NATIONAL UNIVERSITY RAIL (NURAIL) CENTER

KICK-OFF MEETING – URBANA, IL

17 MAY 2012

NURail Center

University of Illinois at Urbana-Champaign
University of Illinois at Chicago
Massachusetts Institute of Technology
Michigan Technological University
University of Kentucky
University of Tennessee, Knoxville
Rose-Hulman Institute of Technology

Table of Contents

NURail Center Partners' Meeting – Day 1
Kick-Off Meeting with RITA, FRA & FTA – Day 2
May 16 – 17, 2012
1233 Newmark Civil Engineering Lab (NCEL)
University of Illinois at Urbana-Champaign

May 16, 2012
NURail Center Partner Meeting
Agenda

8:10 AM	Guests Board Vehicles at Hawthorn Suites Hotel
8:15 AM	Transportation to Newmark Lab
8:30 AM	Continental Breakfast, Room 1233
9:00 AM	Welcome and Introductions (Barkan)
9:05 AM	Review Agenda and Meeting Objectives (Barkan)
9:15 AM	Status of Research/Education Project Selection Process (Saat)
9:30 AM	Strategic Development Plan *(Barkan/Saat) – 20 minutes*
9:50 AM	Proposed Year 1 Projects
	UIUC Projects (Barkan/Saat/Edwards) – 20 minutes
	UIC – Engineering Projects (Shabana) – 20 minutes
10:30 AM	Break
10:40 AM	Proposed Year 1 Projects (continued)
	MIT Projects (Sussman) – 15 minutes
	UKY Projects (Souleyrette) – 15 minutes
	MTU Projects (Lautala) – 20 minutes
11:30 AM	*NURail Center Educational Plan (Lautala) – 20 minutes*
11:50 AM	Status of Transportation Bill and Potential Impact to UTC Program (McLennand)
12:15 PM	Lunch - Beckman Café
1:30 PM	Practice Run of Director's Overview Briefing to RITA (Barkan)
2:45 PM	Newmark Tour (Edwards)
3:00 PM	Break
3:30 PM	Proposed Year 1 Projects, continued
	UIC – CUPPA (Schlickman) – 15 minutes
	RHIT (McKinney) – 15 minutes
	UTK (Clarke via teleconference or webex) – 15 minutes

4:15 PM	Subawards Status and Questions (Gress)
4:25 PM	Quarterly Report Requirements (Saat/Gress)
4:40 PM	Wrap-up and Closing Remarks (Barkan)
4:45 PM	Adjourn
6:45 PM	Dinner at Escobar
	6 East Columbia Avenue, Champaign, 217-352-7467
8:15 PM	Transportation back to Hotel

May 17, 2012
NURail Center Kickoff Meeting with RITA, FRA and FTA
Agenda

Guests' Transportation

9:00 AM	Guests Board Vehicles at Hawthorn Suites Hotel
9:05 AM	Transportation to Newmark Lab

Opening Session (open)

9:30 AM	Introductions (Singh and Barkan)
9:40 AM	Welcome to the University of Illinois
	Amr Elnashai – Head, Dept of Civil and Environmental Engineering
	Phyllis Wise – Chancellor, University of Illinois at Urbana-Champaign
9:50 AM	Opening Remarks from RITA Viewpoint (Womack)
10:00 AM	NURail Center Overview (Barkan)

"One-on-One" Meetings (closed)

11:00 AM	Discussion with Womack, Singh, Barkan, and NURail Center Leadership Team
	(Attendees: Womack, Singh, NURail Center Director & Managing Director, NURail Consortium Principal Investigators)

Tour of Facilities (open)

11:00 AM	UIUC Facilities Tour (Edwards)
	Newmark Laboratory
	Rail Student Meetings – B-118 NCEL
	Off-Site Facilities – Quade Meeting Room, 1220 NCEL
	(Attendees: Other UIUC and NURail Consortium Representatives, RITA Grant Managers)

Lunch

12:00 PM Beckman Café (All)

Grant Requirements and Management (open)

1:00 PM Overview of Grant Requirements and Q&A Session on Grant Management (RITA Grant Manager)
(Attendees: NURail Center Director, NURail Consortium Members Directors and Representatives, UIUC Grants Office Staff, CEE Business Office Staff, Singh, and RITA Grant Managers)

End Meeting With RITA

3:00 PM Adjourn – RITA Visitors depart

RITA Guests' Transportation

3:15 PM RITA Guests Board Vehicles at Newmark Lab

3:20 PM Transportation back to Hotel and/or Airport

NURail Consortium Partners' Meeting

3:30 – 4:15 PM Discuss meeting with RITA

4:15 – 5:00 PM Discuss path forward

Dinner

6:30 PM Bacaro
113 North Walnut Street, Champaign, 217-398-6982

NURail Center Leadership Team

Chris Barkan
NURail Center Director
University of Illinois at Urbana-Champaign

- **Title:** Professor - Department of Civil and Environmental Engineering
  Director - Rail Transportation & Engineering Center
- **Education**
  - PhD: State University of New York at Albany - 1987
  - MS: State University of New York at Albany - 1984
  - BA: Goddard College - 1977
- **Research Interests**
  - Railroad safety, risk analysis, hazardous materials transport, rail capacity, energy efficiency
- **Teaching**
  - Railroad Transportation Engineering, Railway Signaling and Operation, Advances in Railway Technology, Shared Rail Corridor Engineering and Operation
- **Organizations and Committees**
  - AREMA, ASCE, INFORMS, TRB, FRA R&D Review Committee, AAR Railway Technology Working Committee
- **Honors & Awards**
  - NARP 2012; Inst. Mech. Engineers 2008, 2007; WCRR 2008; IHHA 2005
- **Additional Information**
  - 10 years prior employment in AAR Research & Test and Safety & Operations Departments
  - Website: http://cee.illinois.edu/faculty/christopherbarkan
    http://ict.uiuc.edu/railroad/

Slide 2

NURail Center

NURail Center Proposed Activities:
University of Illinois at Urbana-Champaign

- **TECHNICAL RESEARCH**
  - ***Railroad Infrastructure***
    - Improving track structure for complex loading from high-speed passenger and freight trains
    - Friction-abrasion analysis of railroad track structure interfaces
    - Finite element modeling of loading distribution over multiple concrete ties
  - ***Railroad Vehicle***
    - Research plan under development with Mechanical and Electrical Engineering departments
  - ***Railroad Systems***
    - Micro-level safety and risk analysis of railroad grade crossings
    - Impact of high-speed passenger trains on freight train efficiency in shared railway corridors
    - Causal analysis of passenger train accidents on freight rail corridors
- **EDUCATION**
  - ***University Course Development***: Shared Rail Corridor Technical Challenges, High-Speed Rail Planning, Railway Operations and Capacity Analysis, Railway Safety and Risk Analysis, Introduction to Railway Mechanical Engineering, Introduction to Railway Electrical Engineering
  - ***Non-Degree Short-Courses***: High-Speed Rail Engineering, Design of Railway Yards and Terminals, Railway Safety and Risk Analysis and Management
  - ***Educational Outreach***: to faculty (e.g. REES), to college students (e.g. internships), to primary and secondary school students (e.g. Engineering Open House and school visits)
- **TECHNOLOGY TRANSFER**
  - NURail website and RITA distribution process, Coordination with FRA and AAR R&D programs, Publication of "Research Results", Presentations at rail industry practitioner conferences (AAR, AREMA, IHHA, etc), Special-topic workshops for industry, On-line course development

Slide 3

Ahmed Shabana
NURail Center Co-PI
University of Illinois at Chicago

- **Title:** Professor - Department of Mechanical and Industrial Engineering
  Director – Dynamic Simulation Laboratory
- **Education**
  - PhD: University of Iowa - 1982
  - MS: Ain Shams University - 1978
  - BA: Cairo University - 1974
- **Research Interests**
  - Railroad vehicle dynamics, multibody system dynamics, vibrations
- **Teaching**
  - Railroad vehicle dynamics, vibrations, general dynamics
- **Organizations and Committees**
  - ASME Committees, IFToMM Committee on Multibody System Dynamics
- **Honors & Awards**
  - Fellow of ASME
- **Additional Information**
  - Principal investigator of FRA sponsored projects for the development of rail simulation and virtual prototyping software
  - Editor, ASME Journal of Computational and Nonlinear Dynamics

Slide 4

NURail Center

NURail Center Proposed Activities:
University of Illinois at Chicago
College of Engineering

UIC COLLEGE OF ENGINEERING

- **TECHNICAL RESEARCH**
  - ***Railroad Infrastructure & Vehicles: Integrated Dynamic Modeling***
    - Vehicle Dynamics Modeling: Vibrations, Wheel/Rail Contact
    - Track Substructure Modeling: Fasteners, Ties, Ballast, Subballast, Subgrade (UIC, UIUC)
    - Immersive Visualization of Rail Simulation Data: Derailments, Infrastructure Degradation
  - ***Railroad Infrastructure***
    - Materials, Design, & Testing: Recycled Plastic Ties, Precast Concrete Slabs for Bridges
  - ***Railroad Systems***
    - The Informed Rail Traveler: Rail Traveler Assistant (RTA) Smartphone Application Provides Rail Travelers with Crowd-Sourced Real-Time Modal Transition Information
- **EDUCATION**
  - ***Full-Semester Courses***
    - Railroad Vehicle Dynamics
    - Railway Infrastructure Materials and Design
- **TECHNOLOGY TRANSFER**
  - ***Rail Traveler Assistant (RTA)***
    - Initial Evaluation by Students
    - Public Release via App Stores: Android Market, iPhone App Store + User Improvements

Slide 5

Stephen Schlickman
NURail Center Co-PI
University of Illinois at Chicago

- **Title:** Executive Director of the Urban Transportation Center, College of Urban Planning and Public Affairs, University of Illinois at Chicago
- **Education**
  - JD: DePaul Law School - 1979
  - AB: Georgetown University - 1975
- **Research Interests**
  - Transportation Funding and Finance, Policy, Planning, Advocacy, Economic Development
- **Teaching**
  - Funding and Finance of Transportation Projects
- **Organizations and Committees** APTA (Legislative Committee, VC Intergovernmental Affairs Subcommittee) Active Transportation Alliance Board of Directors, I-Go Car Sharing Board of Directors, Neighborhood Capital Institute Board of Directors, Metropolitan Rail Discussion Group (10 largest old rail transit systems)
- **Honors & Awards** Regional Transportation Authority Dedicated Service Award, 2010; Lambda Alpha International – Ely Chapter (In recognition of his contribution and exceptional technical Crain's Chicago Business 40 Under 40 List of Young Business Professionals, 1992; Regional Transportation Authority Dedicated Service Award, 1989 Illinois Public Transit Association Outstanding Contribution Award, 1989
- **Additional Information:** 30 years of active practice in various transportation policy and legislative positions related to all transportation modes including five years as the Executive Director of the Chicago area Regional Transportation Authority (2005-2010)

Joseph Sussman
NURail Center Co-PI
Massachusetts Institute of Technology (MIT)

- **Title:** Professor – Department of Civil and Environmental Engineering
  Interim Director - Engineering Systems Division (ESD)
- **Education**
  - PhD: MIT - 1967
  - MSCE: University of New Hampshire – 1963
  - BSCE: City College of New York – 1961
- **Research Interests**
  - Passenger and freight railroads, Intelligent Transportation Systems (ITS), complex sociotechnical systems (CSS), regional strategic planning, simulation methods
- **Teaching**
  - Project Evaluation, Engineering Systems Design, Introduction to Complex Sociotechnical Systems
- **Organizations and Committees**
  - Transportation Research Board (TRB), (former chair of TRB Executive Committee and former chair of BRAC committee); American Society of Civil Engineers (ASCE); American Society of Engineering Education (ASEE); ITS America (former board member)
- **Honors & Awards**
  - TRB Roy W. Crum Award, CUTC Distinguished Faculty Award, Distinguished Alumnus Award - School of Engineering, the City College of New York; Fellow, AAAS
- **Additional Information**
  - East Japan Railway (JR East) chair at MIT since its founding in 1991; author of the text *Introduction to Transportation Systems* in use in the US and around the world
  - Website: http://cee.mit.edu/sussman

NURail Center Proposed Activities: Massachusetts Institute of Technology (MIT)

- **TECHNICAL RESEARCH**
  - High-speed Rail and Regional Development
    - HSR as a Complex Sociotechnical System
      - Representation of HSR within the CLIOS Process
      - Case study applications-- design, evaluation, selection
      - Implementation issues
    - HSR Productivity Studies
      - International comparisons
      - Relevance in US cases
      - Tie to economic development
- **EDUCATION**
  - ***University Course Development***: High-Speed Rail Planning (participant) Railway Operations and Capacity Analysis (participant)
  - ***Non-Degree Short-Courses***: High-Speed Rail Engineering (participant),
  - ***Educational Outreach***:
- **TECHNOLOGY TRANSFER**
  - NURail website and RITA distribution process, Coordination with FRA and AAR R&D programs, Publication of "Research Results", Presentations at rail industry practitioner conferences (AAR, AREMA, IHHA, etc), Development and hosting special-topic workshops for researchers and industry

Slide 8

NURail Center

Pasi Lautala
NURail Co-PI and Director of Education
Michigan Technological University

- **Title:** (Research) Assistant Professor – Dept. of Civil & Env. Engineering
  Director - Rail Transportation Program
- **Education**
  - PhD: Michigan Technological University - 2007
  - MS: Michigan Technological University - 2007
  - BA: Tampere University of Technology (Finland) - 1995
- **Research Interests**
  - Railroad engineering education, multimodal transportation, cold climate railroads, workforce development
- **Teaching**
  - Railroad Transportation Engineering, Railway Track Engineering and Design
- **Organizations and Committees**
  - AREMA Education and Training, ASCE Rail Transportation Committee, TRB Freight Rail Committee, FRA Workforce Development Working Group
- **Honors & Awards**
  - Academy of Teaching Excellence Award, 2008, Michigan Tech
- **Additional Information**
  - Website: rail.mtu.edu
  - P.E. License, 2001

Slide 9

NURail Center

NURail Center Proposed Activities: Michigan Technological University

- **TECHNICAL RESEARCH**
  - ***Railroad Infrastructure***
    - Assessment of Aggregate Sources in Michigan for High Speed Railroad Ballast
    - Performance Evaluation of In-Service Ties: A Parametric Evaluation of Tie Material, Design, and Configuration of Loading Demands (Univ. of Virginia)
  - ***Railroad Vehicle***
    - Austempered Ductile Iron (ADI) for Railroad Wheels
  - ***Railroad Systems***
    - Improving Rural Freight Rail in State of Michigan
    - Influence of Driver Attention on Rail Crossing Safety
- **EDUCATION**
  - ***University Education Development***: Conversion of current courses to online format, Development of Undergraduate Rail Transportation / Engineering Certificate, Implementation of Undergraduate Student Projects
  - ***Educational Outreach***: to faculty (REES), to college students (internships), to primary and secondary school students (Summer Youth Program in Rail and Intermodal Transportation)
- **TECHNOLOGY TRANSFER**
  - Technology Transfer Seminar with Michigan Department of Transportation (MDOT)

