


Program Progress Performance Report for University Transportation Centers

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- Project Title: **Center for Transportation, Environment, and Community Health (CTECH)**
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- Signature of Submitting Official

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Signature of Submitting Official: 	Date Report Submitted: June 30, 2017

1. ACCOMPLISHMENTS:

What are the major goals of the program?

The goals of the Center for Transportation, Environment, and Community Health (CTECH) are to pursue research and education innovations to support sustainable mobility of people and goods while preserving the environment and improving community health. It will leverage behavioral and economic sciences, information technology, and environmental and transportation sciences and technologies to address critical issues falling under the FAST Act's priority area of Preserving the Environment: greenhouse gas reduction, use of alternative fuels and energy technologies, environmentally responsible planning, and impacts of freight movement.

To address these challenges, the center organizes its research activities through six thrusts: 1) Behavior, Active Transportation, and Community Health, which studies the links between travel behavior, active transportation, the built environment, and health; 2) New Transportation Technologies and Business Models, which explores how mobility-on-demand services can be used to improve environmental sustainability and human health; 3) Green Multimodal Transportation Systems, which leverages new mobility technologies to promote sustainable and health-enhancing modal integration; 4) Freight Transportation and Community Health, which explores new vehicle technologies and operation paradigms to reduce human exposure to truck exhaust; 5) Data-Driven Transportation-Health Informatics, which leverages Smart City and IoT (Internet-of-Things) technologies to develop community-based and personalized transportation-health indices for promoting healthy mobility choices; and 6) Energy, Technology and Policy Pathways, which studies the impact of different combinations of energy, technology and policy pathways on the environment and community health. The consortium, consisting of Cornell, UC Davis, USF and UTEP, has assembled a team of renowned researchers to collaboratively advance these research activities and goals.

The center will leverage the existing strength of partner universities to create an innovative, multidisciplinary education program capable of training a workforce that will meet the complex challenges at the intersection of transportation, environment, and community health. Beyond the multidisciplinary curriculum designed in parallel with its research, the center will develop a CTECH summer course and pre-college program to attract motivated undergraduates and high school seniors to transportation, particularly from underrepresented groups. Through multi-level, multidisciplinary and institutional collaborations, CTECH will advance transportation sustainability in its broader human and environmental contexts.

What was accomplished under these goals?

Under the major program goals described in the previous section, the CTECH, a newly established UTC, completed the following administrative tasks and research, engagement, and education activities during the first reporting period of January 1, 2017 to June 30, 2017:

Administrative Tasks:

- 1) Cornell University, the leading institute of the CTECH, finalized the budget revision requested by USDOT and completed the contract with USDOT.
- 2) Cornell University, the leading institute of the CTECH, finalized the budget revision and completed the subcontracts with consortium members including University of California, Davis; University of Southern Florida; and University of Texas, El Paso.
- 3) The CTECH hosted monthly teleconferences of the Executive Committee consisting of representatives from all consortium universities.
- 4) The CTECH submitted the data management plan as requested by USDOT;

- 5) The CTECH established the project website with newly designed Center logo and banner (<http://ctech.cee.cornell.edu/>), and submitted the required information to USDOT project manager.
- 6) The CTECH established the Directory of Key Personnel (<http://ctech.cee.cornell.edu/people/>).
- 7) Working with the School of Civil and Environmental Engineering at Cornell, the CTECH has obtained administrative support of the Cornell CEE School Director of Administration Joe Rowe, Finance Specialist Christina Dovi, and Communications Assistant Emily Falco before the CTECH sets up its administrative team.
- 8) The CTECH created the job description for a Center Executive Director Position. The job description went through the Cornell internal review process and was recently approved. The CTECH is currently in search for this position.
- 9) The CTECH has communicated with UTC program manager Robin Kline and scheduled our first 'kickoff' meeting under the 2016 FAST ACT UTC grants to be on Friday September 22, 017.
- 10) The CTECH member Cornell University organized the first round internal research project selection and approved 4 research project descriptions within the research themes of the CTECH that have been posted on project website (<http://ctech.cee.cornell.edu/cornell-university-projects/>) and submitted to RiP.
- 11) The CTECH member UC Davis organized the first round internal research project selection and approved 2 research project descriptions within the research themes of the CTECH that have been posted on project website (<http://ctech.cee.cornell.edu/university-of-california-davis-projects/>) and submitted to RiP.
- 12) The CTECH member USF organized the first round internal research project selection and approved 6 research project descriptions within the research themes of the CTECH that have been posted on project website (<http://ctech.cee.cornell.edu/university-of-south-florida-projects/>) and submitted to RiP.
- 13) The CTECH member UTEP organized the first round internal research project selection and approved 2 research project descriptions within the research themes of the CTECH that have been posted on project website (<http://ctech.cee.cornell.edu/university-of-texas-at-el-paso-projects/>) and submitted to RiP.
- 14) Cornell University, the leading institute of the CTECH, applied for the CUTC membership, and was approved on May 19, 2017.
- 15) CTECH Director H. Oliver Gao, Cornell CEE Director Linda Nozick and CTECH faculty, current Administrator Director Joe Rowe, and Finance Specialist Christina Dovi held weekly meetings to discuss all aspects of the Center. These meetings were important for the planning, operation, and management of the Center.
- 16) The CTECH hosted teleconferences with the Executive Committee on 1/23/2017, 4/24/2017, 5/8/2017, 6/5/2017, and 6/19/2017 to work together closely on Center tasks, to plan and manage the progress of CTECH activities, and to enforce the delivery of CTECH outcomes.
- 17) The CTECH member USF met with the Director of FDOT research center and discussed the possible matching funds for CTECH projects.
- 18) The CTECH member USF met with City of Tampa Traffic Management Center and discussed possible collaborations between CTECH and Smart City initiatives of City of Tampa.
- 19) The CTECH member USF met with USF PIs of other USDOT UTCs and discussed potential collaborations on research projects falling into CTECH scope.
- 20) CTECH member UCD met with the Chief of TMS Development Support Branch at Caltrans' Division of Research, Innovation and System Information and secured certain amount of match fund.
- 21) UCD's CTECH members Michael Zhang, Miguel Jaller and Caroline Rodier met with City of Sacramento's Public Works staff and participated in the city's \$13 million USDOT ATCMTD Grant Proposal.

Research Activities:

Across the four partner institutions, progress continues on research papers, in different stages of development, as listed below in Table 1.

Work is well underway on federally-funded and matching-fund research projects at all four institutions. In particular, 4 projects at Cornell University, 2 projects at UC Davis, 6 projects at USF, and 2 projects at UT El Paso have been selected and launched. Some projects are extensions of the institutions' previous efforts, which begun to release products, in addition to preliminary publications in journals.

