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1. ACCOMPLISHMENTS

A. Goals and Objectives

CM² 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 16 researchers and 18 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
Generational Patterns of Modal Shares Across Megaregions	UT SOA	Ming Zhang	Year 5	Complete
Generational Travel Patterns in the United States: New Insights from Eight National Travel Surveys	UT SOA	Ming Zhang	Year 5	Complete
Analyze the Spatial Inequality Trends in the US Megaregion	UT SOA	Ming Zhang	Year 5	Complete
Vehicle travel and ownership among the US older adults in the digital era	UPenn	Erick Guerra	Year 5	Complete

ii. Education Accomplishments

Both CM² affiliated students and faculty received recognition for their expertise and contributions to their fields of research. The University of Texas at Austin (UT Austin) awarded a graduate continuing fellowship for the 2022-2023 academic year to engineering PhD student, Aupal Mondal, who works with Dr. Chandra Bhat. University of Pennsylvania's (UPenn) Dr. Frederick Steiner was named the 2023 Outstanding Alumnus of the University of Cincinnati College of Design, Architecture, Art, and Planning.

iii. Outreach/Engagement Accomplishments

The COVID-19 pandemic altered the ways in which CM2 has been able to complete outreach/engagement activities. The majority of in-person events were shifted to online platforms such as Zoom and secondary event-specific websites. Research related travel, especially international travel for PIs and students, remains incredibly limited, but CM2 researchers were able to participate in a variety of national and international conferences during this reporting period.

During this reporting period, CM2 staff and researchers attended a variety of regional and national-level conferences. Dr. Bumseok Chun from Texas Southern University (TSU) attended a board meeting for the Korea-America Association for Geospatial and Environmental Sciences on May 6th and September 2nd. Dr. Chun also attended an online webinar entitled 'Goodbye ArcMap: Moving Curriculum and Courses to a Modern GIS', which took place on September 21st. Another Texas Southern University researcher, Dr. Carol Lewis, had the opportunity to present a project to United States Secretary of Transportation, Pete Buttigieg, along with civil rights attorney Portia Allen-Kyle, when both individuals traveled to visit TSU during September. UT Austin researcher Dr. Chandra Bhat was an invited speaker for the 'Distinguished Lecture Series', where he presented over 'Autonomous Vehicle Impacts on Travel-Based Activity and Activity-Based Travel' for the Center for Connected and Automated Transportation (CCAT) at the



Announcement Flyer for 2022 CUTC Meeting

University of Michigan, on May 10th of this year. Furthermore, UT Austin and CM2 director Dr. Ming Zhang was invited to give a guest lecture at the University of Oregon in Eugene, OR, during the month of May. Dr. Zhang also participated in the Council of University Transportation Centers (CUTC) Annual Summer Meeting in Big Sky, MT, Montana, in June, and attended the 2022 Transportation and Economic Development Conference, organized by REMI, in July. UT Austin's Dr. Sandi Rosenbloom, another CM2

researcher, hosted a webinar entitled 'A View from the Pedestrian Wars', where many of Dr. Rosenbloom's students presented on a plethora of topics in the realm of pedestrian

transportation. Finally, Louisiana State University's (LSU) Dr. Brian Wolshon presented over the 'Travel Impacts of COVID-19 Social Separations Restrictions' to the New Orleans Branch of the American Society of Civil Engineers during April.

Several CM2 researchers were able to attend international conferences as well, either in person or through virtual opportunities. In May of 2022, UT Austin's Dr. Chandra Bhat attended the 'International Choice Modelling Conference' in Reykjavik, Iceland. CM2 director Dr. Zhang presented on 'The U.S.-China Collaborative Research on Megaregion Sustainability: A Preliminary Analysis of the Urban Systems in the Texas Triangle and Central Yangtze Delta' for the 12th Asian Conference in Regional Science: Challenges and Opportunities for Regional Science in the Age of Carbon Neutrality in Ulsan, Korea, during this past August. Finally, Dr. Wolshon attended the 7th Session of the Global Platform for Disaster Risk Reduction, in the United Nations Office for Disaster Risk Reduction, taking place in Bali, Indonesia.

