Wisconsin Department of Transportation 2018 Research, Development and Technology Peer Exchange

Wisconsin Department of Transportation
Research & Library Unit

WisDOT ID no. 0092-18-52
April 2019

RESEARCH & LIBRARY UNIT

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TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. 0092-18-52	**2. Government Accession No.**	**3. Recipient's Catalog No.**
4. Title and Subtitle Wisconsin Department of Transportation 2018 Research, Development & Technology Peer Exchange		**5. Report Date** April 2019 **6. Performing Organization Code**
7. Author(s) Wisconsin Department of Transportation Research & Library Unit		**8. Performing Organization Report No.**
9. Performing Organization Name and Address Wisconsin Department of Transportation Research & Library Unit 4822 Madison Yards Way Room 911 Madison, WI 53705		**10. Work Unit No.** **11. Contract or Grant No.** 0092-18-52
12. Sponsoring Agency Name and Address Wisconsin Department of Transportation Research & Library Unit 4822 Madison Yards Way Room 911 Madison, WI 53705		**13. Type of Report and Period Covered** Final Report April 2019 **14. Sponsoring Agency Code**
15. Supplementary Notes		

16. Abstract

The Wisconsin Department of Transportation (WisDOT) Research Program hosted a peer exchange on September 19-21, 2018, in Madison, Wisconsin. The peer exchange examined best practices for managing research as an asset; aligning research and innovation; and documenting and communicating the successes of research and innovation. The first two topics of this peer exchange were inspired by AASHTO's Special Committee on Research and Innovation (SCORI) initiatives to integrate risk management and innovation into research project management. WisDOT's ongoing desire for improved and integrated documentation and communication inspired the third.

Representatives from four state transportation agencies (Kentucky, Missouri, North Carolina, Texas), the Transportation Research Board, and Federal Highway Administration joined WisDOT staff to share experiences relating to the three topics. WisDOT utilized TPF-5(301) Support Services for Peer Exchanges (led by Oregon DOT) for logistics, administrative assistance and facilitation, which were provided by Texas A&M Transportation Institute (TTI).

This report presents the key observations from the peer exchange presentations and group discussions.

17. Key Words Research and Library; Research, development and technology; Peer exchange; Asset management; Innovation; Documentation; Communication; Technology transfer; Best practices	**18. Distribution Statement** No restrictions. This document is available through the National Technical Information Service. 5285 Port Royal Road Springfield, VA 22161

19. Security Classif. (of this report) Unclassified	**20. Security Classif. (of this page)** Unclassified	**21. No. of Pages** 198	**22. Price**

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

DISCLAIMER

This research was funded by the Wisconsin Department of Transportation and the Federal Highway Administration through TPF-5 (301). The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views of the Wisconsin Department of Transportation or the Federal Highway Administration at the time of publication.

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Introduction

The Wisconsin Department of Transportation (WisDOT) Research Program hosted its Research, Development and Technology Peer Exchange on September 19-21, 2018, in Madison, Wisconsin. The peer exchange examined best practices for managing research as an asset; aligning research and innovation; and documenting and communicating the successes of research and innovation. The first two topics of this peer exchange were inspired by AASHTO's Special Committee on Research and Innovation (SCORI) initiatives to integrate risk management and innovation into research project management. WisDOT's ongoing desire for improved and integrated documentation and communication inspired the third.

Peer exchanges enable state departments of transportation (DOTs) to share the challenges and successes they have experienced in developing and implementing best practices for their agencies. Extensive, in-person discussion encourages states to honestly evaluate their practices and openly share what they have done well and how they can improve. WisDOT funded this peer exchange through the federal State Planning and Research Part B (SPRB) program. The event fulfills the requirements of CFR 23.E.420.209 to conduct a periodic peer exchange to review the state DOT's Research, Development & Technology Transfer program.

Key Takeaways

Managing Research as an Asset

Managing research as an asset is an emerging topic and lacks consensus best practices; however, in following with NCHRP Report 551's determination of transportation asset management, it should be policy driven, performance based, analytical, data driven and accountable. To adhere to this standard, research programs should:

- Engage in intentional and relevant research
- Exercise the power of expectation – that is, drive the delivery of quality research with well-defined goals and accountability
- Cultivate networks and engage champions to support and promote research and innovation
- Take a multi-disciplinary approach to research and innovation
- Set meaningful, well-defined and realistic performance measures for the research program
- Use research to enhance knowledge management
- Use research and innovation to mitigate identified risks
- Seek increasingly critical skillsets for information management as assets become more digital

Alignment of Research and Innovation

Opportunities for implementing research may be missed if the research program does not have strong connections with innovation experts. WisDOT can better align research and innovation by:

- Seeking buy-in from decision makers
- Enhancing connections between research staff and innovation experts
- Institutionalizing research into daily business
- Promoting a people-driven culture of innovation
- Making incremental changes that can be sustained

- Including subject matter experts/Region/District more directly in research program/projects
- Involving the eventual implementer in the research process and oversight

Documenting and Communicating Best Practices and Successes of Research and Innovation

Documentation and communication are integral components of research and innovation, not afterthoughts or add-ons. Research too often gets "thrown over the fence;" that is, there is an inadequate bridge between those performing and overseeing the research and those implementing the research. Research needs to be communicated multi-directionally for it to be implemented in a timely fashion. When research findings are not applied, the department loses value, especially for research with a short "shelf life" or relevancy time-frame. To properly document research findings and communicate them, a research program should:

- Identify its partners and audiences, including:
    - Internal staff
    - Industry partners
    - Research institutions
    - Media
    - Public
- Tailor its communication strategies to each audience, rebrand research as necessary
- Consider non-traditional and creative communication strategies (e.g., video briefs)
- Balance its presence; do not communicate too little or too much, too often or too infrequently
- Identify valuable research and opportunities for innovation from external sources and notify subject matter experts
- Facilitate and foster internal communication and institutional knowledge through:
    - Hosting meetings with statewide representation on research in progress and research successes
    - Promoting research and innovation programs and projects internally
    - Demonstrating the value of research and innovation
    - Marketing the research program as a problem-solving service
    - Documenting business and engineering practices that have changed as the result of research

Participants

Representatives from the Federal Highway Administration (FHWA), Transportation Research Board (TRB) and Kentucky Transportation Cabinet (KYTC), North Carolina Department of Transportation (NCDOT), Missouri Department of Transportation (MoDOT) and Texas Department of Transportation (TxDOT) research programs participated in the peer exchange. WisDOT utilized TPF-5(301) Support Services for Peer Exchanges for logistics, administrative assistance and facilitation, which were provided by Texas A&M Transportation Institute (TTI). The contact information for each attendee can be found in Appendix A.

To prepare participants for the peer exchange, WisDOT distributed a list of key ideas and questions to review beforehand (see Appendix B) to guide the discussions on the peer exchange's three topics. Participants were also asked to prepare an opening presentation. Each organization's presentations, which can be found in Appendix E, summarized their agency's research efforts and provided the following context:

- Budget
- Major program components
- Staff positions/chart
- Project selection and award process
- Where research and innovation reside within agency structure and why
- How/if research relates to or interacts with innovation
- Research relationship to State Transportation Innovation Council (STIC)
- Major DOT strategic initiatives or business drivers

A summary chart of each agency's research unit's budget, number of staff, position within the agency and its relationship between research and innovation is shown in Appendix C.

2018 WisDOT Research Peer Exchange Participants

Topic Summaries

The following sections summarize the discussions held on each of the peer exchange's topics:

1. Managing research as an asset
2. Alignment of research and innovation
3. Documenting and communicating best practices and success of research and innovation

Topic 1: Managing Research as an Asset

Asset management is the monitoring and maintaining of assets to achieve their greatest potential returns. At its core, according to NCHRP Report 551, asset management:

- Is policy driven
- Is performance-based (day-to-day and strategic)
- Analyzes options/tradeoffs (how to allocate funds and other resources)
- Uses quality information to justify decisions
- Monitors for accountability and feedback (impact, implementation, effectiveness)

Transportation assets can be tangible, like pavements and structures, but they can also be intangible, like research findings and institutional knowledge. The assets of a transportation research program are not only its findings and the institutional knowledge they produce, but also the physical space, laboratories and equipment it takes to conduct the research, for those DOTs that conduct some of their own research in-house by internal staff.

Asset management includes economic assessments of tradeoffs between options to make cost-effective decisions. Challenges can be strategic or institutional and may include determining what to measure and how, managing risk and gathering continuous feedback. In this session, participants discussed how to apply transportation asset management principles in managing research and its tangible and intangible components.

Participants expressed that their agencies faced the following challenges in managing research as an asset:

- Difficulty in assigning value to research findings
    - Value is often not realized until findings are applied to operations, which can take months or years
    - Research that results in no operational changes or that affirms current practice still has value—this can be challenging to communicate
- Policy goals of the department are not always clear or communicated well
    - The research program may not know what issues to tackle or if their mission aligns with that of the department
- Performance metrics have not been set, or if they have, they are difficult to document and track; portfolio analysis and a "scorecard" of hard measures can be expensive and time-consuming to develop
- Staffing limitations prevent taking on new initiatives
- Risk aversion of state agencies subject to political pressures may restrict research and innovation opportunities
- Those performing and overseeing the research are not adequately incentivized to see it through to implementation
- Knowledgeable staff are difficult to retain and attract

Participants offered the following strategies to overcome these challenges:

- Think about assets relative to the agency's mission and expertise, capabilities and capacity
- Take inventory of the information available before making a decision to seek new information; consider the life expectancy or "shelf life" of research projects and their intellectual capital
- Consider the question "why should we treat research as an asset?"—determine where and how research benefits the business side of the agency (by a cost saving or mitigating a risk, for example)
- Treat research as risk management
    - Research is an intangible asset, but it affects the value of tangible assets
    - Building infrastructure without knowing if it can be better or more cost-effective risks time and money of the department and end-user value
    - Target efforts toward improving areas of greatest risk

        - Research risks losing value the longer it takes to communicate it to implementers; reducing that time reduces risk
- Treat research as knowledge management
    - People are valuable assets, and research has a role in developing and maintaining a well-trained workforce
    - Don't rely entirely on experts to conduct and oversee research; involve less-experienced and younger staff, so they can be engaged
    - Retention is important, especially when hiring freezes or slowdowns are in place and replacement is not a viable option
    - Create clear tracks for interns and new employees to progress in agency
        - E.g., MoDOT's engineering policy guide has a knowledge management component
- Communicate the results of research
    - Value of research is found in implementation results/advancing the state of the practice/field of knowledge
    - The same information has different value in different hands; need to get it to those who can do the most with it
- Align research program and agency objectives/strategies
    - Research the areas; strategic initiatives and business drivers on which the agency is most focused
- Simplify cost-benefit and performance analysis (start small and build incrementally)
    - Create performance metrics (see Appendix E, page 178), compile data, track trends
    - Demonstrate accountability

Summary:

Managing research as an asset is an emerging topic and lacks consensus best practices as well as clear consistent terminology and definitions. Participants wondered if we are all talking about the same thing when we say that research is an asset. Collaboration is needed to clarify this concept. However, there is usefulness in following the guidance found in NCHRP Report 551's determination of transportation asset management—it should be policy driven, performance based, analytical, data driven, and accountable. To adhere to this standard, research programs should:

- Engage in intentional and relevant research
- Exercise the power of expectation – that is, drive the delivery of quality research with well-defined goals and accountability
- Cultivate networks and engage champions to support and promote research and innovation
- Take a multi-disciplinary approach to research and innovation
- Set intentional performance measures for the research program
- Use research to enhance knowledge management
- Use research and innovation to mitigate identified risks
- Seek increasingly critical skillsets for information management as assets become more digital
- Track the outcomes of research as assets: products/deliverables, data and implementation

Topic 2: Alignment of Research and Innovation

The goal of research is to inform decisions that lead to innovation in materials, systems, and methods; therefore, implementation of research findings should be a focus throughout the entire research cycle, which generally follows these steps:

1. Identify issues
2. Identify priorities
3. Review and select projects to advance
4. Issue requests for proposals (RFPs)
5. Award projects and negotiate contracts
6. Conduct research project
7. Communicate results and conduct technology transfer
8. Apply research findings through implementation
9. Measure return on investment

By contrast, innovations can often be quick to deploy and demonstrate benefits. They can be high risk but offer dynamic, high-impact breakthroughs, efficiencies and returns (savings). It might be less complicated to identify the financial benefits/ROI of an innovation and document success or lessons learned compared to a research project's results. Sometimes a "go/no-go" project management focus can make innovation programs nimbler by nature. (See FHWA's Innovator Issue 66.)

The Cooperative Research Programs and State Planning and Research Part B (SPRB) work programs focus on achieving realistic solutions to specific problems through this cycle. The discussion on this topic sought to determine how state DOTs can align research and innovation throughout this cycle to achieve continuous process improvements of various magnitudes.

Participants expressed that their agencies faced the following challenges to the alignment of research and innovation:

- Research staff may not know the goals of agency management with respect to innovation
- Agency management or staff in charge of implementing research findings may not buy into research or changes to current practices
- Research may be an unknown asset to staff and management; functional areas haven't developed relationships
- Research is confined to low-risk projects, as agencies under high public scrutiny tend to be risk averse (little or no latitude for failure)
- Approval of research often goes through many tiers in the agency
    - Time-consuming
    - Where most people see value in research, one person who does not may stall it
- Projects should be relevant to the agency's needs, but the research cycle can be lengthy and time-consuming
    - Project champions must be highly involved, but still perform their normal functions
    - This problem is multiplied when trying to coordinate the schedules and availability of entire committee members
    - Projects reach bottlenecks outside the control of the department
        - E.g., researchers not completing reports on time

- Not enough staff to properly oversee the conduct of research or track its implementation/outcomes
    - If implementation and outcomes are not tracked, return on investment cannot be calculated
- Innovation is confined to silos

Participants offered the following strategies to overcome these challenges:

- Communicate more with staff and management
    - Identify those capable of implementing research findings and build connections with them
    - Find out the goals of the agency, divisions, bureaus
    - Increase awareness of the research program's services
    - Demonstrate the value of research and how it can help staff, the agency
    - Eliminate knowledge silos by disseminating research findings to more staff
- Seek buy-in from staff and management
    - Time is valuable; give people a reason to allocate it to research
    - Holdups in approval processes will decrease if value of research is understood
    - Target "late adapters" to innovation with strategies to encourage earlier adaption (see the buy-in bell curve in Appendix E, page 172)
- Identify holdups in the research process
    - Determine if the step adds value
    - Determine if low-value steps can be removed
- Encourage incremental changes that do not require lengthy, costly projects
    - Research programs are not only research projects; they offer other services
    - Innovations can be expedited when the value is apparent and implementation easy/low cost
    - Communicate small improvements
        - Small improvements multiplied by many can have big results
        - "Many candles still light up a room"
    - Small innovations can make for the most easily demonstrable benefits and easiest return on investment
- Institutionalize research and innovation
    - Encourage a culture that values and rewards improvement
    - Everyone's mind should be focused on ways to improve
- Facilitate coordination between researchers and implementers and asset management teams
    - Encourage or mandate deliverables that ease implementation
- Follow the "Five Steps to Innovation Bliss": incubate, demonstrate, pilot, communicate, implement (see Appendix E, page 175)

Summary:

WisDOT has a less-defined connection between research and innovation than the other states participating in the peer exchange. WisDOT's research program and its innovation experts are not formally linked. For implementable research findings to translate into innovation, the gap must be bridged by:

- Seeking buy-in from decision makers
- Enhancing connections between research staff and innovation experts
- Institutionalizing research into daily business
- Finding appropriate ways to break through or work around barriers and bottle-necks in processes, consensus and approvals
- Promoting a people-driven culture of innovation
- Making incremental changes
- Including subject matter experts/Region/District more directly in research program/projects
- Involving the eventual implementer in the research process and oversight
- Taking a marketing approach or "rebranding" the research program to highlight the value it has in supporting innovation in the agency

Topic 3: Documenting and Communicating Best Practices and Successes of Research and Innovation

The value of research increases as it reaches the hands of more implementers. Research too often gets "thrown over the fence;" that is, there is an inadequate bridge between those performing and overseeing the research and those implementing the research. Simply making research findings available for decision makers and implementers to find may be enough to fulfill program and federal requirements, but it does not achieve the goals of the research program or agency. Documentation and multi-directional communication must be integral parts of the research and innovation processes and not afterthoughts or add-ons. When research findings are not applied, the department loses value, especially for research with a short "shelf life," or relevancy timeframe. To properly document and communicate research findings, the research program should:

- Determine and implement the best methods for documenting best practices and successes
- Identify internal/external audiences
- Target internal/external audiences and match the message to the audience/make it relevant
- Cultivate networks and engage champions

Participants expressed that their agencies faced the following challenges to documentation and communication:

- The research program does not have formal ties to the innovation team
- Research has a shelf life; any time lost communicating it with the right people costs the agency time/money
- Agency management or staff in charge of implementing research findings may not buy into research or changes to current practices
    - Research has a negative connotation to some
        - Perceived as wasteful
        - Ivory tower syndrome
- Research staff may not know the goals of agency management
- Research may be an unknown asset to staff and management
- Physical libraries and library services are being eliminated
- Digitization is time and resource consuming

    - Digitization means more than simply scanning paper documents
        - Must be searchable and accessible
        - Requires consistent metadata
        - Recent uptick in lawsuits over information accessibility
    - Must be hosted somewhere
    - Copyrighted materials can't be scanned
    - Not all physical materials are sized for scanning or are otherwise not scannable
- Curating data and managing content is resource consuming
    - Must develop or adopt common standards and nomenclature
- Communicating research that does not meet its goals has the potential to expose the department to criticism
- Coordinating communication between parties across different locations with different availabilities (e.g., research, innovation and asset management teams)
- Documentation is seen as an expendable or optional extra step

Participants offered the following strategies to overcome these challenges:

- Identify partners, stakeholders and audiences, including:
    - Internal staff
    - Industry partners
    - Research institutions
    - Media
    - Public
- Tailor messages according to target audiences; each has different perspectives and its own positive and negative buzzwords
    - E.g., safety technology sounds good to the public but may sound like a liability to contractors
    - E.g., risk-averse agencies may be more receptive to research if branded as risk-mitigation
- Develop and implement a formalized communications plan
    - Infographics
    - Five-minute webinars or video briefs on finished projects
    - One- or two-page summary reports
    - Incorporate visuals in strategies whenever possible
    - Showcase research and innovation "wins" through social media series
    - Monitor perception of the program and create appropriate strategies
- Formalize connection between research program and innovation team
    - Primary innovation team member can help research program align itself with the agency's mission and specific objectives
- Develop performance metrics and track data to more easily demonstrate value
    - Perform retrospective analysis of past project performance
    - Do not overcomplicate it
- Promote internal communication
    - Have regular touch-base meetings between research staff and division heads
    - Research program staff should be familiar with what's going on across the agency

    - Encourage staff to bring problems to the research program, possibly via an "ask the research program" page on the website
- Reduce the influence of the central office in some discussions and let the regions discuss innovation themselves
- Standardize metadata and content style
    - Use industry standard nomenclature
- Create safe spaces for feedback and challenges to the status quo; this needs cultural change
- Make use of valuable AASHTO Research Advisory Committee (RAC) surveys; increase value by increasing participation, both in outgoing and incoming surveys
    - Develop a "Topic Cheat Sheet" of subject matter experts to forward surveys to
- Have champions be the spokespersons for their research
- Host and attend more peer exchanges
- Cultivate a culture of interest in sharing/transferring information, rather than keeping it siloed
- Have some fun, especially when reaching out to people via leisure activity types of platforms
    - E.g., MoDOT on Facebook with "Barrel Bob" or "fast and furious" brown-bags
- Recognize that cross-training can be as important as documentation processes and procedures

Summary:

Documenting and communicating research and innovation will vary for each of the audiences and stakeholders of the program. Options to achieve program goals include:

- Tailoring communication strategies to each audience, rebranding research as necessary
- Considering non-traditional and creative communication strategies (e.g., video briefs)
- Balancing presence; do not communicate too little or too much, too often or too infrequently
- Identifying valuable research and opportunities for innovation from external sources and notify the agency's subject matter experts
- Facilitating and fostering internal communication and institutional knowledge through:
    - Hosting meetings with statewide representation on research in progress and research successes
    - Promoting research and innovation programs and projects internally
    - Demonstrating the value of research and innovation
    - Marketing the research program as a problem-solving service
    - Documenting business and engineering practices that have changed as the result of research

Appendix A – Participant Information

State DOTs

Kentucky Transportation Cabinet

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Appendix B – Preparation Questions

Topic Summaries and Peer Exchange Preparation

WisDOT Research, Development & Technology Peer Exchange: September 19–21, 2018

Participant DOTs: [KY, MO, NC, TX, WI]

Facilitation: Provided by Texas A&M Transportation Institute

To help prepare participants, following are some ideas and key questions that we hope will guide the discussions on the three topics the peer exchange intends to pursue. In addition, we'd like participants to prepare an opening presentation— please plan for about 25 minutes total to include Q&A. The presentation should summarize the research program and provide context for our topic discussions:

- budget
- major program components
- staff positions/chart
- project selection and award process
- where research and innovation reside within agency structure and why
- how/if research relates to or interacts with innovation
- research relationship to State Transportation Innovation Council (STIC)
- major DOT strategic initiatives or business drivers

Please bring your presentation along on a flash drive or your laptop or other device, or better yet, send in advance to lynnm.hanus@dot.wi.gov. Please include in your email your position, brief background of your education/experience, contact information and a link to your program's external website.

In early 2018, the AASHTO Special Committee on Research and Innovation (SCORI) introduced several initiatives:

- Integrating risk management into project management (Task Group 2)
- Incorporating innovation (Task Group 3)
  - Improving services provided to DOT innovation staff
  - Establishing a national innovation clearinghouse
  - Helping DOTs promote and develop innovations
  - AASHTO Innovation Initiative (AII)

SCORI's new focus and its related tasks helped inspire the first two topics of this peer exchange. An ongoing desire for improved and integrated documentation and communication prompted the third.

