# UTC Semi-Annual Progress Report (SAPR) #10

| | |
|---|---|
| Submitted to: | U. S. Department of Transportation,<br>Office of the Assistant Secretary for Research and Technology (OST-R) |
| Federal Grant Number: | 69A3551747135 |
| Project Title: | Tier 1 University Transportation Center: Cooperative Mobility for Competitive Megaregions ($CM^2$) |
| Center Director: | Dr. Ming Zhang, zhangm@austin.utexas.edu, (512) 471-0139 |
| Submitting Official: | Ms. Sandra Ciarletta, sandrac@austin.utexas.edu, (512) 471- 1291 |
| Submission Date: | April 29, 2022 |
| DUNS Number: | 170230239 |
| EIN Number: | 74-6000-203 |
| Recipient Organization: | The University of Texas at Austin<br>Office of Sponsored Projects<br>3925 West Braker Lane<br>Building 156, Suite 3.11072<br>Austin, TX 78759-5316 |
| Recipient Identifying No: | OSP 201601311-001 |
| Grant Period: | November 30, 2016 – September 30, 2022 |
| Reporting Period End Date: | March 31, 2020 |
| Report Term Frequency: | Semi-Annual |
| Signature of Submitting Official: | Sandra Ciarletta<br>Digitally signed by Sandra Ciarletta<br>DN: C=US, OU=University of Texas at Austin, O=CM2, CN=Sandra Ciarletta, E=sandrac@austin.utexas.edu<br>Reason: I attest to the accuracy and integrity of this document<br>Location: your signing location here<br>Date: 2022-04-28 13:06:35<br>Foxit PhantomPDF Version: 9.7.5 |

TABLE OF CONTENTS

# 1. ACCOMPLISHMENTS

## A. Goals and Objectives

CM$^2$ is committed to advancing research, education, and technology transfer initiatives to improve mobility, promote equity, and enhance the economic competitiveness of urban and rural communities in megaregions.

- We aim to become a leading Tier 1 center specialized in megaregion mobility research. Our goal is to offer advice on strategic transportation planning, smart infrastructure investments, and informed policy-making.
- We provide high-quality transportation education and workforce development and work to connect research with practical actions.
- We promote multimodality ranging from HSR to slow-moving transportation such as walking and bicycling for diverse populations and communities. We facilitate public-private partnerships for freight mobility planning and operation efficiency.

## B. Accomplishments under These Goals

### *i. Research Accomplishments*

Throughout this reporting period, the grant funded 23 researchers and 48 students. Research teams were involved in a series of projects analyzing data, laws, policies, and technologies as well as developing solutions through modeling and analysis for cooperative mobility in megaregions. Table 1 outlines the projects completed by the end of this reporting period.

**Table 1: Completed Projects by Partner Institutions and PIs**

| Project Title | Partner | Principal Investigator | Funding Year | Project Status |
|---|---|---|---|---|
| Spatiotemporal Traffic Characteristics of Megaregion Mass Evacuations | LSU | Brian Wolshon | Year 3 | Complete |

### *ii. Education Accomplishments*

Shunhua Bai and Jiani Guo were selected as recipients of the ACSP Diversity and Inclusion Student Fellowship Award for their project, "Uncover Disparities of COVID-19 Outbreaks in the U.S. Megaregions based on Critical Socioeconomic and Public Health Indicators" during the ACSP 61$^{st}$ Annual Conference in October 2021. Shunhua Bai and Jiani Guo are Ph.D. students in the Community and Regional Planning program at the University of Texas at Austin with a concentration in transportation planning and urban informatics.

CM$^2$ Administrative Graduate Research Assistant Tressa Olsen and fellow University of Texas at Austin students received the Student Project Award for the practicum class thesis project "Drowning in Disinvestment: Addressing historic inequities in stormwater infrastructure in disaster recovery planning in Houston, Texas" during the Texas American Planning Association Conference in November 2021.

$CM^2$ Partners selected Joshua Davidson for the UTC Outstanding Student of the Year in 2021. Joshua Davidson is a doctoral candidate in the Department of City and Regional Planning at the University of Pennsylvania. His current research focuses on transportation equity and geography. He is currently conducting a mixed-methods study of how transit users learn about and ultimately change their route choices, in addition to a project that models the ways that residential displacement impacts commute time. In addition to being recognized as $CM^2$'s Outstanding Student of the Year award recipient, Rebecca Sanders – the Chair of the Standing Committee on Bicycle Transportation of the TRB, invited Joshua to present his $CM^2$-supported research paper, "Broadening Bike Share's Reach: Measuring the Equity Impacts of the COVID-19 Pandemic on Use Patterns in Philadelphia, PA" during the Bicycle Transportation Committee meeting of the TRB 101st Annual Meeting in January 2022.

In addition to our students' achievements, $CM^2$ researchers also received recognition for their expertise and contributions to their fields of research. Drs. Junfeng Jiao and Ming Zhang were honored by Smart Cities Connect at the 5th Annual Smart Cities Awards ceremony on April 4, 2022 in Columbus Ohio for their collaborative research project, "Austin AI Housing Analysis" with the City of Austin. Additionally, Dr. Zhang received a Faculty Innovation Grant award from the Office of the President of the University of Texas at Austin. This grant will support Zhang's research project to develop a multi-objective optimization tool for Equitable Transit-Oriented Development (ETOD) planning in transit corridors.

### *iii. Outreach/Engagement Accomplishments*

On November 16, 2021, $CM^2$ hosted an all-virtual Fall Exhibition where $CM^2$ research faculty and students were invited to present their ongoing research projects for the $CM^2$ grant. The 2021 Fall Exhibition was made available online through the $CM^2$ website and the Texas Architecture YouTube channel, which featured a digital presentation booklet, video presentations, and an online poster session for new and ongoing $CM^2$ research projects. Students, faculty, and online visitors could discuss the research topics, research design, challenges, and current/expected findings during the online exhibition event. The 2021 Fall Exhibition highlighted several research projects being conducted by $CM^2$ doctoral students, including Shengxiao Alex Li from the University of Pennsylvania, and the research projects of Jiani Guo, Ziqi Liu, and Yang Li from the University of Texas at Austin.

