



TPEC | TRANSPORTATION POLICY AND ECONOMIC COMPETITIVENESS



2017–2019 Progress Report



HUMPHREY SCHOOL
OF PUBLIC AFFAIRS
UNIVERSITY OF MINNESOTA

CENTER FOR
TRANSPORTATION STUDIES
UNIVERSITY OF MINNESOTA

TPEC: Benefits for Policymakers and Stakeholders

“The Humphrey School's research on transportation technology, finance, and the freight economy has helped legislators better understand the importance of transportation to the Minnesota economy.”

— *Frank Hornstein, Representative, Minnesota House*



“As a legislator, a major benefit of the Transportation Policy and Economic Competitiveness Program is hearing and learning about upcoming transportation trends and ideas. Especially helpful is looking at new metrics and data to make smarter infrastructure decisions that strengthen the Minnesota economy.”

— *Jon Koznik, Representative, Minnesota House*

“The TPEC research team did a fantastic job of bringing together a multisector stakeholder group, including several policy leaders, at the recent medical industry cluster forum. The discussion highlighted the importance of this unique industry to Minnesota’s economy, facilitated a rich conversation around its implications for infrastructure use and economic development, and initiated a dialogue that is sure to benefit the whole state.”

— *Atif Saeed, Vice President, Finance and Revenue Development, Metropolitan Airports Commission*



“Our economy depends on all of us being able to contribute. The TPEC task force held discussions with people in Greater Minnesota to hear their voices and understand the kinds of policies that we need.”

— *Sandra Vargas, former President and CEO, Minneapolis Foundation, and Chair, TPEC Task Force on Self-Driving Vehicles*

Providing Knowledge for a Healthy Minnesota

A patient gets a life-saving medical device in the nick of time.

The health of our people—and our economy—depends on transportation. The medical device industry, for example, plays a vital role in Minnesota's economic competitiveness. Companies rely on the multimodal transportation system to serve their customers next door and around the world.

Analyzing the state's industry clusters is one focus area of the Transportation Policy and Economic Competitiveness (TPEC) Program. TPEC was created in 2013 to provide a better understanding of the impacts of transportation policies and innovations on Minnesota's economy. The program creates objective knowledge to inform decision making and, ultimately, strengthen our region's economic competitiveness and foster a high quality of life.

This report shares highlights of our recent work. In addition to industry clusters research, we have made important strides in our other focus areas of finance and technology. Our progress would not be possible without your commitment, and we thank you for your continued support.

— Lee Munnich, TPEC Director

Frank Douma, State and Local Policy Program Director

A Quick Look at TPEC

TPEC focuses on three overarching topics:

- **Finance** – maintaining and enhancing a comprehensive transportation finance database for Minnesota and examining finance alternatives and sustainable revenue streams.
- **Industry clusters and freight infrastructure** – improving knowledge of the state's key industries and their supply chains and infrastructure needs.
- **Technology** – examining policy issues involving new and emerging technologies such as automated vehicles.



TPEC **creates and maintains** resources and tools.



TPEC **studies** the issues.



TPEC **brings people together**.



Finance

Identifying revenue streams and examining finance alternatives

Motorization Trends Reshape Roadway Funding

Vehicles, how we power them, and driver behavior are all changing. In a TPEC project, researchers analyzed Minnesota's motorization trends from 1980 to 2016 and their impacts on roadway funding.

The researchers found that the number of registered vehicles in Minnesota almost doubled between 1980 and 2016, from 3 million to 5.4 million vehicles, and Minnesotans traveled more than twice as far, accounting for 60 billion miles in 2016.

However, when taking population growth into account, both measures turned downward in recent years. Since 2000, the number of vehicles per driver and per person declined, and the number of miles traveled per person and per vehicle dropped significantly. "The trend is likely to continue," says Jerry Zhirong Zhao, principal investigator for the study.

Fuel use followed a similar pattern. Fuel consumption per driver and per vehicle has declined 10 and 11 percent respectively since 2000 due to increased fuel efficiency and decreased vehicle miles traveled.

"Fuel consumption is particularly important," Zhao says. "If fuel consumption decreases, transportation revenues decrease, too."

"This research provides us with an understanding of some very important trends surrounding vehicle ownership and travel in the state and the impact on collection of highway revenue."

