Deliver Great Service – Enhance Indiana’s Economic Competitiveness & Quality of Life
– Execute 20 Year Road & Bridge Plan – Develop INDOT’s 21st Century Workforce
FY 18 Research Program Impact Report

Deliver Great Service – Enhance Indiana’s Economic Competitiveness & Quality of Life – Execute 20 Year Road & Bridge Plan – Develop INDOT’s 21st Century Workforce

Impact Areas:

- Operational Excellence
- Professional Development
- Engagement & Networking
- State and National Recognitions
- Forensic Investigations and Specialized Testing Programs
- Innovations, Transformational Technologies & Economic Development
- Program Metrics & Venues for Continuous Improvement

Your investment is having IMPACT

Next Level INDIANA

Road Improvements Ahead: Drive Safely

IMPACT
You are making a difference.
Operational Excellence

- High IMPACT Research (select examples)
  Mobility & Safety

- SPR-3821, Real Time Mobility Traffic Measures (Mobility Reports, traffic signal timing, utilization of probe data)
- SPR-3832, Friction Surface Treatment Selection (2018 Sweet 16)
- SPR-4015, Safety Countermeasures Decision Guide & Updating Crash Reduction Factors
- SPR-4016, Assessment of Alternative Rumble Stripe Construction
- SPR-4167, Synthesis of Autonomous Vehicle Legislation
Operational Excellence

Mobility & Safety
Operational Excellence

• High IMPACT Research (select examples)
  System Preservation

- SPR-3816, Bridge Load Rating
- SPR-3903, Fog Seal Performance on Asphalt Longitudinal Joints
- SPR-3913 Assessment of Legal & Proposed New Permit Loads on Bridge Rating & Posting Policies
- SPR-4121, Pack Rust Identification & Mitigation Strategies
- SPR-4157, QA for Chip Seal Operations Using Macrotexture Metrics
Operational Excellence

System Preservation
Operational Excellence

• High IMPACT Research (select examples)
  Process Improvement

- SPR-4006, Automated (Image Based) Collection and Measurements for Construction Pay Items
- SPR-4151, Synthesis of Culvert Inspection Technologies
- SPR-4158, Implementation of Continuous Improvement for INDOT Maintenance (Training and Tracking Process Improvements)
- SPR-4164, Blast Furnace Slag Usage and Guidance for Indiana
- SPR-4333, Telematics & Utilization Analysis for Mowing Operations
Operational Excellence

Process Improvement
Operational Excellence

- High IMPACT Research (select examples)
  
  Planning & Finance
  
  - SPR-3912, Economic Development Impact of Corridor Improvements and Preservation Projects
  
  - SPR-4225, INDOT Research Program Benefit Cost Analysis – Return on Investment (ROI)
Operational Excellence

• High IMPACT Research (select examples)

Strategic

- **Damage Wise Implementation** (for FY18 the time from crash to billing was less than one month, the amount invoiced increased to $9.0 Million and 90% of the collections were distributed back to the districts for remedy)
- SPR-4017, **WIM Data Quality Control** and Real-Time Dashboard Development
- SPR 4044 Evaluating Opportunities to Enhance the **Hoosier State Train Ridership** through a Survey of Riders’ Opinions and an Assessment of Access to the Line
- SPR-4156, Capital Program Cost Optimization through Contract Aggregation Process (**Projects Bundling**)  
- **S-BRITE**, bridge inspection/training/certification/other activities
- **UAS** Applications Implementation
Operational Excellence

<table>
<thead>
<tr>
<th>Year</th>
<th>Millions</th>
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<tr>
<td>FY10</td>
<td>$1.6</td>
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<td>FY17</td>
<td>$6.5</td>
</tr>
<tr>
<td>FY18</td>
<td>$7.4</td>
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Strategic
Operational Excellence

