ADDITIONALLY SELECTED TECHNOLOGIES 2013

Double Crossover Diamond (DCD) Interchange

The Challenge

When transportation engineers in Lexington, Kentucky, were challenged to make traffic flow more smoothly and safely along US 68 (Harrodsburg Road) at the KY 4 (New Circle Road) interchange with limited funds, they needed an innovative solution to address the problems without constructing a new interchange.

US 68 (Harrodsburg Road) — an Urban Major Arterial route that saw more than 35,000 vehicles per day — was plagued with severe congestion and high accident rates (CRF=5.3). Closely-spaced traffic signals, heavy turning movements, and weaving operations between intersections existed at this location.

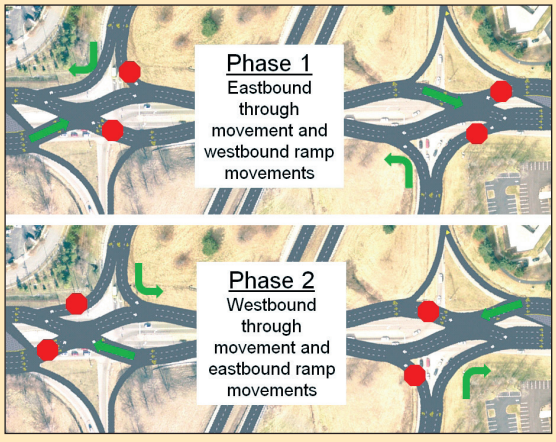
The existing roadway consisted of two through lanes in each direction and single left turn lanes at the New Circle Road Interchange. The project was physically constrained by the existing right-of-way and by the New Circle Road bridge piers. The conventional solution of adding an additional through lane did not address the high crash rate in the area or the capacity issues for left-turning vehicles to the entrance ramps, and in fact would make weave issues even worse. The concept also meant reducing shoulders considerably in order to fit the widened template between the bridge piers. It was clear another solution was needed.

Kentucky's first DCD — the US 68/KY 4 interchange in Lexington, Ky.

Research in Action

To address the corridor's needs, the team turned to an innovative design concept: the Double Crossover Diamond (DCD) interchange. After seeing a presentation at the 2009 Kentucky Partnering Conference that mentioned the I-44 DCD in Springfield, Missouri (and later meeting with the I-44 project team and visiting their DCD), engineers determined a DCD offered safety and capacity of a maximally efficient fix at a minimal price.

A team of more than a dozen roadway design engineers helped complete preliminary design in less than eight weeks over the 2010 holiday season. Following a successful joint inspection at the end of January 2011, the project moved to final design and was completed in May. When construction began in June, engineers were available to address unexpected issues with the contractor directly. The project was operational by the middle of August 2011 and was completed on February 5, 2012. The contractor's post construction review notes, "all parties deserve commendation for performance under difficult circumstances" to meet this schedule.



How does a DCD work?

The Double Crossover Diamond main goal is to better accommodate left turn movements and potentially eliminate a phase in the cycle for the signals. The ability to make left turns without having to cross other traffic streams eliminates the need to account for a left-turn phase. This free flowing left turn movement also reduces the number of conflict points through the interchange, reducing the accident rate.

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Just four months after the DCD opened to traffic, 73.1 percent of drivers polled by the University of Kentucky consider the project a good transportation solution; 71.3 percent believe the DCD should be considered at other locations.

AASHTO Guidelines as Adapted for DCD Design

- **Crossover intersection angle** makes it clear to drivers that they have not veered into oncoming traffic or made a wrong turn.
- Provide appropriate **lane widths and curve radii** for design speeds and large trucks.
- Position **access points** outside of the interchange.
- **Construction of the project happens under traffic,** with limited nighttime lane closures and a brief weekend interchange closing to convert traffic to the DCD.
- **Signing, pavement markings, signals, and lighting design** focuses on visibility and redundancy.
- **Bicyclist and pedestrian accommodations** are provided on a shared use path on the outside of the roadway, with stop signs to warn users of free-flowing entrance ramp traffic to New Circle Road. Lower travel speeds through the DCD makes this safer than conventional interchange types.

Research Results

Feedback from the public has been positive since the DCD opened, despite doubts the public expressed prior to construction during the project's numerous public meetings. Just four months after the DCD opened to traffic, 73.1 percent of drivers polled by the University of Kentucky consider the project a good transportation solution; 71.3 percent believe the DCD should be considered at other locations.

The number of crashes in the area have decreased dramatically since the DCD became operational. Kentucky State Police *Traffic Collision Facts* reports from 2010 indicate accidents along US 68 cost an average of $2 million a year in the three years prior to the DCD's construction. Because there has been a 45 percent reduction in accidents since the DCD opened, drivers will save around a $1 million each year, including indirect accident losses such as medical expenses and lost wages. With a $6.24 million construction cost for the DCD, in a few years the costs savings associated with fewer accidents will exceed the cost of building the interchange; in this sense, the DCD will pay for itself during its lifetime.

While the project was originally intended to simply widen US 68, improving the interchange with KY 4 was the most cost effective option and benefited KY 4 to boot. The DCD design ultimately cost much less than estimates for other options. Further savings were realized by avoiding utilities by constructing retaining walls, lowering utilities in place, or modifying existing drainage systems.

The lasting legacy of this project is that it proved a DCD would work in Kentucky and more DCDs are under design in central and northern Kentucky. The interchange type is now considered a feasible option to greatly improve safety and traffic flow at functionally inadequate interchanges for a much lower cost than some alternatives.

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KYTC US 68 DCD website:
http://transportation.ky.gov/US-68-Double-Crossover-Diamond/Pages/default.aspx

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