Table 1: List of On-Going Research Papers and Research Projects

University	White Papers / Research papers	Status
Cornell	Bayesian ranking and selection models for network design problems with uncertainties	Under Revision
Cornell	Modeling dynamics of congestion in urban networks using macroscopic fundamental diagram: user equilibrium, system optimum, and pricing strategies	Under Revision
Cornell	Aerodynamic equilibrium and stability in ventilation and air quality control of complex urban tunnels	Draft Submitted
Cornell	Optimal ventilation control in complex urban tunnels with multi-point pollutant discharge	Draft Submitted
Cornell	A systems approach to carbon policy for fruit supply chains: Carbon-tax, innovation in storage technologies or land-sparing?	In Progress
Cornell	Informed travelers with air pollution information, traffic stability, and congestion mitigation	In Progress
Cornell	Ridepooling with trip-chaining in a shared-vehicle mobility-on-demand system	In Review
Cornell	Stochastic on-time arrival problem with time-varying travel time distributions	In Progress
Cornell	Reliable route planning with correlated travel-time distributions	In Progress
Cornell	Integrating on-demand ridepooling with public transit	In Progress
Cornell	The price of fragmentation in on-demand mobility systems with multiple service providers	In Progress
USF	Network Design with Behavioral Conditional Value-at-Risk in Hazardous Materials Transportation	In Progress
USF	Shared Autonomous Vehicles and their Potential Impacts on Household Vehicle Ownership: An Empirical Assessment	Under Review
USF	Electric Vehicle Sharing Planning and Operation	In Progress
USF	Impacts of Autonomous Vehicles to Airport Design	In Progress
USF	Integrated Multi-Criteria Signal Timing Optimization for Sustainable Traffic Operations	In Progress
USF	Joint electric vehicle sharing and vehicle2grid service system operations	In Progress
UCD	On-demand Ride-sharing Transit Access Program	In Progress
UCD	Evaluation of mode choice behavioral preferences for ride-sharing in a Metropolitan Area	In Progress
UCD	Modeling ride-sharing using activity-based and agent-based	In Progress

	framework	
UCD	Estimating ride-sharing market share potential in the Bay Area: A Simulation approach	In Progress
UCD	Policy Brief: Using Zero-Emission Vehicles and Other Strategies to Improve Last Mile Deliveries	Submitted
UCD	Policy Brief: Keeping Vehicle Use and Greenhouse Gas Emissions in a Driverless Vehicle World	Submitted
UCD	Shared-Use Mobility Alternatives to Transit in Rural Disadvantaged Areas in the San Joaquin Valley (CS)	In progress

University	Ongoing Projects	Status
Cornell	Active Transportation, Environment, and Health	Launched
Cornell	Environment, Health, and Transportation Infrastructure Networks	Launched
Cornell	Designing Cross-subsidy Mechanisms for Sustainable Multi-modal Transportation Systems	Launched
Cornell	Environmental and Public Health Impacts of Mobility-on-Demand Systems	Launched
UCD	A Study of the Integrated Parking and Ridesharing Pricing/Incentives and their Social and Environmental Impacts in Metropolitan Areas	Launched
UCD	Estimating Activity and Health Impacts of First and Last Mile Transit Access Programs for Work and Shopping Trips Using Shared Mobility Services in a Metropolitan Area	Launched
USF	Electric Vehicle Sharing Planning and Operations	Launched
USF	Spatial Sustainability Assessment of Green Stormwater Infrastructure Transportation Planning	Launched
USF	A Life Cycle Assessment for Pavement Maintenance and Rehabilitation Technologies	Launched
USF	Reducing Airport Pollution and Consequent Health Impacts to Local Community	Launched
USF	Regulating Hazardous-materials Transportation with Behavioral Modeling of Drivers	Launched
USF	Transit-Oriented Compact-Growth on Air Pollutant Concentrations and Exposures in the Tampa Region	Launched
UTEP	Development of a metric to evaluate the impact of transportation- environment on community health	Launched
UTEP	Vulnerable user road safety enhancements for transportation asset management	Launched

University	Completed Project	Status
	None to date	

Engagement Activities:

The tables in this section report the CTECH engagement activities including meetings, presentations, sponsored events, and media and online engagement. To highlight a few:

- 1) Rebuilding the Built Environment--NYC workshop tackles how to build sustainable cities (Source: Cornell Chronicle, June 1st, 2017). Deteriorating infrastructure, rising seas and more

frequent extreme weather events are challenging today’s engineers, architects and urban planners like never before. On May 23, more than 60 people gathered at the Cornell College of Architecture, Art and Planning’s (AAP) studio space in New York City to consider how built environments can help meet these challenges. The CTECH Cornell PIs are fellows of ACSF, and CTECH Director H. Oliver Gao was an invited speaker on the opening panel of the workshop to talk about transportation infrastructure planning, environment, and community health.

- 2) CTECH engagement with the Ivy Plus Sustainability Working Group: H. Oliver Gao, Director of CTECH, gave a keynote speech on Transportation and Environment/Energy Systems to an audience more than 40 university facility managers at the Ivy Plus Facilities Management Spring Conference on April 24th, 2017. The Ivy Plus Sustainability working group is committed to sharing solutions that include the implementation of innovative technologies as well as research and operational methodologies that advance our commitment to greenhouse gas reduction on our campuses.
- 3) CTECH member UC Davis ITS researcher Caroline Rodier gave a presentation on the Land Use Effects of Automated Vehicles at the Urbanism Next Workshop+Charrette in Portland Oregon in April 2017.
- 4) CTECH engagement of application of bicycle friendly university. Yu Zhang is serving on the USF bicycle research council and participated in preparing the application package for USF being bicycle friendly university. It is a program run by the League of American Bicyclist. Given the efforts that USF has made in last several years, including the free-floating bike sharing program led by Yu Zhang and the investment of adding bike lanes and bike racks on campus, the council believes that USF is in a good position of joining the list of universities who have been awarded.
- 5) On May 18, 2017, Dr. Kelvin Cheu delivered lectures on Leadership in Energy & Environmental Design–Neighborhood Development (LEED-ND) and SmartCode to a group on 16 UTEP students and 16 students from University of Piura, Peru. The lectures were followed by a field trip to El Paso’s transit agency Sun Metro. These students were participants of the UTEP-University of Piura study abroad program in sustainability.

