

Wind Retrofit of West Outside Handrail

In accordance with the findings of the wind study report conducted for the Seismic Retrofit Project, the vertical members under the outside handrail on the west side of the Bridge between the two main towers will be modified to reduce the effects of the wind on the handrail. The retrofit modification will replace the existing vertical members and bottom rail with narrower members. The new vertical members will be spaced at 5 inches on center, which will help to increase the porosity of the handrail by allowing the wind to pass through the pickets more freely, thus reducing the wind loads inducted upon these elements. The top rail and main support posts will remain unchanged.

Wind fairings will be installed at the west outer edge of the sidewalk and the top chord of the main stiffening truss. A quarter round fairing, with a radius of 19 inches, will be placed at the sidewalk's edge and a half round fairing, with a radius of 25 inches will be placed along the top chord of the stiffening truss. The fairings will be painted to match the existing Bridge color. The fairings radius and diameter will be equivalent to the width of the edge of sidewalk and top chord of the stiffening truss of which they cover. This will retain the same scale and the same relationship of solids and voids of the main suspension truss' elevation. This modification was previously approved as part of the Seismic Retrofit Project.

1.6 COMPARISON OF ALTERNATIVES

The current project, including the engineering design work and environmental evaluation associated with development of a physical suicide deterrent system, was initially authorized by Resolution #2005-15, adopted by the District's Board at its March 11, 2005 meeting. At this time the criteria were revised, as shown in Section 1.2 of this chapter, to encompass the considerations listed in that section while also recognizing the historic significance of the Bridge.

All of the build alternatives generally satisfy the revised criteria established by the District. During the screening process, many groups of alternatives, as discussed in Section 1.6 of this chapter, were considered and evaluated for their ability to meet the project's purpose and need, which included the District's criteria. The build alternatives evaluated in this environmental document were selected because they all impede the ability of an individual to jump from the Bridge and generally satisfy the District's criteria. Table 1-1 on the following page compares the alternatives in relation to their ability to satisfy the District criteria.

1.6.1 FINAL DECISION-MAKING PROCESS

After the public circulation period, all comments will be considered, and the District will select a preferred alternative and make the final determination of the project's effect on the environment. In accordance with CEQA, the District will certify that the project complies with CEQA, prepare findings for all significant impacts identified, prepare a Statement of Overriding Considerations for impacts that will not be mitigated below a level of significance, and certify that the findings and Statement of Overriding Considerations have been considered prior to project approval. The District will then file a Notice of Determination with the State Clearinghouse that will identify whether the project will have significant impacts, mitigation measures were included as conditions of project approval, findings were made, and a Statement of Overriding Considerations was adopted. Similarly, if the Department, as assigned by FHWA, determines the NEPA action does not significantly impact the environment, the Department will issue a Finding of No Significant Impact (FONSI) in accordance with NEPA. If the Department determines the NEPA action significantly impacts the environment, an Environmental Impact Statement (EIS) will be prepared.

1.7 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER DISCUSSION

1.7.1 ALTERNATIVE EVALUATION PROCESS

The concept of installing a physical suicide deterrent system on the Bridge has been explored since 1971. A variety of concepts have been studied, with all concepts ultimately rejected based primarily on aesthetic and effectiveness concerns. Subsequently, the District enhanced its monitoring, patrol, and intervention capabilities, which was effective for certain situations and instances. Nonetheless, approximately two dozen individuals jump from the Bridge each year.

On March 11, 2005, the District's Board approved proceeding with environmental studies and preliminary design work, contingent upon outside funding for those efforts, for development of a physical suicide deterrent system on the Bridge. The resolution authorizing this action stipulated that suicide deterrent system concepts conform to the 11 specific criteria (see Section 1.2 for criteria).

