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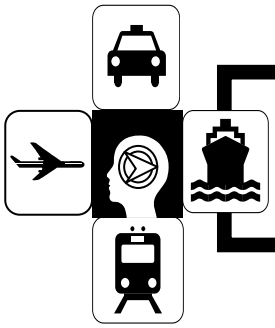

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Think Jersey DOT

Tech Brief

VMS and HAR Messages

FHWA-NJ-2001-010 December 2001

HERE ARE SOME OF THE ISSUES…

- The use of variable message signs (VMSs) by the New Jersey Department of Transportation in urban areas to tell drivers of crashes, roadwork and other events that adversely affect travel is increasing.
- To maintain credibility, VMSs must give the right information at the right time so that drivers can make good decisions about travel speed, which lanes to use, and which routes to take.
- In most situations, drivers have only about eight seconds or less available to read a message on a VMS. This must be done while the driver is also concentrating on other traffic. Therefore, measures must be taken in the design and display of messages that can be read and understood in a short period of time and that satisfies the needs of drivers.
- The VMS messages displayed must be "transparent" to travelers in the state and region. Therefore, messages need to be presented in a consistent manner and in a consistent order based on driver expectancies.
- Human factors design guidelines were needed to meet the needs of VMS message designers and VMS operators in New Jersey.

HERE'S WHAT WAS DONE…

- Following a thorough review of the literature and reviews of the VMS and highway advisory radio messages and display practices at the TOCs in New Jersey and other TOCs in the United States, numerous laboratory and field human factors studies were designed and then conducted in New Jersey as a means of defining driver requirements and developing effective messages for display on VMSs.
- Engineering formulas were formulated to develop relationships between VMS characteristics, measurable environmental factors, and VMS message design requirements.
- Proving ground and field studies were conducted in New Jersey and Texas to determine legibility distances of VMSs during both daylight hours and at night.

- A VMS operating policy was developed in concert with NJDOT.
- A highway advisory radio operating policy was developed in concert with NJDOT.
- Decision models and flowcharts were developed for a large number of congestion, incident, and roadwork situations to ensure that the correct and best VMS messages are designed and displayed.
- A 654-page VMS Operations Manual—considered a pioneering and classic publication—was prepared.
- Training on the use of the Manual and effective VMS message design and display was conducted for staff at the two TOCs in New Jersey during two different years.

HERE'S WHAT IS RECOMMENDED…

A Systematic Approach to Variable Message Sign Message Design and Display

Design of VMS messages begins with an understanding of the information desires of drivers and the amount of information they can read and understand while traveling at typical highway operating speeds. The principle of *unit of information* was introduced and developed in the Manual. A unit of information is defined as a short answer to a question a driver may have about a situation such as a crash or roadwork. The message in the following table has three units of information and serves to illustrate the concept of units of information.

Units of Information Defined

Question	Answer	Info Unit
1. What happened?	**MAJOR ACCIDENT**	**1 unit**
2. Where?	**PAST ROWLAND ST**	**1 unit**
3. What was advised?	**USE OTHER ROUTES**	**1 unit**

Another new concept that was introduced was the *Base Message*. A Base Message is the sum total of all the information that drivers desire in order to make a fully informed driving decision (e.g., whether to take an alternative route). The Base Message is composed of a number of message elements. Potential message elements for incidents or work zones are as follows:

- Incident/roadwork descriptor;
- Incident/roadwork location;
- Lanes closed (blocked);
- Closure descriptor;
- Location of closure;
- Effect on travel;
- Audience for action;
- Action; and
- Good reason for following the action

In most cases, the Base Message will exceed the maximum amount of informational units that should be displayed on a changeable message sign. Therefore, the Base

Message must be reduced in length and content to allow drivers to read, understand, and react to the message.

The maximum number of units of information that should be displayed in a message is presented in the Manual for various operating speeds and day vs. night for different VMS technologies. An example of the maximum number of units of information that should be displayed on light-emitting and fiber-optic VMSs is shown in the table below.

Suggested Legibility Distances for Use in Message Design for Variable Changeable Message Signs with 450-mm (18-inch) High Characters

	Light-Emitting Diode [A]			Fiber Optic		
	0-56 km/h (0-35 mi/h)	57-88 km/h (36-55 mi/h)	89-112 km/h (56-70 mi/h)	0-56 km/h (0-35 mi/h)	57-88 km/h (36-55 mi/h)	89-112 km/h (56-70 mi/h)
Mid-Day	5 units	4 units	4 units	5 units	4 units	4 units
Washout	5 units	4 units	4 units	5 units	4 units	4 units
Backlight	4 units	4 units	3 units	4 units	3 units	2 units
Nighttime	4 units	4 units	3 units	4 units	4 units	3 units

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

In addition, the following principles for effective message design and display are highlighted:

- No more than four units of information should be displayed in a message when the operating speeds are 56 km/h (35 mi/h) or higher;
- No more than five units of information should be displayed in a message when the operating speeds are less than 56 km/h (35 mi/h);
- A message should not contain more than two phases; and
- No more than three units of information should be displayed in any one phase.

The VMS Operations Manual contains step-by-step processes for effective VMS message design and display for incidents and roadwork situations. In addition example problems are worked through to help the reader to better understand the message design process. Tables of typical messages for a variety of conditions are also provided.

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A final report is available online at
http://www.state.nj.us/transportation/refdata/research/

If you would like a copy of the full report, please call the NJDOT, Bureau of Research at (609) 530-5637 or send an e-mail to Research.Bureau@dot.state.nj.us and ask for:

Variable Message Sign Operations Manual

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