# MESSAGE STANDARDIZATION ON VARIABLE MESSAGE SIGNS (VMS)

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**Summary**

The ministère des Transports du Québec (MTQ) is always striving to improve road safety conditions, while at the same time facilitating traffic flow. In recent years, this effort has taken the form of ongoing updates of road sign standards, which have been documented in *Volume V—Traffic Control Devices*. Updates are based on the integration of new procedures, improved equipment, experimentation, special training, and mechanisms for disseminating information and raising awareness.

In particular, the MTQ has recently begun to focus on the development of Intelligent Transport Systems (ITS). Variable Message Signs (VMS), which are illuminated panels that allow different messages to be transmitted to road users in real time, are a key element of these systems.

The messages displayed on VMS can provide information about construction in progress, traffic conditions, road conditions, or about incidents and accidents. The use of VMS therefore allows users to change their travel plans according to traffic conditions and obstructions, and thereby improves both user safety and traffic flow.

VMS are thus becoming more and more common on Quebec roads. It was decided that current practices needed to be studied, evaluated and improved in order to ensure the consistency of messages transmitted to users.

A research project to that effect was carried out by a team at the Université de Montréal, under the supervision of the ministère des Transports du Québec (MTQ). The project was completed in the summer of 2005. With the submission of the final report, a working group of Ministry experts in the use of VMS was given the task of making recommendations for provincial standards based on the findings presented. The following points were addressed:

- Type of VMS to be used—display characteristics and dimensions;
- Regulations for placement and installation;
- Regulations and guidelines for message prioritization;
- Message content—i.e. terminology for different circumstances (traffic congestion, construction, weather conditions, etc.);
- Various examples of uses of the main terms on different sizes of VMS;
- A series of pictograms designed especially for VMS.

Standards were introduced in *Volume V—Traffic Control Devices* in March 2006, and have been used by the managers of Quebec's road systems ever since.

## TYPES OF VMS

There are five types of variable message signs:

- Permanent overhead VMS installed on highways;
- Permanent overhead VMS installed on on-ramps and entrances to highway tunnels;
- Permanent roadside VMS installed on expressways;
- Permanent roadside VMS installed in urban settings;
- Mobile VMS.

Minimum sizes of the display matrix vary depending on the type of sign. For mobile VMS, the matrix should be at least 27 x 72 pixels, whereas the permanent overhead VMS should be at least 36 x 140 pixels. The exact dimensions of each type of VMS are given in Table 1.

A reflective border can also be added around the VMS to increase visibility. The border may be orange or green, depending on the types of messages being displayed: orange is recommended for signs displaying primarily roadwork notices; and green is used for those displaying information on traffic conditions, road conditions, and accidents and incidents. Reflective borders used for this purpose should be type III. An example of a sign with a reflective border is shown in Figure 1.

## PLACEMENT AND INSTALLATION

Whether installed beside or over the roadway, VMS should always be placed so as to be easily readable and unobstructed by any structures or temporary signs—such as those for roadwork, for example.

A sign installed over a roadway should be inclined 3° to 5° from the vertical towards the road below. Those installed beside the road should similarly be angled slightly toward the road—approximately at an 87° angle from the road centre line. The VMS should not be installed on a curve in the road.

Variable message sign structures are expensive to make and need to be protected, unlike other roadside signs. Protective equipment should conform to the design and construction standards set by the MTQ.

Mobile VMS should be placed so as to leave enough clearance from the roadside, as specified by MTQ standards, or be placed behind safety equipment protecting an obstacle already in place. Otherwise, visual markers should be placed leading up to the VMS, as shown in figure 2.

The minimum visibility distances of VMS range between 250 and 300 m, and minimum legibility distances range between 60 and 250 m. See Table 2 for more details.

## RULES AND STRATEGIES FOR DISPLAYS

In order to ensure the legibility of messages, certain regulations have been established. The most important ones are listed here, with further details provided below.

