



California State University
Transportation Consortium

SB 1 Research Activities 2018-2020 / Research Plan 2020-2021

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1. Overview

The California State University Transportation Consortium (CSUTC) unifies and focuses the efforts of four outstanding CSU campuses that represent and support the geographical, cultural, racial, and socioeconomic diversity that makes California, and the CSU system, strong: (1) CSU Chico – California Pavement Preservation Center; (2) CSU Fresno – Fresno State Transportation Institute; (3) CSU Long Beach – Center for International Trade and Transportation/College of Engineering; and (4) San José State University – Mineta Transportation Institute. CSUTC is led by the Mineta Transportation Institute (MTI) at San José State University, a federally-funded University Transportation Center since 1991.

CSUTC researches safe, reliable solutions that increase the mobility of people and goods and strengthen California's economy. CSUTC research aligns with SB1 priorities related to congestion relief (including traffic management systems), trade corridor enhancements, improved transit and rail, pedestrian and cyclist safety projects, as well as maintenance and rehabilitation for California's road and bridge infrastructure. Specifically, CSUTC research is designed to achieve the following objectives:

- **Objective 1:** Leverage new technologies, including vehicle automation, and innovative processes to achieve a seamless, multimodal surface transportation system that integrates with other “smart city” investments.
- **Objective 2:** Develop tools and approaches, such as life-cycle cost analysis, that will identify cost-effective materials and methods to facilitate road and bridge rehabilitation/maintenance decision-making and improve the long-term benefits of transportation investments.
- **Objective 3:** Develop advanced solutions for the application of new materials, design, and technologies to address long-term road and bridge maintenance and pavement/concrete rehabilitation needs.
- **Objective 4:** Create safer communities, increased access to transit, and greater opportunities for use of active transportation modes (i.e., biking and walking) through complete streets and innovative land use planning so that people of all abilities and socioeconomic levels enjoy the same opportunities for learning, living, labor, and leisure.
- **Objective 5:** Maximize opportunities for California's cap-and-trade program to reduce the impact of transportation on climate change.
- **Objective 6:** Promote intermodal connectivity, station development, and innovative finance solutions for multimodal transit centers.

- **Objective 7:** Inform and improve decision-making on transportation-related issues through timely, relevant and nonpartisan public opinion polling of Californians.
- **Objective 8:** Optimize passenger and freight movements to improve mobility of people and goods through development of more accurate data models and advanced congestion management tools to achieve trade and commute corridor improvements.

2. Summary of Research Activities

This section summarizes research projects and publications across the Consortium since 2018. To date, **97 research projects have been funded across the CSU system**, including projects selected for Year 3, which are described in detail.

Table 1. Summary of Research Activities Across the California State University Transportation Consortium, by Year

Description	Number
<i>Year 1 Funding: 2018-19</i>	
Number of projects funded	32
Number of CSU campuses represented (based on PI's home campus)	10
Number of projects published to date ^a	28
<i>Year 2 Funding: 2019-20</i>	
Number of projects funded	35
Number of CSU campuses represented	9
Number of projects published to date ^b	3
<i>Year 3 Funding: 2020-21</i>	
Number of projects funded	30
Number of CSU campuses represented	6
Number of projects published to date ^c	1

^a Two projects in peer review and/or editing, two projects in progress

^b Sixteen project in peer review and/or editing, sixteen projects in progress

^c Twenty-nine projects in progress

To date, 32 research reports have been [published to the CSUTC website](#). These are summarized in Table 2 and show the breadth of research undertaken system-wide funded through the Consortium. All reports are peer-reviewed, professionally edited, and formatted with a consistent style to represent CSUTC. Currently, research teams are working on 47 individual projects, while 18 draft reports have been submitted and are in the peer review/editing/formatting process. **A total of 12 unique CSU campuses have received project funding** (based on PI's home campus).

