

Road Weather System for Canada

RWSC ARWIS Specifications - Sensors & Accuracy

Sensors from which jurisdictions will configure their road weather information systems.

Class	Sensor	Parameter	Accuracy	Range		
				Operating	Survival	
COMMON CORE SENSORS						
Atmospherics	Thermistor	Air Temperature	+/- 0.5 C	- 40 to + 40 C	- 40 to + 40 C	
	Hygristor	Dew point temp.	+/- 0.5 C	- 30 to + 30 C	- 40 to + 40 C	
	Anemometer	Wind Speed	+/- 1.0 m/s	1 to 60 m/s	- 40 to + 40 C	
		Gusts	+/- 1.0 m/s	< 80 m/s	- 40 to + 40 C	
	Barometer	Wind Direction	+/- 5 (V > 1.0 m/s)	0 to 360	- 40 to + 40 C	
		Pressure	+/- 1.0 hPa	800 to 1080 hPa	- 40 to + 40 C	
Occurrence Meter	(Territories and elevations > 5000')	Precipitation	Yes/No (95%)	600 to 1100 hPa	0.5 to 500 mm/hr	- 40 to + 40 C
Pavement Surface	Thermistor	Temperature	+/- 0.2 C	- 40 to + 50 C	- 50 to + 50 C	
Sub-Surface	Thermistor	Temperature	+/- 0.2 C	- 30 to + 30 C	- 30 to + 30 C	
OPTIONAL SENSORS						
Atmospherics	Vis/Weather Meter	Visibility & Wx	+/- 10 m	10 to 1000 m	- 40 to + 40 C	
	(Less occurrence metre above)					
	Video Camera	Visual Images		- 40 to + 40 C	- 40 to + 40 C	
	Pyranometer	Total Radiation (solar & IR)	+/- 3 %	0 to 1500 W/m ²	- 40 to + 40 C	
Acoustic Range	Snow Depth	+/- 2 cm	0.5 to 10 meters	- 40 to + 40 C		
Pavement Surface	Detector	Moisture	Yes/No (95%)	- 15 to + 10 C	- 50 to + 50 C	
	AND					
	Passive Type	Chemical Factor	+/- 5 %	5 to 35 %	- 50 to + 50 C	
	OR					
Active Sensor	Freeze Point	+/- 0.5 C	- 15 to 0 C	- 50 to + 50 C		
OR AS Traffic Counter	Combo Unit					
Magnetic	Traffic vol/speed	+/- 5 kph	- 40 to + 40 C	- 50 to + 50 C		
Vehicle mounted	GPS	Vehicle location	+/- 5 meters	- 40 to + 40 C	- 40 to + 40 C	
	IR Road Sensor	Road temp	+/- 1.0 C	- 40 to + 40 C	- 40 to + 40 C	
	Thermistor	Air Temperature	+/- 0.5 C	- 40 to + 40 C	- 40 to + 40 C	
	Hygristor	Dew point temp.	+/- 0.5 C	- 30 to + 30 C	- 40 to + 40 C	
	Liquid sampler	Freeze Point	+/- 0.5 C	- 15 to 0 C	- 40 to + 40 C	
	ABS Friction Sens	Friction	+/- 0.1 u	0.1 to 0.7 u	- 40 to + 40 C	

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RWSC ARWIS Specifications - Exposure

