

Chapter Hy 21

TRAFFIC CONTROL SIGNALS

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Hy 21.01 General. (1) **AUTHORITY FOR THESE RULES.** Pursuant to section 349.08(1), Wis. Stats., the commission prescribes these rules for the design, installation and operation of traffic control signals.

(2) **APPLICATION.** These rules shall apply to all traffic control signals, including those presently installed.

History: Cr. Register, August, 1962, No. 80, eff. 9-1-62.

Hy 21.02 Effective date of regulations. All traffic signal installations made after January 1, 1963, shall comply with these rules. Installations made prior to January 1, 1963, shall comply with Chapter Hy 15 as published in the Wisconsin Administrative Register for January, 1956, or with these rules. After September 30, 1970, all installations on all highways shall comply with these rules.

History: Cr. Register, August, 1962, No. 80, eff. 9-1-62; am. Register, April, 1967, No. 136, eff. 5-1-67; am. Register, September, 1970, No. 177, eff. 10-1-70.

Hy 21.03 Design of vehicular traffic control signal equipment. (1) **DESIGN OF LENSES, REFLECTORS AND LAMP RECEPTACLES.**

(a) **Shape.** All signal lenses used to control vehicles shall be circular in shape except that arrow lenses may be rectangular.

(b) **Size.** 1. There are two approved nominal sizes of lenses—8 inches and 12 inches.

2. The 8-inch circular lens shall have a visible diameter of not less than $7\frac{3}{4}$ inches and an over-all diameter of not less than $8\frac{3}{8}$ inches. The 8-inch rectangular lens shall have a visible dimension of not less than $7\frac{3}{4}$ inches and an over-all dimension of not less than $8\frac{3}{8}$ inches.

3. The 12-inch circular lens shall have a visible diameter of not less than $11\frac{1}{2}$ inches and an overall diameter of not less than $12\frac{1}{32}$ inches. The 12-inch rectangular lens shall have a visible dimension of not less than $11\frac{1}{2}$ inches and an overall dimension of not less than $12\frac{1}{32}$ inches.

(c) **Colors and arrow design.** 1. The colors of red, yellow and green signal lenses shall conform to standard specification D-10.1-1958, UDC 656.057 adopted on October 16, 1958, by the American Standards Association, 70 East 45th Street, New York 17, New York, as to spectral transmission. Copies of the said standard specification and the

1960 supplement thereto are on file at the main office of the commission in Madison, and in the office of the secretary of state and revisor of statutes.

2. All arrows shall be on an opaque background and the arrow shall be the illuminated part of the lens. The arrow shall be reproduced on the lens in conformance with the dimensions and shapes shown on either Figure 2 in the aforesaid standard specification D-10, 1-1958, or Figure 2 in the supplement thereto, whichever is needed. Each arrow lens shall show only one arrow direction.

(d) *Lettering.* Lettering shall in no case be used on the visible part of vehicular signal lenses.

(e) *Illumination.* Each lens shall be illuminated independently. Especially designed traffic signal lamps shall be used with a minimum of 67 watts for 8-inch lenses and 108 watts for 12-inch lenses. When 12-inch yellow lenses are used for flashing operation, the wattage shall be reduced so that the brilliance of the illuminated lens will be equivalent to the brilliance of an 8-inch yellow lens with a 67-watt lamp.

(f) *Visibility.* When a vehicular traffic signal lens is illuminated and the view of such an indication is not otherwise physically obstructed, it shall be clearly discernible to drivers it controls at all distances from 10 feet to 1,000 feet under all atmospheric conditions except dense fog, and the green arrow shape shall be recognizable from 10 feet to at least 200 feet in advance of the signal.

(g) *Sun phantom.* The optical unit (lens, reflector, socket and visor) shall be so designed that sun phantom, or apparent illumination of the lens will be at a minimum when the lens faces the sun and the lamp is not burning.

(h) *Lamp receptacle.* The lamp receptacle shall be designed to hold a lamp of required wattage with the light center at the focal point of the reflector.

(i) *Visors.* Each optical unit shall be equipped with a suitable visor of such shape and size as is necessary to aid in reducing sun phantom and insure that the signal indication shall not be visible to cross-traffic to such an extent as to be confusing.

(2) DESIGN OF SIGNAL HEADS. (a) *Number of lenses.* 1. Each vehicular signal face, except on a ramp metering signal, shall have at least 3 but not more than 5 lenses—red, yellow and green (circular or arrow)—except where a green arrow lens is used alone to indicate continuous movement, or where because of special turning or other movement problems, flashing yellow or flashing and steady red indications are used to supplement an otherwise normal signal installation. Ramp metering signals may have only 2 lenses—red and green.

