As co-chairs, we are very pleased to present these proceedings that summarize the discussions of educators and practicing professionals who gathered to improve the first year course in transportation engineering taught by more than 220 civil engineering programs in the United States.

More than 60 people attended the conference at Portland State University. The four main sessions of the conference were:

- Presentations on innovations in transportation engineering education;
- A workshop on the learning domain;
- A workshop on creating active learning environments; and
- A workshop that identified six ways in which the group can continue to contribute to the improvement of engineering education.

We encourage you to read through the proceedings to learn more about the exciting discussions that occurred during these two days. We also hope you will find ways to become engaged in the continuing effort to improve transportation engineering education.

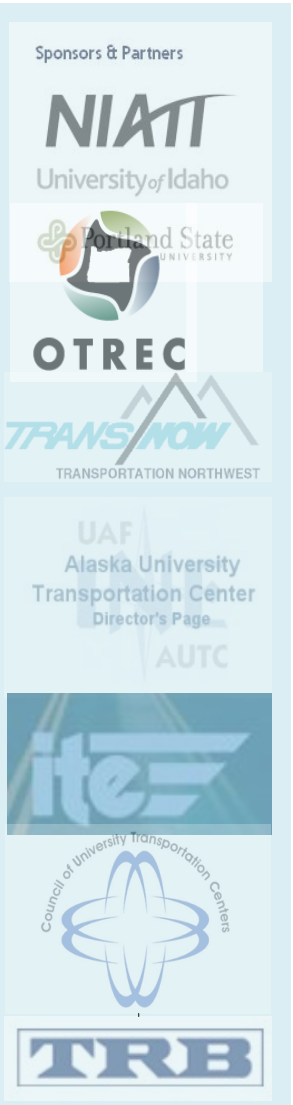
Robert Bertini, Portland State University

Michael Kyte, University of Idaho

Help Design the Future of Transportation Engineering Education

The Transportation Education Conference was a three-day program designed to improve the content and delivery of transportation engineering education. Educators and practitioners convened to exchange innovations and address ways to improve teaching methods and enhance the overall learning environment.

A consortium of six academic and professional partners (see list at right) sponsored the event held June 22-24, 2009, in Portland, Oregon.



Why Hold A Conference?

The conference was designed to bring to together university faculty and transportation professionals to focus on the introductory transportation engineering course and collaborate on ways it can be improved. The highly interactive format encouraged the exchange of innovative ideas and best practices, the discussion of current research, and the development of action plans to sustain progress on specific topics after the conference.

Why is this important?

Nearly all of the nation's 224 civil engineering programs have one or two required transportation courses as part of their undergraduate program. For some civil engineering sub-disciplines, there is a logical sequence of courses leading to the required junior level courses such as geotechnical, materials, structures and hydraulics. For other disciplines, however, the logic and sequence is less clear or linked. This is certainly the case in transportation courses. A lack of clarity and connection with other sub-disciplines pose significant challenges for faculty, students and practitioners in transportation engineering.

Our Challenge

Three questions provided a unifying theme during the first two days.

1) How do we map the learning domain for transportation engineering;
2) How do we create active learning environments for undergraduate transportation engineering students; and
3) How do we develop collaborative tools for sharing transportation engineering curricular materials?

On the third day, participants were offered a mini-version of the American Society of Civil Engineers' Exceed teaching workshop.

This report is a summary of the conference presentations and workshops. It also features a set of action plans developed by participants to advance work on a set of six priority issues.

Day One, Morning

Opening Remarks

Conference hosts Robert Bertini, of Portland State University and Michael Kyte, of the University of Idaho offered a warm welcome and overview of the 3-day event.

They both encouraged participants to identify barriers to understanding in the classroom, focus on the full spectrum of the education process, and consider ways to extend new collaborations beyond the conference.

Presentations

Innovations in Transportation Engineering Education

A series of brief presentations introduced new tools, approaches, and research efforts focused on creating an active learning environment for students. Discussions throughout the conference were inspired and energized by this overview of innovations.

1. **Simulating Transportation for Realistic Engineering Education and Training (STREET)**
   David Levinson, University of Minnesota

Professor Levinson described the web-based simulation modules he has developed to improve instruction in the Introduction to Transportation Engineering course. Simulation tools have been proven to encourage active learning in other disciplines, but have not yet been widely employed in transportation engineering education.

He noted that the modules are based on real tools and cover fundamental topics such as roadway design, demand modeling, traffic flow and network growth. In addition, an editable textbook has been produced with an evolving set of teaching materials to support an interactive learning environment.

