

UTAH DEPARTMENT OF TRANSPORTATION

ANNUAL EFFICIENCIES REPORT

— 2015 —



INTRODUCTION

Efficiencies in the Utah Department of Transportation (UDOT) often generate cost savings for the public and the Department through better utilization of resources and innovative technologies. This report contains summaries of key efficiency initiatives from State Fiscal Year 2015.

These efficiencies highlight the significant progress made during 2015 toward accomplishing the Strategic Goals of the Department. Working to achieve the Strategic Goals is how the Department fulfills its Vision of “Keeping Utah Moving” and its Mission of “Innovating transportation solutions that strengthen Utah’s economy and enhance quality of life.”

The current Strategic Goals of the Department are listed below:

- Zero Crashes, Injuries and Fatalities
- Preserve Infrastructure
- Optimize Mobility

This report fulfills a statutory requirement for the Department to describe the efficiencies and significant accomplishments achieved during the past year to the State Legislature. Statements of time and cost savings are best estimates at the time of document preparation. This and past annual reports are available online at www.udot.utah.gov/go/efficiencies.

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SUCCESS FRAMEWORK INITIATIVE

In his 2013 State of the State Address, Governor Herbert challenged all State of Utah agencies to become more efficient when he stated, “Our obligation to the taxpayer requires that we continue delivering outstanding results... [Our] target is to improve government operations and services by 25 percent (a combination of quality, cost and throughput) throughout the next four years.”

The SUCCESS Framework is a resulting set of management principles designed to boost the quality and efficiency of government services, with the goal of delivering ever-increasing value per dollar to the citizens of the state of Utah. These tools also provide assistance in meeting the complex challenges facing government services – including increased demands, fragmentation and reduced budgets.



The SUCCESS Framework within the Utah Department of Transportation can be viewed as consisting of three phases:

1. Department leaders identified six major systems in our business. Goals of these major systems are identified at initial meetings between the Department team and the Governor’s Office of Management and Budget (GOMB). The goals of each major system are configured into an equation known as QT/OE, which means quality throughput divided by operating expense.
2. A one-page operational improvement strategy is completed at subsequent meetings between the Department and GOMB. This improvement strategy provides a high-level process map of a system, identifies the critical resource for the system and “what good looks like” at each point in the process.
3. The Department applies the operational excellence tools to the system as guided by the one-page improvement strategy and the measurement of resulting effects on quality throughput and operating expense.

The application of these three phases assists the Department in determining how we can best improve the value per dollar rendered to taxpayers by our services. On a monthly or annual basis, depending on the given system, the Department reports to the GOMB on efficiencies realized to date for the six major systems. Highlights of these six systems, including additional progress in Fiscal Year 2015, and the associated cost savings or other efficiencies are described below.

STATEWIDE ACCESS MANAGEMENT PROGRAM

Savings: Internal costs were driven down for Conditional Access Permits by \$858 for each permit meeting the 45-day quality standard, and by \$487 for all permits in this program area.

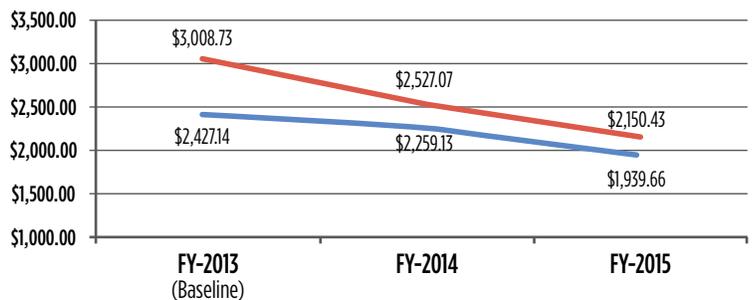
Efficiency: By meeting increased demand for Conditional Access Permits, while maintaining high standards of quality (without increased costs), the Department has achieved more than a 40 percent overall quality and throughput improvement rating.

The Department's Statewide Access Management Program oversees the coordinated planning, design, regulation and permitting of vehicle access point connections (driveways and streets) between state highways and land development. It encompasses a range of methods that promote the efficient and safe movement of people and goods by reducing conflict points on the state highway system at its interface with other integrated modes of travel. For example, this program benefits the traveling public, mass transit systems, pedestrians and bicyclists. A well-managed access management program also contributes to improving the air quality for all Utahns through reductions in commuter delay.

By effectively managing vehicle access points on the state highway system and promoting necessary network enhancements, the Department maintains the operational efficiency of the state highway system. This statewide effort also helps to protect public safety, increase the viability of modal alternatives and improve the appearance and quality of the built environment. In addition, the Statewide Access Management Program plays a vital economic development role across the state of Utah. In this capacity, the program strives to achieve a responsible balance between operational safety, network speed and reasonable access to land development.

There are several key factors driving operational excellence within the Statewide Access Management Program. The first is the partnership that was forged between the Department and the GOMB. When the GOMB first engaged the Department's Statewide Access Management Team we knew little to nothing about Eli Goldratt's Theory of Constraints Model, and they knew little about the Department's Statewide Permitting Operations. Through a rapid exchange of ideas, concepts and processes, the Department and the GOMB were able to quickly identify a systems-based control point where a natural bottleneck developed within the program. That control point was identified as an incomplete access permit application being submitted for review (see diagram below), which pointed towards a deficiency in what we now call applicant education efforts. From there, a systematic series of SUCCESS Framework Initiative tools were applied to ease the identified point of constriction within the program.

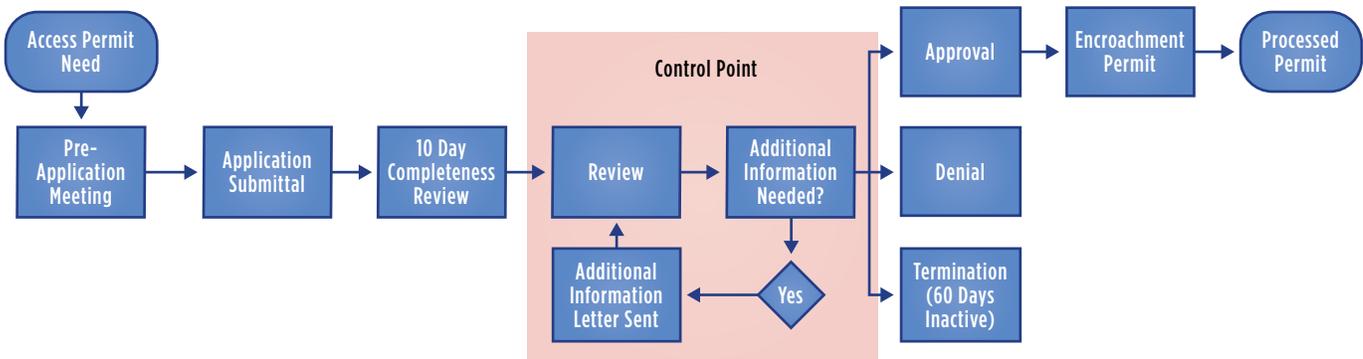
Statewide Access Management Program
Conditional Access Permit
Cost Per Unit & Per Quality Unit Reductions by Fiscal Year



— = Cost per Quality Unit (OE/QT)
 \$858 ↓
 — = Cost per Unit (OE/T)
 \$487 ↓

Note: A Quality Unit is defined as the number of applications being processed to completion with < 45-days of handling time by UDOT. The Cost per Unit calculation includes all applications being processed to completion including those that do not achieve the 45-day quality standard.

The second key factor driving operational excellence is exceptionally great people at the operations level in the Department’s four Regions and phenomenal overall leadership at the highest levels of the Department and the GOMB. On the GOMB side, they sent in their seasoned professionals with strong qualifications in their respective operational areas. On the Department’s side, we assembled a statewide steering committee consisting of key operational practitioners, engineers and organizational leaders. Together, we diagnosed the conflict point and then began adding available resources to that conflict point to effectively decrease delay and increase throughput within the program.



The major program improvements included revamping the administrative rule governing the program. This paved the way for our statewide team to completely revamp website content, application forms and applicant education materials. The program has since transformed from a virtual black box, with very little program information available to the public, defined process or standardization across the state into a much more transparent program with more statewide consistency.

Even with a number of noteworthy improvements being made in this program area, the work goes on. This year, Statewide Permitting Operations, in collaboration with the Department’s Business Information Technologies team and the Department of Technology Services (DTS), successfully launched a new geospatial tool within our Online Permits System called iMap. This tool will help revolutionize Statewide Permitting Operations (including this program) by paving the path to the first dynamic permit mapping capabilities in the program’s history. Being able to see program outputs in a visual environment will be a game-changer.

Additional efforts are being applied to make mission-critical workflow and process-related improvements within the Online Permit System itself. Such improvements are indispensable to Statewide Permitting Operations. They are the keys to capturing additional efficiencies, and they hold a large amount of promise to take this program to unprecedented levels of achievement in the months and years to come.

PRECONSTRUCTION PROJECT SCOPING

Savings: Savings in both time and money through avoiding rework on projects, by clearly defining the scope and effectively managing the schedule.

Efficiency: During Fiscal Year 2015, increased the number of preconstruction projects advertising on time by 11 percent, leading to the QT/OE improving by 19 percent from the baseline.

By using MS Project and the Project Definition Document (PDD), project teams can now efficiently define a clear scope and create a more adequate roadmap for the team to follow in achieving the project goals. This equates to more efficient use of staff time.

Projects are born based on an idea or a need. A concept of the need is then explored and includes a draft scope and estimated budget. Once the funding is approved and a project manager is assigned, the scoping process begins. At that time, the project manager organizes the project team to kick off the project and begin a more formal scoping of the project.

The PDD guides the team and helps them to define the objective of the project along with the goals for the project and how they will be measured. The scope of the project is defined by statements of what the project will include. It is vital that the project manager includes all critical team members in this process to ensure that all voices are heard and concerns acknowledged. Many times, statements of what the project will not include are a critical part of this section of the PDD.

As part of the PDD, the project team will also select a delivery method and will include a list of any major risks that the team anticipates will need to be managed. An effort is also made to better approximate the project budget during this phase, and this value is included in the PDD.

Important dates for project delivery and construction are also included. The MS Project schedule is the critical tool that allows each team member to give input into the overall schedule for the project. With the workload and availability of all team members accounted for, the MS Project schedule then provides the Proposed Advertise Date that is included in the PDD.

