

Appendix B-5

Rural and Urban Transit Systems WIST Needs Template

Sector Activities for Rural and Urban Transit Systems

Roadway maintenance. This activity includes roadway surface treatment for snow and ice control in the winter, as well as maintenance to repair damage to roads and infrastructure.

Bus operations. In addition to bus driving, this activity includes road supervision and maintenance of the bus fleet, terminals and other facilities, and bus stops.

Trolley bus. This activity refers primarily to electric trolleys with overhead wires.

School transportation. This activity includes transportation of students by bus and commuting to school by young, inexperienced drivers.

Rail operations. This activity includes passenger rail operations above and below ground, and station and platform areas. Trains are predominantly electric, using a power rail (“third rail”) or overhead wires.

Traffic management. Activity consists primarily of managing traffic signals and traffic routing to enhance safety and efficiency.

Weather Needs for Rural and Urban Transit System (Local Roads and Light Railway) Operations

<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
Freezing Precipitation (ice)	Any	Roadway maintenance	Safety risk to maintenance personnel and motorists, travel delays, loss of visibility, loss of traction, loss of stability/maneuverability, lane obstruction, impaired mobility, road damage, loss of life, property damage, loss of communications/power	Predict threatened area, select treatment strategy, advise operators. Begin preparation procedures. Warn the public through press releases, to ensure public awareness and allow adjustment to travel plans.	24 hours
			Operational and travel delays, increased workload, ice treatment requirements	Prepare, deploy, and track treatment assets. Apply anti-icing, de-icing treatment chemicals/abrasives, manage traffic flow, remove debris, repair damage.	6- 12 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, passenger injuries and resulting claims, traffic congestion, routes may require detours, delays of scheduled operations, traffic accidents, increased risk of damage to busses/property, delays in maintenance (facilities, fleet, bus stops)	Advise operators, implement preparation procedures.	12-24 hours and current observation
			(During ice/snow episodes, minor accidents are common for busses, snow removal vehicles and equipment. Striking poles, curbs, or fixed objects often results in damage, which can range from \$500 to \$2500. Source: Rockford, Illinois, Transit.)	Advise operators to drive with extreme caution, modify or restrict operations (especially on hills), suspend operations as appropriate. Advise passengers via bus radio system. Clear station parking lots and platforms.	3-6 hours
		Trolley busses	Malfunctions due to ice and heavy frost on wires	Remove ice from wires, equip trackless trolleys with ice cutters at start of precipitation.	3-6 hours
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12 hours
		Rail operations	Safety risk (sliding, braking), collisions, passenger injuries and resulting claims, damage risk	Advise operators, begin preparation procedures.	24 hours
			Power outages (ice buildup on third rail, catenary lines)	Inspect and clear rails, railbeds, catenary wire.	6 hours
		Traffic management	Traffic congestion	Restrict or suspend operations, treat/remove ice from platforms and parking lots, activate third rail and switch heaters, remove graded tracks from service.	2-4 hours
			Resequence traffic signals, clear major routes.	6 hours	
Structure Ice Accumulation (inches)	Any	Roadway maintenance	Safety risk, loss of communications/power, property and structural damage	Select treatment strategy, remove debris, repair damage.	Current observation
Pavement Ice Accumulation (inches)	Any	Roadway maintenance	Safety risk, impaired mobility, loss of stability/maneuverability, loss of traction, pavement damage, pavement temperature, effects on snow removal/ice treatment operations	Select treatment strategy, remove debris, repair damage.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	Current observation
Frozen Precipitation (snow, inches)	Any to <2 inches	Roadway maintenance	Safety risk to maintenance personnel, motorists, travel delays, loss of visibility, loss of traction, loss of stability/maneuverability, lane obstruction, impaired mobility, road damage, loss of life and property damage	Predict threatened area, select treatment strategy, advise operators. Begin preparation procedures for equipment, crew planning, shift changes, geographical reassignment and deployment. Warn the public through press releases, to ensure public awareness and allow adjustments to travel plans.	24 hours
			Operational delays, increased workload, snow accumulation on roadways	Prepare, deploy, and track treatment assets. Implement roadway treatment/clearing (sanding, plowing, applying treatment chemicals/abrasives, snow removal). Manage traffic flow.	6 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, passenger injuries and resulting claims, traffic congestion, routes may require detours, delays of scheduled operations, traffic accidents, increased risk of damage to busses/property, delays in maintenance (facilities, fleet, bus stops)	Advise operators, begin preparation procedures.	12-24 hours and current observation
				Advise operators to drive with extreme caution, modify or restrict operations (especially on hills), suspend operations (in some regions). Advise passengers via bus radio system. Clear station parking lots and platforms.	3-6 hours
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12 hours

Weather Needs for Rural and Urban Transit System (Local Roads and Light Railway) Operations

