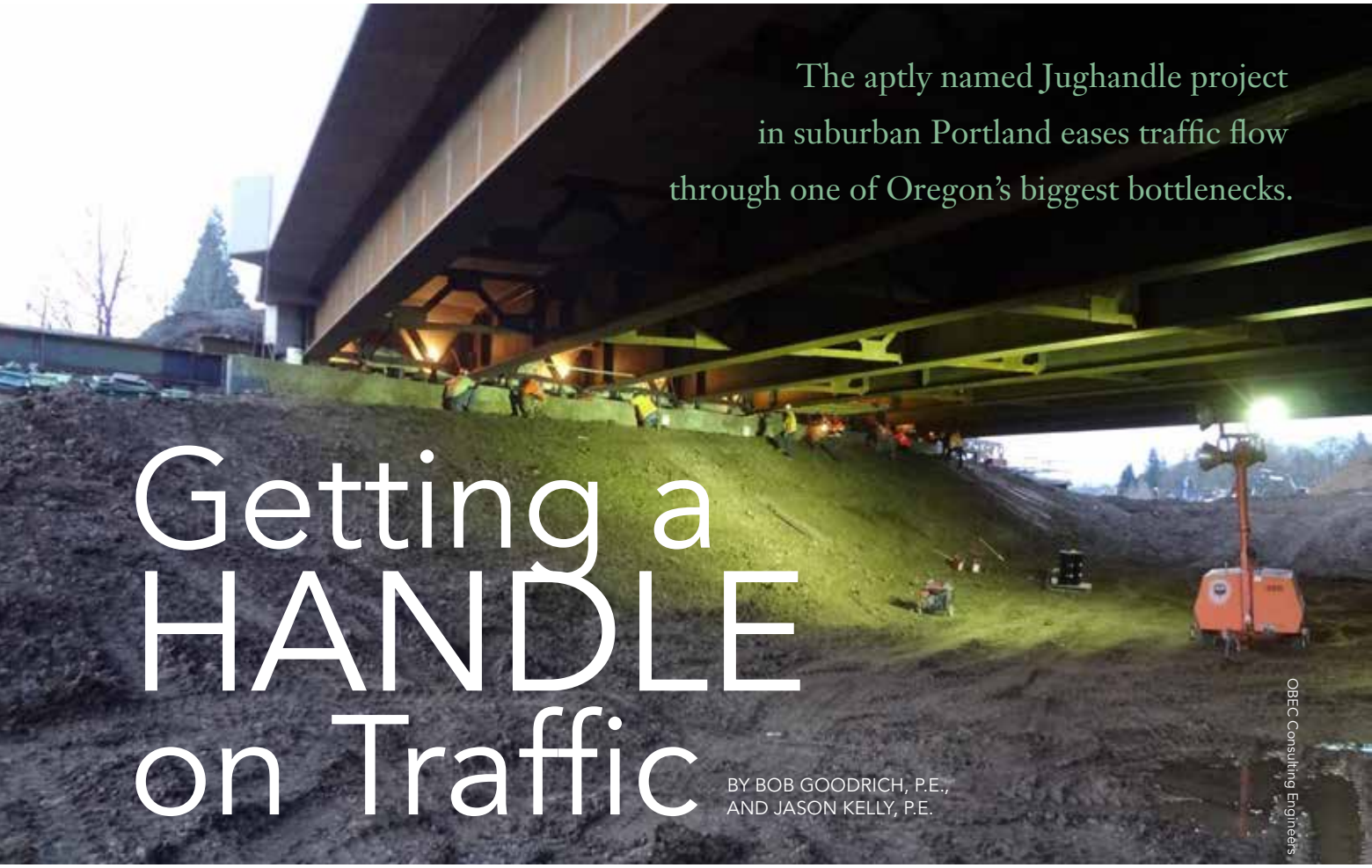

The aptly named Jughandle project in suburban Portland eases traffic flow through one of Oregon's biggest bottlenecks.

Getting a HANDLE on Traffic

BY BOB GOODRICH, P.E., AND JASON KELLY, P.E.

OBEC Consulting Engineers

THE INTERSECTION OF OR 213 and Washington Street in Oregon City, Ore., had the distinction of being the state's busiest signalized intersection.