1. Managing Research as an Asset

Transportation assets are generally thought of as things like pavement and structures—and asset management thought of as how to manage these physical assets through their life-cycle. Research may be intangible outside of deliverables and not bear much similarity to material assets and traditional models but might be relatable as a capital asset, which can include property (intellectual or physical) or economic resources. Research certainly requires human/intellectual capital and technological capital to drive performance that feeds into goals and objectives.

Asset management also performs economic assessments of tradeoffs between options to make cost-effective decisions. Challenges can be strategic or institutional and may include determining what to measure and how, managing risk and gathering continuous feedback.

According to NCHRP Report 551, at its core, transportation asset management

- Is Policy-driven
- Is Performance-based (day-to-day and strategic)
- Analyzes options/tradeoffs (how to allocate funds and other resources)
- Uses quality information to base decisions upon
- Monitors for accountability and feedback (impact, implementation, effectiveness)

What are the benefits to DOTs of applying asset management principles to managing their research programs? How can states best do this?

2. Alignment of Research & Innovation

In the Cooperative Research Program/SPR2 work program realm, the focus is on applied research addressing a specific problem seeking a realistic solution with relatively low risk and, hopefully, a reasonably "short-term" focus. The research is followed, we hope, with developments that turn results into something useful---materials, devices, systems, methods. But all this occurs within an agency that may lean toward being risk averse. Many tiers of approval can be required and there is pressure to be good stewards of SPR and matching funds. Projects must be relevant and key stakeholders must be involved. Generally, the traditional research life-cycle isn't very nimble:

- Identify issues: Panels/committees can be time-consuming; calls for topics, suggestion boxes and open solicitations can go ignored (or the submittals collected from them may not be directly relevant to agency needs)
- Identify priorities: Time-consuming panels; evaluation process (match to agency mission/goals, if known or if communicated)
- Proposal review and selection: Time-consuming panels and approvals
- Awarding projects: RFPs, contracts
- Conduct research project
- Tech transfer/implementation
- Measure return on investment

Innovations can often be quick to deploy and demonstrate benefits. They can be high risk but offer dynamic, high-impact breakthroughs, efficiencies and returns (savings). It might be less complicated to identify the financial benefits/ROI of an innovation and document success or lessons learned compared to a research project's results.

David Esse (WisDOT Innovation, Research & Technology Program Chief in the Division of Transportation System Development) established "5 Steps to Innovation Bliss." (See **FHWA's Innovator Issue 66.**) These steps seem lightning fast relative to the research life-cycle with their "Go/No-Go" project management-oriented decision criteria:

Incubate ► Demonstrate ► Pilot ► Communicate ► Implement

So, with such fundamental distinctions, how can we align the two in our DOTs in meaningful ways? Innovation need not be just about project delivery—how can we achieve continuous process improvement for innovations that aren't "blockbusters" or that might just help create capacity?

3. Documenting and Communicating Best Practices and Successes of Research & Innovation

Documentation and communication must be integral parts of the research and innovation processes and not afterthoughts or add-ons. This means much more than just disseminating findings. How can DOTS

- Determine and secure the best methods for documenting best practices and successes
- Identify internal/external audiences
- Target internal/external audiences and match the message to the audience/make it relevant
- Cultivate networks and engage champions

Appendix C – Research Program Background Chart

	Research Program			
State DOT	Budget ($ millions)	Number of Staff	Position within Agency	Alignment of research and innovation
Kentucky	3.8 (All federal; SPR only)	One	State Highway Engineer's Office (reports to Assistant State Highway Engineer for Innovation)	Each Project, during the scoping, must have a general "Implementation Assessment" form completed before the workplan is approved by the Study Advisory Chair.
Missouri	4.6	Three (plus contract librarian)	Unit within Construction and Materials Division	Innovation is integrated throughout MoDOT, so there is not one centralized location or innovation officer. Innovative things tend to land in research unless it is fiscal related; we have a different division that handles innovative finance issues. However, a lot of innovation happens within the districts that we may never hear about.
North Carolina	6.0 Additionally, we facilitate another 2.5-3.0 from other sources each year (non-SPR monies)	Six	Division of Highways; Transportation Program Management Unit (TPMU); Research and Development Unit	Innovation is not officially centralized within any one unit or individual at NCDOT. We have the NC Transportation Innovation Council (NC-TIC), which manages our STIC program. Our Value Management (VM) Office is housed within TMPU along with Research. VM handles/approves new and innovative products. Governance Office does department-wide six sigma and handles department process improvements. There may be some official centralization of innovation efforts in the future.
Texas	26	14	Under Director of Strategy and Innovation	RTI is under TxDOT's Director of Strategy and Innovation with two other divisions: Strategy and Information Management.
Wisconsin	4.09	Six	Executive Offices; Office of Management and Budget; Performance, Policy and Research Section; Research and Library Unit	WisDOT's Research and Library Unit has an informal relationship with the department's innovation program, which resides in the Division of Transportation System Development.

September 19–21, 2018 Agenda

Managing Research as an Asset

Alignment of Research and Innovation

Documenting and Communicating Best Practices and Successes of Research and Innovation

Wednesday, September 19

8:00 am	**Shuttle to WisDOT Hill Farms Building**
8:30 am-9:15 am	**Welcome** **Introductions** **Agenda Goals/Topic Summaries**
9:15 am-10:15 am	**State-by-State Presentations** State 1 State 2
10:15 am – 10:30 am	**Break**
10:30 am – 12:00 pm	**State-by-State Presentations** State 3 State 4 State 5
12:00 pm – 12:45 pm	**Lunch (provided)**
12:45 pm – 1:45 pm	**TRB & FHWA Presentations** **FHWA – John Moulden** **TRB -- Claire Randall**
1:45 pm – 3:00 pm	**Managing Research as an Asset** Group discussion
3:00 pm – 3:15 pm	**Break**
3:15 pm – 4:45 pm	**Alignment of Research & Innovation** Introductory presentation – David Esse, WisDOT Innovation, Research & Technology Program Chief Group discussion
4:45 pm	**Shuttle to hotel**
6:00 pm	**Optional Group Dinner** **(eligible for reimbursement for visiting State DOT participants)**

Thursday, September 20

8:00 am	**Shuttle to WisDOT Hill Farms Building**
8:30 am- 10:00 am	**Day 1 re-cap and follow-up discussion**
10:00 am – 10:15 am	**Break**
10:15 am- Noon	**Documenting and Communicating Best Practices and Successes of Research & Innovation** Group discussion
12:00 pm – 12:45 pm	**Lunch (provided)**
12:45 pm – 2:00 pm	**Documenting and Communicating Best Practices and Successes of Research & Innovation** Group discussion continued
2:00 pm – 2:15 pm	**Break**
2:15 pm – 4:45 pm	**State-by-state remarks**
4:45 pm	**Shuttle to hotel and/or airport**
6:00 pm	**Optional Group Dinner** **(eligible for reimbursement for visiting State DOT participants)**

Friday, September 21

8:30 am	**Shuttle to WisDOT Hill Farms Building**
9:00 am – 9:45 am	**Day 2 re-cap and follow-up discussion**
9:45 am – 10:45 am	**Finalize findings of overall peer exchange**
10:45 am – 11:00 am	**Break**
11:00 am - Noon	**Close-out presentation / discussion with invited guests from WisDOT Research and Library Advisory Committee and WisDOT Division leadership**
Noon – 1:15 pm	**Lunch for peer exchange participants (provided)**
1:15 pm	**Shuttle to hotel / departures to airport**

WisDOT Research, Development & Technology Peer Exchange

Managing Research as an Asset
Alignment of Research & Innovation
Documenting and Communicating Best Practices and Successes of Research & Innovation

Madison, Wisconsin

September 19-21, 2018

Agenda Day 1

8:30-9:15: Welcome & Introductions

9:15-Noon: State by state presentations about their research and innovation programs (10:30 break)

Noon-12:45: Lunch (provided)

12:45-1:45: TRB and FHWA presentations

1:45-4:45: Group discussions (3:00 break)

- Managing research as an asset
- Alignment of research & innovation
  - Brief presentation by David Esse, WisDOT, Innovation, Research & Technology Program Chief, followed by group discussion

Welcome & Introductions

- Host state: Wisconsin DOT
- Facilitators: Texas A&M TTI
- Kentucky Transportation Cabinet
- Missouri DOT
- North Carolina DOT
- Texas DOT
- Guests from FHWA and TRB

Self-Introductions and Icebreakers

- What is your role at your agency?
- What is your advice / best takeaway from other peer exchange experiences?
- What is your proudest accomplishment? (Outside of work and children!)
- What was your best vacation?

Purpose of a RD&T Peer Exchange

- FHWA requirement
- Exchange ideas and best practices
- Prepare report to share findings

Objectives of This Peer Exchange

- Examine the research program with respect to the three topical areas
- Improve the quality and effectiveness of WisDOT's (host state) research program
- Articulate insights, lessons learned and ideas for improvement to state DOT leadership (and AASHTO SCORI and AASHTO RAC)

Food for Thought

At the end of this peer exchange, I will / we will . . .

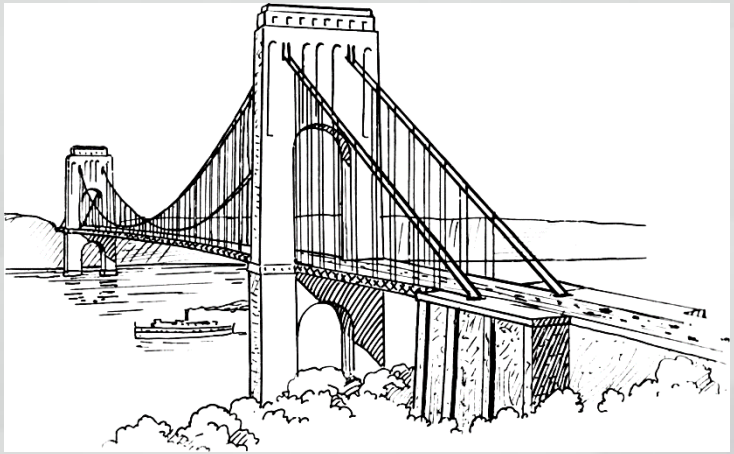
State Presentations

- Program budget (SPR and other funding sources)
- Major research/innovation program components
- Staffing levels/positions/chart
- Project selection and award process
- Where research and innovation reside within agency structure and why
- How/if research relates to or interacts with innovation
- Research relationship to State Transportation Innovation Council (STIC)
- Major DOT strategic initiatives or business drivers

National Presentations

- Perspectives from
  - John Moulden, FHWA, Manager, Research & Technology National Partnership Program
  - Claire Randall, TRB, Senior Program Officer

Beyond bridges and pavement . . .



How can / do DOTs apply transportation asset management principles to their research programs?

Managing Research as an Asset

- Transportation asset management is
  - Policy driven
  - Performance based (day-to-day and strategic)
  - Analytical (options/tradeoffs/allocation of resources)
  - Data driven (uses quality information to make decisions)
  - Accountable (monitors for feedback, impact, implementation, effectiveness

(NCHRP Report 551)

Alignment of Research & Innovation

Not All Innovation Comes from Implementation of Formal Research

Research stereotype:
Slow, methodical, incremental, expensive

Innovation stereotype:
Immediate, ingenious, revolutionary, cost-saving

(Dave Huft, SD DOT; AASHTO Innovation Initiative)

Traditional Research Life-cycle

Identify issues ► Identify priorities ►
Review proposals ►
Selection/award process ►
Conduct research ►
► Tech transfer / implement
► Measure / evaluate

“Innovation Bliss”

Go / No-Go

Incubate ► Demonstrate ► Pilot ► Communicate ► Implement

(David Esse, WisDOT; FHWA’s *Innovator* Issue 66)

Stereotypes Can Be Dangerous

Consider

- Value of rigor and documentation
- Long-term effects
- Range of conditions
- Level of risk

How can research and innovation thrive in our agencies?

(Dave Huft, SD DOT, AASHTO AII)

AASHTO AII working now to: support SHRP2 implementation, EDC and STIC; solicit innovations from states; establish a clearinghouse for innovation; support a community of practice

- How to deal with the “instability” of innovation?

Day 1 Wrap-up Roundtable

- What are you most proud of or happy about regarding your state's research and innovation efforts?
- What's your vision for improvement?

Agenda Day 2

8:30-10:00 Recap from Day 1 discussions

- Managing research as an asset
- Alignment of research & innovation

10:00-10:15: Break

10:15-Noon: Group discussion

Documenting and communicating best practices and successes of research & innovation

Noon-12:45: Lunch (provided)

12:45-2:00:Group discussion continued

2:00-2:15: Break

2:15-4:45: State-by-state remarks

Document and Communicate

- Integral parts of research & innovation processes---not after-thoughts or add-ons
- The “shelf-life” of the relevance of information? It’s brief.
- Balance what we want or need to communicate with what our audiences want or need to receive.

How Can Our Agencies:

- Determine and secure useful methods to document our best practices and successes in research and innovation
- Target internal/external audiences and match the message to the audience to make it relevant
- Cultivate networks and engage champions to support and promote research and innovation

Day 2 Closing Comments by Agency

Any ideas/takeaways from discussions that you will try to implement?

Or ideas for ways to build on your successes?

Agenda Day 3

9:00-9:45: Recap from Day 2 discussions

- Documenting and communicating best practices and successes of research & innovation

9:45-10:45: Group discussion

- Finalize findings

10:45-11:00: Break

11:00-Noon: Closeout presentation/discussion with guests from WisDOT Research and Library Advisory Committee and WisDOT Division leadership

Noon: Lunch (provided)

1:15: Adjourn, departure to hotel/airport

Review and Finalize Findings

- Managing Research as an Asset
- Alignment of Research & Innovation
- Documenting and Communicating Best Practices and Successes of Research & Innovation

Presentation, Recommendations and Discussion

- The peer exchange will be joined by
  - Invited WisDOT Division leadership
  - Members of WisDOT Research and Library Advisory Committee

Lunchtime Discussion
Before We Hit the Road

- Reflect on your peer exchange experience
- Next steps: final report timeline; other follow-up

KYTC Research Program

Presented to WisDOT Peer Exchange

September 19, 2018

Jason J. Siwula, PE

Assistant State Highway Engineer

Kentucky Transportation Cabinet

KENTUCKY TRANSPORTATION CABINET

Mission

To provide a safe, efficient, environmentally sound and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life in Kentucky.

Our Focus

Safety *Communication* *Teamwork* *Efficiency* *Innovation*

KENTUCKY TRANSPORTATION CABINET

A CLOSER LOOK AT KENTUCKY

POPULATION	4.45 million
STATE GDP	$196 billion
BRIDGES	14,292
MILES OF ROADS	80,041 miles
LICENSED DRIVERS	3 million

Major KYTC Initiatives

SHIFT
KENTUCKY AHEAD

BRIDGING KENTUCKY
Restore | Renew | Replace

Innovation is a Team Effort!

STIC
State Transportation Innovation Councils

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

EDC

National Center for Asphalt Technology
NCAT
AUBURN UNIVERSITY

KTIC

AASHTO

TRB
TRANSPORTATION RESEARCH BOARD

KAHC

Fayette Urban County Government
Lexington Kentucky
1775

Louisville
1778
Jefferson County

ACEC
American Council of Engineering Companies
of Kentucky

KENTUCKY
TRANSPORTATION
CABINET

TAP
Local & Tribal Technical
Assistance Program

U.S. Department
of Transportation
Federal Highway
Administration

UK
UNIVERSITY
OF KENTUCKY
College of Engineering

UNIVERSITY OF
LOUISVILLE.
J.B. SPEED SCHOOL
OF ENGINEERING

waze
OUTSMARTING TRAFFIC, TOGETHER

STATE PLANNING AND RESEARCH IDEA SUBMISSION FY2019

ADA Technical Infeasibility Evaluation

Longer Service Life Bridge Coatings

In order to maximize the value of the Transportation Cabinet's research program, we want to make sure research projects meet real needs and solve real problems. We invite you to use the online portal to submit ideas for research projects.

The online portal is available through: http://resproject.engr.uky.edu/resIdeaSubmit19.aspx

The submission deadline is January 19, 2018.

If you have any questions about submitting research ideas, please contact Jason Siwula, KYTC Innovation Engineer, at jason.siwula@ky.gov.

For more information on completed research projects, visit: http://www.ktc.uky.edu/publications/reports/

KENTUCKY TRANSPORTATION CABINET

KTC KENTUCKY Transporation Center

Paris Pike Repaving

Louisville Southern Indiana Ohio River Bridges

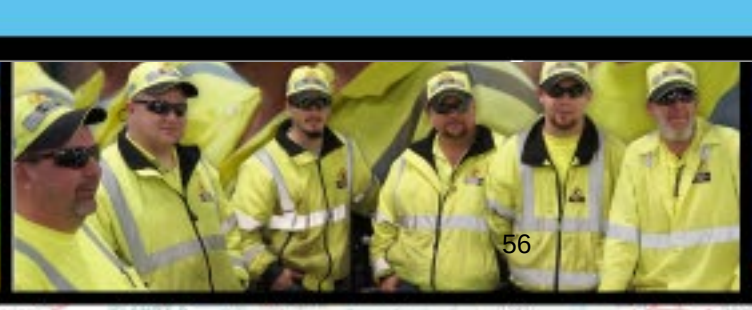
KENTUCKY TRANSPORTATION CABINET


Milton-Madison Bridge Slide
Watch later
Share

High Friction Surface Treatments

Waze Connected Citizen Partnership

CONNECTED CITIZENS
by waze



KENTUCKY TRANSPORTATION CABINET

GoKY

KENTUCKY TRANSPORTATION CABINET

AUTONOMOUS VEHICLES IN KENTUCKY

KENTUCKY TRANSPORTATION CABINET
May 19th 2017

Technological advances have brought autonomous vehicles (also referred to as automated vehicles or self-driving vehicles) closer to reality. The Google Waymo Self-Driving Car Project has reached the testing stage in California, Arizona, Nevada, Washington, and Texas, with test vehicles having travelled over two million miles to date. Ford has announced plans to introduce a fully autonomous vehicle (no steering wheel or control pedals) in 2021. Volvo and Uber are partnering to develop autonomous vehicles – Volvo will manufacture the "base vehicles" with Uber adding its own autonomous driving software to the vehicles. Uber also began testing retrofitted vehicles in Pennsylvania, Arizona, and California although drivers remain in the vehicles to monitor their performance. Finally, General Motors and Lyft are collaborating to deploy thousands of ride-sharing autonomous electric vehicles beginning in 2018.

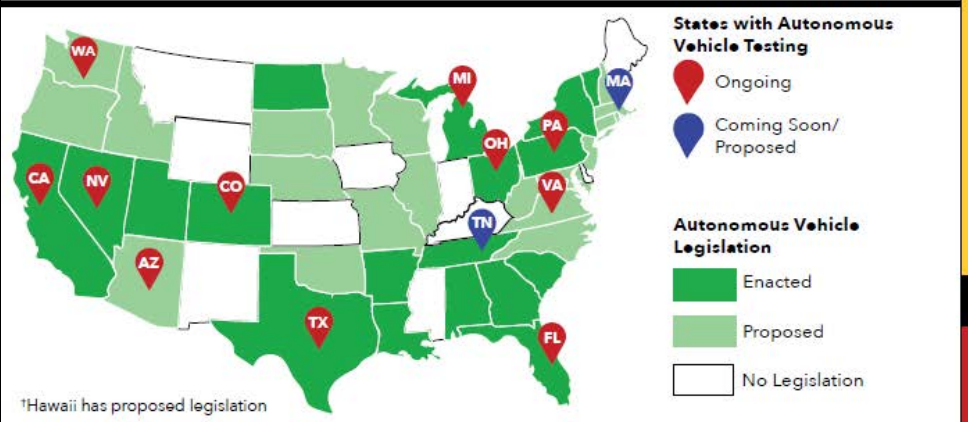
LEVEL 0 No Automation	LEVEL 1 Driver Assistance	LEVEL 2 Partial Automation
Driver is in control of vehicle at all times	Vehicle can assist driver with some elements of driving such as adaptive cruise control	Vehicle can conduct some elements of driving such as speed and lane position while driver continues to be engaged

What are Autonomous Vehicles?

Autonomous vehicles (AVs) are equipped with technologies such as sensors, radar, sonar, LIDAR, & cameras, which let vehicles sense their environment and potentially operate without human assistance. These vehicles allow for some aspect of critical control such as steering, throttling, or braking to be done without direct driver input. There are several levels of automation, ranging from no automation to fully automated vehicles.

LEVEL 3 Conditional Automation	LEVEL 4 High Automation	LEVEL 5 Full Automation
Vehicle can perform all aspects of driving in limited situations and can inform the driver when he/she must take control	Vehicle performs all aspects of driving under certain conditions	Vehicle performs all aspects of driving under any conditions and can operate with or without a driver or occupants

Status of Autonomous Vehicle Legislation & Testing



†Hawaii has proposed legislation

Highway Freight Flows in 2040

Kentucky serves as a major junction for the nation's freight network. U.S. freight volumes are expected to increase 40 percent by 2040.

Benefits of Autonomous Vehicles

There are numerous benefits that can be realized from the adoption of autonomous vehicles including crash reductions, route planning, increased capacity of current infrastructure and reduced congestion, improved transportation access for underserved populations such as the elderly and disabled, reduced freight transport costs through related technologies such as truck platooning which can improve fuel efficiency by 5-10%, and increased productivity by allowing other activities to be performed instead of driving.