<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
		Rail operations	Safety risk (sliding, braking), collisions, passenger injuries and resulting claims, damage risk, power outages (ice buildup on third rail, catenary lines)	Advise operators, preparation procedures.	24 hours
			Operational delays, increased workload, snow on passenger platforms	Modify operations, increase manpower for increased operations and maintenance, remove snow from passenger platforms and parking lots.	2-4 hours
		Traffic management	Traffic congestion	Resequence traffic signals, clear major routes.	6 hours
Frozen Precipitation (snow, inches)	≥ 2 to <8 inches	Roadway maintenance	Safety risk to maintenance personnel and motorists, travel delays, loss of visibility, loss of traction, loss of stability/maneuverability, lane obstruction, impaired mobility, road damage, loss of life, property damage	Predict threatened area, select treatment strategy, advise operators. Begin preparation procedures for equipment, crew planning, shift changes, geographical reassignment and deployment. Warn the public through press releases, to ensure public awareness and allow adjustments to travel plans.	24 hours
			Operational delays, increased workload, snow accumulation on roadways	Prepare, deploy, and track treatment assets. Apply treatment chemicals/abrasives, plow snow. Manage traffic flow (implement tire chain controls, restrict access to designated vehicle types, restrict access to roadways and bridges).	6 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, passenger injuries and resulting claims, traffic congestion, routes may require detours, delays of scheduled operations, traffic accidents, increased risk of damage to busses/property, delays in maintenance (facilities, fleet, bus stops)	Advise operators, begin procedures to implement snow routes.	12-24 hours and current observation
				Advise operators to drive with extreme caution, modify or restrict operations (especially on hills), suspend operations (in some regions). Advise passengers via bus radio system. Clear station parking lots and platforms.	3-6 hours
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12 hours
		Rail operations	Safety risk (sliding, braking), collisions, passenger injuries and resulting claims, damage risk, power outages (ice buildup on third rail, catenary lines), operational delays, increased workload, snow on passenger platforms	Advise operators, begin preparation procedures.	24 hours
				Inspect and clear rails, railbeds, catenary wires. Modify operations, increase manpower for increased operations and maintenance, remove snow from passenger platforms and parking lots.	3-6 hours
				Run service vehicles or snow trains to keep third rail and overhead catenary lines clear. Remove graded storage tracks from service, use ice scrapers and snow brakes.	Current observation
		Traffic management	Traffic congestion	Resequence traffic signals, clear major routes.	6 hours
Frozen Precipitation (snow, inches)	≥ 8 inches	Roadway maintenance	Safety risk to maintenance personnel and motorists, travel delays, loss of visibility, loss of traction, loss of stability/maneuverability, lane obstruction, impaired mobility, road damage, loss of life, property damage, slope instability (avalanche risk)	Advise operators. Begin preparation procedures for equipment, crew planning, shift changes, geographical reassignment and deployment. Warn the public through press releases, to ensure public awareness and allow adjustments to travel plans.	24 hours
				Prepare, deploy, and track treatment assets. Conduct snowfighting operations to treat/clear roadways (apply treatment chemicals/abrasives, plow snow), implement tire chain controls. Manage traffic flow (restrict access to designated vehicle types, restrict access to roadways and bridges, close roadways and bridges).	6 hours

Weather Needs for Rural and Urban Transit System (Local Roads and Light Railway) Operations

<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, passenger injuries and resulting claims, traffic congestion, routes may require detours, delays of scheduled operations, traffic accidents, increased risk of damage to busses/property, delays in maintenance (facilities, fleet, bus stops)	Advise operators, preparation procedures to implement snow routes.	12-24 hours and current observation
				Put snow routes into effect, advise operators to drive with extreme caution. Modify or restrict operations (especially on hills), suspend operations as necessary. Advise passengers via bus radio system. Clear station parking lots and platforms.	3-6 hours
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12 hours
		Rail operations	Safety risk (sliding, braking), collisions, passenger injuries and resulting claims, damage risk, power outages (ice buildup on third rail, catenary lines), operational delays, increased workload, snow on passenger platforms	Advise operators, begin preparation procedures.	24 hours
				Inspect and clear rails, railbeds, catenary wires. Modify operations, increase manpower for increased operations and maintenance, remove snow from passenger platforms and parking lots.	3-6 hours
			Slower train movement, snow buildup on switches and trucks, potential power problems if snow level is above third rail	Run service vehicles or snow trains to keep third rail and overhead catenary lines clear. Remove graded storage tracks from service, use ice scrapers and snow brakes, continuously clear rail switching areas, monitor third rail and switch heater performance, use plows if necessary.	Current observation
		Traffic management	Traffic congestion	Resequence traffic signals, clear major routes.	6 hours
Drifting Snow (inches)	≥6-8 inches	Roadway maintenance	Safety risk to maintenance personnel and motorists, travel delays (Winds >15 mph can lead to blowing snow and drifting in some areas. The amount of snow already on the ground may not be the determining factor; if snow storage areas are full, even a few inches can cause drifting problems. Drifting snow can cause continuous and prolonged clearing operations, which strain manpower resources.)	Predict threatened area, consider road closures. Construct and place living and structural snow fences. Begin equipment preparation, crew planning, shift changes, geographical reassignment and deployment. Warn public through press releases, to ensure awareness and allow adjustment to travel plans.	24 hours
			Operational delays, increased workload, loss of visibility, loss of traction, lane obstruction, impaired mobility	Select treatment strategy. Prepare, deploy, and track treatment assets. Conduct roadway treatment/clearing operations (sanding, plowing, snow removal), implement tire chain controls, manage traffic flow, modify lane configuration.	6 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, passenger injuries and resulting claims, traffic congestion, routes may require detours, delays of scheduled operations, traffic accidents, increased risk of damage to busses/property, delays in maintenance (facilities, fleet, bus stops)	Advise operators, begin preparation procedures.	12-24 hours and current observation
				Advise operators to drive with extreme caution, modify or restrict operations (especially on hills), suspend operations (in select areas). Advise passengers via bus radio system. Clear station parking lots and platforms.	3-6 hours
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12 hours
		Rail operations	Safety risk (sliding, braking), collisions, passenger injuries and resulting claims, damage risk, power outages (ice buildup on third rail, catenary lines), operational delays, increased workload, snow on passenger platforms	Advise operators, preparation procedures.	24 hours
				Inspect and clear rails, railbeds, catenary wires. Modify operations, increase manpower for increased operations and maintenance, remove snow from passenger platforms and parking lots.	3-6 hours

