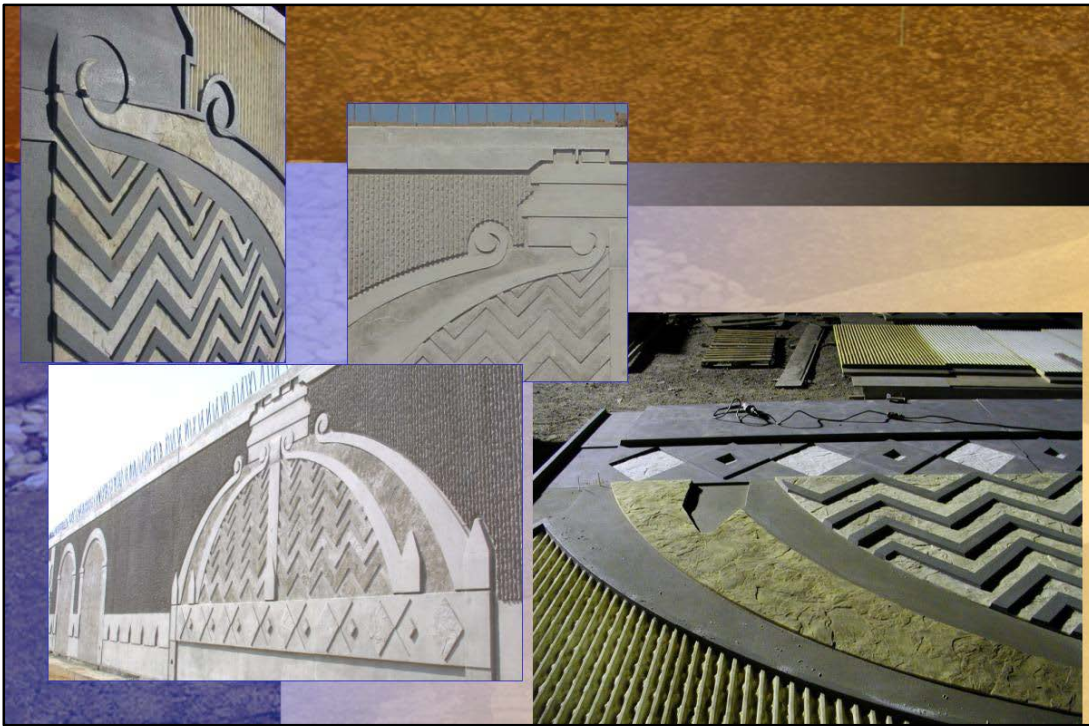
### 2.2.2 Concrete Form Liners

Caltrans Standard Specifications section for Concrete Surface Textures requires that form liners be used for concrete surface treatments, such as for wall structure aesthetics, except when heavy blast textures and formed relief textures which have a Class 1 (smooth) surface finish are desired. Form liners must be manufactured from elastomeric material by a manufacturer of commercially available form liners.

Elastomeric form liners are required by the Standard Specifications because they are the most durable material and can be used 100 times or more without degrading the clarity and definition of the aesthetic texture. They are required for wall structure aesthetic treatments to facilitate gang forming, multiple uses, and to result in high quality complex or finely detailed surface treatments. They produce the highest quality finishes in terms of texture definition, pattern complexity, level variation, surface coarseness, edge clarity, and the depiction of realistic stone and brick masonry.

Nonstandard foam form liners may be considered only for limited applications where unique and distinctive context sensitive imagery is desired. Foam form liners produce high quality finishes but do not provide the durability required for multiple uses and are therefore limited to single use applications.

Commercially available form liners manufactured from materials other than elastomeric, such as fiberglass or plastic, should not be used, even for single use applications, as they do not provide the durability and high quality finishes provided by elastomeric form liners and do not typically satisfy the aesthetic expectations of designers and stakeholders. Contractor requests to substitute another form liner material type for elastomeric form liners in a Value Engineering Change Proposal (VECP) must be evaluated and approved by the District Landscape Architect or Structures Architect to ensure that the quality and integrity of the project and highway corridor aesthetic treatments are maintained.



Elastomeric form liners are required for aesthetic treatment for the high quality results they provide.

