

Deployment: Comparative Travel-Time System

Description:

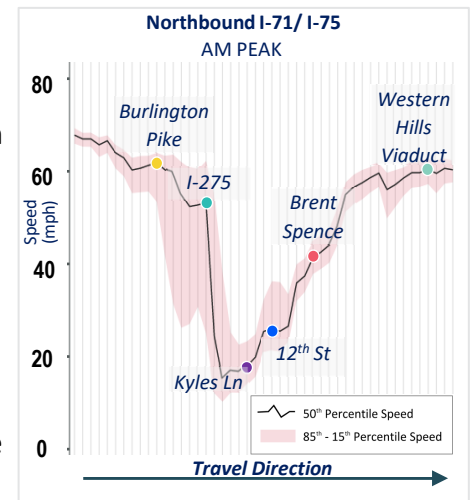
Install Dynamic Message Signs (DMS) to provide drivers with comparative travel-time information for alternatives routes, primarily from near the I-71/I-75 and I-275 interchange to Ohio. The main routes to be compared would be I-71/I-75 NB and I-275 EB to I-471 NB. Other routes/destinations could also be compared.

Identified Needs:

The I-71/ I-75 corridor experiences congestion in both directions, but particularly in the NB direction during the AM peak. The average speeds begin to drop approaching the I-275 system interchange and do not return to typical speeds until beyond the Brent Spence Bridge.

As the congestion often extends to or just beyond the I-275 interchange, drivers may be unaware of alternative route options (i.e. I-275 EB to I-471 NB) which likely has less congestion and potentially a shorter travel-time to Cincinnati.

Origin-Destination data indicates that during congested AM peak period conditions, 3% to 6% of travelers shift from I-71/ I-75 to I-275 and I-471. This is with limited informational signage and is likely based on experience and mobile device routing applications. Larger shifts could be beneficial.



Proposed Improvement:

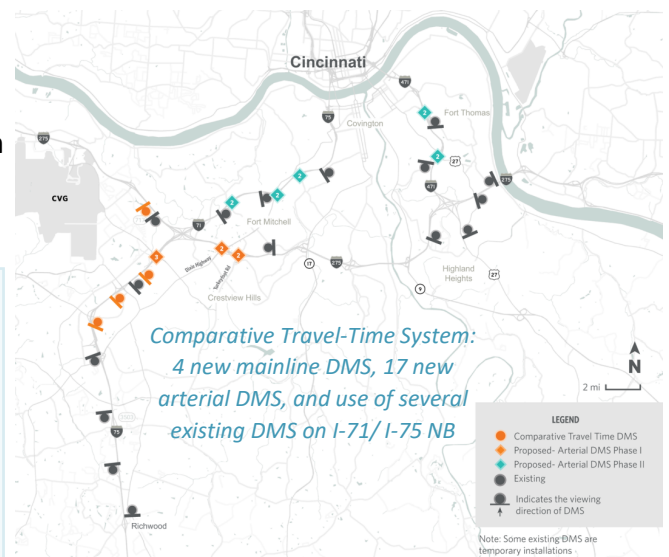
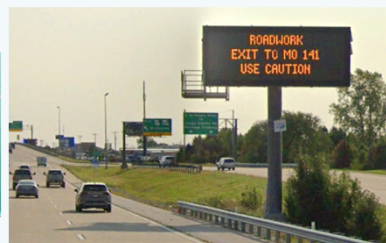
The improvement includes the installation of three mainline DMS on I-71/I-75 NB, one mainline DMS on I-275 EB, and 17 arterial DMS at key interchanges. The 21 new DMS, along with existing DMS on I-71/I-75 would use real-time data to display travel-times for alternative routes to common destination. It is recommended that the mainline DMS use inserts (see lower left below). They are less expensive and prevent the messages from being superseded by other messages during congested times. The travel-time information would be displayed prior to key decision points to inform drivers of options. The information would reduce congestion as it would incentivize drivers to use alternative routes under congested conditions, resulting in better utilization of the available roadway network.

Example Comparative Travel-Time DMS:

Travel Time Sign with Dynamic Inserts



Side Mounted DMS



Comparative Travel-Time DMS Installations

Benefits:

Operational:

- Systemwide Annual VHT reduction: **140,000 hours**
- User Cost Savings: **\$3,769,200**

Cost Estimate:

Construction:	\$ 2,475,000
+ O&M:	\$ 340,000
+ Contingency:	\$ 422,250

Total: \$ 3,237,000

Benefit/Cost Assessment:

(10-year project lifecycle)

Benefit Total:	\$ 28,326,000
÷ Cost Total:	\$ 3,237,000

B/C Ratio: 8.8

Deployment: Queue Warning System

Description:

Install Dynamic Message Signs (DMS) to provide advance warning of the presence and location of the back of queues on the Northern Kentucky Interstate corridors: I-71/ I-75, I-471, and I-275. This system would enhance the system already in operation in the region.