— Ken Buckeye, Program Manager,
MnDOT Office of Financial Management



Half of Minnesota's roadway funding comes from the state fuel tax, the motor vehicle sales tax, and the motor vehicle registration tax.

Taxing Ride-hailing Services: A Framework for State and Local Governments

Ride-hailing services such as Uber and Lyft create challenges for transportation policymakers and planners. A TPEC study analyzed ride-hailing taxes and fees imposed on service providers and users in cities across the US. It particularly focused on those revenue strategies levied on ride-hailing usage, which generally are on a per-trip basis, because they have a direct impact on users.

Some key findings:

- The majority of localities in the study use ride-hailing revenue strategies to cover regulatory costs or fill general budget gaps. Very few use the proceeds to improve transportation systems and mobility overall.
- Most of the localities adopted a non-tax-revenue strategy.
- Local governments tend to adopt fees, while states tend to adopt assessments.
- Most localities adopted a fixed fee or surcharge paid per trip. Only two localities established differential fees depending on the type of ride (such as solo or shared trip).



“Our findings provide a framework of current practices to help state and local governments make informed decisions regarding taxes and regulations.” — Jerry Zhirong Zhao, principal investigator

The team concluded that taxing ride-hailing companies can be a source of revenue for state and local governments, and a variety of strategies are available. Revenues could help offset losses from other transportation modes, such as the taxi industry and public transit, which may see reduced ridership because of ride hailing.

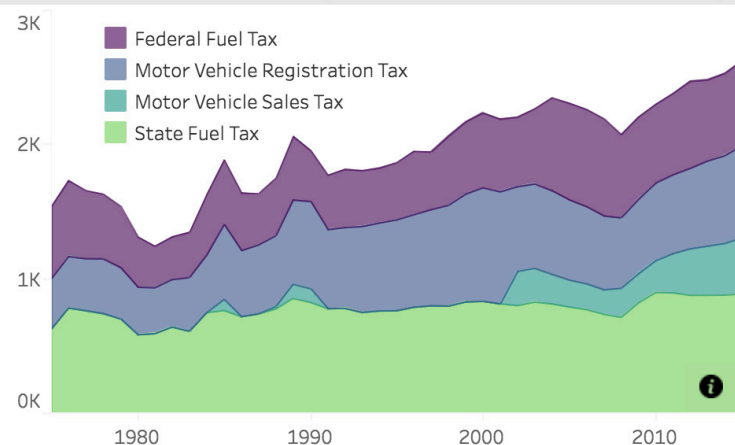
Finance Database: Visualization Tool Enables Access and Usage

TPEC researchers continue to update and enhance the Minnesota Transportation Finance Database. The data-rich resource provides an objective foundation for understanding transportation finance issues in Minnesota.

The database is composed of annual data from various transportation funding sources—at the state, MnDOT district, and local levels—as well as transportation expenditure allocations. It also includes state road construction expenditures (by county), operations and maintenance expenditures (by MnDOT district), and vehicle count and registration tax (by county).

In 2018, TPEC researchers added a data visualization tool to the database that allows more people to access and easily understand the data. Data dashboards are available through a public version of Tableau, an interactive data visualization product. Most of the dashboards are interactive, allowing users to pick variables that better fit their needs in a dynamic way.

Highway Special Revenues (millions of constant 2015 dollars)



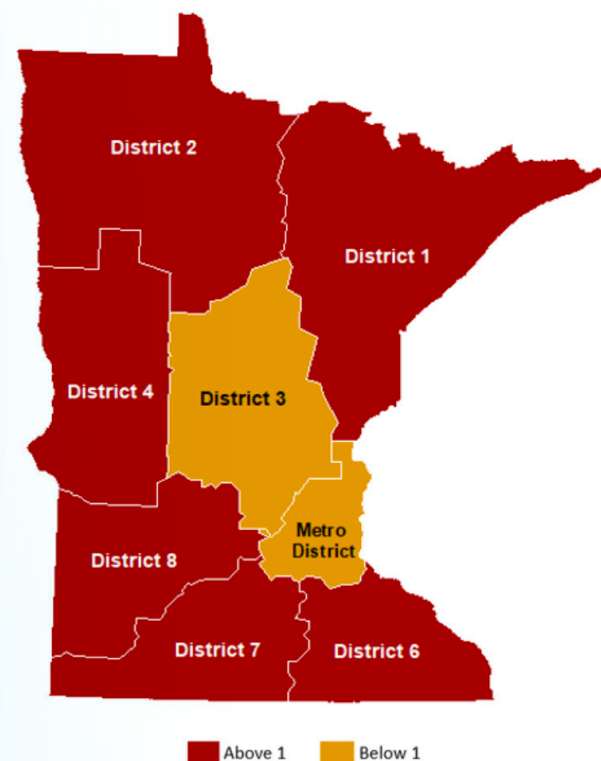
Minnesota Transportation Funding: How Are Federal, State Funds Redistributed?

