The John Lewis Memorial Bridge

Seattle Department of Transportation

APWA WASHINGTON 2023 PROJECT OF THE YEAR AWARD

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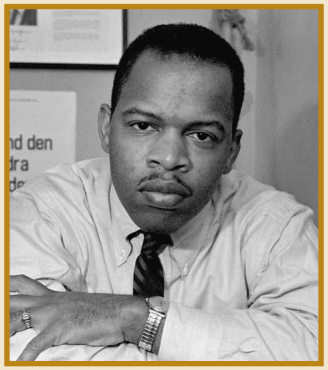
Project Background and Introduction



The John Lewis Memorial Bridge was named to honor John Lewis, an African American hero, civil rights leader, and U.S. Congressman.

For over a half-century, I-5 has divided the North Seattle community of Northgate by separating residential areas and North Seattle College west of I-5 from shopping districts, business parks, and major transit stations for bus, light rail, and parking facilities east of I-5 (see the project location map on page 2). For those traveling locally by foot, travel times upward of 22 minutes to cross I-5 were not uncommon, because there were only two crossings that were spaced approximately 1 mile apart and that did not directly connect the major points of interest.

Building off of an earlier design effort that was over budget and not fundable, the project was restarted in 2016 with a new team led by the City of Seattle Department of Transportation (SDOT). Through this effort using small businesses along with David Evans and Associates, Inc. (DEA) as the lead structural design firm, the team developed a new concept through a value engineering approach to redesign the original alignment and simplify construction that satisfied budget constraints while meeting the design and pragmatic goals set by the community. The project was constructed by Kraemer North America for a total of $44 million.

The Seattle Department of Transportation (SDOT) and its team of consultants/contractors delivered a new 1,900-foot-long pedestrian and bicycle bridge that spans over I-5, 1st Avenue NE, and wetlands, improving non-motorized access within the Northgate community, and to the new Northgate Sound Transit station. The John Lewis Memorial Bridge (John Lewis Bridge) creates a direct connection for 1,500 projected daily users traveling between east and west of I-5. The bridge creates a third centralized crossing that reduces local travel from 22 minutes to 10 minutes on average for non-motorized users crossing I-5.

The aesthetically pleasing bridge serves as an iconic gateway into the North Seattle neighborhood and enhances its surroundings

The design for the John Lewis Bridge also had to address complexities, including safety and ease of access for all types of non-motorized modes of transport; environmental considerations including local wetlands, Bartonwood Natural Area preservation, and drainage issues; and construction limitations due to site constraints and the need to minimize disruption to traffic on I-5. SDOT and its design and construction team of small/disadvantaged businesses incorporated significant public outreach to help inform the design while addressing these challenges. In addition, this bridge has high visibility for those traveling on I-5 and in the area, so the bridge needed to be an aesthetically pleasing structure.

The design team, through collaboration with the architect, used a Vierendeel truss that now serves as an iconic gateway into the North Seattle neighborhood and enhances the surroundings. The design seamlessly combines four different span types to create strong visual continuity and rhythm along the bridge, without negatively impacting the local environment. The bridge alignment was designed to create clear sightlines for safety, and the use of a highly transparent cable netting barrier enhances visibility while providing sufficient protection for those crossing the bridge.

To address site and traffic constraints, the Accelerated Bridge Construction (ABC) method enabled construction to occur while limiting the closure of I-5 to just two nights—one night for each span over I-5 northbound and southbound.

The successful use of a Self-Propelled Modular Transporter (SPMT) was essential to the erection of the bridge and helped to advance this technology within the industry in general.

PROJECT LOCATION

The project site and surrounding areas that benefit from the John Lewis bridge.

Source: Seattle Department of Transportation

CRITERION 1

Construction Management Techniques and Project Schedule

CONSTRUCTION SCHEDULE

Despite many challenges and disruptions, including adherence to COVID-19 health safety protocols, health hazard due to smoke from widespread forest fires, and labor shortages, the project was delivered on time to coincide with the grand opening of the Northgate light rail segment and its three stations between U District and Northgate Stations.