Traditionally, CM2 utilizes the summer break to host its annual Summer Forum event, a collaborative research event when PIs from all partner institutions are invited to come and share their recent research and findings with the consortium. However, the CM2 Executive Committee decided that due to extenuating circumstances, this year's summer forum would be postponed until next year, which nicely coincides with CM2's final year. This will be an opportunity for researchers to share an overview of everything they have accomplished during their time with CM2, and will be a special event indeed.

iv. Administrative Accomplishments

Data analytics have shown a growth in the [CM² website](#) activity over the past six months. Audience page views showed 2,360 total users with 2,328 new users visiting the website, and 4,452 page-views. Approximately half of the CM² website audience are users from the United States (51.14%), with the second largest user audience coming from China (23.84%). The remaining country demographics include audience users from Australia, Canada, and Peru.

We have continued developing our [Twitter account](#) to disseminate news and information about CM2 related events. The account earned over 5,463 new impressions since the previous reporting period, which is defined as the number of times users saw our tweets on Twitter. Our account has a total of 233 followers and has received 2,834 profile visits during this most recent reporting period. We will continue to utilize and expand upon this platform.

The [CM² LinkedIn company page](#) and the [CM² LinkedIn Group](#) serve as a space where CM² 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 103 members, and the company page has increased from 206 members to 213 members over the past six months.

Additionally, the CM² administration team published the Spring and Summer 2022 newsletters during this reporting period. Our current newsletter email list has 189 subscribers. The CM²

administration and research team will continue to focus on growing our social media base by regularly posting current and interesting content that crosses disciplines and reflects the mission of CM².

We will continue to utilize and expand our social media platforms, including engagement of the [CM² LinkedIn company page](#), [CM² LinkedIn Group](#), and our [Facebook page](#).

C. Dissemination of Results

The results of work completed to date includes four (4) final project reports disseminated on the CM² website. During this reporting period, CM² researchers gave six (6) presentations at conferences and lectures. Twenty-one (21) refereed journal papers have been published. Peer-reviewed articles from our researchers have been cited over 2400 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 CM² consortium expects to see nine (9) completed projects with final reports. Consortium researchers will continue to share the findings of their research through conference presentations, workshops, and journal publications. Additionally, researchers already have plans to attend several virtual conferences including ACSP, ASLA, WSTLUR, TRB, WRSA, AAG, Texas APA, and others during the next reporting period.

One (1) manuscript will be developed during the next reporting period. Dr. Bumseok Chun will be developing a manuscript for a project on the Houston bike system.

We are excited to see how our researchers will find creative ways to adapt and stay connected to their research with these new circumstances that have been developed in response to the ongoing COVID-19 pandemic.

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, CM² gained several new organizational partners, including Florida State University, Trinity Metro of Fort Worth, and more. Additionally, Table 2 presents a list of current CM² partners.

Table 2: Current CM² 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
Johns Hopkins University	Baltimore, MD	Research
Area Agency on Aging of the Capital Area	Arlington, TX	Research, Technical Contributions

B. Other Collaborators or Contacts

The CM² research team has consistently promoted multi-jurisdictional collaboration between consortium members by setting aside funds specifically for multi-institutional proposals. There is currently one (1) multi-institutional research project currently in progress.

