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ACEC 2019

ENGINEERING EXCELLENCE AWARDS

At 1,070 feet, Salesforce Tower is the tallest building in San Francisco. The unique lattice structure atop the tower reduces both wind loads and building shadows.

PHOTO BY STEVE PROEHL

Structural systems

National finalist: Platinum award

Magnusson Klemencic Associates

Project: Salesforce Tower
Client: Boston Properties/Hines

From the first-of-its-kind foundation system that reaches more than 300 feet into the ground to its whimsical public art "lantern" 61 stories up, the 1.4 million-square-foot Salesforce Tower has transformed San Francisco's skyline and has been called the centerpiece of the city's new Transbay District.

The 1,070-foot-tall building's high-performance core, designed by Magnusson Klemencic Associates, is one of its crowning jewels. It required extensive proof-of-concept and the approval of an independent structural peer review panel to allow its use beyond the prescriptive provisions of the building code.

The "core only" system works without the aid of any contribution from the exterior structural system to resist winds and earthquakes. The concrete reinforcing steel was sized and distributed in the walls based on the predicted demands of 22 actual earthquake records applied to the computer model of the core, rather than the standard simplified earthquake model used by the prescriptive method of the code.

Not only does this core deliver a 40 percent increase in seismic safety compared with other office buildings in San Francisco, it also eliminates all the requirements for closely spaced exterior columns, exterior bracing systems, damping systems, and "outrigger" or "belt" systems that tie the exterior structure to the core. As a result, the space and daylighting inside the building is greatly increased.

Because of its location just eight miles from the San Andreas Fault and 10 miles from the Hayward Fault — and atop almost 250 feet of soil deposits that would typically be too soft for a building of this size — the tower required a robust foundation system. The result: a system that is the deepest in the city and one of the deepest ever built in the U.S.

The 42 cast-in-place concrete foundations, or load-bearing elements (LBEs), are as deep as 310 feet, then drilled an additional 10 to 70 feet into the bedrock until satisfactory support was obtained. The high-capacity LBEs are connected with a 14-foot-thick concrete mat foundation, which provides a robust base for the superstructure.

The Salesforce Tower project took seismic analysis to the next level with an expanded application of already-robust soil-structure interaction analysis technology.

Most advanced projects use computer modeling to analyze how horizontal forces interact with the motion of both the soil and the structure as a system. For Salesforce Tower, the modeling was expanded to include not only the structure and soil but also the structures of several surrounding buildings.

This was important because the very weak soils in the area and the tower's close proximity to the under-construction Salesforce Transit Center could cause the buildings to bang against each other below grade. The analysis identified some areas where the tower and transit center might interact, creating some areas of unusual stress. Additional reinforcement was added in certain areas to eliminate that possibility.

The owner and the architect wanted a 150-foot-tall tower-top crown, illuminated with 11,000 LED lights for public art. This massive, 12-story installation was designed by artist James Campbell and reflects abstract scenes from around the Bay Area, transforming the night skyline with an animated dance.

The "canvas" for this art required a sophisticated structure to provide the necessary resistance to wind and earthquake loads and support building maintenance units, but at the same time minimize shadow casts on the city below. Through careful selection of materials, designers achieved a porosity of 41 percent.

The LEED platinum-certified project is owned by Boston Properties and Hines, with architecture by Pelli Clarke Pelli and Kendall/Heaton Associates.

MKA TAKES PLATINUM FOR SALESFORCE TOWER

Magnusson Klemencic Associates was once again the top winner in the American Council of Engineering Companies of Washington's annual Engineering Excellence Awards program. MKA took home the top honor — the platinum award — for the 1,070-foot-tall Salesforce Tower in San Francisco.

Sponsored by ACEC's Washington state chapter, the awards program recognizes projects that represent a wide range of engineering achievements and demonstrate the highest degree of skill and ingenuity.

Twenty-nine projects were honored in this year's program (including one that won in both the national and Washington state competitions.) The top national awards will go on to compete in the ACEC national competition in Washington, D.C., in May.

John D. Hooper, director of earthquake engineering at MKA, was named Engineer of the Year.

Project entries were evaluated by a six-judge panel: Bob Axley, engineer emeritus at Wood Harbinger; Bill Bender, chair of the University of Washington Department of Construction Management; Amy Haugerud, engineer emeritus at RoseWater Advisors; Steve Johnston, engineer emeritus at Landau Associates; Supriya Kelkar, Sound Transit; and Benjamin Minnick, construction editor at the Daily Journal of Commerce.

ACEC Washington is a professional trade association representing consulting engineering, land surveying and affiliated scientific and planning firms statewide.

