Annual Winter Maintenance Report

FY 2013

A glance at the past!

A look towards the future!

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INTRODUCTION

INDOT Winter Operations

Safety is Indiana's number one priority and as an agency it is also INDOT's number one priority. Keeping the traveling public safe on Indiana's 30,584 lane miles of state highways must be the first priority and goal of INDOT's snow and ice removal operations. However, to be successful you must couple this with strategies that offer the most cost effective decisions and practices.

INDOT monitors the effectiveness of its fleet of 1037 snowplows and 1,832 snowplow drivers through performance targets that are based on public safety, agency levels of service, operational costs, and weather hours. Ongoing studies continue searching for the best methods of tracking and monitoring our performance using various methods.

Training and technology help snowplow operators stay safe and assist them in making the right decisions in selecting and applying winter maintenance chemicals to increase efficiency and limit environmental impacts. INDOT is committed to exploring and staying current with the new technologies and ideas that enhance our snow and ice removal operations in an effort to reduce our overall operational costs while still yet providing excellent customer service. The agency continues to maintain a partnership with Purdue University and an active in-house maintenance research program that investigates and adopts innovative strategies that continues to improve INDOT's snow and ice removal operations.

Scientist has found there to be more than 66,666 various storm variations. With all the variables that are associated with snow and ice operations performance metrics and targets become very complex. On the following pages you will find dialogue, tables, and graphs that will illustrate the past and current data that is used to compare previous years and search for correlations that offer or suggest consistency with various operational data, weather data, and material usages.

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Infrastructure:

The total number of lane miles each district is responsible for dictates the total number of snow routes that each district has by design. The total number of routes will determine the specific number of drivers and trucks that are needed in each district for winter operations. Below is the current number of CDL drivers that are currently staffed and the number of CDL drivers required for a state wide event if you were to deploy trucks out on every route. The last column indicates the average routes length by design. Efforts are continuously being made to find opportunities and methods that allow an increase in the snow route lengths. Studies and research continue in searching for technologies which result in lower operational costs by reducing the number of trucks and drivers that are needed.

At the present time there are three classifications of routes that are primarily based off of the daily traffic count with considerations given for hospitals and other emergency facilities along each route. Each classification has different levels of service. A class 1 route is given to those routes that exceed 10,000 cars per day. Those routes are serviced every 2 hours. A class 2 route is given to those routes that have 5,000 to 10,000 cars per day. Those routes are serviced every 2 ½ hours. A class 3 route is given to those routes that have less than 5,000 cars per day. Those routes are serviced every 3 hours.

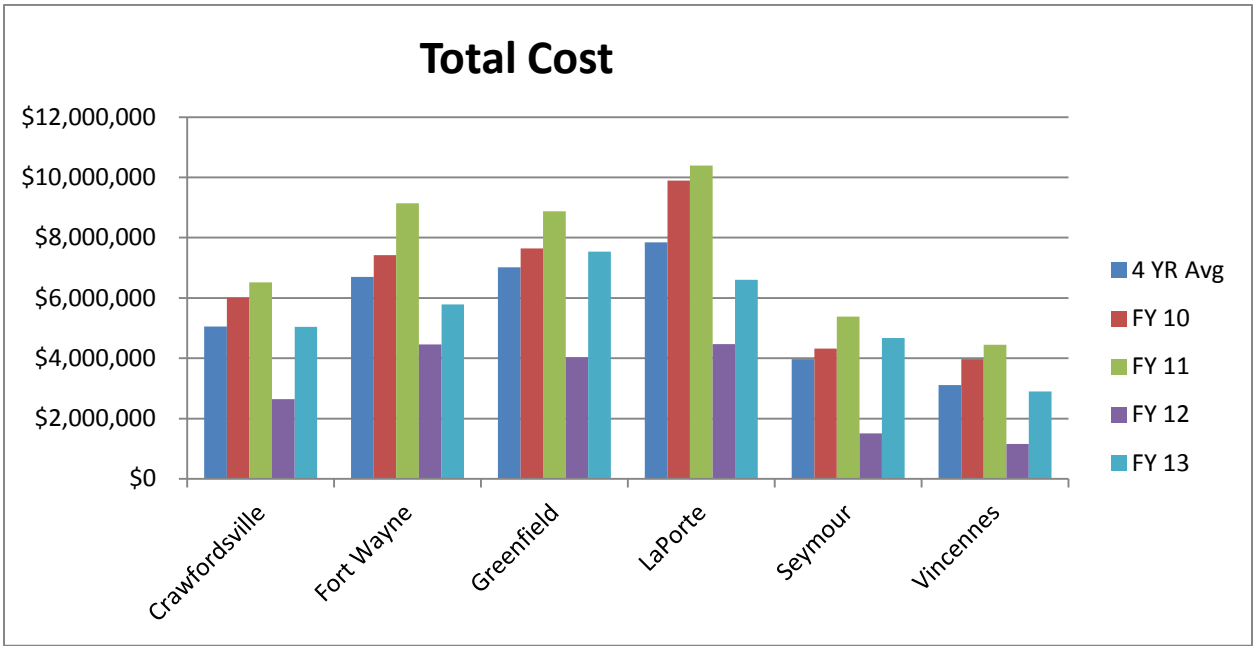
Studies and evaluations are ongoing across the country that introduces new innovative ideas and best practices that offer lower operational costs. INDOT continues as a participant and as a leader in many of these strategies and studies. The route optimization that was done by INDOT is one example of these strategies. Another is the use of brine as a deicer during winter operations that was initiated by the LaPorte District is an example of a material and best practice strategy. Also the use of the tow plow that we use in the Fort Wayne District is an example of an equipment strategy that has been in the evaluation process.