- The type size should be at least 5 x 7 pixels, with a minimum height ranging from 300 mm for mobile VMS to 460 mm for those permanently installed on the side of expressways;
- All letters should be capitals, and should never be compressed;
- There should be no more than three lines of text per message;
- Characters, words, and lines should all be sufficiently spaced apart so as to avoid creating a halo effect that would obscure part of the message.

VMS should be able to display three lines of text. All text should be in capitals, including abbreviations. Fonts should be consistent throughout the message, for the sake of uniformity and to reduce the risk of errors.

Diacritic marks should not be omitted, and letters should never be compressed. In order to ensure legibility on VMS, messages should conform to the spacing rules presented in Figure 3.

VMS can use several consecutive frames to convey the relevant information. Each frame is termed a “phase”—they are composed of text or pictograms or both, and taken together they convey the complete message.

A phase thus contains units of information, which responds to a question about some aspect of the use or state of the network, and can thus serve to inform the decision-making process of a road user. Each unit of information is composed of a word or phrase that is meaningful on its own.

Messages must be presented clearly and concisely; vocabulary and pictograms should therefore be carefully chosen to display the message in one phase (pictograms can be useful when they can replace several words). Where messages cannot be expressed in one phase, a maximum of two phases is permitted.

The display interval (the time it is on) for each phase varies between two and three seconds, depending on the number of units of information being displayed:

- A minimum of two seconds for a phase with only one unit of information;
- A maximum of three seconds for a phase with three units of information.

Each phase of the message must be static—i.e. it must not be flashing or rolling, either horizontally or vertically.

According to section 22 of the Quebec Charter of the French Language, all VMS messages must appear in French. To avoid any confusion, potentially difficult terms can be replaced with appropriate pictograms or symbols. Preference should also be given to terms that are simple and easily understood by Francophones and non-Francophones alike.

In certain circumstances, important public safety messages that require an immediate response may be displayed--e.g. smog alert, AMBER alert, etc.). Public safety campaigns are also permitted, but must not be displayed for long periods, in order not to lose the attention of road users.

## MESSAGE CONTENT (TERMINOLOGY)

To ensure the credibility of messages, they should be simple, clear, short, and accurately describe the situations being faced by road users. They should therefore be revised as needed, according to the evolution of the situation (traffic situation, construction, accidents, etc.).

Two types of messages can be conveyed using a variable message sign: “route” messages and “network” messages.

A “route” message refers to an event or incident that has occurred further along on the same road, whereas a "network" message refers to an event or incident that has occurred relatively nearby but on another road.

In the case of network messages, the road or highway on which the incident has occurred must be specified in the first line of text. In route messages, this information is optional, since the incident has occurred on the same road. In certain circumstances however, it may still prove useful to provide this information, in which case it must also be given in the first line of text. Where the cause of the incident is given, it generally follows the location.

Where more specific information on the location of the obstruction is given, it generally appears after the cause, and is specified using either the name of the exit or the distance from the sign location. If space on the VMS is limited, the exit can be specified using its number.

Impacts, advice, and/or options can be provided next if necessary. Where an alternate route is being suggested, a detour is provided, or traffic conditions are causing long delays, approximate travel times can also be provided in the final line of the text.

The terms used will depend on the nature of the situation being reported. Those used to describe traffic conditions are chosen according to the speed at which the vehicles are moving:

**Circulation fluide** (moving well): vehicles are traveling between 70 and 100 km/h.

**Au ralenti** (moving slowly): vehicles are traveling between 20 and 40 km/h in an urban context or between 40 and 70 km/h in rural areas.

**Congestion:** Vehicles are traveling less than 20 km/h in urban areas or under 40 km/h in rural areas.

**Congestion majeure** (heavy congestion): Congestion that is irregular and greater than normal.

**À éviter** (avoid): Unusual congestion that may persist for an extended period; the situation may deteriorate and the system operator wants to advise users to change their route.

Figure 4 provides examples of both large and small VMS reporting traffic conditions.