TPEC researchers provided insight on how federal and state transportation funding is redistributed in Minnesota.

In one study, which looked at the six-year period between 2010 and 2015, researchers analyzed funding revenues and expenditures at the MnDOT district level for both roadways and transit. The team found that the Twin Cities Metro district contributed about 49 percent of federal and state transportation revenues and received about 47 percent back in expenditures.

The researchers also examined the funding structures for roadways and transit in Minnesota. They found that during 2010–2015, local efforts accounted for about 45.5 percent of total roadway funding in Minnesota. Metro counties had a higher reliance on local efforts—about 56 percent.

The transit structure analysis showed that about 65 percent of public transit expenditures in Minnesota comes from federal and state special revenues. Fare revenue accounted for about 14 percent, while other local efforts accounted for about 21 percent.



Expenditure-revenue ratio, 2010–2015: Districts with a ratio higher than 1 received more than they contributed in state and federal transportation funding.

During 2010–2015, local efforts accounted for about **45.5%** of total roadway funding in Minnesota.

Industry Clusters and Freight Infrastructure

Improving knowledge of the state's key industries and their supply chains and infrastructure needs

Medical Device and Health Services Industries Rely on Multimodal Transportation System

Minnesota has one of the highest concentrations of medical device companies in the US, and the value of those medical goods is a major contributor to the state's economy. The medical device industry cluster is also a global leader in the development and distribution of medical devices.

TPEC researchers analyzed how key industry clusters have developed in Minnesota and the implications for the transportation system. In a spatial analysis, they determined the locations of medical device companies and medical device industry clusters in the state. This analysis showed that while most medical device companies are located within the seven-county Twin Cities region, industries linked to the medical device industry cluster are much more dispersed throughout the state and continue to develop.

In a qualitative analysis, which included interviews with key stakeholders, they learned that the transportation of medical device goods is inherently multimodal. Air transportation, especially, plays a crucial role in ensuring the timely delivery of medical devices nationally and internationally.

"It's hard to overstate the vital role that MSP International Airport and the surrounding surface transportation network play in the timely delivery of high-value, time-sensitive products," says Lee Munnich, principal investigator.

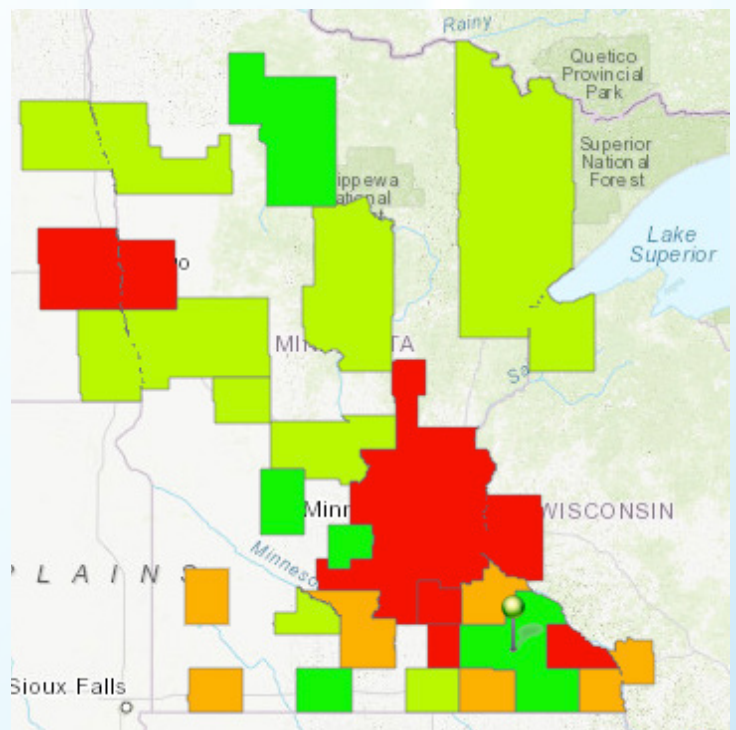
Key policy dimensions identified in the study are economic competitiveness contributions, economic development implications, workforce challenges, transportation implications, and data/research needs.