Slide 10

Jerry G. Rose
NURail Center Co-PI
University of Kentucky

- **Title:** Professor of Civil Engineering
  Department of Civil Engineering
  Education
  - PhD: Texas A&M University- 1971
  - MSCE/BSCE: University of Kentucky – 1966; 1967
- **Research Interests**
  Transportation Engineering (Railroad emphasis), Construction Materials & Methodology
- **Teaching**
  - Railroad Engineering and Operations, Transportation, Construction Materials
- **Organizations and Committees**
  - TRB, AREMA, ASCE
- **Honors & Awards**
  - Industry Achievement Award, National Asphalt Pavement Association, Howard Roberts Special Service Award, Kentucky Ready Mixed Concrete Association, Distinguished Service Award, Asphalt Institute
- **Additional Information**
  - 40 Years on Faculty at University of Kentucky, …
  - Website: http://www.engr.uky.edu/~jrose/

Slide 11

Reginald Souleyrette
NURail Center Co-PI
University of Kentucky

- **Title:** Commonwealth Professor of Transportation Engineering
  Department of Civil Engineering
  Education
  - PhD: University of California, Berkeley - 1989
  - MSCE/BSCE: University of Texas at Austin – 1986; 1984
- **Research Interests**
  - Data and Information Systems, Remote Sensing, Transportation Safety, GIS, Railroads
- **Teaching**
  - Traffic Safety, GIS in Civil Engineering, Planning Models, Railroad Engineering, Airport Design, Highway Design, Transportation Engineering
- **Organizations and Committees**
  - TRB (Chair, Data and Information Systems Section), AREMA, ASCE, ATSIP
- **Honors & Awards**
- National Safety Council Best Practices (2), Vice Presidents Award for Reinventing Govt., Olson Professorship; Iowa DPS Commissioner's Special Award; USDOT National Roadway Safety Award
- **Additional Information**
  - 18 Years on Faculty at Iowa State University, Associate Director, Midwest Transp. Consortium and CTRE, Associate Chair CCEE at ISU
  - Website and Portfolio: http://www.engr.uky.edu/~rsouley/

Slide 12

NURail Center

NURail Center Proposed Activities: University of Kentucky

- **TECHNICAL RESEARCH**
  - ***Railroad Infrastructure***
    - Tie ballast interface – in situ assessment
    - Long term performance of improved track bed subgrade
  - ***Railroad Systems***
    - Rail crossing smoothness, performance metrics and safety using 3D scanner
    - US Commuter rail in shared corridors – policy and financing best practice
    - Operational impact of lock and dam outage on rail system
- **EDUCATION**
  - Multimodal Transportation Operations Course Development - Civil Engineering
  - REES I and II modules and training
  - Graduate student internship at TTCI
  - Rail industry graduate fellowships

Slide 13

NURail Center

David B. Clarke, P.E.
NURail Center Co-PI
University of Tennessee, Knoxville

- **Title:** Research Assoc. Professor – Dept. of Civil and Envr. Engineering
  Director – Center for Transportation Research
- **Education**
  - PhD: University of Tennessee, Knoxville - 1995
  - MS: University of Tennessee, Knoxville - 1982
  - BSCE: University of Tennessee, Knoxville - 1979
- **Research Interests**
  - Railroad safety, rail capacity, railroad economics, railroad track and structures performance, intermodal freight transport
- **Teaching**
  - Design of Rail Transportation Systems, Railroad Track Inspection, Railroad Bridge Inspection, Railroad Track Maintenance
- **Organizations and Committees**
  - AREMA (Cmtes 14 and 24), ASCE (Rail Transportation Cmte), TRB (AR030, AR040, AT010), APWA
- **Honors & Awards**
  - Chi Epsilon, Eno Transportation Fellow '94, Clemson University CLE Award
- **Additional Information**
  - Prior employment at Clemson University and SAIC, Consulting railway engineer
  - Website: http://ctr.utk.edu

Slide 14

NURail Center

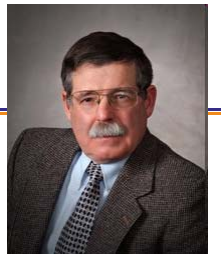
NURail Center Proposed Activities:
University of Tennessee - Knoxville

- **TECHNICAL RESEARCH**
  - Behavior of Railroad Bridges with Hybrid Composite Beams
  - Assessment of Foreign HSR Bridge Design Practices
  - Development of New Damping Materials for Ballastless Trackbed
  - Evaluation of Terminal Capacity Models for Rail Freight Flow Analysis
- **EDUCATION**
  - Incorporate railroad modules in existing CE courses (e.g., Materials, Asphalt Design)
  - Short courses for working professionals
  - REES I and II modules and training
  - AREMA Student Chapter
- **TECHNOLOGY TRANSFER**
  - NURail website
  - UTC report distribution process
  - Presentations at industry conferences
  - Interaction with TRB and ASCE rail committees
  - Specialty workshops and short courses

Slide 15

NURail Center

Jim McKinney, P.E.
NURail Center Co-PI
Rose-Hulman Institute of Technology



- **Title:** R.C. Hutchins Distinguished Professor of Civil Engineering
- **Education**
  - PhD: Purdue University - 1980
  - MSCE: Purdue University – 1976
  - BSCE: Purdue University – 1969
- **Teaching**
  - Transportation Engineering; Civil Engineering Materials; Cost Engineering; Construction Methods & Equipment; Construction Planning & Scheduling; Engineering Economics; Surveying; Senior Design; Freshman Design
- **Organizations and Committees**
  - AREMA; ASCE; APAI; INDOT HMAQA/QC Certification Program; Terre Haute / Vigo County Railroad Relocation Committee
- **Honors & Awards**
  - APAI Hall of Fame; APAI Award of Merit; Indiana Sagamore of the Wabash; Indiana ASCE Civil Engineer of the Year; ASCE Practitioner Advisor Award; ACEC Public Service Award
- **Additional Information**
  - Civil Engineering Department Head – 20 years
- **Website: http://www.rose-hulman.edu/civil.aspx**
  - http://www.rose-hulman.edu/academics/academic-departments/civil-engineering/faculty-staff.aspx/

NURail Center Proposed Activities:
Rose-Hulman Institute of Technology

EDUCATION

- Interdisciplinary (CE,EE,ME) Railroad Engineering Course Development
- Senior Capstone Design Course - Railroad Client
- Freshman Design Course – Railroad Client
- REES I and II Roundtables and Training
- Railroad Industry Guest Speakers – Class and Student Professional Organizations
- Fieldtrips – Railroad Operations; Railroad Manufacture/Design/Service
- Professional/Industry Meetings – AREMA “Meet the Next Generation”; Industry Speakers
- Summer Internships/Graduate Job Placement – Railroad Industry
- Secondary School Student Outreach Program
- Historical Railroad Group and Museum
- AREMA Student Chapter

Tyler Dick
NURail Center - Assistant Director for Education
University of Illinois at Urbana-Champaign

- **Title:** Senior Railway Research Engineer
  Rail Transportation and Engineering Center
- **Education**
  - MS: University of Illinois at Urbana-Champaign - 2001
  - BSc: University of Manitoba - 1999
- **Research Interests**
  - Railroad capacity, railroad infrastructure planning, railroad alignment studies, railroad yard and terminal design & operations
- **Teaching**
  - Railroad Engineering Education Symposium
  - HDR Advanced Yard Design short course
- **Organizations and Committees**
  - AREMA (Committees 16, 24), ASCE
- **Honors & Awards**
  - Recognized as an HDR Professional Associate for technical expertise and excellence in railroad alignment studies and yard and terminal design (2009)
- **Additional Information**
  - 11 years prior employment as Senior Railroad Design Engineer with HDR Engineering
  - Licensed Professional Engineer (Texas)

NURail Center

Timothy A. Gress
NURail Managing Director
University of Illinois at Urbana-Champaign

- **Title:** Assistant Director - Dept. of Civil & Environmental Engineering
  Business Development and Administration Manager –
  Rail Transportation & Engineering Center (RailTEC)
- **Education**
  - MA: Indiana State University – 1989
  - BS: University of Illinois at Urbana–Champaign – 1986
  - BS: Eastern Illinois University - 1984
- **Professional Interests**
  - Management and administration of science and engineering research centers, project management, business development, remote sensing and GIS for natural resources assessment and management
- **Additional Information**
  - 5 years prior experience with the Mid-America Earthquake Center a NSF funded engineering research center within the Department of Civil and Environmental Engineering at the University of Illinois
  - 15 years with the Institute for Technology Development (ITD) a geospatial technologies research company and contractor for NASA, last 5 years served as Vice President for Midwest Operations
  - 1 year as interim program manager with NASA's Commercial Remote Sensing Program's (CRSP) Applications Development Branch at the Stennis Space Center, MS

NURail Center

University of Illinois at Urbana-Champaign

University of Illinois at Urbana-Champaign

NURail Center Planned Activities:

Research

Education & Workforce Development

Technology Transfer

RAILTEC
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Outline

- **Research**
  - Strategic Development Planning (SDP) Areas
  - Technical Research Areas
    - *Infrastructure*
    - *Vehicle*
    - *Systems*
- **Education Activities**
  - University Course Development
  - Online Courses
  - Non-Degree Short-Courses
  - Educational Outreach & Work Force Development
- **Technology Transfer**
  - Industry Conference Involvement
  - Workshops and Symposia

Strategic Development Planning Areas

- **Overview**
  - Strategic development planning involves collaboration among several NURail Center partners to develop the long-term vision, tasks and timeline for specific thematic research topics
- **Objective**
  - Develop long-term vision and strategies in key research topics by identifying the current state of the art/practice, knowledge gaps and future research needs
- **Strategic Development Planning (SDP) Areas**
  - Integrated Railroad Track and Vehicle Interaction and Dynamics Modeling (*co-lead with UIC-Engineering*)
  - Railroad Network Capacity Planning
  - Railroad Safety and Risk on Shared Passenger and Freight Rail Corridors

Integrated Railroad Track and Vehicle Interaction and Dynamics Modeling SDP

- **Objectives:**
  1. Establish integrated model working group with sub-model leads
  2. Develop the overall vision, tasks and timeline
  3. Identify state of the art and practice from previous/current modeling
  4. Develop understanding of inputs and outputs of the integrated model
  5. Organize a mini-symposium on the topic with all team members and outside researchers
- **Relationship to DOT Strategic Goals:** Assist in the state of good repair planning and management, and ensure safe railroad operations
- **Potential Collaborators:** UIC-Engineering (co-lead), UTK, UK, and MTU
- **Timeline:**
  - Years 0-1: SDP Development and Implementation*
  - Years 1-2: Sub-Model Development*
  - Years 3-4: Sub-Model Validation and Refinement
  - Years 5-6: Holistic Model Development
  - Years 7-8: Holistic Model Validation and Refinement

**To be accomplished under current NURail Center funding*

Railroad Network Capacity Planning SDP

- **Objectives:**
  1. Develop the overall vision, tasks and timeline
  2. Identify state of the art and practice of previous/current modeling efforts
  3. Establish base train equivalent concept and analytical methods
  4. Organize a workshop on the topic with NURail and outside researchers
- **Relationship to DOT Strategic Goals:** More efficient freight and passenger transportation will result in advancing economic competitiveness, livability, and environmental sustainability
- **Potential Collaborators:** UIC-CUPPA
- **Timeline:**
  - Years 0-1: Line Capacity Model and Based Train Equivalent and Unit*
  - Years 1-2: Shared Corridor Capacity Models*
  - Years 3-4: Yard Capacity Model
  - Years 5-6: Revenue Generating Capacity Model
  - Years 7-8: Capacity Planning Project Selection Model

**To be accomplished under current NURail Center funding*

Slide 5

NURail Center

Railroad Safety and Risk SDP

- **Objectives:**
  1. Develop the overall vision, tasks and timeline
  2. Identify state of the art and practice of previous/current railroad safety and risk research
  3. Develop an online depository to provide descriptions, literature and updates on recently completed or on-going research projects
- **Relationship to DOT Strategic Goals:** Will advance our understanding on how to most efficiently and effectively manage risk on shared rail corridors
- **Potential Collaborators:** UIC-CUPPA, UK, MTU
- **Timeline:**
  - Years 0-1: SDP Development and Implementation*
  - Years 1-2: Identification of Risk Factors on Shared Rail Corridors*
  - Years 3-4: Shared Corridor Risk Analysis Model Development
  - Years 5-6: Nationwide Shared Corridor Risk Assessment
  - Years 7-8: Identification and Evaluation of Risk Reduction Strategies
  - Years 9-10: Optimization of Risk Reduction Strategy Implementation

**To be accomplished under current NURail Center funding*

Slide 6

NURail Center

Technical Research Areas

- ***Infrastructure***
  - Improving track structure for complex loading from high-speed passenger and freight trains
  - Concrete crosstie fastener sub-system frictional testing and modeling
  - Development of a 3D FEA model for concrete crossties and fastening systems
- ***Vehicles***
  - Research plan under development with Mechanical and Electrical Engineering departments
- ***Systems***
  - Micro-level safety and risk analysis of railroad grade crossings
  - Impact of high-speed passenger trains on freight train efficiency in shared railway corridors
  - Causal analysis of passenger train accidents on freight rail corridors

NURail Center

Technical Research - *Infrastructure*

1. **Improving track structure modeling for complex loading from high-speed passenger and freight trains**
   - A discretely supported tie, ballast and subgrade track model will be used to study complex dynamic loading patterns from high speed passenger and freight trains
2. **Concrete crosstie fastener sub-system testing and modeling**
   - Experimental testing will be conducted to understand the frictional relationships between fastening system components, to improve our fundamental understanding of the tie and fastener system
   - FEA modeling will be conducted to facilitate parametric analyses to investigate optimized materials choices and frictional properties
3. **Development of a 3D FEA model for concrete ties and fastening systems**
   - A single tie FEA model will be enhanced to include multiple ties, which will allow us to understand the response of a wheel load on multiple ties
   - Development of the model will require complex understanding of inter-crosstie interactions and loading distribution from a single wheel load

NURail Center

Technical Research - *Systems*

1. **Micro-level safety and risk analysis of railroad grade crossings**
   - Conduct a micro-level analysis to determine the risk of crashes at a given location (or a set of similar locations), accounting for, among others, past crash history at that location and different elements that affect traffic safety at RR crossings
2. **Impact of high-speed passenger trains on freight train efficiency in shared railway corridors**
   - Develop a decision support tool that can help evaluate the impact of higher-speed passenger trains on freight corridor capacity
3. **Causal analysis of passenger train accidents on freight rail corridors**
   - Perform statistical analyses using the FRA Accident database to identify important safety and risk factors based on the most frequent and high severity accident causes

NURail Center

Planned Education Activities

- **University Courses Developed or Under Consideration**
  - **Undergraduate**
    - High-Speed Rail Planning (to be offered Fall 2012)
    - Introduction to Railway Mechanical Engineering
    - Introduction to Railway Electrical Engineering
    - Railway Safety and Risk Analysis
  - **Graduate**
    - Shared Rail Corridor Engineering and Operation (taught Spring 2012)
    - Railway Capacity Analysis
    - Advanced Track System and Component Design
- **Online Courses**
  - Existing and proposed, new university courses

NURail Center

Planned Education Activities (Cont.)

