

OHIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS

**PREPARED BY
DEPARTMENT OF TRANSPORTATION
OFFICE OF TRAFFIC ENGINEERING**

**IN COOPERATION WITH
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OHIO DEPARTMENT OF TRANSPORTATION

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PREFACE

Uniform traffic control standards throughout the country have been recognized as necessary to meet the ever increasing demand of modern transportation. To meet this need for nationwide unification of standards for signs, signals, markings and other devices on or adjacent to streets and highways, the Federal Highway Administration publishes a Manual on Uniform Traffic Control Devices and periodic revisions. The Director of the Ohio Department of Transportation is required by law to adopt a state manual of uniform traffic control devices.

The purpose of this Manual is to establish standards for traffic control devices in Ohio in general conformance to the national manual. It also serves to promote uniformity in design and application of traffic control devices.

The publication of this Manual is authorized by Section 4511.09 of the Ohio Revised Code. Sections 4511.10 and 4511.11 of the Ohio Revised Code authorize the Ohio Department of Transportation and local authorities within their respective jurisdiction to place and maintain traffic control devices which conform to this Manual.

The 1972 Edition of the Ohio Manual and subsequent additions and revisions apply to all traffic control devices erected in Ohio after their adoption.


Jerry Wray
Director of Transportation

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PART 1

GENERAL PROVISIONS

1A PURPOSE OF TRAFFIC CONTROL DEVICES

The purpose of traffic control devices and warrants for their use is to help insure highway safety by providing for the orderly and predictable movement of all traffic, motorized and non-motorized, throughout the national highway transportation system, and to provide such guidance and warnings as are needed to insure the safe and uniform operation of individual elements of the traffic stream.

Traffic control devices are used to direct and assist vehicle operators in the guidance and navigation tasks required to traverse safely any facility open to public travel.

Guide and information signs are solely for the purpose of traffic control and are not an advertising medium.

(Rev. 18)

1B REQUIREMENTS OF TRAFFIC CONTROL DEVICES

This Manual sets forth the basic principles that govern the design and usage of traffic control devices. These principles appear throughout the text in discussions of the devices to which they apply, and it is important that they be given primary consideration in the selection and application of each device.

The Manual presents traffic control device standards for all streets and highways open to public travel regardless of type or class or the governmental agency having jurisdiction. Where a device is intended for limited application only, or for a specific system, the text specifies the restrictions on its use.

To be effective, a traffic control device should meet five basic requirements:

- (a) Fulfill a need.
- (b) Command attention.
- (c) Convey a clear, simple meaning.
- (d) Command respect of road users.
- (e) Give adequate time for proper response.

In the case of regulatory devices, the actions required of vehicle operators and pedestrians are specified by State statute, or by local ordinance or resolution which are consistent with national stan-

dards. Uniformity of meaning is vital to effective traffic control devices. Meanings ascribed to devices in this Manual are in general accord with the national Manual of Uniform Traffic Control Devices (MUTCD) adopted by the Federal Highway Administrator in conformance with Title 23, U.S. Code.

Five basic considerations are employed to insure that these requirements are met: design, placement, operation, maintenance, and uniformity.

Design of the device should assure that such features as size, contrast, color, shape, composition, and lighting or reflectorization are combined to draw attention to the device; that shape, size, colors, and simplicity of message combine to produce a clear meaning; that legibility and size combine with placement to permit adequate time for response; and that uniformity, size, legibility and reasonableness of the regulation combine to command respect. Except for symbols on traffic control devices, minor modifications in the design of specific design elements of a device may be necessary provided that the essential appearance characteristics are met. All symbols must be adopted using the procedures described in the MUTCD. All symbols shall be unmistakably similar to or mirror images of those shown herein.

Placement of the device should assure that it is within the cone of vision of the viewer so that it will command attention; that it is positioned with respect to the point, object, or situation to which it applies to aid in conveying the proper meaning; and that its location, combined with suitable legibility, is such that a driver traveling at normal speed has adequate time to make the proper response.

Operation or application should assure that appropriate devices and related equipment are installed to meet the traffic requirements at a given location. Furthermore, the device must be placed and operated in a uniform and consistent manner to assure, to the extent possible, that vehicle operators can be expected to properly respond to the device, based on their previous exposure to similar traffic control situations.

Maintenance of devices should be to high standards to assure that legibility is retained, that the device is visible, and that it is removed if no longer needed. Clean, legible, properly mounted devices in good working condition command the respect of vehicle operators and pedestrians. In addition to

physical maintenance, functional maintenance is required to adjust needed traffic control devices to current conditions and to remove unnecessary traffic control devices. The fact that a device is in good physical condition should not be a basis for deferring needed replacement or change. Furthermore, carelessly executed maintenance can destroy the value of a group of devices by throwing them out of balance. For example, replacement of a sign in a group or series by one that is disproportionately large may tend to depreciate others in the vicinity.

Uniformity of traffic control devices simplifies the task of the road user because it aids in recognition and understanding. It aids road users, police officers, and traffic courts by giving everyone the same interpretation. It aids public highway and traffic officials through economy in manufacture, installation, maintenance and administration.

Simply stated, uniformity means treating similar situations in the same way. The use of uniform traffic control devices does not, in itself, constitute uniformity. A standard device used where it is not appropriate is as objectionable as a nonstandard device; in fact, this may be worse, in that such misuse may result in disrespect at those locations where the device is needed.

(Rev. 18)

→ 1C LEGAL RESPONSIBILITIES AND PLACEMENT AUTHORITY

The standards of this Manual apply to all streets and highways regardless of type or the level of governmental agency having jurisdiction. The following sections of the Ohio Revised Code establish the responsibilities of the various governmental bodies in adopting and using traffic control devices on the streets and roadways in Ohio.

4511.09 Uniform System of Traffic Control Devices

"The department of transportation shall adopt a manual and specifications for a uniform system of traffic control devices, including signs denoting names of streets and highways, for use upon highways within this state. Such uniform system shall correlate with, and so far as possible conform to, the system approved by the American Association of State Highway and Transportation Officials."

4511.10 Placing and Maintaining Traffic Control Devices

"The department of transportation may place and maintain traffic control devices, conforming to its manual and specifications, upon all state highways as are

necessary to indicate and to carry out sections 4511.01 to 4511.78, and 4511.99 of the Revised Code, or to regulate, warn, or guide traffic.

No local authority shall place or maintain any traffic control device upon any highway under the jurisdiction of the department except by permission of the director of transportation."

4511.11 Uniformity of Control Devices ←

"(A) Local authorities in their respective jurisdictions shall place and maintain traffic control devices in accordance with the department of transportation manual and specifications for a uniform system of traffic control devices, adopted under section 4511.09 of the Revised Code upon highways under their jurisdiction as are necessary to indicate and to carry out sections 4511.01 to 4511.76, and 4511.99 of the Revised Code, local traffic ordinances, or to regulate, warn, or guide traffic.

(B) The director of transportation may require to be removed any traffic control device that does not conform to the manual and specifications for a uniform system of traffic control devices on the extensions of the state highway system within municipal corporations.

(C) No village shall place or maintain any traffic control signal upon an extension of the state highway system within such village without first obtaining the permission of the director. The director may revoke such permission and may remove or require to be removed any traffic control signal which has been erected without his permission on an extension of a state highway within a village, or which, if erected under a permit granted by the director, does not conform to the state manual and specifications, or which is not operated in accordance with the terms of the permit.

(D) All traffic control devices erected on a public road, street, or alley, shall conform to the state manual and specifications.

(E) No person, firm, or corporation shall sell or offer for sale to local authorities any traffic control device which does not conform to the state manual and specifications except by permission of the director.

(F) No local authority shall purchase or manufacture any traffic control device that does not conform to the state manual and specifications, except by permission of the director."

Traffic control devices shall be placed only by the authority of a public body or official having jurisdiction, for the purpose of regulating, warning or guiding traffic. No traffic control device or its support shall bear any advertising or commercial message, or any other message that is not essential to traffic control.

Section 4511.16 of the Ohio Revised Code (see Appendix B) prohibits the display of any unauthorized sign, signal, marking or device which interferes with the effectiveness of any official traffic control device and permits its removal by the authority having jurisdiction over the street or highway.

Additional legal authority information may be found in separate parts of this Manual. Appendix B also contains references to other legal provisions in the Ohio Revised Code.