Weather Needs for Rural and Urban Transit System (Local Roads and Light Railway) Operations

<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
			Slower train movement, snow buildup on switches and trucks, potential power problems if snow level is above third rail	Run service vehicles or snow trains to keep third rail and overhead catenary lines clear. Remove graded storage tracks from service, use ice scrapers and snow brakes, continuously clear rail switching areas, monitor third rail and switch heater performance, use plows if necessary.	Current observation
		Traffic management	Traffic congestion	Resequence traffic signals, clear major routes.	6 hours
Snow Accumulation Observation (inches)	Any	Roadway maintenance	Drifting snow, impaired plowing, lane obstruction, loss of stability/maneuverability, loss of traction, pavement temperature effects, slope instability (avalanche risk)	Prepare, deploy, and track treatment assets. Apply treatment chemicals/abrasives, manage traffic flow, remove debris, repair damage.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	Current observation
Snow Drift Levels Observation (inches)	Any	Roadway maintenance	Impaired plowing, lane obstruction	Select treatment strategy.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	Current observation
Roadway Snow Depth Observation (inches)	Any	Roadway maintenance	Loss of traction, impaired mobility, effects on snow removal/ice treatment operations	Select treatment strategy.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	Current observation
Roadway Snow Pack Depth Observation (inches)	Any	Roadway maintenance	Loss of traction, impaired mobility, effects on snow removal/ice treatment operations	Select treatment strategy.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	Current observation
Adjacent Snow Depth Observation (inches)	Any	Roadway maintenance	Drifting snow, roadway snow depth	Select treatment strategy.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	Current observation
Snow/Ice Bonding Observation (inches)	Any	Roadway maintenance	Effects on snow removal/ice treatment operations	Select treatment strategy.	Current observation
Liquid Precipitation	Any	Roadway maintenance	Safety risk, maintenance activity delays, public travel delays, loss of visibility, loss of traction, loss of stability/maneuverability, lane obstruction /submersion, road damage, treatment chemical dispersion, toxicity and environmental damage	Predict threatened area, advise operators and travelers. Begin preparation procedures, induce drainage.	12 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, traffic congestion, vehicle damage risk, routes may require detours, delays of scheduled operations, traffic accidents, increased risk of damage to busses/property, delays in maintenance (facilities, fleet, bus stops)	Begin preparation procedures.	12-24 hours and current observation
			Operational delays	Advise operators of wet road conditions or areas of pooling water, drive with extreme caution, modify operations.	3-6 hours
		School transportation	Safety risk, vehicle damage risk, schedule delays	Advise operators, modify operations as necessary.	12 hours
		Rail operations	Safety risk, damage risk	Advise operators, begin preparation procedures.	12 hours
		Moderate to heavy		Operational delays, potential flood damage to railroad line, bridges, culverts	Modify operations. Inspect railroad lines, bridges, and culverts.
	Any	Traffic management	Traffic congestion	Resequence traffic signals, clear major routes.	6 hours
Flooding	Any	Roadway maintenance	Safety risks, road submersion, loss of life and property, road damage, bridge damage, travel delays	Review contingency plans, issue alerts, advise operators. Begin preparation procedures.	12-24 hours
			Maintenance activity delays, traffic slowdowns	Begin local mobilization/action and road closures, advise travelers. Prepare to monitor/induce drainage.	6-12 hours

Weather Needs for Rural and Urban Transit System (Local Roads and Light Railway) Operations