3. OUTPUTS

Table 3 summarizes output performance metrics for the reporting period, as identified in the CM² 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	Actual for 4/1/22-9/30/22	Actual Annual Total
1. Publications, conference papers, presentations, or final project reports	10	26 (10 journal publications, 1 final report, 15 presentations)	31 (21 journal publications, 4 final reports, 6 presentations)	57
<i>1.1 Publications: diversity of fields/journals submitted to (e.g. engineering, modelling, law, policy, geography, economics, infrastructure, etc.)</i>	3	5 (Planning, Transportation, Travel Behavior, Environment, Sustainability)	5 (Transportation, Engineering, geo-information, Planning, Environment, Health)	10

1.2 Conferences: by entity (e.g. TRB, APA, ASCE, WTS, SXSU, etc.)	2	3 (ACSP, TRB, ISCTSC)	3 (TRB, ACRS, ASCE)	6
2. Workshops, seminars in collaboration with or participation of MPOs and transportation agencies	2	1	1	2
2.1 Type of activity	2	1	1	2
2.2 Type of professional organizations involved	2	1	1	2
2.3 Event scales/number of attendees (small (up to 10), medium (11-29), large (30 and up))	2	2	1	3
3. Web Presence	n/a	n/a	n/a	n/a
3.1 Website visits/page views	3,000	4,169	4,452	8,621
3.2 Number of impressions on Twitter	30,000	27,139	5,463	32,602
3.3 Number of additional members in LinkedIn Group	20	0	0	0

A. Publications

i. Journal Publications

- Azimian, A. and Jiao, J. (2022). Modeling Factors Contributing to Dockless E-Scooter Injury Accidents in Austin, Texas. *Traffic Injury Prevention*. DOI:10.1080/15389588.2022.2030057
- Bissiri, T., Jiao, J., and Chen, Y. (2022). A scoping review of the benefits of face mask use on pedestrian and bicyclist exposure to air pollutants. *Journal of Transport & Health*.
- Guerra, E. and Sandweiss A. (September 3, 2022). Does Rationing Really Backfire? A Critical Review of the Literature on License-Plate-Based Driving Restrictions. *Transport Reviews* 42, no. 5. <https://doi.org/10.1080/01441647.2021.1998244>
- Jiao, J., Azimian, A., and Degen, N. (2022). Identifying Hospital Deserts in Texas Before and During the COVID-19 Outbreak. *Transportation Research Record: Journal of Transportation Research Board*. <https://journals.sagepub.com/doi/full/10.1177/03611981221095745>
- Jiao, J., Azimian, A., and Degen, N. (2022). Understanding the Relationship Among E-scooter Ridership, Transit Desert Index and Health-Related Factors. *Transportation Research Record*:

- Jiao, J., Mira, B., Azimian, A., and Farahi, A. (2022). Housing Market Price Movements Under Tech Industry Expansion During COVID-19, *International Journal of Housing Markets and Analysis*. *International Journal of Housing Markets and Analysis*. <https://www.emerald.com/insight/content/doi/10.1108/IJHMA-02-2022-0022>
- Jiao, J. and Chen, Y. (2022). Is the Relationship between Bus and Light Rail Transit a Competition Substitution or a Congestion Substitution? An empirical study in Seattle. *Public Transport*. <https://www.researchgate.net/publication/360078532>
- Jiao, J., Lee, HK, and Choi, S. (2022) Impacts of COVID-19 on Bike-Sharing Usages in Seoul, South Korea. *Cities*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9376118/>
- Jiao, J. and Wang, H. (2022). Traffic Behavior Recognition from Traffic Videos under Occlusion Condition: A Kalman Filter Approach. *Transportation Research Record: Journal of Transportation Research Board*. <https://journals.sagepub.com/doi/abs/10.1177/03611981221076426>
- Li, S., Zhai, W., Jiao, J., and Wang, C., (2022). Who loses and who wins in the ride-hailing era? A case study of Austin, Texas. *Transport Policy*. <https://ideas.repec.org/a/eee/trapol/v120y2022icp130-138.html>
- Li, Y. and Zhang, M. (2022). Generational patterns of modal shares across megaregions. *Transportation Research Record. Journal of the Transportation Research Board*. Doi: 10.1177/03611981211073090.
- Majumdar, S. and Chun, B. (2022). Fracking and Traffic Crashes in Eagle Ford Shale of Texas. *Public Works Management & Policy*. DOI: 10.1177/1087724X221100559
- Mandalapu, A., Jiao, J., and Azimian, A. (2022) Exploring the Spatial Distribution of Air Pollutants and COVID-19 Death Rate: A Case Study for Los Angeles County, California. *International Journal of Geospatial and Environmental Research: Vol. 9: No. 1, Article 4*. <https://dc.uwm.edu/ijger/vol9/iss1/4>
- Mondal, A., and Bhat, C.R. (2022). A Spatial Rank-Ordered Probit Model with an Application to Travel Mode Choice. *Transportation Research Part B*, Vol. 155, pp. 374-393.
- Parr, S., Acevedo L., Murray-Tuite P., and Wolshon B. (2022) Methodology to Quantify Statewide Evacuations. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 2676, No. 2, pp. 775-787.
- Steiner, F. (2022). Ecological Urbanism for Health, Well-being, and Inclusivity. *Culture, Consciousness, and Nature in Routledge Companion to Ecological Design Thinking in Architecture & Urbanism*. Routledge, pp. 107-119.