- **Non-Degree Short-Courses**
  - High-Speed Rail Engineering
  - Design of Railway Yards and Terminals
- **Educational Outreach & Work Force Development**
  - Primary / Secondary School Students
    - Engineering Open House (EOH)
    - Primary and Secondary school visits
  - University Students
    - NURail Summer Internships
    - Internship, Co-op, and Job Placement
    - Comprehensive Rail Engineering Recruitment Website
    - Senior Rail Engineering Professional in Residence
  - Professionals
    - Railroad Engineering Education Symposium (REES)
    - Short Courses

NURail Center

Undergraduate
Courses Under Development or Consideration

- **High-Speed Rail Planning**
  - Introduction to the planning requirements of a HSR passenger transport system and methodologies for station and route selection, capital cost estimation, operation and maintenance costs estimation, ridership forecasting, economic analysis, project implementation and financing
- **Railway Safety and Risk Analysis**
  - Introduction to transportation safety and risk management, qualitative and quantitative risk analysis procedures, and risk analysis tools (e.g. ArcGIS, PC-Rail)
- **Introduction to Railway Mechanical Engineering**
  - To be developed in conjunction with other NURail partners
- **Introduction to Railway Electrical Engineering**
  - To be developed in conjunction with other NURail partners

NURail Center

Graduate
Courses Developed or Under Consideration

- **Shared Rail Corridor Engineering and Operation**
  - Introduction to the engineering, operational and institutional requirements and challenges of operating higher-speed (greater than 79 mph) passenger trains on infrastructure also used for heavy-axle-load (ca. 40 ton) freight trains
- **Railway Capacity Analysis**
  - Introduction to railway scheduling, operations and line/network capacity analysis concept and tools (e.g. Rail Traffic Controller)
- **Advanced Track System and Infrastructure Component Design**
  - In depth focus on the design, performance, and maintenance of railway infrastructure and its components (e.g. ballast, crosstie, fastening system, and rail)

NURail Center

Educational Outreach & Work Force Development

- **Primary and Secondary Schools**
  - **Engineering Open House (EOH)**
    - UIUC faculty will partner with students to host the annual Engineering Open House (EOH) rail exhibits, which are typically visited by 20,000 grade and secondary school students over the course of the two day engineering event
  - **Primary and Secondary School Visits**
    - UIUC faculty, staff, and students will visit schools to present basic elements of rail engineering to secondary school students
- **University Students**
  - **NURail Summer Internship**
    - UIUC will facilitate the hosting of students for summer internships that focus on rail engineering research topics
  - **Internship, Co-op, and Job Placement**
    - UIUC faculty will facilitate the placement of students in a variety of positions within the rail industry

NURail Center

Educational Outreach & Work Force Development

- **University Students (Cont.)**
  - **Comprehensive Rail Engineering Recruitment Website**
    - Support in the development of a website to inform engineering and HR representatives about NURail educational programs, candidates for internships or full-time positions, recruitment events and opportunities
  - **Senior Rail Engineering Professional in Residence**
    - Invitation of experienced rail engineers for an extended visit to campus; weekly extended discussion period on various focused topics and the possibility of offering online access to NURail partners and others
- **Professionals**
  - **Railroad Engineering Education Symposium (REES)**
    - UIUC will support the Railroad Engineering Education Symposium (REES) by providing presentation material and speakers to assist in training other faculty in teaching the domain of rail engineering
  - **Short Courses**
    - HSR Engineering
    - Design of Railway Yards and Terminals

NURail Center

Technology Transfer Activities

- **Industry Conferences – Organization and Planning**
  - Railroad Environmental Conference (RREC)
  - Joint Rail Conference (JRC)
  - Transportation Research Board (TRB)
- **International Concrete Crosstie and Fastening System Symposium**
  - In June 2012, UIUC will host the largest concrete crosstie and fastening system conference to date, drawing an international pool of experts in design, research, and maintenance of systems
- **Concrete Crosstie and Fastening System Workshop (TRB 2013)**
  - Planning a workshop focused on the design and performance of concrete crossties and fastening systems
- **Rail Capacity Workshop (TRB 2013)**
  - Planning a workshop to discuss challenges and opportunities to address rail line/network capacity with new passenger and high-speed rail developments in the U.S.
- **Coordination with FRA and AAR R&D Programs**
- **Publication of UTC *"Research Briefs"***

NURail Center

University of Illinois at Chicago College of Urban Planning & Public Affairs (CUPPA)

University of Illinois at Chicago College of Urban Planning & Public Affairs

NURail Center Planned Activities:

Research

Education & Workforce Development

Technology Transfer

RAILTEC
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Slide 1

Research Activities

UIC Urban Transportation Center
UNIVERSITY OF ILLINOIS AT CHICAGO
COLLEGE OF URBAN PLANNING & PUBLIC AFFAIRS

- Four independent projects identified
- Represent a range of planning, policy and financial interests
- Faculty and research staff from various research centers and colleges
- Match for research provided by CN and UIC's Office of the Vice Chancellor for Research (OVCR)

CN

UIC UNIVERSITY OF ILLINOIS AT CHICAGO OFFICE OF THE VICE CHANCELLOR FOR RESEARCH

Slide 2

Research Activities

UIC Urban Transportation Center
UNIVERSITY OF ILLINOIS AT CHICAGO
COLLEGE OF URBAN PLANNING & PUBLIC AFFAIRS

- Project name: Economic Benefits of Productivity Increases through Truck-to-Rail Mode Shift in Freight Transport
- PI: Dr. Kazuya Kawamura
- Project will focus on measuring impacts of transitioning freight from truck to rail
  - Will create a Computable General Equilibrium (CGE) for the entire US
  - Patterned after Chicago-area CGE developed for previous projects
  - To simulate freight activity the project will use the FAME model
- Deliverables: Modified FAME model that can estimate impacts from modal shifts nationwide

NURail Center

Research Activities

UIC Urban Transportation Center
UNIVERSITY OF ILLINOIS AT CHICAGO
COLLEGE OF URBAN PLANNING & PUBLIC AFFAIRS

- Project name: Value Capture Tactics for Rail Transport
- PI: Dr. Janet Smith; Stephen E. Schlickman, JD
- Project will focus on connecting disparate elements of value capture planning and implementation:
  - Various governmental entities, community planners, transportation organizations, and private developers
- There will be three phases:
  - Literature review of value capture tactics and challenges
  - Case studies of foreign and domestic projects using value capture
  - Development of strategies for successful implementation
- Deliverables: Reports for each of the three phases plus a final report and presentation of findings

NURail Center

Research Activities

UIC Urban Transportation Center
UNIVERSITY OF ILLINOIS AT CHICAGO
COLLEGE OF URBAN PLANNING & PUBLIC AFFAIRS

- Project name: Pedestrian Safety at Rail Grade Crossings
- PI: Dr. Paul Metaxatos/Dr. P. S. Sriraj
- Project will focus on generating a profile of current practices in crossing design and policy and recommending new practices based on inconsistencies
  - Task 1: Research review
  - Task 2: Document currently published industry grade crossing design standards, guidelines and operating procedures
  - Task 3: Industry interviews
  - Task 4: Conduct comparative analysis of Tasks 2 & 3
- Deliverables: Individual task reports and a final report

Slide 5

NURail Center

Research Activities

UIC Urban Transportation Center
UNIVERSITY OF ILLINOIS AT CHICAGO
COLLEGE OF URBAN PLANNING & PUBLIC AFFAIRS

- Project name: Environmental Impact Assessment of Rail Infrastructure in Illinois
- PI: Dr. Ning Ai
- Project will work to integrate spatial analysis, risk assessment and lifecycle assessment to evaluate environmental impacts of rail infrastructure in Illinois
  - Will create as a GIS tool
  - Seeks to make resulting tool web-based in a pilot program
- Deliverables: Environmental GIS database and accompanying web-based pilot as well as documentation and report covering all phases of research and development.

Slide 6

NURail Center

Education + Workforce Dev.

UIC Urban Transportation Center
UNIVERSITY OF ILLINOIS AT CHICAGO
COLLEGE OF URBAN PLANNING & PUBLIC AFFAIRS

- At least one research assistant (RA) will be assigned to each project. For many RAs these projects will provide:
  - Knowledge
  - Industry Connections
  - Research/Work Independence
- Metra Operations Management Development Program
  - UTC and the Great Cities Institute (CUPPA) will work with Metra to develop curriculum
  - Training is for Metra employees

NURail Center

Technology Transfer

UIC Urban Transportation Center
UNIVERSITY OF ILLINOIS AT CHICAGO
COLLEGE OF URBAN PLANNING & PUBLIC AFFAIRS

- The UTC has identified two actions that will assist in transferring beneficial information to project sponsors (Federal, Local, and Industry) and other interested parties:
  - UTC Staff Hire
    - Internal and External Communication
    - Not exclusive to NURail
  - UTC will remain in constant communication with its partners, match providers, and other involved parties to update on research progress

NURail Center

University of Illinois at Chicago
College of Engineering (COE)

University of Illinois at Chicago
College of Engineering

NURail Center Planned Activities:

Research

Education

Technology Transfer

UIC COLLEGE OF ENGINEERING
UNIVERSITY OF ILLINOIS AT CHICAGO

NURail Research Team
UIC College of Engineering (2012)

UIC COLLEGE OF ENGINEERING

Ahmed Shabana (Mechanical Engineering)
Integrated Dynamic Modeling of Rail Vehicles and Infrastructure

Craig Foster (Civil Engineering)
Track Substructure Modeling

Jason Leigh (Computer Science)
Immersive Visualization of Rail Simulation Data

Mohsen Issa (Civil Engineering)
Rail Infrastructure Materials & Design

Ouri Wolfson (Computer Science)
The Informed Rail Traveler

UIC College of Engineering
NURail Center Proposed Activities:

UIC COLLEGE OF ENGINEERING

- **TECHNICAL RESEARCH**
  - ***Railroad Infrastructure & Vehicles: Integrated Dynamic Modeling***
    - Vehicle Dynamics Modeling: Vibrations, Wheel/Rail Contact
    - Track Substructure Modeling: Fasteners, Ties, Ballast, Subballast, Subgrade (UIC, UIUC)
    - Immersive Visualization of Rail Simulation Data: Derailments, Infrastructure Degradation
  - ***Railroad Infrastructure***
    - Materials, Design, & Testing: Recycled Plastic Ties, Precast Concrete Slabs for Bridges
  - ***Railroad Systems***
    - The Informed Rail Traveler: Rail Traveler Assistant (RTA) Smartphone Application Provides Rail Travelers with Crowd-Sourced Real-Time Modal Transition Information
- **EDUCATION**
  - ***Full-Semester Courses***
    - Railroad Vehicle Dynamics
    - Railway Infrastructure Materials and Design
- **TECHNOLOGY TRANSFER**
  - ***Rail Traveler Assistant (RTA)***
    - Initial Evaluation by Students
    - Public Release via App Stores: Android Market, iPhone App Store + User Improvements

Slide 3

Integrated Dynamic Modeling of Rail Vehicles and Infrastructure (I)

UIC COLLEGE OF ENGINEERING

- **Objective**
  - Develop general procedure for the integration of vehicle/infrastructure models.

- **Issues**
  - Vehicle dynamics, vibrations, wheel/rail contact.
  - Rail and track infrastructure, concrete crossties.
  - Finite element method, discreet element method.
- **Specific Tasks**
  1. Integration of Track Foundation Modeling with Rail Vehicle Dynamics.
  2. Effect of High Speed Vibrations on Track Substructure and Foundation.
  3. Modeling Concrete Crossties and Fastening Systems for Dynamic Track Structure Simulation.

Slide 4

NURail Center

Integrated Dynamic Modeling of Rail Vehicles and Infrastructure (II)

UIC COLLEGE OF ENGINEERING

- **Project Period**
  - May 1, 2012 to January 31, 2014
- **Collaboration**
  - Mechanical and Civil, UIC and UIUC
- **Investigators**
  - Craig Foster, Jason Leigh, Ahmed Shabana (UIC)
  - Riley Edwards (UIUC), Erol Tutumluer (UIUC)
- **USDOT Strategic Goals and NURail Center Areas**
  - Safety, State of good repair, Infrastructure, Rolling stock/equipment, Public transportation

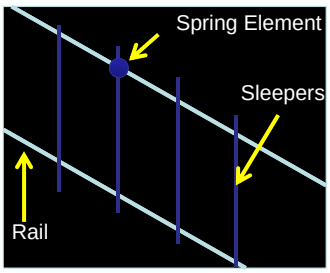
Slide 5

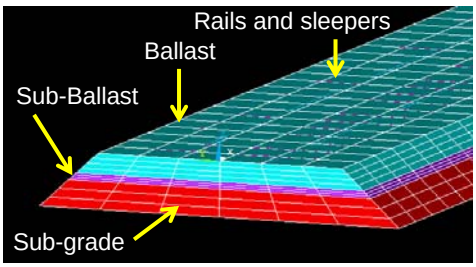
NURail Center

Track Substructure Modeling (I)

UIC COLLEGE OF ENGINEERING

- **Objective**
  - Develop a comprehensive finite elements model of track and substructure including:
    - Fasteners
    - Sleepers
    - Ballast
    - Subballast
    - Subgrade
- **Specific Tasks**
  1. Couple finite element model to existing codes and develop multibody codes for wheel-rail interaction.



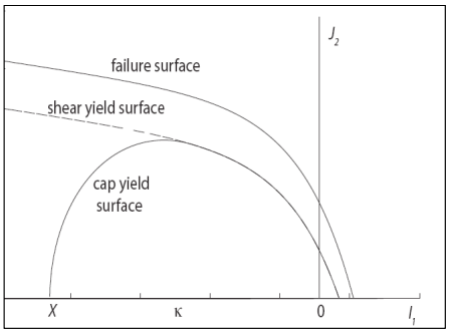


Slide 6

NURail Center

Track Substructure Modeling (II)

- **Specific Tasks (continued)**
  2. Fit ballast material model using experimental and discrete element simulation to elasto-viscoplastic geomaterial model.
  3. Evaluate effect of substructure on wheel/rail dynamics.
  4. Particular attention to long-term settlement of ballast, changing stiffness at bridge approaches.



Slide 7

NURail Center

Immersive Visualization of Rail Simulation Data

UIC COLLEGE OF ENGINEERING

- **Objective**
  - Develop visualizations that will help troubleshoot simulations and also present results to high-level decision makers.
- **Issues**
  - Need to develop a process to convert simulation data types (ANCF and FFR) into visualizations.
- **Specific Tasks**
  1. Develop visualization pipeline.
  2. Integrate visualization in CAVE2 virtual reality system.