<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
		Bus and trackless trolley operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, traffic congestion, vehicle damage risk, routes may require detours, delays of scheduled operations, traffic accidents, increased risk of damage to busses/property, delays in maintenance (facilities, fleet, bus stops), busses may be called upon to provide evacuation assistance.	Advise operators, begin preparation procedures.	12-24 hours and current observation
			Operational delays, complete loss of bus service in affected areas, notification of road authorities and public relations required	Advise operators, roadway authorities, and public relations of real time road conditions. Modify, restrict, or suspend operations. Divert routes as necessary where flooding may be occurring or is at high risk of occurring. Shelter busses on high ground until water levels subside. Assist as requested in civil defense evacuation from flood-prone areas to safe shelters.	3-6 hours
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12 hours
		Rail operations	Safety risk (trains losing power, evacuations), damage risk (trackbed, electrical), operational delays	Advise operators, begin preparation procedures, acquire additional manpower for emergency operations and maintenance. Build dams if necessary.	8-12 hours
			Operational delays	Modify, restrict, or suspend operations.	6 hours
			Power outages (third rail blowouts); flood damage to railroad lines, bridges, culverts	Clear rails and catenary wires. Inspect and repair railroad lines, bridges, culverts.	2-6 hours
			Passenger notification requirements	Check pumps and drains. Notify passengers (public address system, public broadcast).	0-4 hours
	Traffic management	Traffic congestion	Resequence traffic signals, clear major routes, reroute.	6 hours	
Thunderstorms with Lightning (proximity to route or operational area in miles)	≤5-10 miles	Roadway maintenance	Safety risk, loss of life and property damage, loss of communications/ power, maintenance activity delays, travel delays	Cease refueling, restrict or suspend operations and outdoor activities.	3-6 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety risk, damage risk, operational delays	Advise operators, restrict or suspend outdoor activities. NOTE: During thunderstorms, transits will normally not suspend operations because of safety concerns for passengers waiting at bus stops.	3 hours and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	6 hours
		Rail operations	Safety risk (personnel working in train yard or on tracks), damage risk (lightning striking switches or electrical boxes causing signal outages), operational delays	Advise operators, restrict or suspend outdoor activities.	3 hours
		Traffic management	Traffic congestion, damage to signal operations	Monitor/resequence traffic signals.	6 hours
Thunderstorms with Hail (hail size and proximity to route or operational area in miles)	<1/4 inch, ≤ 5-10 miles	Roadway maintenance	Safety risks and travel delays, loss of visibility, loss of traction, impaired mobility, lane obstruction, loss of life and property, loss of communications/power	Predict threatened area, prepare to implement warning and evacuation plans, advise travelers, advise operators, restrict or suspend outdoor activities.	3-6 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety risk, damage risk, operational delays	Advise operators, restrict or suspend outdoor activities. NOTE: During thunderstorms, transits will normally not suspend operations because of safety concerns for passengers waiting at bus stops.	3 hours and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	6 hours
		Rail operations	Safety risk, damage risk, operational delays	Advise operators, restrict or suspend outdoor activities.	3 hours
		Traffic management	Traffic congestion, damage to signal operations	Monitor/resequence traffic signals.	6 hours
Thunderstorms with Tornado (proximity to route or operational area in miles)	Within 20-30 miles	Roadway maintenance	Safety risks and travel delays, loss of visibility, loss of traction, impaired mobility, lane obstruction, loss of life/property, loss of communications/power, maintenance activity delays	Predict threatened area, advise operators and travelers, review and implement warning and evacuation plans, suspend outdoor operations.	3-6 hours and current observation
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety risk, damage risk, operational delays	Advise operators, restrict or suspend outdoor activities.	3 hours and current observation

Weather Needs for Rural and Urban Transit System (Local Roads and Light Railway) Operations

<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	6 hours
		Rail operations	Safety risk, damage risk, operational delays	Advise operators, restrict or suspend outdoor activities.	3 hours
		Traffic management	Traffic congestion	Resequence traffic signals, clear major routes, reroute.	6 hours
Severe Storm Cell Track—Location, Direction, Speed, Severity (proximity to route or operational area in miles)	≤20 miles	Roadway maintenance	Credibility of evacuation orders, flood risk, property damage, road damage loss of visibility, loss of traction, impaired mobility, lane obstruction/submersion, loss of life and property damage, loss of communications/power	Predict threatened area, select treatment strategy, mobilize maintenance personnel, implement warning and evacuation plans. Issue evacuation orders, operate outflow devices, manage traffic flow. Remove debris, repair damage.	1-3 hour forecast and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	1-3 hour forecast and current observation
		Rail operations	Safety risk, damage risk, operational delays	Advise operators, restrict or suspend outdoor activities.	1-3 hour forecast and current observation
		Traffic management	Traffic congestion	Resequence traffic signals, clear major routes, reroute.	1-3 hour forecast and current observation
Major Storms					
Blizzard	Within 25-50 miles	Roadway maintenance	Loss of visibility, loss of traction, impaired mobility, lane obstruction/submersion, loss of life, property damage, loss of communications/power	Predict threatened area, select treatment strategy, advise operators and travelers, suspend outdoor operations. Implement warning and evacuation plans, mobilize maintenance forces.	24-48 hour forecast and current observation
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Disruption of scheduled service, disruption of local business operations, schedule delays, increased safety risk, damage to busses and property, scheduled operations modified/restricted/suspended	Advise bus operators, road supervisors, and other personnel. Operate with extreme caution. Begin preparation procedures. Modify, restrict, or suspend operations in inundated areas. Coordinate transportation and other action requirements in support of civil defense evacuation operations, including evacuation of the elderly and disabled. Halt all activity on the road prior to the estimated time of arrival of the leading edge of the storm. Deploy all busses and other personnel designated evacuation shelters or return them to bus facilities.	24-48 hour forecast and current observation
Tropical Cyclone/Hurricane	Any within a radius of 900 nautical miles	Roadway maintenance	Loss of visibility, loss of traction, impaired mobility, lane obstruction/submersion, loss of life, property damage, loss of communications/power	Predict threatened area, select response strategy, implement warning and evacuation plans. Advise operators and travelers, suspend outdoor operations, mobilize maintenance forces.	72 hours or 900 naut. miles
				Review prediction of threatened area and response strategy, update and reissue warnings and advisories.	48 hours or 600 naut. miles
				Weather Service issues official hurricane/cyclone watch.	36 hours
				Weather Service issues official hurricane/cyclone warning.	24 hours or 300 naut. miles
				Depending on conditions, begin planned evacuation procedures.	12 hours or 150 naut. miles

Weather Needs for Rural and Urban Transit System (Local Roads and Light Railway) Operations

