

City of Wichita School Traffic Safety Manual



Policies and Practices
2008

SCHOOL TRAFFIC SAFETY MANUAL

INTRODUCTION

The purpose of the School Traffic Safety Manual is to provide parents, teachers, and school officials with the most current information regarding the establishment of controlled crossings for the safety of school children.

This manual conforms to the school crossing criteria published in the 2003 Edition of the Manual on Uniform Traffic Control Devices (MUTCD), which has been adopted by the Kansas Department of Transportation and the City of Wichita.

The goal of this manual is to encourage the proper use of uniform traffic control devices that have been installed using good traffic engineering practices.

GENERAL

School traffic safety is a highly sensitive subject; requests for school crossing protection are continuously received from concerned parents, SITE Councils, school authorities, and local governing bodies. Although these requests express a definite concern for the school child's safety, they do not always coincide with actual needs and good traffic engineering practices. Traffic studies indicate that some requested school crossing controls are often not required and, if installed, would only tend to lessen the overall respect for those controls that are warranted. It is important to stress that regardless of the school location, safe and effective traffic control can best be obtained through uniform application of realistic policies, practices, and standards developed through engineering studies. To achieve uniformity of traffic controls in school areas, comparable situations must be treated in the same manner.

Wichita's highly successful school crossing protection plan presently in force is the result of many years of extensive cooperation between the Wichita Police Department's School Liaison, the Board of Education, the Wichita-Sedgwick County Planning Department, and the Department of Public Works. Continued success of this school safety program will rest with those dedicated individuals who will continue to spend many hours of concentrated effort toward providing proper safety controls for the protection of school children.

It is an unfortunate but unavoidable fact that schools are sometimes located near congested streets and that school boundaries require students to cross these busy roads. Without adequate traffic controls at these locations, children are forced into the dangerous situation of attempting to cross a street through traffic with inadequate gaps.

Traffic flow gaps can be created to provide the time required for children to safely cross a street. Each traffic control device and method described in this manual fulfills a specific function as related to traffic conditions. The type of traffic control device used must be related to vehicular volume and speed, street width, and the number of children utilizing a crossing location. The creation of such gaps in traffic is the responsibility of the Traffic Engineering Section. The method

utilized to determine if such action is warranted, and various types of traffic controls which can be adapted for such instances, are described in this manual.

SCHOOL ROUTE PLAN

Parents should plan a route for their child to follow when walking to and from school. Planned routes should take advantage of the protection afforded by existing traffic controls, such as stop signs, traffic signals, and crosswalks. In some instances, the best route may require the child to walk a short distance out of the way in order to take advantage of a traffic control device that would give the child a safe place to cross the street. In such situations, the following factors should be considered:

- The availability of adequate sidewalks to and from the existing controlled locations.
- The number of students using the crossing.
- The age level of the students using the crossing.
- The total walking distance.

SCHOOL CROSSING PROTECTION

Parents, schoolteachers, and school officials are interested in three main factors that contribute to the safety of a school child crossing a street: 1) educating and training the child; 2) guarding against the child's own carelessness; and 3) seeing to it that traffic is controlled so that a safe crossing can be accomplished.

Teaching a child how to cross a street starts in the home. The parents should begin instructing their children even before they reach school age. After entrance into school, schoolmates and teachers normally influence a child's behavior more than the parents; therefore, without proper follow-up in school by teachers and administrators, some of the caution instilled by parents might get lost.

A child's carelessness is another factor that affects the safety of walking to and from school. One must observe that the child does not enter the street unaware of approaching vehicles. The child must also learn to judge gaps in traffic and be taught not to play while in the process of crossing streets.

It is essential to take advantage of every opportunity to properly instruct children and develop their ability to take care of themselves at any pedestrian crossing.

SCHOOL CROSSING CONTROL CRITERIA

The key to crossing any street safely, whether by an adult or by a child, lies in the gaps in vehicular traffic. Gaps of adequate duration provide the pedestrian with the time required to safely cross a street. If the gaps in traffic are too short due to high vehicular volumes on the street, an artificial method must be selected to lengthen the gap duration.