(Rev. 18)

1D ENGINEERING STUDY REQUIRED

The decision to use a particular device at a particular location should be made on the basis of an engineering study of the location. Thus, while this Manual provides standards for design and application of traffic control devices, the Manual is not a substitute for engineering judgment. Except for sections of this Manual that mandate the installation of a traffic control device, it is the intent that the provisions of this Manual be standards for traffic control device installation, but not a requirement of installation.

Qualified engineers are needed to exercise the engineering judgment inherent in the selection of traffic control devices, just as they are needed to locate and design the roads and streets which the devices complement. Jurisdictions with responsibility for traffic control that do not have qualified engineers on their staffs should seek assistance from the Ohio Department of Transportation, their county, a nearby large city, or a traffic engineering consultant.

(Rev. 18)

1E MEANING OF "SHALL", "SHOULD" AND "MAY"

In the Manual sections dealing with the design and application of traffic control devices, the words "shall", "should", and "may" are used to describe specific conditions concerning these devices. To clarify the meanings intended in this Manual by the use of these words, the following definitions apply:

- (a) **SHALL**—A **mandatory** condition. Where certain requirements in the design or application of the device are described with the "shall" stipulation, it is mandatory when an installation is made that these requirements be met.
- (b) **SHOULD**—An **advisory** condition. Where the word "should" is used, it is considered to be advisable usage, recommended but not mandatory.
- (c) **MAY**—A **permissive** condition. No requirements for design or application is intended.

(Rev. 18)

1F PROCEDURES FOR DEVELOPING NEW STANDARDS AND FOR INTERPRETATIONS AND REVISION OF EXISTING STANDARDS

Continuing advances in technology will produce changes in the highway, the vehicle and in driver proficiency; therefore, portions of the system of control devices in this Manual will require updating. In addition, unique situations often arise for device applications which may require interpretation or clarification of this Manual. It is important to have a procedure for recognizing these developments and for introducing new ideas and modifications into the system.

Any person has the privilege of suggesting changes or additional traffic control devices to improve highway operations. All requests for interpretations, proposed changes or additions should be mailed to the Ohio Department of Transportation, Office of Traffic Engineering, P.O. Box 899, Columbus, Ohio 43216-0899.

The format of a request for a ruling is flexible; however, requests for the use of new devices or methods should contain information on: (1) why a device recommended in the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) could not be used; (2) advantages of using the proposed device; and (3) factual supporting data showing why the proposed device is considered to be the solution and/or study procedures to be used for field tests of the proposed device. As discussed in Section 1B, requests for new symbols must be adopted using procedures described in the national MUTCD. Those requesting new symbols may write the Engineer of Traffic at the above address to receive a copy of these procedures.

(Rev. 21)

1G RELATION TO OTHER DOCUMENTS

Other documents, to the extent they are incorporated by specific reference, are made part of this Manual:

Ohio Revised Code, current edition.

American National Standard Practice for Roadway Lighting, Illuminating Engineering Society of N. America, 1983.

An Informational Guide for Roadway Lighting, American Association of State Highway and Transportation Officials, 1976.

Manual of Traffic Signal Design, Institute of Transportation Engineers, 1991.

Pedestrian Traffic Control Signal Indications,

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REGULATORY SIGNS

2H RIGHT-OF-WAY SERIES

2H-1 STOP Sign (R-1)

STOP signs are intended for use where traffic is required to stop. The STOP sign shall be an octagon with white message and border on a red background.

A STOP Sign Beacon (see Section 6E-4), may be used in conjunction with a STOP sign. It should generally be mounted just above the sign.

Secondary messages shall not be used on STOP sign faces.

At an intersection, the higher classification street or highway should be used to determine the size of STOP sign to be erected at that intersection. STOP signs on freeway ramps shall be the 48 inch size.

STOP signs at Railroad Grade crossings are addressed in Section 2L-40.



R-1

Type	Code No.	Size
Std. & Maj. Std.	R-1-30	30"x30"
Expressway	R-1-36	36"x36"
Freeway	R-1-48	48"x48"

(Rev. 20)

2H-1.1 Warrants for STOP Signs

Because the STOP sign causes a substantial inconvenience to motorists, it should be used only where warranted. A STOP sign may be warranted at an intersection where 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-entry rule is unduly hazardous.
- Street entering a through highway or street (see Section 4511.65 of the Ohio Revised Code in Appendix B).
- Unsignalized intersection in a signalized area.
- Other intersections where a combination of

high speed, restricted view and serious accident record indicates a need for control by the STOP sign.

Prior to application of these warrants consideration should be given to less restrictive measures, such as the YIELD sign (Section 2H-3) where a full stop is not necessary at all times. Periodic reviews of existing installations may be desirable to determine whether, because of the changed conditions, the use of less restrictive control or no control could accommodate traffic demands safely and more effectively.

STOP signs should never be used on the through roadways of expressways. Properly designed expressway interchanges provide for the continuous flow of traffic, making STOP signs unnecessary even on the entering roadways.

Where at-grade intersections are temporarily justified for local traffic in sparsely populated areas, STOP signs should be used on the entering roadways to protect the through traffic. STOP signs may also be required at the end of diverging roadways where they intersect other highways not designed as expressways. In most cases the speeds will not warrant any great increase in sign sizes.

STOP signs shall not be erected at intersections where traffic control signals are operating. The conflicting commands of two types of control devices are confusing. If traffic is required to stop when the operation of stop-and-go signals is not warranted, the signals should be put on flashing operation with the red flashing light facing the traffic that must stop.

STOP signs should be used in conjunction with the flashing red indication of Intersection Control Beacons (Section 6E-3).

Where two main highways intersect, the STOP sign(s) should normally be posted on the minor street to stop the lesser flow of traffic. Traffic engineering studies, however may justify a decision to install a STOP sign(s) on the major street, as at a three-way intersection where safety considerations may justify stopping the greater flow of traffic to permit a left-turning movement.

Portable or part-time STOP signs shall not be used except for emergency purposes.

STOP signs should not be used for speed control.

(Rev. 20)

2H-2 Multiway Stop Installations (R-1A, 1B)

The multiway stop installation is useful as a safety measure at some locations. It should be used only where the volume of traffic on the intersecting roads is approximately equal. It should be used sparingly because of the significant increases in delays and operating costs which result from requiring all of the

vehicles using the intersection to stop. Unnecessary stops, when the intersection is clear of conflicting movements, lead to general disrespect for STOP signs. A traffic control signal is more satisfactory for an intersection with a volume of traffic large enough to meet the appropriate warrants.

Any of the following conditions may warrant a multiway STOP sign installation:

- (a) Where traffic signals are warranted and urgently needed, the multiway stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the signal installation.
- (b) An accident problem, as indicated by five or more reported accidents of a type susceptible to correction by a multiway stop installation in a twelve-month period. Such accidents include right- and left-turn collisions as well as right-angle collisions.
- (c) Where it is necessary to change the stop pattern at an intersection, the multiway stop may be used as a temporary measure during a transition period.
- (d) Minimum traffic volume:
 1. The total vehicular volume entering the intersection from all approaches must average at least 500 vehicles per hour for any 8 hours of an average day, and
 2. The combined vehicular and pedestrian volume from the minor roadway must average 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 maximum hour, but:
 3. When the 85th percentile approach speed of the major-street traffic exceeds 40 miles per hour, the minimum vehicular volume warrant is 70 percent of the above requirements.

At a multiway stop intersection each STOP sign should be supplemented by a separate plate mounted just below it, reading () WAY, in white letters on a red background.



R-1A



R-1B

Type	Code No.	Size
Standard &	R-1A-12	12"x6"
Maj. Standard	R-1B-18	18"x6"

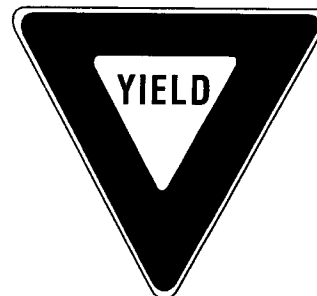
(Rev. 20)

2H-3 YIELD Sign (R-2)

The YIELD sign assigns right-of-way to traffic on certain approaches to an intersection. Vehicles controlled by a YIELD sign need stop only when necessary to avoid interference with other traffic that is given the right-of-way. See Section 4511.43 of the Ohio Revised Code in Appendix B.

