

Executive Summary

1. Introduction

Bridge #339 located at milepost 36 on the Copper River Highway near Cordova, Alaska has structurally failed and has been closed indefinitely since August 2011.

Shortly after the closure the Alaska Department of Transportation & Public Facilities (Department) began working on a bridge replacement design. During design, site-specific construction challenges were identified that introduce unacceptable risks (costs) to the bridge replacement project.

The Department, assisted by a specialized Bridge/Engineer/Construction consultant (The National Constructor's Group) has developed a Constructability Analysis Report to define bridge alternatives, construction challenges and costs.

Based on this report the Department's recommended design (Option #2) is a box girder bridge on pipe pile extension piers. The current construction estimate for this bridge is \$50,700,000.

2. Background

The 50 mile long Copper River Highway begins in Cordova and ends at the Million Dollar Bridge. The first 13 miles are paved. During the winter the road beyond milepost 16 is not maintained and is closed to vehicle traffic (typically November thru mid April). The 2010 summer Average Daily Traffic Volume (ADT) at Bridge 339 was 65.

The Copper River flows through a 9-mile wide delta which discharges under 11 bridges on the Copper River Highway. This complex flood plain consists of highly erodible material. Multiple braided river channels continually scour, fill and move from one location to another, resulting in a constant migration of the river across the flood plain.

The natural migration of the river has led to a dramatic increase in the volume of water flowing under Bridge 339. Because the bridge was not designed to accommodate the increased flow, the bridge opening became a constriction, increasing the velocity of water flowing under the bridge. The higher velocities increased scour beneath the bridge, developing a scour hole that approached the bottom of the bridge foundation. As a result, the bridge foundation failed due to loss of lateral and vertical support.

Since the bridge was closed in August of 2011, the river has continued to migrate east, washing out an additional 1,000 feet of the Copper River Highway. Erosion is now threatening Bridge No. 340 located 1,100 feet east of Bridge No. 339.

3. Construction Challenges

The existing site has many complex challenges to overcome during construction:

- a. The Copper River is very dynamic, powerful and difficult to predict. The main river channel is deep, has high velocities and is continually shifting.
- b. Winter construction is not feasible. The Copper River Delta commonly experiences extreme winter weather with snow drifts approaching 40 feet in height and sustained winds nearing 100 mph that can last for weeks. It is unfeasible if not impossible to keep the road open during the winter due to the extreme weather conditions.
- c. Only the west (Cordova) side of the river is accessible. There is no practical way to get construction equipment or materials to the east side of the river.

4. Bridge Options

Option #1

Decked Bulb-Tee Girders on Drilled Shaft Piers.

Estimated construction cost: \$66,250,000

This option would construct a 10–span bridge using decked bulb-tee girders. Each span would be 140-feet long and would be founded upon single 8-ft diameter drilled shafts. The drilled shafts are estimated to be approximately 170 feet in depth and would support hammer-head style pier caps. Sixty decked bulb-tee girders would be required, each with a depth of 5.5 feet.

This option requires a 1,400-foot temporary construction trestle located downstream of the proposed bridge. In addition to the trestle itself, reusable oscillator and oscillator crane platforms are needed to support the drilled shaft equipment. The work trestle would be erected using a “span-by-span” construction technique which limits the span length to about 47 feet. Once the new bridge is completed, the temporary work trestle and oscillator platforms would be removed.

Option #2

Box Girders on Pipe Pile Extension Piers.

Estimated construction cost: \$50,700,000

This option would construct a 14-span bridge using box girders. Each span would be 100-feet long and would be founded upon two 4-ft diameter driven pipe piles at each pier. The driven pile piles are estimated to be approximately 150 feet in depth and would support a precast concrete pile cap beam. A total of 140 precast, pre-stressed concrete box girders would be required, each with a width of 3.5 feet and a depth of 5.0 feet.

This bridge option is designed to account for construction equipment loading and critical handling at the Port of Cordova. The construction approach consists of an “over-the-top” construction access trestle that is recycled four times over the duration of the project while utilizing the complete bridge in each cycle as the access roadway.

5. Recommendations

This Constructability Analysis Report reviewed the failure mechanism of Bridge No. 339, evaluated current conditions at the site, explored constructability challenges presented by the site, and evaluated bridge types most compatible with site conditions. Based on the results of this analysis, we believe the bridge type most appropriate for this site would be a box girder bridge supported by a precast concrete pile cap beam founded on driven pipe piles. We estimate the construction cost for this bridge would be approximately \$51,000,000. Approximately 4 years will be required to complete design and obtain necessary permits before we could advertise the bridge for construction.

6. Conclusion

This report completes our constructability analysis of this bridge. The next step is to begin detailed environmental studies and actual design of the bridge. This step will require a substantial commitment of time and money, followed by a significantly greater commitment for construction. This report provides estimates of the commitments involved, in order to guide a decision on whether to proceed or to shelve the project. If the decision is to construct a new bridge approximately \$51,000,000 of dedicated funding is required for the recommended bridge.

Finally, the Copper River is unpredictable, and the Department does not believe this will be the final project required to keep the road open and useable. The Copper River will continue to migrate throughout the delta for the foreseeable future. We believe additional projects will be required to repair future loss of the highway embankment and bridges to erosion and scour by the Copper River.