### 2.2.3 Aesthetic Texture and Pattern

To ensure the quality of highway corridor aesthetics and to create a cohesive, harmonious, and unified whole, the various features of the highway such as the retaining walls, bridge abutments, slope paving, concrete barriers, and sound walls should visually complement one another through a well-considered design concept. Aesthetic treatments for these features must be thoughtfully considered during planning, design, and construction so that their textures, patterns, and colors are compatible from one feature to the next, so they visually relate to one another. For example, the textures and patterns used for a retaining wall structure could be incorporated into adjacent sound walls, bridge abutments, and/or slope paving, so they are all visually cohesive through similar aesthetic treatments. When individual highway features are designed in isolation, without careful consideration of the other features within the highway context, they can be seen as an intrusion on the landscape, appear as a collection of incompatible and disjointed parts, be distracting to the driver, and diminish the aesthetic appeal of the highway corridor and adjacent community.

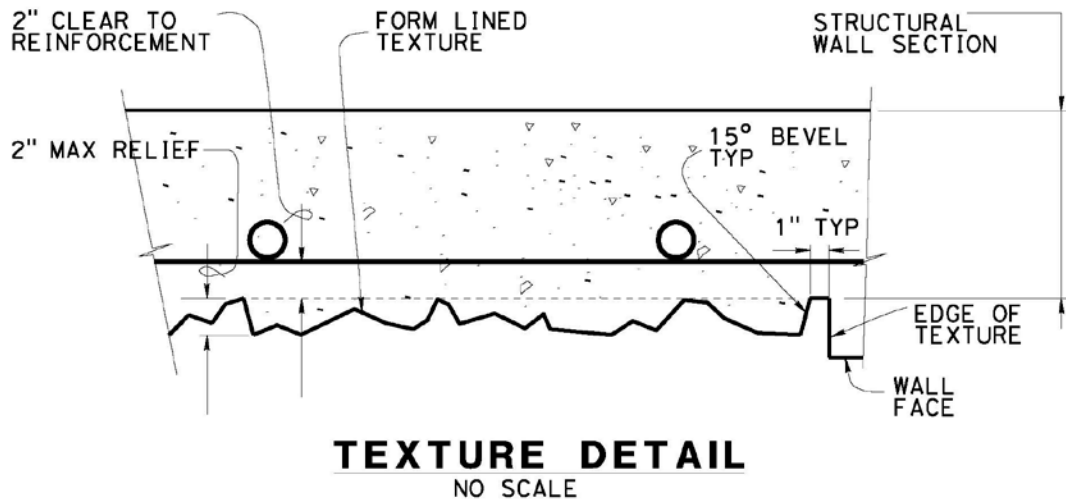
Texture and pattern options available to the designer for wall structure aesthetic treatments are nearly unlimited. When making design decisions for textures and patterns the designer must consider the entire context of the corridor including other highway features, the viewers, the aesthetic preferences of the local community, safety, and maintenance. Is the wall on a busy urban freeway or on a two-lane scenic highway? How close will viewers be to the wall and what is the duration of time they will be viewing it? What image does the local community want aesthetic treatments to convey about who they are? What maintenance will be required and will the level of maintenance be appropriate considering available resources? Will the wall be safe to maintain? Questions such as these must be considered early in the planning and design of the wall structure in order to choose the most appropriate textures and patterns for the aesthetic treatments.



The aesthetic treatment concept used for the retaining wall (top left) was repeated in the bridge barriers, MSE walls, and low landscape retaining walls to help unify the overall highway corridor aesthetics in the City of Riverside.

Aesthetic textures and patterns should extend outward from the structural wall section, adding thickness to the outer face of the wall. Outward extending textures and patterns allow the contractor to block out the form liner to conform to line and grade without cutting the form liner, allowing for its reuse and resulting in cost savings. Textures and patterns should not be recessed into the face of the structural wall section. Recessed textures and patterns cause constructability issues when the aesthetic design requires the form liners to be cut to conform to line and grade, which wastes elastomeric material and increases material cost. Textures and patterns should not be recessed into the face of the structural wall section because minimum clearances between steel reinforcement and the face of concrete wall may be compromised, which could affect the structural integrity of the wall [Figure 3].

