

# Center for Teaching Old Models New Tricks (TOMNET)

## A USDOT Tier 1 University Transportation Center

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### PROFJECT SCOPE 2017 - 2018

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**Title:** Understanding Community Behaviors and Attitudes for Resilience:  
Developing a Scalable Survey Methodology

**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

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## 1. Introduction/Problem Statement

This proposal describes the **first phase** of what is anticipated to be a multi-year project:

- **2017 – 2018: Literature review assessing the state of the field regarding incorporating attitudinal information into resilience survey methodologies, and testing of draft methodology**
- 2018 – 2019: Field work to develop and test ideas in case study communities
- 2019 – 2020: Contribute to and participate in the proposed TOMNET panel survey across sites and communicate findings through presentations and publications
- 2020 – 2021: Further information collection and analysis; continued communication of findings

**Background:** In the resilience literature, adaptive capacity is defined as a community's capability to absorb shocks or reconfigure and transform in response to disruption or change.<sup>1,2</sup> We hypothesize that adaptive capacity is inherently related to community characteristics and can be greatly strengthened by localized strategies that in turn trigger a community's self-organizing capability.<sup>3,4</sup> Examples of adaptive capacity include: arranging new transportation modes (e.g., ridesharing and carsharing) and enabling new social ties. The goal of creating a scalable survey methodology is to develop an understanding of community needs and resources that can be used to enable communities' adaptive capacity. When implemented, such a survey methodology will help to build a database of community assets and their potential for connection and/or transformation given a disruption or other long-term changing conditions.

**Problem statement:** As a critical dimension of community resilience<sup>5</sup>, adaptive capacity is rarely quantified—there is little understanding about what it entails and how it can be represented, modeled, and enabled in a community context.<sup>6,7</sup> Although it is broadly recognized that adaptive capacity plays an important role in community resilience, we do not yet have a reliable and scalable methodology for collecting and disseminating information on community assets and resources that enable adaptive capacity. To better understand the nature of relationships (social and physical-social ties) within a

community, we need to collect information on community assets, attitudes and values regarding unique social and physical assets – not just after, but *before* a disruption occurs.<sup>8</sup> The proposed project responds to this critical gap by creating a scalable survey methodology designed to answer a set of questions relevant in understanding community adaptive capacity. These questions focus on understanding community assets and localized strategies for potential community response to disruption and how community characteristics and assets might contribute to adaptive capacity.

**Context:** The proposed survey methodology will link adaptive capacity directly to community resilience behavior by uncovering how attitudes and values about different kinds of interconnected assets within a community (e.g. social, transportation) affect adaptive capacity. Understanding the components that make up a community’s universe of assets – and community attitudes toward those components – can help us to characterize their importance, uniqueness, adaptability and potential fragility in the face of a disruption or disaster. In future phases of the project, this survey methodology will be tested through pilot projects in a series of case study neighborhoods across Seattle.

## 2. Project Objectives

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. This first phase will set the stage for that line of inquiry by exploring and assessing the state of the field and best practices regarding attitudinal surveys in the areas of both resilience and transportation planning.

**Specific goals for the first phase project include the following:**

- Understand, via a thorough literature review, the state of the field in survey methodology with a focus on intersections between the transportation, resilience, and appreciative inquiry literatures
- Identify and address issues of relevant to creating a scalable methodology
- Develop a scalable survey methodology focused on identifying and characterizing community resources as well as attitudes about those resources, including their current and future use
- Potentially implement a small pilot project and collect preliminary data

This project will stimulate new ways of thinking about the interaction of physical systems (such as multimodal transportation networks) and social systems (such as community organizations or families of children attending a neighborhood school) in a community resilience context, expanding the convention of modeling humans primarily as demand on physical systems, and vulnerabilities (as opposed to unique community assets) as the sole focus for resilience planning. The survey methodology will create an original resource for designing an attitude- and values-based assessment of community resilience.<sup>9</sup> This data set will complement future project phases that analyze interdependent physical and social networks as contributing to resilience.