The following expressions are used to describe obstructions of one or more lanes:

**Fermé(e)** (closed): used to indicate a road or exit closure due to weather conditions, or an event that has led to total obstruction of the road, such that it must be blocked off and traffic must be redirected to an alternate route.

**Bloqué(e)** (blocked): used to indicate an incident or accident having created an obstruction that blocks one or several traffic lanes.

**Barré(e)** (closed for roadwork): Used to warn of lane closures due to road construction.

Figure 5 provides examples small and large VMS reporting lane closures.

The following terms are used to indicate changes in routes:

**Option**: indicates an optional alternate route to avoid a construction zone or traffic congestion.

**Détour** (detour): indicates a mandatory alternate route to avoid a construction zone or traffic congestion.

**Accès** (access): used to describe situations specifically relating to highway on-ramps.

Figure 6 provides examples of small and large VMS reporting route changes.

Different units of time (e.g. months, days, hours, and minutes) are used to give notice of upcoming construction periods, to estimate detour times, or to provide approximate waiting times in periods of congestion. Figure 7 provides examples of messages on small and large VMS announcing an upcoming construction period and estimated waiting periods.

Distances are posted to inform users of the extent of the problem area (construction zone, blocked traffic, etc.) or the distance to be travelled before reaching the problem area. They should always be represented as numbers, followed by the appropriate symbol--i.e. "M" or "KM". In general, abbreviations can lead to confusion and should be avoided where possible—however, symbols representing units of distance (M and KM) and time (H) are exceptions to this rule and should always be used. Figure 8 provides examples of the use of distances on both small and large VMS.

Other abbreviations familiar to road users may be used when there are space constraints—e.g. compass points, street types, days of the week, months, and numbers. Abbreviations must respect the rules of the French language. In rare circumstances, roads and highways may be designated using symbols—e.g. R-XXX and A-XXX, in which the “X’s” represent the number of the highway or road. This practice is only permissible on variable message signs. Figure 9 provides examples of the use of abbreviations.

## PICTOGRAMS

Pictograms are used to facilitate the reading and comprehension of road signs, because they do not require drivers to read or remember anything. Where a situation is difficult to describe using words within the space limits of a VMS, pictograms can be used to replace some or all of the text.

Certain standardized pictograms have been reworked to be legible on VMS. These pictograms are well-known to road users and need not be accompanied by explanatory text. One exception is the pictogram indicating “congestion”, which was designed specifically for VMS, is used only on VMS, and must always be accompanied by the word “congestion” in the second phase (see Figure 10).

Figure 11 shows other pictograms that may be used on VMS.

## CONCLUSIONS AND FUTURE ACTIONS

For several years the MTQ has been proposing strategies to improve traffic management by providing support for users and by providing road information using variable message signs (VMS).

Past efforts to standardize VMS messages at the provincial level are documented in a recent study submitted to the MTQ by the Université de Montréal entitled “Optimisation des messages et des graphiques utilisés pour l’information transmise sur les panneaux à messages variables” (Optimal use of text and graphics to report information on variable message signs), as well as in the VMS standards published in 2006.

In 2007, the MTQ has also formed a standing committee with the goal of establishing preferred practices in the deployment of new VMS and VMS management in Quebec. More specifically, the committee will:

- Perform an analysis of the current situation and thereby identify problems needing to be addressed.
- Establish VMS message priorities, giving top priority to safety and traffic related messages.
- Investigate the possibilities of expanding the application of VMS, particularly in the service of safety campaigns or other social campaigns.
- Identify strategies to increase the effectiveness of VMS, looking particularly at their placement with respect to road architecture, road users, and routes taken (i.e. travel patterns and origins/destinations).
- Consider the possibility of centralizing traffic management centres, in order to monitor and ensure the consistency of messages displayed throughout the road network.
- Refine the approach based on the vision of the two major arteries—freeways 20 and 40—linking the two main poles of Quebec and Montreal and serving as the core of the network.
- Propose a gradual implementation strategy, beginning with the acquisition and deployment of mobile VMS, to be used primarily for traffic management purposes.
- Propose a VMS management strategy for Quebec.
- Develop and propose an implementation plan relevant in the short, medium and long term.