Assurance of reasonable safety for crossing a street without traffic control devices requires that natural traffic gaps be of sufficient duration for a child or group of children to walk from one curb to the other. Observations indicate that elementary children walk at a rate of 3.5 to 4.5 feet per second. A 3.5 feet per second walk rate is utilized in conjunction with a pedestrian reaction time of 3 seconds for purposes of establishing the minimum required safe gap time. If the time between natural safe gaps averages more than approximately one minute, children will lose patience. They may start to play, which distracts from the task of crossing the street, or they may enter the street in gaps too small to permit complete crossing, causing them to wait in the middle of traffic.

Large groups of children will obviously require more time to cross a street than small groups or a single child. It can be expected that thirty to forty children crossing as a group will straggle or extend to 20 feet. That is, when the first ones are across, the last ones will still be 20 feet from the curb.

Based on these observations, it is possible to compute the volume of traffic that will give natural gaps of sufficient duration or frequency to permit children to cross without interference. For example, natural gaps permitting small groups of children to completely cross a 40-foot street will occur, on average, more than once per minute if traffic volumes (total flow in both directions) are 500 vehicles per hour or less.

A safety factor, in addition to that included in the 3-second child reaction time, is provided for slow walkers, inability of children to judge borderline opportunities to cross, and other unfavorable conditions. This safety factor is provided by the fact that rarely is the whole width of the street blocked at any given point in time, and the child can start crossing while the opposite side is still blocked. The obstructing vehicle will have cleared the crossing before the child gets to that side of the street; thus, the actual time available for crossing is greater than that used as a basis for calculation. This is especially true at school crossings since children typically cross in only one direction during a gap in traffic.

Minimum warrants have been established to determine if conditions justify the installation of a marked or signalized school crosswalk. The warrants are based on a point system evaluation of pedestrian volume, vehicle approach speed, gap time, and other general conditions. These warrants and computations are identified in Appendix I.

METHODS OF PROTECTION

School crossing locations vary in complexity, both in layout and traffic flow. These locations may be put in one of three categories: 1) those that do not need protection; 2) those requiring limited protection; and 3) those that require full protection.

No protection is required where only a few children cross a minor street of average width having a low volume of vehicular traffic allowing adequate gaps for safe crossing. Crossing locations such as this are the type which school children are confronted with most often. It is at these locations where the child is

dependent upon the previous training received, both from the parents and in the classroom.

Limited protection becomes necessary as gaps in traffic become shorter and occur less frequently. At these locations, it is the responsibility of the child, aided sometimes by school safety patrols or other traffic control devices, to select the proper gap in traffic. Marked crosswalks are usually used at these locations as a means to identify limited crossing locations.

Full protection is used on streets with heavy traffic and virtually no gaps that would allow children to safely cross a street.

The following items may be considered when selecting appropriate crossing protection and suggested routes for the child:

- School boundaries
- Sidewalks
- Stop signs
- Signalized intersections
- School signs
- Signalized school crosswalk
- Special pedestrian signal indications
- School crosswalk pavement markings
- School safety patrols
- Adult guards

School Boundaries

The ideal case would be to centrally locate one elementary school within each square mile of a residential area. This would essentially eliminate the need for crossing a major street since these major streets would form the school boundaries. This theory is not feasible in actual practice because of the unavailability of suitable school sites as well as the economics of such a measure. Careful planning of school boundaries by school administrators helps to reduce the number of children needing to cross major or arterial streets.

Sidewalks

Sidewalks provide suitable routes for a child to take going to and from school. The danger involved in children playing in the streets and utilizing the streets as walkways is quite obvious and supported by safety statistics. Pedestrians of any age should not be required to compete with a vehicle for the use of the street area. Every effort should be made to provide sidewalks in school areas in order to keep children away from conflicting vehicular traffic.

Stop Signs

Numerous traffic control devices that might aid children as they walk to and from school already exist. Intersections controlled by stop signs are in this category. These controls are often requested in the belief they may be “cure-alls”

for existing traffic and pedestrian problems. However, stop signs are to be erected only on the basis of vehicular demands and are not the most desirable control device for alleviating a pedestrian problem. Stop signs are desirable where specific warrants justify their usage. These warrants are described in Appendix II.

