The University of Chicago

Planning Beyond Cars: Disability Accommodations Driving Public Transportation Incorporation in Evacuation Plans

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A thesis submitted for partial fulfillment of the requirements for a Bachelor of Arts degree in *Environmental and Urban Studies* and *Public Policy Studies*.

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Abstract

Residents of Seattle, Washington, live under constant threat of natural disasters, and the risks are only increasing due to climate change. Hurricane Katrina made clear that disasters are more dangerous for residents lacking private transportation for evacuations. Through a comparison of the 2001 Nisqually Earthquake and the 2014 Oso Mudslide, this project analyzes to what extent Seattle has learned lessons from the shortcomings of evacuation planners that were revealed by Katrina. Evacuation plans for Seattle and relevant federal policies reveal that there is a recognized need for accommodations for low-mobility residents, but the prior arrangements needed for equitable support are not properly established. The Seattle Office of Emergency Management has shown an increased awareness of the need for public transportation in emergency evacuations, but this paper argues that the city accounts for this population as a minority instead of a majority of evacuees.

Abstract

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I. Introduction

As the climate is changing, people are adopting habits like relying on public transportation to reduce their carbon footprint, but this change may be putting them in significant danger as a result of the very problem they are trying to address. Extreme natural disasters are becoming increasingly common as anthropogenic activities drive climate change (Yazdani et al., 2020). One of the major recommendations and social campaigns to reduce the emissions contributing to climate change is to rely more on sustainable forms of transportation: public modes such as trains and buses and active modes like biking and walking, instead of personal vehicles (Intergovernmental Panel On Climate Change (IPCC), 2023). If the frequency of evacuations are increasing, and people are meant to rely even more on public transportation, then evacuation plans must effectively account for public transportation options in order to save people from natural disasters.

Adapting evacuation plans to rely on public transportation has become more critical due to climate change but has always been a necessary approach to equitably plan for the safety of all residents. Reliance on public transportation is not always optional and can be the result of support needs for individuals with disabilities, inability to drive while being under the driving age or elderly, and lack of income to afford a personal vehicle. A lack of proper emergency planning for those without personal transportation resulted in catastrophic results during the evacuation of New Orleans during Hurricane Katrina. Of the 270,000 survivors stranded in New Orleans, 93 percent were black, and 55 percent lacked personal means to evacuate the city (Wailoo et al., 2010). Katrina made clear to policy makers and the public that marginalized and vulnerable communities are put at greater risk when evacuation plans do not account for public

transportation needs. The outcomes of Katrina were so drastic that the Post-Katrina Emergency Management Reform Act (PKEMRA) was passed to formalize federal guidance on planning and broadly improve the equitability and effectiveness of emergency planning efforts.

Seattle, Washington is a valuable location to evaluate the incorporation of public transportation in evacuation planning at the city, county and state level. As a city, Seattle is uniquely positioned to understand the role of natural disasters, for it is the largest city in its area and it "ranks number one in the country in terms of the number of hazards faced, which includes winter storms, landslides, flooding and earthquakes" (Emergency Management, n.d.). Seattle has faced, and will continue to face, hazards that warrant evacuation, and it is a top concern for the city through the Office of Emergency Management to prepare for such situations. Not only is Seattle an ideal location for understanding the importance of evacuation planning, it also invests heavily in its public and active transportation. The city has gotten attention in recent years for being a leader in public transportation availability, attributable to expansion of its Light Rail (train line) and high bus ridership rates (Whitley, 2018). As planners in the United States adapt to the increasing number of natural disasters and the need to rely less on personal vehicles overall, Seattle will be an important case to understand due to its disaster vulnerability and developments in public transportation.

To evaluate the response to and preparedness for disasters in Seattle, two cases of natural disasters in the area are reviewed in-depth: the Nisqually Earthquake in 2001 and the Oso Mudslide[1] in 2014. Both of these cases are large-scale historical disasters in the region that chronologically frame Katrina, as you can see in Figure 1 below.

[1] For clarity, mudslide and landslide are used interchangeably. Through the analysis of these cases, it is revealed that Seattle emergency planners have shown an increased awareness of low-mobility populations and incorporated public transportation into their plans for evacuations.

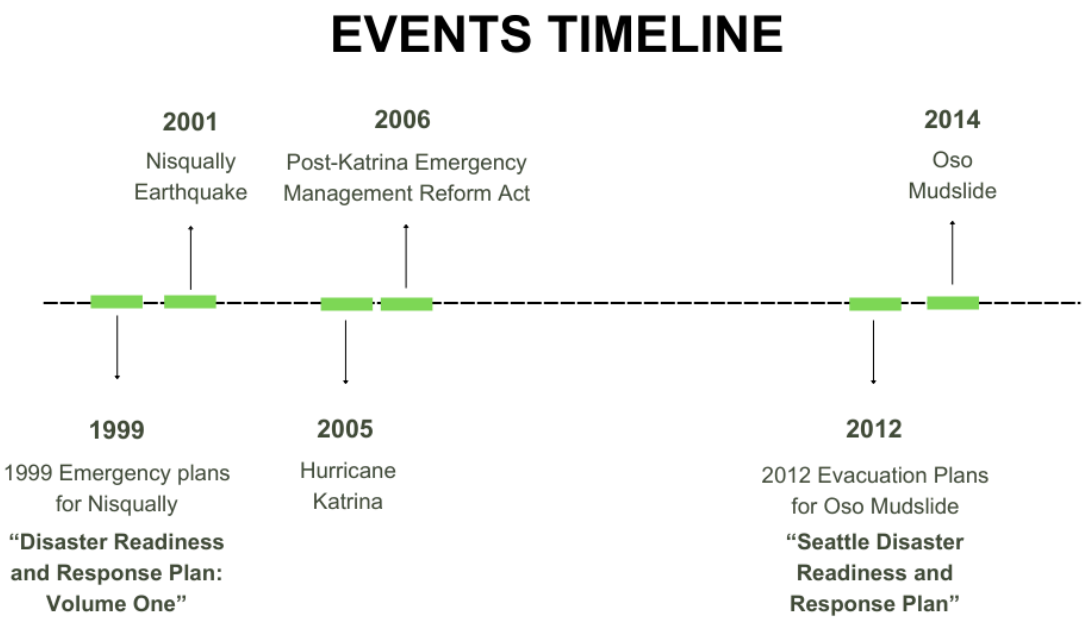

Figure 1. Chronological timeline of important events including publishing year of primary documents reviewed and natural disasters discussed

Nisqually was an earthquake in 2001 of 6.8 magnitude, 36 miles southwest of the city (Disaster Management Committee [DMC], 2001). The Seattle Operations Center (OEC) activated immediately to centralize communications, over 200 residents of low-income housing were displaced (DMC, 2001) and severe damage occurred to several components of transportation infrastructure including airports and bridges (State of Oregon Department of Geology and Mineral Studies, 2001). Oso occurred in 2014 and is one of the worst landslides in U.S. history (SR 530 Landslide Commission, 2014). The disaster struck 50 miles northeast of Seattle where it forced 15 helicopter evacuations, caused 43 casualties (SR 530 Landslide Commission, 2014) and resulted in a "major disaster" declaration from the President of the United States (SR 530 Landslide Commission, 2014, p. 1).