Infrastructure

DISTRICT	LANE MILES	ROUTES	DRIVERS	REQUIRED	LENGTH
Crawfordsville	5061	145	264	290	34.9
Fort Wayne	4978	144	285	288	34.6
Greenfield	5424	181	355	362	30.0
LaPorte	5261	171	326	342	30.8
Seymour	4907	146	286	292	33.6
Vincennes	4953	147	299	294	33.7
Total	**30,584**	**934**	**1,832**	**1,872**	**32.7**

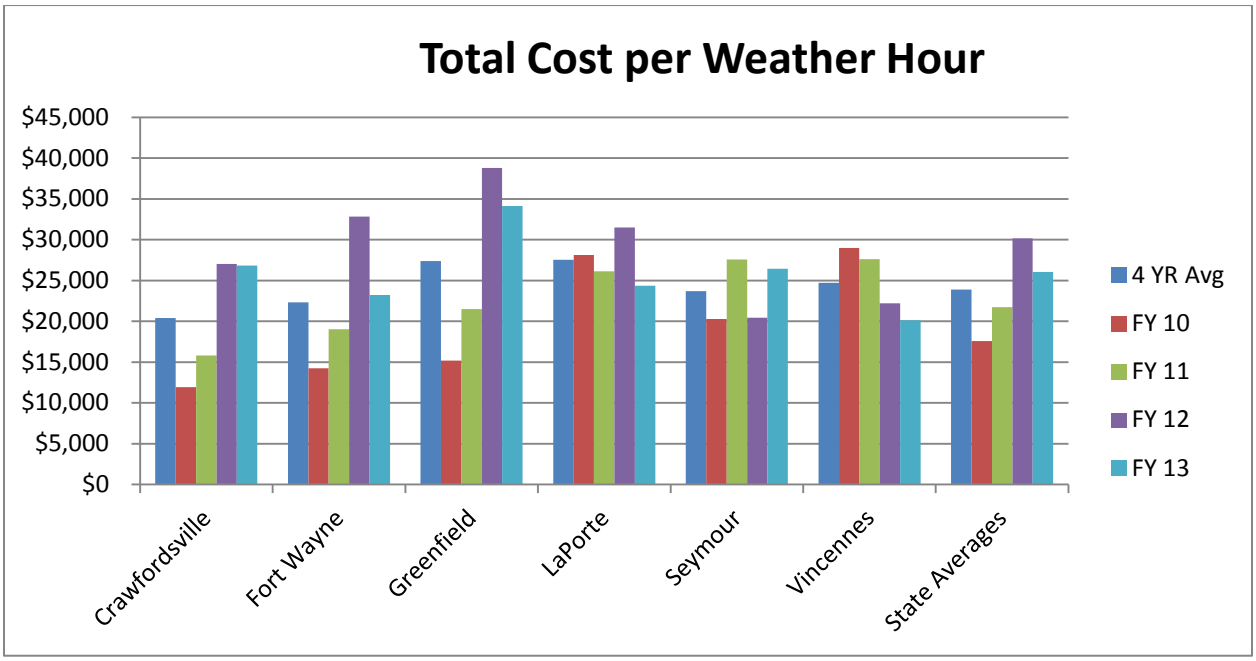
Total Costs

This graph displays the total costs per district for a four year period.



Graph # 2 Total Cost per Weather Hour

This graph displays the total costs per weather hour per district.

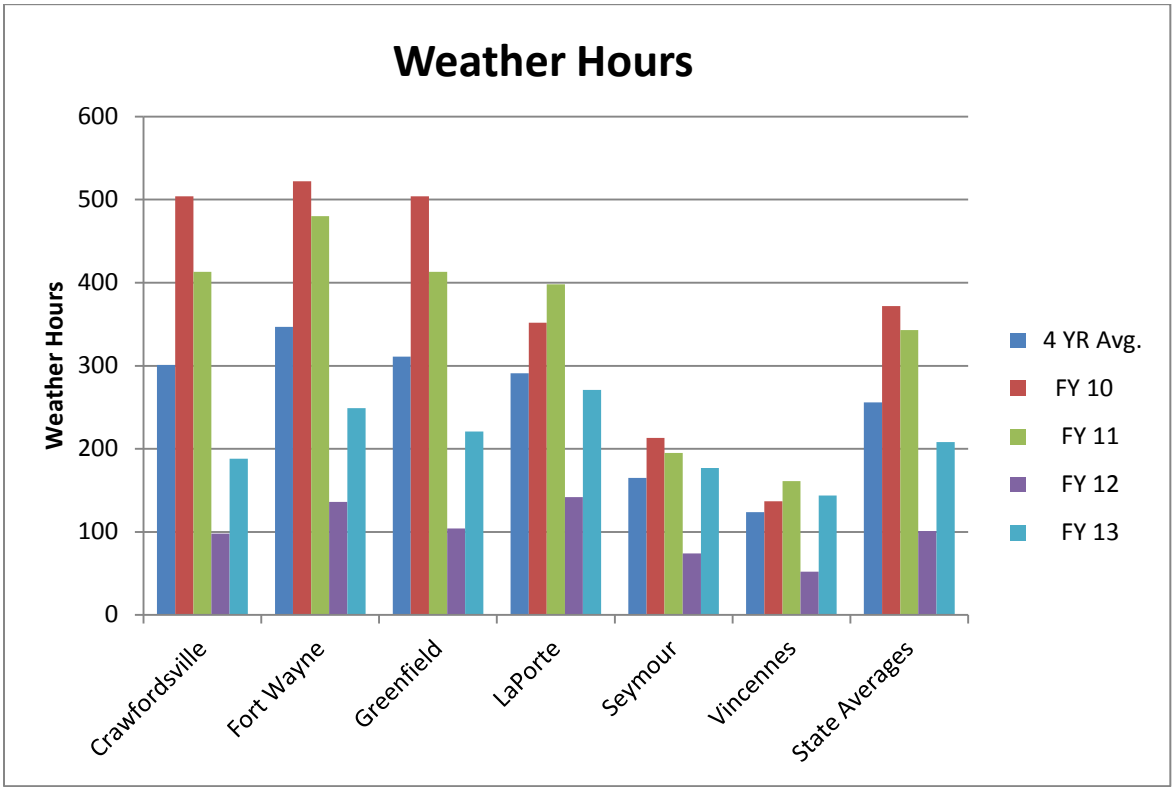


Weather Hours:

In this graph you will find the number of weather hours that were observed at preselected National Weather Service locations. These numbers are used as a measurement to determine a season's winter severity and to set performance targets and goals. However, with all the variables weather hours do not cover all the variables associated with winter operations such as blowing snow or extreme cold conditions for several consecutive days. Chemicals do not respond well in colder temperature ranges nor do they do much good on the pavement when you have drifting issues.

The graph below has the four year average and a comparison of the state averages.