AVs By The Numbers

90%

Reduction in fatalities could save 753 lives in Kentucky
(source: Kentucky State Police reported 835 fatalities in 2016)

90%

Reduction in crashes could save nearly $16 billion in related costs in Kentucky
(source: Traffic Collision Facts 2015 Report)

Opportunities

KYTC		Toyota
US DOT		GM
Lyft		Ford
Uber		Google

Items Under Consideration by KYTC

- Allow autonomous vehicle testing
- Explore partnerships with automakers and ride sharing companies
- Continue research into autonomous vehicles & the potential benefits for all KY communities

For more information about autonomous vehicles, sources cited and the full autonomous vehicles report, please visit: http://uknowledge.uky.edu/ktc_researchreports/1568/

KENTUCKY TRANSPORTATION CABINET
In partnership with
KTC KENTUCKY Transportation Center
University of Kentucky

Contact information:
Jason Siwula - Assistant State Highway Engineer, Kentucky Transportation Cabinet
200 Mero Street Frankfort, KY, 40622 (P) 502.782.5537 (E) jason.siwula@ky.gov

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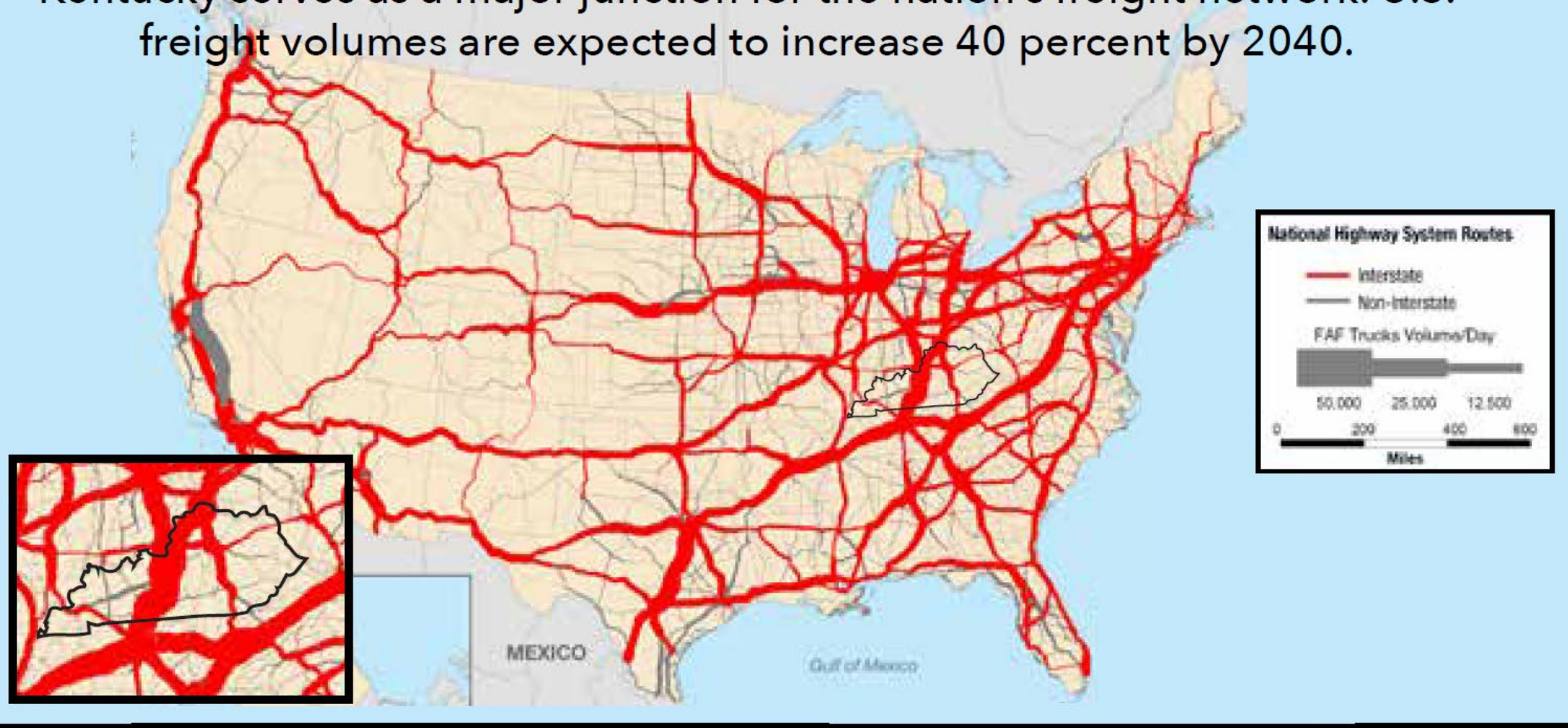


Questions?

Jason J. Siwula, PE

Executive Director – Kentucky Office of Highway Safety

Assistant State Highway Engineer - Innovation

Kentucky Transportation Cabinet

Jason.Siwula@ky.gov

Wisconsin Research Peer Exchange

Missouri DOT Research Presentation

September, 2018

Missouri DOT Research Program

- Overall Budget of $4,600,000
- Less Additional Commitments
  - NCHRP ≈$1,100,000
  - Pooled Funds ≈$560,000
- Contract Research Core Budget of $2,016,908
- Managed by Research Staff of 3 and 1 Librarian (Contract)
- Essentially all Research is by Contract – exception is “New Product” Evaluations

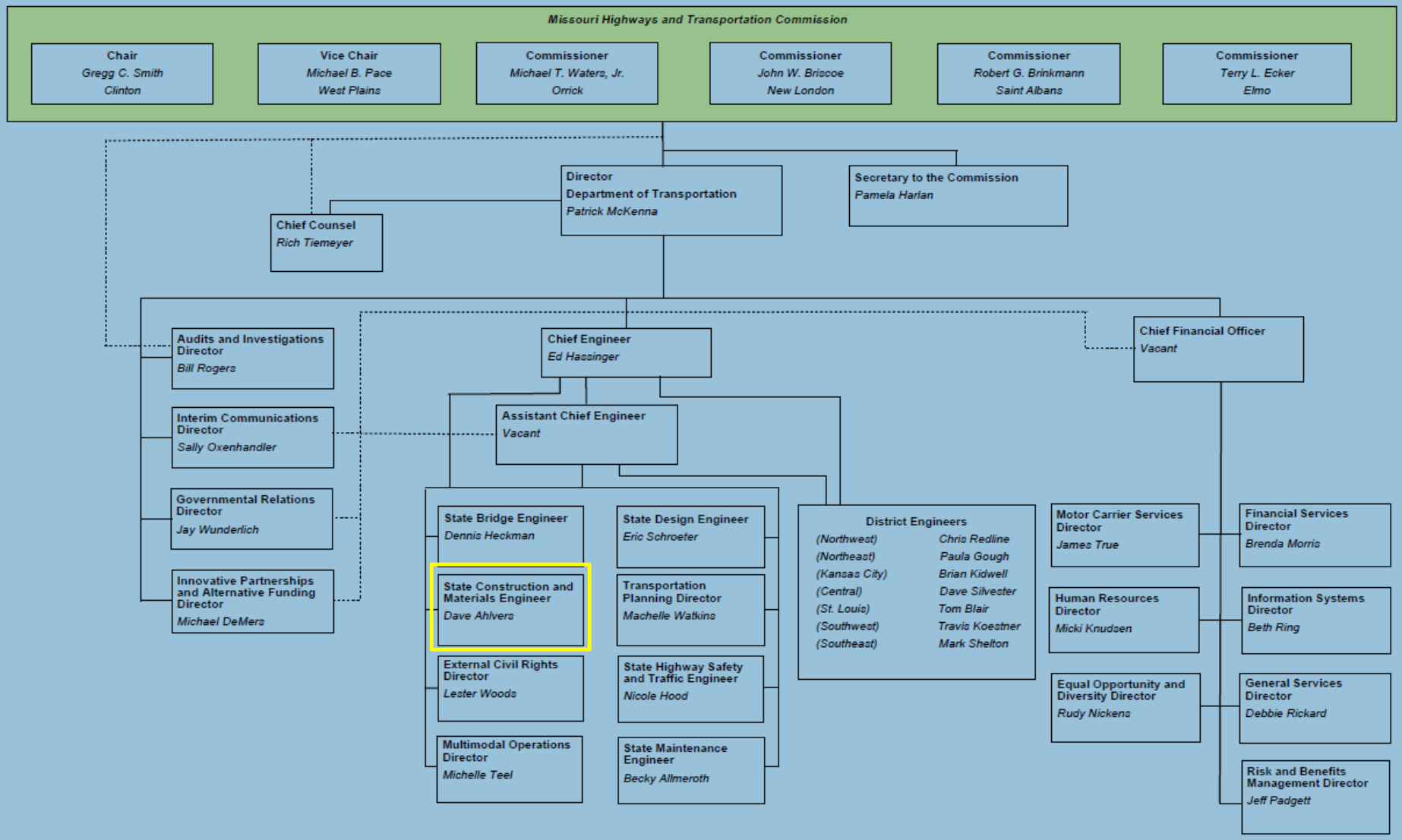
Missouri DOT Research Program

- Contract Research
- New Products (products without a current specification)
- Administer LTAP
- Coordinate FHWA Every Day Counts program including Statewide Innovation Council
- Provide library services/tech transfer
- Administer Pooled Funds

Missouri DOT Staff Positions

- Research Administrator—Bill Stone
- Research Engineer—Jen Harper
- Research Analyst—Vacant
- Research Librarian (contract employee) Renée McHenry

Missouri Department of Transportation



Research Project Selection

- Solicit internal proposals
  - Meet with division staff and sometimes district staff
  - Get prioritization high, medium, low priority
- Solicit external proposals
  - Meet with professors
  - Have “Research Statement Form”
- Work within our division to get final list
- Meet with Chief Engineer to get final blessing

Research Proposal Overview

- Use Qualification Based Selection Process (QBS) for proposal selection (Private and University)
  - Selection team formed with Research staff, Division staff, District Staff and FHWA representative invited.
- Exceptions are when conducting follow-up or implementation research or when University Transportation Center funds are available
- Engineering Professional Services must be lead by Missouri Licensed Professional Engineer (PE)

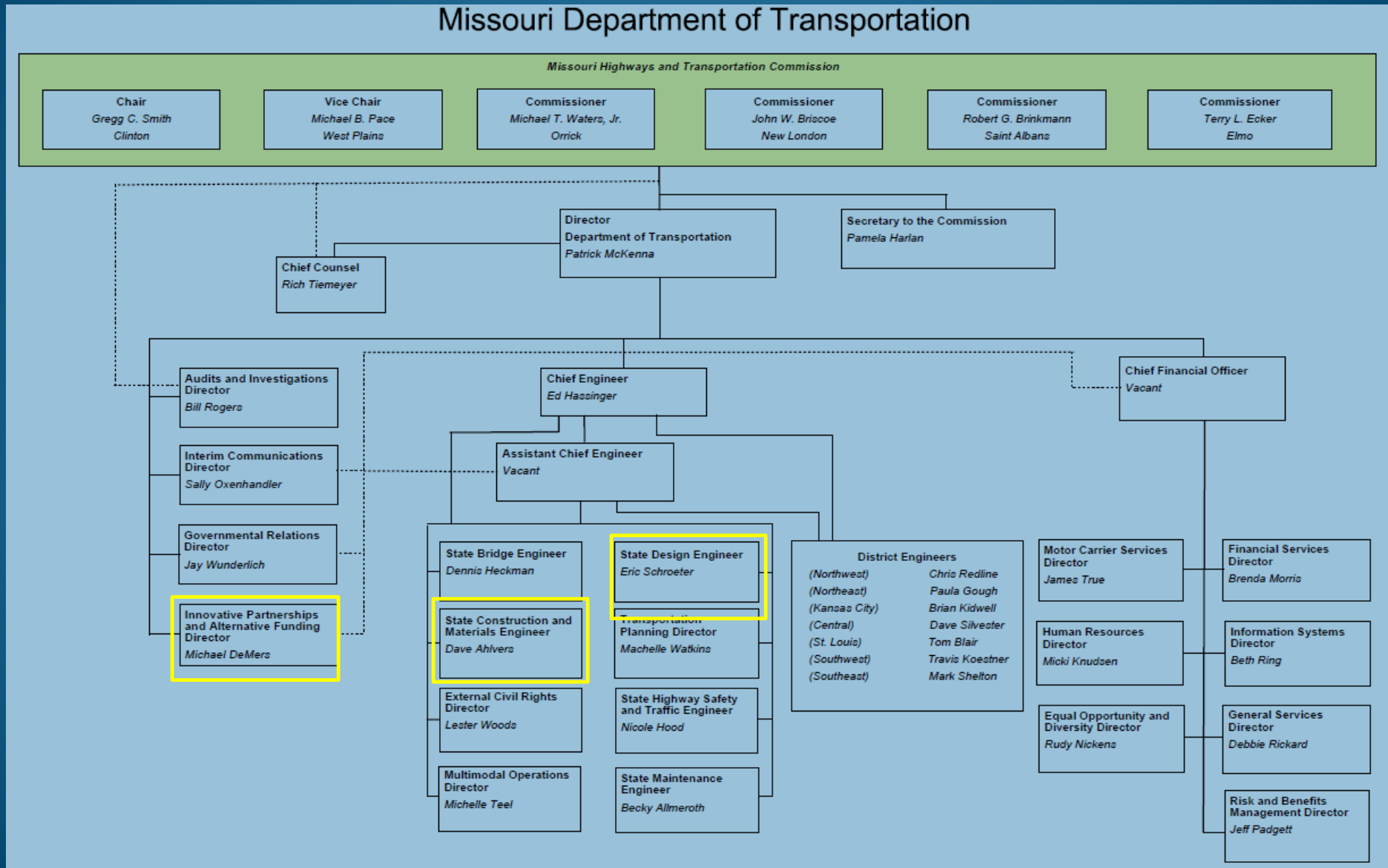
University Contracts

- Universities with Executed Basic Agreements **(Task Order)**
  - University of Missouri-Columbia
  - Missouri University of Science & Technology
  - University of Missouri-Kansas City
  - University of Missouri-St. Louis in progress
- All others contracted via Standard Research Agreement

Project Monitoring

- Technical Advisory Committee formed
  - Lead technical contact
  - Others from the selection team
- Quarterly Reports
- Mid Project Presentation
- Face to face or conference calls as needed
- Draft report & sometimes final presentation
- Final Report

Innovation at MoDOT-Officially



Innovation at MoDOT-Everywhere

Value: Be Bold

I Embrace New Ways of Doing Work. I will be flexible and support changes that help us all get better.

I Take Risks and Accept Failure. I will use my failures to identify ways to get better.

So We Can Be Innovative in Our Pursuit of Excellence. I will push myself and others around me to not be satisfied with average results.

Innovations Challenge

- Project Best Practices
  - Exceptional results for transportation users or internal operations
- Productivity Best Practices
  - Improvements to office and field processes, materials, and products
- Tool and Equipment Best Practices
  - Items fabricate or modified by MoDOT employees

- https://youtu.be/w5TGlOovh68

Leader-Follower TMA

Automated Flagger

Safety Design Build—St. Louis

- 31 Locations given to the DB teams
- Budget: $24 million
- Project Goals:
  - Reduction of fatal and serious injuries
  - Deliver improvements with reasonable service life and maintenance cost
  - Minimize impacts to the public
  - Completion of project by October 1, 2019

Next Gen Movement

Improve capacity of existing staff

- How do you deliver a larger program with same amount of staff?
- Approx. 150 strategies identified
  - Evaluated based on impact and ease of implementation
- 11 strategies identified for implementation

Thank you

Jen Harper
Research Engineer
Missouri Department of Transportation
Jennifer.harper@modot.mo.gov
573-526-3636

NORTH CAROLINA
Department of Transportation









NCDOT Program Highlights

Steven Bolyard

Research Project Manager

2018 Wisconsin Peer Exchange

NCDOT Research Basic Info

6 Staff Members

- 3 Research Project Managers
- 1 Librarian
- 1 Implementation Manager
- 1 Program Manager

Located in Division of Highways → Chief Engineer's Office → Transportation Program Management Unit

Physical Library - Papers and items are cataloged in state library system and can be checked out

Annual Research Program Goals

Improve NCDOT Planning, Engineering and Business Practices

Support NCDOT Operations and Maintenance Activities

Develop relationships with researchers so they understand the needs and operations of NCDOT and our partners to maximize research benefits

Conduct research that can be implemented

How is Research Funded?

State Planning and Research (SPR) Part B – (0.5% of Annual Federal Allocation) ~ $5.1M

- Annual Work Plan $3.2-$4.0M per year
- NCHRP – Share cost with planning - $300k per year
- AASHTO Pooled Fund Program - $600k per year
- AASHTO Technical Service Programs

Federal Discretionary Funds

- Typically Grants - (Often 100 % Federal)

State or Other Federal Funds

- TIP Projects
- Maintenance/Resurfacing Funds
- HSIP Funds etc

Annual Research Program

Match NCDOT research needs with expertise at universities and transportation research centers

Initiate **~25 - 35** new projects per year

More than **100** active research projects and programs

Nearly all NCDOT activities are eligible for research funding

Annual Program FAQ

Who typically submits Research Needs?

- Anyone at NCDOT
- University researchers in coordination with DOT Business Units
- Outside groups in coordination with NCDOT Subject Matter Experts

How are projects selected?

- NCDOT selects projects through a multi-step committee process that
  - Ideas are solicited and reviewed
  - Selected ideas are distributed in an RFP
  - Received proposals are evaluated and selected for funding.

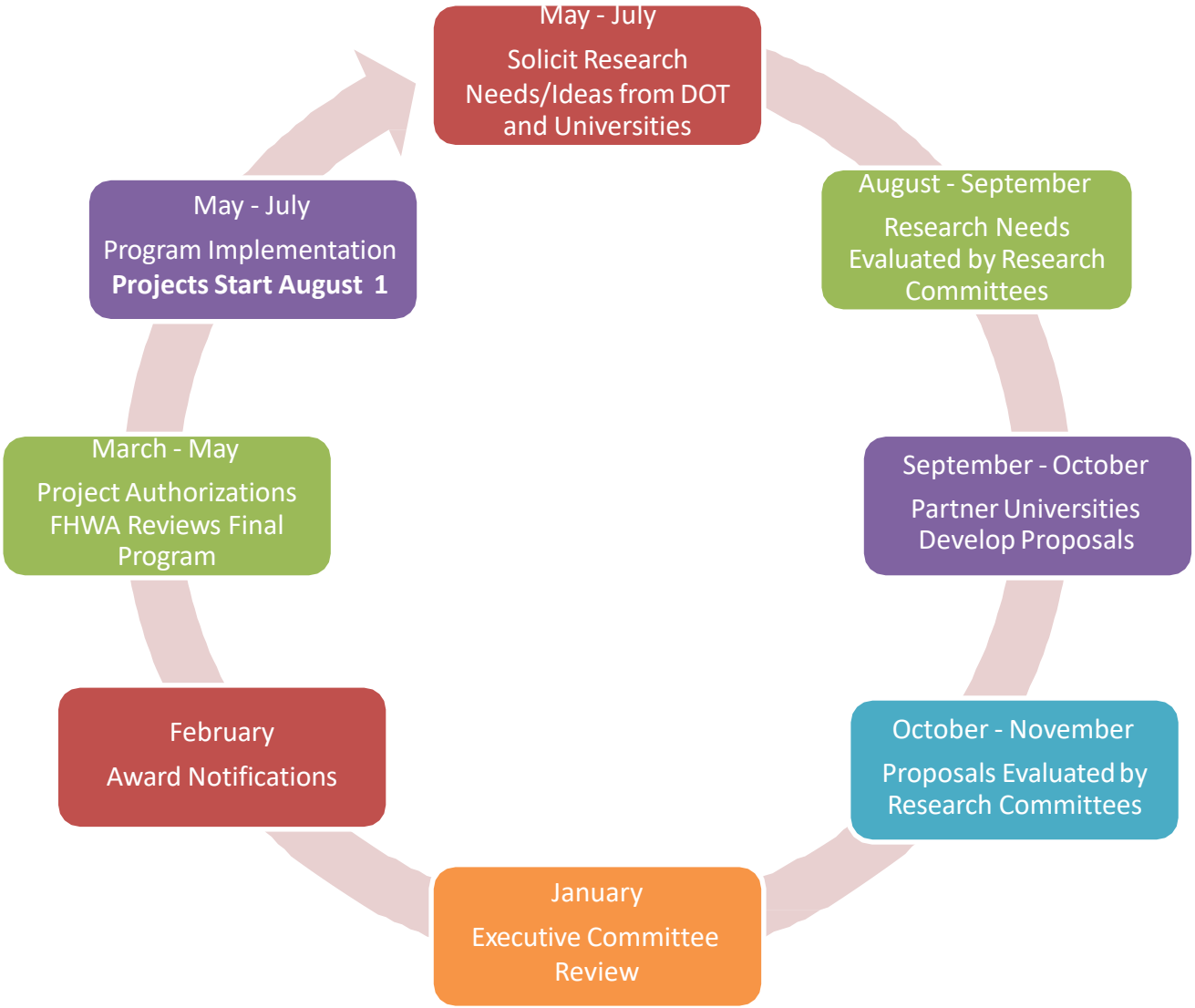
How long does it take for an Idea to become a project?