Table 1-1 Comparison of Alternatives

Project Alternative	DISTRICT CRITERIA									
	Must impede the ability of an individual to jump off the GGB	Must not cause safety or nuisance hazards to sidewalk users, including pedestrians, bicyclists, District staff, and District contractors/security partners	Must be able to be maintained as a routine part of the District's ongoing Bridge maintenance program without undue risk of injury to District employees.	Must not diminish ability to provide adequate security of the Golden Gate Bridge.	Must continue to allow access to the underside of the Bridge for emergency response and maintenance activities.	Must satisfy requirements of State and Federal historic preservation laws.	Must have minimal visual and aesthetic impact on the Golden Gate Bridge.	Must be cost effective to construct and maintain.	Must not, in and of itself, create undue risk of injury to anyone who comes in contact with the Suicide Deterrent System.	Must not prevent construction of a moveable median barrier on the GGB.
1A - Add Vertical System to Outside Handrail	Configuration of thin rods vertically aligned provides for a system that is difficult to grasp and climb. Overall height sufficient to prevent a climber from reaching top of barrier from sidewalk level.	System serves as a passive barrier deterrent, and does not pose a safety or nuisance hazard to sidewalk users, District staff and District contractors/security partners.	Primary fence materials (posts, rods, etc) will utilize materials and components similar or identical to those used on the recently installed bike/ped railing.	System will not impede security patrols and will have no negative impact on sidewalk and above-deck security. System will help to protect main cable components (suspenders, main cable) and underbridge areas by making access to these components/areas more difficult.	Current underbridge emergency response access will be maintained through the provision of access gates. Maintenance workers will have to walk along the upper chord of the truss, on the outside of the railing to access the maintenance traveler from the gates.	Project implementation will be in accordance with State and Federal historic preservation laws.	Use of thin vertical rods allows views through the barrier from the roadway/sidewalk perspectives, although stacking of rods will obstruct angled views from roadway/sidewalk perspectives. Barrier could be visible in views towards the Bridge, depending on the distance and duration of the view.	System utilizes conventional, readily available materials that can be installed using standard construction equipment and tools. Maintenance traveler modification costs can be avoided. System will increase the painted steel surfaces of the Bridge, which will increase maintenance costs.	System is not expected to cause injury to those in contact, since it is passive and relies upon fixed, stationary elements for its anti-climb effectiveness.	Based on wind tests, system can be installed in conjunction with a moveable barrier system.
1B - Add Horizontal System to Outside Handrail	Horizontal cable alignment provides a foot-hold for climbing, but winglet will impede climbing over barrier. Overall height sufficient to prevent a climber from reaching top of barrier from sidewalk level.	System serves as a passive barrier deterrent, and does not pose a safety or nuisance hazard to sidewalk users, District staff and District contractors/security partners	Primary fence materials (posts, rods, etc) will utilize materials and components similar or identical to those used on the recently installed bike/ped railing. Transparent winglet will require periodic maintenance in order to maintain aesthetics and transparency.	System will not impede security patrols and will have no negative impact on sidewalk and above-deck security. System will help to protect main cable components (suspenders, main cable) and underbridge areas by making access to these components/areas more difficult.	Current underbridge emergency response access will be maintained through the provision of access gates. Maintenance workers will have to walk along the upper chord of the truss, on the outside of the railing to access the maintenance traveler from the gates.	Project implementation will be in accordance with State and Federal historic preservation laws.	Use of horizontal system would allow head-on and angled views from sidewalk/roadway perspectives. Barrier could be visible in views towards the Bridge, depending on the distance and duration of the view. Use of above-deck winglet could be in conflict with Bridge aesthetics.	System utilizes conventional, readily available materials that can be installed using standard construction equipment and tools. Maintenance traveler modification costs can be avoided. Maintenance costs associated with winglet will be greater than 1A. System will increase the painted steel surfaces of the Bridge, which will increase maintenance costs.	System is not expected to cause injury to those in contact, since it is passive and relies upon fixed, stationary elements for its anti-climb effectiveness.	Based on wind tests, system can be installed in conjunction with a moveable barrier system.
2A- Replace Outside Handrail with Vertical System	Configuration of thin rods vertically aligned provides for a system that is difficult to grasp and climb. Overall height sufficient to prevent a climber from reaching top of barrier from sidewalk level.	System serves as a passive barrier deterrent, and does not pose a safety or nuisance hazard to sidewalk users, District staff and District contractors/security partners.	Primary fence materials (posts, rods, etc) will utilize materials and components similar or identical to those used on the recently installed bike/ped railing.	System will not impede security patrols and will have no negative impact on sidewalk and above-deck security. System will help to protect main cable components (suspenders, main cable) and underbridge areas by making access to these components/areas more difficult.	Current underbridge emergency response access will be maintained through the provision of access gates. Maintenance workers will have to walk along the upper chord of the truss, on the outside of the railing to access the maintenance traveler from the gates.	Project implementation will be in accordance with State and Federal historic preservation laws.	Use of thin vertical rods allows views through the barrier from the roadway/sidewalk perspectives, although stacking of rods will obstruct angled views from roadway/sidewalk perspectives. Barrier could be visible in views towards the Bridge, depending on the distance and duration of the view.	System utilizes conventional, readily available materials that can be installed using standard construction equipment and tools. System will increase the painted steel surfaces of the Bridge, which will increase maintenance costs.	System is not expected to cause injury to those in contact, since it is passive and relies on fixed, stationary elements for its anti-climb effectiveness.	Based on wind tests, system can be installed in conjunction with a moveable median barrier system.

