

APPROVED BY NCUTCD COUNCIL ON JANUARY 19, 2007

**RECOMMENDED CHANGES TO
CHAPTER 6F TEMPORARY TRAFFIC CONTROL ZONE DEVICES, SECTION
6F.55 IN 2003 MUTCD
WITH REVISION 1 DATED NOVEMBER 2004 INCORPORATED**

Section 6F.55 PCMS

Standard:

PCMS shall be TTC devices with the flexibility to display a variety of messages. ~~Each message shall consist of either one or two phases. A phase shall consist of up to three lines of eight characters per line. Each character module shall use at least a five wide and seven high pixel matrix.~~

Support:

Typically, a Portable Changeable Message sign is an electronic sign that consists of up to three lines of eight characters per line or consists of a full matrix display. PCMS are used most frequently on high-density urban freeways, but have applications on all types of highways where highway alignment, road user routing problems, or other pertinent conditions require advance warning and information.

PCMS have a wide variety of applications in TTC zones including: roadway, lane, or ramp closures, incident management, width restriction information, speed control or reductions, advisories on work scheduling, road user management and diversion, warning of adverse conditions or special events, and other operational control.

The primary purpose of PCMS in TTC zones is to advise the road user of unexpected situations. PCMS are particularly useful as they are capable of:

- Conveying complex messages,
- Displaying real time information about conditions ahead,
- Providing information to assist road users in making decisions prior to the point where actions must be taken.

Some typical applications include the following:

- A. Where the speed of vehicular traffic is expected to drop substantially;

- B. Where significant queuing and delays are expected;
- C. Where adverse environmental conditions are present;
- D. Where there are changes in alignment or surface conditions;
- E. Where advance notice of ramp, lane, or roadway closures is needed;
- F. Where crash or incident management is needed; and/or
- G. Where changes in the road ~~user~~ traffic pattern occur.

There are two primary types of matrices that are used on electronic PCMS.

- A. Line matrix (character and continuous); and
- B. Full Matrix

A line matrix sign has pixels with constant horizontal pitch and provides the capability to display messages of a fixed character height. There is a blank space (no pixels present) between lines of characters to achieve inter-line spacing. Two types of line matrix signs are character and continuous. A character line matrix sign uses character matrices with a fixed amount of blank space (no pixels present) between character matrices to achieve the inter-character spacing. A continuous line matrix sign has no hardware defined blank spaces (no pixels) between characters.

A full matrix sign does not have fixed characters or lines. The entire message portion of the display area contains equally spaced pixels. The sign is capable of displaying multiple lines of any height, length, symbols, graphics, or color.

Guidance:

The components of an electronic Portable Changeable Message sign should include: a message sign panel, control systems, a power source, and mounting and transporting equipment. The front face of the sign should be covered with protective material. The color of the pixels should be yellow or orange on a black background. The pixels on a Speed Display Changeable Message sign displaying variable speed limits should be white on a black background.

PCMS should subscribe to the principles established in Section 2A.07 and other sections of this Manual and, to the extent practical, with the design (that is, color, letter size and shape, and borders) and applications prescribed in this Manual, except that the reverse colors for the letters and the background are considered acceptable.

The maximum length of a message should be dictated by the number of units of information contained in the message in addition to the size of the Changeable Message sign.

Support:

Road user reading times for typical messages displayed on Changeable Message signs are longer than for messages on static signs.

A Unit of information (Informational Unit) refers to the answer to a question a road user might ask. Stated another way, a unit of information is each data item in a message that a driver could use to make a decision. Each short answer is one unit of information. A unit of information typically is one to three words, but can be up to four words. The message on the following table has four units of information and serves to illustrate the concept of units of information.

<u>UNITS OF INFORMATION</u>				
<u>Question</u>		<u>Answer</u>		<u>Info Unit</u>
<u>1. What happened?</u>	<input type="checkbox"/>	<u>MAJOR ACCIDENT</u>	<input type="checkbox"/>	<u>1 unit</u>
<u>2. Where?</u>	<input type="checkbox"/>	<u>NEAR EXIT 12</u>	<input type="checkbox"/>	<u>1 unit</u>
<u>3. Who is advisory for?</u>	<input type="checkbox"/>	<u>TO NEW YORK</u>	<input type="checkbox"/>	<u>1 unit</u>
<u>4. What is advised?</u>	<input type="checkbox"/>	<u>USE ROUTE 46</u>		<u>1 unit</u>

The maximum allowable number of units of information in a changeable message sign message is based on the above principles, current highway operating speed, legibility characteristics of the sign, and the lighting conditions.

