**Potential IRISE Research Topics: October 18. 2018 Brainstorming Session**

Note: **Bolded** items are the titles of ongoing or recent research on the topic.

1. . Drainage/retention pond issues (new MS4 requirements)

a. Due to the increased pattern of severe storms & flooding which may necessitate the construction of more ponds, increasing the ROW needs

b. Are there any better design/implementation practices

c. What are other States doing? Are there any new or innovative ideas we can incorporate?

**Surface water modeling, stormwater analysis and water quality assessment of urban areas**

2. Resiliency/Sustainability

a. Landslide predictability/stabilization in face of increased precipitation and impact of landslide repairs on budgets

b. Increased flooding and scour as a result of big storms – soil type considerations

c. Enhanced re-use of construction materials

d. Examine innovative construction materials (e.g., luminescent materials and natural rubber) to reduce environmental impacts and cost

3. Bridge Durability

a. Corrosion prevention, mitigation and rehabilitation

i. Structural steel pack rust (evaluate coatings)

ii. Dehumidification

**Waterproofing bridge abutments**

b. Durability of concrete bridges (repair, bio-additives)

c. Long term performance of new technologies (UHPC, SMA)

c. Multi-span girder cracking (> 200’)

d. Demonstration of fiber-reinforced polymer repairs of concrete structures

e. Bridge Decks

i. Seal deck cracking (best materials/processes)

ii. Polymer concrete and epoxy overlays durability

iii. Latex overlays: vibration (rapid and normal set), deflection

iv. Longitudinal and transverse grinding specs

v. Rapid set deck patching with latex overlay

vi. Evaluate use of waterproofing membrane under overlay

vii. Demonstration of glass-fiber reinforced polymer reinforcing bars for longer lasting bride decks

viii. Effects on steel deterioration, use of ultra-high performance concrete

ix. Non-destructive assessment of delamination

x. Impact of weight overloads on bridges and roadways

xi. Monitoring of stormwater flow on decks and into scuppers

**Novel approach for the noninvasive assessment of fresh concrete**

**Evaluation of Bridge Cleaning Methods on Steel Structures**

**Structural Evaluation of Slab Rehabilitation by the Method of Hydrodemolition and Latex Modified Overlay**

f. Bridge scour issues, repairs using concrete filled steel tubes

**Remote Sensing of Bridge Scour Installation Testing Phase**

**Corrosion Repair Strategies for Steel Bridges using High Performance and Traditional Materials**

**Data Management, Mining, and Inference for Bridge Monitoring**

4. Automated bridge inspections (also water inlets)

a. What works best (trust/accuracy)?

i. Ultrasound

ii. GP radar

iii. Hand-held LIDAR

iv. Cathodic protection types, what works, is it worth the cost

v. Drones (loss of GPS signal under bridge)

b. Structural health monitoring

i. When to use? Funding is always an issue. A lot of data to process. Has it been beneficial when fully implemented (I35)?

ii. Application: How many? Where?

iii. B/C

iv. Transform data into information

c. Vibration monitoring and development of models to predict health and remaining life of structure

5. Bridge Design and Construction

a. When is it appropriate to use 3D?

b. Bridge pavement quality – appropriate IRI for long bridges

c. Can joints be eliminated?

d. Horse/buggy – rhythmic trotting

e. Methodologies and technologies to resist LTB buckling during construction

f. Use of bridge inspection reports to identify trends in deficiencies

g. Review of bridge inspection reporting system, integrate reports with programming of repairs/rehabs

**Depth to Bedrock Seismic Measuring Devices**

**50 KSI Steel Piles**

6. Pavement Durability

a. Early indicators

b. Data driven understanding of life cycle (asset management), # interventions needed and when

c. Best/most durable materials to use

ci. Methods to reduce concrete shrinkage

e. Construction/maintenance guidelines for relief joints (heaving)

f. Experience with use of micro-surfacing, especially in winter conditions, e.g., paint lines

g. Innovative methods to determine concrete strength

7. Pavement Design

a. Are subgrades being overdesigned?

b. Bituminous thickness and impact on cost (value engineering), spec revision?

c. Waterproofing

d. Assess harder asphalt

e. Long term performance/constructability of hybrid design/construction

f. Tailoring to local conditions

g. High strength/high durability tradeoff

h. Application of biofilms to extend benefits of pervious concrete pavements

i. Life cycle assessment of use of nanomaterials to improve performance of concrete pavements

j. Development of thin-high performance pavement designs to avoid reconstruction under overpasses when overlaying

k. Conduct scan for new material or techniques (chemical, mechanical, materials)

l. Maximum lifts for bituminous placement

8. Pavement Maintenance

a. Evaluate rapid set patch materials

b. Reinforced concrete - breaking procedures prior to overlay placement

c. Impact of design on maintenance

d. Center/edge joint deterioration for asphalt pavements: best practices elsewhere (minimize further deterioration, durability)

e. Joint sealing – proper materials/workmanship

f. Improved non-destructive assessment methods for asphalt compaction uniformity

9. Impact of long wall mining on ground reaction (sinking). Impact on negotiations with mining comapnies

10. Consistency of specifications relative to other states – value engineering, alternative designs, what’s to be learned

11. Assessment of accelerated techniques: ABC Best Projects

a. Rapid bridge replacement/accelerated maintenance and user cost benefit

b. Use of P3s

c. Accelerated bridge construction

d. Use of concrete-filled steel tubes (piers)

e. How much curing time needs to be provided? How strong does it need to be before opening?

Environmental (weather) effects.

f. Optimize construction time. Minimize downtime and impact on construction co costs and penalties. (e.g., use of deicing)

g. Use of accelerated concrete (strength/durability)

h. Tradeoff between construction efficiency and maintaining traffic

i. Use of new technologies: visualization, automated mapping, robots (e.g., Tybot)

12. Evaluate/road test performance of new products (e.g., crack fillers, microsurfacing, aspahlty-polymer spray-ons)

13. Integration of State road, bridge and construction/materials data systems to share data and improve ability to diagnose/pinpoint issues

14. Assessing impacts on users

a. Develop procedures for evaluating impacts on traffic of multiple, concurrent construction projects

b. Provision of information on multi-modal travel options during construction-related closures

14. Impact of AVs on infrastructure (e.g., visibility of pavement markings, impacts of truck platooning on structures/pavements)

15. Workforce issues (e.g., ability to use new tools, lack of qualified supervisors)

16. Construction contract flexibility (e.g., performance payments)

17. Future infrastructure investment needs, economic (societal benefits) analysis, future funding sources (e.g., P3s, sales tax dedicated to improvements, tolling, MBUFs) .

18. P3s - use of P3s for bridge projects, review of RPRP from PennDOT,

Clicking on the icons below will open the presentations given by the Pennsylvania Turnpike and University of Pittsburgh faculty during the session.

