#358 Synthesis of Research Results and Technology Trends to Inform Federal, State, Regional and Local Policies for Smart Mobility of People and Goods Phase 4

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June 30, 2022

Final Research Report
Contract # 69A3551747111

Disclaimer

Synthesis of Research Results and Technology Trends to Inform Federal, State, Regional and Local Policies for Smart Mobility of People and Goods: Phase 4

Mobility 21 UTC Project #358 - Final Research Report
June 30, 2022

Project Details:

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Chris Hendrickson, Co-PI   **https://orcid.org/0000-0002-9812-3580**

Period of Performance July 1, 2021 through June 30, 2022

Federal Funding: $100,000

Research Description

This proposal leverages three previous years of research which has informed policymakers of disruptive transportation technology trends and provided guidance on policies to take advantage of opportunities and mitigate risk. The synthesis builds upon relevant research conducted by Mobility21 and Traffic21 with a strategic equity focus on "Innovating Mobility for All". Policy briefs and research papers have been published and numerous presentations made to disseminate research results, with documented impacts on policy. Results have also been incorporated in Carnegie Mellon University undergraduate, graduate and executive education courses.

Focus of the project in Phase 4 will include the following:
- Continuing involvement with development of vehicle automation and connectivity policies, especially in Pittsburgh, Pennsylvania and the Smart Belt (Michigan, Ohio and Pennsylvania).
- Track infrastructure initiatives at the federal and state levels for opportunities to advance innovative transportation technology and policy.
- Expanded involvement with development of vehicle electrification policies for greenhouse gas emissions abatement.
- Work with the American Public Transportation Association (APTA) on policy for standardizing fare collection technologies in the United States.
- Continue research in support of PennDOT post-COVID planning efforts.
  The research in the fourth phase of this project is intended to continue tracking disruptive technologies affecting transportation, assess a variety of policy alternatives and to synthesize research results from the full range of CMU and partner research efforts to inform smart mobility policy. It is also intended to identify new opportunities for smart mobility research. The research work is conducted through a variety of activities:

- Meetings with civic and business leaders and government policy makers to discuss transportation challenges and advise on applicable smart mobility policies. These meetings include southwestern Pennsylvania, state, regional, national and international leaders and policy makers. Leverage the Mobility21 Deployment Partner Consortium of over 165 members.
- Presentations and publications providing policy analyses of smart mobility alternatives, such as connected and automated vehicle, electric vehicle, shared transportation, intelligent infrastructure and multi-modal operational policies.
- Active participation in policy-making groups such as the Pennsylvania Autonomous Vehicle Task Force, PA State Transportation Innovation Committee, Southwestern Pennsylvania Commission, Smart Belt Coalition, and the Pittsburgh Mobility Collective.
- Interaction with researchers at Carnegie Mellon and elsewhere to identify new opportunities for research and transportation policy improvement. Included in this activity is participation in national organization such as Transportation Research Board Executive Committee and the American Public Transportation Association, and the Emerging Technologies Committee of the Intelligent Transportation Society of America.
- Research national and international disruptive transportation technology trends and associated policies. Synthesize and disseminate this information through the Traffic21/UTC blog, social media and industry recognized Smart Transportation Dispatch weekly email newsletter.
- Publish policy briefs and other publications that result from the synthesis research.
- Contribute to local and national media stories highlighting impacts of disruptive transportation technologies and their implications on policy.

Personnel
The project involves effort by Stan Caldwell and Chris Hendrickson:

Stan Caldwell is an Adjunct Associate Professor for Transportation and Policy and serves as Executive Director of Carnegie Mellon's Traffic21 Institute which is housed in the Heinz College and Executive Director of the Mobility21 National University Transportation Center (UTC) which are housed in the College of Engineering. Both Traffic21 and the UTC are co-housed and co-staffed, and Stan manages the day-to-day operations of these research centers. These centers fund and coordinate faculty from across the University in interdisciplinary transportation research. The research centers maintain a primary focus on deploying transportation research and technology in the community and work with public and private partners to use Pittsburgh, Pennsylvania, and the region as a smart transportation test bed. Through the work of these centers Stan has taken a nationally active role in the emerging intelligent transportation industry and serves on the Leadership Circle of the Intelligent Transportation Society of America and developed the industry recognized Traffic21 Blog. He is founding member of the Smart Belt Coalition the Pennsylvania

Autonomous Vehicle Policy Tasks Force and the State Transportation Innovation Council and supports various local and national initiatives focused on transportation technology policy.

Chris Hendrickson is the Hamerschlag University Professor Emeritus, Director of the Traffic 21 Institute at Carnegie Mellon University, member of the National Academy of Engineering and Editor-in-Chief of the ASCE Journal of Transportation Engineering Part A (Systems). 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.

Budget
Salary for SC and CTH to equal regular project amount. Funding of a masters level graduate assistant.

Matching Funds
The Traffic21 sponsored Smart Mobility Challenge is a direct complement to this research activity and the Hillman Foundation funding for the challenge can be used as matching funds.
Carnegie Mellon University's Traffic21 Institute and its affiliated US DOT National University Transportation Center, Mobility21, are sponsoring a challenge to demonstrate how innovative technology can improve mobility using southwestern Pennsylvania as a test bed.
This challenge is inspired by Traffic21's years of successful collaboration with the City of Pittsburgh to become a globally recognized smart city test bed and the desire to demonstrate how suburban and rural communities can also benefit from innovative transportation.

Data Management Plan
This project does not involve extensive data resources. The primary data involves text and presentation. These documents will be managed and updated in accordance with the overall Mobility21 center data management plan.

Problem
New disruptive technologies such as vehicle automation, connected vehicles, alternative fuels and data analytics are rapidly developing and impacting society in both positive and negative ways. Federal, state, regional and local officials along with community organizations are challenged by a lack of technical capacity and information to assess these disruptive technologies and develop policies to manage their deployment in communities. Effective public policies have the potential to apply new technology to improve safety and efficiency of transportation systems and these policies can also mitigate unintended consequences of disruptive technology.

Approach
Carnegie Mellon University's Traffic21 Institute and Mobility21 National University Transportation Center have developed a proven model of Research, Development and Deployment through community partnerships. Traffic21 and Mobility21 maintain a Deployment Partner Consortium of over 170 public, private and non-profit members who collaborate with researchers

to identify real-world transportation needs.

Deployment Partner Consortium

Over the past 12 years Traffic21 has developed a reputation as an objective third-party advisor to government agencies and community organizations for technology and policy issues related to new developments and trends in transportation. Traffic21 also funds and manages cutting edge research in new transportation technology and interfaces with corporate partners to transfer that technology through pilot deployments and commercialization.

This positioned Traffic21 well to synthesize research results and technology trends to inform policies for smart mobility of people and goods. As Director of Traffic21, Chris Hendrickson, and Executive Director of Traffic21, Stan Caldwell the approach of the researchers in this project was to leverage Traffic21 model and partnerships to advance this synthesis research.