It's near the northern end of the OR 213 corridor, which stretches from Salem to this southern suburb of Portland. With an average daily traffic (ADT) count of 65,000 vehicles, OR 213 is one of the state's busiest transportation corridors and until recently struggled to accommodate this high capacity.

Luckily, relief has been provided in the form of the $25 million OR 213: I-205 to Redland Road project (also known as the Jughandle project), which involved building a new bridge along OR 213 and realigning Washington Street so that it now passes under the highway—thus creating new, safer traffic patterns. Left turns have now been eliminated at the intersection and additional travel lanes have been added, thereby increasing capacity and separating out traffic merging onto the adjacent I-205 freeway. And a new roundabout, which accommodated the traffic passing under OR 213, avoided the need to add a signal.

Pencil Sketch

The Jughandle concept started in 2007 as a rough pencil sketch by the traffic engineer, Hermanus Steyn, of Kittelson and Associates, of how to improve OR 213 with limited funding. The project was initially led by a private developer looking to build on an adjacent property, but with the downturn in the economy in 2009, they decided not to proceed. However, Oregon City staff, recognizing the vital importance of this project, picked it up and ultimately secured state and federal funds to see it completed.

In order to eliminate the left-hand turns at the OR 213/Washington Street intersection that were making congestion worse and creating unsafe conditions for drivers and pedestrians, the team knew it was necessary to extend Washington Street underneath OR 213 through a grade-separated undercrossing and connect it to S. Clackamas River Drive via a roundabout. Due to the very high traffic volumes and the proximity of the new bridge to an interchange with I-205, traffic staging and constructability required careful consideration. The project's structural engineer, OBEC, analyzed four traffic staging alternatives to construct the new bridge:

1. Full closure for the duration of construction.
2. A temporary detour alignment.
3. Close one lane in each direction and construct the bridge in three stages.
4. Implement accelerated bridge construction (ABC) and do a full closure for a very short duration (four days, give or take).

Closing the highway for the entire duration of construction would have impacted thousands of commuters and freight traffic for an extended period of time (as much as 60 days for total closure and 30 weeks for single-lane staged closures) by essentially closing a prominent interchange; impacts to the region and nearby businesses such as Home Depot and the Metro Transfer

▲ This project plan view from the design phase illustrates the various changes the project would implement, as well as potential future improvements (depending on available funding).

◀ Crews prepare for the big move.

▲ An aerial view of the overall project site illustrates the reworked interchange, including the new roundabout and the new bridge to the west.

▼ The completed OR 213 bridge, as seen from Washington Street below. The new roundabout can be seen in the distance, directly east of the bridge.

Station would have been too severe. Constructing a detour alignment was cost-prohibitive for several reasons, including crossing Union Pacific Railroad tracks and maintaining connections to the I-205 interchange. And constructing the bridge in stages would have still resulted in significant traffic impacts given the ADT and available capacity—and closing even a single lane during daylight hours would have created unacceptable traffic delays every day for the 12 to 18 months of construction. As such, ABC was ultimately selected as the preferred alternative. While it did come with a large impact—full closure of the highway for 104 hours to move the bridge superstructure into its final position—it balanced the variety of site constraints and resulted in the shortest overall project duration.

Bob Goodrich (**rgoodrich@obec.com**) is the bridge division manager at OBEC and has more than 15 years of experience designing and managing bridge projects. **Jason Kelly** (**jkelly@obec.com**) is a construction project manager and leads OBEC's construction and inspection work in northern Oregon and southwest Washington. He has more than 12 years of engineering experience, with an emphasis on bridge projects.

▲ A shot from the live project webcam shows the new bridge, which was constructed along the existing highway, shortly before crews pushed it into place.

▼ The new OR 213 bridge after it was moved into place and traffic was reopened four hours earlier than originally scheduled.

▲ An aerial view of the project site (looking southwest) shows the project with excavation underway prior to pushing the new bridge into place.

Bridge Design

The new OR 213 crossing over Washington Street is a six-lane, single-span bridge with a multimodal walkway on one side and additional width for a future travel lane, for a total width of approximately 112 ft, and is 130 ft long; the clearance is 16 ft. The bridge was designed per 2010 AASHTO LRFD *Bridge Design Specifications* and in accordance with the Oregon Department of Transportation Bridge Design and Drafting Manual. The superstructure comprises nine steel plate girders and a conventional concrete deck. The girders, fabricated by Fought and Company, are made from ASTM A709 Grade 50 weathering steel and are 4 ft, 7¼ in. deep.