Many textures and patterns require deep relief in order to meet the aesthetic design intent and satisfy stakeholder expectations. Some patterns, like simulated stone masonry, need sufficient depth to provide the forms, grout lines, and shadows necessary to produce the realistic effect of a stone wall. However, the deeper relief adds thickness to the concrete form and increases its weight. The heavier forms require more effort to move and place during construction which can increase construction costs. Therefore the depth of relief must be considered early in planning and design of the wall structure and should be minimized whenever appropriate to reduce weight and provide cost savings. Consideration of the depth of relief and wall thickness, as well as for the overhang of the wall cap and column dimensions, should be identified early in project development so they are accommodated in the project budget.



**Figure 3**

Aesthetic treatments for walls located within the clear recovery zone must be designed so they do not snag an errant vehicle. The wall area between the grade line and 6 foot above it should be free of any designed indentations or protrusions that may snag errant vehicles. Textures and patterns within this area should conform to the design guidance found in Caltrans California Highway Barrier Aesthetic Report, at [http://www.dot.ca.gov/hq/LandArch/16\\_la\\_design/aesthetics/barriers/index.htm](http://www.dot.ca.gov/hq/LandArch/16_la_design/aesthetics/barriers/index.htm). Though this report concentrates on concrete barrier aesthetics, the recommendations are applicable to wall aesthetic treatments used within the bottom 6 foot area of the wall.



Textures and patterns that extend outward from the face of the structural wall section avoid constructability issues and control construction costs.

Repetitive patterns are preferred for ease of construction and cost savings, but non-repetitive patterns are acceptable to match existing corridor aesthetic features, comply with established corridor aesthetic guidelines, and achieve local stakeholder expectations for the aesthetic treatments.



Repeating patterns can provide a sense of rhythm and movement and add interest and visual appeal to a wall. A wall cap formed into the top of the wall provides definition and a finished appearance.

Vertical patterns are preferred over horizontal patterns to reduce constructability issues and result in cost control. Though more complicated to construct, horizontal patterns such as those in simulated masonry designs are often required to achieve a context appropriate aesthetic treatments. A common constructability issue with horizontal patterns is the misalignment of the pattern that can occur when aesthetic design is not adequately coordinated with the structural design of the wall. This constructability issue can be alleviated by carefully evaluating the horizontal pattern in relation to the wall structure line and grade, footing steps, expansion joints, and weakened plane joints. Transitions for both vertical and horizontal patterns must be carefully considered for tapering wall heights, across expansion joints, and at wall corners to provide pattern continuity.

In considering an aesthetic texture for a wall structure, generally the greater the distance the viewer will be from the wall and the shorter the duration of time they view it, the rougher the texture should be to create adequate contrast and define shapes or pattern. Rougher textures create more shadow across the face of the wall making them appear darker when placed adjacent to smoother textures. This makes them appear to recede into the background, emphasizing depth and creating a three dimensional effect.

Wall structure aesthetic designs should consider the incorporation of a formed concrete cap at the top of the wall to establish a top border for textures and patterns and provide a finished appearance to the wall. The proportions of the wall cap should be considered in relationship to the scale of the wall and the scale of the texture and pattern.



Continuous alignment of horizontal and vertical patterns as the wall height tapers and a concrete cap contributes to the aesthetic quality of the wall structure.

## 2.3 Soil Reinforcement Systems

### 2.3.1 Mechanically Stabilized Earth (MSE) Walls

Precast concrete face panels for MSE walls are typically square, rectangular, or cruciform in shape and are erected in an offset alternating pattern. The offset alternating pattern in itself can create a striking aesthetic appearance for the wall even without the incorporation of texture and pattern into the face panels. However, this inherent aesthetic pattern can be enhanced when the face panels are fabricated with standard textures and patterns or custom imagery to satisfy context sensitive aesthetic requirements. Patterns and custom imagery must be compatible with the dimension of the modular face panel and the offset alternate pattern method of construction to assure proper alignment of patterns and images. Also, aesthetic treatments for adjacent bridge abutments should align with and be compatible with the aesthetic treatment of the MSE walls.