"The research team has become the control tower for understanding the importance of air and surface transportation to Minnesota's dynamic medical device and health care industry clusters."

— Bill Goins, Access to Solutions, and member, TPEC Advisory Board

Why are industry clusters important?

As a critical mass, industry clusters promote efficiencies that individual businesses or industries cannot, and they tend to have a large economic impact on a region.



This story map from TPEC's National Freight Economy Atlas shows medical device industry clusters.



Industry Clusters in Minnesota Regions

Humphrey School researchers have partnered with the Minnesota Department of Transportation in developing and implementing a unique approach linking economic development and transportation planning. Their work has focused on getting manufacturers' perspectives on transportation issues as part of regional transportation decision making. The Humphrey School has worked with MnDOT, the Minnesota Department of Administration, University of Minnesota Extension, and SRF Consulting in these efforts.

A study of MnDOT's District 3 is currently under way. This builds on a pilot study in MnDOT District 8 that was completed in 2014 and on projects conducted in Districts 1, 2, 4, 6, and 7. A similar study was conducted on a more limited basis in the Twin Cities metro area. MnDOT has incorporated results of the studies into its statewide freight planning.

For these studies, researchers led by Lee Munnich used the Economic Development Administration's US Cluster Mapping tool to identify competitive traded industry clusters in MnDOT operations districts. U of M, MnDOT, and local economic development staff interviewed manufacturers and their carriers within these clusters to better understand the transportation and logistics issues these companies face. The team also explored how MnDOT could make improvements to its operations and systems to help alleviate or minimize these issues.

"These manufacturers' perspective studies have provided critical information to MnDOT district engineers on transportation challenges facing Minnesota businesses and allowed us to make real-time improvements to help manufacturing thrive in Greater Minnesota."

— Jon Huseby, MnDOT District 8 Engineer

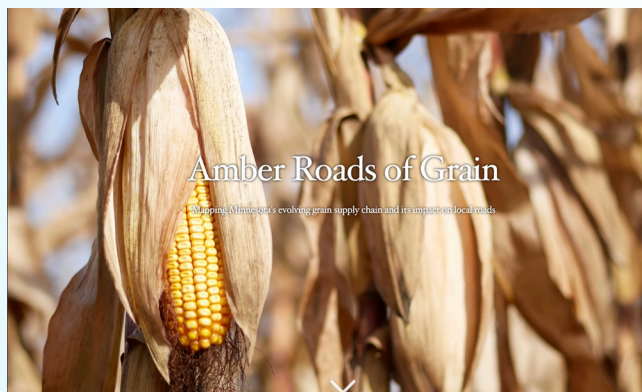
National Freight Economy Atlas

To better understand freight flows and foster the growth of freight infrastructure, TPEC researchers created and maintain an online platform—the National Freight Economy Atlas. The atlas allows users to analyze freight infrastructure at the national, regional, state, and metropolitan/combined statistical areas.

The atlas displays information in a series of interactive maps. National and regional maps provide detailed analysis of freight and economic clusters. Industry cluster maps provide freight economy information geared to specific characteristics of industry clusters, such as cereal grains.

A featured story map is *Amber Roads of Grain*. This analysis unveils how technological, political, and market shifts in the grain supply chain impact the way local producers and wholesalers navigate their local freight networks—networks that span road, rail, and barge infrastructure.

The atlas is a combined effort of TPEC, Esri (a geographic information systems company), and the Center for Information Systems and Technology at Claremont Graduate University. Additional funding for the project was provided by BNSF Railway.



