

# WORKSHOP OVERVIEW

ANDREW BERTHAUME

ITS PCB TEAM

# PROBLEM

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## Teaching ITS Concepts can be difficult.

New and emerging concepts may require specialized tools, resources, and approaches to teach.

- Some **educators found effective methods** for teaching core ITS concepts.
- **Tools and resources** currently exist,...
- ...however, **additional tools and resources** may be required.

## Alignment between ITS education and field is critical.

ITS Systems are...

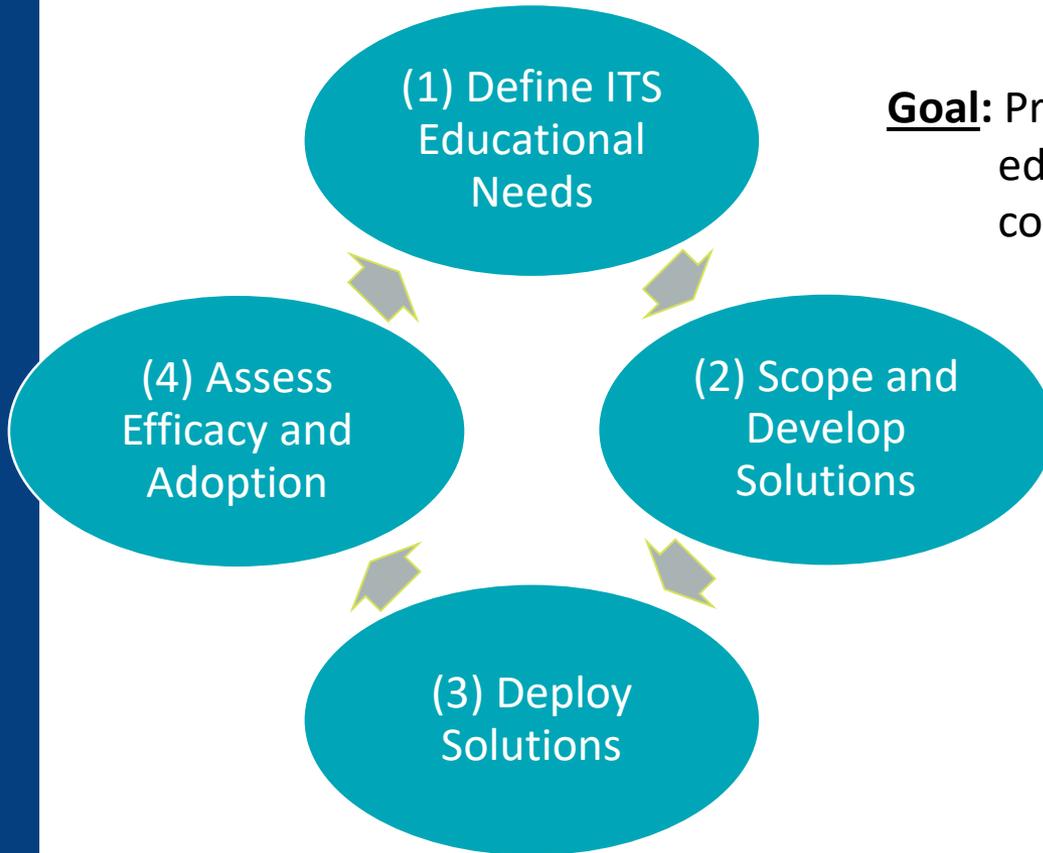
- Becoming increasingly **complex**
- More **prevalently deployed** and used on US roadways
- Require **specialized knowledge** and **multi-disciplinary teams** to plan, install, and operate

As **technology evolves**, so does our **core knowledge requirements**. And our **work processes**.

Finally, **shortages in the ITS workforce** need to be addressed early in education.



# ITS ACADEMIC STRATEGIES



**Goal:** Provide tools and services to aid ITS education at the high school, community college, university, and graduate levels.