ON THE COVER

Magnusson Klemencic Associates won ACEC Washington's platinum award for its structural design of the 61-story Salesforce Tower in San Francisco. It's anchored by a foundation system that reaches more than 300 feet deep. PHOTO BY STEVE PROEHL

DJC SPECIAL SECTION TEAM

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SECTION DESIGN: JEFFREY MILLER
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ADVERTISING: MATT BROWN

NATIONAL FINALISTS

PLATINUM AWARD

STRUCTURAL SYSTEMS

MAGNUSSON KLEMENCIC ASSOCIATES
Project: Salesforce Tower
Client: Boston Properties/Hines

GOLD AWARDS

STRUCTURAL SYSTEMS

BERGERABAM
Project: Vancouver Waterfront Park
Client: City of Vancouver

SPECIAL PROJECTS

DAVID EVANS AND ASSOCIATES
Project: Mariposa Grove of giant sequoias restoration
Client: U.S. government/Yosemite National Park

STRUCTURAL SYSTEMS

HDR/SHANNON & WILSON
Project: SR 520 West Approach Bridge North
Client: Washington State Department of Transportation

TRANSPORTATION

WSP
Project: Alaskan Way Viaduct Replacement Program
Client: Washington State Department of Transportation

BEST IN STATE

GOLD AWARDS

SOCIAL, ECONOMIC AND SUSTAINABLE DESIGN

BERGERABAM
Project: Vancouver Waterfront Park
Client: City of Vancouver

SUCCESSFUL FULFILLMENT OF CLIENT/OWNER NEEDS

CARY KOPCZYNSKI & CO.
Project: Lincoln Square South
Client: Kemper Development Co.

SUCCESSFUL FULFILLMENT OF CLIENT/OWNER NEEDS

GOLDER ASSOCIATES
Project: I-90 Snoqualmie Pass snowshed replacement
Client: Washington State Department of Transportation/Jacobs

FUTURE VALUE TO ENGINEERING PROFESSION

LANDAU ASSOCIATES
Project: Columbia Pulp mill
Client: Columbia Pulp

COMPLEXITY

REID MIDDLETON
Project: Naval Medical Center San Diego seismic upgrades
Client: Vasquez Marshall Architects/U.S. Navy

UNIQUE OR INNOVATIVE APPLICATIONS

STANTEC CONSULTING SERVICES
Project: U.S. 12 Wildcat Creek Bridge replacement
Client: Graham Contracting/Washington State Department of Transportation

ENGINEER OF THE YEAR

JOHN D. HOOPER
Magnusson Klemencic Associates

This cable-stayed pier at Vancouver Waterfront Park juts nearly 100 feet over the Columbia River without any in-water support.

PHOTO PROVIDED BY LIONEYE AERIALS

Structural systems

National finalist: Gold award

BergerABAM

Project: Vancouver Waterfront Park
Client: City of Vancouver

The new $24 million Vancouver Waterfront Park offers not only public plazas, viewpoints, a water feature, a playground and an urban beach, but it also creates public access to the river for the first time in almost a century.

Since 2012, BergerABAM has led a multidisciplinary team that has helped the city of Vancouver plan, design and construct the 7-acre destination on a former paper mill site.

The project's focal point is the Grant Street Pier, a concrete, cable-stayed structure conceived by public artist Larry Kirkland that projects almost 100 feet over the Columbia River — with no in-water elements. As part of the city of Vancouver's $1 billion waterfront revitalization program, the park anchors the plan for multifamily and commercial growth in the downtown Vancouver area.

By avoiding any in-water structural support, the pier maintains unhindered aquatic species migration. The pier also uses white colored concrete instead of painted steel or painted concrete. This design decision provides economic and environmental sustainability benefits, as it reduces maintenance requirements and eliminates the need for future over-water painting. Further, stormwater runoff from the wood surfaces of the pier is collected and treated in low-impact-development bioretention treatment cells.

The design of the Grant Street Pier's foundation faced a number of challenges, including unstable soils and a constrained site. BergerABAM and GRI collaborated to design a system that includes drilled shafts, sheet piles, micropiles and ground anchors.

Particularly innovative was the dual purposing of a portion of the work-isolation cofferdam. The site is underlain by liquefiable sand that can result in lateral spreading during an earthquake, causing the ground to move toward the river.

The most economical mitigation for lateral spreading is usually ground improvement, such as the installation of stone columns. However, the permanent foundation elements were located completely upland of the ordinary high-water mark in a very narrow right of way between the river and the private development.

As such, there was no room available to install ground improvements without significantly affecting the private development schedule. Therefore, lateral spreading had to be resisted by the brute force of the structure itself.

Because a sheet pile cofferdam was being used to isolate the foundation construction from the river, the engineers made use of what would otherwise have been a temporary back wall of the cofferdam and repurposed it as a permanent tied-back bulkhead to cut off the lateral spreading. This was a critical design decision that solved the geotechnical problem while allowing private upland construction to continue on an independent schedule.

DOUBLE WINNER

The park also won a best-in-state gold award in the social, economic and sustainable design category.

Special projects

National finalist: Gold award

David Evans and Associates

Project: Mariposa Grove of giant sequoias restoration
Client: U.S. government/Yosemite National Park

A road on this Yosemite National Park site was removed to protect a grove of giant sequoias.

PHOTO BY ORION AHRENSFELD

For more than 150 years, visitors to the giant sequoias in the southwest corner of Yosemite National Park have been enchanted by the massive trees, two of which are among the 30 largest sequoias in the world. Unfortunately, the enjoyment Mariposa Grove of giant sequoias has offered has come with a price.

Improvements made to the tourist attraction in the past century to improve visitor access — including paved roads, parking lots and a portable toilet area — have aged and degraded over the years, threatening the giant trees and interfering with the peacefulness of the area. A parking lot just 30 feet from some of the giant trees was often overflowing, some of the road culverts were plugged, and the odor from the portable toilets was disturbing visitors.