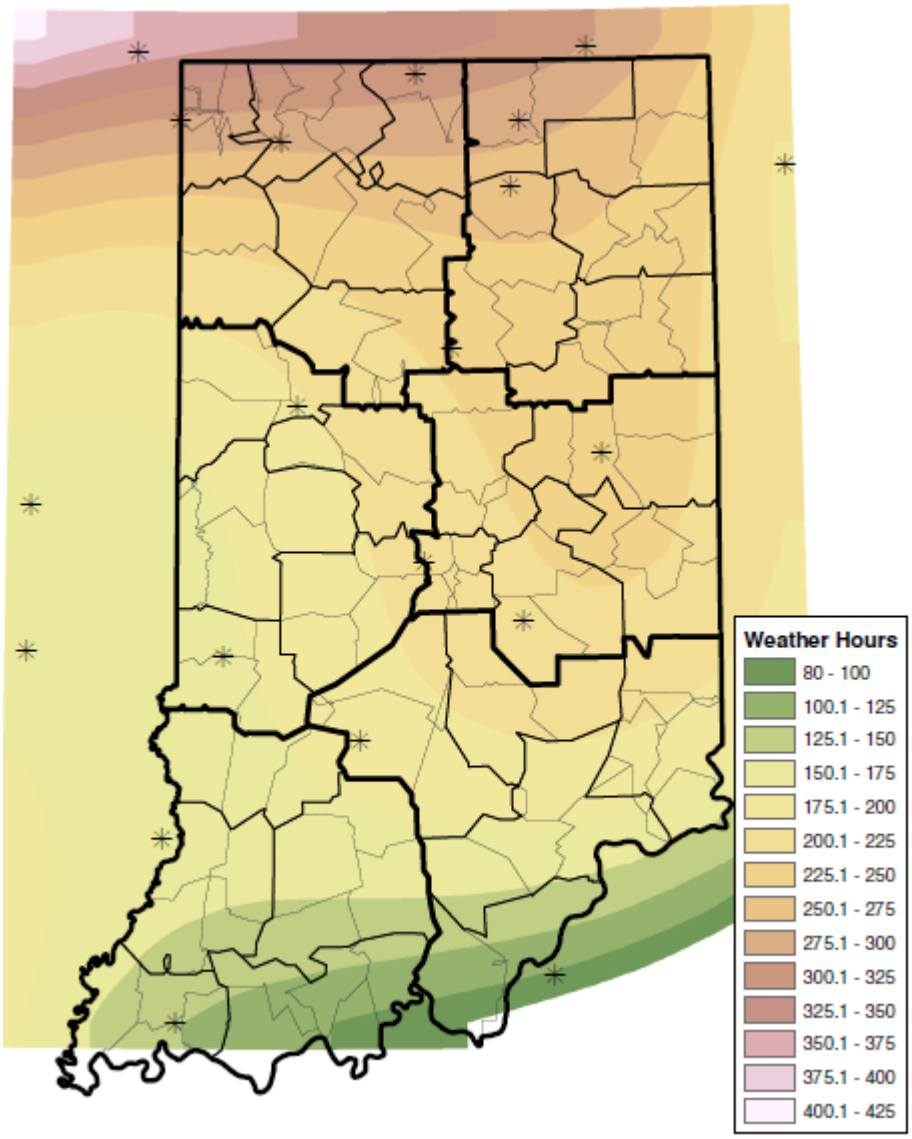
Weather Hours



Weather Hour Map

Weather hours are inserted into a program map which triangulates the weather hours and gives a more specific number to each maintenance location across the state. These numbers are used to set performance standards, operational strategies, and specific operational goals.

FY 13 Weather Hours
11/11/12 to 03/30/13

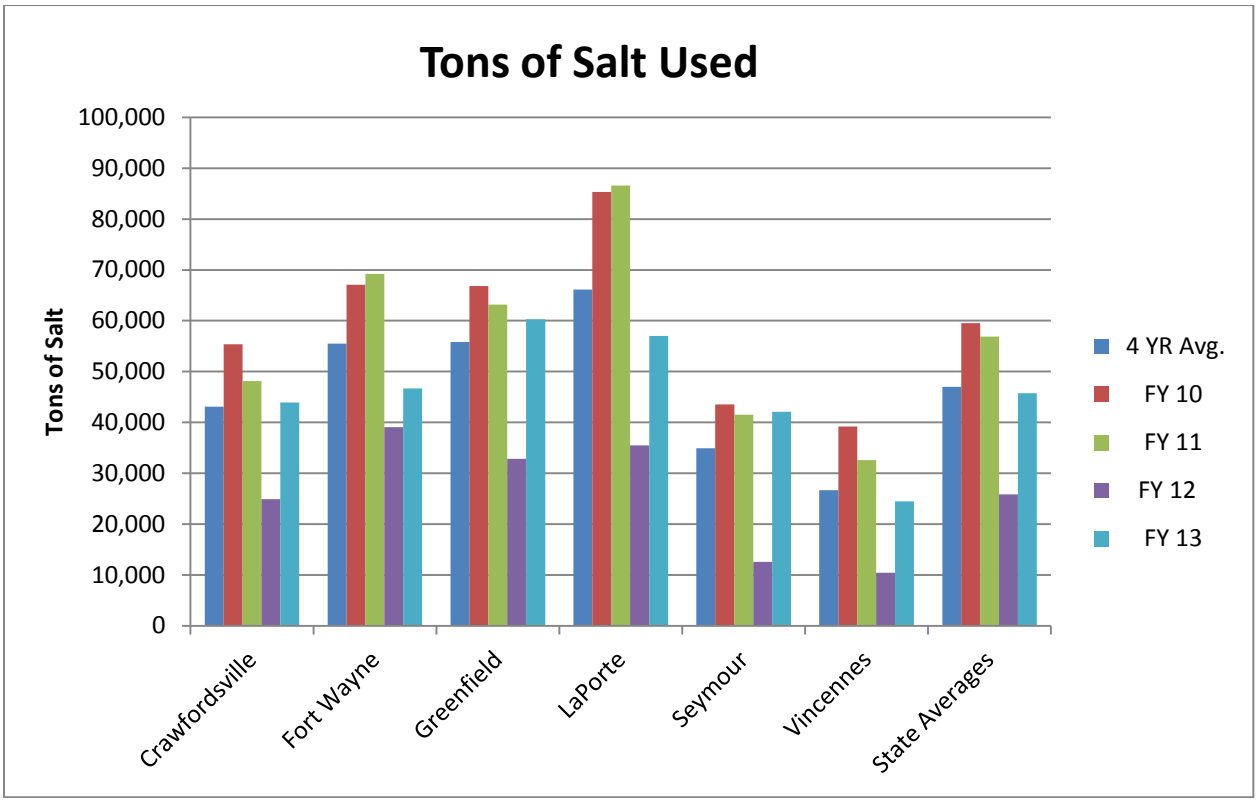


MATERIALS

Tons of Salt Used:

This graph contains the four year average salt usage along with each individual year's district use. Monitoring and tracking salt usage adds value in creating future plans and cost based off of averages. You can also measure and track to see if there is any correlation from year to year in an effort to establish best practices during similar winter weather types and patterns.

