

Implementation of Research at the Arizona Department of Transportation

SPR-727

October 2014

Published by:

Arizona Department of Transportation

206 South 17th Avenue

Phoenix, Arizona 85007

In cooperation with

U.S. Department of Transportation

Federal Highway Administration

This report was funded in part by the Federal Highway Administration, U.S. Department of Transportation. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data, and for the use or adaptation of previously published material, presented herein. The contents do not necessarily reflect the official views or policies of the Arizona Department of Transportation or the Federal Highway Administration, U.S. Department of Transportation. This report does not constitute a standard, specification, or regulation. Trade or manufacturers' names that may appear herein are cited only because they are considered essential to the objectives of the report. The U.S. government and the State of Arizona do not endorse products or manufacturers.

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Technical Report Documentation Page

1. Report No. FHWA-AZ-14-727	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Implementation of Research at the Arizona Department of Transportation		5. Report Date October 2014	6. Performing Organization Code
		8. Performing Organization Report No.	
7. Author Diane Ginn and Deb Pryor		10. Work Unit No.	
9. Performing Organization Name and Address Partners in Brainstorms 3420 E. Shea Blvd, Suite 130 Phoenix, AZ 85028		11. Contract or Grant No.	
		13. Type of Report & Period Covered FINAL	
12. Sponsoring Agency Name and Address Arizona Department Of Transportation 206 S. 17th Avenue Phoenix, AZ 85007		14. Sponsoring Agency Code	
		15. Supplementary Notes Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration	
16. Abstract The study examined 128 research studies completed by the Arizona Department of Transportation (ADOT) Research Center between 2002 and 2012, the extent to which their recommendations were implemented at the department, and the impact of the implemented research. It concluded that for 78 percent of the completed studies, one or more recommendations had been implemented. The study also identified benefits that research provided to the agency, as well as factors affecting the implementation of research and the utilization of Research Center services.			
17. Key Words Research, Implementation		18. Distribution Statement Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161	
23. Registrant's Seal		21. No. of Pages 63	
19. Security Classification Unclassified	20. Security Classification Unclassified	22. Price	



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Findings and Key Insights

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October 2014

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- ▶ Insights from Stakeholder Interviews: Non-Implementation of Research at ADOT
- ▶ Insights from Stakeholder Interviews: Factors Contributing to Non-Utilization of ADOT Research Center Services
- ▶ Implementation Plan

Purpose of the Study

- ▶ Provide a thorough understanding of implementation of research at ADOT.
 - Create an inventory of research completed at ADOT during the past 10 to 12 years.
 - Document the extent to which research recommendations have been implemented or are actively being implemented.
 - Document the resultant impact of this research on ADOT.
- ▶ The study was designed to provide the Research Center with:
 - An enhanced *Research Implementation Report*.
 - Recommendations to aid and facilitate continuous improvement in the delivery of research that has been thoughtfully crafted to meet the Department's needs and produces implementable results.
 - An enhanced tool (Access database) to support Research Center project management personnel in tracking and monitoring progress and implementation of research studies.

Process Overview – SPR-727, Implementation of Research at ADOT

1

Workplan

- Key tasks
- Methodology
- Deliverables

2

Inventory of Research

- Multi-phased
- ProjectTrack
- Define scope 2002-2013
- Create matrix
- Review studies
- Documentation
- Interview aids
- Stakeholder interviews

3

Document Implementation

- Obtain/analyze feedback
- Project status
- Perceived benefits
- Factors impacting implementation
- Non-utilization Research Center
- Continuous improvement

4

ResearchTrack Database

- Next-generation
- Process flow
- Functionality
- Queries/reports
- Agile and robust
- Easy to use
- Easy to maintain
- In progress

5

Implementation Report

- Research at ADOT
- Value/benefits
- Implementation
- Process/procedure recommendations
- Report template
- Project review
- Formal debrief

Creating the Inventory of Research

1

ProjectTrack

- Export data
- Analysis
- Criteria: record selection

2

Create Matrix

- Project
- Emphasis area
- Year published
- Sponsor
- Champion
- TAC
- Library link
- Research Note
- ProjectTrack data

3

Refine Matrix

- Review matrix (PM)
- Topic areas
- Alignment: workgroups
- Categorize P&A
- Interdisciplinary studies

4

Create Inventory

- Consult with TAC
- PM staff review
- Outreach to managers
- Outreach to staff
- PM/PIB review
- Finalize

5




Inventory: 128 Studies

- Distribute matrix
- Develop interview aids
- Develop orientation meeting materials

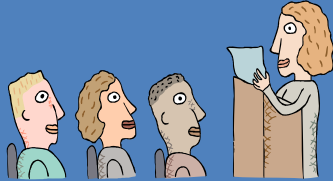

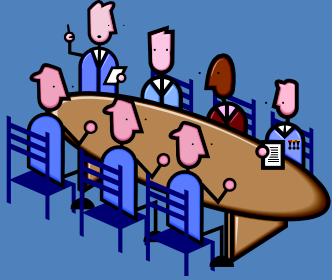
The Inventory of Research

Topic Area: Stakeholder Group Interview/Discussion	Number of Research Studies in Inventory N= 128
Environment	24
ITS	16
Maintenance	7
Materials & Construction	10
Structures & Roadway	8
Traffic & Safety	27
P&A: Communications	5
P&A: MVD and ECD	16
P&A: Planning & Transit	10
P&A: General	9

Materials and Tools to Aid Stakeholder Interviews

<p>Matrix</p>	<ul style="list-style-type: none"> • Inventory of research projects by emphasis/topic area • Excel spreadsheet • Electronic and print distribution 	
<p>Stakeholder Information Packets</p>	<ul style="list-style-type: none"> • By emphasis/topic area (7 notebooks) • Index of studies in inventory • Report format: Research Note, Executive Summary, findings and recommendations • ProjectTrack record detail • Electronic and print distribution 	
<p>Pre-Interview Project Assessment Form</p>	<ul style="list-style-type: none"> • Rank research studies. Implementation status (most or all, some, none) • Top 3 recommendations (benefits) • Impact: cost savings, process or procedural improvement, product development, safety, collaboration, and/or other • Factors driving/impeding implementation) 	

Communications and Recruitment for Stakeholder Interviews

Orientation Meeting	<ul style="list-style-type: none">• ADOT Research Center & PIB• Inform and educate—process overview, packet of materials to aid participation• Group interviews and SME participation• Information exchange (who should attend)• Customer appreciation	
Recruitment	<ul style="list-style-type: none">• Project manager outreach sets the stage for PIB communications• Contacts by e-mail: invitation & scheduling options, reminder, confirmation, post-interview thank you• Of 79 invitees:<ul style="list-style-type: none">• 53 (68%) said yes• 46 attended (88% of yes; 58% of total invitees)	
Research Stakeholder Interviews	<ul style="list-style-type: none">• November–December 2013• 13 groups (+ 5 accommodation interviews)• 2- to 4-hour group discussions• 1–8 participants per group	

Implementation of Research at ADOT

Emphasis or topic area	Number of studies for which feedback obtained	All or some recommendations implemented	No recommendations implemented	Implementation rate
Environment	24	22	2	92%
ITS	16	10	6	63%
Maintenance	5	4	1	80%
Materials	11	8	3	73%
Structures & Roadway	7	6	1	86%
Traffic & Safety	23	19	4	83%
Planning & Administration	29	21	8	72%
• P&A: Communications	5	4	1	80%
• P&A: MVD	4	1	3	25%
• P&A: ECD	8	6	2	75%
• P&A: Planning & Transit	9	7	2	78%
• P&A: General	3	3	0	100%
Summary	115	90	25	78%

Value and Benefits of Research at ADOT

- ▶ The analysis of stakeholder feedback provides insights into the important role that research has played in **advancing the state of knowledge and state of practice at ADOT** and in encouraging innovation in supporting transportation system priorities.
- ▶ These insights provide an **expansive and holistic view of the impact of research**—one that looks beyond the core measures of value currently in use by the Research Center (i.e., cost savings, process improvements, safety benefits, and other benefits).
- ▶ These insights address the **foundational value of research and the net value impact** that implementation of research has had and actively continues to have on ADOT.

