



Winter Performance Management

*2016 National Rural ITS Conference
Session G7*

Photo courtesy of MnDOT

October 5, 2016

- Project background
- State practices recap
- ITD featured practice
- Closing comments



PROJECT BACKGROUND



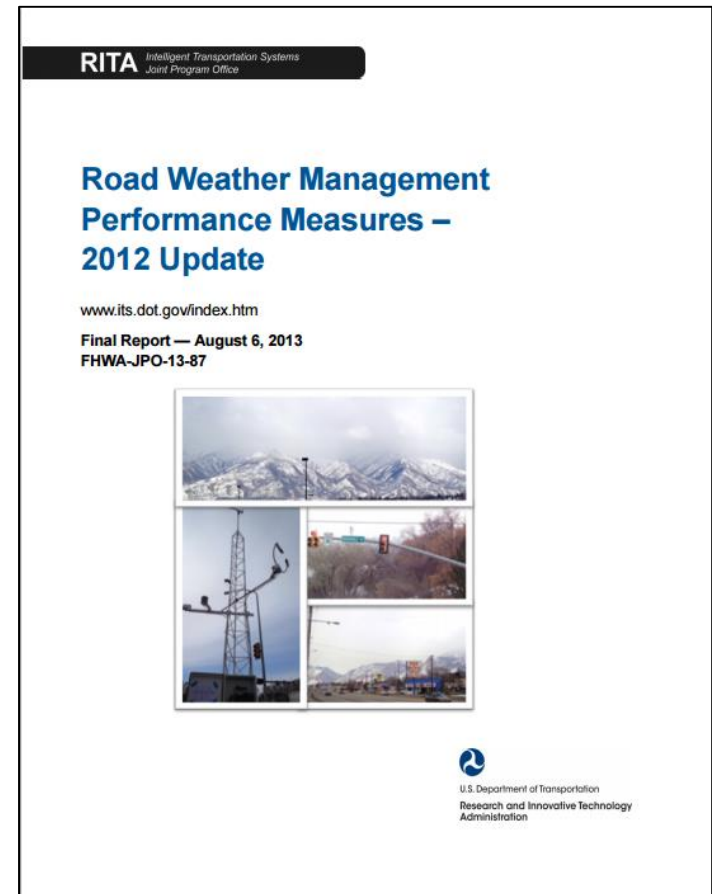
Background

- Project recommended by Ops Task Force
 - Tony Ernest, ITD, is Project Champion
- Variety of approaches to measuring performance of winter weather management
 - Time to bare pavement, customer satisfaction, mobility indexes

***In light of similar operational challenges along I-90/
I-94, what are the common practices?***

Background

- FHWA RWMP established performance measures in 2006 and updated them in 2012
 - Reductions in cost, reductions in crashes, increased travel time reliability
 - No allowances for roadway class, storm characteristics or traffic conditions



<http://ntl.bts.gov/lib/51000/51000/51065/26615E33.pdf>

- [NCHRP 14-34 Guide for Performance Measures in Snow and Ice Control Operations](#) is exploring additional dimensions of snow and ice control performance management
 - Project started April 2015 and will be complete April 2017