This project aims to address the growing concern of evacuations during climate change while accounting for the equity concerns of such planning efforts. By focusing on Seattle, a city

that is vulnerable to many forms of disasters that would warrant evacuations, and narrowing in on the impact of Katrina as a key catastrophic disaster in the field of emergency planning, the selected cases help answer the question: have planners learned from Katrina? And if so, is there still room for improvement?

II. Background and Context

Important Terminologies

My investigation spans two decades, and as such, terminologies have changed and evolved. When referring to specific citations, I will use the term referenced directly by that resource, but otherwise use the most contemporary terms in the discussions of transportation and emergency management. Below is a non-exhaustive list of terms defined for convenience of understanding.

Disabled Individuals: Those who are categorized as disabled according to the Americans with Disabilities Act of 1990

Low-mobility: Individuals who are transportation challenged and cannot rely on a personal car for transportation. This includes youth, elderly, those with mobility related disabilities, and non-personal car owning individuals.

Public transportation: Any method of transportation available to the general public (trains, buses, ferries, etc.)

Vulnerable populations: Non-exclusively including all low-mobility individuals as well as those who are non-English proficient and those with disabilities that are not mobility related.

Current Demographics of Seattle

According to a recent report on the commuting habits of those working in Seattle, more people are commuting to work with active or public transportation methods than driving alone. In 2019, 46 percent of commuters reported relying on public transit to get to work, and a combined 10 percent reported using either a bike or walking to work (Ashour et al., 2023). Public transportation reliance significantly decreased during the pandemic, but use numbers are

increasing to 22 percent relying on public transportation and 6 percent relying on active transportation in 2022 (Ashour et al., 2023). It is clear that a large population of individuals in the city are dependent on public transportation, and would be at higher risk if anything were to happen while they are at work.

The reliance on public transit is partly due to active choice, and partly due to access to vehicles. A staggering 34 percent of those commuting on public transit cited reducing their carbon emissions as the reason for their choice (Ashour et al., 2023). There are further equitability concerns as well, for those making less than $60,000 a year rely on public transportation the most, and 58 percent of those relying on public transportation for their commute cited cost of driving and parking as the main reason for their mode of choice (Ashour et al., 2023). Not accounting for the needs of these low-mobility individuals, whether low income or trying to mitigate climate change, in emergency planning endangers them because of their reliance on public transportation.

In addition to commuters, the recent 2020 American Community Survey allows a more updated picture on how many residents in and around Seattle have no vehicle for their household. As shown below in Figure 2, there are almost 30 census tracts where at least 39 percent of residents do not have a vehicle in their household (United States Census Bureau, 2022). Unless plans properly account for this magnitude of low-mobility individuals during evacuations, they cannot be adequately prepared for large-scale disasters.

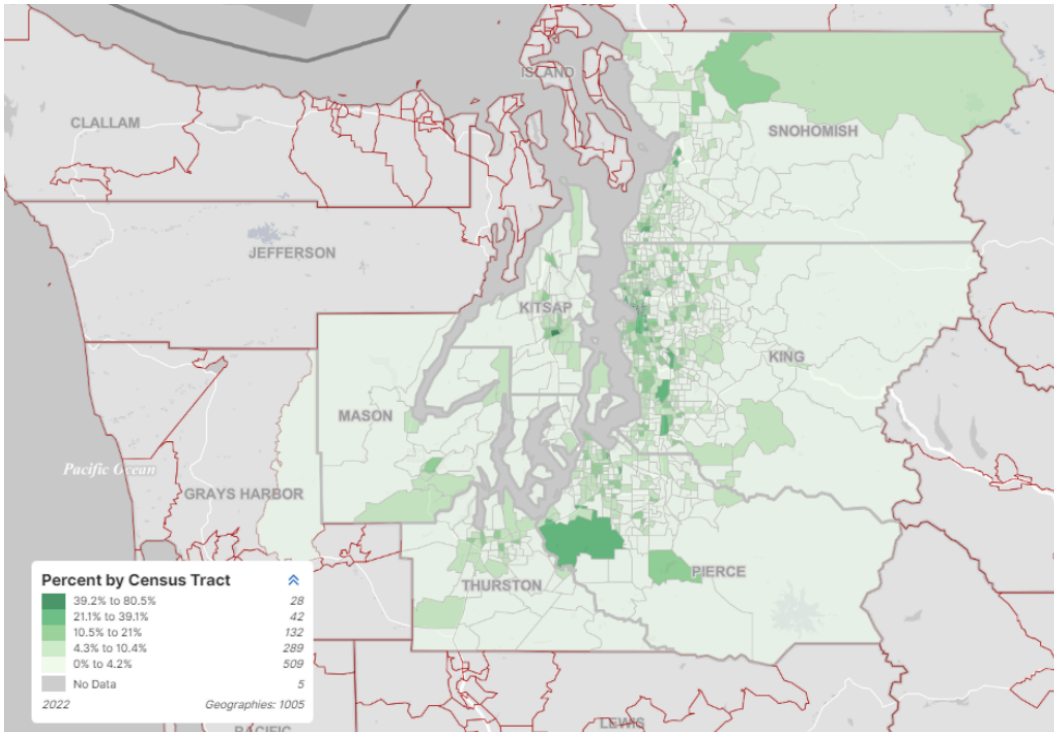

Figure 2. Map of Occupied Housing Units with no vehicle available in counties near Seattle, WA. Made at data.censu.gov using the 2022: ACS 5 Year Estimates Subject Tables dataset from the United States Census Bureau.

Situating Seattle Emergency Planning

Due to both its importance in the region and the reality that natural disasters do not respect municipal borders, Seattle plans for and assists with disasters that affect Washingtonians on a city, metropolitan, county and a sub-state regional level. The diversity of locations that the city supports can convolute discussion, so for clarity I rely on the term "Puget Sound" to refer to the area surrounding Seattle beyond even its county, King County, boundaries. This region is meant to include the sub-regions of "South Puget Sound" and "North Puget Sound", see Figure 3, which cover all locations discussed regarding the two cases of investigation in this work: Nisqually and Oso.

