

# North Carolina Diverging Diamond Interchanges

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According to government data, North Carolina is one of the fastest growing states in the country due in part to its location in the center of the eastern seaboard, temperate climate, and scenic attractions. Five major interstates and many urban freeways cross the state providing safe and efficient movement of people and goods. However, with growth comes significant increases in vehicle miles traveled, leaving NCDOT and its partners seeking cost-effective solutions to congested diamond interchanges.

In the 1990's, the single point urban interchange (SPUI) was shown to increase efficiency over traditional diamond interchanges. As SPUIs were constructed in North Carolina and nationally, some safety issues were realized with the large radius turns through the center of the SPUI, and cost issues were realized due to the complexity of the bowtie-shaped structure required of a SPUI. SPUIs also proved difficult for bicycles and pedestrians to cross due to the long, skewed ramp crossings.

North Carolina discovered the Diverging Diamond Interchange (DDI, also known as the Double Crossover Diamond Interchange) by research and studies performed in conjunction with the Missouri Department of Transportation as they designed and constructed the first DDI in the United States in Springfield in 2009. Research showed that a DDI could be constructed with improved mobility and safety at a lower cost than a SPUI. Further data indicated that pedestrian operations can be greatly improved with a DDI compared to a SPUI.

NCDOT and their partners investigated construction of DDIs in lieu of other interchange designs, especially where there are equally high volumes of through traffic and left-turns to/from the freeway. Analysis of freeway interchange projects has shown significant

mobility benefits of the DDI in many cases due to the simplified signal phasing at the crossover intersections and that left-turns onto the freeway no longer are required to yield to oncoming traffic. In addition, in many cases DDIs have been found to move more traffic through interchanges without the need to replace or widen existing bridges, hence saving money.

NCDOT and its stakeholders developed multiple public involvement tools to explain this relatively new concept, including an informational flyer, a narrated video to describe how to navigate a DDI, and 3-D visualization of motorists driving through a DDI including appropriate signing and marking. Upon release of DDI designs, public concerns emerged with driving on the opposite side through the interchange. However, a greater public understanding was achieved at public meetings upon explanation and visualization of navigating DDIs.

As of October 2013, there are 12 DDIs either in design or under construction in North Carolina. Initial construction bid estimates for a proposed DDI near Charlotte were near \$6 million, whereas the expected constructed cost of a SPUI was about \$30 million. Another proposed DDI near Wilmington saved the state nearly \$12 million in construction costs compared to the original partial cloverleaf design. In both cases, levels of service and maximum queuing is greatly improved with the DDI over originally-proposed interchange designs.

North Carolina expects to have its first DDI open in 2014, with others soon to follow. NCDOT and its partners will continue to evaluate and pursue Diverging Diamond Interchanges in the proper contexts to promote the safest and most efficient travel for our citizens, especially where there is significant cost savings. ■