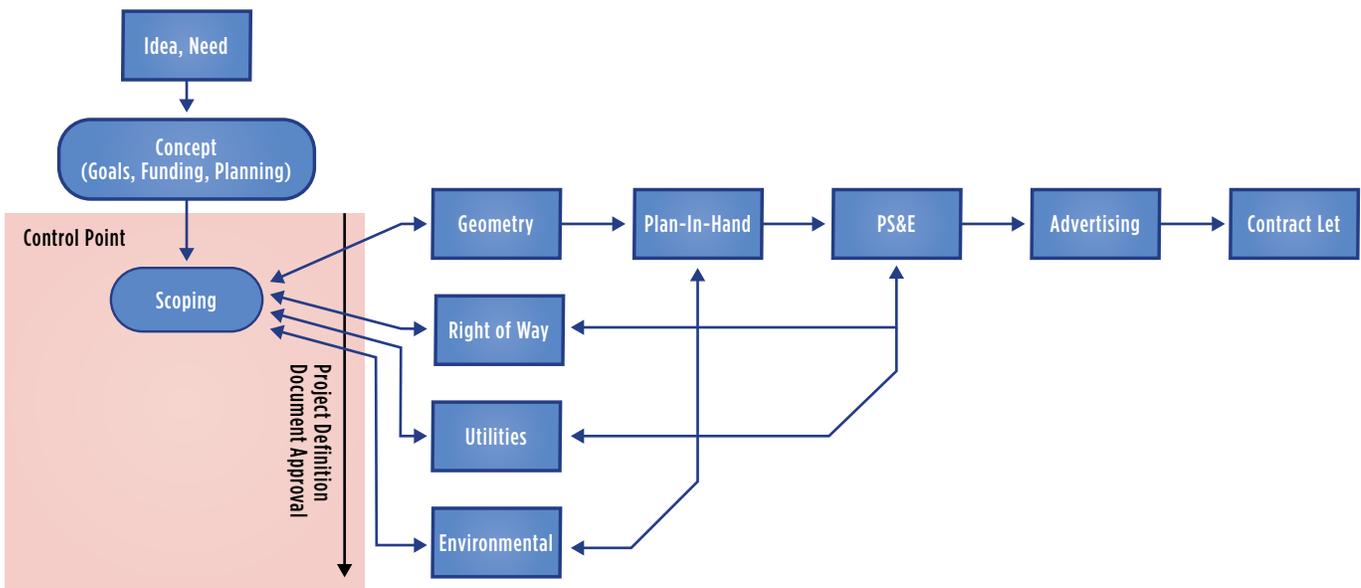
The image shows a screenshot of the 'Executive Project Definition Document' (PDD) form. The form is structured as follows:

- Project Information:** Fields for Project Name, Date, Primary Project Type, Primary Concept, and Location.
- Personnel:** Fields for PIN, Project Manager, and Project Sponsor.
- Project Objective Statement:** A large text area for defining the project's purpose.
- Project Goals and Metrics:** A text area for defining project goals and how they will be measured.
- Project Scope Statements:** A text area for defining the project's boundaries and what is included/excluded.
- Project Delivery Method:** A dropdown menu for selecting the delivery method.
- Potential Project Risks:** A text area for identifying risks to the project budget or schedule.
- Preliminary Budget Estimates:** A grid of input fields for various cost categories: Environmental, Utilities, Concept Dev., Construction, P.E., C.E., ROW, Incentives, Misc, Contingency, Total Budget Estimate, and Project Value.
- Schedule:** Includes a checkbox for 'Project Baseline Set' and fields for 'Proposed Advertise / Proposed Due Date' and 'Construction Completion / Work Completion Date'.
- In House Design Lead:** A field for identifying the design lead.
- Approval Signatures:** Fields for Project Manager, Program Manager, and Region Director / Group Leader, each with a signature line and a date field.

By guiding the project manager through this process and by allowing all team members input into the scope objectives, goals and MS Project schedule, the PDD provides a concise one-page summary of all aspects of the project. This one page document is then taken to upper management in the Department for final approval and signature.

As the project then moves forward through the design phase, the project manager can refer back to the PDD when scope questions arise, avoiding the tendency to allow scope creep into the project. The MS Project schedule provides the roadmap for successful delivery of the project in a timely fashion. Since all team members had input into and assist in managing the schedule, our teams have been able to increase the on-time delivery of projects by the above-mentioned 11 percent.

For reference, the diagram below is an excerpt from the Preconstruction Project Scoping throughput operating strategy. It shows the control point, or the focus of our efficiency, occurring at the project scoping phase.

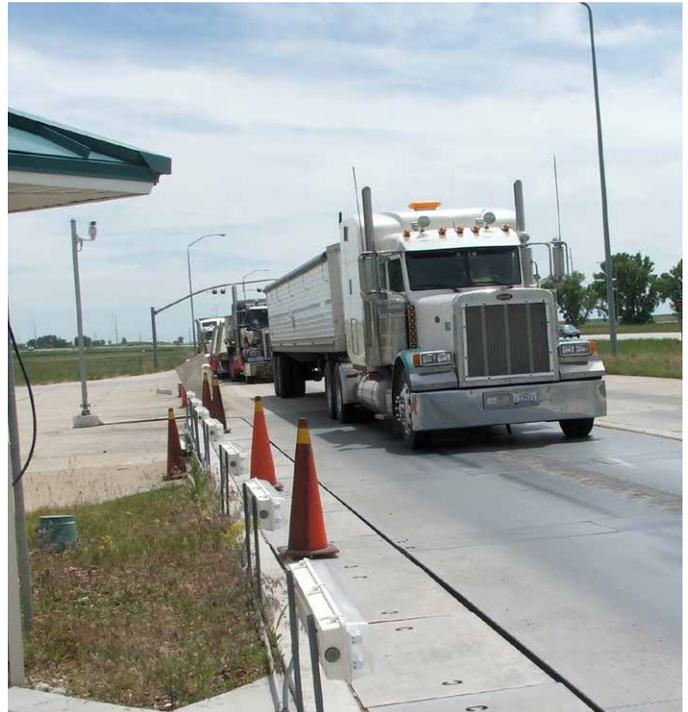


PORTS OF ENTRY TRUCK PROCESSING

Savings: Savings of over \$13.4 million to the trucking industry using PrePass data (\$8.68 savings per pull-in).

Efficiency: Percentage of trucks allowed to bypass the ports of entry increased from 22.4 percent in 2014 to 23.1 percent in 2015, despite decreases in the total truck bypasses and the number of trucks passing the State's ports.

Several factors played into the number of trucks allowed to bypass the State's ports of entry in Fiscal Year 2015. The total number of truck bypasses decreased from 1,674,072 in Fiscal Year 2014 to 1,550,176 in Fiscal Year 2015, but the percentage of bypasses increased from 22.4 percent in 2014 to 23.1 percent in 2015. Fewer trucks were counted in Fiscal Year 2015 because the busiest port, Perry on I-15, closed in mid-April for a rebuild and would not open again until October 2015. The Echo Port of Entry was closed for a month for scale relocation and ramp modifications. The Daniels Port of Entry saw a significant decrease in the number of crude haulers through the port due to the drop in oil and gas prices. In Fiscal Year 2014, there were 7,483,921 trucks passing the State's ports, and in Fiscal Year 2015 there were 6,705,115 trucks through the ports.



The Department's Motor Carrier Division plan encompasses several initiatives including improved availability of trucks passing the ports and implementation of new mobile technology for port agents and inspectors. These activities will save a significant amount of operational cost for the State as well as time, fuel, and operational cost to private industry and emission reductions to the environment.

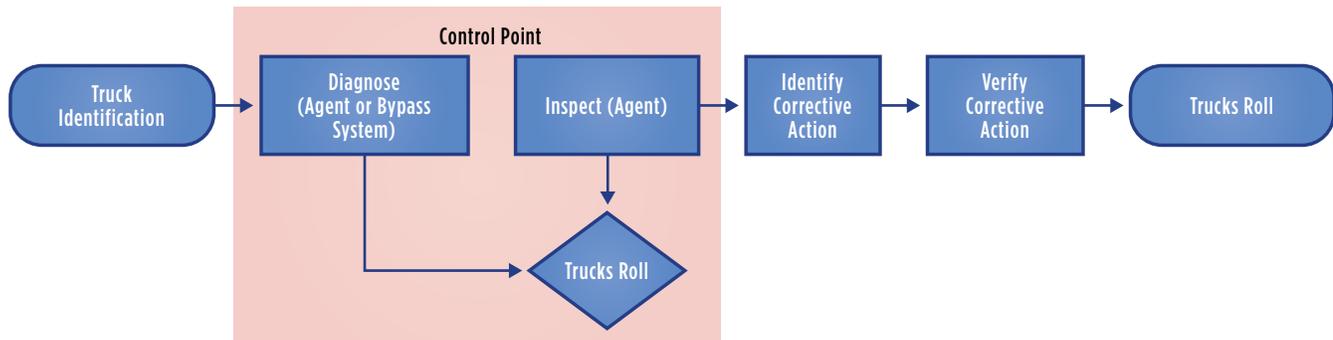
With the License Plate Readers (LPR) and Optical Character Reader (OCR) technologies online at our interstate ports, and a portable unit coming online in Fiscal Year 2016, we will be able to identify non-compliant carriers and focus our energy on them. The Drivewyze bypass program is slowly gaining popularity with the trucking industry and we are seeing those bypass opportunities grow. The Division promotes the use of PrePass and Drivewyze by qualified carriers on our website and through industry-backed communication.

In addition, a bypass program was instituted at the Daniels Port of Entry near Heber City. This allows eastbound carriers traveling empty back to the Uintah Basin, having delivered their product, to bypass the port if they have been seen westbound. This saves time as the eastbound entry in and back out of the port is via left turns across Highway 40. Most of these vehicles are carrying crude oil to the refineries in Salt Lake City. In Fiscal Year 2015, the 47 companies granted this bypass had over 83,000 bypasses.



The Division has spent considerable time and effort in searching for technologies to upgrade current Motor Carrier systems and mobile solutions to improve and streamline port of entry operations and permit verifications. The Division is currently working to gather requirements to move forward with a new Motor Carrier System. This will provide a more efficient port operation for our people and decrease the time carriers are spending at the ports of entry.