Signalized Intersections

Traffic signals, familiar to everyone, are intended as a control of vehicular traffic. It is highly desirable to use this control device at pedestrian crossings in school areas when the warrants required for their installation are met. A careful analysis of traffic operations and other factors at a large number of signalized and unsignalized intersections, coupled with the judgment of experienced traffic engineers, have provided a series of warrants to define the minimum requirements under which signal installations are justified. The warrants are explained in Appendix III.

Past experience has indicated that a well-trained member of the school safety patrol can adequately supervise the school crossings at most signalized intersections within the City Of Wichita.

School Signs

Traffic signs are a type of traffic control device that have been used effectively to alert motorists to the presence of school zones and school crosswalks as well as control vehicular speed in school areas. These signs, if properly enforced and used in conjunction with school safety patrols (where available), provide the school child with some protection within the immediate vicinity of the school. It is important to note unwarranted use of signs or their excessive use will foster contempt and a corresponding disregard for all signs in general.

A standard and uniform signing practice has been adopted by the City Of Wichita that conforms to the standards set forth by the Federal Highway Administration. This uniform approach to school area traffic controls assures the use of similar controls for similar situations. Signs pertaining solely to school zone signing are discussed in the following paragraphs.

School Advance Warning Assembly



The School Advance Warning assembly should be installed in advance of locations where school buildings or grounds are adjacent to the street. The sign alerts motorists to the presence of a school zone, reduced speed zone, or a school crosswalk. When used, the School Advance Warning assembly shall be installed not less than 150 feet nor more than 700 feet in advance of the school grounds or school crossings. The School Advance Warning assembly shall consist of a School Advance Warning sign supplemented with a plaque with the legend AHEAD or XXX FEET to provide advance notice to the motorists.

School Crosswalk Warning Assembly



The School Crosswalk Warning assembly shall be installed at the marked crosswalk, or as close to it as possible, and shall consist of a School Advance Warning sign supplemented with a diagonal downward pointing arrow plaque to show the location of the crossing. These signs are not to be used at marked crosswalks other than those adjacent to schools and those on established school routes. The School Crosswalk Assembly signs also shall not be installed on approaches controlled by stop signs.

School Speed Limit Assembly



A School Speed Limit Assembly or a School Speed Limit sign shall be used to indicate the speed limit where a reduced speed zone for a school area has been established. The School Speed Limit assembly shall consist of a top plaque with the legend SCHOOL, a Speed Limit sign, and a bottom plaque indicating the specific period the school speed limit is in effect. The posting of such signs will be limited to those streets adjacent to Wichita's elementary school buildings and grounds, and to those unsignalized school crosswalks utilized by elementary school children. The reduced speed zone should begin either at a point 200 ft from the crosswalk, or at a point 100 ft from the school property line, based on whichever is encountered first as traffic approaches the school. The assembly shall be located on the right side of the roadway on two-way streets and on the opposite sides of the roadway on one-way streets.

Flashing Signals



A Speed Limit Sign Beacon also may be used with a WHEN FLASHING legend to identify the periods that the school speed limit is in effect. Flashing signals are utilized for signalized crosswalks associated with elementary schools to indicate when a 20 mph speed limit is in effect. They should be installed 200 ft in advance of those crosswalks where vehicular traffic is controlled by the standard three-section (red, yellow and green lens) traffic control signals. A 20 mph speed limit sign is mounted on the pedestal supporting the advance-flashing signal and is supplemented by an additional sign informing the motorist that the speed limit is in effect when the signal is flashing.

End School Zone Sign



The end of a school speed zone shall be marked with an END SCHOOL ZONE sign. The sign is located on the reverse side of the School Speed Limit Assembly, and therefore, on the left-hand side of the road on a two-way street. Motorists may resume normal speeds

after passing this sign as conditions permit.

Signalized School Crosswalk

A signalized school crosswalk may be justified if a traffic engineering study indicates that the warrants described in Appendix I are fulfilled. School pedestrian signals installed solely under these warrants should have the following characteristics:

- Each vehicular signal face shall have three circular lenses. The lenses shall be red, yellow and green in color, and arranged vertically in that order with the red lens on top.
- Pedestrian indications will be provided for each crosswalk established as a school crossing. Each pedestrian signal face shall have two indications: A white WALK or symbolic person and an orange DON'T WALK or symbolic hand.
- A school advance warning assembly and school crosswalk sign shall be used in conjunction with the signal. A 20 mph speed zone will be implemented at school pedestrian signal locations utilized by elementary school children.