• Peer Exchange, Every Day Counts (EDC) & SHRP 2 National IMPACT

- Peer Exchange for the Research Program Focusing on “Transformational Technologies”
- Facilitated 11 Innovations in EDC 4 (INDOT 6, LTAP 3 and 2 institutionalized already)
- Facilitating 10 Innovations in EDC 5 (INDOT advanced 4, 5 institutionalized already and 1 not advanced). LTAP support for 2 of the these institutionalized
- $380K STIC Incentives leveraging 4 INDOT studies.
- SHRP 2 Implementation Assistance ($635k for Indiana)
- Pooled Fund Studies, PFS. INDOT participated in the PFS “Effect on capacity of freeways, 2-lane highways, arterial streets, and intersections of connected autonomous, vehicles; and on expected adoption & penetration rates”
Operational Excellence

National IMPACT

EDC – 5 Regional Summit in St. Louis Missouri

<table>
<thead>
<tr>
<th>No.</th>
<th>Host City</th>
<th>Dates</th>
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<tr>
<td>1</td>
<td>Baltimore</td>
<td>October 18-19</td>
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<tr>
<td>2</td>
<td>St. Louis</td>
<td>October 29-30</td>
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<td>3</td>
<td>Albany</td>
<td>October 24-25</td>
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<tr>
<td>4</td>
<td>Portland</td>
<td>November 6-9</td>
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<tr>
<td>5</td>
<td>Orlando</td>
<td>November 27-28</td>
</tr>
</tbody>
</table>

Every Day Counts EDC – 5 Innovations

1. ADVANCED GEOTECHNICAL EXPLORATION METHODS
2. COLLABORATIVE HYDRAULICS: ADVANCING TO THE NEXT GENERATION OF ENGINEERING (CHANGE)
3. PROJECT BUNDLING
4. REDUCING RURAL ROADWAY DEPARTURES
5. SAFE TRANSPORTATION FOR EVERY PEDESTRIAN (STEP)
6. UNMANNED AERIAL SYSTEMS (UAS)
7. USE OF CROWDSOURCING TO ADVANCE OPERATIONS
8. VALUE CAPTURE: CAPITALIZING ON THE VALUE CREATED BY TRANSPORTATION
9. VIRTUAL PUBLIC INVOLVEMENT
10. WEATHER-RESPONSIVE MANAGEMENT STRATEGIES
Professional Development

- Advanced **Pavement Training** for District and C.O. Pavement Engineers
  - Pavement Training in July 16 & July 17, 2018 (27 total participants).
  - Pavement Asset Management Training from July 18 to July 20, 2018 (27 total participants).

- **INDOT EVOLVE**, Purdue/JTRP Events
  - Field Trip to Burns Harbor (October 25, 2017)
  - Field Trip to I-69 Section 5 (April 18, 2018)

- INDOT staff serving as **Business Owners/SAC** with faculty, practitioners, other DOT staff. INDOT staff indicates positive professional development from SAC engagement
Professional Development

Seymour District Business Owners & SAC Members
114 Projects

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Project Title</th>
<th>Project Status</th>
<th>Name</th>
<th>Role</th>
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<td>4236</td>
<td>INDOT Permit Manual Development Project</td>
<td>Active</td>
<td>Devin Maynard</td>
<td>SAC Member</td>
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<td>4157</td>
<td>Quality Assurance Procedures for Chip Seal Operations Using Macrotexture Metrics</td>
<td>Active</td>
<td>Brian Wathen</td>
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<tr>
<td>4002</td>
<td>Risk-based Specification for Construction</td>
<td>Active</td>
<td>Jason Bunselmeier</td>
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<tr>
<td>3908</td>
<td>Algorithm and Software for Proactive Pothole Repair</td>
<td>Complete</td>
<td>Jason Lowther</td>
<td>SAC Member</td>
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<tr>
<td>3801</td>
<td>Using Field Electrical Conductivity Measurements for Scheduling Chip Seal Spreading/Sweeping Operation</td>
<td>Complete</td>
<td>Jason Lowther</td>
<td>SAC Member</td>
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<td>3551</td>
<td>Feasibility of the New Indiana Coordinate Reference System</td>
<td>Complete</td>
<td>John Kurtz</td>
<td>SAC Member</td>
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<td>Nondestructive Evaluation of the Condition of Subsurface Drainage in Pavements using Ground Penetrating Radar (GPR)</td>
<td>Complete</td>
<td>Jason Lowther</td>
<td>SAC Member</td>
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<td>3404</td>
<td>Development of a Design Flexibility Toolkit</td>
<td>Complete</td>
<td>Jim Ude</td>
<td>SAC Member</td>
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<tr>
<td>3377</td>
<td>Earthquake Resistance of Integral Structures: Phase 2</td>
<td>Complete</td>
<td>Tony McClellan</td>
<td>SAC Member</td>
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</tbody>
</table>
Engagement & Networking

