Highway Factors Attachment – Ohio Turnpike Maintenance Snow & Ice Training

Mount Pleasant, PA

HWY20MH002

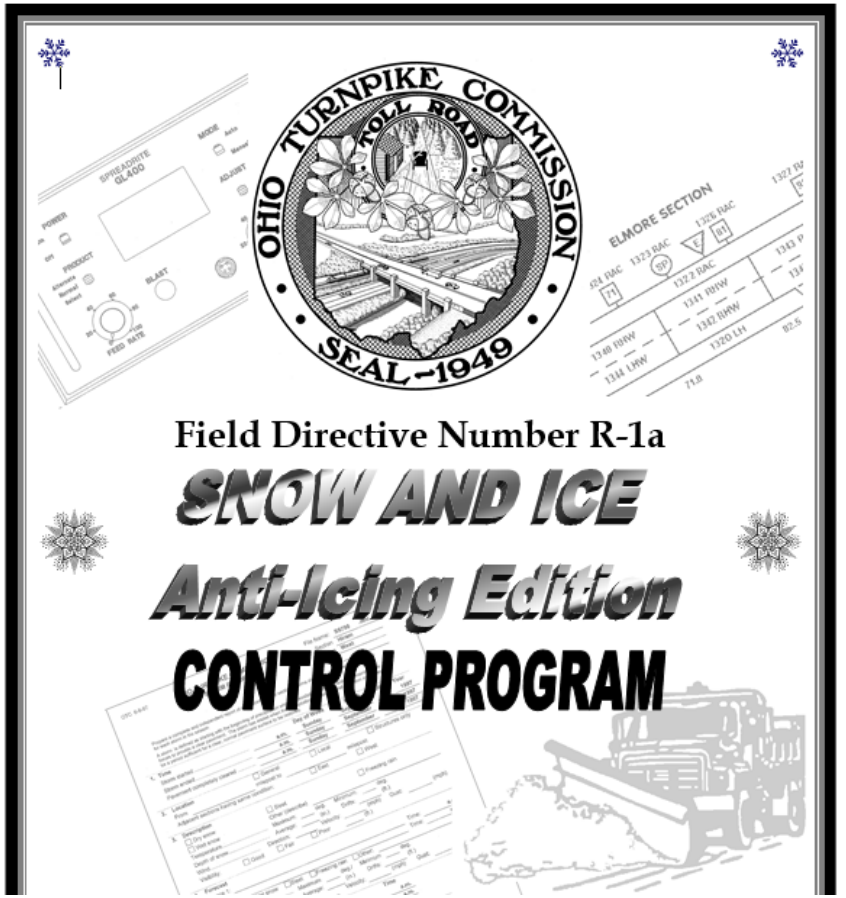
(76 pages)

Ohio Turnpike Maintenance Snow & Ice Training

OHIO TURNPIKE & INFRASTRUCTURE COMMISSION

OCTOBER 2018

Snow & Ice Control Program
Field Directive R-1



Introduction – Mission Statement

To operate and maintain a user-fee supported highway with sound financial management that provides motorists and travelers with safe, modern and helpful services.

- The Ohio Turnpike must strive, be staffed, maintain equipment and treatment material stockpiles, to provide excellent snow and ice operations.
- Maintain a traversable pavement at all times consistent with storm conditions, and to strive to have a pavement in a “wet” condition within one-hour of storm cessation.

Level of Service (LOS)

- Categorizing of traffic flow with corresponding safe driving conditions
- Ranges from LOS A – LOS F
  - LOS A – Drive at posted speeds, mobility between lanes
  - LOS C – Drive at or near posted speeds, reduced mobility between lanes
  - LOS E – Cannot maintain posted speed, severely reduced mobility
  - LOS F – Stop and go, speeds less than 25 mph, no mobility

LOS A/B

- Expected to be maintained during all light and medium storm events, above 24°F
- Pavement Condition – Wet
- Shoulders Clear

LOS C/D

- Expected to be maintained during all medium storm events when temps below 20°F & medium-heavy storm events when temps above 24°F
- Pavement Condition – Wet w/ some slush between wheel tracks and lane lines

LOS E/F

- Never a goal. However, conditions will exist which will make it impossible to maintain > LOS E
- Extreme pavement temps, wind speed, snowfall intensity, time of storm event

Plowing Priorities

Priority	Area
1	Mainline Pavement, Interchange and Service Plaza Ramps
2	Paved Shoulders on Mainline and Ramps, Administration Building Ramps, Crossovers
3	Service Plaza Parking Areas
4	Access Roads
5	Administration Building and Toll Plaza Parking Areas
6	Tandem Trailer Lots
7	Sidewalks and Islands at Toll Plazas

Supervisory Responsibilities
Division Superintendent

Responsible for the supervision of the snow and ice control operations within their Division. They shall temporarily assign or transfer personnel, equipment, and materials within their Division, to carry out the snow and ice duties effectively and efficiently.

- Ensure sufficient materials are stockpiled
- Ensure sufficient personnel are available/scheduled
- Ensure equipment is kept in good repair and operating condition
- Ensure continuity of operations

Supervisory Responsibilities
Section Foreman

Responsible for the supervision of the snow and ice control operations within their Section. They shall assign personnel and equipment in accordance with the procedures and charts contained in or referred to in this directive.

- Ensure established procedures are being followed
- Regular inspections of equipment and materials
- Maintain accurate records of equipment, labor, and materials
- Check weather reports, air and pavement temps, and actual conditions

Weather Forecasting Services
dtn WeatherSentry

Choose a location

MB 5 - Amherst ▾ Manage Locations
Default Location

Local Radar

Current Conditions Add Slide

Sunny
Observed at LORAIN/ELYRIA, OH (KLPR)
Mon 9:53 AM EDT

Temperature	60 °F
Feels Like	60 °F
Wind	V at 6 mph
Dew Point	53 °F
Humidity	78 %
Sky Cover	Clear
Road Temp	-
Bridge Temp	-

Weather Bulletins Add Slide

All Clear — None

Wind Monitor Add Slide

All Clear — No winds exceeding 30 mph
change settings

PrecipTimer Add Slide

Caution — No moderate precipitation detected by radar in the next 3 hours.
There is a chance of Rain through 2:00 PM EDT 9/24/18.
change settings

Local Forecast Add Slide

	11 AM	12 PM	1 PM	2 PM	3 PM
Weather Condition					
Air Temp	65 °	68 °	71 °	71 °	67 °
Road Temp	-	-	-	-	-
Bridge Temp	-	-	-	-	-
Road Frost	-	-	-	-	-
Bridge Frost	-	-	-	-	-

more details

Mon	Tue	Wed	Thu	Fri
46° | 71°	63° | 76°	57° | 70°	49° | 66°	51° | 69°

more details

Today's Observed Weather Add Slide

Temperature (Lo/Hi)	46 °F | 60 °F
Feels Like (Lo/Hi)	43 °F | 60 °F
Humidity (Lo/Hi)	78 % | 93 %
Wind (Max)	8 mph
Wind Gust (Max)	-
Dew Point (Average)	49 °F
Rainfall (Liquid Amount)	0.0 in.

more details

Yesterday's Observed Weather
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Wind (Ma
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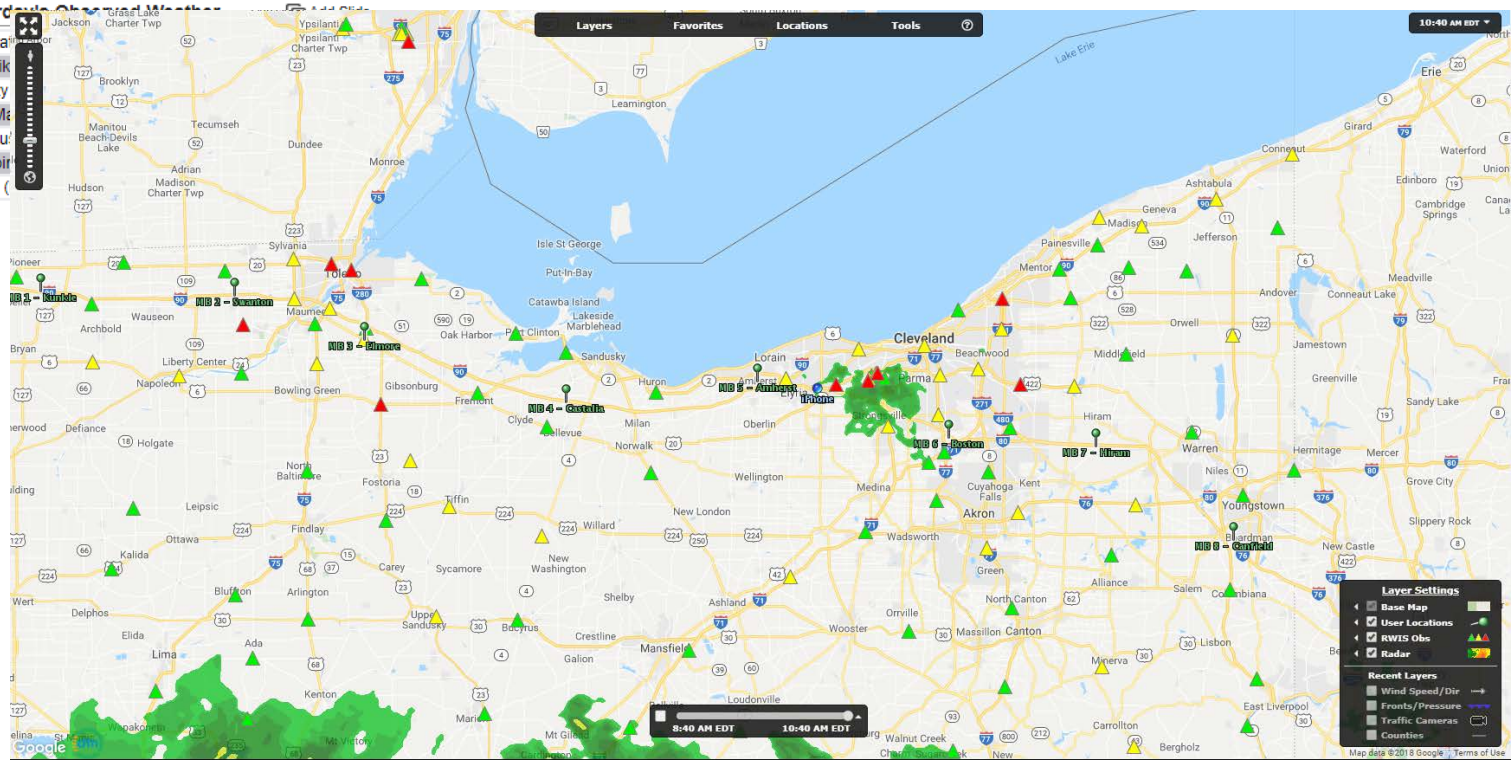
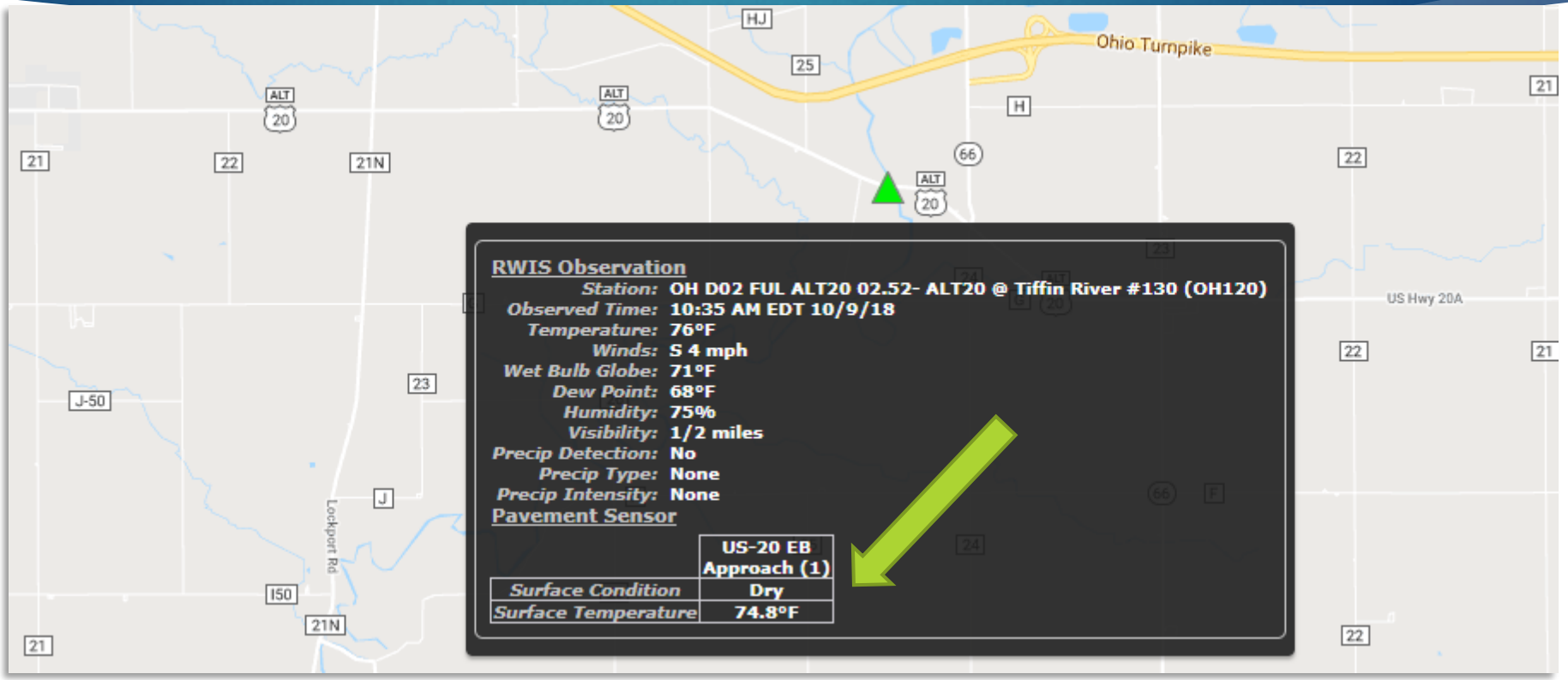


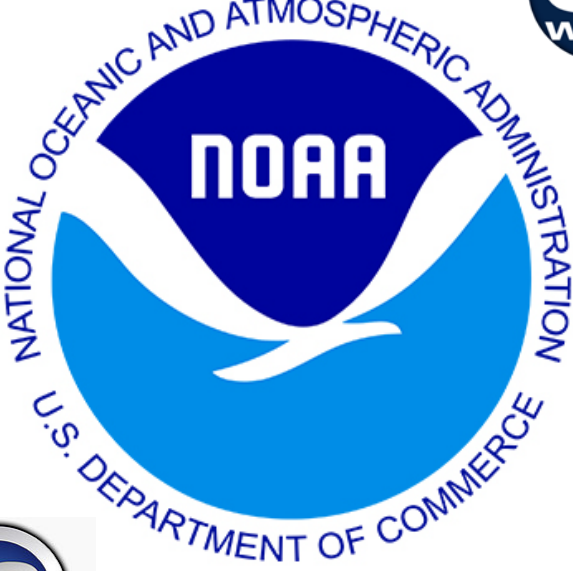
Weather Forecasting Services
dtn WeatherSentry



