ASCE Seattle Section Local Outstanding Civil Engineering Achievement (LOCEA) Projects 2018

Outstanding Structures Project:

Flexible Bridge - SR 99 Alaskan Way Viaduct Replacement South Access - NB Off Ramp

Location: Seattle

Project Team: Washington Department of Transportation (WSDOT), University of Nevada – Reno, Interwest Construction Inc.

Shape Memory Alloy (SMA) and Engineered Cementitious Composite (ECC) have been incorporated into the bridge in this project. SMA and ECC are used in the plastic hinge region of columns to replace conventional steel reinforcement and concrete.

The current design philosophy for bridges experiencing strong seismic ground motions is to have a low probability of collapse. Such bridges may suffer significant damage, including concrete cracking and spalling, and steel reinforcement yielding. This damage may require closure for column repair or bridge replacement, leaving the structure unusable.

SMA is a superelastic nickle-titanium alloy that replaces the steel reinforcement in the plastic hinge region of each column. Like steel, SMA undergoes elastic and inelastic deformation when forces are applied to the material to dissipate energy. Unlike steel, SMA will return to its undeformed shape after the force has been removed. ECC replaces concrete in the plastic hinge region to eliminate the cracking and spalling that conventional concrete would incur.

Incorporating SMA and ECC into bridge columns has been tested thoroughly by the University of Nevada-Reno, in their structural testing laboratory. Scale testing of full bridges on their shake tables has simulated real earthquakes to examine the materials behavior under expected conditions.

Outstanding Water Resources Project - Drinking Water Treatment and Distribution Systems:

North City / Denny Clouse Pump Station

Location: Shoreline

Project Team: North City Water District, BHC Consultants, Follett Engineering, Rolluda Architects, FSi, Van De Vanter Group, Greenbusch

The North City/Denny Clouse Pump Station (NCDCPS) serves three water system pressure zones within the North City Water District. The station is the largest and most complex District facility and meets 16 Functional Objectives for three pressure zones by providing:

- Domestic and fire flows to the closed 615 Zone
- Improved reliability and pressure relief for the 615, 590, and 502 Zones
- Access to 1 million gallons of dead storage
- Seismic valve to preserve water for emergency supply
- Emergency supply tap for public access and distribution during a disaster
- Water circulation in the reservoir and associated improvement in water quality

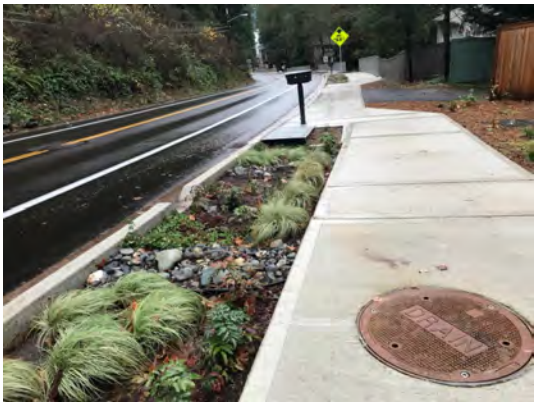
The station includes: low flow pumps to meet average day demands; medium flow pumps to meet peak day demands; high flow pumps to meet peak domestic and fire flow demands; water quality monitoring equipment; pressure relief valves to alleviate high system pressures; pressure reducing valves to allow upper zones to provide water to lower zones; two bladder-type surge tanks to mitigate pressure variations in the 615 and 502 pressure zones; SCADA and telemetry monitoring; an office to manage and control system operation; and, an onsite generator to power the station during power outages.

Outstanding Water Resources Project - Surface Stormwater Treatment and Conveyance:

NE Inglewood Hill Rd Stormwater Retrofit and Non-Motorized Improvement Project

Location: Sammamish

Project Team: City of Sammamish, Osborn Consulting, Inc., The Watershed Company, Aspect Consulting, Perteet, Inc.



Over 5500 linear feet of new stormwater conveyance and water quality treatment of approximately 3.3 acres of existing pollution generating roadways was recently constructed in the Inglewood neighborhood to resolve the existing drainage problems and complete the missing link in multi-modal corridor improvements connecting downtown Sammamish to Lake Sammamish.

Osborn Consulting led the design of the bike lane, sidewalk, and stormwater retrofit. Conveyance improvements included a new stormwater trunkline to convey public and private runoff safely through slope stability hazard areas to existing ditches at the bottom of the hill, allowing for redevelopment to resume. Water quality retrofit was achieved via a large sand filter vault, seven modular wetland units, and 6,000 SF of raingarden planter strips.

The project redefined the street section and provided six-foot bike lanes and sidewalks along the north side of the steep and winding roadway. Raingarden planter strips enhance aesthetics and safety for the corridor. Five different ramp types were designed for 13 ADA compliant sidewalk curb ramps to the maximum extent feasible with the steep roadway grades.

Careful planning, cost benefit analysis, and efficient design set the stage for this project to be constructed within its planning level budget with more amenities than originally intended.