Modules

ROAD – Roadway Online Application for Design
OASIS – Online Application for Signalized Intersection Simulation
ADAM – Agent-based Demand and Assignment Model
SONG – Simulation of Network Growth
SAND – Simulation and Analysis of Network Design
SOFT – Simulation of Freeway Traffic

STREET is designed for faculty and students and will be updated to reflect the feedback and contributions of users. Extensive efforts to evaluate and test the simulations are underway in civil engineering programs across the country. Results will be disseminated and teaching materials updated based on faculty evaluations.

Links

David Levinson
dlevinson@umn.edu

STREET
www.street.umn.edu

Fundamentals of Transportation
http://en.wikibooks.org/wiki/Fundamentals_of_Transportation

Presentations

2. Developing an Engineering Environment Fostering Effective Critical Thinking Through Measurements (EFFECT)
Andrew Nichols, Marshall University

Professor Nichols began by explaining the disconnect between the manipulation of equations and the development of understanding. Students spend time learning equations, but don't necessarily build the critical thinking skills needed to effectively use them. Teaching students ***how*** to think rather than ***what*** to think is the focus of EFFECT.

He suggests that there is a need to develop an Introduction to Civil Engineering course that:

- Focuses on critical thinking
- Provides an overview of real world Civil Engineering disciplines
- Addresses at least one difficult concept
- Offers hands-on exercises or labs to enhance learning
- Utilizes extensive team work
- Assesses the critical thinking and concept outcomes

Using the EFFECT approach, course components revolve around and relate to broad, driving questions. Each active learning module leads to learning of relevant fundamental concepts. Exercises challenge students to consider the various factors involved in an assessment and calculation. They are asked to record their thought processes, and the knowledge and assumptions they used to address the driving question in journal entries.

In a sample exercise, students consider how much time it will take to get all evacuees out of a designated area under a mandatory evacuation. Working first on their own, and then in a team, they prepare responses to a series of follow up questions about their approach, reasoning, and research.

EFFECT has resulted in a successful module format for lab activities. There are however, several challenges identified by the researchers that may lead to the refinement of current exercises.

Challenges

- Successfully guiding group discussions to encourage critical thought
- Designing exercises to help understand difficult concepts
- Providing the significant class time required for this approach
- Capturing the level of critical thought

Links

Andrew Nichols,
Marshall University
andrew.nichols@
marshall.edu

Presentations

3. What are the "Understandings" for the Introductory Transportation Engineering Course

Shane Brown, Washington State University
Michael Dixon, University of Idaho
Brock Andrews, Washington State University

The development of fundamental concepts in engineering courses, Brown, Dixon and Andrews believe, will better prepare students for a rapidly changing technological world. What do students learn and understand about fundamental elements of geometric design? Are they prepared for advanced courses or a successful professional career?

Through their research, Brown, Dixon and Andrews have identified subject-specific difficulties that have implications for design. An engaging presentation shared the highlights of their work.

Approach

Brock Andrews discussed the qualitative research approach they used involving interviews with students. A standardized protocol was developed that featured nine questions, provided figures and problems to the subjects, and allowed for individualized probing questions. Twenty students participated from the Introduction to Transportation Engineering course at Washington State University and the University of Idaho.

The interview protocol was based on two objectives:

- Avoid questions addressing more than one concept
- Have multiple questions focused on the same concept

Results

The researchers presented their initial results that indicate several subject areas are especially difficult for students.

Common challenges for students:

- Sight distance vs. stopping sight distance misconceptions
- Trouble with horizontal curve design
- Reliance on equations and past homework to solve new problems

Implications

What are the implications of this lack of understanding among students? Professors Brown and Dixon are working to further characterize conceptual understanding and common misconceptions.

They will be expanding their research to include interviews with new professional engineers. They expect the results will be useful to improve curriculum and enhance the teaching of geometric design.

Links

Shane Brown
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Michael Dixon
University of Idaho
mdixon@uidaho.edu

Brock Andrews
Washington State University
k2bandit7@hotmail.com

Presentations

4. To Be a Transportation Engineer or Not, How Civil Engineering Students Choose a Specialization

Jennifer Dill, Portland State University

Professor Dill challenged conference participants to consider the growing shortage of transportation engineering and planners. She suggested that the focus of most universities is on recruiting and retention. Professor Dill's research looked instead at how to enlarge and improve the pool of civil engineering students.

Her research considers factors that lead undergraduate students to specialize in transportation. The primary method was a web-based survey of 1,852 civil engineering students. Professor Dill discussed the central questions of her work and what improvements are suggested by the results.