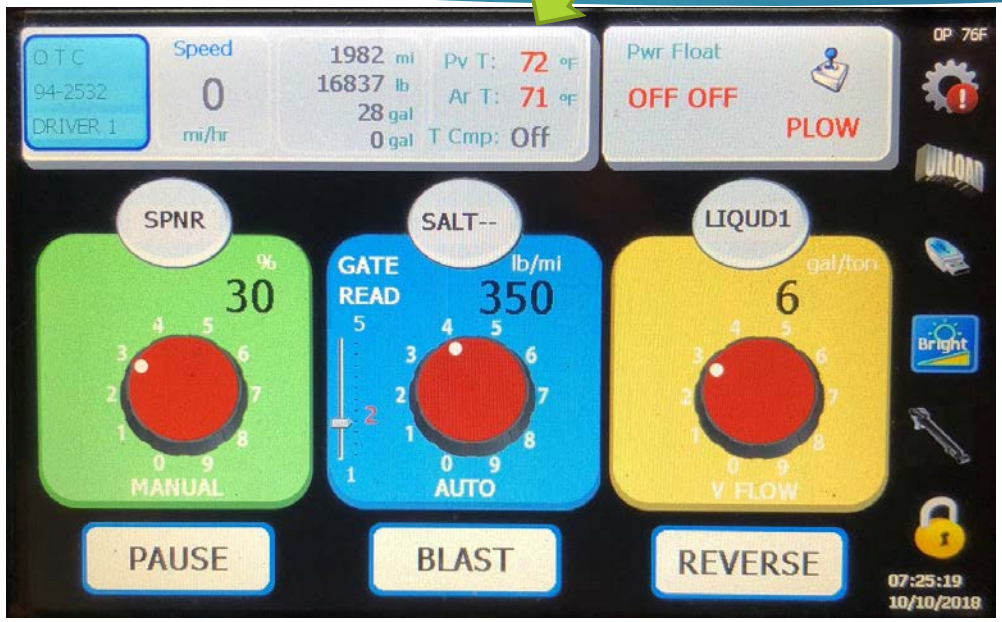
- ODOT RWIS Stations
- Surface Condition and Temperature Sensors
- Available on Section Office Computer

Weather Forecasting Services Additional Resources

- NOAA
- Local TV/Weather
  - TV Provided to each Foreman/Superintendent

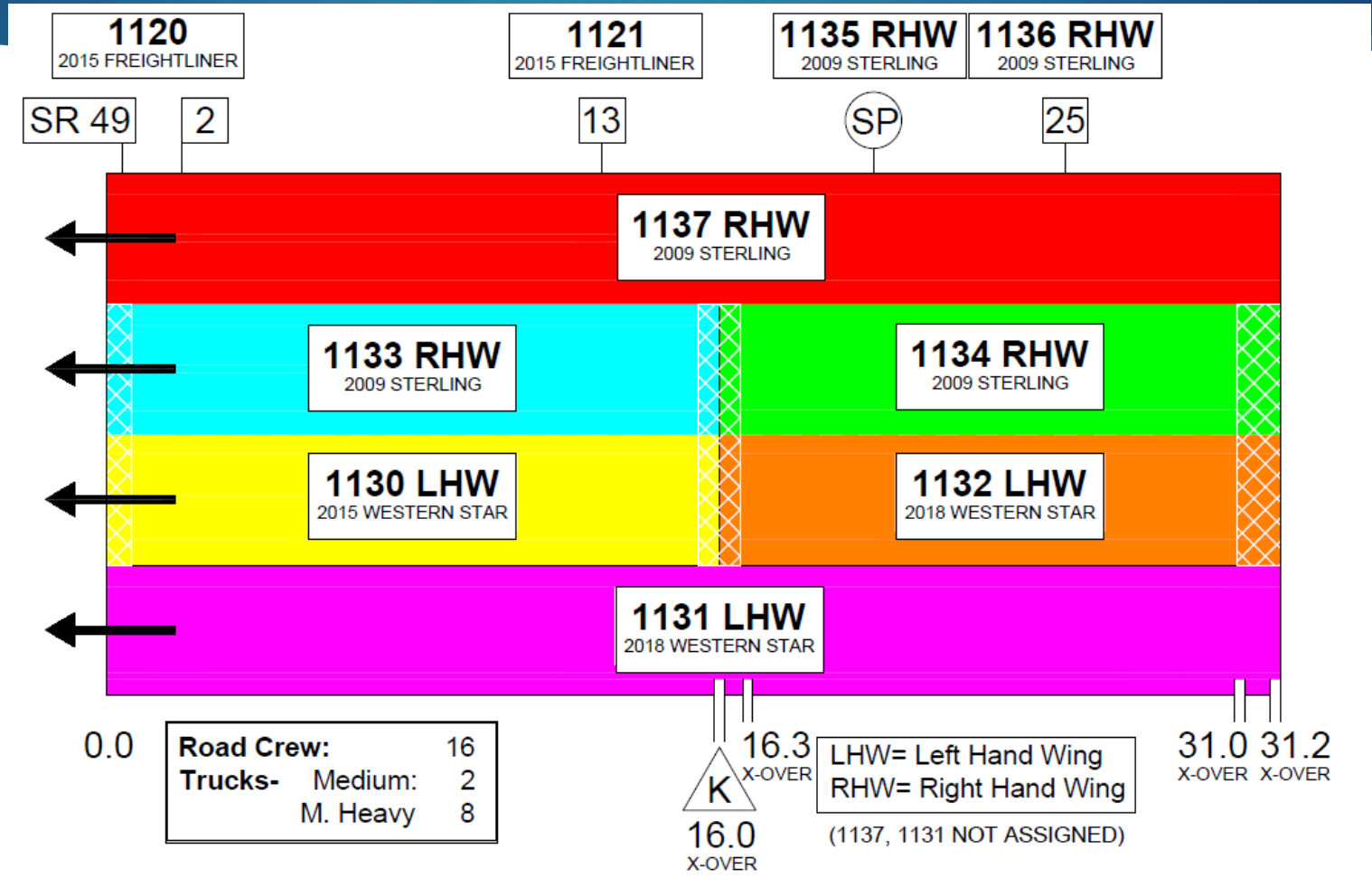


Weather
Road and Air Temps

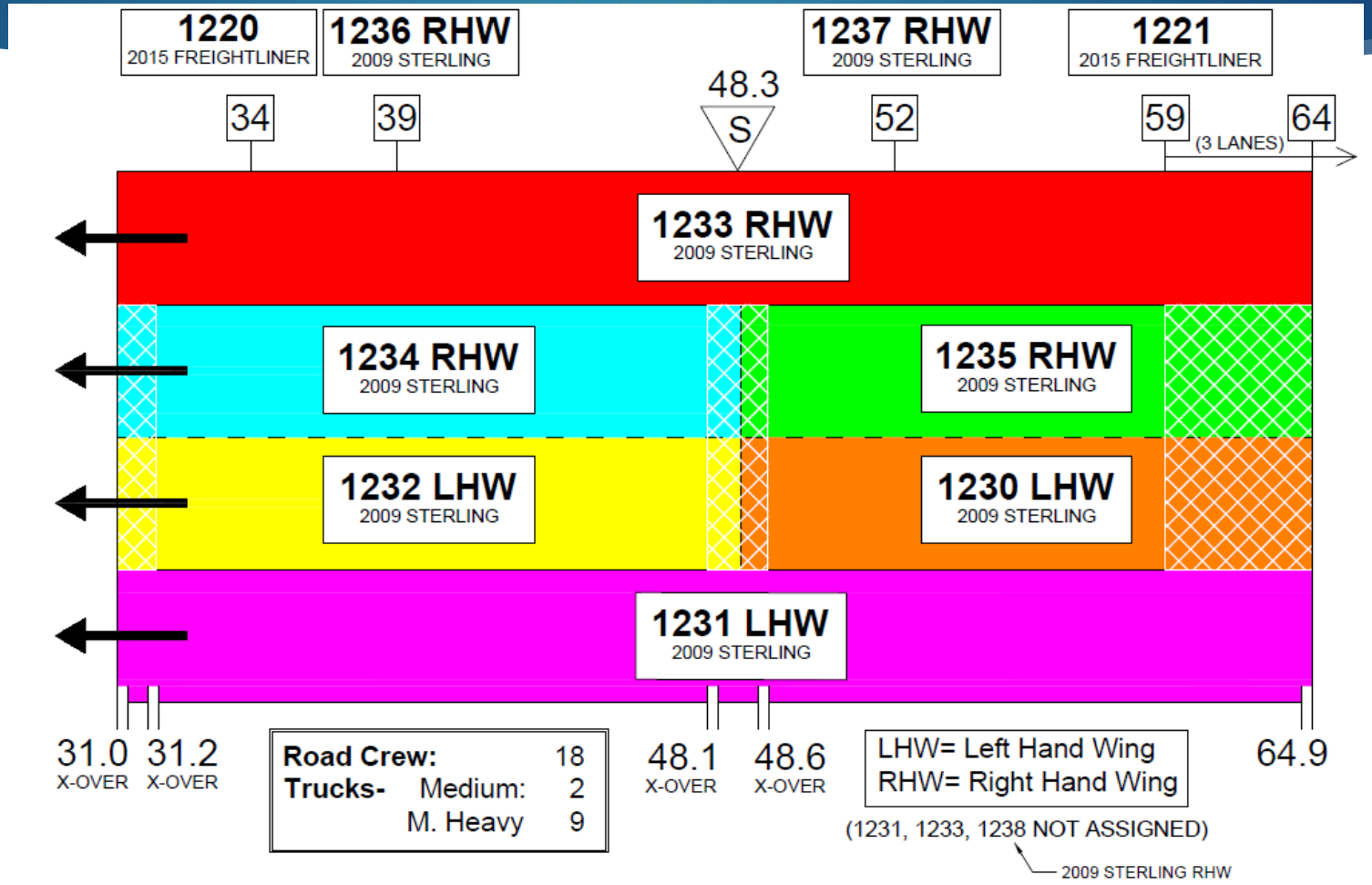


- Supervisor vehicles are equipped with RoadWatch Temperature Sensors (road & air)
- Newer trucks have road and air temp displayed on the control head

Truck Assignments Kunkle



Truck Assignments Swanton

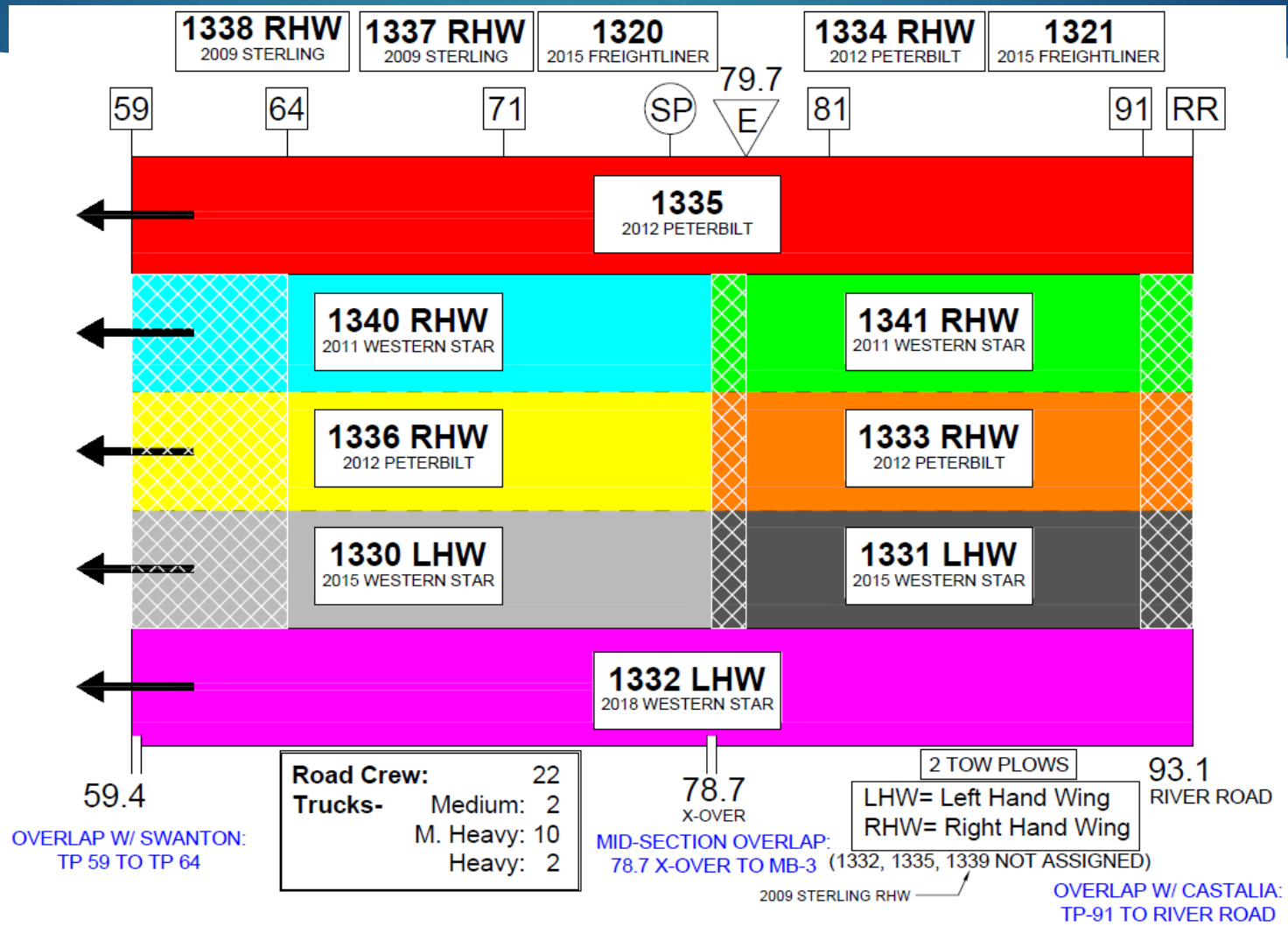


OVERLAP W/KUNKLE:
31.0 X-OVER TO 31.2 X-OVER

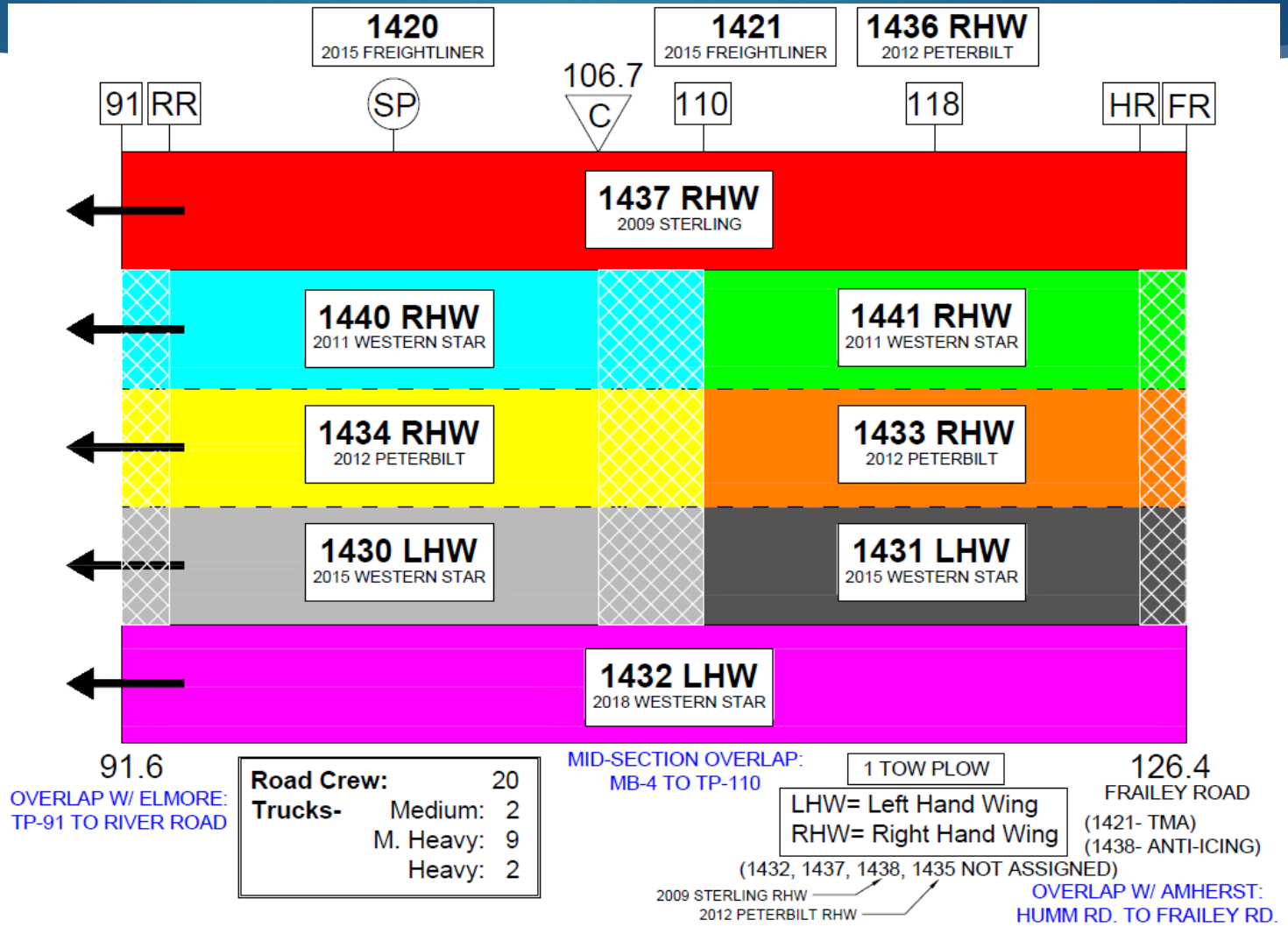
MID-SECTION OVERLAP:
48.1 X-OVER TO 48.6 X-OVER