ADOT Research Has Aided in Federal Compliance and Increased Emphasis on Accountability

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Compliance with federal laws	Product development, including expanded use of technology applications, and process and procedural improvements have provided ADOT with enhanced reporting and monitoring capabilities to support compliance with federal laws (e.g., EPA audit and ADA).	<ul style="list-style-type: none"> • <i>SPR-474, Development of a Statewide GIS-Based Feature Inventory System, 2005, Maintenance</i>
Increased emphasis on accountability	Expanded use of technology applications and agency focus on project management have supported continuous improvement.	<ul style="list-style-type: none"> • <i>SPR-511, Best Practices in Project Management, 2003, Planning & Transit</i> • <i>SPR-515, Program and Project Financial Management Needs Assessment, 2002, Structures & Roadway</i>

ADOT Research Has Supported Tribal Outreach, Environmental Stewardship, and ITS Innovation

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Outreach to tribal communities to address safety priorities	Information sharing and exchange with the tribal communities regarding available resources and supports have facilitated engagement, aided capacity building, and addressed tribal traffic safety.	<ul style="list-style-type: none"> • <i>SPR-592, Building Tribal Traffic Safety Capacity, 2007, Traffic & Safety</i>
Strategic goals regarding environmental stewardship	Research has enabled and effectively made the case for advancing an agenda for environmental stewardship that moves beyond safety and risk mitigation to wildlife connectivity.	<ul style="list-style-type: none"> • <i>SPR-540, Evaluation of Measures to Minimize Wildlife Vehicle Collisions and Maintain Wildlife Permeability Across Highway—Phases I and II, 2007, Environment</i>
Innovation in ITS	Research has enabled innovation in ITS design, providing a framework for planning, design improvements, and project implementation.	<ul style="list-style-type: none"> • General comments regarding studies reviewed, ITS

Voice of the Stakeholder

- ▶ Compliance with federal laws

“Environmental compliance has also started using FIS to record their inspections. Two areas where FIS has turned out to be a key program is with the EPA audit, and the second thing is that in 1991 the Americans with Disabilities Act was passed, and as a result of that, DOTs and other government agencies had to do a self-assessment of the ADA issues, accessibility, and prepare a report. ADOT was just a tad late in getting started on that, but we finished it. All of the inventory, all of the assessment, all of that information is contained in the FIS. So that was a huge thing and was one of the number one priorities for the agency.” (SPR-474, Development of a Statewide GIS-Based Feature Inventory System, 2005, Maintenance)

- ▶ Emphasis on performance measures/accountability

“Under the federal mantra of Every Day Counts—to the extent that we can measure accomplishment and proceed along—what gets measured gets managed, and what gets managed gets done. So this study certainly helped. (SPR-511, Best Practices in Project Management, 2003, General & Transit)

- ▶ Outreach to tribal communities

“I would say that with regard to tribal traffic safety, it’s because of this particular project, SPR-592, that ADOT has opened the doors with the tribes.” (SPR-592, Building Tribal Traffic Safety Capacity, 2007, Traffic & Safety)

Voice of the Stakeholder (cont'd)

- ▶ Environmental stewardship

“So that’s why I said it was a landmark when they funded that US-89 study, because it was the first project that they’d funded where we couldn’t demonstrate a highway safety issue. It was stewardship. It was connectivity.” (SPR 540, Evaluation of Measures to Minimize Wildlife Vehicle Collisions and Maintain Wildlife Permeability Across Highway—Phases I and II, 2007, Environment)

- ▶ Innovation in ITS

“In 20 years, we’re so innovative now with the ideas that we had back then are being implemented now. Where they were just ideas, and we didn’t know how we were going to do it, but now we’re doing it with the technology available.” (General comments regarding ITS studies reviewed, ITS)

ADOT Research Has Supported Safety, Organizational Development, and Consumer Access to Transit

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Safety	Vast majority of all research implemented was identified as providing benefits in safety and other areas, but a few studies were primarily focused on safety (e.g., TraCS, photo enforcement demonstration).	<ul style="list-style-type: none"> • <i>SPR-667, TRQS-04: Data Collection Software Used by Law Enforcement Agencies in Arizona, 2007, Traffic & Safety</i> • <i>SPR-684, Evaluation of the City of Scottsdale Loop 101 Photo Enforcement Demonstration Program, Traffic & Safety</i>
Organizational development	Awareness of resource needs has aided decision making regarding establishment of the Communications Division.	<ul style="list-style-type: none"> • <i>SPR-579, Making a Good First Impression: Improving Predesign and Environmental Public Information, 2007, Communications</i>
Consumer access to transportation systems	Research in the area of mobility management has promoted and facilitated coordination among local transit operators to address needs regarding access to transportation systems in rural areas.	<ul style="list-style-type: none"> • <i>SPR-530, Critical Factors in the Development of Transit Systems in Rural Arizona, 2005, Planning & Transit</i>

ADOT Research Has Supported Funding Efforts

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
ADOT funding	Research studies have aided and continue to aid efforts to inform, educate, and provide cost justification for ADOT funding (e.g., results of the RAP panel, studies to meet federal requirements to use FHWA funding).	<ul style="list-style-type: none"> • <i>SPR-622, Price Trends for Major Roadway Inputs, 2006, Structures & Roadway</i> • <i>SPR-570 Rural ITS Progress Study – Arizona, 2004, and SPR- 615, ITS Concepts for Rural Corridor Operations, 2007, ITS</i>
ADOT funding- tax revenue collections	Technology advances, in conjunction with process and procedural improvements continue to support ADOT via tax revenue collection activities (e.g., tax collection & compliance and revenue-generation opportunities).	<ul style="list-style-type: none"> • <i>SPR-578, Evaluating and Improving the Dyed Diesel Education and Enforcement Program, 2006, ECD</i> • <i>SPR-565, Grand Canyon National Park & Northern Arizona Tourism Study, 2005, Planning & Transit</i>
<i>Arizona Highways</i> magazine	Research has equipped AHM with return-on-investment data (e.g., impact on state tourism) to aid funding (i.e., through the State Enterprise Fund).	<ul style="list-style-type: none"> • <i>SPR-568, Arizona Highways Magazine’s Impact on Tourism, 2005 and SPR-686, Arizona Highways Magazine’s Impact on Tourism, 2012, Planning & Administration</i>

