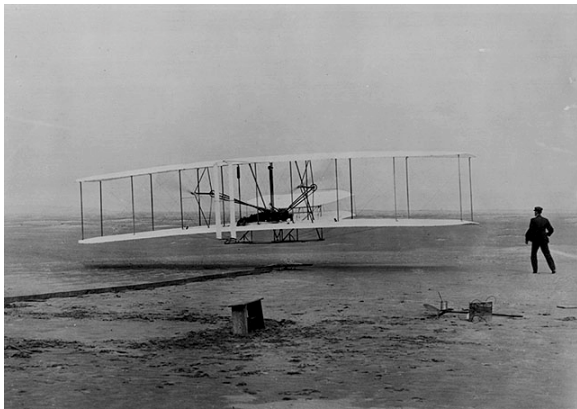


**NORTH CAROLINA SUPPLEMENT
TO THE
MANUAL ON UNIFORM TRAFFIC
CONTROL DEVICES
Millennium Edition**



*Celebrating 100 Years of Flight-
Kitty Hawk*



NC Ferry Service- Outer Banks



The Piedmont

Prepared By:

Traffic Engineering Branch
Division of Highways
Department of Transportation
State of North Carolina

Adopted: January 2003



HOV Lanes - Charlotte

NORTH CAROLINA SUPPLEMENT

TO THE

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

Millennium Edition



Prepared By:

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Division of Highways
Department of Transportation
State of North Carolina

Adopted: January 2003

ADOPTION – THE 2002 EDITION OF THE NORTH CAROLINA SUPPLEMENT TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS.

WHEREAS, the Board of Transportation has the authority to make rules, regulations and ordinances and is authorized to delegate the adoption and promulgation of rules, regulations and ordinances to the Secretary of Transportation; and

WHEREAS, The Board of Transportation has authorized the Secretary of Transportation to adopt and promulgate on behalf of the Board of Transportation all necessary rules, regulations and ordinances for use of and to police traffic on the State Highway System; and

WHEREAS, the 2000 Millennium edition of THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS (MUTCD) dated December, 2000, was published by the Federal Highway Administration on December 18, 2000 and became effective on January 17, 2001; and

WHEREAS, General Statutes 136-30 state “all traffic signs and other traffic control devices placed on a highway in the State highway system must conform to the Uniform Manual” and Administrative Code 19A NCAC 02B.0208 references the MUTCD and states “any subsequent revisions or additions of the same is hereby adopted and incorporated by reference”; and

WHEREAS, it is deemed desirable and necessary to publish a North Carolina Supplement to the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS (MUTCD) containing standards for all traffic control devices applicable to North Carolina not contained in the MUTCD;

NOW THEREFORE, on behalf of the Department of Transportation, the Secretary of Transportation hereby adopts the 2002 edition of the North Carolina Supplement to the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS.

January 13, 2003
Date

Troy A Peoples
State Traffic Engineer

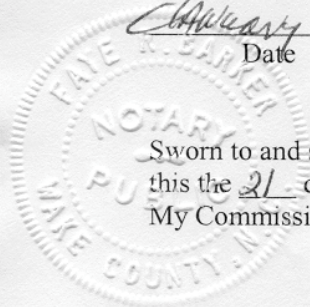
January 21, 2003
Date

LA Sanders
State Highway Administrator

APPROVED:

January 21, 2003
Date

[Signature]
Secretary of Transportation



Sworn to and subscribed before me
this the 21 day of Jan, 2003.
My Commission expires July 18, 2004

[Signature]
Notary Public

**NORTH CAROLINA SUPPLEMENT
TO THE
MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES**

(NCSMUTCD)

millenium edition

Introduction

This *North Carolina Supplement to the Manual on Uniform Traffic Control Devices (NCSMUTCD)* is published to provide a document containing standards, guidelines, and policies for traffic control devices not contained in the *Manual on Uniform Traffic Control Devices (MUTCD)*, which are approved by the North Carolina Department of Transportation (NCDOT) or required by the North Carolina General Statutes. These standards, guidelines, and policies contained herein are intended to supplement the *MUTCD* in the use of traffic control devices on the State Highway System.

