# TRAFFIC ENGINEERING HANDBOOK

## 6TH EDITION

Institute of Transportation Engineers


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When the approach detectors are set back from the stop line, care must be taken to ensure that no entrances or parked vehicles are between the detector and the stop line. Vehicles that approach the stop line without entering the detection zone will not be recognized by the controller and will not receive a green signal.

**Length of Detection Area.** No single length or table of lengths constitutes an ideal length of a detection zone versus some operational parameter. As detector capability and controller and system software evolve, the criteria for selecting the size of a detection zone evolve as well.

The length of the detection area also relates to the use of presence detection as a traffic operational measure. For some systems, density of traffic (vehicles/unit length or seconds occupied/unit of time) is a factor in the decision-making process and an MOE. The size of the detection zone for this purpose is usually suggested in the systems' technical data.

In intersection operation, not all vehicles stop exactly at the stop line. Some stop before it and others stop and creep across it to varying degrees. It may not be desirable to erase a call from a vehicle that has crossed the stop line but not proceeded through the intersection, or to fail to detect a vehicle that stops one-half a car length behind the stop line. These are operational decisions that the designer must make in conjunction with the operating agency.

**Dilemma Zone.** The dilemma zone is a space between two points on an approach to a signalized intersection, generally defined as beginning at a point where approaching drivers—when shown a yellow display—will stop at the stop line of the intersection and ending where drivers—again, when shown a yellow display—will proceed through the intersection before the red indication is displayed. Between these two points, drivers are in a dilemma as to whether to stop or proceed. Some will decide to stop and others to continue on. An abrupt stop may cause a rear-end crash and failing to stop may cause a right-angle crash.

The dilemma zone's actual position and size depend in part on the operating speed, size and weight of the vehicle and may vary for different vehicle types.

If the traffic control signal does not display a yellow indication on an approach when a vehicle is in the dilemma zone, a significant source of crashes can be eliminated. To minimize the likelihood of an untimely yellow display, an actuated controller with an appropriate detection system can be provided. Essentially, the controller provides a green display until the detectors indicate that there is no vehicle in the dilemma zone. Under heavy traffic conditions, such gaps in traffic may not exist often enough to allow the other approaches to be served properly, which in turn may reduce the overall effectiveness of the operation.

The extension time-setting requires a compromise. If a setting of only 2.5 sec. is used, the result is an efficient operation but poor protection for slower vehicles. If slower vehicles are to be protected by increasing the extension time, the green display may be extended to the maximum green interval.

**Calling Detector.** Calling detectors are placed near the stop line or at a facility exit to ensure that the controller recognizes any vehicle that enters the roadway downstream of the approach detectors. Such vehicles may be leaving an on-street parking space or exiting from a facility.

**Preemption/Priority.** Detectors assigned to detect vehicles that require preemption or priority response by the intersection controller or signal system are of two general types—emitter/receiver and position-of-vehicle. Emitter/receiver types are used extensively for preemption because of their communications range and message-content capability. Preemption response times must be based on the worst-case starting position of the controller, making long-range notification highly desirable.

The emitter is placed on the vehicle, and the receiver is normally placed at the intersection. The receiver must be placed where the transmitted signal can be most easily received from a distance. If the detector is optical, it needs an open line of sight. The best location is usually over the approach lane.

Position-of-vehicle detectors must be able to "read" a unique feature of the vehicle, or the detector must be placed in an exclusive-use lane.

### *6. Preemption/Priority Control*

Traffic signals may be designed and operated to respond to certain classes of approaching vehicles by altering the normal controller timing and phasing plans during the approach and passage of those vehicles. The alternate plan(s) may