Central Questions

- What factors are important to students?
- What factors do students consider when choosing a specialty?
- What sources of information do they use to choose the specialty?
- How helpful are these resources?
- How do students perceive the transportation specialization?

Key Factors for Students

Knowing when and how students make their selection is critical. The findings indicate that only one quarter of students who had chosen a specialization did so before starting college. Most decided before their junior year.

What is important to students?

The content of the work is of primary importance:

- Improving quality of life in cities in towns
- Influencing public policy
- Improving the natural environment
- Working for a private company

Job security and salary are secondary considerations.

Professor Dill noted that primary information sources for students were what they learn in classes, web resources, and internship experiences.

How might we influence decisions?

- Provide more and better information
- Identify and address the misconceptions of the field
- Raise awareness of interesting faculty research in transportation
- Improve the quality of teaching
- Integrate a focus on specialties early in curriculum
- Invite guest speakers into the classroom

Links

Jennifer Dill,
Portland State University
dnwm@pdx.edu

Full Report at Mineta Transportation Institute
www.transweb.sjsu.edu

Presentations

5. Pavement Interactive! A Wiki
Joe Mahoney, University of Washington

Professor Mahoney presented this new web-based tool developed by a consortium of state DOTs. He explained the online reference and collaboration center to be a resource, not a course. It features an encyclopedia of 600 pavement articles, interactive maps and a format for online sharing and collaboration. The popular site has 165 registered users and has hosted visits from 191 countries and more than 7700 cities.

Elements

- Reference Desk
- Collaboration Tool
- Training Tool
- Textbook – the major use at University of Washington
  (All Professor Mahoney's class materials are now online.)

Benefits

- Flexible
- Allows for user interaction and 2-way communication
- Growth through community contribution
- Underlying engine is open source

Core modules

- Pavement Types
- Design Parameters
- Testing
- Green Roads
- Maintenance
- Specifications
- Rehabilitation
- Materials
- Mix Design
- Structural Design
- Construction
- QC & QA
- Pavement Evaluation
- Pavement Management

What's next?

New articles are continually added to keep the site current. Professor Mahoney discussed plans to conduct a study of users with specific emphasis on Universities. He looks forward to presenting the interesting work of colleagues, like those in South Africa, to enhance the resources available on the site.

To those starting wiki-based research, Professor Mahoney offered lessons from his experience with Pavement Interactive. Go into it for the long haul, and don't expect much collaboration. There will be some, but not as much as you might expect.

Links

Joe Mahoney
University of Washington
jmahoney@u.washington.edu

Pavement Interactive
www.PavementInteractive.org

Presentations

6. Integrating Textbooks and Classroom Goodies

Karen Dixon, Oregon State University

To enhance the traditional education experience, Professor Dixon encourages the integration of interactive, technology-based tools or "goodies." She explained that the historic process that involves a conventional lecture, static textbook, and homework followed by exams to test knowledge is not effective with current students.

Today, students expect and require more. They are trained to be visual learners by their computers, games and phones. Educators need a variety of approaches using an array of tools and resources to engage them in learning. Creating and finding a set of interactive tools can be time consuming. She has developed and compiled materials and goodies to improve the learning experience.

Available goodies and materials

- Interactive in-class exercises
- Classroom websites and software (Blackboard, etc)
- Textbooks
- Instructional Videos
- Photographs and Images

Do it yourself Goodies

Professor Dixon offers these tools on her class website so they are always available to review, reinforce and deepen the understanding of concepts.

- Demonstration videos of in-class exercise (Cam Studio)
- Spreadsheets
- Develop in-class exercise
- Develop / Use Adobe Flash animations
- Simple continuous loop flash animation
- Intelligent user-driven flash animation (progression diagram)

What is next?

Working with three colleagues, Professor Dixon is producing on a new Introduction to Transportation textbook to be published by Wiley and ITE. It will be possible to purchase chapters individually.

A companion website will feature

- ABET-ready Materials
- Spreadsheet Examples
- Interactive Examples
- Data Collection and Analysis Labs
- Select Flash Simulations

She welcomes guidance on how best to use materials and exercises with small, medium and large size classes.

Links

Karen Dixon
Oregon State University
Karen. Dixon@ oregonstate.edu

Blackboard
www.gc.maricopa.edu

CamStudio
www.osalt.com

Presentations

7. What Undergraduates Should Understand
Wayne Kittelson, Kittelson and Associates

Mr. Kittelson began by noting the impressive gathering of leaders convened in the room. He told participants, “You are all setting the foundation of our work and shaping the future by preparing the transportation engineers of the future.”