The numbering system for the sections of the *NCSMUTCD* correspond directly to the numbering system for the sections of the *MUTCD*. The NCDOT is in full agreement with the sections in the *MUTCD* not addressed in the *NCSMUTCD*. Any subjects not addressed in the *NCSMUTCD* can be located in the *MUTCD*.

PART 1 GENERAL PROVISIONS

Section 1A.07 Responsibility for Traffic Control Devices

Support:

The Division of Highways of the North Carolina Department of Transportation (NCDOT) has the responsibility for traffic control devices on all of the North Carolina State Highway System to include Interstate, primary, and secondary highways, both rural and urban. For municipal streets not on the State Highway System, the municipality has the responsibility for traffic control devices. For State Highway System streets within a city or town, the Division of Highways may, by contractual agreement, delegate the maintenance of traffic control devices to the local government. However, the devices used must be approved by the Division of Highways and conform to the *Manual on Uniform Traffic Control Devices (MUTCD)* and the *North Carolina Supplement to the Manual on Uniform Traffic Control Devices (NCSMUTCD)*.

Any agency performing construction and maintenance work on or adjacent to a street or highway on the State Highway System is responsible for using the proper traffic control devices. The devices used are subject to approval by the Division of Highways and shall conform to the *MUTCD* and the *NCSMUTCD*.

Standard:

The Division of Highways of the NCDOT shall be responsible for traffic control devices on all of the North Carolina State Highway System. Local municipalities shall be responsible for municipal streets not part of State Highway System. The Division of Highways shall approve all traffic control devices used on the State Highway System.

Option:

The Division of Highways may delegate by contract the maintenance of State Highway System streets within a city or town to the local municipal government.

Section 1A.08 Authority for Placement of Traffic Control Devices

Support:

Under General Statute 20-158, 20-158.1, 20-169, 136-18, 136-30, and 136-66.1, and Section 2B-0202, Title 19A, North Carolina Administrative Code, the NCDOT is authorized to install and maintain traffic control devices on State Highway System right-of-way. Under General Statute 160A-269 and 160A-300 a municipality, with reference to streets under its jurisdiction, is authorized to control and regulate traffic.

All traffic control devices installed on the State Highway System shall be in substantial conformance with the *MUTCD* and the *NCSMUTCD*. In addition, since the *MUTCD* has been approved by the Federal Highway Administrator as a national engineering standard, it is applicable to all highways open to public travel in accordance with Title 23, United States Code, Sections 109(b), 109(d), and 402(a), and 23 CRF 1204.4. The *MUTCD* contains provisions for

the design and use of traffic control devices on all streets and highways regardless of type or class or the governmental agency having jurisdiction. These facilities include local municipal streets and highways, and highways under Federal administration such as the National Park Service, United States Forest Service, Bureau of Land Management, Military reservations, etc.

Standard:

Under the General Statutes of North Carolina, the NCDOT shall be responsible for traffic control devices on all of the North Carolina State Highway System. All traffic control devices used on public streets and highways in North Carolina shall conform to the *MUTCD* and the *NCSMUTCD*.

PART 4 HIGHWAY TRAFFIC SIGNALS

CHAPTER 4A. GENERAL

Section 4A.02 Definitions Relating to Highway Traffic Signals

Standard:

The following terms are intended to supplement the definitions as defined in Part 4 of the *MUTCD*. When used in the *NCSMUTCD*, they shall be defined as follows:

