Research Report Summary

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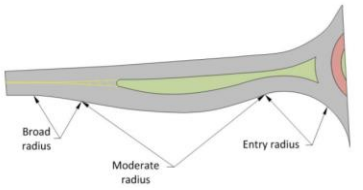
Impact of S-Curves on Speed in a Modern Roundabout

Despite the increased adoption of modern roundabouts across the US, there are many specific design elements for which the direct impact they have on operational and safety related performance of the roundabout remains unknown. More specifically, there is currently no conclusive research on the direct speed effects of a reverse curve (S-curve) and its geometry when such a curve is introduced at an approach to a roundabout.



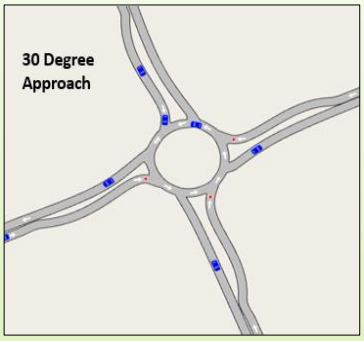
An S-Curve at a Roundabout Approach

This research employed a series of microsimulation-based analyses to investigate the speed-related impacts of S-curves introduced to the entry of a roundabout.

Roundabout Test Site

An existing roundabout in Amherst, MA, USA, was used as a case study for this experiment. The existing geometry and traffic conditions were initially modeled, after which the conventional linear approach was modified to an S-curve and evaluated. Field data from the locations were used to calibrate microsimulation models developed in AIMSUN.

Experimental S-Curves



30 Degree S-Curve

45 Degree S-Curve

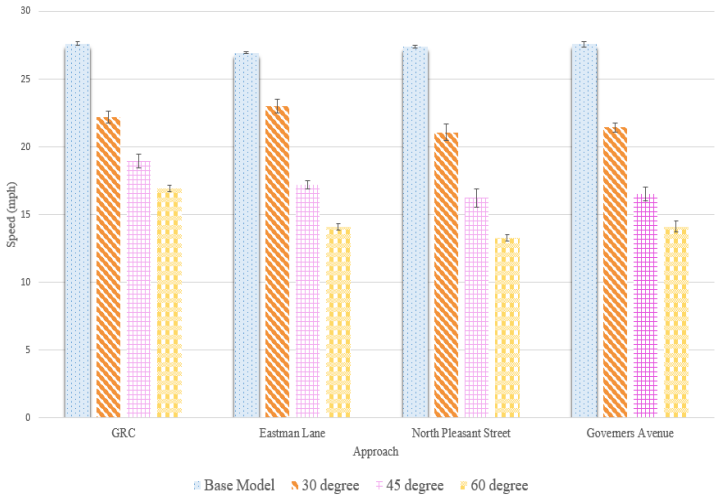
60 Degree S-Curve

The resulting trajectory data was analyzed for the base case as well as three levels of experimental S-curves (ranging from 30 to 60 degrees) on each roundabout approach (16 total).

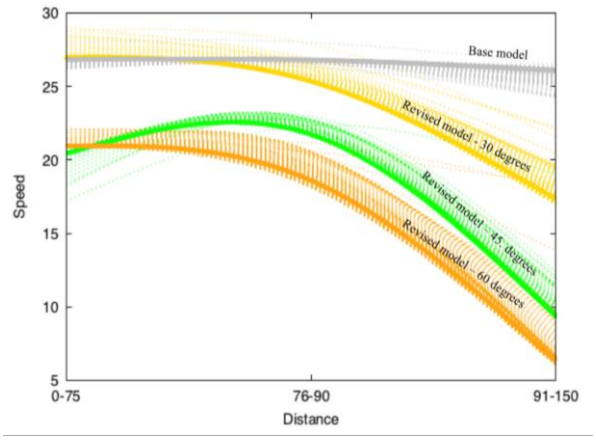
The results from ten replications of the simulated roundabouts reveal that there are statistically significant reductions in speed at all roundabout approaches when S-curves with different angles are introduced. The results also show that the higher the angle of the S-curve is, the higher the reduction in approach speeds.

The results suggest that a significant reduction in speed can be realized with a minimal amount of the reverse curvature on the roundabout approach.

The introduction of reverse curvature on the approach to a roundabout produces significantly slower speeds over a greater distance compared to a roundabout with a linear approach. In the existing roundabout, the speed of the vehicle as it approaches the roundabout remains relatively constant, even when it is approaching the entry of the roundabout. For the roundabout models with S-curves, a reduction in speeds is observed as the vehicles are approaching the entry of the roundabouts. S-curves are also likely to improve visibility of pedestrians and vehicles circulating the roundabout, further improving safety.



Mean speed plot for each approach for all S-curves tested.



Individual vehicle trajectories and an average trajectory as a function of distance from the beginning of the approach (Eastman Lane approach).