Voice of the Stakeholder

- ▶ Safety

“We are moving forward to implement TraCS statewide with local law enforcement, and that’s really a tier 1. I mean, we’re doing it. We’ve got a clear program to implement it statewide with local agencies, and it’s prioritized based on the number of crash reports from the agencies.” (SPR-667, TRQS-04: Data Collection Software Used by Law Enforcement Agencies in Arizona, 2007, Traffic and Safety)

- ▶ Organizational development

“This was the foundation that has resulted the current communications division that we have today. This study is responsible for that.” (SPR-579, Making a Good First Impression: Improving Predesign and Environmental Public Information, 2007, Communications)

- ▶ Consumer access to transit

Interviewer: “Two other quick things that were brought up in this study—PTD should devise a program to proactively promote more cooperation between neighboring local rural transit operators.” Response: “And again, we’ve done that. We’ve focused over the last two to three years on mobility management, which really emphasizes coordination between transit providers within a region. I’d say we’ve done a very good job of implementing that in terms of requiring and encouraging coordination.” (SPR-530, Critical Factors in the Development of Transit Systems in Rural Arizona, 2005, General & Transit)

Voice of the Stakeholder (cont'd)

- ▶ Funding: Revenue Generation

“Having the electronic data has been really helpful. We have a bill of lading project where the officers actually collect bills of lading from the fuel tankers as they are coming into Arizona.” Interviewer: “So you’re able to integrate data from a couple of different sources?” Response: “Yes, and I think this year alone, the 12 months preceding, we brought in about \$600,000. So we measure the revenue that’s actually paid to ADOT, so that’s the measurement on our side.” (SPR-578, Evaluating and Improving the Dyed Diesel Education and Enforcement Program, 2006, ECD)

- ▶ AHM funding

“So we use data from the study in a number of different venues with the legislature. I use it when I’m meeting with civic groups, with Chambers of Commerce, with business groups, with tourism groups, again, as a means to help underscore the importance of the magazine, and not incidentally its independence. . . We don’t get any state funding.” (SPR-568, Arizona Highways Magazine’s Impact on Tourism, 2005 and SPR-686, , Arizona Highways Magazine’s Impact on Tourism, 2012, Planning & Administration)

ADOT Research Has Aided in Risk Management, Core Competencies Development, and Cultural Change Initiatives

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Risk management	While risk management is an integral component of all ADOT policies, research in the area of strategies for mitigating wildlife–vehicle collisions has provided the state with data to support legal arguments to limit state liability in lawsuits.	<ul style="list-style-type: none"> Feedback regarding the benefits of research conducted during the past decade on wildlife and highway relationships (Environment)
Development of core competencies at the Department level	Research highlighting the need for core competencies in the areas of communication and leadership has supported focus on organizational development priorities.	<ul style="list-style-type: none"> <i>SPR-655 Identifying Customer-Focused Performance Measures, 2010, and SPR-506, What Is the Best Way to Address Environmental Justice Issues?, 2002, Communications</i>
Efforts to promote cultural change	Research has provided foundational information that has supported cultural change initiatives (e.g. , project management).	<ul style="list-style-type: none"> <i>SPR-511, Best Practices in Project Management, 2003, Planning & Transit</i>

ADOT Research Has Aided in Building Partnerships and Institutional Credibility

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Interagency and industry partnerships	Research protocols have facilitated collaboration building that effectively and efficiently utilizes resources and garners stakeholder buy-in to meet strategic goals.	<ul style="list-style-type: none"> • <i>SPR-524 Development of Mix Design Procedures for Gap-Graded Asphalt-Rubber Asphalt Concrete, 2007, Materials</i> • <i>SPR-646, AASHTOWare Turborelocation Software Development, 2008</i> • <i>SPR-619, Antelope Movements North of Interstate 40 in Arizona, 2010, Environment</i>
Institutional credibility with the public and ADOT suppliers	Research has facilitated improvements in how ADOT communicates with: (a) the public (e.g., information to aid public understanding of noise walls) and (b) suppliers (e.g., data systems that support proactive communications with suppliers).	<ul style="list-style-type: none"> • <i>SPR-555, Determination of Atmospheric Effects on Highway Noise Propagation, 2005, Environment</i> • <i>SPR-578, Evaluating and Improving the Dyed Diesel Education and Enforcement Program, 2006, ECD</i>

ADOT Research Has Supported Agency Recognition and Decision Making

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Efforts to elevate Department stature	Research has drawn national and international interest and acclaim for ADOT innovation (e.g., studies addressing land use and traffic congestion and research in the area of wildlife connectivity).	<ul style="list-style-type: none"> • <i>SPR-618, Land Use and Traffic Congestion, 2012, Planning & Transit</i> • <i>SPR-540, Evaluation of Measures to Minimize Wildlife–Vehicle Collisions and Maintain Wildlife Permeability Across Highway—Phases I and II, 2007, Environment</i>
Policy and planning decision making	Research has provided ADOT with critical tools to aid formulation of data-driven policy decisions (e.g., reference documentation to support traffic & safety policy, historical context information to aid current transit planning initiatives, and information to aid discussions with regulators regarding what is/is not relevant to Arizona environment and landscape, etc.).	<ul style="list-style-type: none"> • <i>SPR-530, Critical Factors in the Development of Transit Systems in Rural Arizona, 2006, Planning & Transit</i> • <i>SPR- 602, Sampling of Analysis of Stormwater Runoff on the Red Mountain Freeway, Loop 202 between Gilbert Road and Lindsay Road, 2010, Environment</i>

ADOT Research Has Supported Data-Driven Assessment and Provided Data on What Works

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Knowledge building regarding policy and planning priorities	Research has enabled data-driven assessment and review of strategic priorities in the areas of policy and planning, and answered key questions regarding factors impacting transportation planning.	<ul style="list-style-type: none"> • <i>SPR-618, Land Use and Traffic Congestion, 2012, Planning & Transit</i> • <i>SPR-622, Price Trends for Major Roadway Inputs, 2006, Structures & Roadway</i>
Evaluation of practice standards and shared-practice discussions with state DOTs and industry that have enabled progress	Research has provided data for responses to questions regarding what works and how to improve processes and procedures (e.g., communications, practice standards, and tools to aid data collection).	<ul style="list-style-type: none"> • <i>SPR-560, Improving Construction Communication, 2004, Communications</i> • <i>SPR-524, Development of Mixed Design Procedures, 2007 Materials</i> • <i>SPR-598, Should State DOTs Prefer Bicycle Lanes or Wide Curb Lanes, 2008, Traffic & Safety</i>

ADOT Research Has Advanced the State of Knowledge and Contributed to Improved Efficiencies