David Evans and Associates led the design effort to help restore the natural systems by removing parking lots, rerouting roads and trails, constructing boardwalks over critical areas, establishing a modern transit system and modernizing the visitor center and transit facilities. The goal: to help restore the health of the grove for the owner, the U.S. government, while continuing to provide visitors with a pleasant experience.

Removing an existing access road and replacing it with an elevated boardwalk created an opportunity to restore and protect the natural environment, but it came with some challenges.

The design had to take into account the construction methods available to the owner and the trail crews that would build the boardwalk. It also had to work around the restrictions on the amount and kinds of equipment and materials that could be brought into the site.

In addition, the design had to minimize the impact of foundation elements to vegetation, drainage and other natural systems. Tree roots were everywhere, so steel support framing for the boardwalk was designed so the locations of the piles could be adjusted up to 7 feet in plan without affecting the path or alignment of the boardwalk.

Multiple variables made upgrades to the park's onsite wastewater treatment system difficult. Work included the construction of a new system at the park's south entrance that included a new 19,920-gallon-per-day wastewater treatment system and an extensive 3-acre hillside pressure distribution leach field.

Restoration work also included replacement of the vault toilet facilities with flush toilets in another area of the park, as well as an additional new onsite wastewater treatment system. Designers sought to maintain adequate setbacks from significant trees, avoid bedrock and rock outcroppings, locate leach fields appropriately in hillside terrain, and provide access for service vehicles as they accomplished the environmentally sensitive work.

The design team also replaced and optimized a number of parking lots and access roads in order to protect the giant trees. Of particular note was the removal of the 120-space lower grove parking area that surrounded a half-dozen giant sequoias in a loop. Also removed was an access road to the upper grove area that served to transport visitors.

New parking was consolidated at the park's south entrance, accommodating visitors while eliminating vehicle noise and congestion at one of the most popular areas of the park. As a result of the new parking, more than 1.5 acres of asphalt were removed from the lower grove and the soil matrix was reestablished, improving conditions for the giant sequoias.

The $200 million SR 520 West Approach Bridge North was built with seismic isolation bearings so the structure can carry traffic even after a major earthquake.

PHOTO PROVIDED BY WSDOT

Structural systems

National finalist: Gold award

HDR/Shannon & Wilson

Project: SR 520 West Approach Bridge North
Client: Washington State Department of Transportation

Built in the 1960s, the 1.2-mile state Route 520 West Approach Bridge North was vulnerable to catastrophic failure from earthquakes. With hollow-core columns, limited reinforcing steel and foundations buried in loose, non-competent soil, the structure was at constant risk from two active fault zones just six miles away.

Carrying more than 115,000 vehicles and operating near capacity for more than 13 hours a day, the bridge's narrow shoulders and lack of transit/HOV lanes meant that a single disabled vehicle could cause major backups.

In 2009 the Washington State Department of Transportation identified the SR 520 bridge as "essential," meaning it must be open to emergency traffic immediately after an earthquake and open to all traffic within days. Designing the bridge to accommodate this requirement meant the design team of HDR/Shannon & Wilson had to put into use a number of innovative systems.

The old bridge was a fixed structure, and the hollow columns supporting it were vulnerable to catastrophic failure during an earthquake. The new $200 million west approach bridge uses 108 isolation bearings and 95 solid columns, resulting in the state's most extensive use of seismic isolation bearings to date. This new system will enable the new SR 520 West Approach Bridge North to remain in service immediately following a 1,000-year earthquake.

With three sources of earthquakes in Western Washington, each generating different types of shaking, the design team used a new technique to develop shaking records.

Conditional mean spectra (CMS) is a tool that develops earthquake records with realistic shaking levels by considering the characteristics of individual earthquake sources, as well as bridge behavior when subjected to those earthquake types. The tool helped create a detailed, peer-reviewed test of computer bridge models, resulting in optimized design.

A first in the United States, the bridge uses Tensa-Modular expansion joints with noise-reducing sinus plates. The plates create smaller gaps in the roadway surface, allowing passing vehicles to maintain constant contact with the joints' surface and eliminating the noise caused by impact with the gap edges.

The project was a pilot test for the products, which also provide a smooth driving surface, minimize vibration and noise by up to 80 percent, and create a safer deck for motorcycles and bikers.

The west approach bridge north project also accommodates bicycle riders by adding a bike and pedestrian lane where none existed before, completing the 12-mile trail between Redmond and Montlake. The project is also designed to support light rail in the future.

The design team's embrace of the seismic isolation bearings and CMS resulted in a savings of more than $74 million.

The team was able to reduce the drilled shaft size and eliminate 39 drilled shafts and columns, shoring casing and crossbeams. By reducing the amount of concrete used in the improvement, 12.5 million pounds of carbon dioxide emissions were eliminated.

The 1.7-mile Alaskan Way Viaduct replacement tunnel runs more than 200 feet underground.

PHOTO PROVIDED BY WSDOT

Transportation

National finalist: Gold award

WSP

Project: Alaskan Way Viaduct Replacement Program
Client: Washington State Department of Transportation

After the Alaskan Way Viaduct opened in 1953, it became one of the main north-south highway corridors through Seattle. This elevated section of state Route 99 has been a fixture of the city's landscape, running more than two miles along the Elliott Bay waterfront and at times carrying more than 100,000 vehicles per day.