<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Disruption of scheduled service, disruption of local business operations, schedule delays, increased safety risk, damage to busses and property, operations modified/restricted/suspended	Advise bus operators, road supervisors, and other personnel of pending storm. Operate with extreme caution. Begin preparation procedures. Modify, restrict, or suspend operations in inundated areas. Coordinate transportation and other action requirements in support of civil defense evacuation operations, including evacuation of the elderly and disabled. Halt all road activity 45 minutes prior to estimated time of arrival on shore of leading edge of 40 mph winds. Deploy all busses and other personnel to designated evacuation shelters or return them to bus facilities.	Lead time sequence same as for road maintenance, above
General Weather/Environmental Parameters					
Air Temperature including Maximum and Minimum (degrees F)	Variable, based on impact criteria	Roadway maintenance	Air quality, loss of communications/power, precipitation type, pavement temperature, slope instability (avalanche risk), effects on snow removal/ice treatment operations	Advise operators, monitor surface moisture, modify operations.	12-24 hour forecast and current observation
Air Temperature Relative to Freezing and Trend (degrees F and rising or falling trend)	Decrease to less than 32° or increase to exceed 32°, with moisture	Roadway maintenance	Safety and health risk, potential effects on ice/snow removal operations, traveler delays	Provide early warning, advise operators and travelers, monitor surface moisture, begin preparation procedures. Apply salt to city streets or conduct other treatment actions as appropriate.	6-12 hours
	<40°	Bus operations (road supervision, facility, fleet, bus stop maintenance)	Life threat to homeless	Transport homeless to shelters.	12 hours and current observation
	≤32° with moisture	Bus operations	Safety and health risk, passenger injuries and resulting claims, potential operational delays	Advise operators, modify or restrict operations (especially on hills).	12 hours
	<20	Bus operations	Safety and health risk, inoperable vehicles, wayside equipment	Issue cold weather alert to operators and passengers, implement cold weather plan. NOTE: During extreme temperatures, transits will normally not suspend operations because of safety concerns for passengers waiting at bus stops.	12 hours
	≤32° with moisture	School transportation	Safety risk, vehicle damage risk, schedule delays	Advise operators, modify or restrict operations.	12 hours
	≤32° with moisture	Rail operations	Safety and health risk, passenger injuries and resulting claims, potential operational delays	Advise operators, modify or restrict operations.	12 hours
	<20°	Rail operations	Safety and health risk, inoperable vehicles, wayside equipment	Issue cold weather alert to operators and passengers, implement cold weather plan. NOTE: During extreme temperatures, transits will normally not suspend operations because of safety concerns for passengers waiting at bus stops.	12 hours
	≤32° with moisture	Traffic management	Traffic congestion	Resequence traffic signals, clear major routes, reroute.	6 hours
Air Temperature (degrees F)	≥85-95°	Roadway maintenance	Health and safety risk, engine/equipment heat stress	Advise operators, monitor personnel safety and equipment for signs of heat stress, modify or restrict operations as needed.	12 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Personnel safety, engine/equipment heat stress	Advise operators (issue heat alert), modify operations, ensure climate control units are operating properly. NOTE: During extreme temperatures, transits will normally not suspend operations because of safety concerns for passengers waiting at bus stops.	12 hours and current observation
		Rail operations	Personnel safety, engine/equipment heat stress	Advise operators (issue heat alert), modify or restrict operations.	12 hours

Weather Needs for Rural and Urban Transit System (Local Roads and Light Railway) Operations

<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
Air Temperature (degrees F)	≥100-110°	Roadway maintenance	Personnel safety, heat exhaustion, engine/equipment heat stress	Advise operators, monitor personnel safety and equipment for signs of heat stress, modify or restrict operations as needed.	12 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Personnel safety, heat exhaustion, engine/equipment heat stress	Modify or restrict operations, ensure climate control units are operating properly.	12 hours and current observation
		School transportation	Health/safety risk, vehicle damage risk, schedule delays	Modify operations, dismiss school early.	12 hours
		Rail operations	Personnel safety, heat exhaustion, engine/equipment heat stress	Restrict or suspend operations, ensure climate control units are operating properly, reduce speeds.	12 hours
Dew Point Temperature (degrees F)	Variable, based on temperature and impact criteria	Roadway maintenance	Precipitation type, effects on fog formation and air quality, slope instability (avalanche risk), effects on snow removal/ice treatment operations	Predict threatened area, select treatment strategy, advise operators, monitor surface moisture, modify operations.	12-24 hour forecast and current observation
Air Temperature Change Rate (degrees F per 24 hours)	Approx. 60° in 24 hours	Roadway maintenance	Precipitation type, pavement temperature, pavement buckling damage due to rapid expansion and contraction	Predict threatened area, select treatment strategy, repair roadways.	12-24 hour forecast and current observation
Time and Air Temp Integrals (heating/cooling degree days)	Variable	Roadway maintenance	Road and property damage risks under extreme heating degree days or cooling degree days	Determine stockpile or resources needed to repair damage.	Forecast and actual tally
Wet Bulb Temperature (degrees F)	Variable, based on temperature and impact criteria	Roadway maintenance	Air temperature, fog dispersal effectiveness	Predict threatened area, select treatment strategy, disperse fog (cold fog) using CO ₂ application.	12-24 hour forecast and current observation
Relative Humidity (percent)	Variable, based on impact criteria	Roadway maintenance	Precipitation type, visibility restrictions	Predict threatened area, select treatment strategy.	12-24 hour forecast and current observation
Air Stability	Stable/unstable	Roadway maintenance	Air quality (Stable atmosphere inhibits dispersion of pollutants.)	Modify operations.	12-24 hour forecast and current observation
Subsurface temperature	Variable, based on contributing factors such as wind, shade, sun	Roadway maintenance	Pavement effects (Subsurface temperature affects pavement temperature, along with wind, insolation, shade, and other contributing factors.)	Predict threatened area, select treatment strategy.	12-24 hour forecast and current observation
Pavement Temperature (degrees F)	≥85-90°	Roadway maintenance	Personnel health and safety, heat exhaustion, engine/equipment heat stress, pavement "blow-ups"	Provide early warning, monitor equipment/personnel heat stress. Modify or restrict maintenance activities as required. Take prescribed health and safety precautions and road repair actions as needed.	6-12 hours
	≤32° but >15°, with moisture	Roadway maintenance	Safety and health risk, effects on ice/snow removal operations	Apply appropriate ice/snow removal chemicals.	12 hours