Class	Sensor	Parameter	Ref	Exposure
COMMON CORE & OPTIONAL SENSORS				
Atmospherics	Thermistor	Air Temperature	1,2	Stevenson screen or white mat gill shield.
	Hygristor	Relative Humidity	1,2	1.8 meters above ground or average max snow depth. If possible locate in grassy area or natural vegetation.
	Anemometer	Speed & Gust	1,2	10 meters above ground. (Top of mast)
		Wind Direction	1,2	Distance to obstructions = 10 X height of obstructions. Min distance to be at least 5 X obstruction height.
	Barometer	Pressure	1,2	In protected enclosure - 1.5 to 3.0 m above ground.
	Occurrence Meter	Precipitation	3	Near top of mast and on upwind side.
	Vis/Weather Meter (Less occurrence metre)	Visibility & Wx	2	On mast at 3 to 5 meters. For visibility alone - at driver eye level (1.5 m.)
	Video Camera	Visual Images		On mast near top without affecting wind readings.
	Pyranometer	Incident Radiation (solar & IR)	2	On mast at between 2 and 5 meters.
Acoustic Range	Snow Depth	2	On mast 1 m above average max snow depth. Away from surface effects such as drifting.	
Pavement Surface	Thermistor	Temperature	3,4	Just outside of right tire track of main traffic lane. @ a depth of 2 mm from the surface and well away from any active sensors (minimum of 40 cms).
	Detector	Moisture		Recommend 2 pavement surface sensors per A/RWIS. Locate in opposing lanes of traffic. Optionally on bridge deck or nearby overpass.
	Passive Type OR	Chemical Factor	3,4	As above.
	Active Type OR AS Traffic Counter Combo Unit	Freeze Point	3,4	As for Passive Sensor.
	Magnetic	Traffic Vol/Speed		Centre of lane - otherwise, as for passive sensor.
Sub-Surface	Thermistor	Temperature	3,4	40 cms directly below road surface in substrate. At 1.5 m & other depths for engineering purposes. 2 pairs of sub-surface sensors are recommended.
Vehicle mounted	All	All	5	Specifications under development - led by MTQ

References:

1. World Meteorological Organization Standard.
2. Environment Canada - Guidelines for Co-operative Climatological Autostations (Version 2.0).
3. US National Research Council - SHRP RWIS Vol. 2: Implementation Guide.
4. Ministère de l'Équipement du Logement et des Transports (France).
5. Ministère des transports du Québec.

RWSC ARWIS Specifications

SITING

Siting Guidelines for Meteorological Instrument Tower

Open level ground at least 4 X 4 m (ideal is 15 X 15 m), covered with grass or natural vegetation.

Bare ground is an acceptable second choice but never pavement.

A concrete base for the mast is necessary as this will keep the tower vertical.

Provincial building code approved anchor bolts are to be used when installing mast over ledge rock.

A province/territory lead shall develop standard drawings for siting towers on fill, sand, clay, and rock.

A tilting tower is highly recommended to facilitate maintenance of the instruments.

Grounding for lightning protection is necessary.

Chain link fencing is recommended to keep animals and vandals at bay.

The distance from the wind tower to any obstructions should ideally be 10 times the height of the obstructions. The minimum distance, wherever practicable within reasonable costs and with due regard for the environment, is 5 times the height of obstructions.

Tower should be as close to the road as possible without being influenced by passing vehicles or presenting a safety hazard.

The elevation of the base of the tower should ideally be within 1.5 meters of the road elevation.

The use of meteorological personnel to help with siting is strongly recommended for all sites.

ISO-9000 certified personnel shall be used to assist in siting ARWIS so that the sites satisfy the recommendations for meteorological representativeness above to the maximum extent possible.

Environment Canada may provide assistance with difficult siting choices by reviewing digital photographs in the four compass directions for each of the various options available and making recommendations.

Environment Canada shall take steps to establish itself as an ISO-9000 certification agency.

Other Considerations

The availability of convenient and economical electrical power and telephone connections.

If there are overhead hydro lines, consider installing on the opposite side of the roadway.

Access roads and a wider right of way offer advantages.

AVOID

Isolated ponds or streams.

Locations likely to be affected by snow plows or passing vehicles.

Locations with excessive drifting.

Locations where artificial light could affect visibility readings.

Vehicle parking areas.

Locations where heat is exhausted from vehicles or buildings.

Tops of hills or bottoms of valleys unless these are the specific conditions to be sensed.

Future road development areas.