Table 2: List of CTECH Presentations

Date	Title	Speaker(s)	Event/Organization	Location
01/19/17	From transportation to air pollution and public health	H. Oliver Gao, Cornell	Environmental Advocates of New York	Albany, NY
01/19/17	From transportation to air pollution and public health	H. Oliver Gao, Cornell	NYS Department of Environment Conservation	Albany, NY
02/22/17	Built environment, natural environment, and health	H. Oliver Gao, Cornell	Cornell Tech	NYC, NY
03/24/17	Integrated transportation and air quality modeling	H. Oliver Gao, Cornell	Webconference with Boeing, and Uber	Ithaca, NY
04/24/17	Transportation and environment/energy systems	H. Oliver Gao, Cornell	Ivy Plus Facilities Management Spring Conference	Ithaca, NY
04/27/17	Center for Transportation, Environment, and Community Health	H. Oliver Gao, Cornell	Meeting with Cornell ACSF leadership team	Ithaca, NY
05/12/17	CTECH Living Lab for Transportation Innovations-Carbon-neutral Cornell by	H. Oliver Gao, Cornell	Meeting with Cornell President’s Sustainable Campus	Ithaca, NY

	2035		Committee Transportation Focus Team	
05/19/17	CTECH Living Lab for Transportation Innovations- -Carbon-neutral Cornell by 2035	H. Oliver Gao, Cornell	Tompkins County MPO	Ithaca, NY
06/15/17	CTECH Living Lab for Transportation Innovations- -Carbon-neutral Cornell by 2035	H. Oliver Gao, Cornell	Meeting with representatives from the International Parking Institute and US Green Building Council	Ithaca, NY
1/10/17	Integrating Shared-Vehicle Mobility-on-Demand Systems with Public Transit	Samitha Samaranayake, Cornell	TRB Annual Meeting	Washington D.C.
2/10/17	Real-time High-Capacity Ridepooling at an Urban Scale	Samitha Samaranayake, Cornell	Workshop on Urban Mobility in the Era of Smart and Connected Communities	Chicago, IL
3/30/2017	Solving Large Scale of Bike Rebalancing Program of Free-Floating Bike Sharing	Yu Zhang, USF	Tsinghua University Distinguished Lecture Series	Beijing China
6/08/2017	Adaptive Multimodal Transportation Planning and Operations	Yu Zhang, USF	Southeast University	Nanjing China
5/11/17	Principles of sustainability	Carlos Chang	UTEP-UDEP Study Abroad Program on Sustainability	El Paso, TX
5/18/17	Leadership in Energy & Environmental Design- Neighborhood Development (LEED-ND)	Kelvin Cheu, UTEP	UTEP-UDEP Study Abroad Program on Sustainability	El Paso, TX
5/18/17	SmatCode	Kelvin Cheu, UTEP	UTEP-UDEP Study Abroad Program on Sustainability	El Paso, TX
5/25/17	CTECH: Center for Transportation, Environment and Community Health	Kelvin Cheu, UTEP	69th meeting of the Joint Advisory Committee (JAC) for the Improvement of Air Quality	El Paso, TX
5/24/17	First/ Last Mile Mobility	Miguel Jaller	STEPS 2017 Spring Symposium	Davis, CA
4/24/17	Land Use Effects of Automated Vehicles	Caroline Rodier	Urbanism Next Workshop+Charrette	Portland, OR

Table 3: CTECH Sponsored/Engaged Events

Date	Event Name	Description	Organizer	Location
04/21/17	CTECH seminar: Innovative Transportation Developments in Japan and the United States	Both Masaki Ogata and Carol Schweiger studied in the graduate transportation engineering program at Cornell University (CEE) in the early 1980s. They returned to Cornell on April 21 2107 for this special seminar to discuss interesting highlights of their professional careers.	Cornell	Ithaca, NY
04/28/17	Cornell Institute for Public Affair (CIPA) roundtable discussion on China's Environmental Problems and Solutions	A roundtable session to give CIPA students exposure to topical research, but in a format that permits them to ask questions and discuss.	Cornell	Ithaca, NY
3/10/17	USF Transportation Research Seminar	Legislation and Enabling AV/CV/EVs in Florida	FL Senator Jeff Brandes	Tampa, FL
4/21/17	USF Transportation Research Seminar	Travel Time Reliability and Truck Level of Service on the Strategic Intermodal System, Lily Elefteriadou, PhD University of Florida	USF	Tampa, FL

Table 4: CTECH Meetings

Date	Purpose and Description	Location
01/19/17	H. Oliver Gao met with Pete Iwanowicz, an expert on air quality and energy and Director of Environmental Advocates NY for potential opportunities and collaboration for CTECH	Albany, NY
01/19/17	H. Oliver Gao met with NYS DEC staff who handle climate change and air and energy for potential opportunities and collaboration for CTECH	Albany, NY
02/21/2017	H. Oliver Gao met with faculty in Division of Health Informatics, Weill Cornell Graduate School of Medical Science, for potential collaboration with CTECH	NYC, NY
02/22/2017	H. Oliver Gao met with Ron Brachman, Director of Jacobs Technion-Cornell Institute, for potential collaboration with CTECH	NYC, NY
03/21/2017	H. Oliver Gao, met with: SwiftATN –Public demonstration discussion and R&D collaboration	Ithaca, NY
03/22/2017	H. Oliver Gao and Alex Travis met with Elena Craft, Ananya Roy , and Rory Christian from Environmental Defense Fund (EDF).	Ithaca, NY
03/24/2017	H. Oliver Gao and Ricardo Daziano: Web conference with Uber and Boeing on urban air transport	Ithaca, NY

04/27/17	H. Oliver Gao met with Cornell ACSF leadership team	Ithaca, NY
05/08/2017	H. Oliver Gao, met with Hugh Possingham, Chief Scientist of The Nature Conservancy	Ithaca, NY
05/12/17	H. Oliver Gao met with Cornell President's Sustainable Campus Committee Transportation Focus Team	Ithaca, NY
05/19/17	H. Oliver Gao met with Tompkins County MPO	Ithaca, NY
06/15/17	H. Oliver Gao had a webconference with representatives from the International Parking Institute and US Green Building Council	Ithaca, NY
06/16/17	CTECH faculty H. Oliver Gao and Samitha Samaranyake attended the meeting with SwiftATN	Ithaca, NY
6/14/17	Samitha Samaranyake met with Eric Hathaway, Transportation Engineering for the City of Ithaca to discuss potential collaborations between Cornell Transportation Faculty and the City Traffic Operations group.	Ithaca, NY
4/21/17	Yu Zhang met with Darryll Dockstader, Manager of FDOT Research Center to introduce CTECH, and discuss possible matching support from FDOT.	Tampa, FL
5/12/17	Yu Zhang met with Vik Bhide, Director of Traffic Management Center of City of Tampa to discuss potential collaborations between USF Transportation Faculty and their center.	Tampa, FL
6/3/17	Miguel Jaller met with Jennifer Venea (Sustainability Manager) at the City of Sacramento for potential collaboration in last mile sustainable transportation	Sacramento, CA
6/7/17	Miguel Jaller shared ideas with Evangeline Lucas and Samar Hajeer from the City of Sacramento Public Works	Sacramento, CA
4/16/17	Presentation to the San Joaquin Valley (CA) Metropolitan Transportation Agencies (eight) Executive Directors: Analysis of Potential Shared-Mobility Alternatives and Locations for First and Last Mile Access to High Quality Transit in Rural Disadvantaged Areas.	Fresno, CA
5/18/17	Presentation to the Kern County (CA) Metropolitan Transportation Agency's Board: Findings for Kern County on Potential Locations and Pilot Concepts for First and Last Mile Programs	Kern, CA

