2017 NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RESEARCH PEER EXCHANGE—SUMMARY REPORT

SUSTAINING AND GROWING A RESEARCH PROGRAM DURING TIMES OF CHANGE

CONDUCTED SEPTEMBER 24–25, 2017

RALEIGH, NORTH CAROLINA

PREPARED FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
WITH ASSISTANCE FROM THE TEXAS A&M TRANSPORTATION INSTITUTE

Texas A&M Transportation Institute

REPORT DATE: REVISED JANUARY 2018

CONTENTS

INTRODUCTION

The transportation research program at the North Carolina Department of Transportation (NCDOT) hosted a peer exchange to discuss how to sustain and grow a research program during times of change.

The host state contributed to the funding of the Support Services for Peer Exchange Pooled Fund (TPF-5[301]) to engage the Texas A&M Transportation Institute to assist with peer exchange planning, facilitate meetings, take notes of the discussion at each session, and prepare the peer exchange final report.

The NCDOT Research and Development Program planned the sessions pertaining to sustaining and growing a research program during times of change. This report documents the discussions, outcomes, and takeaways of the peer exchange participants. It includes brief summaries of each agency's research program along with the agency's best practices and challenges with sustaining and growing its research program. This peer exchange report is structured as follows:

- Peer exchange background.
- Peer exchange participants.
- State research program overview, successes, and challenges.
- Peer exchange session summaries.
- Key takeaways from the research peer exchange.
- Research peer exchange agenda (Appendix A).
- State transportation research program representatives (Appendix B).
- State transportation research program presentations (Appendix C).

PEER EXCHANGE BACKGROUND

The use of peer exchanges was established to provide state departments of transportation (DOTs) with the opportunity to examine and evaluate their own research, development, and technology programs through a collaborative team of peers, experts, and persons involved in the process. The idea was that the exchange of vision, ideas, and best practices could benefit both the DOT's programs and the programs of the peer team participants. Peer exchanges may also be used to examine more focused areas of the state DOT's research program.

PEER EXCHANGE PARTICIPANTS

The peer exchange participants included staff members from research programs in the DOTs of Alaska, Florida, Illinois, Maryland, North Carolina, and Utah. Other guest participants included the U.S. Department of Transportation Federal Highway Administration (FHWA) and the University of North Carolina at Charlotte. Contact information for participants is provided in Appendix B.

2017 NCDOT Research Peer Exchange Participants.

From Left to Right: George Hoops (FHWA), John Kirby (NCDOT), Steven Bolyard (NCDOT), Lamara Williams-Jones (NCDOT), Allison Hardt (Maryland Department of Transportation), Curtis Bradley (NCDOT), Carolyn Morehouse (Alaska Department of Transportation and Public Facilities), Megan Swanson (Illinois Department of Transportation), Neil Mastin (NCDOT), Darryl Dockstader (Florida Department of Transportation), and Cameron Kergaye (Utah Department of Transportation). Not Pictured: Mustan Kadibhai (NCDOT), Thomas Nicholas (University of North Carolina at Charlotte), and Jimmy Travis (NCDOT).

STATE RESEARCH PROGRAM OVERVIEW, SUCCESSES, AND CHALLENGES

Each state participating in the NCDOT Research Peer Exchange discussed its research program structure, processes, successes, and challenges. This section summarizes the presentations by state.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

The Research and Development Program at NCDOT is located within the Division of Highways' Technical Services Division Transportation Management Unit and is comprised of six staff members including a full-time research librarian. Over several years, NCDOT staff levels have decreased by more than one-third due to attrition, early retirement programs, and a shift to using consultants. This

reduction in staff has challenged the research program due to the loss of institutional and technical knowledge and the subsequent need to educate new staff and expand the research program.

The research program at NCDOT has a State Planning and Research (SPR) budget of $5.1 million, including an annual work plan of about $4 million, National Cooperative Research Program (NCHRP) program of $300,000 (shared cost with the planning program for $1.2 million total), and an American Association of State Highway and Transportation Officials (AASHTO) Pooled Fund Program budget of $600,000. Annually, NCDOT initiates 20 to 30 new projects and has 90 active research projects and programs. Nearly all research activities at NCDOT are eligible for SPR funding.

NCDOT reserves $150,000 per year of state funds for the Technical Assistance Program. The program funds short projects such as conducting laboratory testing, writing technical papers, and conducting surveys. Projects in the Technical Assistance Program are managed by the Institute for Transportation Research and Education and are limited to 80 hours of investigator time. This program is advertised through meetings around the state, research newsletters, and professional networks. Investigators are required to provide a summary of the output and activities for each project.

The goals for the research program at NCDOT are to:

- Improve planning, engineering, and business practices.
- Support operations and maintenance activities.
- Conduct research that can be implemented.
- Convey the needs and operations of the DOT to maximize research benefits.

Research needs are solicited from May to July each year and can be submitted by any NCDOT staff member with manager approval and by university researchers in coordination with a DOT sponsor. Selected needs statements are then developed into full proposals. Research subcommittees review and recommend proposals for funding, and the Research Executive Committee approves the final work program. The Research and Development Unit provides project selection oversight throughout the entire process.

The annual research program matches NCDOT's research needs with expertise at universities and transportation research centers. NCDOT has current research projects with seven universities and master agreements in place with eleven, including both in- and out-of-state institutions. The research program plans to focus on updating university master research agreements in 2018.

NCDOT participates in several national initiatives, including the Long Term Pavement Project, Strategic Highway Research Program, AASHTO, Transportation Pooled Fund (TRP), Transportation Research Board (TRB), NCHRP, and National Center for Asphalt Technology at Auburn University.

ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

The Research Development and Technology Transfer Program (RD&T2) is within the Statewide Design and Engineering Services Division of the Alaska Department of Transportation and

Public Facilities (AKDOT&PF), and is comprised of six staff members. As a whole, AKDOT&PF has experienced a decrease in staff because as individuals retire or leave the agency, roles are merged rather than filled.

RD&T2:

- Assists in the development of research to solve problems.
- Provides the latest technology, materials, and procedures for conducting business.
- Provides education and technical assistance outreach to local governments.
- Provides the statewide technical training program.

Alaska does not have counties, so AKDOT&PF operates many local roads and trains local entities about operations and maintenance procedures. RD&T2 has an annual budget of $3.15 million for mandatory national dues, pooled fund studies, rapid research, and deployment research projects.

Research project selection criteria are determined by the Research Advisory Board (RAB). RAB consists of the chief engineer, regional preconstruction chief, regional construction chief, maintenance representative, FHWA Alaska division representative, and research chief. The chief engineer provides direction to the RD&T2 section, serves as chair of RAB, and selects two regional representatives for the board to serve two-year terms.

Research managers solicit, review, and evaluate research needs from AKDOT&PF employees, universities, and industry and develop those of highest merit for consideration. The Expert Advisors Committee ranks the research needs statements to determine whether the project:

- Has statewide significance.
- Has an AKDOT&PF champion.
- Has a high likelihood for implementation.
- Aligns with the Strategic Highway Safety Plan.
- Preserves infrastructure.
- Has a cost savings for maintenance and operations.
- Includes efficient project delivery.
- Improves the quality of maintenance and operations projects.
- Improves intermodal connectivity.
- Includes match funding.
- Provides economic development opportunities for the state.

Members of the Expert Advisors Committee develop the annual work plan to submit to RAB for approval. Research managers develop and manage approved research projects, which entail the following activities:

- Principal investigator (PI) selection.
- Budget preparation and schedule setting.
- Contract negotiation, management, and reporting (progress and annual).

- Facilitation of a technical advisory committee to support and implement research.
- Development and execution of statewide research implementation and training plans to improve department specifications, policy, and practice related to the planning, design, construction, maintenance, and management of the state's transportation infrastructure, and work with other sections as required for implementation.

The project implementation plan explains the expected research products and how findings can be applied within AKDOT&PF. The plan also outlines the audience or market for the research products, whether the findings are economically justifiable, and whether the findings will improve service to citizens of Alaska.

Implementation techniques include final reports, seminars, trainings, workshops, newsletters, and changes to department policies and procedures. Reports have the advantage of reaching large numbers of people at a relatively low cost. However, due to the large volume of reports circulated today, it is difficult for practitioners to identify useful information. Therefore, the project manager (PM) must ensure that the information presented in a report is clear and concise. If long reports are required, the PM should require an executive summary of the research results. Seminars provide a ready means to disseminate information to relatively large groups, and provide two-way communication between the user and the researcher. Managers need not wait until the completion of a project to present seminars.

The department's Alaska Transportation Technology Transfer Program (T2) can help develop workshops, webinars, trainings, and tech briefs to train people to use new techniques and products that have been developed through the statewide research program. T2 also circulates *Technology for Alaskan Transportation*, a newsletter with a distribution of more than 2,000. It may be used to inform readers of the initiation of a project, developments, or results. It may also be used to disseminate information about national or international research.

FHWA's Experimental Features Program allows the state to incorporate new ideas into a federally funded highway construction project. If the idea fails, FHWA participates in the reconstruction of that feature. Where new equipment is required, a project to purchase and demonstrate the equipment may be appropriate. If newly developed techniques are difficult, the PM may be required to work directly with individuals to demonstrate and teach them new procedures. While this may be time consuming, it may be one of the most effective means of implementation. When suggesting a change in department policy and procedures, the PM must work with the appropriate department staff to ensure that the change is made through the proper channels.

Following the completion of a research project, the research manager must document those efforts in the project file. All implementation efforts are monitored for three years. The research project undergoes an external peer review to measure performance measures, such as the percentage of goals met, the percentage of project implemented, and on-budget and on-time metrics.

FLORIDA DEPARTMENT OF TRANSPORTATION

The Florida Department of Transportation (FDOT) Research Center is a cost center within the department with funding programmed in the five-year work program, which is a five-year plan of transportation projects as defined in Florida state law. The Research Center recently was reorganized to report to the assistant secretary of strategic development (it previously reported to the chief engineer). The Research Center also oversees the Internship and Recruitment Program in cooperation with Human Resources. The FDOT research program has $14 million in annual funding with four full-time employees (FTEs), two time-share employees, and two FTEs in the Internship and Recruitment Program.

At FDOT, the Research Center issues a call to Central Office research coordinators and districts for research requests for the annual research program solicitation in October. Each functional area and district within FDOT determines its needs, ranks and prioritizes those needs, coordinates with affected stakeholders, and sends ranked problem statements to the Research Center in January. The list of problem statements undergoes peer and executive reviews, and the approved list of research projects is sent to the FHWA division office. Mid-cycle requests and pilot/demonstration projects are available throughout the year based on available funding.

FDOT noted several successful aspects of its research program, including:

- Engagement and executive support.
- Communication between functional areas.
- Implementation and performance analysis.
- Internship and Recruitment Program. There have been 349 intern hires at FDOT since 2013, with 29 hired into full-time positions.

FDOT identified several challenges the research program faces, including:

- Consistent, effective project management and the need for an effective program/project management system. Currently, the Research Center portfolio includes 149 active projects being managed and conducted by 80 FDOT PMs and 81 principal investigators, respectively.
- Resources required to effectively manage implementation and performance analysis.
- Loss of project champions.
- Succession planning due to loss of expertise.

ILLINOIS DEPARTMENT OF TRANSPORTATION

The Bureau of Research at the Illinois Department of Transportation (IDOT) is within the Office of Planning and Programming and includes the Technical Research Unit, the IDOT Library, and the Pavement Technology Unit. The Technical Research and Pavement Research Units separated from the Central Bureau of Materials in the IDOT reorganization in 2015. The Technical Research Unit has two full-time employees. Thirty-six employees represent IDOT on 60 different national-level research efforts, including NCHRP panels and TRB standing committees. IDOT also

participates in the FHWA Transportation Pooled Fund Program. IDOT recently carried out a Safety Project Outreach webinar series to showcase implementation projects. Over 450 attendees from 60 Illinois cities, as well as Arkansas, Missouri, and Iowa, have participated.

IDOT receives approximately $7 million annually of the SPR Part 2 funds from FHWA and $400,000 in state funding toward state research activities. The total fiscal year 2018 research work program is $10.1 million. Contract research at IDOT is administered by the Illinois Center for Transportation (ICT) through an intergovernmental agreement between IDOT and the University of Illinois Board of Trustees.

IDOT has three types of research projects: regular projects that are part of the annual program cycle, special projects, and off-cycle projects too urgent to wait for the regular cycle. As of June 2017, IDOT had 23 active research projects and will have additional 14 projects started by January 2018. The contract research cycle begins in May when technical advisory groups begin discussing research and ideas for implementation. Research needs are posted to the ICT website in August, and problem statements must be submitted by October 1 using the online form. Technical advisory groups review and vote on problem statements in October as well, identifying a Technical Review (TRP) chair to lead the research panel. The ICT Executive Committee approves projects for funding in February, and researchers and TRP members are selected from February through July. TRP panels consist of IDOT subject matter experts, representatives from other effected agencies, industry stakeholders, and the FHWA Illinois Division Office. The work plans and budgets are also finalized during this time. Work on funded research projects begins in August and January. IDOT and ICT have an online system to meet the Code of Federal Regulations requirement for reporting. PMs complete quarterly reports, time and budgets extensions, implementation planning, and close-out evaluations in this system.

All deliverables are subject to a three-month editing process. A technical editor, paid for through the intergovernmental agreement with ICT, is required to streamline the quality of reports and to streamline the project close-out process. Project managers send reminders to PIs at six months and four months prior to the project end date. The PI provides a draft report to the technical editor three months prior to the project end date for the initial edit for spelling, grammar, punctuation, and missing information. The edited draft is then submitted to the TRP for several iterations to address any issues, concerns, or needed clarification. The final edit incorporates all changes and includes the technical report documentation page.

