

# AWARD WINNING PROJECTS

*The NE 90th Street Bridge was presented a Merit Award (Bridge Projects) in the NCSEA Fifth Annual Excellence in Structural Engineering Awards.*

## NE 90th Street Bridge

### *Award Winning Gateway to Redmond, WA*

*America's national character is defined by smaller communities, each with their own distinct culture and history. The test of success for public works projects is often in the engineering—the ability of engineers to meet the community's needs by combining form with function. In the case of the NE 90th Street Bridge, it has been successfully demonstrated that engineering is art, and that there can be a true integration of architecture and engineering. The City of Redmond is delighted that the NE 90th Street Bridge gives their community an artistic sense of pride and character.*



The new crossing over the Sammamish River, at NE 90th Street in Redmond, WA, acts as a gateway to the City's downtown core. More than just the construction of a bridge to create a river crossing, the City insisted that this project be a showcase for how Public Works can develop a project that creates a sense of place, promotes a sense of pride in the community, and provides a multi-use facility connecting the commercial and light industrial areas on the west side of the river with the high-density residential areas on the east side.

Innovation was key to the success of the NE 90th Street Bridge Project. Precise three-dimensional computer renderings were created to solve numerous complex geometric issues, including the integration of the leaning arches with the vertically curved box girder and to assist in the construction of the arch forms. Advanced three-dimensional modeling was also used for the structural analysis of the bridge, including shear flexible grillage analysis and three-dimensional solid finite element analysis. Lastly, three-dimensional modeling was used to create isometric construction details of reinforcing steel placement at key locations of the arches.

#### **Project Participants:**

**Structural Engineer of Record:** *Entranco, Inc.*, Bellevue, WA

**Structural Consulting:** *John Clark, Ph.D., P.E.*, Wenatchee, WA

**Owner:** City of Redmond, WA

**Architect of Record:** *LMN Architects*, Seattle, WA

**Prime Contractor:** *Guy F. Atkinson Construction*, Renton, WA

*Entranco, Inc., Bellevue, WA, led a multidisciplinary team through the planning, design, and construction phases of the NE 90th Street Bridge Project. In addition to the overall project management, Entranco provided the structural, utility, and roadway design for this project, as well as the environmental documentation and permitting and structural inspection of the bridge and general construction assistance during the construction phase of the project.*

Some of the unusual structural components of the project include:

- This is the first arch bridge in Washington constructed where the arches are out of vertical plane. The shallow concrete arches lean 30-degrees from vertical.
- The arch supports were strategically placed at the outside edges of the nearly 60-foot wide box girder. Placing the supports at the outside edges of the box girder increased the span of the structure between them.
- The entire bridge was constructed without post-tensioning, saving on cost and complexity.
- For this project, engineers specified 8,000-psi concrete. This high strength concrete enabled the bridge to meet the architectural concept without creating deflection problems, and without increasing member sizes and weights
- Variable width, truss-supported sidewalks were constructed to cantilever off the sides of the bridge.
- The vertical curvature of the bridge and roadway was minimized by integrating the arches with the box girder.
- Special artist-designed concrete forms were used during the construction of the bridge abutments and wing walls, creating wildlife scenes cast onto both. A stainless steel ribbon is also cast into the walls, indicating the water surface for the images of fish, birds, and otters.
- Special architectural lighting over the bridge was designed in an arch shape. Extra emphasis was placed on illuminating the unique aspects of this bridge, e.g., highlighting the natural art located in the walls, and back-lighting on the arches to emphasize the slant and design of the canted arches.

*"Entranco was committed to the project. They believed in its importance, they were invested in its success, and they understood our vision."*

Dennis Brunelle, Project Manager

City of Redmond, Public Works Department