Table 2. Published CSUTC Research Reports

	Report Title
1	A New Materials and Design Approach for Roads, Bridges, Pavement, and Concrete
2	A Supercapacitor-based Energy Storage System for Roadway Energy Harvesting Applications

3	Aging of Fiber Reinforced Elastomeric Bridge Bearings
4	Automated Measurement of Heavy Equipment Greenhouse Gas Emission: The Case of Road/Bridge Construction and Maintenance
5	Bridge Monitoring Using a Digital Camera: Photogrammetry-Based Bridge Dynamic Deformation Monitoring
6	Collaboratively Connecting: Public Polling as a Foundation for Integrated Transportation Decision-Making Networks
7	Critical Issues in Trucking Workforce Development
8	Developing a Computer Vision-Based Decision Support System for Intersection Safety Monitoring and Assessment of Vulnerable Road Users
9	Developing a Fair Accessibility Framework through Green (Non-Auto) Transportation Modes for Fresno, California
10	Development of a Quality Control Method and Guidelines for Hot Mix Asphalt Using Recycled Concrete Aggregate
11	Geospatial Information Tools in the Service of Mobility and Transportation
12	Green Strategies for Design and Construction of Non-Auto Transportation Infrastructure
13	Green Up Pavement Rehabilitation Design Tool
14	Harmonizing Climate Change Mitigation and Adaptation in Transportation and Land-Use Planning in California Cities
15	Image-Based Remote Measurement of Retro-Reflectivity of Roadways Assets in the Daytime
16	Literature Review on Performance, Best Practices, and Training Needs for Chip Seals, Slurry Surfacing, and Cape Seal
17	Local Government Policy and Planning for Unmanned Aerial Systems
18	Manual for Cape Seals
19	Manual for Chip Seals
20	Manual for Slurry Surfacing
21	Moving from Walkability? Evaluation Traditional and Merging Data Sources for Evaluating Changes in Campus-Generated Greenhouse Gas Emissions
22	Numerical Investigations of Air Flow Around a Model Freight Truck with a Rear Active Flow Control
23	Reducing NOx Emissions of Cargo Handling Equipment (CHE) with Humid Air Systems
24	Sensitivity Analysis on Semi-Circular Bending Tests Using the Plackett-Burman Matrix
25	The "GO-Virtual Initiative": Using Flexible Workplace Practices to Reduce Traffic Congestion, Increase Economic Development, and Provide More Access to Affordable Housing Choices in the South Bay Region of Los Angeles County
26	The Future of California Transportation Revenue
27	The Geographic Disparities in Transportation-Related Physical Activity in the United States: An Analysis of the 2017 NHTS Data
28	The Impact of COVID-19 on California Transportation Revenue

29	The Impact of ZEV Adoption on California Transportation Revenue
30	The People Behind the Wheel: Exploring the Policy Changes, Job Characteristics, and Social Stressors Driving Turnover Among California Truck Drivers
31	Underpinnings of User-Channel Allocation in Non-Orthogonal Multi-Access for 5G
32	Youth Design the Future of Transportation for Their Community

3. Consortium Highlights

Developing a transportation workforce that possesses the skills needed to plan, design, deploy, operate, and maintain transportation systems that may not even exist today presents a unique and exciting challenge. As a Consortium, we engage with industry leaders on an ongoing basis to identify emerging career pathways, continually review and revise their existing K-12 and workforce development programs, find creative ways to attract potential entrants, and not only provide participants with the skills they need today but inspire them to lead the way into the future.



Figure 1 CSUTC Partners at TRB Annual Meeting 2020

To ensure collaboration and seamless integration, Consortium partners met in-person at the annual TRB meeting to share progress, discuss future opportunities, and to maintain connectivity. The following section presents highlights from across the Consortium.

