Traffic Engineering & Highway Safety Bulletin

Military Surface Deployment and Distribution Command Transportation Engineering Agency

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Intersection Control

Did You Know?

One of the most common questions SDDCTEA receives is, *"What is the appropriate type of intersection traffic control for a given set of conditions at an intersection?"* In practice, there are five basic types of intersection traffic control:

- ✓ No control
- ✓ YIELD control
- ✓ STOP control
- ✓ Multiway stop control
- ✓ Traffic control signals

Use the minimum appropriate level of traffic control that promotes safe and efficient traffic operations and minimizes delay while still being cost effective. The Federal Highway Administration's *Manual on Uniform Traffic Control Devices* (*MUTCD*) provides guidelines for selecting appropriate traffic control devices.

The assessment of needed traffic control must be conducted by a qualified traffic engineer. When appropriate, installations should seek traffic engineering assistance from others, such as the state transportation agency, their county, a nearby city traffic engineering consultant, or SDDCTEA.

No Control

The most basic control type is not to have any traffic control. In this case, the motorist has the basic responsibility to navigate through the intersection and to assign right-of-way among other vehicles. The absence of traffic control should be used only in very low-volume applications where sufficient sight distance is available.

Some applications for intersections with no control may include very low-volume streets in housing areas, parking areas, or low-volume driveways that intersect local or collector roadways.

IN THIS ISSUE:

Yield Control

Purpose and Applications

Vehicles controlled by a YIELD sign must slow down or stop, when necessary, to avoid interfering with conflicting traffic. YIELD signs may be warranted if engineering judgment indicates that one or more of the conditions shown in the table on page 3 exist.

Sign Layout and Placement

R1-2

Sizes of the YIELD sign vary from 30 inches by 30 inches to 60 inches by 60 inches depending on roadway classification. In most cases, the use of a 36-inch by 36-inch sign is appropriate for conventional roads. The use of a 48-inch by 48-inch sign is appropriate for an expressway. Expressways are typically divided with full to partial control of access. Conventional roads typically include all roadway classifications less than expressways.

The YIELD sign shall be installed on the right side of the roadway approach to which it applies. The YIELD sign shall be located as close as practical to the intersection it regulates, at the point where a vehicle should yield, while optimizing its visibility to the road user. When a YIELD sign is installed at an intersection and the sign visibility is restricted, a Yield Ahead (W3-2) sign shall be installed in advance of the YIELD sign.

W3-2

What is Wrong with This Picture?

Answer on Page 7

When to use a YIELD sign	
	Although uncommon, when the ability to see all potentially conflicting traffic is sufficient to allow a motorist traveling at the posted speed to pass through the intersection or to stop in a reasonably safe manner.
	At a merging area where there is not adequate sight distance.
	At a channelized right-turn lane without an acceleration lane.
	At the entrance to a roundabout.
	At the second crossroad of a divided highway, where the median width at the intersection is 30 feet or greater.
	At an intersection where special problems exist and where engineering judgment indicates that the problems are susceptible to correction by the use of a YIELD sign.

Stop Control

Purpose and Applications

R1-1

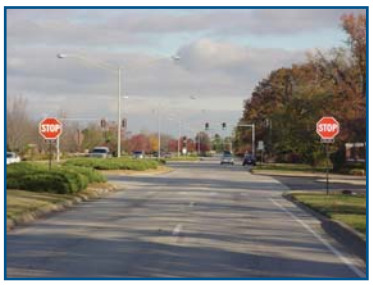
STOP (R1-1) signs should be used when vehicles are required to stop if engineering judgment indicates that one or more of the conditions shown in the table at the bottom of this page exist.

Once the decision has been made to install two-way stop control, the decision regarding the appropriate street to stop should be based on engineering analysis. In most cases, use stop control on the street carrying the lower volume of traffic. There are exceptions to this, such as when traffic volumes on both streets are balanced and visibility, pedestrian safety, or geometric conditions warrant stopping the other legs.

Stop control should never be used to reduce vehicular speeds. Stop control used in this manner breeds disrespect for stop control that is actually warranted by volumes. Traffic rarely comes to a full stop, and drivers tend to increase their speed between STOP signs to make up for lost time.

Layout and Placement

In most military applications the 30-inch or 36-inch version should be used. The 30-inch version should be used on conventional roads, and the 36-inch version should be used on expressways. At unexpected locations or where traditional sizes have failed to alert motorists, an oversized, 48-inch STOP sign can be used.