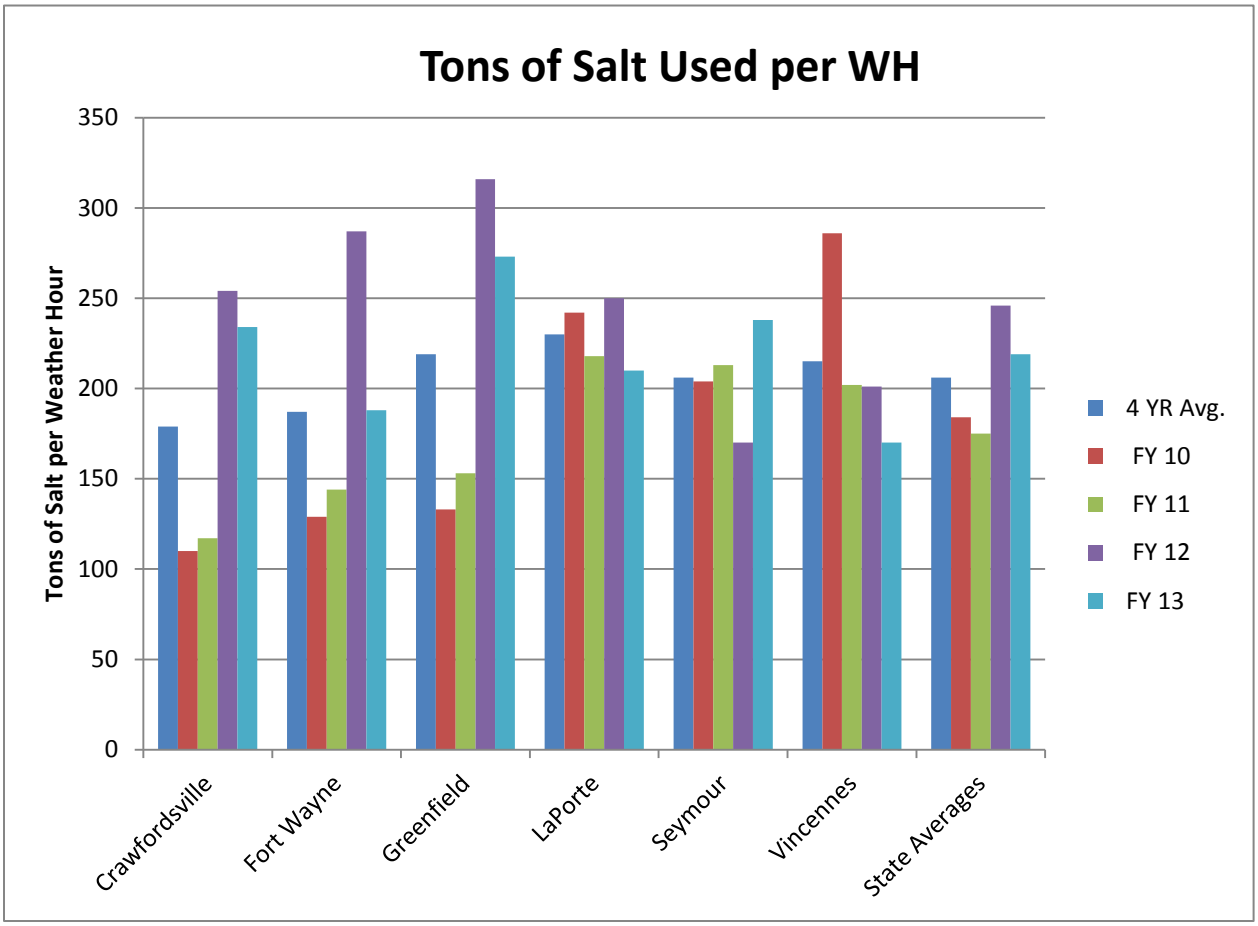
Tons of Salt Used



Tons of Salt Used per Weather Hour

In this graph you will see the four year average salt use per weather hour at each district. This graph does not reference the temperature range, which ultimately dictates the spread rate during winter operations.

Tons of Salt Used per Weather Hour



CAPACITIES

Salt Storage and Capacities:

The table below indicates the amount of salt that is on hand for the next year at the start of the season, the capacity for each district, and the requested QPA amounts for last year and this coming season. To determine each year's QPA amounts the following considerations are taken.

The amount of salt we have on hand, the total storage capacity, the three, five and ten year average usages, the minimum and maximum record use, and the obligation to purchase 80% of the total QPA along with the ability to purchase up to 150% without a price change.

The last two columns indicate the tons suggested and the estimated projected cost for the 2014 Salt QPA based off of the average current 2013 pricing. IDOA is currently negotiating the 2014 salt prices.

Salt Storage and Capacities

DISTRICT	ON HAND	CAPACITY	FY 13 QPA	FY 14 QPA	EST. COST
Crawfordsville	24,377	46,800	34,000	40,500	**$3,187,350.00**
Fort Wayne	36,999	57,700	42,000	50,000	**$3,349,350.00**
Greenfield	15,711	75,120	40,000	62,500	**$4,291,875.00**
LaPorte	36,063	95,200	46,000	62,500	**$3,655,000.00**
Seymour	18,014	55,500	28,000	32,000	**$2,203,200.00**
Vincennes	20,168	50,400	16,000	22,500	**$1,598,850.00**
TOTAL	**151,333**	**380,720**	**206,000**	**270,000**	**$18,285,775.00**

Salt Brine Use, Capacities, and Equipment

The tables that are below look at this year and last year's total salt brine usages. Also an inventory of what equipment is on hand along with the storage capacity in order to successfully plan for liquid usages. Best practices have suggested that you can lower operational costs by properly utilizing salt brine applications. This data will be beneficial in the 2014 Liquid Route Plan.