OVERLAP W/ ELMORE:
TP-59 TO TP-64

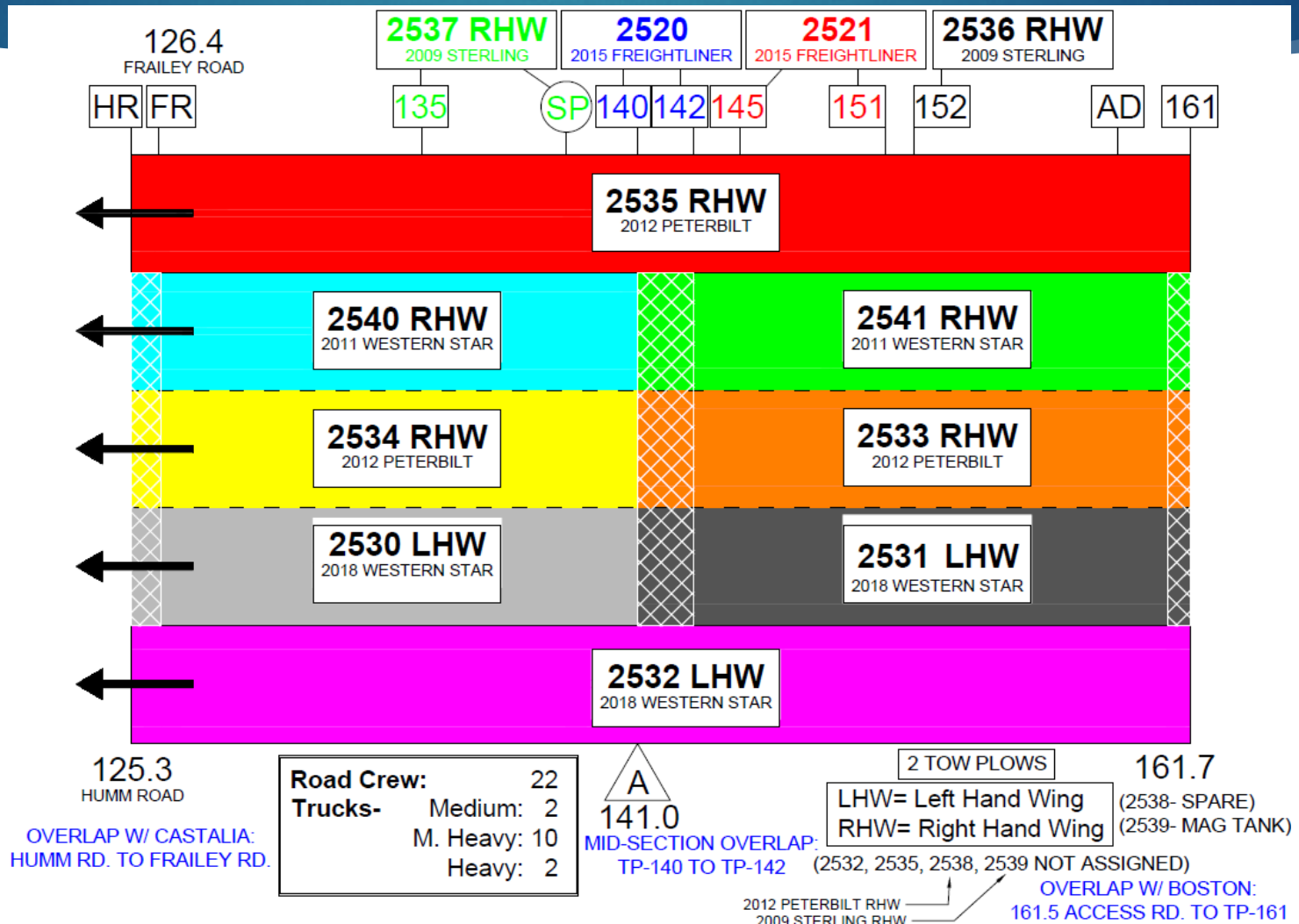
Truck Assignments Elmore



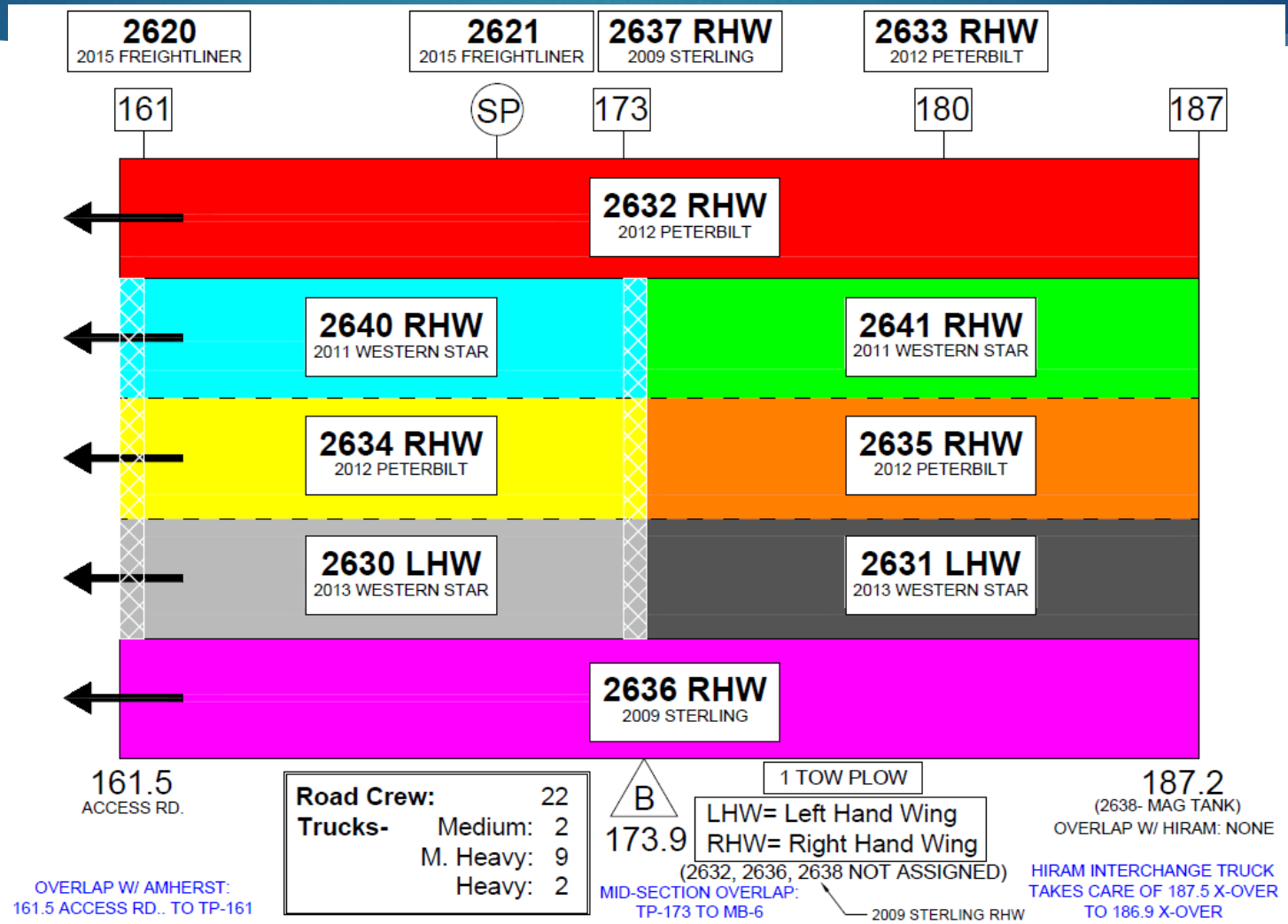
Truck Assignments Castalia



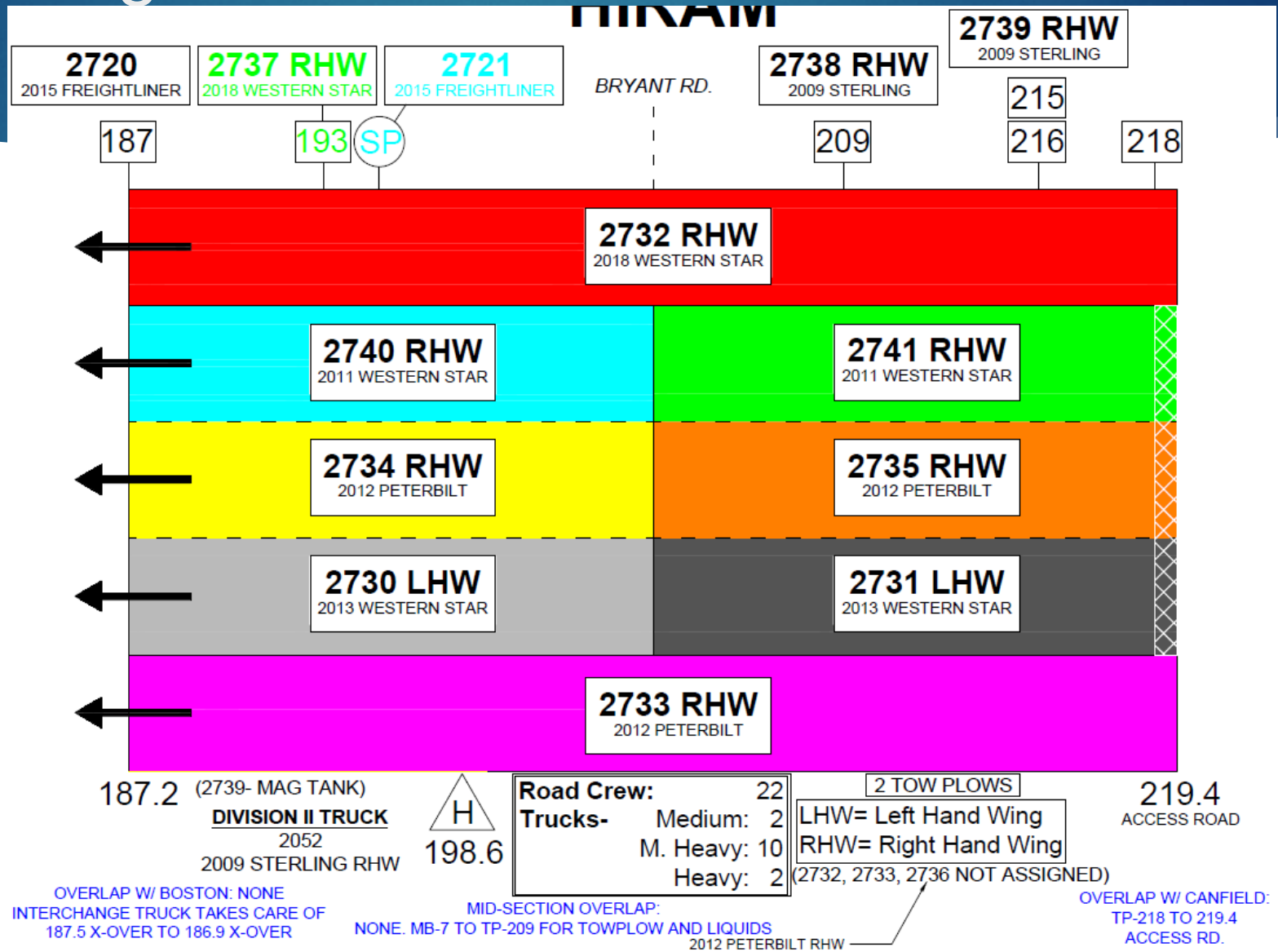
Truck Assignments Amherst



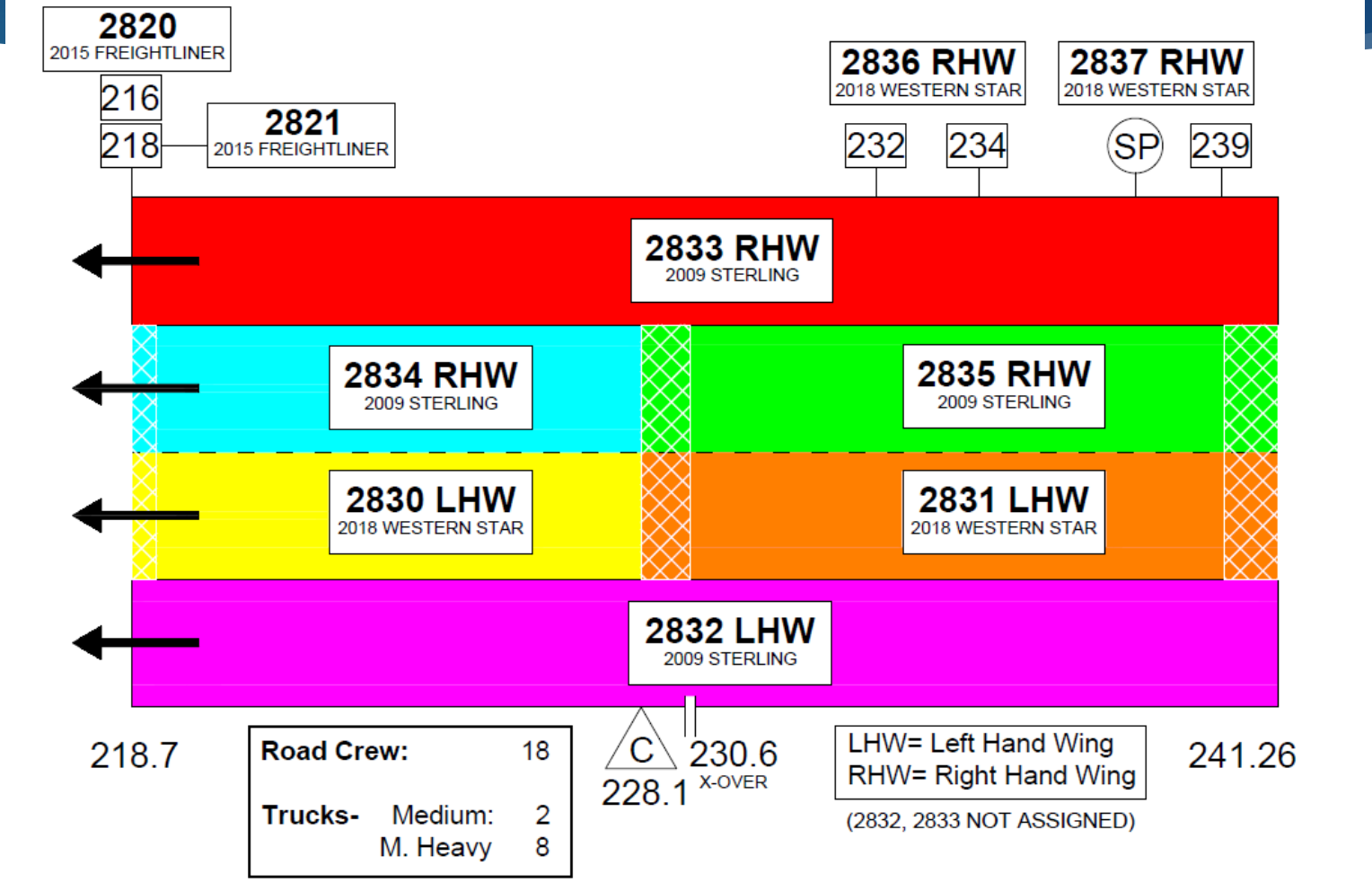
Truck Assignments Boston



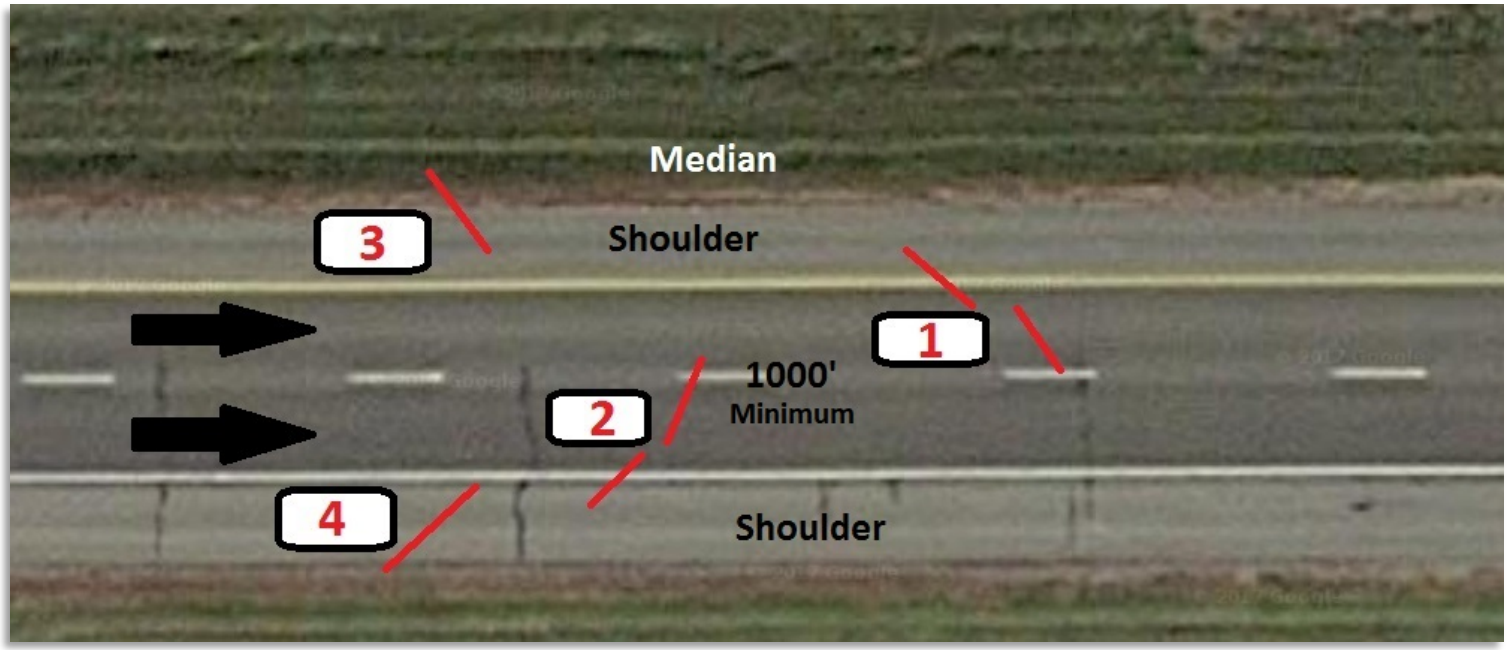
Truck Assignments Hiram



Truck Assignments Canfield