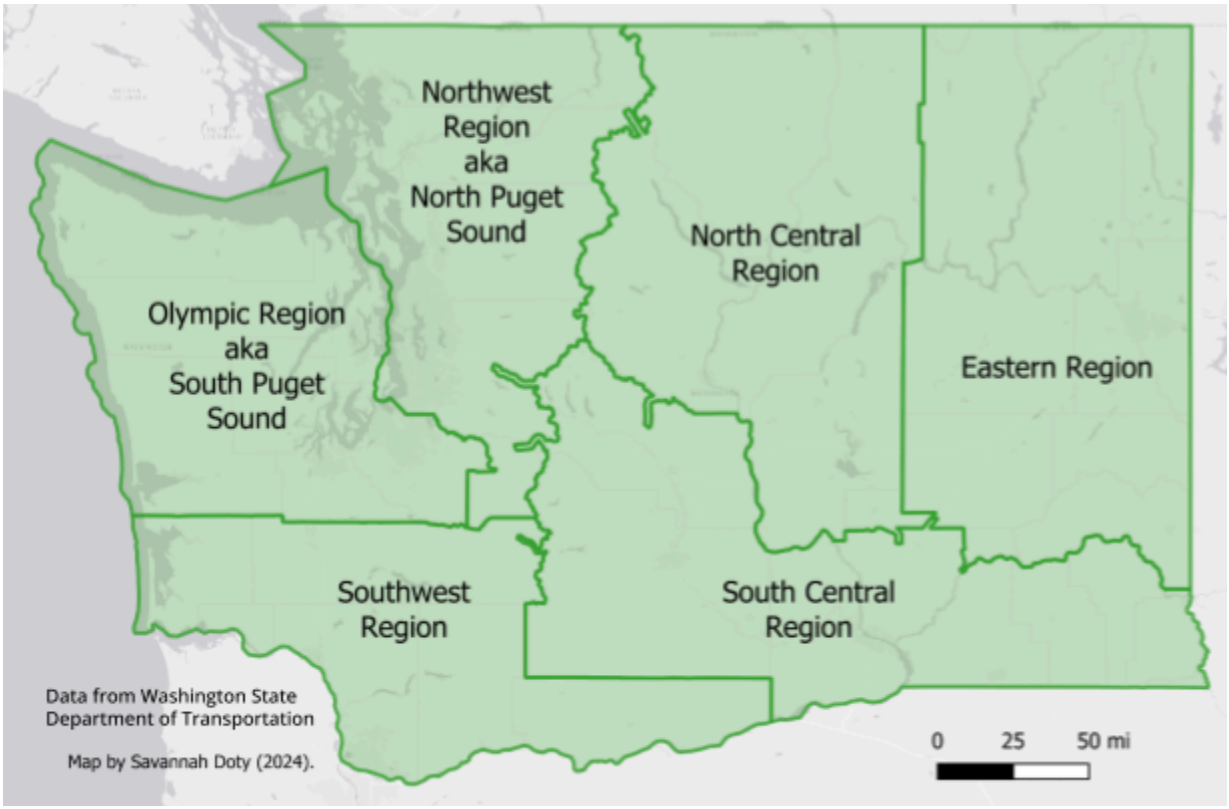

Figure 3. Map of regions in Washington State

Emergency management for the Puget Sound is handled on several government levels, but Seattle-directed planning is under the Seattle Office of Emergency Management (OEM). Throughout its operation, OEM has activated several times for situations beyond the city in the Puget Sound area such as a water outage at Snoqualmie Pass (54 mi Southeast of the city) or the 2018 lockdown of Highline Community College (20 mi South of the city) (Seattle Office of Emergency Management, 2020b). The OEM can serve many roles during a disaster—from basic monitoring and coordinating intergovernmental communication to assisting other cities in managing their emergency efforts from across the country (Seattle Office of Emergency Management, 2020b). The expansive role of this office is clear, and it currently operates as an independent office in city government. However, this office seems to have grown out of the Disaster Management Committee (DMC), for the DMC and OEM hold parallel roles in the

execution of city emergency plans reviewed in this research (City of Seattle, 1999). During both cases, the managing group, DMC or OEM, was under the purview of the Seattle Police Department. It was not until 2020 that OEM was separated from SPD as an independent office (Seattle Office of Emergency Management, 2020a), so the offices DMC and OEM should be taken to mean the same thing in the context of this project.

The Role of Katrina in Seattle Emergency Planning

It is critical to include Hurricane Katrina in any discussion of the role of public transportation in evacuations, for Katrina was a catalyst for policy and conversations about how to properly plan for evacuations for low-mobility individuals. Almost twenty years ago, Hurricane Katrina hit New Orleans, Louisiana and had catastrophic effects on the population of the city, especially for the 270,000 survivors stranded in the city during the storm (Wailoo et al., 2010) and the estimated 1,800 people that died during the disaster (Pruitt, 2023). A combination of empty city buses with no assigned drivers and the evacuation of police boats in advance of the storm, forced residents to get out by private car, or not at all (Wailoo et al., 2010). Residents who did not have a car were left to face the storm and try to survive extreme conditions, while those with cars were significantly more likely to survive by evacuating before the worst of the storm. Katrina was a case of a failed evacuation. The catastrophe served as a black mark on the nation in terms of effective evacuation planning. Backlash on planners was so severe that a national response occurred in the form of the PKEMRA of 2006 which aimed to address the Federal Emergency Management Agency's (FEMA) role in ensuring proper evacuation plans in the United States (U.S. Government Accountability Office, 2016).

Hurricane Katrina is a "focusing event" (Birkland, 1997) on a national awareness scale for evacuation planning, but it had a particular effect on Seattle that is important to note for this

project. Following Katrina, the Department of Homeland Security (DHS) rated several metropolitan areas on their preparedness for disaster. Seattle, and its surrounding areas, received a "sufficient" rating for all aspects of "catastrophic disaster planning" except for evacuating the area (Andersen, 2006). In response to the rating, Seattle's emergency planning director at the time acknowledged that "the region would be in trouble with a Katrina-level disaster" (Andersen, 2006, p. 1). Two years later, DHS awarded Seattle funds as part of the Regional Catastrophic Preparedness Grant Program (RCPGP) because it was thought to be "representative of the risks, hazards, and operational structures around the Nation" (U.S. Department of Homeland Security, 2008, p. 10). This program is part of the departmental mandates under PKEMRA and is meant to help regions develop their response to catastrophic events (U.S. Department of Homeland Security, 2008). Actions by DHS make it clear that the Seattle area needed to improve its preparedness for evacuations, and that it should receive support in doing so due to its representativeness of emergency planning and hazards across the nation.