Salt Brine Use, Capacities, and Equipment

District	FY 12 Use	FY 13 Use	Capacities	Makers	Applicators	Tankers
Crawfordsville	128,500	169,811	65,000	8	12	1
Fort Wayne	17,400	594,190	75,000	4	8	0
Greenfield	428,781	897,591	172,000	11	23	1
Laporte	2,587,800	3,169,057	235,410	10	21	3
Seymour	183,283	363,579	132,000	5	26	2
Vincennes	214,622	138,826	94,000	7	14	1
Totals	**3,511,632**	**5,333,054**	**773,410**	**44**	**104**	**8**

Salt Brine Differences and Uses by Districts

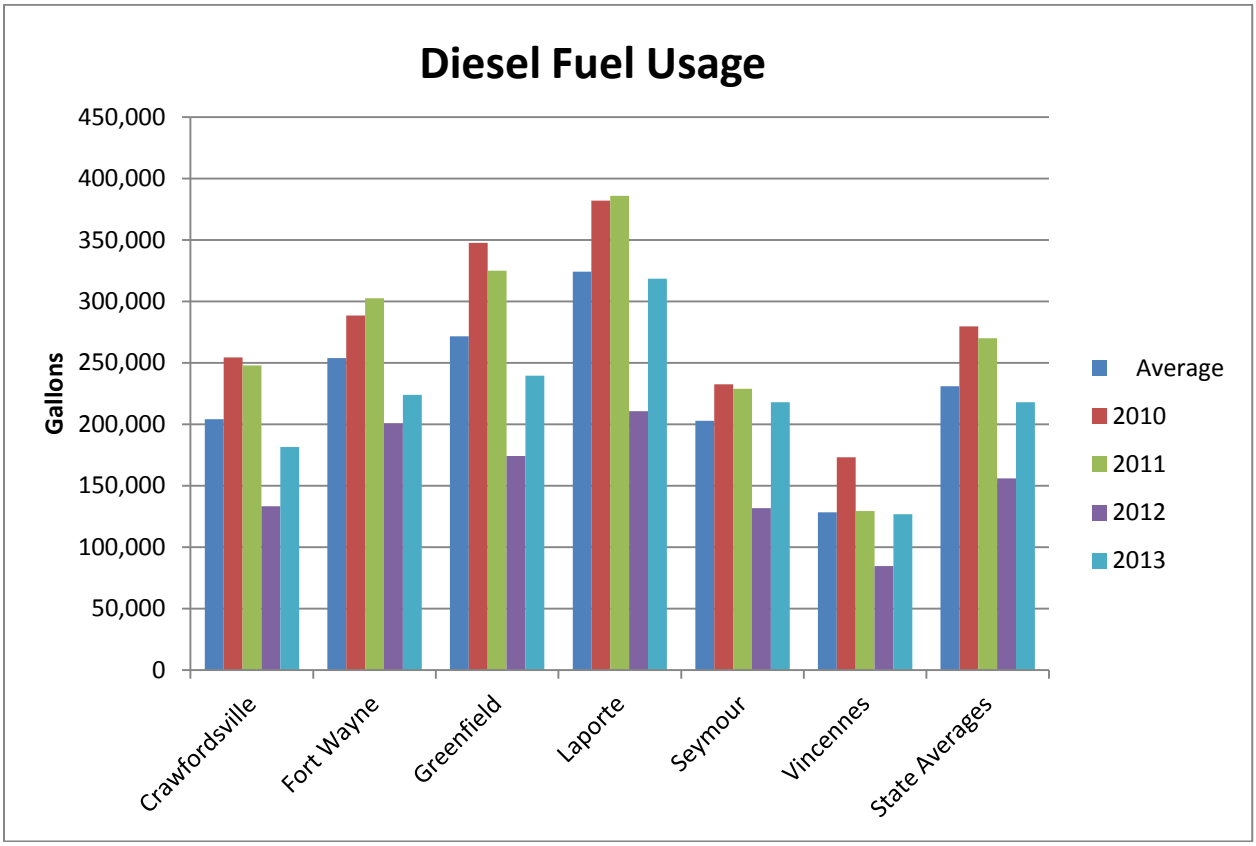
District	FY 12 Use	FY 13 Use	Difference	Anti-Icing	De-Icing
Crawfordsville	128,500	169,811	+41,311	154,266	15,545
Fort Wayne	17,400	594,190	+576,790	238,625	164,865
Greenfield	428,781	897,591	+468,810	478,526	329,065
Laporte	2,587,800	3,169,057	+581,257	792,030	2,377,027
Seymour	183,283	363,579	+180,296	335,393	28,186
Vincennes	214,622	138,826	-75,796	125,031	13,795
Totals	**3,511,632**	**5,333,054**	**+1,821,422**	**2,123,871**	**2,928,483**

Diesel

Diesel Fuel Use

The Graph below shows the diesel fuel usage during the past four years and will give you the four year and state averages. The diesel fuel usage is monitored as a way of gauging our cost during winter operations from year to year. Methods and technologies continue to be studied to see how fuel consumption is impacted by winter severity. Diesel fuel use is also affected by strategies that have increased more road activity maintenance practices during the winter months.