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<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
	<15° with moisture	Roadway maintenance	Safety and health risk, effects on ice/snow removal operations	Because ice removal chemicals ineffective, apply abrasives or plow.	12 hours
Pavement Freeze Point Temperature with Dew Point Temperature (degrees F)	<32° with moisture (observation and forecast)	Roadway maintenance	Safety risk to maintenance personnel and motorists, loss of traction, operational delays, increased workload, anti-icing and de-icing operations required (Applying ice preventative treatment to roadways requires preparation of equipment and crews.)	Select treatment strategy, advise operators. Begin preparation procedures for applying chemicals (prepare liquid chemical tanks or hoppers for salt application) 12 hours prior to time for applying treatment to roadways. Treat/clear roadways with anti-icing, de-icing treatments. Manage traffic flow.	Current observation and 12-48 hour forecast
Pavement Temperature, Moisture Present (degrees F)	>(15-18)° but <32°	Roadway maintenance	Snow/ice bonding, effects on snow removal/ice treatment operations, loss of traction	Predict threatened area, select treatment strategy. Prepare, deploy, and track treatment assets. Apply treatment chemicals/abrasives.	12 hours
	<(15-18)°	Roadway maintenance	Snow/ice bonding, effects on snow removal/ice treatment operations, loss of traction, treatment chemical effectiveness	Predict threatened area, select treatment strategy. Prepare, deploy, and track treatment assets. Plow snow, apply abrasives.	12 hours
Pavement Temperature	Variable, based on impact criteria	Roadway maintenance	Snow/ice bonding, effects on snow removal/ice treatment operations, loss of traction, treatment chemical effectiveness, melting	Predict threatened area, select treatment strategy. Prepare, deploy, and track treatment assets. Plow snow, apply treatment chemicals/abrasives.	Current
Pavement Condition	Wet	Roadway maintenance	Safety risk, impaired mobility, loss of traction, loss of stability/ maneuverability	Predict threatened area, manage traffic flow.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement appropriate precautionary measures.	Current observation
	Snow	Roadway maintenance	Safety risk, impaired mobility, loss of traction, loss of stability/ maneuverability	Predict threatened area, select treatment strategy. Prepare, deploy, and track treatment assets. Apply treatment chemicals/abrasives, plow snow, manage traffic flow.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	Current observation
	Ice	Roadway maintenance	Safety risk, impaired mobility, loss of traction, loss of stability/ maneuverability	Predict threatened area, select treatment strategy. Prepare, deploy, and track treatment assets. Apply treatment chemicals/abrasives, manage traffic flow.	Current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	Current observation
Chemical Concentration (in-road sensor or mobile infrared)	Variable, based on application, residue	Roadway maintenance	Safety risk, effects on snow removal/ice treatment operations, snow/ice bonding	Select treatment strategy, apply treatment chemicals/abrasives, deploy and track treatment assets, operate outflow devices.	Current observation
Visibility, Including Restricting Conditions such as Fog, Haze, Dust, Smoke (statute miles)	<1/4 mile	Roadway maintenance	Safety risk, loss of visibility, impaired mobility	Advise operators, modify operations, reduce speeds.	6 hours
	<1/4 mile	Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety risk, schedule delays	Advise operators, modify operations, reduce speeds.	6 hours and current observation
	<1/4 mile	School transportation	Safety risk, vehicle damage risk, schedule delays	Modify operations, consider/implement delayed school start or early dismissal.	12 hours
	<1/4 to 3 miles	Rail operations	Safety risk, schedule delays, difficulty monitoring switch alignment	Advise operators, modify operations (reduce speed).	2-6 hours
	<1/4 mile	Traffic management	Traffic congestion	Modify operations.	6 hours
Sun Glare	Any	Roadway maintenance	Safety risk, restricted visibility in glare quadrant of horizon	Advise operators, reduce speeds, modify operations.	3 hours