## 3. Proposed Methodology and Data

**Approach.** We will base the development of our survey methodology on an appreciative inquiry approach that focuses on the identification of community strengths over vulnerabilities and risks.<sup>10</sup> The approach involves defining current community values (quality of life, and developmental aspirations) and assets, including both physical (facilities and transportation systems as well as other assets such as food,

vehicles, etc.) and social resources (individuals, families and organizations and their respective social ties). This information will provide us with a picture of the range of assets that are valued by a community, and the community's attitudes about those assets, considering both the present and the future. In further phases of the project, this data will inform the identification of longer term pre-emptive or adaptive strategies that could reduce the likelihood of community function disruption due to the loss of an asset. We will build upon previous field work that has tested an appreciative inquiry approach to engaging communities regarding topics of community values and potential for resilience.<sup>11</sup>

Key overarching questions include:

- Understanding and characterizing community resources. What are the everyday resources that people use (transportation, utilities)? In what ways can these assets be categorized?
- Localized strategies. What are community members' anticipated adaptation behaviors? What can we learn from these behaviors about the strength (or weakness) of community physical-social connections?

***Developing the survey methodology.*** The survey methodology will be designed to collect specific kinds of data relevant to community attitudes and resilience: 1) social entities and ties, 2) attitudes toward community resources; and 3) patterns of behavior as related to identified resources, both in the present and what might be expected or anticipated in the future. Our investigation will focus on the relationships between physical and social assets that comprise a community (examples might include water, food, transportation resources, family connections, community organizations, social services, public buildings, public open space, etc).

Components of the methodology development and preliminary data collection effort include:

- Completing the methodology literature review. A literature review will identify best practices in resilience survey methodologies. In particular, the literature review will address dealing with issues of scalability as well as assessing methodological approaches, including appreciative inquiry.
- Variables to be collected. Data will be collected on social entities, social ties, attitudes toward community resources and their past and expected future behaviors when access to an asset is lost. In addition, participants will also answer brief surveys to establish comparability with other, previously-studied communities on attributes such as levels of trust, collective efficacy and social capital to establish validity of the questions.<sup>12,13</sup>
- Questionnaire design. Clearly define constructs of interest, and design questions that will provide an accurate measure of those constructs.<sup>14</sup> Test draft questions as appropriate.
- Determining the target population and desired sampling frame. The target population will likely include all households, businesses, and institutions (e.g. schools) within a selected study area. We will determine the availability of existing lists maintained by community groups to our initial sampling frames. These lists will be supplemented by commercial lists that can be purchased (e.g., for resident families within a study area).
- Choosing an appropriate sampling method. Our primary survey effort will likely employ a snowball sampling method, potentially to be supplemented with random sampling.<sup>15</sup> We will first

identify a group of selected informants representing diverse perspectives with a small random sample of the population of interest as the seed. The sample will be expanded and updated by tracking the various relations noted by the seed subjects.

- A pilot test will be carried out first to test survey protocols. This pilot test will help us to fine-tune our survey and question design before implementing the survey in the targeted case study communities. Pilot surveys might also be implemented if possible in cases of minor disruptions (such as electrical outages) to test the validity of the questions and methodology approach.

#### **4. Work Plan (Project Tasks)**

The 2017 – 2018 project is organized according to the following principal tasks and subtasks:

##### ***Task 1: Literature review.***

1A. Review the following topics/literatures to inform survey methodology development:

- Review the state of the field in survey methodology with a focus on issues of scalability
- Travel choice behavior/travel patterns survey methodology
- Appreciative inquiry survey methodology
- Understanding and characterizing social capital
- Resilience planning for transportation infrastructure
- Review and assess appreciative inquiry as applied in the context of FEMA-funded resilience projects.<sup>16</sup> Extract lessons learned that could be applied to this project.

1B. Complete a working paper based on findings from literature review and appreciative inquiry assessment.