When to use a STOP sign	
	For a street entering a through highway or street.
	At an unsignalized intersection in a signalized area.
	Where restricted view or crash records indicate a need for STOP sign control.

W3-1

The STOP sign shall be installed on the right side of the roadway approach to which it applies. Locate the STOP sign as close as practical to the intersection it regulates at the point where a vehicle should stop, while optimizing its visibility to the road user. When the STOP sign is installed at the required location and the sign visibility is restricted, install a Stop Ahead (W3-1) sign in advance of the STOP sign.

The CROSS TRAFFIC DOES NOT STOP (W4-4p) plaque may be used in combination with a STOP sign when engineering judgment indicates that conditions are present that could cause drivers to misinterpret the intersection, perhaps as a multiway stop. Alternate messages such as TRAFFIC FROM LEFT (RIGHT) DOES NOT STOP or ONCOMING TRAFFIC DOES NOT STOP may be used on the W4-4p plaque when such messages more accurately describe the traffic controls established at the intersection.

W4-4p

"How far in advance of an intersection do I place a Stop Ahead or Yield Ahead sign?"	
Posted Speed	**Distance**
35 mph or less	*
40 mph	125 ft
45 mph	175 ft
50 mph	250 ft
55 mph	325 ft

** No distance is provided since placement location depends on site conditions and other signing to provide an adequate advance warning to the driver.*

Note: These distances are minimum distances. If space is available, it is preferable to use longer distances.

SPECIAL ANNOUNCEMENTS

The US Army Corps of Engineers is conducting two separate workshops:

1. **Access Control Point Workshop**
   August 20 – 22, 2007

   This course will provide guidance and standards for planning and designing Access Control Points (Entry Control Facilities) into military installations.

2. **"DoD Security Engineering Facilities Planning Manual and DoD Minimum Antiterrorism Standards for Buildings"**
   August 23 – 24, 2007

   This course will provide an overview of the "DoD Minimum Antiterrorism Standards for Buildings" (UFC 4-010-01) and the "DoD Security Engineering Facilities Planning Manual" (UFC 4-020-01) and how they relate to each other and to the overall process of designing to mitigate the effects of terrorist, criminal, and foreign intelligence threats. The class will also include a preview of the upcoming "DoD Security Engineering Facilities Design Manual" (UFC 4-020-02)

Both workshops will be conducted at the San Destin Hilton Golf Resort and Spa, South Destin, Florida.

For more information or to register, contact Gary Kehoe at: Gary.L.Kehoe@usace.army.mil. When registering, provide your name, position, organization, location and choice of workshop(s).

Multiway Stop Control

Purpose and Application

Multiway stop control is helpful at locations where sight distance or crash history cannot be corrected through other means. Multiway stop control can be used where the volume of traffic on the intersecting roads is approximately equal.

The decision to install multiway stop control should be based on an engineering study. The criteria in the table below should be considered.

Multiway STOP signs must always be supplemented with a plaque (R1-3 or R1-4) so that approaching motorists are aware of the traffic control requirements on other approaches. Such plaques shall have a white legend and border on a red background. The minimum size for the 4-WAY sign is 12 inches by 6 inches. The minimum size for the ALL WAY sign is 18 inches by 6 inches. These plaques should only be used if all approaches to the intersection are required to stop.

R1-3

R1-4

Justification for Multiway Stop Control	
Temporary Measure	✓ Where traffic control signals are justified, the multiway stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.
Crashes	✓ If a crash problem is present, as indicated by five or more reported crashes in a 12-month period, and susceptible to correction by a multiway stop installation.
Minimum Traffic Volumes	✓ The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day, and; ✓ The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour.
High Speed Considerations	✓ If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrant is 70 percent of the values shown for the "minimum traffic volume" warrant.
Combination Warrant	✓ If there are four or more reported crashes in a 12-month period that are susceptible to correction by a multiway stop installation, and the minimum vehicular volume warrant is 80 percent of the values shown for the "minimum traffic volume" warrant.

continued on page 7

Stop and Yield Lines

Stop lines supplement STOP signs. When used, the location of the stop line is determined primarily by the geometry of the intersection, road width, sight distance, and the design-vehicle turn radius. The stopping point should be positioned on the approach leg such that it will not conflict with vehicles turning left from the cross street.

The stop line should be marked only across the approach lanes in which traffic is, or may be, required to stop. The line should be parallel with the intersecting roadway or crosswalk.

The stop line is located at the desired stopping point. In no case should the stop line be located more than 30 feet nor less than 4 feet from the edge of the intersecting roadway or crosswalk. The stop line is reflective white and is no less than 12 nor more than 24 inches wide. The width depends on the speed of the roadway and/or the presence of hazardous conditions.