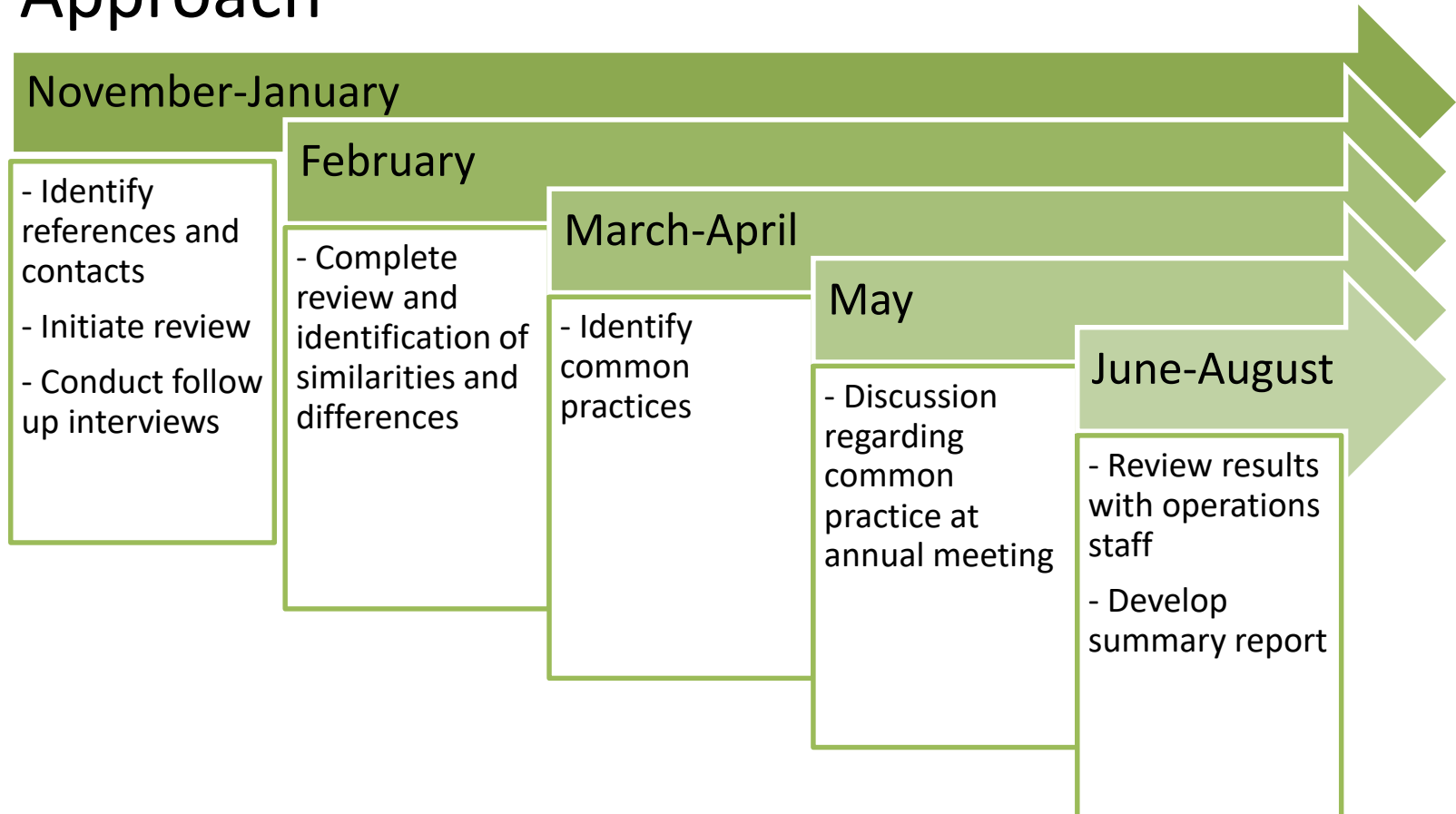
What can North/West Passage states do in the meantime to learn from their own practices?

- Project purpose
 - Summarize North/West Passage states' practices surrounding winter performance measures
 - Measures, data/analysis, targets, reporting



Photo courtesy of WSDOT

- Approach



STATE PRACTICES RECAP



State Practices

- Summary of practices highlights:
 - General information about winter maintenance program
 - Important to provide context
 - Measures being used (title/description)
 - Targets
 - Data/data sources/analysis
 - Application to decisions



State Practices

- Spreadsheet summarizing states' practices was attached to webinar meeting notice