- Typically 1 year from close of solicitation period
- Contingency or project funds can be used to speed this timeframe up to < 1mo

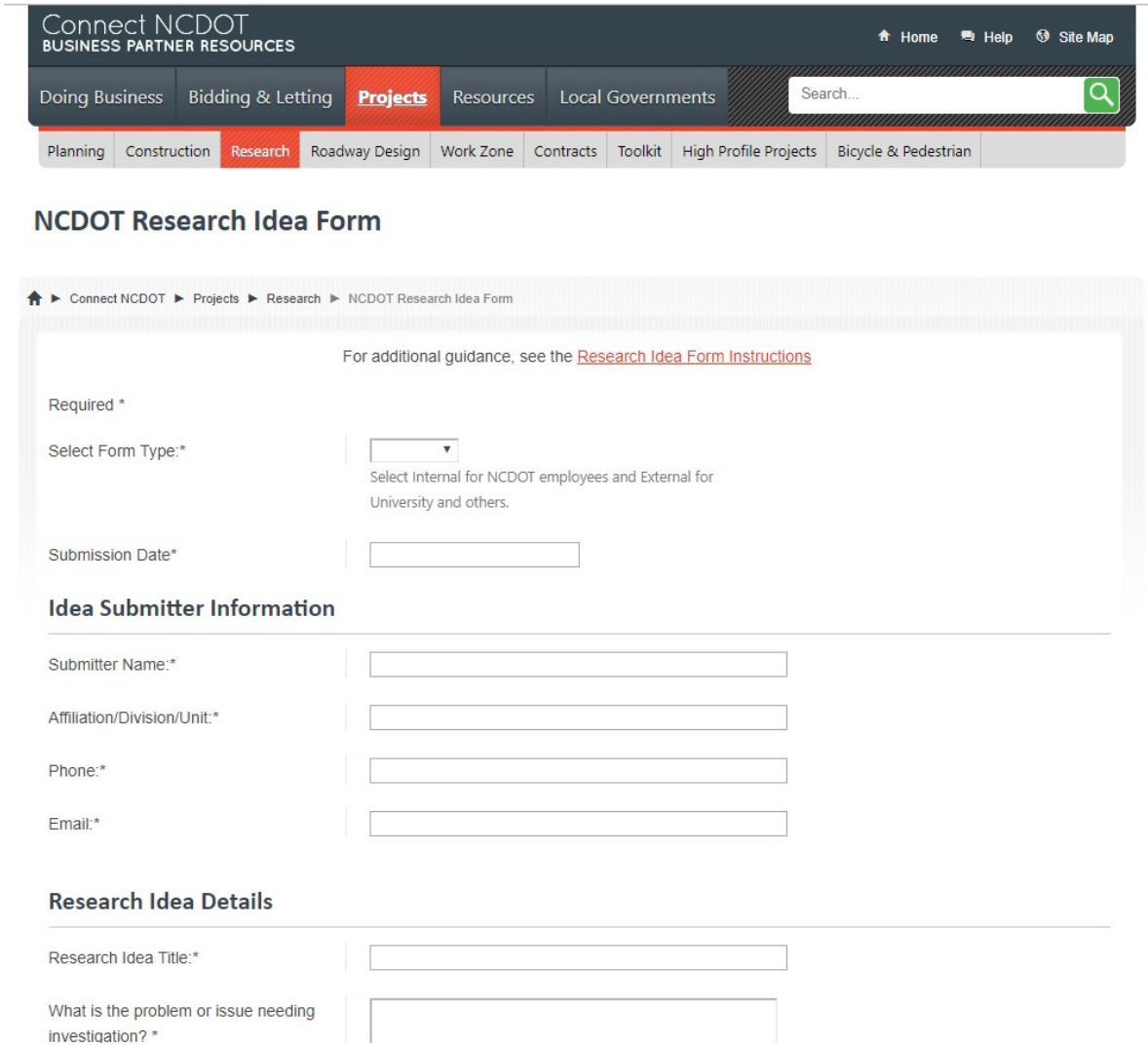
How long do Research Projects Last?

- 2 years is typical but varies between 6 months and 3 years

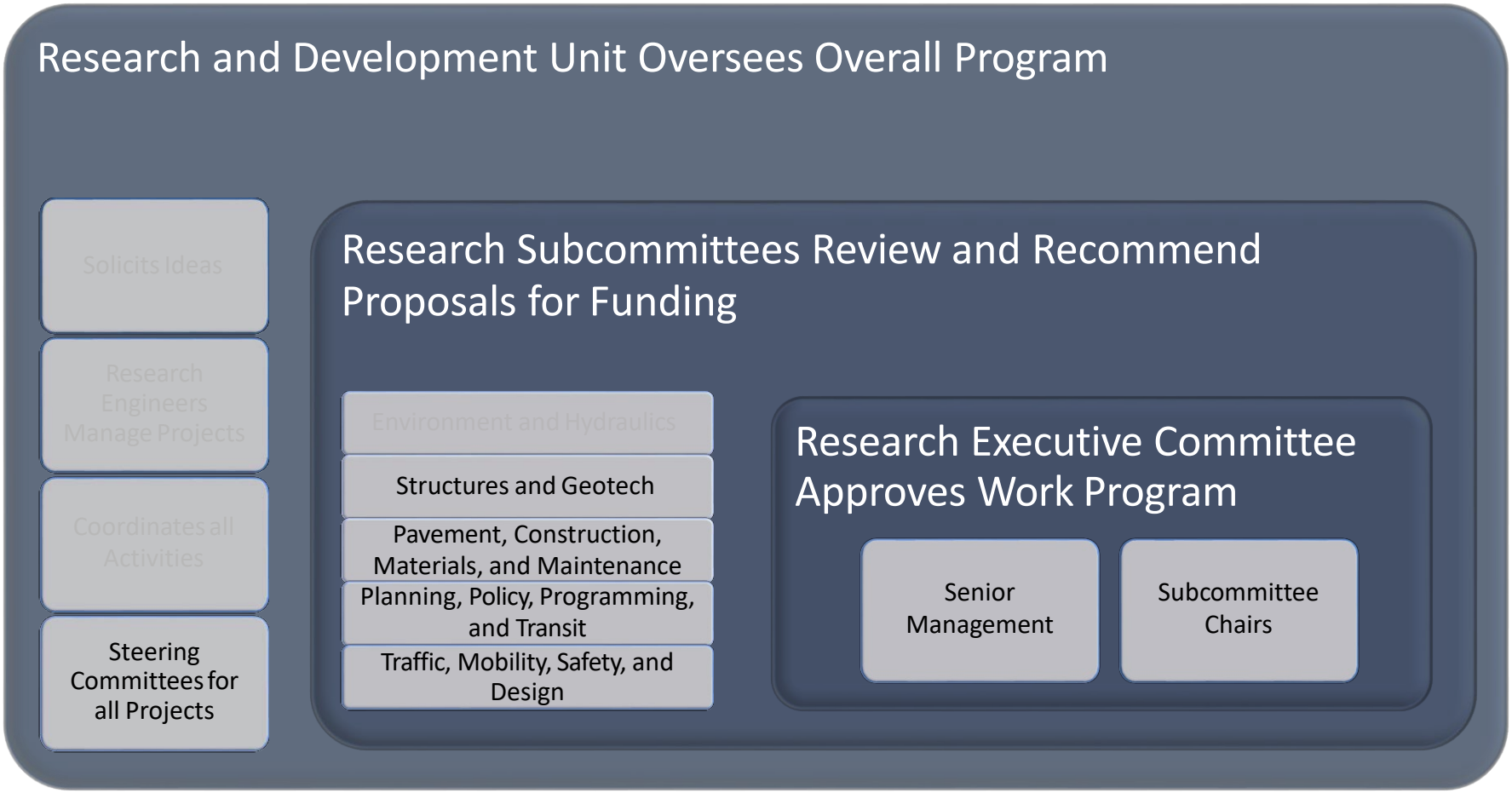
New Research Program Annual Timeline



Online Research Form



Program Oversight



Past and Present University Participants

UNC-Charlotte*

UNC-Greensboro

UNC-Wilmington

Indiana State*

Michigan State*

Virginia Tech*

Central Florida*

Illinois

Auburn

Current Research

Local Technical Assistance Program (LTAP)

https://itre.ncsu.edu/focus/ltap/

- Managed by ITRE
- Technical and policy training for local agencies
- “Roads” Scholar Program to train transportation workers and supervisors
- NCTROADS is a mailing list for information exchange

Technical Assistance Requests

(~$150k per year of state funds)

Need a quick hit project?

Lab testing?	White paper writing?	Survey conducted?

Try our technical assistance program

Managed by ITRE	Easily contract with expertise across the state	Limited to 80 hours of investigator time

Technology Transfer (T^2)

Beginning an effort to rapidly move completed state and national research into practice with a focus on implementation and field deployment

Implementation Manager position to facilitate T^2 activities and track deployment across the agency of other projects

Officially Soliciting Tech Transfer Projects

Research Library Services (If you need help finding it)

- On-staff Librarian provides Research Services - Has access to national databases
- Many engineering and transportation related books, journals, specs and other documents
- Historical information to the 1920s
- Board of Transportation Minutes
- Reading and Workspace available along with circulation privileges.
- Located in the Raney Building at 104 Fayettville St in downtown Raleigh

Online Catalog: http://ncgov.nccardinal.org/eg/opac/home

Implementation

- Kick-off Meeting Plan
- Interim Plan (projects ≥ 2 years)
- Close-out Meeting Plan

- Predictive “Success” Model
- Defining (what we) Value
- Benefit Cost Analysis

RP 2017-21: C/B Analysis

$$B/C = \frac{K \times (HB + SB)}{RC + IC}$$

HB & SB = “Hard” Benefits and “Soft” Benefits

RC & IC = the cost of researching and implementing the project results

K = Constant (K = 1 + IF)

IF = Impact Factor

RP 2017-21: Impact Factor

$$IF = 0.19(K_i) + 0.18(IR_i) + 0.17(E_i) + 0.15(GS_i) + 0.16(V_i) + 0.15(PC_i) \leq 1$$

- K_i - Level of Knowledge Gained – development of standards, policies, specifications, changes to operations, etc.
- IR_i - Implementation of Research Products
- E_i - Experience Gained between the NCDOT and Researcher (PI)
- GS_i - Student Participation and Exposure (workforce development)
- V_i - Positive Visibility of NCDOT
- PC_i - Publications, Peer Reviewed (conferences, journals)

None	Low Impact	Impacted	High Impact
0	0.33	0.67	1

New and Active Projects

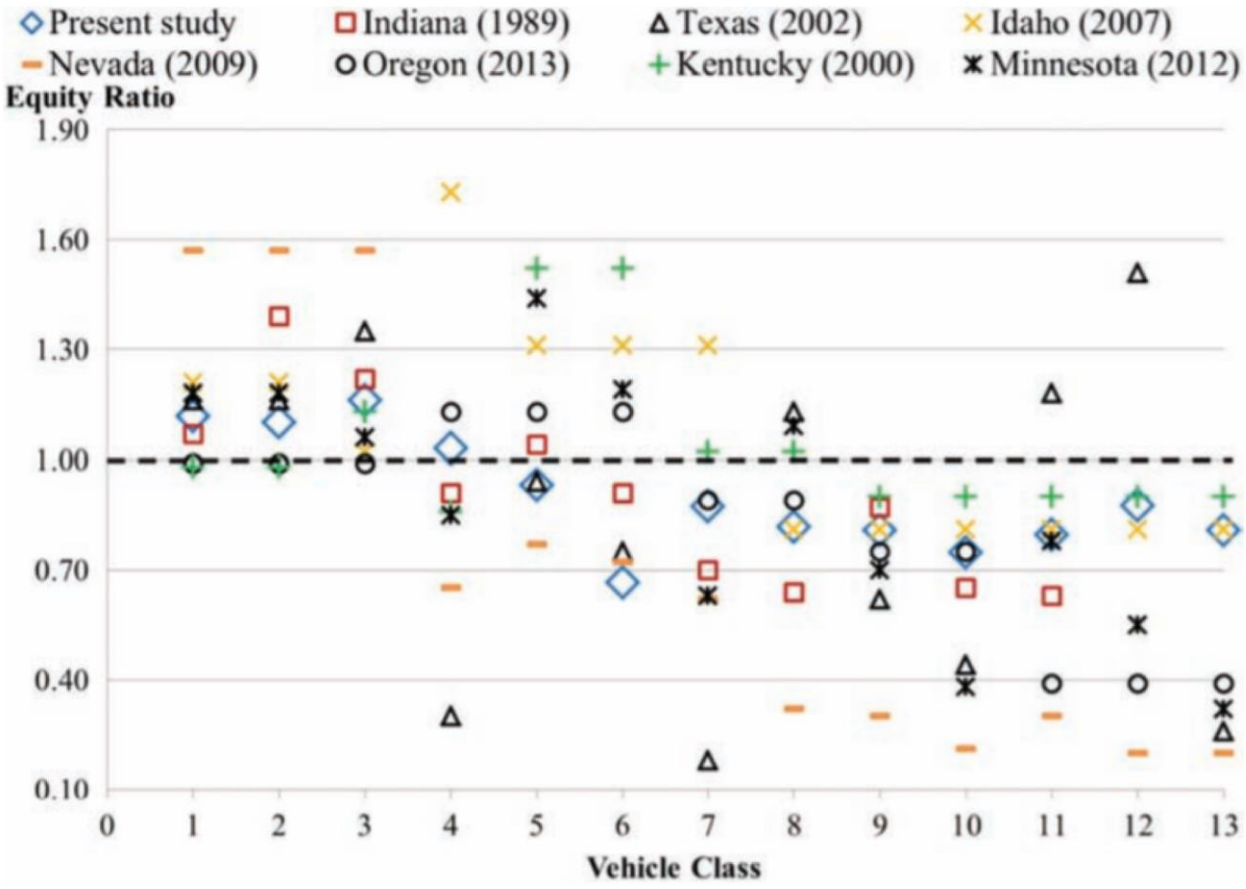
RP 2018-17: Effects of Torsion and Moment on Traffic Signal Structures' Foundations in Coastal Conditions

https://connect.ncdot.gov/projects/research/Pages/ProjDetails.aspx?ProjectID=2018-17

- Meeting more stringent standards
- Literature Review / State of Practice
- Looking for foundation alternatives

RP 2019-14: North Carolina State Highway Cost Allocation and Revenue Attribution Study

https://connect.ncdot.gov/projects/research/Pages/ProjDetails.aspx?ProjectID=2019-14



RP 2019-28: Enhancing AV Traffic Safety through Pedestrian Detection, Classification, and Communication

https://connect.ncdot.gov/projects/research/Pages/ProjDetails.aspx?ProjectID=2019-28

- Continuation of previous project: 2017-25 (EcoPRT)
  - Build and program vehicle to follow specific and adjustable route(s)
  - Determine best route(s)
- Develop interaction protocols between
  - Vehicle → Pedestrians
  - Pedestrians → Vehicle

RP 2018-36 Distribution, Roosting and Foraging Ecology and Migration Pathways for Gray Bats in Western NC

https://connect.ncdot.gov/projects/research/Pages/ProjDetails.aspx?ProjectID=2018-36

- Gray Bat listed as endangered and uses stable roosts such as caves, culverts, and bridges
- Tracking 90 bats (45 with beeper tags and 45 with coded tags) for 2 years
- Also performing acoustic monitoring with 16 acoustics stations in and around the Asheville area

Freshwater Mussels

- Understand long-term impacts of Highway 19E corridor project on endangered
- Testing to determine the toxicity of Polyacrylamides (flocculants) versus toxicity
- $5 million for NCSU Research Lab upgrades and expenses (540 extension)

NCDOT Web Resources

https://connect.ncdot.gov/projects/planning/Pages/ResearchAnalysis.aspx

Research Forms

Quarterly Newsletter

Current and Past Projects and Reports are Online

Easiest way to find us: Go to google and search for “NCDOT Research”

Neil Mastin, PE	Research Manager	919-508-1865	jmastin@ncdot.gov
Steven Bolyard	Mobility, Safety, and Roadway Design	919-508-1874	sjbolyard@ncdot.gov
John Kirby	Environment and Hydraulics	919-508-1816	jkirby@ncdot.gov
Mustan Kadibhai, PE	Pavement, Materials, Maintenance, Structures	919-508-1819	mkadibhai@ncdot.gov
Curtis Bradley, PhD	Implementation Manager, Policy, Planning, Programming, and Transit	919-508-1832	cbradley8@ncdot.gov
Lamara Williams-Jones	Research Librarian	919-508-1820	lcwilliams2@ncdot.gov
General Contact		919-508-1790	research@ncdot.gov

Research Connect Page (for Forms, completed and active projects and more):
https://connect.ncdot.gov/projects/research/Pages/default.aspx

Research Directory Page:
https://apps.ncdot.gov/dot/directory/authenticated/UnitPage.aspx?id=8781

We accept research ideas year round!

Annual due date is July 20 for this Year

R&D can help develop and refine Research Ideas
(or find someone that can)

Research Idea Guidelines

Research Idea Online Form

https://connect.ncdot.gov/projects/research/Pages/RNS-Form.aspx

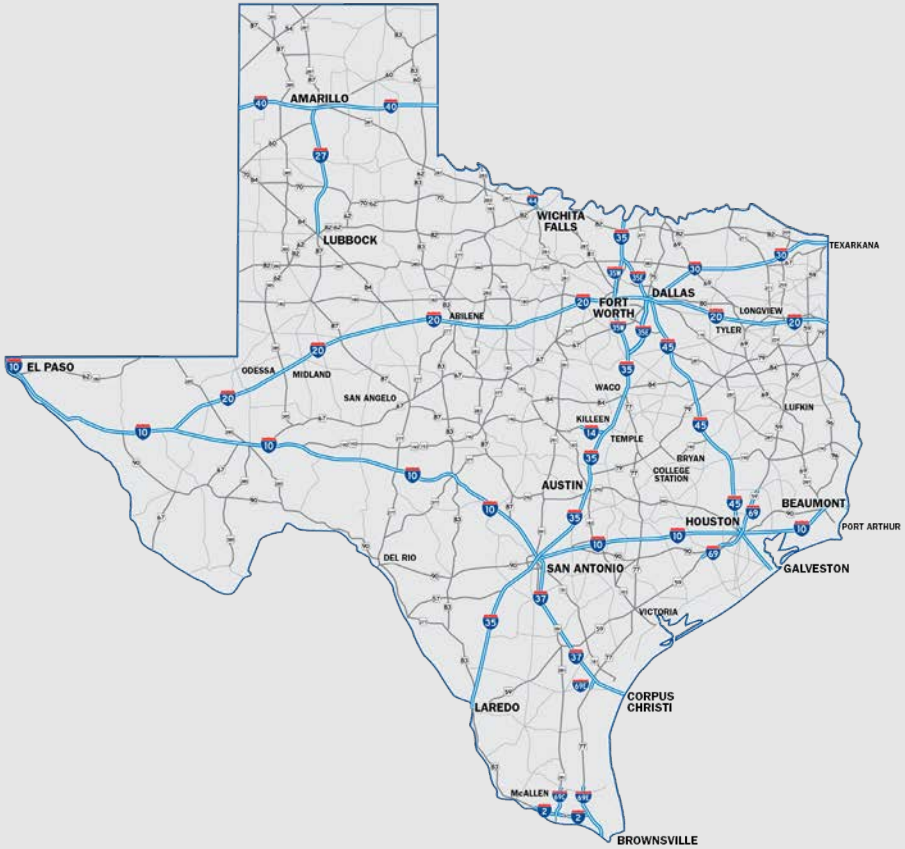
Thank You

TXDOT RESEARCH PROGRAM

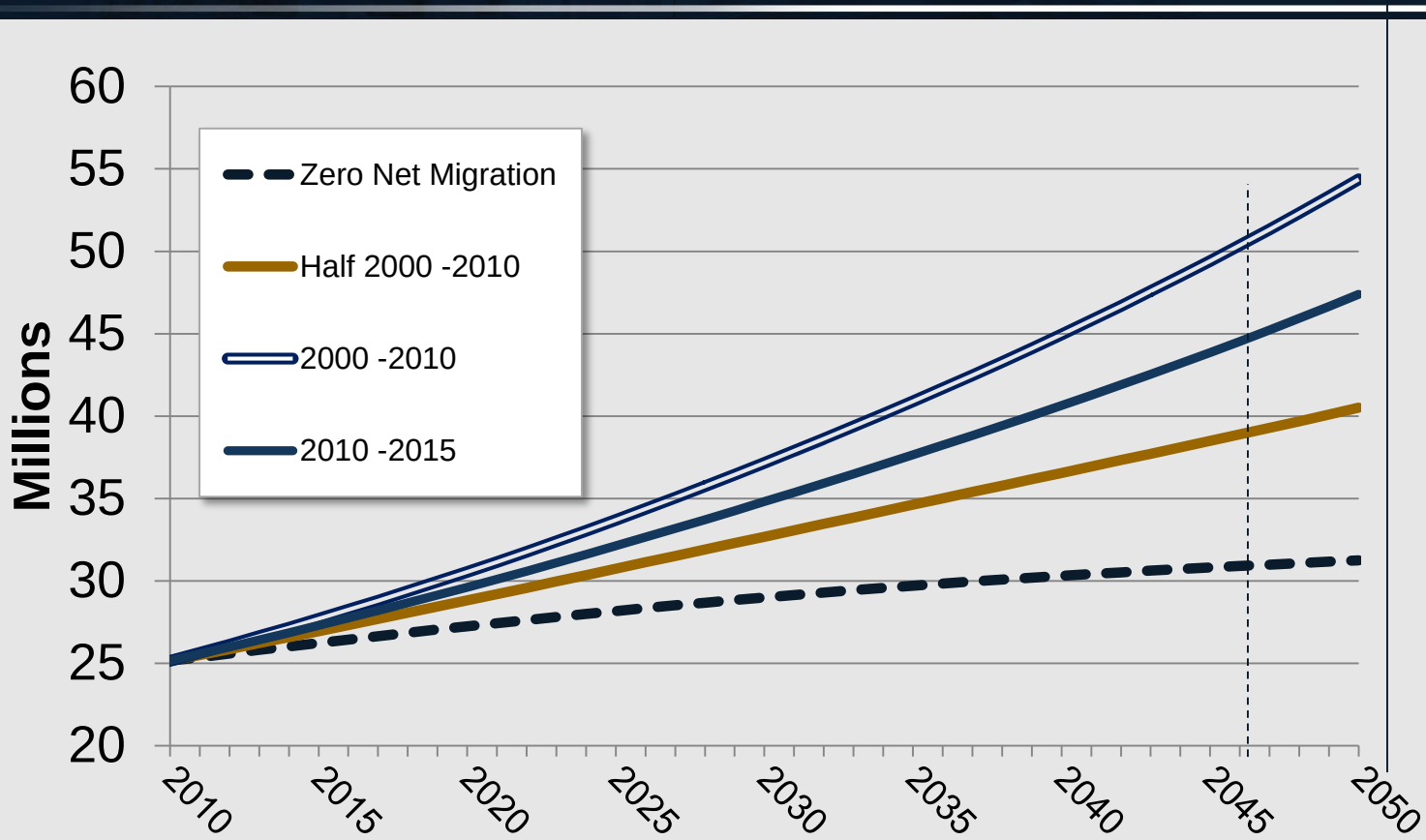
WisDOT Peer Exchange

Table of contents

Texas Transportation System



Texas Population Projections



TxDOT Funding FY2018

$9.2 B	• Project Development and Delivery
$313 M	• System Optimization • Research ($27.8 M)
$12.9 B	• Total Budget

Major Program Components/Goals

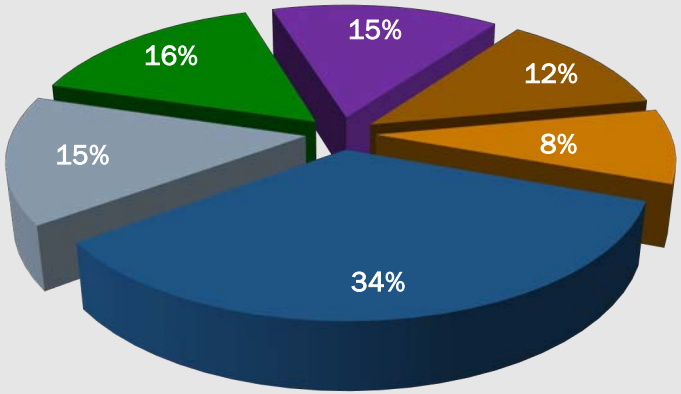
Deliver the Right Projects – Implement effective planning and forecasting processes that deliver the right projects on-time and on-budget.