Concurrent Sound Transit projects were closely coordinated without interruption to construction of the John Lewis Bridge

- Northgate Link Station (significant coordination was needed)
- Lynnwood Link Extension
- East Link Extension (mainly for I-5 closures and need to coordinate with I-90 closures)

COMPREHENSIVE TRAFFIC MANAGEMENT

Other concurrent projects in proximity to the John Lewis Bridge included the Sound Transit Northgate Station (bus, light rail, and park-and-ride transit hub), other Sound Transit projects, and the redevelopment of the Northgate Mall. These added the complexity of coordinating with multiple competing development activities. Depending on the phase of the Sound Transit projects, the project team had to deal with multiple contractors working in the same footprint. The bridge work also required several lane closures and two full closures of northbound and southbound I-5. The team effectively coordinated not only with the John Lewis Bridge contractor (Kraemer North America), but also with the Washington State Department of Transportation (WSDOT), and all Sound Transit contractors working in the vicinity while maintaining access to the Northgate park-and-ride to ensure that everyone had access to public transportation and the contractors had access to their sites and materials..

Transporting the thru-girder span and using Self-Propelled Modular Transporter for final placement

The team was composed of several Small and/or Disadvantaged Business Enterprise firms

Consultant	Role
DEA	Lead Structural Designer
Clearway Environmental	Environmental Mitigation
CM Design Group	Civil (Site Preparation, Trail, Site, Signalization, Signing)
HWA	Geotechnical
Integrity Structural Engineering	Project Management and Peer Reviewer
Johnson Southerland	Landscape Architect (Restoration)
Joseph Couples Engineering	Signalization and Lighting
Osborn Consulting Inc.	Civil (Stormwater and Drainage)
Ott-Sakai Construction	Cost Estimator, Scheduler, and Constructability Reviewer
PACE	Survey
PacificBridge	Structure (Main Span)
Stepherson and Associates	Communications
TranTech Engineering	Construction Management
VIA Architecture	Bridge Architect
VSM Structural Design	Structural (Main Span Peer Reviewer)
Watershed Company	Construction Management (Environmental Compliance)

CONSTRUCTION MANAGEMENT

The City of Seattle led both the design and construction phases of the project, serving as the Prime Consultant, and was supported by a team composed completely of Small and Disadvantaged Business Enterprises (SBEs/DBEs) subconsultants to deliver this complex bridge project. Using a team of SBE/DBE firms helped generate revenue in the local economy, expanding the capabilities and capacity of the SBE/DBE firms, and served as a resume builder for the SBE/DBE firms by giving them experience working directly with SDOT.

Construction Management (CM) was successfully performed through a joint effort involving SDOT, TranTech Engineering with the support of AECOM, and the design team. The flow of information was managed using the SDOT Construction Administration Manual and filing system, and all communication went through the Resident Engineer. The project used the SDOT system for all project information, including submittals, schedules, serial letters, requests for information, record of materials, materials documentation, change management (design changes, change orders), inspectors' daily reports, field memos, field construction records, progress estimates, and other project documentation.

The bridge's Vierendeel truss, thru-girder, and pre-cast girders span I-5 and adjacent wetlands

Multimodal transportation connections at terminus of bridge

Weekly construction progress meetings between SDOT, the contractor, and the CM team were held in person until COVID restrictions mandated by Washington State and the City of Seattle required the meetings be held virtually using Microsoft Teams. COVID restrictions also impacted daily construction activities; workers onsite were required to wear masks, practice safe social distancing, and manage lead times of material deliveries due to material shortages. The overall team met these challenges, with no overall project interruptions or schedule impact, and therefore was able to meet the scheduled completion date.

These regular meetings, along with frequent communication between the CM team and the design team, allowed the overall team to foresee and resolve many issues before they became problems. When issues did arise, this approach allowed for quick communication and resolution.