State	General Information	Measure	Description	Targets	Data	Data Sources	Analysis	Application to Decisions	Information Source
Applicable North/West Passage state	General information about the agency maintenance program	Brief title of the measure	More detailed description of what the measure consists of	Various targets identified by the agency for a certain desired level of performance in relation to the measure	Element or unit of data used for the measure	Sources used to gather data associated with the measure	Describe the analysis performed with the data once it is gathered to arrive at a conclusion about performance in relation to established targets	Explain how the final performance information is used in the agency's decision-making process	Note the source(s) where information was found
Washington	<ul style="list-style-type: none"> - Budget approximately \$75-80M annually - Maintains 18,600 lane miles - Fleet of 500 plow trucks - 1,110 full-time employees and 166 seasonal/part-time employees - Geography ranges from temperate rain forests near the coast, high mountain passes in the Cascades, desert like Central Washington plateaus, and the rolling wheat fields of the Eastern Washington Palouse 	Level of Service	Treatment level goals 1-5 are established for all routes within a region. Level 1 is the highest with instructions for treatment prevent, during event and post-event. The Snow and Ice Plan contains maps illustrating treatment level goals for each route within a region. Following treatment, level of service is measured in terms of the resulting impact on road surface conditions and in terms of the impact on travelers.	<p>Level of service targets:</p> <ul style="list-style-type: none"> - LOS A to B: Snow or ice buildup encountered rarely. Bare pavement attained as soon as possible. Travel delays rarely experienced. - LOS B to C: Snow or ice buildup encountered at times but infrequent. Travel at times may experience some isolated delays with roads having patches of black ice, slush, or packed snow. - LOS C to D: Snow or ice buildup encountered regularly. Travel likely to experience some delays with roads having black ice or packed snow with only the wheel track bare. - LOS D to F: Compact snow buildup encountered regularly. Traveler will experience delays and slow travel. 	- Field inspection	<ul style="list-style-type: none"> - Highway Activities Tracking System (HATS) is the platform staff use for recording level of service entries, whether or not trucks are equipped with AVL systems. Trucks equipped with AVL systems do not automatically gather the information needed to determine level of service. 	Performance is measured in terms of sanding/deicing operations. The measured result is the condition of the travel lanes provided by these operations in response to winter weather events (i.e. snow, ice, frost). Measurement of these conditions is used to determine the level of service provided by the maintenance program throughout the winter season. Road surface conditions are assessed by staff after sanding or deicing activities occur. Assessment and documentation should be made after the activity is completed and the outcome (i.e. bare pavement, wheel tracks bare, etc.) is known. Maintenance personnel conduct the road condition assessments by observing the surface condition of a roadway (all lanes, both directions). Observations are documented in HATS. The minimum requirement is the completion of one level of service rating form per shift, when there is some kind of a measurable condition.	The Maintenance Accountability Process (MAP) is used to evaluate level of service, outline data collection processes used to record all sand, solid and liquid deicer applications, and describe the weather forecasting services provided to WSDOT. The Snow and Ice program is funded and equipped based primarily on historical records and the average winter conditions collected and compared over time. When occasional extreme winter weather occurs, the program cannot provide the accustomed level of service because existing resources are insufficient for this type of event. Since these types of events happen infrequently, it would be inefficient management of resources to size and base a winter maintenance program for the exceptional winter weather event.	<ul style="list-style-type: none"> - Maintenance Performance Measures - MAP Level of Service Definitions - 2015-2017 MAP Targets - MAP Manual - 2015-2016 Snow and Ice Plan
Idaho	<ul style="list-style-type: none"> - Budget \$26 million annually - Maintain 12,000 lane miles - 512 full-time staff - Fleet of 500 plus vehicles - Diverse geography ranging from high desert to mountainous terrain 	Winter Performance Index	Derived using a two step process starting with the Storm Severity Index that uses sensor data (wind speed, surface precipitation layers and surface temperatures) inserted into a formula to calculate an Index value. The Storm Severity Index value is then inserted into a formula along with the ice-up duration to establish the Winter Performance Index.	The goal is to have a Winter Performance Index of 0.20 or less.	<ul style="list-style-type: none"> - WS=wind speed (mph) - WEL=water equivalent layer (millimeters) - ST=surface temperature (degrees F) - Ice-Up Time=when grip is below 0.6 for at least a 30-minute period (hours); grip measures how quickly the snow/ice surface was reduced and good traction (grip) surface restored 	<ul style="list-style-type: none"> - RWIS for roadway data; TAMS currently for resource data; in process of switching to WARS (Winter Automated Reporting System) for more integrated resource tracking 	The index value is then compared with a performance scale (typically 0.00 to 0.70 with a goal of 0.20 or less). Calculations are automated and done through the RWIS program visualization application - Navigator II.	Used to identify how successful the road treatment and timing were by the field maintenance personnel.	<ul style="list-style-type: none"> - Development of Winter Maintenance Performance Measures - paper from ITS World Congress (2013)