After the 2001 Nisqually earthquake shook the region and damaged the viaduct, the Washington State Department of Transportation began looking at options to repair or replace the elevated structure. Since then, WSP has served as general engineering consultant to WSDOT and has been involved in every aspect of the work from planning through construction of the viaduct's replacement: a double-deck, 57.5-foot-diameter tunnel running 1.7 miles at more than 200 feet under downtown Seattle. At the time of construction, it was the largest bored tunnel in the world.

The Alaskan Way Viaduct Replacement Program is one of the largest infrastructure projects built in the western United States and the largest multi-agency project ever undertaken in Washington state history. The draft environmental impact statement involved more than 75 replacement concepts and evaluated five different alternatives. Ultimately, the project comprised 30 individual construction projects, including six that can stand as major transportation projects on their own.

The project site itself was a huge challenge, requiring the project team to integrate a major piece of critical infrastructure in the built-up urban environment of a major metropolis with more than 150 years of development. The site was located directly in front of the Port of Seattle's largest shipping facility, BNSF Railway's largest switching yard in Seattle, and Washington State Ferries' busiest terminal.

The tunnel had to be constructed next to and under the existing viaduct, requiring extensive effort by the contractor to ensure the structure wasn't damaged by the tunneling. Below the surface, the team had to address unfavorable and unpredictable soil and geotechnical issues; coordinate massive utility relocations; and work around Seattle's "underground city," a network of spaces that were formerly at ground level when the city was first built in the mid-19th century.

Construction monitoring was used to check how the ground and surrounding structures were affected by the tunnel construction. Noise and vibration monitoring had been carried out during portal construction, and vibration monitoring was done along the entire alignment during tunneling to ensure no negative effects. An additional 158 buildings along the tunnel alignment, including historic buildings, were monitored for movement throughout construction. Ultimately, more than 4,000 monitoring devices were used in the program.

The completion of the Alaskan Way Viaduct Replacement Program realizes an almost 20-year effort to remove one of the largest transportation safety concerns in the Seattle metropolitan area and returns the waterfront to the city by opening up 9 acres of new public space.

NATIONAL SILVER AWARDS

STUDIES, RESEARCH AND CONSULTING

DAVID EVANS AND ASSOCIATES
Project: East Link (E335 segment), the Spring District
Client: Sound Transit

TRANSPORTATION

DAVID EVANS AND ASSOCIATES
Project: Tacoma trestle track and signal project
Client: Sound Transit/Mark Johnson

STUDIES, RESEARCH AND CONSULTING

HDR
Project: Wildfire transmission line risk assessment
Client: Public Utility District No. 1 of Chelan County

WATER RESOURCES

HDR
Project: Murray wet weather facility
Client: King County Wastewater Treatment Division

STRUCTURAL SYSTEMS

HDR
Project: Yesler Way Bridge reconstruction
Client: Seattle Department of Transportation

WATER RESOURCES

HDR
Project: Henderson CSO reduction
Client: Seattle Public Utilities

Successful fulfillment of client/owner needs

Best in state: Gold award

Cary Kopczynski & Co.

Project: Lincoln Square South
Client: Kemper Development Co.

The design team for Lincoln Square South, led by Cary Kopczynski & Co., incorporated a number of unique features into the downtown Bellevue mixed-use project. The design optimized floor space, made construction easier and quicker for the building contractor, and resulted in considerable savings for the owner, Kemper Development Co.

One of the most significant aspects of the project, which includes retail, parking, a hotel and residential space in two towers (a 31-story office tower and 41-story hotel and residential tower), is the use of steel fiber-reinforced concrete (SFRC) in the concrete shear wall coupling beams. This was the first major implementation of SFRC throughout a project as part of the lateral force resisting system in a region of high seismicity.

The addition of steel fibers to the concrete increased its tensile strength, significantly added to the coupling beam shear strength, and was used in part to resist flexural loads. This reduced coupling beam reinforcing bar quantities by nearly 40 percent and greatly improved the speed and constructability of the lateral system. Due to CKC's pioneering work, SFRC now provides structural engineers a valuable tool for improving the constructability of reinforced concrete buildings in high-seismic regions.

The project also included a long-span framing system for the office tower that eliminated internal columns within the leasable space. The long-span post-tensioning system in the garage reduced the subterranean floor-to-floor height, which minimized excavation and shoring depth.

The placement of concrete basement walls was delayed and taken off the critical path, enabling the frame of the towers and the podium to advance ahead. This allowed shrinking of the concrete decks to occur prior to final placement of the basement walls, producing concrete parking decks that are virtually crack free.

The specification of grade 80 and 90 reinforcing steel for concrete column ties also improved constructability and reduced cost. Additionally, column concrete for the lower levels of the project utilized 14,000 psi concrete to minimize column size. This provided more usable space within the garage and lower levels of the hotel tower. Further, the specification of ASTM A913 grade 65 structural steel for the office tower columns reduced the steel tonnage and fabrication costs.