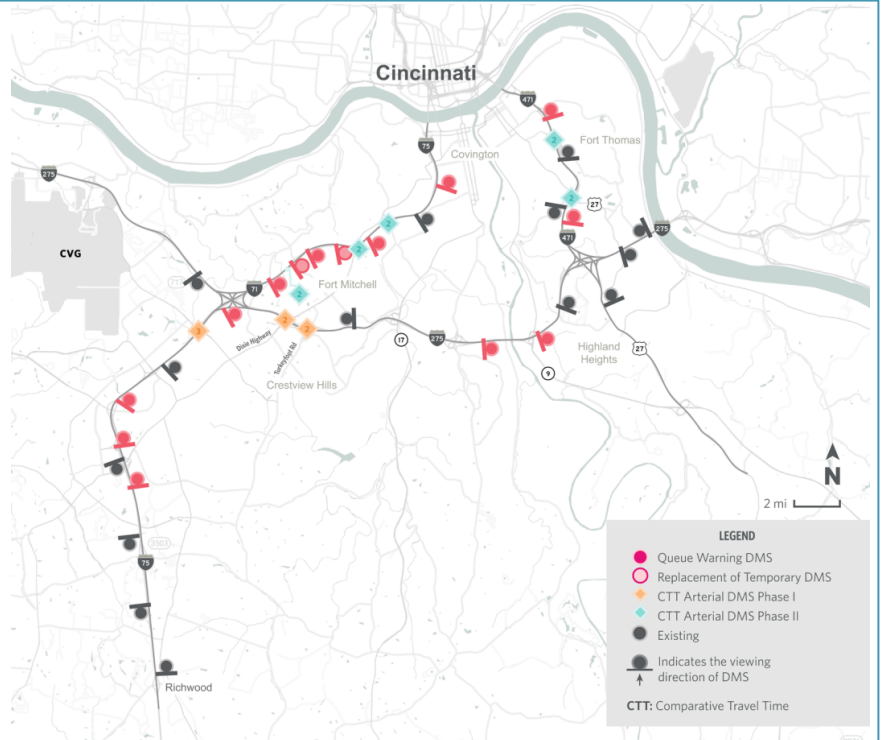
Identified Needs:

The recurrent peak period traffic congestion as well as the non-recurrent congestion on the Northern Kentucky Interstate corridors causes considerable queues along the roadway. Even local commuters cannot anticipate the queues since many are the result of crashes, non-crash incidents, or weather events.

The queues create traffic bottlenecks, but they also present a safety hazard. The high number of rear-end crashes in the more frequently congested areas is likely related to this queuing. Drivers traveling at free-flow speeds of 60 to 70 mph may not observe the downstream queues soon enough to react appropriately. The current limited queue warning system in the region is beneficial, but it could be significantly enhanced to be more effective.

Proposed Improvement:

Queue Warning Systems (QWS) alert drivers about slowed or stopped traffic to prevent sudden slowing and to reduce the number and severity of rear-end or erratic lane change crashes. The proposed Northern Kentucky QWS deployment would upgrade and extend the current system and make it permanent. The proposed QWS deployment would install up to 14 new side-mount DMS along the interstates in the study area. As shown, the focus of these new signs is on I-75 NB, I-471 NB, and I-275 EB. The existing permanent DMS signs would also be used as part of the QWS, providing extensive system-wide coverage. With the new DMS in place, the QWS would cover the most congested areas of the Northern Kentucky Interstate system with mainline signs nearly every mile (and closer in some locations).



Queue Warning DMS Installations

Benefits:

Operational:

- Systemwide Annual VHT reduction: **110,300 hours**
- User Cost Savings: **\$2,969,500**

Safety:

- Systemwide Annual Rear-End Crash reduction: **14 crashes**
- User Cost Savings: **\$656,810**

Cost Estimate:

Construction:	\$ 4,200,000
+ O&M:	\$ 560,000
+ Contingency:	\$ 714,000
Total:	\$ 5,474,000

Benefit Cost Assessment:

(10-year project lifecycle)

Ops Benefit Tot.:	\$ 22,316,000
Safety Benefit Tot.:	\$ 4,936,000
÷ Cost Total:	\$ 5,474,000

B/C Ratio: 5.81

Deployment: Ramp Metering System

Description:

Install ramp meters (signals) on the I-71/ I-75 northbound on-ramps from I-275 to the Brent Spence Bridge and on the I-471 northbound on-ramps from I-275 to the Daniel Carter Beard Bridge. The ramp meters would improve peak period mainline freeway operations and safety by metering (smoothing) the ramp entry flows.