Similarly, yield lines supplement YIELD signs. Determining their location is similar to determining the location of stop lines. When used, yield lines consist of a row of solid white isosceles triangles pointing toward approaching vehicles extending across lanes to indicate the point at which a yield is to be made. As shown in the figure below, the individual triangles should have a base of 12 to 24 inches wide, and a height equal to 1.5 times the base. The space between the triangles should be 3 to 12 inches.

A common mistake is placing the stop or yield line too far away from the intersecting road where drivers do not have a clear view of traffic on the crossing road. Therefore, it is always important to check sight distances from a location about 10 feet behind the proposed location of the stop or yield line.

Traffic Signals? Yes or No?

Traffic signals assign the right-of-way between conflicting traffic flows at intersections. Traffic signals are needed when STOP sign control cannot do the job effectively. Traffic signals can also better accommodate pedestrian crossings at intersections.

Unjustified, ill-designed, improperly operated, or poorly maintained traffic signals may cause:

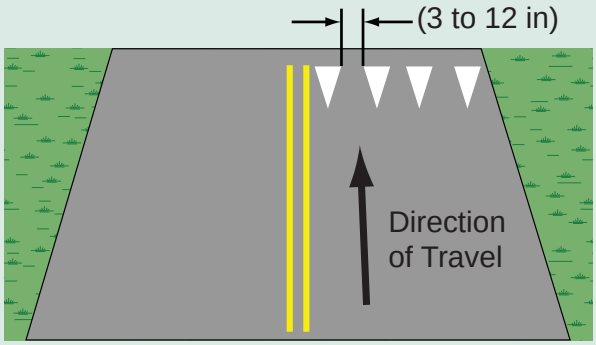
- ✓ Increased crash frequency
- ✓ Excessive delay
- ✓ Disregard of signal indications
- ✓ Circuitous travel by alternate routes

The selection and use of signals should be based on an engineering study of roadway, traffic, and other conditions. Traffic signals should not be installed unless one or more of the signal warrants are met. The *MUTCD* includes eight warrants for signals based on vehicular volume, pedestrian activities, and crash experience. **Warrants must be professionally evaluated by a qualified traffic engineer.**

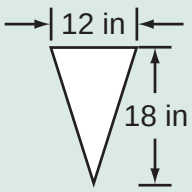
Answer from Page 2

1. There is a YIELD sign on one approach and a STOP sign on the opposite approach. Although YIELD signs at intersections are appropriate in certain situations, they should not be mixed with STOP signs at the same intersection.
2. The STOP sign is mounted too low.
3. The crosswalk markings are faded.
4. There are no stop lines present. Although stop lines are not necessary at all STOP signs, they should be provided when crosswalks are present.
5. In the upper-left quadrant of the photo, there is no sidewalk and no ADA accessible curb cut to meet the crosswalk spanning the top of the photo.

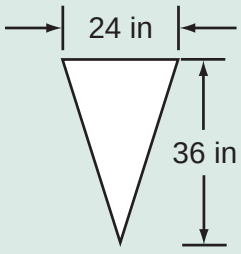
Yield Line Placement Example



Minimum Dimensions



Maximum Dimensions



Note: Triangle height is equal to 1.5 times the base dimension.

Traffic Signal Warrants

Warrant	Purpose
Warrant 1: Eight-Hour Vehicular Volume	✓ The eight-hour vehicular volume warrant is intended for application where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal, or where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict when entering or crossing the major street.
Warrant 2: Four-Hour Vehicular Volume	✓ The four-hour vehicular volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.
Warrant 3: Peak Hour	✓ The peak hour signal warrant is intended for use at a location where conditions are such that for a minimum of one hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. The warrant should be applied only in unusual cases where land uses discharge or attract a larger number of vehicles over a short time period.
Warrant 4: Pedestrian Volume	✓ The pedestrian volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. ✓ Intersection MAY be a candidate if the pedestrian volume crossing the major street at an intersection or midblock location during an average day is 100 or more for each of any four hours or 190 or more during any one hour; and in the same hour, there are fewer than 60 gaps in the traffic stream of adequate length to allow a pedestrian to cross.
Warrant 5: School Crossing	✓ The school crossing signal warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic control signal. ✓ Intersection MAY be a candidate if there are a minimum of 20 students during the highest crossing hour, and there are insufficient gaps in traffic.
Warrant 6: Coordinated Signal System	✓ The coordinated signal warrant is intended for application where the progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals in order to maintain proper platooning of vehicles.
Warrant 7: Crash Experience	✓ The crash experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal. ✓ Intersection MAY be a candidate if five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period.
Warrant 8: Roadway Network	✓ Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