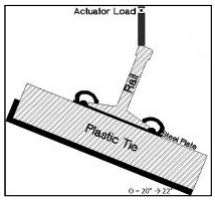
Slide 8

CAVE2

Rail Infrastructure Materials and Design (I)

UIC COLLEGE OF ENGINEERING

- **Objectives**
  - Perform experimental and numerical analysis of **recycled plastic railroad ties**
  - Investigate use of **prefabricated precast concrete slabs** on ground and elevated bridge structures in high speed rail



- **Issues**
  - Rail and track infrastructure, state of good repair
  - Mechanical properties, mode of failure
  - Elevated structures, bridges under impact & dynamic load, rail displacement, rail–fastener interaction

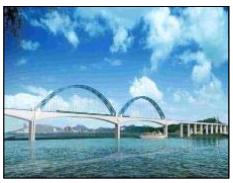
- **Specific Tasks**
  1. Identify mechanical properties of the plastic material used in high speed rail ties
  2. Investigate the fabrication of plastic ties with and without fiber reinforced polymer bars

NURail Center

Rail Infrastructure Materials and Design (II)

UIC COLLEGE OF ENGINEERING

- **Specific Tasks (continued)**
  3. Perform experimental testing of plastic ties subjected to static loading
  4. Perform experimental testing of plastic ties subjected to cyclic loading of at least 2 million cycles
  5. Investigate the use of full depth precast concrete panels for slab bridges
  6. Investigate the types of elevated structures using these precast concrete panels and bridge systems
  7. Investigate the behavior of fastener system (bolts interaction) on the plastic ties with/without temperature effect



- **USDOT Strategic Goals and NURail Center Areas**
  - State of good repair, infrastructure, environmental sustainability, rail capacity

NURail Center

The Informed Rail Traveler (I)

UIC COLLEGE OF ENGINEERING

- **Objective**
  - Promote passenger rail usage by increasing passengers' ability to transition from/to other transportation modes (driving, taxi-cab, etc.)
- **Expected Outcome**
  - A smartphone application that informs rail travelers with real-time transition information, the Rail Traveler Assistant (RTA), which …
    - Presents options to transition to/from rail
    - Finds parking spaces and cabs at station
    - Alerts of delays, outages, next-train
    - Navigates through station to the right platform

Slide 11

NURail Center

The Informed Rail Traveler (II)

UIC COLLEGE OF ENGINEERING

- **Methodologies**
  - Building mobile crowd-sourcing communities using social media (e.g., Twitter) and mobile peer-to-peer communication (e.g., WiFi)
  - Exploiting the capability of social media to scale to millions of users and constant streams of information supplies/queries

Slide 12

NURail Center

Massachusetts Institute of Technology

Massachusetts Institute of Technology (MIT)

NURail Center Planned Activities:

Research

Education & Workforce Development

Technology Transfer

High-Speed Rail: An International Program at MIT

Professor Joseph Sussman
Principal Investigator

- Dr. Travis Dunn
- Mr. Henning Colsman-Freyberger (DB)
- Ms. Sevara Melibaeva (WB)
- Ms. Regina Clewlow
- Mr. Teng Huang
- Mr. S. Joel Carlson
- Mr. Andres Archila
- Ms. Naomi Stein
- Ms. Maria Pena
- Mr. Ryusuke Sakamoto (JR East)

HSR- A Framing

- HSR and ***E***conomic Development
- HSR and the ***E***nvironment
- HSR and Social ***E***quity [collectively ***Sustainability***]
- HSR and "megaregions"
- HSR and supporting institutions
- HSR and its stakeholders
- HSR and uncertainty
- HSR in a competitive landscape
- HSR and its financial viability
- HSR and its societal contribution

NURail Center

HSR - Two coupled projects

- HSR: a complex sociotechnical system view
- HSR productivity: International comparisons and implications for the U.S.

NURail Center

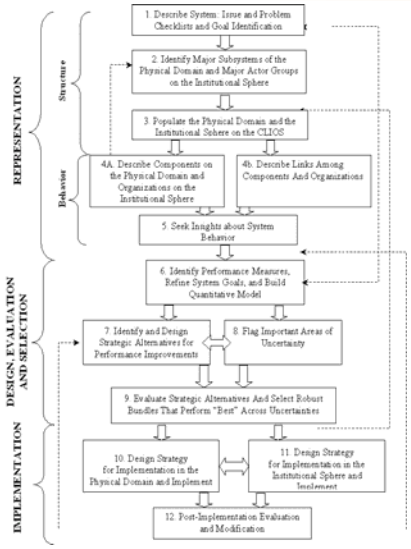
HSR: A complex sociotechnical systems view

- Applying the CLIOS Process to HSR

NURail Center

The CLIOS Process

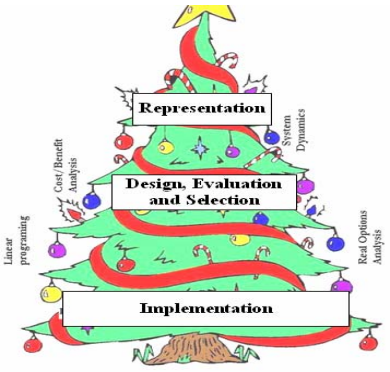
- *A process to facilitate the understanding, analysis, and decision-making related to CLIOS systems.*
- 3 stages
- 12 steps



NURail Center

CLIOS PROCESS: CHARACTERISTICS OF THE THREE STAGES

Stage 1 **Representation**	Primarily Qualitative *Key Idea:* Understanding the CLIOS System Establishing Preliminary Goals
Stage 2 **Design, Evaluation, and Selection**	Both Qualitative and Quantitative Aimed at improvement of the CLIOS System *Key Idea:* Developing bundles of strategic alternatives
Stage 3 **Implementation**	Pragmatic in nature. How to implement bundles of strategic alternatives *Key Idea*: Follow-through: changing and monitoring the performance of the CLIOS System



NURail Center

CLIOS System/ CLIOS Process Ideas

- Three stages
  - Representation
  - Design, Evaluation and Selection
  - Implementation and performance monitoring
- Strategic alternatives &
  - Robust bundles of strategic alternatives
- Recognize different kinds of complexity
  - *"nested" complexity* (we separate "organizations" from other components in the CLIOS System world view)
  - *"evaluative"* complexity
- Emphasis on dealing with uncertainty
- Emphasis on stakeholder roles
- Concern with implementation and monitoring of performance

NURail Center

CLIOS Process Application

The CLIOS Process has shown itself of value in gaining insights, on many dimensions, into various complex sociotechnical systems (CSS). Surely the deployment of HSR, either at international quality or incremental in nature, can be classified as a CSS.

We will apply the CLIOS Process in this context, hoping to gain insights and a pathway to implementation in the U.S. context.

Our approach is inherently inclusive, connecting transportation to other realms including the environment, energy, economic development, technology development and societal impact. As such, our CLIOS Process links directly to the USDOT Strategic Goals and the NURail Center Topic Areas.

NURail Center

Some CLIOS Process Applications

- Transportation and Air Quality in Mexico City
- Extracting Information from Blogs for Strategic Planning in Advanced Technologies (e.g. Cloud Computing)
- Cape Wind-- Off-shore Renewable Energy in Nantucket Sound: Understanding Stakeholder Views
- Organizational Infrastructure and Technology for Air Combat
- Provision of Broadband Telecommunication Services by Municipal Electric Utilities (MEUs)
- Regional Strategic Transportation Planning (RSTP) as Coupled to Supply Chain Management (SCM)
- Providing High-Speed Broadband Internet Access in Developing Countries: The Case of Kenya

NURail Center

HSR Productivity: International comparisons and implications for the U.S.

Why is productivity important?

Investments in enhanced mobility must be effective and efficient, that is, characterized by strong productivity growth over time.

For HSR to be a competitive investment, it should achieve productivity comparable to other modes

How can we achieve HSR systems with this characteristic?

Consider international HSR deployments, their productivity growth and how they achieved it

Implications for potential HSR systems in the U.S.

NURail Center

High-Speed Railway Productivity:

How to achieve High-Speed Rail Productivity Improvements

Organizational Restructuring and Institutional Change

Technology

Operating Practices

Ryusuke Sakamoto (JR East, MIT)
Joseph Sussman (MIT)

NURail Center

Productivity equation

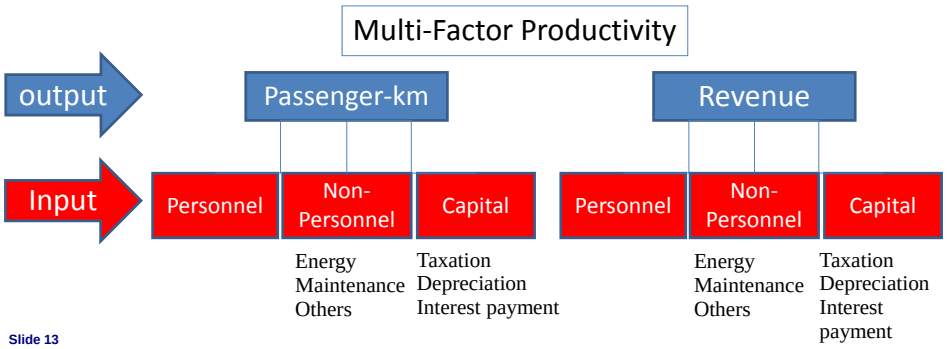
$$\ln\left(\frac{MFP_k}{MFP_l}\right) = \ln\left(\frac{y_k}{y_l}\right) - \sum_{j=1}^{N} S_j \ln(x_{jk}/x_{jl})$$

y_k: output in year k
y_l : output in year l

N : input variable
S_j : cost share of input x_j

Source: Cowie (2001)

x_{jk}: input j in year k
x_{jl} : input j in year l



Slide 13

HSR Productivity: International comparisons and implications for the U.S.

Work Plan

- Literature review on general productivity studies
- Literature review on rail and especially HSR productivity
- Data Gathering on various international HSR systems
- Productivity Analysis of international HSR systems and identification of key variables affecting productivity
- Application to California HSR
- Application to HSR in the NEC

Slide 14

NURail Center

Workforce Development

Some overarching ideas

- Complexity and the New Transportation Professional
- "T-shaped" New Transportation Professional
- Modalities for workforce development
- The role of the New Transportation Professional going forward

NURail Center

Transportation and the Challenge of Complexity

- Transportation has been a fundamental element of society for centuries - central to economic development and improved quality of life
- But now we transportation professionals are challenged as never before-- and this new challenge is brought on by *complexity* of many types
- We need to think about the *"new transportation professional"* who can effectively deal with this complexity

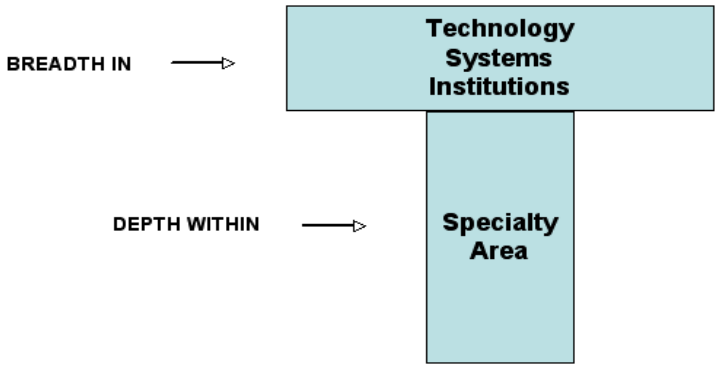
NURail Center

Workforce Development

- This professional environment requires a "New Transportation Professional" and
- The aim of workforce development should be to create this "New Transportation Professional"

NURail Center

THE "T-SHAPED" NEW TRANSPORTATION PROFESSIONAL



A DEEP UNDERSTANDING OF SUSTAINABILITY

NURail Center

What does the "T-shaped" professional have?

- Breadth for an integrative "systems" view
- Depth for professional confidence
- An open and curious mind
- Ability to communicate
  - In writing
  - In oral presentations
- Ability to work as a member of a team
- Ability to lead a team (or perhaps an enterprise)
- An ethical sense

NURail Center

Modalities for workforce development

- Workforce development for current professionals - a joint responsibility of the professional and the practicing organization, with some contributions from academia
- Workforce development for current students-- a joint responsibility of the student and the university, with some contributions from the practicing organization
- Overall guidance and opportunities provided by the profession broadly conceived (eg professional capacity building)
- But always a responsibility of the individual

NURail Center

The future and the need for flexibility

- The world is an ever-changing place
- The only thing we know about the future is that we can't predict it
- To deal with this uncertainty, individuals and organizations must develop a ***workforce*** able to flexibly respond to the needs of the (unknown) future
- ***The new transportation professional*** is a vital part of this flexible response

NURail Center

Thanks for your attention!

NURail Center

Michigan Technological University

Michigan Technological University

NURail Center Planned Activities:

Research

Education & Workforce Development

Technology Transfer

MichiganTech

NURail Center Proposed Activities: Michigan Technological University

MichiganTech

- **TECHNICAL RESEARCH**
  - ***Railroad Infrastructure***
    - Assessment of Aggregate Sources in Michigan for High Speed Railroad Ballast
    - Performance Evaluation of In-Service Ties: A Parametric Evaluation of Tie Material, Design, and Configuration of Loading Demands (Univ. of Virginia)
  - ***Railroad Vehicle***
    - Austempered Ductile Iron (ADI) for Railroad Wheels
  - ***Railroad Systems***
    - Improving Rural Freight Rail in State of Michigan
    - Influence of Driver Attention on Rail Crossing Safety
- **EDUCATION**
  - ***University Education Development***: Conversion of current courses to online format, Development of Undergraduate Rail Transportation / Engineering Certificate, Implementation of Undergraduate Student Projects
  - ***Educational Outreach***: to faculty (REES), to college students (internships), to primary and secondary school students (Summer Youth Program in Rail and Intermodal Transportation)
- **TECHNOLOGY TRANSFER**
  - Technology Transfer Seminar with Michigan Department of Transportation (MDOT)

Assessment of Aggregate Sources in Michigan for High Speed Railroad Ballast

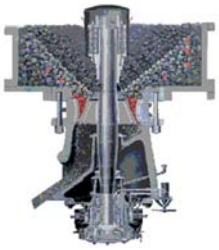
- **Objective**
  - The object of the project is to conduct a preliminary investigation on aggregate sources from Michigan that can be used for high speed rail (110 mph) ballast.
- **Issues**
  - The state of Michigan is very geologically diverse with about three quarters of the state consisting of sedimentary rocks and the remaining igneous and metamorphic rocks. Ballast for high speed rail will generally require more competent igneous and metamorphic rock for ballast. The study will investigate rock sources that will meet high speed rail specifications and be economically viable.
- **Specific Tasks**
  1. Identify potential ballast sources within Michigan including iron and copper mining sources in northern Michigan.
  2. Conduct laboratory testing on potential ballast sources.
  3. Complete an assessment of potential ballast sources in Michigan with a final report.