Table 5: Media and Online Engagement Summary

Media and Online Engagement	
Web Page	The main CTECH website (http://ctech.cee.cornell.edu/) has been set up and running. We recently set up Google Analytics account so we can begin tracking traffic to the site. As of right now there isn't any data but moving forward we'll be able to track it.
Online Engagement	CTECH manages three active social media accounts (Facebook, LinkedIn and Twitter) to facilitate the dissemination of research results, news, events, and other important updates; and to engage in discussion with policymakers and practitioners who are active on these social media platforms.

Education Activities:

1. CTECH curriculum development:

USF team members discussed how to adjust the course content of the course “Sustainable Transportation”. It is a course attracting not only transportation students, but also students from Patel College of Global Sustainability of USF.
2. CTECH training activities: CTECH faculty members were involved in the following training activities during the reporting period:
 - a. Training of New York Metropolitan Transportation Council Technical Modeling Staff: H. Oliver Gao’s research group has developed the nation’s first web-based emissions post-processing software, CU-PPS using EPA’s Motor Vehicle Emission Simulator (MOVES) in conjunction with the New York Metropolitan Transportation Council’s (NYMTC’s) Best Practice travel demand model. CU-PPS is the official software for transportation conformity assessment in the NYMTC region.
 - b. New PhD student (Elham Pourrahmani) at UCD has received training in the Bay Area Metropolitan Transportation Commission Activity Based Model (MTC-ABM) and MatSim software.
 - c. UTEP has recruited one undergraduate student as summer intern from June 1 to August 31. The student is given a stipend of \$600 per month. He is tasked to assist in the CTECH funded research projects at UTEP.
3. Professional development: CTECH faculty members were involved in the following professional development during the reporting period
 - a. Cornell Master of Engineering Program in Transportation Systems: The professional M.Eng. degree program in transportation systems at Cornell prepares students for professional careers with both private companies and public agencies. The Cornell program is interdisciplinary because the effective development and operation of transportation systems requires integration of concepts from a variety of disciplines, including civil engineering, computer science, city and regional planning, economics, environment, community health, public policy and management. This past May, CEE graduated 2 M.Eng students within the Transportation Systems program. The Cornell CTECH faculty members were actively involved in the education activities of this Master of Engineering Program in Transportation Systems Engineering.
 - b. USF Master of Civil Engineering, Master of Science in Civil Engineering, and Ph.D. Civil Engineering Program in Transportation Systems: The field of Transportation Systems Engineering (TSE) encompasses a wide range of subjects including planning, design, and monitoring of transportation infrastructure, systems safety, and applications of emerging and advanced technologies in transportation, network optimization, large-scale microsimulation modeling, and intelligent transportation systems. Yu Zhang, Fred Mannering, Qing Lu, Xiaopeng Li, and Robert Bertini are actively involved in teaching courses and supervise students who are pursuing these degrees. Besides collaborating with other departments on USF Tampa campus, such as Industrial and Management Science Engineering, Computer Science, Public Health, Geography, Urban Planning, transportation group faculty is also seeking international collaborations with prestigious universities in Netherland and China.
 - c. USF Master of Environmental Engineering: This Master degree was established

several years ago because of the high demand of environmental engineering students. Q. Jane Zhang has been involved in this planning and development of this program led by Jim Mihelcic. Q. Jane Zhang has been teaching one of the core course of this degree and have supervised several students in last year who are pursuing this degree.

- d. USF Transportation Systems Analysis Certificate: The curriculum for the Transportation Systems Analysis graduate certificate provides an opportunity to advance one's credentials and knowledge in the field of transportation engineering. It includes extended knowledge in such areas as planning, analysis and design, all vital to transportation planners. Course offerings from Civil and Industrial Engineering provide a range of contemporary materials. Four courses (12 credits) are required to complete the certificate. The courses are offered on campus and via APEX distance learning. Yu Zhang has been teaching the core course of this certificate program: transportation planning and economics. In the coming years, the course will be divided into two courses, one is the transportation planning and policy and the other transportation economics. The adjustment of the courses will provide better knowledge foundation for the students.

How have the results been disseminated?

Research activities for the CTECH have not yet produced final results. The engagement activities listed above served to introduce key stakeholders to and engage them in ongoing CTECH research and to disseminate other research from the consortium members. Some consortium members have disseminated draft versions of their research through presentations, meetings and publications (see engagement above and products below).

CTECH posts news items regularly on its website. These announcements can be viewed at <http://ctech.cee.cornell.edu/news/>.

What do you plan to do during the next reporting period to accomplish the goals?

Continuing the healthy headways that the consortium has made in establishing the new CTECH during the first reporting period, we plan to move the Center forward along the multiple fronts of administration, research, engagement, and education activities during the next reporting period.

Administrative Tasks:

- 1) Coordinate among consortium members to work out the 2nd year budget.
- 2) Host monthly teleconferences of the Executive Committee.
- 3) Complete the search for and hiring of the Center Executive Director.
- 4) Host the UTC site visit to CTECH for the 'kickoff' meeting.
- 5) Form the CTECH combined industry and scientific advisory board by identifying and inviting preeminent experts from both industry and academia in transportation, environment, and community health. CTECH will have charge for the board, and membership on the industry and scientific advisory board will be a three-year term.
- 6) Form the CTECH Student Leadership Council that will be made up of at least one graduate student from each member university.
- 7) Plan the CTECH workshop in fall 2018 to showcase research outcomes of CTECH projects.

Research Activities:

Management of on-going CTECH Research Projects: As reported in the earlier section, CTECH consortium members have selected 1st-year research projects. Researchers at each of the consortium universities will continue work on these projects (see Table 6). All research projects funded by CTECH will involve graduate students, providing them with hands-on opportunities to engage in interdisciplinary and cutting-edge research. CTECH Executive Committee will monitor ongoing project via quarterly reports to ensure they are progressing on schedule with products and results delivered. We expect most of these projects will yield results that can be disseminated via regular journal publications, meeting presentations, and other channels during next reporting period.