For reference, the diagram below is an excerpt from the Ports of Entry Truck Processing throughput operating strategy. It shows the control point, or the focus of our efficiency, occurring when the port of entry identifies trucks for inspection through the time they leave the port.



SNOW AND ICE CONTROL

Savings: No improvement in efficiency or cost savings was observed for Fiscal Year 2015 due to the small number of snow storms.

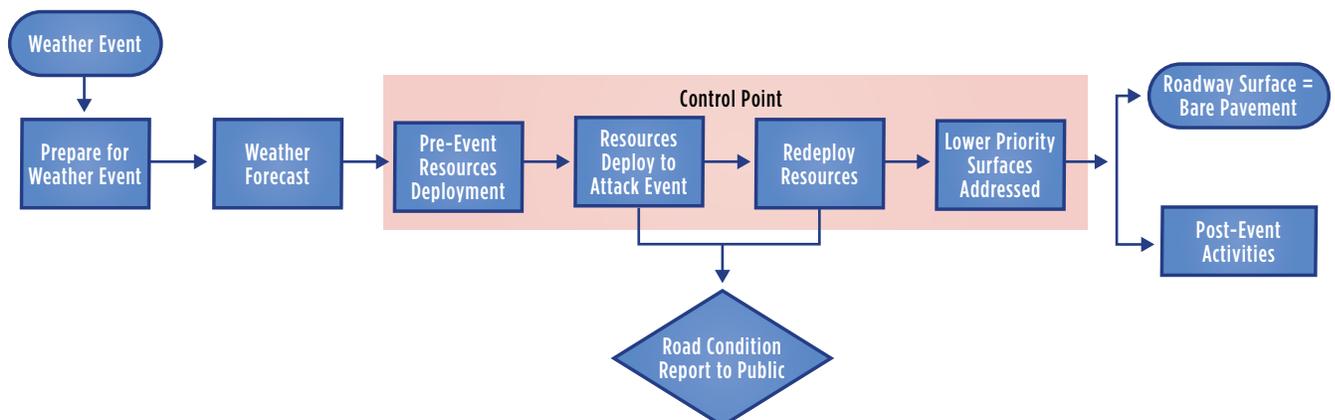
Efficiency: Important actions were taken that together will produce positive benefits for both the Department and the traveling public.

Maintenance Operations did not see improvement in the efficiency of its snow removal operations during the 2014/2015 snow season. In fact the data shows a drop in the level of efficiency from the 2013/2014 fiscal year and the baseline. The Department feels the reason for this change is due to the small number of storm events during the 2014/2015 measurement time period. The small amount of data that was collected does not accurately reflect the overall SUCCESS strategic goal of the Department and the level of effort that was used to remove snow from our state highways.



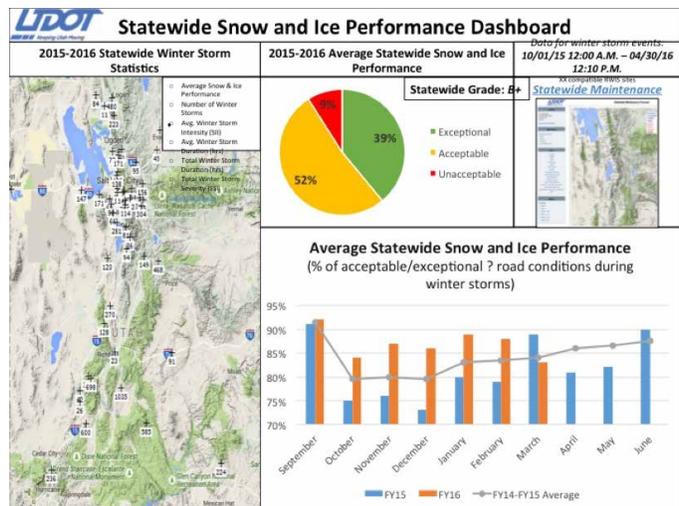
Snow and ice control is one of the Department's primary tasks, one that the public relies upon in order to maintain the ability to travel safely to desired destinations during and immediately following winter weather events. The Department measures its efficiency in regard to ice and snow control by examining the total cost of the operation, along with the number of labor hours for related activities, the number of hours used by snow removal equipment and the effect of the snow removal operation on the condition of the roadway surface. Labor hours are most efficiently used when operators are actually anti-icing prior to an event or plowing snow during the event. Thus, the Department's aim is to reduce time spent in tasks that take away from time available for the plowing operation.

For reference, the diagram below is an excerpt from the Snow and Ice Control throughput operating strategy. It shows the control point, or the focus of our efficiency, occurring when a weather event has been forecasted until the road surfaces are clear.



In order to continue to improve the efficiency measure for future fiscal years from the baseline (average of Fiscal Year 2011 to 2013), a variety of important actions were taken:

- This effort included implementing new contracts for de-icing salt that allowed maintenance station supervisors the ability to select the product they needed to most effectively fight each storm at the right price.
- The Regions employed better use of anti-icing and pre-wetting strategies that led to lower usage of solid salt products and better outcomes on the road.
- The Regions focused snow plan revisions on efficient movement of trucks and use of staff time to keep “dead head” time to a minimum.
- All staff was prepared through various training and preparation events to be ready for the season.
- Before the season began, care was taken to ensure that trucks were properly serviced and ready to perform with a minimum of breakdowns during the season. More focus was placed on keeping the equipment in a state of good repair.
- The Department expanded the network of remote weather cameras by over 100 additional cameras. Also, advanced weather prediction tools were better utilized.
- Automated Vehicle Location (AVL) devices have been placed in all of the Department’s snow plow fleet. This new technology will help the Department to better understand where our snow removal fleet is during a storm event and will aid the Department in the more efficient distribution of our snow removal equipment.
- A new “Snow and Ice” performance measure has been developed using data from our Roadway Weather Instrumentation Systems (RWIS). Using additional sensors and a newly developed road condition metric, the Department will have the ability to evaluate the condition of our roadways in real time during a storm event. Combining this new performance measure with the new AVL system will give the Department’s Maintenance Division a new set of performance tools to increase the efficiency of our snow and ice control efforts. A new Statewide Snow and Ice Performance Dashboard is also being developed that will show the performance of our snow removal efforts.



In addition to the actions listed above, the Department is currently undertaking an initiative to complete a comprehensive, GIS-based analysis of snow plow routes across the Wasatch Front to optimize our snow removal fleet.

PROCUREMENT SYSTEM

Savings: Improved procurement requisition quality throughput by 50.4 percent in Fiscal Year 2015.

Efficiency: Requisition process improvements through procurement training sessions, revision of policies and development of purchasing and contract guides for end-users.

The Department's Procurement Division tracks quality requisition throughput as a performance measure. Process improvements were made possible through implementation of the following action plan:

- Procurement training sessions held throughout all areas of the Department
- Procurement training added to UDOT University for easier access and tracking
- Revision of the Department's Procurement Policy for improved clarity and information flow
- Development of purchasing and contract guides for end-user reference and training
- Development of purchasing flow chart to provide a clear set of instructions to end-users

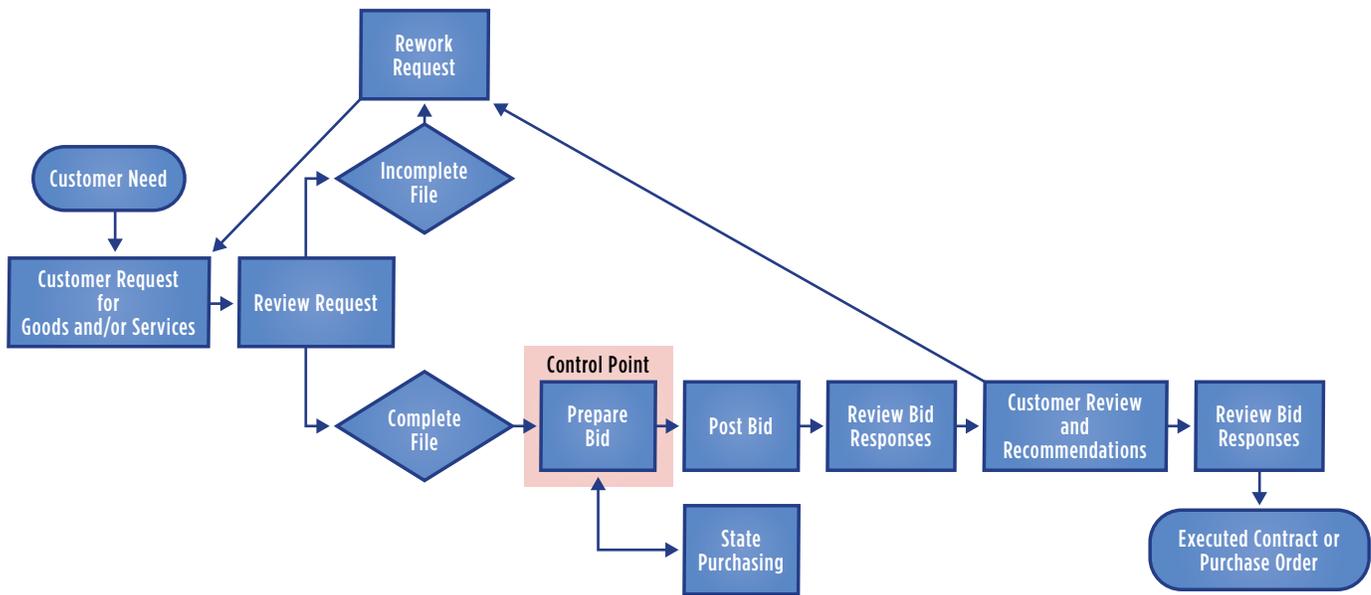
The purpose of measuring quality requisition throughput is to track performance improvements resulting from the implementation and execution of the above action plan. The more quality requisitions, the better and faster we meet the needs of our customers and the overall Vision and Mission of the Department.

As a result of the efficiency improvements this past year, the Department's Procurement Division was able to create an entirely new procurement position at no additional operating expense. This new position is dedicated to technology-related procurements and will provide inventory and purchasing support for each Region and Division within the Department.