Expected Impacts

This project is intended to continue to influence transportation decision making and policies with regard to new technology implementation and the improvement in mobility of people and goods both in Pennsylvania and nationally. Progress is assessed from activities such as meetings, presentations and publications as well as policy changes, technology implementations and new research projects. The first three phases of the project have resulted in accomplishments such as written policy briefs and impacts on polices adopted by partners such as the Pennsylvania Department of Transportation and the City of Pittsburgh as result of this research.

Metrics include number of publication, number of research presentations to both academic and industry audiences and number of instances of policy influence and adoption.

Methodology

The research work for this project was conducted and transferred through a variety of activities highlighted in the following pages. Under each category are specific outputs by the researchers that include:

1. Meetings with civic and business leaders and government policy makers to discuss transportation challenges and advise on applicable smart mobility policies. These meetings include southwestern Pennsylvania, state, regional, national and international corporate and civic leaders and policy makers.

2. Presentations and publications providing policy analyses of smart mobility alternatives, such as connected and automated vehicle policies or multi-modal operational policies.

3. Active participation in policy-making groups such as the Pennsylvania Autonomous Vehicle Policy, Task Force, Smart Belt Coalition, and the Oakland Transportation Management Association.

4. Interaction with researchers at Carnegie Mellon and elsewhere to identify new opportunities for research and transportation policy improvement. Included in this activity is participation in national organization such as Transportation Research Board Executive Committee and Emerging Technologies Standing Committee of the Intelligent Transportation Society of America.

5. Research national and international disruptive transportation technology trends and associated policies. Synthesize and disseminate this information through the Traffic21/UTC blog, social media and industry recognized Smart Transportation Dispatch weekly email newsletter.

   To enable the synthesis of technology trends related to improving mobility, Stan Caldwell curates an industry recognized blog and weekly email newsletter. The Smart Transportation Dispatch is a weekly synopsis of Caldwell's research on mobility technology and research trends. Key articles along with insightful excerpts are posted on a blog and a weekly email newsletter is sent to the over 4,000 subscribers. During the 12 months of this research project 1,035 news articles were researched, synthesized, blogged and shared in social media with 1,173 twitter followers along with the 4,000 email subscribers.

Research Deployment and Transfer Activity (including support of workforce development)

- *July 1, 2022 - Traffic21 Director Chris Hendrickson Writes Decarbonization Editorial for ASCE* - Traffic21 Director Chris Hendrickson authored an editorial for the American Society of Civil Engineers in the Journal of Transportation Engineering, Part A: Systems titled \"Deep Decarbonization and Transportation Engineering.\"
- *October 4, 2021 - Chris Hendrickson Re-Appointed to the TRB Executive Committee* - Traffic21 Director Chris Hendrickson has been re-appointed to the Transportation Research Board\'s Executive Committee for 2022-2025. The Executive Committee is the senior policy body of TRB.
- *July 21, 2021 - Traffic21 Director Chris Hendrickson Attends TRB Meetings in Woods Hole, MA* - Chris Hendrickson, Director of the Traffic21 Institute and a Mobility21 researcher, attended the TRB Technical Activities Group meeting on July 16 and the TRB Executive Committee meeting on July 19-20. The Executive Committee meeting was held in Woods Hole, MA.
- *June 3, 2022 - International Conference on Transportation & Development Plenary Features Traffic21 Director* - Traffic21 Director Chris Hendrickson was a featured speaker during a plenary session at the International Conference on Transportation & Development titled \"Envisioning the Future of Cities and Transportation\" along with Paula Hammond, Senior Vice President and National Transportation Market Leader of WSP USA and Dr. Hani Mahmassani, William A. Patterson Distinguished Chair in Transportation of Northwestern University.
- *March 25, 2022 - Research Recap: Synthesis of Research Results and Technology Trends*

- *[to Inform Federal, State, Regional and Local Policies for Smart Mobility of People and Goods: Phase 3](#)* - March 25, 2022 Today, Mobility21 UTC released its latest \"Research Recap\" for Stan Caldwell and Chris Hendrickson\'s project \"Synthesis of Research Results and Technology Trends to Inform Federal, State, Regional and Local Policies for Smart Mobility of People and Goods: Phase 3.\" Recaps are one-page overviews of the UTC funded research that describe the research project\'s purpose, approach, key findings, conclusions, contact information for the research team and a link to the final research report.
- *December 21, 2021 - [National Academies Releases New Report on Improving Safety of 'Duck Boats'](#)* - December 20, 2021 The National Academies released a new report on improving safety of 'Duck Boats' used for commercial passenger service, called Options for Improving the Safety of DUKW Type Amphibious Vessels.   The review of the report was overseen by Traffic21 Director and Mobility21 researcher, Chris Hendrickson, and Craig Philip of Vanderbilt University.
- *December 17, 2021 - [Traffic21 Director Presents Keynote to Chinese Overseas Transportation Association (COTA)](#)* - December 17, 2021 Chris Hendrickson, Director of the Traffic21 Institute and researcher in the Mobility21 UTC, presented a keynote talk on \"Recent ASCE Journal of Transportation Engineering Editorials\" for the Chinese Overseas Transportation Association (COTA) during the opening ceremony of the 21st COTA International Conference of Transportation Professionals. Watch the his keynote presentation here.
- *November 11, 2021 - [Traffic21 Director Reviewing CUTC Doctoral Dissertation Nominations](#)* - November 11, 2021 Chris Hendrickson, Director of the Traffic21 Institute and a Mobility21 UTC researcher, is part of a panel reviewing doctoral dissertation nominations for the Council of University Transportation Centers\' Charles E. Wootan Memorial Award.
- *November 4, 2021 - [CAMMSE Research Symposium Features Traffic21 Director as Keynote Speaker](#)* - Traffic21 Director Chris Hendrickson delivered the keynote presentation during the Fourth Annual CAMMSE Research Symposium. CAMMSE (Center for Advanced Multimodal Mobility Solutions and Education) is a Tier 1 University Transportation Center and a consortium of five universities, led by The University of North Carolina at Charlotte, each with programs in synergistic research, education, technology transfer and innovation on multimodal transportation planning, design, operations, and maintenance.
- *October 1, 2021 - [Traffic21 Releases Policy Brief on Driver Warning Technologies and Partial Vehicle Automation](#)* - Traffic21 researchers released their latest policy brief, \"Driver Warning Technologies and Partial Vehicle Automation: Save Lives and Money,\" authored by Stan Caldwell, Chris Hendrickson, Corey Harper and Costa Samaras.   The brief reviews empirical data on changes in crash frequency and severity with driver warning technologies and partial automation; provides estimates of benefits, costs and lives saved; and concludes with policy recommendations.
- *July 8, 2021 - [TRB Holds Diversity, Equity & Inclusion Committee Meeting](#)* - Chris Hendrickson, Director of the Traffic21 Institute and Mobility21 researcher, attended the TRB Diversity, Equity and Inclusion Committee meeting July 8. The committee is helping to implement TRB\'s strategic goal of increasing the diversity, equity and inclusiveness of TRB participants.