1. **Combination Lane** – A lane designated to allow two or more separate movements from the same lane. These movements may include through-left, through-right, right-left, or left-through-right.
2. **Exclusive Turn Lane** – A turn lane, either left or right, serving only one movement. This lane may be controlled either independently (protected movement) or in conjunction with (permitted movement) the adjacent through movement.
3. **Overlap** – The additional assignment of right-of-way for a traffic movement associated with one or more phases other than its normal phase.
4. **Pedestrian Phase** – See Phase.
5. **Phase** – The right-of-way assignment of one or more traffic or pedestrian movements within the signal cycle.
 - a. **Pedestrian Phase** – Those right-of-way and clearance intervals assigned to a phase within the signal cycle for pedestrian movement either concurrently with one or more vehicular movements, or to the exclusion of all vehicular movement.
 - b. **Traffic Phase** – Those right-of-way and clearance intervals assigned to a phase within the signal cycle for vehicular movements.
6. **Split Phase** – A type of signal phasing where opposite approaches at an intersection are each given their own right of way phase independent and free of conflict from all other movements at the intersection.
7. **Strobe Light** – A supplementary electronic flashing device providing a high-intensity pulsating light usually placed in the red section of a traffic signal head to alert drivers of the red display.
8. **Traffic Phase** – See Phase.

CHAPTER 4D. TRAFFIC CONTROL SIGNAL FEATURES

Section 4D.04 Meaning of Vehicular Signal Indications

Support:

General Statute 20-158(b)(2) of the Motor Vehicle Laws of North Carolina states “except where prohibited by an appropriate sign, vehicular traffic facing a red light controlling traffic passing (straight) through an intersection, after coming to a complete stop at the intersection, may enter the intersection to make a right turn but such vehicle shall yield the right of way to pedestrians and to other traffic using the intersection.”

Although not specifically defined by the general statutes, a red light is implied to be either a **CIRCULAR RED** or a **RED ARROW**.

To reduce potential motorist confusion and misinterpretation of the meaning of signal indications, the use of signs prohibiting or allowing turns on red indications should be consistent. Motorists usually assume they can turn unless a sign is in place prohibiting the movement.

Standard:

Vehicular traffic facing a steady CIRCULAR RED or RED ARROW signal indication shall stop at a clearly marked stop line; but if there is no stop line, traffic shall stop before entering the crosswalk on the near side of the intersection; but if there is no crosswalk, then before entering the intersection, and shall remain stopped until a signal indication to proceed is given, or as provided below.

Except when a sign is in place prohibiting a turn on red, vehicular traffic facing a steady CIRCULAR RED or RED ARROW signal indication may enter the intersection to turn right after stopping. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

Where turning movements are not allowed when a traffic signal is emitting a steady red indication, a “NO TURN ON RED” sign (R10-11B) shall be used.

Section 4D.05 Application of Steady Signal Indications

Standard:

A steady RED ARROW signal indication shall be displayed when it is intended to prohibit traffic, except pedestrians directed by a pedestrian signal head, from entering the intersection or other controlled area to make the indicated turn. Turning after stopping is permitted as stated in Section 4D.04 of this supplement.

Where turning movements are not allowed when a traffic signal is emitting a steady CIRCULAR RED or RED ARROW indication, a “NO TURN ON RED” sign (R10-11B) shall be used in conjunction with the steady red signal indication.

Section 4D.06 Application of Steady Signal Indications for Left Turns

Support:

At some intersections with a physical median (barrier wall, monolithic island, grass island, etc.), the potential exists for some traffic in the left turn lane to make a U-turn movement. When this U-turning traffic moves on a GREEN left turn ARROW, a conflict could be encountered if the adjoining street has a GREEN right turn ARROW which displays as an overlap simultaneously with the left turn movement. In case of such conflict, the U-turn movement should yield to the right turning traffic.

Standard:

Three section RED, YELLOW, and GREEN left turn ARROW indications shall be the standard display for all protected only (exclusive) mode left turn movements. No sign is required in conjunction with the use of this type of signal head; however, if one is used, it shall be a “LEFT ON GREEN ARROW ONLY” sign (R10-5).

At least one 3 section head consisting of RED, YELLOW, and GREEN left turn ARROW indications shall be used for single lane protected only left turn approaches. At least two 3 section heads consisting of a RED left turn ARROW, YELLOW left turn ARROW, and GREEN left turn ARROW indication shall be used for multi-lane left turning movements.