Project Alternative	DISTRICT CRITERIA									
	Must impede the ability of an individual to jump off the GGB	Must not cause safety or nuisance hazards to sidewalk users, including pedestrians, bicyclists, District staff, and District contractors/security partners	Must be able to be maintained as a routine part of the District's ongoing Bridge maintenance program without undue risk of injury to District employees.	Must not diminish ability to provide adequate security of the Golden Gate Bridge.	Must continue to allow access to the underside of the Bridge for emergency response and maintenance activities.	Must satisfy requirements of State and Federal historic preservation laws.	Must have minimal visual and aesthetic impact on the Golden Gate Bridge.	Must be cost effective to construct and maintain.	Must not, in and of itself, create undue risk of injury to anyone who comes in contact with the Suicide Deterrent System.	Must not prevent construction of a moveable median barrier on the GGB.
2B - Replace Outside Handrail with Horizontal System	Horizontal cable alignment provides a foot-hold for climbing, but winglet will impede climbing over the barrier.	System serves as a passive barrier deterrent, and does not pose a safety or nuisance hazard to sidewalk users, District staff and District contractors/security partners.	Primary fence materials (posts, rods, etc) will utilize materials and components similar or identical to those used on the recently installed bike/ped railing. Transparent winglet will require periodic maintenance in order to maintain aesthetics and transparency.	System will not impede security patrols and will have no negative impact on sidewalk and above-deck security. System will help to protect main cable components (suspenders, main cable) and underbridge areas by making access to these components/areas more difficult.	Current underbridge emergency response access will be maintained through the provision of access gates. Maintenance workers will have to walk along the upper chord of the truss, on the outside of the railing to access the maintenance traveler from the gates.	Project implementation will be in accordance with State and Federal historic preservation laws.	Use of horizontal system would allow head-on and angled views from sidewalk/roadway perspectives. Barrier could be visible in views towards the Bridge, depending on the distance and duration of the view. Use of above-deck winglet could be in conflict with Bridge aesthetics.	System utilizes conventional, readily available materials that can be installed using standard construction equipment and tools. Maintenance costs associated with winglet will be greater than 2A. System will increase the painted steel surfaces on the Bridge, which will increase maintenance costs.	System is not expected to cause injury to those in contact, since it is passive and relies upon fixed, stationary elements for its anti-climb effectiveness.	Based on wind tests, system can be installed in conjunction with a moveable barrier system.
3- Add Net System that Extends Horizontally from Bridge	Horizontal net designed to collapse and capture potential jumpers.	Design requires District staff to rescue captured individuals.	Net material will collect debris and garbage, requiring periodic cleaning.	System will not impede security patrols and will have no negative impact on sidewalk and above-deck security.	Net is hinged at the bottom and rotates up to allow current maintenance traveler operations.	Project implementation will be in accordance with State and Federal historic preservation laws.	Net system would not be visible from motorists traveling along the Bridge and would have limited visibility to pedestrians. Net system could be visible in views towards the Bridge, depending upon the distance and duration of the view.	Netting support system and netting itself will utilize conventional materials that can be installed using standard construction equipment and tools. System will increase the painted steel surfaces on the Bridge, which will increase maintenance costs.	System will require Bridge workers to rescue individuals who land in the net.	Based on wind tests, system can be installed in conjunction with a moveable barrier system.
No-Build Alternative	The retention of the existing 4 foot high outside handrail would not impede the ability of an individual to jump off the Bridge.	The outside handrail does not pose a safety or nuisance hazard to sidewalk users, District staff and District contractors/security partners.	Under this alternative there would be no change to current maintenance activities.	Under this alternative there would be no change to existing security operations.	Under this alternative continued access to the underside of the Bridge would be available.	There would be no change to the outside handrail and therefore no impact to the historic character of the Bridge.	Under this alternative there would be no change to the existing visual environment.	No new construction would occur and therefore there would be no construction costs associated with this alternative.	The outside handrail does not cause injury to those in contact, since it is passive and relies upon fixed stationary elements.	Based on wind tests, retention of the 4 foot high outside handrail would not interfere with installation of a moveable barrier system.

