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CONCRETE BRIDGE DECK AND GIRDER STANDARDS
Savings with Deck Panel Standards: Up to $1,000,000 per bridge in user travel time reductions
Savings with Girder Standards: $23,000 per span for a typical 100-foot long bridge
Efficiency: Reduced construction time and reduced design, fabrication and construction costs

As part of the Department’s current effort to make accelerated bridge construction (ABC) a common practice, it has undertaken a significant effort to develop design standards and standard details for precast concrete deck panels and for precast prestressed concrete girders called “bulb tees.” The use of design standards reduces the amount of drafting time, and the repetitive detailing saves money during fabrication and construction.

To develop precast concrete deck panel standards and details, the Department researched other states’ successes. National and local experts evaluated the chosen standards for quality. The standardized deck panels can be used for new bridge construction or for replacement of aging, deteriorated bridge decks. As much as $1,000,000 per bridge can be saved by road users due to reduced travel time when precast deck panel standards and other ABC methods are employed. The cost of precast deck panel projects has dropped to approximately the same as conventional construction. Savings from standardization have started to be realized. With increased use of precast panels, further reductions in construction costs are anticipated.

Bulb tees are a new generation of concrete girders that the Department plans to use for all future concrete bridges. They are more slender and offer better structural efficiency than standard “I” girders currently used by the Department. This efficiency will result in reduced construction costs by spanning longer distances with lighter girders that require less concrete and reinforcing steel. Additional cost savings are expected in design and fabrication by developing formal standard sheet drawings for the more efficient bulb tee girders. After a nationwide search of various bulb tee girder standards, the Department selected one developed by Washington State DOT that offered the best overall performance for implementation in Utah. The Department has also reached out to local contractors and fabricators to ensure that the girder will be efficient and cost effective to build. The estimated cost savings with the new girder for a typical 100-foot long bridge is approximately $23,000 per span. Development costs for the standards will be recouped with the design of approximately 8 bridges, and significant cost savings will occur as the use of these girders becomes more widespread.
CANTILEVER SIGN STANDARDS
Savings: $8,000 per unique structure in design costs
Efficiency: Reduced design, fabrication and construction costs

The Department recently developed standard designs for cantilever sign structures. This type of sign structure is common for exit signs and other locations and has, in the past, often added cost to the project design budget and delays to the project advertisement. The new standards consist of drawings and a section of the Structures Design and Detailing Manual on Minor Structures. In the Design Manual, the Department defines the parameters and the method for selecting the structure requirements and also outlines the foundation selection based on expected soil types. In the event the structure does not fit the standard design parameters for span, structure height or soil types, the new standards include direction as to when a custom design is required. The details for the sign standards still apply, but the designer of the custom structures is responsible for developing the structure requirements based on the specific needs of the sign structure.

During development of the design standards, coordination with the local fabricator allowed for the consolidation of some best practices from other states, as well as for the cost-saving detailing methods that were acceptable to the Department. All future cantilever sign structures can be specified for wall thickness and tube diameter on the basis of these design standards. It is estimated that each unique design that qualifies for the standard design will save approximately $8,000 in design costs to the public. The consistency and standardization of the designs likely equates to some additional savings in construction and bidding.
IMPLEMENTATION OF THE SELF-PROPELLED MODULAR TRANSPORT

Savings: $8 million and upwards annually in user costs
Efficiency: Reduced travel time and delays during bridge replacement projects

In line with the Department’s current effort to make accelerated bridge construction (ABC) more common and efficient, use of the Self-Propelled Modular Transport (SPMT) has risen from a fringe technique to a mainstream construction practice in building and replacing bridges in the state of Utah. Early projects, such as the bridge replacement at 4500 South over I-215 in Salt Lake County, were successful proofs of concept. Further projects using the SPMT refined the process, thereby improving efficiencies and lowering costs, including several bridges along I-80 east of State Street in Salt Lake City and still more located further to the east on I-80 in Parley’s Canyon.

