

US 34 Flood Recovery Project

Category 3: Meeting the Challenge of a Difficult Job – General Contractor

The US 34 Flood Recovery Project was about more than just rebuilding a highway. It was also about restoring a sense of normalcy and security for the people who drive the highway daily and reside in the Big Thompson Canyon. After floods devastated this canyon in 1976 and 2013, the need to make the US 34 corridor more resilient became evident. After the most recent disaster, Governor John Hickenlooper assured Coloradans that all highways would be “built back better than they were before.” This project honored his pledge. This permanent repair project, completed in two years, involved extensive stakeholder coordination and various engineering innovations to help the roadway and river work together to withstand future disasters.

Solutions of Special Projects: Nearly everything about this project was unique – starting with the natural disaster that necessitated it in the first place. Planning ahead for potential challenges and conditions, the contracting team of Kiewit Infrastructure (Kiewit) worked closely with the Colorado Department of Transportation (CDOT) and Jacobs Engineering to mitigate circumstances and events that could have derailed the project if not addressed upfront. The primary challenge was developing a construction approach to simultaneously facilitate efficient work while minimizing the impact on the traveling public.

With single direction traffic volumes varying from 200 to 300 vehicles per hour on winter weekdays to more than 700 vehicles per hour on summer weekend days, Kiewit took the counterintuitive approach of doing most of the construction in this high-altitude, mountain corridor during the winter months. Working over two consecutive winters, Kiewit kept US 34 open from late May to mid-October for the seasonal residents and 3 million annual visitors to Rocky Mountain National Park, the nation’s fourth most visited park in 2017.

This truncated schedule to protect the region’s valuable tourism industry required a unique traffic control approach. While local traffic was maintained through the tight canyon corridor, through travel on US 34 was restricted from October 2016 to May 2017 and again from October 2017 to May 2018. This approach gave construction crews the ability to maximize the resiliencies that could be incorporated – entirely digging up the roadway in one area to install a foundation of

grouted riprap – while still accommodating access for canyon residents. This closure strategy also shaved 18 months from the overall construction schedule.

To separate the streams of through and local traffic, Kiewit developed a one-of-a-kind vehicle-permitting process and distributed rear-view mirror permit tags to canyon residents before each winter closure. These permits allowed local residents to travel on US 34 at specified times each day. These travel times, based on input from canyon residents, maintained access for people living along US 34 and gave Kiewit the predictability needed to schedule daily work activities. As construction activities moved up and down the canyon, people living within established work zones received a second level of access through a resident scheduling service. This service, which was again something that had never before been implemented on a CDOT project, gave residents the ability to schedule travel to and from their properties at times other than the permitted travel windows. These requests, made online or through a 24/7 call center, were coordinated with planned construction activities so traffic control personnel could provide safe escorts to and from canyon properties.

Kiewit and the traffic control subcontractor also coordinated access with local service providers and delivery services, e.g. waste haulers, propane delivery companies, package delivery companies and residential contractors. As much as possible, Kiewit also maintained access to recreational amenities like hiking trails, hunting and fishing sites, and a shooting range.

Excellence in Project Execution and Management/Team Approach: Using the Construction Manager/General Contractor (CM/GC) delivery method allowed Kiewit to coordinate with CDOT and Jacobs Engineering on construction phasing, permit and easement acquisitions, right-of-entry agreements with more than 200 property owners for surveying, and identification of value engineering approaches.

Given the tight construction windows, the CM/GC model allowed for efficient resolution of design issues and the quick mobilization of resources. This “get in and get out” expedited delivery approach also catered well to the canyon residents who had endured so much since September 2013 and were anxious to return to their normal daily routines.

As might be expected with a state highway that winds through several national forest service parcels to connect two Colorado communities, there were more than a dozen different federal,

state and local organizations and agencies interested in the project's successful delivery and completion. To effectively collaborate and partner with these agencies, the project team hosted monthly stakeholder coordination meetings. These meetings allowed for ongoing, open dialogue, establishing trust between project representatives and groups including, but not limited to, the U.S. Forest Service, Bureau of Reclamation, Town of Estes Park, Larimer County, City of Loveland and Colorado Parks and Wildlife. The project team also worked hand-in-hand with the Big Thompson Watershed Coalition – a collaborative non-profit formed in the wake of the 2013 flood to help restore the Big Thompson River corridor. This group was able to leverage local resources and tap into grant programs to provide additional stream and embankment restorations beyond the scope of the \$186 million emergency relief funds.

The project team's collaborative efforts were also illustrated in the formation of a "challenge team" to identify key innovations in delivering the ultimate resiliency goal within the fixed budget. Knowing it would be virtually impossible to flood-proof the entire 26-mile corridor with the given budget, this challenge team refined its resiliency focus to making the canyon as accessible as possible so there would be at least a 15-foot wide section of drive-able roadway remaining after the next flood – enough for emergency services to get into the canyon and for people to get out. The team focused on common areas of damage from the 1976 and 2013 disasters and the realistic resiliency measures that could be incorporated within the closure schedule and budget. The challenge team's efforts led to several innovative solutions for damage-prone areas that would have otherwise been too cost- or schedule-prohibitive to protect.

Construction Innovations/State-of-the-Art Advancement: Using 2-D hydraulic modeling of the 1976 and 2013 floods, common areas of damage were identified and resiliency measures implemented to improve long-term public safety, including:

- Using a technique called soil cement mixing where crews drilled deep beneath the roadway to expose natural bedrock material and existing soils to mix with cementitious material to create a 15-foot wide section of man-made bedrock, ensuring the river will not scour and erode the roadway from below.
- Cutting into rock faces where feasible to move the roadway further away from the river and placing a minimum 15-foot wide section onto solid bedrock. Material removed

during drill and shoot operations was then crushed into four different sizes of riprap and road base material for use throughout the project.