Overall, the MTQ’s deployment and management strategies for VMS have improved travel for users, and will soon result in the transmission of even more effective and realistic messages, thus reducing delays, reducing incidents and accidents, and improving the safety of all users throughout the entire Quebec road network.

## References

"Optimisation des messages et des graphiques utilisés pour l'information transmise sur les panneaux à messages variables", Université de Montréal, Jacques Bergeron and Martin Paquette, September 2005.

*Volume V—Traffic Control Devices*, ministère des Transports du Québec, Gouvernement du Québec, updated December 2006.

Table 1 – VMS dimensions

| Type | Housing | | Display Matrix | | Contrasting Border |
|---|---|---|---|---|---|
| | Minimum height | Width | Minimum height | Minimum width | Minimum width |
| 1. Permanent – Overhead – Freeways | 3 m | 10 m minimum | 36 pixels | 140 pixels | 400 mm(1) |
| 2. Permanent – Overhead – Entrance ramps and entrances to freeway tunnels | 2 m | 6.5 m minimum | 36 pixels | 140 pixels | 300 mm(1) |
| 3. Permanent – Side-mounted – Expressways | 3 m | 6 m minimum | 36 pixels | 82 pixels | 230 mm(2) |
| 4. Permanent – Side-mounted – Urban area | 2 m | 3.5 m minimum | 36 pixels | 72 pixels | 150 mm(2) |
| 5. Mobile | 1.4 m | 3.5 m maximum | 27 pixels | 72 pixels | — |

1. For type 1 and 2 VMS, the width of the contrasting border should be at least equal to the minimum height of a character without an accent.
2. For type 3 and 4 VMS, the width should be at least equal to the minimum half height of a character without an accent.

Table 2 – Minimum distances for visibility and legibility

| Type | Minimum sight distance | Minimum legibility distance |
|---|---|---|
| 1. Permanent – Overhead – Freeways | 300 m | from 70 m to 250 m |
| 2. Permanent – Overhead – Ramps and entrances to tunnels | 250 m | from 60 m to 165 m |
| 3. Permanent – Side-mounted – Expressways | 300 m | from 70 m to 250 m |
| 4. Permanent – Side-mounted – Urban area | 250 m | from 60 m to 165 m |
| 5- Mobile | 250 m | from 60 m to 165 m |