The SPMT is a means of moving an existing bridge off-site or of moving a newly constructed bridge, built on a site near the final bridge location, to the final bridge site. When the new bridge structure and the new on-site abutments are complete, an SPMT lifts the new bridge from its construction cradle, “walks” it over to the new abutments and sets it gently in place. Once tie-ins between the new bridge and the existing roadway are completed, the structure is opened to traffic with minimized travel delay in the area.

The use of the SPMT has directly benefited the Department and the public. As more SPMT projects are completed, the process moves more toward a standardized plan. As specifications are fine-tuned, and as the practices involved in SPMT projects become more familiar to design, management, and construction teams, efficiency of expediting SPMT projects can be expected to improve. SPMT projects have an advantage over traditional construction in that they help mitigate user costs such as lost time and fuel consumption by reducing road closures, lane restrictions and detours. The associated annual user cost savings are estimated to be over 8 million dollars over the past few years, based on the length and complexity of the projects, the volume of traffic through the job sites and the number of bridge projects.

Given the success of SPMT projects to date, the Department expects to expand the use of the SPMT to include as many bridges as possible. The time and cost savings to the traveling public, combined with increasing efficiency in expediting bridge construction and replacement projects, strongly support this course of action.
CONSTRUCTION MANAGEMENT/GENERAL CONTRACTOR PROCESS

Savings: 30 to 40 percent reduction in costs to some projects
Efficiency: Reduced time to advertise, design and construct certain projects

The Construction Management/General Contractor (CMGC) process is a modified Design Build contracting process in which the owner holds the contract for both the consultant designer and the contractor. This puts the owner, in this case the Department, in charge of project decisions and keeps the cost savings with the Department. The chief benefits of this process are speed of delivery and flexibility. Comparing CMGC projects to traditional projects shows time savings through beginning the project earlier, the design taking less time, the construction taking less time and reducing project time by overlapping design and construction.

With the CMGC process, projects can begin earlier because a design is not needed to advertise, and the selection process is simpler. Some CMGC projects report a cost savings of 40 percent in design, for a 25 percent or more reduction in time. This savings is attributed to the improved communication that occurs between the contractor and the designer in the design process, which also reduces risk and improves constructability. Additional project time savings is also possible by the overlapping of construction and design. CMGC is a delivery method that provides flexibility in responding to the priorities of cost, schedule and quality.

The CMGC method was chosen over the Design Build method for the recent Riverdale Road project in Region One because of the need for project speed and to manage risk. The CMGC method provided the project team with the flexibility to deal with risk in real time. The contractor was able to meet the public early and become committed to the public's needs, the project goals and the design. As a result, a significant reduction in change orders over traditional projects was realized on the Riverdale Road project.

Region Four of the Department has also been using CMGC projects to deliver finished projects in a much shorter time and at lower costs, including portions of the Southern Parkway, State Street in Hurricane and SR-18 from the Trails Interchange to the Ledges Interchange. The CMGC process has allowed the use of some of the state’s most innovative contractors to complete difficult projects on time and on budget. Use of this project delivery method on an increasing number of appropriate projects statewide is anticipated by the Department.
PUBLIC SAVINGS FROM TRAFFIC DELAY REDUCTION

TRAFFIC SIGNAL DETECTION IMPROVEMENT PROGRAM
Savings: $17 million in travel time savings for the first year
Efficiency: Reduction in traffic delay at intersections

Properly functioning vehicle detection is essential for the efficient operation of a traffic signal. Simulation studies conducted by the Traffic Management Division in the Department have found that malfunctioning detection can add anywhere from 13 percent up to 83 percent to total intersection delay. In order to improve traffic signal operations, the Division began a program to upgrade traffic signal detection throughout the state. The Division received an annual building block of $2,000,000 dedicated to this purpose.

