

CHANGEABLE-MESSAGE SIGNS

Irwin Hart

At the Winko-Matic Signal Company, we believe that changeable-message signs are basically driver-information signs providing either advisory or regulatory information. There are several types of changeable-message signs; 3 types manufactured by our company are the lamp matrix, drum sign, and blank-out sign. Other types on the market are the roller screen and flipping disc.

Changeable-message signs can be used both as part of a system or as individual-message signs not incorporated into a system. The following are examples:

1. Lamp-matrix signs reading either OPEN or CLOSED and used as an insert into a signboard or a truck-weighing station sign;
2. Large, mounted roadside signs reading MERGE RIGHT or MERGE LEFT and utilizing a matrix approach combined with a neon blank-out reading CAUTION SQUEEZE RIGHT or CAUTION SQUEEZE LEFT;
3. Matrix lane-control signals consisting of a single unit showing the red X or green down arrow along with the new yellow arrow for clearance interval;
4. Variable speed signs generally displaying speed limits in 5-mph increments and using an internally illuminated upper portion reading SPEED LIMIT with a lamp-matrix portion showing the variable speeds;
5. A sign with similar construction using lamp matrix reading in mph in 1-mph increments and internal illumination called progression speed indicators advising the driver of the speed that the signals are set for; and
6. Lane-use signals such as a left-turn arrow and the word ONLY that change to a straight up arrow and the word ONLY when the operation of the lane changes.

These typical changeable-message signs can be used on both high-speed and urban-area roadways in a given single situation. However, driver-information, changeable-message signs that give information on roadway conditions probably have the greatest use and those that give additional information on what the driver is to do have the next greatest use. Examples are as follows:

1. ACCIDENT AHEAD followed by REDUCE SPEED 30 MPH;
2. MEN WORKING followed by USE RIGHT LANE or USE LEFT LANE or CENTER LANE CLOSED;

3. ONE LANE AHEAD followed by REDUCE SPEED, MERGE RIGHT, or MERGE LEFT;

4. Road conditions such as HILLS, CURVES, SLIPPERY, ICE, FOG AHEAD, USE CHAINS, HIGH WIND TRAILERS PROHIBITED, BLOCKAGE AHEAD followed by DELAY OF ... MINUTES BECAUSE OF ... and USE ALTERNATE ROUTE

I would like to describe the 3 types of signs manufactured by our company. The first one is a changeable-message, blank-out sign that provides 1 message or no message at all on a single sign face with a painted message. When the light is turned off, the painted message is invisible; when the light is turned on, the painted message is visible to the approaching driver. Light sources vary from fluorescent tubes to neon tubes and in some cases even a group of incandescent lamps although the latter is not in general use. The advantages of this sign are that it has simple construction, has fairly low current cost, can be manufactured in a fairly small size, complies with U.S. Department of Transportation specifications, and is not entirely limited in color selection.

The second is a drum sign, having the ability to provide a series of either 3 or 4 messages on a single line with as many as 3 lines available before the vertical dimension gets difficult to handle. Legends can be reflectorized, and the background and color of each sign message can vary within the same drum. That is, as the drum revolves, different messages having different colors can be displayed. This sign can also be externally illuminated and is in general passive in nature. Its disadvantages are that it does not stand out any more than any other flat, reflectorized, externally illuminated sign; it is difficult to make this sign small if any message selection at all is required; the number of messages is completely restricted by the number of messages that can be controlled on a given drum or a given group of drums; and the mechanical aspects of the sign, gear-drive motors, and requirements for heaters in winter serve to make this sign in general something that should be used only in a system where maintenance can be performed at regular intervals. The life expectancy of drum signs is not known at this time.

