



U.S. Department
of Transportation
**Federal Highway
Administration**

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1200 New Jersey Avenue, SE
Washington, D.C. 20590

In Reply Refer To: HOTO-1

Ali Mozdbar, P.E., PTOE
Signal Engineer
Austin Transportation Department
2006 East 4th Street
Austin, Texas 78702

Dear Mr. Mozdbar:

Thank you for your April 22 request for approval to experiment with a non-standard signal display sequence as a part of an adaptive flashing red arrow (AFRA) operation. The AFRA operation would switch between protected-only left-turn mode and permissive left-turn mode, depending on whether or not the opposing left-turn bay is occupied, as determined by vehicle detectors.

It is our understanding that the purpose of the AFRA operation is to increase the capacity of the left-turn movement by allowing turns to be made on a permissive basis on a flashing red arrow indication (after coming to a full stop) when the opposing left-turn bay is unoccupied. During such times, sight distance for the AFRA left-turn movement is not blocked by an opposing left-turn vehicle. The switch between modes could occur at any time and at multiple times during the parallel through movement's green phase.

As noted in your request, when the left-turn mode is changing from permissive (flashing red arrow) to protected (steady red arrow) within a given parallel through green phase, the display of the steady yellow arrow that is required by the MUTCD for the change interval would result in a "yellow trap", since the opposing through movement has a continuing circular green at that time. Therefore, you propose to experiment with a non-standard display that would omit the steady yellow arrow change interval display for the AFRA left-turn movement when the change in mode occurs within a parallel green phase. In such a case, the flashing red arrow would go directly to steady red arrow. However, when the left-turn change interval occurs simultaneously with the yellow change interval for the parallel through movement and opposing through movement (such as when transitioning from the major street to the side street), the steady yellow arrow would be displayed, since there would not be a yellow trap in that transition.

We have reviewed your request and your evaluation plan for the experiment. We fully understand your desire to provide increased capacity by using this innovative adaptive operation, and we recognize the issue regarding the yellow trap that is introduced by the adaptive sequence. However, we are concerned that the omission of the steady yellow change interval display might introduce unanticipated safety issues for a left-turn vehicle that has stopped at the stop line on the flashing red arrow indication and then has proceeded into the intersection while looking for a gap in opposing through traffic. When that left-turn driver sees the left-turn signal face change from

flashing red arrow to steady red arrow, will he or she incorrectly assume that the opposing through movement is also being stopped? In essence, will the left-turn driver still be “trapped” even though yellow is not being displayed to the left-turn movement?

In consideration of both the possible benefits of the adaptive operation as well as the concerns for safety, we are willing to approve your experiment, but only under the following conditions:

- The Phase 2 public education campaign must include specific information to educate drivers that opposing traffic will still have the green when a flashing red arrow changes directly to steady red arrow without the steady yellow arrow display, and what a left-turn driver who has pulled beyond the stop line into the intersection is expected to do when that change occurs.
- The police department must be actively involved in the public education campaign and during the experiment, particularly in regard to what is and is not considered legal behavior for the left-turn driver under the experimental sequence of displays, and what enforcement actions will or will not be taken during the experiment.
- Commencing immediately upon activation of the AFRA operation, and continuing throughout the multi-week acclimation period before data collection starts, city of Austin signal engineers must conduct thorough on-site observation and monitoring of how left-turn drivers behave when the flashing red arrow changes directly to steady red arrow. If there is any evidence that left turns are being made on unsafe gaps because of an incorrect assumption that the opposing through movement is preparing to stop, the experiment must be promptly terminated and the sequence and displays must be restored to meet the MUTCD standards.
- The on-site observations and careful monitoring of left-turn driver behavior must continue periodically throughout the experimentation. Such observations are to be done on-site and not just via subsequent examinations of the videotapes that are made for data collection purposes.
- Data to be collected and analyzed must include the number of occurrences of left-turn drivers who proceed into the intersection to seek a gap after stopping at the stop line on flashing red arrow, and what each such driver does when the flashing red arrow goes to steady red arrow without a yellow change interval.

Your experiment is approved for a period not to exceed one year following installation, contingent on your acceptance of the above-stated conditions. If you agree to these conditions, please send an email stating such agreement to Mr. Scott Wainwright of our MUTCD Team at scott.wainwright@dot.gov. Your specific approval has been numbered "4(09)-9 (E) Non-standard Sequence with Adaptive Flashing Red Arrow – Austin, TX." Please reference this number in any future correspondence. Also, please be aware of any State laws and/or directives covering the application of MUTCD provisions that may exist in Texas.

Thank you for your innovative thinking and your interest in improving signalized intersection capacity. We hope that this experiment can be pursued safely and that it will provide useful information.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Mark R. Kehrl". The signature is fluid and cursive, with a large initial "M" and a distinct "K".

Mark R. Kehrl
Director, Office of Transportation
Operations