III. Literature Review

Hurricane Katrina was a quintessential natural disaster in that it sparked academic research on the ways in which cities should plan for the safety of low-mobility populations in environmental disasters due to the apparent failures of evacuation plans largely dependent on personal vehicle transportation. Emergency planning is an ever evolving-process that is dependent on policy planning where changes are often prompted by new knowledge gained from failures and successes in responses to major disasters. Aspects of the dynamic nature of emergency planning such as the history of emergency planning, the analysis of failed responses, the evaluation of how to better prepare, and the passing of policy that requires planners to implement the lessons learned, are discussed below through the scholarly literature surrounding

public transportation use in evacuations. This review of the literature illustrates the importance of investigating how emergency evacuation planning in Seattle, WA evolved to incorporate public transportation following Hurricane Katrina and the corresponding federal requirements and guidelines that were promulgated nationwide following the disaster.

How Emergency Planning is Conceived

The driving forces behind changes in emergency planning and the main criteria contained in plans have developed over time based on political, social, and environmental factors. Much of the literature on evacuation policies involves the role that poorly planned evacuations have in informing subsequent plans to avoid repeating the same mistakes. Thomas Birkland refers to this effect by calling extreme events "focusing events" to emphasize how these disasters affect future planning and policy making (Birkland, 1997, p. 22). This terminology properly encompasses the importance of natural disasters in policy and planning spheres which this project relies upon in comparing two cases before and after Katrina to identify just how impactful it was as an event for Seattle.

It is important to recognize that much of the emergency planning for disasters has evolved from evacuation plans for "civil defense emergencies" and have only recently included transportation as a key factor in response to increasing severity of disasters and the growth of urban centers (Wolshon et al., 2005, p. 137). The reality that evacuations for natural disasters were not originally the driving force of emergency planning helps contextualize the challenges planners face, as they adapt plans to meet the new goals of emergency planning. The broad trends in emergency management marked out by these historians are at the core of both this project and disaster preparedness in Seattle. Katrina acts as a focusing event of specific interest

in this analysis, and the historic position of OEM under the Seattle Police Department amplifies the importance of the historical context of emergency planning itself.

Katrina as a Focusing Event on Personal Vehicles in Disasters

Some researchers started their work on Hurricane Katrina by investigating the influence of social class on the level of risk that New Orleans residents were at during the disaster. By looking at how New Orleans was impacted by Katrina, authors found extremely inequitable vulnerability for residents: residents of color were negatively affected disproportionately, not least because the evacuation plan relied on private vehicle ownership which they were less likely to have (Wailoo et al., 2010). City buses that could have potentially been used to transport those lacking a car out of New Orleans sat empty in parking lots due to a lack of planning for drivers on the city's part (Wailoo et al., 2010). Another resource that could have aided in evacuation, especially after the streets were flooded, were the city police boats, but they were preemptively ordered to leave the city in favor of a safe location for the vessels (Wailoo et al., 2010). The reality that many residents would be unable to leave using personal cars was not a surprising reality for New Orleans planners though, for a piece by Wolshon (2002) published three years prior to the storm identified that an estimated 200,000 to 300,000 people in high-risk areas would be unable to evacuate using personal vehicles (as cited in Litman, 2006). New Orleans evacuation managers prioritized economic assets in the form of boats over the lives of its citizens and failed to properly plan for alternative evacuation methods to personal vehicles despite knowing that that would be a problem that a significant number of residents would face in a disaster.

Other research has extended this analysis of Katrina to involve comparative cases with other failures in evacuation like Hurricane Rita where different challenges of transportation

caused many people to be unnecessarily harmed by the storm (Litman, 2006). Unlike Katrina where the lack of access to personal vehicles left many stranded, Rita showed the reality of what can happen when everyone is relying on their personal vehicles to evacuate. Hours spent on the highway, fully jammed evacuation routes, a severe fuel shortage and other logistical challenges of too many vehicles leaving at the same time without proper planning left thousands either out in the open for the storm or forced to return home despite having access to the necessary personal vehicles and directly following the guidance of officials (Litman, 2006). Researchers have investigated Hurricane Katrina through comparison to Hurricane Rita to identify the logistical challenges faced by personal vehicle dependent evacuation plans in order to guide better planning in future situations (Litman, 2006). This project similarly uses a comparative case study strategy to understand the impacts of Katrina, but by comparing cases before and after Katrina in the same region to understand how Seattle in particular applied the lessons learned from the hurricane. Researchers in evacuation planning have investigated Katrina as a case study to understand the reality of the disaster and areas where planning could be improved (Litman, 2006; Wailoo et al., 2010), while my work applies their findings to identify how Seattle has learned from the mistakes they have revealed.

Optimizing Future Planning

Other researchers have taken Katrina as a sign that public transportation needs to be better accounted for during evacuation planning. There have been efforts to create evacuation simulators that allow planners to adapt their plans to the specific characteristics of their city in order to better incorporate all resources available. Transportation can be a challenge to model under ideal and routine circumstances, but the models that evacuation teams are building attempt to account for variables like vehicle behavior, potential bottlenecks on roadways, and time span

of evacuation (Chen et al., 2020). Each variable is critical for both public and private transportation options in an evacuation, but the analysis by Chen et al. relies predominantly on small cars like most privately owned vehicles and involves much more technologically advanced transportation infrastructure than most cities currently have. Other challenges to predictive models include the large magnitude of data that results in long computation times while still leaving variables unaccounted for (Yazdani et al., 2020). Optimization methods for evacuation will likely become advantageous in the future, but in their current state they are unable to account for the role that public transportation plays in evacuations and in some cases explicitly rely on cars as the sole form of transportation.

Articulating the Goals of Emergency Planning

As researchers have grappled with extreme disasters to inform policy, identify problems, and attempt to model more efficient transportation, others have questioned what the goal of emergency planning is. Beyond saving as many lives as possible, there is significant discussion on what other goals planners should have for emergency planning, all of which operate to define success in the case of disaster.

Though Katrina highlighted transportation vulnerability based on those who owned cars and those who did not, there has been a growing movement toward social equity as a goal for emergency planners. The term “social equity” became recognized as a goal of emergency planning in the 1960s, but still lacks a broadly accepted definition (Rivera & Knox, 2023, pp. 1172, 1179). According to River & Knox, social equity is “The active, culturally competent, and equal provision of services to every social group across all phases of emergency management and the continuing reduction of all groups’ social vulnerability that contributes to desperate physical and social damages associated with natural, technological, and na-tech hazards (2023, p.

1179). In short, social equity is a goal for emergency planning to account for the unique needs of socially vulnerable communities. There are several groups of individuals recognized as socially vulnerable including "economically disadvantaged, racial and ethnic minorities, the elderly, the uninsured, the homeless, the disabled, those with chronic health conditions, and those with language barriers" (Dhakal et al., 2021, p. 1). Socially vulnerable individuals are at potentially greater danger in the event of a disaster due to their vulnerabilities, and researchers show that emergency planners should account for this in their planning efforts.