Two Issues and Their Resolutions

1. The camber in the precast prestressed slab girders was higher than the design assumption. The design team collaborated with the contractor and the CM team to reanalyze the fabricated girders (based on field adjustments) and used the girder "as-is" without impacting the construction schedule. If the girders had to be refabricated, it would have delayed the installation by several months.
2. Because the contractor could not source readily available stanchions and compression struts for the cable netting barrier that would meet the "Made in America" requirements, the contractor, and the CM and design teams collaborated to develop a custom design and domestically fabricated stanchions and compression struts that met the requirements.

OTHER MANAGEMENT PRACTICES TO SUCCESSFULLY MANAGE THE PROJECT

- ***Diligent auditing and controls*** to enable compliance with Federal Highway Administration and funding requirements.
- ***Close coordination with external stakeholders*** including Sound Transit, WSDOT, North Seattle College, King County Metro Transit, neighborhood businesses, environmental resource agencies, Seattle Public Utilities, and Seattle Building Officials.
- ***Thorough and timely contract administration*** to minimize risks (schedule and commitment to external stakeholders).
- ***Careful planning*** to provide safe traffic operations during construction.
- ***High levels of collaboration and trust*** among team members established through weekly meetings and ongoing communications, such as the assessment of the weekly look-ahead schedule and monthly completion baseline schedule, to identify critical issues necessary and make adjustments and to keep the construction on schedule.
- ***Ongoing coordination*** with other projects, contractors, and developers (occurring simultaneously within proximity of this project) to minimize traffic disruptions.
- ***Dedicated public involvement programming and outreach*** with other projects, contractors, and developers (occurring simultaneously in proximity to this project) to minimize traffic disruptions.

CRITERION 2

Safety Performance

There were no significant reportable injuries to the contractor's staff and no reported injuries to the public during construction

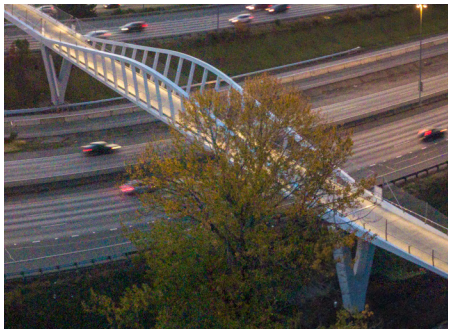
DESIGNING FOR PUBLIC SAFETY AND ACCESSIBILITY

For enhanced accessibility, the bridge was designed with a 5 percent running slope, an 8 percent ramp with landings, and horizontal curves that meet bicycle requirements to allow ease of access for all types of non-motorized transportation.

Below are examples of how we achieved public safety and accessibility:

- The project demonstrated a good safety performance and awareness of the need for a good overall safety program for workers and the public during and after construction.
- Due to the long main span of the bridge, the bridge alignment was designed to create clear sightlines for safety. A highly transparent cable netting, which functions as a safety barrier and provides sufficient for protection on highway spans, enhances visibility. This system is inclined to match the open angle of the main span of the truss, creating a sense of openness in the structure.
- Instead of utilizing WSDOT standard overhead illumination to provide for the safety and well-being of users during hours of darkness (without causing glare to the drivers on I-5), a lighting level sufficient for illuminating oncoming travelers on the John Lewis Bridge was accomplished using fixtures that are seamlessly integrated into the handrail system.