The upgrade project began with detailed inspection of over 200 intersections with known problems. A priority list was compiled, and improvements were completed on 91 intersections spread across the four Regions of the Department. Improvements consisted of repairing or replacing pedestrian pushbuttons, inductive wire loop detectors and video detection equipment. Estimated benefits in the first year of the program, as a result of the improvements at the 91 intersections, include over 1,000,000 hours of travel time savings, equivalent to approximately $17 million in value to the public, and over 500,000 gallons of gasoline saved by the public.

MOVABLE CONCRETE BARRIER IN I-80 RECONSTRUCTION ZONE
Savings: $4,000,000 in user costs
Efficiency: Reduced traffic delays, travel time and congestion

The section of I-80 between State Street and 1300 East in Salt Lake City was being reconstructed from three lanes in each direction to four lanes in each direction plus auxiliary lanes. It was anticipated that the construction activity would reduce the travel way to two lanes in each direction and severely impact the traffic. This would create unacceptable delays and decreased safety in the corridor. In order to minimize impact to the traveling public, it was decided that there could not be a reduction in travel lanes during peak commute times; therefore, three lanes would need to be maintained. The concept of movable barrier was implemented that allowed for three lanes of traffic in the westbound direction during the morning commute. The barrier would then be shifted to allow three lanes of traffic eastbound for the evening commute. Delays in the corridor were minimal, and safety concerns that result in congestion were eliminated. An estimated 1,600 hours of traffic delay were eliminated, with a user cost savings over a 10-month period of approximately $4,000,000.
SAVINGS FROM SUSTAINABILITY INITIATIVES

WIND AND SOLAR POWER AT MAINTENANCE STATIONS AND CONSTRUCTION OFFICES

Savings: Supplies 20 to 40 percent of the facilities’ power use and reduces greenhouse emissions
Efficiency: Contributes to the Governor’s renewable energy program

The Governor has mandated that State government will establish programs to install on-site renewable energy sources to reduce energy consumption by two percent by 2015, as compared to 2005 levels. The three projects described below are the Department’s contribution to this long-term program for this year, following a 3,200 watt, grid-tied solar photovoltaic system installed in Murray the previous year. Funding for the projects was provided by the Department and matching grants from the Utah Geological Survey’s State Energy Program.

In March 2008, the Department put into operation its first grid-tied wind turbine at the Milford Maintenance Station 4531. The 1,800-watt, Skystream 3.7 wind turbine sits on top of a 45-foot tower and can generate as much as 2,200 watts of AC electricity. The turbine is tied directly into the electrical grid and uses no batteries. The Milford Maintenance Station is participating in Rocky Mountain Power’s net metering program that allows the Department to cogenerate electricity on-site and to use the credits for the amount of any excess power that is fed back into the grid at a later date. Milford was selected as a good candidate for this project due to the steady and consistent wind. It is estimated that this turbine will provide up to 40 percent of the station’s yearly power use.

In September 2008, a 3.8-kilowatt solar photovoltaic array went into operation on the Wanship Maintenance Station near SR-32. This system consists of twenty 190-watt solar panels and a single inverter. It is expected to offset approximately 20 percent of the station’s annual energy consumption.

In October 2008, a 5.7-kilowatt solar photovoltaic system went into operation at the Moab Construction Field Office. This system consists of thirty 190-watt solar panels and a single inverter. It is expected to offset approximately 25 percent of the office’s annual energy consumption.
SAVINGS FROM SUSTAINABILITY INITIATIVES

IN-PLACE ASPHALT PAVEMENT RECYCLING

Savings with Full-Depth Reclamation: Up to 30 percent cost savings of materials and construction
Savings with Cold-in-Place Recycling: $7,500,000 savings versus full reconstruction on one project
Efficiency: Reduced construction time and costs and material costs; unmeasured energy and user cost savings