2. Green arrow signals shall be used at intersections where specific movements are individually controlled. These include a straight-through arrow, a left-turn arrow, and a right-turn arrow.

(b) *Arrangement of lenses.* 1. Lenses in a traffic signal face that is not mounted over the roadway (hereinafter referred to as post-mounted) shall be arranged in a vertical line. Lenses in a traffic signal face that is mounted over the roadway (hereinafter referred to as overhead-mounted) shall be arranged in either a vertical or horizontal line.

2. When the lenses are arranged in a vertical line the red shall be placed at the top, the yellow immediately below, and the green at the bottom. Green arrow lenses shall be located as near as practicable to the movements they control, but when more than one arrow lens is placed in the same vertical line, the straight-through arrow shall be below the circular green (if any), the left-turn arrow next, and the right-turn arrow at the bottom. Yellow arrows (if used) shall be placed immediately above the corresponding green arrow.

3. When the lenses are arranged in a horizontal line the red shall be placed at the far left, the yellow next, and the green at the right. When used, the left-turn arrow shall be to the immediate right of the yellow, the circular green (if used) shall be next, followed by the straight-through and right-turn arrows, respectively. Yellow arrows (if used) shall be located immediately to the left of the corresponding green arrow.

4. Arrows as enumerated above, may be placed at angles other than 0 and 90 degrees with the vertical to indicate movement into the streets which leave the intersection at various angles. The straight-through arrow shall point up.

(c) *Adjustment of signal heads.* Each signal head shall be so constructed that it may be rotated upon its vertical axis to allow each signal face to be directed at the traffic it is intended to control.

History: Cr. Register, August, 1962, No. 80, eff. 9-1-62; am. (2) (a) 1., Register, January, 1970, No. 169, eff. 2-1-70.

Hy 21.04 Installation of vehicular traffic control signal equipment.

(1) **NUMBER OF FACES.** There shall be a minimum of 3 vehicular signal faces visible to traffic on each approach to a signalized intersection except that there shall be a minimum of 2 vehicular faces for ramp metering signals. The vehicular faces shall be supplemented by pedestrian signals, where warranted, located at each end of each controlled crosswalk. A single signal face is permissible for the control of an exclusive turn lane. Such a signal face shall be in addition to the minimum of 2 signal faces for through-traffic. When the indications of a separate signal face or faces controlling an exclusive turn lane will also be visible to traffic with other allowable movements, a sign "Left (or Right) Turn Signal" shall be located adjacent to such signal face. When the face consists entirely of arrow indications, such a sign is not required. Left turn arrows shall not be used in near-right faces. Right turn arrows shall not be used in far-left faces. A far-side median mount signal shall be considered as a far-left signal for this application.

(2) **LOCATION OF SIGNAL FACES.** (a) *Visibility.* Signal faces shall be located so as to give drivers and pedestrians a clear and unmistakable indication of the right of way assignment from their normal positions on the approaches and as they enter or pass through the intersection area. Where separate pedestrian signals are not provided, vehicular traffic control signals readily visible from each end of every crosswalk shall be provided.

(b) *Location.* The location of signal faces for each direction of approaching traffic shall be as follows:

1. There shall be at least 2 signal faces on the far side, one on the far-left and one on the far-right, and one signal face on the near-

right side, except for ramp metering signals, where only near-right and near-left signals may be used.

2. Required near-right, near-left and far-left signal faces shall be post-mounted.

3. Far-right signal faces, near-center signal faces and far-center signal faces may be either post-mounted or overhead-mounted.

4. All overhead-mounted signal faces shall be in line with the approach they control and far-side overhead-mounted signal faces shall be visible from the point of compliance. The use of back plates to increase the target value of overhead signal faces is recommended.

5. On divided highways far-center signal faces shall be used in lieu of the far-left location and near-center signal faces shall be used where separate left-turn indications are provided.

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(c) *Auxiliary signals and signs.* Where physical conditions prevent the operator of a vehicle from having a continuous view of at least one signal indication for approximately 10 seconds before reaching the stop line, an auxiliary signal shall be used to provide this visibility. If physical conditions make this impossible, a "Signal Ahead" sign or a flashing yellow signal with a "Signal Ahead" sign shall be erected in a suitable position to warn approaching traffic.