Focus on the Customer – People are at the center of everything we do.

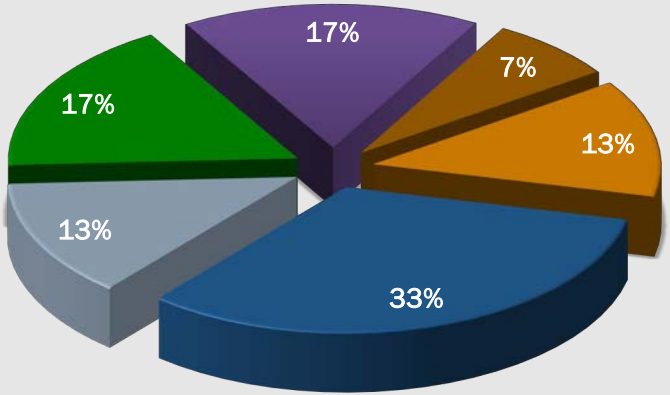
Foster Stewardship – Ensure efficient use of state resources.

Optimize System Performance – Develop and operate an integrated transportation system that provides reliable and accessible mobility, and enables economic growth.

Research Focus

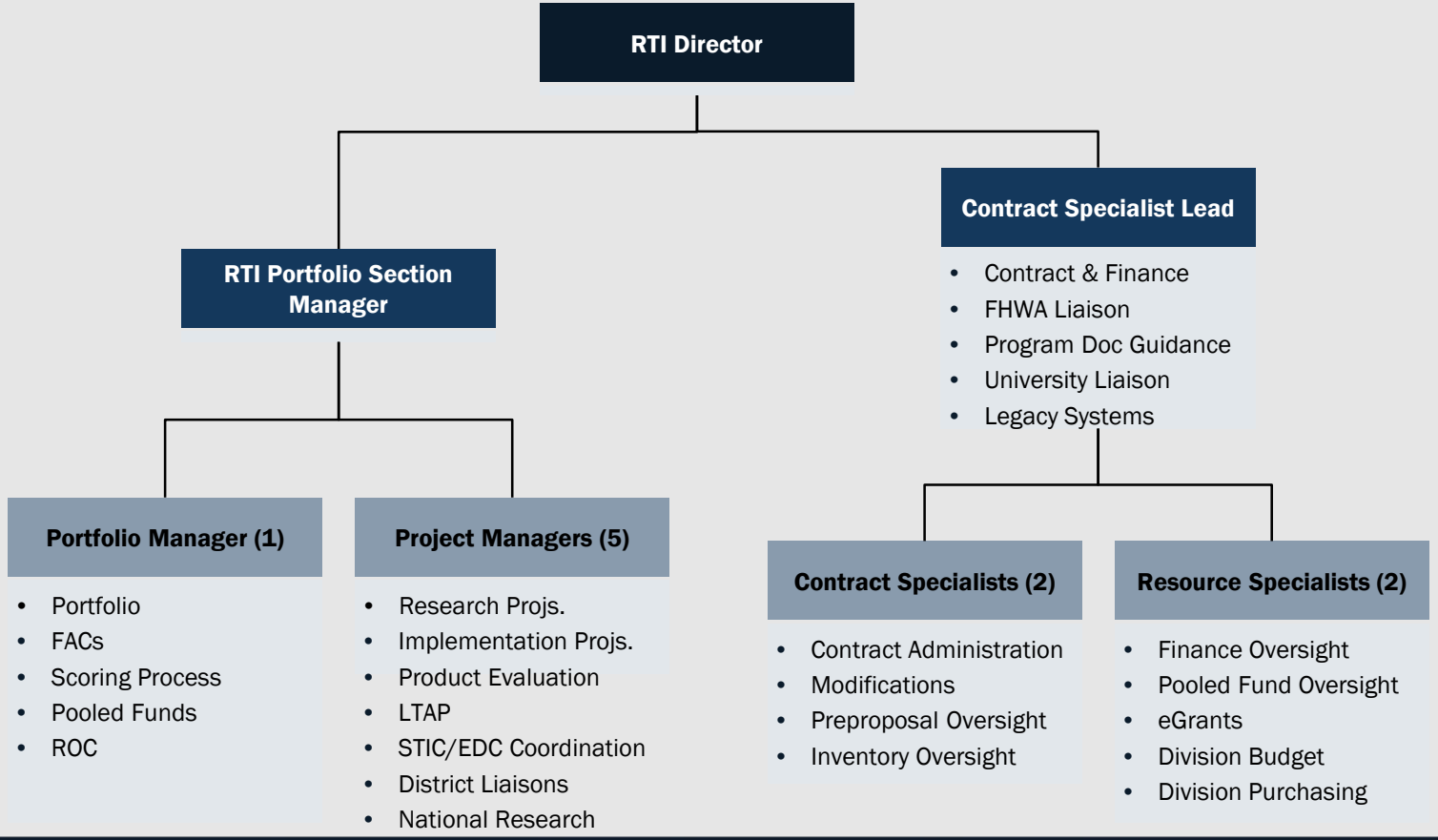


Agency Distribution
5 year Average, FY '12- FY '16

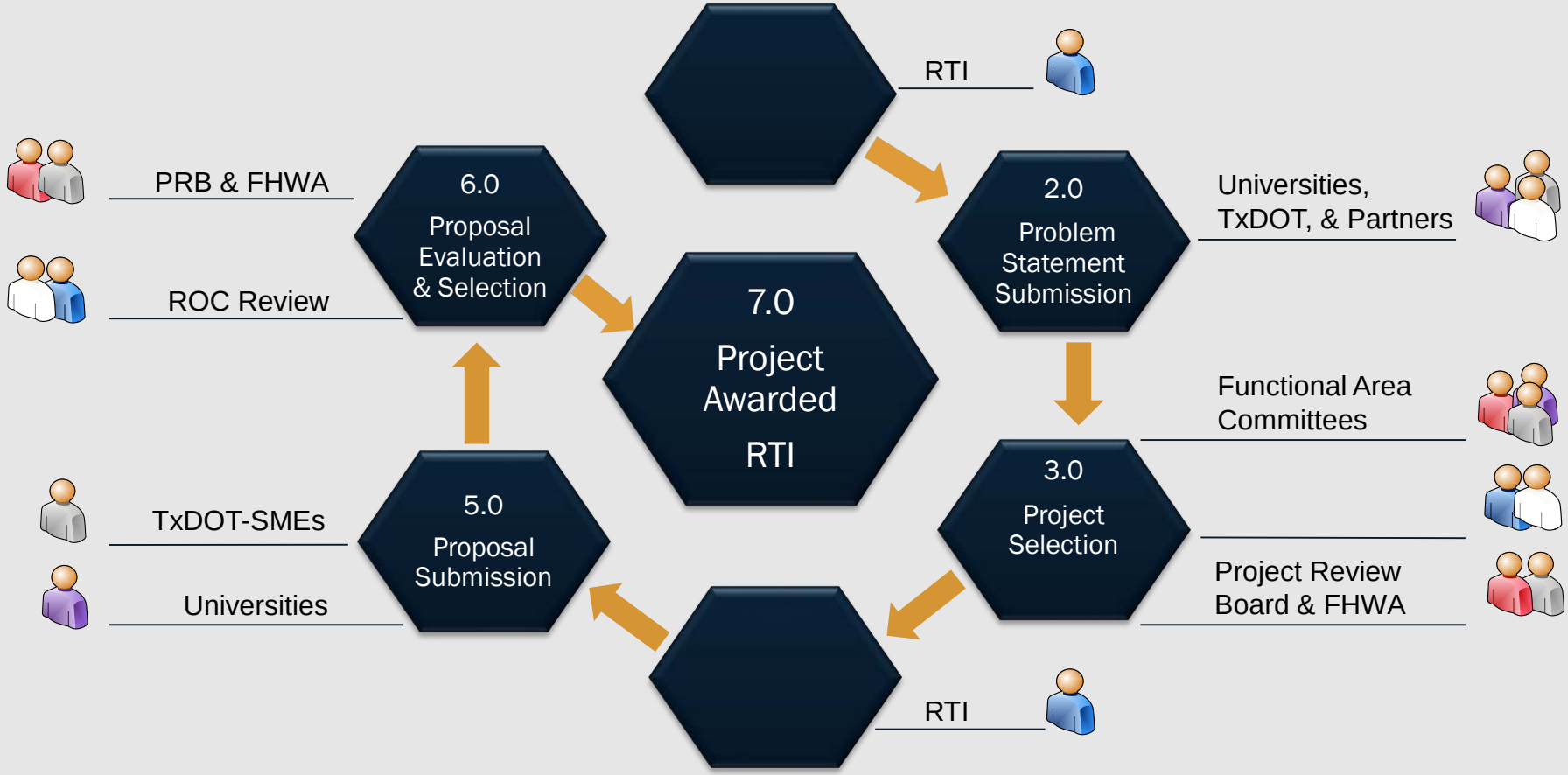


- Construction and Maintenance
- Safety and Operations
- Strategy and Innovation
- Planning and Environmental
- Structures and Hydraulics
- Program Support

Organization Chart



Process


RTI
2.0
Problem Statement Submission
Universities, TxDOT, & Partners
3.0
Project Selection
Functional Area Committees
Project Review Board & FHWA
RTI
5.0
Proposal Submission
TxDOT-SMEs
Universities
6.0
Proposal Evaluation & Selection
PRB & FHWA
ROC Review
7.0
Project Awarded
RTI

Research Competitive Bid Process Steps

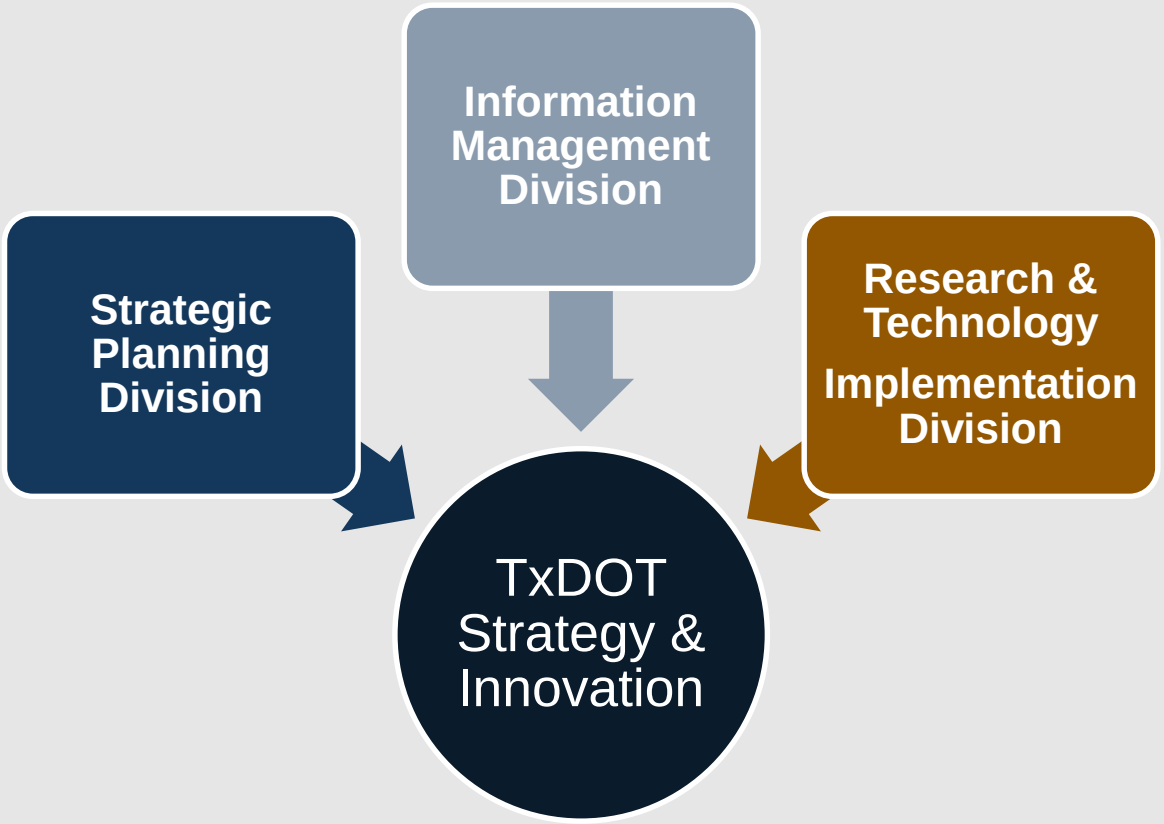
Steps	Description
Call For Problem Statements	• A solicitation for new projects/ problems/ideas/ important issues needing to be researched that impacts surface transportation is issued by RTI to its research partners
Problem Statement Submission	• Problem Statements are received by RTI from TxDOT Districts and Divisions, Universities, and others such as MPOs and FHWA
Project Selection	• Functional Area Committees are key in the project selection process and are made up of TxDOT subject matter experts (voting members) and research partners (non-voting) members • Problem Statements are vetted by the committees and rated on importance • RTI will compile the ranked problem statements for recommendation as projects • DE&DD Committee review and approves the highest ranked projects • Recommended projects are submitted to the Project Review Board (PRB) and FHWA for approval to proceed with the recommendation in a request-for-proposals (RFP)
Request for Proposal	• RTI works with TxDOT SME to prepares project statements and submits in an RFP to state universities for proposing research solutions
Proposal Submission	• Universities submit proposals to RTI • RTI screens proposals for compliance and prepares evaluation packages
Evaluation and Selection	• TxDOT SMEs review and rate each proposal based on evaluation criteria • RTI compiles proposal ratings and scores. The proposals with the highest scores are identified along with its university. These are recommended for awarding • RTI informs FAC & DED Committees of recommended projects for awarding • RTI submits the recommended awarding list of proposals to the PRB and FHWA for approval
Project Awarding	• Once approved, RTI notifies the university of project awarding • Project teams are developed and negotiations begin to obtain an approved contract for execution

How Proposals are Scored

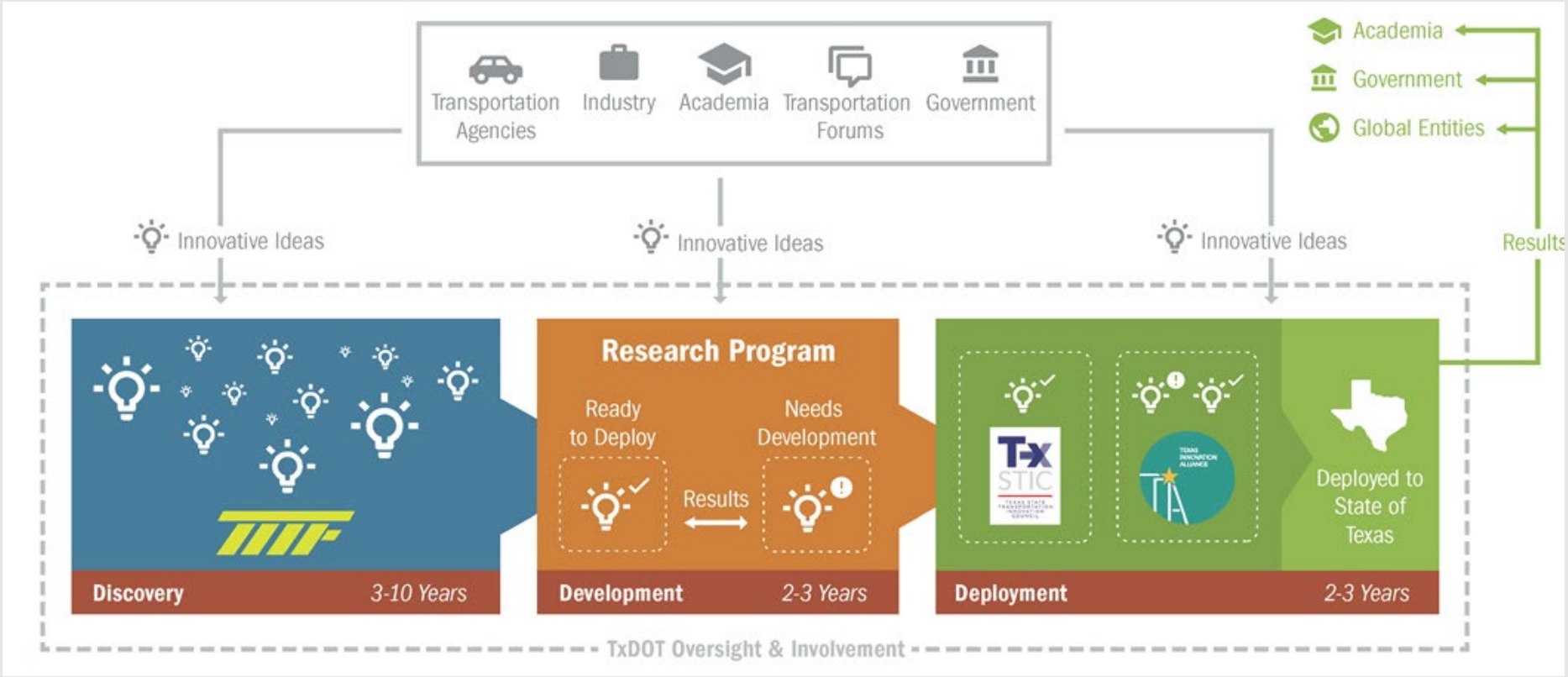
Rating Area	Weight	Includes
Benefits to the State of Texas	27%	▪ Innovation ▪ Methodology ▪ Success
Proposed Tasks	27%	▪ Project Statement Understanding ▪ Focus ▪ Clarity ▪ Products
Research Team	20%	▪ Qualifications ▪ Effort
Proposed Schedule	16%	▪ Task Schedule ▪ Plan ▪ Project Duration
Budget	10%	▪ Total Project Budget
TOTAL	**100%**	

Acronym	University		Acronym	University
CTR	Center for Transportation Research/University of Texas Austin		**TSUSM**	Texas State University San Marcos
Lamar	Lamar University		**TTI**	Texas A&M Transportation Institute
PVAMU	PrairieView A&M University		**UH**	University of Houston
SFASU	Stephen F. Austin State University		**UNT**	University of North Texas
SHSU	Sam Houston State University		**USGS**	United States Geological Survey
TAMUAgriLife	Texas A&M AgriLife Research		**UTA**	University of Texas Arlington
TAMUC	Texas A&M Commerce		**UT-Dallas**	University of Texas Dallas
TAMUCC	Texas A&M Corpus Christi		**UTEP**	University of Texas El Paso
TAMUK	Texas A&M University Kingsville		**UTHSC**	University of Texas Health Science Center
TARL	Tarleton State University		**UTRGV**	University of Texas Rio Grande Valley
TECHMRT	Texas Tech University's Center for Multidisciplinary Research in Transportation		**UTSA**	University of Texas San Antonio
TEEX	Texas Engineering Extension Service		**UT-TYL**	University of Texas Tyler
TSU	Texas Southern University		**WTAMU**	West Texas A&M University

Strategy & Innovation



Strategy & Innovation

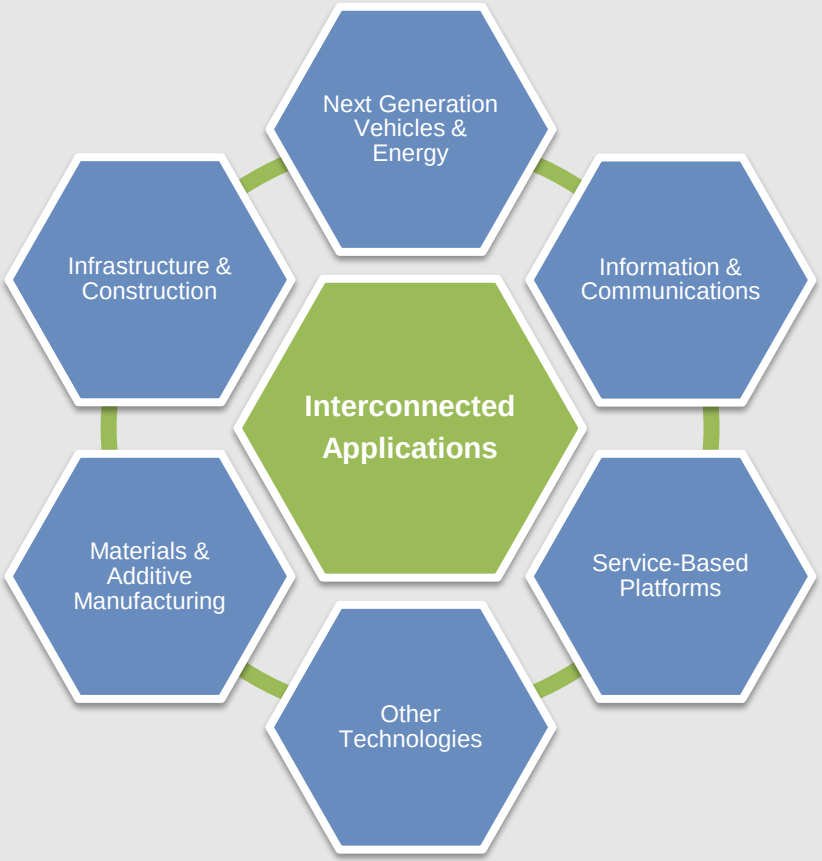


Texas Technology Task Force

Next Generation Vehicles & Energy
Automated Vehicles
Connected Vehicles
Electric Vehicles
Unmanned Aerial Vehicles

Infrastructure & Construction
Infrastructure Enhancements
Construction Techniques
Equipment

Materials & Additive Manufacturing
Self-Healing Pavements
Nanotechnologies
3D Printing



Texas Innovation Alliance

- Team Arlington
- Team Austin
- Team Bryan-College Station
- Team Coastal Bend

Industry

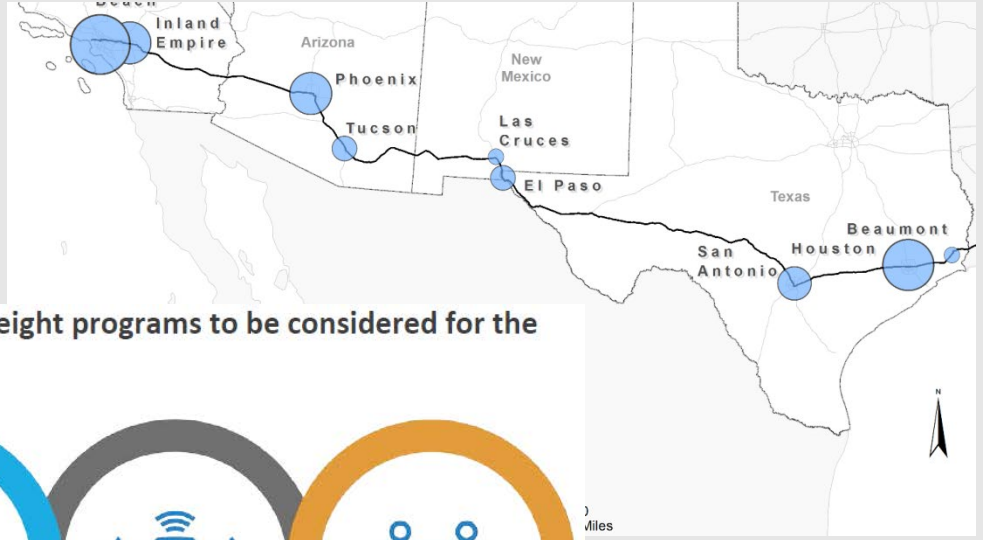
- Data
- OEMs
- AEP Firms
- Shared Mobility
- Other

- Team Dallas-Fort Worth
- Team El Paso
- Team Frisco
- Team Houston
- Team San Antonio

Research Institutions

- University of Texas Center for Transportation Research (CTR)
- Texas A&M Transportation Institute (TTI)
- Southwest Research Institute (SwRI)
- 8 others across Texas

I-10 Corridor Coalition



Freight Stakeholders have identified the following freight programs to be considered for the Corridor ConOps:

Interstate credentialing and permitting for regular and oversize/overweight movements.

