U.S. DOT Center for Connected and Automated Transportation (CCAT)

Henry Liu, Center Director
Debby Bezzina, Managing Director
OUR CONSORTIUM

UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE

- Purdue University
- University of Illinois at Urbana-Champaign
- University of Akron
- Central State University
- Washtenaw Community College
• Period of Performance: 11/30/16 – 9/30/22
• Annual funding ~$2.6M
OUR MISSION

Significantly impact the evolution of the U.S. next-generation transportation systems with emerging technologies on safety, mobility, and sustainability. Provide national and regional leadership for connected and automated transportation research, science, education, training, and deployment.
OUR FOCUS

- Leadership Development
- Education and Workforce Development
- Research
- Tech Transfer
- Outreach
OUR RESEARCH

CCAT RESEARCH ACTIVITIES

- CATS' ENABLING TECHNOLOGY
- CATS' POLICY & PLANNING
- CATS' HUMAN FACTORS
- CATS' INFRASTRUCTURE DESIGN & MANAGEMENT
- CATS' CONTROL & OPERATIONS
- CATS' MODELING & IMPLEMENTATION
<table>
<thead>
<tr>
<th>2017 Funded Projects</th>
<th>UM</th>
<th>Purdue</th>
<th>UIUC</th>
<th>WCC</th>
<th>Akron</th>
<th>CSU</th>
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<tr>
<td>Enabling Technologies</td>
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<td>Modeling and Implementation</td>
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<td>Control and Operations</td>
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<td>Infrastructure Design and Management</td>
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<td>Policy and Planning</td>
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<td>Outreach: Education, Leadership and Workforce Development, and Tech Transfer</td>
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• Certificate Program on Connected and Automated Transportation (15 Credits)
• Core course #1: CAT Fundamentals
• Core course #2: CAT Professional Practice
• Three elective courses from:
  – Infrastructure Systems
  – Vehicle Technologies
  – Urban Planning, Law, Business, etc.
Project Objective:

Develop a certification of completion training program in the Traffic Technician field as an entry-level employment program. In addition, professional development training seminars would be developed in topical areas for the incumbent workforce, especially the infrastructure areas of Connected and Automated Transportation.

Year One Project Highlights:

- Work with key MDOT infrastructure contractors to define emerging job description, key skills mix and other required competencies
- Identify critical thinking and problem solving skill sets
- Utilize U.S. DOL Occupational Competency Model where applicable
- Create a learning design concept for a Certificate of Completion to prepare students for technician careers in the CAT industry cluster
- Move from design concept to development of Phase 1 Certificate of Completion
CCAT Outreach and Technology Transfer

- CCAT Website (ccat.umtri.umich.edu), Newsletter, etc.
- CCAT Distinguished Seminar Series (2 per year)
  - Save the date – October 4, 2017 Chris Hendrickson
- CCAT Annual Research Symposium
  - Student Competition
  - Save the date – March 7-8, 2018
- CCAT Summer Internship Program
- K-12 Outreach
Research objectives

- Cognitive effects of real-time information
- Driver cognitive state in mixed traffic conditions
- Impacts of driver cognitive state on route choice decision
- AV control transition
- Develop information dissemination mechanisms

Interactive driving simulator with biosensors
Development of in-vehicle information dissemination mechanisms to reduce cognitive burden in the information-rich driving environment

- Driver physiological data
  - Brain electrical signals
  - Heart rate
  - Eye movements and gazing behavior
  - Blinking behavior

- Driver cognitive state
  - Mental workload
  - Sensory engagement
  - Fatigue and drowsiness
  - Emotional state
The Future: Platoons that Fix the Roads
University of Illinois at Urbana-Champaign

- Impacts and “externalities” of growing freight traffic

- Vehicle-infrastructure integration via CAV

- Freight Traffic Planning & Operations
  - Origin/destination
  - Timing and volume

- Freight Shipment
  - Route choice
  - Platooning
  - Lane use

- Public Travel
  - General public’ travel demand and route choice

- Sustainable Development of Economy

- Economic, Energy, and Environmental Sustainability

- Pavement Management
  - Deterioration process
  - Rehabilitation frequency, timing, and intensity

- State of Good Repair
Operations of Connected and Autonomous Freight Trucks Under Congestion and Infrastructure Cost Considerations

• Research Tasks
  1. Vehicle-infrastructure instrumentation and integration
  2. Pavement deterioration and management
  3. Connected and autonomous truck routing, platooning, and lane use
  4. Model integration
The Future: Seamless Access Control
University of Akron

Regular Vehicle
Autonomous Vehicle

$h_{cr} =$ minimum critical headway
$h_b =$ safe following headway
$h =$ required headway
Research Objective

• To conduct a proof of concept study and preliminary field investigation to study the benefit of CAV on gap utilization at intersection entrance in mixed traffic.

• To assess the intersection performance improvements in capacity increase and delay/queue reduction.

• To define technical and non-technical issues for field implementation.
The Future

• Is Connected
• Is Automated
• Is Here!
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Transformational Transportation Technologies: Research at Carnegie Mellon University

Chris Hendrickson
Director, Traffic21 Institute
Hamerschlag University Professor of Engineering Emeritus
Carnegie Mellon University

Transportation is undergoing revolutionary changes due to automation, improved communications and data analytic applications. This talk will provide an overview of research on transformational transportation technologies at Carnegie Mellon University through the Traffic21 Institute and related University Transportation Centers. In particular, Carnegie Mellon is known for over three decades of research on autonomous vehicles. Some policy implications of partial and full driverless vehicle automation will be highlighted.

Hendrickson is a member of the National Academy of Engineering and Editor-in-Chief of the ASCE Journal of Transportation Engineering. His research, teaching and consulting are in the general area of engineering planning and management, including design for the environment, system performance, construction project management, finance and computer applications. He has pioneered model of dynamic traffic equilibrium and was an early contributor to the development of probabilistic network analysis for lifeline planning after seismic events. His work in construction project management emphasized the important of the owner’s viewpoint throughout the project lifecycle.

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