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Design and procedural improvements	Research in the areas of product design and process and procedural improvements has advanced state of knowledge and practice at ADOT.	<ul style="list-style-type: none"> • <i>SPR-538, High Performance Concrete for Bridge Structures in Arizona, 2007, Materials</i> • <i>SPR-545, Roundabouts and Arizona Case Study and Design Guidelines, 2003, Traffic and Safety</i>
Operational efficiencies	Research has advanced the state of practice and contributed to operational efficiencies and systems efficiencies (e.g. ,driver training, compatible field radios for rural DPS patrol cars, and improved dispatch console technology).	<ul style="list-style-type: none"> • <i>SPR-585, Snowplow Simulator Training Evaluation, 2006, ITS</i> • <i>SPR-635, Improved Efficiency Through Driving Simulator Training, 2007, ITS</i> • <i>SPR-561, Transportation Communications Interoperability Phase One Needs Assessment, 2004, ITS and SPR-569, Transportation Communications Interoperability, Phase 2 Resource Evaluation, 2006, ITS</i>

ADOT Research Has Aided in Cost Savings

Research Has Aided and Supported	Analysis of Stakeholder Feedback	Representative Studies
Cost savings	Research has provided data-driven validation of cost-savings strategies and helped to identify future opportunities (e.g., monitoring service life, maintenance costs, durability, cost-benefit analysis).	<ul style="list-style-type: none"> • <i>SPR-601, Cost Evaluation of Cross-Border Truck Emissions Testing using Heavy Duty Remote Sensing (HDRS) Equipment 2008, Environment</i> • <i>SPR-538, High Performance Concrete for Bridge Structures in Arizona, 2007, Materials</i> • <i>SPR-460, Evaluation of Cold In-Place Recycle Methods, 2006 Materials)</i>

Voice of the Stakeholder

- ▶ Partnerships

“There was a cooperation between ADOT and the industry that was fostered through the study and it continues today. And what was real beneficial about this is that we had industry contractors, local lab material testing labs involved in ADOT. So it was a joint effort between all three groups.” (SPR-524 Development of Mix Design Procedures for Gap-Graded Asphalt-Rubber Asphalt Concrete, 2007, Materials)

- ▶ Credibility

“Well, the public would say, “At night, sometimes I hear the train. I don’t live anywhere near a train track.” And what the study enabled us to do is explain it better to the public, which was invaluable, because the problem that people have is you build a noise wall, and they still have noise at certain times of the day. So it just helped us explain it, and it gave us exact times to explain when it happened. So I thought that was very valuable research.” (SPR-555, Determination of the Atmospheric Effects, 2005, Environment)

- ▶ Stature

“I guess I’m not surprised because of the national relevance of the topic, but I’m surprised the study got out of Arizona.”

“Yeah, all these planning outlets picked it up, and even the director got calls from people at the national level—‘We didn’t know that you were doing these kinds of progressive things over at ADOT.’” (SPR-618, Land Use and Traffic Congestion, 2012, Planning and Transit)

Voice of the Stakeholder (cont'd)

- ▶ Policy and planning

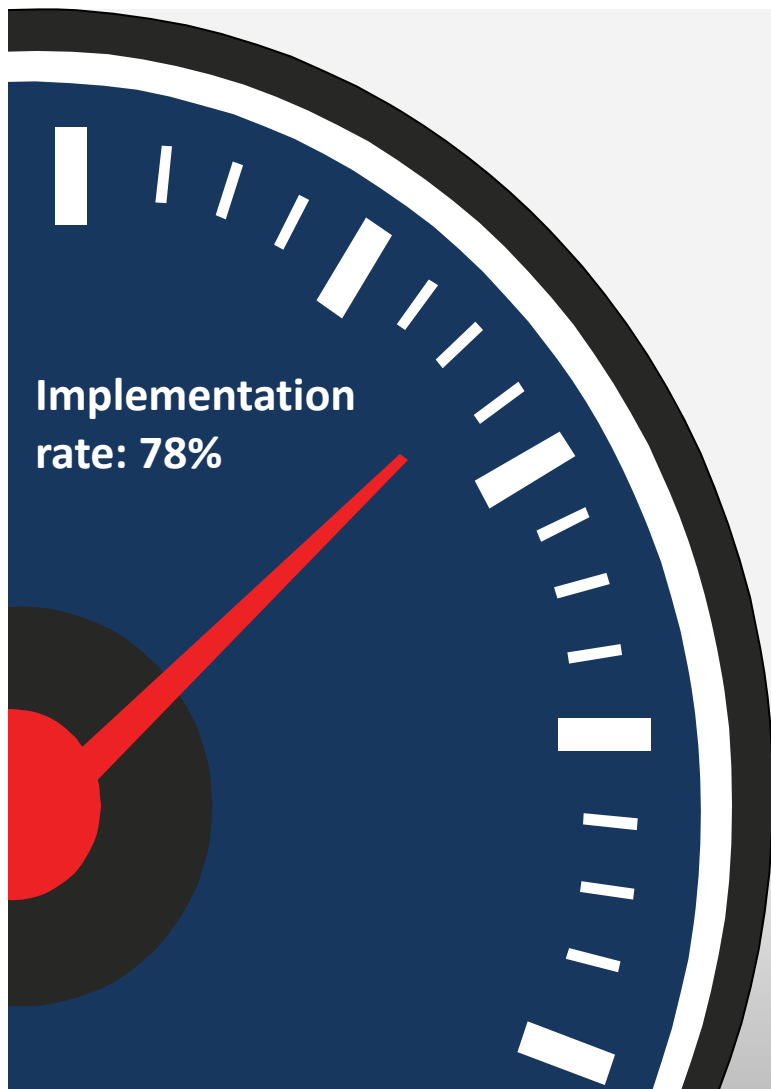
“The study is a reference document for our new policy.” (SPR-550, The Impact of Red Light Cameras (Automated Enforcement) on Safety in Arizona, 2005, Traffic and Safety)

- ▶ Planning

“If you’re looking at a 20-year window of time, nobody can tell you what’s going to happen 20 years from now. In 2006, nobody could have told you what happened in 2007, 2008, and 2009. But over a long trend, maybe it starts to become fairly useful information. And certainly, if nothing else, the study is a tool to document what has happened over the course of the last few years to show what was the impact on the program. What started out in 2004 can’t be delivered in 2014 because of these changes that are well documented through this research process.” (SPR-622, Price Trends for Major Roadway Inputs, 2006, Structures & Roadway)

- ▶ Cost savings

“But the study is starting to be resurrected again, and there is actually a project going on right now looking at lifecycle costs with high-performance concrete, and then developing another specification that we can implement right away.” (SPR-538, High Performance Concrete for Bridge Structures in Arizona, 2007, Materials)



RESEARCH IMPLEMENTATION

- Implementation status by project by emphasis/topic area
- Non-implementation: challenges or barriers impacting implementation

FACTORS IMPACTING UTILIZATION OF THE ADOT RESEARCH CENTER

- Key insights

IMPLEMENTATION PLAN

- Implementation Planning (process)
- ResearchTrack reporting tool
- Recommended template for annual report

Environment – Wildlife

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2007	SPR-540	Evaluation of Measures to Minimize Wildlife Vehicle Collisions and Maintain Wildlife Permeability Across Highways (Phase I and Phase II)	X			
*2007	SPR-576	US-93 Big Horn Sheep Study	X			
*2008	SPR-588	Effectiveness of Bighorn Sheep Underpasses on SR68	X**	X**		
*2007	AZ-594	Flat-Tailed Horned Lizard Highway Crossing Study		X**	X**	