State Practices

Washington

Measure	Level of service
Description	Treatment level goals 1-5 are established for all routes within a region. Level 1 is the highest with instructions for treatment pre-event, during event and post-event. Following treatment, level of service is measured in terms of the resulting impact on road surface conditions and in terms of the impact on travelers.
Target	LOS A-F <ul style="list-style-type: none"> <i>(Example) LOS A to B: Snow or ice buildup encountered rarely. Bare pavement attained as soon as possible. Travel delays rarely experienced.</i>
Data/Sources	Field inspection / HATS
Analysis	Staff assess road surface conditions for LOS after treatment
Decisions	Snow and Ice program is funded and equipped based primarily on historical records and the average winter conditions collected and compared over time.

State Practices

Idaho

Measure	Winter performance index
Description	Derived using a two step process starting with the Storm Severity Index that uses sensor data inserted into a formula to calculate an index value. The Storm Severity Index value is then inserted into a formula along with the ice-up duration to establish the Winter Performance Index. (WPI=Ice-Up Time/Storm Severity Index)
Target	0.20 or less
Data/Sources	Wind speed, surface precipitation, surface temperatures / RWIS, TAMS (WARS in future)
Analysis	Calculations automated through Navigator II where index value is compared with performance scale (0.00-0.70)
Decisions	Used to identify how successful the road treatment and timing were by the field maintenance personnel.

State Practices

Montana

Montana	
Measure	Service level guidelines
Description	Guidelines provide uniform service levels between maintenance areas and provide better resource allocation
Target	Levels I-V with I assigned to urban areas and objective is to keep at least one travel lane open and intermittent bare pavement as soon as possible. Level V includes seasonal roads that receive no maintenance.
Data/Sources	Maintenance patrolling observations / Staff, RWIS, weather forecasts
Analysis	Treatments are continuously evaluated by staff before, during and after storm, and then adjusted for intensity, duration and type of precipitation
Decisions	Levels of service are used to provide uniform service

State Practices

Wyoming

Measure	Level of service
Description	Priority plan sets direction for snow and ice removal based on roadway service level classification
Target	High Volume-Closed with high volume service including a bare roadway for driving safety as reasonable speeds and closed serve based on the cost of keeping a road open overriding the benefit.
Data/Sources	None directly, but onsite staff road condition reports (for TI) serve as confirmation / Staff
Analysis	Local foremen determine amount of effort to apply following storm
Decisions	Foremen can adjust hours based on storm intensity. WYDOT is also exploring how to compare material, labor and equipment use in relation to a local winter storm scale.

State Practices

South Dakota

Measure	Level of service
Description	Operational guidelines establishing maintenance activities associated with the removal of snow and ice from roadways. Generally establishes end-of-storm condition, intermediate stages acceptable while obtaining that condition, or frequency of snow and ice control maintenance operations.
Target	Two levels of road classification (priority and non-priority routes) established with levels of service goals for both during and following an event (e.g. remove snow and ice in a manner such that the driving surface will be 80% clear of snow and ice within 18 hours).
Data/Sources	Staff observations, materials usage / Staff, maintenance management records
Analysis	Levels established from analysis of variables such as policy, road classification, facility locations, etc.
Decisions	Used to varying degrees in localized fashion. SDDOT exploring Winter Severity Index and Winter Maintenance Response Index

State Practices

North Dakota

Measure	Speed recovery
Description	When average speeds are reestablished to at or above 90% of pre-storm speeds (4-hr average) and are sustained for a period of 1 hour
Target	Prospective winter measure being developed by NDDOT to determine how well maintenance practices meet desired levels of service. Maintenance is developing a summary of objectives and procedures for management to determine a statewide course of action.
Data/Sources	Speed / ATR, WIM (NPMRDS potential future)
Analysis	Speeds analyzed before, during and after a winter storm event for when they return to levels at or above 90% of pre-storm speeds
Decisions	This pilot project will help shape the direction of the measure and how it could potentially be used in decision-making.