- *May 1, 2022 - [Stan Caldwell Appointed to the 100 Questions Initiative on Urban Mobility and Transportation](#)* - The 100 Questions Initiative seeks to map the world's 100 most pressing, high-impact questions that could be answered if relevant datasets were leveraged in a responsible manner. This domain is focused on identifying the top 100 questions related to urban transportation and mobility. This work is essential due to the need to steer the use of data more purposefully to better inform decisions on urban development. The GovLab, along with CAF - Development Bank of Latin America, the Transformative Urban Mobility Initiative (TUMI), and the New Urban Mobility Alliance (NUMO) will collaborate in identifying priorities for the field by creating and sourcing a curated community of "bilinguals" from around the world. Mobility21 UTC Executive Director Stan Caldwell was selected as one of the bilinguals and participated in the first panel discussion and formulated questions related to his UTC research.

- *February 15, 2022 - [Stan Caldwell Receives 2022 CUTC – ARTBA Award for Administrative Leadership](#)* - Mobility21 Executive Director Stan Caldwell received the CUTC - ARTBA Award for Administrative Leadership, which recognizes outstanding administrative leadership contributions to the transportation field by non-academic appointments. View the acceptance video here.

- *February 2, 2022 - [Stan Caldwell Awarded ITSPA Person of the Year](#)* - Traffic21/Mobility21 Executive Director Stan Caldwell received the Person of the Year Award from the Intelligent Transportation Society of Pennsylvania. Stan serves as a founding member of the Unmanned Aerial Systems Task Force with the vision of \"safe and strategic integration of UAS technologies in Pennsylvania\'s transportation system.\" He also serves on the ITSA Broadband Deployment Task Force, the ITSA AV Safety Task Force, and is the chair of the ITSA Standing Committee on Emerging Technologies.

- *September 23, 2021 - [SAE International Podcast Features Stan Caldwell to Discuss Smart Mobility in Pittsburgh](#)* - Traffic21 Executive Director Stan Caldwell was featured on the recent SAE International podcast with host Grayson Brulte, Innovation Strategist and Co-Founder of Brulte & Company, to discuss how Traffic21 has helped place Pittsburgh at the forefront of the intelligent transportation field, improving the economy and attracting new businesses along the way. Listen to the full podcast here.

- *June 17, 2022 - [Council of University Transportation Center's Annual Meeting](#)* - Held earlier this week, the Annual Council of University Transportation Center\'s summer meeting brought together the nation's leading transportation professionals from academia and industry along with U.S. DOT and other transportation agency officials. Raj Rajkumar, Director, Stan Caldwell, Executive Director and Lisa Kay Schweyer, Program Manager of Mobility21 participated in the meeting.

- *May 24, 2022 - [Pennsylvania Chambers of Commerce Join for Annual Meeting and Reception](#)* - Mobility21 Executive Director Stan Caldwell traveled to state capital Harrisburg, PA, where he participated in the joint Pittsburgh and Philadelphia Chambers of Commerce Annual Meeting and Reception. Stan met with state legislators and state officials, along with deployment partners to provide updates on UTC impacts and accomplishments.

- *May 20, 2022 - [Mobility21 Executive Director Discusses Research with Aviation Industry Professionals](#)* - Stan Caldwell provided a tour of CMU, as well as industry automated vehicle research and development sites, to officials from the Allegheny County Airport

Authority and Spirit Airlines. Caldwell discussed his Mobility21 research on emerging transportation technology and industry trends, along with its economic impact on the Pittsburgh region.

- *May 15, 2022 - [Heinz College Students Present Final Capstone and Thesis Presentations](#)* - Students in the Heinz College MISM and MSISPM programs presented their final capstone projects and thesis presentations over the course of two days, two of which were advised by Traffic21 Executive Director Stan Caldwell and Mobility21 Program Manager Lisa Kay Schweyer, and included clients from the US Department of Transportation, PennDOT, and Honda.

- *May 4, 2022 - [Mobility21 UTC Researcher Appointed to IIJA Study on Impacts of AVs](#)* - As part of the Infrastructure, Investment and Jobs Act, Congress directed the Federal Highway Administration to conduct a study of the impacts of Automated Driving Systems (ADS) in consultation with a defined expert panel. Mobility21 Executive Director Stan Caldwell was appointed to this panel as a representative from academia and participated in the initial panel discussion today focused on ADS impacts on the roadway infrastructure.

- *May 4, 2022 - [UTC Researchers Participate in AFL-CIO Workshop at CMU](#)* - The CMU Block Center for Technology and Society hosted a workshop on campus with the AFL-CIO Technology Institute and the AFL-CIO Industrial Unions Council to discuss impacts of manufacturing technology on the workforce. Mobility21 Director Raj Rajkumar make a presentation titled \"Perspectives on Alternative Pathways for the Development of Autonomous Vehicles and the Convergence of Connectivity, Electrification and Autonomy\" and other UTC researchers participated including, Nik Martelaro, Sarah Fox and Stan Caldwell. Mobility21 Advisory Council Member Amanda Ballantyne was also participated and is Director of the AFL-CIO Technology Institute.

- *April 26, 2022 - [CMU Engineering & Public Policy Course Focuses on Transit in the City of Pittsburgh](#)* - CMU\'s Spring 2022 Engineering and Public Policy Senior Project Course was focused on transit in the City of Pittsburgh and culminated with a poster session highlighting five group projects. Mobility21 researcher Destenie Nock was co-instructor of the course and UTC researchers Corey Harper and Stan Caldwell served as advisors and provided feedback throughout the course and at the poster session. In the photo is Professor Nock and Pittsburgh Department of Mobility and Infrastructure Acting Director Kim Lucas along with some of the students.

- *April 25, 2022 - [Pittsburgh's Smart Loading Zones Launch Event](#)* - Mobility21 Executive Director Stan Caldwell participated in the ribbon cutting of the City of Pittsburgh\'s new Smart Loading Zone Pilot Project, launched in cooperation with the Pittsburgh Parking Authority and Automotus. Mobility21 researcher Sean Qian is working through a Department of Energy grant to evaluate this pilot.

