Kansas
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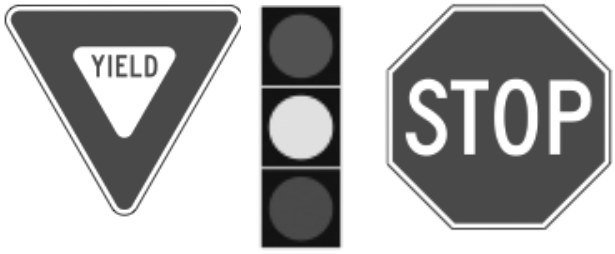
Which Type of Traffic Control is Needed at This Intersection, if Any?

By Mehrdad Givechi, P.E., P.T.O.E.

A guide for local agencies in knowing how to tell.



When it comes to controlling traffic at intersections, one size does not fit all. Whether to place a stop or yield sign or traffic signal, add a roundabout, or just leave the intersection without any traffic control, depends on a few important factors, including approach speed, sight distance, and traffic volumes. This article will outline the considerations for installing different types of traffic control on local roads for optimal traffic safety.

Function of traffic control at intersections

Traffic control devices alter the "rules of the road" for driver behavior to improve safety. Where there are no traffic control devices, the right-of-way rules of the road apply. These rules are established by the state and local laws in accordance with the state *Motor Vehicle Code*. The rules say:

1. The driver of a vehicle approaching an intersection must yield the right-of-way to any vehicle or pedestrian already in the intersection; and

2. The vehicle on the left must yield to the vehicle on the right if they arrive at approximately the same time. Traffic control devices, such as YIELD or STOP signs or traffic signals, can be used to assign the right-of-way at intersections on one or more approaches. Roundabouts or mini traffic circles provide another way to assign right of way; we'll mention those on page 2.

Guidelines on selection of intersection control type

The *Manual on Uniform Traffic Control Devices* (MUTCD), which is the national standard for traffic control, outlines the specific types of information needed to make the decision about installing a traffic control device. The MUTCD states that engineering judgment should be used to establish intersection control type with the following factors as guidance:

- Vehicular, bicycle, and pedestrian traffic volumes on all approaches;
- Number and angle of approaches;
- Approach speed;
- Available sight distance on each approach; and
- Reported crash experience.

No traffic control. Where there is no history of crashes, sight distance is good, and total entering traffic volumes are very low (less than 400 vehicles per

Do you need to be an engineer to determine where traffic control devices will be placed? According to the MUTCD, Section 1A-09, the decision to use a particular traffic control device at a particular location should be made on the basis of an engineering study or the application of an engineering judgment, both of which shall be performed by an engineer or by an individual working under the supervision of an engineer (See MUTCD, Section 1A-13, items 64 and 65).

What is an engineering study? According to the MUTCD, an engineering study is the comprehensive analysis and evaluation of available pertinent information, and the application of appropriate principles, provisions, and practices as contained in the MUTCD and other sources, for the purpose of deciding the applicability, design, operation, or installation of a traffic control device. The MUTCD requires that an engineering study be documented.

Images from the MUTCD 2009 edition

day), uncontrolled intersections may be a good choice.

In fact, according to FHWA-SA-05-11 "Road Safety Fundamentals," uncontrolled intersections may even be safer than stop-controlled intersections at low volumes because a driver may be more likely to run a STOP sign if he or she knows there is little chance of a vehicle coming the other way. The publication states that drivers typically are more cautious when crossing an intersection when they believe other drivers do not have to stop.

Yield and stop control.

Yield control. Uncontrolled intersections may not work well when daily volumes exceed 400 vehicles. Use a YIELD sign if there is no crash history and sight distance is adequate. Often, a YIELD sign causes less delay than a STOP sign, because it requires drivers to adjust speed to yield to another vehicle and not necessarily to come to a complete stop.

Stop control. Stop control may be necessary because of sight distance restrictions, high traffic volumes, or unusual conditions such as high crash locations. Local agencies use two-way stop control on minor roads that intersect roads with heavier traffic volumes, higher operating speed, or those that appear to be major roads. All-way stop control works best when traffic volumes are roughly the same on each approach to the intersection.

The MUTCD states that YIELD and STOP signs should be used at an intersection if one or more of the following conditions exist:

- An intersection of a minor roadway with a main roadway where application of the normal right-of-way rule would not be expected to provide reasonable compliance with the law;
- A roadway entering a designated major roadway (e.g. state route, arterial, thoroughfare, parkway); and/or
- An unsignalized intersection in a signalized area.

The MUTCD also says the use of YIELD or STOP signs should also be considered at the intersection of two minor streets or local roads where the intersection has more than three approaches and where one or more of the following conditions exist:

—The combined vehicular, bicycle, and pedestrian volumes entering the intersection from all approaches average more than 2,000 units per day;

—Restricted sight distance; and/or

—Five or more crashes within a 3-year period, or three or more crashes within a 2-year period, all caused by failure to yield the right-of-way under the normal right-of-way rules.