##### ***Task 2: Preliminary survey design.***

2A. Determine variables of interest and constructs for communicating and capturing them in the survey.

2B. Develop survey administration process (including questionnaire design) as informed by literature review and selection of key variables.

2C. Implement pilot project/s to test survey methodology.

##### ***Task 3: Define sampling strategy.***

3A. Determine target population for survey dissemination and collect relevant contact information for sampling frame.

3B. Consider and assess potential sampling methods to determine an appropriate sampling approach.

##### ***Task 4: Create outreach materials***

4A. Create project poster and activity for UW Discovery Days, a free, annual, two-day event during which UW engineering departments share their work with students, teachers, families and the community.

4B. Develop working paper into a journal article and submit. Prepare conference presentation (as appropriate, TBD).

## 5. Project Schedule

Tasks	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
<b>1 Lit review</b>												
1A Lit review												
1B Working paper												
<b>2 Survey design</b>												
2A Variables												
2B Questions												
2C Pilot project												
<b>3 Sampling</b>												
3A Population												
3B Methods												

## 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 and physical 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, 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). This includes understanding the potential for sharing and reconfiguring community transportation resources. In addition, this project will explore issues of scalability for gathering information on attitudinal variables and incorporating them into transportation modeling.

***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 resilience and disaster mitigation planning but also in terms of anticipating innovative and practical approaches to uncertainty across multiple possible futures and addressing the long-term struggles of under-served neighborhoods.

## 7. Anticipated Outcomes and Deliverables

***Outcomes and benefits.*** Our research will develop an innovative and scalable methodology that can be widely applied to communities across the U.S. The development of the survey methodology will enable future phases of the project, such as community visioning for long range plans, or playing out disaster scenarios. 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,<sup>17</sup> 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:

- The preliminary survey methodology, which can be applied in pilot projects
- Findings from pilot tests
- A draft subset of questions about attitudes and resilience to be used in a TOMNET panel survey
- A working paper focused on the use of appreciative inquiry survey methodologies in the context of resilience and transportation planning
- A project poster that can be presented at conferences or other events, such as UW's Discovery Days (see Workforce Development section below)

## **8. Research Team and Management Plan**

***Research team and qualifications.***

- Prof. Cynthia Chen, Civil 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 Rochelle Starrett, Civil Engineering, research assistant. Rochelle's research interests include developing more effective and sustainable transportation systems through a better understanding of human travel behavior.

***Team management and communications plan.*** Profs. Chen and Abramson will supervise the research work, which will primarily be carried out by Katherine and Rochelle. This UW internal team will meet once every two weeks to review progress and review work completed to date. 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.*** One goal of the project is to submit the initial literature review as a journal article, and future phases will provide findings to support additional publications. The literature review article produced in this first phase of the project will focus on bringing together the diverse bodies of literature reviewed into a framework to support a scalable methodology. The project team will create a poster for the UW Discovery Days event and potentially conference presentations as appropriate based on research completed in 2017 – 2018.

**Workshops.** Although this first phase of the project (2017 - 2018) focuses on literature review and question design, it may be feasible to hold some project-focused workshops with members of City and regional governance to get their feedback on the project development and applicability. Future phases will incorporate community workshops into the process of developing and testing the methodology.

**Technical assistance.** This project will be 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 for ways in which future phases of this project can contribute to their goals.

## **10. Workforce Development and Outreach Plan**

**Outreach to communities.** Community adaptive capacity not only significantly boosts a community's resilience post-disaster, but also enhances everyday quality of life regardless of whether a disruption occurs. Creating the survey methodology will lay the groundwork for participatory activities with project partners in future project phases, which will involve outreach to community groups and institutions (including schools) to help them to build their own adaptive capacity by identifying assets, enhancing community emergency preparedness, and assisting them to participate in Seattle's Community Emergency Hubs program. This first phase of the overall project may include a pilot survey or surveys. Will meet regularly with pilot project communities and keep them involved in the project in future phases as appropriate.

**Graduate student involvement.** This project will support two PhD student as full-time Research Assistants for one year and will comprise the first phase of the research.