If a 4 section T-head signal head or 4 section vertical head consisting of two CIRCULAR RED and separate YELLOW and GREEN left turn ARROW indications are used, in accordance with the option below, a “LEFT TURN SIGNAL” sign (R10-10L) shall be used adjacent to the signal head.

When the protected left turn movement of a GREEN ARROW is accompanied by a simultaneous overlap display of a GREEN right turn ARROW and a median exists adjacent to the left turn lane(s), a “U-TURN MUST YIELD” sign (R3-27) shall be used and mounted adjacent to the left turn signal head. If more than one left turn signal head exists, then the “U-TURN MUST YIELD” sign (R3-27) shall be mounted adjacent to the signal head closest to the median (serving the inner most turn lane).

Guidance:

At signalized locations, a protected only (exclusive) left turn movement should be provided when there are two or more left turn lanes on the same approach at an intersection subject to conflicts from opposing through traffic. If one of the left turn lanes is a shared

movement lane, then split phasing should be considered for the opposing through movements as necessary.

When the protected left turn movement of a GREEN ARROW is accompanied by a simultaneous overlap display of a GREEN right turn ARROW and there is a high potential for a U-turn movement, a "U-TURN MUST YIELD" sign (R3-27) should be used and mounted adjacent to the left turn signal head, even if the median is a double yellow line or part of two-way left turn lane.

Option:

For a single left turn lane approach operating as a protected only left turn, a 4 section T-head signal head or 4 section vertical head consisting of two **CIRCULAR RED** and separate **YELLOW** and **GREEN** left turn **ARROW** indications, in conjunction with an adjacent "**LEFT TURN SIGNAL**" sign (R10-10L) when the **CIRCULAR RED** indications are readily visible to other traffic, may be used. An existing 4-section signal head may be used for the remainder of its useful service life.

Section 4D.10 Yellow Change and Red Clearance Intervals

Standard:

The yellow change interval shall be followed by a red clearance interval before conflicting traffic movements are given the right-of-way.

The use of red light camera photo enforcement systems shall not be a consideration in determining the duration of yellow and red clearance intervals.

Guidance:

A yellow change interval should have a duration of approximately 4.0 to 5.5 seconds. The red clearance interval should be at least 1.0 second in duration.

Option:

The red clearance interval may be omitted if the designated phase is an all red clearance holding (dummy) phase.

Longer clearance intervals may be used on approaches with higher speeds or severe downhill grades or other high judgement areas.

Section 4D.11 Application of Flashing Signal Indications**Support:**

Section 4D.12 of the *MUTCD* requires that “during programmed changes, no steady green signal indication or flashing yellow signal indication shall be terminated and immediately followed by a steady red or flashing red signal indication without first displaying the steady yellow signal indication.” This implies that left turn **ARROWS** should flash red to properly clear from the flashing mode. If the **YELLOW ARROW** flashed concurrently with the adjoining **CIRCULAR YELLOW** of the through phase, and the opposing through movement also flashed a **CIRCULAR YELLOW**, then a display conflict, as defined in section 4D.09 of the *MUTCD*, is created when the signal changes from flashing mode to steady mode. This display conflict is created when a steady **YELLOW** left turn **ARROW** is displayed simultaneously with a **CIRCULAR YELLOW** on the opposing through movement. Since a flashing yellow indication must clear to either a steady green or steady yellow when changing from flashing mode to steady mode, there is no way that this conflict can be prevented.

There is no clearance conflict created by a flashing **YELLOW** right turn **ARROW**. Vehicles turning right on a flashing yellow typically yield only to pedestrians crossing the intersection. During flashing operation, pedestrian signal heads are usually dark. During steady (stop and go) operation, pedestrian signal heads typically display a steady **DON'T WALK** during the yellow clearance interval of the accompanying through movement. The transition from a flashing **YELLOW ARROW** to a steady **YELLOW ARROW** during a change from flashing operation to steady operation does not create a signal head display or vehicular movement conflict.