By integrating mechanical/electrical/plumbing and fire protection penetrations within the structural steel framing of the office tower, these pre-planned penetrations provided space for mechanical systems to feed through the floor framing, allowing for owner-requested 9.5-foot ceiling heights within a 12.75-foot floor height. This framing concept ultimately resulted in an additional leasable floor within the zoning height limit of 450 feet.

Bellevue's Lincoln Square South development includes a 31-story office tower and 41-story hotel and residential tower.

PHOTO BY ED SOZINHO

Successful fulfillment of client/owner needs

Best in state: Gold award

Golder Associates

Project: I-90 Snoqualmie Pass snowshed replacement
Client: Washington State Department of Transportation/Jacobs

A half-mile stretch of Interstate 90 at Snoqualmie Pass required protection from the hillside, where falling rock was common and threatened the roadway.

Golder's analysis of the Washington State Department of Transportation's design of a snowshed replacement involving twin avalanche bridges resulted in changes to standard rock stabilization procedures. Golder challenged the state of practice and the project requirements by suggesting an approach that would create a safer passage for cars while reducing costs for the owner and accelerating the schedule.

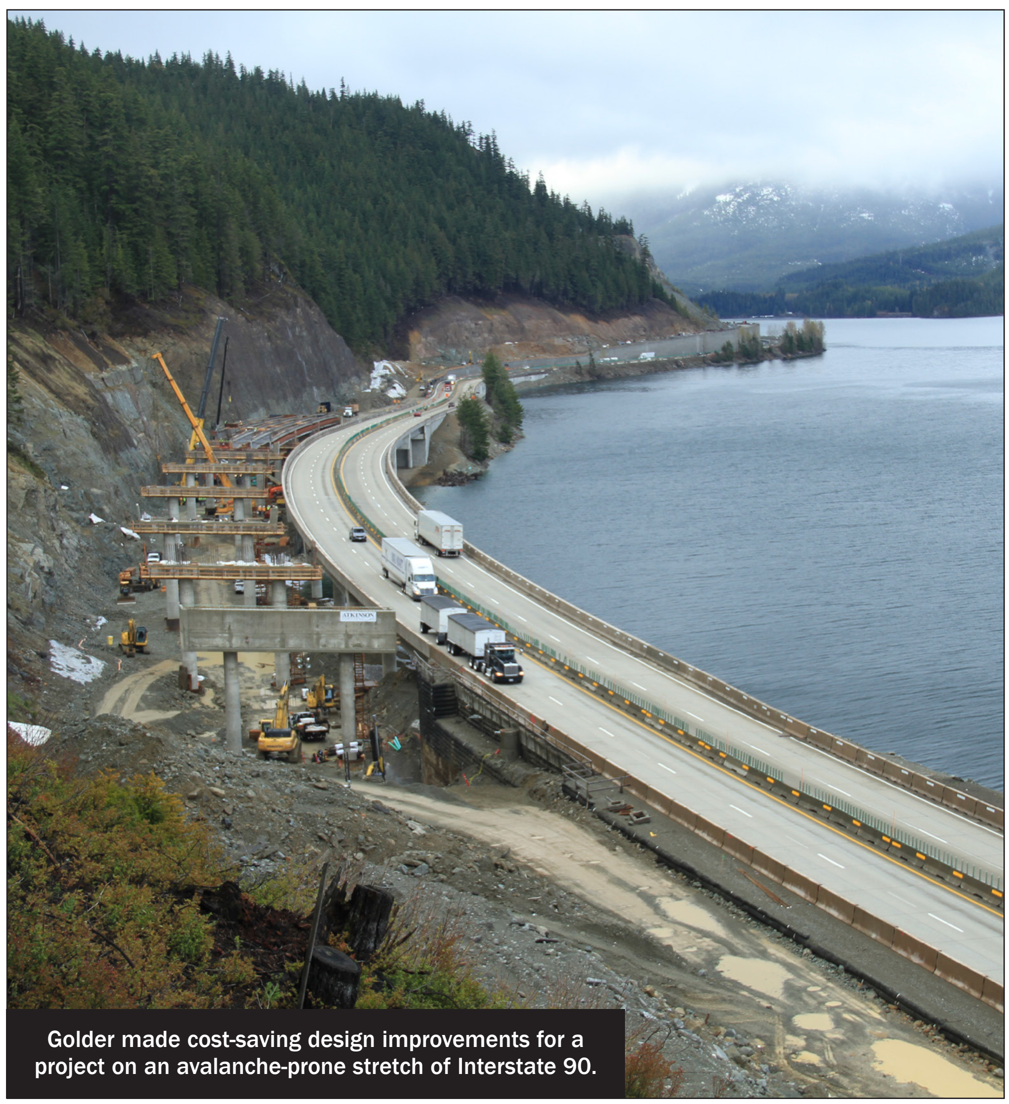
As the project's geotechnical consultant, Golder conducted a field investigation that confirmed unfavorable rock joint orientations at the site of construction that would make a safe stabilization very costly if the state of practice was implemented in the cut design.

The initial rock cut design indicated two inclinations: one at 76 degrees and the other at 50 degrees. With unfavorably oriented and weak rock joints, extensive rock reinforcement was initially required for the entire sector, even for the 50-degree cuts, to achieve the specified stability factors of safety under static and seismic loading. The extensive rock reinforcement requirements would have been very costly and caused construction delays.