In addition to the enhancement of requisition throughput from the added procurement support staff, the Purchasing and Contract User Guide developed within the Department's Region Four increased efficiency in a few specific areas. First, the Purchasing and Contracts User Guide provides end users in all Divisions of the Department with a quick reference to find relevant procurement rules, procurement support contact information and access to a Region's frequently used procurement contracts. As a result, the guide has reduced purchasing errors by 51 percent, which enabled Region Four to find a 27 percent savings in typical operation-oriented procurements.

For reference, the diagram below is an excerpt from the Procurement Quality Requisition throughput operating strategy. It shows the control point, or the focus of our efficiency, occurring when Procurement receives the file for a procurement requisition until the time they post the bid or send it to State Purchasing.



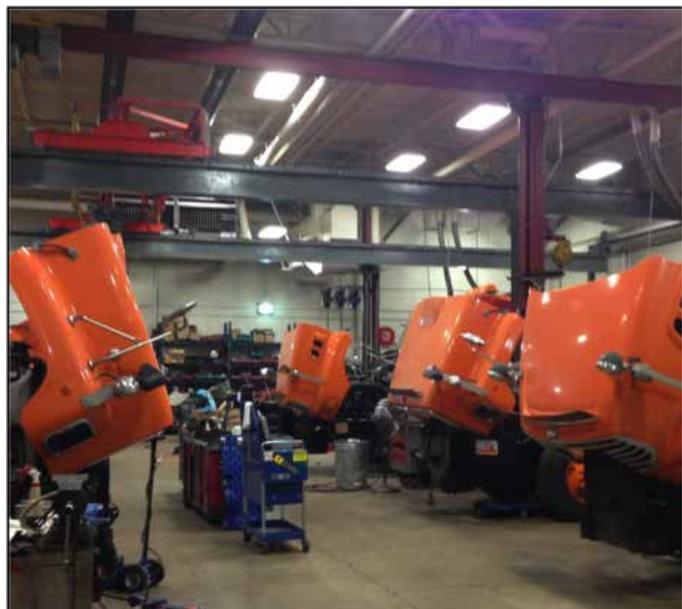
HEAVY DUTY TRUCK MAINTENANCE

Savings: Estimated 25 percent increase in efficiency by the end of 2016.

Efficiency: Developed and implemented internal training for better data acquisition throughout all central and Region shops.

Ensuring our heavy duty trucks are properly maintained and repaired safeguards that they are available to plow snow and help maintain traction on the road surface. This directly aligns with our Zero Crashes, Injuries and Fatalities Strategic Goal.

The Department is focused on creating a “TLC Culture of Ownership” with the equipment shops in regards to heavy duty truck maintenance and devising a plan to ensure trucks and resources are available to match the snow plan expectations. Implementing this plan will allow more transparency in the effectiveness of the equipment shops to get trucks in need of attention through the repair process.

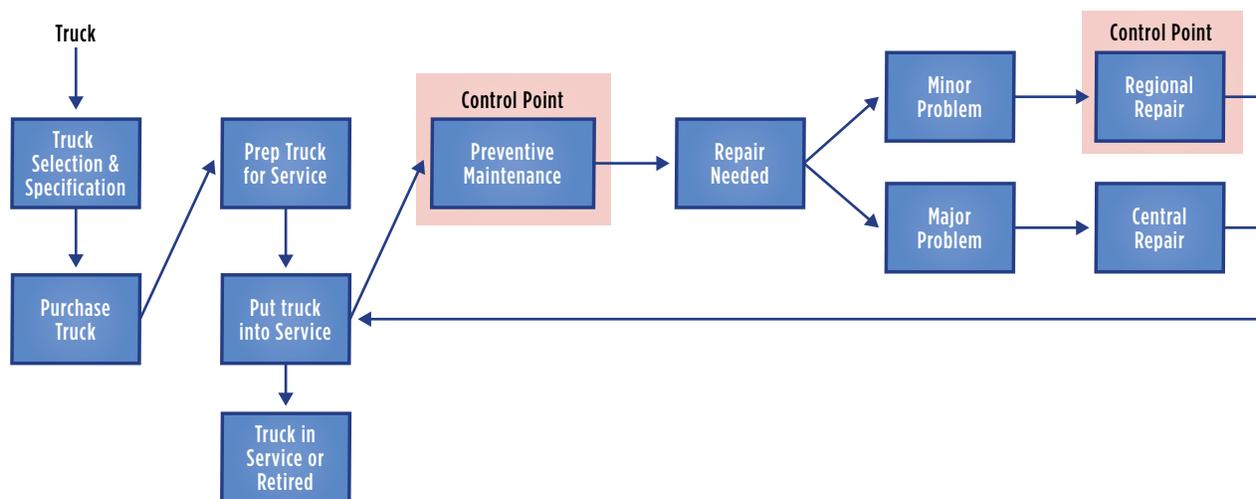


The measurement for heavy duty trucks is focused on heavy duty trucks being available to plow snow and maintain traction on the road from October 15th through May 15th. The baseline measurement is 80.6 percent availability. The goal of Equipment Operations management is to have 90 percent of our total trucks available to plow when needed.

Following are some important steps taken recently by Equipment Operations to improve the efficiency of equipment maintenance:

- We implemented a procedure to add automatic lubrication features to critical wear points on new equipment put into service. This will help reduce future downtime during the peak snow removal season.
- By refining the internal repair procedures, implementing concepts from the Theory of Constraints model, we have increased throughput in shops to reduce potential downtime.
- With the addition of an Equipment Program Manager position, we have improved communications between the central shops and the Regions.
- As a management team we met with contracted vendors to discuss expected outcomes and the desired level of performance. This communication allowed us to align our vendors with our SUCCESS Framework expectations.
- Hands-on training was held both at the Department’s central office, as well as individual Region shop locations, to streamline the data input and have a clearer understanding of what information is necessary.

With these combined improvements, the truck availability “up time” has increased. Reporting data for the SUCCESS Framework is also more accurate. For reference, the diagram below is an excerpt from the Equipment Maintenance throughput operating strategy. It shows the control point, or the focus of our efficiency, occurring when preventative maintenance should happen through the repair process.



The next steps in this process are focused on monthly analysis of the efficiency during the snow season and developing a proposal for additional funding for aggressive replacement of our aging fleet to additionally reduce the repair cost and downtime.

WALKING SCHOOL BUS MOBILE APP

Savings: The UDOT Walking School Bus mobile app has saved Utah families more than \$50,000 in gas and vehicle costs.

Efficiency: During the 2014-2015 school year, the Walking School Bus app resulted in 91,000 fewer car trips, with students and parents walking more than 88,000 miles to and from school.

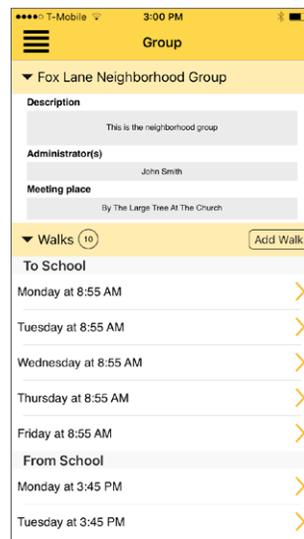
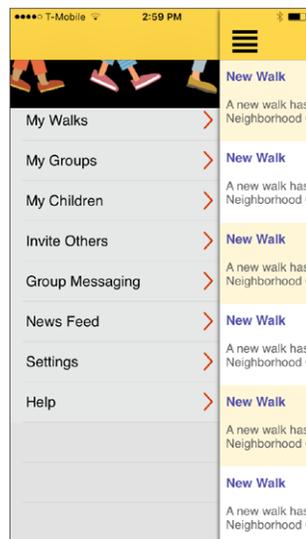
The Department's Student Neighborhood Access Program (SNAP) encourages students living within walking distance of their neighborhood school to walk or bike to help reduce the number of vehicles around schools, making it a safer environment for Utah children and families.

The UDOT Walking School Bus app is a forward-thinking digital tool that makes walking and biking to school easier and safer than ever. The app allows parents to search by elementary school for existing walking groups, create new groups and invite neighbors to join, plan walks to and from school, assign parent leaders to walk with students and group text within the app. It also alerts parents when students have arrived safely at school. It's like a carpool without the car!

The UDOT Walking School Bus app also tracks the following:

- Trips Reduced
- Miles Walked
- Emissions Saved
- Calories Burned

During the 2014-2015 school year, the Walking School Bus app resulted in over 500 walking groups statewide and 91,000 fewer car trips, with students and parents walking more than 88,000 miles to and from school. In addition to reducing 37 million grams of CO2 emissions, this saved Utah families more than \$50,000 in gas and vehicle costs (based on the IRS standard mileage rate of \$0.575). Screenshots from the app are shown below.