Integrated dedicated bike lanes adjacent to the John Lewis Bridge



Seamlessly integrated lighting provides safety for users during hours of darkness

Transparent cable netting functions as a safety barrier and provides an unobstructed view

Ramps with 8 percent slopes have landings for all types of non-motorized travelers

CRITERION 3

Community Relations

> *"I wanted to give you some feedback on one citizen's experience with the new light rail between Northgate and Seattle downtown. I live in the Licton Springs neighborhood and have been watching construction for several years so decided since I am retired, I could dedicate today (Oct 4) to experiencing the connection. It was terrific..."*
>
> Kathleen Braden, resident

The John Lewis Bridge is the result of a community-centered design and involved ten public involvement events, including open houses and drop-in sessions with over 250 attendees, over 50 community briefings, and over 90,000 mailers that provided information and updates to the local community and an opportunity to collect feedback from future users. The public responded with enthusiasm and influenced the design, particularly in the areas of safety and security, wayfinding and traffic control, environmental elements, and accessibility. The design gave special consideration to pedestrian lighting, ease of access on ramps and the bridge deck (by reducing the slope of bridge approaches and increasing the width of the deck), and mitigation of impacts to wetlands. Now that the bridge is open to the public, the design team has already heard from members of the community who have spoken favorably of the impacts on their mobility in the area. Here is one example of this positive feedback:

- *I left my house on foot (Densmore Avenue North) at 10:10 AM and was in the University Street station downtown at 10:35 AM. That was an amazing time to me. I have a senior Orca card, so it was very easy to pay for the train.*
- *The pedestrian bridge is a good design and a lot of fun to cross. I love the view and the friendly "telephone" greeting. The explanatory signs about, for example, the tree plantings, were appreciated too.*

Grand opening of the John Lewis Memorial Bridge reconnecting the Northgate community

> *"In short, bravo to all the SDOT people who made this happen and even though I will be traveling largely for recreation, I intend to be a regular rider."*
>
> Kathleen Braden, resident

- *I have avoided going downtown for many years unless truly necessary, I feel bad driving and contributing to air pollution and carbon emissions, not to mention the high cost of parking. But today was so easy! No traffic jam at the I-5 bridge, no hunting around for a parking space or finding a garage.*
- *I patronized three separate merchants downtown, ate lunch there, and had a visit to the Aquarium. In part because of the rail link, I had taken out an aquarium membership in August. The train itself was very comfortable. Because I was traveling later in the morning (I assume), I had no trouble finding a seat. I love the little symbols SDOT chose for each station.*

IN THE NEWS

A recent article published by the ***Community College Daily*** (December 5, 2022 written by Ed Finklel) highlighted the importance of the connection the John Lewis Bridge between the North Seattle College and the rest of the Northgate community (which includes residential neighborhoods, shopping districts, business parks, high school, and major transit hubs).

The John Lewis Bridge connects directly to Northgate Station

Crossing I-5 on the Vierendeel truss span

NAMING THE BRIDGE

"You see how much it reflects, or could reflect, the whole John Lewis bridge story" referring to the "Bloody Sunday" march across the Edmund Pettus Bridge in Selma, Alabama.

"This bridge is about access; it's about equity; it's about bringing communities together."

BRIDGE ACCESS

"The bridge has improved access "1000%," including reducing parking needs."

Chemene Crawford, North Seattle College president

CRITERION 4

Environmental Considerations

STORMWATER MITIGATION

Stormwater mitigation for the nearby Sound Transit station improvements was relocated as part of the project. In addition to the complex stakeholder coordination at the bridge site, the site is constricted, which limited the possible options for stormwater management. The design team developed an onsite approach that worked with the surrounding conditions and provided dispersion where possible, reducing the amount of stormwater runoff and further helping to improve water quality in the basin. The stormwater engineers performed a wetland hydroperiod analysis to ensure the drainage design would not negatively impact flows to the surrounding wetlands, and the stormwater engineers collaborated with the landscape architects to enhance the wetlands so that they function naturally.

