

# APPENDIX

## SUMMARY OF MoDOT RESULTS

Innovation/Efficiency	2019 MoDOT Savings	2019 Customer Savings	2019 Additional Funds	2019 Lives Saved	Cost-Benefit Details
MoDOT's Bolder Five-Year Direction	\$ 121,000,000				By reexamining everything we do, MoDOT achieved substantial savings through the sale of obsolete facilities and equipment and a significant workforce reduction (1,200 employees). We transferred these savings to meet customers' road and bridge expectations. This effort began in 2010. Savings are reinvested in the Missouri highway system.
Alternating Passing Opportunities with Shared 4-Lane Design	\$ -	\$ 26,932,512		3	A shared 4-lane can be thought of as a 2-lane road featuring a passing lane that alternates every mile or so between opposing traffic. This provides safe opportunities for drivers in both directions to pass slower vehicles. Four Missouri highways use the 4-lane approach, totaling 117 centerline miles. Savings shown here reflect the difference in cost between building traditional 4-lane highways and the shared 4-lane approach. Traveler savings in time and fuel costs are not shown, but are thought to be significant.
Paving With Recycled Materials	\$ 24,592,153				As asphalt costs rose in other states, MoDOT's emphasis on asphalt pavement recycling and use of used roofing shingles in pavement mix helped contractors keep the average bid price per ton of asphalt steady in Missouri. The use of recycled asphalt can reduce material costs by \$5-10 per ton. This effort began in 2004 and savings are ongoing.
Achieving the Improbable With Design-Build Approach	\$ 1,800,000			6	In the early 2000s, Missouri's legislators authorized MoDOT to use a design-build approach on three projects to demonstrate whether the public sector success of this innovative bid-build approach could be replicated in public works. Since then, MoDOT has delivered 11 Design-Build Projects that were completed 74 months ahead of schedule. MoDOT continues to partner with the public and private sectors to deliver projects that maximize available resources into collaborative solutions that achieve goals. This collaborative effort challenges the way projects are delivered. MoDOT pushes the boundaries to execute projects of different size and complexity using innovative data driven processes and a wide range of public and private partnerships. Concentrating on project goals, innovation, schedule and budget, construction is completed more efficiently, with less impact on travelers.
Engineering Reviews Enhance Value	\$ 10,919,574				Before design and construction projects can be called complete, consultants or sharp-eyed co-workers review methods and procedures. The ideas they offer often improve project practicality and the bottom line.
Building Slim Shoulders Where None Existed	\$ 17,914,000	\$ 69,977,806		7	MoDOT has installed thousands of miles of shoulders and rumble strips on rural highways where there were none. Using a 2-foot standard rather than the 4-foot shoulder required for major roads made this possible. The result - a 30 percent reduction in run-off-road severe crashes. Engineered shoulders helped drivers regain control. The paving cost of a 2-foot versus a 4-foot shoulder saves \$106,000 per mile and reduces the cost to obtain sufficient right-of-way.
Offender Work Crews	\$ 12,379,600				The Missouri Department of Corrections partners with MoDOT to allow offenders to perform labor-intensive work. This allows MoDOT to focus its resources on more skilled tasks.

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At-Grade Crossing Conversion to J-Turn	\$ 35,700,000	\$ 44,218,099		4	<p>J-Turns, a cost-effective alternative to an overpass, reduce the number and severity of crashes at at-grade highway intersections. Traditional interchanges cost \$5-10 million to build. J-Turns average cost is \$800,000. At locations where J-Turns were installed, crashes are down 25 percent and those incidents result in 88 percent fewer fatalities.</p> <p>This design innovation allows us to address a minimum of six severe crash sites with the same money it would take to build a single traditional overpass. MoDOT's first J-Turn was built in 2007.</p>
Optimizing Pavement Striping Strategies	\$ 14,400,000				<p>Because we found that stripes on low-volume highways show less wear than those on major roads, we chose to extend the duration of the minor route restriping schedule. As a result, we sold 30 percent of our specialized striping equipment and reassigned employees to other needed work. This approach maintains traveler safety and meets customer expectations.</p>
Innovative Finance	\$ 17,876,552				<p>MoDOT refinanced and paid off some bond debt years early, allowing millions to be directed to Missouri's roads and bridges.</p>
Converting Roadside Assets to Truck Parking	\$ 1,704,241				<p>Though other states have shuttered rest areas in an attempt to save money, Missouri converted obsolete and expensive-to-maintain rest areas and weigh stations to basic truck parking areas.</p> <p>The costs of decommissioning these sites is quickly recouped. When converted, there is no need for building cleaning services, site maintenance or water. Electricity costs are slashed.</p> <p>Motor carriers praise Missouri. The conversions increased the number of publicly provided truck parking spaces in the state, making it easier to find a safe place to sleep. Rested drivers are safer drivers.</p>
Efficient Traffic Signal Design	\$ 1,500,000				<p>By scrutinizing every aspect of traffic signal design and operation, we found efficiencies and now save more than \$1.5 million that can be used on road and bridge work each year. We shared our discoveries with Missouri cities, counties and developers. As a result, the savings opportunities stretch beyond MoDOT alone.</p>
Mowing Smart	\$ 1,500,000				<p>Starting in 2011, MoDOT adjusted our mowing schedule on low-volume highways to shift more of the budget to Missouri's roads and bridges each year. On odd years, two passes are required to make sure no substantial growth occurs in the clear recovery zone and on even years, only one pass is required on the final mowout to assure there are no sight distance issues.</p>
Converting Signals to LED Lighting	\$ 1,159,261				<p>Replacing incandescent signal bulbs with LED bulbs results in remarkable energy savings. Also, because LEDs last longer, they are changed less often, resulting in lower labor costs. MoDOT's LED efforts earned an AASHTO Sweet Sixteen award and is emulated by other states.</p>
Fighting Snow with Beet Juice and Salt Brine	\$ 1,418,000				<p>Salt brine, a liquid solution, soaks into pavement. It is used to pretreat roads for expected storms because rock salt is scattered by passing traffic. Beet juice is a waste product of sugar production. The sticky substance helps rock salt adhere to pavement, increasing the effectiveness of MoDOT's winter storm activity. Both innovations reduce MoDOT's salt usage.</p>