Signalized School Crossing

Pedestrian Signal Indications

Pedestrian signal indications are intended to assist an individual in crossing a roadway. Caution should still be exercised when these indications are present at a crossing location. Pedestrian signal indications shall have the following meanings:

- A steady WALK or symbolic person indication means that pedestrians facing the signal indication may proceed across the roadway in the direction of the indication.

- The flashing DON'T WALK or symbolic hand indication, while flashing, means that a pedestrian shall not start to cross the roadway, but any pedestrian who has partly completed their crossing still has time to safely proceed to a sidewalk or a safety island.
- The steadily illuminated DON'T WALK indication means that a pedestrian shall not enter the roadway in the direction of the indication.

Pedestrian Pushbuttons

Pedestrian pushbuttons shall be conveniently located near each end of the crosswalk where actuation is required. Where two crosswalks oriented in different directions begin at or near the same location, positioning of pedestrian pushbuttons should clearly indicate which crosswalk signal is actuated by each pushbutton.

Special Pedestrian Signal Indications

At some intersections a special pedestrian signal indication is used to prohibit vehicular traffic from being in the crosswalk when the WALK or symbolic person is displayed. The criteria for installing these indicators are: 1) the location involved must be a signalized intersection of two arterial streets; 2) the intersection must be adjacent to an elementary school; 3) the intersection must be controlled by a school safety patrol; and 4) there must be a minimum of ten elementary students using the crossing during school hours. If the intersection meets the criteria, during specific times when a pedestrian activates the crosswalk pushbutton, an all-red signal phase and an internally illuminated NO RIGHT TURN sign accompany the WALK or symbolic hand.

School Crosswalk Pavement Markings

Crosswalk markings, when used in conjunction with proper signing or signalization, have been effective in indicating school crossing locations. Crosswalk markings provide guidance for pedestrians as well as alerting motorists to pedestrian crossing points. Crosswalk lines shall be white lines marking both edges of the crosswalk. They shall not be less than six inches wide. The gap between the lines should not be less than 6 ft. Other options for crosswalk markings are permitted and may be found in other jurisdictions.

Stop lines may be used in conjunction with crosswalk markings to indicate the point at which vehicles are required to stop in compliance with a stop sign, traffic signal, or other traffic control device. Stop lines are white and should be twelve to twenty-four inches wide and extend across all approaching lanes. Stop lines at mid-block signalized locations should be placed at least 40 ft in advance of the nearest signal indication.

School Safety Patrols

School safety patrols may be used to direct and control pedestrians at crossings near schools where adequate gaps in traffic occur frequently enough that gaps do not need to be created. They may also be used to direct and control pedestrians at signalized crosswalks or signalized intersections where turning

movements are not a significant problem. School safety patrols should not direct vehicular traffic.

Adult Guards

Adult crossing guards should not direct traffic in the usual law enforcement regulatory sense. To control the traffic, they should pick opportune times to create a reasonably safe gap. At these times, they should stand in the roadway to indicate that pedestrians are about to use or are using the crosswalk, and that all vehicular traffic must stop.

Conclusion

It is intended that this Manual will help the reader understand the basics of school area traffic safety. When combined with input from SITE councils, administrators, and parents, each school should be able to ensure the safe travel of students to and from school. By working together we hope to continue to improve the safety of students as they travel to and from school.

APPENDIX I CROSSWALK WARRANTS

Crosswalk warrants are based on a point system evaluation of gap time, pedestrian volume, vehicle approach speed, and general conditions at the crossing location. As a general rule, 10 or more points justifies a marked crosswalk, 16 or more points justifies a signalized crosswalk.

Gap Time Warrant

The Traffic Engineering Section may perform a Gap Time study at the requested crosswalk location using a stopwatch during the peak vehicle hour. The required gap size includes a three-second reaction time as well as the time to cross the street at a walk rate of 3.5 feet per second. The gaps in traffic that are long enough to permit crossing are timed and recorded during that hour. The length of those gap times is added, then divided by 12 to obtain the average total gap time over a five-minute interval. That result is divided by the pedestrian crossing time (in seconds) to obtain the average number of suitable gaps occurring in an average 5-minute interval. Roadways having a raised median greater than 4' wide may be considered as two separate roadways.