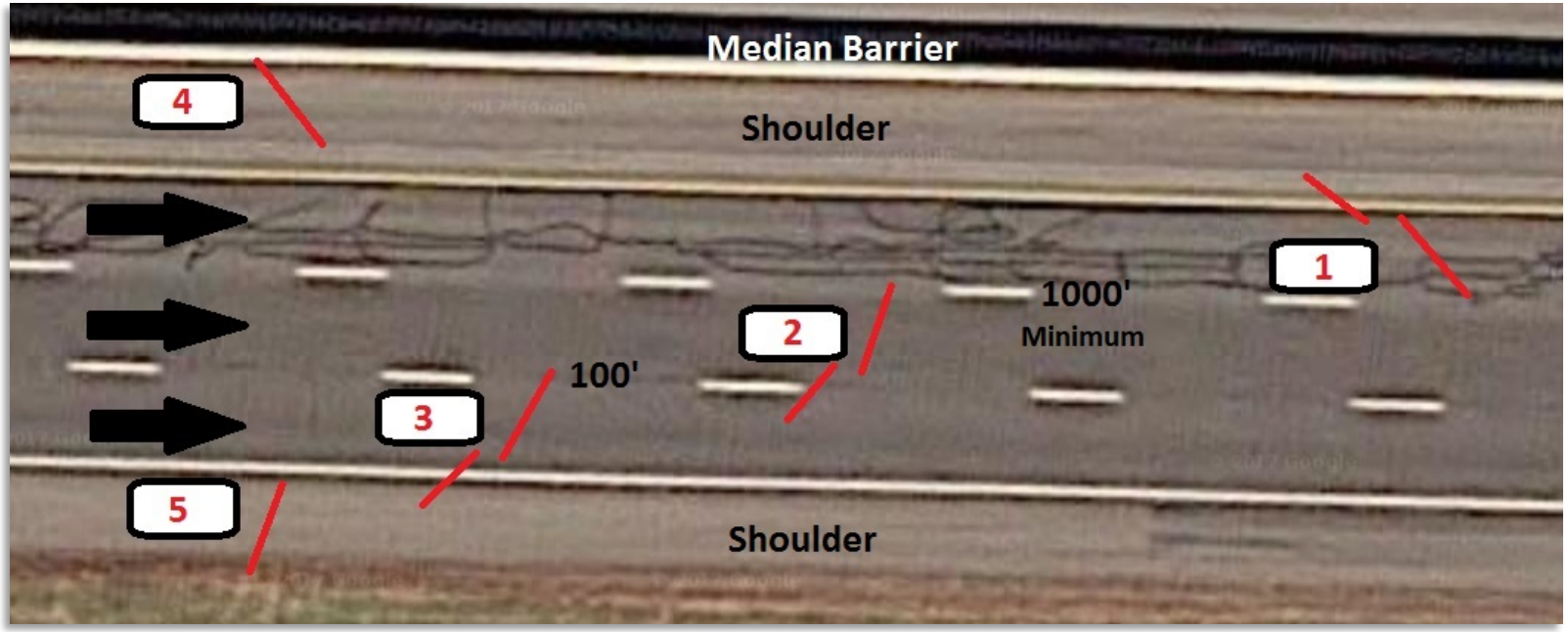


Plowing Formations Diagram 1



Two-Lane Roadway

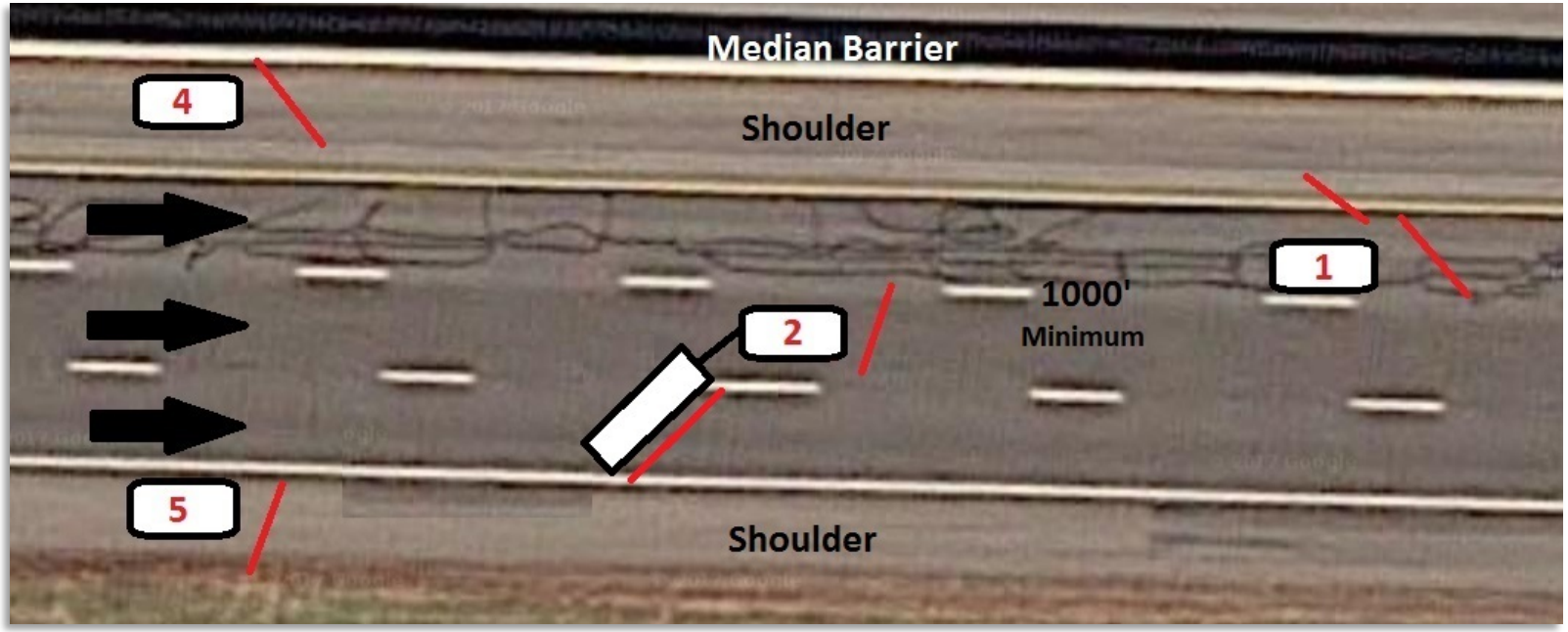
Plowing Formations Diagram 2



Three-Lane Roadway

(Scheme "A")

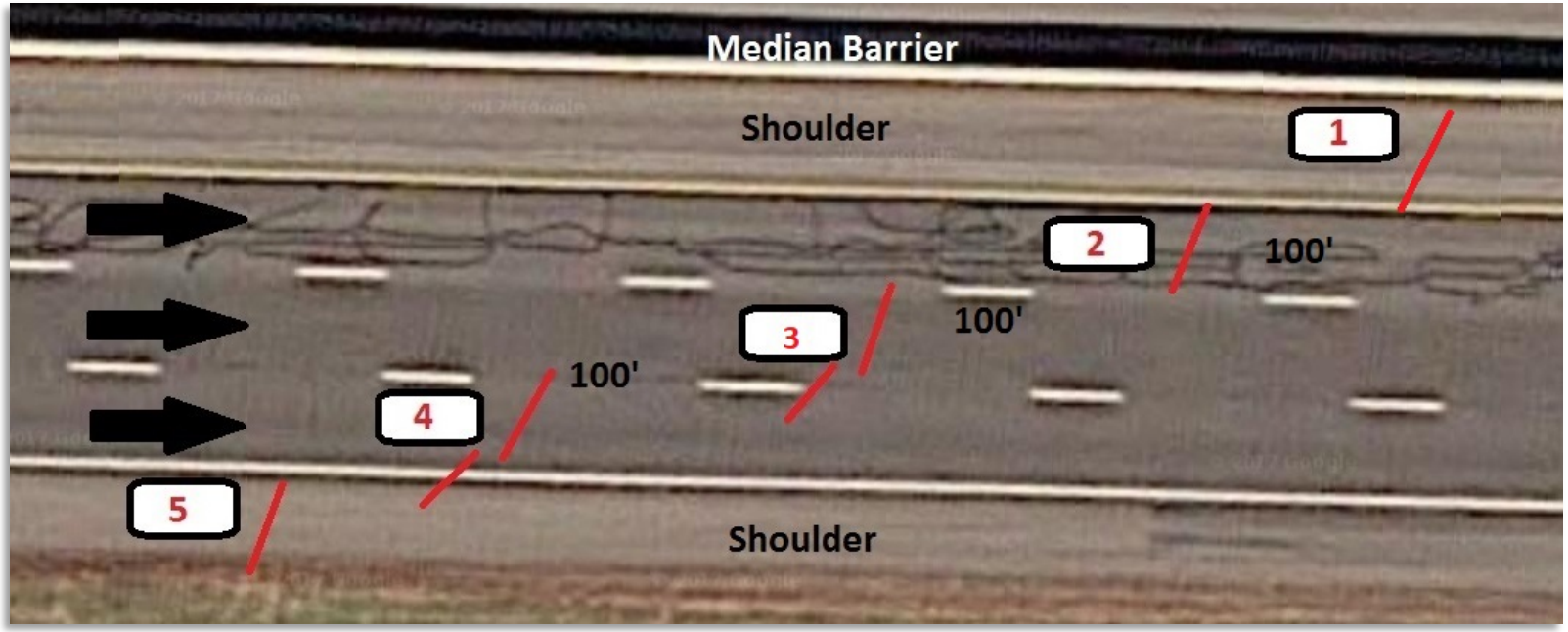
Plowing Formations
Diagram 2 – Towplow Alternate



Three-Lane Roadway

(Scheme "A")

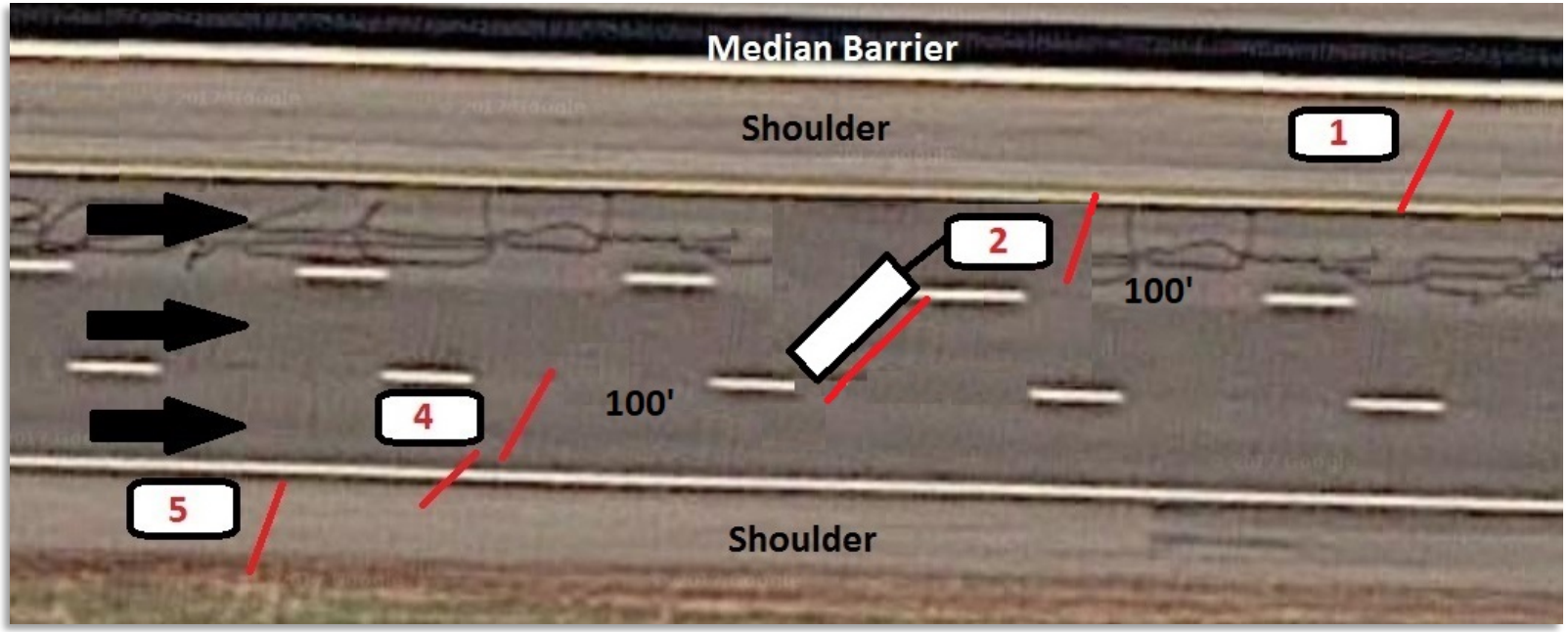
Plowing Formations
Diagram 3 (Echelon)