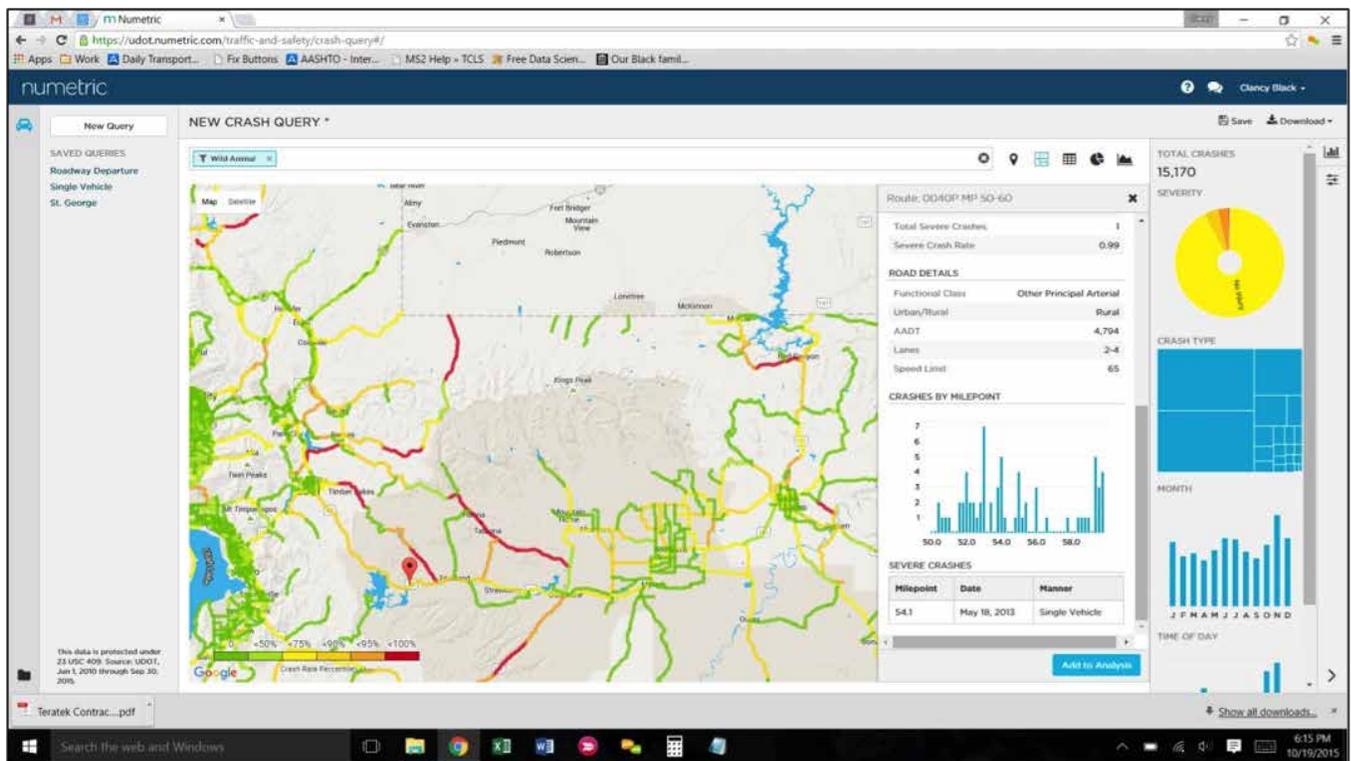


CRASH ANALYSIS REPORTING TOOL

Savings: Approximately \$140,000 annually from savings of staff and consultant time to acquire and analyze the data.

Efficiency: Data and analysis are available immediately instead of taking weeks to acquire data and perform analysis.

The Numetric Traffic & Safety Application for the Department is a powerful new analysis tool designed to allow engineers, planners, designers and decision makers to perform analysis, reporting and crash data reviews in one streamlined, easy-to-use platform. The tool allows merging of multiple data sets including crash data, roadway data and various safety layers for a seamless experience referencing data from different sources and using it to make data-driven decisions regarding roadway safety. The tool includes the ability to quickly identify crash patterns, drill down within the data, analyze segments at varying levels, compare potential projects and develop benefit-cost analyses according to Highway Safety Manual methods. The tool also provides a public portal, allowing anyone to view high-level crash data summaries. Below is a screenshot from the new tool.



FLASHING RIGHT TURN ARROW

Savings: Estimated \$5,000 to \$10,000 in annual savings due to reduced driver delay.

Efficiency: Improved safety and reduced driver delay.

Utah's first flashing yellow right turn arrow at the northbound I-15 off-ramp to eastbound SR-92 in Lehi was installed in 2015. The northbound I-15 off-ramp at the SR-92 right turn lane is received by the entrance to the SR-92 Express Lanes, but a large portion of drivers want to move to the left turn lane of the next intersection to access retail and commercial areas in northern Lehi. This was causing backing on the ramp because, instead of operating as a free right turn, a lot of traffic was waiting for an opportunity to drive across lanes to the left turn queue.



Vicinity map of signal location at I-15 northbound off-ramp at SR-92

The Department's signal engineers from the Traffic Operations Center and Region Three suggested a flashing right turn arrow so that drivers know when to watch for and yield to the through-traffic when moving from the ramp's right turn to the left turn queue at the next intersection. This idea was tested in the lab at the TOC to ensure that there were not any safety or programming issues that would create conflicts. A green arrow indicates there is no oncoming traffic to merge with, allowing a period of time of free-flow traffic from the right turn lane of the off-ramp. The flashing yellow signals a yield condition for drivers who want to move to the left lane on SR-92 as well as for the queue of traffic on the ramp. We estimate the flashing right turn arrow provides \$5,000 to \$10,000 in annual savings due to reduced driver delay. It also creates a safer condition for turning traffic and reduces frustration of drivers waiting in the queue because they can see when the arrow is green versus flashing yellow.



Flashing yellow arrow signal at I-15 northbound off-ramp and SR-92

The right turn signal is almost always green or flashing yellow, but it briefly turns solid yellow and red as part of the signal's cycle. The red arrow is also triggered by the pedestrian button that serves the trail and pedestrian facilities on the south side of SR-92. Pedestrian traffic between the employment centers and retail outlets on either side of I-15 is common in this area, and the red arrow creates a safer pedestrian crossing through this busy interchange. The flashing right turn arrow improves safety and helps optimize mobility for vehicles and active transportation users.

FREEWAY PERFORMANCE MEASUREMENT WEBSITE

Savings: Reduced time required for data gathering and sharing through a one-stop, public-facing location for the Department’s freeway performance data.

Efficiency: Improved availability of real-time and historical freeway performance information to inform project funding priorities in the Department, as well as enable the public to make informed travel decisions.

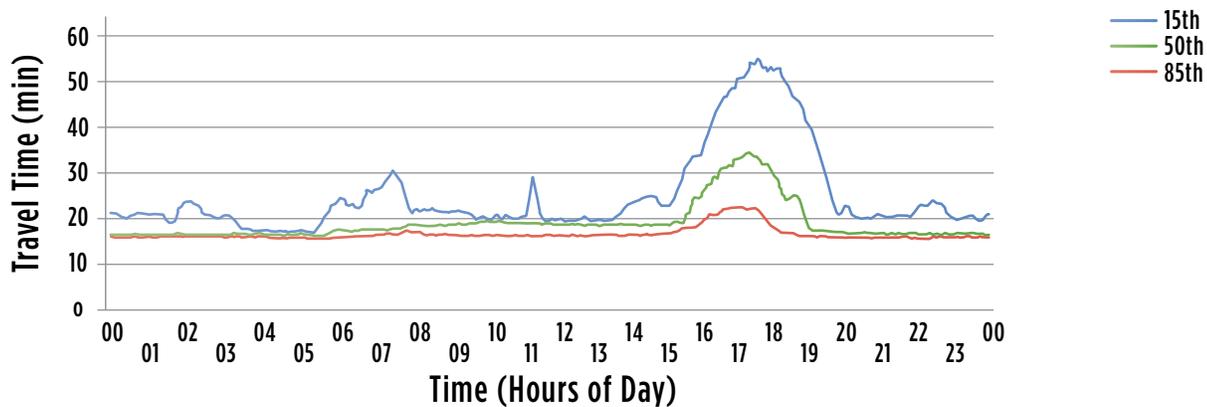


The Freeway Performance Measurement (FPM) website and dashboard were created to provide access to the Department’s freeway operations data. The website allows the Traffic Management Division (TMD), other groups within the Department and the public to query traffic related data for the freeway system along the Wasatch Front, including I-15, I-215, I-80, SR-201 and Legacy Parkway. This data has been used to provide the Department’s internal users and external partners with information needed to facilitate informed decisions, considering the mobility implications of alternatives. The website is available here: udottraffic.utah.gov/freewayperformancemetrics.

Currently, two measures are available on the website:

- Travel Time Report:** This report allows users to analyze how travel time along a route varies by time of day. The travel time report shown at right represents one month of data for southbound I-15 from I-215 to Lehi Main Street, highlighting the 15th, 50th and 85th percentile travel times, a statistical engineering term used to describe travel time trends. The blue line represents the worst case scenario. Over a month's time, commuters will experience this scenario (or worse, slower travel times) approximately 3 times. The red line represents the best case scenario. Over a month's time, commuters will experience this scenario (or better, faster travel times), approximately 3 times in one month. The green line is the median scenario where travel time is worse than the green line on half of the days and better on the other half of the days.

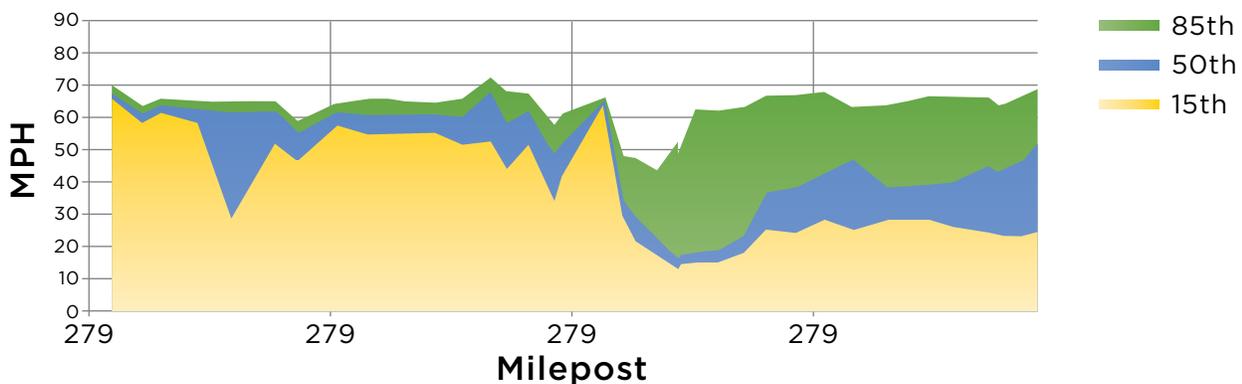
Travel Times: Southbound I-15 & I-215 S to I-15 Lehi Main St



- Speed Report:** This report allows the user to define the location, day and hours for the query. The report shows the median, best and worst speeds for the timeframe chosen. The speed report allows the user to see at a glance how the freeway is performing at specific locations, and to compare locations along the corridor. The Department is using the speed report to better consider mobility in the decision-making process. The speed report has proven to be an effective tool to help prioritize projects in the urbanized area of the state. A sample speed report is shown at right. This figure depicts a variation in speeds that commuters experienced during the month of September 2015 along southbound I-15 during the evening rush hour from I-215 to Lehi Main Street.

