

Center for Teaching Old Models New Tricks (TOMNET)

A USDOT Tier 1 University Transportation Center

PROJECT SCOPE 2019 - 2020

Title: Anticipated Willingness to Share Resources in a Disaster Scenario: The Role of Attitudinal Variables

Principal Investigator: Cynthia Chen, Professor, Department of Civil and Environmental Engineering, University of Washington, Seattle

Co-Principal Investigator: Daniel Abramson, Associate Professor, Department of Urban Design and Planning, University of Washington, Seattle

1. Introduction/Problem Statement

This proposal describes the **second phase** of a multi-year project:

- 2017 – 2018: Literature review assessing the state of the field regarding incorporating attitudinal information into resilience survey methodologies, development of draft methodology
- 2018 – 2019: Field work to develop and test ideas in case study communities via a community self-assessment survey and community workshops
- **2019 – 2020: Complete field work and begin data analysis; report preliminary findings through conference presentations**
- 2020 – 2021: Further information collection and analysis; communicate findings through presentations and publications

Background and context: In a disaster response and recovery context, most of the current work on resource sharing assumes a top-down, centralized approach to resource allocation. There is a gap in knowledge in terms of how to share resources among community members when resources are not at a centralized location, but at community members' private locations, such as homes. In this context, community members' willingness to share becomes an important factor for exploration. Willingness to share becomes especially relevant given the isolating effects of many types of disasters on communities and the subsequent need for localized self-sufficiency. It is also important given the diversity and potential complementarity among households in terms of the resources they possess.

In this phase of the project, we address this knowledge gap. We specifically explore the role that attitudinal factors play in anticipated willingness to share resources, and we compare willingness to share transportation resources with that of other resources needed to meet people's everyday essential needs. We focus on attitudes that relate to disaster preparedness (level of concern about disasters), community social relationships (trust), and relationship to place (place attachment) in order to better understand what kinds of community-scale interventions could help to support disaster preparedness in specific contexts. This research builds upon a previous pilot project investigating willingness to share and social ties in the same study community.¹

Place attachment, or the emotional and cognitive experience linking people to places, has been shown to affect people's perceptions of and responses to natural hazard risks.² It has also been shown to motivate participation in cooperative efforts to improve one's community,³ to build connections between individuals within a community,⁴ and to enhance social trust.⁵ Because our focus is place-based, and

because place attachment has been shown to play a role in both social trust and disaster perception and response, we include it as one of our dimensions of study. We give the place-based approach regional significance by implementing the research in strongly contrasting communities on spectra important to regional resilience planning: urban-rural; high-low SES; and connected-isolated with respect to transportation and telecommunications.

Problem statement: Social behavioral responses to resource scarcity in a disaster scenario, including resource-sharing within communities, are not well-understood.⁶ This phase of the project advances this exploration by focusing in more detail on anticipated willingness to share specific types of disaster resources. The findings can be applied practically by disaster preparedness planners and community-based organizations seeking to prioritize the distribution or development of disaster preparedness resources within community settings, as we discuss further in our conclusions.

Accounts of ad-hoc adaptations made by communities facing disaster provide some insight into the importance of flexibility and social cooperation to overcome challenges faced by the failure of brittle infrastructure.^{7,8} Though informal, the use of such services has been shown to be extremely valuable and can play a significant role in disaster recovery — communities that can self-organize to redistribute resources and provide services on their own can survive longer (before the arrival of the external help) and recover faster.⁹ This research has utility in the realm of emergency planning for transportation and communication system failures. Understanding the ability to substitute modes that rely upon (and potentially build) social trust are important considerations for enabling flexibility – and adaptability – in the infrastructure systems that connect communities to vital health and wellness resources.

In contrast to disaster preparedness approaches that focus on strengthening physical infrastructure, this project adopts a holistic understanding of *community resilience*; that is, one that integrates ecological, engineering, and psycho-social factors^{10,11} to inform our approach to understanding adaptive capacity. We also address the issue of scale. Approaches to disaster preparedness education and outreach tend to target the individual or household, but we argue that a community-scale approach that takes social trust and place attachment into account is critical because communities are likely to be cut off from outside resources during a disaster and will need to rely upon their own local resources, including the social ties that connect people within the community.