State Practices

Minnesota

Measure	Return to bare pavement
Description	Tracks frequency with which MnDOT achieves highway-specific targets over an entire winter season. Measured from the time a winter event ends to when MnDOT's snow and ice operations regain bare-lane driving conditions.
Target	Achieving bare lanes within targeted number of hours after a winter weather event. Ranges from 0-3 hours for a Super Commuter to 9-36 hours for a Secondary Collector.
Data/Sources	Staff observations / Plow operators
Analysis	Results are compared from year to year. MnDOT also uses a Winter Severity Index to simplify the comparison of winter severity from year to year. Each district uses several factors (e.g. precipitation, temperature, etc.) to calculate a single relative number. MnDOT has achieved its target in nine of the last 10 seasons.
Decisions	Districts may redirect summer maintenance funds to snowplowing activities or use information to counteract fuel and material costs.



State Practices

State	Source	Location	Phone	Email	Notes
Washington	James Morin, Maintenance Operations Branch Manager		360-705-7803	morinj@wsdot.wa.gov	From Bill Legg
Washington	Maintenance Performance Measures	http://www.wsdot.wa.gov/Maintenance/Accountability/default.htm			From Bill Legg
Washington	MAP Level of Service Definitions	http://www.wsdot.wa.gov/Maintenance/Accountability/los.htm			From Bill Legg
Washington	2015-2017 MAP Targets	http://www.wsdot.wa.gov/NR/rdonlyres/4C851083-16BF-4526-989F-22B8FC15143D/0/MAPTargetchart.pdf			From Bill Legg
Washington	MAP Field Data Collection Manual	http://www.wsdot.wa.gov/NR/rdonlyres/0475068D-CE61-4EFB-B785-157315E7F7BF/0/FieldDataCollectionManual.pdf			From Bill Legg
Washington	MAP Manual	http://www.wsdot.wa.gov/Maintenance/Accountability/mapmanual.htm			From Bill Legg
Washington	2015-2017 Statewide Priority Matrix	http://www.wsdot.wa.gov/NR/rdonlyres/0F80C02B-8FF6-42CF-8E55-5BA83337DDDE/0/LOSPriorities.pdf			From Bill Legg
Washington	CY2014 MAP Service Level Report - Statewide	http://www.wsdot.wa.gov/NR/rdonlyres/B5A62A60-D332-414C-BE91-AE4790CD8208/0/Statewide_comb.pdf			From Bill Legg
Washington	Statewide Snow and Ice Plan 2015-16	http://www.wsdot.com/winter/snowiceplan.htm?_ga=1.105464576.2049147996.1457452427			From James Morin
Idaho	Dennis Jensen, Winter Maintenance Coordinator		208-334-8472	dennis.jensen@itd.idaho.gov	From Tony Ernest
Idaho	Development of Winter Maintenance Performance Measures - paper from ITS World Congress (2013)	https://itswc.confex.com/itswc/AM2013/webprogram/ExtendedAbstract/Paper11335/Winter%20Maintenance%20Performance%20Measures%20Over%202.pdf			From research and confirmed by Tony
Idaho	Idaho TD Winter Maintenance Performance System – excerpt from Best Practices for Road Weather Management (2012)	http://www.ops.fhwa.dot.gov/publications/fhwahop12046/rwm10_idaho1.htm			From research and confirmed by Tony
Idaho	Idaho's Winter Performance Measures – presentation at Western States Forum (2013)	http://www.westernstatesforum.org/Documents/2013/presentations/Idaho_Jensen_FINAL_WinterMaintenancePerformanceMeasures.pdf			From research and confirmed by Tony
Idaho	ITD Malad foreman Thorpe again sets ITD road-clearing standard – article from The Transporter (10/23/15)	http://itd.idaho.gov/transporter/2015/103015_Trans/103015_D5ThorpeAgain.html			From research and confirmed by Tony
	Department Memorandum Regarding TTO Requirements for 2016	File in project folder			From Dennis Jensen
Idaho	Transportation Technician Operations (TTO) Step Pay Program Policy	File in project folder			From Dennis Jensen

State Practices

- Similarities
 - Storm (winter) severity index
 - Some recognize and try to address variations in storm (winter) characteristics (MN, ID, SD, WY)
 - Provides context for what's measured and how comparisons are made from storm to storm (winter to winter)