Slide 3

NURail Center

Assessment of Aggregate Sources in Michigan for High Speed Railroad Ballast

- **Project Period**
  - May 1, 2012 to December, 2012
- **Collaboration**
  - Michigan Tech Transportation Institute
  - Michigan DOT
- **Investigator**
  - Stan Vitton, PhD, PE
- **USDOT Strategic Goals and NURail Center Areas**
  - Economic Competitiveness, State of good repair, Infrastructure, Rolling stock/equipment, Public transportation



Slide 4

NURail Center

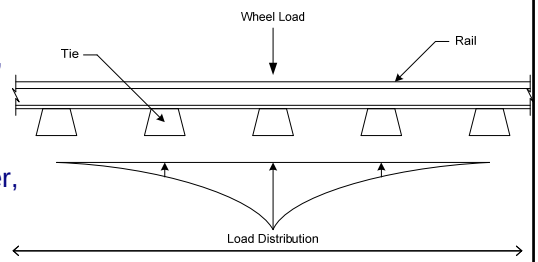
Performance evaluation of in-service ties: A parametric evaluation of tie material, design, and configuration of loading demands (I)

- **Objective**
  - The proposed study would investigate the load sharing characteristics of mixed tie track segments and assess the effects placed on tie design demands. Included would be load distribution behavior considering aspects such as tie stiffness, geometry, and spacing.
- **Issues**
  - It is commonly recognized that the type of tie used in service is a function of a variety of factors and no one solution is ideal for all scenarios. This feature results in sections of track that may have mixed tie configurations or lines that may be overdesigned when using a specific tie type. This mixed tie use pattern results in variations in load sharing and distribution that can either enhance system performance or place higher demands on other components.
- **Specific Tasks**
  1. State of the Practice on Tie Design
  2. Synthesis of Tie Demand Requirements
  3. Development of Preliminary Track System Model
  4. Parametric Investigation of Tie Behavior
  5. Final Reporting

NURail Center

Performance evaluation of in-service ties: A parametric evaluation of tie material, design, and configuration of loading demands (II)

- **Project Period**
  - May 1, 2012 to January 31, 2014
- **Collaboration**
  - Union Pacific and LB Foster, CXT
- **Investigators**
  - Devin Harris (University of Virginia – MTU Subcontract)
- **USDOT Strategic Goals and NURail Center Areas**
  - US DOT: State of good repair
  - NURail: Infrastructure



Investigation Parameters
Spacing, Geometry, Material, Mixed tie usage, Ballast type, ballast condition

NURail Center

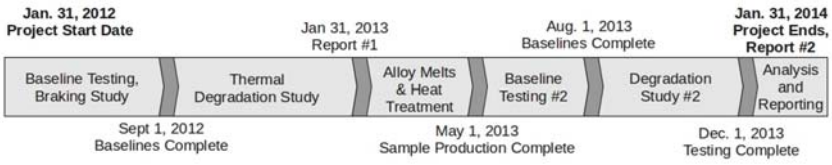
Austempered Ductile Iron for Railroad Wheels (I)

- **Objective**
  - Improve thermal stability of austempered ductile iron (ADI) at railroad braking temperatures
- **Benefits**
  - 10% decreased wheel weight
  - 10% lower cost
  - Lower wheel and rail wear
  - Lower noise
- **Primary Tasks**
  1. Characterize of wheel tread temperature profiles
  2. Evaluate of thermal stability of current ADI grades
  3. Develop alloy and heat treatment to improve thermal stability

NURail Center

Austempered Ductile Iron for Railroad Wheels (II)

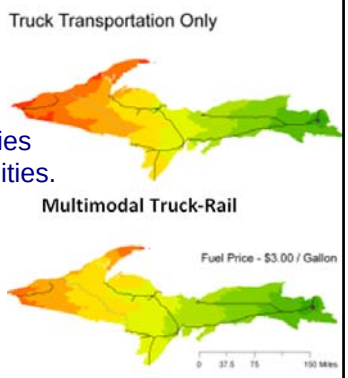
- **Investigators**
  - Paul Sanders, Karl Warsinski (Michigan Tech)
- **USDOT Strategic Goals and NURail Center Areas**
  - State of good repair, Economic competitiveness, Environmental sustainability, Rolling stock/equipment, Economics
- **Timeline:**



NURail Center

Improving Rural Freight Rail in the State of Michigan

- **Objective**
  - Identifying rural rail service challenges on light-density lines. Developing tools and methods to facilitate the use of rail and multimodal transportation in rural Michigan
- **Issues**
  - Limited understanding of rural rail opportunities and operations. Lack of data on rail commodities. Shipper / railroad communications
- **Specific Tasks**
  - GIS-based rail inventory map
  - On-line shipper survey
  - Commodity data collection and analysis
  - Shipper / railroad perception analysis



Slide 9

NURail Center

Improving Rural Freight Rail in the State of Michigan

- **Project Period**
  - June 1, 2012 to January 31, 2014
- **Collaboration**
  - Michigan DOT, Great Lakes Timber Professionals Association, Michigan Railroad Association
- **Investigators**
  - Pasi Lautala, PhD, PE, Frank Pentti (US DOT Retired)
- **USDOT Strategic Goals and NURail Center Areas**
  - USDOT: state of good repair, economic competitiveness, environmental sustainability
  - NURail: Operation, Planning, Economics, Multimodal

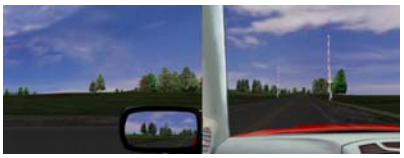
Slide 10

NURail Center

Influences of Driver Attention on Rail Crossing (I)

- **Objective**
  - Quantify visual field and visual scanning patterns on the part of drivers for several types of railroad crossings and driving environments.

- **Issues**
  - Vehicle-train collisions, driver distraction at crossings, effect of safety devices on driver awareness.
- **Specific Tasks**
  1. Identify baseline visual scanning patterns at crossings.
  2. Assess the effect of driver distractions on visual scanning patterns.
  3. Assess human performance at high crash rate crossings.



Slide 11

NURail Center

Influences of Driver Attention on Rail Crossing (II)

- **Project Period**
  - May 1, 2012 to January 31, 2014

- **Collaboration**
  - Depts. Of Mechanical, Civil and Cognitive Science at MTU
- **Investigators**
  - John Hill and Alexander Hardy (MTU)
- **USDOT Strategic Goals and NURail Center Areas**
  - Safety, Livable Communities, Infrastructure, Public transportation

Slide 12

NURail Center

Education – Railroad Engineering Education Symposium (REES)

- **Objective**
  - Provide faculty interested in railway engineering with materials to add railroad engineering content to their engineering courses and curricula.
- **Issues**
  - Railroad engineering content is extremely limited in most North American universities
- **Specific tasks**
  - Lead content development, function as presenters, participate in follow-up surveys
- **Project Period**
  - May-June, 2012
- **Collaborators**
  - Several NURail members, AREMA Committee 24

Slide 13

NURail Center

Education – Rail and Intermodal Transportation Summer Youth Program

- **Objective**
  - Increase awareness of the education and career opportunities available in the rail industry for high school students
- **Issues**
  - Rail transportation has low visibility among today's youth
- **Specific tasks**
  - Lead, coordinate and provide instruction in the program, provide financial scholarships for program fees
- **Project Period**
  - July, 2012 and 2013
- **Collaborators**
  - Univ. of Wisconsin – Superior, Railroad Club (REAC) at Michigan Tech

Slide 14

NURail Center

Education – Undergraduate Senior Design and Enterprise Student Projects

- **Objective**
  - Introduce rail transportation / engineering to undergraduate students by sponsoring several hands-on undergraduate team projects in various engineering disciplines.
- **Issues**
  - Limited understanding of rail topics among students and faculty
- **Specific tasks**
  - Identify projects, guide students teams and disseminate results to industry
- **Project Period**
  - August, 2012 – January, 2014
- **Collaborators**
  - Michigan DOT, various industry companies, various Tech depts.

Slide 15

NURail Center

Education – Rail Transportation Certificate and Online Course Conversion

- **Objective**
  - Convert current courses to online format and obtain university approval for undergraduate rail transportation / engineering certificate
- **Issues**
  - Access to rail education limited to students on a few universities. No current recognition on rail studies completed at the university.
- **Specific tasks**
  - Modify course design to meet the online requirements. Develop certificate proposal and submit for approval by university senate
- **Project Period**
  - June, 2012 – December, 2013
- **Collaborators**
  - Various Tech departments

Slide 16

NURail Center

Tech Transfer – Railroad Seminar for Michigan DOT and Stakeholders

- **Objective**
  - Provide a one-day railroad seminar for government entities in topics identified as important by MDOT
- **Issues**
  - Limited understanding among MDOT staff and local government agencies on rail related issues
- **Specific tasks**
  - Identify topics, develop content, manage seminar (including webinar), develop ideas for future seminars
- **Project Period**
  - June, 2013 – September, 2013
- **Collaborators**
  - Michigan DOT, local government agencies, Michigan Tech Center for Technology and Training (CTT)

Slide 17

NURail Center

University of Kentucky

University of Kentucky

NURail Center Planned Activities:

Research

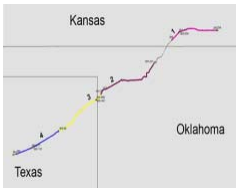
Education & Workforce Development

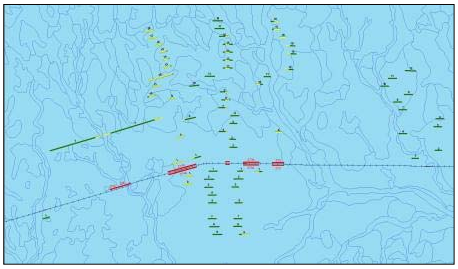
UK UNIVERSITY OF KENTUCKY

Slide 1

Long term performance of improved track bed subgrade

- collect component and Surface Quality Index data
- collect data for soil condition and other relevant factors
- Develop database
- summary and descriptive statistics
- propose model form
- conduct regression modeling
- report preliminary conclusions
- recommendations for larger study to include maintenance activity and additional causal factors





TransCon™ Corridor

Slide 2

Rail crossing smoothness, performance metrics and safety using 3D scanner

- Lit Review
- Propose geometric “trigger” and design vehicle
- Design/build DAQ – Kinect or laser photogrammetry
- LiDAR validation
- Collect data
  - Geometry
  - Accelerations
- Compute geometries
- Correlation
- Establish threshold(s)
- Report

Slide 3

US Commuter rail in shared corridors – policy and financing best practice

- detailed survey of the history and effectiveness of commuter rail policy in the United States
- federal, state and local policies and financing initiatives
- details of the right of way agreements

Slide 5

NURail Center

Operational impact of lock and dam outage on rail system (joint project with MTIC)

- collect and code rail network data
- identify and interview certain strategically linked ports and major shippers to identify potential impacts of lock and dam closures as well as alternative transportation means
- develop sketch plan of alternative transportation options and costs for a particular port or region given short or long term disruptions in service

Slide 6

NURail Center

Multimodal Transportation Operations Course Development - Civil Engineering

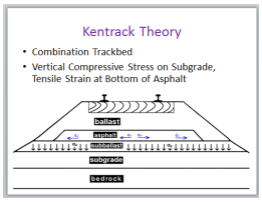
- A semester long senior-level undergraduate course on rail systems operations. CE 433, will be enhanced to include multi-modal transportation components. Includes waterways and trucking, and the rail interface. Guest speakers will be arranged from the various modes. Field trips will be organized.

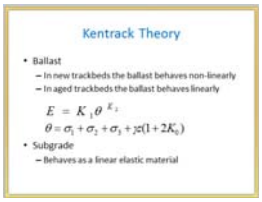
Slide 7

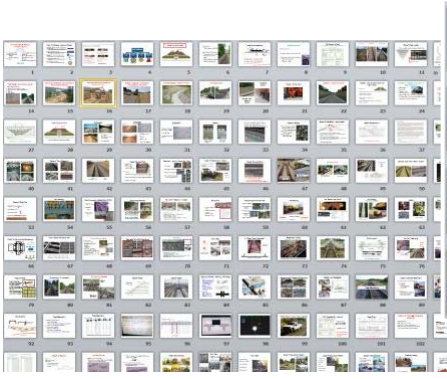
NURail Center

REES I and II modules and training

- REES I: Introduction to Railway Infrastructure
- REES II: Performance-Based Trackbed Structural Design and Analysis Utilizing Kentrack







NURail Center

Graduate student internship at TTCI

- Mike McHenry (AREMA, Wethington and Eisenhower Fellow)
- Summer 2012
- Funded by TTCI, supplemented by NuRail
- Tie-ballast interface (see next slide)

U.S. Department of Transportation
Federal Highway Administration

Technolo

Dwight David Eisenhower Transportation Fellowship Program

Charles T. Wethington, Jr./W.L. M
Study

For First Year Graduate Students
Nomination Deadline: January 25, 2012

Fellowship	Amount
Wethington	$20,000

Slide 9

NURail Center

Tie ballast interface – in situ assessment

- Develop test methodology for earth pressure cells
- Eval. repeatability and consistency
- Develop method, protection and field based calibration to assess sensor drift in Matrix Based Tactile Surface Sensors
- Measure peak pressures at ballast-tie interface
- Report on influence of factors affecting pressure distribution
  - ballast type and gradation
  - tie cross section and material
  - presence of elastic “under tie” pads

Slide 10

NURail Center

Rail industry fellowships and support

- Norfolk Southern
- Jerry Nichols (retired CSX)
  - CSX undergrad
  - grad

NURail Center

University of Tennessee, Knoxville

University of Tennessee, Knoxville

NURail Center Planned Activities:

Research

Education & Workforce Development

Technology Transfer

NURail Center Proposed Activities: University of Tennessee - Knoxville

- **TECHNICAL RESEARCH**
  - Behavior of Railroad Bridges with Hybrid Composite Beams
  - Assessment of Foreign HSR Bridge Design Practices
  - Development of New Damping Materials for Ballastless Trackbed
  - Evaluation of Terminal Capacity Models for Rail Freight Flow Analysis
- **EDUCATION**
  - Incorporate railroad modules in existing CE courses (e.g., Materials, Asphalt Design)
  - Short courses for working professionals
  - REES I and II modules and training
  - AREMA Student Chapter
- **TECHNOLOGY TRANSFER**
  - NURail website
  - UTC report distribution process
  - Presentations at industry conferences
  - Interaction with TRB and ASCE rail committees
  - Specialty workshops and short courses

Lateral Behavior of Railroad Bridges with Hybrid-Composite Beams

- **Objective**
  - The Hybrid-Composite Beam (HCB®) combines advanced composite materials with conventional concrete and steel to create a bridge that is stronger, lighter and more resistant to corrosion than conventional materials. HCB may offer promise for the construction of new and replacement rail bridges, particularly for new High-Speed Rail (HSR) routes. The objective of this study is to evaluate performance of HC girders when subjected to lateral over-height vehicle impact loading.
- **Issues**
  - Damage due to lateral impact to the bridge superstructures by over-height vehicles is a concern conspicuously overlooked by standard bridge code provisions. This experimental and analytical study of lateral impact to an HCB bridge will help provide data to satisfy concerns regarding safety of these bridges. It will also help to identify inspection and evaluation methods for these structures and help further facilitate and promote their use in our nation's rail infrastructure.
- **Specific Tasks**
  1. Literature review.
  2. Develop FEM models to evaluate theoretical beam behavior.
  3. Design and conduct field experiment to examine beam behavior
  4. Develop conclusions and document in final report