* Pre-interview assessment form completed

** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Environment – Wildlife (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2012	SPR-603	Continued Evaluation of Measures to Minimize Wildlife-Vehicle Collisions & Maintain Wildlife Permeability – Kohls Ranch Section, State Route (SR) 260	X			
*2010	SPR-619	Antelope Movements North of Interstate 40 in Arizona	X**	X**		
2012	SPR-626	State Route 64 Wildlife Accident Reduction Study Monitoring	X**	X**		
*2012	SPR-650	Predicting Desert Tortoise (<i>Gopherus agassizii</i>) Habitat and Identifying Movement Patterns Within the Proposed Highway 95 Realignment	X**	X**		
*2012	SPR-659	Genetic Variation of Pronghorn Across US Highway 89 and State Route 64		X		

* Pre-interview assessment form completed

** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Environment – Other

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2006	SPR-495	A Field Study of Particulate Emissions from Major Roadways in the Phoenix Airshed		X**	X**	
*2005	SPR-496	Identification of Sources and Development of Effective Control Measures at High Particulate Emission Areas.		X**	X**	
2003	SPR-509	Develop and Evaluate Hazardous Materials Inventory Status and Action Plan			X	
*2003	SPR-519	Dust Mitigation: PM-10 for Developing Educational Tools & Outreach Programs	X			
2004	SPR-543	Develop Strategies that Best Integrate Environmental Stewardship into ADOT's Business.	X**	X**		
*2005	SPR-555	Determination of Atmospheric Effects on Highway Noise Propagation	X**	X**		

* Pre-interview assessment form completed

** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Environment – Other (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2006	SPR-572	Evaluation of Benefits and Opportunities for Innovative Noise Barrier Designs		X		
*2008	SPR-584	Survey of Traffic Noise Reduction Products, Materials, and Technologies		X		
*2012	SPR-587	Evaluation of Salvage and Replanted Native Plants on ADOT Projects	X			
2012	SPR-589	Determination of 404 Permit and Habitat Restoration Requirements		X		
2012	SPR-600	Evaluating the Effectiveness of Microbe Application to Petroleum Spills at Crash Sites	X**	X**		
*2008	SPR-601	Cost Evaluation of Cross-Border Truck Emissions Testing using Heavy Duty Remote Sensing (HDRS) Equipment			X	

* Pre-interview assessment form completed

** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Environment – Other (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2010	SPR-602	Sampling and Analyses of Storm Water Runoff on the Red Mountain Freeway Loop 202 between Gilbert Rd. and Lindsey Rd.		X**	X**	
2010	SPR-624	Hazardous Materials Transportation in Arizona		X		
*2013	SPR-696	A Preliminary Study of Climate Adaptation Issues for the Statewide Transportation System in Arizona	X			

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** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

ITS

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2004	SPR-473	Arizona Intelligent Vehicle Research Phase 3: 2002-2003 (followed by Long-Term Evaluation)		X		
*2002	SPR-481	Field Test of RHODES-ITMS Ramp Metering Systems.			X	
*2005	SPR-512	ITS Traffic Data Master System	X			
*2002	SPR-513	Alternate Route Interactive System (ARIS)			X	
*2003	SPR-525	Evaluation of Roadway Weather Information System (RWIS) Options for ADOT	X			
*2005	SPR-557	Congestion Mitigation at Railroad-Highway At-Grade Crossings (see Railroad & Highway Crossing Cooperative Signal Control)			X	

* Pre-interview assessment form completed

ITS (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2004	SPR-561	Transportation Communications Interoperability Phase I - Needs Assessment	X			
*2004	SPR-562	ITS Program Acceptance in Elderly Communities	X			
*2006	SPR-569	Transportation Communications Interoperability Phase 2- Resource Evaluation	X			
*2004	SPR-570	Rural ITS Progress Study – Arizona 2004		X		
*2006	SPR-585	Snowplow Simulator Training Evaluation	X			
*2006	SPR-595	Real-time Adaptive Ramp Metering: Phase 1 - Simulation & Proof of Concept			X	

* Pre-interview assessment form completed

ITS (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2007	SPR-615	ITS Concepts for Rural Corridor Operations		X		
*2007	SPR-635	Improved Efficiency Through Driving Simulator Training	X			
*2005	AZ-665	TRQS-02: Arizona WiFi Network for Probe Vehicle Tracking			X	
*2007	AZ-666	TRQS-03: Proof-of-Concept Demonstration – I-19 WiFi Corridor Probe Vehicle Tracking			X	

* Pre-interview assessment form completed

Maintenance

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2006	SPR-371	Maintenance Cost Effectiveness Study			X	
2005	SPR-418	Maintenance Management System Procedures	X			
2005	SPR-461	Procedures for Winter Storm Maintenance Operations	X			
2005	SPR-474	Development of a Statewide GIS-Based Feature Inventory System	X**	X**		
2006	SPR-494	Enhance the Pavement Management System so that It Can Determine Preventative Maintenance Strategy Effectiveness				X
2007	SPR-612	Synthesis of Animal-Vehicle Collision Mitigation Measures				X
2009	SPR-657	Options for Reducing Copper Theft	X			

** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Materials

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2006	SPR-460	Evaluation of Cold In-Place Recycle Methods		X**	X**	
*2005	SPR-491	Evaluation of the Cost Benefits of Continuous Pavement Preservation Design Strategies Versus Reconstruction			X	
*2011	SPR-493	Bridge Foundation Design Parameters and Procedures for Bearing in SGC Soils.			X	
*2006	SPR-494	Enhance the Pavement Management System so that It Can Determine Preventative Maintenance Strategy Effectiveness		X		
*2007	SPR-524	Development of Mix Design Procedures for Gap-Graded Asphalt-Rubber Asphalt Concrete	X			
*2007	SPR-538	**High Performance Concrete for Bridge Structures in Arizona	X**	X**		

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** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Materials (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2006	SPR-574	Use of NDT Equipment for Construction Quality Control Of Hot Mix Asphalt Pavements			X	
*2009	SPR-575	Concrete Aggregate Durability Study.		X		
*2008	SPR-608	Development of Rational Pay Factors Based on Concrete Compressive Strength Data		X		
*2008	SPR-630	Critical Review of ADOT's Hot Mix Asphalt Specifications	X**	X**		
*2009	SPR-658	Performance Testing of HPC on the Sunshine Bridge Project		X		

* Pre-interview assessment form completed

** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Structures & Roadway

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2006	SPR-510	Performance of Various Types of Bridge Deck Joints			X	
2003	SPR-511	Best Practices in Project Management	X			
2002	SPR-515	Program and Project Financial Management Needs Assessment		X		
2005	SPR-518	Reducing the Development Cycle Time for Construction Process		X**	X**	
*2006	SPR-520	Maintenance Repair Procedures for Bridge Decks	X			