Preparation for selection 2nd-year research projects: CTECH will make preparations for internal solicitation of 2nd-year projects by developing and distributing Request for Proposals (RFP). The solicitation will aim to stimulate innovative, impactful, interdisciplinary research in transportation, environment, and community health at consortium universities. The RFP will help form interdisciplinary teams of CTECH scholars and where appropriate, connect these teams with external partners.

Preparation for CTECH Dissertation Grant solicitation and application: CTECH will set aside funding to sponsor four dissertation research grants for advanced PhD students, which will be offered on a competitive basis beginning the second year after the center is awarded. During next reporting period, CTECH will prepare for internal solicitation for PH.D. dissertation research grant applications.

Planning for the bi-annual student conference: CTECH will host a student-run, bi-annual student conference to showcase students' achievements, providing opportunities for exchanges and presentations, and enhancing students' organizational and communication skills. The first one will be at UCD in Fall 2018.

2017 CUTC Award Nominations: CTECH Executive Committee will work with the consortium members to nominate graduate students in transportation for the two best PhD dissertations, MS theses and MS/ME reports.

Exploration of cross-university research proposals for external funding: CTECH will explore into opportunities for cross-university collaborations across consortium members and external partners to form interdisciplinary teams for research proposal development.

Engagement Activities:

The CTECH team has identified a wide range of engagement opportunities/activities that help the Center to make progress in achieving its major goals. Some of the activities that are already planned are listed in the tables below. CTECH consortium members will sponsor local ITE, ASCE, and WTS student chapter activities, and expose the student members to CTECH's research and educational activities.

CTECH living lab for transportation innovations towards carbon-neutral Cornell. There is a university wide efforts towards carbon-neutral campus, for which transportation/mobility can play an important role. There are an array of exciting initiatives in transportation and mobility that Cornell can take and lead in university and college town mobility planning in meeting both the mobility and sustainability challenges. Two undergraduate students have been in touch with CTECH to work on CTECH living mobility lab for carbon-neutral Cornell. Jared Hibshman is a rising junior affiliated in Chemical Engineering with a strong interest in sustainable energy and plan on entering the renewable energy industry. Jared will work on technical feasibility and benefit/cost analysis of alternative transportation energy sources. Yu Jin Hur is a Junior Operations Research major who is interested in research for Transportation Systems Engineering, in which she can apply her coursework (e.g., optimization, stochastic processes, and networks) to solve real life problems. Yu Jin will work with us on transportation data analysis and network modeling using Tompkins County Travel Demand Model and the Cornell transportation data to quantify environment/health benefits of carbon-neutral initiatives.

CTECH involvement towards a user-friendly and safe campus: At USF, CTECH faculty will participate in Bulls Walk and Bike Week, a program sponsored by FDOT aiming to improve the awareness of

pedestrian, bicyclists, and drivers on how to share the streets and make the campus more user friendly and safer. During the week, faculty members lead student volunteers to offer sessions on complete street, traffic safety, and sustainable transportation.

The Cornell Engineering Diversity Programs CATALYST Academy is a one-week summer residential program for rising high school juniors, and seniors. The mission of the CATALYST Academy is to advance diversity in engineering and its related disciplines. Therefore, applications from students from backgrounds (African American, Latino/a, or Native American) critically underrepresented in the fields of science, technology, engineering, and math are especially encouraged to apply. In the Summer 2017 CATALYST Academy project, Built Environment and Sustainability, CTECH will expose forty-eight students to a wide spectrum of lab topics from human behavior/decision to structure design/testing. The students will study the concept and management of built environment, natural environment, and community health. Specific topics of built environment and sustainability may include 1) planning, design and management of multimodal transportation systems in which engineers can contribute to addressing a wide variety of challenges, ranging from congestion to security to environmental impact; 2) Analysis, design, and construction of built environment such as buildings, bridges, concrete dams, tanks, and towers, as well as a great diversity of other structures; and 3) Programs in water systems such as the AguaClara program to address the need for sustainable municipal scale water treatment in resource poor communities.

Table 6: Planned Research Projects

Cornell	<ul style="list-style-type: none"> • Active Transportation, Environment, and Health • Environment, Health, and Transportation Infrastructure Networks • Designing Cross-subsidy Mechanisms for Sustainable Multi-modal Transportation Systems • Environmental and Public Health Impacts of Mobility-on-Demand Systems
UCD	<ul style="list-style-type: none"> • A Study of the Integrated Parking and Ridesharing Pricing/Incentives and their Social and Environmental Impacts in Metropolitan Areas • Estimating Activity and Health Impacts of First and Last Mile Transit Access Programs for Work and Shopping Trips Using Shared Mobility Services in a Metropolitan Area
USF	<ul style="list-style-type: none"> • Electric Vehicle Sharing Planning and Operations • Spatial Sustainability Assessment of Green Stormwater Infrastructure Transportation Planning • A Life Cycle Assessment for Pavement Maintenance and Rehabilitation Technologies • Reducing Airport Pollution and Consequent Health Impacts to Local Community • Regulating Hazardous-materials Transportation with Behavioral Modeling of Drivers • Transit-Oriented Compact-Growth on Air Pollutant Concentrations and Exposures in the Tampa Region
UT El Paso	<ul style="list-style-type: none"> • Development of a metric to evaluate the impact of transportation-environment on community health • Vulnerable user road safety enhancements for transportation asset management

CTECH USF faculty will offer several summer short courses in other institute, including: Xiaopeng Li, “Reliable Facility Network Location Design”, a Short Summer Course for the Summer OR/SCM

Workshop, National Taiwan University, Taiwan, August 2016; Yu Zhang, “Transportation System Analysis and Sustainable Transportation”, a short summer course for College of Transportation at Harbin Institute of Technology, China.

CTECH is helping to launch an Autonomous Vehicles student club at UC Davis, where students from Computer Science, CEE, ECE and MAE will be supervised by CTECH member Prof. Michael Zhang and his Computer Science and ECE colleagues Dipak Ghosal and CN Chuah and carry out training and research activities concerning the development and application of Autonomous Vehicles technology.

CEE at Cornell is part of a freshmen advisory course (ENGRG 1050) that is taught in the Fall: Engineering Seminar All first-year students are pre-enrolled in a section of ENGRG 1050: Engineering Seminar. This 1-credit fall course gives first-year students an opportunity to get to know their faculty advisors on a more personal level, and help new students adjust to the demands of their engineering curriculum. Activities in ENGRG 1050 usually include discussion of engineering careers, active research in the college and engineering in general, ethics, and workshops on study and exam skills useful to engineering students. Practicing engineers, advising staff, and faculty members from different disciplines may join the group from time to time. Cornell CTECH faculty will work with ENGRG1050 organizers to develop a module on transportation, environment, and community health. This CTECH module will engage freshmen engineering students with the Center activities and expose them to the general challenges and knowledge in these areas. This is a good way for CTECH to connect with new students.