Figure 1 – VMS with reflective green border

Figure 2 – Installation of visual markers leading up to a mobile VMS

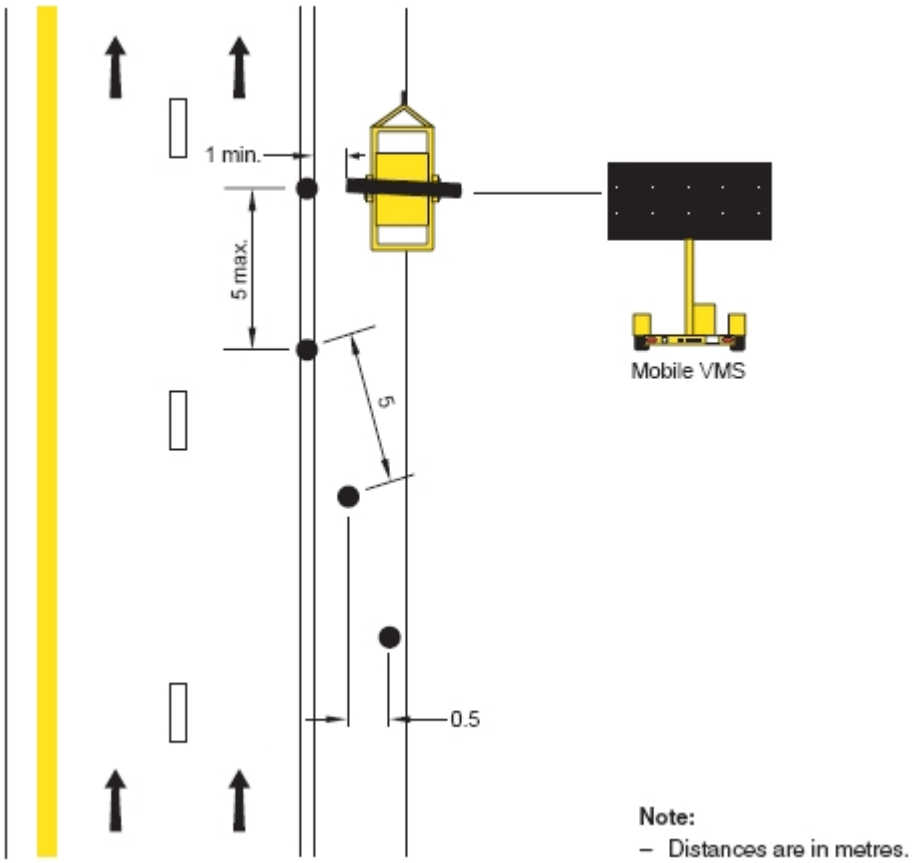



Figure 3 – Type size and spacing on permanent VMS