A smaller pedestrian bridge spanning an enhanced watercourse

WETLAND MITIGATION

The project site is in the upper reaches of Thornton Creek, in an urban watershed that drains into Lake Washington. Mitigation was required in order to address project impacts to fish habitat and riparian functions for a series of connected watercourses, wetlands, and wetland buffers on the North Seattle College campus west of I-5 and for a watercourse on the east side of I-5. A combination of onsite and offsite wetland creation, re-establishment, restoration, and enhancement provides mitigation. On the college campus, the watercourse paralleling the bridge ramp was a straight, narrow ditch with steep banks dominated by invasive species. Restoration included reshaping the bottom of the watercourse to create an improved, meandering low-flow channel, along with high-flow terraces and large woody debris salvaged from the site. Where possible without impacting mature trees to be preserved, streambanks were regraded to provide gentler slopes and replanted with native riparian species. The ramp and bridge provide an extensive overlook into the restored watercourse and over a large wetland pond, bringing community awareness to these features, which had previously been hidden.

CRITERION 5

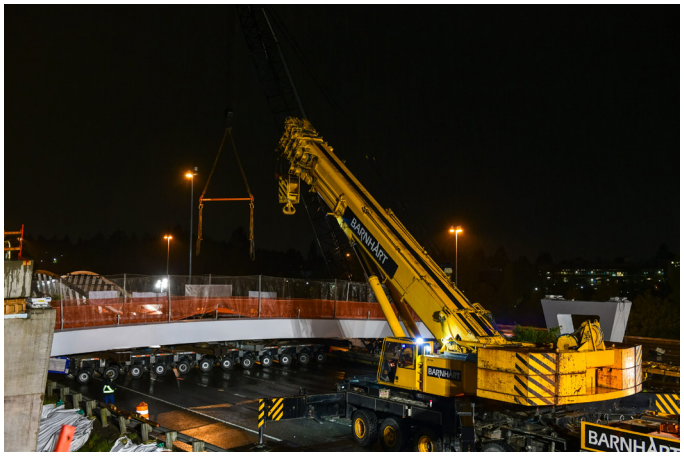
Unusual Accomplishments Under Adverse Conditions

CONSTRAINED SITE

To minimize the bridge length, which needed to span over I-5 at a horizontal distance of 370 feet, a single column pier (Pier 5) founded on a drilled shaft was placed between the I-5 Express Lane ramp and the I-5 northbound lane. The designers chose this layout because of the available open space, which allowed for the use of two shorter spans in lieu of one long span. A 234-foot-long Vierendeel steel truss and a 135-foot-long steel thru-girder were used to span over the ramp and the southbound, northbound, and express lanes of I-5. The use of these types of trusses and thru-girders was crucial for application of the ABC method, which enabled the erection of the main spans with minimum traffic impact to I-5. The main spans were fabricated and assembled at the fabrication plant for fit-up. Because of their large size, they were broken down into smaller and transportable pieces to be delivered to the onsite assembly yard via heavy haul. The pieces were re-assembled at the onsite assembly yard and then transported to the bridge using a SPMT located in the I-5 median. The main spans were erected overnight to limit the closure of I-5 to just two nights (normal construction would have lasted months, and related maintenance of traffic operations could have adversely affected local roads and neighborhoods).