Precast concrete face panels for MSE walls can be fabricated with standard textures and patterns or customized with context sensitive imagery to satisfy local community aesthetic goals.

### 2.3.2 Soil Nail Walls

Soil Nail walls that have the appearance of natural rock formations that blend with natural surroundings may be needed to comply with environmental mitigation requirements and satisfy stakeholder aesthetic desires for retaining walls. This aesthetic treatment is often required for Soil Nail walls along scenic and/or rural corridors. To successfully simulate natural stone outcroppings the rock design should be modeled after nearby indigenous geological formations, textures, and colors. A reference site in the vicinity of the wall that demonstrates the type of rock formation desired should be identified, documented, and provided during advertisement for bid and referred to during construction.

To mimic rugged rock outcrops the wall structure should be engineered for an uneven load and have sufficient shotcrete thickness to allow for the sculpting of deep recesses, and/or include a steel framework for the forming of extensive relief. Soil Nail walls that lack sufficient relief or lack variety in form, texture, and color tend to look artificial and do not blend into the natural environment. Sharply angled protrusions, ledges, fissures, and recesses increase the realism of the wall appearance. Care must be taken in the design and construction of these features to avoid creating handholds and footholds that could encourage unauthorized climbing of the wall. Repetitive patterns tend to be obvious and appear unnatural and should be avoided. Color alone should not be relied on to compensate for a lack of sufficient relief and texture. For terraced shotcrete soil nail walls it may be desirable for strata lines to continue from wall to wall to provide a sense of visual continuity, as would be experienced in a natural rock formation.



The shotcrete face of Soil Nail walls on Highway 1 at Devil's Slide Tunnel were sculpted and stained to create the appearance of natural rock formations. This aesthetic treatment helps to reduce the visual impact of the walls by helping to integrate them into the scenic coastal environment.

The interface between a sculpted shotcrete Soil Nail wall and the adjacent landform and land cover can be a noticeably artificial characteristic if not adequately considered during design. These interfaces, especially the top of wall profile, should mimic the rough and uneven profile of a rock formation found in nature, including protrusions specifically intended for aesthetic purposes.



Abrupt changes in elevations may be necessary to mimic natural rock forms to create a naturally appearing profile. Where maintenance efforts would not be increased, it may be desirable to allow for naturalized and native grasses and other vegetation to encroach onto the top of wall to enhance a natural interface. In such cases, potential conflicts with above-wall drainage features, cable railing, and fencing must be considered. Planting pockets may be incorporated into the wall face to introduce vegetation to help create a more natural and integrated appearance.

The contract plans for the aesthetic treatment design of Soil Nail walls should delineate the wall elevation shapes and forms, top and bottom profiles of the wall, major and minor strata lines, and construction details. The design intent for shotcrete sculpting, texturing, and color staining is difficult to delineate on plans. Appropriate direction for the contractor must rely on the contract specifications, reference site, test panels, photographs, contractor expertise, and close construction oversight by the landscape architect or Structures architect, and the Resident Engineer (RE). However, the contract plans and specifications must be sufficiently developed for the contractor to bid and complete the work.



Sculpting and texturing the wet shotcrete face of a Soil Nail wall is highly specialized work that must only be performed by contractors experienced in the techniques of simulated rock fabrication.

Specialized construction techniques are required to sculpt wet shotcrete surfaces to create realistic rock forms and textures and apply stains. Contract documents should specify that only contractors with a specialty in simulated rock fabrication and a demonstrated expertise in this construction technique should perform the sculpting, texturing, and color staining work. Reference site information, referee samples, photographs, and other information that demonstrate the design intent of the aesthetic treatment should be provided to the RE and contractor to assure desired results.

Construction of the sculpted shotcrete walls should not begin until after review of the test panels by the landscape architect or Structures architect and their written recommendation for authorization is provided to the RE.

