Every day, thousands of western Wisconsin residents commute to the metropolitan area of Minneapolis-St. Paul, and every one of them has to cross the St. Croix River to get to the Twin Cities.

The St. Croix River Bridge on I-94 at Hudson, Wis., is one of only three river crossings between the states in a 22-mile stretch from Prescott, Wis., to Stillwater, Minn. When the need arose to reded the westbound three-lane St. Croix River Bridge, it was apparent that the project could cause severe traffic delays.

"Bottlenecks are one of the biggest causes of congestion in major metropolitan areas around the country," said Bruce Ommen, P.E., a transportation manager at Ayres Associates, Eau Claire, Wis., who managed the project's design. "We knew that reducing the number of lanes on the St. Croix River Bridge was going to cause trouble."

The construction itself was a relatively straightforward project on a relatively small (0.635-mile) stretch of highway. But the logistical considerations were a major challenge.

"On the Minnesota-Wisconsin border, this is the highest-volume traffic bridge there is," said Bob Anderson, who was the Wisconsin Department of Transportation's (WisDOT) project development supervisor overseeing the project. "On that stretch of road we have 70,000 cars a day. It's a heavily traveled commuter route, with peak traffic volumes in the morning and evening."

Yet despite this heavy use, the $7.8 million construction project was completed in six months without a single major accident—and without causing significant travel delays for drivers. Seamless execution of a detailed safety plan kept the project site safe and also resulted in the project's designer, Ayres Associates, receiving the American Road & Transportation Builders Association's 2005 Roadway Work Zone Safety Awareness Award in the private local outreach category.

Ayres Associates, an engineer-
said, adding, “It could have easily turned into an extra 40 minutes in delays if we would have had the barriers fixed in one location.” WisDOT's Anderson called the barrier system a major factor in the project’s success.

“Basically we ended up right on schedule,” Mick said. “Work began on the approaches to the bridge on March 15 [2004]. When it came time, we poured 6,000 yards of concrete in less than a two-month period. And the renovated bridge opened to traffic again on Sept. 14.”

While the moveable barrier was perhaps the most visible aspect of the safety plan, a number of other components also helped keep motorists and workers safe.

Of trows, shuttles and signs
Ommen noted that the incident management plan developed for the project was a major element in its safe and successful completion. The plan included tow trucks and state troopers patrolling the site at peak travel times. The tow trucks helped to maintain the free flow of traffic and assisted the state patrol. They did everything from removing debris from the road to towing stalled vehicles. The towing services estimated assisting motorists 150 to 250 times during the construction period.

A mitigation contract with the Wisconsin State Patrol made it possible to have officers on the site for traffic surveillance and enforcement during the morning and afternoon rush hours. During the project, the state patrol had 7,371 contacts in the area, ranging from speeding to assistance with accidents. The state patrol and towing service worked closely to clear up accidents quickly to minimize traffic flow restrictions.

Bicycle traffic counts and discussions at the public informational meeting before construction began made it apparent that a large number of bicyclists and pedestrians used the sidewalk on the bridge to cross the St. Croix River. That sidewalk was eliminated to provide the auxiliary lane during construction. Because of interest in bicycle accommodations during construction, discussions were held with local bicycle shops and clubs.

The solution was to provide a shuttle service to drive pedestrians and bicyclists across the St. Croix River. Call boxes were placed at the drop sites for the shuttle transport vehicle. The call boxes allowed pedestrians and bicyclists to call for the shuttle without a personal phone. The shuttle served 1,152 individuals during the construction period.

“The shuttle service that was implemented was efficient at transporting people in a timely manner during reasonable hours of operation,” said Art Doyle, owner of Art Doyle’s Spokes and Pedals bicycle shop in Hudson. “The call boxes ensured access even for the uninformed, and the signage was obvious and clear. My use of the system proved very satisfactory, and I received many positive comments from other cyclists and pedestrians.”

Prime contractor Lunda Construction Co. of Black River Falls, Wis., also conducted daily safety huddles and biweekly safety reviews by the contractor's safety director.

The effectiveness of the safety plan is shown by the fact that work was completed without a single significant traffic accident. “Just a few fender benders, usually caused by drivers who were gawking at the construction work,” said Mick, the resident engineer.

Anderson, WisDOT's project development supervisor, was delighted with that safety record.

“That was a real surprise,” he said. “Typically, when you start taking lanes down like that, you increase your chances of a crash happening. But Ayres Associates had developed an excellent traffic mitigation plan. We had extra state troopers on site. We had two tow trucks on site during peak hours. We had alternate routes planned in the event we needed to close down the bridge. Fortunately, we never had to do that.”