Speed Report: I-15

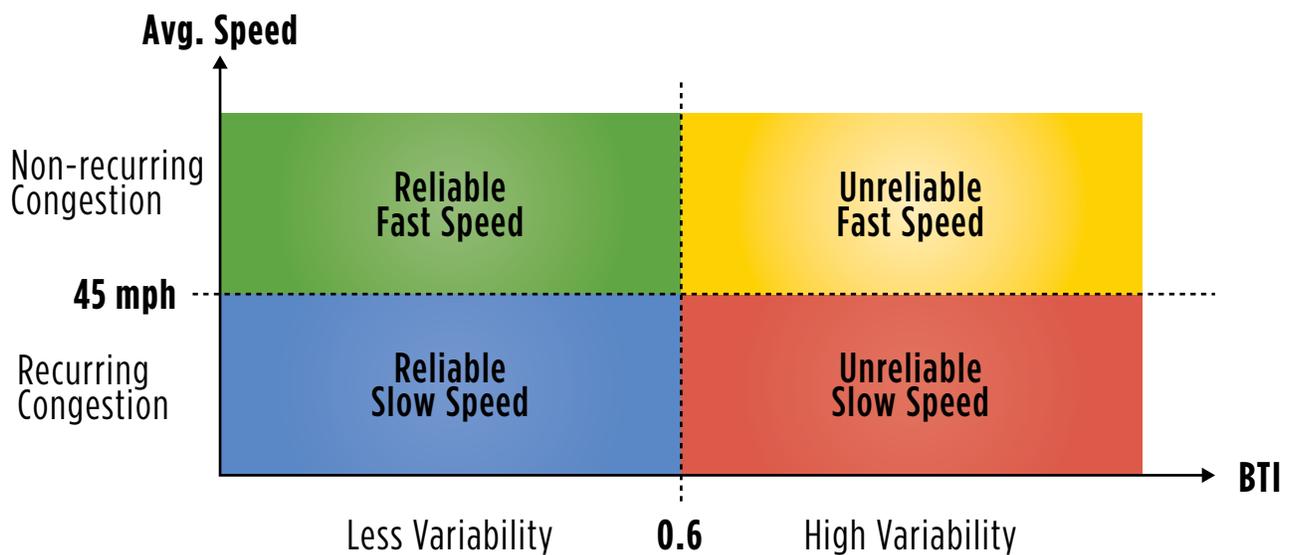
Dates: 9/1/2015-9/30/2015 Time 5:00 - 6:00 p.m Days: Mon-Fri Direction: Southbound



Other metrics the TMD continues to work on include travel time reliability, “mobility cake” and congestion forecast. Travel time reliability is a new way to evaluate freeway performance that considers the consistency of operation in addition to quality. The graphic below illustrates the Department’s approach to defining travel time reliability. It classifies the operations of roadway segments by the degree to which travel time varies, and by the average speed. Ideally our system would operate with fast average speeds with low variability in those speeds (upper left quadrant). System users will be able to use this reliability metric to help plan travel by adding additional travel time into their plans as appropriate during heavy travel periods. An example of varying travel time reliability can be observed in the Travel Time and Speed Reports above.

The “mobility cake” will be a tool to measure what is causing congestion at user-defined locations along the freeway system. This metric will show contributions to congestion at a location, including crashes, weather, construction, or other factors in the form of a layered “cake”. The congestion forecast will help predict bad travel days with the associated heavy travel time periods, such as holiday weekends, school breaks or even Halloween when everyone wants to be home early.

As development of the FPM website continues, we expect it to become an even more useful tool to inform decision makers on project funding priorities, and for the general public in making informed travel decisions that will improve the overall function of the freeway system.



UTAH STATE RAIL PLAN

Savings: Approximately \$620,000 by completing the Utah State Rail Plan for \$180,000 versus the national average of \$800,000 for such plans.

Efficiency: Created a statewide rail plan for a comparatively small amount of funding, using internal and external resources and long-standing working relationships with rail carriers.

The Utah State Rail Plan (USRP) was developed by the Department in 2015 and cooperatively funded by the Department and the Utah Transit Authority (UTA). Both agencies' goal was to develop a state rail plan that would make Utah eligible for capital grants under Sections 301, 302 and 501 of the Passenger Rail Investment and Improvement Act of 2008 (PRIIA), relating to intercity passenger rail, congestion relief and high-speed rail, respectively. To do this, the Department needed to create a state rail plan that was compliant with the PRIIA and accepted by the Federal Railroad Administration (FRA). The plan was completed utilizing in-house expertise and a minimal consulting contract, resulting in significant cost savings to the State of Utah compared to other plans developed across the country. For example, two of Utah's neighboring states paid in excess of \$1 million for their respective rail plans.

The ability of the Department to create an FRA-compliant rail plan for such a comparatively small amount of funding resulted from the plan authors, our freight planner and the consultant, both having background and experience with railroads and a long-standing, close, cooperative working relationship and collaborative partnership with the rail carriers in Utah, who also took an active part in the plan's creation. The consultant's low overhead cost also contributed significantly to the USRP's low cost.

The USRP allows for more comprehensive projections for freight planning in Utah, laying the groundwork for any UTA expansion of commuter rail, as well as the potential for expanding rail freight service in Utah. Even though the September 2013 FRA Final Guidance for state rail plans changed from the August 2012 FRA Draft Guidance, which the Department was following at the start of this project, the Department was able to incorporate the changes for final acceptance of the USRP. The FRA determined that the USRP meets the minimum required elements in accordance with Section 303 of PRIIA and notified the Department in writing of the FRA's acceptance on April 20, 2015. The FRA acceptance of USRP 2015 is valid until April 20, 2020.

The railroad industry continues to play a vital role in the movement of freight to and through Utah. There are currently 11 railroads that operate in Utah, as shown at right. These include eight freight railroads and three passenger railroads. A brief overview of some of these railroads is given below.

Freight Railroads	Passenger Railroads
BNSF Railway	Amtrak (National Railroad Passenger Corporation)
Deseret Western Railway	Heber Valley Railroad
Salt Lake City Sothern Railroad	Utah Transit Authority Commuter Rail
Salt Lake, Garfield and Western Railway	
Savage, Bingham and Garfield Railroad	
Union Pacific Railroad	
Utah Central Railway	
Utah Railway	

The Wasatch Front is the hub for six railroad routes, all of which are owned by Union Pacific (UP). The historic Overland Route was America's first transcontinental railroad and the first railroad built through Utah. The completion of the Overland Route culminated with the driving of the Golden Spike at Promontory, Utah, on May 10, 1869. The connection of the two railroads was moved to Ogden in 1874, and Ogden remained the busiest rail center in the state until it was surpassed by Salt Lake City during the 1980's. The historic Overland Route east of Ogden continues to be the busiest railroad freight mainline in Utah.



BNSF Railway serves the state of Utah via trackage rights over two UP routes that link Denver, Colorado, with Stockton, California, via Helper, Provo, Salt Lake City and Wendover. The Utah Railway is a Genesee & Wyoming short-line railroad that interchanges with BNSF and UP. The Utah Railway also operates over an extensive network of trackage rights assigned to BNSF Railway. Utah Railway serves customers throughout the Provo, Salt Lake City to Ogden Wasatch Front population corridor, including the Little Mountain and Weber areas near Ogden, as an agent of BNSF Railway.



UTA's FrontRunner commuter rail provides service from Provo to Salt Lake City to Pleasant View, just north of Ogden. UTA was formed in 1970 as the Wasatch Front's transit bus provider, expanding into light rail in 1999 and commuter rail in 2008. UTA's service area encompasses more than 1,400 square miles and 75 communities in a six county area that includes 80 percent of Utah's residents.

The National Railroad Passenger Corporation, known as Amtrak, is a quasi-governmental corporation that took over most of America's intercity passenger trains from the private railroad companies on May 1, 1971. Amtrak's daily Chicago to San Francisco Bay Area California Zephyr serves Utah with stops in Green River, Helper, Provo and Salt Lake City.

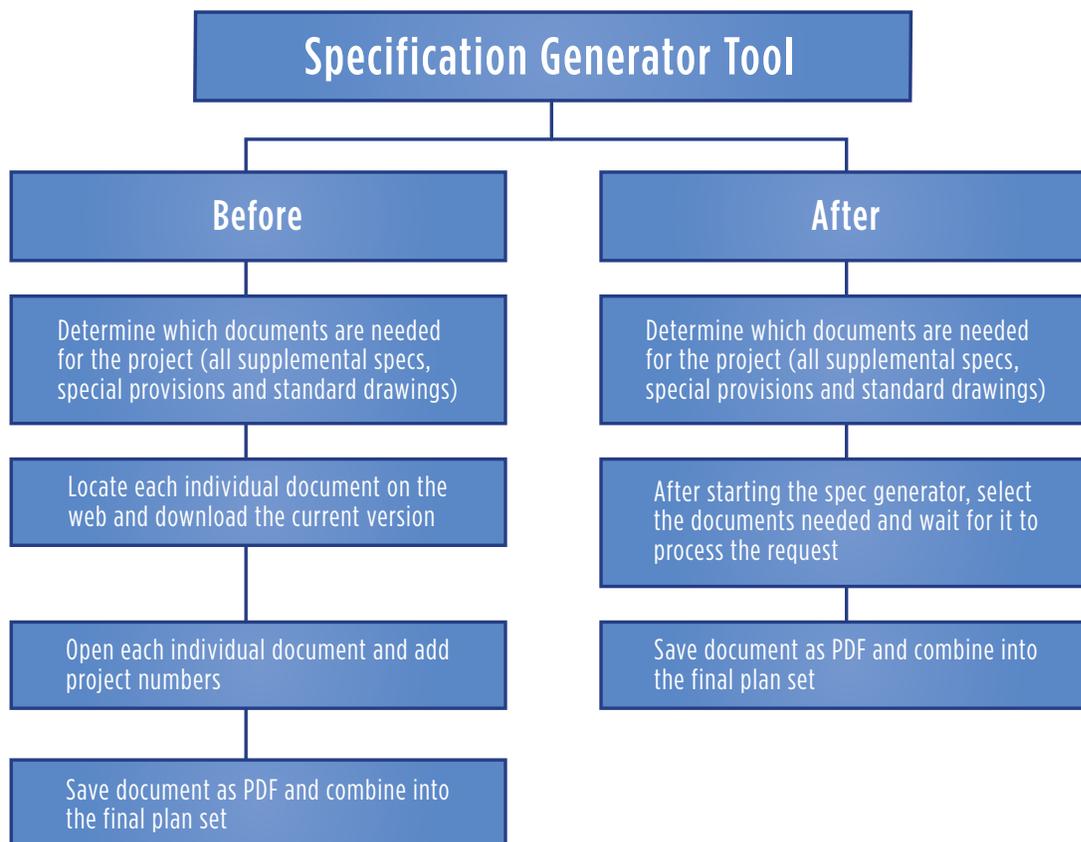
SPECIFICATION GENERATOR AND OTHER TOOLS

Savings: Estimated at approximately \$60,000 per year in Region Four, based on a savings of 12 hours per project and assumed advertising of 50 projects per year.

