Introduction:

Portable changeable message signs (PCMS) are traffic control devices that are frequently used by Traffic Engineers to inform motorists of unusual driving conditions, and to guide traffic through work zones. Typically, a PCMS is housed on a trailer and can be deployed quickly for meeting the temporary requirements.

The NTPEP program has successfully supplied material performance data to AASHTO member departments for these products for several years. With the reduction in staffing that most departments continue to experience the NTPEP data has become an integral part of many member departments qualification process. With few exceptions, developing criteria for product qualification has been a difficult task for individual states. This guide is offered as information for AASHTO member departments for interpretation and use of the data generated through the NTPEP evaluation program.

Key Aspects of the Program:

Within the NTPEP Committee there is a PCMS Technical Committee. The Technical Committee consists of AASHTO members and Industry members assigned by the NTPEP Chairman. One Industry Representative is allowed on the committee to act as the industry representative and an additional Industry Participant can be present during quarterly teleconferences, but does not act as a representative for the industry as a whole. The only members eligible to vote are the member state agency personnel.

Manufacturers that elect to participate in the program are assessed fees which cover the cost of the testing and reporting of information. States are assessed and annual fee for all Technical Services programs provided by AASHTO.

All performance data collected through these evaluations is reported through an online data base. Access to proprietary data is limited to the submitting manufacturer and the member departments of transportation.
While NTPEP works to make the product evaluation process comprehensive and meet the requirements for AASHTO member departments, all test data should be carefully reviewed by the specifying agency and in the context of field experience with these products. With this in mind, review of the data produced through this evaluation program should be viewed as a tool in making reasonable judgments and selection of portable changeable message signs for projects in any specific location.

**Terminology:**

3.1 **Pixel** - Short for picture element. A pixel can consist of one or more LED diodes. When combined with other pixels they form a character.

3.2 **Matrix** – A group of pixels defining a character. An example may be a group of five pixels wide by seven pixels high.

3.3 **Character** - Letter, numeral, or symbol formed by a group of pixels, usually an array of five-wide by seven-high pixels

3.4 **Legibility Distance** - Distance at which a motorist with normal vision can read a message.

3.5 **Cold Weather Test Deck** – Deck location where the average daily temperature during performance testing is in the low 40’s.

3.6 **Hot Weather Test Deck** – Deck location where the average daily temperature during performance testing is in the upper 80’s.

**Review of Evaluations and Significance of Data Generated:**

The data usage guide provides details regarding the testing cycles and testing that is used for evaluation of these solar powered PCMS. It is understood that individual agencies may elect to utilize variations of these parameters.

**Sight Tests**

The sign is placed at the end of a long flat road surface displaying a three line message that is viewed by three evaluators. Driving a sedan toward the sign, the evaluators check the sign for visibility, legibility, and angularity. The tests are performed under daytime and nighttime conditions for each sign.

A three line message is entered into each sign. Two lines use non-traffic related words and one line with letters that do not form a word (e.g., eye chart).

**Visibility**

This test is used to determine at what distance a message on the sign is visible moving in a line perpendicular to the sign face. This test is started 25 feet from the center of the sign and at a distance of 4800 feet from the sign face. The sign message is considered visible whenever the message portion is apparent, though not necessarily legible.
The average of visibility distances is recorded.

**Legibility**
Similar to the visibility test except the average legibility distances is recorded for the two non-traffic word message and the “eye chart” message.

**Angularity**
This test is started 25 feet from the center of the sign and at a distance of 200 feet from the sign face. Moving in a line perpendicular to the sign face the distance that a character in the sign message is no longer legible is recorded. The angularity of the angle is then calculated.

**Performance Test**
Signs are tested concurrently on a flat test deck in cold weather conditions to best stress the equipment. The signs are leveled and the display panel is raised to its highest position and set for automatic dimming mode.

All of the signs are programmed with the same static three line message that uses 75 to 85 percent of the total characters of the three lines to be illuminated. The signs are verified that they are operational and functioning properly.

The beginning voltage level of the battery-bank for each sign is recorded. This is done by temporarily disconnecting the solar array, waiting 6 to 24 hours and then measured using a digital voltmeter and by running the onboard diagnostics.

The starting date is recorded and the sign is operated with the programmed message continuously for 30 days in accordance with the manufacturer’s instructions.

At the end of the 30 days, the test is stopped and the ending voltage is measured following the same procedures from the beginning voltage measurement.

The testing period dates, beginning and ending battery-bank voltage levels, and any failures or significant problems are reported.

**Shutdown Test**
Signs are tested concurrently on a flat test deck in cold weather conditions to best stress the equipment. The signs are leveled and the display panel is raised to its highest position and set for automatic dimming mode.

All of the signs are programmed with the same static three line message that uses 75 to 85 percent of the total characters of the three lines to be illuminated. The signs are verified that they are operational and functioning properly.

Following performance testing, the solar array is disconnected and the sign is allowed to operate via the battery-bank alone. The sign is monitored every other day over a thirty day period or until the sign shuts down and ceases to display the message. The shutdown test is limited to thirty days. Once the thirty day period has elapsed the discharging of the battery-bank is accelerated per the manufactures recommendations. The voltage and the date the sign shuts down is recorded.

The solar array is then reconnected and the system is allowed to charge to operational voltages. Once recharged, the programmed message and the operation of the sign are verified.
The number of days the sign operated on battery backup, the “shutdown” voltage set by the manufacturer and the voltage level found at shutdown is reported.