MARYLAND DEPARTMENT OF TRANSPORTATION

The research program at the Maryland Department of Transportation (MDOT) is located within the State Highway Administration Office of Policy and Research and has three FTEs. The research program is approximately $3.2 million annually, of which approximately $2.8 million is federal funds and $400,000 is state matching funds. The research program administers and manages the SPR Part 2 research program, supports participation in national research programs, serves on national committees, develops and administers technical assistance agreements with institutes of higher education, and manages a summer internship program.

In 2014, MDOT initiated a new research needs process to ensure research ideas were driven by the needs of the agency and to increase competition among researchers. Ideas have leadership support, and multiple researchers can respond to a request for proposals. The research needs process begins in February when the annual call for research needs is emailed to the senior management team. Research ideas are ranked based on anticipated benefits, urgency, and impact to MDOT, and then projects are selected to receive funding and announced in May. The annual request for proposals is sent to IHEs, and proposals are awarded from June through August. The work program is sent to FHWA for approval in September.

MDOT noted the following successful initiatives within the research program:

- Use of SurveyMonkey for quick research on current and best practices.
- Information announcements for completed research in other states and by other research agencies.
- Knowledge transfer. Every process within the Research Division has been documented to help with training new staff. These step-by-step instructions are accessible on internal shared drives.

MDOT identified the following challenges within the research program:

- Leadership and management turnover.
- Lack of time for technical offices to provide oversight.
- Lack of a research library.
- Establishment of a link between innovations and research.
- Lack of researcher competition.
- Quality of deliverables.

UTAH DEPARTMENT OF TRANSPORTATION

The Utah Department of Transportation (UDOT) Research and Innovation Division (RID) has recently completed a major effort to develop the current organizational chart and has hired an FTE to serve as the meeting coordinator to arrange and schedule all project meetings. RID has 101 active research projects and field evaluations, of which 66 are Utah Transportation Research Advisory Council (UTRAC) and rapid response, 25 are pooled fund, and 10 are experimental features. In 2017, 67 problem statements were submitted to the UTRAC research program, and 22 were selected for funding.

RID has four main goals:

- Idea discovery.
- Innovation implementation.
- Sharing and communicating.
- Access to information.

RID networks with internal and external stakeholders in Utah, other DOTs, and national groups. RID scans technical publications, surveys, and problem statements to stay up to date with current and

ongoing research efforts, and to generate new, innovative ideas. RID implements innovative ideas by providing seed money to encourage idea development, prioritizing results based on implementability, testing new and proven products in the field, leading pooled fund projects, and collaborating with other research institutions.

Information from RID is shared and communicated by leveraging the DOT's involvement on national committees; supporting State Transportation Innovation Council and Every Day Counts initiatives; responding to national solicitations and grants; performing technology transfer; hosting TRB visits, peer exchanges, and webinars; and circulating information about surveys and awards. UDOT also has an Innovations Working Group that meets quarterly to develop problem statements that are applicable in Utah but also in line with other states and national research ideas.

RID provides access to information by publishing research and other reports, maintaining technical manuals, circulating new books and periodicals, coordinating leadership book discussions, updating research summaries, and updating committee members on the RID website. RID also publishes the *Innovations and Efficiencies Report* and a quarterly newsletter.

UDOT noted several successful implementation practices, including:

- Management support.
- A culture of innovation ingrained at the agency.
- Stakeholder engagement.
- Accountability.
- Communication. Project champions and research partners communicate well. The PMs drive the research process and content.

UDOT also identified several challenges with implementation, including:

- Communication.
- Funding.
- Management/project champion turnover.
- Training and promotion of staff.

UDOT measures the benefits of research for all completed projects. Benefits from research include pavement and bridge life extension, congestion mitigation for commuters, crash avoidance, and noise reduction. In 2016, UDOT determined that 66 research projects provided $68.2 million in benefits.

PEER EXCHANGE SESSION SUMMARIES

This section summarizes discussions at the peer exchange group by topic—library functions, mechanisms for coping with change, engagement of staff and external customers, and the implementation and value of research.

LIBRARY FUNCTIONS

Research libraries play a variety of roles within DOTs. The research library at NCDOT has recently been reorganized and has a full-time, on-staff librarian available to assist employees with literature searches and checking out engineering- and transportation-related documents, technical journals, and books. Items in the library are also cataloged in the state library system and can be checked out by employees. The library contains historical information dating back to 1920 and includes the Board of Transportation minutes. The library is somewhat isolated in its current location, but NCDOT is looking at how it can expand.

IDOT has a physical library with a degreed, full-time librarian. The Bureau of Research at IDOT is focused on improving the library and in the process of determining the best method to secure historical information. This library is part of the state library system in Illinois.

The UDOT research library is located in the learning center of the DOT building. The research library has recently been reorganized and now includes conference rooms and areas with conference tables. The research library is determining appropriate journals and magazines to which the DOT will maintain subscriptions.

FDOT has implemented a paperless initiative and plans to educate and instruct employees to use library resources online. At AKDOT&PF, all transportation-related material has been moved to the state library; state plans are archived in the state library as well. MDOT does not have a library. If employees have library needs, they work with TRB or NCHRP to locate technical reports and documents.

Most participants were not aware of their agency's retention policy for documents, but all agreed that any policy should adhere to federal and state requirements.

MECHANISMS FOR COPING WITH CHANGE

Staff turnover creates issues with knowledge transfer, training, and organizational awareness. A variety of ways to cope with this change were discussed, including:

- Conducting succession planning for retirement.
- Having individual conversations with staff to encourage participation.
- Coordinating the research advisory committee instructors, summer meetings, and mentoring guidelines.
- Marketing the program with national organizations.
- Overlapping the most vocal champions and participation on committees.

It is important to expand the pool of staff participants in research projects and committees. The DOTs have several methods to train staff to serve on a committee and champion projects, including:

- Incorporating the research process into project management.
- Valuing individual performance.

- Reinforcing expectations.

AKDOT&PF, MDOT, and IDOT provide a one-page document explaining the role and expectations. FDOT provides ad hoc training; project manager expectations are provided in the Research Program Manual. UDOT has an informal process where all PMs review training with each other, similar to a mentoring program.

Recruiting staff to participate on national committees and panels is another important aspect of a research program. AKDOT&PF has annual meetings with each region to encourage membership and participation at TRB and NCHRP. It is preferred that staff attending national conferences be at least a "friend" to a committee prior to the meeting. AKDOT&PF focuses on panels that are of the most benefit to its agency and best fit its subject matter experts. UDOT sends approximately 15 staff to TRB annually. Participants are expected to implement ideas after TRB and are required to meet monthly to explain how their ideas are being implemented. The agency calculates a benefit-to-cost ratio to measure all TRB implementation ideas versus the cost of sending staff to the annual meeting. FDOT requires staff to provide a trip report to the innovators committee after attending the TRB annual meeting. Staff that are panel or committee members must actively participate. TRB is open to all MDOT staff to attend due to the proximity and low travel costs associated with attendance. IDOT provides funding for committee chairs and for staff with accepted papers.

ENGAGEMENT OF STAFF AND EXTERNAL CUSTOMERS

A research program can use a variety of ways to effectively encourage ideas and participation, such as:

- Hosting workshops.
- Attending monthly status meetings.
- Including district representatives as technical advisors.
- Soliciting ideas from subject matter experts.
- Engaging municipalities in the research needs solicitation process.
- Participating in private-sector meetings.
- Discussing the research program at meetings for specific technical areas.

UDOT hosts an annual research workshop to explain research ideas in eight subject areas. At the end of this workshop, UDOT creates a prioritized list of research ideas and what will go into its annual work program. AKDOT&PF participates in private-sector meetings to help solicit ideas. IDOT includes industry in each of the technical advisory groups. NCDOT has also begun engaging private-sector partners in conjunction with appropriate business units.

Many states expressed concerns with low participation from staff in the research process or that staff are not interested in serving as project champions. One method to engage staff and encourage participation is to incentivize research by recognizing both the PIs and PMs or providing internal research project awards.

One DOT suggested states be innovative for the TRB annual visit by hosting a roundtable discussion and inviting junior-level or new staff to get a primer/seminar on national programs (TRB, NCHRP, etc.). This gives the DOT an opportunity to discuss urgent issues and learn how TRB can provide assistance.

IMPLEMENTATION AND VALUE OF RESEARCH

Several participating DOTs use research implementation worksheets to keep projects focused on the end goal. Completing these worksheets ensures the PI and the project champion look at the implementation plan and understand what performance metrics will be evaluated at the end of the project. These worksheets are an extension of the work plan and are revisited at every meeting.

University of North Carolina at Charlotte professor Tom Nicholas discussed the results of his research into how to capture and communicate the value of NCDOT research. As part of his research, Dr. Nicholas surveyed NCDOT researchers and stakeholders to define the characteristics of a successful research project and how to define the value of research. The research results indicated that the definition of the value of research will need to be flexible and communicated differently to different stakeholders. If cost-benefit is to be used, the cost-benefit methodology should include both qualitative and quantitative benefits. Dr. Nicholas identified how various stakeholders see success and value. For example, executives and politicians view money as the medium to measure value. Engineers, managers, and end users see money as important but also view the overall impact from the project and problem solution as a measurable value. Researchers also view publication of research results and experience for graduate students as valuable measures.

Dr. Nicholas described a model he developed for predicting research success based on project success indicators. These indicators include:

- Regular communication from the PI.
- Researcher experience.
- Proposal quality.
- NCDOT champion involvement.
- Research need.
- Co-PI experience.

The preliminary model results indicate that communication and proposal quality are not as significant predictors of project success as PI experience and research need. Dr. Nicholas also indicated that additional data are required to test this model hypothesis. The research presentation by Dr. Nicholas gave new insights into how state DOTs and researchers should approach communicating the value of research in their research programs.

Participants of the Research Peer Exchange toured the Construction Facilities Laboratory Tour at North Carolina State University.

KEY TAKEAWAYS

Key takeaways from the research program representatives at the NCDOT Research Peer Exchange are as follows:

- Challenges—organizational change, leadership turnover, the need to re-educate the management workforce, engagement of staff in research, and communication of the value of the research—are consistent among the participating DOTs.
- Although most DOTs are experiencing some level of organizational change, there is little to no standardization across DOTs for research methods and processes.
- Enforce brevity in reports, statements of value, and other research deliverables by requiring a technical editor or setting page limits for reports.
- Create step-by-step standard operating procedures to document processes for institutional memory and to cope with change/organizational turnover.
- Internship and recruitment tracking is beneficial to the agency.
- It is vital to communicate the results of the research to consumers.
- Close the loop with customers and with researchers. Many researchers that do excellent work are not always aware of how their products are implemented.
- Recognize PMs and PIs for participating in research activities, national committees, and implementation successes, but also recognize those who do not meet project requirements.
- Ensure that PIs and PMs understand project requirements and expectations by going over the scope during the project kick-off meeting, requiring monthly or quarterly progress reports, and scheduling mid-cycle meetings to assess project status and next steps.
- Create or repurpose a position to specifically encourage and facilitate implementation activities. Several of the attending states, including NCDOT, have recently done this.
- Constant outreach to existing and potentially new customers. Engage through multiple internal business forum as frequently as possible.
- Consider conference and workshops to engage researchers and agency employees

APPENDIX A. RESEARCH PEER EXCHANGE AGENDA

This appendix contains the agenda for the NCDOT Research Peer Exchange.

Sustaining and Growing a Research Program during Times of Change

Day 1

8:00 a.m.–9:00 a.m.—Introductions

- Introductions for all attendees
- Discuss purpose of the peer exchange

9:00 a.m.–10:00 a.m.—Research Program Structure and Successes Part 1

- Each state will discuss its own structure and processes (20 minutes × 6)
    - Staff and budget size, place in organization, research need gathering process
- Challenges you face currently and have dealt with in the past
- Successful initiatives moving your program forward

10:00 a.m.–10:15 a.m.—Break

10:15 a.m.–11:15 a.m.—Finish Overview

11:15 a.m.–12:00 a.m.—Follow-Up Discussion Driven by Presentations

- What has worked for you?
- What did you learn that was interesting?
- What challenges do you see in the near future?

12:00 p.m.–1:00 p.m.—Lunch, Provided

1:00 p.m.–1:45 p.m.—Continue Follow-Up Discussion

- What are you most proud of/happy about regarding your state research program?
- How much do you rely on universities to drive programs?
    - What percentage of your problem is made up of university ideas?
    - How do you make sure you get the best value from those projects?

1:45 p.m.–2:30 p.m.—Library Functions

- Do you have a library?
- Increasing library use and awareness across the agency
- Library measures in a changing environment
- What is most effective at other states?
- What role does the library play in your agency?

2:30 p.m.–3:00 p.m.—Travel to North Carolina State University Construction Facilities Laboratory

3:00 p.m.–5:00 p.m.—Technical Tour, Construction Facilities Laboratory Tour at North Carolina State University

6:30 p.m.—Dinner (Reservations at a Local Restaurant)

Day 2

8:00 a.m.–9:45 a.m.—Mechanisms for Coping with Change

- Staff turnover in R&D—knowledge transfer, training, maintaining momentum
- Massive staff turnover at agency: subject matter experts and champions have left
    - How do you most effectively engage, recruit, and retain new champions?
    - How are you increasing or at least maintaining organizational awareness?
- How do we expand the pool of participants in research projects/committees?
- Building a research skillset for our customers and champions—how to best train to serve on a committee and champion projects; this is an often-overlooked piece of research programs
- National engagement—NCHRP/TRB, etc.—effective mechanisms for recruitment

9:45 a.m.–10:00 a.m.—Break

10:00 a.m.–11:45 a.m.—Engaging with the Field and External Customers

- Reach out to field personnel most effectively to get ideas and participation
    - Workshops
    - Write and circulate ideas
    - Develop a guide for developing an idea
    - Web-based form
- Engaging the private sector—benefits/risk
    - AGC, CAPA, aggregate industry, ACPA, PCI, ACEC, etc.
    - Other state agencies including MPOs and RPOs
- How can the research office be a more forceful driver of identifying needs and developing a program?

