

SIGNALIZED INTERSECTION SAFETY STRATEGIES



Employ Multiphase Signal Operation

WHERE TO USE

Signalized intersections with a high frequency of angle crashes involving left turning and opposing through vehicles. A properly timed protected left-turn phase can also help reduce rear-end and sideswipe crashes between left-turning vehicles and the through vehicles behind them.



Photos by: Texas Transportation Institute, FHWA

DETAILS

This strategy includes using protected left-turn phases and split phases. A two-phase signal is the simplest method for operating a traffic signal, but multiple phases could improve safety. Left turns are widely recognized as the highest-risk movements at signalized intersections. Protected left-turn phases significantly improve the safety for left-turn maneuvers by removing conflicts with the left turn. Split phasing, which provides individual phases for opposing approaches, could improve intersection safety but increases the overall delay and should be used cautiously.

KEY TO SUCCESS

The overall length of the turn lane is a key element in the design of the lane. A lane that does not provide enough deceleration length and storage space for left-turning traffic could cause the turn queue to back up into the adjacent through lane. This can contribute to rear-end and sideswipe crashes and increase delay for through vehicles.

ISSUES

A separate phase for the left-turn movement may reduce delay for the vehicles turning left but could result in more overall delay. The length of signal phase and cycle length should be compatible with the left-turn lane length. Through-vehicle queues could block turn lanes that are too short, making the lane inaccessible and also negating the effectiveness of a lead left-turn phase. Provision of a left-turn lane on an approach may involve restricting left turns in and out of driveways. Implementation of improvements to signal phasing may necessitate the replacement of older controllers.



TIME FRAME ●○○○

Implementing this strategy may range from a few months to three or four years. Protected-only phasing can be implemented only where a separate left-turn lane exists. Where the intersection channelization already exists, the cost can be very small. Even where no such channelization exists, it could be possible to re-stripe an approach to provide it.

At other locations, lengthening the left-turn lane, widening the roadway, acquiring additional right-of-way, or redesigning the roadway alignment may be needed in conjunction with changes in signal operation policies.

COSTS ●○○○

Costs could be highly variable and may depend on the condition and flexibility of the existing traffic signal and controller. If the existing traffic signal only requires a minor modification, then the cost would be low. If a completely new traffic signal is needed, then the cost could be higher. In addition to the equipment costs needed for the signal, expenditures are needed for advance warning signs and markings. Similarly, costs would be higher if additional dedicated left-turn lanes are required; these costs may include right-of-way, pavement, pavement markings, and lane use signs.

EFFECTIVENESS

TRIED/PROVEN: Various studies have proven that installing protected left-turn phases improves left-turn safety. The isolation of left-turning traffic usually reduces rear-end, angle, and sideswipe crashes, and improves the flow of through traffic. A protected/permitted left-turn phase has not been shown to provide the higher degree of safety of a protected-only phase, but it is safer than permitted-only phasing.

The Federal Highway Administration's *Signalized Intersections: Informational Guide* provides a summary of studies of the effectiveness of adding left-turn lanes and protected left-turn phases, and concludes that providing both a left-turn phase and left-turn lane appears to provide the most safety benefit. One study concluded that left-turn crashes can be reduced 16% and right-angle crashes 19% when a protected left-turn phase is provided. An ITE study indicates that employing split phasing can reduce crashes by 25%. Another study showed a 17% reduction in left-turn crashes with the use of a protected/permissive left-turn phase.

COMPATIBILITY

This strategy can be used in conjunction with other strategies for improving safety at signalized intersections, most notably strategies concerning the addition of left-turn lanes.

SUPPLEMENTAL INFORMATION

Highway agencies should review their traffic engineering and design policies regarding the use of, or warrants for, protected left-turn phases to ensure that appropriate safety-based action is being taken on routine projects. *NCHRP Synthesis 225: Left-Turn Treatments at Intersections* summarizes recent guidance on determining left-turn phasing.

For more details on this and other countermeasures: <http://safety.transportation.org>

For more information contact:

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