Via a sample survey of three Washington State communities, we will explore how different modes of transportation and communication, combined with local social attributes and resources like social trust and place attachment, enable access to community resources for both disaster preparedness and everyday well-being.

2. Project Objectives

The overarching goal of the longer-term (four-phase) project is to understand, model and develop ways in which communities can leverage unique – and interconnected – physical and social resources of place to enhance their own adaptive capacity. This third phase will build upon our Phase II findings to analyze data gathered about issues of social trust, place attachment, and disaster preparedness and response as relevant to different modes of transportation and communication services. Understanding the interactions among these three aspects of community will provide us with data to inform strategies for enhancing adaptive capacity via collaborative infrastructure in future phases.

Specific goals for the third phase of the project include the following:

This phase of the project focuses on better understanding the ways in which the attitudes of individual community members relate to their potential actions in response to a disaster. Specifically, we seek to understand how respondent attitudes about social trust and attachment to place influence household disaster preparedness. We also explore how those attitudes shape respondents' willingness to share different types of preparedness resources, including transportation, with others in their immediate community in a disaster scenario. Specific goals are described below.

Understanding how attitudinal factors such as disaster concern, community social relationships, and place attachment are associated with disaster preparedness:

- Understanding how attitudinal factors affect actual household preparedness with different types of resources
- Understanding which attitudinal factors affect respondents' anticipated willingness to share different types of resources with others in their community in a disaster scenario
- Understanding how willingness to share transportation resources compare to other types of resources

3. Proposed Methodology and Data

Data collection. Phase III of the project involves administering the full-scale survey in three study communities with varying degrees of urban-ness and socioeconomic status.

The proposed project seeks to understand the interactions between social trust, place attachment, and participation in collaborative transportation services to help leverage local social networks, match resources (vehicles) and needs (such as need to travel) within place-based communities. Three characteristically different types of communities in the state of Washington will be tested.

Within Seattle, we are working with the neighborhoods of Laurelhurst and South Park, and the third community is the town of Westport on the Pacific coast. These three communities comprise a range of median household income, density, and racial and ethnic composition. Laurelhurst is an affluent and mostly white Seattle neighborhood situated near the University of Washington and multiple world-class medical institutions. This neighborhood is primarily residential and occupies a peninsula on the shores of Lake Washington. South Park is an ethnically diverse and historically underserved community in south Seattle and comprises a mix of residential and industrial uses. This neighborhood faces public health challenges due to legacy of industrial pollution, and residents of this neighborhood have a life expectancy that is ten years less on average than those who live in Laurelhurst. Westport, located in primarily rural Grays Harbor County, has an economy that is supported largely by local natural resources and tourism. Westport is located on a low-lying peninsula that is particularly susceptible to tsunami hazards and is home to the first tsunami vertical evacuation center constructed in North America.

The research team will collect data from these two communities (via surveys and focus groups), develop interventions, and conduct citizen science activities aimed at both engaging communities and generating potential solutions. The target population for this survey is adult neighborhood residents, that is, members of households that are likely to be involved in decisions about household disaster preparedness.

Data analysis. The survey consists of four modules focused on 1) access to health care and wellness resources, 2) social trust and place attachment, 3) disaster preparedness and 4) demographic data. The objectives of the survey are to understand how different people in the community are connected to different resources, to understand community connection to place, to assess levels of trust associated with community networks and resources, and to gauge levels of household disaster preparedness.

For the questions that evaluated using Likert or other scales (e.g., willingness to share), we will sum the individual responses for each item to create a continuous scale variable. We will then evaluate the strength of association between the variables using Pearson's correlation coefficient/ We use the interpretation scale adopted by Dancey and Reidy¹² in which Pearson's r indicates a weak association at 0.1-0.3, a moderate association at 0.4-0.6, a strong association at 0.7-0.9, and a perfect association at 1.0 (43).