Driver expectancy also supports that a vehicle is normally required to stop when it approaches a three section **ARROW** signal head. Under normal circumstances, as a driver approaches the intersection, a **RED ARROW** indication is displayed on the signal head. Once a phase call is received through the vehicle detectors, the signal will cycle and display a **GREEN ARROW** for the turning movement to proceed through the intersection without conflict.

Standard:

All signal head indications for the same approach shall flash concurrently during flashing operation.

A RED ARROW indication shall be flashed when a signal face consists entirely of ARROW indications and is used exclusively in the protected mode under normal operating conditions. Where a 4 section “Tee-Head” or 4 section vertical signal head is used for protected left turn control under normal operating conditions, both RED CIRCULAR indications shall be flashed. These RED CIRCULAR indications shall flash simultaneously with each other.

Option:

A **YELLOW ARROW** indication may be flashed when a right turn signal face consisting entirely of a 3 section signal head with either a **CIRCULAR RED** or **RED ARROW** indication and **YELLOW ARROW** and **GREEN ARROW** indications are used exclusively for right turn control under normal operating conditions. This **ARROW** indication shall flash concurrently with the flashing **CIRCULAR YELLOW** indication of the adjacent through movement on the main street.

A **YELLOW ARROW** indication may be flashed when a signal face consists entirely of arrow lenses and is used for split phase control on the main street under normal operating conditions. This **ARROW** indication should flash concurrently with the flashing **CIRCULAR YELLOW** indication of the adjacent movements on the main street approach.

Section 4D.12 Flashing Operation of Traffic Control Signals**Support:**

As a means of preventing unnecessary delays at signalized intersections, signals may be put into flashing operation during off-peak hours. Off-peak hours generally consist of the overnight hours between 11:00 PM and 6:00 AM, but may be defined differently for individual intersections.

Standard:

Programmed changes from steady mode (stop-and-go) to flashing mode shall be made at the end of the common major roadway red interval (ie, just prior to the start of the green in both directions on the major roadway).

Traffic signals with railroad preemption shall not be put into off-peak flashing operation.

Guidance:

Traffic signals should operate in flashing operation during off peak hours unless it is determined that the flashing operation of traffic signals could jeopardize the safety of travel through the intersection.

Option:

Traffic signals with preemption, excluding railroad preemption, may be considered for off peak flashing operation if it is determined that the operation of the vehicle benefiting from preemption is not otherwise significantly impacted and safe travel through the intersection is not jeopardized.

Section 4D.14 Coordination of Traffic Control Signals

Guidance:

Traffic signals operating within 1600 meters (1 mile) of each other should be considered for coordination. Additionally, signals located such that the travel time between them is less than or equal to one cycle length should be considered for coordination.

Traffic signals operating along a main highway corridor, on a corridor that has unpredictable heavy traffic flow, or on a road considered key to a regional network should be considered for interconnected coordination. This is to provide system control of the cycle length if necessary for events that may include, but not be limited to, evacuation of coastal and low lying, flood prone areas, and establishing detour routes when a major superhighway, such as an interstate, is closed.

Section 4D.15 Size, Number, and Location of Signal Faces by Approach

Support:

NCDOT Traffic Engineering Branch generally acknowledges the posted speed limit as the accepted design speed for traffic control purposes. In some cases, traffic flows at a speed different than the posted speed limit. For this reason, some traffic control devices may be designed for a speed different than the posted speed limit.

Standard:

Three hundred millimeter (12 inch) signal lenses shall be used:

- **On approaches where the design speed exceeds 56 km/hr (35 MPH).**
- **When signal faces are located more than 35 meters (120 feet) from the stop line.**
- **For approaches to all signalized intersections for which the minimum visibility distance in Table 4.1 of the *MUTCD* cannot be met.**
- **For all ARROW sections.**
- **At intersections with ramp terminals where traffic exits a superhighway (freeway).**

Guidance:

Three hundred millimeter (12 inch) signal lenses should be used in all traffic signal heads.

The design speed for traffic signals should be considered as the posted speed limit for an approach unless a speed study determines that the 85th percentile speed is faster. If this is the case, the 85th percentile speed may be used.