The YIELD sign shall be a downward pointing, equilateral triangle having a red border band and a white interior and the word YIELD in red inside the border band.

YIELD signs at Railroad Grade Crossings are addressed in Section 2L-40.



R-2

Type	Code No.	Size
Standard & Maj. Standard	R-2-36	36"x36"x36"
Expressway	R-2-48	48"x48"x48"
Freeway	R-2-60	60"x60"x60"

(Rev. 20)

2H-4 Warrants for YIELD Signs

The YIELD sign may be warranted:

- (a) At the entrance to an intersection where it is necessary to assign right-of-way and where the safe approach speed on the entrance exceeds 10 miles per hour.
- (b) On the entrance ramp to an expressway where an acceleration lane is not provided.
- (c) At intersections on a divided highway where the median between the roadways is more than 30 feet wide. At such intersections, a STOP sign may be used at the entrance to the first roadway of the divided highway and a

PART 6

SIGNALS AND ILLUMINATION

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PART 6 SIGNALS AND ILLUMINATION

6-A SIGNALS

6A-1 Types

A highway traffic signal is any power-operated traffic control device, other than a warning light or steady burning electric lamp, by which traffic is warned or directed to take some specific action.

The following types and uses of highway traffic signals are discussed in this part of the Manual: traffic control signals, Pedestrian Signals, beacons, Lane-Use Control Signals, Movable Bridge Signals, priority control of traffic signals and traffic signals for one-lane, two-way facilities. For additional information on bicycle-related concerns see Section 9D.

(Rev.21)

6A-2 Basis of Installation

In most cases the installation of a highway traffic signal will operate either to the advantage or disadvantage of the vehicles and persons controlled. A careful analysis of traffic operations and other factors at a large number of signalized and unsignalized intersections, coupled with the judgment of experienced engineers, have provided a series of warrants that define the minimum conditions under which signal installations may be justified (see Section 6C-2). Consequently, the selection and use of this control device should be preceded by a thorough investigation of roadway and traffic conditions conducted by a qualified engineer.

Engineering studies should be made of operating signals to determine if the type of installation and the timing program meet the current requirements of traffic.

(Rev.13)

6A-3 Definitions Relating to Signals

For definitions relating to traffic signals see Appendix A of this Manual.

(Rev.13)

6A-4 Legal Authority

On state highways outside municipal corporations, Section 4511.10 of the Ohio Revised Code provides: *"The department of transportation may place and maintain traffic control devices, conforming to its manual and specifications upon all state highways as are necessary to indicate and to carry out Section 4511.01 to 4511.78, inclusive, and 4511.99 of the Revised Code, or to regulate, warn or guide traffic. No local authority shall place or maintain any traffic control devices upon any highway under the jurisdiction of the department except by permis-*

sion of the director of transportation."

Under this section, the Director of Transportation, ODOT, has sole authority over the installation and maintenance of traffic control signals on state highways outside the limits of municipal corporations.

On other streets and highways, except extensions of state highways in villages, Section 4511.11 (A) of the Ohio Revised Code provides: *"Local authorities in their respective jurisdictions shall place and maintain traffic control devices in accordance with the department of transportation manual and specifications for a uniform system of traffic control devices, adopted under section 4511.09 of the Revised Code upon highways under their jurisdiction as are necessary to indicate and to carry out sections 4511.01 to 4511.76 and 4511.99 of the Revised Code, local traffic ordinances or to regulate, warn, or guide traffic."*

Under this section, local authorities become responsible for the determination of locations on the highways and streets included in this section where traffic signals are warranted, and for purchasing, erecting and maintaining the same.

On extensions of state highways in villages, Section 4511.11 (C) of the Ohio Revised Code provides:

"No village shall place or maintain any traffic control signal upon an extension of the state highway system within such village without first obtaining the permission of the director. The director may revoke such permission and may remove or require to be removed any traffic control signal which has been erected without his permission on an extension of a state highway within a village, or which, if erected under a permit granted by the director, does not conform to the state manual and specification, or which is not operated in accordance with the terms of the permit."

(Rev.13)

6A-5 Village Signal Permit Procedures

Requests by village authorities for permission to install and operate traffic control signals on state highway extensions within villages (Figure TS-1) should be substantiated by appropriate traffic studies and submitted to the District Deputy Director of Transportation. If it is determined that a traffic control signal is warranted, authorization for the installation of a traffic control signal will be issued to the village authorities.

The authorization is valid for 180 days. During this time, the village shall prepare and submit to ODOT an operation plan for the proposed traffic signal installation (Figure TS-2). Upon approval of this plan, the village may purchase and install the traffic control signal. The fact that the Director of Trans-

portation is authorized to determine whether a traffic control signal is warranted does not relieve the village authorities in any way from bearing the costs of purchasing, installing and maintaining the traffic signal equipment.

As soon as the traffic control signal has been installed and put into operation, the certification at the bottom of the form shown in Figure TS-2 should be filled out and returned to the District Deputy Director. The final Traffic Control Signal Permit (Figure TS-3) will then be issued by the Director of Transportation and his agent will install an identification tag with the correct permit number.

A request for modification of the hours of operation or the timing of these village traffic control signals shall be submitted to the District Deputy Director for approval (Figure TS-4). However, alteration of any other aspect of the operation of a traffic signal covered by permit requires approval of the Director of Transportation and the request shall be submitted using the form shown in Figure TS-1.

It is the responsibility of the village authorities to periodically review their traffic signals (see Section 6C-2.1).

A village ordinance imposing a penalty for the violation of a traffic control signal operated without a permit on an extension of a state highway in a village cannot be enforced (*Englewood vs. Bettis*, 30 NP. (NS) 491).



Identification Tag
15" x 8"

(Rev. 21)

6B TRAFFIC CONTROL SIGNALS

6B-1 General Aspects

A traffic control signal (traffic signal) is a type of highway traffic signal by which traffic is alternately directed to stop and permitted to proceed.

Traffic control signals are described as either pre-timed or traffic actuated. Under pretimed control duration of red, green and yellow intervals are pre-determined. Under traffic-actuated control, the duration of green intervals vary according to traffic demands.

The features of traffic control signals in which vehicle operators and pedestrians are interested are the location, design, indications and legal signifi-

cance of the signals. These are identical for all types of traffic control signals. Uniformity in the design features that affect the traffic to be controlled (as set forth in this Manual) is especially important for safe and efficient traffic operations.

Special police supervision and /or enforcement should be provided for a new nonintersection location.

(Rev. 20)

6B-2 Area of Control

A traffic control signal shall control traffic only at the intersection or midblock location where the installation is place.

(Rev. 13)

6B-3 Advantages and Disadvantages of Traffic Control Signals

Traffic control signals are valuable devices for the control of vehicle and pedestrian traffic. However, because they assign the right-of-way to the various traffic movements, traffic control signals exert a profound influence on traffic flow.

Traffic control signals, properly located and operated usually have one or more of the following advantages:

- (a) They can provide for the orderly movement of traffic.
- (b) Where proper physical layouts and control measures are used, they can increase the traffic-handling capacity of the intersection.
- (c) They can reduce the frequency of certain types of accidents, especially the right-angle type.
- (d) Under favorable conditions, they can be coordinated to provide for continuous or nearly continuous movement of traffic at a definite speed along a given route.
- (e) They can be used to interrupt heavy traffic at intervals to permit other traffic, vehicular or pedestrian, to cross.

Many laymen believe that traffic signals provide the solution to all traffic problems at intersections. This has led to their installation at a large number of locations where no legitimate factual warrant exists.

Traffic signal installations, even though warranted by traffic and roadway conditions, can be ill-designed, ineffectively place, improperly operated or poorly maintained. The following factors can result from improper or unwarranted signal installations:

- (aa) Excessive delay may be caused.
- (bb) Disobedience of the signal indication is encouraged.

- (cc) The use of less adequate routes may be induced in an attempt to avoid such signals.
- (dd) Accident frequency (especially the rear-end type) can be significantly increased.

(Rev. 13)

6B-4 Portable Traffic Control Signals

A portable traffic control signal must meet the physical display and operational requirements of conventional traffic signals described herein. A portable traffic control signal should normally not operate longer than 30 days unless associated with a construction or maintenance project, in which case it shall be removed when no longer needed on the project. It is desirable to use advance signing when employing this device. A portable traffic control signal should be used only when an engineering study so indicates.