- *April 22, 2022 - [Pittsburgh Robotics Network Hosts The State of Our Autonomous Vehicle Industry](#)* - Traffic21 Women in Transportation Fellow Hajra Shahab and Executive Director Stan Caldwell participated in the \"The State of Our Autonomous Vehicle Industry\" event hosted by Pittsburgh Robotics Network. \"Seeing industry leaders in the AV space coming together to discuss the future of this technology and the industry at large was an enriching experience. Hearing from leaders from Aurora, Argo AI, Motional, Waymo, and Locomation about the humble beginnings of this technology to full-scale commercialization and IPO listings speaks to how much the industry has

grown in a couple of years. It was also quite interesting to see how each industry leader was or has been very closely affiliated with Carnegie Mellon University, particularly the Robotics Institute and University Professor William (Red) L. Whittaker who happens to have mentored almost everyone on the panel during their time at CMU. Professor Red also received the Pittsburgh Robotics Impact Award for his Leadership and Excellence in Robotics at the event.\" - Hajra Shahab

- *April 22, 2022 - [Mobility21 Hosts PennDOT's 'Moving Forward with STEM' Discussion](#)* - The Mobility21 UTC hosted the Pennsylvania Department of Transportation (PennDOT) Secretary Yassmin Gramian and other leaders in the industry for PennDOT\'s \'Moving Forward with STEM\' panel discussion. Mobility21 Executive Director, Stan Caldwell, opened the event welcoming the panelists and attendees on behalf of Carnegie Mellon University. He highlighted the university\'s history in STEM and the UTC\'s focus on workforce development. Hajra Shahab, the 2020 - 2022 Traffic21 Women in Transportation Fellow then introduced the panel and the moderator for the event: Matt Blackburn, Senior Manager, Government Relations, Aurora; Rachel Burcin, Manager of Carnegie Mellon University Robotics Institute Global Programs; Robert Koch, Chair for Community College of Allegheny County Skilled Trades Department and Automotive Ford ASSET program professor; Audrey Russo, CEO Pittsburgh Technology Council PennDOT District 11 Executive Director Cheryl Moon-Sirianni (moderator). Panelists then shared their views on the importance of STEM, cultivating the next generation of transportation industry workers, and Pittsburgh's leading role in the transportation revolution (through higher education institutions and transportation-related technology companies). Additionally, the panel discussed ways to increase diversity and equity in STEM and the transportation workforce. Over 100 national industry leaders from departments of transportation, intermediate units, school districts, higher education institutions, transportation providers, community organizations, industry as well as students registered for the event and participated by submitting questions for the panel. You can view the video of the discussion here.
- *April 19, 2022 - [SWPA Connected Initiative Launches Connectivity Roadmap](#)* - A briefing was held on Phase 1 Results of the Southwestern Pennsylvania Connected - Equitable Broadband Access Plan for local government officials and foundations who funded the plan. Mobility21 UTC researchers Jon Peha and Stan Caldwell presented, highlighting the CMU faculty and student contributions to the planning process.
- *April 6, 2022 - [Mobility21 Highlighted to Visiting Delegation from Dortmund](#)* - A delegation from the City of Dortmund, Germany visited Pittsburgh and CMU, hosted by the Scott Energy Institute, to learn about our work with technology in energy, transportation, food systems, etc. Stan Caldwell presented an overview of Mobility21, and UTC researchers Don Carter and Ray Gastil presented their research associated with the Remaking Cities Institute.
- *March 25, 2022 - [Research Recap: Synthesis of Research Results and Technology Trends to Inform Federal, State, Regional and Local Policies for Smart Mobility of People and Goods: Phase 3](#)* - Today, Mobility21 UTC released its latest \"Research Recap\" for Stan Caldwell and Chris Hendrickson\'s project \"Synthesis of Research Results and Technology Trends to Inform Federal, State, Regional and Local Policies for Smart Mobility of People and Goods: Phase 3.\" Recaps are one-page overviews of the UTC funded research that describe the research project\'s purpose, approach, key findings,

conclusions, contact information for the research team and a link to the final research report.

- *March 17, 2022 - [Pennsylvania Holds Legislative Hearing on HAVs](#)* - Mobility21 Executive Director Stan Caldwell attended a field hearing on pending highly automated vehicle legislation with the Pennsylvania House Transportation Committee. The hearing was held at the Westmoreland County Community College Advanced Technology Center at RIDC Westmoreland. Stan had the opportunity to meet with state legislators, as well as labor and industry officials to discuss his UTC research on emerging transportation technology policy.

- *March 3, 2022 - [Mobility21 Research Highlighted in Course for Building Managers](#)* - The Building Owners and Managers Association (BOMA) Pittsburgh Chapter hosted a continuing education credit course for property managers, owners and brokers real estate license renewal. In a session on drone technology, Stan Caldwell presented his UTC research on industry trends and potential impacts of advanced air mobility and was joined by Pittsburgh based drone company AERAS, who discussed their innovative drone applications for buildings.

- *February 11, 2022 - [Mobility21 Research Applied to NCHRP Project](#)* - Stan Caldwell was invited to join a Transportation Research Board National Cooperative Highway Research Program (NCHRP) workshop for Project 20-126(01) Developing a Research Program for Programmatic Issues of Future System Performance. Stan applied his research in emerging transportation technology policy and industry trends to help develop research problem statements for the project.

- *January 20, 2022 - [Mobility21 Researcher Presents "Managing AI in Transportation" to DVRPC](#)* - Mobility21 researcher Stan Caldwell presented an overview of the Traffic21/Heinz College Executive Education Course "Managing AI in Transportation" to 35 participants from New Jersey and Pennsylvania at the quarterly meeting of the Delaware Valley Regional Planning Commission (DVRPC) Transportation Operations Task Force Meeting. This is a quarterly meeting that DVRPC facilitates to bring their various transportation partners together that provides an opportunity for agencies to coordinate and share information regarding their TSMO Programs, and share information about new and innovative technologies or best practices.

- *December 28, 2021 - [Latest Consequential Podcast on Transit of the Future Features UTC Researchers](#)* - Public transportation is one of the most critical aspects of our infrastructure, but it is also one of the most imperiled and underfunded. This episode looks at how the Bipartisan Infrastructure Plan\'s historic investment in public transit and other targeted policymaking can build the transportation systems of the future, with guests and UTC researchers Stan Caldwell and Corey Harper, as well as Eric Goldwyn, and Anthony Foxx. Consequential is a Heinz College of Carnegie Mellon University podcast that looks at the human side of technological change and develops meaningful plans of action for policymakers, technologists and everyday people to build the kind of future that reduces inequality, improves quality of life and considers humanity. In its third season, Consequential will examine how AI and machine learning will impact research practices and data collection, as well as the development and dissemination of knowledge. Topics will include combatting disinformation, the ethics of crowdsourced research, and representation in open source software development. Hosted by Lauren Prastien and Eugene Leventhal.