4. Work Plan (Project Tasks)

The 2019 – 2020 project is organized according to the following principal tasks and subtasks:

Task 1: Sample survey implementation

1A. Survey preparation

- Make revisions based on pilot survey; prepare sampling frames and send out survey mailings in two waves (Sept. – Nov. and March – April)

1B. Data collection

- Administer full-scale survey in partner communities
- Collect and clean survey data

Task 2: Create outreach materials

- 2A. Prepare conference posters and/or presentations based on first wave of results

5. Project Schedule

Tasks	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1 Sample survey												
1A Prepare survey												
1B Data collection												
2 Outreach												
2A Materials												

6. Relevance to the Center Theme/Mission

Understanding and predicting the behavioral impacts of changes in transportation patterns and technology. Developing a better understanding of attitudes and behavior patterns can help us to understand changes associated with new transportation technologies in the context of potential disasters or other long-term disruptions to social and physical infrastructures. This includes exploring how social (e.g., social networks) and physical (e.g., transportation/communication systems) infrastructures might interact with one another in times of stability as well as disruption.

Integrating attitudinal variables into transportation modeling. Attitudes communicate personal and community values for the present and the future. Using an appreciative inquiry-based survey methodology that focuses on community strengths and values, we aim to better understand community attitudes about priorities and tradeoffs to enable bottom-up planning for the future (vs. traditional top-down, disaster-focused scenarios that tend to highlight vulnerabilities). This includes understanding the potential for sharing and reconfiguring community transportation resources. Additionally, current regional transportation modeling only examines normal day scenarios. This project will enable the connection to use of transportation modes under disastrous situations.

Developing approaches for quantifying the effects of attitudinal variables on transportation choices and outcomes. The attitudinal variables collected through this survey can be integrated into models in future phases of the project. This information will be valuable in context of disaster preparedness planning but for anticipating innovative and practical approaches to uncertainty across multiple possible futures and addressing the long-term struggles of under-served and/or isolated communities.

7. Anticipated Outcomes and Deliverables

Outcomes and benefits. Our research will continue to develop and implement an innovative and scalable methodology that can be widely applied to communities across the U.S. Engaging regional and municipal partners in a workshop to discuss preliminary results and to consider the potential benefits of collaborative infrastructure will help us to shape future phases of the project. Sharing our research results will also contribute to city-wide initiatives to make Seattle and cities around the country more resilient. As a participant in the Rockefeller Foundation-supported 100 Resilient Cities initiative,¹³ Seattle is expanding its inter-departmental coordination for emergency preparedness, recovery and mitigation as

well as creative approaches to a wide range of chronic threats, from climate change to housing affordability. This project, in all of its phases, is tailored to inform these efforts.

Anticipated products and deliverables. Anticipated products and deliverables from this project include presentations at the Association of Collegiate Schools of Planning annual conference; the Natural Hazards Center annual workshop and researcher's meeting; and the Transportation Research Board Annual Meeting (poster) and the compilation of a survey data set from three communities.

8. Research Team and Management Plan

Research team and qualifications.

- Prof. Cynthia Chen, Civil & Environmental Engineering, Principal investigator. Prof. Chen's interdisciplinary research focuses on the sustainability and resilience of a city through the lens of human beings interacting with the physical environment. Her research results facilitate real-time disaster response and recovery efforts and explore three inter-connected themes: travel behavior (human mobility) analysis, resilient infrastructures, and their intersections.
- Associate Prof. Daniel Abramson, Urban Design & Planning, Co-PI. Prof. Abramson's research in urban planning includes a focus on methods of socio-spatial analysis and public participation, including community resilience and adaptive planning in disaster recovery and hazard mitigation. Recent projects include FEMA- and NSF-funded research on new protocols for state agencies and communities to envision earthquake- and tsunami-resilient development.
- PhD student Katherine Idziorek, Urban Design & Planning, research assistant. Katherine's research interests include community resilience and connections between physical and social infrastructures with a specific focus on transportation systems.
- PhD student Xiangyang Guan, Civil & Environmental Engineering, research assistant. Xiangyang's research interests involve resilience of infrastructure systems, social media data mining for civil engineering, and modeling the complex dynamics in interdependent infrastructure networks.

Team management and communications plan. Profs. Chen and Abramson will supervise the research work, which will primarily be carried out by Katherine and Xiangyang. This UW internal team will meet every other week to review progress and work completed. The UW team will provide the TOMNET team with quarterly project updates and will seek advising and feedback from the team as needed.