## Examples of Activities

- (1, 4) ITS Academic Workshops
- (1, 4) Community College Workshop
- (2, 3) Transportation Technology Tournament
- (2, 3) T3e Webinar
- (2) APA Coordination
- (2) TWC Coordination
- (3) ITS Curriculum Website
- (1, 2, 3) SBIR ITS-CV-AV Lesson Plans for 6-12
- (1, 2) SBIR ITS-CV-AV Technician Training
- (2, 3) ITS PCB Website Updates
- (1, 3) TRB Attendance and Discussions



# ITS ACADEMIC WORKSHOP - ABOUT

A **two-day collaborative event** where **educators** and **practitioners** work together to:

- Align ITS education with field needs and
- improve ITS educational materials and practices.

Builds on previous workshops.

## Attendees:

- **Educators** (university, community college, technical school, trade school, and high school),
- **Federal employees,**
- **Practitioners** (from state DOTs, MPOs, and private consultancies), and
- **Professional associations** (ITSA, ITE, APTA, APA, NADO, AASHTO).



# ITS ACADEMIC WORKSHOP - OBJECTIVES

1. **Define** the current (and future) **knowledge, skills, and abilities (KSAs)** required for entry-level ITS positions.
2. Collaboratively **explore the continuum of ITS education**, defining student needs as they progress in levels of ITS learning.
3. **Identify** and discuss **existing tools, best practices, and strategies** used to **teach and build these KSAs** in students.
4. **Identify** any **unmet educational needs, define solutions, and set action-items**.
5. Provide educators and practitioners with a **peer-to-peer network** to exchange best practices.



# ITS ACADEMIC WORKSHOP - AGENDA

## Day 1:

**Define the knowledge, skills, and abilities (KSAs) required for entry-level ITS positions. (obj. 1)**

Time (ET)	Activity
9:00am	Welcome
9:20am	About Today's Workshop
9:40am	Peer Group Discussions
10:10am	<i>Break</i>
10:20am	[State of the ITS Workforce] Perspectives from DOTs and other Agencies
11:20am	[State of the ITS Workforce] Perspectives from Professional Societies and Associations
12:00pm	Working Lunch (onsite) Overview of THEA CV Pilot
12:45pm	Tour of THEA CV Pilot Site & Control Center
4:00pm	<i>Break</i>
4:10pm	Recent Graduates Panel Discussion
5:15pm	Day 1 Closure, with Q&A
5:25pm	Adjourn
5:25pm	OPTIONAL: Tour of District 7 RTMC



# ITS ACADEMIC WORKSHOP - AGENDA

## Day 2:

Explore the **continuum of ITS education**. (obj. 2)

Discuss **existing tools, best practices, and strategies** used to **teach and build these KSAs** in students. (obj. 3)

Identify **unmet educational needs, define solutions, and set action-items**. (obj. 4)

Provide educators and practitioners with a **peer-to-peer network** to exchange best practices. (obj. 5)

Time (ET)	Activity
8:45am	Recap of Day 1 and Overview of Day 2
9:15am	Best Practice Presentations
10:45am	<i>Break</i>
11:00am	Transportation Workforce Centers  Question Answer Period
11:40am	NOCoE – Presentation on NCHRP Report
12:00pm	Lunch (onsite).
12:30pm	Open Marketplace & Informal Discussion Session
2:00pm	<i>Break</i>
2:15pm	Open Discussion
3:45pm	Close the Workshop
4:15pm	Adjourn



# KSA RECAP & EXPLANATION OF FIRST BREAKOUT

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- *Explain breakout by table*
- *Show handout*
- *Explain day-long activity*
- *Recap KSAs...*



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# DAY 1: DEFINE THE CURRENT AND FUTURE ITS NEEDS

2017 University Workshop

November 8<sup>th</sup> & 9<sup>th</sup>

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# SKILLS/ABILITIES

*WHAT DO STUDENTS NEED TO BE ABLE TO DO WHEN THEY ENTER THE ITS WORKFORCE?*

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- **Critical Thinking.** Problem solving, approaching problems from different angles.
- **Communication.** Technical and non-technical information. Written and verbal. Communication is critical in all ITS job positions.
  - Not just clear wording, but communicating the right content to the right audiences using the right mechanisms. (For example, you wouldn't tell a decision-maker about the technical details; you'd tell them about the benefits of the system).