Table 7: Upcoming Presentations

Date	Title	Speaker(s)	Event/Organization	Location
6/26/17	Integrated Systems Modeling of transportation, air pollution, and public health	H. Oliver Gao	The 8 th International Conference on Green Intelligent Transportation System and Safety, GITSS2017	Changchun, China
7/8/17	Center for Transportation, Environment, and Community Health	H. Oliver Gao	International Conference of Transportation Professionals (CICTP2017)	Shanghai, China
7/9/17	Integrated Multi-Criteria Signal Timing Optimization for Sustainable Traffic Operations	Yu Zhang, USF	International Conference of Transportation Professionals (CICTP2017)	Shanghai, China
7/10/17	Planning and Operation Management of Free-Floating Bike Sharing Systems	Yu Zhang, USF	Invited talk at Zhejiang Institute of Technology	HangZhou, China
7/28/17	Ridesharing in a Mobility-On-Demand System	Samitha Samaranayake	INFORMS Transportation and Logistics Society First Triennial Conference	Chicago, IL
7/27/17	Hazardous Materials Network Design Problem	Changhyun Kwon, USF	TSL Conference 2017	Mile North, Maryland

	with Behavioral Conditional Value at Risk			
10/16/17	Impacts of community design and commute behavior on exposures to traffic-related air pollution	Amy Stuart, USF	International Society of Exposure Science 2017 Annual Meeting	Durham, NC
10/23/17	Mobility Pattern Analysis Of Free-floating Bike Sharing And Insights On System Operations	Yu Zhang, USF	2017 INFORMS Annual Meeting	Huston Texas
10/24/17	Joint electric vehicle sharing and vehicle2grid service system operations	Xiaopeng Li, USF	2017 INFORMS Annual Meeting	Huston Texas

Table 8: Upcoming CTECH Sponsored Events/Activities

Date	Event Name	Description	Organizer	Location
7/17/17	The CATALYST Academy	The CATALYST Academy is a one-week summer residential program for rising high school juniors, and seniors. During the CATALYST Academy this summer, CTECH and Cornell CEE faculty and graduate students lead participants in classes, lab sessions, and project research in the topical area of Built Environment and Sustainability.	Cornell	Ithaca, NY
9/22/17	UTC Site Visit to CTECH	USDOT site visit for the kickoff meeting of CTECH	CTECH	Ithaca, NY
Fall 2017	Launch of WTS-USF Student Chapter	Yu Zhang initiated the establishment of WTS-USF Student Chapter. It is planned to have a launch ceremony in Fall 2017, inviting the Tampa Chapter, UF Student Chapter representative and local WTS members and transportation leaders to attend.	USF	Tampa, FL

Table 9: Upcoming Meetings

Date	Purpose and Description	Location
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7/19/17	H. Oliver Gao will meet with Laura Spitz, Vice Provost for International Affairs Cornell University to discuss CTECH activities and to solicit input on possible international collaborations.	Ithaca, NY
8/16/17	Cornell CTECH faculty will meet with The Office of Engagement Initiatives for the support in creation of new community-engaged curricula, research, and opportunities	Ithaca, NY
8/21/17	CTECH Executive Committee Webconference	Internet
9/11/17	CTECH Executive Committee Webconference	Internet
9/5/17	Yu Zhang will meet with local EPA officers to discuss potential collaborations between USF faculty members and EPA project managers.	Tampa, FL
9/20/17	Yu Zhang will meet with a delegation from Beijing Institute of Technology to discuss international collaborations between CTECH and BIT.	Tampa, FL

Table 10: Planned Media and Online Engagement Activities

Media and Online Engagement	
Web Page	We will continue to keep the CTECH website current. The Executive Committee will discuss the idea for consortium universities to develop outreach web pages for the research topics that individual member universities are working on.
Youtube video	CTECH plans to develop a short introductory Youtube video for engagement with general public.
Webinar	CTECH aims to start a monthly webinar series in Fall 2017 for CTECH faculty, students (both graduate and undergraduate), and visiting scholars to showcase their research outcomes, and share knowledge and experiences gained from conducting collaborative research among consortium members.
Online Engagement	Cornell will continue manage CTECH’s three social media accounts, and will keep track of user visits and interactions.

In addition to presentations described above, CTECH Cornell will co-organize CEE seminars and systems engineering seminars. CTECH USF will co-organize Transportation Research Seminars at USF.

Education Activities:

During the next reporting period, the CTECH consortium will continue to encourage, inspire and support students in pursuing transportation engineering or related careers through a comprehensive education program, while continuing and expanding workforce development efforts geared to practice professionals.

CTECH course development: CTECH will continue to strengthen the educational programs of consortium universities for preparing next-generation transportation professionals, and educating current practitioners to be responsive to rapid changes in the transportation field with respect to environment and community health. Along with core courses focusing on the technical aspects related to planning, operations/engineering, and modeling of transportation systems (which include statistical/econometric modeling, data analytics, and optimization), CTECH@Cornell will improve CEE 3610 Introduction to Transportation Engineering to introduce technological, economic, and social aspects of transportation by covering supply-demand interactions; system planning, design, and management; traffic flow, institutional and energy issues; and environmental/health impacts.

USF will add one lecture focusing on transportation-environment-community health in introductory

transportation courses to all civil engineering students. CTECH USF faculty will adjust the content of Sustainable Transportation and highlight the linkage between transportation-related environmental issues to community health. Faculty from public health will offer guest lecture in this course. USF also encourage all CTECH sponsored faculty to highlight their CTECH-related projects in their courses and encourage students working on transportation-environment-community health related term projects.

University as a living lab for transportation innovation towards carbon-neutral campus: For students and staff engaged with CTECH through the initiative of university as a living lab for transportation innovation towards carbon-neutral campus, we will have short lectures/discussions as well as seminar talks on different aspects of transportation and environment systems. Under the guidance of CTECH faculty and graduate students, the students will work in teams to explore various options of transportation innovation. CTECH will educate the train the participating students and staff members to develop quantitative tools to analyze viable transportation alternatives for the Cornell Ithaca campus to achieve carbon neutrality by 2035. Reducing carbon emissions while adapting to alternative transportation will require innovative technological solutions, a significant increase in capital investment in alternative energy sources, behavior change and demand management that CTECH will focus on.