Golder meticulously optimized the design, resulting in a cut inclination that differed from the state of practice. Its detailed stability analysis indicated that reducing the cut inclination from 76 to 65 degrees would significantly reduce the reinforcement requirements with only a slight increase in the volume of cut materials. Further interaction with the project team indicated that flattening the cut would also ease the construction operation. As such, Golder concluded that the state of practice using a 76-degree cut was not the appropriate approach for this project.

Furthermore, considering the unique site features and three-dimensional impacts of potentially unstable rock, Golder secured WSDOT's approval to refine the project performance criteria. Coupling the revised cut design with the refinement of performance criteria resulted in substantial reduction in stabilization reinforcement.

Golder's responsiveness to unforeseen rock conditions during construction was critical to the project's success.



Golder made cost-saving design improvements for a project on an avalanche-prone stretch of Interstate 90.

PHOTO PROVIDED BY ATKINSON CONSTRUCTION

Future value to engineering profession

Best in state: Gold award

Landau Associates

Project: Columbia Pulp mill
Client: Columbia Pulp

This Columbia County pulp mill turns waste straw into a tree-free paper replacement.

PHOTO PROVIDED BY COLUMBIA PULP

A new pilot plant and pulp mill in Columbia County introduces an entirely new, proprietary, low-chemical pulping process.

The mill, owned by Columbia Pulp, takes waste straw and generates a tree-free replacement for traditional paper and packaging products. The process uses less energy and water and produces fewer air emissions than wood pulp mills.

As the consultant team lead for environmental engineering and permitting, Landau Associates was able to enhance the facility's sustainable operations, shrink its environmental footprint and reduce operational costs.

The 449-acre project site is located on the south bank of the Snake River along state Route 261, two miles upstream from Lyons Ferry, in the heart of one of the densest wheat farming regions in North America. The plant introduces many components, including a pulp processing building, a carbohydrate concentration building, a pulp storage warehouse, a process/firewater tank, several ancillary structures and two new substations.

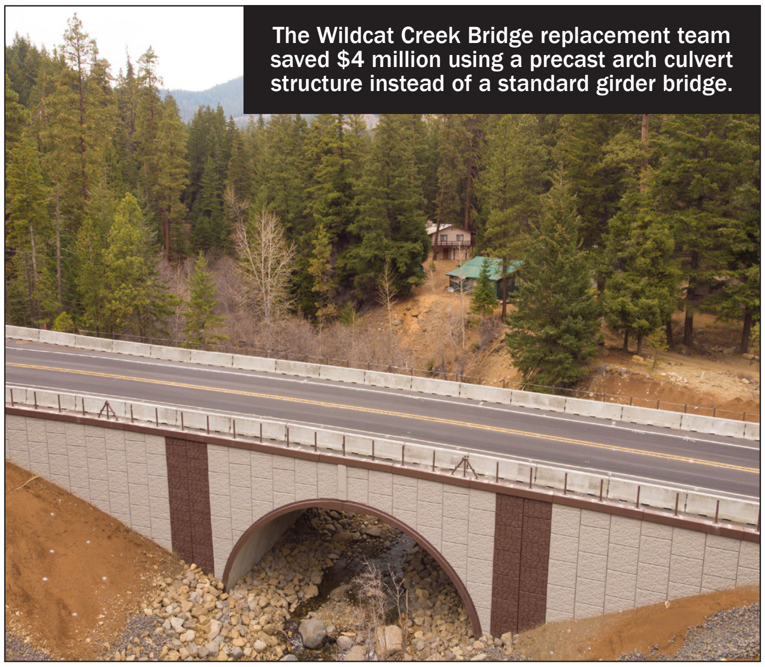
Landau was challenged with securing environmental permits for a facility with no industrial-scale precedent — a job that required careful characterization of the facility's processes and collaboration with regulatory agencies to ensure the facility's engineering controls would meet regulatory requirements.

The most common wastewater treatment methods in the pulp and paper industry are aerated ponds and activated sludge systems, which produce effluent wastewater containing pollutants. Landau introduced a process engineering design change that incorporated the use of a multiple-effect evaporation process that allowed the plant to be a zero-liquid-discharge facility with no pollutant loading to local surface water bodies.

In addition to eliminating the discharge of 600,000 gallons per day of wastewater, the design change allowed reduced use of fresh water and expedited facility permitting by avoiding the need for National Pollutant Discharge Elimination System wastewater discharge permitting.

To prove to the state Department of Ecology that the new mill would produce far fewer emissions than its pulp mill counterpart, Landau partnered with Columbia Pulp to complete an evaluation to estimate emissions from the facility, document air quality impacts to the surrounding community, and ensure the facility was designed to meet Ecology's best available control technology requirements.

The evaluation, which was approved by Ecology, demonstrated that Columbia Pulp's new manufacturing process will have the potential to emit 99 percent fewer criteria air pollutants than other traditional pulp and paper facilities.



The Wildcat Creek Bridge replacement team saved $4 million using a precast arch culvert structure instead of a standard girder bridge.

PHOTO BY JEFFREY FONG PHOTOGRAPHY

Unique or innovative applications

Best in state: Gold award

Stantec Consulting Services

Project: U.S. 12 Wildcat Creek Bridge replacement
Client: Graham Contracting/Washington State Department of Transportation

After more than 80 years of service, the 150-foot long Wildcat Creek Bridge on U.S. Highway 12 in Yakima County was showing its age.

