QUEUE WARNING

Missouri Department of Transportation

Cost:	●●○○○
Time:	**Moderate**
Impact:	**Corridor**
Who:	**State**
Hurdles:	**Public Support, Operations**

Description

Differences in speed tend to cause vehicle conflicts and can lead to abrupt stopping and slowing leading to increased congestion and the potential for collisions. Queue warning's basic principle is to inform travelers of the presence of downstream stop-and-go traffic (based on real-time traffic detection) using warning signs and flashing lights. Drivers can anticipate an upcoming situation of emergency braking and slow down, avoid erratic behavior, and reduce queuing-related collisions. Dynamic message signs (DMS) show a symbol or word when stop-and-go traffic is near. Variable speed limits and lane control signals that provide incident management capabilities can be combined with queue warning. The system can be automated or controlled by a traffic management center operator. Work zones also benefit from queue warning with portable dynamic message sign units placed upstream of expected queue points.

Target Market

- Frequently congested freeways or roads.
- Facilities with frequent queues in predictable locations.
- Facilities with sight distance restricted by vertical grades, horizontal curves, or poor illumination.

How Will This Help?

- Queue warning can help reduce primary and secondary crashes by alerting drivers to congested conditions. Furthermore, the incident severity is reduced because drivers are prepared for impending congestion.
- Queue warning can help delay the onset of congestion. With more uniform speeds, traffic flows more smoothly and efficiently. This allows higher traffic volume to be handled and improves trip travel time reliability.
- Environmental benefits with queue warning can include decreased emissions, decreased noise, and decreased fuel consumption.

Implementation Examples

Houston, Texas: In 2008 and the beginning of 2009, researchers tested a queue warning system on IH 610 West in Houston. The right two lanes of IH 610 near the US 59 interchange often backup sporadically throughout the day, causing significant safety concerns from the speed differential across all traffic lanes. Some drivers in the center lane even come to a complete stop in free-flowing traffic to make a late merge, thus compounding the problem.

Researchers performed a before-after analysis of speeds and crash rates. The average speeds were generally higher, and the variance of speeds across all lanes was significantly reduced. Crash incidents changed little during the period, though a more detailed evaluation should be completed based on a 12 month period to determine the true effect on crashes.[1]

Germany: Queue warning deployment on the A8 Autobahn between Ulm and Stuttgart in Germany shows that it improves the quality of traffic flow, reduces speeds with closer headways, encourages more uniform driving speeds, and slightly increases capacity. Since drivers know about the possibility of queues, crashes are less severe and less frequent. It was also noted that users are interested in knowing the location of the queue and what route they should take to avoid it.[2]

Sweden: When queue warning is included in a larger traffic management project that has lane control signals, variable speed limits, and dynamic message signs, it is possible to reduce the speed incrementally and move traffic out of a lane to provide access and safety for emergency workers. In Sweden, this type of system helped to reduce crashes by 23 percent overall, specifically serious crashes decreased by 35 percent, and secondary crashes decreased by 46 percent. In Germany, crashes were *reduced* by 20 percent on an autobahn with queue warning while they *increased* by 10 percent on a similar autobahn without queue warning.[3]

Worldwide: Work zones also take advantage of queue warnings. Many agencies use mobile DMS to warn approaching traffic of queues. The results are very positive, an example being, in Belgium where 60 percent of rear-end crashes were avoided.[4] On some roads, like on both the inner and outer ring roads in Paris, France, congestion occurs so regularly that users are much more interested in knowing the expected travel time to their exit than the presence of a downstream queue.[5] A study in Washington found that queue warning could reduce congestion related collisions by 15 to 20 percent and that the benefits were estimated to outweigh the cost within one to three years.[6]

Application Techniques and Principles

General criteria for queue warning include considerable peak hour congestion on a freeway facility; the presence of queues in predictable locations; sight distance restricted by vertical grades, horizontal curves, or inadequate illumination; right-of-way for overhead gantries and DMS; and a significant number of incidents related to queuing or merging. Additionally, a facility can benefit from queue warning if it has a large mix of high profile vehicles or steep downgrades that contribute to higher operating speeds. Furthermore, its success is enhanced by good communication connections to a traffic management center that can coordinate the use of a range of strategies and an agency willingness to automate the deployment of those strategies to aggressively attack congestion when and where it happens.

Issues

The following are key factors that can facilitate successful deployment:

- When implemented with variable speed limits, the queue warning pictograms and/or flashing lights need to be visible to all vehicles. During normal operation, all the signs are blank. The signage should also be consistent and uniform to clearly indicate congestion ahead.
- An expert system that deploys the strategy based on prevailing roadway conditions without requiring operator intervention is optimal.
- Queue warning can be more effective when deployed in conjunction with variable speed limits.

Who Is Responsible?

The local TxDOT office bears the responsibility of developing and maintaining queue warning. This agency should determine the viability of and need for the strategy along with the availability of right-of-way required for sign installation at regular intervals for adequate visibility. In addition, it should provide the adequate infrastructure for the traffic management center and the deployment of other devices.

Project Timeframe

The length of queue warning projects differ based on the scale of the problem and the available infrastructure. The systems should have adequate connections to the local traffic center, and other supporting infrastructure and policies should be in place. Furthermore, since some additional signage will be required, a typical queue warning may take between one and two years to initiate.

Cost

The cost of queue warning installation within a corridor varies considerably depending on the existing infrastructure and the selection and spacing of overhead gantries, DMS, and other related signage.

Data Needs

Queue warning deployments require standard traffic information to evaluate the need and to deploy the strategy. Data regarding traffic volumes, travel speeds, and incident presence and location are essential to determine the need for deployment.

Queue Warning Best Practice

- Type of Location: Congested freeway segments.
- Agency Practices: Roadways should be monitored for speed and volume.
- Frequency of Reanalysis: Annual analyses should ensure that any changes in queueing patterns are identified; warning devices may also require redeployment with changes in operating strategies or road configurations.
- Supporting Policies or Actions Needed: Monitoring equipment; overhead sign and light installations.
- Complementary Strategies: Variable speed limits.

For More Information

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