Points for the Gap Time warrant are assigned using the table below:

Gap Time Warrant Point Assignment	
Average Number of Gaps per 5-Minute Period	Maximum Number of Points Allowed
0 – 0.99	10
1 – 1.99	8
2 – 2.99	6
3 – 3.99	4
4 – 4.99	2
5 or over	0

Pedestrian Volume Warrant

The Pedestrian Volume warrant is based upon the total number of pedestrians crossing in the vicinity of the proposed crosswalk location during the peak vehicle hour.

Points for the Pedestrian Volume warrant are assigned using the table below:

Pedestrian Volume Warrant Point Assignment	
Total Number of Pedestrians in One Hour	Maximum Number of Points Allowed
Over 120	5
91 – 120	4
61 – 90	3
31 – 60	2
11 – 30	1
0 – 10	0

Approach Speed Warrant

The Approach Speed warrant is based on the speed of the approaching traffic from both directions of travel, as determined by the investigating engineer through speed study techniques.

Points for the Approach Speed warrant are assigned using the following table:

Approach Speed Warrant Point Assignment	
Approach Speed	Maximum Number of Points Allowed
Under 20 mph	0
20 – 25 mph	3
30 – 35 mph	5
40 – 45 mph	3
50 – 55 mph	1
Over 55 mph	0

General Conditions Warrant

The General Conditions warrant is based up on those factors affecting the movement of pedestrian traffic other than gap time, pedestrian volume and vehicular approach speed. Consideration is given to the intersection location and layout, pedestrian accident history, vehicle turning movements, adjacent grounds and buildings, and pedestrian generators.

The General Condition warrant is limited to a maximum of 5 points. One point is assigned for each of the following General Conditions that exist at the location in question:

- Major arterial or expressway location
- Intersection location
- Skewed crosswalks
- Pedestrian accident history
- Adjacent pedestrian generators
- Sight distance

Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.

The School Crossing signal warrants shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.

APPENDIX II STOP SIGN WARRANTS

When a sign is used to indicate that traffic is always required to stop a STOP sign shall be used. This appendix contains the minimum warrants that must be met before an intersection may be controlled by stop signs.

A stop sign should be used if engineering judgment indicates that one or more of the following conditions exist:

- Intersection of a less important road with a main road where application of the normal right-of-way rule would not be expected to provide reasonable compliance with the law;
- Street entering a through highway or street;
- Unsignalized intersection in a signalized area; and/or
- High speeds, sight obstructions, or crash records indicate a need for control by the STOP sign.

Multi-way Stop Sign

A multi-way stop sign installation can be used as a safety measure at intersections if certain conditions exist. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal. Traffic signals are much more satisfactory at intersections experiencing heavy volumes of traffic. The following criteria should be considered in the engineering study for a multi-way STOP sign installation:

- A. Where traffic control signals are justified, the multi-way 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.
- B. A crash problem, as indicated by 5 or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right- and left- turn collisions as well as right-angle collisions.
- C. Minimum Volumes:
 1. 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
 2. 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, but
 3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the above values.
- D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.

APPENDIX III TRAFFIC SIGNAL WARRANTS

An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location. The investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in the following traffic signal warrants and other factors related to existing operation and safety at the study location:

- Warrant 1, Eight-Hour Vehicular Volume.
- Warrant 2, Four-Hour Vehicular Volume.
- Warrant 3, Peak Hour.
- Warrant 4, Pedestrian Volume.
- Warrant 5, School Crossing.
- Warrant 6, Coordinated Signal System.
- Warrant 7, Crash Experience.
- Warrant 8, Roadway Network.