He urged academics and practitioners alike to approach their work with two key things in mind:

- An understanding of interconnectedness, and
- A focus on systems rather than components.

Mr. Kittelson emphasized that these themes should be at the core of the learning experience for future transportation engineers. An emphasis on materials, teaching tools and approaches that expand the understanding of interconnectedness and the presence of systems will produce the best results.

Interconnectedness

Transportation engineering brings together components of planning, design, safety, and operations. Mr. Kittelson believes that a teaching approach that focuses on the interdependence of these elements and how this is reflected in the profession will best prepare students.

Systems

He further encouraged faculty to demonstrate that this work is about systems rather than individual components. While introducing tools is important, so is teaching students how to thoroughly evaluate, manage and apply tools effectively. He suggested students be challenged to consider how their work impacts the ecology, environment, safety and operation of the larger system.

Fundamentals for Undergraduates

1) Collaboration – the ability to solve problems and work effectively in teams.
2) Innovation – a mind-set that can adapt, create, and be open to new ideas.
3) Experiential Learning – build lasting knowledge and skills based on 3 basic questions:
   a. Why does it happen?
   b. What to do?
   c. Why do it?
4) Assess Multiple Components – every problem requires an understanding of interconnected implications.
5) Communication – key to successful collaboration, information exchange and teamwork.

Mr. Kittelson suggested that educators strengthen connections with current professionals and engage them in the learning experience.

Qualities of Ideal Professionals

- Problem-solving skills and abilities
- Communication – written, verbal, interpersonal
- Independent thought– the confidence to challenge and work alongside those older and more experienced.
- Self-management of time, priorities, and work

Links

Wayne Kittelson
Kittelson & Associates
www.kittelson.com

Presentations

8. What Do We Currently Teach?
Rod Turochy, Auburn University

The focus of Professor Turochy's research is this basic question about the topics taught in the first course in transportation engineering. His approach is to synthesize the current practice of topics, and compare these with previous studies.

He reviewed the differences between the results of a 1985 survey of 50 professionals and 1983 survey of 50 educators that ranked the importance of topics of the first year course. He also compared a 2004 survey of 200 transportation professionals.

He has found an increase in the ranking of Description of Transportation Systems and of Traffic Flow Characteristics. Why is this and what does it say about changes in the field?

A recent review conducted by Professor Turochy looked at the syllabi of current transportation engineering courses. This study compared 30 online syllabi from 220 ABET accredited Civil Engineering programs. He found that about 85% or 190 programs offer transportation courses.

Facts from the 30 syllabi surveyed

- 20% of courses have a lab
- 33% refer to ABET outcomes and objectives
- 83% are required courses in their programs
- 9 different textbooks are used

Professor Turochy finds that there is reasonably good alignment in course content among the syllabi considered in the study. He challenged educators to consider two basic questions:

- What should we teach? There is tension between depth and breadth of topics we cover in the course. There are trade-offs and choices to make in determining the right mix.
- How do we prepare students for success in follow-up courses, the professional workplace, in graduate study?

Suggestions and Ideas

- Focus and refine content - consider what topics are covered in other areas of the curriculum
- Consider the needs of local and state practitioners
- Infuse class work with interactive assignments to motivate students
- Teach cooperative learning with In-class design problems
- Use videos and simulations that reflect professional tools
- Invite practitioners to be guest speakers and offer internships

Links

Rod Turochy
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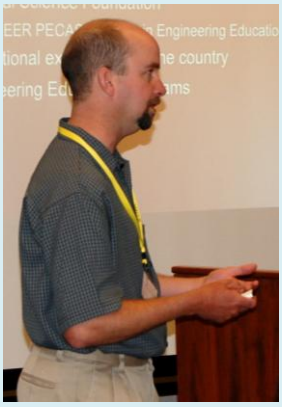
rodturochy@auburn.edu

Day Two – Afternoon
Workshop #1

How do we map the learning domain for transportation engineering?

Shane Brown, Washington State University and
Michael Dixon, University of Idaho



The focus of Brown and Dixon's work is to develop best practices in curriculum design. They suggest that educators emphasize fundamental concepts and big ideas. They note great interest in this topic among funders and experts across the country.

Student Learning Outcomes

Their work prioritizes three levels of student learning outcomes and suggests they be used as a framework for course development.