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Building on a Strong Base - Intelligent Compaction	\$ 2,862,420				Improvements to soil and aggregate compaction under the highway increase pavement service life and decrease maintenance costs for MoDOT. The approach also saves considerable time and labor costs for contractors.
Bridge Redecking Template	\$ 148,050				When bridge supports are in good shape, MoDOT redecks older bridges rather than replacing the entire structure. MoDOT uses a standard template for the design of bridge redecking projects to save design time and costs. Travelers enjoy the design time savings and Missourians benefit from cost savings.
Achieving Savings Through Research	\$ 1,035,000				MoDOT actively pursues academic and other research to discover new methods to drill bridge support shafts. Methods derived from spread footing geotechnical research conducted in 2011, for example, will save \$100,000 in a typical year.
Streamlining Survey Costs with Light Detection and Ranging (LiDAR) Technology	\$ 2,800,000				LiDAR instruments measure distance to a target by illuminating it with a laser light. Adopting this technology reduced the cost of survey design.
TowPlow - Missouri-Made Snow Fighter	\$ 520,506				The TowPlow was created by a former MoDOT employee. The TowPlow blade swings out to the side of a snow plow-equipped truck to help clear more lane miles with fewer trucks and operators. MoDOT includes 81 TowPlows in its snow-fighting arsenal. Many other four-season states investigated our success and obtained TowPlows for their own fleets.
Sign Design Modifications	\$ 500,000				MoDOT designs as many signs as possible to fit on existing posts, resulting in significant savings.
Modifying Chevron Sign Spacing	\$ 467,667				MoDOT adopted federal standard spacing for installation of chevron signs in curves, eliminating the need for an engineer's field visit. The change also reduced the need for an average of two signs per curve, a savings of \$720 on each.
Achieving Efficiency with Bridge Analysis Software	\$ 321,940				New LARSBridge software helps bridge engineers more quickly and accurately conduct structural analysis for the movement of specially-permitted super-heavy truckloads. The quicker response and more accurate restrictions save motor carriers time and money while reducing the need for staff resources and improving bridge preservation efforts.
Efficiently Mitigating Wetland Impacts- MoDOT Wetland Mitigation Banks	\$ 35,500				Wetland banking allows MoDOT to mitigate for wetland impacts by restoring larger wetland sites that are more ecologically beneficial for the environment. Wetland banking aids in reducing the realty, construction and maintenance burdens imposed by creating wetland mitigation for individual projects.
Choosing the Most Cost-Effective Sign Posts	\$ 400,000				By changing its one-size-fits-all sign post philosophy, MoDOT saves by choosing the smallest post for the job at hand and avoids costs associated with well-intentioned over-building.
Energy Saving Lighting	\$ 64,000				When existing bulbs for overhead and task lighting burn out, MoDOT replaces them exclusively with LED lamps. LEDs consume much less energy and last far longer, saving both electricity and labor costs. The effort expands beyond offices and maintenance areas. The Rock Port, Mo., welcome center earned LEED Silver certification in part because of its use of LED lighting.