Technology

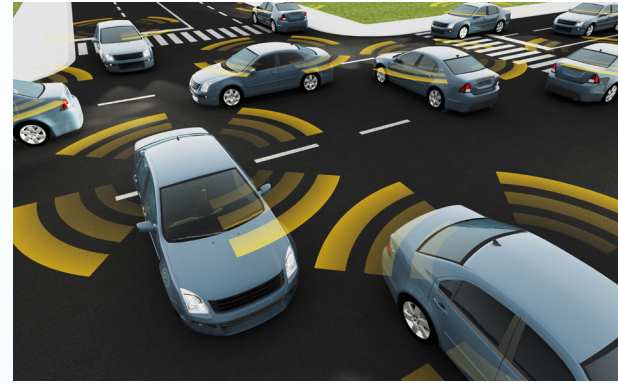
Preparing for new and emerging technologies

Automated Vehicles

Task Force

TPEC researchers formed a self-driving vehicle (SDV) task force in the spring of 2017 to identify how various SDV deployment strategies could improve mobility and access for transportation-dependent Minnesotans: seniors, people with disabilities, and others who are not able to drive themselves.

The task force was made up of representatives from the Minnesota Department of Transportation, Metro Mobility, local governments, nonprofits, and organizations from the Twin Cities and Greater Minnesota.



At the close of its work, the task force constructed a matrix of users to cross-compare geography, barriers to participation, and the potential forms of self-driving transportation that may be implemented in Minnesota. The matrix separated Minnesota's population into four geography ranges: central city, suburban, small city, and rural locales.

Stakeholder Meetings

As follow-up to the SDV Task Force, TPEC initiated stakeholder meetings across the state to better understand transportation needs and identify opportunities for connected and automated vehicle (CAV) technology.

The research team gathered valuable feedback from local officials, stakeholders, and community members. "In these discussions, we heard that CAVs offer an opportunity to improve safety, accessibility, and equity," says TPEC researcher Adeel Lari.



TPEC partnered with several organizations to hold public engagement sessions in Grand Rapids, St. Cloud, Mankato, and Fergus Falls. Participants conveyed broad excitement about the potential for CAV technology to improve economic well-being and the overall quality of life in their communities. Stakeholders identified CAVs as a way to enable aging in place and improve mobility for individuals who depend on transit.

The discussions also highlighted several implementation models that could supplement existing transit services. In addition, stakeholders identified a range of questions and concerns about the implementation of CAV technology in Greater Minnesota.

"We have very limited affordable, accessible transportation after 8 p.m. on weekdays and all weekend hours in rural areas. That limits social and work opportunities for those with physical, mental, and financial needs. I see self-driving vehicles as a positive step to assist that population especially."

— Myrna Peterson, Co-director, Mobility Mania, Grand Rapids

Greater Minnesota Workshop

A workshop in November 2018 in Mankato allowed the research team to share findings from the public engagement sessions. A goal of the workshop was to offer decision makers input, context, and insight from the community discussions to better inform current and future policy decisions.

The event was also an opportunity to tell a story about the transportation needs of residents in Greater Minnesota and a chance to highlight the opportunities and obstacles involved in ensuring that the benefits of CAV technologies help all Minnesotans.

Key takeaways from the workshop:

- CAVs offer opportunities to improve equity and accessibility, supplement rural transit, and provide affordable transportation options.
- The private sector is interested in the economic implications and opportunities.
- There is particular interest in the implications for the freight industry: Are there opportunities to improve supply chains, address driver shortages, and help encourage businesses to consider locating in Greater Minnesota?
- A shared mobility model like that used by Uber and Lyft could be a business model for CAV implementation.
- It's important to get CAVs in front of the general public and show people that this technology is real and viable in their communities.

Continuing Efforts

TPEC researchers are using the results of their public engagement efforts to propose best methods for deploying CAV technologies in different parts of the state. TPEC also launched a similar initiative to understand the needs of transportation-disadvantaged communities on Saint Paul's East Side.

Blockchain: A Disruptive Technology for Transportation?

Blockchain, the technology behind cryptocurrency Bitcoin, is a decentralized, distributed, and public digital ledger used to record transactions among various computers. It also is a potentially disruptive force for various aspects of transportation. TPEC researchers are exploring blockchain and its implications for industries, supply chains, and government agencies.