Co-curricular Activities and Student Chapters of Transportation Professional Organizations: Co-curricular activities such as industry mentorship programs and seminar series in conjunction with active student chapters of professional organizations provide students with a well-rounded educational experience. Consortium universities currently offer various transportation research seminars covering a wide spectrum of research topics in transportation, environment/energy, and health systems. For instance, Cornell hosts the Ezra Systems Seminar Series, which includes transportation, environment, and health topics research. Transportation-related student chapters at consortium institutes include American Society of Civil Engineer (ASCE), Institute of Transportation Engineers (ITE), Women Transportation Seminar (WTS) and Texas PE, International Council on Systems Engineering (INCOSE), and Engineers for a Sustainable World (ESW). In next reporting period, CTECH will continue along these lines of efforts in co-curricular activities for education and engagement. The CTECH grant will be used to further support student chapters of professional organizations and industry mentorship programs to facilitate the connections between students and transportation industry professionals (are we going to be able to provide documentation and record of such activities in next reporting?). In these activities, CTECH will make outreach efforts to help attract new entrants and minorities into the transportation field, sustain minorities such as Latinos and females in such programs, and encourage students to pursue transportation as their future career. In particular, CTECH Director H. Oliver Gao worked with Jonathon P. Schuldt in the Department of Communication on a proposal “Promoting pro-environmental engagement among U.S. racial and ethnic minority groups by correcting misperceived environmental norms”. The proposal was recently selected for funding by the Cornell Atkinson Center for a Sustainable Future (ACSF). We have been approached by Debra A. Castillo, Director of Latino/a Studies Program and Emerson Hinchliff Professor of Hispanic Studies to talk about our project at one of their Faculty luncheons, which are very popular with their students for informal discussions about issues of importance to the Latina/o community.

CTECH Pre-College Program: CTECH will conduct summer interdisciplinary pre-college program. Activities will include classroom discussion and field explorations led by faculty and professionals. CTECH faculty members will share the responsibility of offering program contents on specific topics. As mentioned earlier, CTECH at Cornell will offer the Engineering Diversity Catalyst program this summer. Carefully-designed education components on transportation, environment, and community health will be incorporated in the 2017 summer CATALYST Academy program.

Industry Mentorship Program: CTECH will strengthen existing, and in some cases establish new industry mentorship programs. The mentorship program calls for volunteers from local transportation industry companies and government agencies to mentor graduate student research by offering comments and suggestions from a practitioner’s point of view, and by providing data or other information. Students benefit

from working closely with both a major advisor and a transportation industry mentor. USF currently has an industry mentorship program. The experience and lessons learned from previous years will be shared among CTECH consortium members and the executive committee will work out a refined plan to involve alumni to strengthen the mentorship program.

2. PRODUCTS:

While all CTECH-funded projects just got started in this reporting period, examples of products from CTECH members during the last six months are reported below.

- Journal Publications
 1. Tan, Z., H.O. Gao (2017). Optimizing vent configuration for complex urban tunnels considering environmental constraints, *IEEE Transactions on Control Systems Technology*, DOI: 10.1109/TCST.2016.2646326
 2. Zhao, L., J. Wang, H.O. Gao, Y. Xie, R. Jiang, Q. Hu, Y. Sun (2017), Evaluation of particulate matter concentration in Shanghai's metro system and strategy for improvement, *Transportation Research Part D*, Volume 53, June 2017, Pages 115–127
 3. Amirgholy, M., M. Shahabi, H.O. Gao (2017). Optimal design of sustainable transit systems in congested urban networks: A macroscopic approach. *Transportation Research Part E: Logistics and Transportation Review*, Volume 103, July 2017, Pages 261–285
 4. Heo, J., H.O. Gao, P. J. Adams (2017) Public health costs accounting of inorganic PM_{2.5} in metropolitan areas of the United States using a risk-based source-receptor model, accepted, *Environment International*
- Conference Papers and Presentations
 1. Amirgholy, M., M. Shahabi, H.O. Gao (2017). Designing a sustainable transit system in grid urban networks using the macroscopic fundamental diagram, presented at the 2017Transportation Research Board, Washington, D.C., USA.
 2. Amirgholy, M., L. Liu, H.O. Gao (2017). Modeling dynamics of congestion in urban networks using the macroscopic fundamental diagram, presented at the 2017Transportation Research Board, Washington, D.C., USA.
 3. Amirgholy, M., L. Liu, H.O. Gao (2017). Dynamic pricing of users and attracting activities in urban networks using the macroscopic fundamental diagram, presented at the 2017Transportation Research Board, Washington, D.C., USA.
- Website(s) or other Internet site(s)
 1. Cornell created the main CTECH website (<http://ctech.cee.cornell.edu/>) and continues to update it with information on our research, education, and engagement activities. We recently set up Google Analytics account so we can begin tracking traffic to the site. As of right now there isn't any data but moving forward we'll be able to track it.
 2. H. Oliver Gao's group completed the update of the CU-PPS-AQ software for NYMTC's transportation conformity assessment. The software is web-based and accessed by NYMTC users via a private website. We have updated the CU-PPS-AQ website for NYMTC.
 3. H. Oliver Gao's group completed the update of the CU-PPS-CMP software for NYMTC's transportation congestion management assessment. The software is web-based and accessed by NYMTC users via a private website. We have updated the CU-PPS-CMP website for NYMTC.
- Other products.

Nothing to report

3. PARTICIPANTS & COLLABORATING ORGANIZATIONS

Our key partners are the members of our consortium from Cornell University, University of California Davis, University of Southern Florida, and University of Texas El Paso. As a newly awarded UTC in its initial stage, in this past reporting period CTECH focused on developing its organizational infrastructure, operational mechanism, and functional procedures, and strengthening CTECH internal collaborations across consortium member institutions and researchers. The Center has yet to establish collaboration and partnership with external organizations. However, as reported in both previous and planned activities, CTECH has developed strategies and started efforts (e.g., meetings, visits, web conferences, etc.) for the development of external collaboration and partnership with public and private organizations including State DOTs, metropolitan planning organizations (MPOs), other public-sector organizations at all levels of government, non-profit institutions, technical and practitioner organizations, and industry partners.

4. IMPACT

Transportation that sacrifices environmental quality and public health is simply untenable. Successful solutions call for innovative cross-disciplinary research and education, and integrated technologies and approaches that meet goals in mobility alongside goals in environmental and health protection. Focused on FAST Act's priority area of Preserving the Environment, CTECH will use its fundamental research activities as the driving force to create downstream innovations, practices, and to spur an education program for workforce development. Even in its initial stage, CTECH is already showing its impact on the development of the principal discipline(s) as a unique platform for synergistic and multidisciplinary research and education in the nexus of Transportation, Environment, and Community Health, defining and advancing clear broad impacts to meet global challenges.