- Three JTRP Executive Committee Meetings at INDOT Districts
  - October 24, 2017 at **Fort Wayne** District
  - August 16, 2018 at **Seymour** District (followed by a visit to Cummins Seymour Technical Center)
  - October 4, 2018 at **Greenfield** District (followed by WIM site visit, Richmond Scales)

- Two JTRP Executive Committee Meetings followed by Site Visits
  - August 17, 2017 at **IUPUI campus** (followed by a **TASI** Lab Tour and demonstration)
  - November 27, 2018 at Bowen Lab (followed by a visit to **S-BRITE** Site and a Lab tour and demonstration)
Engagement & Networking

JTRP Executive Committee Meeting – GF District

JTRP Executive Committee Meeting – Bowen Lab
Engagement & Networking

- **TRB State Visit** – September 21, 2017 (Nelson Gibson & Waseem Dekelbab) with Bridge & Construction Management Divisions
  - Bridge Preservation, New & Emerging Bridge Technologies, ongoing Bridge Related Research & Alternative construction processes
- January, 2018, **TRB Annual meeting** (presentations, papers, posters)
- February 5, 2018, **Poster Session/Board Meeting at IGCS**
- April 16 & 24, 2018, **Faculty/INDOT Research Program Workshops**
- August 17, 2017, **Workshop with IUPUI, Stutz Facility Indianapolis**
- November 20, 2018 **Focus Groups Faculty Liaisons Meeting at INDOT R&D**
- **NCHRP, TRB, AASHTO Committees**
Engagement & Networking

Evaluation of Consumer Grade Unmanned Aircraft Systems for Photogrammetric Crash Scene Documentation

By Michelle M. Mekker, Ph.D., Fangning He, Ph.D., John L. Bullock, Ayman F. Habib, Ph.D., and Darcy M. Bullock, Ph.D., PE.
Engagement & Networking

- **INDOT Communications Peer Group Visit & Meeting** in Campus (October 26, 2017)
- **UAS Night time Workshop** (November 8, 2017)
- **Missouri and Ohio DOT Visits** (November 14, 2017)
- **Industrial CAV Campus Engagements** (April 2018 - Ford, VW, Cummins, 3M)
- Meetings with **OMB State Budget Director, Purdue Government Relations & Faegre Baker Daniel** representatives regarding HB 1002 & Cost allocation Study (April 17)
- Visiting and **Meeting with ODOT representatives**, regarding transformational technologies (April 23)
Engagement & Networking

- **Conexus Breakfast**: Exploring Transportation Megatrends (June 7), providing talking points for Commissioner & Data Science Initiative (Purdue Science Dean)
- **Public Safety UAS Workshop** (June 15), UAS Visit by Marty Blake from INDOT (August 2)
- **BMV Workshop on Platoon Legislation** (June 19)
- **Peloton Interface and INRIX data** follow-up (July 13)
- **VW Settlement Opportunities** (July 26 visit with Pam Fisher)
- **LiDAR and Photogrammetry for Construction** (Roland Fegan Campus Visit on August 3)
Engagement & Networking
Engagement & Networking

2018 Focus Groups Poster Session

2018 Road School Planning Committee
State & National Recognition

- Awards, Sweet 16 HVR projects.
  - **Sweet 16 Award 2018**: Friction Surface Treatment selection
  - **Sweet 16 Award 2017**: Site Selection for New Lighting Technologies
ERIN articles, INDOT website links, Inside INDOT newsletter articles

- July-SPR 4044, Opportunities to Enhance the Hoosier State Train Ridership
- November-SPR-4017, WIM Data Quality Control & Real-Time Dashboard
- November- SPR 4158, Lean Workshops Help Shape Up INDOT’s Processes
- December- Drone Over I – 69
- January- Forget the S&P: INDOT’s Research Program Has Huge ROI
- August- INDOT is a significant partner in a new innovation hub (for Connected and Autonomous Transportation Technologies) that is receiving national attention
State & National Recognition