Guidance:

The maximum number of units of information that should be contained in a Changeable Message sign message with 450-mm (18-in) characters on light-emitting diode (LED) and fiber-optic PCMS is shown in Table 6F-1. The maximum number of units of information that should be displayed on flip-disk Changeable Message signs is shown in Table 6F-2.

Table 6F-1. Maximum Number of Units of Information for Use in Message Design and Display on Light Emitting Diode^A and Fiber Optic Portable Changeable Message Signs with 450-mm (18-inch) High Characters

	<u>70-80 km/h (45-50 mi/h)</u>	<u>90-105 km/h (55-65 mi/h)</u>	<u>115 -120 km/h (70-75 mi/h)</u>	<u>130 km/h (80 mi/h)</u>
<u>Daytime</u>	<u>4 units</u>	<u>4 units</u>	<u>4 units</u>	<u>3 units</u>
<u>Daytime with sun behind sign</u>	<u>4 units</u>	<u>3 units</u>	<u>3 units</u>	<u>2 units</u>
<u>Nighttime</u>	<u>4 units</u>	<u>3 units</u>	<u>3 units</u>	<u>2 units</u>

^A Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs

Table 6F-1. Maximum Number of Units of Information for Use in Message Design and Display on Light Emitting Diode^A and Fiber Optic PCMS with 450-mm (18-inch) High Characters

	<u>70-80 km/h (45-50 mi/h)</u>	<u>90-115 km/h (55-70 mi/h)</u>	<u>X km/h (75-80 mi/h)</u>
<u>Daytime</u>	<u>4 units</u>	<u>4 units</u>	<u>X units</u>
<u>Daytime with sun behind sign and Nighttime</u>	<u>4 units</u>	<u>3 units</u>	<u>X units</u>

^A

Valid only for the aluminum indium gallium phosphide (or equivalent) LEDs

Table 6F-2. Maximum Number of Units of Information for Use in Message Design and Display on Flip Disk Portable Changeable Message Signs with 450-mm (18-inch) High Characters

	<u>70-80 km/h (45-50 mi/h)</u>	<u>90-105 km/h (55-65 mi/h)</u>	<u>115 -120 km/h (70-75 mi/h)</u>	<u>130 km/h (80 mi/h)</u>
<u>Daytime</u>	<u>4 units</u>	<u>3 units</u>	<u>3 units</u>	<u>2 units</u>
<u>Daytime with sun on sign face</u>	<u>3 units</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>
<u>Daytime with sun behind sign</u>	<u>2 units</u>	<u>1 unit</u>	<u>1 unit</u>	<u>1 unit</u>
<u>Nighttime</u>	<u>2 units</u>	<u>1 unit</u>	<u>1 unit</u>	<u>1 unit</u>

Table 6F-2. Maximum Number of Units of Information for Use in Message Design and Display on

Flip Disk PCMS with 450-mm (18-inch) High Characters

	<u>70-80 km/h (45-50 mi/h)</u>	<u>90-115 km/h (55-70 mi/h)</u>	<u>X km/h (75-80 mi/h)</u>
<u>Daytime</u>	<u>4 units</u>	<u>3 units</u>	<u>X units</u>
<u>Daytime with sun on sign face</u>	<u>3 units</u>	<u>2 units</u>	<u>X units</u>
<u>Daytime with sun behind sign and Nighttime</u>	<u>2 units</u>	<u>1 unit</u>	<u>X unit</u>

~~The front face of the sign should be covered with a protective material. The color of the elements should be yellow or orange on a black background.~~

The minimum letter height for PCMS should be 450 mm (18) PCMS used on 90 km/h (55 mi/h) roadways or higher should be visible from 800 m (0.5 mi) under both day and night conditions and legible from a minimum distance of 244 m (800 ft) under optimum viewing conditions. If a Portable Changeable Message sign cannot achieve this legibility distance because of environmental or other conditions, the number of units of information should be reduced to values less than that shown in Tables 6F-1 and 6F-2

For a trailer or large truck mounted sign, the letter height should be a minimum of 450 mm (18 in). ~~For Changeable Message signs mounted on service patrol trucks, the letter height should be a minimum of 250 mm (10 in).~~

Option:

Smaller letter sizes may be used on a PCMS mounted on a trailer or large truck provided that the message is legible at least 200 m (650 ft), or mounted on a service patrol truck provided that the message is legible from at least 100 m (330 ft).