- Steiner, F. (2022). Envisioning Health, Safety, and Welfare for All: Retrospect and Prospect. *Journal of Comparative Urban Law and Policy* 5, pp. 42-51.
- Seong, K., Jiao, J., and Mandalapu, A., (2022). Evaluating the Effect of Heat Vulnerability on Heat-Related Emergency Medical Service (EMS) Incidents: Lessons from Austin, Texas. *Environment and Planning B: Urban Analytics and City Science*.
- Zhang, M. and Li, Y. (2022). Generational travel patterns in the United States: New insights from eight national travel surveys. *Transportation Research Part A*, 156:1-13. <https://doi.org/10.1016/j.tra.2021.12.002>.
- Zhang, M. and Lan, B. (2022). Detect megaregional communities using network science analytics. *Urban Science*, 6(1):12. <https://doi.org/10.3390/urbansci6010012>
- Zhang, Z., Fu D., Liu F., and Wolshon B. (May 2022). Estimating Long-Term and Short-Term Influence of COVID-19 Activity Restriction on Regional Highway Traffic Demand: A Case Study in China. *International Journal of Disaster Risk Reduction*.

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

Professors Robert Yaro (UPenn), Ming Zhang (UT Austin), and Fritz Steiner (UPenn) authored a book “Megaregions and America’s Future”, published by the Lincoln Institute of Land Policy and distributed by Columbia University Press in March 2022. The book has attracted attention from media (Bloomberg Cities Network, Futurist, Penn Today, FastCompany, Ten Across Podcast, and Talking Headways Podcast) and federal and regional transportation agencies (FRA and NCTCOG).

UPenn’s Dr. Lin Zhongjie was interviewed by New York Times journalists Winnie Hu, Nadav Gavrielov, and Jack Ewing for their story "Here's how slowly New York City is Moving on Electric Vehicles," published on NYT on April 5, 2022.

<https://www.nytimes.com/2022/04/05/nyregion/nyc-electric-vehicle-evs.html>

LSU’s Dr. Brian Wolshon was quoted as an expert in evacuation in “Emergency planners rethink evacuations for era of fast, explosive storms like Hurricane Ida”, an article for the Times-Picayune, New Orleans, LA, on June 19 of 2022. https://www.nola.com/news/politics/article_e506b058-ee79-11ec-85e4-bb11f251ee81.html

Currently, UPenn researcher Dr. Erick Guerra is working on his book, and has currently finished three chapters along with a revised book proposal. UT Austin’s Dr. Danelle Briscoe is working on her book titled “Future Hub”.

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

The Planning Forum is an annual publication produced by graduate and doctoral students in the Department of Community and Regional Planning at UT Austin. The journal publishes peer-reviewed scholarly articles as well as critical explorations in less-conventional formats. Planning

Forum serves as a platform for emerging voices and new perspectives on the most pressing issues in the field. Dr. Ming Zhang, Dr. Jake Wegmann, and Dr. Alex Karner act as the faculty advisors to the student-led editorial board, which is comprised of several UT Austin graduate research students/PhD candidates, including Taylor Cook, Jiaxuan Huang, Ziqi Liu, Adam Ogusky, Mashrur Rahman, and Leon Staines.