Identified Needs:

The I-71/ I-75 and I-471 corridors experience recurrent and non-recurrent congestion in both directions, but particularly in the northbound direction during the AM peak period. During weekday mornings, median speeds drop between I-275 and the Ohio River crossings. Volumes often reach or exceed capacity at various points in the corridors.

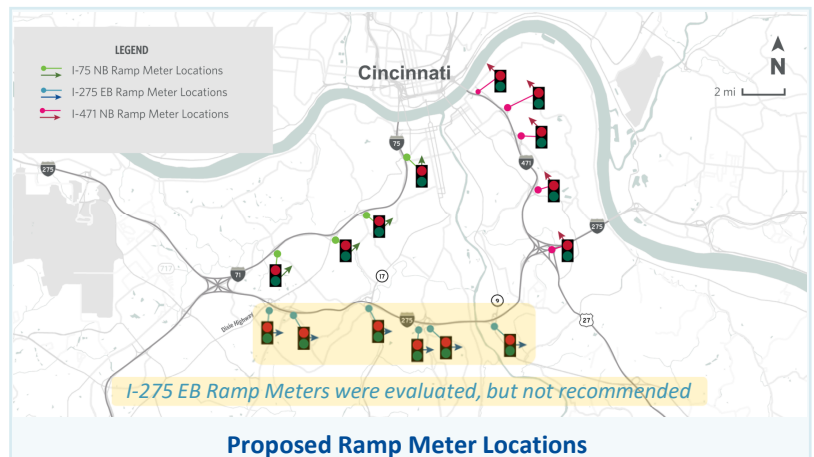
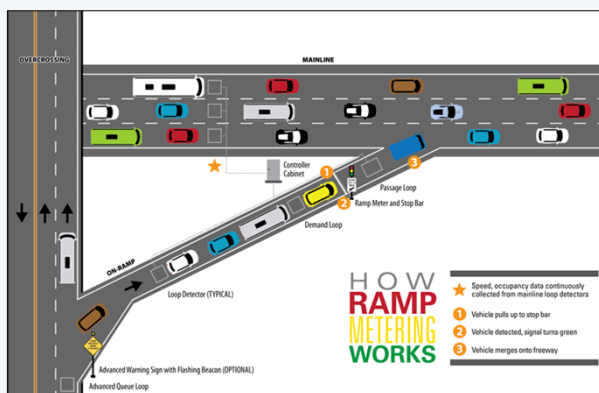
The ramp entering volumes in both corridors contribute to the congestion by causing turbulence at the merge points which lowers the capacity as the demand increases. The on-ramp volumes also often arrive in platoons or groups due to upstream traffic signals. This magnifies the impact of the entering vehicles on mainline flows.

Ramp metering systems meter the flow of entering traffic and create consistent gaps between merging vehicles. This improves the mainline traffic operations because the gaps simplify the merge conditions for both mainline and entering drivers, thereby reducing turbulence in the mainline traffic flow.

Proposed Improvement:

The improvement includes the installation of northbound ramp metering systems on I-71/ I-75 and I-471 from I-275 to the Ohio River. The systems would include on-ramp signals, ramp vehicle detection, mainline vehicle detection, signage, and striping. Some ramps may require widening to accommodate dual-lane ramp meters for improved operations and vehicle storage. The I-71/I-75 system would include 4 metered on-ramps and the I-471 system would include 5 metered on-ramps. The ramp metering systems would be timed to not create significant ramp delays or queues while vehicles wait to enter. Metering would also only be active during peak or congested conditions and would be designed to accommodate a range of typical ramp demand volumes. Each corridor would function as a system to optimize performance. The system would be controlled from a central hub and various algorithms could be used to maximize flows.

Ramp Metering Example



Benefits:

Operational:

- Systemwide Annual VHT reduction: **67,600 hours**
- User Cost Savings: **\$1,819,900**

Safety:

- Annual Rear-End & Sideswipe Crash reduction: **32 crashes**
- User Cost Savings: **\$1,156,500**

Cost Estimate:

Construction:	\$ 3,650,000
+ O&M:	\$ 2,500,000
+ Contingency:	\$ 922,500
Total:	\$ 7,072,500

Benefit Cost Assessment:

(10-year project lifecycle)

Benefit Total:	\$ 22,369,000
÷ Cost Total:	\$ 7,072,500

B/C Ratio: 3.16