- *December 21, 2021 - [New Policy Report on "How COVID-19 Affects Major Trends and Forces Shaping The Future of Transportation"](#)* - Stan Caldwell applied his UTC research on emerging transportation technology policy in support of a year-long advisory round-table exploring "How COVID-19 Affects Major Trends and Forces Shaping The Future of Transportation" for Pennsylvania Department of Transportation Secretary Yassmin Gramian. CMU Heinz College Master of Public Policy and Management student Erick Shiring served as research assistant throughout the project to PennDOT Senior Policy Advisor and report lead Roger Cohen. Mobility21 UTC research Professor Megan Ryerson from the University of Pennsylvania also served on this round-table advisory group and applied her UTC research. Research & Policy Papers - Traffic21 - A transportation research institute of Carnegie Mellon University - Carnegie Mellon University (cmu.edu)
- *December 16, 2021 - [Emerging Transportation Technology Trends Shared with High School Students and Teachers](#)* - Stan Caldwell, Mobility21 UTC Executive Director & researcher, presented a session on his emerging transportation technology policy research to high school students and faculty from suburban and rural school districts throughout western Pennsylvania. The event titled Automotive Technician Scholarship Contest & Student / Instructor Transportation Update was sponsored by Bob Koch from Mobility21 UTC academic partner, Community College of Allegheny County and held at their West Hills Campus Automotive Technology Center. There were 62 attendees, 39 of which competed for scholarships.
- *December 13, 2021 - [Honda Visits CMU and Learns about UTC Research](#)* - A group from Honda R&D America visited CMU and met with various UTC researchers including Sean Qian, Stan Caldwell, Nik Martelaro and Mobility21 Director Raj Rajkumar.
- *December 9, 2021 - [Mobility21 Presents at Transportation Engineering & Safety Conference](#)* - Mobility21 presented the Transportation Engineering and Safety Conference session "Welcome to the Smart Cities – Managing AI in Transportation." This conference session provided a preview of several topics included in the executive education session, including an overview of technology and AI impacts in transportation today, AI and predictive analytics and how to make a better decision with transportation data, and equitably applying AI for safe and efficient transportation. Lisa Kay Schweyer, Program Manager for Mobility21 moderated the session. The other CMU speakers included UTC researchers: Sean Qian on AI and Predictive Analytics: How to Make Better Decisions with Transportation Data, Allanté Whitmore on Equitably Applying AI for Safe and Efficient Transportation, and Stan Caldwell on the Technology and AI Impacts in Transportation Today.
- *December 9, 2021 - [Heinz College Masters Students Present Capstone](#)* - CMU Heinz College Masters of Information Systems Management Capstone students Shiyi Liu, Yanwen Peng. Jiaoying Mu, Kehan Li, Yilin Hua and Zhenyuan He made a final presentation of their capstone project developing an automated truck departure user interface. The client was Klara Oberhollenzer, Manager of Development Autonomous Truck Mission Control Product & Partnerships at Daimler Truck North America and the course advisor was Stan Caldwell, Executive Director, Mobility21 UTC.
- *December 8, 2021 - [UTC Researchers Attend ITS America Annual Meeting in Charlotte](#)* - UTC researchers attended the ITS America annual meeting in Charlotte this week. CMU

Mechanical Engineering Ph.D. Candidate and Swartz Center Innovation Fellow Matt Guttenberg presented his research with Professor Venkat Viswanathan on their INCEPTS software, which optimizes EV charging and is poised for commercialization. Mobility21 Executive Director Stan Caldwell presented annual accomplishments of the Emerging Technologies Standing Committee to the ITSA Board, presented his UTC research in an executive session titled "Equity, Climate, Safety and Infrastructure for Automated and Autonomous Mobility Deployments" and participated in the quarterly meeting of the Smart Belt Coalition.   Watch Stan\'s panel here.

- *December 2, 2021 - CMU Students Share Final Capstone Projects* - Students of the CMU Heinz College engage in semester long "Capstone Projects" to apply coursework to real-world scenarios. Today, students shared the results of their semester long research projects during a poster fair. The projects featured today included the following transportation related projects: Team US Ignite, advised by Mobility21 Program Manager, Lisa Kay Schweyer Team Daimler Trucks North America, advised by Mobility21 Executive Director, Stan Caldwell

- *December 2, 2021 - Congressman Higgins Discusses Transportation & Infrastructure with Mobility21* - Congressman Brian Higgins, member of the United States House of Representatives serving New York's 26th congressional district, spoke to Mobility21 Director Raj Rajkumar, Mobility21 Executive Director Stan Caldwell, Mobility21 UTC researcher Steve Smith, and Metro21 Executive Director Karen Lightman to discuss the broad array of federally supported intelligent transportation and infrastructure research at CMU.

- *December 1, 2021 - UTC Researcher Appointed Co-Chair of PennDOT's Advanced Air Mobility Subcommittee* - Mobility21 researcher Stan Caldwell joined Joby Aviation's Max Fenkell in co-chairing the first Advanced Air Mobility Subcommittee of PennDOT's new Unmanned Aerial Systems Task Force. The subcommittee is meeting to discuss potential initiatives to safely advance applications of this emerging technology in the Commonwealth.

- *November 23, 2021 - Pittsburgh Coro Fellows Learn How Transportation Research Impacts Public Policy* - The 2021-2022 Group of Fellows from the Coro Center for Civic Leadership (Pittsburgh) conducted an "Established Nonprofit Sector Leaders Interview" with Mobility21 Executive Director Stan Caldwell to learn how transportation research, education and technology transfer initiatives from University Transportation Centers impact public policy.

- *November 4, 2021 - Traffic21/Mobility21 University Transportation Center Deployment Partner Consortium Symposium Held* - The Traffic21/Mobility21 University Transportation Center Deployment Partner Consortium Symposium kicked off earlier today with the Mobility21 UTC Director, Raj Rajkumar, providing a welcome and an overview of updates on activities and plans at the Mobility21 National University Transportation Center. The keynote speaker for 2021 Symposium was Yassmin Gramian, Secretary of Transportation, Pennsylvania Department of Transportation. The Symposium's first panel focused on Equity/Justice and Mobility. The panel was moderated by Stan Caldwell and featured: Ben Bear, CEO, Spin Carol Lewis, Chair, Transportation Research Board, Equity, Diversity and Inclusion Committee Irene Marion, Director, Department of Civil Rights, DOT Beth Osborne, Director, Transportation for America The second panel focused on Environment/Climate Change and Mobility. The

panel was moderated by Chris Hendrickson and featured: Rachael Nealer, Deputy Director for Transportation Technology and Policy at White House Council on Environmental Quality Rohan Patel, Senior Global Director, Public Policy and Business Development, Tesla Kelsey Owens, Environmental Protection Specialist, US Department of Transportation The Symposium also featured 7 research and academic project presentations, comprising the UTC Academic and Research Showcase. The projects allowed for a brief Q&A with the researchers upon the conclusion of their video presentation. Over 130 people from academia, government, community and industry registered to attend the symposium. View the full list of presenters and videos of the sessions here.