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Structures & Roadway (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2007	SPR-538	High Performance Concrete for Bridge Structures in Arizona	X**	X**		
2006	SPR-621	High Density Polyethylene Pipe Fill Height Table				X
2006	SPR-622	Price Trends for Major Roadway Inputs	X			
*2005	AZ-664	TRQS-01: Superelevation Design Exception				X

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** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Traffic & Safety

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2005	SPR-449	Development of Electrical and Landscape Approved Product List		X		
2003	SPR-451	Pavement Marking and Signing Database		X		
2002	SPR-482	Continuous Evaluation of In-Service Highway Safety Feature Performance.			X	
2003	SPR-486	Highway Facilities for an Aging Arizona Population	X			
2002	SPR-501	Evaluation of Operational Efficiencies, Cost and Accident Experience at Modified Single Point Urban Interchanges	X			
2003	SPR-522	An Evaluation of Current Recommended Roadway Light Levels			X	

Traffic & Safety (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2002	SPR-531	Development of a Plan for Compliance NCHRP 350 for Temporary Concrete Barriers	X			
*2006	SPR-537	Crash Data Collection and Analysis System	X**	X**		
2002	SPR-542	Congestion Mitigation Resources & Strategies for Arizona's Highway System				X
2003	SPR-545	Roundabouts: An Arizona Case Study and Design Guidelines	X**	X**		
*2004	SPR-546	**What is the Effect of Driver Education Programs on Traffic Crash And Violation Rates?		X		
*2005	SPR-550	The Impact of Red Light Cameras (Automated Enforcement) on Safety in Arizona	X**	X**		

* Pre-interview assessment form completed

** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Traffic & Safety (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2004	SPR-551	Actual Speed on the Roads Compared to the Posted Limits		X**	X**	
2004	SPR-552	HOV Lanes: Issues and Options for Enforcement				X
2003	AZ-554	Light Use Study for Vertical Channelization Devices				X
2006	SPR-556	Right Turn Control Study: Yield Signs or Signals for Off Ramp at Single-Point urban Traffic Interchanges,		X		
2005	SPR-558	High-Risk Crash Site Identification in Arizona		X		
*2004	SPR-567	Remedies for Driver Error		X		
*2007	SPR-592	Building Tribal Traffic Safety Capacity	X**	X**		

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** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Traffic & Safety (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2005	AZ-596	Evaluation of Photo Radar for Freeway Enforcement	X**	X**		
*2007	SPR-597	Feasibility of Forecasting Highway Safety in Support of Safety Incentive and Safety Target Programs			X	
*2008	SPR-598	Should State DOTs Prefer Bicycle Lanes or Wide Curb Lanes?		X**	X**	
*2008	SPR-609	**Driver Education for Safety in Adverse Driving Conditions	X			
2007	AZ-667	TRQS-04: Data Collection Software Used by Law Enforcement Agencies in Arizona	X			
2008	SPR-670	SB2008-30: Restraint Use (Seat belt and child passenger seats) Survey			X	
2007	AZ-684	Evaluation of the City of Scottsdale Loop 101 Photo Enforcement Demonstration Program		X		

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** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Planning & Administration

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
*2002	SPR-506	What is the Best Way to Address Environmental Justice Issues?			X	
2003	SPR-511	Best Practices in Project Management	X			
2003	SPR-526	Coordination of Commercial Vehicle Data Collected by Automatic Traffic Counter (ATC) and Weigh-in-Motion (WIM)	X**	X**		
2003	SPR-527	Measurement Tools for Assessing Motor Vehicle Division Port-of -Entry Performance		X		
2006	SPR-528	Estimating the Cost of Overweight Vehicle Travel on Arizona Highways		X		

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** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Planning & Administration (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2005	SPR-530	Critical Factors in the Development of Transit Systems in Rural Arizona	X			
2008	SPR-535	535(2) Evaluation of the Integration of CVISN at the Nogales Port-of-Entry; 535(1) - May 04 - Commercial Vehicle Information Systems Network (CVISN) Safety Information Exchange;			X	
*2003	SPR-539	Third Party Transaction Cost-Benefit Analysis			X	
*2008	SPR-544	What is the Best Mix of Service Delivery Strategies that Can Be Employed to Reduce Customer Time in Motor Vehicle Division Field Offices?			X	

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Planning & Administration (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2004	SPR-546	What is the Effect of Driver Education Programs on Traffic Crash And Violation Rates?				X
*2004	SPR-548	Uninsured and Underinsured Motorists: Trends In Policy and Enforcement		X**	X**	
2004	SPR-549	Options for Improving Compliance with Vehicle Registration Laws		X		
2005	SPR-553	Drivers License Manual Best Practices				X
2005	SPR-559	New, Improved, Comprehensive, and Automated Driver's License Test and Vision Screening System				X
*2004	SPR-560	Improving Construction Communication	X			
2005	SPR-563	Port Runners – Impact and Solutions		X		

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** In some cases, stakeholders had different recollections or viewpoints regarding implementation of recommendations

Planning & Administration (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2005	SPR-565	Grand Canyon National Park & Northern Arizona Tourism Study		X		
2004	SPR-566	Alternate Modes as an Air Quality Mitigation Strategy			X	
2005	SPR-568	Arizona Highways Magazine's Impact on Tourism	X			
2006	SPR-578	Evaluating and Improving the Dyed Diesel Education and Enforcement Program	X			
*2007	SPR-579	Making a Good First Impression: Improving PreDesign and Environmental Public Information	X			
2006	SPR-582	Multimodal Use of Freeway Corridors		X		

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Planning & Administration (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2008	SPR-609	Driver Education for Safety in Adverse Driving Conditions				X
2008	SPR-610	Implementing a Statewide Rideshare Program in Arizona		X		
2008	SPR-614	Origins and Destination Study for Older Persons				X
2012	SPR-618	Land Use and Traffic Congestion		X		
2007	SPR-620	Developing a Stabilized Public Transportation Revenue Source	X			
2008	SPR-637	Cost/Benefit Analysis of Electronic License Plates			X	
2011	SPR-646	AASHTOWare Turborelocation Software Development		X		

Planning & Administration (cont'd)

			Recommendations Implemented			
Year	Project	Title	Most or all	Some	None	NA Unable to comment
2012	SPR-654	Travel Demand Management: Strategies to Reduce Single Occupant Vehicle Trips and Increase Alternate Mode Usage in Arizona			X	
*2010	SPR-655	Identifying Customer-Focused Performance Measures		X		
*2011	SPR-660	Arizona Transportation History		X		
*2008	SPR-662	Cost Effectiveness of MVD Fee Collections			X	
2012	SPR-686	Arizona Highways Magazine's Impact on Tourism	X			

* Pre-interview assessment form completed

***Factors Impacting Implementation of
Research at ADOT and Utilization of the
ADOT Research Center***

Research Recommendations and Advances in the State of Practice

- ▶ In a number of instances, stakeholders **could not comment with certainty** on whether implementation came to fruition **as a result of the research recommendations**, or as a result of the **natural progression of advances in the state of practice** (e.g., rapid advancements in technologies supporting design of intelligent transportation systems). This uncertainty was compounded by the:
 - Length of the **look-back period**.
 - **Reassignment and/or attrition of staff**, contributing to knowledge gaps regarding implementation of research and loss of momentum for championing research sponsored by predecessors.
 - **Scarcity of institutional knowledge** regarding implementation planning efforts.
 - Unawareness of research prior to participation in this project.