**Undergraduate student involvement.** The project PI will also apply for NSF REU funding to support two undergraduate student research positions for the summer of 2018.

**K-12 and teacher involvement.** See "Outreach to communities" above. Future phases of the project could potentially engage schools within case study neighborhoods in related learning activities. The project team will participate in the University of Washington College of Engineering's Discovery Days in April of 2018 by creating a project poster and a hands-on activity for learning about transportation and resilience.

**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

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## 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](mailto: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. 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
2. 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.
3. Guan, X.; Chen, C. (2014) Using social media data to understand and assess disasters. *Natural Hazards* 74, 837-850.
4. 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.
5. Wang, T. and Chen, C. (2012) Attitudes, mode switching behavior, and the built environment: a longitudinal study in the Puget Sound region. *Transportation Research Part A* 46, 1594-1607.

### 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](mailto: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**

1. Abramson, D. (2016) "Messy Urbanism and Space for Community Engagement in China," in *Messy Urbanism: Understanding the 'Other' Cities of Asia*, edited by Manish Chalana and Jeffrey Hou, Hong Kong University Press.
2. 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.
3. 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.
4. 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.
5. 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.

### **Recent Honors, Grants, and Awards**

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.

UW College of Built Environments interdepartmental research cluster seed fund for Resilience in the Built Environment. Co-PI. \$35,000. 2013-2016.

Fulbright Senior Research Scholarship for 6 months research on earthquake recovery in Sichuan, China, 2010.

### 13. Budget Including Non-Federal Matching Funds

**Institution:** University of Washington Seattle

**Project Title:** Understanding community behaviors and attitudes for resilience: developing a scalable survey methodology

**Principal Investigator:** Cynthia Chen

**Budget Period:** 8/1/2017 - 07/31/2018

CATEGORY	Budgeted Amount from Federal Share	Budgeted Amount from Matching Funds	Explanatory Notes; Identify Source of Matching Funds
Faculty Salaries			
Cynthia Chen	11,719	26,016	1 summer month support. 2.2 academic months applied to cost share.
Daniel Abramson	8,338	18,438	1 summer month support. 2.2 academic months applied to cost share.
Other Staff Salaries			
Student Salaries	52,090		2 students each year at 50% FTE
Fringe Benefits	14,094	10,802	24.3% for faculty; 17.7% for student
<b>Total Salaries &amp; Benefits</b>	<b>86,241</b>	<b>55,256</b>	
Student Tuition Remission	38,383	24,629	4 quarters of support for each student on the project. Non-resident tuition waiver applied to cost share.
Operating Services and Supplies			
Domestic Travel	14,838		Attend workshops organized by the center and conferences
Permanent Equipment (specify)	10,000		2-3 computers
Other Direct Costs (specify)	10,000		Publication costs, datasets purchases and computational costs

<b>Total Direct Costs</b>	159,462	79,885	
F&A (Indirect) Costs	60,538	30,115	MTDC: 54.5%
<b>TOTAL COSTS</b>	220,000	110,000	

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

### Exhibit F

UTC Project Information	
Project Title	Understanding community behaviors and attitudes for resilience: developing a scalable survey methodology
University	University of Washington, Seattle
Principal Investigator	Cynthia Chen
PI Contact Information	<a href="mailto:qzchen@uw.edu">qzchen@uw.edu</a> ; 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	\$330,000 (including matching funds)
Agency ID or Contract Number	
Start and End Dates	8/1/2017 - 07/31/2018
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 first phase (one-year) sets the stage for that line of inquiry by exploring and assessing the state of the field and best practices regarding attitudinal surveys in the areas of both resilience and transportation planning. The goal is to conduct a thorough review of the literature pertinent to resilience, transportation choices, and survey methodologies and develop a scalable survey methodology that can be applied to many communities to identify their unique community resources, which will enable their community adaptive capacity.
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"> <li>• Reports</li> </ul>	

• Project Website	
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