A portable highway advisory radio (HAR) system was installed on the Minnesota side of the project to supplement the existing HAR system in Wisconsin. The system was controlled by the Wisconsin State Patrol and broadcast during incidents to warn motorists and inform them of potential delays.

Additional changeable message signs were added to the project for incident management. These signs were controlled by the Wisconsin State Patrol from its office.

WisDOT sent regular project e-mail updates to members of the public who asked to be on the e-mail list. Updates also were posted on the WisDOT project website. A survey of e-mail recipients found unanimous agreement on the value of this system. One user commented, “On the first day or two of a change in the project, I adjusted my work hours to try to avoid most of the major hassles.” Another stated that the updates “allowed me to better plan the route and timing of my commute.”

The work-zone safety measures also resulted in a cost-effective project.

“The barrier system and other safety mitigation measures kept this project from becoming a bottleneck and causing massive user-delay costs,” Ommen said. “They also allowed the entire bridge to be redecked in just one construction season, rather than stretching the project into another construction season.”

The safe and efficient movement of traffic during this construction project—and its successful completion—resulted in a satisfied client.

The state of Wisconsin was very pleased with the project,” Anderson said. “There were no major accidents. It was completed on time. That’s what we wanted.”

Kinderman is marketing editor at Ayres Associates, Eau Claire, Wis.

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ties, including the Wisconsin and Minnesota DOTs, state patrols and environmental protection agencies; the U.S. Fish and Wildlife Service; the U.S. Army Corps of Engineers and Coast Guard; and dozens of municipal agencies from nearby communities on both sides of the St. Croix River.

"WisDOT had more work than manpower to do everything the project called for," Anderson said. "So we hired Ayres Associates because we needed somebody to basically design the river crossing. Ayres Associates figured out how to handle traffic, how to build the approaches to the bridge, how to handle lane closures during construction and how to handle all that agency coordination, which really was one of the toughest things with this project."

Andy Dana, P.E., the final design engineer for Ayres Associates, said the biggest challenge was maintaining smooth traffic flow during the six months of construction when only one bridge was open.

For every hour someone is sitting in a vehicle waiting, engineers assign a certain dollar amount in user-delay costs, Dana explained. This includes things like lost work time and the amount of fuel burned by idling vehicles.

"Going into this we projected the user-delay costs could be in the millions of dollars," Dana said. "So to minimize that we really needed to come up with a way to keep three lanes of traffic open in the primary direction of traffic at all times."

The designers narrowed the shoulders on the eastbound bridge to only 2 ft; eliminated the sidewalk to create an auxiliary lane to handle eastbound traffic merging onto I-94 or exiting onto Wisconsin State Highway 35; created two 11-ft westbound lanes, two 11-ft eastbound lanes and an additional lane to switch between eastbound and westbound traffic; and designated a 6-ft central median for a new technology called the Quickchange.

A moveable barrier system allowed contractors to quickly move the large concrete barriers that divided traffic on the eastbound bridge while the adjacent westbound bridge was being redecked.

Moveable Barrier. This moveable barrier system allowed contractors to quickly move the large concrete barriers that divided traffic on the eastbound bridge while the adjacent westbound bridge was being redecked. Rented at a cost of near-

ly $800,000, the machine was seen as the key to keeping traffic moving across the St. Croix River at something approximating normal traffic flow. This project represented the first use of the system in either Wisconsin or Minnesota. Barrier Systems Inc. of California designed the barrier transfer machine.

It would have taken a full day to move the more than half a mile of heavy concrete barriers used to divide eastbound and westbound traffic by the conventional method using a crane. Forget about doing it twice daily.

The barrier transfer machine moved the concrete lane dividers twice each day, each time completing the arduous task in half an hour.

"The really nice thing about the machine is that it protects itself," Dana said, so there was no need to close down a lane of traffic while the barriers were moved.

Twice daily—at about 10 a.m. and 7 p.m.—4,916 ft of concrete barriers were moved. Looking like some kind of prehistoric beast, the barrier transfer machine gobbled up the concrete slabs in its path on one side of the machine and neatly deposited each slab on the opposite side of the machine.

"The barrier machine worked awesomely," said Staci Mick, P.E., the Ayres Associates project engineer. "We never had any problems with it breaking down."

Without the machine allowing for three open lanes of traffic at all times in the direction of maximum traffic flow, commuters would have experienced extensive travel delays each day, Mick said.

Throughout the redecking project, the typical rush-hour commuter had only five to 10 minutes added to normal travel time, Dana.