# SKILLS/ABILITIES (CONTINUED)

*WHAT DO STUDENTS NEED TO BE ABLE TO DO WHEN THEY ENTER THE ITS WORKFORCE?*

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- **Continue learning & maintain flexibility.** Technology is continually advancing. Between continuing education, on-the-job training, and additional degrees, folks in ITS should be capable of learning and applying new concepts, processes, and technologies.
- **Define the Operational/Safety Problem.**
- **Basics of Project Management,** within the context of ITS.
- **Data Analytics.** System optimization, statistics, etc.
- **Computer Programming & Software Literacy.** May include coding (such as C++). May include software and analytical tools (such as Python)



# KNOWLEDGE

*WHAT DO STUDENTS NEED TO KNOW WHEN THEY ENTER THE ITS WORKFORCE?*

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- **Emerging Technologies.** Identified as a difficulty in ITS education (by educators) and a topic of significant importance by the workforce.
- **Networking.** Switches, routers, fiber optics, and IP addresses... how do networking devices work, how do you install them, how do you use them, and how do you operate and maintain them?
- **Terminology.**
- **Standards.**
- **Systems Engineering.**
- **Math.** Statistics and math are requirements for nearly every ITS and transportation job.



# KNOWLEDGE (CONTINUED)

*WHAT DO STUDENTS NEED TO KNOW WHEN THEY ENTER THE ITS WORKFORCE?*

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- **Electronics/Electrical and Computer Systems.**
- **ITS 101.** Systems and solutions: what they, what their benefits are, the problems they're best suited for solving, etc.
  - Knowledge of technology components. What's available, each components strengths, weaknesses, etc. (ex. Bluetooth vs. wifi).
  - Know how to use this information to assess policies.
  - Being able to quantify the benefits so that others can make decisions (i.e. know enough to do a Cost Benefit Analysis)
  - Basic and advanced concepts



# KNOWLEDGE (CONTINUED)

WHAT DO STUDENTS NEED TO KNOW WHEN THEY ENTER THE ITS WORKFORCE?

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- **Planning Processes and Tools.** ITS Projects require forethought and planning. Understanding the processes and tools helps young professionals (in both planning and engineering) to deploy ITS solutions where needed, how needed.
  - **Strategic Planning.** Aligning Operational Need with Operational Solutions.
  - **The role of planning in ITS.**
  - **Stakeholder Coordination.** Who the critical stakeholders are, how to engage them, how to maintain effective communication and coordination. Who, when, and how to engage.
- **Governance.** How things get done, and who/when/how to work with others to get things done. Local, regional, and state processes.
- **Institutional Issues.** What internal barriers could prevent successful deployment of ITS solutions?



# OTHER - EXPERIENCE

*WHAT ELSE DO STUDENTS NEED WHEN THEY ENTER THE ITS WORKFORCE?*

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- **Experience.** Understand how to apply concepts, skills, and theory in the real world for practical purposes. Provides context for advanced concepts, helps “fill in gaps” left in coursework, and helps students learn to effectively apply concepts and tools in a practical setting.
- **Apprenticeship/mentorship/Internships.** Some ITS skills have to be learned on-the-job, and require hands-on skill. Planned apprenticeships/internships/mentorships could grow experience.
- **Multidisciplinary Team Experience.**
  - Not just engineering (civil and electrical), but planning, public administration, computer science,
  - How to communicate among/between team members, manage information,
  - Terminology



# OTHER – PERSONAL ATTRIBUTES

*WHAT ELSE DO STUDENTS NEED WHEN THEY ENTER THE ITS WORKFORCE?*

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- **Curiosity.**
- **Creativity.**
- **Hard-working.**
- **Social skills.** Able to champion efforts and effectively lead a group. Able to create and maintain effective partnerships. Interpersonal skills and social skills are a requirement.
- **Structured, organized thinkers.** ITS requires a structured and organized approach.



