

Designing Roundabouts for Truck Traffic

Location

Paola, Kansas

Site Characteristics and Implementation Results

- ✓ Opened in 2002 with AADT of 8,500 and 20% trucks.
- ✓ The first rural and high-speed approach roundabout in Kansas.
- ✓ Combined two closely-spaced intersections to form a five-leg roundabout.
- ✓ Reduced overall crashes by 67% and severe crashes by 100% based on a comparison of 6 years of before and after data.

Strategies Employed

- ✓ Reached out to key freight stakeholders early in the project development process in order to obtain and incorporate feedback.
- ✓ Selected an appropriate design vehicle based on freight that travels through this intersection.
- ✓ Invested in an independent peer review by an expert roundabout designer.
- ✓ Modified curb height to help large trucks better traverse the intersection.
- ✓ Used advance transverse rumble strips in lieu of reverse curves to help raise intersection awareness and reduce approach speeds.



Introduction

Maneuvering through intersections can be challenging for trucks, and these challenges become even more pronounced when the load is exceptionally large or heavy. Oversize/overweight (OSOW) vehicles are particularly sensitive to how intersections are designed. The geometry of roundabouts must be carefully considered to achieve a good balance between safety for all users and the basic ability of freight to flow through the intersection. Working together, road agencies, freight company owners, and truck operators can improve both the design of roundabouts and the ability of drivers to navigate them.

Safe and efficient movement of trucks on rural highways is vital to the Kansas economy.

Background

With over 140,000 miles of public roads, Kansas has the third-most public road miles of any State, although its population ranks only 33rd. More than 90 percent of those miles are considered rural, and a substantial portion of the vehicle-miles traveled involves commercial motor carriers on rural highways carrying long-distance freight loads or goods related to the State's extensive agriculture industry. As a result, the safe and efficient movement of trucks on rural highways is vital to the Kansas economy.

Additionally, recent trends in the renewable energy industry have increased the volume of OSOW vehicles on Kansas roadways. For example, transporting a blade for wind turbines requires an OSOW vehicle with trailers as long as 80 feet without rear-wheel steering.

In 1996, the Kansas Department of Transportation (KDOT) identified the intersections of Kansas Highway 68 (K-68) with Old Kansas City Road and Hedge Lane near Paola as a high-crash location. The location featured two closely-spaced intersections: Old Kansas City Road and K-68 was a four-leg, two-way stop-controlled intersection; Hedge Lane terminated at a T-intersection with K-68 approximately 200 feet away. All were two-lane roads. The posted speed limits were 65 mph along K-68 and 55 mph on Old Kansas City Road. The combined average annual daily traffic (AADT) at the intersections was approximately 8,500, 20 percent of which were large trucks.

In 1998, KDOT temporarily changed the Old Kansas City Road intersection to all-way stop control with larger signs and a flashing beacon, but right-angle and high-severity crashes continued. Rather than install a traffic signal, KDOT evaluated other solutions

with the potential to reduce crashes and accommodate future traffic volume growth, and determined that a roundabout was the best solution. Given the high volume of truck traffic using the intersection, KDOT carried out targeted outreach efforts to understand the needs of area freight stakeholders and adjust the roundabout design to accommodate their operations.



Figure 1 & 2: K-68 Before and After
Source: Google Earth Pro

Based on freight stakeholder input, KDOT reduced truck apron curb heights at the roundabout to provide a more forgiving edge of traveled way for large trucks.

Lessons Learned

Roundabouts can provide substantial safety improvements at rural, high-speed approach intersections.

Proactive outreach to freight-specific businesses gets them involved in the design process, resulting in roundabout features that can work better for trucks.

Other Resources

KDOT QuickFacts

http://www.ksdot.org/PDF_Files/QuickFacts2010.pdf

Kansas Roundabout Guide

http://www.ksdot.org/Assets/wwwksdotorg/bureaus/burTrafficEng/Roundabouts/Roundabout_Guide/KansasRoundaboutGuideSecondEdition.pdf

Roundabouts in Kansas Video

<http://www.youtube.com/watch?v=HnlxJ2CTBXk>



Figure 3: Truck navigating a roundabout
Source: KDOT

Approach

The Paola area is home to a number of freight-related businesses, including a major warehouse distribution center and a commercial vehicle driving school. KDOT knew the new roundabout needed to accommodate large vehicles. They also understood the importance of the roundabout providing both safety and operational benefits compared to other intersection designs. KDOT undertook several stakeholder involvement activities prior to and during the design process in order to deliver a project that would meet agency safety goals and serve the freight community.

For most projects on state highways, KDOT evaluates a combination semi-tractor and 53-foot trailer (an AASHTO WB-67) as the design vehicle, while also considering possible OSOW loads that might travel through the intersection. With the Paola roundabout located east of a Walmart distribution center, KDOT knew there would be a high volume of truck traffic using the intersection. Accordingly, their first key decision was to continue their practice of using a WB-67 semi-trailer as the design vehicle for the roundabout. This assisted with the alignment design of the approaches and circulating roadway to provide sufficient accommodation for freight traffic and emergency vehicles to safely and efficiently navigate through the intersection.

With a draft design completed in-house, KDOT hired an external roundabout design expert to conduct a peer review of the roundabout's ability to accommodate trucks and achieve the desired safety improvement. KDOT used the resulting design when meeting with freight stakeholders, many of whom had expressed initial opposition to the roundabout idea. KDOT contacted representatives from the freight industry to present the roundabout design, discuss the other intersection options considered, and solicit feedback. This allowed KDOT to present their concept and justification for the roundabout while also being responsive to stakeholder concerns.

Results

As a result of the outreach efforts to freight stakeholders, KDOT reduced curb heights on the truck aprons at the roundabout to provide a more forgiving edge of traveled way to large trucks. Additionally, KDOT had planned to use reverse curves on the approaches to the roundabout to help reduce speeds into the intersection. However, to alleviate the concerns expressed by the stakeholders, KDOT agreed to use elongated splitter islands with advance transverse rumble strips instead.

KDOT proceeded to construct the roundabout and opened it to traffic in 2002. It was a "first" roundabout for Kansas in two ways: the first with high-speed approaches and the first in a truly rural setting. Additionally, the roundabout featured five legs, due to combining the two original intersections – one four-leg and one three-leg - into a single intersection that preserved the 55 mph and 65 mph posted speed limits on the approaches. Data shows a marked reduction in crashes after construction. From 1995-2000, there were 33 crashes with 42 injuries in the six years prior to the roundabout installation. After the roundabout was installed, these numbers declined dramatically with 11 crashes and zero injuries in the six years following installation (2003-2008).

Despite some initial trepidation, the roundabout has exceeded the expectations of the agency and the public for improving safety and accommodating freight movement. The success of this installation has led KDOT to install five more roundabouts at rural, high-speed approach intersections on the State highway system, and two more are planned for construction. In addition, KDOT used the knowledge and experience gained from this project to create the *Kansas Roundabout Guide* to assist local Kansas agencies in assessing the viability of roundabouts in their areas. The second edition of the guide was published in spring 2014.

Learn More

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