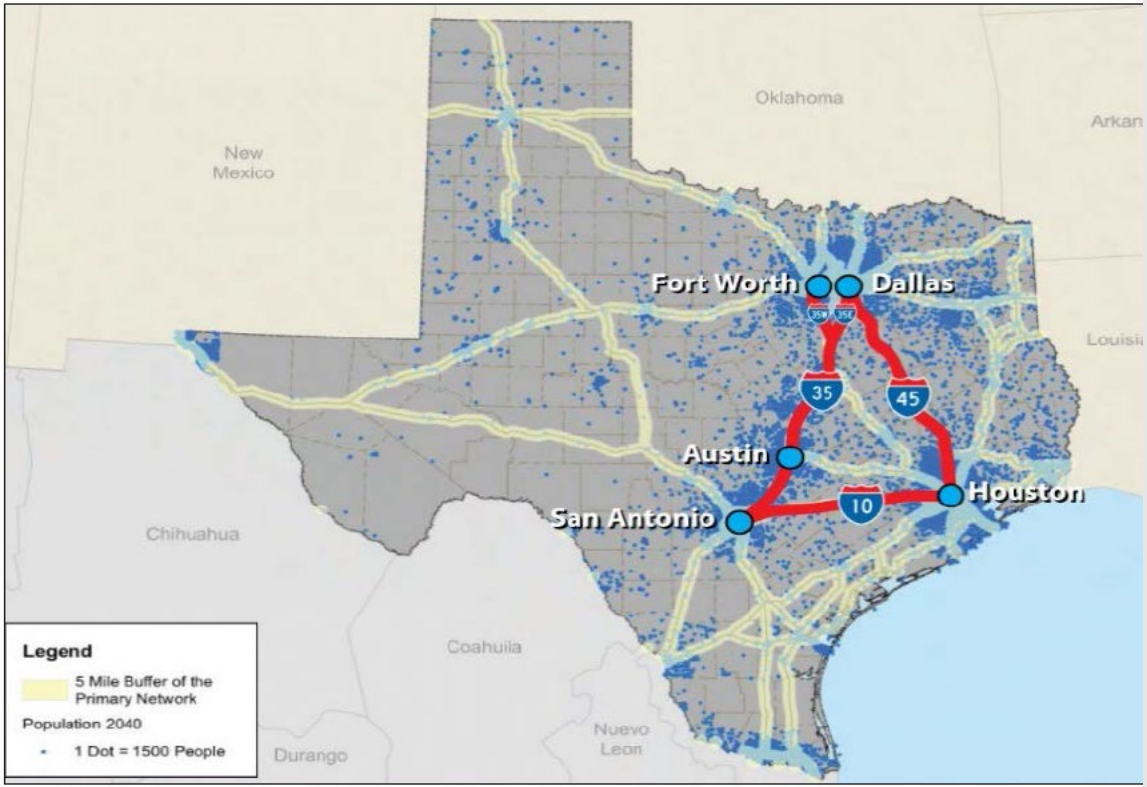
Truck parking and reservation systems.

Transponder and roadside detection technology for safety and weight enforcement.

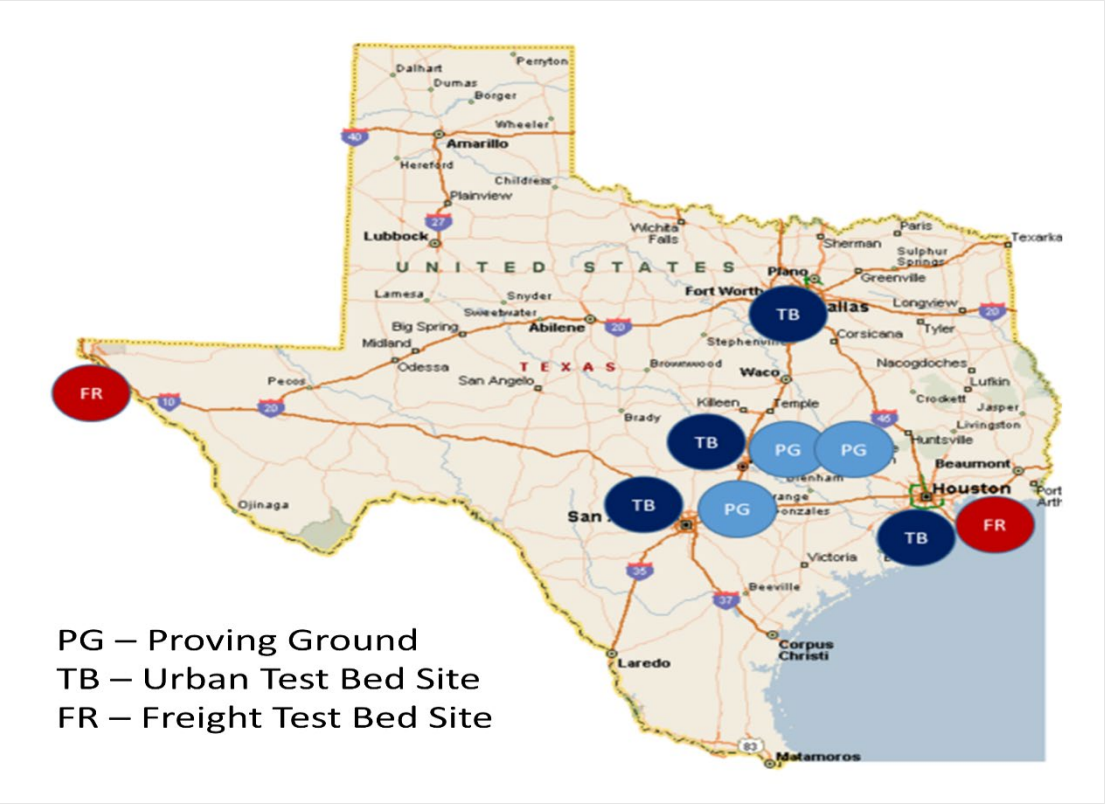
Truck platooning and other commercial motor vehicle automation.

Corridor-wide information on incidents, work zones and weather.

Texas Connected Freight Corridor



Texas Proving Grounds



JAMES.KUHR

@Txdot.gov

WisDOT Research Program Overview

Diane Gurtner

Research & Library Services Supervisor

RD&T Peer Exchange

Madison, Wisconsin

September 19, 2018

WisDOT agency overview

- Established in 1967 when various agencies were combined
- Organization includes five divisions and three executive offices:

Divisions

- Business Management (DBM)
- Motor Vehicles (DMV)
- Transportation Investment Management (DTIM)
- Transportation System Development (DTSD)
- State Patrol (DSP)

Offices

- Management and Budget (OMB)
- General Counsel (OGC)
- Public Affairs (OPA)
- Inspector General

(All three offices report to the Secretary's Office)

WisDOT research program overview

- WisDOT's research program is part of the Executive Offices, within the Office of Management and Budget (formerly the Office of Policy, Finance and Improvement)
- The research budget is approximately $4.1 million per FFY: 90% SPR Part B ($3.69 million) and 10% in state match ($410,000)

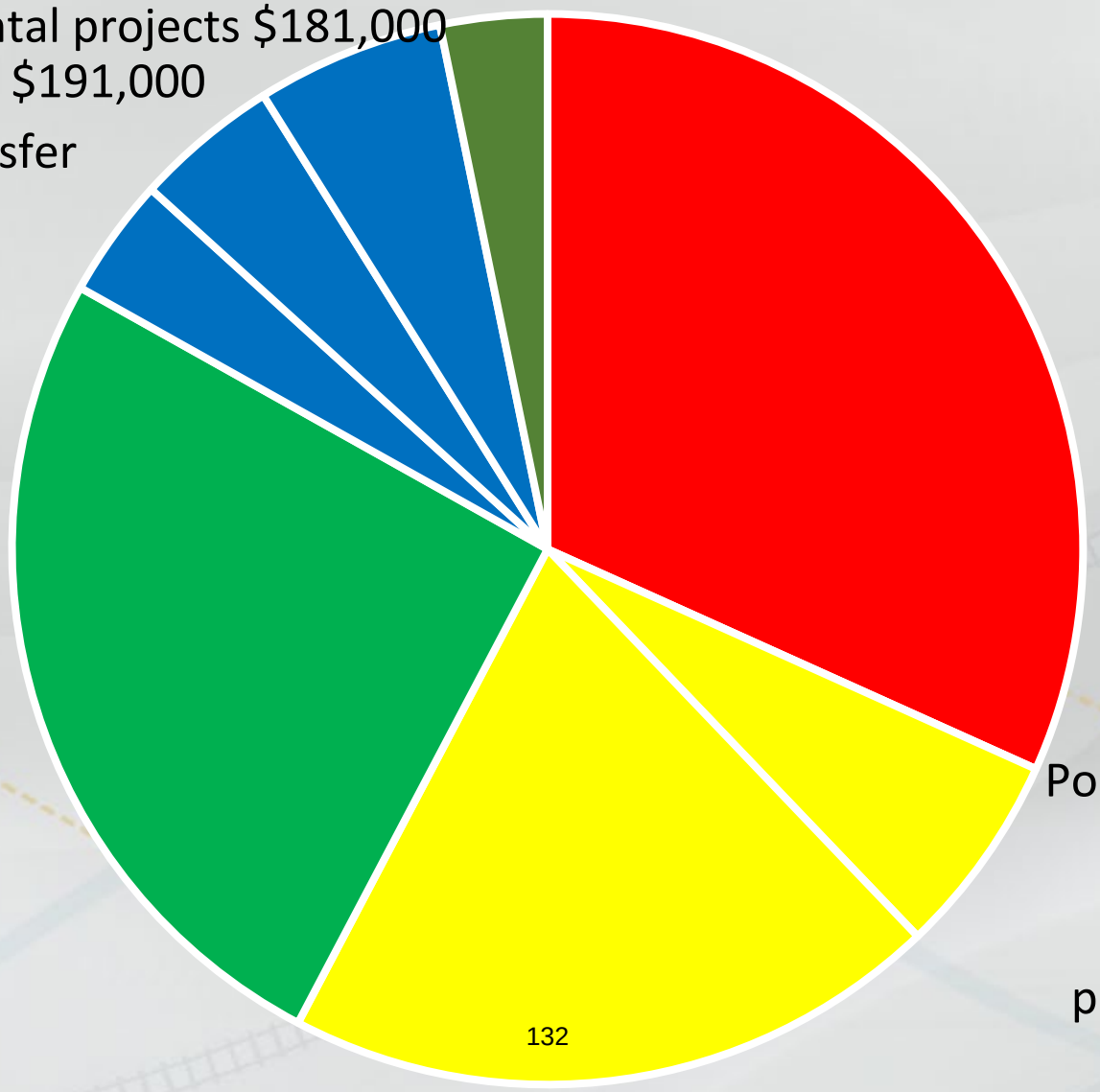
Who's who in WisDOT research

- WisDOT research program staff
  - Jacquelyn Irving – Performance, Policy & Research section chief
  - Diane Gurtner – Research & Library Services unit supervisor
  - Lynn Hanus – Budget and implementation coordinator
  - Andrew Eiter – Research communications coordinator
  - Heidi Noble – Contracts specialist
  - Vacant – National research coordinator
- WisDOT Library
  - John Cherney – Librarian
  - Wendy Brand – Librarian *(half-time)*

Research program components

- Staff administrative functions and technology transfer
- Wisconsin Highway Research Program (WHRP)
- National research programs (TRB, NCHRP)
- Transportation pooled funds (TPFs)
- Materials management section projects and AASHTO Technical Services Program
- Policy research and other projects

Funding distribution FFY2017



Wisconsin Highway Research Program (WHRP)

- WHRP was established in 1998
- Applied research for pavements, materials and structures
- Annual RFP cycle / $850,000 - $1.2 million
- Four technical committees:
  - Flexible pavements (asphalt)
  - Rigid pavements (concrete)
  - Structures (bridges, signs, etc.)
  - Geotechnics (soils and foundations)

WHRP research cycle

Timeframe	Activity
May – Aug	Generate research ideas
Sept – Nov	Develop request for proposal (RFP)
Nov – Jan	RFP solicitation
Feb – Mar	Proposal review / researcher selection
May – Aug	Work plan development
July – Sept	Contract / agreement negotiation
October	Anticipated project start dates

Policy research and other projects

- Applied research for planning, traffic, safety, etc.
- Overseen by internal WisDOT committees or tech rep
- Variable RFP cycle depending on funding availability and research needs
- Project examples:
  - Wisconsin Lane Closure System Planning and Design (DTSD/ Traffic Operations)
  - Wisconsin Winter Liquid Brine (DTSD/Highway Maintenance)
  - Identifying Highly Correlated Variables Relating to the Potential Causes of Reportable Wisconsin Traffic Crashes (DSP)
  - Materials Laboratory Design Guidelines (DBM/Facilities)
  - Vehicle Registration Compliance in Wisconsin (DMV)

National research

Transportation Pooled Fund (TPF) program

- Allows transportation agencies to combine resources
- WisDOT is currently the lead state for 3 pooled funds
- WisDOT currently participates in 45 pooled funds

Other national research programs

- Provides opportunities for research idea submission
- WisDOT participation:
  - NCHRP project panels: 36 positions held by WisDOT staff*
  - TRB Committees: 25 positions held by WisDOT staff*
  - AASHTO Committees: 45 positions held by WisDOT staff*

*(*some individuals on more than one)*

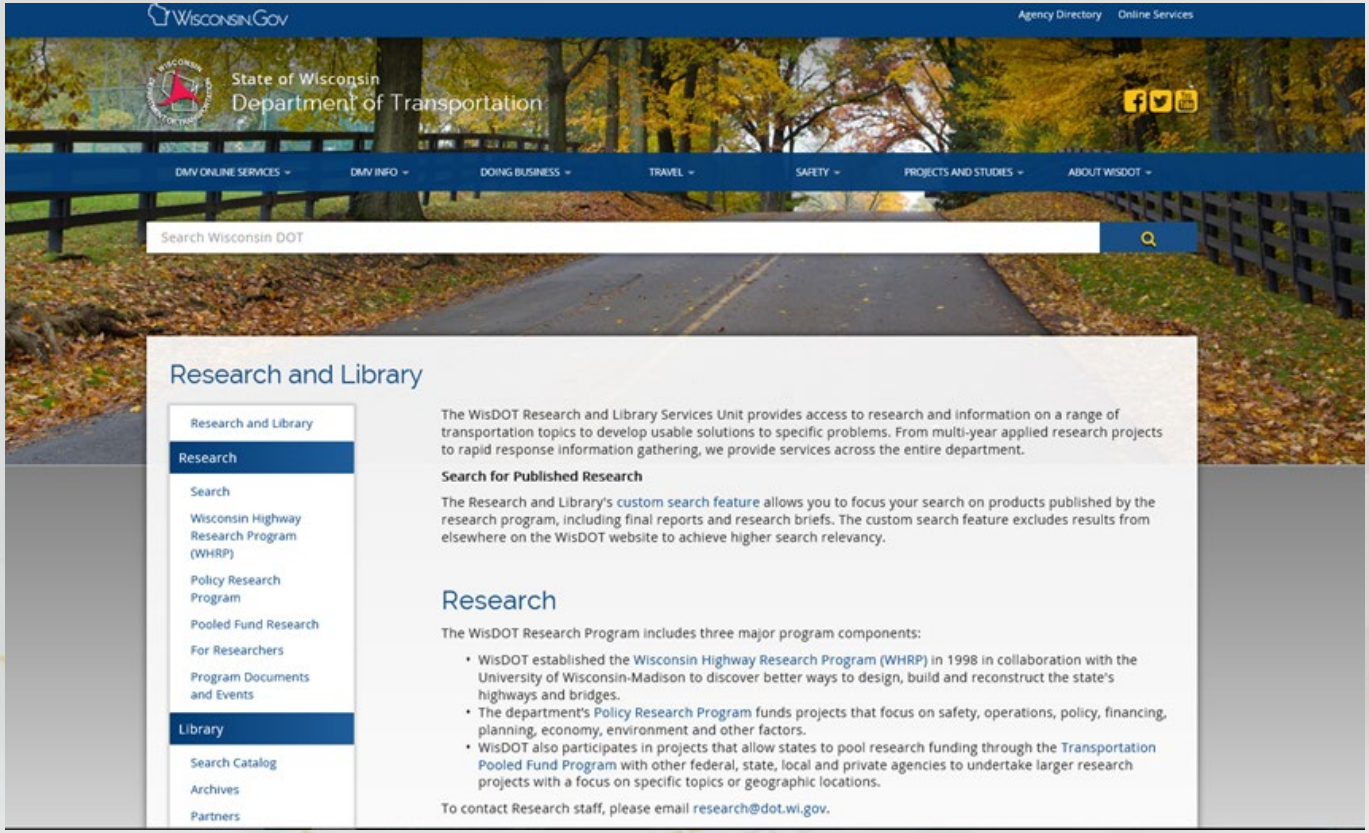
Technology transfer

- Project reports
  - Final reports & project briefs
- Literature searches
  - Identify published materials – reports, papers, articles
- Synthesis reports
  - Identify current practice through surveys and other methods
- Peer exchanges
  - Allow WisDOT staff to discuss key issues directly with experts and counterparts from other state transportation agencies
- Research Annual Reports
  https://wisconsindot.gov/Pages/about-wisdot/research/prog-docs.aspx

WisDOT library

- History
  - The WisDOT Library began in 1968 as a collection of Wisconsin city, village and town comprehensive planning documents
  - Hired library science graduate to manage the collection in 1971
  - Physical library space closed in March 2018
- Statistics (FFY2017)
  - Library user inquiries – 767
  - Document delivery – 347 items
  - Wisconsin Digital Archives – 473 items added
- Education / Outreach
  - LearnCenter module (Transportation Databases and Beyond)

WisDOT research website



Interaction of research and innovation

- Research & library unit within OMB
- Innovation & technology section within DTSD

  David Esse, Program Chief
  - Roles with R&L unit
    - Research & Library Advisory Committee
    - Wisconsin Highway Research Program
  - Lead role:
    - State Transportation Innovation Council (STIC)
    - WisDOT Innovation Review Committee (IRC)
    - Every Day Counts (EDC)
    - AASHTO Strategic Highway Research Program (SHRP)

Major initiatives / business drivers

- Focus on preservation
- Performance measures / process improvement
- “Lean Government”
- Cost savings and efficiencies
- Data-driven decision-making
- Improved stakeholder engagement, collaboration and transparency

Contact information

Diane Gurtner
WisDOT Research & Library Services Supervisor
diane.gurtner@dot.wi.gov
(608) 267-1842

website: http://wisdotresearch@dot.wi.gov

FHWA Corporate R&T Update
Wisconsin Peer Exchange

John V. Moulden

Office of Research, Development, and Technology (RD&T)
Turner-Fairbank Highway Research Center (TFHRC)
McLean, VA

Topics

- Moving Innovation
- Technology Readiness Level
- Updating the SP&R Subpart B guidance

Objective

- To have a better coordinated effort in managing the innovation life cycle from agenda setting, through research, to implementation and assessing the impact after deployment.