(Rev. 13)

6B-5 Meaning of Signal Indications

The following meanings (as specified in Sections 4511.13 and 4511.15 of the Ohio Revised Code) shall be given to highway traffic signal indications, except those on Pedestrian Signals (see Section 6D-2) and Lane-Use Control Signals (see Section 6E-9):

4511.13

“(A) Green indication:

- (1) Vehicular traffic, streetcars, and trackless trolleys, facing a circular green signal may proceed straight through or turn right or left unless a sign at such place prohibits either such turn. But vehicular traffic, streetcars, and trackless trolleys, including vehicles, streetcars, and trackless trolleys turning right or left, shall yield the right-of-way to other vehicles, streetcars, trackless trolleys, and pedestrians lawfully within the intersection or an adjacent crosswalk at the time such signal is exhibited.*
- (2) Vehicular traffic, streetcars, and trackless trolleys facing a green arrow signal, shown alone or in combination with another indication, may cautiously enter the intersection only to make the movement indicated by such arrow, or such other movement as is permitted by other indications shown at the same time. Such vehicular traffic, streetcars, and trackless trolleys shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully*

using the intersection.

- (3) Unless otherwise directed by a pedestrian-control signal, as provided in section 4511.14 of the Revised Code, pedestrians facing any green signal, except when the sole green signal is a turn arrow, may proceed across the roadway within any marked or unmarked crosswalk.*

(B) Steady yellow indication:

- (1) Vehicular traffic, streetcars, and trackless trolleys facing a steady circular yellow or yellow arrow signal are thereby warned that the related green movement is being terminated or that a red indication will be exhibited immediately thereafter when vehicular traffic, streetcars and trackless trolleys shall not enter the intersection.*
- (2) Pedestrians facing a steady circular yellow or yellow arrow signal, unless otherwise directed by a pedestrian-control signal as provided in section 4511.14 of the Revised Code, are thereby advised that there is insufficient time to cross the roadway before a red indication is shown and no pedestrian shall then start to cross the roadway.*

(C) Steady red indication:

- (1) Vehicular traffic, streetcars, and trackless trolleys facing a steady red signal alone shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication to proceed is shown except as provided in divisions (C)(2) and (C)(3) of this section.*
- (2) Unless a sign is in place prohibiting a right turn as provided in division (C)(5) of this section, vehicular traffic, streetcars, and trackless trolleys facing a steady red signal may cautiously enter the intersection to make a right turn after stopping as required by division (C)(1) of this section. Such vehicular traffic, streetcars, and trackless trolleys shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.*
- (3) Unless a sign is in place prohibiting a left turn as provided in division (C)(5) of this section, vehicular traffic, streetcars, and trackless trolleys facing a steady red sig-*

ming device may be desirable to reduce the brilliance of the flashing yellow.

(Rev. 18)

6B-11 Visibility and Shielding of Signal Faces

Each signal face shall be so adjusted that its indications will be of maximum effectiveness to the approaching traffic for which they are intended.

Visors should be used on all signal faces to aid in directing the signal indication specifically to approaching traffic, as well as to reduce "sun phantom" resulting from external light entering the lens. Where the background to the signal significantly reduces the visual effectiveness of the signal lens, backplates may be desirable. A backplate is a strip of thin material which extends outward parallel to the signal face, on all sides of the signal housing, to increase the signal target value.

In general, vehicular signal faces, should be aimed so that the continuation of the optical axis of the signal lens passes through a point on the approach, which is located at least the minimum-visibility distance from the Stop Line (specified in Section 6B-12) and at driver's eye height. If the approach sight distance is limited by horizontal or vertical alignment, the signal faces shall be aimed at a point on the approach at which the signal indication first becomes visible.

Irregular street design frequently necessitates placing signals for different street approaches with a comparatively small angle between their indications. In these cases, each signal indication shall, to the extent practicable, be shielded or directed by visors, louvers, or other means so that an approaching driver can see only the indication controlling his movement. Tunnel visors exceeding 12 inches in length shall not be used on free-swinging signals.

The use of visors, or the use of signals or devices which direct the light without a reduction in intensity, should be considered as an alternative to louvers due to the reduction in light output caused by louvers.

The foregoing does not preclude the use of special signal faces such that the driver does not see their indications before seeing other indications, when simultaneous viewing of both signal indications could cause the driver to be misdirected.

(Rev. 20)

6B-12 Number and Location of Signal Faces

The primary consideration in signal face placement shall be visibility. Drivers approaching a signalized intersection or other signalized area, such as a mid-block crosswalk, shall be given a clear and unmistakable indication of their right-of-way assignment. Crit-

ical elements are lateral and vertical angles of sight toward a signal face, as determined by typical driver eye position, vehicle design, and the vertical, longitudinal and lateral position of the signal face. The geometry of each intersection to be signalized, including vertical grades, horizontal curves and obstructions, should be considered in signal face placement.

The visibility, location and number of signal faces for each approach to an intersection or a mid-block crosswalk shall be as follows:

- (a) For through-traffic, a minimum of two signal faces shall be provided, and should be continuously visible to traffic approaching the signals, from a point at least the following "minimum visibility distance", until the traffic reaches the Stop Line. This range of continuous visibility should be provided unless precluded by a physical obstruction or if there is another signalized intersection within this range.

TABLE TS-1

85th Percentile Speed (mph)	Minimum Visibility Distance (ft.)
20	175
25	215
30	270
35	325
40	390
45	460
50	540
55	625
60	715

On the stem approach to a T intersection (where there is no through-traffic), at least one of the turning movements shall be signalized according to the requirements of this paragraph.

- (b) Where the visibility requirements in Table TS-1 cannot be met, a Signal Ahead sign (W-47) shall be erected to warn approaching traffic (see Section 2N-19). Such a sign may be supplemented by a Hazard Identification Beacon (see Section 6E-1) if drivers do not have a continuous view of at least one signal indication for the minimum visibility distance.

In some circumstances an additional advance Warning Sign or a special detector design may be desirable to supplement the Signal Ahead sign. When used, the additional sign installation may include a Hazard Identification Beacon (Section 6E-1) which is interconnected with the traffic signal controller in such a manner as to flash yellow during the period when drivers passing this beacon at the legal speed

time to cross the roadway. This may be accomplished by adjusting the signal operation and timing to automatically provide this assurance or via pedestrian actuation.

Where it is desired to prohibit certain pedestrian movements at a traffic control signal a No Pedestrian Crossing (R-72D or R-72E) sign may be used (see Section 2L-2).

(Rev. 18)

6C TRAFFIC SIGNAL WARRANTS

6C-1 Determining Need for Traffic Signal Control

Prior to the selection and use of traffic signal control at a location the first and basic question that must be addressed is whether or not traffic signalization is needed. Since traffic signals are considered to be one of the most restrictive of the traditional traffic control devices, they should be used only where the less restrictive signs or markings do not provide the necessary level of control.

It is the responsibility of the local authorities in their respective jurisdictions to determine whether a location can be best served by the use of traffic signal control. The decision should be based on a comprehensive investigation of traffic conditions and location characteristics. The comprehensive investigation will also provide the data necessary for the design and operation of a traffic control signal that it found to be justified.

The data which will be required in order to determine the need for signalization should be identified at the start of the investigation. Examples of studies that provide the type of data needed are:

- (a) Traffic volumes (vehicular and pedestrian),
- (b) Approach travel speeds,
- (c) Physical condition diagrams,
- (d) Accident history and collision diagrams,
- (e) Gap studies, and
- (f) Delay studies.

The studies above may not provide all of the data needed; likewise all of these studies may not be necessary depending on the characteristics of the location.

Procedures for obtaining this data are contained in publications (see Section 1G) such as:

Traffic Engineering Handbook-Institute of Transportation Engineers
Manual of Traffic Engineering Studies-Institute of Transportation Engineers
Manual of Traffic Signal Design-Institute of Transportation Engineers
Traffic Control Devices Handbook-Federal Highway Administration

Adequate roadway capacity at a signalized intersection is desirable. Widening of both the major street and the minor street may be warranted to reduce the delays caused by assignment of right-of-way at intersections controlled by traffic signals. Widening of the minor street is often beneficial to operation on the major street because it reduces the green time that must be assigned to minor street traffic. In urban areas, the effect of widening can be achieved by elimination of parking at intersection approaches. It is always desirable to have at least two lanes for moving traffic on each approach to a signalized intersection. Additional width may be necessary on the leaving side of the intersection, as well as the approach side, in order to clear traffic through the intersection effectively. Before an intersection is widened, the additional green time needed by pedestrians to cross the widened streets should be checked to ensure that it will not exceed the green time saved through improved vehicular flow.