Warrant 1, Eight-Hour Vehicular Volume

The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:

- The vehicles per hour given in both of the 100 percent columns of Condition A in the table below exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or
- The vehicles per hour given in both of the 100 percent columns of Condition B in the table below exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

In applying each condition the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

Condition A—Minimum Vehicular Volume					
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)		Vehicles per hour on higher-volume minor-street approach (one direction only)	
Major Street	Minor Street	100%	80%	100%	80%
1	1	500	400	150	120
2 or more	1	600	480	150	120
2 or more	2 or more	600	480	200	160
1	2 or more	500	400	200	160

Condition B—Interruption of Continuous Traffic					
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)		Vehicles per hour on higher-volume minor-street approach (one direction only)	
Major Street	Minor Street	100%	80%	100%	80%
1	1	750	600	75	60
2 or more	1	900	720	75	60
2 or more	2 or more	900	720	100	80
1	2 or more	750	600	100	80

The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exist for each of any 8 hours of an average day:

- The vehicles per hour given in both of the 80 percent columns of Condition A in the table above exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; and
- The vehicles per hour given in both of the 80 percent columns of Condition B in the table above exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

These major-street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Warrant 2, Four-Hour Vehicular Volume

The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 2 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.

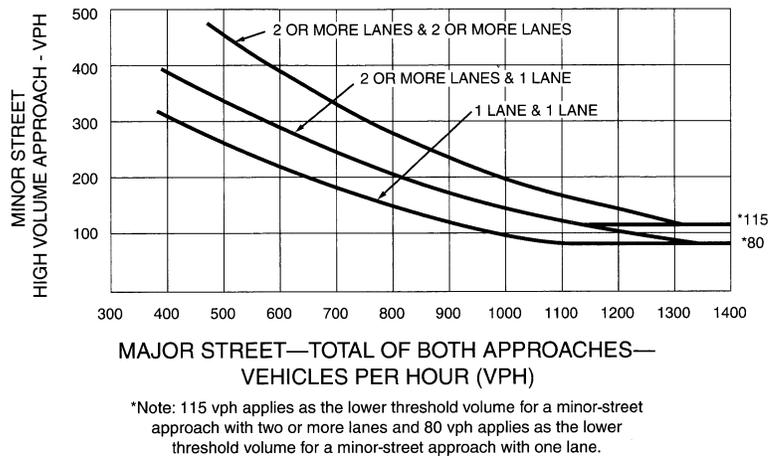


Figure 2

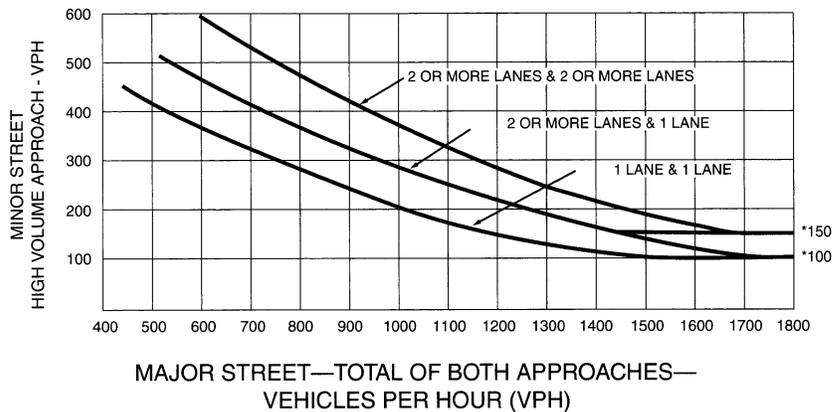
Warrant 3, Peak Hour

The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

- If all three of the following conditions exist for the same hour of an average day:
 - The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach; or 5 vehicle-hours for a two-lane approach, and
 - The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and
 - The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

- The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour of an average day falls above the applicable curve in Figure 3 for the existing combination of approach lanes.



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 3

Warrant 4, Pedestrian Volume

The need for a traffic control signal at an intersection or mid-block crossing shall be considered if an engineering study finds that both of the following criteria are met:

- The pedestrian volume crossing the major street at an intersection or mid-block location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour; and
- There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.

The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic.

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. The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of school children at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period and there are a minimum of 20 students during the highest crossing hour.

Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.

Warrant 6, Coordinated Signal System

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

The need for a traffic control signal shall be considered if an engineering study finds that one of the following criteria is met:

- On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning; or
- On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

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.

The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:

- Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and
- Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and
- For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in for Warrant 1, or

the vph in both of the 80 percent columns of Condition B in Warrant 1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

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 need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:

- The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or
- The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday).

A major route as used in this signal warrant shall have one or more of the following characteristics:

- It is part of the street or highway system that serves as the principal roadway network for through traffic flow; or
- It includes rural or suburban highways outside, entering, or traversing a City; or
- It appears as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study.