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		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety risk, restricted visibility in glare quadrant of horizon	Advise operators, reduce speeds, modify operations.	3 hours and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Advise operators, reduce speeds, modify operations.	12 hours
		Rail operations	Safety risk, restricted visibility in glare quadrant of horizon, difficulty monitoring switch alignment	Advise operators, reduce speeds, modify operations.	3 hours
		Traffic management	Safety risk, restricted visibility in glare quadrant of horizon	Advise operators, reduce speeds, modify operations.	3 hours
Wind: Head, Cross, or Tail, including Convective Winds (wind speed in miles per hour)	>30 mph but <50 mph	Roadway maintenance	Safety risk, increased roadway debris, potential operational slowdown (Speed and direction are most important when snow has accumulated and drifting results.)	Predict threatened area, select treatment strategy. Modify operations, increase debris removal operations. When snow drifting is likely, implement early warning procedures, advise travelers, construct and place living and structural snow fences for snow drift management.	12 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, roadway debris, flying debris, traffic congestion, downed live electric lines and or poles, routes may require detours, increased risk of damage to busses and property, schedule delays, delays of scheduled operations, delays in maintenance (facilities, fleet, bus stops), speed restrictions for express routes	Advise operators when high wind watches are issued. Modify, restrict, or suspend operations. Detour routes as needed. Notify passengers (public address system, public broadcast).	12-24 hours and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Advise operators, modify operations.	12 hours
		Rail operations	Safety risk; downed live electric lines, catenary wires, and poles; schedule delays	Advise operators, modify operations (reduce speed) of high-profile cars.	2-6 hours
		Traffic management	Traffic congestion, potential damage to traffic management systems	Monitor traffic management systems.	6 hours
	≥50 mph	Roadway maintenance	Safety risk, increased roadway debris, operational slowdown (Speed and direction are most important when snow has accumulated and drifting results.)	Predict threatened area, select treatment strategy. Modify operations, increase debris removal operations. When snow drifting is likely, implement early warning procedures, advise travelers, construct and place living and structural snow fences for snow drift management.	12 hours
	≥50 mph	Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, roadway debris, flying debris, traffic congestion, downed live electric lines and or poles, increased risk of damage to busses and property, routes may require detours, schedule delays, delays in maintenance (facilities, fleet, bus stops)	Advise operators when high wind warnings are issued. Modify, restrict, or suspend operations. Detour routes as required. Reschedule delayed operations and maintenance.	12-24 hours and current observation
	>50 mph	School transportation	Safety risk, vehicle damage risk, schedule delays	Advise operators, modify or restrict operations.	6 hours
	≥50 mph	Rail operations	Safety risk; downed live electric lines, catenary wires, and poles; schedule delays	Advise operators, modify or restrict operations.	6 hours
	>70 mph		Service over bridges suspended		3 hours
	≥50 mph	Traffic management	Traffic congestion, potential damage to management systems	Monitor management systems.	6 hours
Rail Temperature (degrees F)	≤32° with moisture	Rail operations	Potential safety risk, damage to track	Inspect tracks, modify operations.	6 hours
	≥ 85-130°	Rail operations	Health and safety risk, equipment heat stress, sagging catenary wires, potential for track damage (heat kink in rails)	Advise operators, modify or restrict operations. Inspect rails while hot, reduce speed of trains.	2-6 hours
Wind Chill (degrees F)	≤20°	Roadway maintenance	Safety and health risk (hypothermia, frost bite)	Advise operators, restrict or suspend operations as necessary.	6 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety and health risk (hypothermia, frost bite)	Advise operators, modify operations. NOTE: During extreme temperatures, transits will normally not suspend operations because of safety concerns for passengers waiting at bus stops.	6 hours and current observation
		School transportation	Safety and health risk (hypothermia, frost bite)	Modify operations. If necessary, select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12 hours

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<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
		Rail operations	Safety and health risk (hypothermia, frost bite), frozen switches/vehicles/equipment	Advise operators, rotate personnel working out of doors, modify operations. Exercise switches constantly, exercise doors and equipment while not in use.	6 hours
Heat Index (degrees F)	≥100-105°	Roadway maintenance	Safety and health risk (heat exhaustion)	Advise operators, restrict or suspend operations.	6 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety and health risk (heat exhaustion)	Advise operators, modify operations. NOTE: During extreme temperatures, transits will normally not suspend operations because of safety concerns for passengers waiting at bus stops.	6 hours and current observation
		School transportation	Health and safety risk, vehicle damage risk, schedule delays	Modify operations. Dismiss school early, if appropriate.	12 hours
		Rail operations	Safety and health risk (heat exhaustion)	Advise operators, modify operations. NOTE: During extreme temperatures, transits will normally not suspend operations because of safety concerns for passengers waiting at bus stops.	6 hours
Air Quality	Poor/code red	Roadway maintenance	Potential health and safety risk	Advise operators, modify or restrict operations.	12 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Potential health and safety risk	Reschedule, increase passenger capacities.	24 hours and current observation
		School transportation	Potential health and safety risk	Reschedule, increase passenger capacities.	12 hours
		Rail operations	Potential health and safety risk	Reschedule, increase passenger capacities.	24 hours
		Traffic management	Traffic congestion	Advise motorists to take mass transit.	6 hours
Space Weather (e.g., solar flares)	Any	Roadway maintenance	Radio/cellular phone communication disruptions	Advise operators, monitor communications outages.	12 hours
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Radio/cellular phone communication disruptions	Advise all operators, road supervisors, and other users of the bus radio system of temporary disruptions in communications.	12 hours
		School transportation	Radio/cellular phone communication disruptions	Advise operators, monitor communications outages.	12 hours
		Rail operations	Radio/cellular phone communication disruptions	Advise operators, monitor communications outages, place communications personnel on standby to address disruptions.	12 hours
		Traffic management	Potential impact on traffic management systems	Monitor traffic management systems.	12 hours
Total Sun (insolation per 24 hours)	Total per 24 hour period	Roadway maintenance	Air temperature, pavement temperature, toxicity and environmental damage	Modify operations as necessary.	12-24 hour forecast and current observation
Cloud Cover Forecast	Scattered, broken, overcast	Roadway maintenance	Air temperature, pavement temperature, toxicity and environmental damage	Modify operations as necessary.	12-24 hour forecast and current observation
Water Course Flow Volume (cubic meters per second)	Variable, based on flood stage criteria	Roadway maintenance	Flood risk, lane submersion, loss of life and property, road damage	Predict threatened area, select treatment strategy, operate outflow devices, develop warning and evacuation plans.	12-24 hour forecast and current observation
Water Body Depth (feet)	Variable, based on flood stage criteria	Roadway maintenance	Flood risk, lane submersion, loss of life and property, road damage	Predict threatened area, select treatment strategy, operate outflow devices, develop warning and evacuation plans.	12-24 hour forecast and current observation