- Excavating a 2-mile stretch of US 34 and installing layers of grouted riprap beneath the surface to create a more solid roadway foundation.
- Building new bridges through the horseshoe curve – the most severely damaged section of roadway in both floods – to shift the roadway to the inside of the bend, considering roadway and river as a system and giving the river floodplain room to flow more naturally through this section of the canyon.

Environmental/Safety: US 34 runs through the Arapaho and Roosevelt National Forests and Pawnee National Grassland and sits immediately adjacent to the Big Thompson River, so preserving the wild, natural environment of the narrow Big Thompson Canyon was a project priority. Practices used to maintain the canyon included:

- Dewatering and river diversion activities to build bridge piers and install grouted riprap revetment along river banks, extending from scour depth in some places to 10 feet below the existing water elevation.
- Preservation of numerous aquatic plants and habitat for brown and rainbow trout.
- Monitoring of nesting birds and migratory animals including big horn sheep and elk.
- Daily water quality monitoring procedures at various work locations in the river to track turbidity and pH levels, particularly during grouting operations.
- Partnering with local stakeholders including the Big Thompson Watershed Forum, the City of Loveland, and the US Geological Survey to perform winter water quality testing.
- The onsite use of removed natural materials to prevent the spread of invasive species. More than 400 trees and 143,000 cubic yards of blasted rock were reused along the corridor to help stabilize the river bank and for riprap and road base, eliminating the need to import non-native materials.

Through attention to detail, Kiewit and subcontractor crews worked more than 587,000 personnel hours without an accident.

Excellence in Client Service and/or Contribution to Community: The biggest community contribution this project made by far was to provide a more resilient highway and river corridor

that will better withstand future floods and allow people safe passage into and out of the canyon. While delivering on Governor Hickenlooper's pledge to build the road back better than it was before, Kiewit exemplified community and customer service excellence by:

- Responding to more than 4,000 email inquiries.
- Accommodating 5,095 resident scheduling service requests with special pilot car escorts.
- Purchasing 350 pies from a local business in the canyon.
- Donating 100 toys to the Larimer County Toys for Tots program.
- Donating 30 turkeys, all the Thanksgiving trimmings and money to the Larimer County Food Bank.
- Working with transportation officials at two local school districts to provide bus service through the canyon.
- Teaming with Colorado Youth Outdoors to provide relationship building opportunities for youth in Northern Colorado.

Editorial - Opening up U.S. 34 was great present for town

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The Colorado Department of Transportation and Kiewit Infrastructure sent Estes Park businesses and residents a special Christmas present.

CDOT announced this week that it will extend the weekend holiday openings of U.S. Highway 34 between Loveland and Estes Park to include all of this week. In fact, U.S. 34 will be open from Dec. 22 through 8:30 a.m. Jan. 3 for all motorists, with or without permits.

It's hard to put into words just how much we appreciate this "holiday gift."

But, we'll try.

Thank you CDOT. Thank you Kiewit.

You are a great team. Thank you for all of the work you are doing. We appreciate what you are doing, for the consideration you are showing those of us who live in the canyon and for keeping us informed.

You're the best!
Sincerely,
Jim Boyd

From: mmcct@frii.com
Sent: Friday, November 18, 2016 7:30 PM
To: InfoUS34@kiewit.com
Subject: Opening 34

Great move on your part, opening up the highway for Thanksgiving. A big thank you and kudos to the team!!

You are all doing a wonderful job not only of repairs, but also of managing all the different needs of the communities up here. We appreciate you!
Sincerely,
Robbi Telfer

James,

Last night at the Town Board meeting one of the Trustees publicly complimented and thanked CDOT for the holiday opening. We had a lot of visitors in town and it really helped the economy and parade attendance. We learned a hard lesson on better manual traffic control for mass exodus of the parking garage. That one's on us. I drove Waltonia to Estes 4x on Friday after Thanksgiving and it was smooth flowing each time. Good job!

Gregory P Muhonen, PE

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Whole sections of US 34 between Loveland and Estes Park washed away in September 2013, trapping residents inside the Big Thompson Canyon and making it difficult for emergency crews to reach them.



To help the public better understand the improvements being made through the "horseshoe curve" area of the inner canyon, the project team developed this rendering showing the realigned roadway above the river.



To better protect US 34 from future flood damage, Kiewit Infrastructure realigned the roadway through a rock cut and elevated the highway above the Big Thompson River through the heart of the canyon.



To minimize the impact on Big Thompson Canyon residents trying to get into and out of the canyon, Kiewit crews worked overnight to pour the deck for the new horseshoe curve bridge structures.



To help make US 34 more resilient to flood damage, crews put in several layers of riprap beneath a section of the highway and then grouted the void areas between the large rocks.



In the most narrow sections of the canyon, crews mixed dense bedrock material with concrete to create a 15-foot wide section of roadway that is more resilient to the eroding effects of water.



Soil cement mixing operations were effective in the tight right-of-way conditions dubbed "the narrows."



New drainage structures with riprap armoring will help protect US 34 from future damage.



After installing grouted riprap beneath US 34 to help it better withstand the eroding effects of water, crews grade the sub-base course prior to putting down the base course and then paving the roadway surface.



Crews blasted and hauled more than 380,000 cubic yards of rock in making US 34 more resilient.