

ITS SERVICE BOOK

ITS1202 WEATHER WARNING SYSTEM – PATROL DATA

Purpose

Weather Warning Systems may utilize field or patrol data to support road and weather advisories or they may be more localized systems that issue warnings of weather-related conditions to approaching drivers. Since MTO has two separate streams of input sources for Weather Warning Systems, ITS1201 is separated into two (2) Service Books; one focused on patrol/external data sources and the other on field systems. This Service Book focuses on patrol data-based sourcing.

Weather conditions that are currently taken into consideration by the various regions include:

- General Road conditions (e.g. icy, bare and wet)
- Drifting snow conditions
- Fog conditions

Warnings associated with the above conditions can be provided to travellers through VMS and traveller information services such as Ontario511.

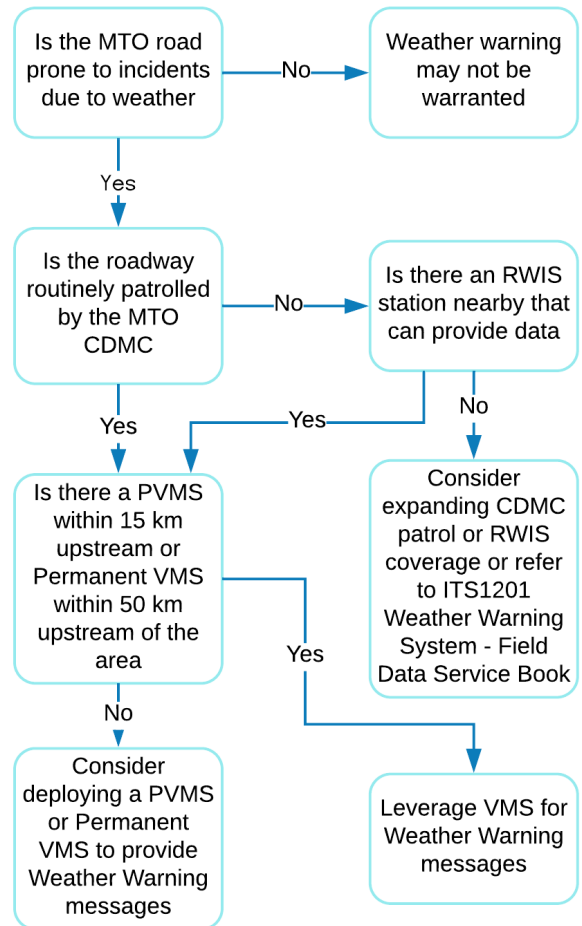
The objectives of a Weather Warning System are to:

- Improve safety through awareness of downstream driving conditions
- Infer a detour to those not used to driving in the conditions
- Reduce weather-related primary and secondary collisions
- Maintain mobility

Considerations for Use

Weather Warning System can be considered for all road types but should be given a higher priority to key commuter and commercial vehicle routes prone to unsafe driving conditions due to weather, (e.g. micro-climates, bridges and road features such as long grades) exemplified by collision and road reporting data.

The following decision tree provides a method for determining the need for Weather Warning Systems based on patrol data on Ontario roads.



ITS Service Applicability and Limitations of this Service Book

This Service Book may be used in conjunction with other related MTO ITS Services that may have Service Books associated with them.

- ITS1105 – CVAV Road Weather Motorist Alert and Warning
- ITS1201 – Weather Warning System – Field Data

Limitations

This Service Book may be used in conjunction with other Service Books that have been developed.

This Service Book will aid in determining the need, for a Weather Warning System. Further analysis, specific to the application, is encouraged.

While technologies and data sources continue to evolve, this Service Book references technologies open to using by the MTO.

System Components

The key components of a Weather Warning System are:

- **Road Conditions Sources** – a means to monitor and/or track weather conditions
- **Communication** – a structured approach to convey weather conditions to the TMC/TOC
- **Traveller Information** – a means to convey to travellers the warning messages associated with the weather conditions

Road Condition Sources

Detection of conditions can be carried out through manual and automated processes depending on the type of data being collected.

Environment Canada

Public alerts issued by Environment Canada are monitored and information is relayed for appropriate maintenance and traveller information response.

MTO Road Patrols

MTO and Contract-Directed Maintenance Contractors (CDMC) continuously patrol roadways. During these patrols, they record road and weather conditions along the road network.