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<u>Weather Element</u>	<u>Threshold</u>	<u>Activity</u>	<u>Impacts</u>	<u>Action</u>	<u>Lead Time</u>
Storm Surge (height above mean high tide, in feet)	Any	Roadway maintenance	Safety risk, damage to vehicles, road damage, evacuation route delays	Predict threatened area, repair damage.	12-24 hour forecast and current observation
	>5 feet	Bus operations (road supervision, facility, fleet, bus stop maintenance)	Increased safety risk, damage to busses, delays to scheduled operations or complete disruption of service on routes through coastal areas	Advise operators and road supervisors of pending conditions, request radio reports of observed storm surge crossing the highway. Modify, restrict, or suspend operations.	12-24 hour forecast and current observation
High Surf (wave height in feet)	>8 feet	Roadway maintenance	Safety risk, damage to vehicles, road damage, evacuation route delays	Predict threatened area, repair damage.	12-24 hours
	18-20 feet	Bus operations	Increased safety risk, damage to busses, delays to scheduled operations or complete disruption of service on routes through coastal areas	Advise operators and road supervisors of pending conditions, request radio reports of observed surf crossing the highway. Modify, restrict, or suspend operations. As requested, assist Civil Defense in evacuation of coastal areas to safe shelters.	12-24 hours and current observation
Avalanche Danger	High, moderate, low	Roadway maintenance	Impaired mobility, loss of life and property, lane obstruction, effects on snow removal/ice treatment operations	Close roadways, release avalanche, remove snow, modify operations as necessary.	12-24 hour forecast and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12-24 hour forecast and current observation
		Bus operations	Bus routes and service likely impacted due to blocked roads, possible requests to provide evacuation assistance	Modify routes as required, be prepared to provide assistance.	12-24 hour forecast and current observation
Seismic Activity (earthquakes)	Any seismic activity	Roadway maintenance	Road damage, property damage, impaired mobility, loss of life and property	Manage traffic flow, modify operations, remove debris, repair damage.	12-24 hour forecast and current observation
		Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety risk, damage to buses and property, potential for tsunami in coastal areas, disrupted operations, operations modified/restricted/suspended	Conduct immediate, spontaneous, unassisted evacuation. If communications are still up, advise fleet of event. Take roll of operators and supervisors. Assist police department, civil defense, and the public as needed.	12-24 hour forecast and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select response strategy, e.g., school opening delays, closure, or early dismissal.	12-24 hour forecast and current observation
Tsunami (Japanese for "wave in the harbor")	Any alert or warning from the Pacific Tsunami Warning Center	Bus operations (road supervision, facility, fleet, bus stop maintenance)	Safety risk, disrupted operations, service delays, damage to equipment, operations modified/restricted/suspended	Advise operators and road supervisors. Begin preparation procedures. Modify, restrict, or suspend operation in inundated areas. Coordinate transportation and other action requirements in support of civil defense evacuation operations, including evacuation of the elderly and disabled. As situation and time permit, provide service for endangered residents/visitors from tsunami evacuation areas to designated tsunami evacuation shelters. Terminate service 45 minutes prior to the estimated time of arrival of the tsunami wave.	From a maximum of 15 hours to a minimum of 5 minutes

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Volcanism	Any volcanic activity	Roadway maintenance	Road damage, property damage, impaired mobility, loss of life and property, air quality	Manage traffic flow, modify operations.	12-24 hour forecast and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12-24 hour forecast and current observation
Soil moisture	Saturated, unsaturated	Road maintenance	Flood risk, road and pavement damage, effects on pavement condition	Select treatment strategy.	12-24 hour forecast and current observation
Fire	Any fire event or activity	Roadway maintenance	Loss of visibility, loss of life and property, air quality	Manage traffic flow (e.g., close roadways and bridges).	12-24 hour forecast and current observation
		School transportation	Safety risk, vehicle damage risk, schedule delays	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	12-24 hours forecast and current observation
Fair Weather	1 to 10 Days	Roadway maintenance	Operational planning (The tasks that will be undertaken in periods of good weather depend somewhat on how much good weather is anticipated. Crews work year round; there are no reserves or part-time personnel to call in for snow or other severe weather events. Details of crew assignments vary day to day, some days plowing and sanding, some days working on drainage, some days on signs and guardrail, etc. A certain amount of mobilization is required for some tasks.)	Examples: (1) Ditching requires removing the sanders, mounting a truck box, and replacing the blower attachment on a loader with a bucket. These jobs would probably take 2 days. Such actions cannot be started without a forecast of 10 days of good (non-snow) weather because of the time needed to reconvert the equipment. (2) In urban areas, snow hauling is necessary following a storm. The same amount of work is needed to clean up after a 6-inch fall as a 12-inch one. If good weather is forecast following a 6" snow event, hauling might be started. If another snow event is forecast within several days, hauling may be delayed. (3) Forecasts of good weather, as well as bad, aid managers in deploying crews efficiently.	24-48 hours
Nuclear, Biological, or Chemical Release	Any	Roadway maintenance	Severe threat to life, health and safety risk, dispersion of extremely dangerous hazardous materials, agents, substances	Close/detour roadways, assist in Atmospheric Transport and Diffusion and HAZMAT response operations as needed.	1-3 hours and current observation
		School transportation	Severe threat to life, health and safety risk, dispersion of extremely dangerous hazardous materials, agents, substances	Select and implement response strategy, e.g., 2-hour delay, school closure, early dismissal.	1-3 hours and current observation