

UTC Project Information	
Project Title	MPC-480 – A Comprehensive Safety Assessment Methodology for Innovative Geometric Designs
University	Utah State University
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Project Duration	September 30, 2013 to September 30, 2018
Brief Description of Research Project	<p>Innovative geometric designs are often considered as a solution to the challenge of meeting the increasing travel demands with limited recourses (FHWA, 2009). This study focuses on one such design, the diverging diamond interchange (DDI), which aims to improve traffic flow and reduce congestion at highway junctions (Schroeder et al., 2014); but the methodology proposed is transferable to other geometric designs. Utah was among the first states to consider the DDI as a viable interchange option. The state opened its first DDI at the intersection of American Fork Main Street and I-15 in August 2010. Empirical studies have demonstrated the operational and cost benefits of DDIs (Bared et al., 2006; MoDOT, 2011; UDOT 2012; Yang et al, 2014); however, the safety impact remains inconclusive. Theoretically, the DDI design offers a safety benefit because it reduces the number of conflict points in comparison to other interchange options, which can lead to fewer crashes in general. Moreover, the lower design speeds in DDIs may also result in fewer and less severe crashes.</p>

One major safety concern with DDIs is that drivers may stay to the right at the crossovers and accidentally enter the opposing lanes. Despite the theoretical safety benefits, little research has been undertaken to quantify the safety impact of DDI using real-world crash data, primarily because of the limited accident history available. A preliminary safety study (MoDOT, 2011) directly compared the crash rates before and after the construction of a DDI in Missouri and concluded that total crashes dropped by 46% in the first year of operation. However, the simple before-and-after method assumes that any changes to the safety performance can be attributed solely to the DDI design. In reality, confounding factors that change continuously, such as traffic flow, traffic composition, and weather conditions, can also affect the safety performance. Therefore, we propose an alternative approach to deal with possible confounding factors by comparing the safety performance of DDIs with that of a group of reference sites.

In addition, most existing safety studies on novel geometric designs only investigate vehicle crashes. Nevertheless, to fully understand the overall safety impact, we also need to take pedestrian and cyclist safety into consideration. Since a DDI usually attracts more traffic to the interchange, pedestrians and cyclists may feel intimidated by this increase and they may take detours to avoid the interchange. Hence, pedestrian and cyclist crashes may migrate from the interchange to nearby intersections. As a result, we also propose to examine all crashes involving pedestrians and cyclists within a one- to three-mile radius of the interchange and comprehensively evaluate the true safety effects of DDIs.

Utah has been a pioneer and leader in adopting innovative interchange and intersection designs. Currently, the state has six operating DDIs and more are under construction or planned. Four DDIs in the state have been opened to traffic for more than two years, which provides sufficient accident data for a comprehensive safety study. This study will be one of the first independent studies in the nation to investigate the overall safety impact of DDIs. The results will be useful in evaluating DDI construction and retrofit projects in Utah as well as other states. The research is expected to have a broad and significant impact on the implementation of innovative interchange and intersection designs.

Research Objectives:

The proposed study will accomplish the following three objectives:

1. Conduct a comprehensive before-and-after study to assess the overall safety impact of DDIs;
2. Propose a methodology to quantify the safety effects of DDIs on different crash and road user types; and

Develop a generic framework for before-and-after safety studies that applies to other types of facilities in the state.

<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<p>This analysis can be used by UDOT and other transportation agencies as they consider the implementation of the diverging diamond interchanges in the future.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>This study is one of the first independent studies in the nation to investigate the overall safety impact of DDIs. The results will be useful in evaluating DDI construction and retrofit projects in Utah as well as other states. The research is expected to have a broad and significant impact on the implementation of innovative interchange and intersection designs.</p>
<p>Web Links</p> <ul style="list-style-type: none">• Reports• Project Website	<p>https://www.ugpti.org/resources/reports/details.php?id=917</p>