Minnesota

Dew point/relative humidity, wind speed/gusts/direction, frost/black ice, precip type/duration/amount, air temp, road temp, cloud cover, blowing snow, surface pressure

Winter Severity Index by district for past 3 years			
District	2012-13	2013-14	2014-15
1	82	100	83
2	101	125	85
3	78	112	69
4	112	128	82
Metro	75	82	66
6	74	134	65
7	75	110	87
8	83	115	82
Statewide	80	125	87

State Practices

- Similarities
 - Data sources primarily consist of:
 - RWIS
 - Plow operator observations
 - Resource management systems (e.g. materials, time)
 - Analysis typically considers storm severity, resources (inputs) and results (outcomes) to produce a contextual measure of performance



Road Weather Information System

- Differences
 - Targets for “return to normal” vary
 - By road type (ND, MN, MT, WY, SD)
 - Further variation in road type categories
 - Across the board (ID)
 - “Return to normal” definition varies
 - Level of service (WA, MT, WY, SD, ND)
 - Bare pavement (MN)
 - Mobility (ID, ND, MN pilot)



- Differences
 - Applying results to decision-making
 - Shop to shop application (WA, SD)
 - Strategic planning (SD)
 - Pay by performance (ID)
 - Some consider public satisfaction a measure of performance
 - MN, ND and SD conduct periodic surveys to measure satisfaction



State Practices

- Traditional vs. untraditional characteristics of state practices

Traditional	Untraditional
Level of service	Customer satisfaction
Historical material consumption	MDSS recommendations
Labor costs	Pay for performance
Area level adjustments	Statewide target setting
Bare pavement	Mobility based indexes
Staff observations	Detectors, NPMRDS, RWIS

ITD FEATURED PRACTICE: APPLYING MEASURES TO EMPLOYEE CLASS AND PAY





IDAHO'S EVOLUTION INTO DATA DRIVEN DECISION MAKING FOR WINTER OPERATIONS

Operator expectation of storm management changed

- Equipment more sophisticated
 - Open loop verses closed loop
 - Calibration of controllers
- Treatment selection moved from one product to multiple products
 - Anti-icing, prewetting, solid and liquid applications
 - Matching the product to the event
- Operators were required to attain metrics
 - Simple response moved to effectiveness of treatment
 - Measurable success
 - Critique operations.



IDAHO'S EVOLUTION INTO DATA DRIVEN DECISION MAKING FOR WINTER OPERATIONS

Building the expectations and developing a compensation package

- Governor and Divisions of Financial Management and Human Resources
- Horizontal career path
 - Technicians increased their value to the department compensation was awarded
 - Clear goals established
 - Level of progress and expected duration for accomplishments
 - Teams constructed of SME and field supervisors.



IDAHO'S EVOLUTION INTO DATA DRIVEN DECISION MAKING FOR WINTER OPERATIONS

The goals include multiple disciplines expected completed in two years

TTO Requirements, Step 1

Checklist of items to be completed by June 30

REQUIREMENT	
TRAINING	TYPE
<i>Workplace Training</i>	
Behavioral Styles in the Workplace	Instructor-led
Constructive Culture	Instructor-led
Respectful Workplace 2014	Online
<i>Software Systems</i>	
Technology Boot Camp	Instructor-led
AMS Timesheet Training	Online
Learning Hub Upgrade March 2014	Online
Vaisala PowerPoint Presentation	Online
<i>Operator Training</i>	
Defensive Driving	Instructor-led
5.86 Proper Plowing Techniques	Online
10.28 General Flagger Training	Instructor-led
10.07 Basic Traffic Control	Instructor-led
<i>Industrial Safety</i>	
First Aid/CPR/AED 2-Year Renewal	Instructor-led
5.25 Hazardous Materials Module 1 'Employee Awareness'	Instructor-led
Fall Factors	Online
Ladder Safety	Online
PPE: Your Last Layer of Protection	Online
Power Lift	Online
SKILLS TESTING	
5.71 Dump Truck Operator	
5.72 Snowplow Operator	
5.79 Loader Operator	