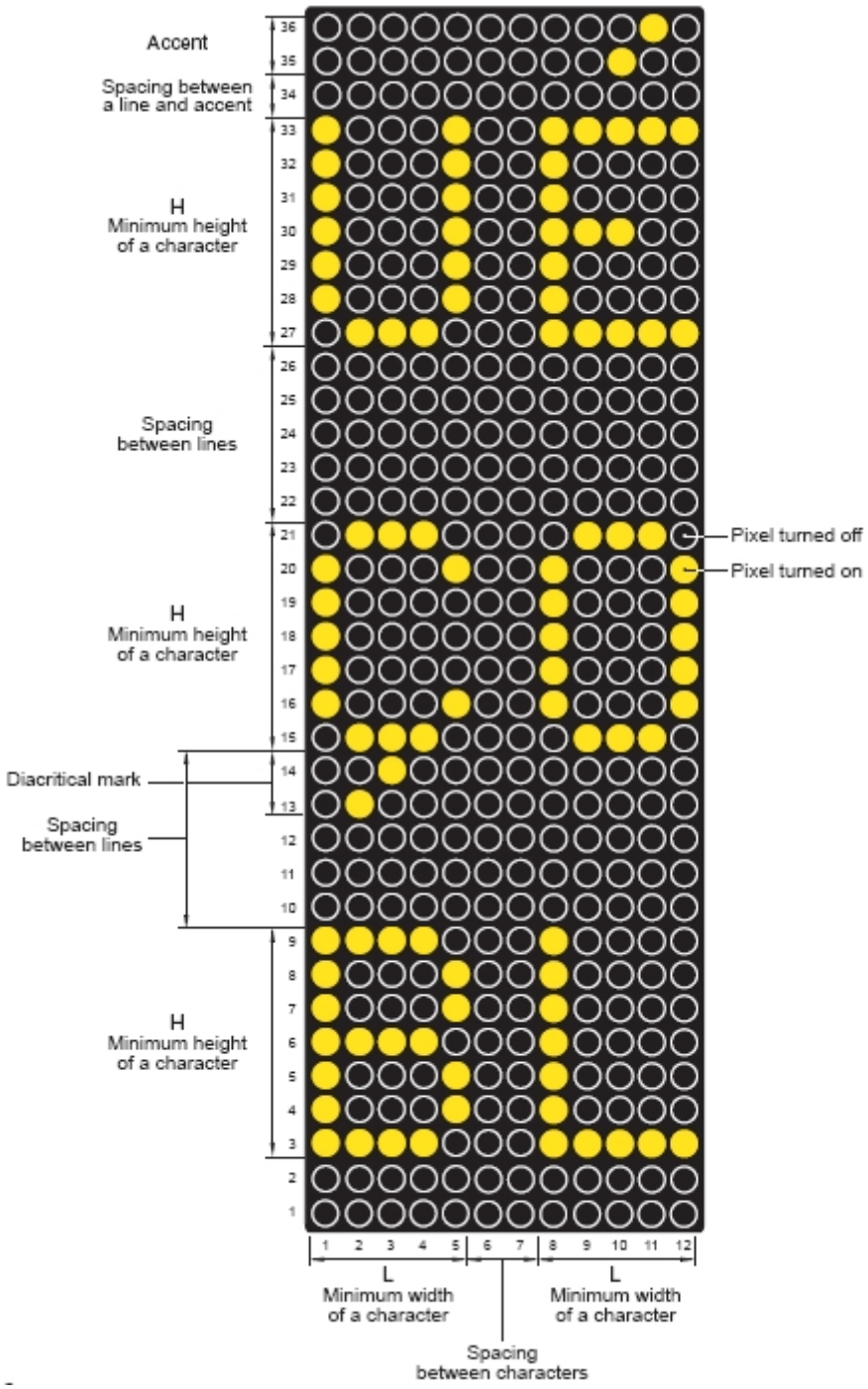


Figure 4 – Examples of messages reporting traffic conditions

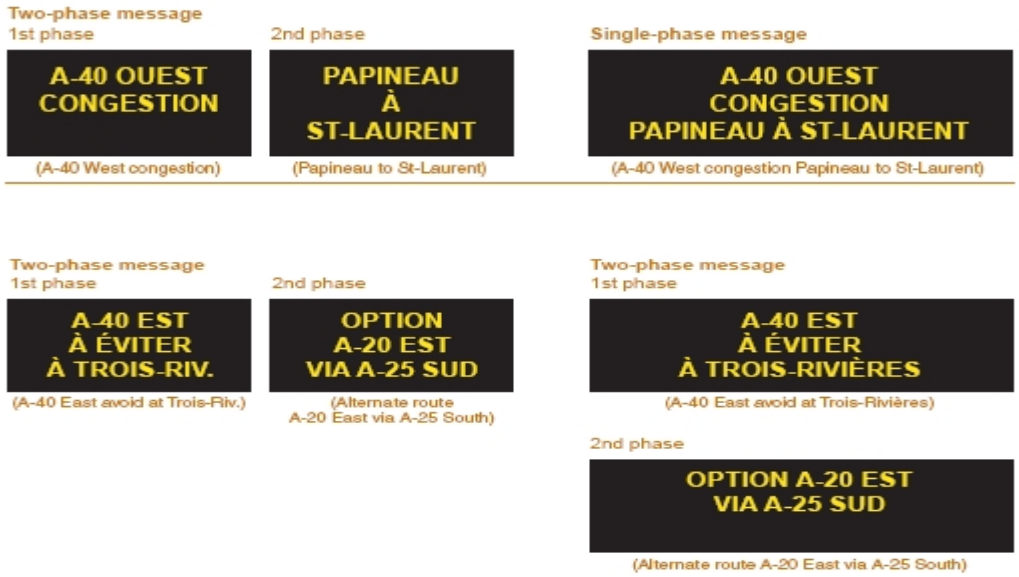
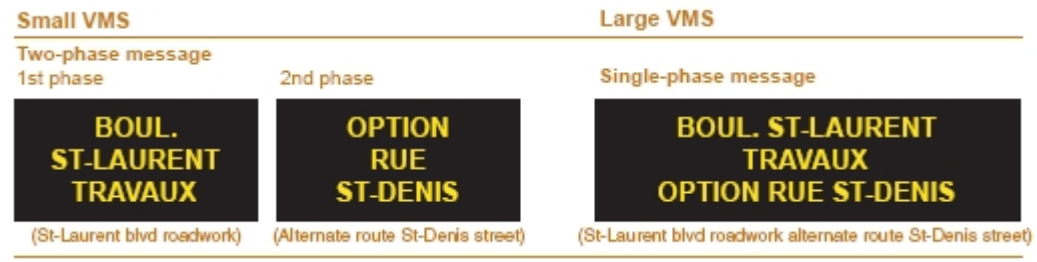