Planning with social equity in mind can itself take many forms and it is not fully established what successful planning looks like in this regard. In Tohoku, Japan, researchers looked at a case of disaster not just investigating what happened in the disaster, but what happened after it to see how affected residents were able to rebuild communities or economies (Shimizu, 2012). Such an evaluation prioritized the resilience of communities and not just the number of lives lost versus saved. Evacuations are costly, and some researchers have investigated the reality that it may be better to invest in infrastructure to avoid the need to evacuate in most circumstances (Wolshon et al., 2005) or better to expand social policy and community connectedness (Fraser et al., 2021) as more nuanced approaches to emergency management. This type of approach deemphasizes the role of evacuation planning overall and focuses on reducing the need for the evacuation plan itself. There is unlikely to be a universal set of priorities in evacuation planning, but how researchers are currently measuring success can be applied to discuss the relative successes and failures of the cases at hand in this piece.

Project Contributions

Currently, there has been much research into why Katrina was so catastrophic, what lessons can be learned from such an event and how to effectively plan for evacuations in a way

that accounts for varying vulnerability. New Orleans planners prior to Katrina failed to properly prepare to plan for non-personal vehicle evacuation methods despite demographic knowledge that pointed to a major need for city planning. Researchers have identified the existence of low-mobility groups that require a different type of planning than which highways can be used to evacuate, and work continues on identifying how planners can more properly account for these vulnerable populations.

My review of relevant literature demonstrates that there is insufficient investigation on how emergency plans have changed to account for public transportation needs, and if those changes have improved outcomes for people during evacuation scenarios. By comparing cases of evacuations before and after Katrina in the Seattle area, this project can begin to address whether or not cities are learning from the emergency planning mistakes of the past. Thus, this project contributes to the broader literature on emergency planning by building upon research into the lessons learned from Katrina by identifying to what extent lessons identified by other researchers have led to changes in Seattle emergency plans. Further, I am contributing to literature on the equitability of emergency planning by investigating the tangible accommodations made in evacuation plans for vulnerable populations, including low-mobility individuals.

IV. Overview of Research

This project investigates how Seattle's emergency evacuation plans have evolved to integrate public transportation, in response to federal requirements instituted after Hurricane Katrina exposed gaps nationwide. Through an analysis of reports and historical and current emergency planning documents, I evaluate evacuations in Seattle during two cases—the 2001 Nisqually Earthquake and the 2014 Oso Mudslide—to identify key differences in the evacuation plans and their effectiveness at removing individuals without personal transportation, before and

after Katrina prompted new federal guidelines. Results of this analysis help to identify plan changes that helped save lives and that could be further incorporated. The reality of a situation often differs from what was initially planned to happen, so review of both the disasters and the plans that were in place at the time they occur can reveal differences between plans and actual outcomes.

Residents of Seattle have benefited from being a community with a long history of planning and preparing for disaster (Andersen, 2006; U.S. Department of Homeland Security, 2008). Although a great deal of literature identified non-personal transportation as a widespread insufficiency in urban evacuation planning (Litman, 2006; Wailoo et al., 2010; Wolshon et al., 2005), I found that the city formally acknowledged the presence of low-mobility individuals and their unique evacuation needs prior to the national awareness raised by Katrina. As my research shows, Seattle has continued its history of preparedness following Katrina by better incorporating explicit public transportation methods and plans for low-mobility populations into formal evacuation plans by following guidance that came from the Americans with Disabilities Act (ADA). Though the city appears to be effectively planning for low-mobility populations on a smaller scale, there is not widespread support for evacuations that would use public transportation for the majority of evacuees. In order to properly support the current global requests that residents rely on public transportation to reduce their personal fossil fuel emissions, there needs to be a reframing in the planning for low-mobility populations that assumes this population is the majority of residents, not the minority.

V. Methods & Data

My research was guided by a comparative analysis of two cases in which evacuations occurred in Seattle. The comparisons focus on similarities and differences regarding the role of

public transportation and accommodations for low-mobility populations between two cases of comparable disasters.[2] A comparative case study approach is most appropriate to evaluate the incorporation of public transportation into emergency planning due to the inherent complexity in managing responses to emergency situations and the diversity of natural disasters. In any given disaster, there are several levels of governmental cooperation, numerous responder departments involved, potentially millions of people affected, and the unpredictability of nature, all of which have countless nuanced, and complicated, interactions with one another in creating the reality of a disaster response. With a comparative case study approach, I was able to obtain high granularity data for the cases and use a comparison of before and after disaster cases to see how a large-scale event like Katrina affected Seattle evacuation and emergency response.

Through a comparative case study approach involving historical and current emergency planning documents, my project investigates how emergency evacuation planning in Seattle, WA evolved to incorporate public transportation following Hurricane Katrina and the corresponding federal requirements and guidelines that were promulgated nationwide following the storm. Based on my analysis, I have found that emergency evacuation planning in Seattle has begun to incorporate the role of public transportation by acknowledging the potential necessity of it and including it in unique annexes, but current main plans lack actionable procedures for public transportation.

The Cases in Depth

Learning from mistakes is a central tenet of how emergency planning has evolved, which is why it is so critical to look at the local cases of emergency responses to better adapt to local threats. The first case is the 2001 Nisqually Earthquake which sparked concerns of a tsunami threat causing some Seattle residents to evacuate to higher ground while many others were

[2] Justification for why the two disasters are seen as comparable for this analysis is discussed later in this section.

evacuated and relocated from buildings due to structural integrity concerns (Donovan, 2023). The epicenter of the quake was located in Nisqually, Washington about 35 miles southwest of Seattle, but the effects of the earthquake on Seattle and its surrounding area in the Puget Sound were severe (State of Oregon Department of Geology and Mineral Studies, 2001). Regionally, the earthquake cost an estimated $2 (State HAZUS estimate) to $3.9 billion (FEMA HAZUS estimate), resulted in 400 injuries, and created significant infrastructural damage through building collapse, liquefaction of ferry terminals and pipe breakage at the SeaTac, Seattle-Tacoma, airport (State of Oregon Department of Geology and Mineral Studies, 2001). Nisqually is a valuable case to investigate because it was the most recent wide-scale catastrophe to hit the area before Katrina and was a large enough disaster that finding records of what occurred during and after the disaster more attainable than smaller cases in the more distant history.

The second case of my analysis is the Oso Mudslide that occurred in 2014. Oso, Washington is a small town located about 50 miles northeast of Seattle and the natural disaster was one of the worst mudslides that the United States has ever seen (The Slide Memorial, n.d.). The Seattle OEM activated for the disaster which received a Presidential Disaster Declaration (Seattle Office of Emergency Management, 2020b). The disaster occurred several years following Katrina which allows buffer time for new knowledge on planning to be created and implemented as well. Additionally, enough years have passed since Oso which allows formal reports to be included in my analysis. The scale of this disaster, the role of OEM in managing the situation, and the temporal situation make Oso a great comparative case to analyze the changes in emergency management in Seattle.