## 2.4 Color Treatment and Coatings

Color for aesthetic treatments of concrete wall structures can be accomplished through integral coloring and surface staining. Painting concrete structures is not recommended because it can hinder structure inspections and create long term maintenance requirements. Color choices depend on design intent, but in general should integrate the wall structure into its natural or built context and help reduce surface glare. When making color choices, designers should consider that colors exposed to sunlight will fade over time, even with the application of ultraviolet inhibitors and sealants. While some colors such as earth tones may simply fade to a lighter shade of brown or tan, other colors can fade resulting in an unintended color, for example, from a brick red or terra cotta to pink. Sealants can have an undesirable glossy affect and may yellow over time. A variety of colors should be used when specifying stain for rock patterns to resemble the appearance of natural rock. The contract should specify special application techniques for accomplishing the color work such as veining, speckling, gradations, overlapping, highlights, accents, or other coloring techniques.

Where graffiti is prevalent or is a potential issue on a wall structure, a sacrificial anti-graffiti coating should be applied to the surface as a part of the contract to facilitate maintenance and help preserve the appearance of the wall aesthetics over the long term.

## 2.5 Referee Sample and Test Panel

A referee sample for all wall aesthetic textures, patterns, and colors should be made available for review during advertisement for bid, when available. Referee samples help ensure that the specified textures, patterns, and colors are being considered and all bidders are pricing the same materials and construction techniques. The project specifications identify where the samples are available for bidder review. When existing wall aesthetic treatments within a corridor are being matched on a new project it can be beneficial to direct bidders to locations where they can view the existing aesthetic treatments in addition to, or in lieu of, providing referee samples.



Test panels serve as a benchmark for measuring consistency and controlling the quality of the wall structure aesthetic treatments.

Project specifications require that the contractor construct test panels to demonstrate proficiency in producing the wall aesthetic treatments required by the project. More than one round of test panels may be necessary to allow for adjustment and refinements to achieve the desired appearance. The specifications, cost estimate, and construction schedule should reflect the potential need for multiple test panels. Test panels must be constructed using the same materials, methods, forming techniques, scale, colors, textures, patterns, and/or graphics that will be used for the wall structure construction. To ensure consistent quality in all aesthetic wall treatments, the test panels must be constructed by the same workers who will do the actual sculpting, texturing, and coloring of the walls. Test panels should be constructed within close proximity to the wall structure whenever possible so they can be easily referenced by the landscape architect, Structures architect, RE, and contractors as the wall is being constructed.



A reference site (top) located within the vicinity of a proposed Soil Nail wall is used to influence the aesthetic treatment design and guide the fabrication of the test panel (bottom).

### 3.0 PROCESS

Caltrans practices a CSS approach, engaging an interdisciplinary team, to develop wall structure aesthetic treatments. The CSS process begins early in the planning phase to balance transportation goals with other goals of local stakeholders and leads to aesthetic treatments that reflect

community aesthetic, scenic, cultural, or historical values. PDT members may include transportation planners, engineers, landscape architects, environmental planners, structure architects, maintenance personnel, consultants, representatives of the affected community, and other stakeholders, all having a common goal to preserve and/or improve the aesthetics of a highway corridor and satisfy environmental commitments. Collaboration must occur between team members throughout project development to share expertise, ascertain expectations for the aesthetic treatments, analyze corridor context, understand roles and responsibilities, evaluate wall structure alternatives, and coordinate design and construction efforts.

Important decisions concerning wall structure aesthetic treatments must be made by the PDT during all phases of the project development process. Though the process may differ slightly depending on district practices and project specifics, in general, it will include the following activities and considerations:

### **Project Initiation Document (PID)**

- Landscape Architecture provides visual scoping of the existing highway corridor and reviews the project alternatives to determine potential visual impacts that may require mitigation in the form of wall structure aesthetics.
- Identify aesthetic treatment costs for inclusion in wall structure budget scoping. Provide for sufficient wall thickness to allow multiple aesthetic design options. Consider wall thickness, column extrusion, wall cap overhangs, and potential wall terracing with regard to right of way needs. Consider special wall features and construction limitations. Include adequate budget for aesthetic treatment of highway features that should complement the aesthetic treatment of the wall structures, such as for slope paving, concrete barriers, and bridge abutments.
- The project schedule should include adequate time in the planning, environmental and design phases to allow for PDT discussion on aesthetics, visual impact assessment, and community outreach. This may result in multiple meetings and the development of multiple aesthetic alternatives, aesthetic coordination with other corridor design elements, aesthetic design refinements, constructability and safety reviews, and the development and approval of non-standard details and specifications. All functional units that have input on the wall structure aesthetics should include time in work plan estimates to plan and design aesthetic treatments.
- Identify risks involving aesthetic treatments in the Risk Registry, including the risk of not including aesthetic treatments, risks involved in public outreach, and risk of potential changes during construction (e.g. the contractor presents a VECP to change the type of wall or the look of aesthetics).