(3) **HEIGHT AND TRANSVERSE LOCATION OF SIGNALS.** (a) *Height.*

1. The bottom of the housing of a post-mounted signal face shall not be less than 8 feet nor more than 15 feet above the sidewalk or, if none, above the pavement grade of the center of the roadway, except that ramp metering signals may be mounted at a minimum height of 3 feet from the bottom of the housing to the pavement grade.

2. The lowest part of a signal assembly suspended over a roadway shall not be less than 15 feet nor more than 17 feet above the pavement grade of the center of the roadway.

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(b) *Transverse location.* 1. Signal faces mounted at the side of a street with curbs or an established curb line or on a traffic island shall be located as near as practicable to that curb line normally with a 2-foot clearance. Near-side signal faces shall be located as near as practicable to the point of compliance. Far-side signal faces shall be located immediately beyond or over the far-side crosswalk except when they are erected on a properly designed traffic island. A signal or its support shall not obstruct the crosswalk.

2. Where there is no curb, a signal face mounted at the roadside shall be not more than 10 feet from the edge of the pavement or traveled surface provided that it shall not obstruct the free use of the shoulder.

History: Cr. Register, August, 1962, No. 80, eff. 9-1-62; am. (1), (2) (b) 1., 2., and (3) (a) 1., Register, January, 1970, No. 169, eff. 2-1-70.

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Hy 21.05 Operation of traffic control signals and application of color and arrow indications. (1) **NORMAL OPERATION.** (a) Combinations of signal colors (green with yellow, yellow with red, or green with red) shall not be displayed simultaneously except where turn arrows are shown together with steady yellow or steady red under the conditions described below.

(b) A yellow vehicle-clearance interval shall be displayed following each green interval and, where applicable, following each green arrow interval, except that a yellow clearance interval need not be

provided by ramp metering signals. The steady yellow indication shall not be used following a steady or flashing red indication.

(c) Steady yellow shall not be used as a caution signal and the steady red shall not be used to designate a through highway. Right or left turns are prohibited during a showing of a red indication without a modifying arrow.

(d) The circular yellow vehicular-clearance interval when required shall be not less than 3 seconds, nor more than 6 seconds in length. The yellow arrow clearance interval shall be not less than 2 seconds nor more than 4 seconds in length.

(e) A circular green indication shall be given only when it is intended to permit traffic in each lane to proceed in any direction which is lawful and practical for traffic in those lanes. This is not intended to prevent prohibition of turns, at all times or during certain periods of the day, by the erection of signs.

(f) When all required signal lenses are arranged in the same signal face the red indication shall accompany the display of green turn arrows unless the circular green indication or the vertical green arrow is also displayed.

(g) When separate signal faces are used, conflicting indications shall not be displayed simultaneously on the same signal face, and at no time shall a signal face be blank.

(h) Every circular green indication, except those on ramp metering signals, shall be followed by a steady circular yellow clearance interval and every green arrow indication shall be followed by a steady circular yellow or yellow arrow vehicle-clearance interval except following a green arrow when the related movement is permitted to continue by the accompanying or immediately forthcoming display of the circular green indication.

(i) Separate signal faces shall be used when the turning movement is discontinued while the straight-through movement continues, and whenever the sequence of operation is such that a particular turning movement and the straight-through movement at no time are permitted simultaneously. The purpose of a separate signal face shall be made clear by its location and by a sign located close to the signal having an appropriate message, such as "Left Turn Signal" or "Right Turn Signal."

(j) It is required that all signals in use be "live." When not operated as a "stop-and-go" device the signals shall be operated as a flashing device or the signal faces shall be covered, turned or taken down.

(2) FLASHING OPERATION OF TRAFFIC CONTROL SIGNALS. (a) *Color indications.* When signals are put on flashing operation, the color indications given to the several streets shall correspond to the through highway declaration established by appropriate authority. In no case shall flashing yellow indications be given to conflicting movements approaching the intersection.

(b) *Control.* The control of flashing operation of traffic control signals shall be provided by an electrical mechanism supplementary to the controller. The signal controller shall be removable without affecting the flashing operation of the signal. The signal shall be flashed continuously at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall be not less than half and not more than two thirds of the total time.

(c) *Change to and from flashing operation.* Except as described in paragraph (3) below, the change from stop-and-go to flashing operation shall be made at the end of the common major-street red interval (i.e., when a red indication is shown in both directions on the main street) and the change from flashing to stop-and-go operation shall be made at the beginning of the common major-street green interval.