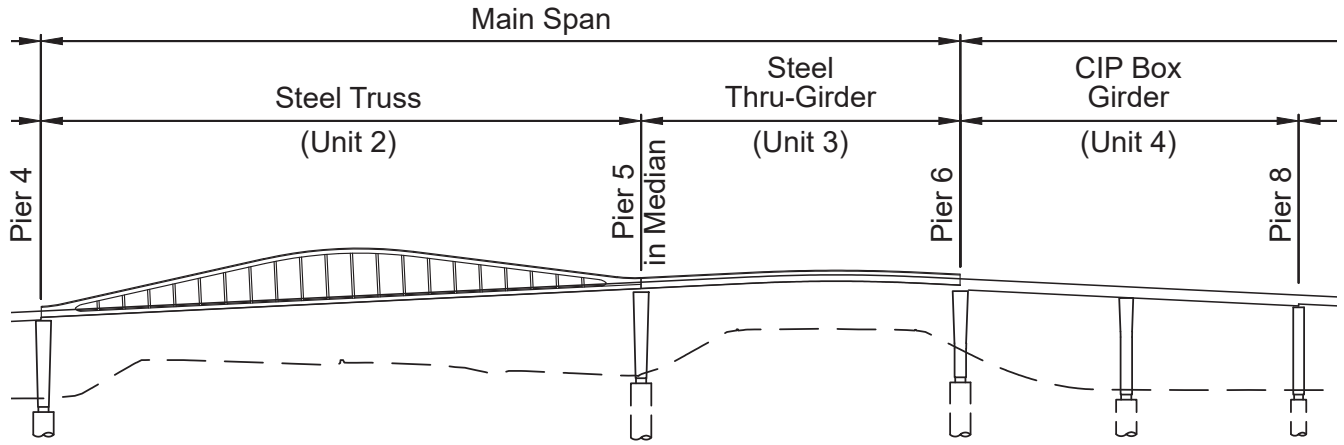
The Vierendeel Ttuss during fabrication

Transporting sections of the Vierendeel truss



Thru-girder installation using SPMT transporter during I-5 closure

The ABC method was used due to the unique circumstances and layout of the bridge, which had severe site constraints and required a high level of consideration for traffic management. This bridge construction method is not common but was deemed the only viable option to transport the truss from the nearby assembly yard to the large crane locations while staying within the I-5 closure windows allowed by WSDOT. Besides meeting the needs of the community, the demonstrated success of this project benefits the engineering community by advancing the use of SPMT in the ABC method, especially in a complex urban environment with multiple stakeholders, limited right-of-way and site access, and a need for minimizing interruption to traffic.



Engineering drawing (above) and photo of completed bridge after construction (at left)

CRITERION 6

Additional Conditions

Curved cast-in-place box girder to facilitate traffic from multiple directions

AESTHETICALLY PLEASING DESIGN

This 1,900-foot-long bridge features a series of span types that are fluidly composed with graceful structural transitions. The design accomplished a strong visual continuity across the various span types through the use of a consistent Curved cast-in-place box girder to facilitate traffic from multiple directions geometric vocabulary that was the outcome of a productive, collaborative process between the engineering and architecture disciplines. Befitting the significance of this community connection, a steel Vierendeel truss draws its inspiration from the lower slopes of Mt. Rainier to create a dramatic gateway and serve as a landmark for the Northgate community.

Bridge connection entering directly into the Link light rail Northgate Station and descending right to the 1st Avenue NE cycle track below

To create a feeling of openness for users on the bridge deck, the trusses are slanted outward by 12 degrees from the vertical line without lateral bracing, which is unique for standard bridges of this type. A family of sculptural V-shaped columns provides support and visual rhythm across the bridge structure. Throughout the design process, strong community and stakeholder involvement guided the selection and refinement of this iconic structure.

VALUE ENGINEERING

To reduce project costs for the approach spans, precast slab girders were used along the straight spans, while cast-in-place box girders matching the precast slab girder cross-section to create geometric continuity were used for the curved spans. To create a whimsical appearance, one of the curved spans was designed without a column at the center of the curve. To minimize torsion on the substructure, the curved span was designed as two continuous spans, with the superstructure fixed into the substructure at the center pier to optimize stability.

SUCCESSFUL FULFILLMENT OF OWNER NEEDS

The bridge design successfully met all of the City of Seattle's goals for this project explicitly mentioned in the Request for Proposal, including:

- Creating a ***new connection*** between the east and west sides of I-5 in Northgate
- Creating a ***better connection*** for students and transit users to North Seattle College
- Creating ***access*** for bicyclists and pedestrians in the Northgate vicinity
- Promoting ***increased ridership*** at the Northgate Transit Center and light rail Northgate Station through ease of access

As part of the funding for the project, SDOT made a commitment to Sound Transit to open the bridge at the same time as (or before) the light rail station opened and became operational. The design and construction teams were able to deliver the project within the necessary schedule to allow SDOT to meet this commitment.