Three-Lane Roadway

(Scheme "B")

Plowing Formations
Diagram 3 – Towplow Alternate



Three-Lane Roadway

(Scheme "B")

Plowing Formations
Diagram 3 - Echelon Formation

- All snow plowed to the outside
- Operated when snow exceeds or is expected to exceed the storage capacity against the median barrier

Plowing Formations
Multiple-Curved Ramp

Multiple-Curved Ramp

Plowing Operations

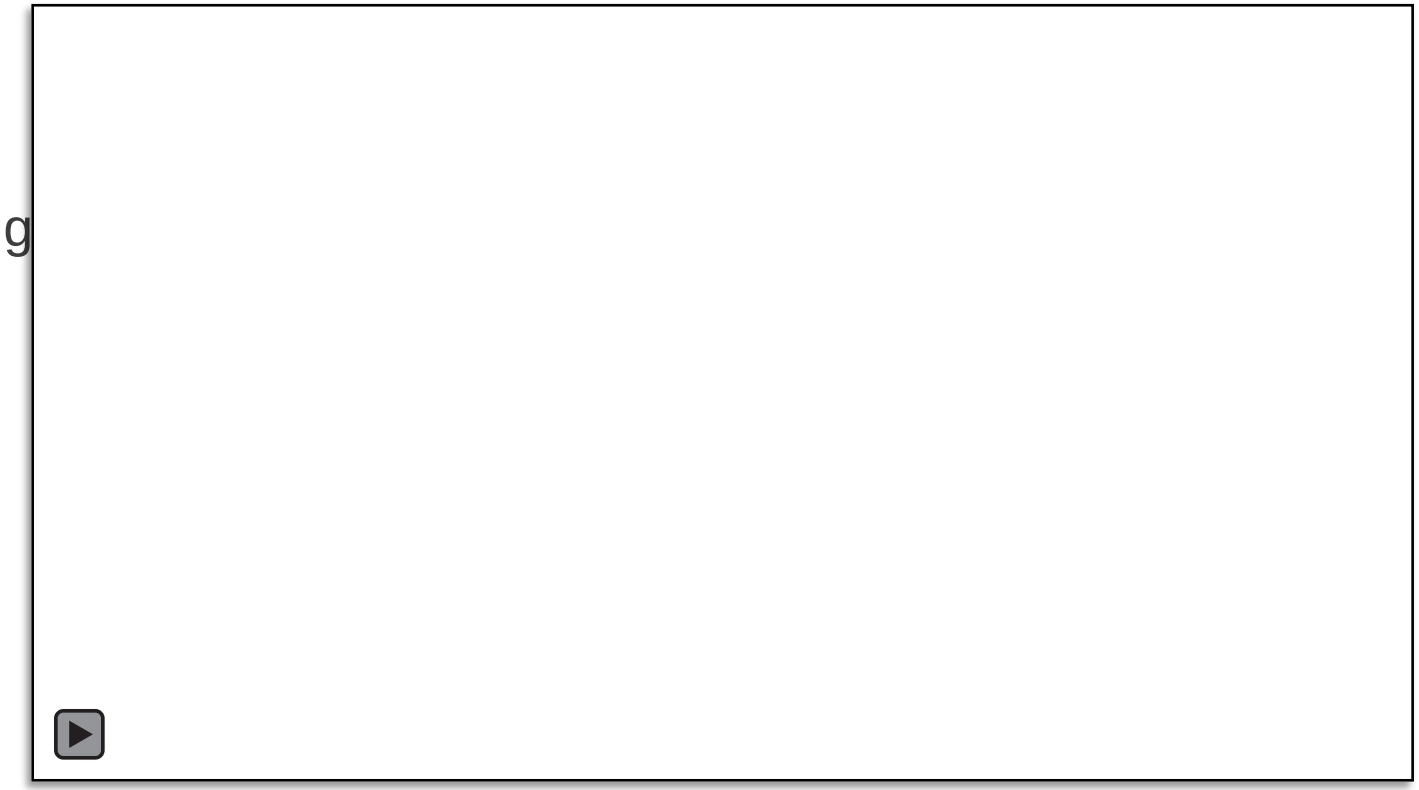
- Maintain Proper Plowing Speed
  - Approx. 30 – 35 MPH
  - Higher speeds make plows bounce and impair visibility due to blowing snow
- Slow down to avoid throwing snow or slush over bridge parapets or median barrier
- Raise plows at uneven bridge expansion joints

Patrolling

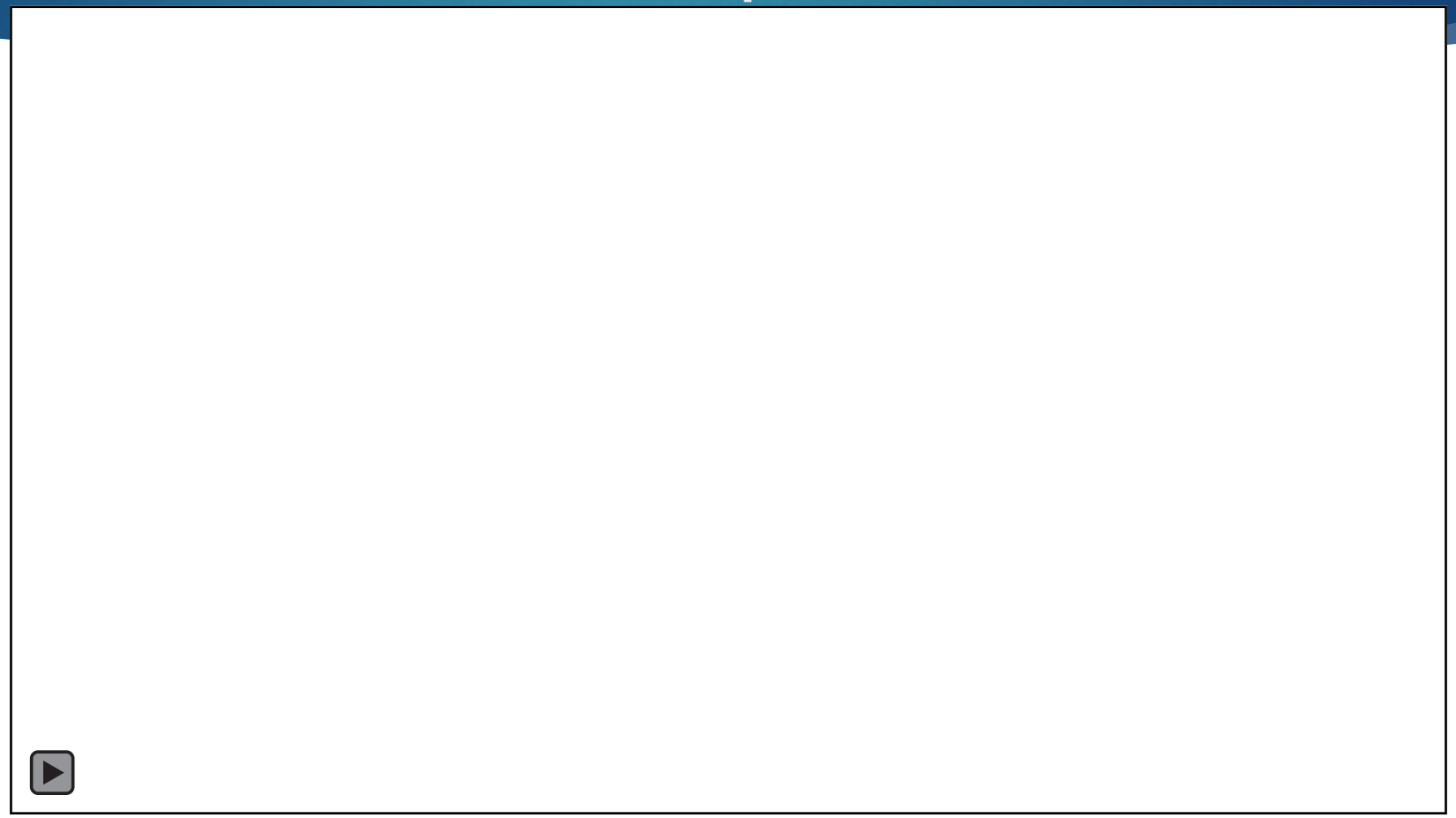
- Keep an eye out over the entire zone
- Keep a close eye on known trouble spots
- Stay in the driving lane, at reasonable speed, with warning lights operating when mobile
  - 2 Lane Section – LHW can patrol in either lane
- Don’t hide when stationary

Equipment Readiness Preparations

- Snow & Ice Equipment Preparations
  - Frame Painting, Touch-up Painting
  - Preventative Maintenance
    - Brakes, Steering, Suspension, etc.
  - Web chain, spinner, liquid applicator maintenance
  - Calibration of rock salt and liquid application



Equipment Readiness
Annual Snow & Ice Inspections

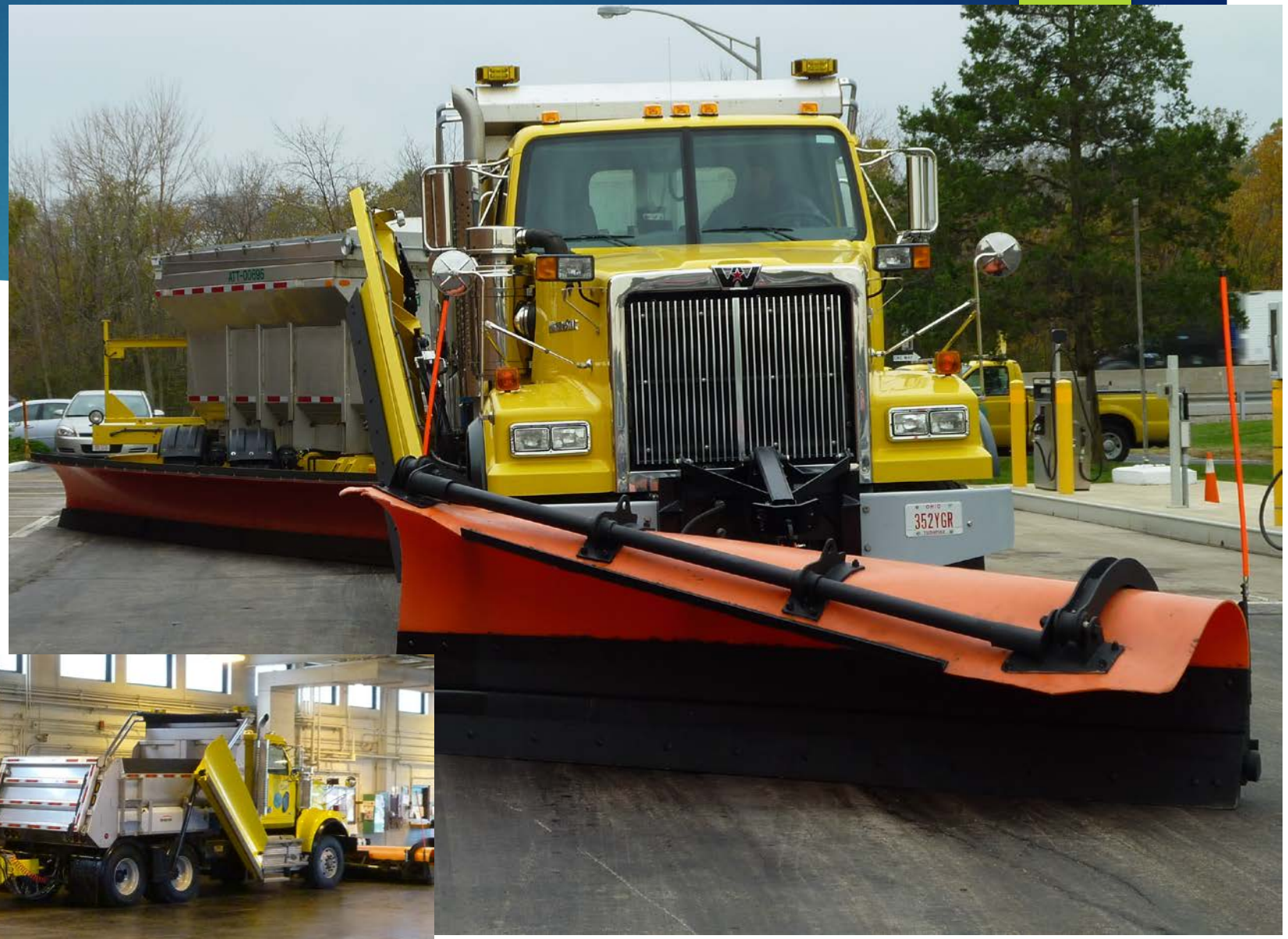


- Each October Snow & Ice Inspections are performed on all equipment at each facility