11:45 a.m.–1:00 p.m.—Lunch, Local Restaurant

1:00 p.m.–2:45 p.m.—Implementation and Value of Research

- UNCC project overview from Tom Nicholas
- Implementation:
    - What has each agency found to be effective?
    - Implementation measures in a changing environment
    - What did you think would work but did not?
- Review NCDOT's creation of an implementation manager position
    - Review the role and help to further define
    - Discuss potential most effective uses and help to develop the role (already filled)
- Tracking implementation over time—success stories
- How do you determine benefits? Specifically, non-monetary type benefits
- Engaging the private sector to support implementation

2:45 p.m.–3:00 p.m.—Break

3:00 p.m.–4:30 p.m.—Outreach, Wrap-Up, and Summarize

- NCDOT R&D is planning an innovation summit for North Carolina involving NCDOT, universities, and partners (likely in conjunction with Value Management)
- What effective means have other states utilized to get results out there to consumers?
    - Social media experiences, newsletters, internal meetings, training

APPENDIX B. STATE TRANSPORTATION RESEARCH PROGRAM REPRESENTATIVES

ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

Carolyn Morehouse, P.E.
Statewide Research and Technology Transfer Chief
Carolyn.morehouse@alaska.gov
907-465-8140

FLORIDA DEPARTMENT OF TRANSPORTATION

Darryl Dockstader
Research Center Manager
Florida Department of Transportation Research Center
darryll.dockstader@dot.state.fl.us
(850) 414-4617

ILLINOIS DEPARTMENT OF TRANSPORTATION

Megan Swanson
Technical Research Coordinator
Illinois Department of Transportation Bureau of Research
Megan.Swanson@Illinois.gov
217-782-3547

MARYLAND DEPARTMENT OF TRANSPORTATION

Allison Hardt
Maryland State Highway Administration
ahardt@sha.state.md.us
410-545-2916

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Neil Mastin, Research Manager, 919-508-1865, jmastin@ncdot.gov

Steven Bolyard, Mobility, Safety, Roadway Design, 919-508-1874, sjbolyard@ncdot.gov

John Kirby, Planning, Environment, Transit, 919-508-1816, jkirby@ncdot.gov

Mustan Kadibhai, Pavement, Materials, Maintenance, Structures, 919-508-1819, mkadibhai@ncdot.gov

Curtis Bradley, Implementation Manager, 919-508-1832, cbradley8@ncdot.gov

Lamara Williams-Jones, Research Librarian, 919-508-1790, research@ncdot.gov

UTAH DEPARTMENT OF TRANSPORTATION

Cameron Kergaye, Ph.D., PMP, P.E.
Director of Research
ckergaye@utah.gov
801-965-2576

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Thomas Nicholas II, P.E., Ph.D.
University of North Carolina at Charlotte
tnichola@uncc.edu

FEDERAL HIGHWAY ADMINISTRATION

George Hoops, P.E.
Planning and Program Development Manager, North Carolina Division
ghoops@dot.gov
919-747-7022

FACILITATORS

John Overman, AICP
j-overman@tti.tamu.edu
817-462-0512

Kristi Miller, AICP
K-miller@tti.tamu.edu
972-994-2203

APPENDIX C. STATE TRANSPORTATION RESEARCH PROGRAM PRESENTATIONS

This appendix contains the peer state slide presentations used during the NCDOT Research Peer Exchange in the following order:

- Slides to Facilitate the Peer Exchange.
- Alaska Department of Transportation.
- Florida Department of Transportation.
- Illinois Department of Transportation.
- Maryland Department of Transportation.
- North Carolina Department of Transportation.
- University of North Carolina at Charlotte.
- Utah Department of Transportation.

NORTH CAROLINA
Department of Transportation

Sustaining and Growing a Research Program During Times of Change

Neil Mastin

September 25-26, 2017

Welcome and Introductions

- North Carolina DOT
- Participating Peers
- Facilitators

ncdot.gov

Participants

Invitee	State
Carolyn Morehouse	Alaska
Darryl Dockstader	Florida
Cameron Kergaye	Utah
Megan Swanson	Illinois
Allison Hardt	Maryland
Steven Bolyard	NCDOT R&D
Curtis Bradley	NCDOT R&D
Mustan Kadibhai	NCDOT R&D
John Kirby	NCDOT R&D
Neil Mastin	NCDOT R&D
Lamara Williams-Jones	NCDOT R&D
Jimmy Travis	NCDOT
George Hoops	FHWA

3

ncdot.gov

Self Introductions

- Where are you from?
- What is your role at work?
- What are your expectations?
- What is your advice from other peer exchanges?

4

ncdot.gov

Icebreaker

Share three things about yourself.

Only two have to be true.

- It can be…
  - About your current job
  - About a previous job
  - An activity or hobby
  - Interesting place(s) you have been
  - Interesting or famous person you met
  - **One of the above can be a lie**

5

ncdot.gov

Agenda - Day 1

8:00	**Introductions**
9:00	**Research Program Structure and Successes Part 1**
10:00	**Break**
10:15	**Finish Overview**
11:15	**Follow-up Discussion driven by Presentations**
12:00	**Lunch – Provided**
1:00	**Continue follow-up discussion**
1:45	**Library Functions**
2:30	**Travel to NCSU Automotive Laboratory**
3:00	**Technical Tour - Demo of six-axis Driving Simulator**
6:30	**Dinner (Reservations at a local restaurant)**

6

ncdot.gov

Agenda Day 2

8:00	**Mechanisms for coping with change**
8:45	**Break**
10:00	**Engaging with "The Field" and External Customers**
11:45	**Lunch – Local Restaurant**
1:00	**Implementation and Value of Research**
2:45	**Break**
3:00	**Outreach, wrap-up and summarize**

7

ncdot.gov

Objectives

At the end of this session you will be able to:

- Describe a peer exchange
- Describe the purpose of this peer exchange
- Identify participants and describe your role in peer exchange
- Identify expectations for peer exchange

8

What is a peer exchange?

Purpose and expectation of peer exchange

- FHWA requirement, guides, resources
- Exchange ideas and best practices
- Prepare report

Peer Exchange Topic

- **Sustaining and Growing a Research Program During Times of Change**

WHY?

- The Golden Circle – TED talk (8 minutes)
- https://www.ted.com/talks/simon_sinek_how_great_leaders_inspire_action

Research Programs

- **Research Program Structure and Successes**
- **Overview**

ncdot.gov

Research Programs Structure and Success

- **State DOT Presentations**
  - **Part 1: 9-10**

13

ncdot.gov

Research Programs Structure and Success

- **State DOT Presentation**
  - **Part 2: 10:15-11:15**

14

ncdot.gov

Research Programs cont'd.

Discussion on Presentations:

- What has worked for you?
- What did you learn that was interesting?
- What challenges do you see in the near future?

15

ncdot.gov

Afternoon Session

1:00 **Research Program follow-up discussion**

2:30 **Travel to NCSU Automotive Laboratory**

6:30 **Dinner (Reservations at a local restaurant)**

16

Discussion Continued

- What are you most proud of/happy about regarding your state research program?
- How much do you rely on universities to drive programs?
  - What percentage of your problem is made up of university ideas
  - How do you make sure you get best value from those projects?

Library Functions

- Do you have a library?
- Increasing library use and awareness across the agency
- Library measures in a changing environment
- What is most effective at other states?
- What role does the library play in your Agency?

ncdot.gov

Travel to NCSU Automotive Laboratory

- **Technical Tour - Demo of six-axis Driving Simulator**

19

ncdot.gov

Day 2

8:00	**Mechanisms for coping with change**
8:45	**Break**
10:00	**Engaging with "The Field" and External Customers**
11:45	**Lunch – Local Restaurant**
1:00	**Implementation and Value of Research**
2:45	**Break**
3:00	**Outreach, wrap-up and summarize**

20

ncdot.gov

Mechanisms for coping with change

- Staff turnover
- How do we expand the pool of participants in research projects/committees?
- Building a research skillset for our customers and champions
- National Engagement – NCHRP/TRB etc

21

ncdot.gov

Engaging with “The Field” and External Customers

- Outreach
- Private sector
- Identifying needs

22

ncdot.gov

Implementation and Value of Research

- UNCC Overview
- Implementation
- Implementation Manager
- Tracking
- Measuring Benefits
- Private Sector Participation

23

ncdot.gov

Outreach, wrap-up and summarize

24

Alaska Department of Transportation & Public Facilities

North Carolina Peer Exchange

September 25&26, 2017

About AKDOT&PF

Vital Statistics 2017

- ~3500 Employees
- 254 Airports
- 11 Ferries
- 30 Ports
- ~14,800 Lane-miles Highway
- 766 State owned Bridges
- 660 Public Facilities
- $640 Million Operating Budget
- >$800 Million Capital Budget (mostly federal$)

Note: Alaska Railroad a separate agency

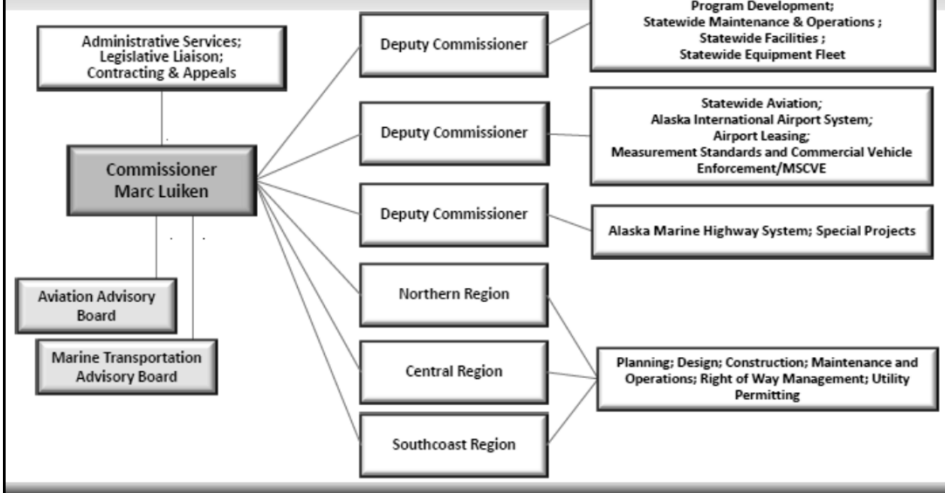
Integrity · Excellence · Respect

Organization Charts

- Alaska DOT&PF
  - Statewide Design & Engineering Services
    - Research, Development & Technology Transfer

Integrity · Excellence · Respect

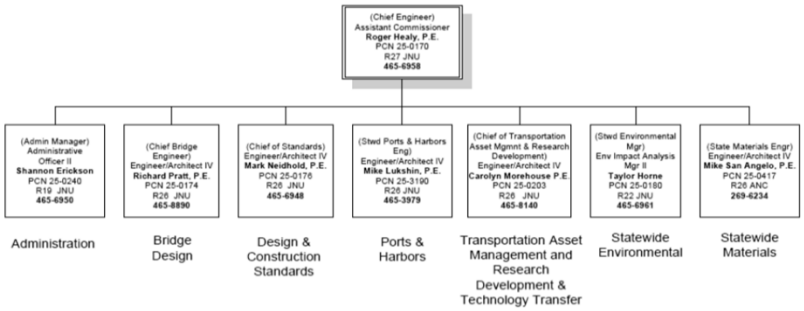
DOT&PF Organization



Integrity · Excellence · Respect

Department of Transportation & Public Facilities
Statewide Design & Engineering Services

CHIEF ENGINEER'S OFFICE



3/10/2015

Integrity · Excellence · Respect

RD&T2

Integrity · Excellence · Respect

RD Mission & Money

- Money STIP line annually $2.5 Million + 650K
  - -Mandatory National Dues
  - -Pooled Funds
  - -Rapid Research
  - -Deployment
  - = “big” research projects.
- Mission – Projects that can be implementable and continuously improve our infrastructure

Integrity · Excellence · Respect

What we do

- Provide latest technology, materials, and procedures for conducting business.
- Assists Department staff with problem solving by providing information to solve a particular problem or assisting in the development of research to solve problems.
- Provides statewide technical training program
- Provides education and technical assistance outreach to local governments and DOT&PF

Integrity · Excellence · Respect

Who does it

- Research Advisory Board (RAB) – Executive
  - chief engineer
  - regional preconstruction chief
  - regional construction chief
  - Maintenance representative**
  - FHWA Alaska Division Representative
  - Research Chief (facilitation only)
- Expert Advisors Committee

Integrity · Excellence · Respect

Expert Advisors Committee

- Ports & Harbors
- Program Development and Planning
- Director Information Systems
- Administration
- Research (RAC liaison)
- Bridges
- Standards
- Hydraulics
- Pavement
- Materials
- Environmental
- Safety & Traffic

Integrity · Excellence · Respect

RD&T2 Staff

Research

- Solicit, compile, evaluate research needs
- Develop & Manage
- Implementation Plans
- Outreach
- Track Research
- Serve on national committees

Technology Transfer

- Solicits complile evaluate training needs
- Develop & Manage
- Training Plan
- Training Clearinghouse
- Outreach
- Track National program
- Serve on National Committees

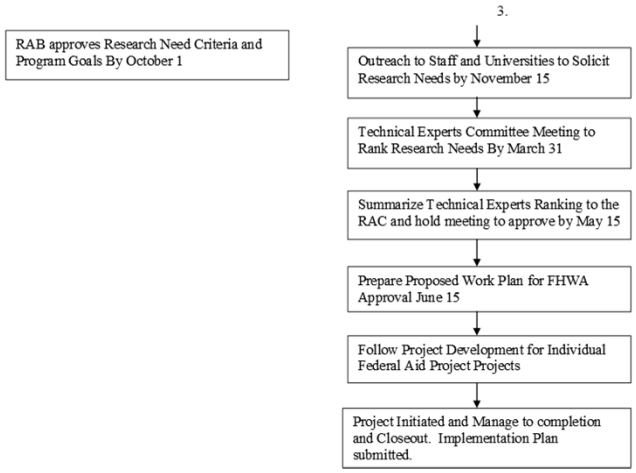
Integrity · Excellence · Respect

Project Needs Statement

- http://www.dot.state.ak.us/stwddes/research/research.shtml
- Form coordinated with DOT Research Contact
- Champion (internal)
- Brief Literature Review
- Objectives and Summary-Applied research
- Benefits
- Estimate and potential match $

Integrity · Excellence · Respect

How we do it



Integrity · Excellence · Respect

10 Questions (yes = 1; no = 0)

1) Statewide importance

2) Has champion and high likelihood for implementation (new process, specification, process, policy)

3) Strategic Highway Safety Plan

4) Infrastructure preservation

5) Cost savings for M&O

Integrity · Excellence · Respect

10 Questions (yes = 1; no = 0) Cont.

6) Efficient project delivery
7) Improve quality of M&O services or projects
8) Improve intermodal continuity
9) Match University, multi-agency or local
10) Economic development within the state

FFY 17/18 Need Statements Summary

Category	# Need Statements
Administration & Policy	0
Bridges & Structures	3
Environmental	1
Hydraulics & Hydrology	0
Materials	5
Maintenance & Operations	0
Safety & Traffic	4

Total 13

Research Project Development

- Select Project Manager/Principal Investigator
- Funding for FHWA/Contract (RSA or PSA)
- Formation of Technical Advisory Group
- Project Progress Reports/Interim Report
- Publication/Distribution Final Report
- Technology Transfer and Outreach
- Project Implementation Plan

Integrity · Excellence · Respect

Implementation

- What are the “products” expected?
- How and where can findings be applied within the Department?
- Who is the audience or “market” for this product?
- Will findings require a revision or new process?
- Will the findings be economically justifiable?
- Will findings improve service to the citizens of the State of Alaska?