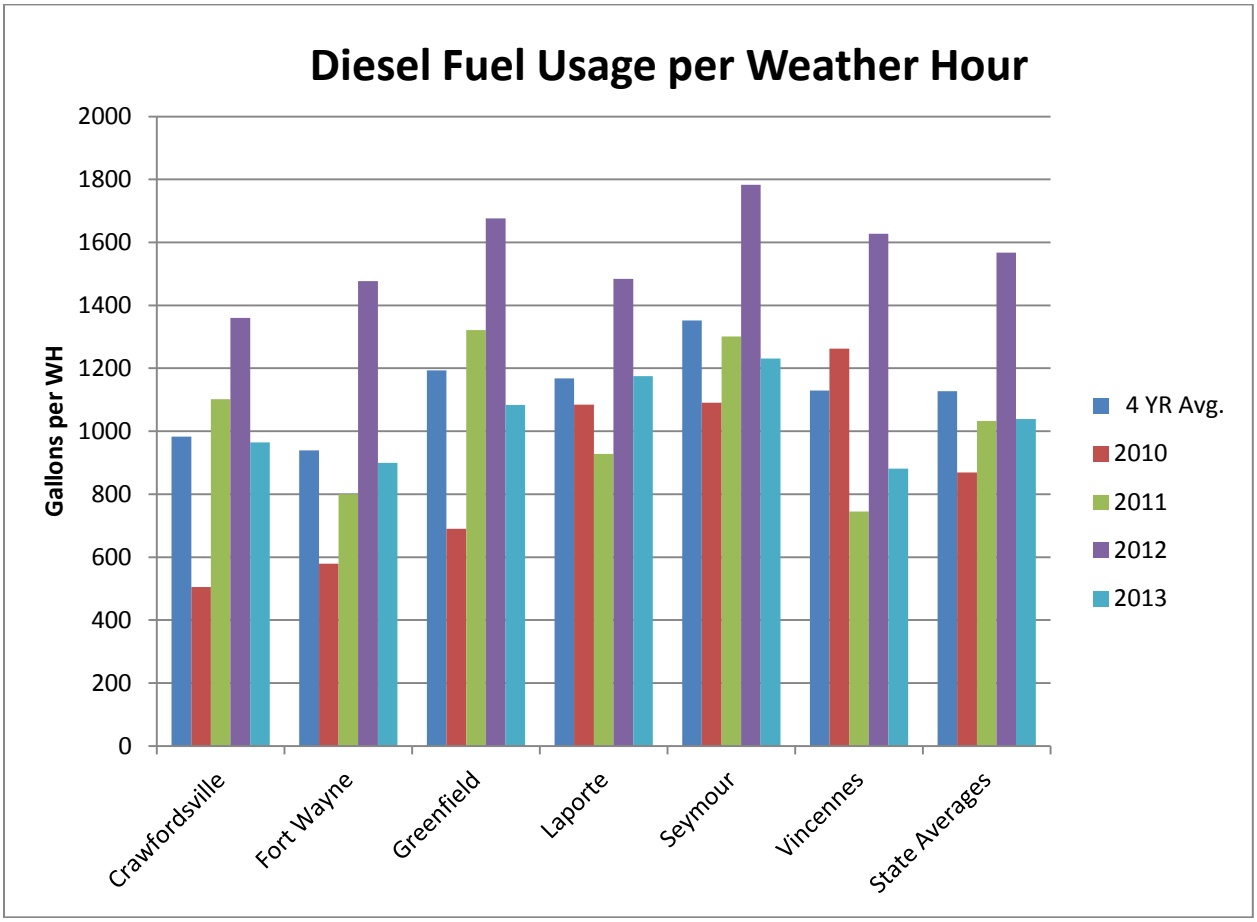
Diesel Fuel Usage



Gallons per Weather Hour per District

In this graph you will see each districts diesel fuel usage per weather hour and the difference over the four year period. The diesel fuel usage is compared to the number of weather hours observed to see if there is consistency in maintenance practices. The winter weather type and frequency of the weather determines the type of winter operations and maintenance practices that can be performed such as crack filling and crack sealing operations.

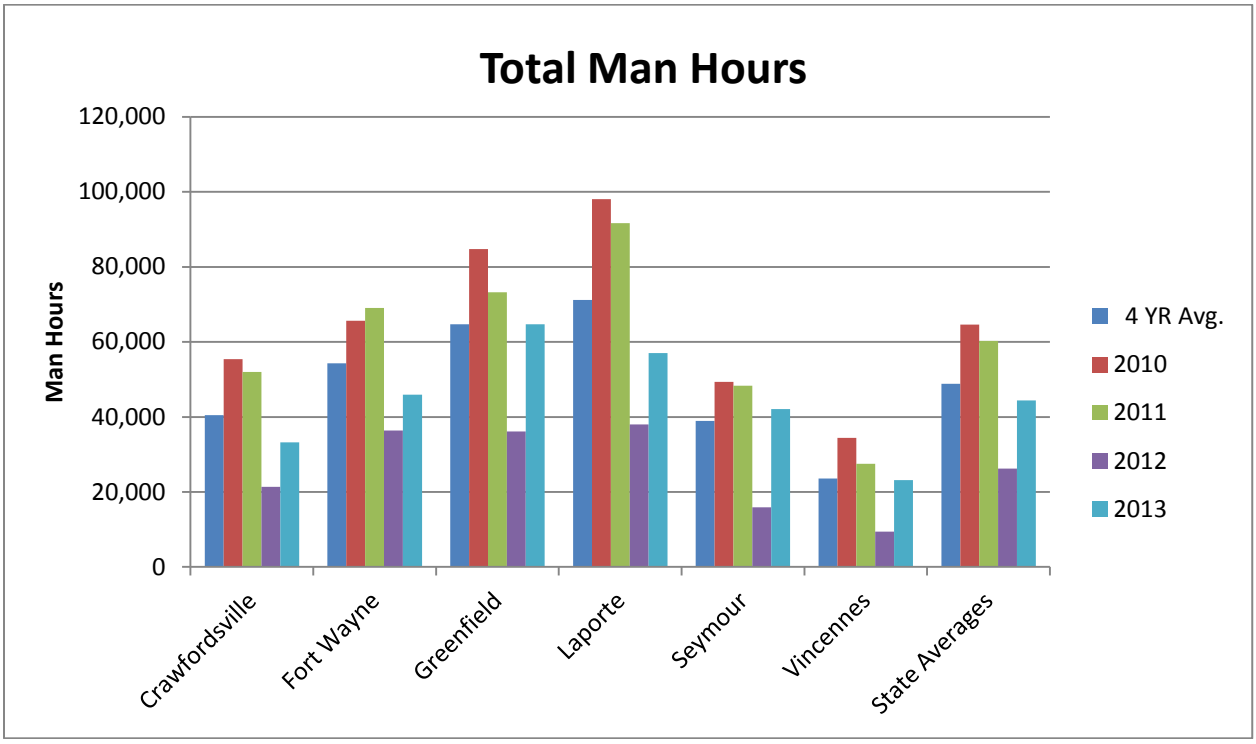
Gallons per Weather Hour per District



LABOR

This graph shows the total man hours that were reported to winter activities over the past four years. Efforts continue to look for ways to gauge time spent to winter operations and to identify consistency that is based off of the winter seasons weather patterns and severity.