- *October 21, 2021 - [Local Government Commission Hosts Inaugural Symposium](#)* - Traffic21 Executive Director Stan Caldwell moderated a panel alongside Metro21 Executive Director Karen Lightman at the Inaugural Local Government Commission Symposium to discuss \"Solving Real-World Problems through Collaboration and Innovation with Municipal and Equity Partners\" and featured: Kimberly Lucas, Acting Director, Department of Mobility & Infrastructure, City of Pittsburgh Kelly Maurer, Director of Public Works, Cranberry Township View all of the presentations from the symposium here.

- *October 12, 2021 - [Mobility21 Supports Student Capstone with Daimler Trucks](#)* - CMU Heinz College Masters of Information Systems Management students Shiyi Liu, Jioaying Mu, Kihan Li, Yanwen Peng, Yilin Hua, Zhenyuan He, along with their advisor Stan Caldwell from Mobility21, presented midterm capstone project results. Attending the presentation were clients from Daimler Trucks North America and Torc Robotics who provided feedback on student plans for an automated truck departure approval application.

- *October 1, 2021 - [Traffic21 Releases Policy Brief on Driver Warning Technologies and Partial Vehicle Automation](#)* - Traffic21 researchers released their latest policy brief, \"Driver Warning Technologies and Partial Vehicle Automation: Save Lives and Money,\" authored by Stan Caldwell, Chris Hendrickson, Corey Harper and Costa Samaras.   The brief reviews empirical data on changes in crash frequency and severity with driver warning technologies and partial automation; provides estimates of benefits, costs and lives saved; and concludes with policy recommendations.

- *September 23, 2021 - [Smart Belt Coalition Quarterly Meeting Held](#)* - Stan Caldwell participated in the quarterly meeting of the Smart Belt Coalition, which included academic and state transportation agencies from Ohio, Michigan and Pennsylvania. The group discussed efforts on vehicle electrification and associated infrastructure, as well as strategic planning.

- *September 22, 2021 - [Mobility21 Presents at ITSA Board Meeting](#)* - Stan Caldwell, Mobility21 Executive Director and Chair of the Intelligent Transportation Society of America (ITSA) Emerging Technologies Standing Committee, presented at the quarterly board meeting on the committee efforts on working groups for personal delivery devices, electric vertical takeoff and landing systems, and digital twinning.

- *September 9, 2021 - [Traffic21/Mobility21 Discusses AI in Transportation Executive Education Session with Southwestern PA Commission](#)* - Traffic21/Mobility21 Executive Director Stan Caldwell and Program Manager, Lisa Kay Schweyer, presented an overview of the recently completed inaugural session of the CMU Heinz College

executive education session "Managing Artificial Intelligence in Transportation" at the Southwestern Pennsylvania Commission's Transportation Safety and Operations Committee. The executive education session was sponsored and developed by the Traffic21 Institute in partnership with the Heinz College Executive Education program.

- *August 27, 2021 - Traffic21/Mobility21 Advising Heinz College Capstone Projects* - Traffic21 Executive Director Stan Caldwell and Mobility21 Program Manager Lisa Kay Schweyer will serve as advisors for Heinz College student capstone projects throughout the fall 2021 semester. The students engage in semester long capstone projects to apply coursework to real world scenarios. Stan will work with students engaged with Daimler Trucks North America on the Departure of the Autonomous Truck and Lisa Kay will work with students engaged with Smart Cities, US Ignite, Fort Carson and the City of Colorado Springs.

- *July 29, 2021 - FHWA Workshop on CAVs and Active Transportation* - A two-day Federal Highway Administration workshop on Planning for Multimodal Networks for a Connected and Automated Future was held with a diverse group of stakeholders to help FHWA define and refine the critical questions around planning for active transportation and CAV. As an expert panel member for this study, Stan Caldwell participated and applied his UTC research in disruptive transportation technology policy.

- *July 26, 2021 - Mobility21 Researcher Appointed to ITS AV Safety Task Force* - Stan Caldwell joined the Intelligent Transportation Society of America's inaugural meeting of the AV Safety Task Force which consists of representatives from the public, private and academic sectors to discuss the public perception of automated vehicle safety.

- *July 22, 2021 - Automated Transit Highlighted at Quarterly CAT Meeting* - The quarterly meeting of the Cooperative Automated Transportation (CAT) Coalition Strategic Initiatives Working Group, attended by member Stan Caldwell, included presentations on the Connecticut Automated Bus Deployment, the Automated Bus Consortium and the AV Shuttle Testing of V2I Data Exchange.

- *July 21, 2021 - PennDOT/FHWA Holds STIC Meeting* - July 21, 2021 Mobility21 Executive Director Stan Caldwell participated in the quarterly meeting of the PennDOT/FHWA State Transportation Innovation Council (STIC) where PennDOT's efforts on Unmanned Arial Systems were highlighted.

- *July 20, 2021 - Pittsburgh Transit Agency Finalizes Long Range Plan* - Stan Caldwell participated in the final meeting of the NEXTransit Stakeholder Advisory Meeting where the Port Authority of Allegheny County presented the completed long range plan and discussed implementation and public outreach efforts.

- *July 13, 2021 - UTC Research Informing Policy Makers* - Stan Caldwell met with Pennsylvania State Senator Ryan Aument to discuss policy research in emerging transportation technologies and impacts in the commonwealth.