Technology Transfer

Faculty and students affiliated with CSUTC engage in a wide range of technology transfer activities including conference presentations, journal publications, media outreach, briefings, and other efforts to ensure that research is accessible to practitioners. Since inception in 2018, there have been **more than 58 presentations by CSUTC researchers at conferences and professional meetings.**

At the request of the California Transportation Commission (an entity responsible for “programming and allocating funds for the construction of highway, passenger rail, transit and active transportation improvements throughout California”), MTI’s Dr. Asha Weinstein Agrawal led a team of researchers to estimate the [impact of COVID-19 on California Transportation Revenue](#). This research was funded using SJSU’s dedicated funding for high-priority research needs. MTI hosted a [webinar](#) on this research that attracted more than 375

registrants. In addition, Dr. Agrawal provided a brief to the California Transportation Commission on the research findings on May 13th and participated in a federal congressional briefing highlighting these same findings on May 14th.

Dr. Agrawal briefed the California Senate Transportation Committee on her CSUTC-funded research looking at the [future of transportation revenues in California](#). Dr. Agrawal also participated in an experts roundtable discussion for the National Governors Association on her CSUTC-funded research on [transportation funding in an era of electric vehicle deployment](#). **Both of these projects were direct research requests from California legislators as part of MTI's "rapid-response" program.**

Dr. Hamid Rahai (CSU Long Beach) has filed **two provisional patents** based on funded research completed through the Consortium: "Reducing Drag of Trucks with Rotating Wire-wrapped Cylinders System" and "System and Method for Reducing NOx Emissions of Cargo Handling Equipment (CHE)."

In collaboration with the UC-ITS program, MTI co-sponsored a [webinar](#) for CSU and UC researchers to introduce new California Department of Housing and Community Development (HCD) datasets. This event brought researchers together from both California university systems and enabled participants to network with representatives from HCD to facilitate additional research collaborations.

An important goal for the Consortium is to ensure that research moves into practice. A high-priority research project funded by MTI and led by CSU Long Beach faculty member, Dr. Shailesh Chandra, looks at railway grade crossings. This work was presented at the TRB annual meeting and resulted in interest from a number of companies and agencies. For example, *Texas Central*, a firm overseeing the development, design, construction, finance and operation of the high-speed rail line between Dallas/Fort Worth and Houston, expressed interest in the financing mechanisms the research has identified for separating at-grade crossing. Similarly, *R.L. Banks & Associates* connected with the research team to better understand how the research findings could inform their own work. In addition, ***Michigan Department of Transportation is planning to use the tool developed*** from the research within their railroad infrastructure section.

CSUTC partner, CSU Chico, continues to emphasize technology transfer through their California Pavement Preservation Center. In addition to producing technical manuals, they develop education materials, provide training and staff development opportunities for pavement professionals, offer technical assistance to public agencies and industry, and publish a [quarterly newsletter](#) focused on latest innovations and information for pavement professionals.

The [2019 Fresno Regional Transportation Innovations Summit](#), co-hosted by CSUTC partner CSU Fresno and the Fresno Council of Governments, brought together transportation professionals and interested stakeholders to learn about the latest in advanced and clean transportation technologies. The Summit included presentations on a number of CSUTC-funded research.



Figure 2 Fresno Regional Transportation Innovations Summit

Leadership

CSUTC partners bring an outstanding record of state, national and international leadership and success in advancing transportation policy and generating solutions. Since forming, we have advised our state’s policy makers through such diverse venues as testimony; conference panels; briefings of senior policy makers and through board and committee service. Thought leadership and the representation of the CSU SB1 funded research and workforce development portfolio in multiple venues is critically important. To that end, following is a table of CSUTC Executive Director activities.

Organization	Service Role: Karen E. Philbrick, PhD
American Public Transportation Association (APTA) High-Speed and Intercity Passenger Rail Committee	Committee Member
APTA Mobility Restoration and Recovery Task Force (a COVID-19 Response)	Task Force Advisor
American Road and Transportation Builders Association (ARTBA)	Board Member and Executive Committee
ARTBA Research and Education Division	President
City and County Pavement Improvement Center, UC Davis Institute of Transportation Studies	Executive Committee
Council of University Transportation Centers (CUTC)	Immediate Past President
LA Metro Office of Extraordinary Innovation (OEI)	Advisory Board Member
Rotary Club of San Jose	Board Member
San Jose Spotlight	Transportation Columnist
Transit Advisory Committee for Safety (TRACS)	Committee Member (appointed by Secretary Chao)
Transportation Research Board AR010 Committee: Passenger Rail	Committee Member, Research Subcommittee Chair, and CRC Chair