EXPERIENCE HOURS	
<i>Winter Maintenance</i>	
100 hours – any combination of M331, M332, M336	
200 hours of any combination of the following:	
<i>Inspection & Testing</i>	
C010, C011, C012, C020, C030, C040, C043, C055, C060, C062, D308, D368, L711, L712, L714, L715, L716, L717	
<i>Line Maintenance</i>	
M111, M112, M113, M116, M418, M254, M255, M256, M257, M419, M420	
<i>Specialty Maintenance</i>	
M154, M155, M157, M158, M159, M311, M312, M321, M324, M326, M329, M211, M212, M213, M214, M216, M411	
WINTER INDEX GOAL	
TEAM WMI (winter index goal) – greater than or equal to 60%	
TEAM WPI – less than or equal to 20% (0.2)	
PERFORMANCE EVALUATION	
Individual Performance Evaluation Rating > or = <i>Achieves Performance Standards</i>	



IDAHO'S EVOLUTION INTO DATA DRIVEN DECISION MAKING FOR WINTER OPERATIONS

The goals include multiple disciplines expected completed in two years

TTO Requirements, Step 2

Checklist of items to be completed by June 30

REQUIREMENT	
TRAINING	TYPE
<i>Workplace Training</i>	
Constructive Communication	Instructor-led
<i>Operator Training</i>	
5.83 AASHTO Anti-Icing/RWIS Curriculum	Online
5.85 AASHTO Equipment Maintenance	Online
5.87 AASHTO De-Icing	Online
<i>Technical Training</i>	
3.30 Environmental Awareness	Instructor-led
4.04 Applied Math for Technicians	Online
5.04 Bridge Fundamentals for Technician	Online
6.40 Properties of Materials	Instructor-led
7.03 Right-of-Way	Online
Maintain Current Certification in: 5.25; 10.07; 10.28; Defensive Driving; First Aid/CPR/AED	



SKILLS TESTING
5.01 Backhoe
EXPERIENCE HOURS
<i>Winter Maintenance</i>
100 hours – any combination of M331, M332, M336
<i>200 hours of any combination of the following:</i>
<i>Inspection & Testing</i>
C010, C011, C012, C020, C030, C040, C043, C055, C060, C062, D308, D368, L711, L712, L714, L715, L716, L717
<i>Line Maintenance</i>
M111, M112, M113, M116, M418, M254, M255, M256, M257, M419, M420
<i>Specialty Maintenance</i>
M154, M155, M157, M158, M159, M311, M312, M321, M324, M326, M329, M211, M212, M213, M214, M216, M411
WINTER INDEX GOAL
TEAM WMI (winter index goal) – greater than or equal to 60% (0.6)
TEAM WPI – less than or equal to 20% (0.2)
PERFORMANCE EVALUATION
Individual Performance Evaluation Rating > or = Achieves Performance Standards



TTO step three to be announce in July 2016



IDAHO'S EVOLUTION INTO DATA DRIVEN DECISION MAKING FOR WINTER OPERATIONS

The TTO (Transportation Technician Operator) was approved and implemented in 2015.

ITD restructure district organizational charts to encourage participation and improve efficiencies

- Restructuring focus on what the department should look like in the year 2020

ITD had 562 employees participate in the program the first year

- Each level attainment was valued to the job requirements
- The compensation packages for each step was approximately \$2.00 per hour increase
- The final level compensation was equivalent to the current supervisor pay.



IDAHO'S EVOLUTION INTO DATA DRIVEN DECISION MAKING FOR WINTER OPERATIONS

Summary

ITD is reducing the work force through attrition

Salary savings are used to fund the increased compensation packages

Employees level of understanding of winter operation has increased many fold

Team concept has been promoted and demonstrated

Performance of crews have improved

TOTL path implemented in FY17

Closing Comments

- Recent system performance NPRM may further influence winter performance management
 - Measures proposed for travel time reliability
 - Percent of the Interstate System providing for Reliable Travel Times
 - Percent of the Interstate System Mileage providing for Reliable Truck Travel Time

More information available online at:

https://www.fhwa.dot.gov/tpm/rule/pm3_nprm.cfm

Closing Comments

- Watch for more on this topic from System Performance NPRM and NCHRP 14-34



<http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3867>

QUESTIONS AND ANSWERS

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