(3) **EMERGENCY OPERATION OF TRAFFIC SIGNALS.** (a) *Colors, indications and sequences.* Traffic signals operated under emergency conditions shall use colors, indications and sequences with which drivers and pedestrians are familiar. The use of auxiliary indications, independent of the traffic signal assembly, to indicate the existence of an emergency condition is permitted. Emergency pre-emption devices may pre-empt the traffic signal during any part of the sequence of operations; however, a normal steady yellow clearance interval shall always precede the change from a green or flashing yellow indication to a steady or flashing red indication.

(b) *Operation of pre-emption devices.* Electronic devices used in emergency vehicles to pre-empt intersectional traffic signal control shall operate at a range sufficient to permit a normal clearance interval to take place in the change from green to yellow to red (or flashing red) before arrival of the emergency vehicle at the pre-empted location. Systems in which intersectional traffic signal is pre-empted by emergency vehicles shall be designed and installed so as to provide a fail-safe indication to the driver of any emergency vehicle approaching an intersection whose equipment fails to pre-empt the traffic signal at that intersection. This fail-safe indication shall be given whether the failure results from a prior pre-emption by an emergency vehicle on the cross street, from equipment malfunction, or from any other cause.

(4) **MAINTENANCE.** (a) *Painting.* The inside of visors or hoods and the entire surface of louvers or fins, shall be painted a dull black. Back plates shall be painted either dull black or highway yellow. The remainder of the signal head including brackets and pedestal shall be painted highway yellow.

(b) *General.* Maintenance of the equipment including servicing of the controller and associated equipment, replacement of lamps, cleaning of lenses and reflectors, etc., shall be carried out in such a manner that the signal will be operating in a satisfactory manner at all times.

(5) **ELECTRICAL INSTALLATION.** The equipment and manner of its installation shall conform to the Wisconsin electrical code.

History: Cr. Register, August, 1962, No. 80, eff. 9-1-62; am. (1) (b), (d) and (h), Register, January, 1970, No. 169, eff. 2-1-70.

Hy 21.06 Pedestrian signals. (1) **GENERAL DESIGN REQUIREMENTS.**

(a) *Message.* All pedestrian signals shall be rectangular in shape and shall contain the lettered messages "Walk" and "Don't Walk." The Don't Walk indication shall be mounted directly above, to the left of, or integral with the Walk indication. The two basic types approved as standard are:

1. Gas-filled tubing type. The letters shall be at least 4½ inches in height and shall be in two lines. The Walk indication shall be green and the Don't Walk shall be red.

2. Incandescent type. The letters shall be at least 3 inches high. The Walk and Don't Walk indications shall be in separate signal sections. The Walk lens shall be white glass with all except the letters obscured by an opaque material. As an alternate, the Walk lens may have an opaque band at least 5% inches high across its center obscuring all except the letters, and a band of white at top and bottom. The Don't Walk lens shall be orange glass with all except the letters obscured by an opaque material.

(b) *Fail-safe design.* The Don't Walk signal shall be designed and constructed so that in case of an electrical or mechanical failure of the word "Don't," the word "Walk" will also remain dark.

(c) *Uniformity.* All pedestrian signals within one intersection shall be of the same approved type.

(2) LOCATION AND INSTALLATION. (a) *Height.* Pedestrian signals shall be mounted with the bottom of the signal not less than 7 feet nor more than 10 feet above the sidewalk level and so that there is a signal in line with each controlled crosswalk.

(b) *Mounting and visibility.* Pedestrian signals may be mounted separately or on the same standard with vehicular signals. When mounted with vehicular signals there shall be a physical separation between the two signal groupings, and they shall be separately adjustable. A pedestrian signal shall be so positioned and adjusted as to provide maximum visibility at the start of the controlled crosswalk.

(c) *Nonintersectional signals.* Signals installed at nonintersectional crossings shall follow the usual location standards for both pedestrian and vehicular signals.

(d) *Push-buttons.* Pedestrian-actuated signals shall have a push-button detector 3½ to 4 feet above the surface of the sidewalk at each end of any crosswalk, median or island used as a pedestrian refuge where actuation is required. A sign explaining its use shall accompany each push-button detector.

(3) OPERATION. (a) *Illumination.* Pedestrian indications shall be constantly illuminated except during the pedestrian clearance interval, when the Don't Walk indication may be flashing. However, when the vehicular signals at the intersection are on flashing operation, the pedestrian signals shall be extinguished.

(b) *Clearance interval.* A pedestrian clearance interval shall always be provided. The duration of the clearance interval shall be approximately one second for each four feet of traveled way.

History: Cr. Register, August, 1962, No. 80, eff. 9-1-62.