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**DAY 2:**  
**GAP IDENTIFICATION,  
SOLUTIONS, AND ACTION ITEMS**

2017 University Workshop

November 8<sup>th</sup> & 9<sup>th</sup>

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# STUDENT

*WHERE DO THE GAPS LIE BETWEEN WHAT STUDENTS NEED TO KNOW IN THE FIELD AND WHAT THEY LEARN IN THE CLASSROOM?*

- **Hands-On Experience.**

- Student competition could help, however, there are some steps to make the student competition more “engaging” or enticing for students to participate...

**FINANCIAL COMPENSATION FOR STUDENT COMPETITION WINNERS**

**IP CONCERNS FOR STUDENT COMPETITION DESIGN**

**ALIGNING THE STUDENT COMPETITION WITH THE ACADEMIC YEAR, SO IT CAN BE A COURSE.**

- **Knowledge of governance and policy**, how local government works, getting approval, funds, etc.
- **Students’ knowledge of job description and need for focus in school.** Be able to search what kind of job and what kind of focus area or minor you might need.
- **Awareness of available information**—through ITE student chapters or other—a way to start disseminating information to broader base.



# ACADEMIC PROGRAMS

*WHERE DO THE GAPS LIE BETWEEN WHAT IS AND SHOULD BE TAUGHT IN UNIVERSITIES?*

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- **Teaching this is a moving target, so is managing employee skill sets**
  - Technology is moving so fast that it is hard to fully understand what will be important to teach in the future. Moving target. Acquisition and preparation time to teach will increase.
  - Employees will need to know more about AV/CV and its accompanying technology.
  - Managing for change- need more leadership qualities in how to deal with change and uncertainty and how to manage tasks that the manager doesn't fully understand.
  - Disconnect between managing teams and the technical expertise needed by employees.



# ACADEMIC PROGRAMS (CONTINUED)

*WHERE DO THE GAPS LIE BETWEEN WHAT IS AND SHOULD BE TAUGHT IN UNIVERSITIES?*

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- **Difficult to balance “generalization” of knowledge (i.e. teach to the ideals) vs. specialization of knowledge that caters to specific companies or agencies.** Niche vs. broad. Teaching toward the advisory board comments (advisory boards being comprised of companies hiring the students) vs. teaching toward IEEE and USDOT Standards and processes. What’s useful? What balance do we strike?
  - Undergraduate education and masters/doctoral education are different in the depth you need to subject students to.



# ACADEMIC PROGRAMS (CONTINUED)

*WHERE DO THE GAPS LIE BETWEEN WHAT IS AND SHOULD BE TAUGHT IN UNIVERSITIES?*

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- **Limited space in engineering curriculum for new topics as well as taking courses outside of the department**
  - How to fit the needs in a limited amount of class time devoted to ITS in class.
  - Universities need to be more willing to share students with other departments (graded by how many students are in seats) to expose students to a more interdisciplinary education.
- **Classroom vs. work experience**
  - The structure of the curriculum might need to change. May be more opportunities for learning by working in the field. Students better understand what they are learning from work experience.



# ACADEMIC PROGRAMS (CONTINUED)

*WHERE DO THE GAPS LIE BETWEEN WHAT IS AND SHOULD BE TAUGHT IN UNIVERSITIES?*

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- **Incorporating the “social” and interpersonal aspects.**
  - Soft skills are highly prized by employers (communications skills, management, etc.) but not as much by educators
- **Professors’ knowledge might be dated.** Some professors learned ITS materials 10+ years ago. Technology is ever-changing, as are the processes by which we implement this technology. It’s important that professors keep updated on new technologies and processes/best practices for implementing technology.