Equipment
30 Series - Medium Heavy Single Axle

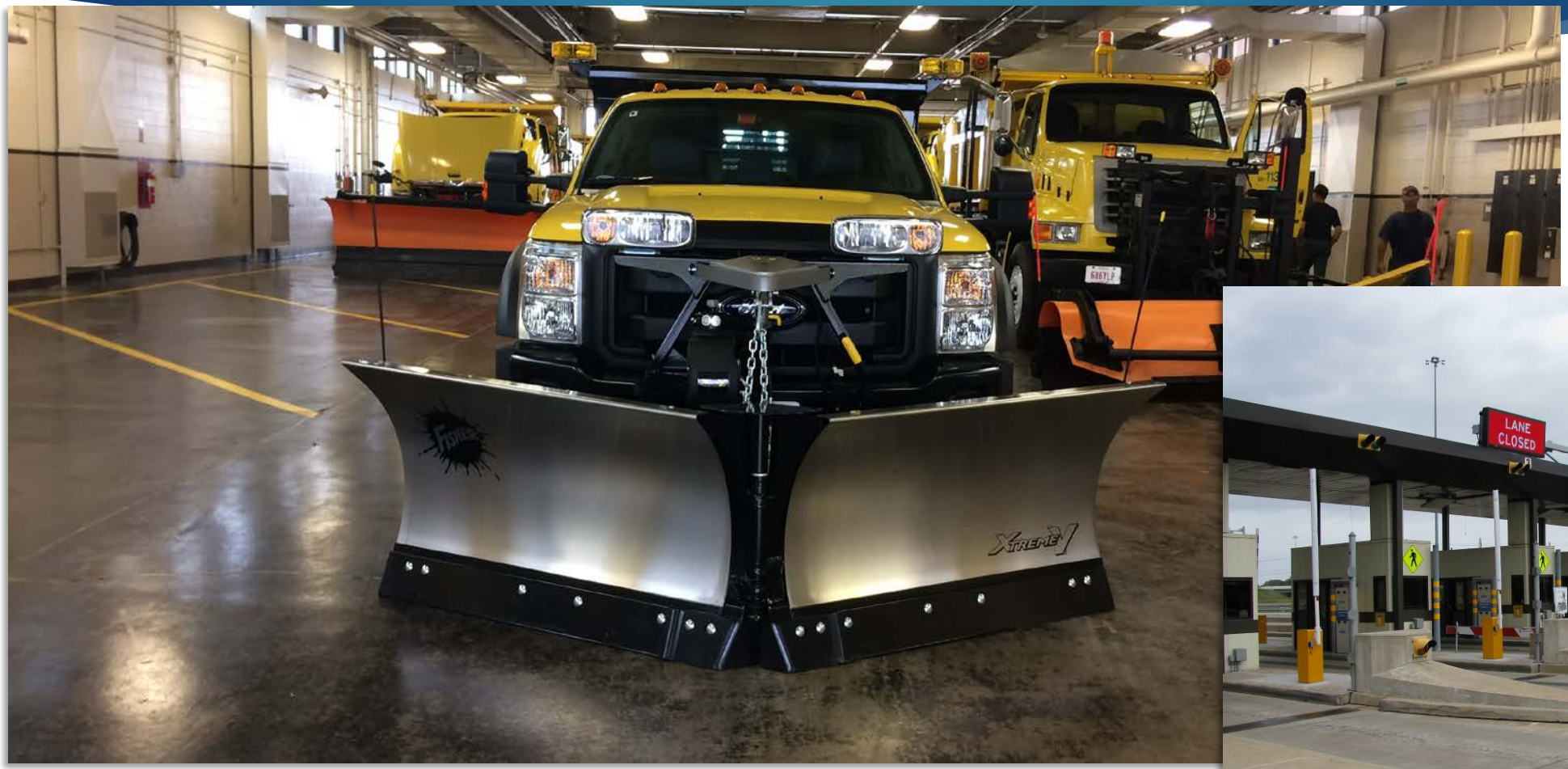
Equipment
40 Series – Heavy Tandem Axle

Equipment TowPlow

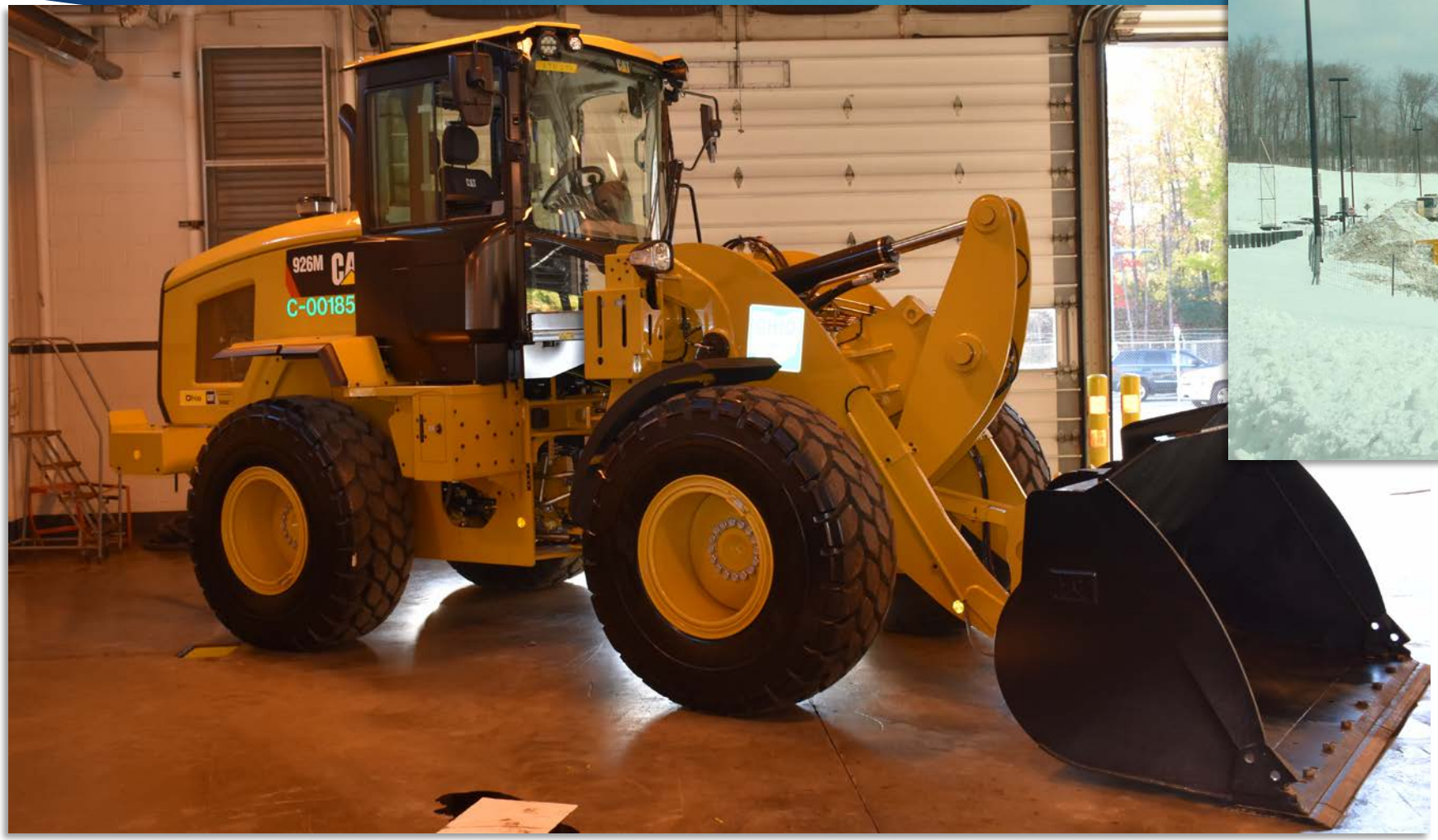


Equipment
20 Series - Medium Single Axle

Equipment
17 Truck – V-Plow



Equipment
Loader & Pushbox



Equipment
Control Head

- Currently use two types:
  - Bosch Rexroth CS 550
  - Certified Power Freedom Model ACS
- Control features are identical
- Joystick control of bed and plow
- Control head control of liquid and salt application

Equipment
Front Plows & Blades

- 11’ or 12’ Widths
- Reversible & Coning (Some Fixed)
  - Adjustable without slowing down
- Multiple checks throughout storm to identify abnormal wear, tears, or breaks
  - Critical Defects – Change blade and adjust plow shoes to avoid damage
- Equipped with soft steel and carbide blades
- Plow Balance

Equipment
Wing Plows & Blades

- 8’ or 9’ Widths
- Mid & Mid-Rear Mount Heavy Duty systems
- Multiple checks throughout storm to identify abnormal wear, tears, or breaks
  - Critical Defects – Change blade and adjust plow shoes to avoid damage
- Joma 6000 Blade System on RHW

Equipment
Inspecting Plows for Damage

Equipment
Cab Heaters

- Anti-Idle Policy
  - Idling kills the exhaust systems
  - Expensive
- All S&I Trucks outfitted with cab heaters
  - Runs when key is in the ‘Accessory’ position
  - Marker Lights can run as well

Equipment
Pre-Trip Inspection

- Thump tires for air pressure
- All Warning Lights & Truck Lights
- Leaks
- Abnormal Noises
- Safety Equipment
  - Fire Extinguishers
  - Camera Systems

6-007-14

OHIO TURNPIKE AND INFRASTRUCTURE COMMISSION
VEHICLE AND EQUIPMENT OPERATION RECORD

OTIC # and Description : _____

Use Authorized By : _____ Date: _____

Section or Division : _____ Operator: _____

PREVENTIVE MAINTENANCE CHECK - Indicate condition of all items and list all deficiencies below.
Use a check mark (√) for items which are OK. Use an "X" for items **not** OK.

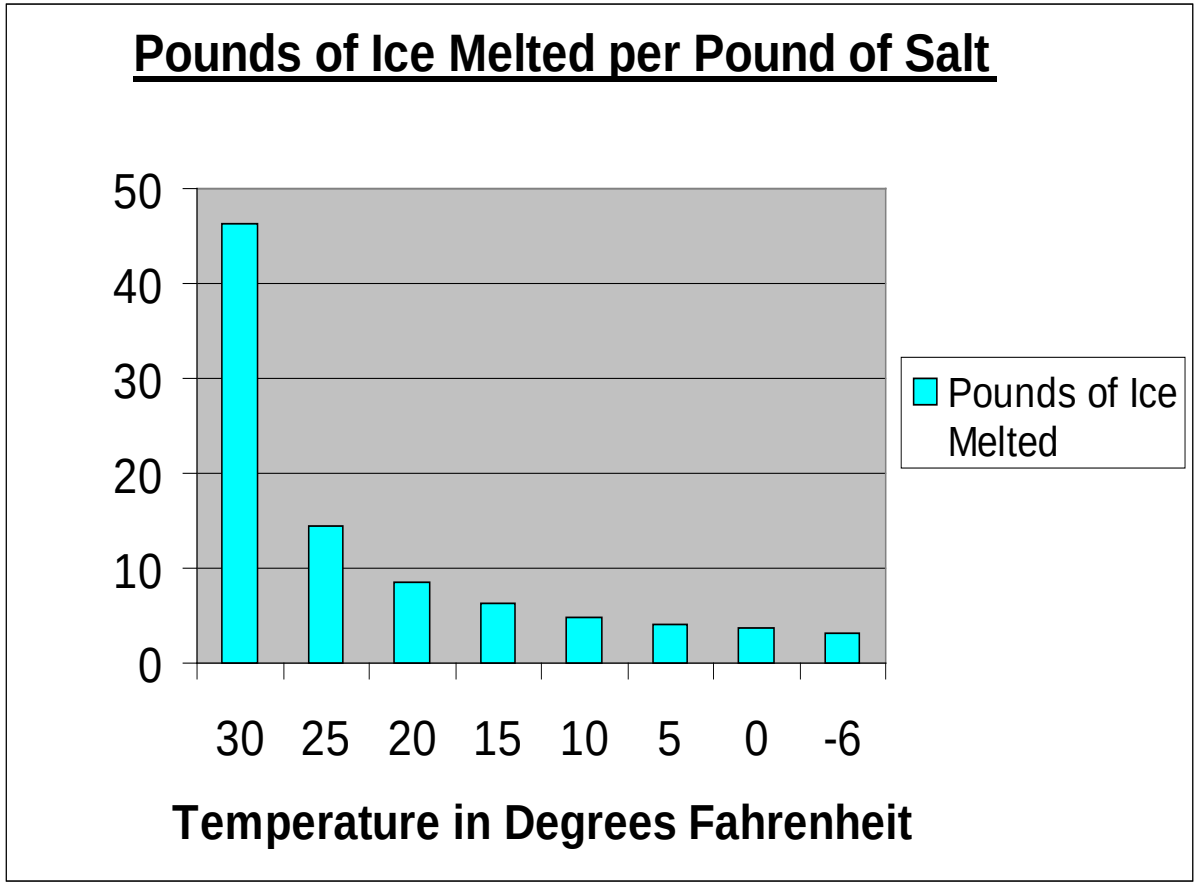
THESE ITEMS MUST BE CHECKED, AND ALL MUST BE O.K. BEFORE OPERATION:	CHECK THESE ITEMS DURING AND AFTER OPERATING VEHICLE OR EQUIPMENT:
____ Engine Oil Level	____ Instruments
____ Radiator and Coolant	____ Brake Operation
____ Battery Level and Condition	____ Clutch Operation; Smoothness; Holding
____ Tire Pressure and Condition	____ Steering Operation
____ Fusees and Flags	____ Engine Smoothness and Power
____ Fire Extinguisher	____ Unusual Noises (Where?)
____ First Aid Kit	____ Air Tanks (Drain)
____ Lights and Turn Signals	____ Tire Condition
____ Mirrors, Reflectors, Windshield and Glass	____ Mirrors, Reflectors, Windshield and Glass
____ Instruments Operating?	____ Fire Extinguishers (Mark "X" if used)
____ Hand and Foot Brakes	____ First Aid Kit (Mark "X" if needs refilling)
____ Transmission Condition (ol, om, fm, tm, dl)	____ Lube System (Mark "X" if low or alarm)
____ Windshield Wipers	____ Windshield Wipers
____ Plow Blades (all)	____ Plow Blades (all)
____ Gates	____ Gates

DEFICIENCIES NOTED _____

De-Icing & Anti-Icing Materials

Materials
Sodium Chloride (Rock Salt)

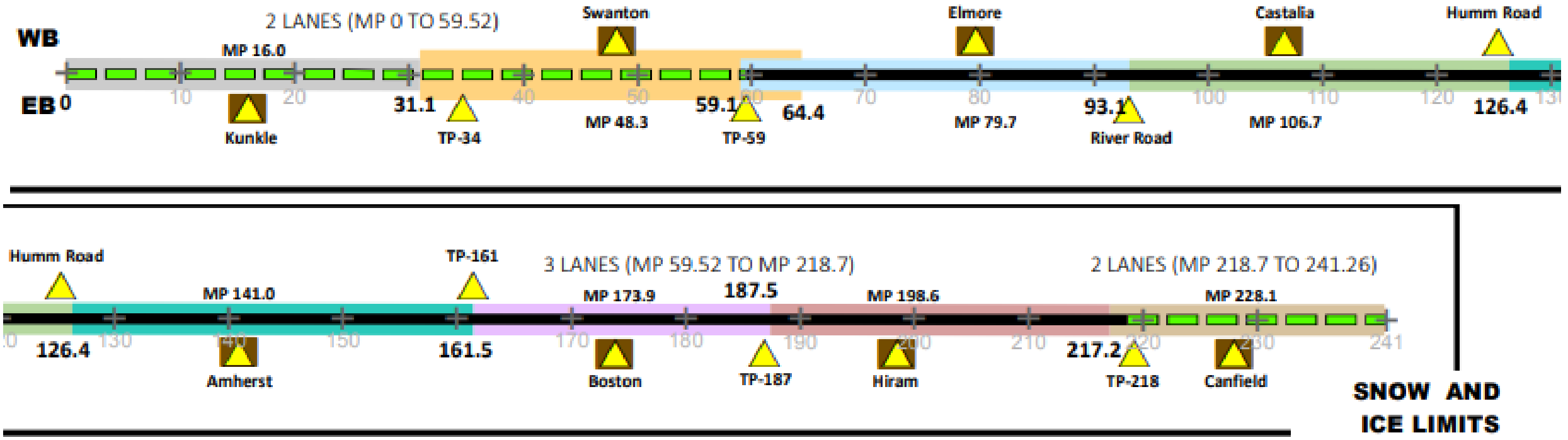
- Why do we use it?
  - Most cost effective
  - Readily available
  - Most effective over 23°F



Materials
Sodium Chloride (Rock Salt)

- Average Annual Usage: 68,000 Tons (10-Year Average)
- Total Storage Capacity: 64,800 Tons
  - 2,800 – 7,200 Ton Dome Capacitities
  - 15 Storage Locations (8 Maintenance Buildings, 7 Satellites)
- Must cover a range of need from 26,000 tons (historical min) to 112,000 tons (historical max) per year
  - Purchased off the ODOT Contract
  - 90% Guaranteed, 110% Maximum
  - We make sure we have enough salt to cover total maximum historic per location + 10%

Materials
Salt Dome Locations



Materials
Rock Salt Stockpiling

- OTIC owned & operated conveying systems
- Four conveying systems currently operated
- System consists of:
  - Mobile power unit
  - Portable loader conveyor
  - Stockpiling conveyor
- Most efficient stockpile shape in dome

Materials
Pre-wet/Anti-Icing Liquids

- OTIC currently uses liquids two ways:
  - Pre-wetting Rock Salt
  - Anti-Icing & Frost Prevention of Bridge Decks & Trouble Areas
- Liquids Used in 2018/2019:
  - AquaSalina+ (Chloride Blend + Brine)
    - Castalia, Amherst, Boston, Hiram, Canfield
  - Beet Heet Severe (Organic Based Carbohydrates + Brine)
    - Kunkle, Swanton, Elmore

Materials
Pre-wet/Anti-icing Liquids

- Average Annual Usage: 142,000 Gallons (5-Year Average)
- Total Storage Capacity: 104,000 Gallons
  - Two 6,500 Gallon Tanks at each location
  - 8 Storage Locations (Only at Maintenance Buildings)
- Usage continues to increase each year