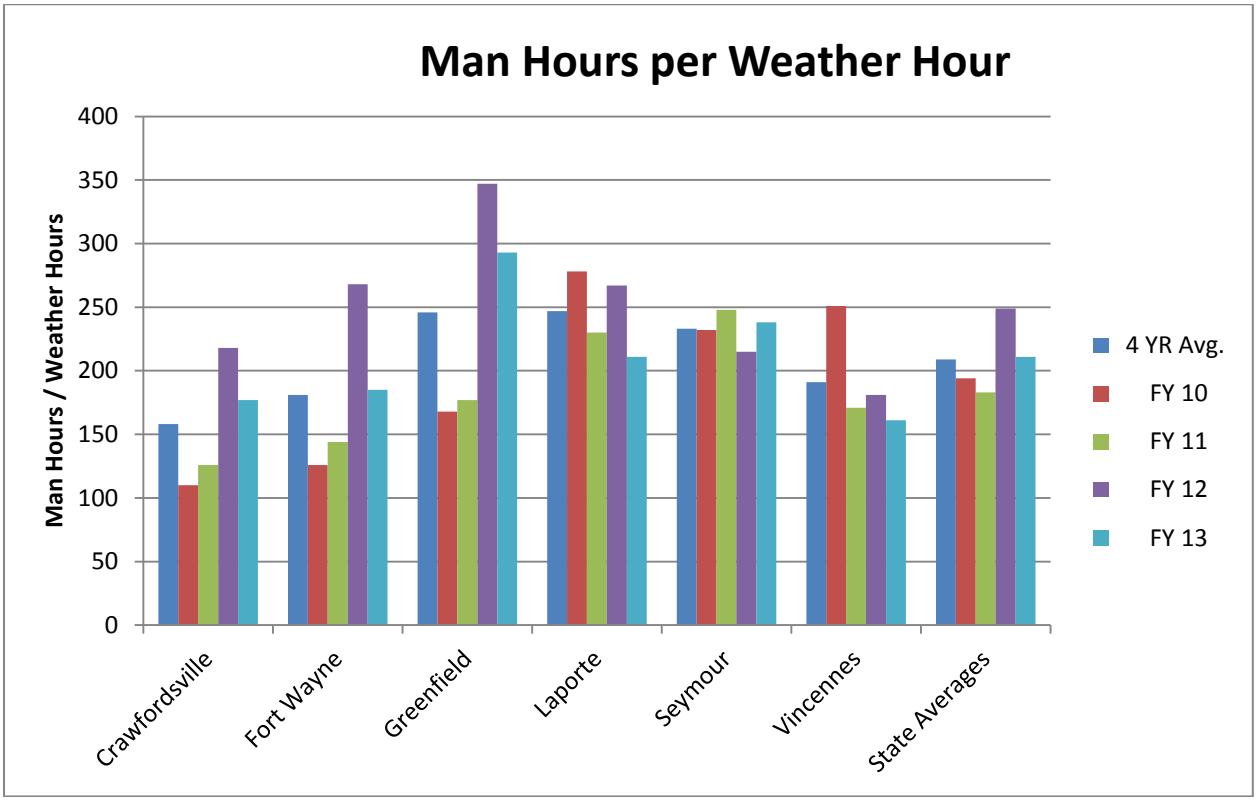
District Man-hours per Fiscal Year



Man Hours per Weather Hour

In this graph you see the total man hours that were reported divide by the total number of weather hours that were officially observed.

Man-hours per Weather hour



Performance Metrics and Goal Cost

Efforts continue to search for methods of measuring performance and a process of setting goals to show accomplishments. The following table illustrates the target cost and actual cost for the past two years.

Performance Metrics

District	CY 12 Goal	CY 12 Actual	CY 13 Goal	CY 13 Actual
Crawfordsville	$5.77	$5.35	$5.57	$5.30
Fort Wayne	$5.73	$6.66	$6.09	$4.66
Greenfield	$6.22	$7.21	$6.40	$6.29
Laporte	$5.00	$5.63	$5.48	$4.63
Seymour	$5.62	$4.18	$5.24	$5.39
Vincennes	$5.70	$4.65	$5.31	$4.06
State Averages	**$5.67**	**$5.61**	**$5.68**	**$5.06**

The formula below uses various parameters to give a weighted average from District to District due to all the variables that are associated with winter operations. For example salt costs alone ranges from $58.48 to $78.70 across the state.

Performance Metric Target Formula

	CY 13 Target Formula (A*30%)+(B*25%)+(C*25%)+(D*20%)					
CY 12 Cost per Weather Hour per Lane Mile ($/Hr-LNM)	(A) CY 11/12 Average ($/Hr-LNM) (30%)	(B) CY11/12 Adjacent Subdistrict Average (25%)	(C) CY11/12 District Average (25%)	(D) CY11/12 State Average (20%)	CY 13 Target	Change from CY 12 Actual

RESEARCH AND INNOVATION

Liquid Routes Study

The Laporte District has shown a decrease in overall salt use by increasing the use of salt brine not only as an anti-icing agent but as a deicer. This practice suggested the potential for lowering our overall snow and ice removal cost without compromising our level of customer service. A study began two years ago as a Joint Transportation Research Project. With the aid of Dr. Bob McCullouch and through various forms of data collection we have continued to research the use of salt brine as a deicer and not just for pre-treat as an anti-icier. The table below represents the cost of the study group routes that were used. In each district a control dry material route was established along with the liquid material route to use as a comparison.

Table 1 – Study Routes Summary Table

	Liquid Routes (22 routes)			Control Routes (18 routes)		
	Salt Used	Total Cost	$/SM	Salt Used	Total Cost	$/SM
Crawfordsville	620.8	$68,933	$9.39	622.9	$56,344	$9.62
Fort Wayne	946.6	$146,381	$7.39	962.2	$109,179	$10.84
Greenfield	833.1	$102,975	$9.36	493.6	$62,653	$11.02*
LaPorte	1694.81	$213,021	$6.88	2061	$174,180	$7.46
Seymour	459.73	$59,574	$7.92	492.82	$65,778	$7.90
Vincennes	421.9	$46,089	$7.87	556.2	$67,570	$8.95
State Totals	4976.94	$636,973	$8.14	5188.72	$535,704	$9.30

SM – Service Mile

*Excluded 1-7-13 $/LM due to inflated $/LM.

Since there are four more liquid routes than granular routes in the study the overall costs are higher, while less salt is used. The cost per service mile is an equitable comparison. Except for the Seymour District, the liquid routes were less costly on a service mile basis compared to the granular routes in that district. The average service mile cost across all study routes indicate that liquid routes cost less to operate.

There were 26 different weather events described. One unique characteristic about this winter was air temperatures and corresponding pavement temperatures were fairly consistent, there were no long periods where it dropped to less than double digits. A final report will be published once all the data has been analyzed.

Weather Study

It has been recognized that with winter weather hazards from snow, to freezing rain, sleet, bridge deck icing, and blowing snow can all result in dangerous road conditions and may make roads impassable without proper treatment. That is why we entered into a Joint Transportation Research Project with the Purdue University Meteorology Department. Substantial resources are required for winter maintenance operations. A large number of decisions related to treatment must be made given quite uncertain information regarding the previous, current, and future weather conditions. It is expected that more accurate and precise weather information will help to reduce the uncertainty related to winter weather, resulting in improved decision-making and significant cost savings for winter operations. State-of-the-art weather information from radar and meteorological data analysis systems can provide high-resolution (~2-5 km scale) information and help with the after-action review of previous seasons as well as the analysis of current weather situations, producing measurable improvements in the winter treatment decision-making process as a result.