The third is the lamp-matrix sign that utilizes a low-voltage, long-life lamp. It is a very bright spotlight and is encased in its own aluminum heat sink with a lens arrangement. This particular optical arrangement provides a maximum amount of vandalism protection; it is designed so that it carries the heat of the lamp away and allows the lamp to operate at various light levels. For example, the normal daytime light intensity will allow the lamp to operate for a period of about 10,000 hours. Reducing the voltage for nighttime operation to obtain satisfactory legibility increases the life of the lamp to 50,000 hours so that maintenance, from the lamp standpoint, is extremely minimal. Additional advantages are as follows:

1. Light intensity can be adjusted for varying degrees of darkness;
2. Sign is legible at almost 100 ft/in.;
3. Message storage is unlimited by using either a variable-matrix, fixed-type of approach or an infinitely variable matrix-type of approach;
4. Message can be flashed or alternately different messages can be flashed;
5. Sign can be controlled by a teleprinter or pushbutton or computer;
6. Sizes are unlimited;
7. Construction is modular; and
8. Ability to flash from one message to another reduces the number of lines required to present a given number of messages.

Because of these advantages, this sign is more useful than any other basic sign type. For example, the message ACCIDENT AHEAD MERGE RIGHT can be contained on one line no longer than necessary for the message ACCIDENT AHEAD. By flashing alternately from one to the other message at any given adjustable rate, the size of the sign is materially reduced, and additional target value or surprise value is provided to the driver in the form of flashing legends. Several points within the electronic circuit for monitoring are (a) readily available confirmation built into the electronics; (b) no moving

parts such as in a drum sign because the entire sign is solid state; and (c) extreme target value because of the high degree of legibility of an internally illuminated lighted message.

The two basic systems for controlling matrix signs can be described as a VMF approach and an ICVM approach. The VMF control for matrix signs consists of the self-storing of as many as 12 messages within each sign line. Remote control can actuate any 1 of the 12 circuits or 12 messages and that particular message is displayed. Random selection for alternate flash can be achieved, and any combination of displays of the 12 messages per line per sign can easily be achieved. A 2-line sign, therefore, could easily display 12 different messages on each line for a total of 24 messages or any combination of these. The ICVM approach is an infinitely variable matrix and is a teleprinter or typewriter type of display. Various schemes are available for operating a system of this type; but in general the base station contains prestored messages on either printed circuit cards, tapes, or magnetic cards, and these are sent out via code to the signs as required. In the event that any of the preselected messages are not applicable, it is possible for the operator to type out a different message and send it out to the given sign on an address basis. Additional peripheral equipment is easily installed at the base station so that the teleprinter message is first read before it is displayed on the sign.

Methods of interconnect, therefore, become increasingly important to changeable-message signs. Winko-Matic manufactures Mark I, Mark II, and Mark III systems. The basic differences are as follows.

The Mark I system is a frequency-division multiplex capable of transmitting 80 separate discrete frequencies over a given pair of voice-grade wires. If the tones can be used in a code (and they generally can), a great number of messages can be actuated by using tone code. By the same token, frequency-division multiplexing allows for simultaneous monitoring of signs and their messages because tones can be transmitted in both directions. The Mark IB allows for the use of as many as 80 tones simultaneously on a given pair of voice-grade wires, which means that an almost unlimited combination code can be arranged for controlling and monitoring a given sign system.

The Mark II system is a time-division multiplex capable of being transmitted over voice-grade wires and operating at a rate of 1,000 bits/sec. A standard 4-bit word code is used to both address and provide message function to the sign; the same code system applies to the monitoring ability.

The Mark III system is designed for a large system in which the code is transmitted over coaxial cable. In this case, we use a 10,000-bit rate and 16-bit words. The system can address 256 different field stations with as many as 128 functions per station and update everything every $\frac{1}{2}$ sec. At the same time detector information can be received over the same wire, held in a storage, and updated every 10 msec in serial with the monitor requirements.

Present installations of variable-matrix signs are Woodrow Wilson Bridge in the District of Columbia, Narragansett Bridge in Rhode Island, Pennsylvania Turnpike, New York Port Authority facilities, New Jersey Turnpike, bridge in Connecticut, I-75 in Kentucky, weigh stations in various states, and Verrazano Bridge in New York City.