Conduct Industry Review

A comprehensive review of industry research, design, and experience related to suicide deterrent systems was conducted that included concepts from past studies performed on behalf of the District, existing installations and suggestions received from the public. A total of 83 concepts were recorded that were then organized into the following 13 groups, with each group representing a primary physical feature of the proposed system.

Group 1 – Fencing with vertical rod, bar or cable components (19 concepts)

Group 2 – Fencing with horizontal rod, bar or cable components (five concepts)

Group 3 – Horizontal net systems (12 concepts)

Group 4 – Glass systems (six concepts)

Group 5 – Enclosed walkway systems (nine concepts)

Group 6 – Chain link fence systems (seven concepts)

Group 7 – Electric systems (seven concepts)

Group 8 – Short systems (five concepts)

Group 9 – Barbed wire systems (four concepts)

Group 10 – Vertical net, metal mesh or wire grid systems (five concepts)

Group 11 – Offset barrier area systems (two concepts)

Group 12 – Laser systems (one concept)

Group 13 – Top chord attachment systems (one concept)

Evaluate Groups/Initial Wind Tunnel Testing

In order to process these groups of ideas down to those that would be considered technically feasible, they were first evaluated against the following list of performance criteria developed from the District-adopted criteria that established clear thresholds for compliance. These performance criteria were intended to screen ideas that contained an obvious flaw or “fatal” flaw.

Criterion 1. System must impede the ability of an individual to jump off the Bridge

Criterion 2. System must not cause safety or nuisance hazard to sidewalk users

Criterion 8. System must have minimal visual and aesthetic impact on the Bridge

Criterion 10. System must not in itself create undue risk of injury to anyone who comes in contact with the system

The District criteria used to screen or eliminate groups of concepts were chosen based on the ability to establish clear thresholds for compliance with each criterion. For example, Short Fence Systems below 6 feet in height were considered ineffective as a deterrent to climbing based on the ease with which an individual could jump over such a height. Similarly, systems that utilized barbed wire or electric shock transmission would create a hazard to sidewalk users and lead to injury to someone coming in contact with the system (District Criteria 2 and 10). Only those systems considered to have an obvious negative visual or aesthetic impact (chain link, barbed wire, or enclosure) were eliminated based on aesthetics.