- Enduring Understanding
  Core concepts that serve as an anchor and are fundamental to the course. Ex: mechanics – relation between loads and internal stresses and deflections, normal and shear stress.
- Important to Know and Do
  Essential knowledge and skills that students should have.
- Worth Being Familiar With
  The broad field of possible content for a particular course.

Professors Brown and Dixon engaged conference attendees in a series of interactive exercises to show that how people perceive and learn is based on the level of knowledge they have and their experience with the topic. This means that students and educators learn and perceive information differently.

Their work indicates that experts and educators focus on big concepts. Students and novices primarily remember random facts and bits of information. Educators often perceive and assume understanding that doesn't exist among students.

Experts see beyond pieces of information and understand patterns, relative values and interdependence. Novices often are distracted by less valuable information, and fail to recognize key concepts and how they are connected.

Their work indicates that traditional teaching methods are not producing students and professionals that understand the core concepts. Covering a topic in class is not enough. Students need key concepts presented in a variety of ways and repeated to emphasize the importance of big ideas.

Links

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Michael Dixon
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Workshop #1, continued

What should students know and how can we measure whether they have learned these fundamentals? Brown and Dixon believe there is a disconnect between what educators think is important and what/how they teach the courses. They note, “It isn’t about covering material, it’s about uncovering material.”

Are we accountable for what students are learning?

ABET is trying but there needs to be more and better ways to do assessment. This research demonstrates that assessment is key to improving the quality of education and practice. Participants were asked if they had taken a course on assessment or curriculum design. Only one person indicated they had. Brown and Dixon believe we can’t expect higher quality and consistency without the necessary tools and training.

Professors Brown and Dixon find their hierarchy of concepts to be a useful tool in designing lesson plans and courses. They suggest that educators consider a formula of one major concept per credit hour in a course.

They offer the following guide to help determine roughly how many concepts from each of these three key areas to use in an introductory course.

4-5	Enduring Understanding
15	Important to Know
15	Worth Being Familiar With
34-35	Total Concepts

Sample Lesson Plan

- Enduring Understanding Concept:
  Relation between loading (demand) and stress (performance)
- Learning Outcome:
  The student will be able to determine the magnitude of normal stress at all locations in a rectangular beam.
- Assessment of Learning Experience:
  Beam ranking task

Recommended Reading

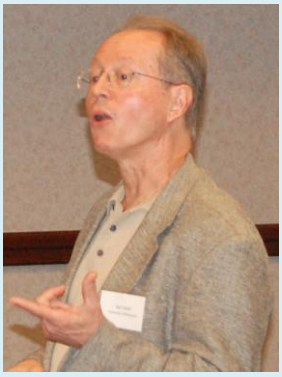
How People Learn: Brain Mind, Experience and School

How People Learn: Bridging Research Into Practice

Published by the National Research Council

Day Two - Morning
Workshop #2

How do we create active learning environments for undergraduate transportation engineering students?
Karl Smith, University of Minnesota / Purdue University



Consider that today's students, in Professor Smith's view, are the future faculty. They may well be the designers of learning experiences, processes and environments.

What does it mean to be an engineer, a transportation engineer? Smith encouraged participants to consider the modes of thinking and the state of mind needed to create caring roadways.

His research focuses on how to move students or novices through a course to achieve the desired outcomes. He suggests that much can be learned from the medical school model. All medical schools have a department of education focused on the process of teaching and learning. What would be gained if all engineering programs offered courses on the education process?

Active, cooperative learning

Professor Smith discussed classroom-based approaches to engage students in active and cooperative learning. This work is based in the knowledge that if people are really engaged in well designed, guided learning they learn and retain more.

Cooperative learning is a teaching method that involves teams of people to achieve a common goal. Key elements are:

- Positive Interdependence (all members cooperate to achieve task)
- Individual and Group Accountability
- Face-to-Face Interaction
- Teamwork Skills
- Group Processing

Professor Smith suggests using a variety of informal and formal tools to regularly engage students during class, assess how well they grasp the key concepts, and encourage them to work together. He notes that teamwork enhances individual learning and that group projects work best when each student contributes and takes responsibility. Cooperative learning is successful if a self-managed structure is provided that encourages positive interdependence and individual accountability.

To encourage students to read course material, Professor Smith suggests asking them for feedback in class. In a brief exercise, he asks them to individually reflect on the reading, pair up with another student, and briefly discuss what they learned. (Think-Pair-Share).

Links

Karl Smith
University of Minnesota,
Purdue University

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www.ce.umn.edu

Background Knowledge Survey

What would you want to know about your students before you begin teaching the course? Smith suggests educators consider a background survey to help assess student interests, knowledge, needs, experience and expectations.