Material Management
Pre-wetting

- Lowers effective melting temperatures of rock salt
- Reduces bounce & scatter, reducing the amount of salt required
- Corrosion Inhibitors

Material Management
Anti-Icing (AKA Pre-treating)

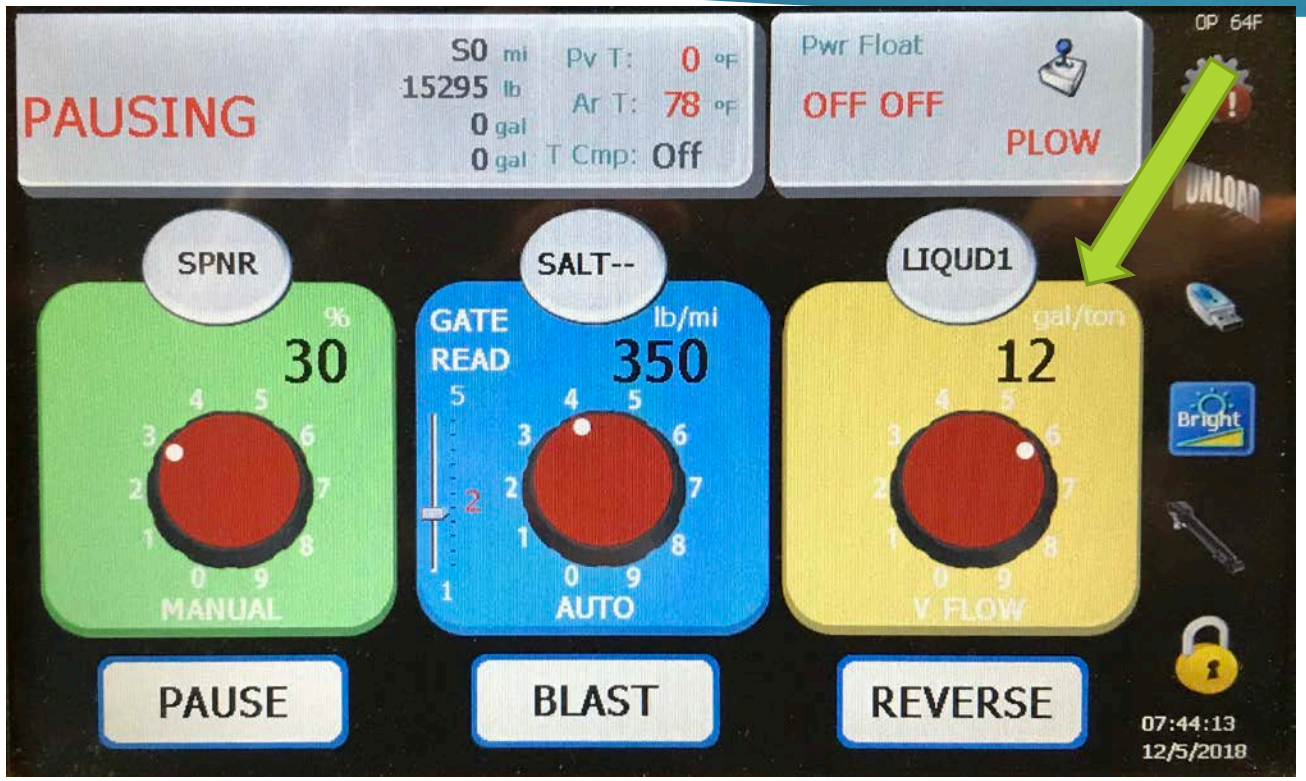
- Helps prevent ice formation
- Remains on the pavement surface longer
- Pretreat bridge decks and trouble areas
- Frost Prevention
- Applied at 30 MPH

Material Management Application Rates

APPLICATION RATES (6% RECOMMENDED PRE-WET RATE AT SPINNER)						
Product	**Percent product (weight)**	**Pounds per ton**	**Gallons per ton***	**Gallons per mile (300lb/mi)**	**Expected pounds (1 min. at 30mph and 300lb/mi)**	**Unit Weights (lbs/gal)**
AquaSalina +	6.1%	121.7	12	1.8	9.13	10.14
Beet Heet Severe	6.2%	123.0	12	1.8	9.23	10.25
			*Salt Brine is recommended at +/- 10 gallons per ton.			

APPLICATION RATE, ANTI-ICING BRIDGE DECKS:		
Product	**Frost Prevention (Gal/mi)**	**Anti-Icing (Gal/mi)**
Beet Heet Severe	15	20-25
AquaSalina +	15	20-30

Material Management
Pre-Wet Control Settings



- Make sure Control Head is set to 12 Gallons/Ton

Liquid Management
Difference Between Anti-Icing & Deicing

Anti-Icing

- Placed before freezing precipitation occurs
- Prevent the bond between frozen precipitation and pavement
- Secondary function is to melt snow and ice
- Proactive
- Typically liquid

Deicing

- Placed after freezing precipitation occurs
- Remove bond between frozen precipitation and pavement
- Primary function is to melt snow and ice
- Reactive
- Typically dry or pre-wetted solids

Liquid Management
Anti-Icing Role

- Another tool to use in Snow and Ice Operations to meet our LOS goals
- Part of total storm management:
  - Anti-ice early, even days ahead of storm
  - Managed transition – keep ahead of the snow by following the anti-icing operation up with de-icing operations (plow/spread)
  - Modified standard operations – See supplemental Field Directive R-1a for Anti-Icing and Frost Prevention operations and guidance
- For frost prevention, we can get by with anti-icing alone
- For snow & ice prevention, anti-icing is meant to be followed up by plowing and spreading if necessary

Liquid Management
Anti-Icing Implementation

The Division Superintendent shall inspect the roadway and review weather reports in the Division prior to initiating anti-icing operations.

- The following factors shall be reviewed with the Section Foremen to determine if anti-icing operations are appropriate:
  - Forecasted Air Temperature
  - Forecasted Pavement Temperature
  - Time of Day
  - Forecasted Wind Speeds
  - Forecasted Precipitation type and amounts

Liquid Management
When Can We Apply Anti-Icing?

Application shall always be done on a bare pavement surface.

Prior to bridge icing/frosting? **YES**

Highly effective method.

Prior to snowfall? **YES**

Inhibits snow/ice bonding to pavement.

As it is beginning to snow? **YES/MAYBE**

Timing and route coverage becomes the issue.

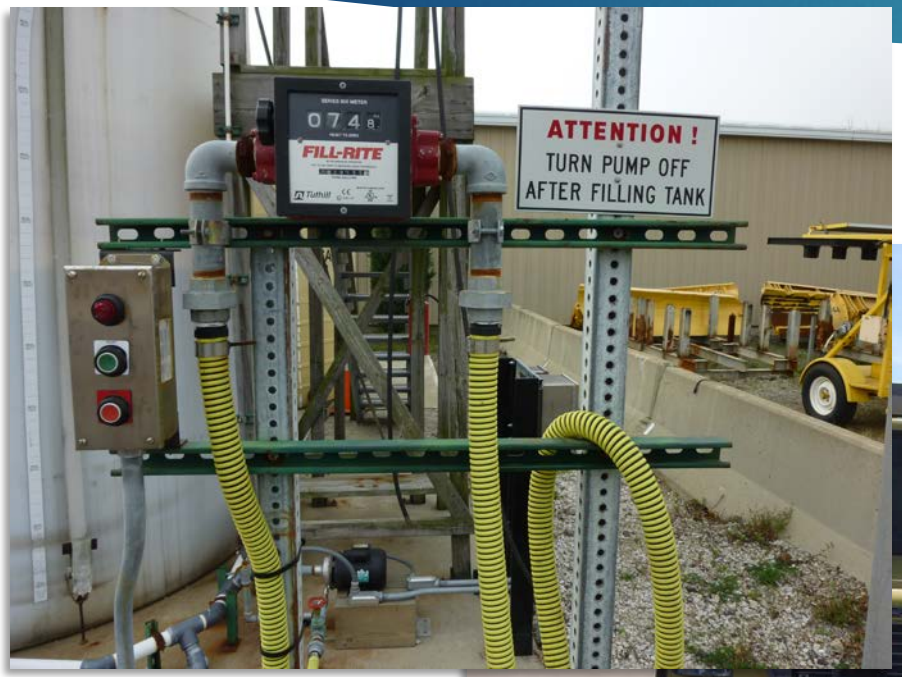
After accumulation has began? **NO**

Accumulation dilutes the product and take away the effectiveness. Also may dilute before it reaches the road surface to break the bond.

After a hard pack has formed? **NO**

Moisture content is very high which leads to excessive dilution rapidly. Dangerous to traffic as due to “skating effect.”

Material Management
Liquid Operation



Material Management
Liquid Operation

Material Management
Truck Material Capacities

Equipment	Salt Load (Tons)	Liquid Load (Gallons)
20 Series Freightliner	7	100
30 Series Sterling	9	120
30 Series Peterbilt	9	150
30 Series 2013, 2015 Western Star	7	150
30 Series 2018 Western Star	8	150
40 Series Western Star	12	200
Tow Plow	9	200

Material Application Guidelines for Various Storm Conditions

Conditions			Light to Medium Snowfall	Medium to Heavy Snowfall	Freezing Rain
Pavement Temp and Drift	Pavement Surface Condition	Recommended Control Application	Pre-wet Salt (#'s/lane mile)	Pre-wet Salt (#'s/lane mile)	Pre-wet Salt (#'s/lane mile)
>32°F Not expected to fall below 32°F	Dry	None			
	Wet	None/Apply Salt			200
	Slush	Plow and Apply Salt	100	100	200-400
>32°F Expected to fall below 32°F	Dry	Anti-Ice per Field Directive prior to frosting or storm event			
	Wet	Apply Salt[2]	100	100	200-400
	Slush	Plow and Apply Salt	200	200	200-400
24°F to 32°F	Dry	Anti-Ice per Field Directive prior to frosting or storm event			
	Wet	Apply Salt[2]	100	100	200-400
	Slush	Plow and Apply Salt	200	200	200-400
15°F to 24°F	Dry	Anti-Ice per Field Directive prior to frosting or storm event			
	Wet	Apply Salt[2]	100-200	300-400	
	Slush	Plow and Apply Salt	200	400	
Less than 15°F	Dry	Anti-Ice per Field Directive prior to frosting or storm event			
	Wet	Apply Salt[2]	100-200	300-400	
	Slush	Plow and Apply Salt	200	400	

Treatment Recommendations

Notes:

1. When storm ceases, maintain patrol until assured that pavement is clear and wet on wet.
2. As necessary to prevent refreezing.

Material Management
Inventory Control

- Salt Received – Delivery Receipt Logs & truck tickets
- Salt Used – Vehicle and Equipment Operation Record/Storm Reports
  - Only as accurate as the reports provided by snowfighters to supervisors
  - Accurate logs of materials used must be maintained
    - Use Control Head to pull quantities of salt and liquids used
    - Record number of loads from each location for inventory
- Quantities are reconciled at the end of the season by comparing inventory system to calculated volume of salt in the dome

Material Management Inventory Control

6-205-11

Sheet ____ of ____

OHIO TURNPIKE COMMISSION

Del. Req. No. _____

SNOW AND ICE CHEMICALS- DELIVERY RECEIPT LOG

Material _____ Location _____ Company _____

	Scale Ticket Number	OTC Vehicle Class	Gross Weight	Net Weight	Trailer License No.	Date	Time	Material Condition	Employee Receiving Material *
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									

*** OTC employee shall stamp toll ticket "AUT" and initial indicating completed delivery.**

- Class 3- High 3-axle vehicles
- Class 4- High 4-axle vehicles.
- Class 5- High 5-axle vehicles
- Class 6- High 6-axle vehicles

- Maximum gross weight is 90,000 lbs.
- Single axles (axles spaced 8 ft. and over)- 21,000 lbs.
- Tandem axles (spaced 4 ft. or less)- 24,000 lbs. for the tandem (12,000 per axle)
- Tandem axles (spaced over 4 ft. but less than 8 ft.)- 34,000 lbs. for the tandem (17,000 per axle)

Received on GRN no. _____

Clerk _____
Signature

Foreman _____
(File with GRN)

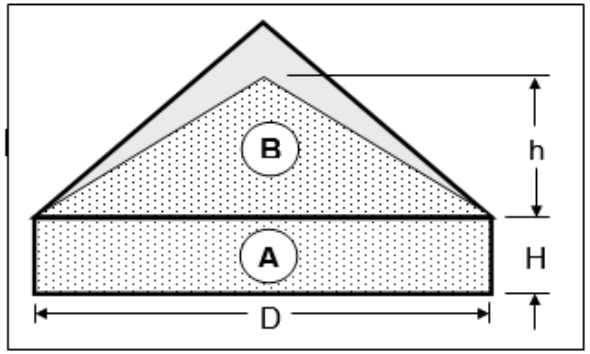
6-119-15

OHIO TURNPIKE

SALT DOME INVENTORY RECORD SHEET

Location of stockpile: _____ Division: _____

Computed weight of rock salt in tons: _____ Section: _____



Computations:

1. Make all computations on backside of this sheet so complete figures are available for checking.
2. Use the figures below for stockpile dimensions.

A **Volume of Concrete Ring = $0.785 \times D^2 \times H$**

D = _____, H = _____ Volume A = _____

B **Volume of Dome Area = $0.2618 \times D^2 \times h$**

D = _____, h = _____ Volume B = _____

Volume (C.Y.) or Weight (Tons) of Salt in Dome = $\frac{A + B}{27}$ - Standard Deduction = _____

Location	(D) Dome Diameter (feet)	(H) Wall Height (feet)	(h) Max. Height (feet)	Max. Capacity (tons)	*Standard Deduction (tons)
KUNKLE	100	4	31.2	4200	70
SWANTON	100	4	31.2	4200	70
TOLL PLAZA 59	82	6	25.6	2800	80
ELMORE	116	6	36.2	7100	115
RIVER ROAD	82	6	25.6	2800	80
CASTALIA M.B.	100	6	31.2	4700	100
HUMM ROAD	82	6	25.6	2800	80
AMHERST M.B.	116	6	36.2	7100	115
TOLL PLAZA 161	82	6	25.6	2800	80
BOSTON M.B.	116	6	36.2	7100	115
TOLL PLAZA 187	82	6	25.6	2800	80
HIRAM M.B.	116	8	36.2	7800	180
TOLL PLAZA 218	82	6	25.6	2800	80
CANFIELD M.B.	100	8	31.2	5500	100

Material Management Inventory Control

6-007-14

OHIO TURNPIKE AND INFRASTRUCTURE COMMISSION
VEHICLE AND EQUIPMENT OPERATION RECORD

MATERIALS USED / HAULED - Track all materials used such as stone, asphalt, salt, calcium, etc.
Also note materials used to service vehicle such as fuel, oil, etc.

LOAD TYPE	MATERIAL / LOCATION	QUANTITY (INCLUDE UNITS)	JOB / PROJECT / WHERE USED
GASOLINE		(gallons)	_____
DIESEL		(gallons)	_____
OIL		(quarts)	_____
OTHER			_____

EQUIPMENT MILES: START _____ END _____ TOTAL _____

EQUIPMENT HOURS: START _____ END _____ TOTAL _____

OTIC Form 6-8-16

OHIO TURNPIKE STORM REPORT

General Information: Date and Time — Report ID:
Storm Started: Date:
Storm Ended: Hrs. Maint Division:
Pavement Completely Cleared: Hrs. Maint Section:
Storm Location From (MP): To (MP): Sections having similar condition West☐ East☐
Precipitation: Other:
Max. Temp. deg. Min.Temp deg. Avg. Snow Depth (in.): Drifts (ft.):
Wind Dir. Wind Vel. (MPH Gust (MPH) Visibility Visibility (ft.