Obviously, earthquakes and landslides are not the same, nor are they similar disasters to hurricanes, but there is still utility in putting the two cases at hand in discussion with each other to better understand emergency planning and preparedness. The needed responses to disasters can vary greatly due to the different threats they pose, however, the reality of disasters means that no two disasters of even the same type, in the same location, will be the same. Thus, there are almost no perfect cases to compare when it comes to natural disasters. Other disasters for the "after" case were considered such as a windstorm event in 2019 and flooding in the South Park neighborhood in 2021. These cases were dismissed because they did not cause as widespread of damage as the current cases, did not warrant any formal evacuations, nor did they result in the activation of OEM (Kent, 2023; Lambert, 2019; Seattle Office of Emergency Management, 2020b). No other "before" cases were heavily considered, for the reduced amount of news reporting and lack of OEM at the time meant that a search for potential cases yielded far fewer options overall.

Oso and Nisqually share enough characteristics for their value as before and after cases to be clear. Like Katrina, both Nisqually and Oso are large-scale natural disasters that required rapid evacuation and mobilization of resources. The reality of how those disasters were handled, and the plans that were in effect when they occurred can show as clear a picture as possible on how Seattle has planned for the evacuation and support of low-mobility populations during disasters. For the purposes of studying disaster evacuation planning, the differences between my cases do not negate their value as comparable examples.

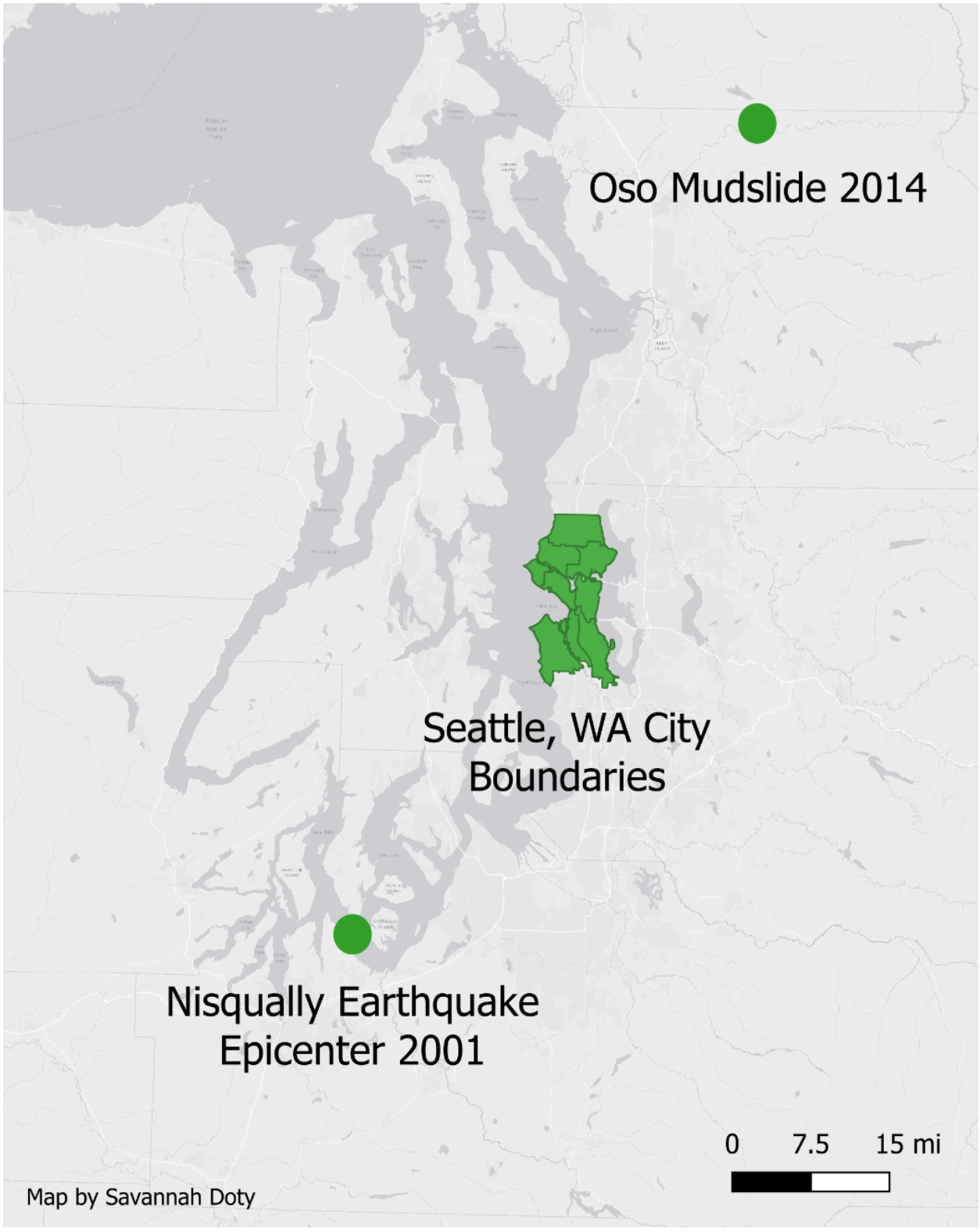

Figure 4. Map of Puget Sound region with markers for case study locations in relation to Seattle, with data from City of Seattle ArcGIS Online.

Data Sources

Examination of the cases involves in-depth review of relevant policies that govern emergency plan content, the emergency plans in place at the times of the disasters, and formal reports on the disasters done by environmental organizations and local education institutions. In-depth review of primary source documents involved qualitative coding using Dedoose, a program designed for mix media research that was used for organizational purposes. Qualitative coding involved the identification of main themes based on the goals of the project. Identified themes were applied as tags to help with later review of common threads across primary sources by tagging every contextual reference[3] to the characteristic of the primary source that the tag represents. Tags allowed for review of themes across primary source content.

Reports of the lived experience of residents during the disaster are included, but it is likely that the full reality of low-mobility individuals is underrepresented. A more thorough representation of the various challenges faced by those without personal transportation could be found through extensive personal interviews with those who experienced the disaster, but that type of analysis is beyond the scope of this project. Furthermore, it appears that formal reports contain sufficient personal narratives to gain a decent understanding of the transportation challenges and supports that existed.

Pertinent policy at the federal level was reviewed to contextualize what is Seattle specific planning and what is mandated as a result of the policy requirements. Policy for review includes PKEMRA and ADA which federal acts that were identified through direct references in planning documents. It is likely that there are other relevant policies at the city and state level that would

[3] Tags are not exhaustive of the potential references, but are viewed in the context of the document being reviewed. For example, the entirety of a report on the Oso disaster could be tagged "Oso Timeline", but this tag was only applied to excerpts where other tags were applied within that document.

have impacted planning efforts, but none were explicitly identified in any materials reviewed and were thus outside the scope of this project.

