

CTIPS

*Center for Transformative
Infrastructure Preservation
and Sustainability*

USDOT Region 8 University Transportation Center

RESEARCH BRIEF

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Assessment of Safety and
Operation Performances of CFIs
and DDIs in Utah



the **ISSUE**

As traffic demand intensifies, motorists at conventional intersections struggle with congestion and severe safety risks. While innovative designs like diverging diamond interchanges and continuous flow intersections provide solutions, transportation agencies lack integrated, locally calibrated evaluation frameworks that simultaneously assess operational efficiency and safety performance to drive evidence-based infrastructure decisions in Utah.

the **RESEARCH**

This research provides a comprehensive evaluation of the operational and safety performance of diverging diamond interchanges and continuous flow intersections under Utah-specific conditions by employing a dual-framework methodology that analyzes 16 years of historical crash and traffic data (2006–2021). To address the limitations of isolated assessment methods, the first component utilizes safety-integrated microscopic traffic simulation via multimodal traffic simulation software, where surrogate safety measures—time-to-collision and maximum deceleration—were extracted and translated into predicted crash frequencies. The second component features a crash-based empirical evaluation to develop locally calibrated safety performance functions (an indicator of expected changes in crashes after implementing a countermeasure) and generate highly reliable, Utah-specific crash modification factors for fatal-and-injury crashes and property-damage-only crashes. By integrating surrogate safety analysis with rigorous empirical evaluation, this research equips transportation agencies with a transferable, data-driven framework to proactively assess both the efficiency and safety of innovative geometric intersection designs.

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Project Title

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the FINDINGS

The dual-framework evaluation revealed that both diverging diamond interchanges and continuous flow intersections deliver substantial operational and safety improvements in Utah. The safety-integrated microscopic simulations accurately replicated field conditions. Applying extreme value theory to surrogate safety measures successfully predicted real-world crash frequencies, revealing that continuous flow intersections exhibit highly stable traffic flow while diverging diamond interchanges show slightly more variability due to complex crossover interactions. The analysis confirmed significant safety benefits, particularly for high-severity collisions. Diverging diamond interchanges achieved a 47.8% reduction in fatal-and-injury crashes and a 28.1% reduction in property-damage-only crashes. Similarly, continuous flow intersections demonstrated a 30.7% decrease in fatal-and-injury crashes and a 21.8% decrease in property-damage-only crashes. These locally calibrated crash modification factors prove that restricting and relocating left-turn movements upstream successfully decrease exposure to severe angle crashes while maintaining operational throughput.

the IMPACT

This research equips agencies with tools to confidently implement alternative intersection designs. Researchers generated five Utah-specific crash modification factors: two for diverging diamond interchanges and three for continuous flow intersections, replacing broad national averages to enable highly accurate benefit-cost analyses. These crash modification factors validate significant safety improvements, including up to a 47.8% reduction in severe crashes. Additionally, we created a comprehensive safety-integrated model calibration and validation procedure to help practitioners proactively assess the safety of unbuilt geometric designs via microsimulation. Together, these five crash modification factors and the simulation procedure empower agencies to optimize infrastructure investments and save lives without costly grade-separated expansions.

For more information on this project, download the Main report at <https://www.ugpti.org/resources/reports/details.php?id=1281>

For more information or additional copies, visit the Web site at www.ctips.org, call (701) 231-7767 or write to Center for Transformative Infrastructure Preservation and Sustainability, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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