TPEC researchers believe blockchain has potential for various aspects of the automotive and transportation world. They propose to study how blockchain may apply to Mobility-as-a-Service, supply chains, vehicle tracking, and the Automotive Internet of Things. They would also like to explore whether blockchain can be an answer to security and privacy concerns with automated and connected vehicles and for mileage-based tax collection systems.

In addition, TPEC researchers want to study the challenges faced in the implementation of blockchain. There is some concern about the ability of blockchain to handle massive data and energy requirements. Another concern revolves around privacy. Blockchain initially started as an open, permission-less, public network to break away from the control of central authorities, but now many new applications are being developed in private blockchain.



Engagement Highlights

Sharing insight with leaders and stakeholders



John Kasarda

Medical Industry Cluster Forum

TPEC held a half-day Medical Industry Cluster Forum on November 8, 2019. The purpose was to have a multisector discussion of the importance of the medical industry cluster to Minnesota's economy and its implications for infrastructure use and economic development. The discussion was organized around the key dimensions identified in the TPEC medical device cluster study (see page 5).

John Kasarda, director of the Center for Air Commerce at the University of North Carolina's Kenan-Flagler Business School, was a featured speaker. He discussed the "aerotropolis" model, an urban form where cities are built around airports, speedily connecting time-sensitive suppliers, manufacturers, distributors, and business people to distant customers, clients, and marketplaces.

The aerotropolis model is multimodal. "The battle is won on the ground, not just in the air," Kasarda said. "Ground movement is critical. How do you improve the efficiency of your multimodal transportation connectivity? The fastest, best-connected places to do business will win in the decades ahead."

The forum featured panels with regional and state leaders from the public and private sectors. Organizations represented included the Minnesota Department of Employment and Economic Development, Rochester's Destination Medical Center, Greater MSP, the Metropolitan Airports Commission, and MnDOT.

In closing remarks, Bill Goins of Access to Solutions made a case for ongoing roundtable discussions among industry leaders, researchers, and policymakers. "What we're talking about here is building strategic relationships," Goins said. Conversations among leaders from every affected sector will help ensure that "10, 20, 50 years from now, this is truly the epicenter of helping the world with innovative solutions." A summary report of the forum is available on the TPEC website.



Tom Horan and Bill Goins

"Economies of speed now supersede economies of scale and scope. It's no longer the big eating the small, but the fast eating the slow."

— John Kasarda, Director, Center for Air Commerce, University of North Carolina Kenan-Flagler Business School

Presentations and Participation

TPEC researchers lend their expertise through presentations, stakeholder engagement, and other activities.

For example, Frank Douma served on the steering committee for the Strategic Visioning Workshop for Automated Vehicles in Minnesota. The June 2018 event convened about 100 representatives from across the public, private, academic, and nonprofit sectors to define and advance an agenda related to AVs in the state. It was sponsored by MnDOT, the McKnight Foundation, Hennepin County, the Metropolitan Council, and CTS. Douma also was a liaison on the Land Use and Planning Subcommittee of the Governor’s Advisory Council on Connected and Automated Vehicles.

Other highlights:

- Jerry Zhirong Zhao testified at a Transportation Finance and Policy Committee hearing of the Minnesota Legislature on January 16, 2019.
- Lee Munnich discussed industry cluster research at an I-494 Corridor Commission Construction & Commerce Business Briefing held at Best Buy headquarters in Bloomington in July 2019.
- Adeel Lari traveled to Copenhagen in September 2018 to present at the ITS World Conference. Attendees were particularly interested in TPEC’s research related to equity and AV implementation in rural areas.

Additional presentations:

- Harvard Business School (Dec. 2018 and 2019)
- Minnesota Local Road Research Board (2019)
- CTS Annual Transportation Research Conferences (2017–19)
- Transportation Research Board Annual Meetings (2017–20)
- ITS Minnesota Fall Conference (Oct. 2018)
- Association of Minnesota Counties (Sept. 2018)
- Minnesota Transportation Alliance (Sept. 2018)
- CTS Executive Committee (Aug. 2018)
- ESRI Business Summit (July 2018)

Educating the Workforce



Travis Fried landed a job as a research analyst at the World Resources Institute (WRI) thanks to the combination of his TPEC work and the skills and research experience he gained at the University.