(Rev. 20)

6C-2 Warrants For Traffic Signals

Generally, traffic control signals should not be installed unless one or more of the signal warrants in this Manual are met. Information should be obtained by means of engineering studies, evaluated and compared with the requirements set forth in the warrants. These warrants will apply to the vast majority of intersections where signals are considered. There will be a small number of intersections where these warrants cannot be rigidly applied due to some unusual characteristics of the traffic flow or the geometric design of the roadway. The warrants represent the minimum levels at which signal operation may be desirable; installation of signals at the minimum levels or above may or may not be recommended by the traffic engineer after considering all pertinent factors.

A traffic study by a traffic engineer shall be the only basis for the installation of a signal unless at least one of the warrants specified in this Manual is met. The study shall identify the specific conditions which render the warrants inapplicable. Copies of the study should be retained on file by the authorities having jurisdiction over traffic control at the intersection.

When a traffic control signal is indicated as being warranted and is installed, the signal and all related traffic control devices and markings shall be installed according to the standards set forth in this Manual. In order to receive the benefits which signals can provide, signal indications must be properly phased, roadways must be properly designed, adjacent traffic

signals must be properly coordinated, and the traffic signal controller must be selected on the basis of engineering study and judgment. There must be adequate supervision of the operation and maintenance of the signal and all of its related devices.

An investigation of the need for traffic signal control should include where applicable, at least an analysis of the factors contained in the following warrants:

- Warrant #1 — Minimum Vehicular Volume
- Warrant #2 — Interruption of Continuous Traffic
- Warrant #3 — Minimum Pedestrian Volume
- Warrant #4 — School Crossings
- Warrant #5 — Progressive Movement
- Warrant #6 — Accident Experience
- Warrant #7 — Systems
- Warrant #8 — Combination of Warrants
- Warrant #9 — Four Hour Volume
- Warrant #10 — Peak Hour Delay
- Warrant #11 — Peak Hour Volume

The traffic study should consider the effects of the right-turn vehicles. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from a traffic count when evaluating the count against the above warrants. The left-turn movement should be likewise considered at the intersection of two one-way streets where left turns on red are permitted.

For the purpose of warranting signalization, a wide median intersection as defined by Section 4511.01 (KK), Ohio Revised Code, should not be considered as separate intersections.

(Rev. 13)

6C-2.1 Periodic Review of Existing Traffic Control Signals

Changing traffic patterns may render an existing signal either inefficient or no longer necessary. Therefore, the responsible agency should periodically evaluate, by conducting a traffic study, the efficiency and necessity of signals under its control and determine what revisions, if any, may be needed. This engineering study may lead to changing timing, sequencing or phasing, or the complete removal of the traffic control signal. Examples of criteria that the traffic study may include are:

- (a) Traffic performance,
- (b) Safety (accidents),
- (c) Fuel consumption, and
- (d) Pollution reduction.

A report published by the Federal Highway Administration entitled "User's Guide for Removal of Not Needed Traffic Signals, November, 1980, Federal Highway Administration Implementation Package

FHWA-1P-80-12" provides a guide for addressing the criteria mentioned above in urban areas.

(Rev. 20)

6C-3 Warrant 1, Minimum Vehicular Volume

The Minimum Vehicular Volume warrant is intended for application where the volume of intersecting traffic is the principal reason for consideration of signal installation. The warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street and on the higher-volume minor-street approach to the intersection.

MINIMUM VEHICULAR VOLUMES FOR WARRANT 1

Number of lanes for moving traffic on each approach		Vehicles per hour on major street	Vehicles per hour on higher-volume minor-street approach
Major Street	Minor Street	*	**
1	1	500	150
2 or more	1	600	150
2 or more	2 or more	600	200
1	2 or more	500	200

* Total of both approaches

** One direction only

These major-street and minor-street volumes are for the same 8 hours. During those 8 hours, the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85th percentile speed of major-street traffic exceeds 40 miles per hour in either an urban or a rural area, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the Minimum Vehicular Volume warrant is 70 percent of the requirements above.

(Rev. 13)

6C-4 Warrant 2, Interruption of Continuous Traffic

The Interruption of Continuous Traffic warrant applies to operating conditions where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or hazard in entering or crossing the major street. The warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street and on the higher-volume minor-street approach to the intersection, and the signal installation will not seriously disrupt progressive traffic flow.

MINIMUM VEHICULAR VOLUMES FOR WARRANT 2

Number of lanes for moving traffic on each approach		Vehicles per hour on major street	Vehicles per hour on higher-volume minor-street approach
Major Street	Minor Street	*	**
1	1	750	75
2 or more	1	900	75
2 or more	2 or more	900	100
1	2 or more	750	100
* Total of both approaches			
** One direction only			

These major-street and minor-street volumes are for the same 8 hours. During those 8 hours, the direction of higher volume on the minor-street may be on one approach during some hours and on the opposite approach during other hours.

When the 85th percentile speed of major-street traffic exceeds 40 miles per hour in either an urban or a rural area, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the Interruption of Continuous Traffic warrant is 70 percent of the requirements above.

(Rev. 13)

6C-5 Warrant 3, Minimum Pedestrian Volume

A traffic signal may be warranted where 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 four hours; or
190 or more during any one hour.

The pedestrian volume crossing the major street may be reduced as much as 50 percent of the values given above when the predominant pedestrian crossing speed is below 3.5 feet per second.

In addition to the minimum pedestrian volume stated above, there shall be less than 60 gaps per hour in the traffic stream of adequate length for 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 the pedestrian(s) to wait, the requirement applies separately to each direction of vehicular traffic.

Where coordinated traffic signals on each side of the study location provide for platooned traffic which result in fewer than 60 gaps per hour of adequate length for the pedestrians to cross the street, a traffic signal may not be warranted.

This warrant applies only to those locations there

the nearest traffic signal along the major street is greater than 300 feet away and where a new traffic signal at the study location would not unduly restrict platooned flow of traffic. Curbside parking at non-intersection locations should be prohibited for 100 feet in advance of and 20 feet beyond the crosswalk.

A signal installed under this warrant should be of the traffic-actuated type with push buttons for pedestrians crossing the main street. If such a signal is installed within a signal system, it should be coordinated if the signal system is coordinated.

Signals installed according to this warrant shall be equipped with pedestrian indications conforming to requirements set forth in other sections of this Manual.

(Rev. 14)

6C-6 Warrant 4, School Crossing

A traffic control signal may be warranted at an Established School Crossing when a traffic 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 the school crossing 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 (see Section 5B-4).

When traffic control signals are installed entirely under this warrant:

- Pedestrian indications shall be provided at least for each crosswalk established as a school crossing.
- At an intersection, the signal shall be traffic actuated, unless the intersection installation is fitted into a progressive system and uses pre-timed control.
- At nonintersection crossings, the signal should be pedestrian actuated, parking and other obstructions to view should be prohibited for at least 100 feet in advance of and 20 feet beyond the crosswalk, and the installation should include suitable standard signs and pavement markings. Special police supervision and/or enforcement should be provided for a new nonintersection installation.

(Rev. 18)

6C-7 Warrant 5, Progressive Movement

Progressive movement control sometimes necessitates traffic signal installations at intersections where they would not otherwise be warranted, in order to maintain proper grouping of vehicles and effectively

regulated group speed. The Progressive Movement warrant is satisfied when:

- (a) On a one-way street or a street which has predominantly unidirectional traffic, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning and speed control, or
- (b) On a two-way street, adjacent signals do not provide the necessary degree of platooning and speed control and the proposed and adjacent signals could constitute a progressive signal system.

The installation of a signal according to this warrant should be based on the 85th percentile speed unless an engineering study indicates that another speed is more desirable.

The installation of a signal according to this warrant should not be considered where the resultant signal spacing would be less than 1,000 feet.