Researchers presented six (6) papers at conferences during the past reporting period. Among these, Dr. Ming Zhang presented a research paper at the 12th Asian Conference in Regional Science: Challenges and Opportunities for Regional Science in the Age of Carbon Neutrality, in Ulsan, Korea, from August 7-9, 2022, UT Austin's Dr. Junfeng Jiao presented three research papers at the 101st Transportation Research Board (TRB) Annual Meeting, in Washington, DC, from January 9-13, 2022, and Dr. Brian Wolshon presented a research paper at the New Orleans Branch of the American Society of Civil Engineers, in New Orleans, LA, during April 2022.

B. Websites

The CM² website URL is <https://sites.utexas.edu/cm2/>. This website is used to disseminate any information related to the program. In addition, CM² 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 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).

CM² related research activities from UPenn 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>).

C. Methodologies, Technologies or Techniques

UT Austin's Dr. Chandra Bhat developed a new Spatial Ranking Model that is being utilized on his year 6 project 'Spatial Travel Mode Choice Model for Megaregions in an Autonomous Driving World', in coordination with Dr. Ming Zhang.

Dr. Erick Guerra from UPenn is currently working on a methodology related to speed camera enforcement for the cities of Philadelphia and Chicago.

D. Inventions, patent applications, and/or licenses

Nothing to report.

E. Outreach activities

LSU's Dr. Brian Wolshon served as a plenary speaker at the 7th Session of the Global Platform for Disaster Risk Reduction (GP2022) in Bali, Indonesia, hosted by the United Nations Office for Disaster Risk Reduction. Dr. Erick Guerra met with City of Philadelphia officials to assist with data and policy review. Graduate students in Dr. Sandi Rosenbloom's spring 2022 term course, Women and Transportation | From Childhood to Widowhood: A Woman's Journey, led a public webinar entitled: *A View from the Pedestrian Wars: Emerging Ideas on Money, Accessible Bus Stops, and Slow Streets*.

On April 9th, the CM2 administrative team hosted a workshop for the 2022 Girls in STEM



CM2 admin Noah Pope helping one group build their city

Conference In Austin, TX. This workshop had girls organize themselves into five teams in order to participate in a city-building exercise designed by CM2 entitled 'Build A City Out of Candy'. Using toothpicks, marshmallows, candy and other common objects as construction materials, the five teams cooperatively planned and built their ideal city. This exercise proved to be a catalyst in directing these young women towards considering a future in STEM-related career fields such as City and Regional Planning, Transportation Planning, and Architecture.

F. Courses and Workshops

The limitations imposed by the COVID-19 pandemic has had a marked impact on the outreach and engagement activities CM2 researchers were able to accomplish during this reporting period. Many workshops and courses planned to take place during the Spring/Summer 2021 academic semester were postponed or even canceled by institutions during this reporting

period due to restrictions for in-person contact. Some institutions had “hybrid” or “dual-modality” courses that allowed for students to attend classes either in-person or online.

Several CM2 researchers taught research courses focused on megaregions and transportation:

1. Dr. Erick Guerra taught one course during the Spring 2022 semester, *Introduction to Transportation Planning* (CPLN – 550), a seminar class focusing on the interplay of stakeholders in the urban setting.
2. Dr. Ming Zhang taught two graduate level courses during the Spring 2022 semester, *Metropolitan Transportation Studies: Applications with TransCAD GIS* (01335), and the *Planning for Megaregions* (CRP384-01600) seminar course focused on U.S. megaregions.
3. Dr. Junfeng Jiao taught two graduate level courses as well during the Spring 2022 semester, *Urban GIS*, and *Smart City*, a practitioner course focusing on tech related urban dynamics.
4. Dr. Sandi Rosenbloom taught the graduate level course on *Pedestrian Needs of Older and Disadvantaged Travelers* in spring of 2022.