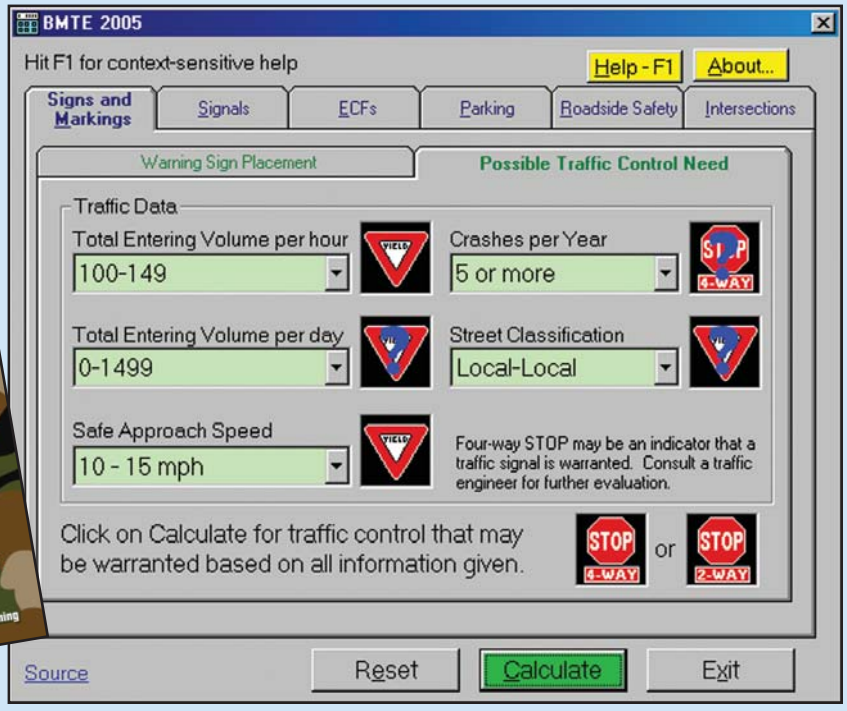
The chart above is for informational purposes only and does not provide complete guidance. If you have a location that you feel should be signalized, consult SDDCTEA or your state department of transportation for a detailed evaluation of an intersection.

What Type of Control Should You Use? A "Rule of Thumb" Guide[2][3]					
Control Type	**No Control**	**Yield Control**	**Stop Control**	**Multiway Stop Control**	**Traffic Signal Control**
Total entering volume per hour[1]	< 100 - likely	100 to 149 - likely	150 to 299 – maybe? 300 to 500 – likely	500 to 800 – maybe?	> 800 – maybe?
Total entering volume per day[1]	< 1000 – maybe?	1000 to 1500 – maybe?	1500 to 2999 – maybe? 3000 to 4999 - likely	5000 to 8000 – maybe?	> 8000 – maybe?
Safe approach speed (sight distance) in mph	> 15 mph	> 10 mph	≤ 10 mph	Blind sight distance	NA
Crashes per year (right angle)	< 3	≥ 3	≥ 3	≥5	≥5
Street classifications	Local to Local	Local to Local, Local to Collector	Local to Local, Local to Collector, Collector to Collector, Local to Major, Collector to Major	Collector to Collector, Collector to Major, Major to Major	Collector to Major, Major to Major

(1) For speeds over 40 mph, minimum volumes need be only 70 percent of values shown.
(2) Information shown for "rule of thumb" purposes only. Consult a qualified traffic engineer for the final determination.
(3) Source: SDDCTEA 55-17, Better Military Traffic Engineering.

SDDCTEA Can Help!

SDDCTEA's interactive CD-ROM, *Better Military Traffic Engineering*, provides an interactive tool which can assist you in determining the appropriate type of traffic control. The CD can be ordered at no charge by calling SDDCTEA at (757) 599-1591.



REFERENCE LIST

- Institute of Transportation Engineers. *Traffic Engineering Handbook*. Washington D.C. 1999.
- U.S. Department of Transportation, Federal Highway Administration. *Manual on Uniform Traffic Control Devices*. Washington, D.C. 2003 Edition (www.mutcd.fhwa.dot.gov).
- www.fhwa.dot.gov
- www.tea.army.mil
- www.ite.org

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