(Rev. 13)

6C-8 Warrant 6, Accident Experience

The Accident Experience warrant is satisfied when:

- (a) Adequate trial of less restrictive remedies with satisfactory observance and enforcement has failed to reduce the accident frequency; and
- (b) Five or more reported accidents, of types susceptible to correction by traffic signal control, have occurred within a recent 12-month period, each accident involving personal injury or reportable property damage; and
- (c) There exists a volume of vehicular and pedestrian traffic not less than 80 percent of the requirements specified either in the Minimum Vehicular Volume warrant, the Interruption of Continuous Traffic warrant, or the Minimum Pedestrian Volume warrant; and
- (d) The signal installation will not seriously disrupt progressive traffic flow.

Any traffic signal installed solely on the Accident Experience warrant should be semi-traffic-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic-actuated if installed at an isolated intersection.

A traffic control signal, when obeyed by drivers and pedestrians, can be expected to eliminate or reduce materially the number and seriousness of the following types of accidents:

- (aa) Those involving substantially right-angle collisions or conflicts, such as occur between vehicles on intersecting streets.
- (bb) Those involving conflicts between straight-moving vehicles and crossing pedestrians.

- (cc) Those between straight-moving and left-turning vehicles approaching from opposite directions, if an independent time interval is allowed during the signal cycle for the left-turn movement.

- (dd) Those involving excessive speed, in cases where signal coordination will restrict speed to a reasonable rate.

On the other hand, traffic control signals cannot be expected to reduce the following types of accidents:

- (ee) Rear-end collisions, which often increase after signalization.
- (ff) Accidents involving pedestrians and turning vehicles when both move during the same interval.
- (gg) Other types of pedestrian accidents, if pedestrians or drivers do not obey the signals.
- (hh) Collisions between vehicles proceeding in the same or opposite directions, one of which makes a turn across the path of the other. This is particularly true if no independent signal interval is provided for these turn movements.

(Rev. 13)

6C-9 Warrant 7, Systems Warrant

A traffic signal installation at some intersections may be warranted to encourage concentration and organization of traffic flow networks. The Systems Warrant is applicable when the common intersection of two or more major routes: (1) has a total existing, or immediately projected, entering volume of at least 1000 vehicles during the peak hour of a typical weekday and has five year projected traffic volumes, based on an engineering study, which meet one or more of Warrants 1, 2, 8, 9 and 11 during an average weekday; or (2) has a total existing or immediately projected entering volume of at least 1000 vehicles for each of any five hours of a Saturday and/or Sunday.

A major route as used in the above warrant has one or more of the following characteristics:

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

(Rev. 14)

6C-10 Warrant 8, Combination of Warrants

In exceptional cases, signals occasionally may be justified where no single warrant is satisfied but

where Warrants 1 and 2 are satisfied to the extent of 80 percent or more of the stated values.

Adequate trial of other remedial measures which cause less delay and inconvenience to traffic should precede installation of signals under this warrant.

(Rev. 14)

6C-10.1 Warrant 9, Four Hour Volumes

The Four Hour Volume Warrant is satisfied when each of any four 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 curve in Figure TS-8 for the existing combination of approach lanes.

When the 85th percentile speed of the major-street traffic exceeds 40 miles per hour or when the intersection lies within a built-up area of an isolated community having a population less than 10,000, the Four Hour Volume requirement is satisfied when the plotted points referred to fall above the curve in Figure TS-9 for the existing combination of approach lanes.

(Rev. 13)

6C-10.2 Warrant 10, Peak Hour Delay

The Peak Hour Delay warrant is intended for application where traffic conditions are such that for one hour of the day minor-street traffic suffers undue delay in entering or crossing the main street. The Peak Hour Delay warrant is satisfied when the conditions given below exist for one hour (any four consecutive 15-minute periods) of an average weekday:

- (a) The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle-hours for a two-lane approach,
- (b) 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
- (c) The total entering volume serviced during the hour equals or exceeds 800 vehicles per hour for intersections with four (or more) approaches or 650 for intersections with three approaches.

A signal installed under the Peak Hour Delay warrant should be traffic actuated. Consideration should be given to operating the signal in the flashing mode

during off-peak periods.

(Rev. 13)

6C-10.3 Warrant 11, Peak Hour Volume

The Peak Hour Volume warrant is also intended for application when traffic conditions are such that for one hour of the day minor-street traffic suffers undue delay in entering or crossing the major street.

The Peak Hour Volume warrant is satisfied when 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 one hour (any four consecutive 15-minute periods) of an average day falls above the curve in Figure TS-10 for the existing combination of approach lanes.

When the 85th percentile speed of major-street traffic exceeds 40 miles per hour or when the intersection lies within a built-up area of an isolated community having a population less than 10,000, the Peak Hour Volume requirement is satisfied when the plotted point referred to above falls above the curve in Figure TS-11 for the existing combination of approach lanes.

A signal installed under the Peak Hour Volume warrant should be traffic actuated. Consideration should be given to operating the signal in the flashing mode during off-peak periods.

(Rev. 13)

6C-11 Factors Governing Selection of Traffic Control Equipment

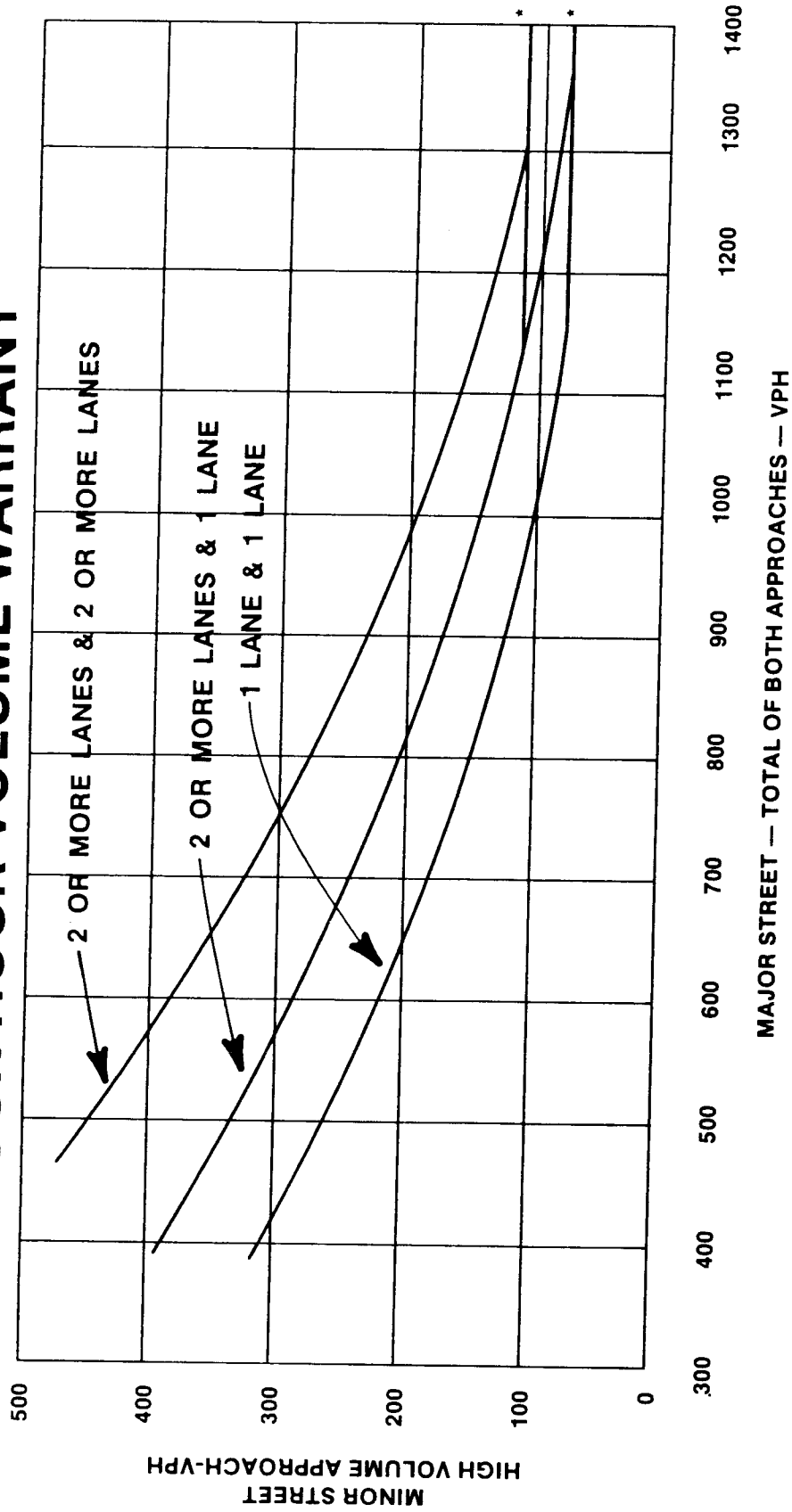
Extreme care should be used in selecting traffic control equipment so that proper features for both present operation and future alterations will be obtained when controllers are purchased.