When evaluated against the performance criteria, nine groups were removed from further consideration: enclosed walkway (2, 8), chain link fence (8), electric fences (8, 10), barbed wire (2, 8, 10), short systems (1), offset barrier area (2, 8, 10), horizontal bars (1), laser (10), and top chord attachment (5).

During this phase of the project conceptual designs were evaluated for their performance during high winds to determine which concepts would and would not affect the aerodynamic stability of the Bridge. Meteorological and topographical analyses of wind hazards specifically associated with the Bridge site found that the Bridge could be subjected to winds of up to 100 miles per hour. Very small changes in the shape of the Bridge cross-sections (including the spacing and design of rail and fence elements) can have a significant impact on the Bridge's aerodynamic stability during high winds. Conceptual designs that significantly affected the aerodynamic stability of the Bridge under high winds were eliminated from further consideration, in accordance with the Board's established criterion that mandated maintenance of the aerodynamic stability of the Bridge.

Initial wind tunnel testing was performed to establish basic wind criteria and the aerodynamic stability of the Golden Gate Bridge. This testing was developed around three generic physical suicide deterrent system types using parametric features impacting Bridge aerodynamic performance (spacing, height, member size and shape, solid ratio, and top treatment). The three generic physical suicide deterrent systems tested were vertical extensions added on to the existing outside handrail, replacing the existing

outside handrail, and utilizing nets that cantilever out horizontally. The preliminary wind tunnel testing determined that all three generic suicide deterrent system types were feasible (i.e. met the established aerodynamic performance criteria) and also that the existence of the movable barrier had little or no impact on the aerodynamic stability of the Bridge. Therefore, District Criteria 11, which indicates that the system must not prevent construction of a moveable median barrier on the Bridge, is satisfied by all potential suicide deterrent systems.

Develop Concept Types

The four groups of concepts remaining after the initial evaluation of the 13 groups were carried forward to be developed into technically feasible alternatives. These groups included 1) vertical rods, bars, or cables; 2) horizontal rods, bars or cables; 3) horizontal net; and 4) glass systems. Design criteria were developed and architectural considerations identified that would guide the evaluation and development of technically feasible alternatives.

Design criteria were established at a parametric level sufficient to define the overall limits and basic forms of physical suicide deterrent system concepts. The design criteria include a barrier solid ratio to ensure the aerodynamic stability of the Bridge, a barrier height range depending on whether the existing outside handrail was retained (12-foot height) or removed (10-foot height), barrier top treatment to impede climbing, and spacing of barrier members (4 inches to 6 inches) in accordance with codes (buildings 4 inches and bridges 6 inches) for pedestrian outside handrails.

Architectural considerations included developing a physical suicide deterrent system compatible with the existing structural and ornamental forms, as well as with the exterior and safety railings. Because the predominant forms of the Bridge are oriented either horizontally or vertically, the primary elements of the physical suicide barrier system were positioned in horizontal or vertical arrays. The other significant aesthetic concern was related to minimization of the various view perspectives of the Bridge. These perspectives include driver, pedestrian, and panoramic. It was determined that any new feature or element must be in visual harmony with the existing Bridge and must minimize impacts to Bridge user view perspectives.

As a result of screening concepts against the identified performance criteria, and by applying the design criteria and architectural considerations discussed above, a total of nine generic concept types were identified. These concepts included three physical suicide barriers using horizontal members, four physical suicide barriers using vertical members, one vertical physical suicide barrier using glass pickets, and one net

alternative. Illustrative examples of these concepts were developed and circulated with the Notice of Preparation Issued in June 2007. These concept renderings were not based on detailed designs, but rather represented idealizations of generic features that complied with the parametric criteria.