Organization	Service Role: Karen E. Philbrick, PhD
Transportation Research Board AP080 Committee: Transit Safety and Security	Committee Member
Women in Transportation Seminar (WTS) Foundation Board	Board Member Secretary

Workforce Development

CSUTC engages with the future of the transportation workforce in a number of different ways, including through research opportunities. Specifically, all of the Consortium’s full-scale research projects are required to include students on the research team. These students benefit from working closely with faculty mentors. As an example, Siddharth Satani, a student at CSU Los Angeles, worked with Dr. Mehran Mazari on a CSUTC-funded research project. His thesis grew out of this work and upon graduation he was *immediately hired as a transportation engineer by Mott MacDonald*. Another of Dr. Mazari’s students, Joshua Garrido, received a prestigious **Eisenhower Transportation Fellowship**.

CSU Fresno student, Roshanak Farshipour, received the **2019 Outstanding Civil Engineering Student Award** from both the ASCE San Francisco and ASCE Fresno sections. She worked on the research team led by Dr. Maryam Nazari, whose CSUTC-funded work received the **Outstanding Research Project of the Year award** from the ASCE San Francisco section. Another of Dr. Nazari’s students, Faiaz Rahman, won the **Outstanding Oral Presentation at the 40th Annual Central California Research Symposium**.



Figure 3 CSU Fresno's Dr. Maryam Nazari

The CSUTC-UC partnership to establish the City and County Pavement Improvement Center has **trained over 600 pavement professionals around the State**.

In addition, 2 new online courses have been developed. This multi-campus partnership involves CSU faculty from SJSU, Cal Poly SLO, CSU Chico, and CSU Long Beach along with UC Davis and UC Berkeley.

CSU Fresno, through their CSUTC partner funding, **supports students to present research** at conferences. Linda Lim, mentored by Dr. Aly Tawfik, presented her research at two conferences with support from CSUTC. Ms. Lim started her doctoral studies in transportation engineering at the University of Virginia in Fall 2020.



Figure 4 CSU Fresno's Dr. Christian Wandler interviewed by KSEE

As part of the Fresno State Transportation Challenge, faculty and students from CSU Fresno have engaged with students at West Fresno Elementary School and Abraham Lincoln Middle School to improve transportation issues in the Central Valley. Project director, Dr. Christian Wandler, was interviewed by KSEE TV about the project.

4. Year 3 Detailed Research Activities

Consortium activities for Year 3 followed a similar pattern as the previous two years. First, each partner received a modest amount of funding to complete high-priority research projects aligned with SB1. CSU Fresno and Long Beach both ran internal competitions, while CSU Chico focused on high-priority pavement research through the California Pavement Preservation Center. SJSU/MTI focused on high priority projects that were identified by key stakeholders – including transit agency CEOs, members of the California State Legislature, and others. Second, a CSU-wide competitive RFP process was led by MTI/SJSU. Selected projects are summarized below.

A. CSUTC Partner Research

1. CSU Chico

CSU Chico, through the California Pavement Preservation Center (CPPC), is focusing their Year 3 research efforts on high-priority pavement research. Specifically, their research this year focuses on the development of a thin asphalt overlay manual and training materials for pavement professionals. This will be combined with training materials produced during the two previous years to develop an online workshop and certification program for pavement preservation. Key personnel include: DingXin Cheng, R. Gary Hicks, and Lerosé Lane.

2. CSU Fresno

CSU Fresno, through the Fresno State Transportation Institute (FSTI), conducted an internal competitive RFP, which funded eight research projects. The table below lists project titles and principle investigators.