Several $CM^2$ researchers and students attended the all-virtual 61st Annual Association of Collegiate Schools of Planning (ACSP) Conference on November 2021. Dr. Ming Zhang and UT Austin PhD candidate Ziqi Liu presented their paper, "What Factor Contributes the Most to Regional Convergence? An Exploratory Analysis on US Megaregions". Dr. Junfeng Jiao and Ph.D. candidate Yefu Chen presented their paper, "Examining the Spatial Patterns of Covid-19 Cases in Austin and Houston, Texas". Dr. Gian-Claudia Sciara presented her abstract with the pre-organized session, "Transportation Funding, Energy Transition, and Governance: The Role

of State Legislators". A full schedule of CM$^2$-related presentations was published online on our website.

On January 9th-13th, 2022, the TRB 101st Annual Meeting was held in-person in Washington, DC. This event included thousands of transportation administrators, practitioners, policymakers, and researchers who came to DC and participated in more than 400 workshops, lectern sessions, and poster sessions, as well as nearly 400 committee meetings. Many of our researchers and students attended this year's TRB conference, including Dr. Gian-Claudia Sciara, Dr. Erick Guerra, Dr. Megan Ryerson, and Ph.D. candidates Joshua Davidson, and Mashrur Rahman. Mashrur Rahman presented his research paper, "Airport Competition and Megaregional Impacts: Challenges and Opportunities for Planning" during the Aviation Administration and Policy Committee meeting, while Joshua Davidson presented his CM$^2$ supported research paper, "Broadening Bike Share's Reach: Measuring the Equity Impacts of the COVID-19 Pandemic on Use Patterns in Philadelphia, PA" during the Bicycle Transportation Committee meeting.

*Image of UT Austin Ph.D. candidate Mashrur Rahman presenting during the Aviation Administration and Policy Committee meeting during the TRB Annual Meeting in January 2022*

Several CM$^2$ researchers attended regional and national symposiums as panel presenters during the reporting period. CM$^2$ researcher Brian Wolshon attended the Research to Practice Transit Symposium hosted by the University of Florida Transportation Institute on October 12-14, 2021, where he presented, "Transit Supported Hurricane Mass Evacuation". Additionally, Dr. Wolshon attended the Institute of Transportation Engineers (ITE) Student Chapter at Florida A&M University Student Leadership Summit 2022 on February 4-6, 2022 in Tallahassee, Fl. He participated in the technical session panel presentation "Disaster Management and Resilient Transportation". Dr. Alex Karner and Dr. Junfeng Jiao hosted separate panels during the University of Pennsylvania Carey Law School's 41st Annual Edward V. Sparer Symposium, "Moving Toward Liberation: Transportation and Mobility Justice," on February 11, 2022. Their panel presentations were entitled, "At a Crossroad: Mobility and Access to Resources" and, "Bought-In & Gridlocked Out: Communities without Transportation Access", respectively.

On March 17, 2022 the Weitzman School of Design at University of Pennsylvania hosted an official Book Launch symposium for the CM$^2$ book *Megaregions and America's Future*, released by the Lincoln Institute of Land Policy (LILP) and distributed by Columbia University Press in

March. The in-person symposium event brought together the book's co-authors Robert Yaro, Fritz Steiner, and Ming Zhang for a closer look at the untapped potential of megaregions for planners, policy makers, academics, and decision makers in transportation, environmental protection, and development agencies. The symposium featured a panel with the co-authors and guest speakers, followed by discussion and Q&A sessions for the in-person audience. Lisa Servon, The Kevin and Erica Penn Presidential Professor and Chair of the Department of City and Regional Planning, of the Weitzman School of Design provided introductory remarks. Fritz Steiner presented "Building Environmental Resilience and Ecosystem Services", Ming Zhang discussed "Connecting People and Places", and Robert Yaro "Making it Happen: Realizing the Vision for America's Megaregions". Barbara Faga, Professor of Professional Practice in Urban Design at Rutgers University provided closing remarks.

$CM^2$ consortium partner TSU has been conducting research showing vulnerability of people living in the megaregion interstices (nonurban areas between the major Texas Triangle cities) and, secondarily, showing that transportation gaps decrease quality of living for these residents. These workshops brought together Metropolitan Planning Organizations (MPOs), public transit agencies, and social service agencies with the charge of thinking about vulnerable communities and incorporating megaregion equity variables in the MPO decision making process. Previously, $CM^2$ researchers Carol Lewis and Gwendolyn Goodwin hosted two regional workshops encouraging dialogue about identification of these communities, and explored research findings to-date with interested transportation organizations. During the last reporting period, TSU submitted a report regarding these workshops, which was distributed on the $CM^2$ website. A third workshop, "Crafting the Megaregion Problem Statement for Vulnerable Communities in Texas", was hosted in collaboration the Houston-Galveston Area Council (H-GAC) on March 31, 2022 via Zoom. This regional workshop was developed to continue the discussion of the workshop series, and consider strategies to increase implementation of projects that would benefit residents in the communities.

### *iv. Administrative Accomplishments*

Data analytics have shown a growth in the $CM^2$ website activity over the past six months. Audience page views showed 2,246 users with 2,212 new users visiting the website, and 4,169 page views. Over half of the CM2 website audience are users from the United States (60.6% users), while the remaining user demographics hail from a variety of countries including Canada, Peru, Australia, and China.