Media Citations for Caldwell and Hendrickson

- *May 30, 2022* - Try these ride-hailing tips on your next trip - "Most of my ride-hailing experiences have been uneventful — except for one recent trip to the airport. On a rainy afternoon, I failed to connect with my driver, which precipitated a soggy 20-minute delay. That got me thinking: Maybe I could benefit from some advice. I asked academics, travelers and ride-hailing experts. And much like the ride-hailing industry itself, the answers I received were all over the map. "The best strategy today is to have access to many services and to use each one when it best fits your trip needs," says Stan Caldwell, executive director of Carnegie Mellon University's Traffic21 Institute, which focuses on transportation issues. For example, he says savvy travelers should consider using Uber or Lyft to get from home to a transit hub. Or they should use the ride-hailing services late at night when mass transit isn't running. On other trips, a Zipcar rental or even a bike share or scooter might be more appropriate." *Link to Article*
- *May 20, 2022* - Will we see self-driving buses on the new bus rapid transit being built in Pittsburgh? - "Just moments into an interview with Vincent Valdes, executive director of Southwestern Pennsylvania Commission (the group that decides how to spend federal transportation dollars, locally) Valdes brought up the idea of autonomous buses along the BRT route... Stan Caldwell does a lot of research on technology trends in automated vehicles with his Traffic 21 Institute initiative. He works at Carnegie Melon University and invited Channel 11 to the Navlab, where they've been doing research on this type of technology since the 80s. While they're not testing any automated buses here, CMU is researching what automation would mean for transit. "The role of the drivers will be elevated because they still have to take care of the duties of the passengers, maintaining safety of passengers and everything around the vehicle but they also will have to manage the technology," said Caldwell. Which is some of the concern for bus riders when Jennifer asked them if they'd ride an autonomous bus." *Link to Article*
- *May 16, 2022* - Signals along 'Smart Spines' optimize traffic flow - "By revamping close to 150 city intersections with adaptive signaling technology, Pittsburgh plans to improve traffic flow and decrease idling times for city buses. The initiative will incorporate technology from Rapid Flow Technologies' Scalable Urban Traffic Control program (Surtrac), an artificially intelligent adaptive signal control system first deployed in 2012, into eight high-priority traffic corridors, or "Smart Spines," throughout Pittsburgh. Surtrac uses cameras, sensors and radar technology to first capture real-time traffic conditions at each intersection. With that data, it creates an optimization plan for moving traffic through the intersection, which it then sends to the signal controllers in a specific intersection, to nearby signals and to connected vehicles. "The original application was to decrease congestion and idling time in the neighborhood of East Liberty" where a number of redevelopment projects were already in progress, said Stan Caldwell, executive director of Carnegie Mellon University's Traffic21 Institute. More>> " *Link to Article*
- *April 26, 2022* - As Some Americans Celebrate End Of Travel Mask Mandates, Most Say 'Not So Fast' - "Yet despite vocal proponents of the new rule, several polls suggest a majority of the public isn't ready for masks to come off. An early April Harris Poll showed that 60% of Americans supported extending air travel mask mandates.Flying in spite of the risks may be the new reality, though the Justice Department is appealing the

ruling. A recent flash poll conducted by OnePulse just before the ruling also found that 60% of respondents believed the government should extend mask mandates. Nonetheless, 61% said they would wear masks voluntarily if mandates ended... "I believe air travel will continue to increase as we move from a pandemic to endemic posture," said Stan Caldwell, associate professor of transportation and public policy at Carnegie Mellon University\'s Heinz College." *Link to Article*

- *April 26, 2022* - The future of open city streets could start with smarter traffic lights - "The Biden administration is moving the U.S. toward an all-electric vehicle future, though making it a reality may still be decades away... A small but growing number of drivers have already switched to electric vehicles, a trend that will need to continue to grow to deliver an all-electric future. Stan Caldwell, executive director of the Traffic21 Institute at Carnegie Mellon University, said more consumers will move to cleaner vehicles as more options come to the market. "With the significant amount of new products coming online from the manufacturers, that\'s going to have a significant impact, where it\'s not just a couple of offerings out there, you\'re really starting to see wider (offerings)," Caldwell said. "The manufacturing of those companies is really starting to increase — they\'re just making, Ford, GM and Toyota, all the companies — now are all claiming billions of dollars in new manufacturing facilities."" *Link to Article*

- *April 15, 2022* - The future of open city streets could start with smarter traffic lights - "In 2009, the billionaire industrialist Henry Hillman decided his hometown of Pittsburgh could do better. Its traffic congestion problems weren't as bad as those of most large US cities, but Hillman had the means to do something about them. His foundation donated to CMU with a writ to work on solutions—a prompt that eventually led to Traffic21, an institute charged with devising novel transportation tech and using the city as a lab to test it. Hillman's grant came at a time when Pittsburgh was looking to reinvent itself. Mayor Luke Ravenstahl dreamed of leading the postindustrial steel town into a new era built on research and entrepreneurship. Traffic21's executive director, Stan Caldwell, began searching for where to start. Civil engineers consistently pointed to the proliferation of traffic cameras: The tools offered lots of data about how folks moved around, but the people sitting in control rooms didn't have the training to manage or interpret it. "They were saying, 'We don't know how to turn that data into information,'" Caldwell recalls." *Link to Article*

- *March 30, 2022* - In 2022, Pittsburgh will break ground on a smart city plan over six years in the making - "When the challenge was announced in 2015, Pittsburgh officials were excited about the chance to use the prize money to shake the city's reputation as a post-industrial steel town, Stan Caldwell, executive director of Carnegie Mellon University's Traffic21 Institute, who worked on the city's proposal, told us. "There was a general opinion in Pittsburgh that the challenge was kind of almost tailor-made for us," Alex Pazuchanics, a former policy advisor to the mayor of Pittsburgh from 2015–2017, told Emerging Tech Brew... The idea for Smart Spines is rooted in an earlier—and still ongoing—project called Scalable Urban Traffic Control (Surtrac), an "intelligent traffic-control system" that began in 2012 and aims to speed up traffic flow and reduce vehicle idle time. The tech, which was developed at Carnegie Mellon University, has since been commercialized via a company called Rapid Flow Technologies. " *Link to Article*

- *March 28, 2022* - You Can Save Money With Usage-Based Auto Insurance — But Should You? - "Allstate\'s program is part of a new breed of insurance programs that use

vehicle telematics to create pay-as-you-go insurance policies. They include Progressive Snapshot, State Farm Drive Safe & Save and Nationwide SmartRide. On average, consumers can save anywhere between 5% and 50% on insurance using pay-as-you-go insurance. The ideas behind these programs are tantalizingly simple: What if you could only pay for the insurance you use? What if an insurance company could reduce your premiums by verifying your good driving habits in real time? \"Telematics has disrupted the automotive insurance industry by providing insurers with customers' real-time personalized data,\" says Stan Caldwell, executive director of Traffic21 Institute at Carnegie Mellon University. He says insurers can now assess risk by a driver\'s actual behavior rather than the demographic and geographic averages of many drivers. \"Customers who actually drive fewer miles and drive more safely than the average driver can save money,\" he adds. " *Link to Article*

- *March 28, 2022 -* How smart is your city? NIST provides a framework to measure - "The goal for developing a guideline and a framework is to provide a standard process for thinking about what gets measured and how, said NIST\'s David Wollman, deputy chief of smart connected systems in NIST\'s Communications Technology Laboratory... An emphasis on citizen engagement in project evaluation might help address a \"techlash,\" according to Stan Caldwell, executive director of Carnegie Mellon University's transportation research institute, Traffic21. The dissolution of high-profile smart city efforts like San Diego's smart streetlights program and Sidewalk Labs\' controversial Quayside project in Toronto shows residents\' skepticism of certain smart city projects or technologies. "My advice for cities is that this is the time where you have to be extra cautious about being very transparent about what we\'re doing," Caldwell said. Cities must engage the public, he said, which often goes counter to how smart cities originally functioned." *Link to Article*

- *November 22, 2021 -* Billions of dollars in infrastructure bill for charging could supercharge electric vehicle adoption -
Most estimates call for battery and plug-in hybrid EVs being between 30% and 50% of the U.S. fleet by 2030. EV charging is still an emerging business model, and no one yet knows which one is going to be the most successful.
That's part of the significance of the $7.5 billion earmarked for EV charging, said Stan Caldwell, executive director of Traffic21 Institute and Mobility21 at Carnegie Mellon University.
"This can start to fill the gaps where the market is not going to come quickly," he said. And not just in terms of urban, where market forces have concentrated the stations, vs. suburban and rural areas, he said.
There are access equity issues at play as well, around EV owners who may not have access to private charging, Caldwell said. "This is where the money (in the bill) can be strategically placed … Technology is not the biggest hurdle, the business model is," he said.More>>

- *November 22, 2021 -* Can travel make you happy? Many Americans plan to find out as they plan trips for 2022 -
These travel trends could affect your happiness in 2022
It'll be more unpredictable than ever. "I expect restrictions will continue to be very dynamic based on both local COVID vaccination and infection rates," predicts Stan Caldwell, executive director of Carnegie Mellon's Traffic21 Institute. If you like

adventure, this may be your year.