Guidance

The maximum number of units of information on LED signs with the letter sizes smaller than 450 mm (18 in) should be limited to that shown in Tables 6F-3 and 6F-4.

For Changeable Message signs mounted on service patrol trucks, the letter height should be a minimum 265 mm (10.6 in). The maximum number of units of information on LED signs with character heights smaller than 450 mm (18 in) should be limited to that shown in Tables 6F-3 and 6F-4 for 305 mm (12 in) and 265 mm (10.6 in) character heights.

Table 6F-3. Maximum Number of Units of Information for Vehicle-Mounted Light-Emitting Diode^A Portable Changeable Message Signs with 305 mm (12 in) Character Heights

	<u>50 km/h (30 mi/h)</u>	<u>55 km/h (35 mi/h)</u>	<u>65 km/h (40 mi/h)</u>	<u>70-90 km/h (45-55 mi/h)</u>	<u>100 km/h (60 mi/h)</u>	<u>105-130 km/h (65-80 mi/h)</u>
<u>Daytime</u>	<u>5 units</u>	<u>4 units</u>	<u>4 units</u>	<u>3 units</u>	<u>2 units</u>	<u>2 units</u>
<u>Daytime with sun behind sign</u>	<u>3 units</u>	<u>3 units</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>1 unit</u>
<u>Nighttime</u>	<u>3 units</u>	<u>3 units</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>1 unit</u>

^A Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs

Table 6F-3. Maximum Number of Units of Information for Vehicle-Mounted Light-Emitting Diode^A PCMS with 305 mm (12 in) Character Heights

	<u>50 km/h (30 mi/h)</u>	<u>55 km/h (35 mi/h)</u>	<u>65 km/h (40 mi/h)</u>	<u>70-90 km/h (45-55 mi/h)</u>	<u>100 km/h (60 mi/h)</u>	<u>105-115 km/h (65-70 mi/h)</u>	<u>X km/h (75-80 mi/h)</u>
<u>Daytime</u>	<u>5 units</u>	<u>4 units</u>	<u>4 units</u>	<u>3 units</u>	<u>2 units</u>	<u>2 units</u>	<u>X unit</u>
<u>Daytime with sun behind sign and Nighttime</u>	<u>3 units</u>	<u>3 units</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>1 unit</u>	<u>X unit</u>

^A Valid only for the aluminum indium gallium phosphide (or equivalent) LEDs

Table 6F-4. Maximum Number of Units of Information for Vehicle-Mounted Light-Emitting Diode^A Portable Changeable Message Signs with 265 mm (10.6 in) Character Heights

	<u>50 km/h (30 mi/h)</u>	<u>55 km/h (35 mi/h)</u>	<u>65 km/h (40 mi/h)</u>	<u>70 km/h (45 mi/h)</u>	<u>90-130 km/h (55-80 mi/h)</u>
<u>Daytime</u>	<u>4 units</u>	<u>3 units</u>	<u>3 units</u>	<u>2 units</u>	<u>2 units</u>
<u>Daytime with sun behind sign</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>1 unit</u>
<u>Nighttime</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>1 unit</u>

^A Valid only for the newer aluminum indium gallium phosphide (or equivalent) LEDs

Table 6F-4. Maximum Number of Units of Information for Vehicle-Mounted Light-Emitting Diode^A PCMS with 265 mm (10.6 in) Character Heights

	<u>50 km/h (30 mi/h)</u>	<u>55 km/h (35 mi/h)</u>	<u>65 km/h (40 mi/h)</u>	<u>70 km/h (45 mi/h)</u>	<u>90-115 km/h (55-70 mi/h)</u>
<u>Daytime</u>	<u>4 units</u>	<u>3 units</u>	<u>3 units</u>	<u>2 units</u>	<u>2 units</u>
<u>Daytime with sun behind sign and Nighttime</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>2 units</u>	<u>1 unit</u>

^A Valid only for aluminum indium gallium phosphide (or equivalent) LEDs

Guidance:

The message panel should have adjustable display rates with a minimum of 2 seconds per phase ~~(minimum of 3 seconds per phase), so that the entire message can be read at least twice at the posted speed, the off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed.~~

Option:

The message sign panel may vary in size

Two PCMS may be used for the purpose of allowing the entire message to be read twice.