Integrity · Excellence · Respect

Implementation Techniques

- Production and distribution of Final Reports
- Seminars
- T2 Trainings/Workshops/Tech Briefs
- T2 Newsletter
- FHWA experimental feature
- Change Department policy and procedures

Integrity · Excellence · Respect

Program Evaluation

- Program – all Projects
  - Contact or PI Evaluation
  - Monitor implementation efforts for three years.
- Program
  - External Peer Review
  - Performance Measures - % meet goals. % implemented, %On budget, schedule

Integrity · Excellence · Respect

Integrity · Excellence · Respect

FDOT Participation in
NCDOT PEER EXCHANGE

25 September 2017

Darryll Dockstader
Florida Department of Transportation
Research Center

STAFF AND BUDGET

- Research Program Staff – 4.67 FTE
  - Program Manager
  - Development Coordinator
  - Performance Coordinator
  - Business Systems Coordinator
  - Technology Transfer Staff (two shared positions)
- $14M Research Program Funding
- Internship and Recruitment Program Staff – 2 FTE
  - North and South Regional Coordinators

ORGANIZATIONAL STRUCTURE

- The FDOT Research Center is a cost center within the Department with funding programmed in the 5-year work program, which is a five-year plan of transportation projects as defined in section 339.135, F.S.
- Recently reorganized to report to Assistant Secretary of Strategic Development (previously reported to Chief Engineer)
- Internship and Recruitment Program cooperatively managed with Human Resources

RESEARCH PROGRAM DEVELOPMENT

- Annual research needs solicitation
  - Sent in October to Central Office research coordinators and Districts
  - Returned in January
  - Peer and executive review
  - Approved list sent to FHWA division office
- Mid-cycle requests available based on available funding
- Pilot/demo projects (year round based on available funding)
- National/regional research programs
  - NCHRP, TPF, AID support projects, etc.

CHALLENGES

- Consistent, effective program management. Currently there are
  - 80 project managers statewide
  - 149 projects
  - 81 principal investigators
- Effective, one-stop, program/project management system (database)
- Resources required to effectively manage implementation and performance analysis

SUCCESSES

- Engagement and executive support
- Implementation and performance analysis
- Internship and Recruitment Program
  - 349 intern hires since Fall 2013
  - 29 interns hired into full-time positions

Research Reset

Megan Swanson
Technical Research Coordinator
Bureau of Research

Illinois Department of Transportation

Reorganization

- Separated from Central Bureau of Materials in the IDOT Reorganization
- Part of the Office of Planning and Programming
- Includes the:
  - IDOT Library,
  - Pavement Technology Unit, and
  - Technical Research Unit.
- Headquartered at 126 East Ash, with the Library in the Hanley Building, and Pavement Technology field personnel at Cook Street

Illinois Department of Transportation

Technical Research Unit

- Technical Research is funded with State Planning and Research Part 2 Funds, and includes:
  - State level research:
    - Illinois Center for Transportation (ICT), and
    - Physical Research Reports
  - National level research:
    - AASHTO Technical Service Program,
    - FHWA Transportation Pooled Funds Program,
    - National Cooperative Highway Research Program, and
    - Transportation Research Board

Illinois Department of Transportation

Total FY18 Work Program: $10.1M

By Funding Sources

- **Federal SPR, Part 2 funds (FY18)**
- $6.5M for Contract Research (includes 20% match)
- ~$386,500 for AASHTO Technical Service Programs
- ~$227,000 for annual TRB contribution
- ~$1.6M for annual NCHRP contribution
- ~$690,500 for current Pooled Funds
- $300,000 contingency for new Pooled Funds
- **State funds (FY18)**
- Administrative expenses for contract research program ($430,000 for FY18)

Illinois Department of Transportation

State Level Research

- Contract research is administered by the **Illinois Center for Transportation (ICT)** in Rantoul, IL
- **Goal:** To provide innovative, implementable solutions to transportation problems, to work collaboratively with FHWA, IDOT subject matter experts, and to utilize expertise within academia.

Illinois Department of Transportation

State Level Research

- Intergovernmental agreement (IGA) between IDOT and University of Illinois Board of Trustees - 4 Intergovernmental Agreements since 2005
- Current IGA FY 2018 – FY 2020 with one option for 2 year extension
- Roughly $6 Million annually
- **Research Project Types**
  - Regular – Part of the annual program cycle, approved by Exec. Comm.
  - Special - $36,000 and results in 6 months, approved by BR
  - Off Cycle – bigger than a SP but too urgent to wait for the regular cycle, approved by Exec. Comm.

Illinois Department of Transportation

State Level Research

- **Research Project Types**
  - Regular – Part of the annual program cycle, approved by Exec. Comm.
  - Special - $36,000 and results in 6 months, approved by BR
  - Off Cycle – bigger than a SP but too urgent to wait for the regular cycle, approved by Exec. Comm.

- **Research Project Types**
  - 23 Active Projects as of June 30, 2017
  - 14 new projects starting between July 1, 2017 and January 1, 2018

Illinois Department of Transportation

Contract Research Cycle

- Annual Cycle
- May -July: Technical Advisory Groups (TAGs) discuss research needs and implementation
- August: Research needs posted to ICT website
- October 1: Deadline for problem statement submittal for current cycle (problem statements accepted year-round)
- October – November: Technical Advisory Groups review and vote on problem statements
- February: ICT Executive Committee approves projects for funding
- February – July: Select researcher, Technical Review Panel; sign off on work plan and budget
- August/January: Start work

Illinois Department of Transportation

Technical Research Heirarchy

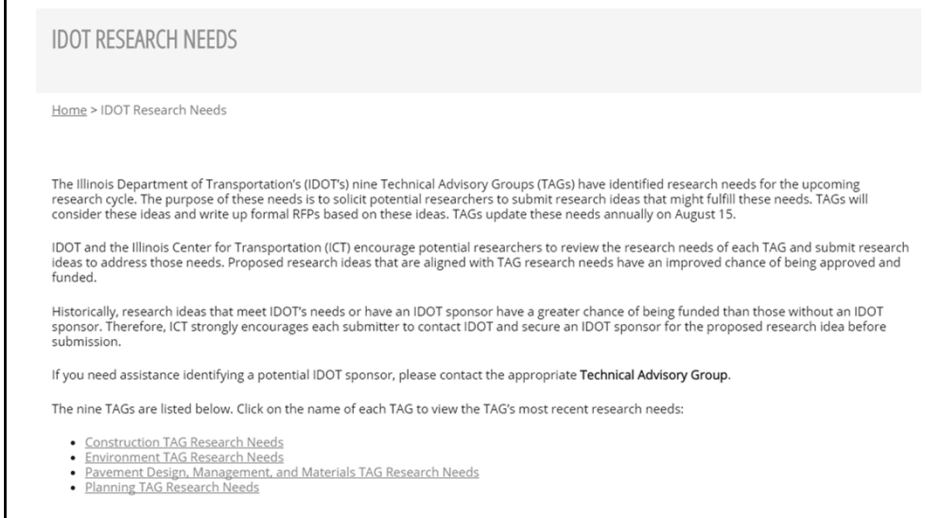
Illinois Department of Transportation

Technical Review Panels

- Technical Review Panels: Chair, District, Central Office, FHWA, Academia, BR, Other Governmental Agencies, and Industry
- Subject Matter Experts – Administrative and Front Line
- Guide the Research
- Spearhead Implementation

Illinois Department of Transportation

Research Needs



IDOT RESEARCH NEEDS

Home > IDOT Research Needs

The Illinois Department of Transportation's (IDOT's) nine Technical Advisory Groups (TAGs) have identified research needs for the upcoming research cycle. The purpose of these needs is to solicit potential researchers to submit research ideas that might fulfill these needs. TAGs will consider these ideas and write up formal RFPs based on these ideas. TAGs update these needs annually on August 15.

IDOT and the Illinois Center for Transportation (ICT) encourage potential researchers to review the research needs of each TAG and submit research ideas to address those needs. Proposed research ideas that are aligned with TAG research needs have an improved chance of being approved and funded.

Historically, research ideas that meet IDOT's needs or have an IDOT sponsor have a greater chance of being funded than those without an IDOT sponsor. Therefore, ICT strongly encourages each submitter to contact IDOT and secure an IDOT sponsor for the proposed research idea before submission.

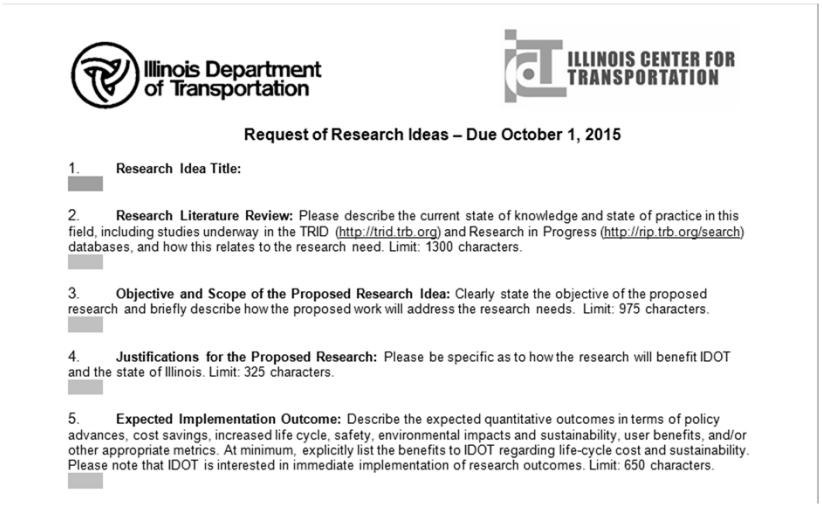
If you need assistance identifying a potential IDOT sponsor, please contact the appropriate **Technical Advisory Group**.

The nine TAGs are listed below. Click on the name of each TAG to view the TAG's most recent research needs:

- Construction TAG Research Needs
- Environment TAG Research Needs
- Pavement Design, Management, and Materials TAG Research Needs
- Planning TAG Research Needs

Illinois Department of Transportation

Research Problem Statements



Illinois Department of Transportation

ILLINOIS CENTER FOR TRANSPORTATION

Request of Research Ideas – Due October 1, 2015

1. **Research Idea Title:**

2. **Research Literature Review:** Please describe the current state of knowledge and state of practice in this field, including studies underway in the TRID (http://trid.trb.org) and Research in Progress (http://rip.trb.org/search) databases, and how this relates to the research need. Limit: 1300 characters.

3. **Objective and Scope of the Proposed Research Idea:** Clearly state the objective of the proposed research and briefly describe how the proposed work will address the research needs. Limit: 975 characters.

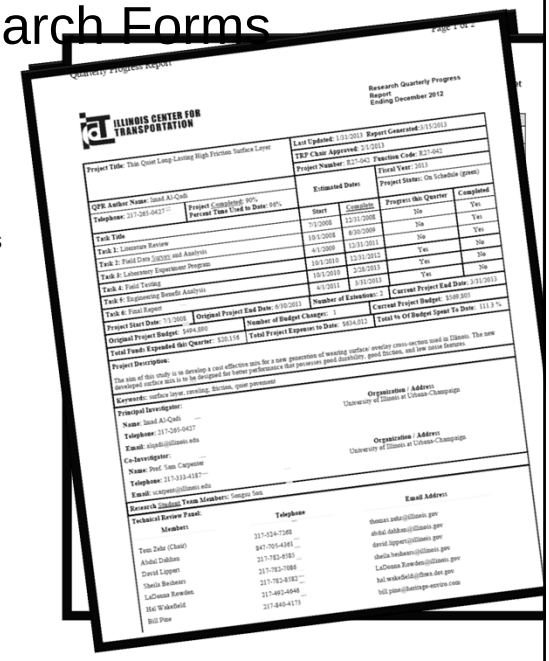
4. **Justifications for the Proposed Research:** Please be specific as to how the research will benefit IDOT and the state of Illinois. Limit: 325 characters.

5. **Expected Implementation Outcome:** Describe the expected quantitative outcomes in terms of policy advances, cost savings, increased life cycle, safety, environmental impacts and sustainability, user benefits, and/or other appropriate metrics. At minimum, explicitly list the benefits to IDOT regarding life-cycle cost and sustainability. Please note that IDOT is interested in immediate implementation of research outcomes. Limit: 650 characters.