WIM Demonstration
State & National Recognition

- “Bundling Bridge and Other Highway Projects: Patterns and Policies,” Best paper award from TRB (D. Grant Mickle Award)
- Best Paper award for TRB “Construction work zone LiDAR paper”
- NCHRP Research Report 883: Fracture-Critical System Analysis for Steel Bridges
- Idaho DOT’s research project: Evaluation of skid resistance of pavements at different speeds (ITD 266) (INDOT R&D is selected for TAC membership).
- FHWA Friction Management (PFM) Support Program (INDOT is one of the four states participated in data collection)
- Selection of INDOT staff (mainly INDOT R&D) for NCHRP projects and TRB committees,
Forensic Investigations & Specialized Testing Programs

- Forensic capabilities & data driven decision-making capabilities, direct result of research program
- **Pipe Failure Analysis**, Hendricks County
- **Pipe-Lining Pilot Project** Draws an Eager Audience (December Inside INDOT News Article)
- **NDT of Bridge Decks** – Impact Echo Emerging Technology – Crawfordsville District – Results & Implications
Friction and Texture Quality testing on crack sealing material to ensure the material met national specifications on the roads with the highest number of complaints of low skid resistance.

Identification of bridges with low friction numbers

I-465 Construction Time Lapse

I-465 Patching Quantity Pilot Survey

Telematics and Utilization Analytics for INDOT Mowing Operations
INDOT participated in a pooled fund study on effect on capacity of freeways, 2-lane highways, arterial streets, and intersections of connected automated autonomous, vehicles; and on expected adoption & penetration rates.

INDOT participated in numerous Usages of High Resolution LIDAR for Transportation Asset & Inventory Management

Posted in June (Inside INDOT) - Precast Concrete is used in US 40 (to maintain tolerance for underpasses & reduce road closure time)

Posted in July (by Inside Edge, Inside Indiana Business) Discovery Park to lead new Innovation Hub for Connected and Autonomous Transportation Technologies
Evaluation of **Consumer Grade Unmanned Aircraft Systems (UAS)** for Photogrammetric Crash Scene Documentation – ite journal, July

Posted in September 21 (AASHTO News), Texas Uses **Pavement Preservation Treatment to Reduce Noise** Developed thorough JTRP Research and installed in 16 States (this is a pavement preservation treatment that combines grinding and grooving to create a texture that improves ride quality and lessens the amount of noise vehicles make on roads)

Posted in October (by INRIX) – **INDOT Case Study**: How applied research is guiding a new generation of transportation management solutions
## Program Metrics & Venues for Continuous Improvement

### Eight Objective Performance measures for INDOT Research Program;

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Goal</th>
<th>Status</th>
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<tr>
<td>1</td>
<td>% Final Report submitted on time of Active Projects</td>
<td>&gt;90%</td>
<td>92%</td>
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<tr>
<td>2</td>
<td>% Successful Implementation of completed projects in a FY (Conversion Rate)</td>
<td>&gt;90%</td>
<td>95%</td>
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<td>3</td>
<td>Return on Investment in a FY (B/C)</td>
<td>&gt; 2</td>
<td>49</td>
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<td>4</td>
<td>Percent Customer Satisfaction Score Meeting or Exceeding Expectations</td>
<td>&gt; 90%</td>
<td>100%</td>
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<tr>
<td>5</td>
<td># &amp; Percent of Time Extensions</td>
<td></td>
<td>Needs Improvement</td>
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<tr>
<td>6</td>
<td>% progress reports submitted on time</td>
<td>100%</td>
<td>100%</td>
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<tr>
<td>7</td>
<td>% Draft Final Report submitted on time</td>
<td>&gt; 90%</td>
<td>90%</td>
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<tr>
<td>8</td>
<td>% Successful Communications</td>
<td>&gt; 90%</td>
<td>84%</td>
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## Progress of Performance Measures