The Washington State Department of Transportation's preliminary design called for construction of a temporary bridge and a construction schedule of four to five months. The Graham/Stantec design-build team instead used an innovative design approach that centered around a 54-foot precast arch culvert structure rather than WSDOT's standard girder bridge. This allowed the team to replace the span in just 17 days and shave one-third off the cost.

Constructed offsite and trucked in, this pre-built solution eliminated the need for custom forms and additional cast-in-place elements including foundations, retaining walls and traffic barriers — all of which require weeks for concrete to cure on site.

With the precast culvert, the curing time occurred at the fabricator's plant before construction began. This allowed demolition of the bridge and installation of the arch structure in a fraction of the time originally assumed. Additionally, the buried culvert maintains passage for fish and wildlife in this remote location.

The Graham/Stantec solution saved WSDOT $4 million.

While the immediate economic benefits of eliminating the detour bridge and shortening construction time are obvious, the decision to embrace the precast culvert design offers long-term economic advantages as well.

Arch structures are far more stable than traditional girder bridges, providing longevity with low life-cycle costs. The structure eliminates the need for expansion joints and costly associated maintenance.

It also eliminates the maintenance of exposed bridge decks and bridge deck de-icing due to the continuity of the pavement-over-arch structure. In addition, off-site fabrication allows for better quality control and tighter adherence to specifications.

Although the design required complete closure of U.S. 12, WSDOT and stakeholders gladly traded months of construction impacts for this brief closure. To determine just how long the road would need to be closed, the team built a highly detailed, hour-by-hour schedule that penciled out to 17 days of round-the-clock construction.

This 17-day window cut inconvenience to the traveling public and residents by 80 percent and eliminated the safety concerns and expense associated with managing live traffic adjacent to the project. To further minimize disruption, Stantec worked with Yakima County officials and other stakeholders to develop a detour based on a route that was successfully used on a WSDOT project during the summer of 2017 and familiar to the public.

The new arch structure adds stability, maintains natural hydrology and fish habitat, and complements local and regional aesthetics. Wildcat Creek Bridge opened to traffic four hours ahead of schedule and well before the first snowfall, restoring a reliable winter route across the Cascades.

Complexity

Best in state: Gold award

Reid Middleton

Project: Naval Medical Center San Diego seismic upgrades
Client: Vasquez Marshall Architects/U.S. Navy

Reid Middleton provided a comprehensive seismic analysis for the Naval Medical Center San Diego, ensuring the U.S. Navy's facility — which sees more than 1.2 million patients every year and employs a staff of more than 6,600 — would be able to improve its reliability and operational capabilities in the event of an earthquake.

The evaluation used 3-D nonlinear dynamic analyses simulations to determine that a design-level earthquake could compromise the operational performance of the hospital. To counteract this, fluid viscous seismic dampers were installed at strategic locations throughout the facility to reduce building drifts and improve the seismic performance of the special steel moment-resisting frames' (SMRF) connections. Work was performed while the hospital was operating normally.

In total, 242 dampers were installed in 131 SMRF bays to protect more than 850 moment frame connections throughout the hospital.

Phased installation of the dampers was choreographed with at least eight other ongoing hospital construction projects to ensure that spaces were accessed only once during construction. This minimized construction disruptions and maximized construction efficiency, resulting in substantially reduced seismic upgrade costs.

Due to construction phasing requirements, not all dampers could be installed in the same area at the same time, which presented a risk of asymmetrical seismic damping and loading if an earthquake struck during the multi-year construction duration.

To address this sequencing challenge, the world's first-ever hollow activation pin design feature was developed and used. Once the dampers were installed, a specially designed 3-inch-diameter, high-strength stainless steel hollow pin was installed in the lower end of the seismic damper.

Small access and inspection hatches were installed in the architecturally finished walls at the location of these hollow activation pins. These hollow pins were designed to transfer overall building wind forces imposed on the dampers, but to shear off with very large seismic forces, reducing the asymmetrical influence of the partially installed dampers on the building structure.

Once all the dampers were installed within a seismically separated building block, a solid high-strength inner activation pin was slid inside the hollow pin to activate the installed seismic dampers.

This unique damper activation system was instrumental in allowing a tremendous amount of flexibility for installation sequencing and construction phasing. The "activation pin" design approach provided substantial project installation savings and allowed the hospital to remain fully functional during construction. It also allowed the seismic upgrades to be completed seven months ahead of the planned construction schedule.

Engineer of the Year

John D. Hooper

Magnusson Klemencic Associates

John D. Hooper is director of earthquake engineering at Magnusson Klemencic Associates, where he has worked on more than 100 projects and has led the earthquake engineering efforts for every MKA project in a seismic zone over the last two decades.

During that time, those projects have been recognized with more than a dozen national ACEC Engineering Excellence Awards, including this year's platinum award-winning Salesforce Tower in San Francisco. Other notable projects include Seattle's CenturyLink Field, which incorporates first-of-its kind seismically isolated roof sections over the seating area; and Levi's Stadium in Santa Clara, California, which uses a system with the world's largest buckling-restrained braces. Hooper has also provided earthquake engineering leadership on projects at Harborview Medical Center, Virginia Mason Medical Center, Marion Oliver McCaw Hall, and Amazon blocks 14, 18, 19 and 20.