Approach

- Direct technical & financial assistance, training, peer exchanges, industry collaboration to disseminate information, evaluation of deployment methods effectiveness, assess needed improvements, document outcomes.
- In the early stages enlist pilot states and early adopters (+ financial assistance to mitigate risk & offset costs)

Moving Innovation (continued)

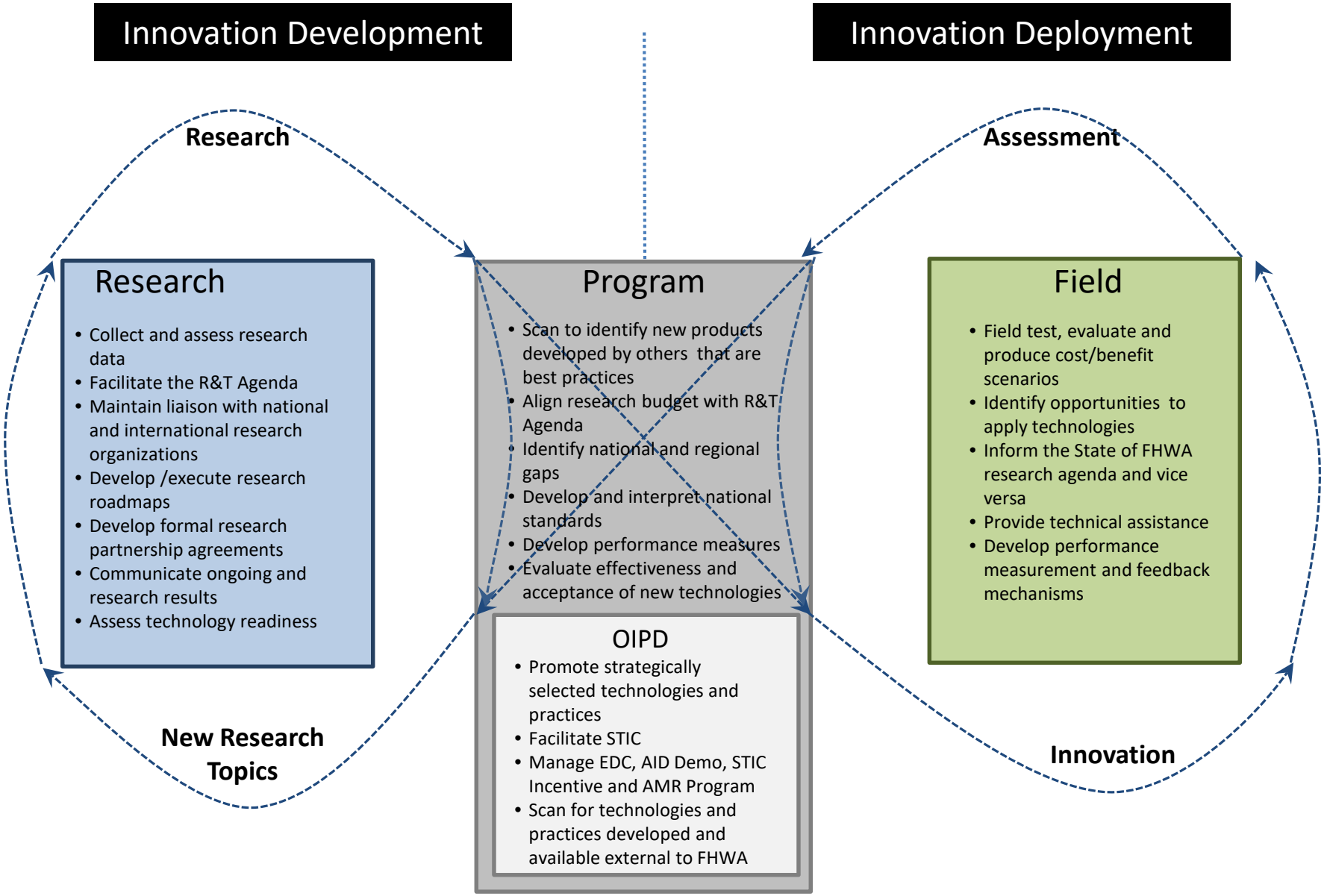
Approach

- Every Day Counts: provides technical assistance to encourage use of underutilized, mature innovations
- Accelerated Innovation Deployment (AID) Grants: provides incentive funding to accelerate adoption
- State Transportation Innovation Councils (STIC): offers technical assistance and $100K to support standardizing innovative practices in state DOTs & other stakeholders
- Disseminate best practices, lessons learned, success stories from the states

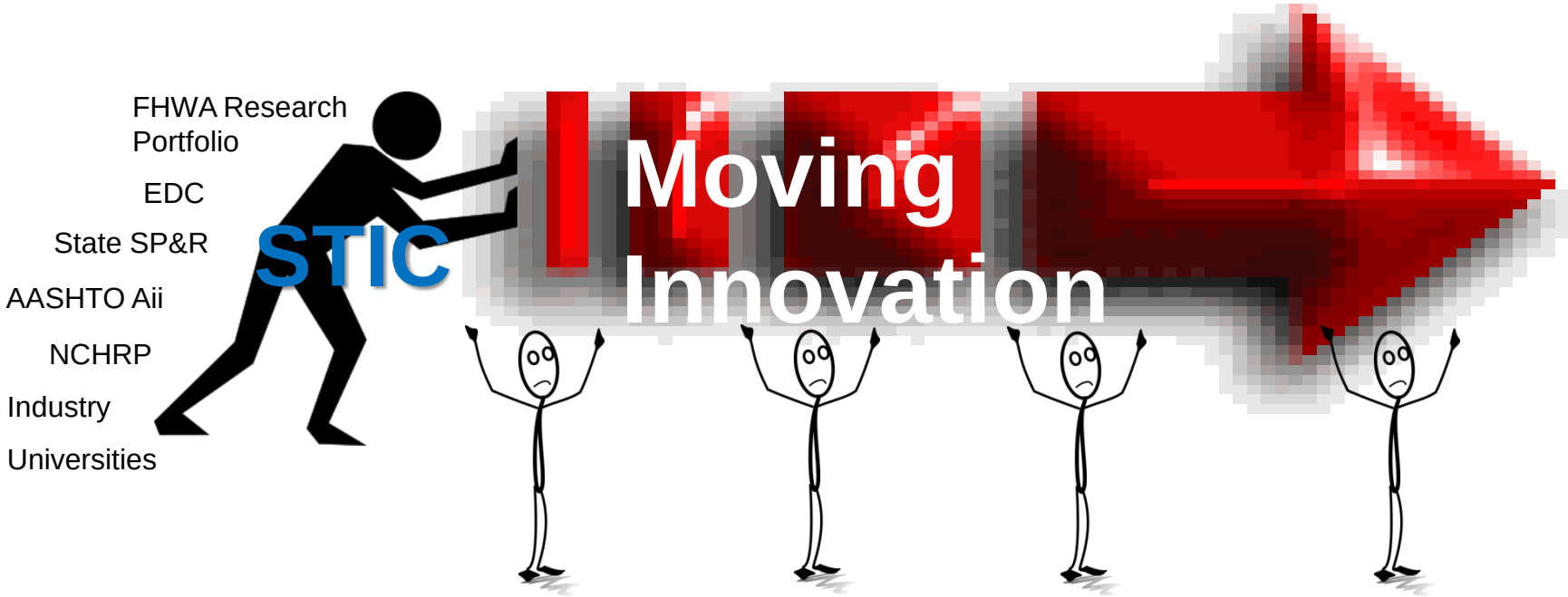
The Innovation Lifecycle

- R&T Program covers the entire innovation lifecycle
  - From agenda-setting to research, development and deployment and evaluation of impacts
- Influenced by recommendations from FHWA's external advisory panel & stakeholder input
  - Research & Technology Coordinating Committee (The RTCC)
  - AASHTO, DOTs, TRB

Moving Innovation
Key Business Process



INNOVATION SUPPORT



FHWA Office of Innovative Program Delivery Mission

- Improve transportation performance by driving innovation into action through partnerships, technology development, and capacity building
- Foster a *Culture of Innovation*

OIPD Centers

Tony Furst
Chief Innovation Officer

Cindi Ptak
Acting Managing Director

Center for Innovative Finance Support (CIF$)

Innovative Finance Support

Center for Transportation Workforce Development (CTWD)

Center for Local Aid Support (CLAS)

LTAP

Center for Accelerating Innovation Core Programs

- https://www.fhwa.dot.gov/innovation

STIC State Transportation Innovation Councils

EDC

AID Demo Accelerated Innovation Deployment

AMR Accelerating Market Readiness

National STIC Network	Every Day Counts	AID Demo Grants	AMR Internal/ External	Goodies

INNOVATOR Bi-monthly Newsletter

EDC-5 Innovations

Safety

- Reducing Rural Roadway Departure
- STEP

Operations

- Crowdsourcing to Advance Operations
- Weather-Responsive

Project Delivery

- UAS (Drones)
- Bundling
- Advanced Geotech
- CHANGE

Innovation

- Virtual Public Involvement
- Value Capture

Center for Accelerating Innovation

Stay Connected

Newsletters

EDC News Weekly Newsletter

INNOVATOR Bi-monthly Newsletter

https://www.fhwa.dot.gov/innovation/resources/

EDC

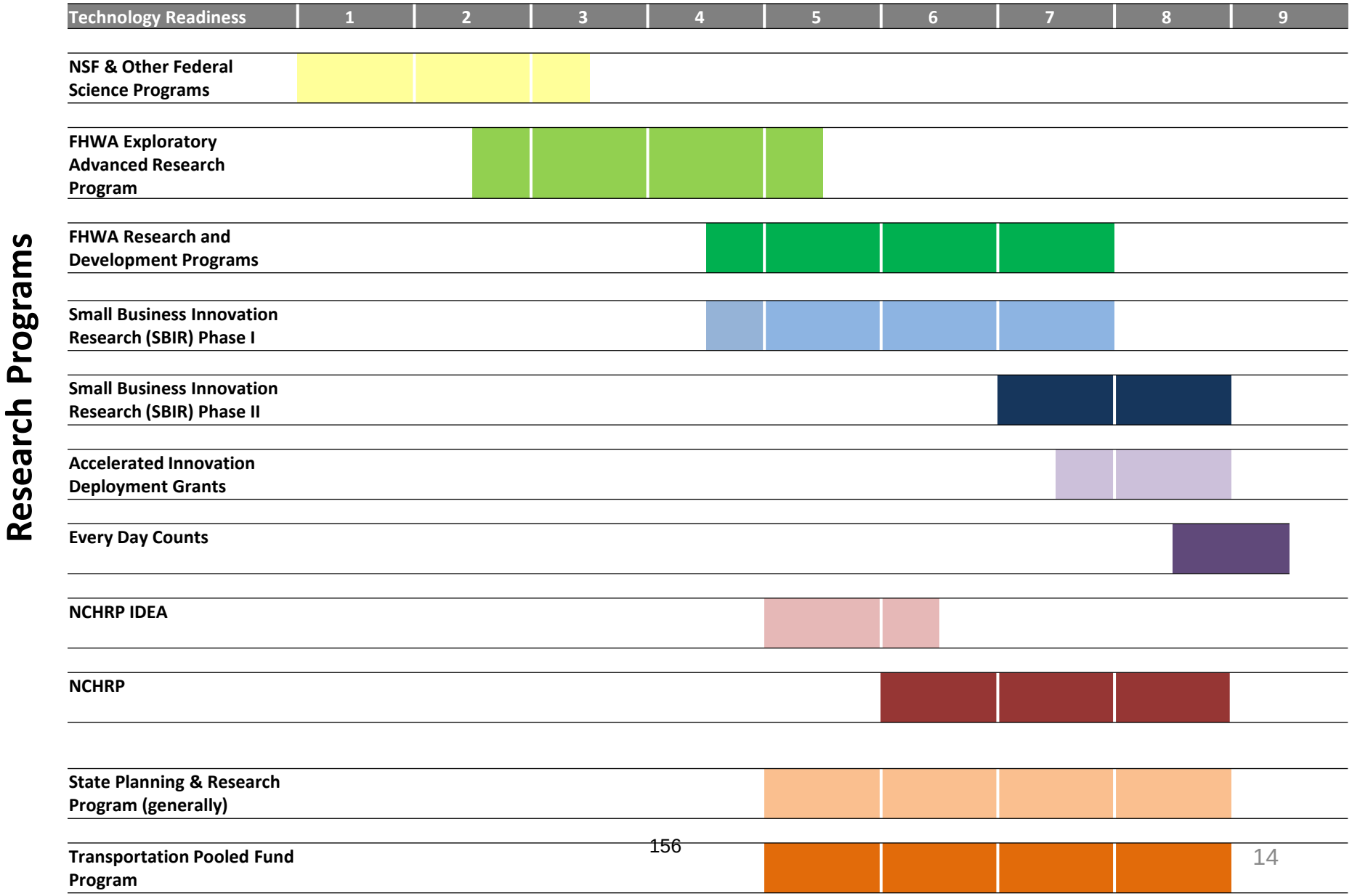
AID Demo Accelerated Innovation Deployment

STIC State Transportation Innovation Councils

AMR Accelerating Market Readiness

Technology Readiness Levels

	TRL	Description	Examples
Basic Research	1	Basic principles and research	• Piezo electric energy harvesting in the roadway • Agent-based modeling and simulations
	2	Application formulated	
	3	Proof of concept	
Applied Research	4	Components validated in laboratory environment	• Cooperative adaptive cruise control • Fiber-reinforced concrete columns
	5	Integrated components demonstrated in a laboratory environment	
Development	6	Prototype demonstrated in relevant environment	• Nondestructive testing for concrete bridge decks (R06A) • Software tools for sharing and integrating GIS data
	7	Prototype demonstrated in operational environment	
	8	Technology proven in operational environment	
Implementation	9	Technology refined and adopted	• EDC technologies – warm mix asphalt, safety edge


Research Programs
Technology Readiness
1
2
3
4
5
6
7
8
9
NSF & Other Federal Science Programs
FHWA Exploratory Advanced Research Program
FHWA Research and Development Programs
Small Business Innovation Research (SBIR) Phase I
Small Business Innovation Research (SBIR) Phase II
Accelerated Innovation Deployment Grants
Every Day Counts
NCHRP IDEA
NCHRP
State Planning & Research Program (generally)
Transportation Pooled Fund Program

Summary of Changes

1. Brings SPR Subpart B Guidance current with existing Law (MAP 21 and FAST Act).
2. Expands eligibility to include Innovation Life Cycle.
3. Authorizes the use of SPR Subpart B funds to develop, administer, communicate, and promote the use of products of research, development, and technology transfer programs under 23 USC Section 505.
4. Requires SPR Subpart B programs and activities to be consistent with the OST transportation research and development strategic plan required under 23 USC Section 508.

5. Includes adoption of requirements of 2 CFR 200 (Supercircular).
   a) Requires Performance measurements
   b) Requires Effective Internal Control
   c) Defines requirement for Period of performance including end date.
   d) Reinforces Pass-through agency responsibility for subrecipient compliance
   e) Clarifies Closeout requirements
   f) Defines Cost Principles
   g) Defines Indirect Costs, responsibilities and approval authority including definitions of specific relationships.

6. Added 23 USC 505 (a) (1-7) list of all eligible SPR activities which includes both Subparts A & B.
7. Added 23 CFR 420.203 definitions for RDT&I applicable to SPR Subpart B (25% set aside) which may limit eligibility of SPR activities.
8. Added clarification that a research project ceases to be eligible once it has been deployed and no longer meets the RDT&I definitions.

Visit our Web site: www.fhwa.dot.gov/research

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Measuring the Impacts of Research

Claire Randall
Senior Program Officer
Technical Activities Division

Why measure?

- Scarce resources
- Competition
- Accountability
- Meaningful? Useful? Beneficial?

What to measure?

- Outputs
- Outcomes
- Measuring “intangible” assets

Focus on Process

What can we control?

- Genesis of research needs
- Participation
- Components/schedules
- Distribution

TRB Initiatives

NCHRP Implementation Support Program

- 2012 survey and report—The impacts of NCHRP Research Products
- 2015 survey and report (upcoming)
- 20-44(09)—How to calculate the benefits of research

TRB Initiatives

TRR and SAGE Publishing

- Impact factor
- Altmetrics

Thank you!