“Working with TPEC taught me that I really enjoyed research and exploring broad questions,” Fried says. “I’ve always had a drive to take what I’ve learned and put it on an international stage.”

Fried credits his academic mentors—Lee Munnich and Thomas Horan—for their guidance and for giving him creative freedom.

His successful stint with TPEC was highlighted by research on Minnesota’s industry hubs and their evolving supply chains. He was awarded the Best Student Agricultural Paper Award by the National Transportation Research Forum (sponsored by the U.S. Department of Agriculture) for a report he co-authored on Minnesota’s grain supply chain. He also received the 2018 John S. Adams Award for Excellence in Transportation Research and Education from CTS.

Former graduate students:

- Dan McNeil, public engagement coordinator, SRF Consulting Group
- Joanne Cho, transportation planner, WSB

Current graduate students:

- Kimberly Napoline, master’s, public policy
- Erika Shepard, master’s, urban and regional planning

Fried also won Best Use of Maps by U-Spatial for a story map he made explaining and visualizing the grain supply chain research. “Story maps are such a fun, effective way to present information,” Fried notes.

After graduating in May 2018, Fried interned at MnDOT in the policy planning unit, where he drew on his skills as a spatial researcher and a transportation researcher and created another story map for MnDOT’s Capital Highway Investment Plan.

Now, he’s applying all of these skills at WRI, a global research nonprofit based in Washington, DC, where he’s researching sustainable urban transportation. “I immediately gravitated toward WRI because it took exactly what I learned as a researcher for TPEC and MnDOT and then applied it to a broader scale,” Fried explains.

Selected Publications

Motorization Trends in Minnesota, TPEC-MTFD-R1-2019, Feb. 2019

Minnesota Transportation Funding Redistribution (2010–2015): Who Contributes More, Who Receives More? March 2018

Evolving Supply Chains and Local Freight Flows: A Geographic Information System Analysis of Minnesota Cereal Grain Movement, Transportation Research Record, 2018, Vol. 2672(9) 1–11

SDV Task Force Matrix of Users, June 2017

The Legal Obligations, Obstacles, and Opportunities for Automated and Connected Vehicles to Improve Mobility and Access for People Unable to Drive, *Michigan State Law Review*, 2017



Video showcases accomplishments

A video created in 2018 showcases TPEC’s work. The video—*TPEC Program: A Foundation for Analysis and Decision Making*—features interviews with researchers and stakeholders.

Related Activities

Researchers leverage TPEC funding to perform related activities for other sponsors and projects. Some of these include:

- Transportation Financing in Changing Times Roundtable (Nov. 18, 2019, State and Local Policy Program)
- Minnesota Distance Based User Fee Demonstration (active research project; sponsor: MnDOT)
- Technical Support for Bridging the Communications Gap in Understanding Road User Charges (active research project; sponsor: Federal Highway Administration)
- Examining the Challenges and Opportunities of Autonomous Vehicles to Urban Planning (active research project; sponsor: CTS)
- Evaluating the Impact of Local Expenditures on State and Regional Transportation Facilities (active research project; sponsor: Minnesota Local Road Research Board)
- Scenarios and Justification for Automated Vehicle Demonstration in Rural Minnesota (completed research project; sponsor: Roadway Safety Institute)

People

Researchers and Staff

TPEC welcomes public engagement and encourages you to contact us with your questions, comments, and research needs.

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Advisory Board

The TPEC Advisory Board provides input and advice on program directions and activities. A key role of this group is to provide insight regarding priority needs for Minnesota and suggestions for how the program might meet them. Membership includes, but is not limited to, the current chairs and ranking members of the Legislative transportation committees, other current and former elected officials, prominent research scholars, and high-level managers from both public and private transportation organizations.

Technical Advisors

Technical guidance is provided by a select group of State of Minnesota and University of Minnesota staff whose work is closely related to the work of the program. Organizations represented include MnDOT, Minnesota DEED, Metropolitan Council, and CTS. Members of this group, both individually and as a group, provide advice regarding research approaches, development of outreach activities, and similar technical discussions. Members of this group are asked to serve, and make recommendations for others to serve, on technical advisory groups for specific research activities.

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