We have continued developing our Twitter account to disseminate news and information about CM2 related events. The account earned over 27,139 new impressions, which is defined as the number of times users saw our tweets on Twitter. These impression numbers represent a 26% increase from the previous reporting period. Our account has 229 followers (+10%) and 13,486 profile visits, which is an incredible 195% increase from the last reporting period of 6,891 profile visits. This increase is due to a collaborative social media PR campaign between the Lincoln

Institute Land Policy (LILP) CM$^2$, the UT Austin School of Architecture, and the Weitzman School of Design in advanced of the publication of the CM$^2$ book, *Megaregion's and America's Future*.

The CM$^2$ LinkedIn company page and the CM$^2$ LinkedIn Group serve as a space where CM$^2$ researchers, students (past and present), and transportation industry partners can connect with each other, share recent developments in research, mention professional accomplishments, and list awards. At submission of this report, the LinkedIn Group has a total of 103 members, while the LinkedIn company page has increased from 182 members to 206 members over the past six months.

Additionally, the CM$^2$ administration team published the Fall 2021 newsletter during this reporting period, as well as sent out event invitations to our subscribing audiences regarding the *Megaregion's and America's Future* book launch symposium and the TSU-led megaregion regional workshop event in March 2022. Our current newsletter email list has 189 subscribers (+11%).

We will continue to utilize and expand our social media platforms, including engagement of the CM$^2$ LinkedIn company page, CM$^2$ LinkedIn Group, and our Facebook page.

## C. Dissemination of Results

The results of work completed to date has included one final project report disseminated on the CM$^2$ website. CM$^2$ researchers gave twenty-one presentations at conferences and lectures both in-person in the US, and online for virtual and international events. Twenty-five refereed journal papers have been published during the past six months. Peer-reviewed articles from our researchers have been cited approximately 1701 times during the reporting period according to Google Scholar. All items are explored in more detail under Section 3.

## D. Plans for Next Reporting Period

During the next reporting period, the CM$^2$ consortium expects to see fourteen completed projects with final reports. Consortium researchers will continue to share the findings of their research through conference presentations and journal publications. As of this report publication, seven researchers already have plans to attend at least eleven conferences in-person or virtually including ACSP, WSTLUR, TRB, WRSA, and others in the next reporting period. The CM2 administrative team will continue to conduct outreach activities in-person and virtually, including a Fall 2022 CM2 Guest Speakers Series.

As reported previously, Dr. John Landis's book *Megaprojects for Megacities* will be published by Edward Elgar in the later part of 2022. Lisa Loftus-Otway will be submitting the draft of her co-authored book with Catherine Ross of Georgia Institute of Technology tentatively entitled, *Megaregion Law and Policy* to Edward Elgar. Dr. Qisheng Pan and Dr. Bumseok Chun will be developing a book proposal and a Special Issue Journal article, "Megaregion Truck Flow Estimation and Planning".

On April 1, 2022, the administrative team posted the following news release regarding the upcoming CM$^2$ Summer Forum:

In April 2021, the US DOT/OST-R announced an additional year of federal funding support to the original 35 UTC Program grant recipients of the FAST Act due to an extension legislation. The additional funding was awarded as a modification, extending the current grant period to September 2023.

In light of this extension, the executive committee members of the CM$^2$ Consortium made the decision to postpone the final CM$^2$ Summer Forum from June 7-8, 2022 to now be in Summer 2023. We hope that by postponing the final forum to coincide with the closeout period of the grant, CM$^2$ researchers and students will be able to share final results and celebrate consortium-wide accomplishments after seven successful years focused on collaborative megaregional transportation research. Additionally, with the continued impact of COVID-19 cases around the globe, we hope that by postponing the forum we can ensure a safer, in-person gathering at a time to be decided that increases attendance and ambition to help tackle the diverse issues surrounding megaregional transportation research and planning.

A decision on new dates is expected to be taken by the executive committee in September [2022]. Further updates and details will follow [on the CM$^2$ website].

# 2. PARTICIPANTS & COLLABORATING ORGANIZATIONS

## A. Organizations Involved as Partners

The members of the consortium include The University of Texas at Austin, Louisiana State University, Texas Southern University, and the University of Pennsylvania. For the most recent reporting period, CM$^2$ gained several new organizational partners, including Florida State University, Trinity Metro of Fort Worth, and more. Additionally, Table 2 presents a list of current CM$^2$ partners.

**Table 2: Current CM$^2$ Partners**

| Organization Name | Location | Contribution |
|---|---|---|
| Texas Department of Transportation (TXDOT) | Austin, TX | Data, In-kind Support |
| City of Austin (Austin Transportation Department) | Austin, TX | Data Support, Research |
| City of Houston (City Planning Department) | Houston, TX | Data Support |
| City of Dallas | Dallas, TX | Data Support |
| City of Austin Senior Centers | Austin, TX | Facilities, In-kind Support |
| Austin Asian- American Resource Center | Austin, TX | Facilities, In-kind Support |
| San Antonio Senior Sections | San Antonio, TX | Facilities, In-kind Support |
| City of Georgetown | Georgetown, TX | Data, In-kind Support |