Project Title	PI
Detecting Driver Drowsiness with Multi-Sensor Data Fusion Combined with Machine Learning	Hovannes Kulhandjian
Developing an Effective Targeted Mobile Application to Enhance Transportation Safety and Use of Active Transportation Modes	Samer Sarofim

in Fresno County: The Role of Application Design, Content, and Messaging	
Do California Residents Save Money on Transportation Costs by Living in Transit-Oriented Developments?	Hongwei Dong
Does Accessibility Affect Your Cycling Exercise? A Geographically Weighted Regression (GWR) Model to Investigate the Effects of Access to Multi-Use Paths	Chih-hao Wang
Examining the Effects of Precision Scheduled Railroading on Intercity Passenger and High Speed Rail Service	John Green
Fresno State Transportation Challenge	Christian Wandeler
Spatio-Temporal Analysis of the Roadside Transportation Related Air Quality (STARTRAQ) and Neighborhood Characterization	Jaymin Kwon
Taming the Data in the Internet of Vehicles for Greater Community Livability	Shahab Tayeb

3. CSU Long Beach

CSU Long Beach ran an internal competitive RFP through TRANSPORT, Transportation Research & Training, a collaboration between the College of Engineering and the Center for International Trade & Transportation. Eight projects were selected for funding. The table below lists project titles and principle investigators.

Project Title	PI
Developing a Solution-based Coating Process to Fabricate the Nanomaterial-coated Polymers as Asphalt Modifiers	Ehsan Barjasteh and Sara Moghtadernejad
Evaluating Innovative Financing Mechanisms for the California High-Speed Rail Project	Shailesh Chandra
How Do Environmental Factors Affect Driver's Gaze Direction and Head Movements?	Vahid Balali
Investigation of the Use of Polymers to Enhance the Performance of Recycled Asphalt Pavement (RAP)	Shadi Saadeh
Large Eddy Simulation of Wind Shear from Passing Vehicles- Experimental Verifications	Hamid Rahai
Novel Eco-friendly and Recycled Composites for Improved California Road Surfaces	Daniel Whisler
Virus Transport Aboard a Public Bus	Hamid Rahai
Wastewater-derived Ammonia for a Green Transportation Fuel	Joseph Kalman and Maryam Haddad

4. San José State University (Research and Workforce Development Activities)

SJSU, through the Mineta Transportation Institute, has undertaken three research projects as well as a collaboration with the University of California through the City & County Pavement Improvement Center. MTI has also retained a small component (~10%

of funding) to respond to additional high priority research needs as identified by the California State Legislature.

Project Title	PI
Critical Issues in Trucking Workforce Development ^a	Tom O'Brien
Deriving Commuting Data from Tweets	Laxmi Ramasubramanian
Utility Fee to Fund Transit in California	Shishir Mathur
^a This project was requested by Assemblymember Frazier. It has been completed and published to the CSUTC website .	

In addition to these research projects, MTI once again hosted the annual Garrett Morgan Sustainable Transportation Competition. This year, four California schools entered the competition. Due to challenges associated with COVID-19, one school had to drop out. [California Montessori Project](#) school won 1st place for their project 'Fast. Easy. Smart: A Sustainable AV Plan for Cities,' which proposes a system for the deployment of autonomous vehicles that meets societal needs as well as safety and environmental concerns. [Aptos Middle School](#) took 2nd place and [American Indian Child Resource Center](#) in Oakland placed 3rd.

MTI will host Paying for Transportation in California: Does COVID-19 Change Everything? in partnership with the Commonwealth Club of California on June 26, 2020.

Description: The COVID-19 pandemic threatens every aspect of transportation funding in California. State revenues from federal, state, regional and local taxes and fees are all at risk. Since California's shelter-in-place order went into effect in March, the state has already faced plummeting revenues from gasoline taxes, tolls, transit fares and sales taxes. These revenue sources will most likely continue to be severely threatened in the coming months and possibly even years. David Kim, Secretary, California State Transportation Agency, will keynote the event. Panelists include: Nuria Fernandez, Chair, American Public Transportation Associate, General Manager and CEO, Santa Clara Valley Transportation Authority; Dr. Ash Weinstein Agrawal, Director MTI's National Transportation Finance Center; Carl Guardino, President and CEO, Silicon Valley Leadership Group, and Therese Watkins McMillan, Executive Director, Metropolitan Transportation Commission.