Alternatives Eliminated from Further Discussion

Prior to being considered technically feasible, further design refinements were developed for each concept and additional wind testing was performed as necessary to confirm the satisfactory aerodynamic performance of the Bridge. Following this testing, each concept was further evaluated against the Board-adopted criteria to identify those alternatives that best met these criteria. Based on this evaluation, four of the nine concepts were rejected. Below are brief descriptions of the four concepts which were removed from consideration and the rationale for removing them from consideration. The five remaining technically feasible concepts are the alternatives evaluated in this EIR/EA.

Additionally, another No-Build Alternative was initially considered, but was removed from consideration.

No Public Access to Sidewalks

This alternative would close the Bridge sidewalks to pedestrian and bicycle traffic. It was removed from further consideration because the sidewalks are currently used by approximately 10 million visitors a year and by up to 5,000 bicyclists a day (commuters and recreational users). Their closure to the public would remove this very popular tourist destination. The sidewalks are also an integral link in the California Coastal Trail, The Ridge Trail and the Bay Trail. The closure would eliminate this important link to the state and regional trail systems and would prevent bicycle commuting in this corridor. This alternative would therefore not be prudent.

Vertical and Horizontal Wire Mesh Added to Railing

This alternative would construct a 10-foot-high barrier of vertical and horizontal wire mesh on top of the railing for a total height of 14 feet. It was removed from further consideration because of its excessive height and the visual impact it would not meet the following District criteria.

Criterion 8. Must have minimal visual and aesthetic impact on the Bridge

Curved Top Horizontal Cable Members Replacing Railing

This alternative would construct a 14-foot-high barrier using horizontal cable members and a curved top. It was removed from further consideration because of its excessive height and the visual intrusion from the curved top. It would not meet the following District criteria.

Criterion 8. Must have minimal visual and aesthetic impact on the Bridge

Curved Top Diagonal Wire Mesh Replacing Railing

This alternative would construct a 12-foot-high diagonal wire mesh barrier with a curved top. It was eliminated because the diagonal wire mesh conflicted with the horizontal and vertical elements of the Bridge. It would not meet the following District criteria.

Criterion 8. Must have minimal visual and aesthetic impact on the Bridge

Vertical Glass Pickets Replacing Railing

This alternative would construct a 12-foot-high vertical glass barrier along the Bridge. It was eliminated from further consideration because it would introduce a new source of light and glare, which could cause safety concerns, it could not be maintained as a routine part of the Bridge maintenance program, it would be difficult to allow access to the underside of the Bridge, and it would not utilize the existing architectural vocabulary of the Bridge. Therefore, it would not meet the following District criteria.

Criterion 2. Must not cause safety or nuisance hazards to sidewalk users, including pedestrians, bicyclists, District staff, and District contractors/security partners

Criterion 3. Must be able to be maintained as a routine part of the District's ongoing Bridge maintenance program and without undue risk of injury to District employees

Criterion 5. Must continue to allow access to the underside of the Bridge for emergency response and maintenance activities

Criterion 9. Must be cost effective to construct and maintain

1.8 PERMITS AND APPROVALS NEEDED

The Bridge and staging areas are located on land owned by the Federal Government and currently administered by the National Park Service (NPS)/GGNRA. Installation of the proposed physical suicide deterrent system may need a permit from the U.S. Coast Guard for construction activities over navigable waters and San Francisco Bay Conservation and Development Commission (BCDC).

Based on the findings of the Natural Environment Study, attached as Exhibit F, no "take" of endangered species would occur. Therefore, no permits would be required under the California Endangered Species Act. Additionally, the project will have "no effect" pursuant to Section 7 of the Federal Endangered Species Act. Further, no other permits for the loss or alteration of biological resources would be required.

As part of the Section 106 process, it will be necessary to obtain concurrence from the State Historic Preservation Officer on the Finding of Effect and approval of the Memorandum of Agreement. The District, as the CEQA Lead Agency, would certify the EIR and the Department, as the NEPA lead agency, would approve the EA and issue the FONSI.