### **Wall Type Selection**

- Include DES Structures early in the planning phase for wall type selection. For retaining walls higher than 5 feet, evaluate if economical and flexible Soil Nail walls are feasible for the location instead of rigid and expensive Type 1 walls. Both types of walls could use the same form work for the aesthetic treatment of the concrete facing.
- Consider the requirement for aesthetic treatment in the wall structure type selection process and determination based on the project aesthetic goals and preliminary design concepts.

Type selection should include adequate structural engineering design characteristics to accommodate the range of aesthetic elements required.

### **Project Approval and Environmental Document (PA&ED)**

- Landscape Architecture provides Visual Impact Assessment recommendation regarding mitigation measures that relate to wall structure aesthetics and help the PDT to discern between mitigation, standard aesthetic treatment, and enhancements. Include mitigation based aesthetic treatment requirements into the Environmental Commitment Record (ECR).
- Develop an aesthetic design intent statement with local community input to guide the PDT on aesthetic design decisions throughout the project development process.
- District Landscape Architecture and DES Structures Design collaborate as needed and reach agreement on aesthetic goals and develop preliminary aesthetic design concepts.
- Circulate preliminary aesthetic design concepts to the PDT and other functional units for review.
- Wall structure aesthetic treatment alternatives are presented to external stakeholders and local community members by the landscape architect and/or Structures architect.
- Update the project budget to include any changes to aesthetic elements resulting from design development and/or public input.

### **Plans, Specifications, and Estimate (PS&E)**

#### **30% Design Milestone**

- Obtain concurrence from the PDT for the preferred aesthetic treatments and confirm consistency with aesthetic design intent statement and traffic safety criteria.
- Develop wall structure aesthetic treatment design based on the preferred alternative.
- Meet with local agency and community members as needed to communicate aesthetic design issues.
- Identify any structural accommodations needed for future transportation art or community identification, if applicable.
- Coordinate structural and aesthetic design with all other project design issues including hydraulics, drainage, safety, and maintenance. Plans, elevations, and details for wall structure aesthetic treatment may be placed on Structures plan sheets signed by the Structures Architect or Structures Engineer, on separate plan sheets signed by the Landscape Architect, or on district civil plan sheets signed by the Project Engineer. Typically, if the project includes special designed walls engineered by Structures, the aesthetic treatments are shown, specified, and estimated within the Structures PS&E documents. Projects that include both Structures designed walls and District designed walls should be coordinated to ensure compatibility.

#### **60% Design Milestone**

- Refine aesthetic design details and specifications. Circulate to PDT and other functional units for review.

- Consult Traffic Safety to confirm that final aesthetic treatments meet traffic safety criteria.
- Local partners and stakeholders should be kept updated on progress and design changes and given opportunity to review and comment. Resolve conflicts and concerns as necessary and obtain concurrence from local partners and stakeholders.
- Review budget for aesthetic treatments and construction methods and update as needed.

### **95% Design Milestone**

- Circulate for constructability review. Include all aesthetic details and specifications, including nonstandards, in the circulation package.
- Update the Risk Registry to reflect potential design changes during construction including contractor proposals to change the aesthetic treatment or the wall type.

### **District Office Engineer (DOE) Review**

- Resolve DOE review comments. Obtain nonstandard special provision (NSSP) approval from specification owner.