B. CSU-wide Competitive RFP Process

MTI/SJSU, in collaboration with the CSU Chancellor's Office, implemented the Year 3 CSU-wide RFP process using the following approach.

- Research needs statements solicited from Caltrans, California Transportation Commission, California State Legislature (through Assemblymember Frazier and Senator Beall), City of San Jose Department of Transportation, CSUTC partners, MTI's Board of Trustees, transit agency CEOs, and others. Fourteen targeted research needs were incorporated into the final RFP.

- RFP (available on InfoReady) distributed to CSU campuses on December 16, 2019 with a deadline to submit February 3, 2020.
- Evaluation rubric based on criteria and weighting listed in the RFP developed for reviews. *Proposals submitted based on targeted research needs received a 10% bonus on their rubric score.*
- Proposals categorized by objective and assigned to subject matter experts for initial review. A total of 31 non-CSU affiliated subject matter experts were identified for this first stage of review.
- Five proposals addressing targeted research needs were ranked in the top 10 of all proposals received. After a final review by the stakeholder submitting the research need, and an agreement that the stakeholder would serve as an external project advisor, these five proposals were selected for funding.
- The remaining top-scoring proposals were then reviewed by panel of five professionals composed of three non-CSU-affiliated academics and two professionals representing Caltrans and the California Transportation Commission. The panel met via video conference on April 9, 2020.
- Final additional set of 5 proposals selected for funding.
- Announcements regarding funding decisions sent to PIs on April 17, 2020.
- Subcontract agreements are in process.

Summary of Proposals Received

A total of 32 proposals were received from ten CSU campuses (see Figure 1).