Roadway Conditions

The following conditions may be recorded as they relate to roadway conditions:

- Bare and dry
- Bare and wet
- Road partly snow covered
- Snow covered
- Snow packed
- Slushy
- Icy

When roads are partly snow covered or worse, the patroller is to notify their respective TMC/TOC and advise of the conditions.

Visibility Conditions

The following conditions may be recorded related to the visibility conditions:

- Visibility is good – more than 500 metres
- Visibility is fair – 250 to 500 metres
- Visibility is poor – less than 250 metres

When visibility is poor or accompanied by severe winds, the patroller is to notify their respective TMC/TOC and advise of the conditions.

Drifting Snow Conditions

The following conditions may be recorded as related to drifting snow conditions:

- No drifting
- Drifting light
- Drifting moderate
- Drifting heavy

When drifting snow is moderate or heavy, the patroller is to notify their respective TMC/TOC and advise of the conditions.

Data Input from Other Sources

Data from other parties or MTO services may also be utilized to initiate weather warning.

These sources may include:

- Other MTO RWIS Stations
- Other Federal/Public Weather Stations

Communication

Standard operating procedures (SOPs) should define the points where conditions are to be communicated to the TMC/TOC. This may include the methods of communicating the patrol data back to operations (e.g. electronically).

Furthermore, tracking field equipment (e.g. wind meter) or other sources shall be monitored in a routine manner to ensure a level of consistency and accuracy and to help ensure warnings are provided when warranted. As important as it is to initiate messages, it is also important to revise or terminate messages in a timely manner.

Traveller Information

Weather warnings can be conveyed on:

Variable Message Signs

- Digital message signs upstream of the weather station relay relevant information via messages to approaching travellers

Ontario 511

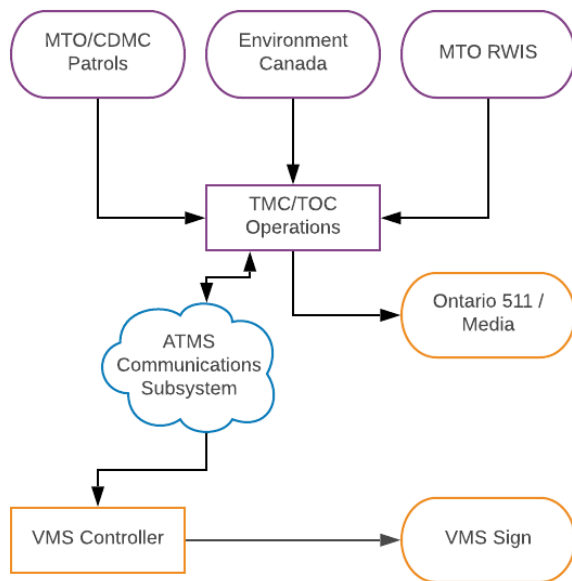
- Broadcast weather information to the Ontario 511 portal and support open-source data feeds

Media

- Communication with media partners

Architecture

The following architecture provides an overview of the system components, their interaction and the flow of information.



Traffic Management

Weather Warning Systems using patrol data operate with the TMC/TOC being central to the dissemination of traveller information. Through defined communication practices, the TMC/TOC operators shall ensure messages are initiated, revised, and terminated in a timely manner to keep the public's perception of the warning as accurate and reliable as possible.

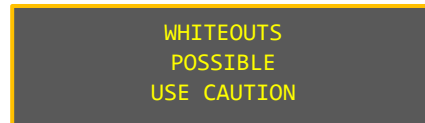
Messaging Examples

Examples of existing message types deployed across the Regions

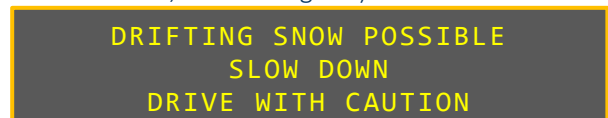
Slippery Roads (Northeastern, Northwestern, Central Regions)



