WSDOT Uses MicroStation Visualizations to Expedite Selection of SR 20 Sharpes Corner Intersection Design

Visual Engineering Resource Group Helps Project Team Communicate Benefits of Modified Roundabout to the Community

Project Summary

Organization:
Washington State Department of Transportation

Solution:
Roads

Location:
Whidbey Island, Washington, United States

Project Objective:

- Select the best design for reducing traffic congestion and collisions at the SR 20 Sharpes Corner intersection.
- Communicate the relative merits of design alternatives to stakeholders and the community.
- Incorporate review comments in visualization of selected design alternative to get buy-in from all parties.

Products used:
MicroStation

Fast Facts

- WSDOT Visual Engineering Resource Group (VERG) has used MicroStation since the group's inception.
- MicroStation's Photomatch command calibrated 3D model viewing perspectives to match that of aerial photos.
- Photorealistic visualizations presented at public open houses illustrated how a modified roundabout would reduce traffic congestion and collisions.

ROI

- Visualizations that took months to produce in the past now take days using MicroStation.
- MicroStation's ease of use enables VERG to put forward the right visuals at the right time.
- Presenting visuals to stakeholders, the public, and the state legislature resulted in buy-in on the selected alternative and funding of the project.

3D Visualizations Help With Buy-in on Highway Improvement Projects

The Washington State Department of Transportation (WSDOT) owns, manages, and maintains a state highway system that carries 86 million vehicle miles per day. Its Visual Engineering Resource Group (VERG) produces 3D visualizations that help get buy-in on highway improvement projects through strategic communication with stakeholders and the public. For the $23.2 million State Route (SR) 20 Sharpes Corner intersection, visualizations created using MicroStation expedited the selection of the best design for reducing traffic congestion and the chance of collisions.

SR 20 provides the only land access to Whidbey Island, the largest of nine islands located about 30 miles north of Seattle. More than 30,000 vehicles per day pass through the Sharpes Corner intersection, where the SR 20 spur heads west to the city of Anacortes, a public-use airport, and ferry service to San Juan Islands and Vancouver, British Columbia. The main route carries traffic south toward Whidbey Island Naval Air Station and the city of Oak Harbor.

WSDOT Identifies Intersection Design Alternatives

The 15 communities located on Whidbey Island have a combined population of about 60,000. The traffic volume traveling through Sharpes Corner has increased 2.5 percent per year for 10 years and is expected to reach 52,000 vehicles per day by 2030. Traffic delays of 20 seconds per vehicle in 2006 were expected to increase to 1.5 minutes per vehicle by 2030. Over the two-year period from 2004 to 2006, delays contributed to 80 collisions involving 152 vehicles and resulting in 51 injuries.

WSDOT began project scoping and preliminary engineering for the SR20 Sharpes Corner improvement project in spring 2007. Initially, six design alternatives were identified ranging in cost from $11 million to $51 million. The goal was to determine which of these alternatives would provide the most effective and cost-efficient solution for maximizing traffic flow and minimizing collisions.

The challenge was communicating the relative merits of these alternatives to stakeholders and the community, then using their feedback to develop the best design. As part of this process, public open houses were scheduled for the project team to present selected design alternatives.

MicroStation Produces Lifelike Visualizations

VERG was assigned the task of developing visualizations for three design alternatives to be presented at the open houses. The alternatives included a Texas-T design, which became the focus of attention. MicroStation, VERG's CAD software of choice since the early 1980s, was used to create a 3D design file based on the 2D design plans.

"MicroStation is the cornerstone modeling software that we have in the department," said Kurt Stiles, visual engineering resource program manager. "It also includes powerful visualization capabilities that we used on this project."

One of the main visualization features that VERG uses is the MicroStation Photomatch command, which calibrates the viewing perspective so that it accurately matches that of a photograph and a rendered image. "We haven't seen anything that makes it this easy to merge renderings into photos," said VERG visualization engineer Ron Jones. "The result is very realistic."

They created a composite of the 3D model of the Texas-T design and existing aerial photos of Sharpes Corner. The initial visualization was sent for review and based on comments received VERG was able to quickly incorporate changes and create a final visualization. MicroStation was used to render the model of the Texas-T design. These images were mounted on display boards and exhibited at an open house, making the designs easily understandable.

Public Comments Suggest More Study

After the presentation of the visuals of the design alternatives, polls taken at the open house indicated that more study was needed. WSDOT brought together engineering experts and local officials from multiple

"For each visualization MicroStation's excellent rendering capabilities allowed me to create clear, understandable, photorealistic images that helped the public get over the hurdle of understanding the plans and allowed them to start discussing the important details of the design concept."