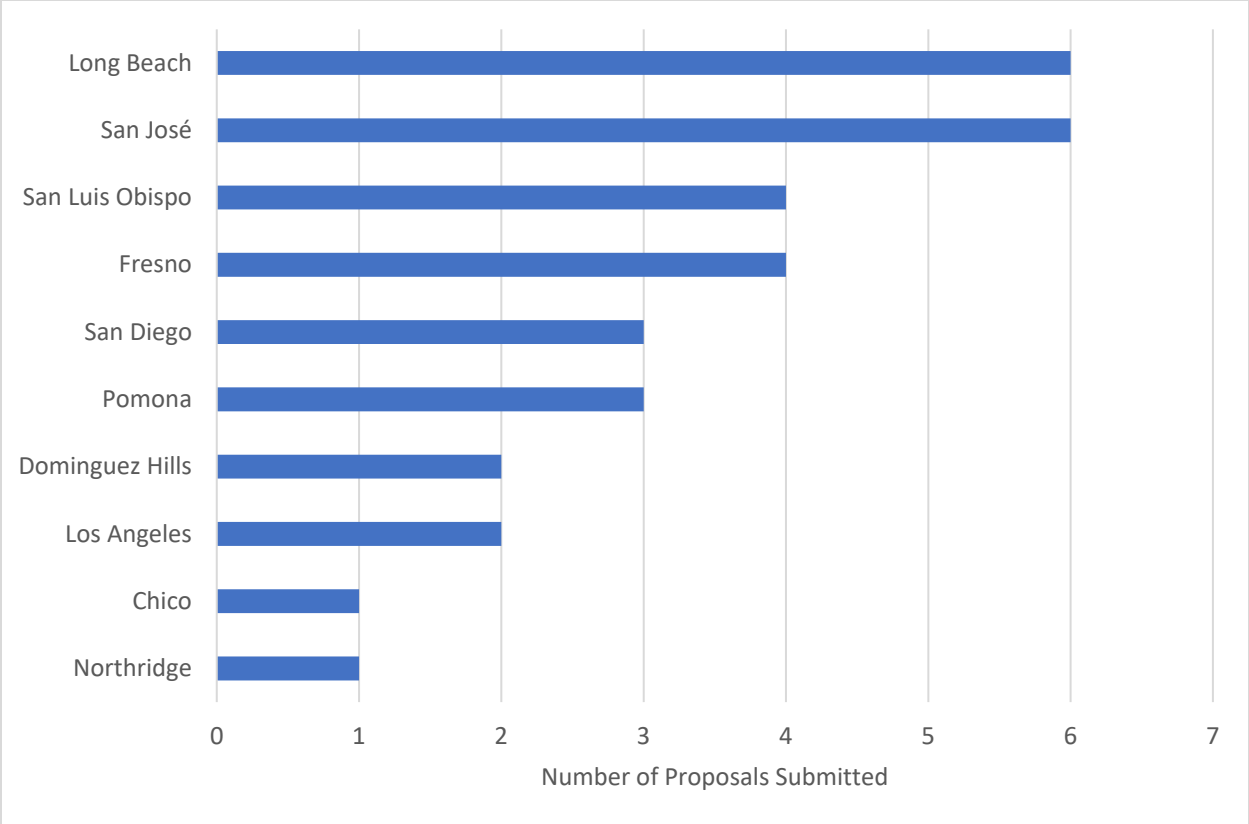


Figure 5 Summary of Proposal Submissions, by Campus

Summary of Proposals Awarded

Ten projects were selected for funding by the review panel and five CSU campuses are represented among the PIs. Subcontracts are in process between the SJSU Research Foundation and the respective campus Offices of Sponsored Programs. MTI provided each PI with detailed information regarding managing their project and submitting regular progress reports.

Title	PI	CSU Affiliation	Award \$
Achieving Excellence for California’s Freight System: Developing Competitiveness and Performance Metrics Incorporating Sustainability, Resilience, and Workforce Development	Jian-yu Ke	CSU Dominguez Hills	\$69,489
Analyzing the Relationship Between Mandatory Helmet Use Regulations and Adult Cyclists’ Behavior in California	Fatemeh Davoudi	San José State University	\$74,948
Central Valley Transportation Challenge	Christian Wandeler	CSU Fresno	\$74,999
Comprehensive Performance Assessment of Passive Crowdsourcing for Counting Pedestrians and Bikes	Wen Cheng	Cal Poly Pomona	\$75,000

Creating Safer Communities for Use of Active Transportation Modes in California: The Development of Effective Communication Message Strategy and Outreach for Vulnerable Road Users	Samer Sarofim	CSU Fresno	\$74,869
Developing a Feasible Business Model for Expanding the EV Market to Lower Income Californians	Aly Tawfik	CSU Fresno	\$74,928
Post-Earthquake Rapid Structural Damage Detection and Damage Localization in Bridges Using Low-Density Sensor Arrays	Mehran Rahmani	CSU Long Beach	\$74,996
Promoting Interest in Transportation Careers Among Female Youth	Eugene Cordero	San José State University	\$74,982
Safeguarding Equity in Off-Site Vehicle Miles Traveled (VMT) Mitigation in California	Serena Alexander	San José State University	\$74,827
Trip Scheduling and the Cost of Congestion: Estimates Using Travel Diary Data and Big Data	Jinwon Kim	CSU Long Beach	\$66,984

C. Final Publication Process

All research projects undertaken as part of the CSUTC results in a final report. Research teams submit a draft version of the report to MTI and MTI manages a technical peer review, professional editing and formatting, and publication of the final report on the CSUTC website. Finally, to move research results into practice, a robust technology transfer program is used, including promotion via press releases, social media, newsletters, as well as the CSU Transportation Research Spotlight in Sacramento.

CSUTC remains dedicated to addressing the complex nature of today’s mobility challenges to advance the body of usable transportation knowledge and identify implementable solutions for California.