Efficiency: Significant decrease in the overall time spent putting together specifications and summary of items sheets for project plan sets, as well as yielding more complete and accurate plan sets by reducing the chance of human data entry error.

The savings and efficiency stated above are the result of three relatively new tools used by the Department to generate final plan sets for projects. These include the Specification Generator Tool, the Summary of Items Export Tool and the Auto Report Generator tool. An overview of each tool is given below.

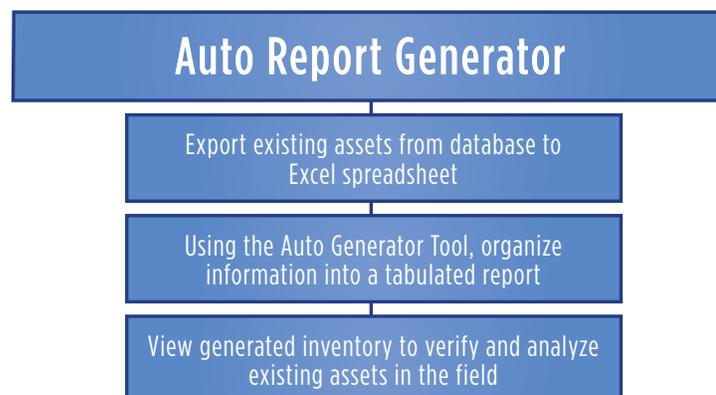
The Specification Generator Tool automatically pulls supplemental specifications, special provisions and standard drawings from the Department’s website, inserts project numbers and saves these documents together. This saves an incredible amount of time since there are so many separate documents that need to be individually edited to include the project numbers. The Specification Generator finds all of the documents needed for the project and saves them in one convenient location. This helps in ensuring that the latest specification is pulled and being used in the final plan sets. This tool provides approximately six hours of direct savings per project.





The Summary of Items Export Tool reduces manual data entry by exporting Project Development Business System (PDBS) data and automatically creating a summary of items sheet. PDBS is the Department's highway construction management tool and database. The Summary of Items Export Tool is extremely helpful in producing accurate information for projects during the preconstruction phase. This also eliminates mistakes, such as transposing figures, during manual entry of quantities in the engineers estimate. This tool provides approximately three hours of direct savings per project.

The Auto Report Generator tool will generate an inventory of existing highway assets such as signing, pavement striping, and barriers that are in place within the project area. This allows the designer to take this information to the site during the kickoff and scoping stages of the project and use it to verify existing assets. Prior to this tool, the designer would document existing elements on these site visits, rather than confirming location, quantity and other aspects. Both efficiency and accuracy are increased as the designer moves into the role of verifying existing assets as opposed to taking inventory for the first time. All of this translates into reduced time spent acquiring and verifying data, with fewer errors, and minimizes the project team's exposure to live traffic, thereby saving time and increasing safety. This tool provides approximately three hours of direct savings per project.



MOVING TO AN INTELLIGENT DESIGN AND CONSTRUCTION ENVIRONMENT

Savings: The Department estimates future savings of up to 60,000 hours per year by eliminating the plan sheet development process and providing the contractor with a three-dimensional model instead.

Efficiency: Three-dimensional designs allow an entire project to be viewed from all angles via a computerized model, reducing the time required to produce bids for Department projects as well as construction work requirements for the contractor, which will produce lower bid prices.

The Department is incrementally moving to an all-3D project design environment and has already realized some efficiency by implementing aspects of 3D design, including the following benefits:

- A more accurate view of all features on a project
- Greater accuracy estimating quantities and building the roadway
- Elimination and mitigation of errors during design and construction
- More efficient use of technology during construction
- A higher quality result
- Reduced time and effort during construction
- Better communication between the designer and contractor

Moving to an Intelligent Design and Construction workflow is a revolutionary change for state departments of transportation (DOTs), and our Department is leading the nation in this important innovation. Many state DOTs, including our Department, produce 3D models that are then converted to 2D paper plan-sets to be advertised and delivered to the contractor. Plan sets are stacks of paper diagrams that illustrate each aspect of the project, such as pavement layers, drainage structures including pipes and culverts and geotechnical features.

The plan set production process takes up 60 to 70 percent of a Department designer's time during pre-construction. Often, contractors need to re-create a 3D model to build the project, and that re-creation introduces the possibility of error. By giving the 3D model directly to the contractor, the Department will save time and project costs and improve quality. Further, each contractor bidding on a project will save up to 50 percent of its effort recreating plan sheets into its own model which will reduce contract amounts.

Many of the Department's contractors use Automated Machine Guidance (AMG) to build roads. AMG allows contractors to use 3D models to program heavy equipment, like excavators and pavers, to be guided directly from the model with very little input from the operator. The Department realized efficiencies in 2015 by providing the 3D model to the contractor on the I-80, Silver Creek to Wanship project. The contractor used AMG on earthmoving work, making a more efficient project timeline. In addition, the contractor eliminated nearly all of the traditional techniques to lay concrete on the westbound lanes using a "stringless" paving operation. After paving was complete, coring tests showed two deficient depth cores (AMG paved section) versus eight deficient cores with traditional paving (non-AMG in the eastbound lanes). AMG also resulted in fewer "must-grind" corrections for pavement ride quality. These advantages add up to longer pavement life and less rework.



This initiative will be implemented on additional projects going forward. In 2016, the Department's Region Two will advertise the I-215 resurfacing project using the 3D model "for information only." Providing this model will:

- Save the contractor from having to recreate a 3D model from the 2D plan sheets
- Allow for better bid pricing
- Provide the construction crews with the ability to check final grade with a Global Positioning System (GPS) unit
- Help identify possible utility conflict locations
- Enhance communication between the designer and the contractor, and greatly reduce the potential for error

Similar to the manner in which the Department is tracking progress with the aforementioned SUCCESS Framework initiatives, the Project Development Group will evaluate cost and efficiency for 3D Design and Construction in the coming years at control points one and two in the throughput diagram below.



HYDRODEMOLITION BRIDGE REHABILITATION TREATMENT

Savings: Estimated savings of \$13.5 million over the next five years on 27 bridges.

Efficiency: Implementation of hydrodemolition as a rehabilitation and preservation treatment for bridge decks reduces the overall bridge life cycle cost and extends the service life of a bridge.

Hydrodemolition is a concrete removal technique which utilizes high-pressure water to remove deteriorated and sound concrete as well as asphalt and grout. Hydrodemolition removes concrete selectively with minimum damage to good concrete in adjacent areas. It is used as a surface restoration and protection method for bridge decks. In most cases the top two to three inches of concrete is removed from the deck surface. Once the concrete is removed and the exposed surface cleaned, a concrete overlay is then placed on the deck. This method for rehabilitating structures can extend the service life of bridges for 15 to 20 years and has become a viable tool in the Department's tool box.



The Department's Bridge Management Program generates data to support project prioritization for maintenance, preservation, rehabilitation and replacement of bridges. The Bridge Management Program encompasses the Bridge Inspection Program, the Bridge Planning Program and Bridge Programming. Data is primarily generated through the Bridge Inspection Program. The Bridge Planning Program utilizes a suite of tools to assess bridge condition, project future deterioration, assess possible treatment and outcome scenarios and ultimately provide the optimal recommendation for the bridge. The goal of the Bridge Planning Program is to identify the right construction activity for the right bridge at the right time for the right reason.

Making the best use of limited funds to meet performance objectives has sharpened the focus on bridge rehabilitation and preservation. Through the planning process, bridge needs are evaluated and possible treatments are assessed. The use of hydrodemolition with a concrete overlay will become a viable option in comparison to deck replacements for extending bridge service life and reducing the whole life cost of a bridge.

Once a bridge is identified, Structures Design oversees the plan and specification development to support the preservation objective and convey requirements to the contractor. During construction, implementation is monitored to understand best practices. Information obtained from implementation is evaluated and incorporated into the Bridge Planning Program and delivery of future projects. This cycle, from inspection through planning and programming through project delivery, is key in monitoring and improving efficiency and effectiveness of the bridge preservation program.



On a recent bridge rehabilitation project, several deck treatment options were considered during design: the use of hydrodemolition with a concrete overlay, structural pothole patching with traditional jackhammer removal, a waterproofing membrane with an asphalt overlay and a deck replacement. Based on the bridge age, deck condition and long term plan for the area, the use of hydrodemolition with a concrete overlay was chosen as the best option due to the structure life cycle costs.

Hydrodemolition with a concrete overlay is a means to rehabilitate a bridge deck that is no longer a candidate for a pothole patch and overlay, at one-third the cost of a deck replacement. The Structures Division has programmed this treatment on 27 bridges over the next five years at an estimated savings of \$13.5 million. Considering the age of Utah's bridge inventory and condition, utilizing hydrodemolition with a concrete overlay is a cost effective means for extending bridge service life.

TOW PLOW SANDER IMPROVEMENTS

Savings: Approximately \$130,000 per year statewide from improving the position of the tow plow sander to more effectively spread material, and time and material savings associated with the new sanding level indicator.

Efficiency: Modification to the position of the sander and spinner on the tow plow allows up to 66 percent more area coverage on each pass and reduces double-coverage between the plow truck and the tow plow, and a new sanding level indicator alerts tow plow drivers when salt is running low.



The Department has 11 tow plows statewide. These, along with conventional snow plows, help to efficiently remove snow and ice from the roadway during winter storms and improve safety for the driving public. In 2015, maintenance crews developed a sensor to alert tow plow drivers when salt is running low. This helps tow plow drivers make the best use of materials and their time.