In addition to his project awards, Hooper has been awarded six national and regional individual recognitions, including the Structural Engineering Institute's Walter P. Moore Jr. Award in 2016 and the Professional Engineer of the Year award from the Washington Society of Professional Engineers in 2008. He was elected a fellow of both the Structural Engineering Institute and the American Society of Civil Engineers in 2014. His technical excellence is in great demand by others in the profession, proven by his 12 years as chair of the ASCE 7 Seismic Subcommittee, an influential group that charts the future of seismic design in the United States.

Jonathan C. Siu, principal engineer/building official with Seattle's Department of Construction & Inspections, has served on many industry committees with Hooper.

"His knowledge on seismic issues is encyclopedic," Siu says, "and he's very willing to share it with anyone who asks, without condescension."

Despite Hooper's heavy load of project and professional work, he still finds time to teach and mentor. Hooper has delivered more than 125 engineering presentations to professional organizations, university programs and lay audiences, and has written more than 50 technical papers. He has participated in more than 50 conferences, seminars and workshops, and has given more than 30 media interviews related mainly to the seismic hazards and seismic performance of buildings. He has also participated in documentaries for the BBC and National Geographic.

"He is a respected colleague, seasoned leader, trusted business partner, and a down-right good person," says Ron Klemencic, chairman and CEO of MKA.

Hooper was born in Washington state and earned his bachelor's in civil engineering from Seattle University. He later earned a master's in civil engineering from the University of California, Berkeley. He was the technical director at Seattle firm Ratti/Fossatti Associates for 10 years before accepting in 1997 a position at MKA (then Skilling Ward Magnusson Barkshire). In 2001, he accepted an offer to become one of the owners of MKA.

Hooper has been a respected mentor to many, including Jared Plank, currently an associate at PCS Structural Solutions. Plank appreciated Hooper's guidance when Plank was a young engineer starting out at MKA.

"He was always available to answer technical questions and gave great direction and guidance on the practical and theoretical," Plank recalls. "John's knowledge of the code and origin of current practice was and continues to be invaluable."

Even after Plank left MKA, Hooper continued to be of assistance.

"While I was president of the Indiana Structural Engineers Association, John was nice enough to do me a favor and come to present the new ASCE 7 code changes to the group," Plank says. "He did this for no speaking fee."

Over the years, Hooper has volunteered countless hours as a youth soccer and basketball coach. He was a member of the Everett Public Schools Foundation from 1997 to 2005 and has been a member/chair of the Seattle University College of Science and Engineering Leadership Council since 2014. He has also been a member of Seattle U's Center for Science and Innovation Task Force board of directors for the past two years.

Hooper and his wife of 37 years, Lisa, live in Everett. They are parents to four children and have one grandchild.

The American Council of Engineering Companies of Washington has selected an Engineer of the Year every year since 1959.

BEST IN STATE

SILVER AWARDS

SUCCESSFUL FULFILLMENT OF CLIENT/OWNER NEEDS

GEOENGINEERS
Project: Point Defiance Waterfront Phase 1 redevelopment
Client: Metro Parks Tacoma

UNIQUE OR INNOVATIVE APPLICATIONS

GEOENGINEERS
Project: Hoa Mai Gardens and hillclimb at Yesler Terrace
Client: Seattle Housing Authority

WOOD HARBINGER
Project: Isla Grande Terminal upgrades
Client: Crowley Puerto Rico Services

FUTURE VALUE TO THE ENGINEERING PROFESSION

GOLDER ASSOCIATES
Project: Blackbird Mine instream stabilization project
Client: Blackbird Mine Group

COMPLEXITY

HART CROWSER
Project: Port of Tacoma Pier 4 reconfiguration
Client: Port of Tacoma/KPFF Consulting Engineers

STANTEC
Project: PRMCE Colby A-Wing switchboard replacement
Client: Providence Heath & Services

SOCIAL, ECONOMIC AND SUSTAINABLE DESIGN

OTAK
Project: Main Avenue and Downtown Commons improvements
Client: City of Twin Falls/Twin Falls Urban Renewal Agency

BRONZE AWARDS

SUCCESSFUL FULFILLMENT OF CLIENT/OWNER NEEDS

BHC CONSULTANTS
Project: North City/Denny Clouse Pump Station
Client: North City Water District

OTAK
Project: Smith Island estuary restoration
Client: Snohomish County

SOCIAL, ECONOMIC AND SUSTAINABLE DESIGN

OTAK
Project: Yellowstone National Park Inspiration Point
Client: Yellowstone Forever/National Park Service

FUTURE VALUE TO ENGINEERING PROFESSION

RH2 ENGINEERING
Project: ShakeAlert pilot program implementation
Client: Northeast Sammamish Sewer and Water District

COMPLEXITY

STANTEC CONSULTING
Project: Lift Station No. 46 regional conveyance system
Client: Soos Creek Water & Sewer District

UNIQUE OR INNOVATIVE APPLICATION

WHPACIFIC
Project: Interstate 5 Emerald Queen Casino roundabout
Client: Puyallup Tribe of Indians

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