9. Technology Transfer Plan

Publications and presentations. In this third-year phase of the project, we will present preliminary findings at conferences in the areas of urban planning; disaster mitigation and preparedness; and transportation planning.

Stakeholder Review Workshops. We propose to hold 1-2 project-focused workshops with project stakeholders, including members of City and regional governance as well as emergency managers to share preliminary survey results and to get their feedback on the project development and applicability.

Technical assistance. This project is designed to support the City of Seattle's participation in the 100 Resilient Cities Initiative. The project team will meet with staff from the Office of Emergency Management to plan how future phases of this project can contribute to their goals.

10. Workforce Development and Outreach Plan

Outreach to communities. We will share collected survey data (in aggregate form) with our community partners to inform a dialogue about potential context-specific interventions for enhancing community adaptive capacity by leveraging collaborative infrastructure.

Graduate student involvement. This project will support one PhD student as part-time Research Assistants for one year.

Undergraduate student involvement. The project PI will also apply for NSF REU funding to support one undergraduate student research positions for the summer of 2020.

K-12 and teacher involvement. No K-12 activities are planned for this phase of the project.

Enhancement of diversity. The project's values- and asset-based protocol and its focus on understanding diverse social networks can reveal unexpected and often under-appreciated community resources, including multilingualism and other aspects of socio-cultural identity, that support resilience.

11. References

1. Idziorek, K., C. Chen, and D. B. Abramson. Integrating Social Factors into Transportation-Focused Disaster Preparedness Research. Presented at the 99th Annual Meeting of the Transportation Research Board, Washington, D.C., 2020.
2. Bonaiuto, Alves, De Dominicis, & Petruccelli. (2016). Place attachment and natural hazard risk: Research review and agenda. *Journal of Environmental Psychology*, 48, 33-53.
3. Manzo, L., & Perkins, D. (2006). Finding Common Ground: The Importance of Place Attachment to Community Participation and Planning. *Journal of Planning Literature*, 20(4), 335-350.
4. Payton, M., Fulton, D., & Anderson, D. (2005). Influence of Place Attachment and Trust on Civic Action: A Study at Sherburne National Wildlife Refuge. *Society & Natural Resources*, 18(6), 511-528.
5. Stefaniak, Bilewicz, & Lewicka. (2017). The merits of teaching local history: Increased place attachment enhances civic engagement and social trust. *Journal of Environmental Psychology*, 51, 217-225.
6. Thomas, J. A., and K. Mora. Community resilience, latent resources and resource scarcity after an earthquake: Is society really three meals away from anarchy?. *Natural Hazards*, Vol. 74, No. 2, 2014, pp. 477-490.
7. de Jong, Feike. (2017). Parks and Bicycles Were Lifelines After Mexico City's Earthquake. *CityLab*. Retrieved from <https://www.citylab.com/environment/2017/09/parks-and-bicycles-were-lifelines-after-mexico-citys-earthquake/541320/>
8. Dickerson, C. (2017). Stranded by Maria, Puerto Ricans Get Creative to Survive. *The New York Times*. Retrieved from <https://www.nytimes.com/2017/10/16/us/hurricane-maria-puerto-rico-stranded.html>
9. Cutter, S., L. Barnes, M. Berry, C. Burton, E. Evans, E. Tate, & J. Webb. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change-Human and Policy Dimensions*. 18: 598-606.
10. Freitag R., D. Abramson, M. Chalana, & M. Dixon. (2014). *Whole Community Resilience: An Asset-Based Approach to Enhancing Adaptive Capacity before a Disruption*. *Journal of the American Planning Association*. 8:324-36.
11. Berkes, F., & H. Ross. (2013). Community Resilience: Toward an Integrated Approach. *Society & Natural Resources*, 26(1), 5-20.
12. Dancy, C. P., and J. Reidy, J. *Statistics without maths for psychology*. Pearson education, 2007.
13. 100 Resilient Cities. *Seattle's Resilience Challenge*. 2017.
www.100resilientcities.org/cities/entry/seattles-resilience-challenge

12. Qualifications of Investigators

CYNTHIA CHEN

Professor, Department of Civil and Environmental Engineering
University of Washington (UW), Seattle, WA 98195-5740 Email: qzchen@uw.edu

Education

Ph.D., Civil and Environmental Engineering, University of California, Davis, 2001.