### Conversion Rate Based on Calendar Year (Now KPI 6)

<table>
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<tr>
<th>CY</th>
<th>Completed Projects</th>
<th>Not Successfully Implemented</th>
<th>Conversion Rate</th>
<th>Goal</th>
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<td>2012</td>
<td>38</td>
<td>6</td>
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<td>90%</td>
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<td>2013</td>
<td>33</td>
<td>3</td>
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<tr>
<td>2014</td>
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<td>2015</td>
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<td>90%</td>
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<tr>
<td>2016</td>
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<tr>
<td>2018</td>
<td>27</td>
<td>1</td>
<td>96%</td>
<td>90%</td>
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### Conversion Rate Based on Fiscal Year

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<th>FY</th>
<th>Completed Projects</th>
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<th>Conversion Rate</th>
<th>Goal</th>
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<td>2012</td>
<td>31</td>
<td>5</td>
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<td>2013</td>
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<td>2014</td>
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<td>90%</td>
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<td>2015</td>
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<td>92%</td>
<td>90%</td>
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<tr>
<td>2016</td>
<td>42</td>
<td>3</td>
<td>93%</td>
<td>90%</td>
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<tr>
<td>2017</td>
<td>24</td>
<td>2</td>
<td>92%</td>
<td>90%</td>
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<tr>
<td>2018</td>
<td>22</td>
<td>1</td>
<td>95%</td>
<td>90%</td>
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FY 2019 February 5 Show Case & Peer Group meetings, focusing on peer groups to identify research needs on an ongoing basis. FY 2020 Show case was February 13. **Faculty Liaisons were engaged in Focus Groups.**

**INDOT Innovative Programs**
https://www.in.gov/indot/2404.htm - Title VI impact/compliance

**Related Links**
- Innovation and Research Needs & Ideas
- Research Program IMPACT Report
- INDOT Research Program ROI
- Submission of Research Ideas to INDOT
FY 16 Research Program Benefit – Cost Analysis

- **Projects 42**

  Agency B/C ratio: 12:1
  non-agency B/C ratio: 46:1

<table>
<thead>
<tr>
<th>Quatifiable Benefits Projects</th>
<th>Qualitative Benefits Projects</th>
<th>Projects Not Successfully Implemented</th>
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<td>3</td>
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- [*Quatifiable Benefits Projects*](#)
- [*Qualitative Benefits Projects*](#)
- [*Projects Not Successfully Implemented*](#)
FY 17 Research Program Benefit – Cost Analysis

<table>
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<tr>
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<th>Qualitative Benefits Projects</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>19</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Projects 24**
  - Agency B/C ratio 46:1
  - non-agency B/C ratio 3:1

![Pie chart showing distribution of projects]
FY 2019, 121 Research Needs submitted, 32 Research Projects funded, 25 Completed Studies thus far, 87 active projects.


Smart-sheet tracking software used for project management (active projects, needs identified, tracking implementation status).

Customer Satisfaction Performance Measures, reported to Executive Board

Annual IMPACT Report, Return on Investment (ROI), Conversion Rate.

JTRP Contract Renewal (June), User manual update (December).
FY 17 Research Program IMPACT Report

20 Year Plan Next Level Roads - Economic Competitiveness & Quality of Life - Great Service - 21st Century Workforce

On-Time, On-Budget – Take Care of What We Have – Customer Satisfaction
Challenges to Research Program

- **Next Level Roads**
  - 5 Year impact
  - 122 lane miles
  - 9,628 lane miles resurfaced
  - 1,295 bridges for rehabilitation or reconstruction

- **Total projects**
  - FY 2018: 670 projects
  - FY 2019 to 2022: 700 to 900 projects each FY

- **Challenges**
  - More specialized Testing requests
  - More pavement investigation requests
  - More focus research projects to resolve issues in the field
  - More new innovations to be studied and implemented in the field
FY2017
RESEARCH PROGRAM IMPACT REPORT
IMPACT Areas

1. Operational Excellence
2. Professional Development
3. Engagement and Networking
4. State and National Recognition
5. Forensic Investigation and Specialized Testing Programs
6. Legislation, Innovations, and Economic Development
7. Program Goals and Metrics
Report Outline