The Disaster Readiness and Response Plan: Volume One (City of Seattle, 1999), the evacuation plan in place when Nisqually occurred, was reviewed for the Nisqually evacuation plan. The pre-Nisqually plan was not easily found through archival or internet search engine searches, so a copy from OEM is reviewed. Emergency plans for the past several years are publicly available on the Seattle Office of Emergency Management webpage (Seattle Office of Emergency Management, 2021), however, the Oso landslide occurred before the first Comprehensive Emergency Management Plan was approved in late 2014 (Seattle Office of Emergency Management, 2015). As a result, the last version of the Seattle Disaster Readiness and Response Plan which was approved and published in September of 2012 was used for the Oso landslide evacuation plan. These plans are meant to be the guide for all responders when disasters occur, so they best reflect the official preparations for any disaster. Official preparations include any planning for public transportation that residents could anticipate accessing in the case of evacuation.

Reports such as “The Nisqually Earthquake of 28 February 2001: Preliminary Reconnaissance Report” and “The Nisqually, Washington, Earthquake of February 28, 2001: Summary Report” that were conducted by academic and government bodies were reviewed to identify the reality of the disasters (Cornwall, 2014; Nisqually Earthquake Clearinghouse Group, 2001; State of Oregon Department of Geology and Mineral Studies, 2001). It is important to evaluate reports that reflect the reality of the situation to identify any discrepancies between the planning for evacuation and the actual execution of those plans since anyone can attest that plans

do not always translate perfectly into reality, especially in a high stress and unpredictable situation like an evacuation.

Comparison

Using the data outlined above, I have compared the emergency response regarding low-mobility populations for Nisqually and Oso. Planning documents were read in detail and any references to public transportation or accommodation plans for low-mobility groups were identified and summarized in a table located in the appendix. Formal reports were used to identify the breakdown on the types of transportation used in the course of evacuation (active, private or public). This content analysis was used to identify to what extent people were unable to evacuate because they lacked private transportation, how public transportation was used to evacuate, and the relative survival of those with cars compared to those without.

VI. Results and Data Analysis

When compared to the Nisqually Earthquake, the Oso Mudslide following Hurricane Katrina reveals a significant increase in the awareness of planning for diverse transportation needs. Many of the outlined changes appear to be in response to the 2007 ADA guidance more so than PKEMRA, for the ADA guidance gives more specific planning guidance where PKEMRA puts forth planning guidelines instead of explicit plan components. Changes for low-mobility populations are mostly the result of accommodations for individuals with disabilities that also help those who do not have a disability as recognized by the ADA. The incorporation of planning for low-mobility populations will be seen by first establishing the baseline through findings in the before case: the Nisqually Earthquake. Then, PKEMRA will be reviewed for its potential impact on the emergency plans that follow its implementation as part of analyzing the after case: the Oso Mudslide.

Qualitative Coding Results

As mentioned in the methods section, a qualitative coding approach using Dedoose software was used to analyze all primary source materials in conversation with one another. Tags that represent certain details of emergency planning or specific disasters were used to track all references to the important themes of my analysis. After comprehensive review of all of the primary sources, I used Dedoose to compile all of the excerpts that a tag was applied to. By doing this, I viewed every reference to areas of interest from all of my sources simultaneously. Through this method, I was able to glean broader trends across documents and track changes that occurred between the before and after cases.

In the context of this project, the most important codes applied to the qualitative analysis of these sources were "Displacement", "Transportation" and "Low-mobility". These tags represent the main question proposed regarding the incorporation of public transit in evacuations. Displacement is a broader term to incorporate instances referencing the movement of people which is not always referred to as an evacuation, but often means the same thing in disaster settings. And, low-mobility individuals are those who would require non-private transportation methods to evacuate in a disaster as defined earlier. For a more comprehensive list of the tags used and their characteristics, including descriptions and relative use, please see the appendix.

The Before Case: Nisqually Earthquake, 2001

Review of the Before Case Plans: "Disaster Readiness and Response Plan: Volume One"

Usefully, the City of Seattle marks out the demographics of the city in its plan to contextualize the local environment. In these demographics, the city outlines various vulnerabilities like limited English fluency and other "special needs"[4] like those who "have

[4] This term appears to be applied in the most literal sense, referring to populations that have diverse needs from the majority.

physical and mental disabilities, or who are too young or too old to care for themselves" which includes the "42,000 persons living alone who are homebound, or who have limited mobility or require life support systems" (City of Seattle, 1999, p. 15). The city even goes so far as to provide a density map of "Special Needs" by Census Tracts (see Figure 5 below).

Vulnerable populations under this plan fall under the responsibility of Human Services ESF-6. The Mass Care Group, a subgroup of ESF-6, is led by a manager from Parks and Recreation with assistance from Seattle Public Library, Seattle Housing Authority, Seattle Public Schools, the Salvation Army and the American Red Cross (City of Seattle, 1999). Considered together, this group is responsible for "coordinating the reception and care of persons displaced by the effects of a major emergency or disaster that would have no alternative shelter [which] may further include arrangements for the care of persons with disabilities, childcare, [and] recreational services" (City of Seattle, 1999, p. 42).