Lateral Behavior of Railroad Bridges with Hybrid-Composite Beams

- **Project Period**
  - July 1, 2012 to December 31, 2013
- **Collaboration**
  - UTK-CEE
  - HC Bridge Co.
  - TTCI
- **Investigators**
  - Drs. R.M. Bennett and John Ma, UTK-CEE
- **USDOT Strategic Goals and NURail Center Areas**
  - Safety, State of good repair, Environmental Sustainability, Infrastructure

NURail Center

Assessment of Existing Railroad Bridges to Accommodate a Higher Speed Considering Chinese Practices

- **Objectives**
  - Evaluate Chinese railroad bridge systems and identify issues uncovered when China upgraded speeds on conventional rail lines
  - Compare US and Chinese railroad bridge systems and identify the most significant technologies for implementation in the United States to accommodate higher speeds in shared rail corridors.
- **Issues**
  - Language and communications issues hinder the transfer of Chinese experience and technology to North American railway practice. China has substantial experience with upgrading conventional railways to accommodate higher-speed passenger trains in shared corridors.
- **Specific Tasks**
  1. Establish contacts with Chinese railway officials and researchers
  2. Conduct visits to interview key contacts and observe bridge systems of interest
  3. Identify promising approaches
  4. Examine applicability to U.S. practice
  5. Prepare final report

Slide 5

NURail Center

Assessment of Existing Railroad Bridges to Accommodate a Higher Speed Considering Chinese Practices

- **Project Period**
  - June 1, 2012 to November 30, 2013
- **Collaboration**
  - UTK-CEE
  - UTK-CTR
  - Southwest Jiaotong University
- **Investigators**
  - Dr. John Ma, UTK-CEE and Dr. David Clarke, UTK-CTR
- **USDOT Strategic Goals and NURail Center Areas**
  - State of good repair, Safety, Infrastructure

Slide 6

NURail Center

Development of New Damping Materials for Ballastless Trackbed

- **Objectives**
  - The objectives of this proposed study are to (1) develop new damping materials for use in ballastless trackbed and (2) to evaluate the behavior of these new materials under mixed traffic such as high-speed passenger trains and heavy axle freight trains.
- **Issues**
  - Damping is a critical factor for the safe operation of passenger and freight shared track railway. Currently, three types of material are commonly used to provide the damping: (1) asphalt trackbed; (2) crumb rubber modified asphalt; (3) asphalt-modified portland cement mortar (AMPCM). AMPCM possesses higher strength and modulus than asphalt materials but lower than those of concrete, which makes it more suited for ballastless railway construction than other materials. In Japan, China, and Europe, AMPCM has been widely used in high-speed rail (HSR). However, little research has been conducted on AMPCM in the U.S.
- **Primary Tasks**
  1. Literature review
  2. Mix design
  3. Static and dynamic property characterization, durability evaluation
  4. Evaluate mechanical responses of trackbed under mixed traffic

Development of New Damping Materials for Ballastless Trackbed

- **Project Period**
  - 7/1/2012 to 12/31/2013
- **Collaboration**
  - UTK-CEE
  - Hebei Institute of Construction
  - Geotechnical Investigation Co., Ltd.
- **Investigators**
  - Dr. Baoshan Huang, UTK-CEE
- **USDOT Strategic Goals and NURail Center Areas**
  - State of good repair, Economic competitiveness, Infrastructure

Evaluation of Terminal Capacity Models for Rail Freight Flow Analysis

- **Objectives**
  - The objective of this research is to develop some terminal capacity models for use in strategic level network models.
- **Issues**
  - RAILNET is a multicommodity, non-linear traffic flow optimization model for railway network analysis. The model incorporates the ability to include capacity functions for rail lines, terminals, and interchange facilities. RAINET has been used in a number of national level studies. However, the terminal capacity capability remains unused because of the lack of general terminal performance functions.
- **Primary Tasks**
  1. Literature review
  2. Analysis tool development
  3. Case study analysis
  4. Final report

Development of New Damping Materials for Ballastless Trackbed

- **Project Period**
  - 9/1/2012 to 12/31/2013
- **Collaboration**
  - UTK-CTR
  - UTK-IEE
  - Norfolk Southern
- **Investigators**
  - Dr. Mingzhou Jin, UTK-IEE, Dr David Clarke, UTK-CTR
- **USDOT Strategic Goals and NURail Center Areas**
  - Economic competitiveness, Planning, Economics

Education – Railroad Modules for Materials Classes

- **Objective**
  - Provide content relevant to railways to existing undergraduate and graduate civil engineering courses related to construction materials
- **Issues**
  - Existing classes focus on highway and airport transportation, with little or no mention of railway applications and design requirements
- **Specific tasks**
  - Lead content development, function as presenters, participate in follow-up surveys
- **Project Period**
  - July 1, 2012 to December 31, 2013
- **Collaborators**
  - Other NURail members, AREMA Committee 24

Rose-Hulman Institute of Technology

Railroad Engineering

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

The facts:

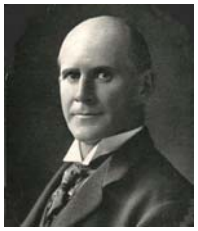
- 1874 - Rose Polytechnic Institute
- 1971 - Rose-Hulman Institute of Technology
- Terre Haute, Indiana
- 1,880 undergraduate students

Undergraduate Degrees

- Applied Biology
- Biochemistry
- Biomedical Engineering
- Chemical Engineering
- Chemistry
- **Civil Engineering**
- Computer Engineering
- Computer Science
- Economics
- **Electrical Engineering**
- Engineering Physics
- Mathematics
- **Mechanical Engineering**
- Optical Engineering
- Physics
- Software Engineering

Chauncey Rose
Terre Haute and Indianapolis RR

Big Four Terminal



Eugene V Debs
Founder of the Brotherhood of Locomotive Fireman

Terre Haute Railroads

Slide 3

NURail Center

Undergraduate Interdisciplinary Railroad Engineering Course

CE 48X Introduction to Railroad Engineering

- CE, ME, EE Majors
- Technical Elective
- 4 Credits (Quarter) – 40 class meetings
- Junior/Senior Level Course
- Faculty - RHIT
  - CE – Jim McKinney
  - ECE – Bill Eccles
  - ME – Mike Moorhead

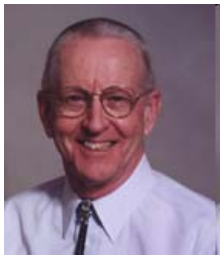
Slide 4

NURail Center

CE 48X Introduction to Railroad Engineering
- Faculty -

Jim McKinney PhD PE
R.C. Hutchins Distinguished Professor of Civil Engineering

B.S., Purdue University, 1969
M.S. Purdue University, 1976
Ph.D., Purdue University, 1980



Bill Eccles PhD PE
Professor of Electrical & Computer Engineering

S.B.E.E., MIT, 1954
S.M., MIT, 1957
Ph.D., Purdue University, 1965

Mike Moorhead PhD
Assistant Professor of Mechanical Engineering

B.S., M.S., Rochester Institute of Technology, 1999
M.S., Cornell University, 2004
Ph.D., Cornell University, 2009

Slide 5

NURail Center

CE 48X Introduction to Railroad Engineering

COURSE MODULES

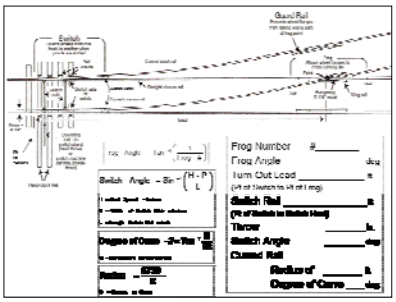
- Railroad Industry
- Railroad Infrastructure
- Rail Systems
- Curves & Gradients
- Track Systems
- Turnout & Switches
- MOW
- Railroad Power
- Locomotives & Rolling Stock
- Signaling
- Grade Crossings
- Operation & Safety Systems
- Passenger Rail
- Railroad Future

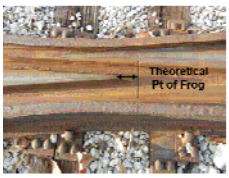
Slide 6

NURail Center

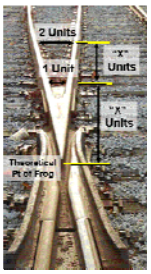
HOMEWORK ASSIGNMENTS

ROSE-HULMAN INSTITUTE OF TECHNOLOGY





FROG NUMBER



HOMEWORK: TRAIN STATISTICS

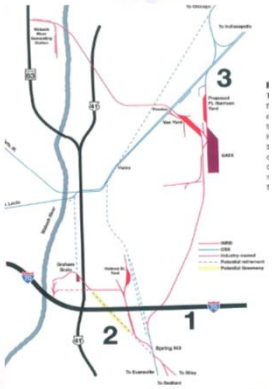
Slide 7

NURail Center

CE 489
SENIOR CAPSTONE DESIGN

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

The Terre Haute Joint Rail Plan



THE INDIANA RAIL ROAD
America's New Regional Railroad.

CSX TRANSPORTATION

Slide 8

NURail Center

CE 489
SENIOR CAPSTONE DESIGN

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Terre Haute Rail Expansion

Peter Ray
VP Engineering
Indiana Rail Road

Midwest Rail Consultants

MRC

THE INDIANA RAIL ROAD

NURail Center

Slide 9

CE 489
SENIOR CAPSTONE DESIGN

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

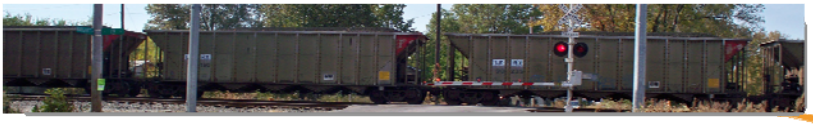
Relocation of Terre Haute Rail Classification Facilities

Larry Ratcliffe
CSX Transportation, Inc.
Director of Network Planning

SBJ Railroad Consultants

SBJ

CSX How tomorrow moves



NURail Center

Slide 10

EM 104
FRESHMAN DESIGN

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Haley Tower Historical & Technical Society

NURail Center

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

FIELD TRIPS

INRD BEAR RUN MINE

INRD JASONVILLE YARD

METROLINK EWING SHOP

NURail Center

OUTREACH & WORK FORCE DEVLOPMENT

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Railroad Capacity Expansion Projects

J. Riley Edwards

RHIT ASCE Student Chapter

ILLINOIS

Slide 13

NURail Center

OUTREACH & WORK FORCE DEVLOPMENT

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

The 7th Annual Meet the Next Generation Event

SOUTH SHORE LINE

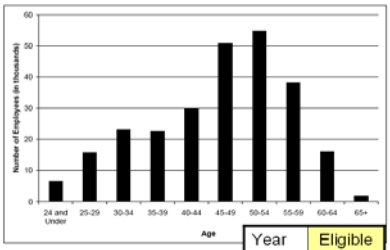
East Chicago

Slide 14

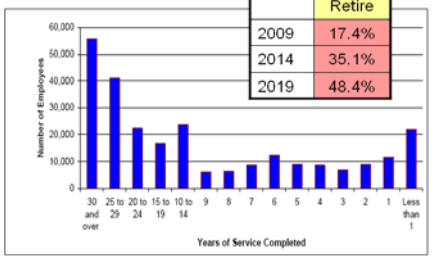
NURail Center

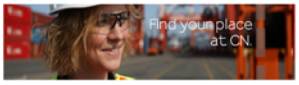
WORK FORCE DEVLOPMENT

ROSE-HULMAN INSTITUTE OF TECHNOLOGY



Year	Eligible Retire
2009	17.4%
2014	35.1%
2019	48.4%





Railroad Job Opportunities

NURail Center

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

COMING SPRING 2013

CE 48X

INTRODUCTION TO RAILROAD ENGINEERING

NURail Center

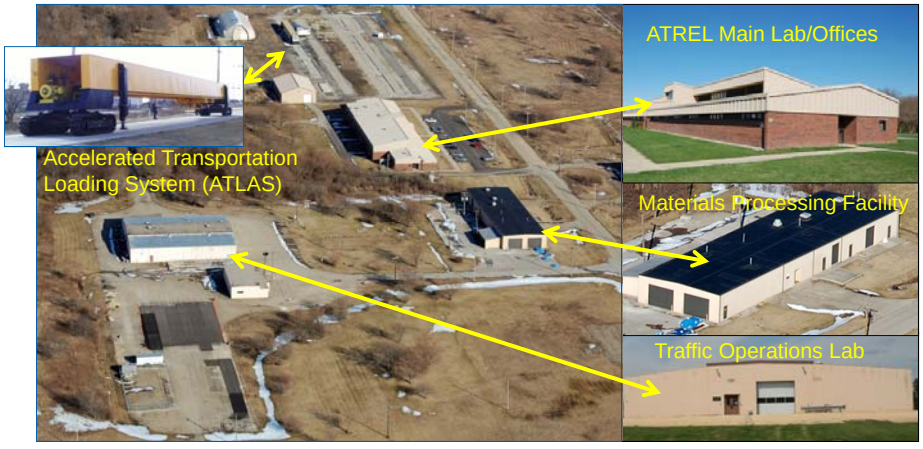
Advanced Transportation Research and Engineering Laboratory Tour

Advanced Transportation Research and Engineering Laboratory (ATREL)

Erol Tutumluer, Professor
Director of International Programs
Civil and Environmental Engineering, UIUC

May 17, 2012

Advanced Transportation Research and Engineering Laboratory (ATREL)



Rantoul, Illinois – ~17 miles North of Champaign

ATREL

- Located on Former Chanute Air Force Base in Rantoul, Illinois
- 47 Acres of Property
- 60,000 ft^2
  - High Bay Laboratories
  - Classroom
  - Office Space
  - Reference Room
  - Computer Facilities



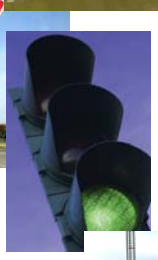

RAILTEC
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

ILLINOIS CENTER FOR TRANSPORTATION

Diversity in Research

- **Green Technologies**
- **Safety**
- **Infrastructure Assessment**
- **Secure Bridges**
- **Traffic Operations**
- **Innovative Pavements**
- **Rail Engineering**

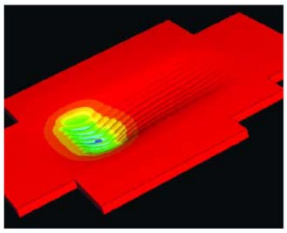



Materials Testing Laboratory

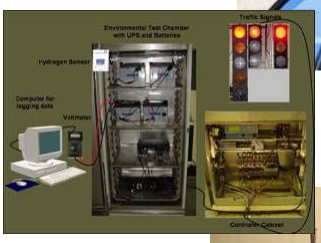
- Testing highway Materials:
  - Construction Materials
  - Advanced Materials:
    - Polymer-Modified
    - Fiber-Modified
    - Recycled
- Specialized Equipment
  - Servo-Hydraulic systems
  - SuperPave equipment
  - UI-Fast Cell
  - Triaxial Shear Apparatus
  - Full-Size Testing

Materials Testing & Modeling



Traffic Operations Laboratory

- Offices, classrooms, testing areas
  - Established to train IDOT on the integration of the highway and railroad signal systems
- Research:
  - Traffic signals
  - Fiber optic communications
  - Traffic signal control hardware