Operational Excellence

Professional Development

Engagement and Networking

State and National Recognition

Forensic Investigation and Specialized Testing Programs

Legislation, Innovations, and Economic Development

Program Goals and Metrics
IMPACT on Mobility and Safety

- **High Friction Surface Treatment Selection (SPR-3832)**
  - Improve friction on horizontal curves, interstate ramps, and bridges
  - Reduce weather related accidents
  - Curves: 28% of all highway fatalities

- **Site Selection for New Lighting Technologies (SPR-3833)**
  - >30% energy savings
  - 20% reduction in crashes due to lighting issues
  - Low maintenance

Operational Excellence  High Impact Research
Centerline/Edge Line rumble strips
- Reduce accidents on rural two lane roads
- Reduced noise level with innovative sinusoidal profile

Performance of Alternative Diamond Interchanges (SPR-3866)
- Innovative interchange design
- Higher traffic capacity, decreased delays
- Reduced construction costs
- Reduced crashes
IMPACT on System Preservation

- Development of a Cost Effective Bridge Preservation and Rehabilitation Program (SPR-3320)
  - Better selection of preservation treatments (crack sealing & deck sealing)
  - Increase in deck service life

- Precast Slab Pilot Implementation (SPR-3947)
  - Faster construction technique to open to traffic
  - Increased mobility, reduced travel time
  - Reduced User Costs
  - Longer lasting pavement patching
IMPACT on System Preservation

- **LiDAR Applications for Safety & Asset Management**
  - Innovative technology
  - Work Zone safety, MOT compliance
  - MSE wall performance

- **NDT testing of bridge decks, SHRP 2 Implementation funding for network level assessment**
  - Innovative technology – nondestructive evaluation
  - Early detection/prevention
  - High ROI
  - Better data – better, cost effective rehabilitation strategies
  - Better selection of bridge candidates for preservation and rehabilitation
IMPACT on Process Improvements

- **LPA Process Improvement (SPR-3823)**
  - Streamlining of local contract processes
  - Local ownership and accountability

- **Smoothness Specifications Implementation**
  - Fair and balance bidding process
  - Objective, more accurate measurements
  - Longer lasting pavement
  - Replaces profilograph with inertial profilometer
Virtual Construction Inspection Technology (SPR-3945), best practices for:
- Pavement
- Bridges
- MSE Walls
- Soil and Geotechnical Investigations
- Innovative technology
IMPACT on Strategic Goals

- **S-BRITE, Bridge Inspector - training/certification**
  - Better bridge inspection procedures and capabilities
  - Better trained bridge inspectors
  - Talent Management & human resource development

- **Unmanned Aircraft System (UAS) Flight Demonstration on 01/21/2017**
  - New technology applications
  - Easier and Safer to reach sites for inspection and monitoring
  - Global view of the whole structures/projects
  - Potential in accident investigations
IMPACT on Strategic Goals

- **Improving Energy Efficiency of Facilities**
  - Facility energy audits and monitoring using EnergyStar
  - Reduced energy costs
  - Uniform energy design practices

- **Weigh-In-Motion: feasibility study**
  - New WIM technology
  - Validated WIM system for compliance & accuracy
  - Gov. Office request
  - INDOT looking at existing WIM and potential retrofits
Cost Allocation, Vehicle Mile Travelled and Revenue Generation Studies
- Legislative impact
- Found truck classes 5 to 13 underpaying
- Found truck classes 1 to 4 overpaying
- Impacted HB1002 & Cambridge Systematics study

Economic Development Impact of Corridor Improvements and Preservation Projects (SPR-3912)
- Additional $150,000 from SHRP 2 Implementation funding.
- Model goes beyond typical economic analysis
IMPACT on Legislative, Planning and Finance Policies

- Ohio River Bridge, East End Crossing Project AAR of Procurement Models (SPR-4200)
  - Captures Best Practices for P3

- Damage-Wise
  - Increasing revenue by better documentation
  - Record number of Invoices and amount invoiced
  - FY17, $10M in receipts
Attracted External Funding & Partnerships

- $200,000 State Transportation Innovation Council (STIC)
- $635,000 SHRP Implementation Assistance