Lastly, the city enacted an executive order (2018-06) to procure more goods and services from small and local businesses. Because the design and CM teams were made up exclusively of small businesses contracting directly with the City of Seattle in addition to those contracting with the general contractor, the project helped the city meet its obligations to SBEs in addition to the goals for utilizing DBEs and Women and Minority Owned Business Enterprises (WMBEs) required by WSDOT, which helped fund this project.

CRITERION 7

Alternative Materials/Practices of Funding Demonstrating a Commitment to Sustainability

SUSTAINABILITY COMMITMENT

Sustainable design was a high priority for the city, the public, and the design team alike. As a major connection to transit, the bridge provides an active, safe, sustainable, and connective spine. The project links across the major freeway right-of-way to a large community college, neighborhoods, and bicycle networks on the other side, thereby expanding access to sustainable transportation. Through this expansion of access to transit, **the project effectively replaces a significant number of automobile trips with light rail, bicycling, and walking trips, thereby reducing metric tons of carbon and replacing fossil fuels with food fuels.** This high-quality active transit facility provides for enriched well-being and safety in providing for the "joyful commute." Active transportation reduces toxic and climate-changing air pollution while reducing health issues associated with sedentary lifestyles.

Through the design and construction process, the project had numerous regulatory approvals from the WSDOT, Sound Transit, and the Seattle Design Commission. The project also needed to meet the requirements of the National Environmental Policy Act, Section 404 of the Clean Water Act, Section 7 of the Endangered Species Act, and Section 401 of the Clean Water Act. To meet these goals and push for a deep commitment to sustainable strategies, the team

Example of public education signage along the project

Trees removed for construction have been replaced at a ratio of 5 to 1 for a total of 450 new trees planted

THE BARTONWOOD NATURAL AREA

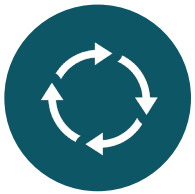
The bridge alignment selected did not impact this area which contains both remnants of historic and restored wetlands that feed the south branch of Thornton Creek. As an educational resource, it is maintained for geological and ecological studies. The wetland habitat provides: absorbing surge flows of water, filtering pollutants from that water, and provides critical habitat for organisms that need this environment.

used an Envision checklist, a guide for certification from the Institute for Sustainable Infrastructure, to refine many project considerations including the materials specifications of the concrete and steel. Selection of materials considered the following criteria: life cycle cost, life span, efficiency (predominantly structural), embodied carbon footprint/greenhouse gas emissions, recycled content, reduced transportation impacts, social equity, and deconstruction/re-use potential. Based on a life cycle analysis, the project exceeds the Association of State Highway and Transportations Officials (AASHTO) code requirement of a 75-year design life by 25 years.

To incorporate sustainable environmental elements into the project and using **biophilic design** (the practice of reconnecting people and nature within the built environment) approach, planting is used to restore the project site; augment the spatial organization of the project; enhance the ecological value of the project area; and create a more comfortable, interesting, healthy, and safe pedestrian experience. The site has a broad range of ecological conditions, and the selected plant communities meet the specific needs of each location. Trees removed for construction have been replaced at a ratio of 5 to 1, for a total of 450 new trees planted. On the west side of the bridge, planting was used to enhance the park-like character along the bridge approach. These plantings support the restoration and mitigation functions within wetlands and buffers while maintaining clear sightlines, so that people can see where they are heading and feel comfortable in terms of wayfinding and safety. New plantings included 127 trees planted in the median within the I-5 right-of-way that will provide valuable tree canopy and a visual break in the freeway experience. A gallery forest of columnar trees was planted along the express ramp paralleling the freeway where it descends towards the transit station and the northbound lanes. When mature, these trees will provide air filtration and a visual screen from traffic.

Special consideration criteria were used when selecting bridge materials that optimized sustainable opportunities

Life cycle cost



Lifespan

Efficiency (predominantly structural)

Embodied carbon footprint/ greenhouse gas emissions

Recycled content

Reduced transportation impacts

Social equity

Deconstruction/ re-use potential