Accelerated Transportation Loading ASsembly (ATLAS)

- Evaluates Full Scale Transportation Systems
  - Rail
  - Aircraft
  - Truck
- Housed in Movable Sprung Structure
- Load Level from 0 to 80 kips
- Max. Speed 10mph
- Can Apply up to 10,000 Repetitions per day

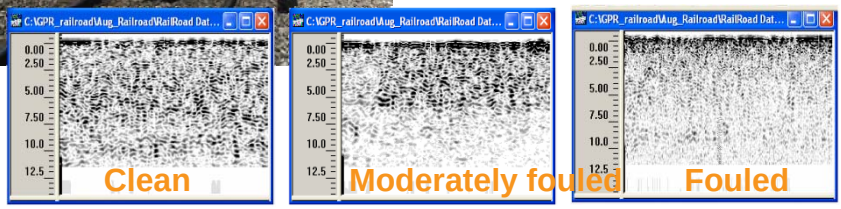
Accelerated Transportation Loading ASsembly (ATLAS)

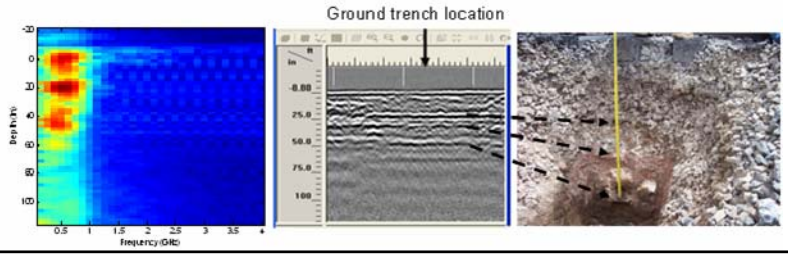
Accelerated Testing Research

Nondestructive Testing

Field Survey

Research Example





ATREL Is the Catalyst for Our Research Opportunities

- RailTEC
- FAA Center for Excellence of Airport Technology (CEAT) and O'Hare Modernization Program
- NEXTRANS University Transportation Center
- Illinois Center for Transportation

Imad L. Al-Qadi
Founder Professor of Engineering
Director of ICT and ATREL

ICT's responsibility is to lead the discovery, development, and implementation of solutions that improve transportation safety, efficiency, and sustainability.

www.ict.illinois.edu

ILLINOIS CENTER FOR TRANSPORTATION

Rail Transportation and Engineering Center Laboratory Facilities Tour

Rail Transportation and Engineering Center Laboratory Facilities

National University Rail (NURail) Center Kickoff Meeting

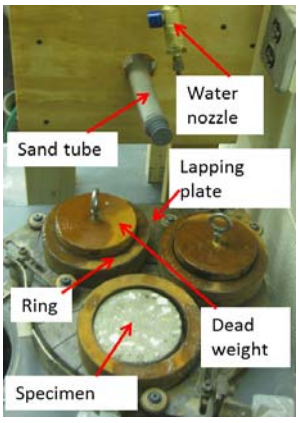
17 May 2012

J. Riley Edwards, Erol Tutumluer, and Christopher Barkan

RAILTEC
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Concrete Crosstie Materials Tests

Large Scale Abrasion Frame:
Used to investigate abrasion as a mechanism leading to rail seat deterioration (RSD) while varying load magnitude and frequency



Lapping Machine:
Provides a means to investigate concrete deterioration rate as a function of loading cycles

Concrete Crosstie Static Test Frames

Static Tie Tester:
Used to study the flexural and bending moment behavior of the concrete crosstie under field loading conditions

Static Load Testing Machine (SLTM):
Provides a means to study the behavior of the crosstie and fastening system under static load

Pulsating Load Testing Machine (PLTM)

- Used for Full Scale Concrete Tie and Fastening System Testing
- Housed at the Advanced Transportation and Research Engineering Laboratory (ATREL)
- Three 35,000 lb. actuators: two vertical and one horizontal
- Provides the ability to simulate various L/V ratios by varying loads

Schnabel Laboratory

45’ x 80’ research laboratory that will allow RailTEC to house large-scale testing frames and perform civil and mechanical research rail research

Shear Strength Testing of Ballast

- **Large Direct Shear Equipment**

12 in. x 12 in. square box

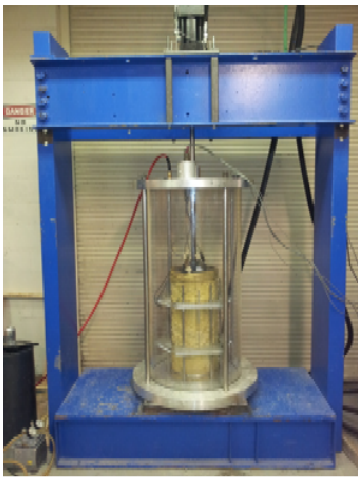
8-in. deep lower box
4-in. deep upper box

up to 30-kip loading

  - Three normal pressures (25, 35, and 45 psi)
  - Shearing rate: 0.38 in./min; Maximum strain recorded: 15%

Large-scale Triaxial Test Device for Repeated Load Ballast Testing

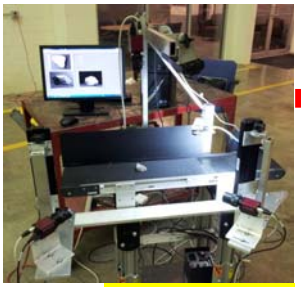
- 12-in. diameter, 24-in. high cylindrical specimens
- MTS actuator capable of applying 100 kN (22 kip) dynamic loading
- On-Specimen Load Measurement (20-kip capacity)
- 3 axial LVDTs located at 120° to measure on-sample axial deformation (range = ± 1 in.)
- 1 circumferential LVDT (range = ± 0.5 in.) for measuring change in sample diameter



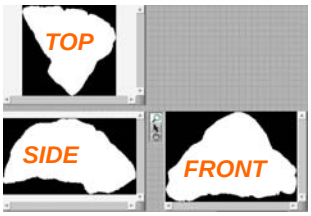
Imaging Based Evaluation of Ballast Shape Properties

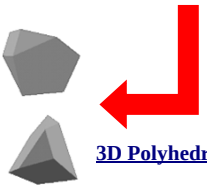
UI Aggregate Image Analyzer (UIAIA)

Ballast Processed through **UIAIA**



Tutumluer et al. (2000)
Rao et al. (2002)





3D Polyhedrons

Ability to Quantify Ballast Shape

- *Flatness & Elongation*
- *Angularity Index*
- *Surface Texture Index*
- *Surface area*
- *Volume*

Element Built in DEM with Desired Shape Properties

Questions

Riley Edwards
Lecturer
e-mail: jedward2@illinois.edu

Erol Tutumluer
Professor
e-mail: tutumlue@illinois.edu

Rail Transportation and Engineering Center – RailTEC
University of Illinois at Urbana-Champaign – UIUC

NURail Educational Plan-RITA

Rail Education and NURail

- **WHY IS EDUCATION MAJOR PART OF NURAIL**
  - Over the past five decades the increasing importance of highway transport has been reflected in our nation's university transportation and engineering curricula…… Today nearly all engineering programs offer both introductory transportation engineering courses….. Most programs pay little, if any, attention to rail transport problems or the interactions between rail and other modes…..
- **HOW IS NURAIL GOING TO IMPROVE THIS**
  - The consortium will accelerate and expand upon its work by involving additional experienced faculty in development of rail educational materials, courses, and curricula; engage and encourage new faculty interest in teaching rail topics, with the ultimate objective of inspiring the interest of many more students, on NURail Center campuses, and beyond…..

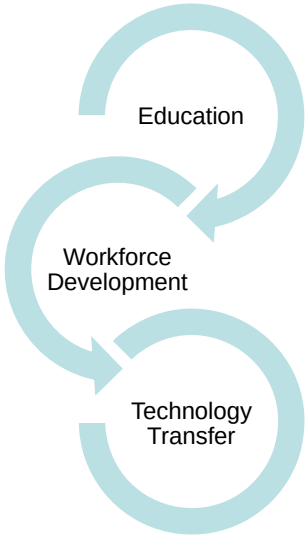
Slide 2

General Objectives

- Increasing the breadth and depth of rail educational materials, courses, and curricula for matriculated students
- Increasing the quality, academic rigor and availability of short courses in rail using both traditional and on-line course delivery
- Increasing outreach to faculty, college and pre-college students and industry
- Expand teaching materials and course accessibility, efficiency and quality through cooperative pooling of resources

Slide 3

Education, Workforce Development or Technology Transfer



Slide 4

Summary of PROPOSED Activities (2012-2013)

2012	2013
• Establish NURail Center Education Subcommittee • New Course / Content Development • Educational Outreach and Workforce development • Identify Synergies and Develop Shared Inventory and Marketing	• NURail Center Articulation Agreements • Initiate Resource Sharing & Increased Access • Outreach to External Stakeholders

Slide 5

NURail Center

Education Subcommittee

- "To guide and coordinate efforts and identify synergies between existing and planned educational activities"
- Members
  - _____
  - _____
  - _____
  - _____
  - _____
  - _____

NURail Center

New Course / Content Development

- **New courses (undergraduate)**
  - Interdisciplinary Railroad Engineering Course (Rose-Hulman)
- **New courses (graduate)**
  - Shared Rail Corridor Engineering and Transportation (UIUC)
  - Railroad Vehicle Dynamics (pending approval - UIC)
  - Railway Infrastructure Materials and Design (pending approval - UIC)
- **Course enhancements**
  - Railway Engineering Modules for Materials Courses (UTK)
  - Multimodal Transportation Operation Course Enhancement (UK)
-

NURail Center

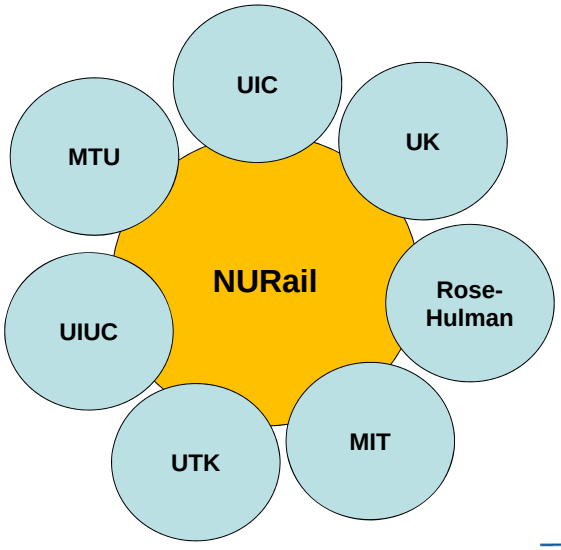
Outreach / Enhancement

- **Undergraduate Students**
  - Senior and Freshman Design Projects (Rose-Hulman)
  - Undergraduate student projects (Michigan Tech)
  - Certificate in Rail Transportation / Engineering (Michigan Tech)
  - Internal / External Internships (UK, Michigan Tech, Rose-Hulman, UIUC)
  - Industry and government practitioner presentations
- **K-12 Students**
  - On-campus rail engineering education events, tours and presentations (UIUC, Rose-Hulman, Michigan Tech)
  - Rail and Intermodal Summer Youth Program (Michigan Tech)

Outreach / Tech Transfer

- **Post-Graduate**
  - METRA Management Training
  - Technology Transfer Seminar with Michigan Department of Transportation (MDOT)
  - General support to ASCE Rail Transportation Committee and AREMA Committees
  - Research projects dissemination and transfer

What makes these “NURail” efforts?



Slide 10

NURail Center

Synergies and Sharing

- **Identifying synergies**
  - Courses
  - Topics
  - Faculty expertise
  - Timing (semesters)
- **Shared resource inventory**
  - Course syllabi and materials
  - Open access for consortium members
  - Shared marketing (web site, brochures)

Slide 11

NURail Center

Continuing Initiatives

- **Implement Resource Sharing and Increased Access**
  - Web-based
- **NURail Center Articulation Agreements**
  - Reduce expertise and resource demands by cross-listing courses
- **Outreach to External Stakeholders**
  - Student exchanges / summer programs
  - Access to NURail courses

Performance Metrics

- Number of rail courses offered
  - Students enrollment in rail courses
- Other NURail Center student activities and student participation
- Rail industry and government employment
  - Internships
  - Full-time positions
- Number of primary and secondary school students participating in outreach efforts
- Percentage continuing to university studies with a rail focus
- Number of students pursuing M.S. and Ph.D. degrees
- Number of industry professionals participating in NURail educational activities

Next Steps

- Establish Education Subcommittee
- Get new material development moving
- Develop processes and tools for
  - Identifying synergies
  - Shared use (inventory, marketing)
  - Performance metrics collection

NURail Educational Plan-Consortium

Rail Education and NURail

- **WHY IS EDUCATION MAJOR PART OF NURAIL**
  - Over the past five decades the increasing importance of highway transport has been reflected in our nation's university transportation and engineering curricula…… Today nearly all engineering programs offer both introductory transportation engineering courses….. Most programs pay little, if any, attention to rail transport problems or the interactions between rail and other modes…..
- **HOW IS NURAIL GOING TO IMPROVE THIS**
  - The consortium will accelerate and expand upon its work by involving additional experienced faculty in development of rail educational materials, courses, and curricula; engage and encourage new faculty interest in teaching rail topics, with the ultimate objective of inspiring the interest of many more students, on NURail Center campuses, and beyond…..