### **Construction**

- **RE File** - Include relevant sections of the visual impact assessment, the aesthetics design intent statement, reference site photographs, and all necessary aesthetic references and material samples in the RE File.
- **Bidder Inquiries and Construction** – Respond quickly to all requests from the Duty Senior for clarification during advertisement for bid.
- **Construction Support** – The landscape architect and/or Structures architect provides on-site support to the RE as necessary to ensure the aesthetic design intent for the wall structure is not compromised in construction. Whenever possible the landscape architect or Structures architect should be present during the construction of test panels to provide oversight. The test panels are reviewed to assure they satisfy the aesthetic design intent and recommendation for approval provided to the RE. The landscape architect or Structures architect review VECPs and other change requests that relate to wall aesthetic treatments and recommendations made to the RE.
- **Final Site Review** – The landscape architect and/or Structures architect should perform final walk-through of wall structure aesthetic treatments with the District Maintenance personnel who will be maintaining the wall and provide information on long-term maintenance requirements of the aesthetic treatments. Provide District Maintenance with a copy of the aesthetic design intent statement and review it with them to ensure their understanding of the aesthetic design intent of the various treatments.

## **Appendix A**

### **Wall Structure Aesthetics Design Considerations**

1. Collaboration must occur between PDT members throughout project development to share expertise, ascertain expectations for the aesthetic treatments, analyzing corridor context, understand roles and responsibilities, evaluate wall structure alternatives, and coordinate design and construction efforts.
2. The architectural design of aesthetic treatments must be compatible with the structural design of the wall and design efforts must be coordinated so that the constructed wall structure satisfies the design intent. The District Landscape Architect and/or the Structures architect are responsible for leading these coordination efforts.
3. To accommodate a gang form construction methodology, wall layout should be based on 4-foot or 8-foot dimensions. Expansion joints, weakened plane joints, begin and end curves, and wall footing step lengths should be placed on 8-foot increments.
4. Align expansion and weakened plane joints with footing step locations.
5. Wall footing step heights should be in 1, 2, or 4-foot increments to facilitate gang form system construction and provide for the alignment of horizontal seams.
6. When aesthetic treatments include vertical or horizontal patterns, wall footing step heights should match the pattern repeat dimensions to facilitate alignment of the pattern at adjacent panels.
7. Top of wall profile lines should be continuous and smooth flowing rather than staggered or with abrupt changes in elevation.
8. The Standard Specifications require that form liners for aesthetic treatments be manufactured from elastomeric material because they provide for multiple uses and produce high quality textures and patterns.
9. Aesthetic textures and patterns should extend outward from the structural wall section, adding thickness to the outer face of the wall.
10. The depth of surface relief must be considered early in planning and design of the wall structure and should be minimized whenever appropriate to reduce form weight and provide cost savings.
11. For walls located within the clear recovery zone, the wall area between the grade line and 6 foot above it shall be free of any designed indentations or protrusions that may snag errant vehicles. Textures and patterns within this area should conform to the design guidance found in Caltrans California Highway Barrier Aesthetic Report, at [http://www.dot.ca.gov/hq/LandArch/16\\_la\\_design/aesthetics/barriers/index.htm](http://www.dot.ca.gov/hq/LandArch/16_la_design/aesthetics/barriers/index.htm).
12. Repetitive patterns are preferred for ease of construction and cost savings but non-repetitive patterns are acceptable to match existing corridor aesthetic treatments, comply with established corridor aesthetic guidelines, and satisfy stakeholder expectations.
13. Vertical patterns are preferred over horizontal patterns because construction can be more straightforward, resulting in cost savings. However, horizontal patterns are often required to achieve a context appropriate aesthetic treatment.

14. Patterns and custom imagery for MSE walls must be compatible with the dimension of the modular face panel and the offset alternating pattern method of construction to assure proper alignment of patterns and images.
15. The simulated rock design for sculpted Soil Nail walls should be modeled after indigenous geological formations, textures, and colors. Soil Nail walls that lack sufficient relief or lack variety in form, texture and color tend to look artificial and do not blend into the natural environment as intended.
16. A referee sample for all wall aesthetic textures, patterns, and colors should be made available for review during advertisement for bid, when available.
17. The Standard Specifications require that the contractor construct test panels that demonstrate the wall aesthetic treatments required by the project.
18. The landscape architect and/or Structures architect provides on-site support to the RE as necessary to ensure the aesthetic design intent for the wall structure is not compromised in construction.