Substantial progress has been made during the first several months of this project. Routine weather forecasting began in November and has continued daily throughout the winter. Prof. Baldwin organized his Team Weather Forecasting and Mesoscale Forecasting classes at Purdue to provide winter weather forecasts, the students (under Baldwin's supervision) have worked to update those forecasts as part of their coursework. The forecasts have consisted of state maps for the probability of winter weather covering the next day, plus district-specific forecast "timelines" that indicate the start time and duration of expected hazards. Each district also has a written weather hazard discussion to go with each timeline. An extended forecast is provided to look beyond the next day, discussing the expected weather conditions for the upcoming seven day period. These forecasts have utilized numerical weather predictions that are generated by Prof. Baldwin's research group, using the WRF model which executes on Purdue high-performance computing resources twice daily. The output from this numerical model is available to INDOT staff on the web.

Prof. Baldwin and his students also visited each INDOT district early in the winter season where presentations were given to INDOT staff regarding winter weather forecasting and the physical processes that produce snow and other types of winter hazards. This training material should be beneficial to those staff fighting snow and ice to better understand the processes going on in the atmosphere, which will help make improved decisions, especially when the actual weather is found to be significantly different than the predicted weather. Derrick Snyder (graduate student working on this project) has completed “Stage I” of the re-analysis of winter weather hours for the past three winter seasons using additional weather stations across the region. Kim Hoogewind (graduate student working on this project), along with Prof. Trapp, has been focusing on providing access to new sources of doppler radar data from dual-polarization upgraded radar sites at the National Weather Service. These radar data include more detailed information related to the type of precipitation observed, which should allow much better determination of sleet and freezing rain and snow versus areas of rain. The next “stages” of analysis of winter weather hours have also begun. We will utilize high-resolution analyses of weather observations to provide gridded data sets across the state. We will soon begin the process of developing performance metrics and evaluating the forecast system to assess how this detailed weather information was beneficial to INDOT.

TECHNOLOGIES

RWIS Weather Stations

Conventional winter maintenance strategies involve waiting for the snow to start falling and then deploying plows and salt trucks to clear the pavement of snow and ice. These strategies produce safe travel conditions but give the storm the upper hand. Scientist has estimated that it takes ten times more material to remove a hard pack of snow and ice than it takes to prevent it.

The acronym RWIS stands for Road Weather Information System. Maintenance crews are able to get under or ahead of the storm by anti-icing or de-icing as surface temperatures drop allowing hard packs to form.

Anti-icing requires applying deicing chemicals before the storm hits, so that snow and ice never get a chance to bond to the pavement. Motorist will get safer travel conditions, and the agency uses less materials which is not only more economical but also better for the environment. Crews can also be more efficiently scheduled, thereby minimizing expensive overtime and standby costs. INDOT crews utilized 2,123,871 gallons of salt brine this year for anti-icing operations and another 2,928,483 gallons for de-icing operations.

Currently there are 33 operational systems strategically placed across the state and another 7 along the Indiana Toll Road. Plans are in place to add systems at the I-641/I-70/SR 46 interchange in the Crawfordsville District at Terre Haute. All future projects will be scoped and evaluated to determine if additional systems would benefit operations.

WEATHER

Weather Service MDSS

Meridian Environmental is the current weather service and MDSS provider. The current QPA expired May 31, 2013 with this service provider. Meridian Environmental which is now ITERIS has agreed to allow service to be extended as specifications are prepared for future services.

Currently a committee has been selected and has been evaluating and reviewing all weather services and technologies that are available. The committee plans to work through this process during the summer months so a new contract can be in place prior to winter operations. The first stage of this process was to solicit weather services through posting a RFI for a weather service. Three vendors returned an interest and presentations were scheduled for review with the committee. The three responses and presentations that are under review were from ITERIS, Vaisala, and Schneider Electric.

Current scope indicates that a new contract should be in place between July 1st and October 1st. Arrangements have been made with ITERIS to keep service in place and ongoing during this process.

EQUIPMENT

Tow Plows

In 2010 a tow plow was purchased and placed in the Fort Wayne District to use and evaluate. This technology and practice is a growing trend across the country with winter operations. The equipment section is in the process of procuring our second tow plow in August with plans to expand this technology further each year thereafter moving forward. It has been determined that the truck specification for the use of a tow plow needed to be modified. The equipment section has had trucks procured that will be designed for this type of application.

The overall goal with the use of tow plows is to reduce the total number of CDL drivers that are needed during winter operations, reduce the total number of trucks that are needed, which will result in an overall cost savings.

In addition this year there will be 79 new dump trucks, 18 CNG fueled light plow trucks, 6 front end loaders, 80 plows, 10 wing plows, 12 benching wing plows, and 32 underbody plows added to the fleet to replace older equipment.

FACILITIES

FY13

Construction has been completed at the new Wabash salt building along with the construction of the new Chesterton wash bay building. Other completed projects include the construction of a new lab at the Indianapolis Materials and Testing for the relocation of the Tibbs lab. Nearly 3 acres of additional truck and vehicle parking and staging areas at the Indianapolis Subdistrict facility including a new fenced sign storage area, 83 personnel lockers in a new locker room, and a complete retrofit for the double wash bay with gray water transfer pumps in preparation for the consolidation of the Sub's units into the Subdistrict facility. The new Fort Wayne Administration building will be complete on May 31, 2013. The construction phase is under way for the new Aurora Subdistrict building and the Westfield Unit building which both should wrap up toward the end of calendar year 13. Also in the construction phase is (3) new brine buildings (Crown Point Unit, Rochester Unit, and the Newport Unit). The new Falls City salt building is scheduled for construction this calendar year (beginning June for a period of 4 months). The new Fort Wayne Materials and Testing building retrofit is scheduled to bid out the first of the new fiscal year July 1. Property is expected to be purchased for the new Brownstown Unit by July 2013.

FY14

With a start of the new fiscal year there are plans to build a new Fowler Subdistrict building. Also there are plans to build the Brownstown Unit salt building and the Bloomfield Unit salt building providing the land is purchased. There are plans to construct (3) new stand-alone wash bays (Wabash Sub, Corydon Unit, and Shelbyville Unit). Plans are still in the works for the new Lebanon Unit and a salt building. There are also plans to build (3) brine buildings (Shelbyville Unit, Bloomington Unit, and the Jasper Unit).

Summary

The focus and goal moving forward is to continue with an annual snow and ice operations training curriculum for INDOT supervisors that will include utilizing technologies that are available, enhance decision making processes, and to improve data collection in an effort to create a system that is not compromised and offers useful data that enables us to affectively evaluate our performance. To increase the use of liquids and continue the studies of products and application processes that can result in lowering the overall operational costs while maintaining excellent customer service. To continue evaluating and improving the facilities, technologies, and the operational processes. Through these practices and innovated ideas INDOT will continue to set the example of excellent customer service and exceptional operational strategies.

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