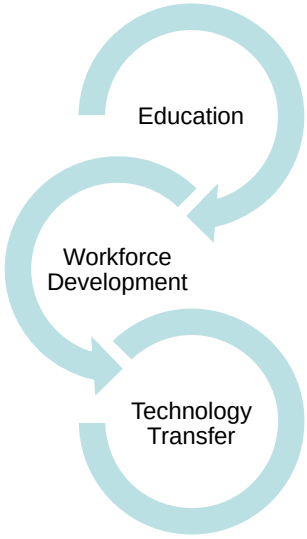
Slide 2

General Objectives

- Increasing the breadth and depth of rail educational materials, courses, and curricula for matriculated students
- Increasing the quality, academic rigor and availability of short courses in rail using both traditional and on-line course delivery
- Increasing outreach to faculty, college and pre-college students and industry
- Expand teaching materials and course accessibility, efficiency and quality through cooperative pooling of resources

Slide 3

Education, Workforce Development or Technology Transfer



Slide 4

Summary of PROPOSED Activities (2012-2013)

2012	2013
• Establish NURail Center Education Subcommittee • New Course / Content Development • Educational Outreach and Workforce development • Identify Synergies and Develop Shared Inventory and Marketing	• NURail Center Articulation Agreements • Initiate Resource Sharing & Increased Access • Outreach to External Stakeholders

Slide 5

NURail Center

Education Subcommittee

- "To guide and coordinate efforts and identify synergies between existing and planned educational activities"
- Members (4 academic and 2 industry??)
  - _____
  - _____
  - _____
  - _____
  - _____
  - _____
  - _____

NURail Center

New Course / Content Development

- **New courses (undergraduate)**
  - Interdisciplinary Railroad Engineering Course (Rose-Hulman)
- **New courses (graduate)**
  - Shared Rail Corridor Engineering and Transportation (UIUC)
  - Railroad Vehicle Dynamics (pending approval - UIC)
  - Railway Infrastructure Materials and Design (pending approval - UIC)
- **Course enhancements**
  - Railway Engineering Modules for Materials Courses (UTK)
  - Multimodal Transportation Operation Course Enhancement (UK)
-

NURail Center

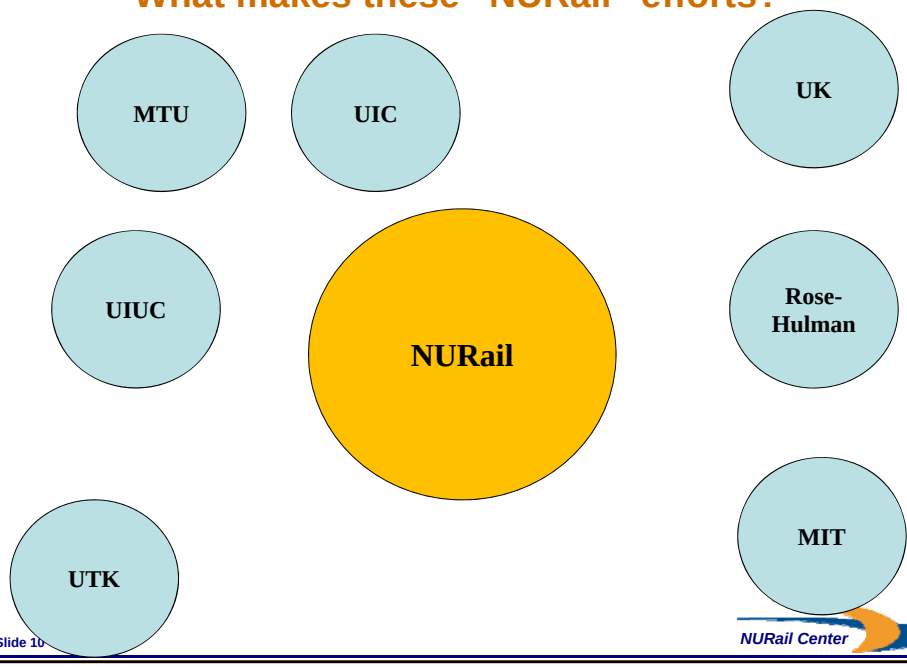
Outreach / Enhancement

- **Undergraduate Students**
  - Senior and Freshman Design Projects (Rose-Hulman)
  - Undergraduate student projects (Michigan Tech)
  - Certificate in Rail Transportation / Engineering (Michigan Tech)
  - Internships (UK, Michigan Tech, Rose-Hulman, UIUC)
  - Industry and government practitioner presentations
- **K-12 Students**
  - On-campus rail engineering education events, tours and presentations (UIUC, Rose-Hulman, Michigan Tech)
  - Rail and Intermodal Summer Youth Program (Michigan Tech)

Outreach / Tech Transfer

- **Post-Graduate**
  - METRA Management Training
  - Technology Transfer Seminar with Michigan Department of Transportation (MDOT)
  - General support to ASCE Rail Transportation Committee and AREMA Committees
  - Research projects dissemination and transfer

What makes these “NURail” efforts?



Slide 10

NURail Center

Synergies and Sharing

- **Identifying synergies**
  - Courses
  - Topics
  - Faculty expertise
  - Timing (semesters)
- **Shared resource inventory**
  - Course syllabi and materials
  - Open access for consortium members
  - Shared marketing (web site, brochures)

Slide 11

NURail Center

Continuing Initiatives?

- **Implement Resource Sharing and Increased Access**
  - Web-based (EdX Platform?)
- **NURail Center Articulation Agreements**
  - Reduce expertise and resource demands by cross-listing courses
- **Outreach to External Stakeholders**
  - Student exchanges / summer programs
  - Access to NURail courses

Performance Metrics

- Number of rail courses offered
  - Students enrollment in rail courses
- Other NURail Center student activities and student participation
- Rail industry and government employment
  - Internships
  - Full-time positions
- Number of primary and secondary school students participating in outreach efforts
- Percentage continuing to university studies with a rail focus
- Number of students pursuing M.S. and Ph.D. degrees
- Number of industry professionals participating in NURail educational activities
- **DEVELOP PROCESS FOR CONTINUING COLLECTION OF DATA**

Next Steps

- Establish Education Subcommittee
- Get new material development moving
- Develop processes and tools for
  - Identifying synergies
  - Shared use (inventory, marketing)
  - Performance metrics collection
- Finally – Identify our weaknesses…..

Strategic Development Planning

University of Illinois at Urbana-Champaign
University of Illinois at Chicago
Massachusetts Institute of Technology
Michigan Technological University
University of Kentucky
University of Tennessee, Knoxville
Rose-Hulman Institute of Technology

Strategic Development Planning

- **Overview**
  - Strategic development planning involves collaboration among several NURail Center partners to develop the long-term vision, tasks and timeline for specific thematic research topics
- **Objective**
  - Develop long-term vision and strategies in key research topics by identifying the current state of the art/practice, knowledge gaps and future research needs
- **Strategic Development Planning (SDP) Areas**
  - Integrated Railroad Track and Vehicle Interaction and Dynamics Modeling
  - Railroad Network Capacity Planning
  - Railroad Safety and Risk on Shared Passenger and Freight Rail Corridors

NURail Center

Integrated Railroad Track and Vehicle Interaction and Dynamics Modeling SDP

- **Objectives:**
  1. Establish integrated model working group with sub-model leads
  2. Develop the overall vision, tasks and timeline
  3. Identify state of the art and practice from previous/current modeling
  4. Develop understanding of inputs and outputs of the integrated model
  5. Organize a mini-symposium on the topic with all team members and outside researchers
- **Relationship to DOT Strategic Goals:** Assist in the state of good repair planning and management, and ensure safe railroad operations
- **Potential Collaborators:** UIUC, UIC-Engineering (co-lead), UTK, UK, and MTU
- **Timeline:**
  - Years 0-1: SDP Development and Implementation*
  - Years 1-2: Sub-Model Development*
  - Years 3-4: Sub-Model Validation and Refinement
  - Years 5-6: Holistic Model Development
  - Years 7-8: Holistic Model Validation and Refinement

**To be accomplished under current NURail Center funding*

NURail Center

Railroad Network Capacity Planning SDP

- **Objectives:**
  1. Develop the overall vision, tasks and timeline
  2. Identify state of the art and practice of previous/current modeling efforts
  3. Establish base train equivalent concept and analytical methods
  4. Organize a workshop on the topic with NURail and outside researchers
- **Relationship to DOT Strategic Goals:** More efficient freight and passenger transportation will result in advancing economic competitiveness, livability, and environmental sustainability
- **Potential Collaborators:** UIUC, UIC-CUPPA
- **Timeline:**
  - Years 0-1: Line Capacity Model and Based Train Equivalent and Unit*
  - Years 1-2: Shared Corridor Capacity Models*
  - Years 3-4: Yard Capacity Model
  - Years 5-6: Revenue Generating Capacity Model
  - Years 7-8: Capacity Planning Project Selection Model

**To be accomplished under current NURail Center funding*

Slide 4

NURail Center

Railroad Safety and Risk SDP

- **Objectives:**
  1. Develop the overall vision, tasks and timeline
  2. Identify state of the art and practice of previous/current railroad safety and risk research
  3. Develop an online depository to provide descriptions, literature and updates on recently completed or on-going research projects
- **Relationship to DOT Strategic Goals:** Will advance our understanding on how to most efficiently and effectively manage risk on shared rail corridors
- **Potential Collaborators:** UIUC, UIC-CUPPA, UK, MTU
- **Timeline:**
  - Years 0-1: SDP Development and Implementation*
  - Years 1-2: Identification of Risk Factors on Shared Rail Corridors*
  - Years 3-4: Shared Corridor Risk Analysis Model Development
  - Years 5-6: Nationwide Shared Corridor Risk Assessment
  - Years 7-8: Identification and Evaluation of Risk Reduction Strategies
  - Years 9-10: Optimization of Risk Reduction Strategy Implementation

**To be accomplished under current NURail Center funding*

Slide 5

NURail Center

Program Progress Performance Report
Quarterly Report Requirments

PPPR Background

- Quarterly report required for UTCs
- Reports to RITA the UTC's:
  - Accomplishments
  - Products
  - Participants and Collaborators
  - Impact
  - Changes/Problems
- Follows new NSF format for progress reporting on Federal research grants
- Maximum of 20 pages including cover page
  - Shorter lengths encouraged as long as content reported is commensurate with level of effort and expenditures

PPPR Background

- Submitted electronically to designated Grant Administrator (Lydia Mercado)
- Posted on the Center website
- First report due 15 calendar days after completion of first 6 months of award (July 15, 2012)
- Thereafter reports due 15 days after the end of the quarter until all funds on the grant expended
  - October 15, 2012
  - January 15, 2013
  - April 15, 2013
  - July 15, 2013
  - Nov 15, 2013
  - Jan 15, 2014
  - Last report due quarter when all grant funds expended

Primary Elements of the PPPR

Program Progress Performance Report

U.S. Department of Transportation
Research and Innovative Technology Administration 11

Slide 4

NURail Center

Accomplishments Information Requested

- What are the major goals and objectives of the program?
  - Generally goals/objectives will not change from one reporting period to next (NC)
  - Show actual completion dates or percentage of completion for important activities (RU)
- What was accomplished under these goals?
  - 1) major activities; (RU)
  - 2) specific objectives; (RU)
  - 3) significant results, including major findings, developments, or conclusions (both positive and negative); (RU)
  - and 4) key outcomes or other achievements. (RU)
- How have the results been disseminated? If so, in what way/s? (RU)
- What do you plan to do during the next reporting period to accomplish the goals and objectives? (RU)

NC = Generally no change from one reporting period to next
RU = Requires update

Slide 5

NURail Center

Products Information Requested

- List any products resulting from the program during the reporting period . Examples of products include:
  - Publications, conference papers, and presentations; (RU)
  - Website(s) or other Internet site(s); (RU)
  - Technologies or techniques; (RU)
  - Inventions, patent applications, and/or licenses; (RU) and
  - Other products, such as data or databases, physical collections, audio or video products, software or NetWare, models, educational aids or curricula, instruments, or equipment. (RU)

NC = Generally no change from one reporting period to next
RU = Requires update

Participants and Collaborators Information Requested

- Applies to (1) program director and PIs; and (2) persons who worked in a research capacity at least 8 hours per month during the reporting period
- What individuals have worked on the program?
  - Provide the name and identify the role the person played in the project
    - Indicate the nearest whole person month (Calendar, Academic, summer) that the individual worked on the project. (RU)
  - Describe how this person contributed to the project and with what funding support (RU)
  - Identify whether this person is collaborating internationally (RU)

NC = Generally no change from one reporting period to next
RU = Requires update

Participants and Collaborators Information Requested (Continued)

- What other organizations have been involved as partners?
  - Organization Name (RU)
  - Location of Organization (RU)
  - Partner's contribution to the project (RU)
- Have other collaborators or contacts been involved? Describe any significant:
  - Collaborations with others within the lead or partner universities; especially interdepartmental or interdisciplinary collaborations; (RU)
  - Collaborations or contact with others outside the UTC; (RU) and
  - Collaborations or contacts with others outside the United States or with an international organization (RU)

Impacts Information Requested

- Describe distinctive contributions, major accomplishments, innovations, successes, or any change in practice or behavior that has come about as a result of the program relative to :
  - The development of the principal discipline(s) of the project; (RU)
  - Other disciplines; (RU)
  - The development of human resources; (RU)
  - Physical, institutional, and information resources at the university and/or other partner institution; (RU)
  - Technology transfer; (RU) or
  - Society beyond science and technology (RU)

NC = Generally no change from one reporting period to next
RU = Requires update

Changes/Problems Information Requested

- Significant changes in projects require prior approval of RITA. After approval describe the following:
  - Changes in approach and reasons for change (RU)
  - Actual or anticipated problems or delays and actions or plans to resolve them (RU)
  - Changes that have a significant impact on expenditures (RU)
  - Significant changes in use or care of animals, human subjects, and/or biohazards (RU)

NC = Generally no change from one reporting period to next
RU = Requires update

NURail Center

Proposed Report Development Process

- Templates will be developed for requested report information and made available as Word documents or Google Documents or both
- The following events will occur at the end of each quarter:
  - 7 days after the end of the quarter consortium partners will submit their report information to UIUC
  - 12 days after the end of the quarter UIUC will develop a draft version of the report and send to consortium partners for review
  - 13 days after the end of the quarter consortium partners will send edits/comments back to UIUC
  - 15 days after the end of the quarter UIUC will send the document to RITA and post to website

NURail Center

NURail 2012 Annual Meeting Attendees

First Name	Last Name	Company/University	Email Address
Pasi	Lautala	Michigan Tech University	ptlautal@mtu.edu
Ahmed	Shabana	University of Illinois at Chicago	shabana@uic.edu
Dan	Bailey	University of Illinois at Chicago	dbailey1@uic.edu
Craig	Foster	University of Illinois at Chicago	fosterc@uic.edu
Jason	Leigh	University of Illinois at Chicago	spiff@uic.edu
Ouri	Wolfson	University of Illinois at Chicago	wolfson@uic.edu
Mohsen	Issa	University of Illinois at Chicago	missa@uic.edu
Jim	McKinney	Rose-Hulman Institute of Technology	James.McKinney@rose-hulman.edu
TC	Kao	University of Illinois at Urbana-Champaign	tckao@illinois.edu
David	Clarke	University of Tennessee, Knoxville	dclarke@utk.edu
Reg	Souleyrette	University of Kentucky	rsouley@engr.uky.edu
Jerry	Rose	University of Kentucky	jrose@engr.uky.edu
Steve	Schlickman	University of Illinois at Chicago	sschlick@uic.edu
Jordan	Snow	University of Illinois at Chicago	jsnow7@uic.edu
Tyler	Dick	University of Illinois at Urbana-Champaign	ctdick@illinois.edu
Conrad	Ruppert	University of Illinois at Urbana-Champaign	ruppertc@illinois.edu
Christopher	Barkan	University of Illinois at Urbana-Champaign	cbarkan@illinois.edu
Rapik	Saat	University of Illinois at Urbana-Champaign	mohdsaat@illinois.edu
Riley	Edwards	University of Illinois at Urbana-Champaign	jedward2@illinois.edu
Terry	McLennand	University of Illinois at Chicago	
Kim	Hagemann	University of Illinois at Urbana-Champaign	kim.a.schlichting@gmail.com
Vicki	Dixon	University of Illinois at Urbana-Champaign	vdixon@illinois.edu
Amy	Stearns	USDOT – RITA	
Lydia	Mercado	USDOT – RITA	
Caesar	Singh	USDOT – RITA	
Kevin	Womack	USDOT – RITA	
John	Tunna	USDOT – FRA	
Jarrett	Stoltzfus	USDOT – FRA	
Phyllis	Wise	University of Illinois at Urbana-Champaign	pmwise@illinois.edu
Lawrence	Schook	University of Illinois	schook@uillinois.edu