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Reassessing Road Sign Needs	\$ 150,000				MoDOT looked at every type of sign and learned some were not essential to safe roadways. These are not replaced when they deteriorate.
Paperless Contract Storage	\$ 65,000				By using electronic storage, MoDOT reduces its long term document storage costs. Contracts and bonds prepared for road and bridge work average well over 100 pages each. Creating, modifying and delivering them electronically for approval cuts processing time from 30 days to 3 days. MoDOT's other agreements, such as reciprocal agreements and memorandums of understanding are stored and often produced paperlessly. This expedites the research, review and handling of such documents, saving staff time and other costs.
Remapping Snow Plow Routes	\$ 38,000				MoDOT's St. Louis District reexamined the routes its snowplow operators drive, discovering changes that resulted in a savings of 10 minutes per cycle. Pavement is treated faster, saving \$9,400 per storm and making the way safer for the millions of travelers in the region in less time.
Merging Operations Software	\$ 75,000				By merging multiple software contracts into one we found efficiencies for our system.
Converting Roadway Lighting to LED	\$ 49,113				Replacing high pressure sodium highway lights with LED lighting results in remarkable energy savings. Also, because LEDs last longer, they are changed less often, resulting in lower labor costs.
Realty to Roads Property Sales Program			\$ 1,703,621		MoDOT sells state-owned property no longer needed for transportation purposes. The proceeds from this program during the past 10 years are reinvested into the road fund. In 2010, MoDOT's Right of Way Division earned the 2010 FHWA Excellence in Right of Way Technical Specialty Award for the team's aggressive approach and rationale in selling excess property.
Realizing Revenue Through Recycling			\$ 270,435		Recycling paper, plastic, ink cartridges and more is second nature for MoDOT office employees. Field staff routinely collect scrap metal, tires, anti-freeze and the like. All of the items are sold with the revenue invested in Missouri's highway system.
Cost Share and Cost Participation Programs			\$ 37,729,000		Communities contribute to state highway projects to receive needed upgrades faster. Revenues from local tax initiatives often provide the local portion in Cost Share Program projects.
Encouraging Economic Opportunity and Competition Using Federal Funds			\$ 444,958		MoDOT uses Federal Highway Administration funds to administer programs that expand business opportunities for historically disadvantaged groups. By educating business owners how to pursue opportunities with the state and by providing real-world experiences through apprenticeships, MoDOT benefits from an expanded pool of competitive vendors and increased numbers of skilled laborers.
Revenue Generated from Leasing Property			\$ 8,000,000		MoDOT leases Commission owned property when it does not interfere with the operation of the system and benefits the public. Areas leased are utilized for agriculture purposes, parking facilities, highway patrol regional sites to list a few. The additional revenue is reinvested in Missouri's highways.

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Keeping Cars on the Road with High Friction Surface Treatment		\$ 6,493,039			MoDOT achieved a 20 percent reduction in run-off-road crashes in areas with high rates of ROR incidents by installing high-grip surface treatments. Ideally, the alignment of those road sections would be corrected, but until that is possible, the pavement helps hold vehicles on the driving lanes, reducing skidding.
Web-Based Motor Carrier Credentialing		\$ 8,527,914			Motor Carrier Express, an online business portal, allows trucking companies to conduct business with MoDOT anytime and drastically reduces the need to speak with an agent. Customers transact more than 125,000 actions each year on their own and receive most required credentials electronically rather than by mail or shipment. Since 2007, Missouri motor carriers realized significant time savings through electronic credential delivery. Trucks get on the road - making money - faster.
Electronic Truck Pre-Screening at Weigh Stations		\$ 19,573,393			Electronic pre-screening using weigh-in-motion scales and other technology helps identify the "good players" among commercial truck traffic in Missouri. Transponder-equipped trucks found in good standing are allowed to bypass weigh stations so Missouri State Highway Patrol Commercial Vehicle officers' inspection efforts are more efficient. Motor carriers who participate in the voluntary service save time, fuel and money while Missouri uses the same resources to process an increasing number of trucks.
Making Highways Smoother and Safer, Sooner		\$ 118,678,838		10	The Smooth Roads Initiative and Better Roads, Brighter Future program were back-to-back efforts that improved 5,600 miles of highways. Completed earlier than scheduled, the efforts delivered smoother pavement, brighter striping, rumble stripes and other safety improvements to the highways that carry 80 percent of Missouri's traffic. These improvements have resulted in over \$1 billion of safety benefits to the customers since 2007.
Reducing Crossover Crashes with Median Guard Cable		\$ 390,264,208		39	Missouri's median guard cable is successful in slowing and guiding wayward vehicles from crossing into opposing lanes. Guard cable is used on portions of all Missouri interstates and other major routes. It drastically reduces the number of median crossover crashes which can be devastating, often fatal.
<b>TOTAL:</b>	<b>\$273,395,577</b>	<b>\$684,665,809</b>	<b>\$48,148,014</b>	<b>69</b>	