Design and Maintenance of Roundabouts

In a technical session at the annual NACE conference, Bill Klingbeil of HR Green and Tim Arvidson of Stonebrooke Engineering held forth on what they’ve learned about designing modern roundabouts. With nearly 100 roundabout designs between them, they knew what they were talking about.

Why roundabouts?
“Projects succeed or fail on their problem statements,” Klingbeil said. “For a roundabout, you need a strong one stating why you’re doing it because the public will challenge you. Roundabouts put forward as landscaping features or gateways often fail in the first public involvement meeting.” He went on to say the legitimate justifications for roundabouts are safety and their ability to handle traffic. He described a safety success story in Scott County, Minnesota: “There had been four or five fatalities at the intersection of Highways 13 and 2. But since 2006 when a roundabout went in, there has been just one minor crash.”

One lane or two?
Klingbeil also warned against trying to justify a two-lane roundabout on the basis that traffic will increase later. He said drivers in two-lane roundabouts with low traffic volumes tend to increase their speeds and may ignore lane markings, which can lead to crashes. He added that a better strategy may be to build a one-lane roundabout with room for expansion.

“One in multi-lane roundabouts,” Klingbeil said, “there’s a problem with keeping trucks in their own lanes. You have to determine if trucks will be able to enter with single-lane entries or if they need both lanes to enter. And does the truck use both lanes in the circulating lanes?” In addition to these design issues, Klingbeil said greater attention needs to be given to driver training.

Snow in roundabouts
In the past, Klingbeil said, roundabouts have sometimes been designed too tight for snowplows; he listed several issues:
• Is the entry wide enough for the plow to get in? (he recommended 22-foot entries)
• Is the truck apron designed so it can be plowed?
• Is the truck apron designed for the plow’s weight?
He also discussed strategies for reducing the amount of snow in roundabouts:

- Snow drift modeling software developed by the University of Minnesota and MnDOT
- Designing sufficient snow berm space into the roundabout
- Corn rows
- Tree rows
- Snow fences
- Living snow fences
- Designing based on prevailing wind and amount of snow fall

Lighting

Klingbeil discussed the need for good lighting in roundabouts—especially in rural locations where there may be no other light source. He said Roundabouts: An Informal Guide published by FHWA (available online) does a good job of explaining lighting needs. In the absence of lighting in a rural roundabout, he added, retroreflective signage should be used and should be positioned at headlight level rather than the 7-foot MUTCD standard.

Construction and maintenance

Klingbeil emphasized the need for communication between designers and construction personnel and listed some issues: “Striping in roundabouts is not all tangent and not all parallel. So if you measure from the side of the curb, you can end with striping that doesn’t match up. And do you use paint or poly preform? Grinding the stripes in prevents them from being torn up by the plows. Also, be sure signs are placed perpendicular to the line of sight.”

Oversize vehicles in roundabouts

Both experts focused attention on how to accommodate oversize vehicles in roundabouts. “Though people used to say you design for WB 62 or WB 67,” Arvidson said, “today, there are much larger trailers that may need to go through roundabouts.” He and Klingbeil showed examples—100-foot-long articulated vehicles with sophisticated steerable rear ends—many carrying wind turbine components. Arvidson used the diagram in Figure 1 to illustrate the problems faced by these vehicles. “Both the center island and the outside edges can be obstacles,” he commented.

Arvidson went on to point out that there’s a fundamental trade-off involved in getting oversize vehicles through roundabouts. “To fit the big load through, if you widen and/or increase the radii of the entry lanes and/or increase the diameter of the circle, you will allow all drivers to increase their speeds. That’s likely to produce crashes and therefore begins to negate the safety factor that was the major justification for the roundabout in the first place.”

Klingbeil added: “There’s no silver bullet for the oversize vehicle problem. In fact, I find that about one out of three projects that starts out as a roundabout ends up being something else because of this issue. You have to think about all of the issues, all of the stakeholders, and use all of the tools available.” He listed several such tools:

- Separated right turns
- J turns
- Mountable curb
- Removable signs
- Truck aprons
- Reinforced soil in the central island
- External truck apron

Klingbeil showed a European roundabout with no raised center island—only a circle painted on the flat asphalt. “Everyone there is familiar with how to drive roundabouts, so they can get away with simply painting a circle,” he commented.

Both experts agreed that, in many cases, the solution is to design a roundabout that will at least allow oversize vehicles to move straight through—even if it will not allow them to make left or right turns. An audience member in the trucking industry agreed that straight-through movement is usually what’s required to get oversize loads where they’re
going. Klingbeil showed the example in Figure 2, currently under construction in Moorhead, Minnesota, as one solution. The left offset of the entry lanes will accommodate straight-through movement of 115-foot 13-axle vehicles.

Arvidson also discussed the possibility of a cut-through lane straight across the center island, as in the photo on page 1.

In concluding, Arvidson said, “People keep asking for standardized roundabout designs that can accommodate all vehicle sizes. And we keep saying ‘Sorry, every intersection is different, and every vehicle is different. We need to know the configuration of the available space and of the vehicles that need to navigate the intersection.’” He added, however, that it would be useful to have a database of roundabout designs for specific situations.