Signal control. When traffic volumes are too high for any type of stop control, consider installing a traffic signal (only if it is warranted in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD) or a modern roundabout, which works well when traffic volumes are nearly even on each approach leg, when left-turn movements are heavy, when severity of crashes are of primary concern, or when speeding is an issue.

Drivers are typically more cautious at an intersection when they believe others drivers do not have to stop.

According to MUTCD, an engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to

Sight Distance Considerations

Sight distance is a factor when considering installing a traffic control device. Poor sight distance can lead to rear-end crashes on the approaches to intersections and to angle crashes within the intersections because drivers may be unable to see and react to traffic control devices or approaching vehicles. As a driver approaches an intersection, two different types of sight distances come into play:

- Stopping sight distance to the intersection—Drivers on the main road need to see far enough ahead so they can stop safely if a vehicle on the side road makes an unsafe move caused by lack of traffic control on minor road or lack of their visibility.
- Intersection sight distance—This is typically defined as the distance a motorist can see approaching vehicles before their line of sight is blocked by an obstruction near the intersection. The driver of a vehicle approaching a yield condition or departing from a stopped position at an intersection should have an unobstructed view of the intersection and enough time to anticipate and avoid potential collisions. Examples of obstructions include farm crops, hedges, trees, fences, berms, bridge railing, culvert headwall, utility poles, traffic control devices such as signs and signal equipment, buildings, parked vehicles, street furniture, etc. The horizontal and vertical alignment (ie., curves and dips or rises) of the roadways approaching the intersection can also reduce the sight distance.

The area needed for provision of the unobstructed view is called the clear sight triangle. There are two types of sight triangles:

- Approach sight triangle, which covers a larger area and is applied to uncontrolled or yield-controlled intersections; and
- Departure sight triangle, which is smaller than its counterpart and is applied to stop-controlled (two-way or all-way) or signalized intersections.

For more information on sight distance, refer to AASHTO's "Green Book": A Policy on Geometric Design of Highways and Streets, 2011 Edition, Sections 3.2 and 9.5. https://bookstore.transportation.org/collection_detail.aspx?ID=110.

determine whether installation of a traffic signal is justified at a particular location. The study shall include analysis of factors related to the existing operation and safety at the study location, the potential to improve these conditions, and the applicable factors contained in the following traffic signal warrants.

- Eight-hour vehicular volume
- Four-hour vehicular volume
- Peak-hour vehicular volume
- Pedestrian volume
- School crossing
- Coordinated signal system
- Crash experience
- Roadway network
- Intersection near a grade crossing

The MUTCD states that satisfaction of one or more traffic signal warrants shall not in itself require the installation of a traffic signal. The need should be based on an engineering study.

Conclusion

If you are considering adding traffic control to an uncontrolled intersection, be sure you are following the guidance in the MUTCD; the Manual is designed to create safer conditions, and following it will help reduce liability for your agency in the event of a crash. More (and more expensive) traffic control is not always the best way to address a safety concern. Sometimes the best approach is a simple one, especially in low-volume situations.

For more information, consult the sources listed below. ■

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Install a YIELD or STOP sign? Helpful hints from the MUTCD

- YIELD or STOP signs should not be used for speed control.
- YIELD or STOP signs should not be installed on a higher volume roadway unless justified by an engineering study.
- When two roadways with the relatively equal volumes and/or characteristics intersect, consider installing YIELD or STOP sign to control the direction that:
  - —Conflicts the most with established pedestrian crossing activity or school walking routes;
  - —Has obscured vision, dips, or bumps that already slow down the drivers; and
  - —Has the best sight distance from a controlled position to observe conflicting traffic.
- YIELD or STOP signs shall not be used in conjunction with any traffic signal control except:
  - —If the signal indication for an approach is a flashing red at all times; or
  - —If minor roadway is located within or adjacent to the area controlled by a traffic signal, but does not require separate traffic signal; or
  - —If a channelized turn lane is separated from the adjacent travel lanes by an island and the channelized turn lane is not controlled by a traffic signal.

Source: MUTCD, 2009, Chapter 2B, http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/part2b.pdf

Modern roundabouts have also proven to be safe and efficient types of intersection traffic control devices. They work well when traffic volumes are nearly even on each approach. Single-lane roundabout is often a good alternative to all-way stop control. Multi-lane roundabout can replace traffic signals, but they are very complicated in design.

Traffic circles, on the other hand, are traffic calming devices (often used on local residential streets) with much smaller inscribed diameters and do not have the characteristics of modern roundabouts.

For more information on roundabouts refer to TRB publication, NCHRP Report 672, Roundabouts: An informational Guide, 2nd Edition, 2010. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_672.pdf

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Sources:

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- NCHRP Report 672, Roundabouts: An informational Guide, 2nd Edition, 2010. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_672.pdf