Topics

- Personal experience with transportation – do they drive a car, ride mass transit, cycle, walk
- Real work experience, have they conducted traffic surveys
- Background in math and science courses like Calculus, Physics
- Expectations for the class
- What they think transportation engineering is

Who are the students and communities you serve? Consider the varied nature of schools and students. There is a diversity of cultures, learning styles and experience levels. For example, 40% of Oregon State University Engineering graduates are the first in their family to go to college.

Professor Smith encouraged the educators to understand that students today need different approaches and tools. He cautioned not to expect them to behave like faculty, or pre-faculty. Students are accustomed to active, visual, adaptive learning and they expect it from their educators.

Effective Course Design

What evidence do you need to show that students know and can do these things? How do you design courses with this in mind? Professor Smith discussed several course design tools and approaches.

The backward design model of Wiggins and McTighe starts with the desired results and creates learning exercises to produce these in an active, cooperative learning environment.

The integrated Course Design (CAP) Model is based on interconnected components of learning goals, learning activities, and feedback and assessment.

Suggestions to create an active, engaged learning environment:

- Use Think-Pair-Share to discuss ideas, encourage reading, and stimulate discussion. The format is individual reflection, then write for 1 minute, discuss in pairs for two minutes.
- Shift from a grading environment to a learning environment. Plan fewer graded assignments and more learning experiences.
- Rethink the model of professor tells and students get it. Peer groups are more influential in student learning than professors.

Recommended Reading

Leading Teams: Setting the Stage for Great Performances

J Richard Hackman

Day Two – Afternoon
Workshop #3

What have you learned?
How can we work together in the future?
Barbara Hart, Barbara Hart Consulting, Portland

To begin the final workshop, participants were asked to reflect on the significant concepts they had learned during the previous day and a half. They were also asked to consider ways that groups could collaborate beyond the conference to move ideas into action.

Barbara Hart, a communications consultant from Portland, facilitated this interactive session. The following notes were generated by the discussion.

Reflections

- There is a need for balance between inward and outward focus. We need to connect with other disciplines in transportation work, develop ways to socialize engineers and provide cross-discipline learning experiences for students.
- We need champions to move ideas forward and improve the learning experience.
- There is a lack of general understanding of what the transportation engineering profession really is. We need to do public education, increase awareness, and seek media attention to improve understanding of the value and benefit of the work.
- Depth and Breadth – get depth by focusing on areas of your passion and specialty. Add breadth by bringing in guests for lectures/presentations on subjects outside your range.
- Let students work on small tasks throughout the course if a lab is not in the curriculum. Present the collection of project work in a group report prepared by the class.
- Goodies! It was very helpful to hear about these and have access to the latest ones for everyone to use.
- Get to know the variety of students in your class, and then focus on what interests them, what they know, and what familiarity they have with transportation.
- Focus on the interconnectedness of concepts and how that relates to the complexity of the work. Think about systems and use this approach to present material and challenge students as they learn.
- My students aren't learning as much as I thought.

Links

Barbara Hart
barbarahart.consulting@gmail.com

Reflections, continued

- Consider how we teach. Approximate parts of practice like project management, communication, and teamwork throughout the course.
- Improve teaching and leaning experience. Design thoughtfully, be creative, engage students in active learning.
- There is a dual focus – individual work and contributing to advance the collective academic and professional field of transportation engineering.
- Need for breadth and depth in coursework. What is the minimum level of depth needed to adequately cover a concept?
- How do we let go of some content to get focused on core concepts?
- Survey results show shift in the important topics. What is the reason for this? What does this mean for the profession?

Questions:

- What should all civil engineers know about transportation engineering?
- Undergrad degree in transportation engineering – does it exist? Would this help?
- How do we sustain the momentum developed in the conference?
- Do practicing engineers have misconceptions, and if so what implications do these have on the quality of their work?
- Who are the champions moving forward?
- What are the core concepts? How do we bring modes in?

Ideas:

- Define the purpose and objectives of the intro course, and then determine the appropriate content.
- Develop a Concept Inventory. This is an NSF opportunity!
- National Database of Problems – There is a need for fresh and expanded pool of problems to use with students.
- Need more financial resources to support research.
- Develop a model introductory transportation engineering course.
- Create taxonomy and share with 1st year course.

Resources

Discovery Channel How Stuff Works Videos
Titles include tunnel boring, transcontinental rail and drawbridges.