| | | |
|---|---|---|
| Houston Metro | Houston, TX | Data Support |
| City of Philadelphia: Office of Transportation, Infrastructure, and Sustainability | Philadelphia, PA | Data Support |
| Southern Pennsylvania Transportation Authority (SEPTA) | Philadelphia, PA | Data Support, Teaching support |
| Delaware Valley Regional Planning Commission | Philadelphia, PA | Data, In-kind Support |
| Alamo Area Metropolitan Planning Organization | San Antonio, TX | Data Support |
| North Central Texas Council of Governments (NCTCOG) | Dallas, TX | Data Support |
| Houston Galveston Area Council (H-CAC) | Houston, TX | Data, In-kind Support |
| Capital Area Metropolitan Planning Organization (CAMPO) | Austin, TX | Data Support |
| Capital Metro- Austin Public Transit | Austin, TX | Data Support, Research |
| Houston APA Chapter | Houston, TX | Data, In-kind Support |
| Texas APA Chapter | TX | Student, In-kind Support |
| University of Southern California | Los Angeles, CA | Research |
| Florida Department of Transportation | Tallahassee, FL | Data support |
| Center for Transportation; Smart City Lab, University of Texas at Austin | Austin, TX | Research |
| Stephenson Disaster Management Institute at Louisiana Emerging Technology Center | Baton Rouge, LA | Facilities, Technical Contributions |
| Clemson University | Clemson, SC | Research |
| Embry-Riddle Aeronautical University | Randolph AFB, TX | Research, Technical Contributions |
| WTS (HoT Chapters, South West Region) | TX, OK, NM, AL, AK | In-Kind Support |
| Girlstart | TX | In-Kind Support |
| Georgia Institute of Technology | Atlanta, GA | Research |
| Jewish Community Center | Austin, TX | Facilities, In-kind Support |
| Tokyo Government | Tokyo, Japan | Student Support, Research |
| Tokyo Olympic Game Committee | Tokyo, Japan | Student Support, Research |
| Tokyo Metropolitan University | Tokyo, Japan | Student Support, Research |
| City of Austin Traffic Management Center | Austin, TX | Student Support |
| Austin Bergstrom International Airport | Austin, TX | Student support |
| Central Texas Regional Mobility Authority | Austin, TX | Student Support |
| Amazon SAT-2 Distribution Center | San Marcos, TX | Student Support |
| Lincoln Institute of Land Policy | Cambridge, MA | Research, Publishing Support |
| UT Good Systems Grand Challenge; University of Texas at Austin | Austin, TX | Research |
| Florida State University | Tallahassee, FL | Research |
| City of Arlington, Tarrant County | Arlington, Tx | Data Support |
| Trinity Metro, Fort Worth | Fort Worth, Tx | Data Support |

| | | |
|---|---|---|
| Austin Transit Partnership Architecture and Engineering Committee | Austin, Tx | Research |

## B. Other Collaborators or Contacts

Throughout the life-cycle of the CM2 consortium, the researchers of the CM$^2$ team have consistently promoted multi-jurisdictional collaboration between consortium members by setting aside funds specifically for multi-institutional proposals. Presently, there is one multi-institutional project currently in progress: "Utilize Crowd-Sourced Data and Machine Learning Technology to Enhance Planning for Transportation Resilience to Flooding" from Ming Zhang and Qisheng Pan.

# 3. OUTPUTS

Table 3 summarizes output performance metrics for the reporting period, as identified in the CM$^2$ Technology Transfer Plan. Subsections A-G provide a specific list of outputs.

**Table 3: Output Performance Metrics**

| Performance Metrics: Output | Annual Target | Actual for 10/1/21 -3/31/22 |
|---|---|---|
| **1. Publications, conference papers, presentations, or final project reports** | 10 | **26** (10 journal publications, 1 final report, 15 presentations) |
| *1.1 Publications: diversity of fields/journals submitted to (e.g. engineering, modeling, law, policy, geography, economics, infrastructure, etc.)* | 3 | **5** (Planning, Transportation, Travel Behavior, Environment, Sustainability) |
| *1.2 Conferences: by entity (e.g. TRB, APA, ASCE, WTS, SXSW, etc.)* | 2 | **3** (ACSP, TRB, ISCTSC) |
| **2. Workshops, seminars in collaboration with or participation of MPOs and transportation agencies** | 2 | 1 |
| *2.1 Type of activity* | 2 | 1 |
| *2.2 Type of professional organizations involved* | 2 | 1 |
| *2.3 Event scales/number of attendees (small (up to 10), medium (11-29), large (30 and up))* | 2 | 2 |
| **3. Web Presence** | n/a | n/a |
| *3.1 Website visits/page views* | 3,000 | 4,169 |
| *3.2 Number of impressions on Twitter* | 30,000 | 27,139 |
| *3.3 Number of additional members in LinkedIn Group* | 20 | 0 |

