PROJECT BACKGROUND

OWNER: State of Alaska Department of Transportation and Public Facilities (DOT&PF)
PROJECT TITLE: KTN. N. Tongass Bridge Improvements – Waterfall Creeks
BRIDGE ENGINEER OF RECORD: DOT&PF Bridge Section, Juneau
ROADWAY ENGINEER OF RECORD: PND Engineers, Inc., Anchorage
CONSTRUCTION MANAGEMENT: DOT&PF and HDL Engineering Consultants, LLC
CONTRACTOR: Orion Marine Contractors, Inc.
CONTRACT AWARD DATE: October 3, 2018
AWARD AMOUNT: $8,323,060
PROJECT COMPLETE AND ALL LANES OPEN TO THE PUBLIC: August 29, 2020

This project replaced two bridges, First and Second Waterfall Creeks (Bridge Numbers 414 and 415), on the North Tongass Highway in Ketchikan. The project involved challenging site conditions: two deep ravines constrained by exposed rock faces, overhead utilities, and narrow right-of-way. There are no alternate routes so detour bridges were required to maintain traffic. Additionally, the COVID pandemic escalated midway through construction, adding another complication to the construction challenges.

Completed First Waterfall Creek Bridge

Completed Second Waterfall Creek Bridge

INNOVATION

Describe how the project demonstrated the use of innovation in materials, technology or construction methods.

The project is the perfect example of how to overcome uncertainty and risk by proper planning and communication. The project had originally been scoped to use roller compacted concrete (RCC) arches, but a value engineering study determined that conventional bridges were less expensive and more practical. The final design proceeded with bridges; however, the geotechnical exploration had been done assuming RCC arches. Plenty of boring logs were available, but none were close enough to one of the First Waterfall Creek Bridge footings. At this location the bedrock appeared to drop off rapidly and the exact elevation of bedrock was unknown. Due to the time and cost of bringing drilling equipment to Ketchikan, the decision was made to mitigate the uncertainty during construction. The contractor would be paid to expose and survey bedrock followed by a 2-week “pause” for the engineers to determine if any adjustments in the footing would be needed. This avoided any claims of “differing site conditions” and allowed the contractor to plan ahead for completing other tasks during the “pause”.

The construction project engineer understood the importance of gathering the needed information within a tight timeframe, so arranged for the bridge engineer, geotechnical engineer, and geologist to be onsite as soon as the bedrock was exposed. Based on the field visit findings, confirmed a few days later by rock analysis, it was decided to move the entire bridge 5 feet to the north. Within a few more days, calculations were checked, revised drawings were issued, and construction could continue. The shift also had the added benefit of optimizing the work space for the contractor. The process ran smoothly, with no delay-related claims, because the contract was written to address uncertainties and the construction management staff were well prepared.

Another innovative approach employed during construction was use of a traffic signal system and traffic speed reduction for the work zone. These approaches were added to the contract, reducing the need for flaggers and allowing the contractor to focus on construction.

BENEFIT TO COMMUNITY

Describe how the project contributed to the well-being of people and communities

The old First and Second Waterfall Creek Bridges were built in the early 1960s by the US Department of Commerce Bureau of Public Roads. The bridges were constructed with timber girders and a timber deck with an asphalt tile wearing surface. Considering the harsh Southeast Alaska climate 60 years is a reasonable life for timber structures, but the bridges were in need of replacement. The roadway over downstream exterior girder at First Waterfall Creek had to be closed to traffic due to excessive cracking and deterioration. The deck of First Waterfall Creek had numerous repairs and worn asphalt tiles. Both existing bridges were load limited such that Ketchikan fire trucks could not cross the bridges when full of water and some fuel delivery trucks were prohibited from crossing the bridges. DOT&PF's large snow plows were also too heavy for the existing structures. These limitations had direct impacts to the safety and well-being of the local residents. The new bridges allow all legal loads with no restrictions to again cross the bridges.

The Old First Waterfall Creek Bridge with Closed Shoulder and Deck Repairs

In addition to building new bridges with a 75-year design life, the replacement bridges are 12 feet wider than the old ones. The wider shoulders and pedestrian-height bridge railings give local residents a comfortable and safe space to walk across the bridge enjoying the views.

PROJECT MANAGEMENT

Describe how the administration of the project demonstrated resourcefulness in planning and overcame scheduling challenges.

Due to the load postings of the bridges, DOT&PF was interested in accelerating design and construction schedules as much as possible. However, the close proximity of an access driveway and adjacent property owners meant the right-of-way process could not be rushed or circumvented. Since the project could not be bid sooner, a requirement was added to the contract requiring a temporary bridge to be installed at First Waterfall Creek as soon as possible. Payment for mobilization was tied to opening of the temporary bridge and an interim completion date item was added to the contract. Both incentives and disincentives were used to ensure this part of the project would be completed quickly.

Construction of First Waterfall Creek Bridge with Tight Constraints

VALUE ENGINEERING

Describe how the design team met the functional requirements of the project in a cost-effective manner.

The first significant cost savings exercise came in the design phase of the project when the RCC option was value engineered. As previously mentioned, the design was switched from RCC arches to conventional bridges, resulting in an estimated cost savings of $700,000.

DOT&PF practice for all bridge designs is to select that most cost effective bridge type that meets the project needs. Various materials and design types are always considered to ensure that the least cost option, both for initial construction and during the lifecycle of the bridge, is selected. For this project location, the deep ravines did not lend themselves to multiple span bridges supported by piers. Thus, the longest and deepest concrete decked bulb-tee girder section was used to create single-span bridges.

The use of accelerated bridge construction (ABC) methods is typical for DOT&PF due to the short construction season in Alaska. An example of an ABC element used on this project was the precast, prestressed decked bulb-tee girders. They are made off-site in controlled temperature and climate conditions, offering superior quality. These precast units can also be installed quickly because the girder

and bridge deck are an integral unit. To further standardize production, both bridges used exactly the same size and length girders. While Second Waterfall Creek could have had a slightly shorter span length, by using the same girders for both bridges the fabricator could speed girder production and the girders would be interchangeable to ease assembly.

Another contracting technique to identify unusual circumstances was the creation of a separate bid item for the First Waterfall Creek footing concrete. The separate bid item allowed the contractor to separate the cost of a higher risk item from the rest of the concrete work on the project. Field changes during construction can be expensive, causing delays and escalating problems. By allowing a mechanism in the contract to evaluate and refine the design during construction, if needed, DOT&PF could control costs and help the contractor keep on schedule.

Overall, this project was well planned and executed. It anticipated typical and unusual problems, as well as providing a valuable project for the community.

Elevation View of the Completed First Waterfall Creek Bridge