Coordinated 22 projects on EDC 3 and EDC 4

- Ready to Implement technologies
- Additional funding/leveraging opportunities
Impacting INDOT Innovation and Staff Development

- Section 1304 (reduced match for innovation) - Karen Hicks
- 3D Engineered Models – Mike Jenkins
- Data-driven safety analysis – Mike Holowaty (also Brad Steckler & John Wright)
- eConstruction – Mike Jenkins and Mark Miller
- GRS-IBS – Patrick Conner with LTAP
- Improving collaboration and environmental documentation – Laura Hilden
- Improving DOT Railroad coordination – Doug Gannaway
- LPA stakeholder partnering – Kathy Eaton-McKalip
- Road diets – Roy Nunnally, (and Laura Slusher with LTAP)
- Smart work zones – Ed Cox and Darcy Bullock
- Ultra-high performance concrete connections – Jeremy Hunter and Anne Rearick
Innovations, Market-ready Technologies, Partnering, Leveraging

- Automated Traffic Signal Performance Measures (ATSPMs)
- Accelerating Traffic Incident Management (TIM) Data Collection
- Advanced Hydraulic Modeling Tools
- Community Connections
- Data-Driven Safety Analysis (DDSA)
- e-Construction and Partnering: A Vision for the Future
- Integrating NEPA and Permitting
- Pavement Preservation (When, Where, and How)
- Road Weather Management – Weather-Savvy Roads
- Safe Transportation for Every Pedestrian (STEP)
- Ultra-High Performance Concrete Connections for PBES
### IMPACTed by SHRP 2 Implementation Assistance Funding

<table>
<thead>
<tr>
<th>Fourth Round Products</th>
<th>Proof of Concept Pilot</th>
<th>Lead Adopter Incentive</th>
<th>User Incentive</th>
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<tbody>
<tr>
<td><strong>June 2014</strong></td>
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<tr>
<td>R09: Managing Risk in Rapid Renewal Projects</td>
<td></td>
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<tr>
<td>R10: Innovative Strategies for Managing Complex Projects</td>
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<tr>
<td>R06C: Rapid Technologies to Enhance Quality Control on Asphalt Pavements</td>
<td>2 (GPR) $50,000</td>
<td>5 – 10 (IR) $60,000</td>
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<td>R06E: Real-time Smoothness Measurements on PCC</td>
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<tr>
<td>C03/C11: T-PICS/Economic Analysis Tools</td>
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<td>6 $125,000</td>
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<tr>
<td>R06A: Nondestructive Testing Technologies for Concrete Bridge Decks</td>
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<td>Sixth Round Products, June 2015</td>
<td>Proof of Concept Pilot</td>
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<td>Utility Investigation Technologies, (R01B)</td>
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<tr>
<td>Precast Concrete Pavement, (R05)</td>
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<td>Up to 4 $300,000</td>
<td>Up to 5 $75,000</td>
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<td>Identifying and Managing Utility Conflicts, (R15B)</td>
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<td>New Composite Pavement Solutions, (R21)</td>
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<td>Up to 3 $160,000 to $500,000</td>
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<tr>
<td>WISE: Work Zone Impacts and Strategies Estimator Software, (R11)</td>
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<td>Plan Works; Better planning, Better projects, (C01)</td>
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<td>Up to 7 $300,000</td>
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<tr>
<td>Product Description</td>
<td>Proof of Concept Pilot</td>
<td>Lead Adopter Incentive</td>
<td>User Incentive</td>
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<tr>
<td>Utility Investigation Technology Bundle (R01A/R01B/R15B)</td>
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<td>Up to 15 $150,000</td>
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<td>Reliability in Simulation and Planning Models (L04)</td>
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<td>Reliability Data &amp; Analysis Tools (L02/L05/L07/L08/C11)</td>
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<td>Regional Operations Forum (L36)</td>
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<td>Railroad-DOT Mitigation Strategies (R16)</td>
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<td>Nondestructive Testing for Tunnel Linings (R06G)</td>
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</tbody>
</table>
IMPACTed INDOT Talent Management and Evolve Program