Claire Randall
Senior Program Officer
Technical Activities Division

Alignment of Innovation & Research

David Esse

DTSD Innovation, Research & Tech Program Chief

WI Dept. of Transportation

Research Peer Exchange – Sept. 19th, 2018

DTSD innovation

Today's Topics

- **DTSD Innovation Program Structure**
- **Innovation + Research**

P2P

Peer-to -Peer

Every Day Counts

innovation ingenuity imagination invention

AASHTO

TRB

TRANSPORTATION RESEARCH BOARD

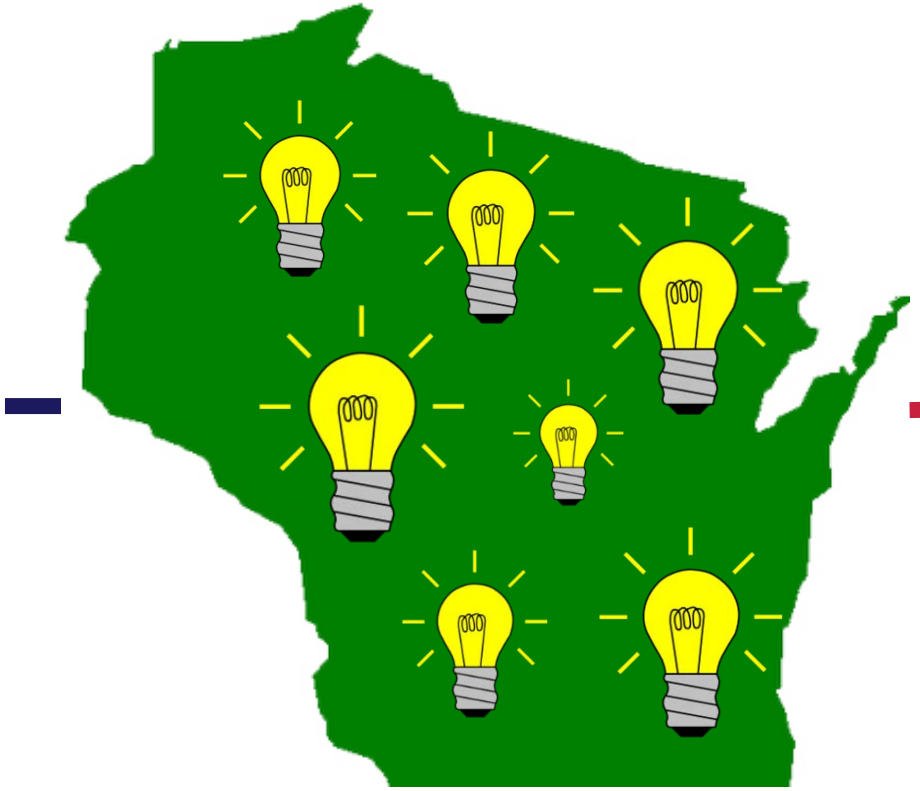
NCHRP

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

SHRP2

STRATEGIC HIGHWAY RESEARCH PROGRAM

TPF STUDIES

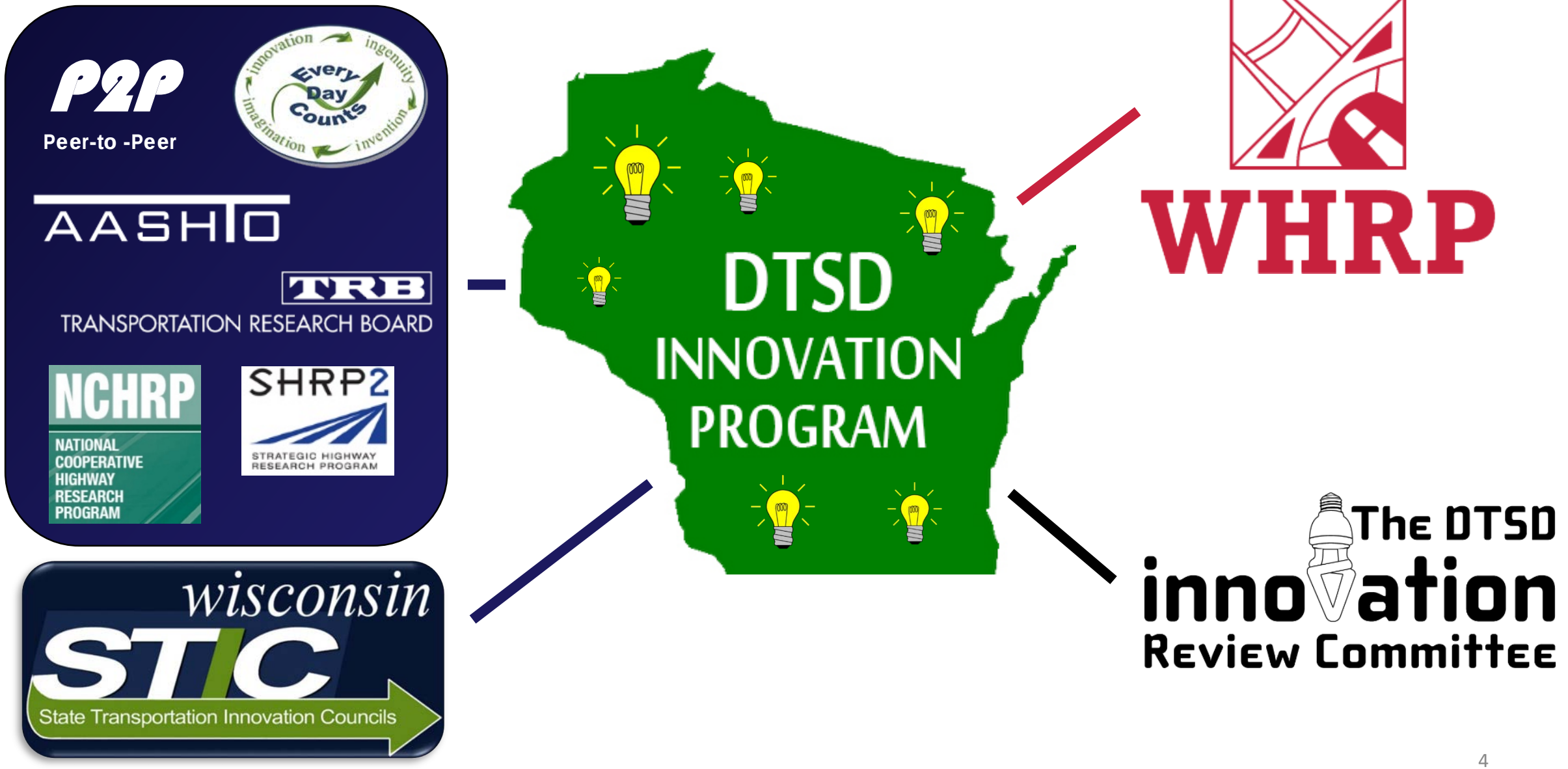


WHRP

WISCONSIN DEPARTMENT OF TRANSPORTATION

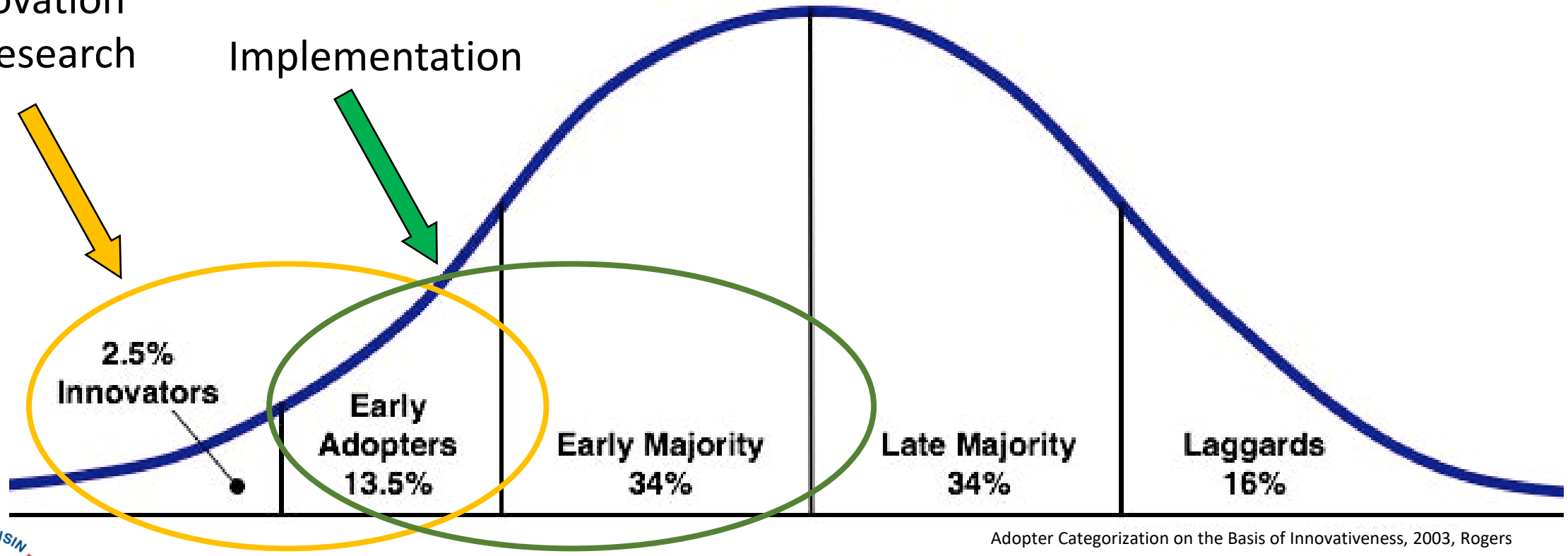
DTSD innovation

WisDOT Innovation & Research



Innovation
& Research

Implementation



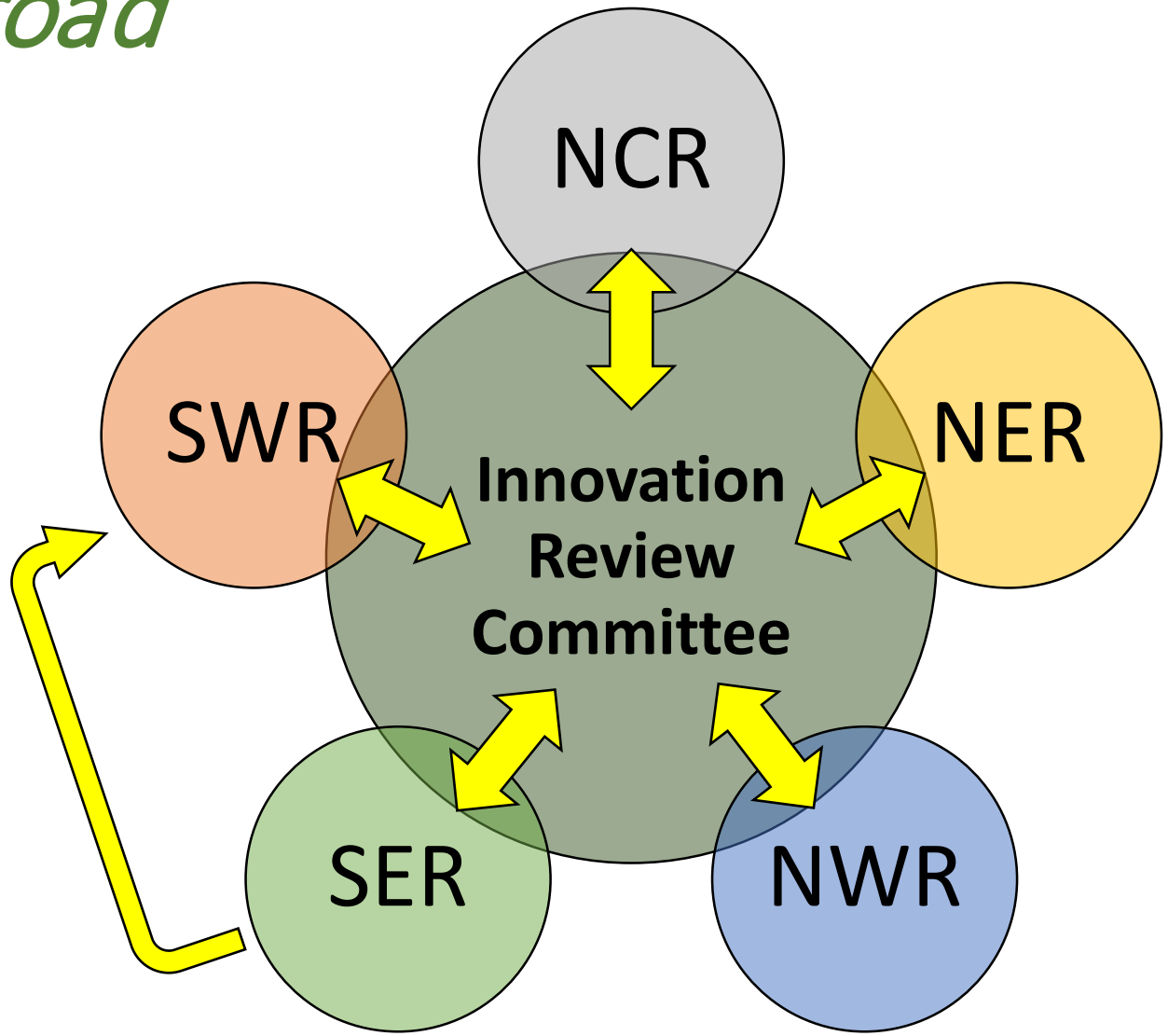
Adopter Categorization on the Basis of Innovativeness, 2003, Rogers

DTSD innovation

Taking innovation on the road

- Local-based innovation teams enable regions to take action, track ideas and measure improvement as part of the division program

- Able to identify similar efforts among innovation teams and align effort



WisDOT Innovation & Research

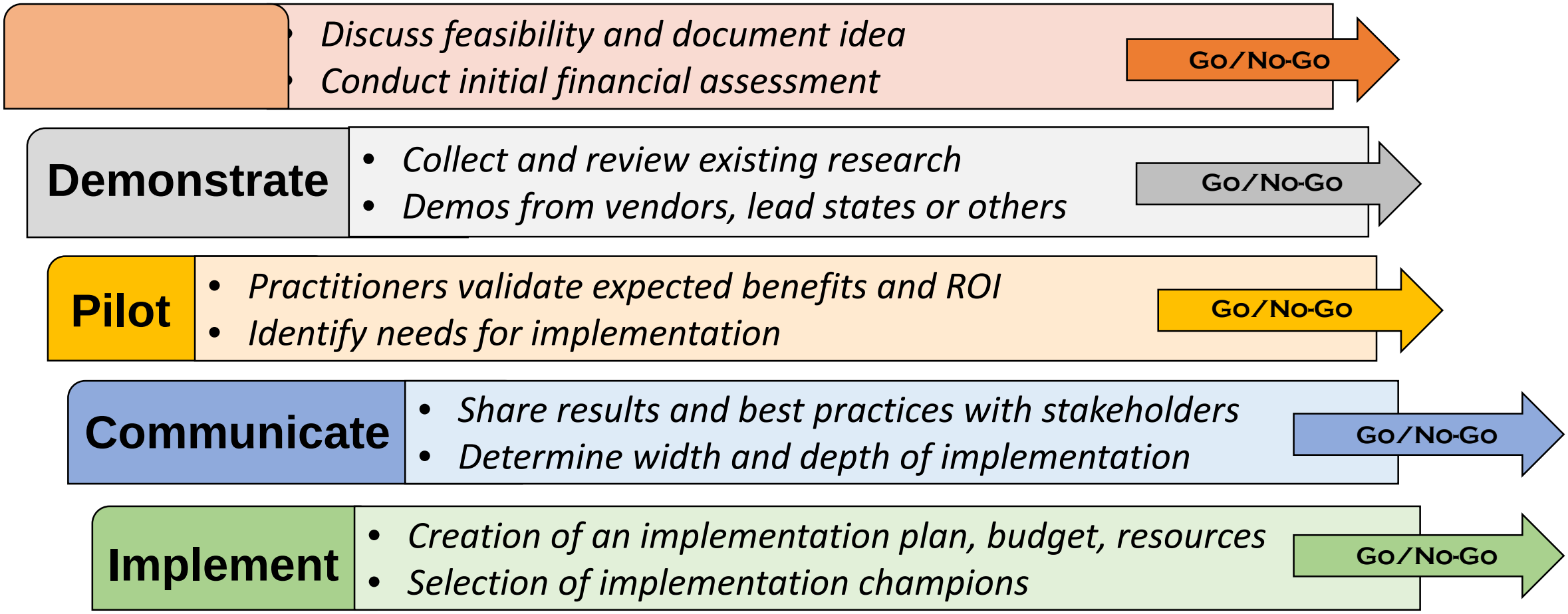
WHRP

The DTSD innovation Review Committee

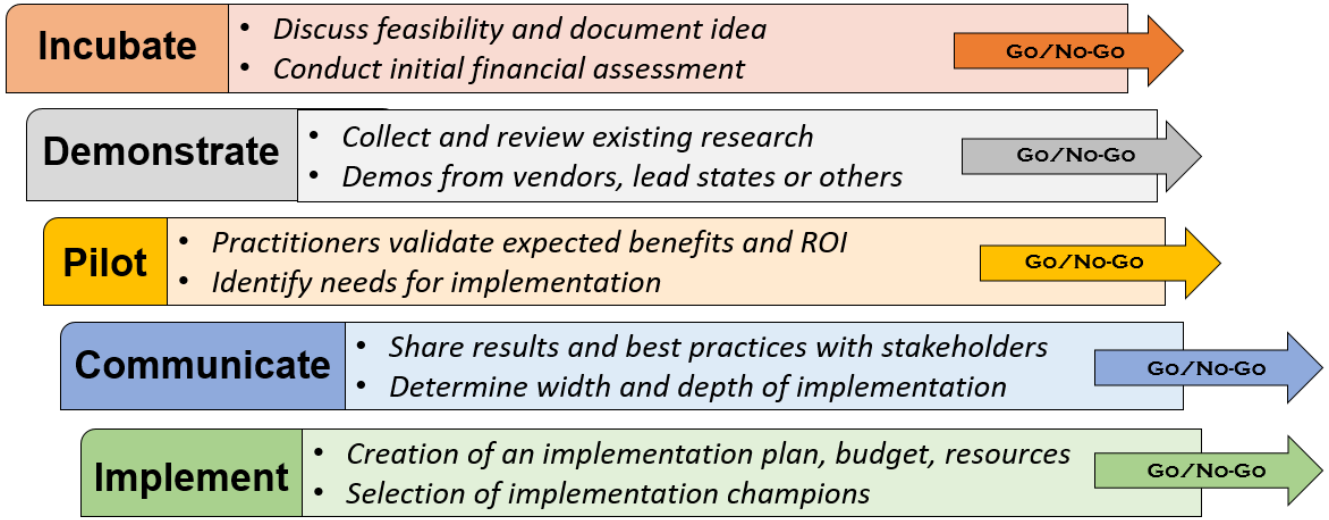
DTSD innovation Local Innovation Teams

JUST DO IT!

5 Steps to Innovation Bliss



Why the five steps?

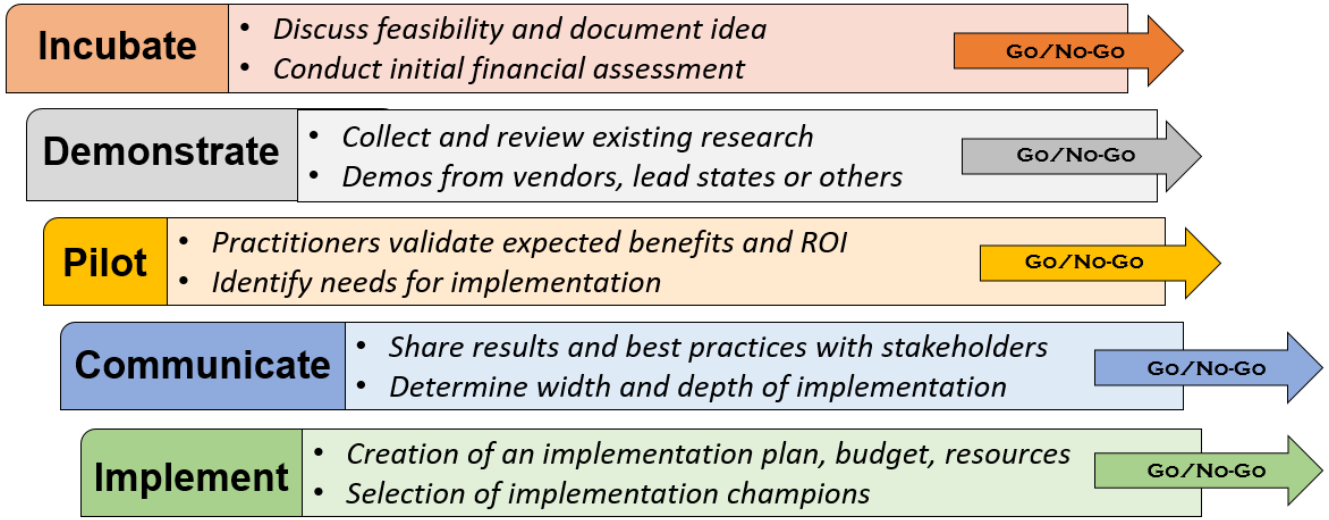


- Go versus No-go versus Need more info, etc.

Examples of using research during the 5 steps

- Literature searches
- National research documents
- Documentation of Best practices
- Contacts at other agencies

- Whose done it before?
- What are industry trends
- Is there B:C data?



Thank you!

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Measuring Success – Research Program Performance Measures

Jason J. Siwula, PE
Assistant State Highway Engineer - Innovation

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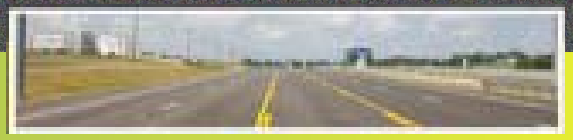
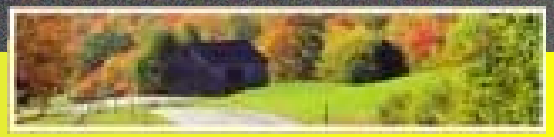

Research Program Goal Setting

- Helps KYTC make timely, well-informed decisions
  - On time
  - On budget
- Provides value to our customers
  - Implementation
  - Benefits of implementation
    - Improved safety
    - Savings
    - Efficiencies

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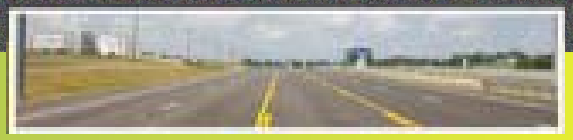
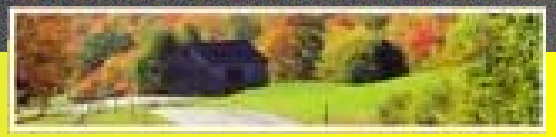

Timely Completion of Projects

- Average time from project start date to delivery of project results
- Average time from project start date to approval of final report

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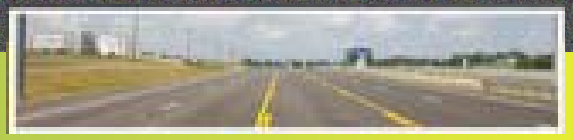
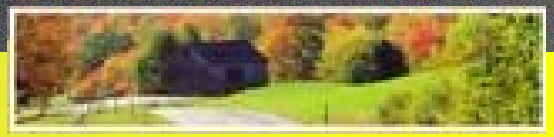
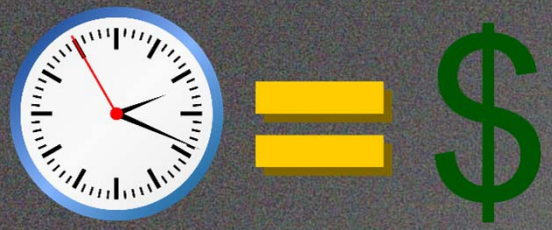



Adherence to Schedule & Budget

- Percentage of projects completed on-time (per work plan)
- Percentage of projects requiring revision to work plan for schedule extension
- Percentage of projects requiring revision to work plan to add funds



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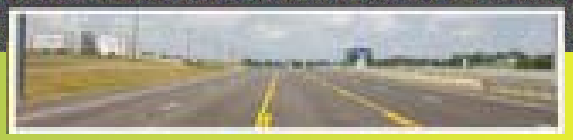
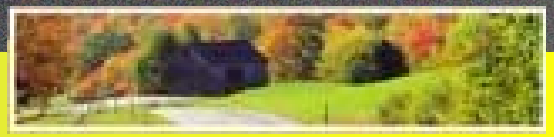

Implementation of Results

- Percentage of projects resulting in documented implementation
- Estimated benefits of documented implementation

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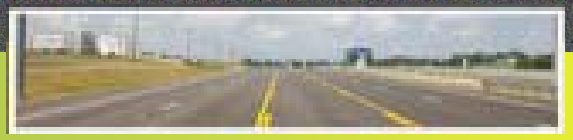
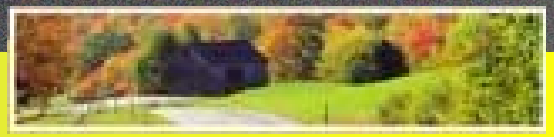

National Contributions

- Number of KYTC research projects selected for national “High-Value Research” publications
- Number of papers selected for presentation and/or publication by TRB
- Number of papers selected for publication in other peer-reviewed journals
- Number of presentations of KYTC research at regional, national, or international conferences

AASHTO

TRB TRANSPORTATION RESEARCH BOARD

U.S. Department of Transportation Federal Highway Administration

KENTUCKY TRANSPORTATION CABINET

WisDOT Research, Development & Technology Peer Exchange

Documenting and Communicating Best Practices and Successes of Research & Innovation

Alignment of Research & Innovation

Managing Research as an Asset

Madison, Wisconsin

September 19-21, 2018

Participants

- Host state: Wisconsin DOT
- Facilitators: Texas A&M TTI
- Kentucky Transportation Cabinet
- Missouri DOT
- North Carolina DOT
- Texas DOT
- Guests from FHWA and TRB

Purpose of a RD&T Peer Exchange

- FHWA requirement
- Exchange ideas and best practices
- Prepare report to share findings

Objectives of This Peer Exchange

- Examine the research program with respect to the three topical areas
- Improve the quality and effectiveness of WisDOT's (host state) research program
- Articulate insights, lessons learned and ideas for improvement to state DOT leadership (and AASHTO SCORI and AASHTO RAC)

State Presentations

- Program budget (SPR and other funding sources)
- Major research/innovation program components
- Staffing levels/positions/chart
- Project selection and award process
- Where research and innovation reside within agency structure and why
- How/if research relates to or interacts with innovation
- Research relationship to State Transportation Innovation Council (STIC)
- Major DOT strategic initiatives or business drivers

Key Discussion Topics

- Documenting and Communicating Best Practices and Successes of Research & Innovation
- Alignment of Research & Innovation
- Managing Research as an Asset

Documenting and Communicating Best Practices and Successes of Research and Innovation

- Marketing is critical
- Promote research and innovation programs and projects internally
- Find ways to show value of research and innovation
- Showcase success/Wins
- Treat research program as a problem solving service
- Document business and engineering practices that have changed as the result of research

Alignment of Research and Innovation

- **Enhance** connection between research and innovation
- Institutionalize research/ingrained in daily business
- People-driven **culture** of innovation
- Incremental changes: “Many small light bulbs still light up the room”
- SMEs/Region/District **engage and direct** research program/projects
- Implementer **involved** in the study

Managing Research As an Asset

- Make research **intentional and relevant**
- Utilize Power of **Expectation**
- **Cultivate** networks and engage champions to support and promote research and innovation
- **Multi-disciplinary** approach to research and innovation
- Set intentional **performance measures** for the research program
- Use research to enhance **knowledge management**
- Use research and innovation to **mitigate** identified risks
- Specific **skillsets** for information management become more critical as assets become more digital

Questions?