M.S., Transportation, New Jersey Institute of Technology, 1995.

B.A., Nan Kai University, Tianjin, China, 1992.

Selected Employment History

Professor, Department of Civil and Environmental Engineering, University of Washington, Seattle, 2016-present

Associate Professor, Department of Civil and Environmental Engineering, University of Washington, Seattle, 2009-2016

Assistant Professor, Department of Civil Engineering, City College of New York, 2003-2009

Postdoctoral Research Fellow, Department of Civil and Environmental Engineering, University of California, Davis, 2002-2003.

Fields of Interest and Expertise

(1) Travel behavior/human mobility analysis; (2) Resiliency of infrastructure networks and community resilience; (3) Modeling of socio-physical systems for resiliency and sustainability

5 Recent Relevant Publications

1. Wang, F. and Chen, C. (2018). On data processing required to derive mobility patterns from passively-generated mobile phone data. *Transportation Research Part C*, 87, 58-74. DOI: 10.1016/j.trc.2017.12.003.
2. Guan, X.; Chen, C.; and Work, D. (2016) Tracking the Evolution of Infrastructure Systems and Mass Responses Using Publically Available Data. *PLoS ONE* 11(12): e0167267. doi:10.1371/journal.pone.0167267
3. Chen, C.; Ma, J.; Susilo, Y.; Liu, Y and Wang*, M. (2016) The promises of big data and small data for travel behavior (aka human mobility) analysis. *Transportation Research Part C*, 68, 285-299.
4. Guan, X.; Chen, C. (2014) Using social media data to understand and assess disasters. *Natural Hazards* 74, 837-850.
5. Chen, C.; Neal, D. and Zhou, M. (2013) Understanding the Evolution of a Disaster—A Framework for Assessing Crisis in a System Environment (FACSE). *Natural hazards* 65(1), 407-422.

Recent Honors, Grants, and Awards

NSF, CMMI-CIS/IMEE, “Inferring failure propagation patterns from post-disaster disruptions data”, \$285k, PI, 2015-2018.

NIH, “3-population 3-scale social network model to assess disease transmission, \$1,106k, MPI, 2015-2020.

DOE TRANSNET, “The connected traveler: a framework to reduce energy use in transportation”, 275k, co-PI, 2016-2018.

DANIEL BENJAMIN ABRAMSON

Associate Professor, Department of Urban Design and Planning
University of Washington (UW), Seattle, WA 98195-5740 Email: abramson@u.washington.edu

Education

Ph.D., Urban Planning, Tsinghua University, April 1998.
M.C.P., Urban Studies and Planning, Massachusetts Institute of Technology, June 1992.
M.Arch., Architecture, Massachusetts Institute of Technology, June 1992.
B.A., European History, Harvard University, Magna Cum Laude, June 1985.

Selected Employment History

Asst./Assoc. Professor, Department of Urban Design and Planning, UW, 2001-present.
Postdoctoral Research Fellow and Lecturer, School of Community and Regional Planning Centre for Human Settlements, University of British Columbia, 1998-2001.

Selected Fields of Interest and Expertise

(1) Community resilience and adaptive planning in disaster recovery and hazard mitigation; (2) Periurban and rural responses to rapid urbanization

5 Recent Relevant Publications

Abramson, D. (2017) "The Uses of Planning History in China," in *The Routledge Handbook of Planning History*, edited by Carola Hein (Routledge): 260-272.
Abramson, D. (2016) "Periurbanization and the Politics of Development-as-City-Building in China: a Case for a Social-Ecological Perspective," *Cities*. In press, corrected proof, available online 5 January 2016.
Hu, J. and D. Abramson (2015). "Visions of New Urban-Rural Relations and Alternative Definitions of Well-being in Rapidly Urbanizing China: the Case of Chengdu, Sichuan," in *Transforming Distressed Global Communities: Making Inclusive, Safe, Resilient, and Sustainable Cities*, edited by Fritz Wagner (Ashgate): 317-337.
Freitag, R., D. Abramson, M. Chalana, and M. Dixon (2014). "Whole Community Resilience: An Asset-Based Approach to Enhancing Adaptive Capacity before a Disruption." *Journal of the American Planning Association* 80/ 4: 324-35.
Abramson, D. & Y. Qi (2011). "'Urban-rural Integration' in the Earthquake Zone: Sichuan's Post-Disaster Reconstruction and the Expansion of the Chengdu Metropole," *Pacific Affairs* 84(3), 495-523.