Option:

Two hundred millimeter (8 inch) signal lenses may be used in traffic signal heads.

- On approaches where the design speed is 56 km/hr (35 MPH) or less.
- An engineering study indicates that extra visibility or target value is not needed.

Section 4D.16 Number and Arrangement of Sections in Signal Faces

Support:

North Carolina General Statute 20-158(a)(3) states “All steady-beam stoplights emitting alternate red and green lights shall be arranged so the red light shall appear at the top of the signaling unit and green light shall appear at the bottom of the signaling unit.”

Standard:

The lenses in a signal face shall be arranged in a vertical straight line; except that in a vertical array, lenses of the same color may be arranged horizontally adjacent to each other at right angles to the basic straight line arrangement. Such clusters shall be limited to two identical lenses or two different lenses of the same color.

Section 4D.17 Visibility, Shielding, and Positioning of Signal Faces

Support:

On some intersection approaches, it may be desirable to provide even greater visibility requirements than the measures discussed in the *MUTCD*. In addition to tunnel visors, optically programmable lenses, louvers, backplates, and tethering may be considered. Tethering allows for the signal head to be attached to span wire on both the top and bottom of the housing to reduce swaying due to wind.

Standard:

The bottom of a signal face mounted or suspended over a roadway shall be at least 5.0 meters (16.5 feet) but not more than 5.8 meters (19 feet) above the crown of pavement.

Optically programmed heads shall not be mounted in a free-swinging manner.

Option:

While rigid mast arm mountings for optically programmed heads are preferable, span wire mountings may be used providing that the bottom of the signal head is tethered with span wire.

Section 4D.18 Design, Illumination, and Color of Signal Sections**Guidance:**

The exterior housing of all traffic signal sections and visors should be highway yellow in color to obtain the best possible contrast with the visual background.

Option:

The exterior housing of all traffic signal sections and visors may be dark green or black in color providing all three of the following conditions are met:

- The traffic signal installation is at a low speed (less than 40 MPH) location.
- The traffic signal installation is in a historic district or central business district.
- The local municipality is responsible for maintaining the traffic signal installation.

CHAPTER 4E. PEDESTRIAN CONTROL FEATURES**Section 4E.06 Accessible Pedestrian Signals****Support:**

The design and operation of traffic control signals must take into consideration the needs of pedestrians as well as vehicular traffic. Accessible pedestrian signals are intended to supplement visual pedestrian signals in assisting pedestrians across an intersection. These signals are devices which click, buzz, whistle, beep, or chirp with the intent of aiding the visually impaired in crossing the street. Special guidelines have been developed that pertain to the feasibility of installation and operation of accessible pedestrian heads.

Standard:

Accessible pedestrian signals, when used, shall be installed only in combination with pedestrian signal heads and pedestrian signal timing. They shall not be used independently or only with a vehicular signal head.

Guidance:

The installation of accessible pedestrian signals at signalized intersections should be based on an engineering study, which should consider the following factors:

- A. Potential demand for accessible pedestrian signals.
- B. A request for accessible pedestrian signals.
- C. Traffic volumes during times when pedestrian might be present, including periods of heavy and light traffic volume, high turn-on-red volumes, and uneven traffic flow.
- D. The complexity of traffic signal phasing.
- E. The complexity of intersection geometry.

- F. History of pedestrian accidents.
- G. The width of pedestrian crossing.
- H. Vehicle speed through intersection.
- I. Proximity to facilities for the blind or visually impaired.
- J. Proximity of key facilities utilized by all pedestrians.
- K. Number of public transit routes and stops.
- L. Number of transit passengers boarding and disembarking each day.
- M. Pedestrian mobility and other factors.