Standard

Each message on an electronic PCMS shall consist of either one or two phases. A phase shall consist of up to three lines of text.

Support:

For the typical three-line Changeable Message sign, road users have difficulties in reading messages displayed on more than two phases.

Guidance:

When a message is divided into two phase, the cycle time for the message should be 8.0 seconds with each phase displayed for 4.0 seconds.

Option:

When a message is divided into two phases, a cycle time of 4.0 seconds may be used with each phase displayed for 2.0 seconds in a cycle.

- A. When a message consists of two phases, the message should be designed and displayed taking into account the principles below and should be understandable by itself. The entire message should be understandable regardless of the sequence in which it is read.
- B. Compatible units of information should be displayed on the same message phase
- C. A line of text should not contain portions of two different units of information
- D. No more than 3 units of information should be displayed on a message phase

All messages should be designed with consideration given to the principles above and taking into account the following factors:

- ~~A. Each phase should convey a single thought.~~
- ~~B. If the message can be displayed in one phase, the top line should present the problem, the center line should present the location or distance ahead, and the bottom line should present the recommended driver action.~~
- A The message should be as brief as possible.
- B If more than two phases are needed to display a message, ~~When a message is longer than two phases,~~ additional PCMS should be used
- ~~C. When abbreviations are used, they should be easily understood~~
~~— (see the provisions specified in Section 1A.14 should be used.~~

~~Option:~~

~~The message sign panel may vary in size.~~

~~Smaller letter sizes may be used on a Portable Changeable Message sign mounted on a trailer or large truck provided that the message is legible from at least 200 m (650 ft), or mounted on a service patrol truck provided that the message is legible from at least 100 m (330 ft).~~

~~Two PCMS may be used for the purpose of allowing the entire message to be read twice at the posted speed.~~

Standard:

PCMS shall automatically adjust their brightness under varying light conditions, to maintain legibility.

The control system shall include a display screen upon which messages can be reviewed before being displayed on the message sign. The control system shall be capable of maintaining memory when power is unavailable.

PCMS shall be equipped with a power source and a battery back-up to provide continuous operation when failure of the primary power source occurs.

The mounting of PCMS on a trailer, a large truck, or a service patrol truck shall be such that the bottom of the message sign panel shall be a minimum of 2.1 m (7 ft) above the roadway in urban areas and 1.5 m (5 ft) above the roadway in rural areas when it is in the operating mode.

The text of the messages shall not scroll or travel horizontally or vertically across the face of the sign.

Guidance:

PCMS should be used as a supplement to and not as a substitute for conventional signs and pavement markings.

When PCMS are used for route diversion, they should be placed far enough in advance of the diversion to allow road users ample opportunity to perform necessary lane changes, to adjust their speed, or to exit the affected highway.

The PCMS should be sited and aligned to provide maximum legibility. ~~Multiple PCMS should be placed on the same side of the roadway, separated from each other at distances based on Table 6C-1.~~ When multiple PCMS are needed, they should be placed on the same side of the roadway, separated from each other at a distance no less than 300 m (1,000 ft) on freeways and expressways, and no less than 150 m (500 ft) on other types of highways.

PCMS should be placed on the shoulder of the roadway or, if practical, further from the traveled lane. They should be delineated with retro-reflective TTC devices. When PCMS are not being used for temporary control messages, they should be removed from the highway ~~if not removed, they should be~~ or shielded behind a traffic barrier and turned away from traffic. ~~;~~ ~~or if the previous two options are not feasible,~~ if removal or shielding are not possible, they should be delineated with retro-reflective TTC devices. When PCMS are used in temporary traffic control zones, they should only display TTC messages.

Portable Changeable Message sign trailers should be delineated on a permanent basis by affixing retro-reflective material, known as conspicuity material, in a continuous line on the face of the trailer as seen by oncoming road users.