In addition, the Department's Spanish Fork Station crew found that their new tow plow was not applying salt effectively behind the tow plow. Most of the salt from the tow plow was being spread directly behind the plow truck, which doubled the coverage on a portion of the road. The crew tried several things to improve the coverage behind the tow plow. They found the best solution was to turn the sander 180 degrees, so the spinner was at the back of the tow plow. The crew ran tests and found this solution was very effective and increased the area covered with salt by roughly 66 percent.

If each of the Department's tow plows covered 66 percent more area with salt, for a typical snow year, the savings in salt would be approximately \$130,000 per year. There can be additional savings of \$2,000 per new tow plow in parts and labor by having the manufacturing company set up the tow plows as the Department has done when they are ordered.

TABLET-BASED MOBILE MMQA COLLECTION

Savings: Increased accuracy with a 25 percent reduction in data collection time and costs, or \$200,000* savings per year.

Efficiency: Increased efficiency and accuracy of MMQA field data collection over previous hand collection methods with a tablet based mobile application.

Utilizing a tablet based mobile application, the Department's Maintenance Management Quality Assurance (MMQA) field data collection efficiency and accuracy was increased over previous hand collection methods. The resulting Geographic Information System (GIS)-based data allows for improved opportunities for analysis and map-based conveyance of maintenance asset conditions.

The Department collects maintenance asset condition data biannually. This is a large undertaking that requires significant personnel resources to accomplish. The mobile tablets improved field collection efficiency, data transfer to the business system and resulting spatial representation of the results. The cost savings are a quantifiable benefit of approximately \$200,000* per year, but the qualitative benefits are just being realized, as the process has allowed new approaches to be considered for further leveraging of the program's benefits.

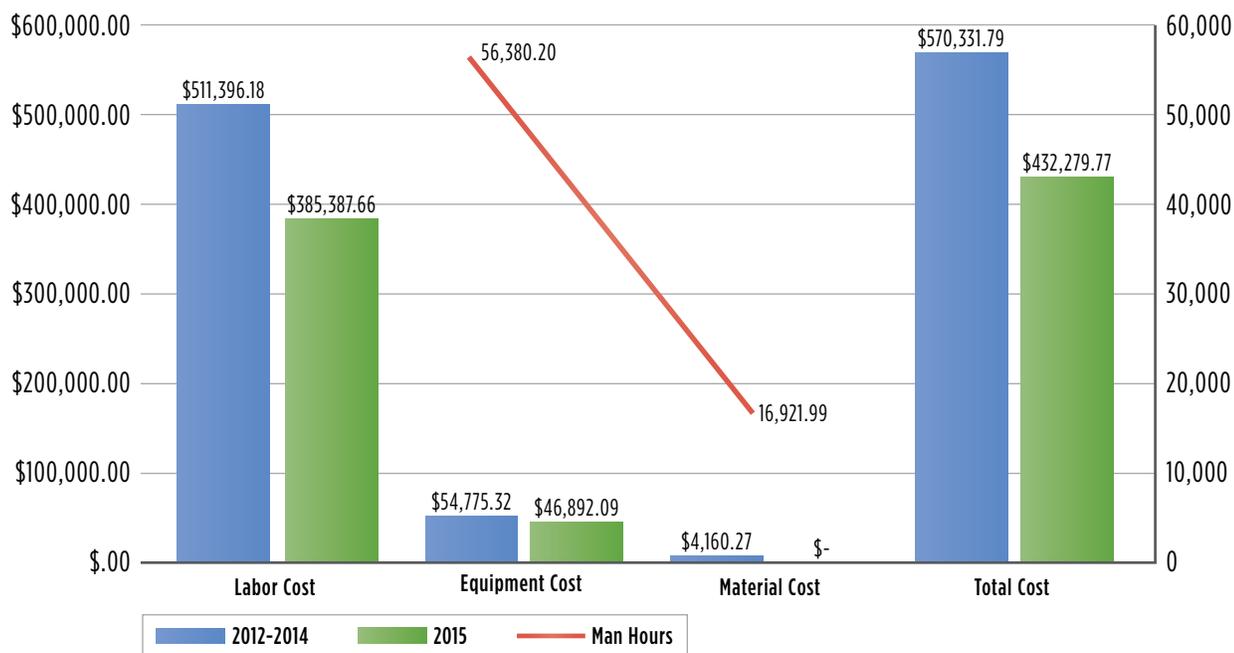
Primary efficiencies have been realized through improved collection efficiency as well as data transfer. The process has also improved the ability to provide Quality Control/Quality Assurance (QC/QA) over the collection process, resulting in more accurate data from which decisions are made. Finally, the interactive GIS-based results can be used and shared at all levels of the Department, yielding greater value from the process. Additional information is provided below on this initiative.

The process began in early spring 2014, when the Operations Management System (OMS) team began designing an iPad application that would help streamline the MMQA data collection process. The goal was to develop a tablet application to collect inspection data and automatically transfer that data to OMS. It was hoped that this demonstration project would expedite the collection process as well as improve the data quality.

Once layout design was completed, the team worked over the summer of 2014 to develop the tablet application as well as the web interface. Work was completed and tested in time for the fall 2014 MMQA counts. The team developed training and traveled statewide to work with MMQA teams to introduce the new system and show them how to use the iPads and the new app. The MMQA teams were quick to learn the app and began fall collections.

Two collection cycles (fall/spring) have occurred since the launch, and the process has shown an annual cost savings of nearly \$200,000* (25 percent reduction) compared to previous collection methods, as illustrated in the figure below. The development and hardware cost to get the program operational was \$125,000. The collection proved not only more efficient, but collected data also included Global Positioning System (GPS) locations which can be further leveraged in spatial analysis.

Total MMQA Costs Before and After iPads (w/o Region 2)



* Because of accounting issues, Region Two was not included in the chart, but savings were similar across all Regions. The included chart shows a savings of \$120,000 for three of the Regions. The overall estimated savings of \$200,000 includes Regions One, Two and Three actual costs, Region Two estimated savings and savings associated with the QA process.

In gearing up for the 2015 fall collections, the team is out again, gathering input from the collection teams about how to improve the program and make it more streamlined and beneficial to the MMQA teams, the maintenance stations, the Regional Offices and the Department as a whole. Much of this data is being processed in a study with the Department’s Research Division and a consultant, to identify additional efficiencies in the methods of sampling data.

The MMQA Mobile program is critical to helping Central Maintenance and Operations meet all of the Department’s Strategic Goals by providing cost effective and efficient maintenance of the Department’s highway assets. Although the program was not without its share of programmatic issues, the overall project was an extremely beneficial improvement over the old methods of collecting, storing and analyzing data. New improvements and enhancements are planned to further expand the program’s functionality.

The efficiencies gained through this new tool and process will measurably decrease the time required to obtain utility agreements. This will decrease the chance that project advertisement will be delayed due to utility agreement delays, and it should reduce the Department time required to complete agreements.

A conservative estimate is that it will improve the Department's Utility employees' efficiency by 10 percent. The Department has approximately 10 employees working on utility agreements. These employee costs are fixed, but if workload exceeds employee capacity, then consultants are hired to augment Region Utility staff. If the Department's Utility employees are 10 percent more efficient, then the Department can hire fewer consultants to augment staff, resulting in a cost savings of at least \$162,000.

The screenshot displays a software interface for tracking utility agreements. It is divided into several functional sections:

- Agreement Record Selection:** Includes fields for 'Clear Selection', 'Select Region Agreement ID Number' (with a dropdown showing '150040'), and 'Select PIN'. A 'Then Select RID & Entity' section is also present.
- Agreement Administration:** Contains buttons for 'Create New Agreement Record' and 'Modify Agreement Information'.
- Authorization Letters:** Features a 'Create Authorization Letters' button.
- Agreement Information:** Displays details for 'Entity' (Rocky Mountain Power, CID: S3570, Comptroller #), 'Entity Contact' (Sue Jensen, Contact Phone: 801-220-2444, Contact Email: Susan.Jensen@rockymt.com), 'Agreement Type' (100% Utility Reimbursement Agreement, Preconstruction), and 'Agreement Comments' (7/21/2015: Record Created) with an 'Add to Comments' button.
- Agreement Progress:** A vertical list of milestones with 'Modify Date' and 'Select Date' fields. Milestones include: Shotgun Estimate Developed (7/16/2015), Preliminary Design Authorization Sent (7/21/2015), Entity Estimate Requested (7/21/2015), Entity Estimate Received (7/16/2015), PM Compatibility Approval Sent (7/30/2015), Agreement & ATP Letter Submitted for QC (7/21/2015), QC Completed (7/30/2015), Entity Agreement Sent (7/30/2015), Signed Agreement Received from Entity (7/30/2015), Region Signatures Obtained (7/30/2015), Signed Agreement Scanned and in PW (7/30/2015), Agreement Sent to Comptroller (7/30/2015), Agreement Received from Comptroller, Executed Agreement Scanned and in PW, PW Link Sent to Notification List, and Executed Agreement Sent to Entity.
- ePM Information:** Shows 'PIN' (10400), 'Project Number' (F-LC05(3)), 'LG' (Y), and 'Pin Status' (Active). It includes 'Project Description' (200 East, 2200 N. to North Logan Boundary), 'Project Concept' (New Construction), 'Project Manager' (TERRY, ROD), 'Design Leader' (H W LOCHNER, INC.), and 'Resident Engineer' (JUB ENGINEERS INC.). It also lists 'Project Delivery Method' (Design, Bid, Build) with dates for SAD (11/4/2015 5:00) and CAD (8/22/2015).
- Cost Info:** Includes fields for 'Entity Share', 'UDOT Share', 'Entity Betterment', and 'Total Cost', with an 'Update Cost Information' button.
- Summary Sort Order:** Offers sorting options for 'Progress', 'CAD', 'RID', and 'PIN', along with an 'Update Summary Table' button.

Screenshot of the Utility Agreement Tracker summary table

The cost savings from a decrease in project delays is more difficult to calculate, but it could be exceedingly more impactful. The delay of one construction year on a large project could add up to a large amount. If a \$200 million project is delayed one construction season, or if the project is advertised with utility limitation and those limitations are not cleared on time, then the cost could be millions of dollars (e.g., \$200 million X 3 percent annual inflation = \$6 million).