The operation and installation of accessible pedestrian signals at signalized intersections should consider the following factors:

- A. Should not be annoying to the average pedestrian or resident.
- B. Should have noise levels measured from 30 to 90 decibels.
- C. Should have upper and lower volume limits.
- D. Should be simple, low-cost installation.
- E. Must require minimal or no maintenance in a harsh environment.
- F. Must be mechanically adjustable as to direction.
- G. Should not require any extra wiring to the cabinet.
- H. Should in no way interfere with the normal signal operation.
- I. Must have a different, easily distinguished sound for each direction.
- J. The audible device should operate either by pedestrian actuation, time clock, or both.
- K. At locations where pedestrians need to know only the onset of walk, sound pressure levels should be measured from the corner.
- L. Should not be more than 5 decibels above ambient sound.

CHAPTER 4F. TRAFFIC CONTROL SIGNALS FOR EMERGENCY VEHICLE ACCESS

Section 4F.01 Applications of Emergency-Vehicle Traffic Control Signals

Guidance:

Vehicles eligible to be considered for special right of way preemption should include official first response emergency vehicles that utilize sirens and flashing red lights to provide services to the public which prevent loss of life and/or property. "Official" vehicles are fire-fighting and emergency medical service vehicles owned, operated, and maintained by the emergency response agency or authority. Authorized law enforcement vehicles that utilize sirens and blue flashing lights are considered eligible vehicles.

When the emergency vehicle building is in close proximity to an intersection, an engineering study should be performed to determine the need for emergency vehicle preemption.

Section 4F.02 Design of Emergency-Vehicle Traffic Control Signals**Standard:**

Except as specified in this section, an emergency-vehicle traffic control signal shall meet the requirements of the *MUTCD* and the *NCSMUTCD*.

The following size lenses shall be used for emergency-vehicle traffic control signals if the signal is used exclusively for emergency-vehicle control: 300 mm (12 in) diameter for steady CIRCULAR RED and steady CIRCULAR YELLOW indications and 200 mm (8 in) diameter for flashing yellow indication. A GREEN indication shall not be permitted in an emergency-vehicle traffic control signal installed at a mid-block location.

Section 4F.03 Operation of Emergency-Vehicle Traffic Control Signals**Standard:**

An emergency-vehicle traffic control signal installed at a mid-block location shall be manually actuated from a local control point or from an emergency vehicle equipped for remote operation of the signal.

As a minimum, the indications sequence, and manner of operation of an emergency-vehicle traffic control signal installed at a mid-block location shall be as follows:

- A. Between emergency vehicle actuations, the signal indication on the major roadway, shall be flashing yellow.
- B. Upon emergency vehicle actuation, a steady yellow change interval shall be displayed to traffic on the major roadway.
- C. A yellow change interval is not required for the emergency-vehicle driveway.
- D. During the emergency vehicle preemption phase, a steady red signal indication shall be displayed for traffic on the major roadway.

**CHAPTER 4G. TRAFFIC CONTROL SIGNALS FOR ONE-LANE,
TWO-WAY FACILITIES****Section 4G.02 Design of Traffic Control Signals for One-Lane, Two-Way Facilities****Standard:**

The provisions of Chapter 4D of the *MUTCD* and *NCSMUTCD* shall apply to traffic control signals for one-lane, two-way facilities except that:

- A. Durations of red clearance intervals shall be adequate to clear the one-lane section of conflicting vehicles.**
- B. A means, such as interconnection, shall be provided to prevent conflicting signal indications, e.g., green and green, at opposite ends of the section.**

CHAPTER 4H. TRAFFIC CONTROL SIGNALS FOR FREEWAY ENTRANCE RAMP

Section 4H.02 Design of Freeway Entrance Ramp Control Signals

Standard:

All signal sections used in ramp control signals shall have 300 mm (12 inch) diameter lenses.

CHAPTER 4I. TRAFFIC CONTROL SIGNALS FOR MOVABLE BRIDGES

Section 4I.02 Design of Movable Bridge Signals and Gates

Standard:

Since movable bridge operations cover a variable range of time periods between openings, the signals shall be the standard three color traffic signals consisting of a **CIRCULAR RED**, **CIRCULAR YELLOW**, and **CIRCULAR GREEN** lens in each signal face. Two signal indications shall be provided for each approach to the movable span.

Signal heads with 300 mm (12 inch) diameter lenses shall be used for each approach to movable bridge spans.