G. Other products

Nothing to report.

OUTCOMES

Table 4 summarizes output performance metrics for the reporting period, as identified in the CM² 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	Actual for 4/1/22-9/30/22	Actual Annual Total
1. Enlarged pool of trained transportation professionals	n/a	n/a	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	11	25
Degree type (Undergrad, Master, PhD)	n/a	0% undergraduate, 89% master, 11% PhD	0% undergraduate, 64% master, 36% PhD	n/a

Gender (male, female)	n/a	33% male, 67% female	45% male, 55% female	n/a
Race (Asian, Black, White, other)	n/a	22% Asian, 67% White, 0% Black, 11% Other	45% Asian, 45% White, 10% Black, 0% Other	n/a
First generation student (undergrad. or grad.)	n/a	0	0	0
1.2 Number of papers developed by students for publication	2	2	0	2
1.3 Number of graduates in transportation jobs	15**** for overall grant period	2	8	10
2. Increased cooperation by local governments and transportation agencies regarding regional and inter-regional issues	n/a	n/a	n/a	n/a

Despite the pressure the COVID-19 pandemic has put on the transportation industry, we are proud to have a total of eight (8) students enter the workforce in the past twelve months and start their careers in the field of transportation. This makes the overall total of 82 graduates in transportation jobs, which exceeds our goal of having 15 students graduate and enter transportation-related jobs during the overall grant period.

In addition to our students' achievements, CM2 faculty researchers across all of our institutions have increased their collaboration efforts with local governments and transportation agencies regarding regional and inter-regional issues.

4. IMPACTS

Table 5 below summarizes the impact performance metrics for the reporting period, as identified in the CM² Technology Transfer Plan.

Table 5: Impact Performance Metrics

Performance Metrics: Impact	Annual Target	Actual for 10/1/21-3/31/22	Actual for 4/1/22-9/30/22	Actual Annual Total
1. Enhanced knowledge base	n/a	n/a	n/a	n/a

<i>1.1 Development of books/handbooks</i>	3*** for overall grant period	1	1	2
<i>1.2 Journal publications in academic or professional journals</i>	5	10	21	31
<i>1.3 Special issues of academic or professional journals</i>	1	0	0	0
2. Increased societal awareness beyond transportation sector of megaregional passenger and freight transportation challenges facing	n/a	n/a	n/a	n/a
<i>2.1 Number and extensiveness of social media coverage of CM² research, education, and outreach activities</i>	1	3	6	9
3. Informed decision making on public policy and transportation infrastructure investments	n/a	n/a	n/a	n/a
<i>3.1 Number of contracted plans and projects conducted for and adapted by local and regional agencies in megaregions</i>	1	0	0	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. Dr. Erick Guerra is currently working on a project relate to speed camera enforcement for Philadelphia and Chicago.

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. 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

CM² 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 CM² graduates have already started working in transportation-related positions across the country. They will be able to bring their knowledge from CM² and implement it in their work. Additionally, the educational camps and outreach activities we have conducted, and continue to plan for the next reporting period, are introducing the next generation to the transportation field.

6. CHANGES/PROBLEMS

As mentioned throughout this report, the impact of the COVID-19 pandemic affected university operations for all Consortium institutions, interrupted national and international travel for our researchers, and reduced the number of in-person outreach activities such as conferences, workshops, and symposiums. While the impact of COVID-19 did slow down certain activities during this reporting period, all Consortium member institutions were able to adapt to changes, and pivot to virtual platforms such as YouTube and Zoom to reschedule the activities that were canceled or disrupted due to uncertainties around in-person events. As the COVID-19 pandemic continues, the way we conduct outreach and research dissemination will continue to evolve, and we anticipate the continued utilization for virtual communication platforms such as Zoom, YouTube, and more.

7. SPECIAL REPORTING REQUIREMENTS

Nothing to report.