– Ron Jones, visualization engineer, WSDOT Visual Engineering Resource Group (VERG)

organizations to look at the best and most cost-effective alternatives for improving the intersection. After exploring roughly 50 options, the value engineering team recommended a modified roundabout as the safest, most efficient and cost-effective solution.

The modified roundabout was chosen over other design options because it exceeds the minimum 20-year design life, meets the criteria for reducing congestion and collisions, and can be built within a budget of $23 million.

The modified roundabout design includes a two-lane roundabout with a bypass lane for traffic heading west to Anacortes. Traffic heading east from Anacortes toward Burlington will travel through a tunnel under the roundabout. This design will give commuters and truckers plenty of room to maneuver safely.

Modified Roundabout Design Gets Buy-in

WSDOT still needed buy-in on this design from stakeholders and the public. Using the same technique as for the Texas-T design visualization, VERG created a realistic picture of how traffic will safely flow through the roundabout.

Basic plans and dimensions for the modified design did not include vertical information. To construct a basic model, plan locations for the roundabout curb and sidewalk areas were extruded to create depth and dimension. For the tunnel section, a line was drawn to create the slopes going in and out of the tunnel. Extruding along that line created the road surface.

"It was easy to do in MicroStation," Jones said. "When we needed a tunnel wall, we just extruded a line along the wall."

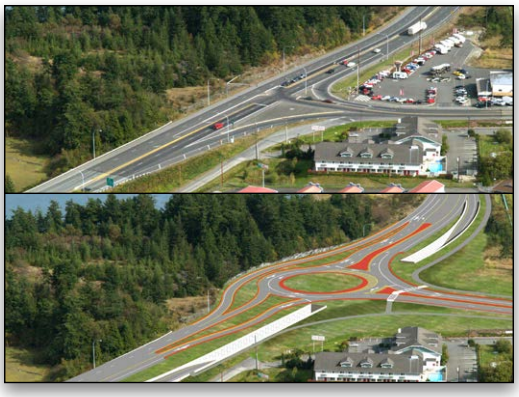
Using photometric views from the previous visualizations saved time during compositing. The 3D model was matched with the aerial photos, materials and lighting were adjusted, and the model was rendered in MicroStation. This process produced a realistic visualization of the proposed interchange.

Design Changes Quickly Incorporated Into Visualizations

The draft visualizations were sent to regional offices for review and comment. MicroStation made it easy to make changes based on the feedback received, so that the visualization communicated what engineers had in mind. VERG was also able to quickly develop alternative versions based on feedback from various stakeholders. When these photorealistic visualizations were presented at public open houses, members of the community then had a chance to ask questions and comment on the new design. These comments prompted design changes that were quickly incorporated.

After one open house, Dave Chesson, WSDOT Communications, noted: "A picture really is worth a thousand words. The design visual told the story and was the best tool we had. I believe we would not have been anywhere near as successful over the past couple of weeks and last night without it. A design visual should be standard for any project where there are multiple issues, and the community may not understand how it's going to function or improve their commutes and lives."

By listening and attending to the concerns of the public, WSDOT demonstrated that it is committed to improving the transportation systems that are so vital to taxpayers and communities. The design visuals played a key role in communicating this project's value.



Roundabout Lane and Tunnel – Existing and Proposed

Turnaround Reduced from Months to Days

Using MicroStation allows VERG to produce visuals that are as simple or complex as needed for the purpose at hand. "We can produce a Pixar-quality movie if we choose, or a parking lot design that is simply a wireframe," Stiles said. And because MicroStation is fast and easy to use, the process takes less time than in the past. "Years ago we built models that took months to create. Now we do it in a week. We're able to put forward the right visuals at the right time for the right reason."

The SR 20 Sharpes Corner roundabout design was 30 percent complete in 2009, when the project was put on hold until additional funding was received. Presentations to the state legislature ultimately succeeded in securing state funding. Work resumed in mid-2012, with construction scheduled for completion by mid-2017. The improvements to the intersection will make the roadway safer for drivers by increasing traffic flow and capacity, and decreasing rear-end collisions. Drive times will be shorter, and less time will be spent sitting in traffic. Bicyclists and pedestrians will also benefit from the enhanced mobility and safety features.

The SR 20 Sharpes Corner project demonstrated that, when used correctly, visualizations can be instrumental in improving a design and getting buy-off on the project. Stiles noted: "We want to be able to democratize design and bring people into the fold so that they understand what is going on, because the public has a vote now."

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