Two asphalt pavement recycling or reclamation methods and associated projects are noteworthy for the year. One method is Full-Depth Reclamation (FDR) which was used for asphalt pavement reconstruction along 3300 South to the east of 700 East, and along Redwood Road from Bangerter Highway to Saratoga Springs in Salt Lake and Utah Counties. For the FDR method, traditional rotomilling was used to remove the top few inches of the roadway. Next, a road reclaiming machine was used to pulverize the road base material and to add emulsion (asphalt oil and water) to the mixture. The aggregate was then graded and compacted. As the reclaimed area dried, the compacted aggregate became a strong, durable base for the final layer of new asphalt pavement. Benefits of using FDR on these projects include up to 30 percent cost savings of materials and construction by reclaiming the existing road base, reduced construction time compared to replacement of the existing base, fewer trucks impacting the traveling public, increased safety due to no drop-off hazards, fewer access closures since motorists can drive over the compacted surface, and use of fewer resources.

The second method to highlight is the Cold-in-Place Recycling (CIPR) method used with an asphalt overlay on US-40 near Soldier Creek and Current Creek in Region Three. The project was originally planned as a full reconstruction of the existing asphalt pavement and road base, with an initial estimated cost of $20,000,000 for the eight-mile section. The Region looked at different alternatives that met the needs of the project and increased the chances of funding. The decision was made to cut the section into two projects and use CIPR to keep the project moving forward. The CIPR method involves in-place processing of existing asphalt pavement, mixing the material without heat with liquid rejuvenators and new asphalt binder, placement and compaction. The pavement design and contractor involvement were critical to keeping costs down on this project and addressing the structural need of the pavement. By milling some of the asphalt and using CIPR for the rest prior to overlay, the stripping that was causing the pavement distress was addressed without full reconstruction. The cost savings from the recycling project for the 5.5-mile section completed, compared to the full-reconstruction estimate, was approximately $7,500,000. By changing to CIPR, the project was funded, designed and constructed under budget and on schedule. This portion of the project was completed in just a couple of weeks with very minimal impact to the traveling public, whereas full reconstruction would have taken months and had higher user costs.
OPERATIONAL SAVINGS

PAVEMENT MANAGEMENT QUALITY IMPROVEMENT TEAM
Savings: Focused strategy for preservation and rehabilitation of roads with limited funding
Efficiency: Spend the available funding in a more effective manner

The large rise in construction costs has required the Department to reduce the number of pavement preservation and rehabilitation projects released for construction over the past four years. This created a backlog in the pavement management program and a subsequent decline in overall condition of the pavement system. In response to this condition and the current economic downturn, the Department enacted a Pavement Management Quality Improvement Team (QIT) Steering Committee to assess the breadth of the challenge and develop a suitable solution. The Steering Committee examined all aspects of the Department’s pavement management program and selected several promising recommendations to be included into a Pavement Management Strategic Plan. This plan included a tiered approach to prioritizing pavement sections in the state system using Maintenance Management Levels (MML), in which higher priority sections were chosen based on their higher number of vehicles and large trucks. Pavement management strategies were identified for each MML and included several innovative, cost-saving, and quality-based approaches to preservation and rehabilitation of the pavement system. Use of these strategies will allow the Department to focus its limited preservation and rehabilitation budget on roads which carry 95 percent of the traffic and provide consistent direction statewide for maintaining the rest of the system.

VALUE ENGINEERING PROGRAM
Savings: $6,700,000 one year
Efficiency: Fine-tunes project scope and costs prior to advertising and allows for alternatives from contractors

In compliance with federal code and where otherwise deemed beneficial, the Department performs Value Engineering (VE) studies in the preliminary engineering phase of some projects. The VE process is a systematic application of recognized engineering and design techniques to add value, reduce costs and improve productivity of projects. VE studies are guided by a specific job plan that includes teamwork, functional analysis, creativity and cost worth. The Department performed six new VE studies during this year that generated 64 recommendations. The project teams implemented 12 of the recommendations for a savings of $500,000 as compared to the original project estimates. Projects carried over from previous years implemented six of 19 recommendations producing additional savings of over $5.8 million.