“So they have to publish this in a documented manual every year to let them know how they are going to handle the snow for this particular year. So I don’t know if that can tie to this. It could be tied to this research, to the recommendation to establish manuals or standards or how to deal with snow operations. If that’s the case, then I would say yes, that’s probably been through the implementation process.” (SPR-461, Procedures for Winter Storm Maintenance Operations, 2005)

Reasons for Non-Implementation of Research Recommendations

- ▶ In total, 25 of the 115 studies (**22%**) for which feedback was obtained were **not implemented**.
- ▶ Most commonly identified reasons for non-implementation were:
 - **Limited resources** to support project implementation and/or ongoing maintenance and support functions (i.e., funding, people, and technology).
 - Changes in **legislation** are required to implement recommendations.
- ▶ Other reasons:
 - **Lack of decision-maker engagement** and/or competing priorities.
 - Stakeholder **inclusion—not having the right people involved in the project** (TAC); lack of individuals with the authority to implement recommendations.
 - **Recommendations are not practical** for ADOT implementation.
 - **User resistance to change** (i.e., adoption of new or enhanced ITS systems or new ways of doing things).
 - **Technology advancements** outpacing proposed technology solutions.
 - In a few studies, concern regarding the **integrity of the data and assumptions** used to form the basis for recommendations.
 - **Poor project management** (e.g., lack of clarity in how the project was scoped, conflicting and changing directives given to suppliers).

Stakeholder Comments about Research Recommendations Not Implemented

- ▶ Stakeholders **did not view non-implementation of research recommendations as synonymous with poor quality** research or research that has no value or benefit to ADOT.
- ▶ To the contrary, the vast majority of these **projects were viewed as important, relevant, and impactful**. Exceptions included projects in which **implementation was outside of ADOT's control** (MVD) and the few projects in which **methodology and/or the practicality of implementation was questioned**.
 - *“Again, if you asked me specifically was this research implemented, my answer would be “no.” If you asked me if it was a helpful study, I would say “yes.” I’ll tell you why the study was important. It raised awareness, the study falls under the particular area of ultimate timing for surface treatment of the highway. So, we know the critical nature of this maintenance and this study tied it all together and raises awareness of the issue.” (SPR-371, Maintenance Cost Effectiveness Study, 2006)*
 - *“The study has not been implemented, but the information has been used and I use it for budget talks. I know the state engineer looks at it even if we’re just doing maintenance and not capacity.” (SPR-491, Evaluation of the Cost Benefits of Continuous Pavement Preservation Design Strategies versus Reconstruction, 2005, Materials)*

Factors Contributing to Under-Utilization of ADOT Research Center Services

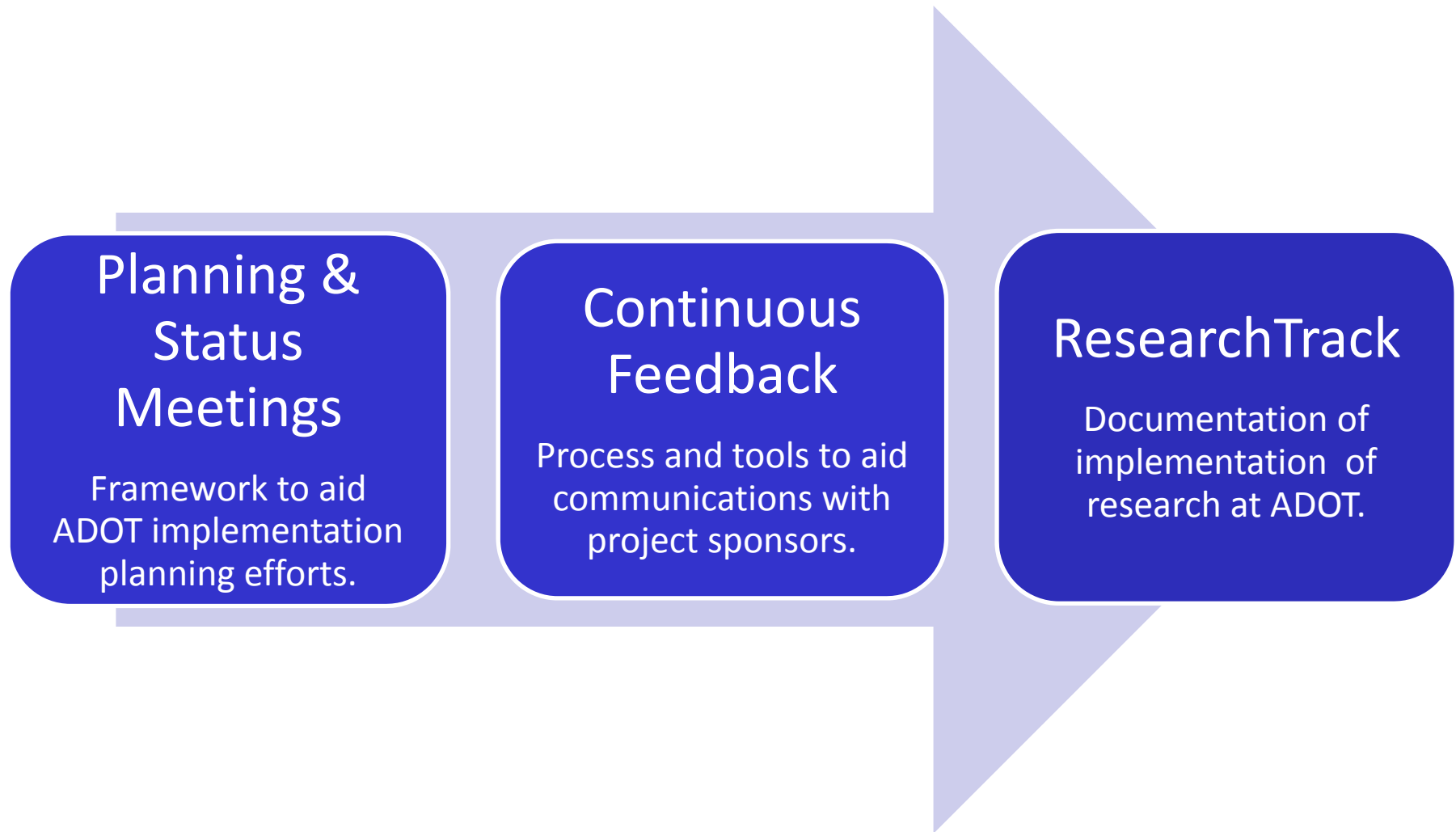
- ▶ Lack of **awareness regarding services** offered by the Research Center and ADOT Library.
- ▶ Lack of **awareness regarding the breadth of research** conducted by ADOT and the **impact of this research** in advancing state of knowledge and practice, innovation, and stewardship.
- ▶ Lack of **knowledge and understanding** regarding **Research Center processes** (e.g., selection of research projects, who is responsible for what, and ongoing monitoring of implementation).
- ▶ Perceived **inability of the Research Center to support time-sensitive “window of opportunity” research** that requires quick turn-around and prompt issuance of research findings to aid decision-making. This includes, for example, product evaluations and materials testing projects.
- ▶ Concern regarding the **timely delivery of research reports** and the process-laden aspects of conducting research at ADOT.