Illinois Department of Transportation

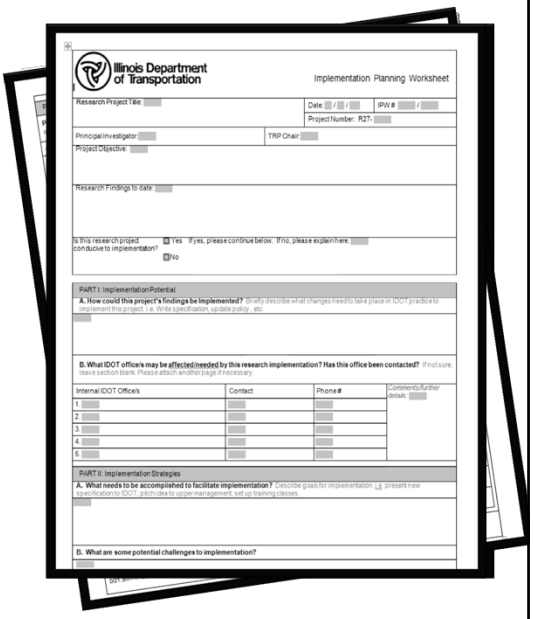
Research Forms

- Online Quarterly Reporting
- Time and Budget Extensions



Research Forms

- Implementation Planning Worksheet
- TRP Close-out Evaluation



Deliverables

Three Month Editing Process

- ICT Technical Editor paid through IGA (Technology Transfer and Editorial Support)
- ICT Project Managers send reminders at 6 months and 4 months prior to project end date
- PI provides draft report to Technical Editor 3 months before the project end date for initial edit (1 month)
  - Spelling, Grammar, Missing Information
- TRP review
  - "Back and forth" to address any issues, concerns or to provide clarifications
- Final editing
  - Incorporating all changes, complete pagination, table of contents and Technical Report Documentation Page

Implementation

- R27-128 Illinois Flexibility Index Test (IFIT):
  - Selected as an AASHTO RAC Sweet 16 project (IDOT projects selected 6 of last 8 years)
  - AASHTO provisional test specification TP-124 (result of R27-128) was approved in March of 2016
- R27-137 Evaluation of PCC Pavement and Structure Coring and In Situ Testing Alternatives
  - Illinois is submitting recommended changes to AASHTO T-24 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete based on the findings.
  - Illinois will be implementing our own IL modified version of AASHTO T-24 this year.

Illinois Department of Transportation

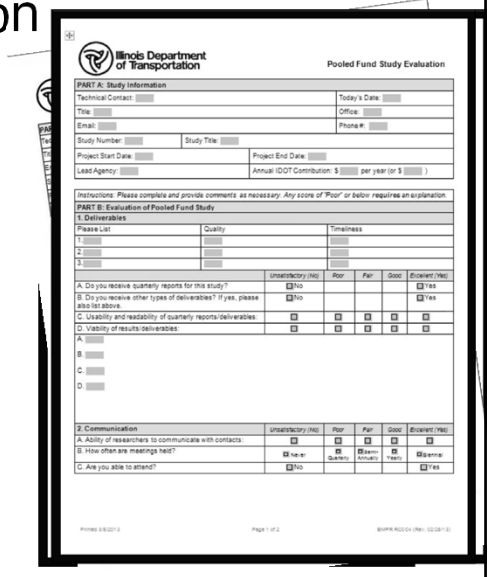
Accomplishments

- The Safety Project Outreach webinar series.
  - Pavement Markings
  - Right Turn Skew
  - Flashing Yellow Arrows
- 450+ attendees (some represented a group of viewers)
  - ~60 Illinois cities and local jurisdictions, as well as registrants from Arkansas, Missouri and Iowa.
  - 452 PDH certificates were issued
- Webinars are available on IDOT's YouTube channel.

Illinois Department of Transportation

Pooled Funds - Tracking & Evaluation

- Participation in FHWA Transportation Pooled Fund Program (~30 studies underway)
  - Pooled Fund Approval Form
  - Annual Evaluation
  - Close-out Evaluation



Illinois Department of Transportation

Pooled Fund Study Evaluation

PART A: Study Information	
Technical Contact:	Today's Date:
Title:	Office:
Email:	Phone #:
Study Number:	Study Title:
Project Start Date:	Project End Date:
Lead Agency:	Annual IDOT Contribution: $ per year (or $)

Instructions: Please complete and provide comments as necessary. Any score of "Poor" or below requires an explanation.

PART B: Evaluation of Pooled Fund Study

1. Deliverables

Please List	Quality	Timeliness
1.		
2.		
3.		

	Unsatisfactory (No)	Poor	Fair	Good	Excellent (Yes)
A. Do you receive quarterly reports for this study?	☐No				☐Yes
B. Do you receive other types of deliverables? If yes, please also list above.	☐No				☐Yes
C. Usability and readability of quarterly reports/deliverables:	☐	☐	☐	☐	☐
D. Viability of results/deliverables:	☐	☐	☐	☐	☐

A:
B:
C:
D:

2. Communication	Unsatisfactory (No)	Poor	Fair	Good	Excellent (Yes)
A. Ability of researchers to communicate with contacts:	☐	☐	☐	☐	☐
B. How often are meetings held?	☐ Never	☐ Quarterly	☐ Semi-Annually	☐ Yearly	☐ Biennial
C. Are you able to attend?	☐No				☐Yes

Printed: 6/6/2013 Page 1 of 2 BMPR RC014 (Rev. 02/28/13)

National Level Involvement
NCHRP, SHRP2, RAC and TRB

- 36 employees representing IDOT on 60 different national level research efforts
  - 40 National Cooperative Highway Research Program panels (6 serving as Chair of the panel)
  - 20 Transportation Research Board Standing Committees
  - 11 of the 36 employees serve on multiple panels and committees

Illinois Department of Transportation

NCHRP, SHRP2, RAC and TRB

- Participation in National Cooperative Highway Research Program (NCHRP)
  - We leverage approximately **$28** in research-related activity for every **$1** we invest in NCHRP activities
- Participating in SHRP 2 Implementation
  - Very limited involvement
- AASHTO – RAC
  - Active in Region 3, Value of Research and Program Management and Quality Task Forces
- Participation in Transportation Research Board (TRB)
  - 10 Employees attended TRB
  - We leverage approximately **$76** in research-related activity for every **$1** we invest in TRB activities

Illinois Department of Transportation

Questions?

Megan Swanson
Technical Research Coordinator
Bureau of Research

(217) 782-3547

Illinois Department of Transportation

Research Program Overview

Allison Hardt
Maryland Department of Transportation
State Highway Administration
September, 2017

Organizational Structure

- Located at the State Highway Administration, a business unit within MDOT
- Division within the Office of Policy and Research
- Office reports directly to the State Highway Administrator
- Three full-time employees

State & Federal Funds

- Research program is approximately $3.2M/year
- Approximately $2.8M in federal funds
- Approximately $400K in state matching funds

Responsibilities

- Administer and manage SHA's SPR, Part 2 Research Program
- Support participation in national research programs (NCHRP, TPF, AASHTO TSPs)
- Develop and administer research and technical assistance agreements with IHEs
- Manage a summer internship program with Morgan State University
- Serve on the AASHTO Research Advisory Committee
- Serve as the TRB State Representative

Research Needs Process

Annual call for research needs emailed to the Senior Management Team **February**

Leadership determines which projects will be funded **May**

Annual request for proposals is sent to IHEs and proposals are awarded **June - August**

Work Program sent to FHWA for approval **September**

Research Ideas Form

RESEARCH IDEA LIST

Office Name:
Coordinator Name:

Ranking	Research Idea		Technical Champion
1	**Title**		
	The problem needing solution	*(What is the specific problem? How does it impact MDOT/SHA?)*	
	Anticipated Benefits	*(If this research is successfully completed, how will it benefit MDOT/SHA?)*	
	Urgency	*(How urgent is this research? Is it important that it be completed by a particular date? What date and why?)*	
	Desired deliverable?	*(What is the desired deliverable resulting from the research, e.g. new or improved technical standard, plan, or specification; manual or guidelines; training; new or updated internal policy; improved business practice; or final report of findings? Please specify.)*	
2	**Title**		
	The problem needing solution		
	Anticipated Benefits		
	Urgency		
	Desired deliverable?		
3	**Title**		
	The problem needing solution		
	Anticipated Benefits		
	Urgency		
	Desired deliverable?		

Check list:

- Has the prioritized list been approved by your Senior Manager?
- Have you identified a champion for each idea?
- Were all of the research idea forms less than two pages in length?
- If the idea is best suited for a consultant, does your office have open-end agreements with the potential consultants?

**Important notes to the coordinator:*

- Please do NOT talk with professors or consultants about these topics.
- The due date for this list is February 28th, 2017.
- If you need a meeting to discuss the research ideas between the Research Division (RD) and your Senior Manager, please inform RD by February 14th. The meeting should happen before the due date.
- The RD will work with you and your identified champion to write the Request for Proposal once a research idea is selected.

Research Needs – why this process?

- Started in 2014
- View from leadership that research ideas were too often driven by university researchers
- Increase competition among researchers

Research Needs –pros & cons

Pros:

- Needs are internally driver - offices submit what matters to them
- Ideas have leadership support
- Multiple researchers can respond to the RFP

Cons:

- Researchers are better at thinking through research ideas
- Less innovation/risk

Program Challenges

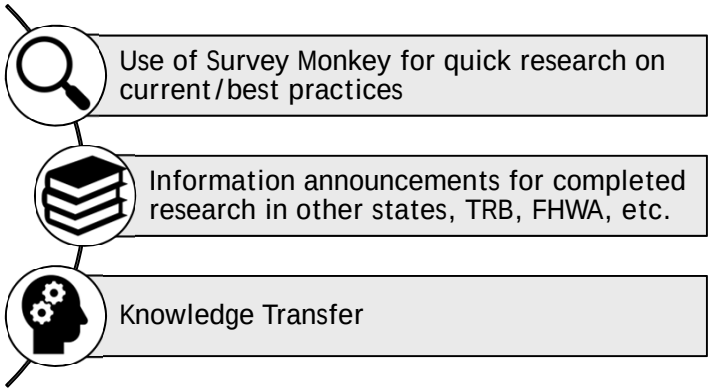
Internal:

- Leadership/Management Turnover
- Technical offices lack time to provide oversight
- No library
- Establishing a link between "innovations and research"

External:

- Lack of researcher competition
- Quality of deliverables

Successful Initiatives



Questions?

NORTH CAROLINA
Department of Transportation

2018 Program Highlights and Call for Research Needs

Neil Mastin, PE – R&D Manager

Summer 2017

NCDOT Research Basic Info

6 Staff Members

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

Located in Division of Highways→Technical Services→Transporation Management Unit

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

How is Research Funded?

State Planning and Research (SPR) Part 2 – (0.5% of Annual Federal Allocation) ~ $5.1M

- Annual Work Plan $3.2-$4M per year
- NCHRP – Share cost with planning - $300k per year
- AASHTO Pooled Fund Program - $600k per year

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 **~20 - 30** new projects per year

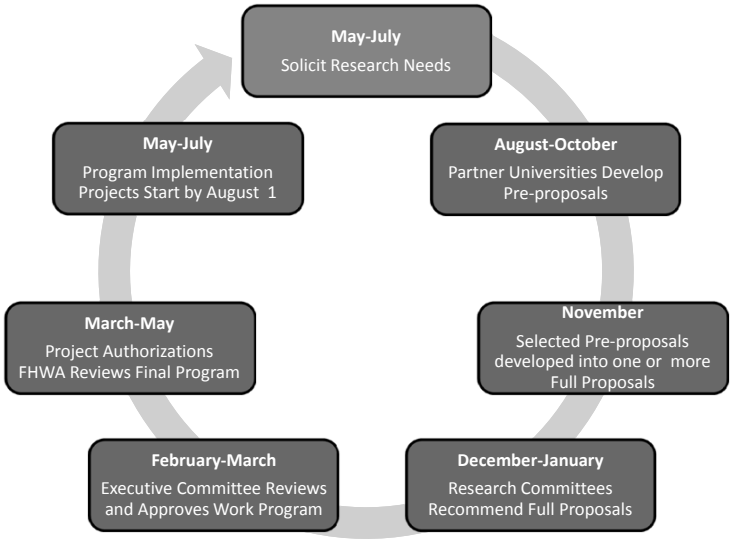
More than **90** active research projects and programs

Nearly all NCDOT activities are eligible for research funding

Annual Research Program Goals

- Improve NCDOT Planning, Engineering and Business Practices
- Support NCDOT Operations and Maintenance Activities
- Conduct research that can be implemented
- Develop relationships with researchers so they understand the needs and operations of NCDOT to maximize research benefits

Research Program Annual Timeline



Annual Program FAQ

Who typically submits Research Needs?

- Anyone at NCDOT, with manager approval
- University researchers in coordination with DOT business units

Who decides on what projects are funded?

- NCDOT selects all projects through a multi step process

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

- Typically 1 year from close of solicitation period*
  - *Contingency funds are available for rapid / off cycle needs

Annual Program FAQ (2)

How long do Research Projects Last?

- *Variable*
  - 2 years is typical, can be as short as 6 months or as long as 3 years

What types of Projects are common?

- Laboratory / Field Testing and Analysis
- Policy / Practice / Design
- Best Practice Synthesis
- Etc, etc.

How are Projects managed?