Figure 5 – Examples of messages reporting lane closures

Figure 6 – Examples of messages reporting route changes



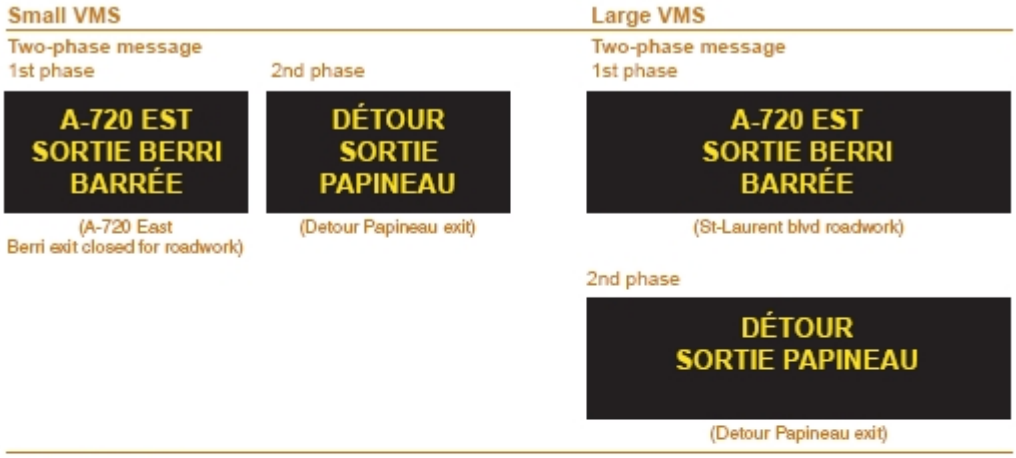




*Figure 8.16–10*
***Using the term "Détour"***

Figure 7 – Examples of messages reporting an upcoming construction period and estimated waiting periods