Check them out at http://videos.howstuffworks.com/science

ITE Education Council
The Transportation Education Council is a cooperative alliance of administrators, faculty, researchers, professionals and students working to address the needs of educational institutions.

Repository of Practical Problems www.ite.org.

National Science Foundation -
Innovations in Engineering Education Curriculum and Infrastructure

Two levels of research grants:

Level 1 - $150,000
Level 2 - $400,000

Proposals due in April www.nsf.gov/funding

Working Groups

Following the discussion, ten topics were pulled from the generated list of ideas and suggestions. Participants were asked to vote for the topic they would most like to focus on with a small working group. The final list of six topics was determined by combining related items.

Topics

1) Develop an NSF funding proposal to map learning domain, key learning outcomes and taxonomies, and core concepts of introductory course for transportation engineering.

2) Create a transportation concept inventory. Determine the misconceptions of planning, design, and operations. Develop a problem statement and funding sources for research.

3) Develop curriculum to support new teaching methods, disseminate new materials, and publish it with a web-based wiki tool. Student competition for Transportation Engineers.

4) Develop a student competition for transportation engineers.

5) Identify options for the introductory transportation class and define the purpose of this class.

6) Determine the misconceptions for students and practicing engineers, and consider the implications these have on design.

What, Who, How, and When

Participants selected one of the six topics to discuss in small work groups. Each group met for one hour to finalize their topic statements, discuss how to proceed, and outline the tasks, assignments and timeline for their efforts.

To close the session, the large group reconvened to hear reports on the approach and specific action plans developed by each work group. The following summaries describe the work underway to advance six of these important topics and sustain the momentum of the conference.

Group 1

Secure NSF funding to map learning domain, key learning outcomes and taxonomies, core concepts of intro course for transportation.

Goals – achieve consensus on core transportation learning outcomes and associated taxonomies for measuring success with civil engineering undergraduates.

Stakeholders – CE faculty, departmental administrators, state and federal government professionals in transportation, consultants, ABET evaluators.

Tasks

- Compare and contrast different undergraduate transportation programs within Civil Engineering programs across the country.
- Analyze rankings of different transportation topics derived from practitioner and educator surveys over the last 20 years (Rod Turochy's presentation).
- Review principles of backward curriculum design by Wiggins & McTighe. Develop a group experience classifying knowledge within a course based on three levels of learning: (a) enduring understanding, (b) important to know, and (c) items for awareness exposure.
- Form subgroup to design and realize a national workshop to establish program level learning outcomes for undergraduate transportation education courses.
    - Create TRB Paper on Workshop Rationale and Work Plan (July 2009)
    - Articulate purpose / motivation
    - Review literature on past programs and efforts
    - Define core concepts from educational theory to be used
    - Build subgroup consensus on tentative work plan
    - Draft Workshop Proposal (August – September 2009)
- Design workshop. Organize background materials; define presentation needs, small group activities, large group reports, real-time recording of results, and post-processing needed.
- Process – identify facilitation team, bring together 30-40 stakeholders for two days in 2010 to propose and vet ideas about core competencies. Subgroup meets for an additional day to distill findings for circulation among wider transportation community for validation.

Group 1 Members

Andrea Bill

Rhonda Young

Shashi Nambisan

Steve Beyerlein

Ida van Schalkwyk

Group 1 Timeline

- Solicit sources for workshop funding from UTC directors, DOT staff, NSF officers (October – November 2009)
- Create promotional materials for recruiting stakeholders (Dec. 2009)
- Revise Workshop Plan with TRB feedback (Jan–March 2010)
- Recruit workshop attendees - 2010 TRB meeting attendees, UTC directors, CE dept. chairs (Jan – May 2010)
- Circulate Materials and Assignments to Attendees (May 2010)
- Hold Workshop (June 2010)
- Draft workshop report as TRB paper for 2011 (July 2010)
- Prepare survey for educators and practitioners (Aug–Oct 2010)
- Disseminate workshop report and survey (Nov 2010 – Jan 2011)
- Analyze results of survey (Feb– March 2011)
- Write up survey results along with recommended program learning outcomes / metrics as TRB paper for 2012 (April – June 2011)

Transportation Education Conference Participants

Group 2

Transportation concept inventory – What are the misconceptions? What are the implications for planning, design, and operations? Develop problem statement and funding sources to do this work.

Group 6

Determine the misconceptions for students and practicing engineers, and consider the implications these have on design.