As part of the VE program, the Department also allows contractors to generate technically viable alternatives in the construction phase in the form of a Value Engineering Change Proposal (VECP). Savings from the accepted VECP are split between the contractor and the Department. The construction VECP program approved three proposals this year with a net savings to the Department of approximately $390,000.
RESPONSIBILITY FOR CATEGORICAL EXCLUSIONS

Savings: Expedited review and approval process for Categorical Exclusion projects
Efficiency: Elimination of FHWA review and approval for almost all Categorical Exclusion documents

In 2008 the Department and the Federal Highway Administration (FHWA) signed a Memorandum of Understanding (MOU) that delegated the responsibility of approving Categorical Exclusion documents from FHWA to the Department. As a brief background, any project that receives federal funding must undergo some type of environmental study, with a provision for specific types of Categorical Exclusion projects that generally do not have significant environmental impacts and do not require a detailed environmental study. For FHWA, these categorically excluded projects include resurfacing, restoration, rehabilitation, reconstruction, turn lanes, intersection improvements, auxiliary lanes, bicycle and pedestrian facilities, bridge rehabilitation and bridge replacements. Although these types of projects are generally not the biggest projects in terms of budget, there are many more of these projects in number, and getting environmental approval for them quickly is a benefit to the Department.

Prior to the signing of the MOU, the Department was required to send many of these categorically excluded projects to the local FHWA division office for review and approval. In 2007, the time required for the FHWA review and approval ranged from one day to 77 days, with an average of 17 days. With the MOU in place, the time for environmental managers in the Department to review and approve documents has been reduced to less than one week. By taking on this responsibility for FHWA, the Department frees up more time for FHWA to focus on Environmental Assessment and Environmental Impact Statement documents for the more complex projects. The Department has shown that it is capable of assuming this type of responsibility and could be considered for more delegation responsibility of this nature in the future.
REMOTE-CONTROL CAMERAS TO VIEW ROAD WEATHER CONDITIONS
Savings: $65,000 annually, improved safety due to more timely response
Efficiency: Assess roadway conditions without sending an observer and truck

Maintenance station supervisors dispatch snowplows based on their understanding of road conditions in their assigned area. In a test program to avoid wasted snowplow trips to distant locations, the Department implemented off-the-shelf remote-control camera technology to provide high-quality still images via wireless technology so that snow managers could assess road conditions via the Internet. Five locations with a variety of power and telephone or wireless Internet availability were selected for this test program to evaluate components and service robustness. The use of solar-powered sites, hard-wired sites, locations with exceptionally poor communications and freeway-side installations tested the concept and equipment under a variety of conditions. Savings from avoiding just two trips per month will amount to over $9,000 in avoided costs. Less fuel will be used, equipment wear will be reduced and more observations can be made, which will lead to more timely response if adverse conditions are detected at these remote locations. Full deployment will include about sixty locations statewide. Annual savings could be well over $65,000.

MEETING TRIP REDUCTION INITIATIVE
Savings: $234,000 annually and upward at full implementation
Efficiency: Reduced travel for training and meetings

In support of the state’s TravelWise initiative that encourages alternatives to driving, the Department has implemented the Adobe Acrobat Connect Pro system for training development and web-conference meetings. Department-wide availability of Adobe Acrobat Connect Pro reduces the need for Department staff in remote locations to attend training and other business meetings in person, reduces traffic congestion, improves air quality and reduces energy consumption. The system offers functionality to support several forms of interactive training sessions and web-conference meetings. The Department has been using Adobe Acrobat Connect Pro for several months and is experiencing a high level of use, especially in the more distant and spread-out Regions. Projected annual savings for the first year are $234,000 based on the reduced travel time.