What is the impact on the development of the principal discipline(s) of the program?

CTECH is an interdisciplinary consortium involving faculty from engineering, urban planning, environmental science, and social science. CTECH research program, as organized by interlocking thrusts through interactive structures, promotes cross-fertilizations of ideas inside and outside of the transportation research discipline. For example, many 1st-year CTECH projects are joint efforts by researchers from various specialty areas, and draw/create knowledge in multiple disciplines (e.g., from human behavior, technology, and traffic flow to networks, air pollutant dispersion, and health costs, etc.). CTECH project "A Study of the Integrated Parking and Ridesharing Pricing/Incentives and their Social and Environmental Impacts in Metropolitan Areas" brought together a transportation theorist and an atmospheric scientist to link parking and ridesharing pricing/Incentives to environmental impacts. CTECH project "Estimating Activity and Health Impacts of First and Last Mile Transit Access Programs for Work and Shopping Trips Using Shared Mobility Services in a Metropolitan Area" enables a researcher in environmental planning and policy analysis to work with an industrial and transportation engineer. CTECH project "Spatial Sustainability Assessment of Green Stormwater Infrastructure Transportation Planning" makes it possible for researchers from the traditionally non-overlapping disciplines to work together on green infrastructure as an effective stormwater management approach with many economic and human health benefits.

What is the impact on other disciplines?

CTECH research and education thrust one on “Behavior, Active Transportation, the Built Environment, and Health” links travel behavior, active transportation and the built environment to community health. Primary goals are to: (a) identify the multiple factors that motivate travelers to choose transportation modes that promote healthy lifestyles; and (b) characterize the benefits of active transportation to good health. For example, one current CTECH project investigates the factors that explain demand for active transportation, including non-instrumental attributes and non-standard observed attributes, and extended decision rules. Data and methods developed in such studies are expected to also have significant implication for economic choice models, city and regional planning, cognitive science, and social psychology.

CTECH research and education thrust two on new transportation technologies and business models links Mobility-on-Demand (MoD) transportation, environment to community health. Mobility-on-Demand (MoD) systems refer to transportation modes that provide service to customers as requested, such as car sharing, bike sharing, and dynamic ridesharing (known by such companies as Uber and Lyft). The business is created by the demand for personal mobility, and the supply is enabled by a host of vehicle and infrastructure technologies such as Big Data Analytics, smartphones and social media. In this thrust, CTECH researchers will: (a) first conduct research on optimizing the operation of selected MoD systems. To achieve this goal, researchers will use Big Data Analytics to improve business plans, applying vehicle routing, facility location and network design models to maximize service to customers; (b) and then evaluate the systems operations on key performance indicators for environmental sustainability and relate them to known public health improvements. To take this a step further, CTECH researchers will later incorporate public health externalities in the optimization of MoD system operations. Insights into how MoD systems can improve environmental sustainability and public health will enable urban policy makers to make informed decisions on what business incentives to provide to MoD operators. Outcomes from this CTECH thrust are expected to contribute to disciplines such as environmental science, operations research, computational optimization, and the emerging data science. So are outcomes from CTECH thrust 5 on data-driven transportation-health informatics.

What is the impact on the development of transportation workforce development?

- CTECH @Cornell hosted bi-weekly conference calls for discussion and training sessions with NYMTC staff, NYSDOT staff and other select planners working in the NYMTC region on CU-PPS software and transportation conformity. The training sessions help staff learn to use the post-processing software and understand the technical details.
- CTECH@Cornell faculty Francis Vanek participated the second Transportation Camp Ithaca hosted by Tompkins County and Cornell University Transportation Services on June 17 (<http://www.tccoordinatedplan.org/transportationcamp-2017.html>). The objectives of the Camp were 1) To focus on to rural and urban mobility challenges, possible solutions and strategies; 2) To explore how technologies and better practices can be used to increase peoples’ mobility choices and community livability; 3) To increase networking among professionals, advocates and citizens; and 4) To offer a high quality TransportationCamp in Upstate NY. Attendees include people with interests and experience in shared-use mobility, mobility management, rural mobility, public transit, access to healthcare, metropolitan transportation planning, social services, public policy, mobility for seniors, regional services, demand-response services, mobility-as-a-service, community & economic development, volunteer driver services, housing & transportation, community mobility education, social equity, environmental sustainability, county planning, new mobility tech services and business models and more. Dr. Vanek gave a high-level presentation

- about long term carbon free transportation energy alternatives at the Camp.
- CTECH@Cornell faculty contributed actively to professional degree programs relevant to transportation: M-Eng in Transportation Systems (2 graduates this past May); M-Eng in Systems Engineering (47 graduates this past May); M-Eng in Engineering Management (38 graduates).
- CTECH@USF faculty contributed significantly to professional degree programs relevant to transportation, M-Engineering in Transportation Systems (4 graduates this past May); M-Science in Transportation Systems (2 graduates); M-Engineering in Environmental Engineering (2 graduates).

What is the impact on physical, institutional, and information resources at the university or other partner institutions?

The CTECH has drawn increased awareness of and created physical, institutional, and information resources/opportunities for transportation, environment, and community health systems approach to add value across different levels to all partner institutions and other collaborating institutions. At Cornell, for instance, CTECH is becoming a major force driving research, education, and engagement for sustainable means of campus transportation to improve campus environment, lessen environmental degradation, and keep the campus free of exhaust fumes, congestion, and energy waste.

What is the impact on technology transfer?

Nothing to report.

What is the impact on society beyond science and technology?

The integrative research and education of CTECH, as evidenced by research and education outcomes reported earlier, is expected to create a continuous stream of knowledge and information to support systems-wide decisions in transportation-environment-health management. For example, new air quality regulations are expected to cost over \$6.5 billion per year and potentially save \$120 billion in health-related expenses. Ultimately, CTECH work will contribute to improved community health and sustainable transportation through the development of more scientifically sound and operationally feasible/cost-effective strategies, and through the education of qualified professionals that can become leaders in creating innovative solutions for harmonized built and natural environments. Given that transportation and environmental problems are tenacious and pervasive across the world, CTECH study framework and methodologies can be applied to other countries via international collaboration, which is underway.

5. CHANGES/PROBLEMS

Nothing to Report.

6. SPECIAL REPORTING REQUIREMENTS

Data Management Plan: <http://ctech.cee.cornell.edu/data-management-and-sharing-plan/>

Website: CTECH website: <http://ctech.cee.cornell.edu/>

Directory of Key Personnel: Information available on the program website: <http://ctech.cee.cornell.edu/people/>

Financial and Annual Share Reports: The SF425 requirements will be met by separate report.

Research Project Descriptions: Available on program website: <http://ctech.cee.cornell.edu/projects/>