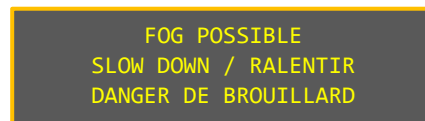
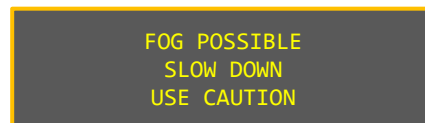
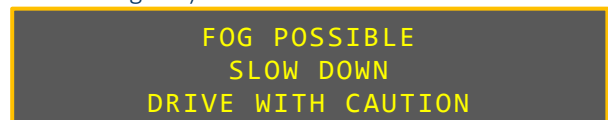
Whiteout Conditions (Northeastern, Northwestern, Central Regions)



Drifting Snow Conditions (Northeastern, Northwestern, Central Regions)



Fog Conditions (Northeastern, Northwestern, Central Regions)



Deployment Considerations

The following are some considerations as part of the deployment of Weather Warning Systems:

- Utilize existing infrastructure for mounting where possible. This may include poles and existing sign supports
- Utilize existing infrastructure for power and communications where possible
- For solar-powered applications, consider areas exposed to sunlight throughout the day. Effects of winter (reduced battery retention and limited daylight) should also be taken into account
- Aim to use PVMS within 15 km of the poor road/weather conditions
- Aim to place permanent VMS within 50 km of the poor road/weather conditions
- Consider geometric constraints, sightlines, clear zones and local grading when placing signage
- Ensure messages are reset to pre-weather conditions once the unsafe weather conditions are abated.
- Consider leveraging Environment Canada or existing RWIS station data for additional sources
- Consider maintenance roles, responsibilities, and processes for field equipment
- Consider safe maintenance access while locating the equipment
- CCTV camera monitoring is optional but often helpful to remotely confirm weather and road conditions
- Maintain communications with the Maintenance Contractor or any other parties to help optimize snow plow operations

Costs and Procurement Strategy

Budgetary costs are provided for system components. A combination of the components can help to provide an estimate based on the application.

There may be additional costs to integrate the Weather Warning System to MTO's TMC/TOC Operations and associated systems.

Refer to HiCo for additional details and regional estimates.

Element	Cost (2019)
Purchase: Supply and Install	
Cellular Modem	\$1,000
Pole-Mounted VMS	\$100,000
Overhead VMS Sign	\$400,000 - \$500,000
Portable VMS	\$30,000
Hybrid Static/Variable Sign	\$6,000
Civil Provisions (Ducts, F/O, Power)	\$150,000 per km
9.0 m Concrete Pole	\$2,800
Traffic Control (per lane closure)	\$4,000
Operations and Maintenance	
Cellular Fees (if applicable)	\$75 per month
Data Processing (cloud)	\$100 per station per month
Maintenance of signs, cabinets, solar power systems, etc.	~10% of capital/year

System Life Cycle

The expected life cycle may range from 5 to 10 years depending on the configuration.

The mean time between failures (MTBF) of relevant equipment for planning, and rehabilitation purposes:

- Cellular Modem – 5 years
- Civil Provisions – 25+ years
- Controller Cabinet – 25+ years
- F/O Cable – 25+ years
- Hybrid Static/Variable Sign – 15 years
- Network Switch – 15 years+
- Overhead VMS – 15 years
- Pole-Mounted VMS – 15 years
- Poles – 25 years+

- Portable Mounted VMS – 5 years
- Portable VMS – 5 years

Case Studies/Previous Deployments

Description	Components
Advanced Road Weather Information System Ministry of Transportation Ontario	<ul style="list-style-type: none"> • Stations deployed based on Ontario’s 5 primary and 40 sub-climatic zones • 151 stations, urban placement every 50 km, rural every 150 km • Utilized for proactive maintenance
Non-Invasive Bridge Surface Sensor Maryland Transportation Authority	<ul style="list-style-type: none"> • Deployed non-invasive spectroscopic surface sensor to monitor road conditions on the Francis Scott Bridge • Stable against vibrations
Wind Advisory System on Highway 22 Alberta Transportation	<ul style="list-style-type: none"> • 20 km stretch known as the “Wind Tunnel” • Many rollover events including 8 vehicles in a single day due to heavy winds • 1 weather station deployed • 6 advisory signs deployed prior to decision points over 100 km stretch • SMS alerts • 80 km/h would trigger flasher beacons

Performance Measures

- Reduction in number of weather-related collisions in the study area
- Increase in overall mobility due to reduced incidents