Prices will rise. As more people book trips, rates will increase. Fare analysts at the airfare app Hopper forecast that ticket prices to Europe will jump about 12% this fall and will average $750 round trip. Roland Rust, a professor at the University of Maryland's Robert H. Smith School of Business, sums up the outlook in a few words: "High prices and fewer options." So book now if you see a rate you can live with because it's not getting any cheaper.More>>

- *September 8, 2021 - How electric autonomous planes could change the logistics industry* -
Will fleets of hybrid-electric ghost planes replace trucks as the delivery's dominant vehicle? Stan Caldwell, Carnegie Mellon University's Adjunct Associate Professor of Transportation and Public Policy, thinks it's feasible. "We're seeing rapid increase in serious consideration of drones for freight delivery, especially last-mile freight," he says. 'Last mile' is the part of a delivery process that reaches the consumer – normally from a distribution center. Some of the world's biggest retailers and logistics companies – like Google, UPS and DHL – are already experimenting with drone delivery.
Caldwell thinks delivery systems are becoming less centralized through a few companies, aiding the drone logistics boom. There are many players on the market. "Distribution of systems is a trend in the freight industry. Walmart has delivery drones, and next, your local independent grocery store gets its own."More>>

- *August 31, 2021 - Why Are Uber And Lyft So Expensive Right Now?* -
Why have Uber and Lyft become so expensive?
It has everything to do with the pandemic.
"The pandemic demonstrated the volatility of the ride-hailing industry with early sharp reductions in passenger demand and subsequent reductions in driver supply," said Stan Caldwell, executive director of Carnegie Mellon's Traffic21 Institute.
Peter C. Earle, an economist at the American Institute for Economic Research, explained that owing to a shortage of drivers, surges (and the higher prices associated with them) have become more common.
Goodbye, Seafood? Inflation and Shortages Have Restaurants Taking Items Off the Menu
Why haven't all previous Uber and Lyft drivers gotten back behind the wheel as the world has opened back up? One reason could be that they're actually making more money being unemployed than they are being a gig worker.More>>

- *July 7, 2021 - A Global Smart-City Competition Highlights China's Rise in AI* -
FOUR YEARS AGO, organizers created the international AI City Challenge to spur the development of artificial intelligence for real-world scenarios like counting cars traveling through intersections or spotting accidents on freeways.
In the first years, teams representing American companies or universities took top spots in the competition. Last year, Chinese companies won three out of four competitions. Last week, Chinese tech giants Alibaba and Baidu swept the AI City Challenge, beating competitors from nearly 40 nations…
Stan Caldwell is executive director of Mobility21, a project at Carnegie Mellon University assisting smart-city development in Pittsburgh. Caldwell laments that China invests twice as much as the US in research and development as a share of GDP, which he calls key to staying competitive in areas of emerging technology…
"We want the technologies to develop, because we want to improve safety and efficiency

and sustainability. But selfishly, we also want this technology to develop here and improve our economy," Caldwell says.More>>

Findings

The following list of publications related to this research can be accessed on the Mobility21 project database found at www.mobility21.cmu.edu and individually hyperlinked below.

Data Management Plan	Caldwell_Hendrickson_2021_Mobility21_Project_DMP.pdf
Progress Report	358_Progress_Report_2021-09-30
Presentation	4-22-21_Hendrickson_illinois_kent_seminar_slides.pdf
Presentation	6-23-21_MASITE_Executive_Education_Slides.pdf
Presentation	6-9-21_PSPE_Course_Caldwell.pdf
Presentation	2021_MAIT_Module_1.pptx
Presentation	2021_Hendrickson_asce_plenary_talk_slides.pdf
Presentation	4-1-21_PSPE_Course_Caldwell.pptx
Presentation	9-9-21_SPC_Executive_Education_Slides.pdf
Publication	How COVID-19 Affects Major Trends and Forces Shaping The Future of Transportation
Publication	TRB_Duck_Boat_Report.pdf
Presentation	3-3-22_BOMA_Caldwell.pdf
Presentation	Recent ASCE Journal of Transportation Engineering Editorials
Presentation	12-16-21_CCAC_Caldwell.pptx
Presentation	12-9-21_Part_1_Penn_State_Executive_Education_Slides.pptx

Presentation	[Recent ASCE Journal of Transportation Engineering Editorials](#)
Presentation	[12-16-21_CCAC_Caldwell_wtGqxwz.pptx](#)
Presentation	[12-9-21_Part_1_Penn_State_Executive_Education_Slides_mCwfYyq.pptx](#)
Publication	[Driver Warning Technologies and Partial Vehicle Automation: Save Lives and Money](#)
Progress Report	[358_Progress_Report_2022-03-30](#)

Conclusion and Recommendations

Building off results in phase 3 (2020/2021) of this research, battery electric vehicle technology has dominated automotive industry news and investments in the past year. Companies have significantly expanded EV models but still cannot meet consumer demand. With increasing supply chain concerns of both semi-conductors (which EVs require more than ICEs) and batteries, there was a trend from automotive companies to invest in US vehicle and battery manufacturing facilities. There was also a growing trend in electric delivery trucks, transit busses and small boats and aircraft followed by applications for hydrogen for class 8 trucks, trains and ships. With significant federal investments, state are developing and implementing plans for deployment of public fast-charge (20-30 min) EV facilities.

For automated vehicles the first fully driverless vehicles commercial taxi vehicles were permitted both in the US and China and Germany permitted the first level three ADAS systems. But the more significant commercial investments of in AVs were with automated and fully driverless trucks particularly in Arizona and Texas delivering freight on regular routes for customers. Applications of advanced air mobility and personal delivery devices continue to progress. Digital Twinning of both infrastructure and transportation operations along with virtual, augmented and parallel reality applications have been trending rapidly in the media.

With significant federal transportation investment from the IIJA we recommend future research on tracking industry trends related to this funding and the federal priorities of equity, climate change mitigation, safety improvement and strengthening the economy.