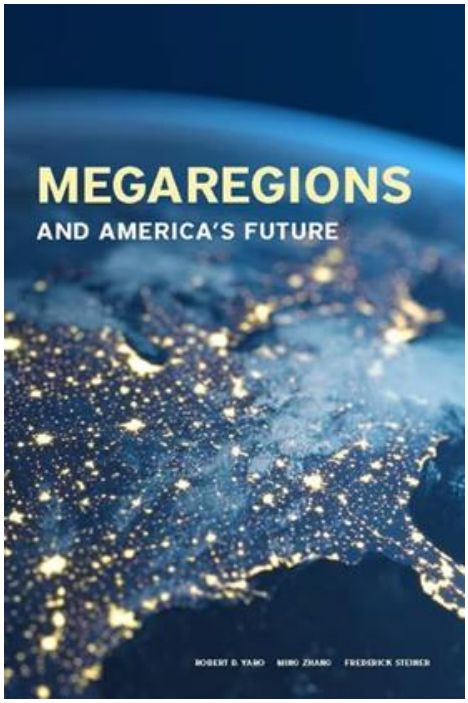
## A. Publications

### *i. Journal Publications*

- Guerra, E. and Ariadna R. “Examining behavioral responses to Mexico City's driving restriction: a mixed methods approach”. Transportation Research Part D: Transport and Environment 2022. https://doi.org/10.1016/j.trd.2022.103191.
- Guerra, E., Sandweiss, A. and Seunglee, D. “Does Rationing Really Backfire? A Critical Review of the Literature on License-Plate-Based Driving Restrictions”. Transport Reviews https://doi.org/10.1080/01441647.2021.1998244.
- Lin, Z., Jing, K., Kong, H. and Dang, A. “Mapping the Dynamics of Electric Charging Demand within Beijing’s Spatial Structure”. Sustainable Cities and Society (2022). https://doi.org/10.1016/j.scs.2021.103507.
- Parr, S., L. Acevedo, P. Murray-Tuite, and Wolshon, B., “Methodology to Quantify Statewide Evacuations” Accepted and in press in Transportation Research Record: Journal of the Transportation Research Board. Vol. 2676, Issue 2, 2022. https://doi.org/10.1177%2F03611981211046922
- Xiaoxia D. “Investigating changes in longitudinal associations between declining bus ridership, bus service, and neighborhood characteristics”, Journal of Public Transportation, Volume 24, 2022. https://doi.org/10.1016/j.jpubtr.2022.100011
- Xiaoxia D. “Linking TNC with passengers: Investigating TNC use among lower-income residents with limited access to cars”, Travel Behaviour and Society, Volume 27, 2022, Pages 184-191. https://doi.org/10.1016/j.tbs.2022.01.007
- Zhang, M. and Guo, J. “Exploring the Patterns and Drivers of Urban Expansion in the Texas Triangle Megaregion”. MDPI – Land November 2021. https://doi.org/10.3390/land10111244
- Zhang, M. and Lan, B. “Detect Megaregional Communities Using Network Science Analytics”. Urban Science, February 2022. https://doi.org/10.3390/urbansci6010012
- Zhang, M. and Li, Y. “Generational patterns of modal shares across megaregions.” Transportation Research Record: Journal of the Transportation Research Board February 2022. https://doi.org/10.1177%2F03611981211073090
- Zhang, M. and Li, Y. “Generational Travel Patterns in the United States: New Insights from Eight National Travel Surveys” Transportation Research Part A: Policy and Practice February 2022. https://doi.org/10.1016/j.tra.2021.12.002

### *ii. Books or other non-periodical, one-time publications*

Frederick Steiner, Robert Yaro, and Ming Zhang co-authored the manuscript *Megaregions and America's Future* for the Lincoln Institute of Land Policy (LILP) in March 2022. The manuscript was reviewed by Lincoln, and has been distributed by Columbia University Press.




*The cover image of the manuscript **Megaregions and America's Future** by Fritz Steiner, Robert Yaro, and Ming Zhang reviewed by Lincoln Institute of Land Policy (LILP) and distributed by Columbia University Press.*

During the reporting period, Dr. Brian Wolshon was quoted as an expert in evacuation in the one-time article "Colorado Springs City Council review fire evacuation ordinance," KRDO TV/Radio, Colorado Spring, CO, December 13, 2021. Available online at: https://krdo.com/news/2021/12/13/colorado-springs-city-council-review-fire-evacuation-ordinance/. Dr. Wolson was also cited as a transportation engineering expert featured on: "Wrong Answers Only" by LabX presented by the National Academy of Sciences (NAS) in November of 2021. Available online at: https://www.eventbrite.com/o/labx-presented-by-the-national-academy-of-sciences-297261365. Finally, Dr. Wolshon was interviewed and quoted as an expert in evacuation for the article "Long wildfire evacuation delays for parts of Colorado Springs shown in models" for The Gazette in Colorado Spring, CO published on November 23, 2021. Available online at: https://gazette.com/wildfires/models-show-long-wildfire-evacuation-delays-for-broadmoor-area-northwest-colorado-springs/article_9bf33188-4bcd-11ec-a722-2fc495484e77.html.

### *iii. Other publications, conference papers, presentations, and working papers*

- Chen, Y., Jiao, J., Zhang, M. "Applying Machine Learning to Understand the Non-Linearity of the Built Environment: Commuting Choice Connection in Cascadia" 101st Annual Meeting of the Transportation Research Board, Washington, DC, January 2022.
- Guerra, E. "The relationship between urban form and mode choice in US and Mexican cities. Universidad de Guadalajara". Inaugural Keynote Lecture to the Graduates of the Maestra Movilidad Urbana, Transporte y Territorio, Centro Universitario de Tonal, December 2021
- Guo, J. and Zhang, M. "Do Megaregions Outperform Non-Megaregions in Economic Productivity, and To What Extent?" Presented at the 61st Association of Collegiate Schools of Planning (ACSP) conference (virtual), October 21-24, 2021.
- Huihai W., Junfeng J. "Traffic Behavior Recognition from Traffic Videos Under Occlusion Condition: A Kalman Filter Approach", 101st Annual Meeting of the Transportation Research

Board, Washington, DC, January 2022.