RWSC ARWIS Specifications

COMMISSIONING AND MAINTENANCE

Commissioning Guidelines for RWSC ARWIS sites

Acceptance testing is to be performed to RWSC standards for each site.
The data dictionary entry for each site must be built before the data reception commences.
Each site is to show 30 days of continuous trouble-free operation prior to acceptance testing.
During the acceptance testing, there are to be no modifications, adjustments or repairs to the site.
The particulars of each site must be fully documented before acceptance.

Maintenance Guidelines for RWSC ARWIS sites

In order to ensure maximum availability, routine maintenance is strongly recommended.
Ideally, routine maintenance/calibration would be done in the fall - prior to the start of the winter season.
It is recommended that certain inexpensive sensors very prone to contamination, such as hygristors, be replaced each year.
Each agency is responsible for ensuring sufficient spare parts for their ARWIS systems.
Repairs should be effected within 2 working days of receipt of notification of failure.

Data validation & Error flagging

The MSC shall perform QA/QC of the RWSC data nationally and return the data in real time.
In this way, the QA/QC shall be done to the same high level for all jurisdictions.
Any missing or suspect data will be flagged by the MSC to alert the responsible agency that corrective measures such as reset, repair, or re-calibration may be necessary.

Inspection Programme for RWSC ARWIS sites

Data integrity requires inspecting each site at least once each year.
Because maintenance is often done by electricians or general contractors, it is important to have each site reviewed annually by personnel with some knowledge of meteorological instruments.
Inspections should be performed by certified meteorological technicians.
Inspections should be scheduled well in advance and performed with the maintenance personnel present.
Inspection reports should be submitted to the province/territory with a copy to the Meteorological Service of Canada regional offices.
The provinces and territories, with MSC assistance, will develop a common RWSC inspection report form.

ISO-9000 Certification

The siting, commissioning, maintenance and inspection programmes shall be ISO-9000 compliant.
The Meteorological Service of Canada shall provide assistance with ISO-9000 certification.

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Data & Telecommunications

Polling Frequency

Meteorological conditions should be averaged over a 1 minute period (10 minutes for wind).
The sampling (typically at 5 second intervals) should be done just prior to the official observation time.
The observations should be collected from the ARWIS stations at least every 30 minutes (20 minutes ideal).

Protocol & Message Formats

National Transportation Communications for ITS Protocol (NTCIP-ESS) is the RWSC standard.
ESS stands for "Environmental Sensor Station".
NTCIP-ESS follows the BUFR international format for weather data format where possible.
BUFR stands for Binary Universal Format for the Representation of meteorological data.
The NTCIP-ESS standard also specifies reporting precision which shall be respected.
NTCIP-ESS shall be strictly enforced **from** all RWSC ARWIS stations **to** the polling agency.
The MSC will not normally accept data from non NTCIP-ESS compliant ARWIS sites.
The MSC will provide a representative to the NTCIP-ESS Standards Review Committee and will track the further development/changes on behalf of the RWSC Board of Directors.

Data Base Formats

The MSC and provinces/territories shall devise a national ARWIS and Road Weather Forecast database format.
The database format established above shall become the national RWSC adopted format.
Database elements shall be transferrable between provinces/territories and the MSC in XML format.
A common RWSC schema will be developed based on RWML.

Station Directories (METADATA)

The full details concerning each ARWIS site will be required.
The minimum information required for each site includes:

- Latitude & Longitude.
- Elevation referenced to the Geodetic Datum of Canada.
- Site physical description & soil type.
- Sensors installed along with make and date.
- Dates of commissioning, maintenance, and inspections.
- Road construction (asphalt/concrete, thickness, fill or cut, insulated or not)
- Vegetation in area (for each side of the roadway to include: type, height, and proximity).
- Effective times of overcoming by shadows (week by week) during the winter months.
- Owner and operator/maintainer contact information.
- Digital photographs of the view in each cardinal compass direction are highly recommended.