Factors Contributing to Under-Utilization of ADOT Research Center Services (cont'd)

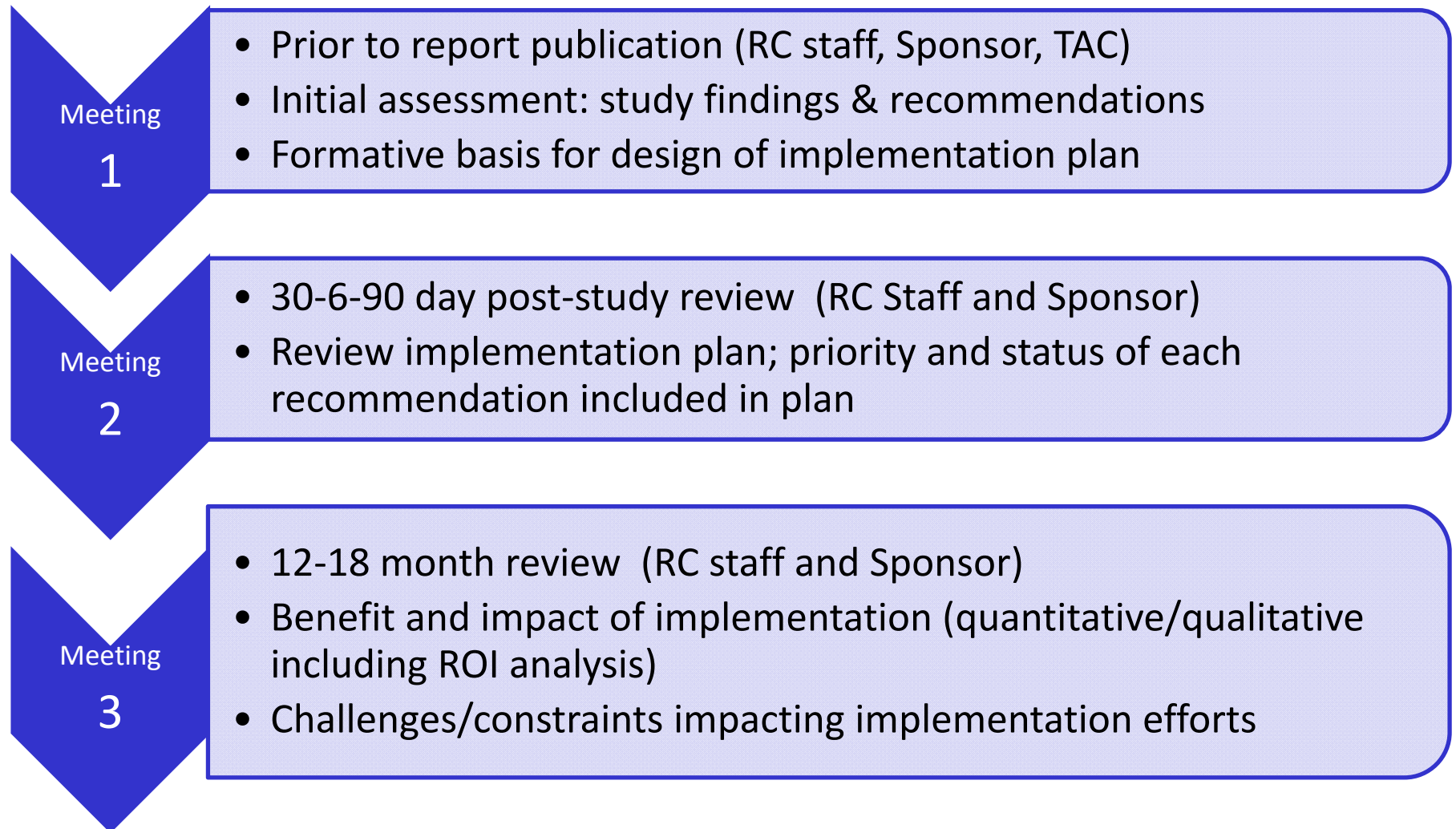
- ▶ Stakeholders **not informing or communicating with their staff** regarding Research Center services and/or the inventory of research housed in the ADOT Library due to personal stressors such as workload, scheduling demands, and “doing more with less resources.”
- ▶ Other factors such as “**information overload**” and the **extent to which they could meaningfully participate in the research process** were identified by some stakeholders as primary reasons for their **reluctance to serve on a TAC.**

***Next Steps:
Implementation Planning***

Elements of Proposed Implementation Plan (Process)



Process Overview: Meetings with Sponsor



Framework for Planning: Research Center Staff, Project Sponsor, and TAC

Meeting

1

- ▶ Initial discussions regarding:
 - Prioritization/ranking of recommendations
 - Personnel charged with implementation
 - Coordination with other ADOT workgroups or partner agencies
 - Areas of impact, anticipated benefits, measures used to assess ROI and impact to ADOT (quantitative and qualitative)
 - Challenges likely to impact implementation efforts
 - Sustainability (e.g., staff, budget, technology integration)
 - Anticipated timeline for implementation
 - Technical assistance support needs
- ▶ Research Center documents information in ResearchTrack.

Implementation Plan Review: Research Center Staff and Project Sponsor



- ▶ Meeting 2: 60-90-120 days post-study
- ▶ Review sponsor/workgroup drafted implementation plan
 - Recommendations included in plan
 - Coordination with other ADOT workgroups or partner agencies
 - Challenges impacting implementation of recommendations
 - Implementation status (planned, pending, or implemented, with scheduled date, or recommendation not implemented)
 - Measures for assessing benefit to ADOT
 - Actual vs. anticipated outcomes
- ▶ Research Center documents information specific to each study recommendation in ResearchTrack.

Implementation Plan Review: Research Center Staff and Project Sponsor

Meeting
3

- ▶ Meeting 3: 12-18 month implementation review
- ▶ Status of implementation efforts
 - Study recommendations
 - Status of project implementation efforts (overarching)
- ▶ Benefit, ROI, and impact to ADOT
- ▶ Outcomes: quantitative and qualitative impacts
- ▶ Challenges or constraints impacting implementation efforts
- ▶ Steps taken to overcome challenges (key learning)
- ▶ Next-step follow-up actions, if needed
- ▶ Research Center documents project implementation status in ResearchTrack.

Implementation of Research at ADOT: Suggested Template for the Research Center's Annual Report

- ▶ Study number, title, and date published
- ▶ Background information
- ▶ Study objectives
- ▶ Overarching benefit of research to ADOT (quantifiable and/or qualitative impact, ROI)
- ▶ How has implementation of study recommendations:
 - Improved or advanced state of knowledge or practice at ADOT
 - Aided ADOT collaboration and partnership-building efforts
 - Supported strategic priorities (Section and Department)
 - Advanced or facilitated ADOT adherence to MAP-21 performance goals for Federal highway programs