The selection of the best form of control for any location can be made only with a full knowledge of local conditions but, in general, can be based on:

- (a) The variation between peak and average hourly volumes on the main street;
- (b) The variation between morning and afternoon average hourly volumes on the main street;
- (c) The variation between morning and afternoon average hourly volumes on the cross street; and
- (d) The percentage of the total average hourly volume using the intersection which enters from the cross street.

The choice between pre-timed and traffic-actuated control is frequently determined by initial equipment cost, installation cost and anticipated operat-

FOUR HOUR VOLUME WARRANT



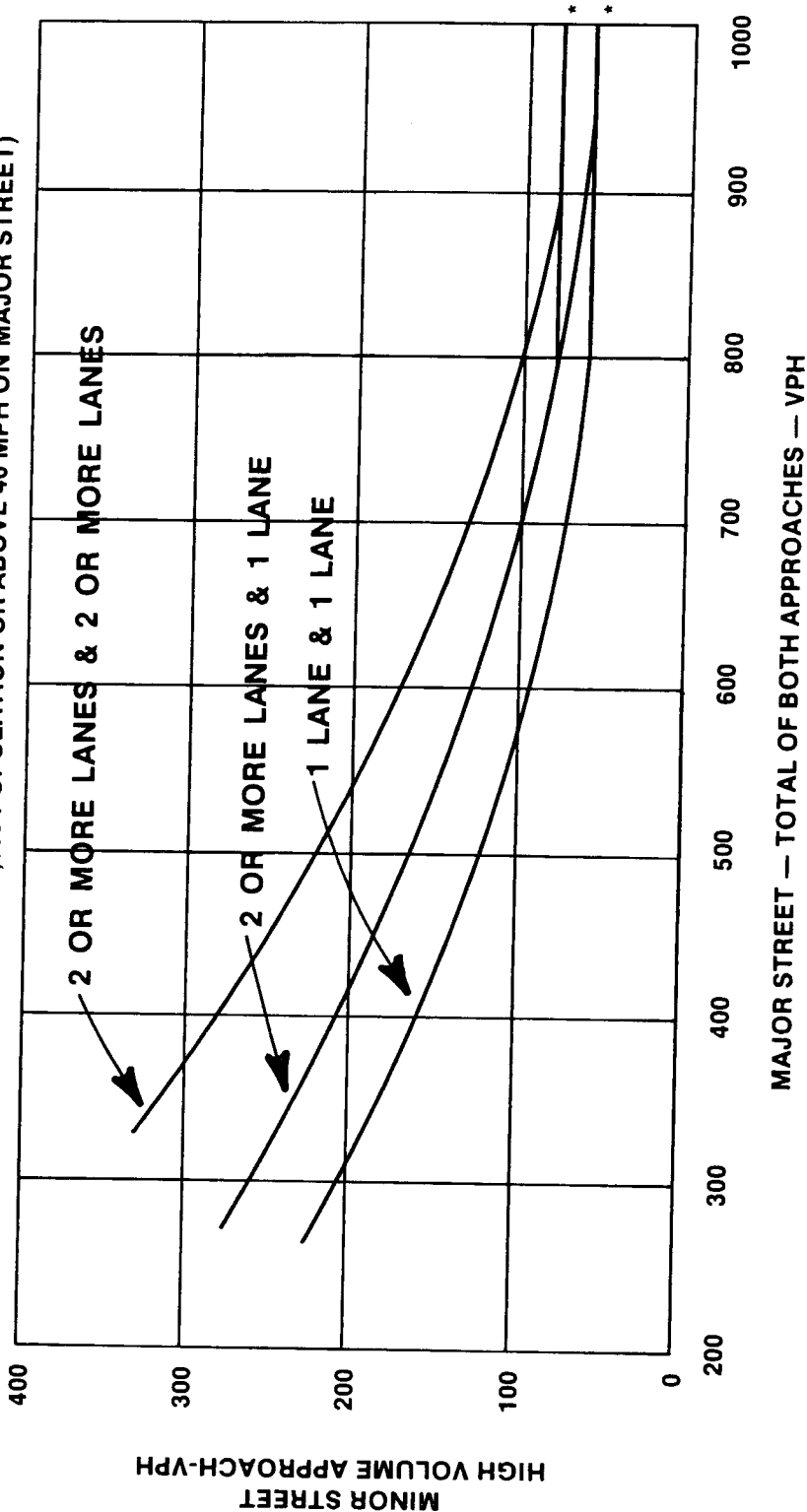
*NOTE: 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES.
80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH ONE LANE.

REF. SEC.
6C-10.1

(Rev. 13)

FOUR HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)

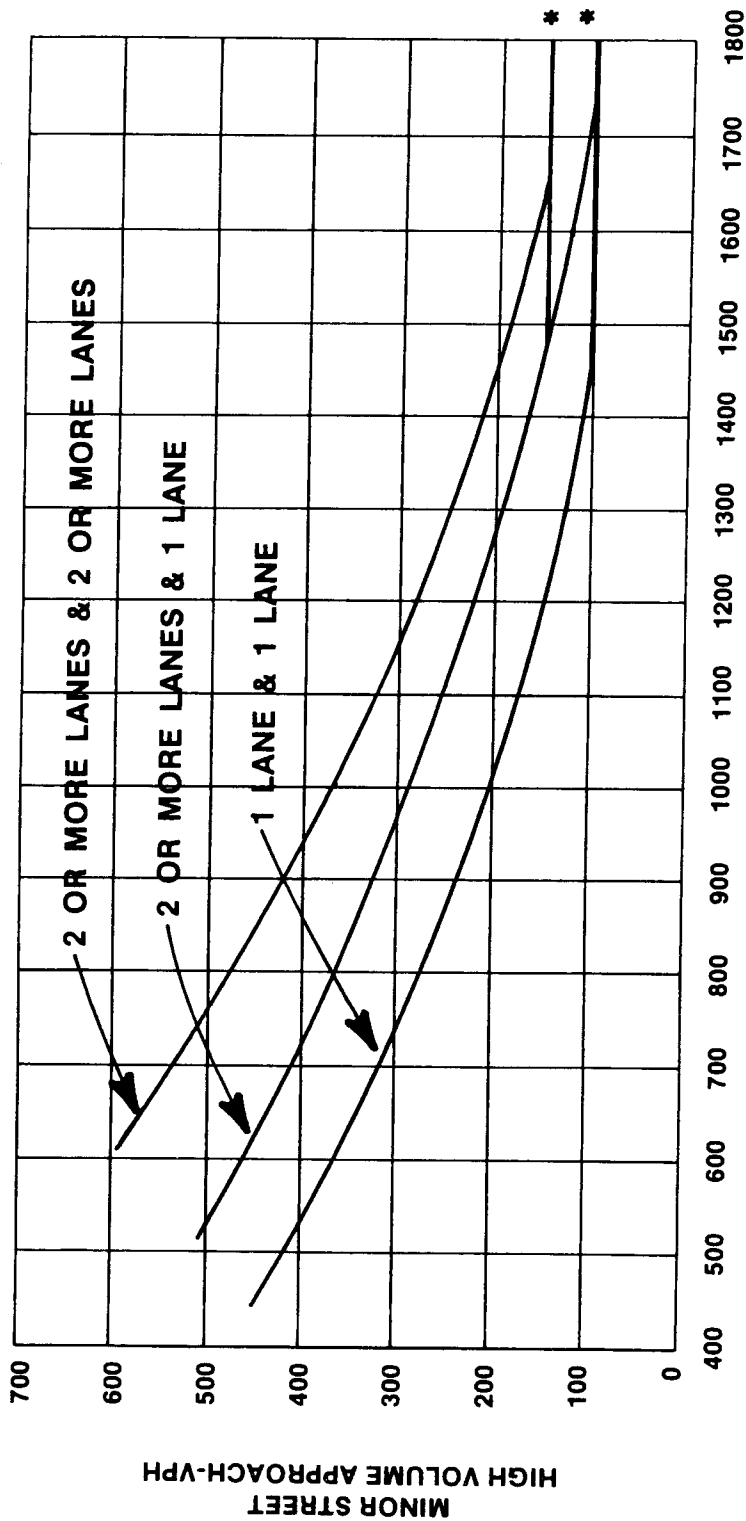


*NOTE: 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES.
60 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH ONE LANE.