- Research Unit handles fiscal and contract portion
- Steering Committee reviews technical content
- Committee Chair is often the idea submitter

Project Selection Oversight

Research and Development Unit Oversees Overall Program

- Solicits Ideas
- Research Engineers Manage Projects
- Coordinates all Activities

Research Subcommittees Review and Recommend Proposals for Funding

- Environmental
- Structures and Geotech
- Pavement, Materials, Maintenance
- Planning, Policy and Transit
- Traffic, Mobility and Safety

Research Executive Committee Approves Work Program

- Senior Management
- Executives

Research Library Services
(If you need help finding…anything)

- Completely revamped and reorganized library
- 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

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

Past and Present University Participants

Appalachian State*
Duke
East Carolina*
Elizabeth City State
NC A&T*
NC Central*
NC State and ITRE*
UNC-Asheville*
UNC-Chapel Hill and HSRC*

* Master Agreements

UNC-Charlotte*
UNC-Greensboro
UNC-Wilmington
Indiana State*
Michigan State*
Virginia Tech*
Central Florida*
Illinois
Auburn

Current Research

Technical Assistance

($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

National Initiatives

Long-Term Pavement Performance Study

Pooled Fund – NCDOT Manager

National Representative

Research Advisory Committee Representative

Coordinator for NCHRP Pooled Funds

13

Contact Info

Neil Mastin	Research Manager	919-508-1865	jmastin@ncdot.gov
Steve Bolyard	Mobility, Safety, Roadway Design, etc	919-508-1874	sjbolyard@ncdot.gov
John Kirby	Planning, Environment, Transit	919-508-1816	jkirby@ncdot.gov
Mustan Kadibhai	Pavement, Materials, Maintenance, Structures	919-508-1819	mkadibhai@ncdot.gov
Curtis Bradley	Implementation Manager	919-508-1832	cbradley8@ncdot.gov
Lamara Williams-Jones	Research Librarian	919-508-1820	lcwilliwams2@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/planning/Pages/ResearchAnalysis.aspx

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

14

Thank You

Capturing and Communicating the Value of NCDOT Research

Thomas (Tom) Nicholas II, P.E., Ph.D.
tnichola@uncc.edu
August 15,2016

UNC CHARLOTTE

Agenda

1. Applied Research Process
2. Value of Research
3. Forecasting
4. Communication
5. Q & A

UNC CHARLOTTE

Before we start…

- How do you define a successful research project?
  - The costs that can be saved from implementing results?
  - The knowledge gained from the research project?
  - Relationships/experience built through the research process?
  - Does a project have to be implemented to be considered successful?

In other words, how do you define value?

UNC CHARLOTTE

"Value"

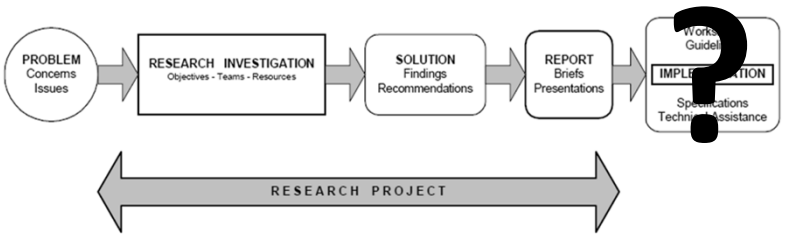
- Unfortunately from a research standpoint, "value" means different things to different people. Monetary for sure, but effort, learning opportunities, and base knowledge also can be of equal or more value that monetary value.

- How can the research process help ensure "value" is obtained for stakeholders.

UNC CHARLOTTE

The Applied Research Process

- The applied research process (cradle to grave), is often described as identification, investigation, formulation, reporting and implementation.



Applied Research Process, (Hartman, et al., 2001)

UNC CHARLOTTE

Why do we perform research?

- Solve a problem
  - Applied research
  - Narrower scope
- Develop understanding
  - Basic research
  - Further knowledge
  - Identify opportunity
  - Broader Scope

UNC CHARLOTTE

Questions we have to ask…

- Are we solving the right problem?
- Are we funding the right project?
- Is the proposal solving our problem?
- Do the results of the project impact our way of thinking? The bottom line?
- How does this project add value….

UNC CHARLOTTE

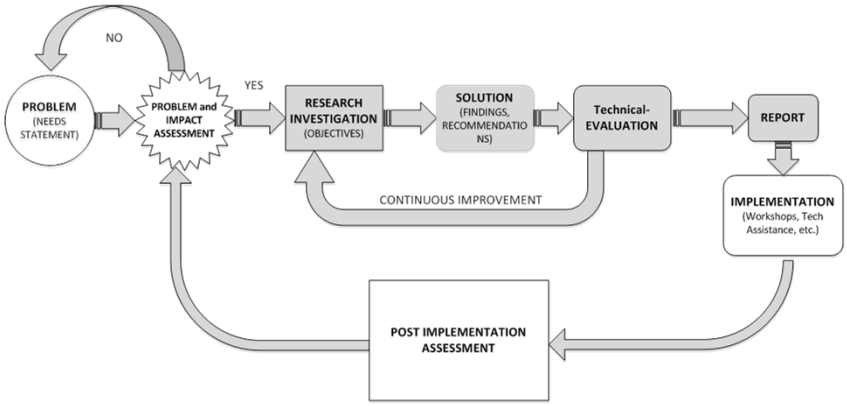
Continuous Improvement

- Continuous Improvement is a methodology that allows us to take a break, assess, correct and move forward in a direction that adds value.

UNC CHARLOTTE

Improving the Applied Research Process

- The new Applied Research Model (Nicholas):



UNC CHARLOTTE

So how does your Stakeholders Define Value?

- This question is not so easily defined for a group, state, or nation.
  - Money
  - Safety
  - Knowledge (Specifications, Statutes, Design Directives, etc.)
  - Immediately Implementable
  - Environmental/Sustainable
  - Experience (as with anything, the more you do it..)

UNC CHARLOTTE

Survey of Stakeholders

- Survey sent out in February 2017 to NCDOT R & D Stakeholders
- Respondents were asked what defined a successful research project and ranked what impacted the research process
- Some demographics such as research project experience, role in the research process and current state of practice assessment were obtained

UNC CHARLOTTE

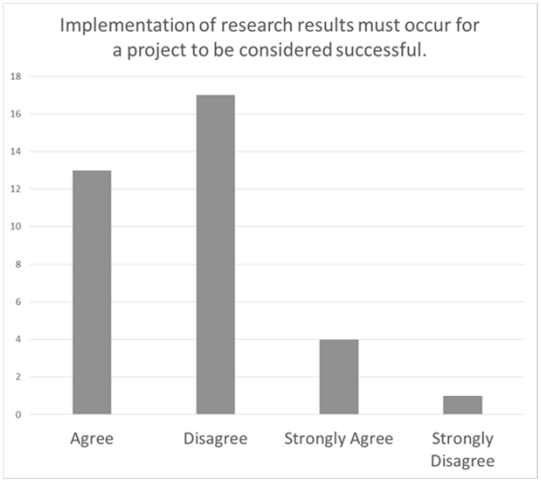
Survey and Results

- How do you define success?

Definition of a successful Research Project	
Knowledge Gained	77.14%
Detailed Implementation Plan	17.14%
Quality Final Report	5.71%

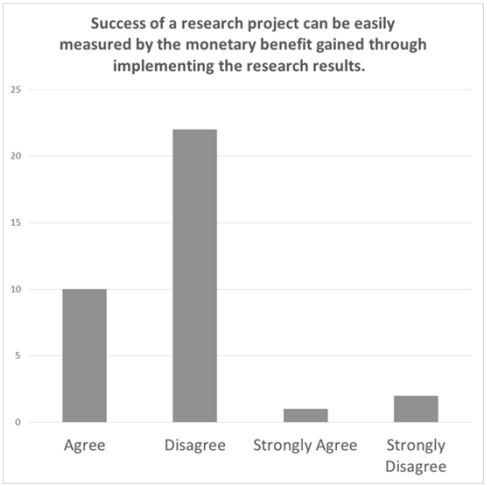
UNC CHARLOTTE

Implementation – How important is it?



UNC CHARLOTTE

What about Cost-Benefit?



UNC CHARLOTTE

What does this mean?

- Definition of the Value of research will have to be flexible and communicated in different ways to different constituents.
- Even though the results about monetary gains from research were divided, it is still a universal language that many understand.

UNC CHARLOTTE

Cost Benefit Analysis

- Value added by a research project can be defined through a cost-benefit analysis (ratio) which generally can be defined as (Ellis, et al., 2003):

$$B/C = \frac{N \times K \times NB}{RC + IC}$$

B/C = the benefit-cost ratio for a research and implementation effort

N = the number of "highway units" or "implementation units" for which the research results are implemented

K = an adjustment factor to account for the staged implementation of the project

NB = the net benefit per "highway unit" or "implementation units" for which the research results are implemented

RC = the cost of the research project

IC = the cost for implementation the results of the research project, which can be estimated as a given percent of RC

UNC CHARLOTTE

Cost Benefit Analysis

- Editing Ellis' equation for account for research instead of highway projects:

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

B/C = the benefit-cost ratio for a research and implementation effort
K = Impact Factor for knowledge, publications, specs, etc.
HB = "Hard" Benefits based on per year calculation
SB = "Soft" Benefits based on per year calculation
RC = the cost of the research project

UNC CHARLOTTE

Cost Benefit Analysis

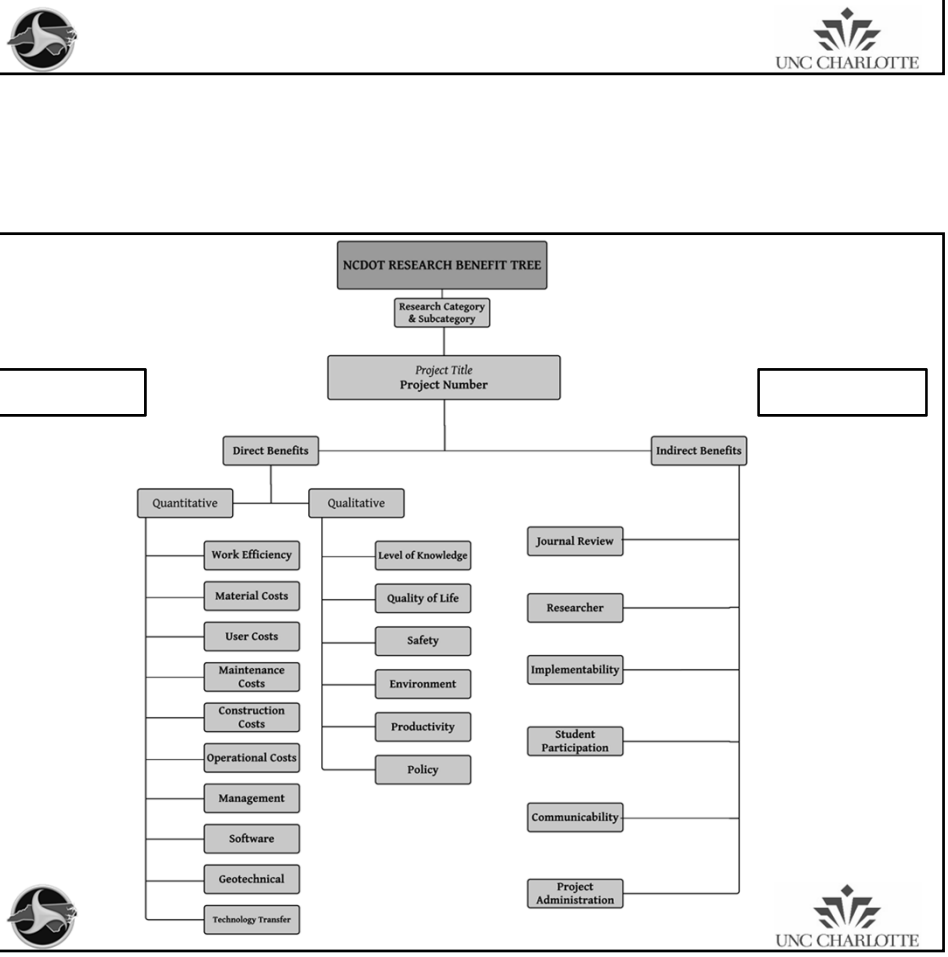
- If monetary benefit is to be used, a methodology must be developed to calculate both hard costs (quantitative) and soft (qualitative) costs

- A benefit tree was developed as a framework for calculations

UNC CHARLOTTE

Proposed Scope of Work

- Tangible benefits represent the benefits readily computed in terms of dollars such as a reduction in material costs, increase in infrastructure life cycle, production increase, etc.
- Intangible benefits such as quality of life, improved safety measures, environmental impacts, etc. will be converted to benefit dollars.



Hard Benefit Example

- Project 2013_06 Impact of Binders from Waste Materials. Material replacement benefits.

Material	Cost Per Ton
Virgin Aggregates	$ 22.00
PG 76-22	$ 538.00
PG 70-22	$ 480.00
PG 64-22	$ 377.00
PG 58-28	$ 350.00
RAP	$ 15.00
RAS	$ 20.00

Material Cost Savings for 9.5C Mixes

Surface Layer Mixture	Total Asphalt Content	% Recycled binder by weight of Total Binder	% Recycled Material by Weight of Total Mix	Cost of Virgin Binder	Cost of Virgin Aggregates	Cost of Recycled Material	Total Cost ($/Ton)	% Savings
Virgin Mix PG 70-22	6.1	0	0	$ 29.30	$ 20.70	$ -	$ 50.00	0%
PG 58-28+25%RAP	5.8	25	29	$ 15.20	$ 14.70	$ 4.40	$ 34.30	31%
PG 58-28+40%RAP	5.6	40	45	$ 11.70	$ 11.40	$ 6.80	$ 29.90	40%
PG 64-22+12%RAP	6.1	12	15	$ 20.20	$ 17.50	$ 2.30	$ 40.00	20%
PG 64-22+25%RAP	5.8	25	29	$ 16.40	$ 14.70	$ 4.40	$ 35.50	29%
PG 64-22+40%RAP	5.6	40	45	$ 12.60	$ 11.40	$ 6.80	$ 30.80	38%
PG 70-22+12%RAP	6.1	12	15	$ 25.70	$ 17.50	$ 2.30	$ 45.50	9%
PG 70-22+25%RAP	5.8	25	29	$ 20.90	$ 14.70	$ 4.40	$ 40.00	20%
PG 70-22+40%RAP	5.6	40	45	$ 16.10	$ 11.40	$ 6.80	$ 34.30	31%
PG 58-28+15%PRAS	6.2	15	5.9	$ 17.90	$ 19.60	$ 1.20	$ 38.70	23%
PG 58-28+30%PRAS	6.2	30	8.7	$ 16.00	$ 19.10	$ 1.70	$ 36.80	26%
PG 64-22+10%PRAS	6.2	10	2.9	$ 21.30	$ 20.10	$ 0.60	$ 42.00	16%
PG 70-22+10%PRAS	6.2	10	2.9	$ 27.20	$ 20.10	$ 0.60	$ 47.90	4%
PG 58-28+25%MRAS	5.8	25	9	$ 15.70	$ 19.00	$ 1.80	$ 36.50	27%
PG 64-22+15%MRAS	6.1	15	5.7	$ 19.80	$ 19.60	$ 1.10	$ 40.50	19%
PG 70-22+15%MRAS	6.1	15	5.7	$ 25.30	$ 19.60	$ 1.10	$ 46.00	8%
PG 58-28+50%MRAS	5.7	50	17.7	$ 10.80	$ 17.40	$ 3.50	$ 31.70	37%
PG 64-22+50%MRAS	5.7	50	17.7	$ 11.70	$ 17.40	$ 3.50	$ 32.60	35%
								23% AVERAGE

UNC CHARLOTTE

Soft Benefit Example

- Project 2014_07 Bridge Alignment. Safety Benefits from detour during construction based on per year/site.