- Hunhua B., Junfeng J. “Envisioning a Carfree Future via Shared Micromobility: A Literature Review”, 101st Annual Meeting of the Transportation Research Board, Washington, DC, January 2022.
- Jin, Z., Pan, Q. “The Impact of Air Pollution on Housing Prices and the Effect Analysis of Environmental Policies: A Case Study of Houston, USA” Presented at the 60th Association of Collegiate Schools of Planning (ACSP) conference (virtual), October 21-24, 2021.
- Khan M., Kermanshachi, S., Rosenberger, J.M., Etminani-Ghasrodashti, R., Pan, Q. “Exploring the Spatial Variability of Socio-Demographics of Paratransit Riders: A Case Study in Arlington, TX” Presented at the 60th Association of Collegiate Schools of Planning (ACSP) conference (virtual), October 21-24, 2021.
- Li, Y. and Zhang, M. “Has the Travel Distance/Time Pattern for Long-Distance Travel Changed across Generations? The Comparison between Generations in the United States” Presented at the 60th Association of Collegiate Schools of Planning (ACSP) conference (virtual), October 21-24, 2021.
- Lin, Z. “How to Reuse, Renew, and Recycle a Ghost Town in China?" Asian Urban Collective inaugural conference, University of Virginia, February 18-19, 2022.
- Liu, Z. and Zhang, M. “What Factors Contribute the Most to Regional Convergence? An Exploratory Analysis on U.S. Megaregions” Presented at the 61st Association of Collegiate Schools of Planning (ACSP) conference (virtual), October 21-24, 2021
- Mondal, A., and Bhat, C.R. "Accommodating Spatial Dependency Effects Within a Rank-Ordered Probit Model: Formulation and Application to Travel Mode Choice in an Automated Vehicle Era," Transportation Research Board (TRB) Annual Meeting, Washington, DC, January 10, 2022.
- Sciara, G.C., Rahman, M. and Ryerson, M. “Airport Competition and Megaregional Impacts: Challenges and Opportunities for Planning Institutions” Presented at the 60th Association of Collegiate Schools of Planning (ACSP) conference (virtual), October 21-24, 2021.
- Sciara, G.C., Rahman, M. and Ryerson, M. “Airport Competition and Megaregional Impacts: Challenges and Opportunities for Planning Institutions” Transportation Research Board Annual Meeting (TRBAM-22-03910), 101st Annual Meeting of the Transportation Research Board, Washington, DC, January 2022.
- Steiner, F. “Ecological Urbanism for Health, Well-being, and Inclusivity: Engaging—Culture, Consciousness, and Nature” in *Routledge Companion to Ecological Design Thinking in Architecture & Urbanism*, Abington, United Kingdom: Routledge. 2022
- Steiner, F. “Ian L. McHarg and Mapping Complex Processes” in *Representing Landscapes: One Hundred Years of Visual Communication*. Abington, United Kingdom: Routledge. 2022
- Wolshon, B. “Application Examples of Transportation Modeling and Simulation for

Evacuation Planning and Analyses" Session 1084, 101st Annual Meeting of the Transportation Research Board, Washington, DC, January 2022.

- Wolshon, B. "Transit Supported Hurricane Mass Evacuation: Research and Practice" Research to Practice Transit Symposium, Jacksonville, FL, (online) October 2021.
- Zhang, M. and Li, Y. "Trip Generation for Mid-Long-Distance Travel in the U.S. Megaregions" Presented at 2021 THNS: Transports Ã  Haut Niveau de Service (The International Symposium on Sustainable Development of Urban Transport Systems) (virtual). Shanghai, October 28-29 + November 4-5, 2021.

## B. Websites

The CM$^2$ website URL is https://sites.utexas.edu/cm2/. This website is used to disseminate any information related to the program. In addition, CM$^2$ has a Twitter account (https://twitter.com/CM2_UTC*)*, LinkedIn group (https://www.linkedin.com/groups/12134034/) LinkedIn company page (https://www.linkedin.com/company/cooperative-mobility-for-competitive-megaregions-cm2/), as well as a company Facebook page (https://www.facebook.com/CM2page/).

All final project reports are also disseminated through the TxDOT Research Library website operated by the Center for Transportation Research Library at the University of Texas at Austin (UT Austin). The TxDOT Research Library serves as the official depository of the Texas Department of Transportation (TxDOT) Cooperative Research Program and supports the information needs of the Research and Technology Implementation Division of TxDOT.

UT Austin's School of Architecture helps disseminate research results and the work of our center through the school's website (https://soa.utexas.edu/headlines/cm2-researchers-launch-new-book-exploring-megaregions), eNews (https://mailchi.mp/utexas/february-2018-enews-1975165?e=48aa70e157), Twitter (https://twitter.com/UTSOA), and Facebook page (https://www.facebook.com/UTSOA/). Additionally, UT Austin's School of Architecture YouTube channel disseminates recordings of CM2 outreach activities such as our monthly Brown Bag sessions, guest lecture series, workshops and seminars (https://www.youtube.com/channel/UCJS9a_AUbsZfhRYBXojeu-Q).

CM$^2$ related research activities from the University of Pennsylvania are disseminated through the Weitzman School of Design website (https://www.design.upenn.edu/), the weekly e-newsletter (https://www.design.upenn.edu/subscribe-design-weekly-news-weitzman) and Twitter (https://twitter.com/WeitzmanSchool). All LSU program activities are disseminated through (http://www.evaccenter.lsu.edu).

As part of the collaborative social media PR campaign between the Lincoln Institute Land Policy (LILP), Columbia University Press, CM$^2$, the UT Austin School of Architecture, and the Weitzman School of Design in advanced of the publication of the CM$^2$ book, *Megaregion's and America's*

*Future*, several editorial reviews and press release articles were published and distributed in February and March of 2022. LILP distributed a press release article that was shared widely across each institution involved in the campaign (https://sites.utexas.edu/cm2/2022/03/18/new-book-megaregions-and-americas-future-provides-a-framework-for-large-scale-public-investment/), and shared the publication details on their website (https://www.lincolninst.edu/publications/books/megaregions-americas-future). Columbia University Press shared the book reviews on their website (https://cup.columbia.edu/book/megaregions-and-americas-future/9781558444287) and Twitter (https://twitter.com/Columbiaup).

## C. Methodologies, Technologies or Techniques

Nothing to report.

## D. Inventions, patent applications, and/or licenses

Nothing to report.