- **EVOLVE field trips**
  - ORB Construction Project Field Visit
  - Subaru of Indiana
  - Port of Indiana
  - INDOT staff, ES, faculty, students (future INDOT employees)

- **Inside INDOT article;**
  “Young Professionals Experience Huge Learning Moments”
**IMPACTed Pavement and MSE Walls Training**

**Pavement Training**
- Complete training curriculum on pavement in 8 weeks
- Better analysis and decision making for INDOT program managers and engineers
- First round, 2012 to 2014, 26 participants
- Second round, 2016 to present, 28 participants
- Result: better, cost-effective pavement designs, longer service life for Indiana pavements

**MSE Walls Training**
- Better inspection procedure for inspectors
- Better trained inspectors
- Avoid costly mistakes
- IMPACTs performance, failed materials and litigation
- First round in 6 Districts, 475 participants
- Second round, TBA
Engagement IMPACTs: INDOT Staff Visit and TRB Visit

- **JTRP Chairman & INDOT Executive Staff Visit R&D Facility and Purdue Campus**
  - Focus: Engagement
  - November 1, 2016

- **TRB State Visits**
  - 2015, Focus: Pavement and Materials
  - 2016, Focus: Construction and Planning
  - 2017, Focus: Bridges and Structures
Engagement IMPACTs: New Transformational Technologies

- Connected and Autonomous Vehicles Workshop
  - Date: June 15, 2017

- Transportation Active Safety Institute (TASI) at IUPUI
  - Date: August 17, 2017

- Potential new partnering, cost sharing opportunities
National Recognition IMPACTs: AASHTO Sweet 16 Awards and TRB Papers

- **AASHTO Sweet 16 Award**
  - SPR-3833, Site Selection for New Lighting Technologies

- **AASHTO Subject Area Award**
  - SPR-3831, Safety Data Acquisition and Management

- **INDOT Traffic Signal Innovation**
  - *TRB best paper award*
  - Highlighted in Inside INDOT

- **Aggregate Durability Testing**
  - Shorter freeze and thaw testing time from 2 weeks to a few hours
  - Cost savings

*State and National Awards*
IMACTing INDOT Forensic Investigations

- **Bridges under fire**
  - Investigate the integrity of concrete bridge after fire
  - Possible damage wise claims

- **MSE Walls investigations, 25 + 11 sites**
  - Potential litigation case
  - Better construction procedures

- **Pavement premature failure on SR-26**
  - Potential latent defect cases
  - Better understanding of best practices in asphalt overlay
Falling Weight Deflectometer
- Pavement scoping
- Pavement design
- Pavement investigation

3D Laser Pavement Condition
- Precise crack width, length, depth
- Super-elevation on slopes
- Longitudinal and transverse profile
- Smoothness and texture

Friction Testing
- To assure safety for the traveling public
- Approval of aggregate materials

Network Level GPR Evaluation of 47 Bridge Decks
- Better scoping and bridge candidates selections
- Data driven decision for preservation and rehabilitations

IMPACTs from Specialized Testing Programs

Forensic Investigation
February 15 Show Case & Peer Group meetings to identify research needs and on an ongoing basis

- 124 needs submitted thus far for FY 2018

FY 2017 INDOT Research Program

- 77 Research Needs submitted,
- 49 Research Projects initiated,
- 24 Completed Studies,
- 79 Active Studies
Research Projects
- 91% of INDOT 32 Business Owners indicated a response of very good or better (Qualtrics survey)
- Research Program IMPACTs all areas of INDOT

Specialized Testing & Forensic Investigations
- 100% of respondents indicated meets expectations or better
- Litigation cases settled in INDOT’s favor!

Satisfied Customers!
IMPACT Challenges going forward

- Additional networking opportunities between INDOT, practitioners and academia
- Developing a research and continuous improvement culture in INDOT Peer Groups
- Better awareness and engagement of all interested faculty
- Managing time extensions
- Follow through on Implementation Plans
- More needs than money
- Others
ABOVE & BEYOND

WHEN A TEAM OF DEDICATED INDIVIDUALS MAKES A COMMITMENT
TO ACT AS ONE... THE SKY’S THE LIMIT.