DETOUR SAVINGS

	Number of Times Saved per year	Unit Cost	Unit	Total
Detour Length	80	0.58	/mile	$46.00
			ROW SUM	$46.00
	Number of Times Saved per year	Unit Cost	Unit	Total
Minor Accidents	15	750.00	/crash	$11,250.00
Major Accidents	5	17,000.00	/crash	$85,000.00
			ROW SUM	$96,250.00
			TOTAL COST SAVINGS	$96,296.00

UNC CHARLOTTE

Cost – Benefit Analysis Example

- RP 2014-05. Oil Life
- Good example that contains both hard and soft benefits.
- Research Budget: $243,000

UNC CHARLOTTE

Cost – Benefit Analysis Example

- Cost of an oil change that includes material and labor costs.

Class	Engine	oil capacity (qts)	used oil	market price of oil	unit cost of oil ($/gallon)	cost of oil	mechanic cost	oil filter	total cost
0209	Navistar DT466 7.6L I6	30	Conoco HD Fleet Supreme		$40.00	$ 300.00	$ 15.00	$30.00	$ 350.00
0210	Powerstroke 6.4L V8	15	Rotella T6	1600/ 55 gallon	$29.09	$ 110.00	$ 15.00	$25.00	$ 150.00
	Powerstroke 6.7L V8	13			$29.09	$ 100.00	$ 15.00	$20.00	$ 140.00
0303	New Holland 6.7L 6-cyl	22	Conoco HD Fleet Supreme		$40.00	$ 220.00	$ 15.00	$30.00	$ 270.00
	John Deere 4.5L 4-cyl	16			$40.00	$ 160.00	$ 15.00	$25.00	$ 200.00
0311	John Deere 6.8L 6-cyl	24	Conoco HD Fleet Supreme		$40.00	$ 240.00	$ 15.00	$20.00	$ 280.00
	John Deere 4.5L 4-cyl	21			$40.00	$ 210.00	$ 15.00	$20.00	$ 250.00
	New Holland 6.7L 6-cyl	16			$40.00	$ 160.00	$ 15.00	$30.00	$ 210.00

UNC CHARLOTTE

Cost – Benefit Analysis Example

- Current Cost of Oil Changes

For Regular Interval				
Threshold		Oil Changes per Machine	Annual Cost per vehicle	Annual Cost
value	units			
5,000	miles	2	$ 700.00	$ 114,800.00
5,000	miles	6	$ 900.00	$ 19,800.00
5,000	miles	6	$ 840.00	$ 46,200.00
200	hours	1	$ 270.00	$ 17,280.00
200	hours	2	$ 400.00	$ 21,600.00
200	hours	2	$ 560.00	$ 24,080.00
200	hours	3	$ 750.00	$ 15,000.00
200	hours	2	$ 420.00	$ 23,100.00
			Cost	**$ 281,860.00**
			Benefits	0
			Benefit / Cost Ratio	0

UNC CHARLOTTE

Cost – Benefit Analysis Example

- Costs of Oil Changes based on Project

from Extended Oil Drain Intervals				
Threshold		Oil Changes per Machine	Annual Cost per vehicle	Annual Cost
value	units			
10,000	miles	1	$ 350.00	$ 57,400.00
5,000	miles	6	$ 900.00	$ 19,800.00
10,000	miles	3	$ 420.00	$ 23,100.00
500	hours	1	$ 270.00	$ 17,280.00
500	hours	1	$ 200.00	$ 10,800.00
500	hours	1	$ 280.00	$ 12,040.00
500	hours	1	$ 250.00	$ 5,000.00
500	hours	1	$ 210.00	$ 11,550.00
			Cost	**$ 156,970.00**

UNC CHARLOTTE

Cost – Benefit Analysis Example

- Estimated Savings per Year

Estimated savings		
Oil Changes per Machine	Annual Cost	Oil (Gallon)
1	$ 57,400.00	1230
0	$ -	0
3	$ 23,100.00	537
0	$ -	0
1	$ 10,800.00	216
1	$ 12,040.00	258
2	$ 10,000.00	210
1	$ 11,550.00	220
	$ 124,890.00	**2671**

UNC CHARLOTTE

Cost – Benefit Analysis Example

- Over the next 5 years:
  - $124,890 x 5 = $624,450
  - This is a CBA of : $624,450 / $243,00 = 2.57
  - CBA greater than 1 is considered acceptable.
  - Note: Mechanic injury rate is currently being updated (soft cost of probability of injury).

UNC CHARLOTTE

What does defining Value allow us to do?

Communicate the value to Stakeholders!

UNC CHARLOTTE

Communicating the Value of Research

- Value Matching
  - Executives, Politicians, Public – Money is the medium for Value
  - Engineers, Managers, End Users – Money is important, but the overall impact (problem solution, knowledge) from the work is Value.
  - Researchers – Resulting publications, experience with NCDOT, and graduate students are the Value.

UNC CHARLOTTE

Research in *MOTION*

- Marketing Campaign
  - Twitter, Instagram, and Facebook for NCDOT R&D
  - Focuses on communicating the IMPACT of NCDOT R&D on the community
  - Research Symposium

UNC CHARLOTTE

Communicating the Value of Research

UNC CHARLOTTE

Project Performance Prediction Model

$$Success = \beta_0 + \sum_{i=1}^{n}\left[\left(\beta_i\right) Indicator_i\right] + error$$

Where:
Success is defined categorically as high probability and moderate probability. A low probability category will be added based on the availability of data for that category.

β_0 = model correction factor (y-intercept)

β_i = importance factors (weighting)

$Indicator_i$ = controlling success indicators

UNC CHARLOTTE

Project Performance Prediction Model

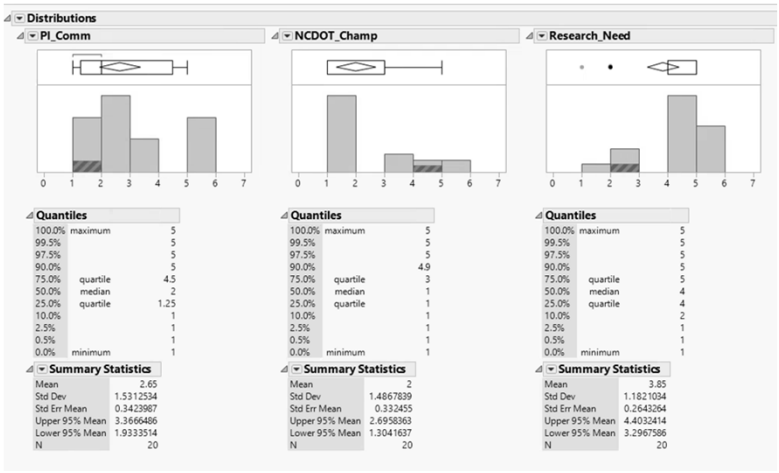
- Based on survey and interview results:

HIERARCHAL RANK	RESEARCH SUCCESS INDICATORS
1	Regular Communication from the PI
2	Researcher Experience with NCDOT
3	Proposal Quality
4	NCDOT Champion
5	Research Need
6	Co-PI Experience

$$Success = \beta_0 + \beta_1\left(PI - StLC\,comm\right) + \beta_2\left(Active\,NCDOT\,Champ\right) + \beta_3\left(Research\,Need\right) + \beta_4\left(PI\,exp\right) + \beta_5\left(Proposal\,Quality\right) + error$$

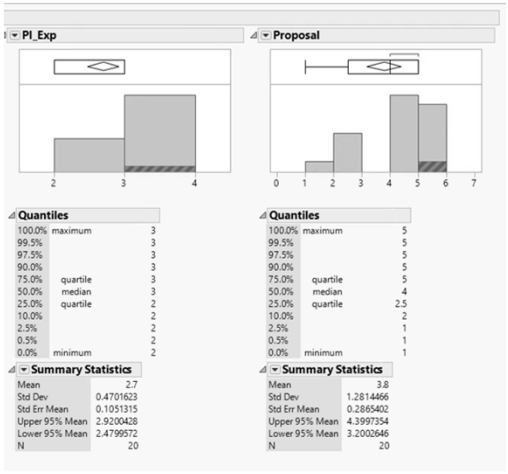
UNC CHARLOTTE

Project Performance Prediction Model



UNC CHARLOTTE

Project Performance Prediction Model



UNC CHARLOTTE

Project Performance Prediction Model

Parameter Estimates

Term	Estimate	Std Error	ChiSquare	Prob>ChiSq
Intercept[1]	-1.7298261	7.4589852	0.05	0.8166
Intercept[2]	-0.3915498	7.460304	0.00	0.9581
PI_Comm	0.01823851	0.4193661	0.00	0.9653
NCDOT_Champ	1.38335649	1.0020548	1.91	0.1674
Research_Need	1.01733403	0.9248964	1.21	0.2714
PI_Exp	-1.5843749	1.3720625	1.33	0.2482
Proposal	0	0	100000	<.0001*

UNC CHARLOTTE

Project Performance Prediction Model

- For a one unit increase in PI_Comm, i.e., going from 1 to 2, the odds of Success=3 vs. the combined [Success=2 and Success=1] are 1.01 times greater
- For a one unit increase in NCDOT_Champ, i.e., going from 1 to 2, the odds of Success=3 vs. the combined [Success=2 and Success=1] are 3.98 times greater

UNC CHARLOTTE

Project Performance Prediction Model

- For a one unit increase in Research_Need, i.e., going from 1 to 2, the odds of Success=3 vs. the combined [Success=2 and Success=1] are 2.77 times greater
- For a one unit increase in PI_Exp, i.e., going from 1 to 2, the odds of the combined [Success=2 and Success=1] vs. Success=3 are 4.88 times greater
- For a one unit increase in Proposal, i.e., going from 1 to 2, the odds of the combined [Success=2 and Success=1] vs. Success=3 are the same

UNC CHARLOTTE

Model Conclusions

- Right now, Communication and Proposal Quality are statistically insignificant as impacts to the probability of success.
- We know at the very least, communication has to impact success but it may not be a factor at the proposal level.
- Additional data is required to test this hypothesis.

UNC CHARLOTTE

Capturing and Communicating the Value of NCDOT Research

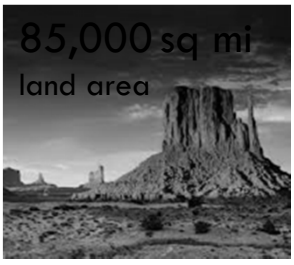
Thomas Nicholas II, P.E., Ph.D.
tnichola@uncc.edu
August 15,2016

Utah DOT
Research and Innovation Division

North Carolina
Peer Exchange

September - 2017

UDOT Assets



$30 billion
of inventory

2

Innovating transportation solutions that strengthen Utah's economy and enhance quality of life.