## E. Outreach activities

On February 19th, the CM$^2$ administration team participated in Girl Day at UT Austin 2022, presented by the UT Austin organization Women in STEM (WiSTEM). UT Austin's national award-winning Girl Day event gives elementary and middle school students a chance to explore STEM through grade-appropriate, hands-on activities hosted by volunteer scientists, engineers, astronomers, and STEM enthusiasts from student organizations, research centers, corporate partners and community organizations. We hosted a virtual, hands-on project called "Build A City!", which encourages kids to explore the complexity of cities and helps them understand the impact of people's everyday decisions on the places where they live, work, and play. Girl Day at UT Austin 2022 had 2,776 registered attendees, aged K-8th Grade, and 175 attendees, aged high school. Of the total number of registered attendees who participated in this year's Girl Day virtual event:

- 87% Identified as Girls
- 36% Identified as Latina/Latino
- 10% Identified as African American
- 14% Identified as Asian
- 71% from Central Texas
- 9% from Greater Houston
- 6% from Greater San Antonio
- 5% from Dallas / Fort Worth
- 4% from Out of State
- 492 (18% of Registrants) Girl Scouts

On April 9, 2022, the CM$^2$ administrative team participated as STEM Presenters during the *Girls in STEM Conference 2022*, hosted by the non-profit organization Girlstart. Girlstart's *Girls in STEM* conference was a one-day, in-person conference designed for 4th-8th Grade girls from the Austin and Central Texas region. Throughout the day, the registered attendees participated in three hands-on workshop sessions led by women in STEM fields. Once again, CM$^2$ presented the hands-on project "Build A City Out Of Candy!" during the workshop portion of the conference event. Thirty 4$^{th}$ Grade registered participants spent the afternoon working in teams designing and building a city using candy and other every-day objects with the CM$^2$ team.


*CM$^2$ Administrative GRA Noah Pope and Girlstart Volunteers overseeing the "Build a City out of Candy!" workshop participants during the Girls in STEM Conference 2022 event on February 19, 2022 presented by Girlstart.*

## F. Courses and Workshops

Professor Ming Zhang taught two courses for the Fall 2021 and Spring 2022 academic calendar "Transit Oriented Development" and "Metropolitan Transportation Studies", both for the Community and Regional Planning (CRP) Program at UT Austin. Researcher Junfeng Jiao taught two (2) courses related to his work with CM$^2$. The first course, CRP 386, was an Urban GIS course, and the second another CRP 386 course titled Urban GIS.

At the University of Pennsylvania, Dr. Erick Guerra taught one course attended by 30 graduate level students 'Introduction to City and Regional Planning'. Dr. Zhongjie Lin taught one course for seven students in the spring term of 2022, "Asian New Towns".

Dr. Brian Wolshon at Louisiana State University taught three transportation-based engineering courses: "CE 7615", "Advanced Highway Design and Traffic Safety", and "CE 4600 Geometric Design of Highways and Airports". Finally, Dr. Wolshon had an invited guest presentation at Clemson University in October 2021 for a course presentation entitled, "CE 3110 Roadway Design, Professional Standard of Care, and Expert Assessment".

On February 23 – 25, 2022, CM$^2$ covered the registration fees for students from the UT Austin Community and Regional Planning (CRP) Program – including several CM$^2$ GRAs – to participate in a three-day introductory seminar on ethical community engagement and community-based planning, *Ethics of Community Engagement*, presented by Thrivance Group in partnership with The Lewis Center, UCLA Luskin School of Public Affairs. The seminar focused on "the applied

moral philosophy in land use contexts [in order to] aid practitioners in establishing, asserting, and implementing ethical planning interventions despite the limitations associated with leadership, funding, and equity challenges".

### G. Other products

Each month researchers at UT Austin gather for monthly Brown Bag sessions to present their current projects and discuss their findings with fellow researchers and students. During these events, students and faculty researchers have an opportunity to share their progress on current $CM^2$ research and receive feedback on research methods and design. All materials and video recordings are available on the Brown Bag Lunch Discussion Page of our website and the Texas Architecture YouTube channel.

For the Fall 2021 and Spring 2022 terms, the $CM^2$ administrative team hosted three virtual Brown Bag presentations. The October 2021 Brown Bag featured two guest presenters from the University of Pennsylvania, Professor John Landis, and Ph.D. candidate Shengxiao Alex Li. First, Dr. Landis presented several case studies from his forthcoming book manuscript, *Megaprojects for Megacities* in a presentation entitled, "Lessons from Global Megaprojects, Good and Bad". Shengxiao Alex Li followed Dr. Landis with his presentation his research project, *Who Are "Stuck in Place": the Mismatch Between Vehicle Ownership and Needs Among Older Adults*.

On February 24, 2022, we hosted the virtual Brown Bag presentation featuring UTC Student of the Year 2021 recipient and University of Pennsylvania doctoral candidate, Joshua Davidson. Josh's presentation included an update to $CM^2$ audiences about his attendance at the Bicycle Transportation Committee meeting at the TRB annual conference in January 2022, and on his current research topic, "Measuring Changes in Bike Share Use: A Raster-Based, Open-Sourced, and Open-Data Approach".

Finally, the March 2022 Brown Bag session featured Texas Southern University's Ph.D. candidate Edward Pettitt with his presentation, "A Mirage in the Desert: A Spatial Network Analysis of Supermarket Expansion as a Mitigator of Food Insecurity in a Formerly Redlined Neighborhood", which discussed the enduring impacts of historic red-lining practices on current food insecurity outcomes in the predominantly Black Third Ward neighborhood in Houston, Texas. As part of his presentation, Mr. Pettitt presented his research findings through an interactive ArcGIS story maps website that has been developed as an educational outreach tool.

## OUTCOMES

Table 4 summarizes output performance metrics for the reporting period, as identified in the $CM^2$ Technology Transfer Plan. Subsections A-G provide a specific list of outputs.