# ACADEMIC PROGRAMS (CONTINUED)

*WHERE DO THE GAPS LIE BETWEEN WHAT IS AND SHOULD BE TAUGHT IN UNIVERSITIES?*

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- **(Professors) Are we really deficient?** Based on career fair job postings, most companies only have a couple openings for ITS positions. Are universities already producing enough people? Do these ITS graduates have sufficient knowledge and skills? If we push beyond what we're already doing, will that create a workforce that exceeds demand?
  - (For emerging technologies) Is the market niche already handled by the schools with testbeds and other hands-on programs?
- **Should we be talking to electrical engineers instead?** Should we be teaching Transportation to electrical engineers, or teaching electrical engineering to civil engineers?
- **Planning in transportation... are we teaching systems, approaches, the overall process?** Con-ops, sausage diagrams... do civil engineering students know what they need to know about planning in transportation?



# EMPLOYERS/PRACTITIONERS

*WHERE DO THE GAPS LIE BETWEEN IS AND SHOULD BE DONE ON BEHALF OF EMPLOYERS AND PRACTITIONERS?*

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- **Does the industry know what they need?** Deep learning, big data analysis, html... students with these skills typically get hired immediately. But those are not the skills that civil companies say they need. Do civil companies know what they need?
- **KSA gaps between employers and employees.** Since employees are doing the majority of the technical work, some employers aren't as knowledgeable about technical needs as the employees.
  - A KSA gap with employers not knowing the true needs of their employees.
  - Disconnect between managing teams and the technical expertise needed by employees.
- **Employers need to be capable of managing for change.** Employers need tools and leadership skills for dealing with change and uncertainty. They also need to be skilled in managing tasks that they don't fully understand



# EMPLOYERS/PRACTITIONERS (CONTINUED)

*WHERE DO THE GAPS LIE BETWEEN IS AND SHOULD BE DONE ON BEHALF OF EMPLOYERS AND PRACTITIONERS?*

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- **(Once they enter the workforce) How do you retain the talent?** Electrical engineering, computer systems, civil engineering... Once someone becomes proficient in the skills necessary to be a great ITS engineer, they're probably going to be poached by much higher paying jobs in other industries.
- **Idealistic concepts vs. the real world.** IEEE has standards, which would be implemented in an ideal world. In the real world, they're implemented and misused.



# ITS PCB PROGRAM

## ACTION ITEMS

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- **ITS Lab Course.** A “laboratory” session to supplement ITS course work, with a list of equipment that could be used to host a lab session.
- **(with NOCoE, ITS America, and ITE) Address any IP concerns with the Student Competition.**
- **Conduct a 6-month follow-up with the professors following T3es.** To tell the professors how many additional people downloaded and viewed the T3e. And to follow-up with students – how has the T3e impacted them? (there are many
  - In the newsletter, we can do a “where are they now” and highlight a student who presented and/or talk about projects that started because of the T3es, and then link to the archived T3e



# ITS PCB PROGRAM

## *ACTION ITEMS*

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- **Virtual University Workshop “check-ins”**. Potentially monthly. To check in with updates in action items, new issues, additional thoughts, etc.
  - **Forum for professors to exchange best practices**—who has used ITS PCB products (or others), the content they used, their experience, how they adapted the material, what their experience was.



# UNIVERSITIES

## ACTION ITEMS

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- **Spin the student competition into a course.**
- **(keeping up with Technology) use the T3s**
- **Look for opportunities to make courses within your department interdisciplinary.** Can a CE course be collaborative with an urban planning, policy, marketing, business, GIS, or public health course?
- **Encourage students to learn about governance**, either through elective course or integrating concepts into a class project
- **Engage alumni and recent grads** –understand their perspective on what was learned in school