Forecast Source 1 Date and Time — **Forecast Source 2** Date and Time
Precipitation: Other:
Max. Temp. deg. Min.Temp deg. Avg. Snow Depth (in.): Drifts (ft.):
Wind Dir. Wind Velocity (MPH) Gusts (MPH):

Response: Date and Time — Date and Time — Results
Chemical☐ From: To: = Hrs.
Plowing☐ From: To: = Hrs.

Labor:

	Men	Regular Hours	+ Overtime Hours	= Total Hours
A-Crew:				
B-Crew:				
Other:				
Total Men/Hrs:				

Equipment

	Trucks	Miles Patrol	+ Spread/Plow	= Total
Medium:				
M-Hvy:				
Heavy:				
Tow Plow:				
Total Trucks/Miles:				

Salt Usage: MB Tons — Alternate Source-1: Tons — Alternate Source-2: Tons — Total Tons

Pre-Wet Salt (Gal.): MgCl- M1000: CaCl: Organic (Beet Heet): AquaSalina+:

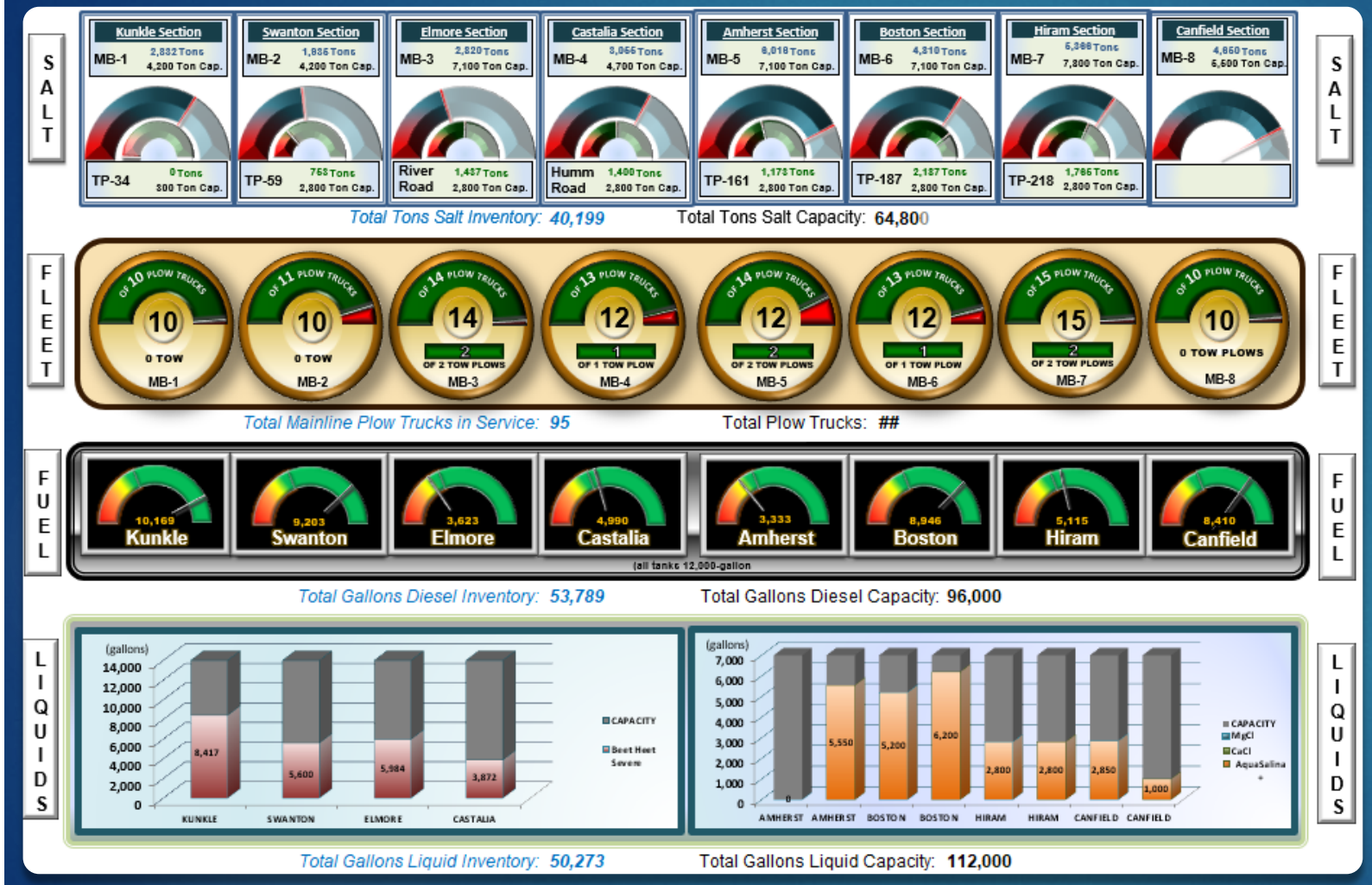
Pre-Treat Pavement: Gallons

MgCl- M1000:	From (MP):	To (MP):	at	gallons/lane mile	Bridges Only: ☐
Organic (Beet Heet):	From (MP):	To (MP):	at	gallons/lane mile	Bridges Only: ☐
AquaSalina+:	From (MP):	To (MP):	at	gallons/lane mile	Bridges Only: ☐

Remarks

Submitted By: Reviewed By:

Operations Dashboard



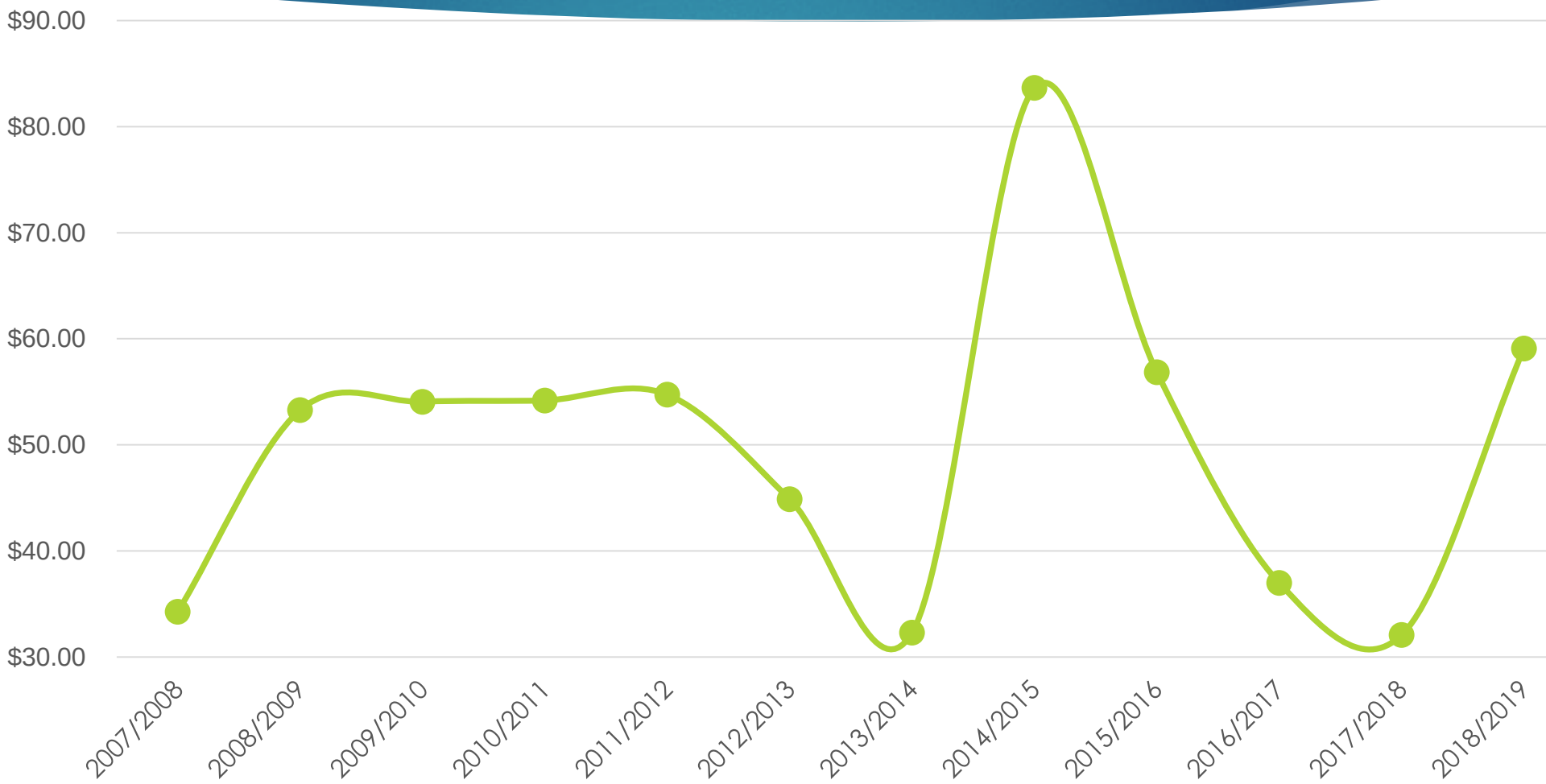
Material Management
Storm Reporting

- Why do we use Storm Reports?
  - Accurate tracking of material usage (salt & liquids)
  - Efficiency – Labor Management & Material Management
  - Evaluation – Are we meeting our LOS goals? How can we improve?
- Process:
  - Snowfighters record information on Vehicle & Equipment Operation Record Forms
    - Use Control Head for quantities of material used (salt & liquids)
  - Assistant Foreman compiles forms, and produces an individual storm report
  - Foreman compiles and confirms the individual storm reports into one entry in the database

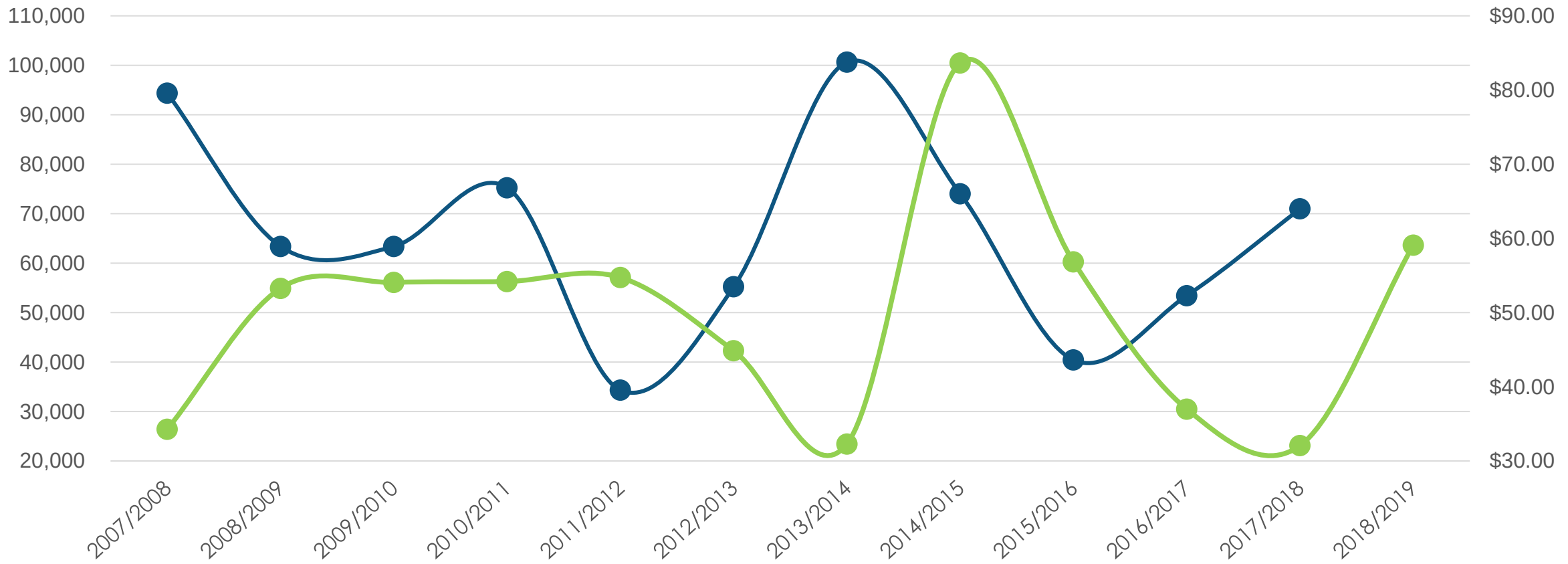
Material Management
2018/2019 Salt Pricing Increase

	(tons)	Unit Prices (material & freight)		Extended Costs	
	2018	2017	2018	2017	2018
Facility	Est. Qty.	Award	Actual	Award	Actual
Kunkle	2,800	$40.56	$58.94	$113,568	$165,032
TP 34*	0	$36.34	$71.04	$0	$0
Swanton	1,900	$36.34	$71.04	$69,046	$134,976
TP 59	400	$33.86	$48.96	$13,544	$19,584
Elmore	3,300	$31.27	$52.74	$103,191	$174,042
River Rd.	800	$31.23	$51.05	$24,984	$40,840
Castalia	4,400	$36.59	$59.61	$160,996	$262,284
Humm Rd.	2,800	$36.59	$59.61	$102,452	$166,908
Amherst	8,300	$30.55	$71.64	$253,565	$594,612
TP 161	4,600	$29.12	$64.76	$133,952	$297,896
Boston	8,600	$30.29	$55.83	$260,494	$480,138
TP 187	2,900	$30.44	$52.85	$88,276	$153,265
Hiram	4,900	$30.44	$52.85	$149,156	$258,965
TP 218	3,900	$31.56	$52.65	$123,084	$205,335
Canfield	3,500	$31.56	$52.65	$110,460	$184,275
Total:	*53,100*			***$1,706,768***	***$3,138,152***
			Total cost @ 110% 2018 estimated quantity:		**$3,451,967.20**
				Total:	**$3,451,967.20**
				Price Increase	**83.9%**

Material Management
Salt Historical Pricing



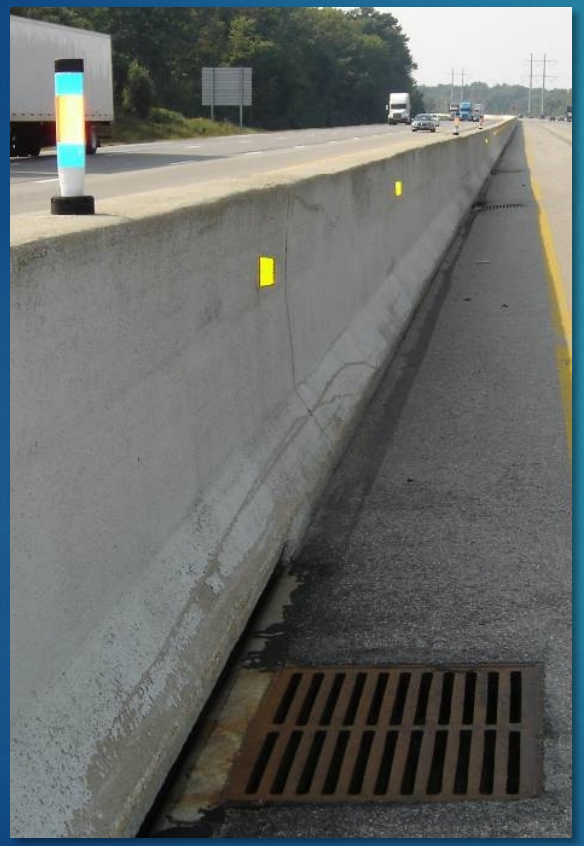
Material Management
Salt Historical Usage vs. Pricing



Post Storm Cleanup
Clearing Wall Drains

- Utilize plows/loaders/hand shovels
- 2 or more drains located within 100’
  - Clear all areas between drains
- Drains near bridge decks
  - 20’ on trailing ends, all the way to the deck on leading ends
- Drains with windows only (no grates)
  - Clear 20’ on each side

Post Storm Cleanup Clearing Wall Drains



Blocked Drain

Blocked Drain

Cleaned Drain

Cleaned Drain

Questions/Open Discussion