**Table 4: Output Performance Metrics**

| Performance Metrics: Outcome | Annual Target | Actual for 10/1/21-3/31/22 |
|---|---|---|

| | | |
|---|---|---|
| **1. Enlarged pool of trained transportation professionals** | n/a | n/a |
| *1.1 Number of students hired by CM², broken down by degree types and levels, diversity metrics, and other social-economic measures* | 25 | 14 |
| *Degree type (Undergrad, Master, PhD)* | n/a | 0% undergraduate 89% master, 11% PhD |
| *Gender (male, female)* | n/a | 33% male, 67% female |
| *Race (Asian, Black, White, other)* | n/a | 22% Asian, 67% White, 0% Black, 11% Other |
| *First-generation student (undergrad. or grad.)* | n/a | 0 |
| *1.2 Number of papers developed by students for publication* | 2 | 2 |
| *1.2 Number of graduates in transportation jobs* | 15 -overall grant period | 2 |
| **2. Increased cooperation by local governments and transportation agencies regarding regional and inter-regional issues** | n/a | n/a |
| *2.1 Number of regional or inter-regional planning activities detailed in long, medium, and short-range transportation plans* | 1 | 0 |
| *2.2 Development and utilization of consistent and usable planning datasets* | 1 | 0 |
| *2.3 Creation of megaregional forums, committees, and communications by megaregional transportation planning entities* | 1 | 1 |

While most of our student researchers graduate during the April - September reporting period, we are proud to have a total of 2 students enter the workforce in the past six months and start their careers in the field of transportation. This makes the overall total of 74 graduates in transportation jobs, which exceeds our goal of having 15 students graduate and enter transportation-related jobs during the overall grant period.

Moreover, one student researcher had two papers developed for publication during the reporting period, which already meets our annual target of two.

In addition to our students' achievements, CM² faculty researchers across all of our institutions have maintained their collaboration efforts with local governments and transportation agencies regarding regional and inter-regional issues throughout the lifetime of the research consortium. To ensure that the datasets and research are useful for their intended audience, researchers collaborate in megaregionally-focused working groups on inter-regional planning activities. Many researchers met at the TRB conference in January 2022 and came together at the megaregional sub-committee meeting to talk about mega-regionally focused transportation projects.

# 4. IMPACTS

Table 5 below summarizes the impact performance metrics for the reporting period, as identified in the CM$^2$ Technology Transfer Plan.

**Table 5: Impact Performance Metrics**

| Performance Metrics: Impact | Annual Target | Actual for 10/1/21-3/31/22 |
|---|---|---|
| **1. Enhanced knowledge base** | n/a | n/a |
| *1.1 Development of books/handbooks* | 3 - overall grant period | 1 |
| *1.2 Journal publications in academic or professional journals* | 5 | 10 |
| *1.3 Special issues of academic or professional journals* | 1 | 0 |
| **2. Increased societal awareness beyond transportation sector of megaregional passenger and freight transportation challenges facing megaregion constituents today and, in the future,** | n/a | n/a |
| *2.1 Number and extensiveness of social media coverage of CM$^2$ research, education, and outreach activities* | 1 | 3 |
| **3. Informed decision making on public policy and transportation infrastructure investments** | n/a | n/a |
| *3.1 Number of contracted plans and projects conducted for and adapted by local and regional agencies in megaregions* | 1 | 0 |

## A. Impact on the effectiveness of the transportation system

The ongoing research findings from our consortium have already had an impact on transportation system around the country. Presently, Dr. Erick Guerra (University of Pennsylvania) is working with the City of Philadelphia on evaluating speed cameras on Roosevelt Blvd, the outcome of which will be used to build a pilot project to help increase safety at traffic intersections.

## B. Impact on the adoption of new practices, or instances where research outcomes have led to the initiation of a start-up company

Nothing to report.

## C. Impact on the body of scientific knowledge

The research projects and findings from the consortium are shared at academic forums, conferences, and in journal publications, as well as through social media. This has contributed to the overall awareness of the importance of megaregional study. Publications like *Megaregions and America's Future* demonstrates how the work we are doing at CM$^2$ is part of a larger conversation around the future for transportation planning. Our principal investigators will continue producing research that shows the importance of planning from the megaregional scale to help create stronger transportation systems across the country.

### D. Impact on transportation workforce development

CM$^2$ partner universities are preparing students to enter both the public and private sectors with expertise in planning, design, project delivery, and financing strategies. Our classes engage students with experts who work on the implementation of the transportation and infrastructure projects they study. Several CM$^2$ graduates have already started working in transportation-related positions across the country. They will be able to bring their knowledge from CM$^2$ and implement it in their work. Additionally, the camps and outreach activities we have conducted with UT Austin's WiSTEM for Girl Day and Girlstart –and continue to plan for the next reporting period— are introducing the next generation to the transportation field.

## 6. CHANGES/PROBLEMS

As previously reported, on September 1, 2020 CM$^2$ researcher Qisheng Pan transferred from TSU to the University of Texas at Arlington. Carol Lewis replaced Dr. Pan as the lead principle investigator for TSU. The impact of Dr. Pan's departure from his role of lead PI with TSU necessitated an internal review of TSU's invoice activity by UT Austin's Office of Sponsored Projects, which found a discrepancy in the reduced indirect cost share rate applied to TSU's invoices; while the official award documentation throughout the life-cycle of the subaward identified a single reduced IDC rate of 24%, TSU had in fact been applying two different IDC rate amounts (24% and 15%) based on the work completed by the two teams from the institution. By applying two different IDC rates, TSU had been overcommitting match funds for Years 1-5 of the subaward, and would quickly exceed the 50% requirement established by the original grant guidelines for the final FY21 grant agreement modification.

In light of this discovery, UT Austin OSP recommended an official rebudget of TSU's subaward agreement for the final FY21 award modification. In October 2021, UT Austin reported these findings to Amy Stearns of US DOT. Ms. Stearns recommended TSU provide documentation identifying how the institution will address/correct the indirect rate discrepancy as reported. In April 2022, TSU provided a response and documentation to Ms. Stearn's feedback, outlining that the institution will apply a single reduced IDC rate of 15% to all match activities for the final FY21 amendment period. Ms. Stearns acknowledged and approved of these updates on April 15, 2022. The details of the subaward amendment process will be provided in the next reporting period.

## 7. SPECIAL REPORTING REQUIREMENTS

Nothing to report.