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State-of-the-practice assessment of climate change adaptation practices across metropolitan planning organizations pre- and post-Hurricane Sandy

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ABSTRACT

Metropolitan Planning Organizations (MPOs) throughout the United States are identifying goals and implementation strategies to reduce the impacts of climate change through transportation adaptation initiatives. Using vulnerability assessments as well as adaptation practices that support mitigation, MPOs are beginning to integrate climate change planning into the long range planning process. Evaluating the state-of-the-practice of adaptation planning and adaptation in support of mitigation is useful in that it helps identify gaps and areas of improvement. Therefore, this research investigates the state-of-the-practice of MPO adaptation planning using the Mid-Atlantic region as a case study. Surveys, administered in 2012 and 2014, are used to identify the level of progress of MPOs with regard to climate change adaptation practices as well as barriers before and after Hurricane Sandy. A cross-sectional analysis using GIS (Geographic Information Systems) maps the results of the surveys and spatially compares regional trends. The results of the case study suggest growing interest in adaptation efforts such as floodplain area designations and efforts to enhance coordination and collaboration as transportation jurisdictions respond to the potential climate change impacts. In addition, MPOs with dense, smaller geographic areas prioritize inter-jurisdictional collaboration as high, suggesting that they are more reliant on other agencies to maintain inter-connectivity of transportation networks and further implement adaptation planning practices.

1. Introduction

Transportation agencies continue to promote sustainable practices and alter behavior in response to growing awareness and evidence of the risk and effects of climate change (Oswald et al., 2012). The National Research Council has emphasized that climate change is not only a future problem but is currently impacting societies (TRB, 2008). Regional impacts, including rising temperatures, increased precipitation, rising sea levels, as well as increases in the frequency of extreme events, will continue to pose a threat on freight and passenger transportation (IPCC, 2013). Recent events, such as Hurricane Sandy, which impacted the Mid-Atlantic coastal region of the U.S. in October 2012, suggest that research on mitigation is timely

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and adaptation is essential to the protection of coastal development and low-lying transportation infrastructure (Kaufman et al., 2012). Therefore, transportation organizations throughout the United States, specifically Metropolitan Planning Organizations (MPOs), can help implement these changes by altering the current planning, design and construction methods in order to combat the effects of climate change.

1.1. Motivation

Due to heightened global awareness, as well as recent governmental initiatives such as the development of the U.S. Interagency Climate Change Adaptation Taskforce in 2013 (The White House, 2013), there is pressure on transportation agencies to begin to integrate climate change adaptation practices into the long range transportation planning process. Although adaptation efforts are essential, there are barriers preventing agencies from adapting (UK Climate Impacts Programme, 2014). Identifying barriers as well as capturing a holistic view of past, current, and future MPO adaptation practices can allow for comparisons of adaptation initiatives, implementation progress and overall agency views on critical climate change issues over time.

1.2. Objectives and research method

This paper reports on research investigating MPO's awareness of, and experience with, adaptation practices, barriers, and efforts related to climate change over time using the Mid-Atlantic region as a case study. The primary objective of the study is to identify changes in the level of implementation of adaptation practices between 2012 (pre-Hurricane Sandy) and 2014 (post-Hurricane Sandy) based on two surveys of MPOs in the Mid-Atlantic region. The survey methodology remained consistent between 2012 and 2014 in order to allow for a valid comparison over time (Oswald and McNeil, 2013a). The following research method was followed in order to complete the objectives:

1. Review literature related to regional climate change, climate change impacts, adaptation/ mitigation practices and current efforts.
2. Develop survey and distribute to MPOs in the Mid-Atlantic region in 2012 and 2014.
3. Analyze progress based on spatial (geographic regions), temporal (2012 and 2014), and jurisdictional (between agencies) analysis of the survey data.
4. Provide recommendations based on survey results and analysis.

The next section reviews the current status of climate change research as related to transportation and transportation planning. This is followed by a description of the survey methodology. The subsequent sections present analyses of the survey results including a before and after (Hurricane Sandy) analysis and a cross-sectional analysis. The last two sections include the discussion of the results and conclusions which summarizes the insights and presents opportunities for future research.

2. Climate change and transportation

Planning for climate change is challenging since the potential impacts are based on regional context and geographic location. This distinctive quality of variations in potential impacts of climate change in different locations requires an assessment of progress at a more regional rather than national scale. Throughout the United States, the range of potential climate change impacts, including changes in temperature, precipitation, sea level rise, and extreme weather intensity, exhibits diversity in terms of the extent, magnitude and potential impact on transportation infrastructure. Therefore, planning strategies and action against climate change must be tailored to needs based on location and geography (CIER, 2007).

The United States can be divided into eight separate regions, each exhibiting their own potential risks as a result of climate change. The regions are: Northeast and Mid-Atlantic, Midwest, West, Great Plains, Southeast, Pacific Northwest, Alaska, Hawaii and U.S. Affiliated Islands (CIER, 2007). This research focuses on the Mid-Atlantic region (DC, DE, MD, NJ, NY, PA and WV). Therefore, the climate change phenomena specific to this region are an increase in very hot days and heat waves, rising sea levels, and an increase in intense precipitation events. These three potential impacts serve as the basis for the types of adaptation goals and practices that are relevant to Mid-Atlantic MPOs.

In 2013, Hurricane Sandy, a Category 3 storm, impacted more than a dozen states, most of which are in the Mid-Atlantic region and led to significant economic loss (FEMA, 2014). This extreme weather event caused severe inundation and forced transportation agencies, such as the New York Department of Transportation, to assess damages, repair systems and identify system vulnerabilities (Kaufman et al., 2012). As a result, awareness of the need for proactive adaptation practices before extreme weather events has increased in Mid-Atlantic transportation agencies.

2.1. Adaptation practices

Adaptation, with respect to transportation, can be defined as "actions to reduce the vulnerability of natural and human systems or to increase system resiliency in light of expected climate change or extreme weather events" (Meyer et al., 2014).