REF. SEC.
6C-10.1

(Rev. 13)

PEAK HOUR VOLUME WARRANT

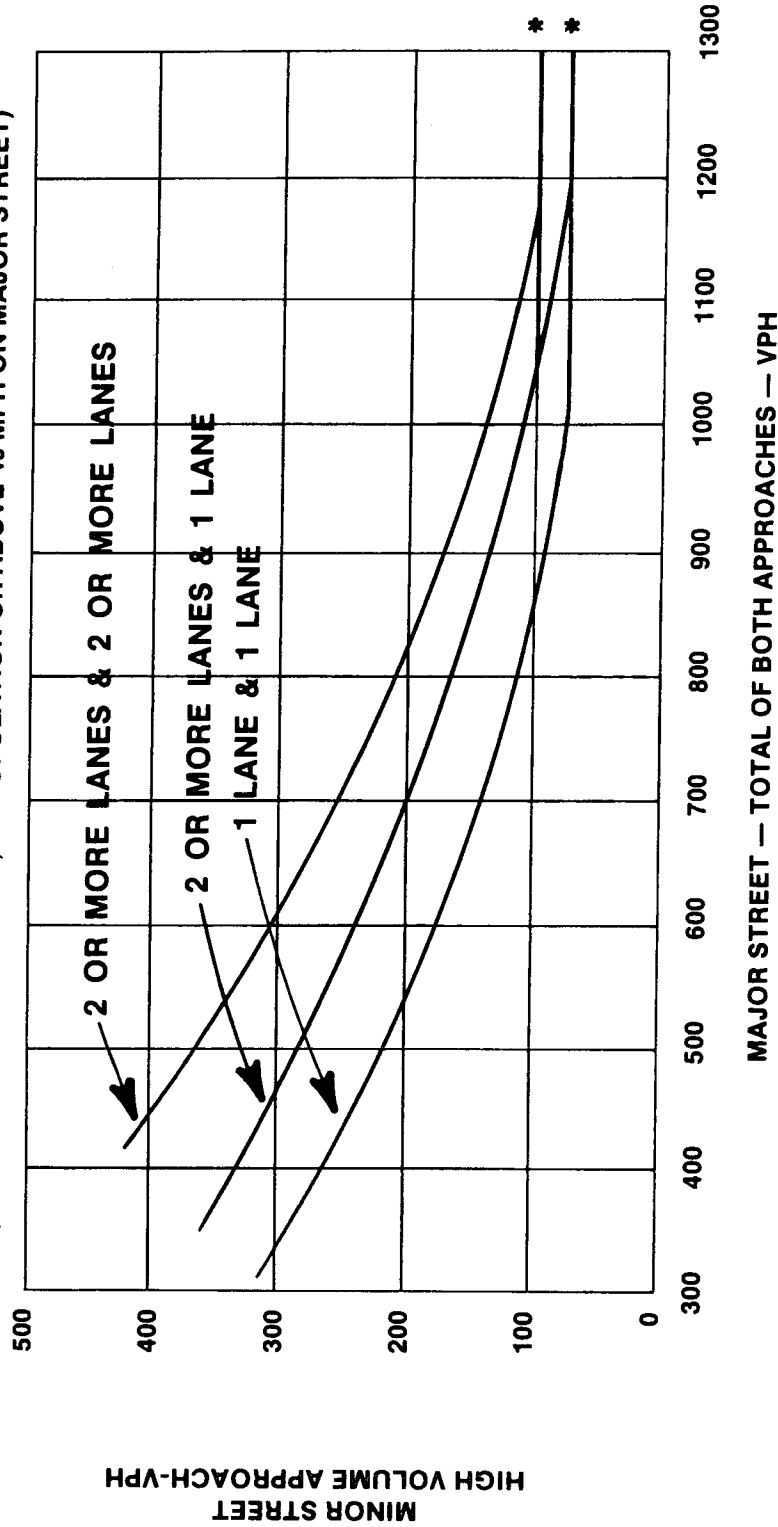


*NOTE: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES.
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH ONE LANE.

REF. SEC.
6C-10.3

PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES.
75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH ONE LANE.

REF. SEC.
6C-10.3

(Rev. 13)

ing expenses. Pretimed control is generally less expensive to install and maintain than other types of control. In considering the economic aspects in the selection of appropriate control apparatus, however, careful attention should be given to economic benefits or losses which may accrue to motorists and pedestrians. Unnecessary stoppages and delays to traffic movement result in economic losses which accumulate to a significant total during the life of the traffic control equipment. In many cases the reduction in motor vehicle operating costs will justify installation of signal control equipment which has a higher first cost but greater efficiency in handling traffic.

The principal factors that may lead to the favorable consideration of traffic-actuated control in the selection of the type of signal control include:

- (aa) Low, fluctuating or unbalanced traffic volumes.
- (bb) High minor-street traffic volumes and delays only during the peak hours.
- (cc) The Minimum Pedestrian Volume, Accident Experience, Peak Hour Delay or Peak Hour Volume warrant is the only warrant which is met.
- (dd) The installation is to provide for one-way movement of two-way traffic.
- (ee) The installation is at a nonintersection location.

Accident hazards also should be considered. While signals are most effective in reducing right-angle collisions, they tend to increase the frequency of rear-end collisions. Possible reduction of these rear-end accidents through more efficient operation of traffic signals frequently will offset added installation and maintenance costs.

(Rev. 13)

6C-12 Pedestrian-Actuated Control

Operation of traffic-actuated signals must take into consideration the needs of pedestrians as well as vehicular traffic. This can be accomplished in the following ways:

- (a) When Pedestrian Signals are not warranted in conjunction with a traffic-actuated signal installation as described in Section 6D-3 but where occasional pedestrian movement exists and there is inadequate opportunity to cross without undue delay, pedestrian detectors shall be installed and should be operated as prescribed in Sections 6D-6 and 6D-7.
- (b) When Pedestrian Signals are not otherwise warranted but a pedestrian movement exists which would not have adequate crossing time during the green interval, Pedestrian Signals and detectors shall be installed and should be

operated as prescribed in Sections 6D-6 and 6D-7.

- (c) When Pedestrian Signals are warranted and installed in conjunction with a traffic-actuated signal, the operation should follow the patterns described in Sections 6D-6 and 6D-7.

(Rev. 13)

6D PEDESTRIAN SIGNALS

6D-1 Pedestrian Signal Indications

Pedestrian Signal indications are special types of traffic signal indications intended for the exclusive purpose of controlling pedestrian traffic. These indications consist of the illuminated words WALK and DONT WALK or the illuminated symbols of a walking person (symbolizing WALK) and an upraised palm (symbolizing DONT WALK).

(Rev. 13)

6D-2 Meaning of Pedestrian Indications

Section 4511.14, (A) and (B), of the O.R.C. prescribes the meanings of Pedestrian Signal indications:

"Whenever special pedestrian control signals exhibiting the words "walk," or "don't walk," or the symbol of a walking person or an upraised palm are in place, such signals shall indicate the following instructions:

- (A) *"Walk" or the symbol of a walking person: Pedestrians facing such signal may proceed across the roadway in the direction of the signal and shall be given the right of way by the operators of all vehicles, streetcars, and trackless trolleys.*
- (B) *"Don't walk" or the symbol of an upraised palm: No pedestrian shall start to cross the roadway in the direction of the signal."*

In addition to the meaning prescribed in the O.R.C. for a DONT WALK indication, a flashing DONT WALK indicates that any pedestrian who has partly completed his crossing during the WALK indication shall proceed to a sidewalk, or to a safety island.

During a WALK indication there may be possible conflicts of pedestrians with turning vehicles. A WALK indication shall not be flashed.

(Rev. 13)

6D-3 Applications of Pedestrian Signal Indications

Pedestrian Signal indications shall be installed in conjunction with vehicular traffic signals (which meet one or more of the traffic signal warrants pre-