Outstanding Small Project - Coastal/Ports and Waterways - Structural Condition Assessment

Puget Sound Atlantic Salmon Net Pen Engineering Assessment

Location: Port Angeles, Cypress Island, Rich Passage, Hope Island

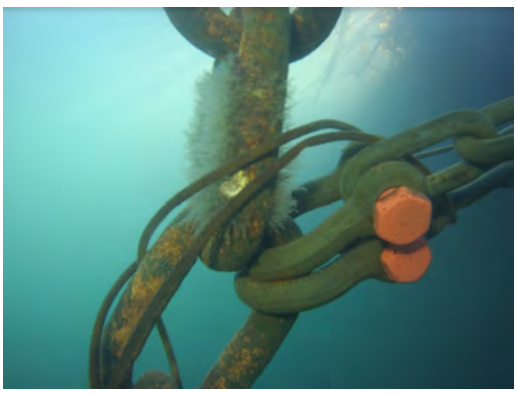
Project Team: Washington State Department of Natural Resources, Mott MacDonald, LLC, Collins Engineers

The failure of an Atlantic Salmon net pen near Cypress Island has led to questions about the condition of the other net pens in Puget Sound. Mott MacDonald and Collins Engineers performed an inspection and engineering assessment of eight net pens at four locations in Puget Sound for the Washington State Department of Natural Resources. The work involved divers, ROV inspections and site observations, all performed on an accelerated schedule in difficult winter conditions in deep water. The attached figure shows locations within the Salish Sea.

After completing the site visits, a review was initiated with these elements:

- Permit applicant documentation
- Site assessment with above water and below water dive inspection.
- Applicant inspection type and frequency.
- Maintenance and repair history.
- Facility design documentation and lease requirements.
- Industry standards for design, operations, maintenance, and best management practices.
- Documentation of inspection observations and results. Identification of any major defects or faults.
- Rated structural elements (Good to Critical) and Damage assessment rating (Minor to Severe).

Mott MacDonald documented the condition assessment findings and recommendations for each facility in a technical report. The work was delivered on time with good quality and safety maintained. All eight reports are available for download at www.dnr.wa.gov/atlanticsalmon.

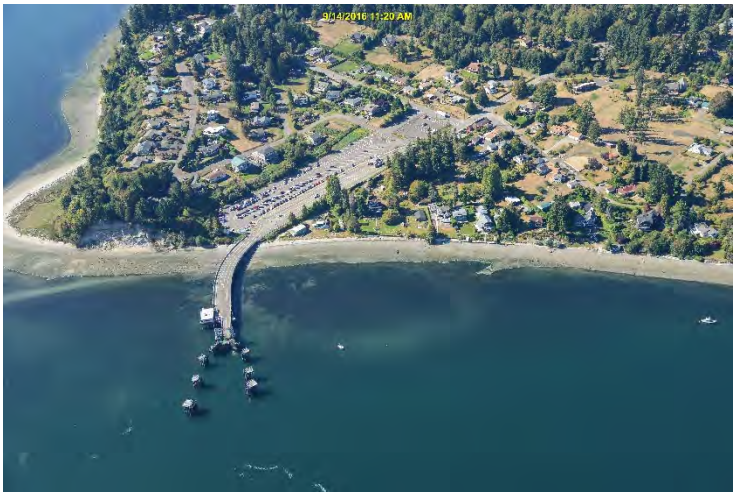


Outstanding Small Project - Coastal/Ports and Waterways - Seismic Design Forces

Southworth Ferry Terminal Trestle Replacement Project: Tsunami Design Forces

Location: Southworth, WA

Project Team: Washington State Ferries, Mott MacDonald



This Tsunami Design Forces Study, supporting the Southworth Terminal Building and Trestle Replacement Project, developed design tsunami loads for the proposed Southworth Ferry Terminal Structure. The terminal structure was designated as a Tsunami Risk Category III structure, and is important to the resiliency of the regional transportation system. Therefore, guidance from the new ASCE 7-16 Chapter 6 “Tsunami Loads and Effects” was interpreted and applied for the nearshore structure.

ASCE 7-16 Chapter 6 appears to be intended for use at buildings and structures located inland of the high-water line, where application of the Energy Grade Line (EGL) methodology is appropriate, however, this project required interpretation of the guidelines for application towards structures located offshore of the high-water line. Offshore structures are not necessarily subject to overland flow assumptions. This study developed a methodology that meets the intent of Chapter 6, but that is tailored for ferry terminal structures which extend past the high-water line. The application and methodology outlined within this study, which is specifically intended for ferry terminals located near and outside the high-water line, will enable Washington State Ferries (WSF) to apply ASCE guidance to multiple sites with greater confidence and efficiency as terminals and trestles are replaced.

Snapshot from ASCE Tsunami Design Geodatabase. Blue dots indicate offshore tsunami amplitude data points, orange dots indicate runup elevation data points.