	Task	Start Date	End Date
1	Write problem statement: Current Practice Problems Proposed solution General methods Resulting outcomes	6/25/2009	6/30/2009
2	Review previous related work Development methods Validation methods Outcomes Applications	7/1/2009	7/30/2009
3	Establish team methods: Roles Funding levels Evaluation team	7/2/2009	8/7/2009
4	Establish key concepts	6/29/2009	8/25/2009
4.1	Common definition for “concept”	6/29/2009	7/4/2009
4.2	Create rough list of concepts	7/4/2009	7/18/2009
4.3	Review list	7/18/2009	8/15/2009
4.4	Categorize concepts	8/15/2009	8/22/2009
4.5	Share list	8/22/2009	8/25/2009
5	Write proposal	8/7/2009	1/5/2010
5.1	Review NSF proposal specifications	8/10/2009	8/15/2009
5.2	Establish proposal responsibilities	8/7/2009	8/14/2009
5.3	Review and revise draft	8/14/2009	11/10/2009
5.4	University approvals Human subjects: research Budgets	11/10/2009	12/25/2009
5.5	Submit proposal	12/25/2009	1/5/2010

Group 2 Members

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Grant Schultz

Tim Gates

Zong Tian

Group 3

Develop curriculum, support new teaching methods, and disseminate new materials

To facilitate the development and dissemination of new materials, the group decided a web-based tool was needed. They agreed to work together to create an online-wiki (like Wikipedia) in order to share course materials and allow ongoing discussions.

Features of the new web tool:

- Designate one or two webmasters
- Create password protections, limit access to members
- Have member-generated content and maintenance (like Wikipedia)
- Include syllabi, multimedia files, homework problems, projects, links to resources
- Arrange pages by subject and allow sorting by most popular and most downloaded topics
- Include discussion threads

The group estimated it would take about a year to develop and launch the new site.

To be successful, they agreed to enlist the help of the education committees of Transportation Research Board (TRB) and the Institute of Transportation Engineers (ITE). Grant Schultz offered to discuss the idea with the ITE education committee at their January 2010 meeting.

Group 4
Student Competition for Transportation Engineers

The work group suggested that the design of a student competition for transportation engineering should be offered as a competition itself, amongst student chapters of ITE, ASCE and transportation students organizations in general.

It was further suggested that the following general criteria be used to guide development of the competition designs:

- Focused on undergraduates
- Hands-on
- Portable to student chapter area meetings (and extensible to high school demos, e.g.)
- Relatively low cost
- Requiring some advanced preparation
- Team based
- Have a live competition element
- Relatively simple
- Measurable goals of the competition (speed, etc.) but can include qualitative aspects
- Attractive to future generation of transportation engineers (high tech, sustainability, etc.)

Some example competition ideas were considered, and these can be provided as fuel for thought to the student chapters:

- Radio Controlled Cars interacting with some type of signal system (with users and systems control participants)
- Travel delay minimization
- Evacuation
- Police chase
- Vehicle routing problem/tours/visits
- Simulation (perhaps not preferred due to lack of hands-on, but open to suggestions)
- Corridor optimization

Group 4 Members

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Group 5 Members

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Andrew Nichols

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Group 5

Identify options for the introductory transportation class and define the purpose of this class.

Key Questions

1) What is the purpose of the course?
2) What are the big ideas and concepts?
3) What are the labs and do labs need to be included?
4) Where do the students want to go/apply in their job?
5) How does the course change by institution?
6) Is there a common language that needs to be spoken?
7) What is the modal approach?
8) What are the key outcomes?
9) What role does the FE exam play in the teaching?
10) What is the role of accreditation/civil engineering body of knowledge in the teaching?
11) What are the objectives of transportation?
12) What does the role of multidisciplinary nature of transportation?
13) When in the curriculum should be offered?
14) What are we doing now that we don't want to do?
15) What are we not doing now because we do not have time?
16) How do we change the cookbook method of teaching?
17) What order should materials be presented?

Ideas and Tasks

1) Synthesize current literature/research on the topic of the intro class
2) Devise a survey to further asses the questions posed (academia/faculty)
3) Survey of practitioners to determine what the most important
4) Survey of transportation graduate programs
5) Survey of transportation undergraduate programs
6) ITE Article April 09 Michael Kyte
7) Develop a transportation body of knowledge
8) Develop scenarios for classes
9) APWA/AGC
10) Identify the big ideas

Appendices

1. **Conference Brochure**
2. **Workshop 1 – Slides**
3. **Workshop 2 – Slides**
4. **Participant List**

Transportation Education Conference

www.webs1.edu/transportation_education_conference-2009/index.htm