Because of the complexity and high-profile nature of the project, it was critical to employ a highly qualified contractor with a strong understanding of, and approach to, the project's challenges. To achieve this, the project team used an alternative bidding process that awarded the contract based on not only a) price but also a technical component consisting of b) qualifications and c) project approach (while not common, this method is used more with historic rehabilitations). Through this process, the project team selected Mowat Construction Company, who scored highly in all three areas. Mowat's approach generally followed the plan outlined by the design team, and its qualifications consisted of several ABC projects in Oregon and Washington State using a horizontal moving system similar to that which was to be employed on this project.

The project started with the bridge foundations, which were constructed at night during single-lane closures. A sheet pile shoring system was constructed across the highway on each side of both abutments, then the roadway was excavated between the shoring and covered using precast concrete panels to maintain traffic in all lanes during the day. The steel pipe pilings were then driven and were followed by the concrete pile caps, which were constructed during the day below traffic thanks to the shoring and panels.

Concurrent with foundation construction, the superstructure, consisting of the steel girders, concrete deck and bridge rail, was constructed during the day adjacent to the bridge's final position. Temporary steel piling and cap foundations, mimicking the permanent abutment skew and grade line, were constructed to support the superstructure until it was moved into position. Special care had to be taken during layout of the temporary foundations so that the alignment and grade of the final bridge location were an exact match. And the temporary foundation also had to not only provide vertical support but also a surface for jacking and rolling.

Upon completion of the bridge foundations and superstructure, the highway was closed for 100 hours (four hours shorter than originally scheduled) from a Thursday night at 7:00 p.m. to Monday night at 11:00 p.m. to complete the new undercrossing. During the first 24 hours of closure, crews relocated approximately 5,000 cubic yards of soil directly north of the bridge site to create an opening for the superstructure. Then the superstructure was pulled into place using a system of hydraulic jacks and rollers. It took approximately 24 hours to pull the superstructure more than 155 ft horizontally and lower it 18 in. vertically into position.

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▲ Crews place the girders of the new OR 213 bridge. The girders are fabricated from ASTM A709 Grade 50 weathering steel and are 4 ft, 7⅝ in. deep.

Public Outreach

Due to the high visibility of the project and the impact the four-day closure would have, the project team developed a robust and proactive outreach program to keep the public up to date on project progress and inform them of the impending closure. Extensive public involvement efforts included public meetings, a newsletter and a web page that featured a live construction camera for the duration of the project. Leading up to the four-day closure, the project team used extensive outreach (social media, print, radio and TV) to inform the public of delays in the area and point out available detour routes. Ultimately, the outreach was very successful, reducing traffic in the immediate area by 75% during the closure.

For a time-lapse video of the bridge move in action, go to **tinyurl.com/pkmg5dp**.

Naturally, it did not all go as planned. Some of the temporary foundation was in conflict and had to be removed. The hydraulic system that pulled the bridge into place could only move 18 in. per iteration. The jacking system also had a limited range of movement, requiring several iterations to lower the bridge. During the remaining 53 hours of closure, Mowat constructed the precast impact panels, bridge joints and asphaltic concrete transitions and reconfigured traffic signals to reopen the highway.

The 3,200-kip load was lifted using a system of 32 hydraulic jacks ranging from 50- to 70-ton capacities and controlled from a central manifold that moved with the bridge. The bridge was designed with an extra-large reinforced back wall that allowed for lifting and lowering and was then pulled into place using 1¼-in. coil rods actuated with twin 40-ton rams pulling against the permanent wing wall/thrust blocks constructed on one side; it rolled into its final position via 34 50-ton Hillman rollers placed inside a steel guide channel stretching 267 ft across both the temporary and permanent foundations. The bridge not only traversed laterally 155 ft but also vertically 2.5 ft due to the superelevation of the road.

Since opening in 2013, the Jughandle project has vastly improved mobility in the area, easing congestion and reducing delays. It may still be a busy interchange in terms of ADT, but it is certainly a safer and more efficient one. ■

Owner
City of Oregon City

Structural Engineer
OBEC Consulting Engineers Eugene, Ore.

General Contractor
Mowat Construction Company, Woodinville, Wash.

Steel Fabricator
Fought and Company, Tigard, Ore.