Selected Recent Honors, Grants, and Awards

Bullitt Foundation, Thought Leadership and Innovation in Applied Urban Sustainability Research, Scholarship and Action grant for "Building Community Adaptive Capacity." PI with Cynthia Chen and John Scott, Co-PIs. \$97,896. Funding approved, April 2018.
UW Jackson School of International Studies Area and International Studies grant for "New Urban-Rural Relations in Asia: Trans-Pacific Perspectives on Resilient City-Regions." PI. \$55,000, 2015-2016.
NSF Hazards SEES Award#1331412, "Magnitude 9 Earthquake Scenarios – Probabilistic Modeling, Warnings, Response and Resilience in the Pacific Northwest." Co-PI with John Vidale (PI), Jeff Berman, Ann Bostrom, and Alison Duvall. \$2,937,478. 2013-2017, no-cost extension to August 2019.
UW College of Built Environments interdepartmental research cluster seed fund for Resilience in the Built Environment. Convener and Co-PI. \$35,000. 2013-2016.

13. Budget Including Non-Federal Matching Funds

Institution: University of Washington Seattle

Project Title: Attitudes and trust in promoting use of collaborative transportation services for community adaptive capacity

Principal Investigator: Cynthia Chen

Budget Period: 8/1/2018 - 07/31/2019

CATEGORY	Budgeted Amount from Federal Share	Budgeted Amount from Matching Funds	Explanatory Notes; Identify Source of Matching Funds
Faculty Salaries			
Cynthia Chen	7,151	8,592	0.5 summer month support. 0.6 academic months applied to cost share.
Daniel Abramson	4,721	9,673	0.5 summer month support. 1.02 academic months applied to cost share.
Other Staff Salaries			
Student Salaries	22,644		One 9-month student at 50% FTE
Fringe Benefits	7,123	4,548	24.9% for faculty; 18.4% for student
Total Salaries & Benefits	41,638	22,813	
Student Tuition Remission	17,238	14,999	3 academic quarters of support for the graduate student on the project. 3 academic quarters of non-resident tuition waiver applied to cost share.
Operating Services and Supplies			
Domestic Travel	2,194		Attend workshops organized by the center and conferences
Permanent Equipment (specify)			
Other Direct Costs (specify)	10,000		Publication costs, dataset purchases and computational costs
Total Direct Costs	71,070	37,812	
F&A (Indirect) Costs	29,877	12,661	MTDC: 55.5%
TOTAL COSTS	100,947	50,473	

Grant Deliverables and Reporting Requirements for UTC Grants (November 2016)
Exhibit F

UTC Project Information	
Project Title	Attitudes and trust in promoting use of collaborative transportation services for community adaptive capacity
University	University of Washington, Seattle
Principal Investigator	Cynthia Chen
PI Contact Information	gqchen@uw.edu ; 206-543-8974 (office)
Funding Source(s) and Amounts Provided (by each agency or organization)	USDOT (RITA) and UW for matching fund
Total Project Cost	\$151,470 (including matching funds)
Agency ID or Contract Number	
Start and End Dates	8/1/2018 - 07/31/2019
Brief Description of Research Project	The overarching goal of the longer-term (four-phase) project is to understand and model ways in which we can leverage unique – and interconnected – physical and social characteristics of place to enhance community adaptive capacity in response to disruptions. This second phase (one-year) is focused on finalizing and implementing the survey instrument developed in the previous year, which assesses community adaptive capacity in terms of social trust, use of transportation networks, and disaster preparedness. Between the pilot data collection and the full survey launch, the team will hold 1-2 stakeholder review workshops to review the initial data and to engage local, municipal and regional stakeholders in a dialogue about the potential benefits of collaborative infrastructure to help connect our work to ongoing regional transportation and resilience planning initiatives.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	
Impacts/Benefits of Implementation (actual, not anticipated)	
Web Links <ul style="list-style-type: none"> • Reports • Project Website 	