Figure 8 – Examples of the use of distances

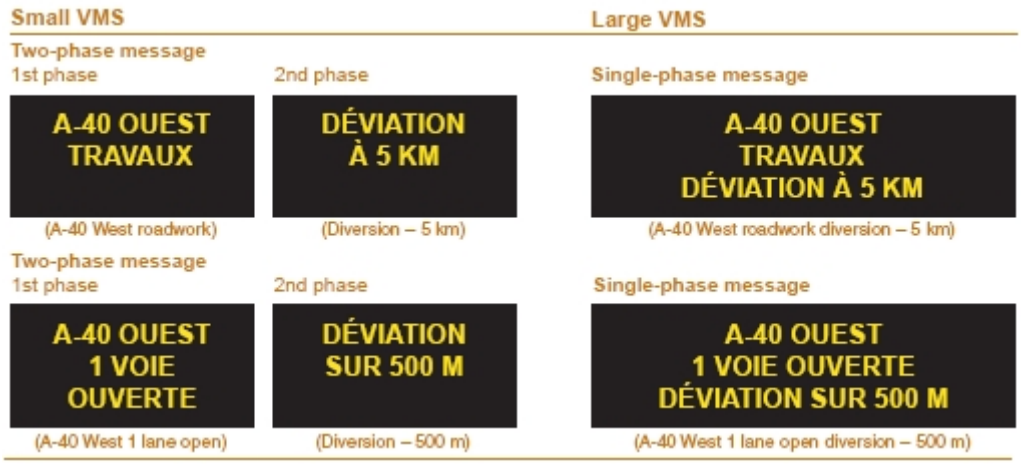
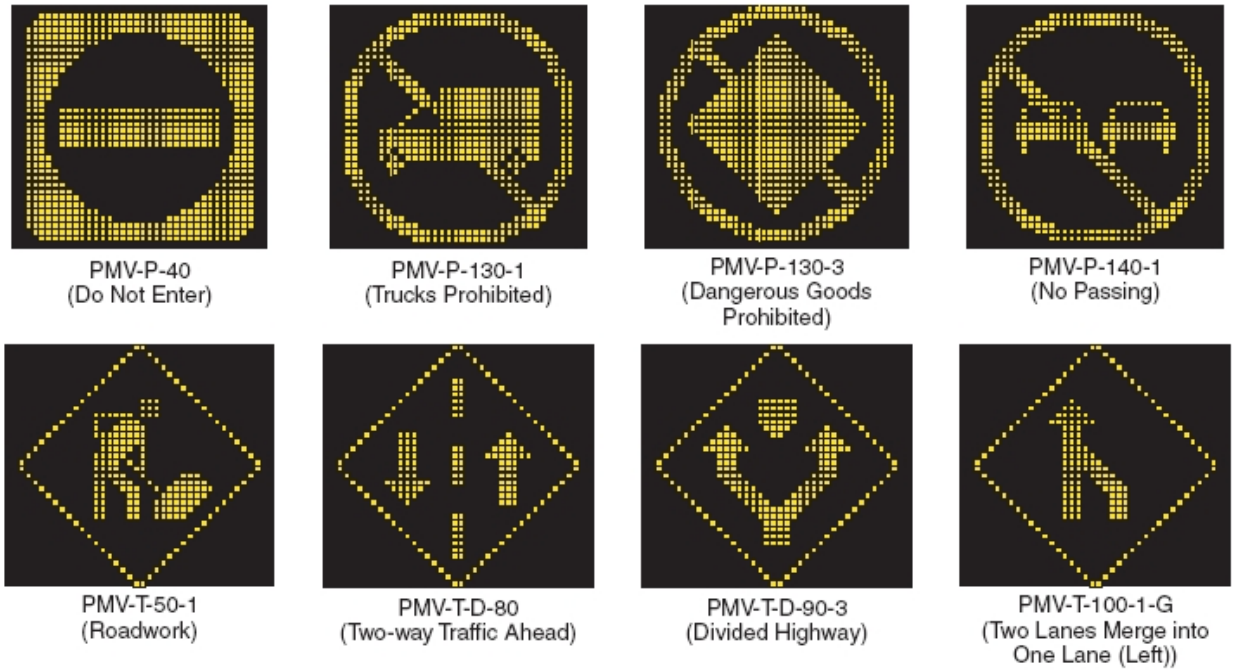


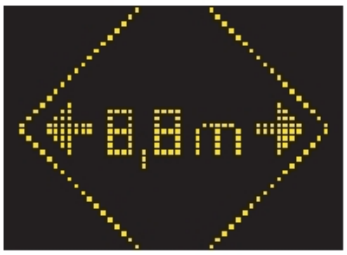

Figure 9 – Examples of the use of abbreviations

Figure 10 – Use of the pictogram indicating congestion


Figure 11 – Examples of pictograms that can be used on VMS

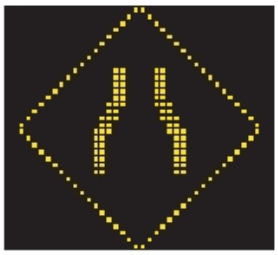


PMV-T-D-170-3-D
(Intersection)



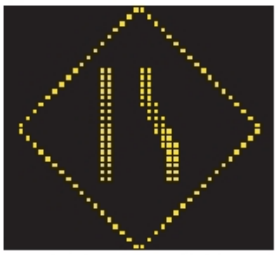

PMV-T-180
(Horizontal Clearance)

PMV-T-D-200
(Narrow Passage)

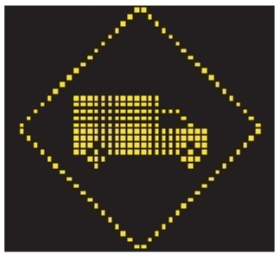


PMV-T-D-210-1
(Roadway Narrows)

PMV-T-D-210-2-G
(Roadway Narrows)



PMV-T-D-210-2-D
(Roadway Narrows)



PMV-T-D-270-11-G
(Truck Entrance)