Section 4I.03 Operation of Movable Bridge Signals and Gates

Standard:

The **CIRCULAR GREEN** signal indication shall be illuminated at all times between bridge openings. The signal shall display a steady **CIRCULAR RED** indication when traffic is required to stop. A yellow change interval shall be provided between the display of the green and red indications.

Guidance:

The yellow change interval should have a duration of approximately 4.0 to 5.5 seconds.

Option:

If the bridge is not expected to open during continuous periods in excess of 5 hours, a flashing **CIRCULAR YELLOW** indication may be used.

CHAPTER 4J. LANE-USE CONTROL SIGNALS

Section 4J.03 Design of Lane-Use Control Signals

Standard:

The bottom of any lane-use control signal unit shall be at least 5.0 meters (16.5 feet) but not more than 5.8 meters (19 feet) above the crown of the pavement.

CHAPTER 4K. FLASHING BEACONS

Section 4K.02 Intersection Control Beacon

Support:

Whereas a beacon is considered a form of a traffic signal, a minimum of two sections, in accordance with section 4D.15 of the *MUTCD* and *NCSMUTCD*, should be used for each approach at a beacon. The size of the beacon sections may be either 200 mm (8 inch) or 300 mm (12 inch) based on the criteria of section 4D.15.

Standard:

There shall be a minimum of two sections with the appropriate lenses in each section used for every approach to an intersection under beacon control. The size of the beacon shall be established according to section 4D.16 of the *MUTCD* and *NCSMUTCD*.

If the beacon is suspended over the roadway, the clearance between the crown of the pavement and lowest point of the beacon shall be at least 5.0 meters (16.5 feet) but not more than 5.8 meters (19 feet).

Guidance:

For single lane approaches, the beacon sections should be vertically aligned and alternately flashed unless an engineering study indicates otherwise. The vertical distance from the bottom of the top beacon to the top of the bottom beacon should be 450 mm (18 inches).

For multilane approaches, the beacon sections should be mounted horizontal to each other and flash simultaneously.

Section 4K.03 Warning Beacon

Support:

A warning beacon consists of a flashing **CIRCULAR YELLOW** signal lens or multiple lenses which are used in conjunction with a warning or regulatory sign to alert drivers to a potential hazard in or adjacent to the roadway ahead. The flashing beacons are intended to help draw attention to the sign, which might otherwise be ignored by the driver.

Standard:

Where two lenses are aligned horizontally, they shall flash simultaneously. If two lenses are aligned vertically, they shall flash alternately.

If a warning beacon is suspended over the pavement, the clearance between the crown of pavement in the roadway and the lowest point of the beacon shall be at least 5.0 meters (16.5 feet) but not more than 5.8 meters (19 feet).

Guidance:

The edge of housing should normally be located no closer than 300 mm (12 inches) outside of the nearest edge of the sign.

Section 4K.06 Overheight Vehicle Detection Warning Beacons

Support:

Some overpasses on primary highways may not provide adequate clearance for vehicles passing beneath the structure. To warn overheight vehicles of potentially low clearance overpasses, detectors and warning beacons may be installed to alert the driver of the potential hazard ahead. The actuated device is intended to attract the driver's attention better than a warning beacon, which is in permanent flashing operation.

Standard:

When the warning beacons are suspended over the pavement, the clearance between the crown of pavement in the roadway and the lowest point on the sign or signal head shall be at least 5.0 meters (16.5 feet) but not more than 5.8 meters (19 feet).

Guidance:

An advance sign with the message "**VEHICLE OVERHEIGHT WHEN FLASHING**" (W14-17) should be mounted over the roadway between two single section 300 mm (12 inch) **CIRCULAR YELLOW** flashers. The flashers should be activated whenever a special detection device senses that the top of the vehicle is less than 300 mm (12 in) from the bottom of the overpass.

Option:

Overheight vehicle detection beacons may be installed prior to underpasses where there has been a problem of overheight vehicles striking the overpass. The flashers may flash either simultaneously or alternately, in accordance with Section 4K.03.