zero Crashes Injuries Fatalities

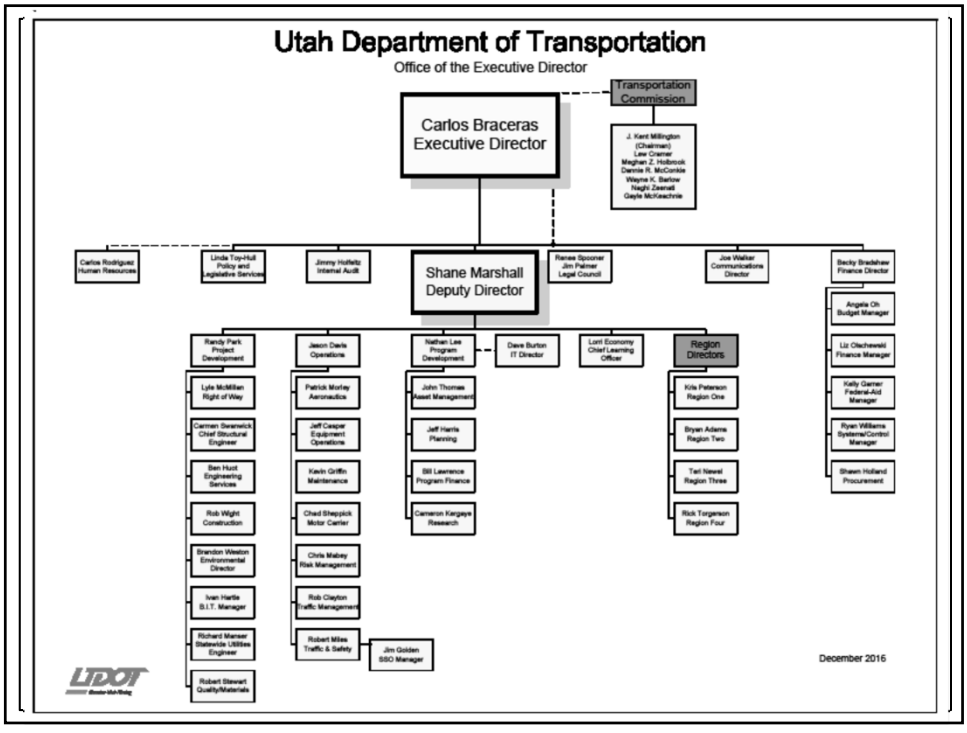
Zero Crashes, Injuries, Fatalities

Optimize Mobility

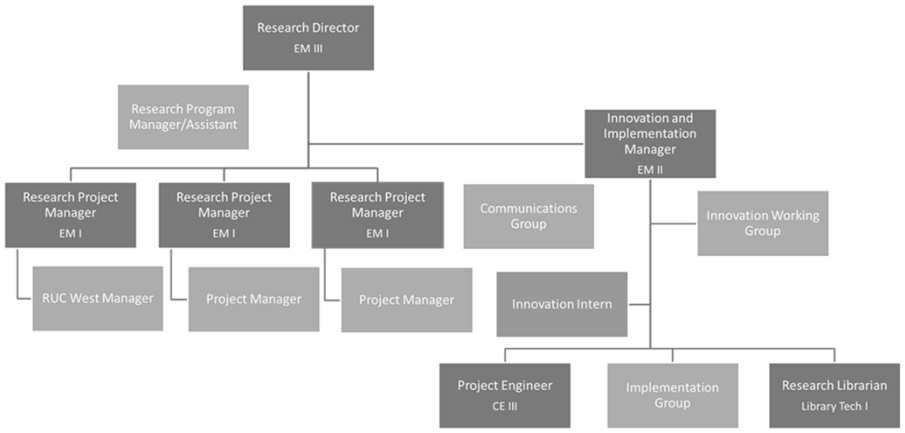
Preserve Infrastructure

LIDOT Keeping Utah Moving

3



Research and Innovation Division



Research and Innovation - Goals

- Idea Discovery
- Innovation Implementation
- Sharing and Communicating
- Access to Information

Idea Discovery

- Network with stakeholders
  - UDOT Divisions, Regions, Cities, MPOs, UTA, Universities, Contractors
- Interact with other DOTs and national groups
  - AASHTO, TRB, ITE, ASCE, PMI
- Read technical publications and newsletters
  - TR News, Public Roads, ITS International, World Highways
- Surveys, Problem Statements, General Scans

Innovation Implementation

- Implement good ideas
  - Provide seed money to encourage innovation
- Program deployment of research results
  - Prioritize import results based on implementability
- Support TRB attendees to implement ideas
  - Everyone is responsible for all ideas
- Test new/proven products in field
  - Use local conditions for Experimental Features
- Utilize eternal research and opportunities
  - Lead pooled fund projects
  - Collaborate with UTA/USTAR/RUC West

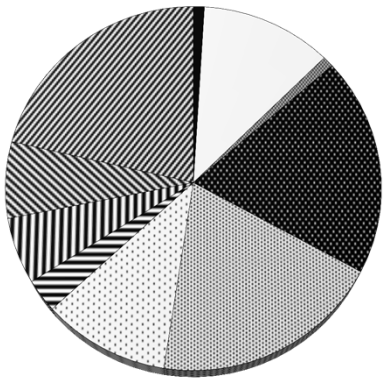
Sharing and Communicating

- Facilitate committee information sharing
- Leverage UDOT's involvement on national committees
- Support STIC and EDC initiatives
- Respond to national solicitations and grants
- Perform technology transfer
- Involve communications office
- Host TRB visits, peer exchanges and webinars
- Circulate surveys and awards information

Access to Information

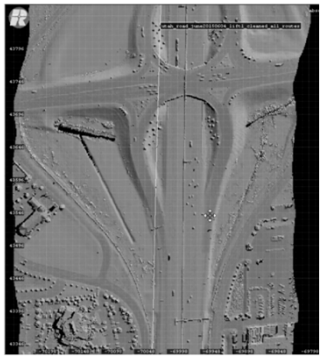
- Publish research and other reports
- Maintain engineering and technical manuals
- Circulate new books and periodicals
- Coordinate leadership book discussions
- Perform literature reviews
- Publish E & I report and quarterly newsletter
- Update benefits of research summaries
- Plan library and learning center open house
- Update committee members on web

Active Research Projects



Research Division Projects

- 101 Active Research Projects and Field Evaluations
  - 66 UTRAC and Rapid-Response
  - 25 Transportation Pooled Fund
    - 9 TPF as Lead State
  - 10 Experimental Features



12

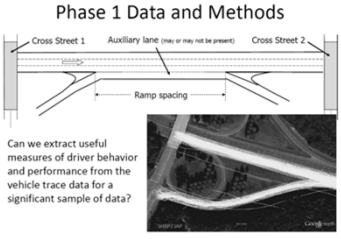
UTRAC 2017

- 67 Submitted Problem Statements
- 22 Selected for Funding
- $790,000 Research Funds
- $760,000 Other Funds

	Subject Area	Statements Submitted	Statements Selected for Funding
	Materials & Pavements	6	2
	Maintenance	13	5
	Traffic Mgmt. & Safety	15	7
	Structures & Geotechnical	5	3
	Preconstruction	1	1
	Planning	12	2
	Data Analytics	8	2
	Public Transportation	7	0

SHRP2 Projects:

- PlanWorks
- Economic Analysis Tools
- Integrating Freight Transport into Highway Capacity
- Organizing for Reliability Tools
- Research to Deployment Using SHRP2 Safety Data
- 3D Utility Location Data Repository
- GeoTech Tools
- Identifying and Managing Utility Conflicts
- Railroad-DOT Mitigation Strategies
- Pavement Renewal Solutions
- Reliability in Simulation and Planning Models
- Reliability Data and Analysis Tools



Newsletter

- New Format
- State and National News
- Research Summaries
- Funding Opportunities
- Upcoming Webinars
- Innovations

UDOT 8

NATIONAL INNOVATIONS

*Click on innovation titles for more information.

Rutgers Launches World's First Accelerated Bridge Testing Facility

This short video highlights the BEAST, the world's first accelerated testing facility for full-scale bridges, located at Rutgers University in New Jersey. UDOT Research was represented by David Stevens at the BEAST bridge workshop in Nov. 2016. Invitation is out for input on initial specimen design and testing plan, as well as future specimens/plans and payload projects.

BEAST

CDOT, Panasonic to turn I-70 into a 'smart highway'

Panasonic announced it is partnering with the Colorado DOT to turn a stretch of Interstate 70 into a smart highway, enabling cars to communicate with each other as well as road infrastructure, and potentially resulting in fewer traffic accidents. This example of technology use and partnering could help UDOT in our connected vehicle efforts.

Smart City Challenge to Build Cities for the Future

USDOT launched the Smart City Challenge in December 2015, asking mid-sized cities across America to share their ideas for the creation of an integrated, cutting-edge smart transportation system using data, applications, and technology to help people and goods move faster, cheaper, and more efficiently. Over 75 cities competed for the resources to connect and deploy new technologies, including the winning city, Columbus, OH. Now, the city applications and a wealth of data are available to the public in a new comprehensive report, Smart City Challenge: Lessons for Building Cities of the Future.

In October 2016, Secretary Foxx announced an additional $65 million in grants to support community-driven advanced technology transportation projects. In all, these advanced technology grants will fund 19 technology-driven projects in local areas to fight congestion, increase connectivity, and improve access to opportunity. With the new compilation of lessons learned, UDOT leaders and our partners will have new insight into how to innovate in the new year.

How We Move
44 cities proposed projects to test the use of automated shared use vehicles to help travelers connect to their destinations.

How We Move Things
11 cities envisioned improving urban freight delivery by implementing smarter curb space management (through sensors, dynamic reservations, and other technologies) to speed loading and unloading.

How We Adapt
17 cities proposed using inductive wireless charging to charge electric vehicles, buses, or shuttles.

How We Move Better
53 cities proposed implementing Dedicated Short Range Communication (DSRC) to connect vehicles to infrastructure and each other.

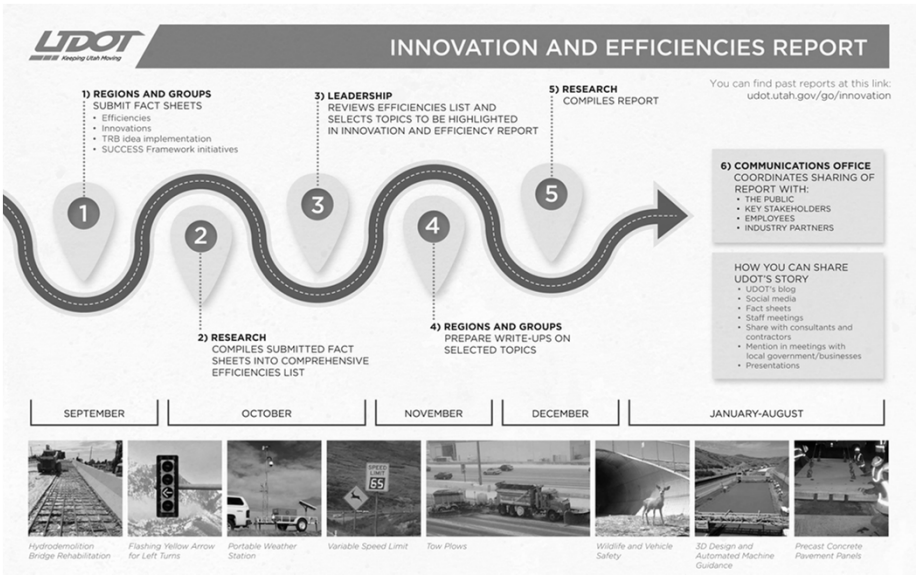
How We Grow Opportunity
9 cities proposed providing free public WiFi on buses, vans, and public spaces. The seven Smart City Challenge finalists proposed over 60 unique strategies to increase access to jobs, provide training, reach underserved areas, and ensure connectivity for all.

How We Align Decisions and Dollars
45 cities proposed implementing a unified traffic or transportation data analytics platform, which would help them make better decisions with their limited resources.

Innovation and Efficiencies Report

www.udot.utah.gov/go/innovation

Process and Timeline

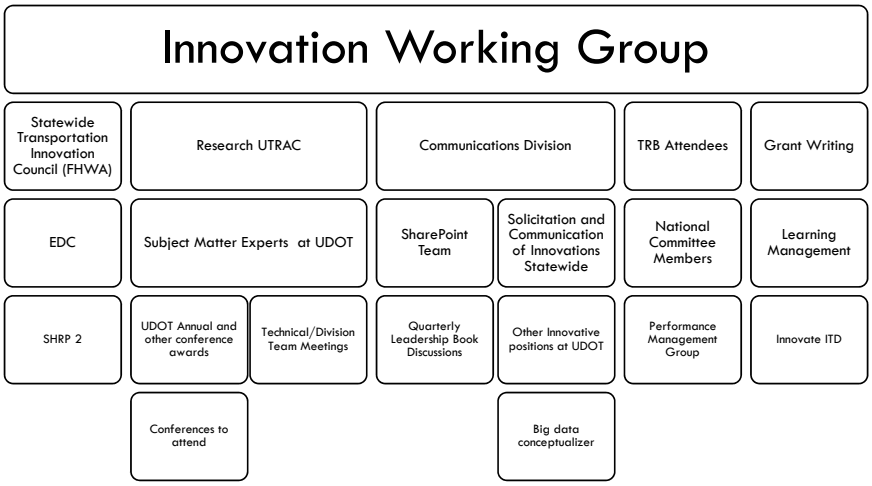


Innovation & Efficiencies

- Grate Lifter
- Region Four Water Truck
- Truck and Trailer Electrical Test Box
- Three-Year Maintenance Planning Tool
- Storm Management Dashboard
- Intelligent Design and Construction
- Real-Time Pavement Smoothness
- Unmanned Aircraft Systems
- Moab Adaptive Signal Control
- Wind Mitigation for Signal Mast Arms
- P+T+Quality Bidding
- Electronic Signature Routing
- Statewide Utility License Agreements
- Statewide Access Management Program
- Transportation and Land Use Connection
- Bicycle & Pedestrian Counts Guidebook

18

Sharing and Communicating



Implementation Successes vs. Challenges

Successes

- Management support
- Culture of innovation
- Engage stakeholders
- Accountability

Challenges

- User inputs
- Communication
- Funding
- Champion leaves or management turnover
- Training and promoting

20

Measuring Research Benefits

$$\text{Benefit/Cost} = \frac{\text{Number x Value x Percentage}}{\text{Contract + TAC + PM costs}}$$

Note: Total program B/C includes projects where benefits could not be identified.

21

Benefits of Research

- 2016 – $68.2 million in benefits, 66 projects, with B/C ≈ 14
  - This estimate is conservative:
    - Conservative methodologies were used to calculate ratios
    - Only 42 percent of projects completed could be evaluated for B/C and total program B/C included projects where benefits could not be identified
- 2010 – B/C ≈ 17 on 41 projects
- 2000 – B/C ≈ 12 on 22 projects
- 1995 – B/C ≈ 14 on 18 projects

22

Types of Benefits from Research

- Pavement & bridge life extension
- Improved rehab & maintenance methods
- Highway design advancements
- Traffic control enhancements
- More efficient & trained staff
- Reduced materials costs
- More efficient equipment
- Better utilize existing equipment
- Improved management
- Congestion mitigation for commuters
- Crash avoidance
- Crash severity reduction
- Construction zone enhancements
- Noise reduction
- Avoid inefficient highway expenditures
- Modify standards to eliminate poor designs
- Replace specs that are unsuccessful
- Reassign staff where not productive
- Find alternatives to inferior technologies
- Informed staff & stakeholders
- Understanding industry advancements
- Knowledge of future trends & challenges

23