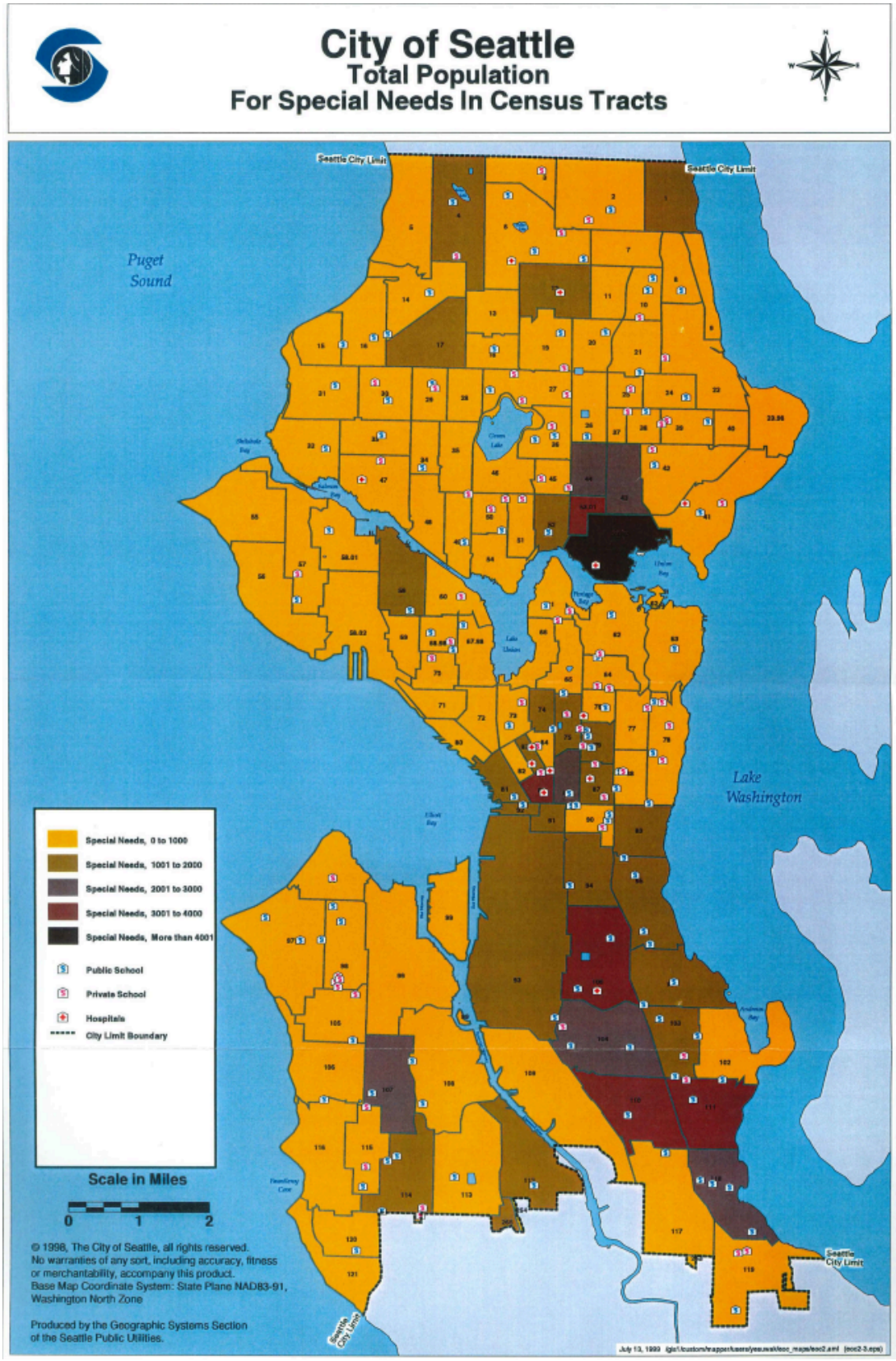

Figure 5. Map of Special Needs density by Census Tract (City of Seattle, 1999, p. 14e)

There are limited accessibility resources identified, and none regarding transportation needs were identified. The Public Information office is advised to prepare "multi-lingual advisory and informational materials for the public" (City of Seattle, 1999, p. 41). Creating resources in commonly spoken languages helps get critical information to people who are not proficient in English. Emergency planners are encouraged to ask "How would persons with disabilities (physical or mental), non-English speaking, or those who have become casualties or who are otherwise injured, disoriented or trapped be assisted and tended to?" (City of Seattle, 1999, p. 3). Here, planners are asked to proactively think about vulnerable individuals. When designing their internal plans, communities are advised to include public information and outreach to "special needs populations" through social service agencies and "outreach to elderly and people with disabilities" (City of Seattle, 1999, p. 3). Clearly there are several explicit recognitions of vulnerable populations, but there is a lack of discussion of their transportation needs.

Events of the Before Case: Nisqually Earthquake

Just before 11:00 am on February 28, 2001 an earthquake of 6.8 magnitude hit Seattle, with its hypocenter merely 36 miles SW of the city with two aftershocks striking the following day (DMC, 2001). Nisqually hit in the mid-morning on a typical weekday where many people would have fully commuted to either work or school which greatly increases the number of people in the city proper at the time of disaster. The Seattle Operations Center (OEC) activated immediately and stayed active for two days while the Mayor declared a "Civil Emergency" in the mid-afternoon on the 28th (DMC, 2001, p. 2).

Concerns about social vulnerability appear clearly. Over 200 residents of low-income housing were displaced (DMC, 2001). Evacuation of these vulnerable residents would have

activated many components of the emergency plan in place to accommodate the residents in need. Transportation challenges complicated displacement response, for several components of transportation infrastructure were severely damaged. The Seattle-Tacoma airport and other nearby airfields, as well as several bridges in the city and destruction to ferry terminals occurred (State of Oregon Department of Geology and Mineral Studies, 2001). Additionally, several landslides were triggered; only one was in Seattle proper, but all of the landslides affected transportation to and from the city (State of Oregon Department of Geology and Mineral Studies, 2001). Transportation across the public and private sectors was dramatically impacted by significant delays.

Figure 6. "Collapsed hollow-clay tile wall at URM building located along Utah Ave. S in South Seattle" (State of Oregon Department of Geology and Mineral Studies, 2001, p. 6)

Despite having few explicit directives within the emergency plan regarding transporting low-mobility individuals, it appears that there were attempts to provide support for these folks during the disaster. It was observed that "Arranging transportation for the persons who needed shelter was problematic. A bus was dispatched several times to one location, but the persons refused to go" (DMC, 2001, p. 33) in an After Action Report, which indicates that there was reliance on buses to transport those requesting assistance. Clearly, there was support for vulnerable individuals without there being an explicit directive within the main city planning document.

Unfortunately, Oso revealed additional faults in planning for vulnerable populations. Support for vulnerable individuals was likely complicated by the fact that there was no unique way to contact OEM for social or health related needs, such as evacuation support, and people had to rely on flooded 911 lines (DMC, 2001). Communication lines went down, and those most vulnerable were likely unable to notify officials that they needed aid, let alone receive aid, in a timely fashion. Furthermore, the disaster highlighted that there were unaccounted for vulnerable populations such as "homeless persons" who were in need of sheltering (DMC, 2001, p. 33). People living on the streets or in informal encampments may not appear in formal census reports on vehicle ownership, but are clearly a population vulnerable in disasters that should be accounted for in a socially equitable plan.

The After Case: Oso Landslide, 2014

Overview of the Post-Katrina Emergency Management Reform Act

PKEMRA was passed in 2006 as part of a federal response to the horrific outcomes of hurricane Katrina. As is evident from the title of the act, PKEMRA was meant to reform emergency management based on the lessons learned from Katrina as a "focusing event"

(Birkland, 1997). For the most part, the act elaborates on the role of the Federal Emergency Management Agency (FEMA) in disaster management efforts and mandates certain levels of national programming and federal support of state, local and tribal governments in their emergency management efforts (Post-Katrina Emergency Management Reform Act of 2006 [PKEMRA], 2006).

Though limited, PKEMRA did explicitly mandate planning efforts to account for vulnerable populations and the reliance on public transportation in disasters. There is one explicit reference to the requirement of including public transit in evacuation planning efforts. The act states:

> "In developing the mass evacuation plans…each government shall, to the maximum extent practicable – identify evacuation transportation modes and capabilities, **including the use of mass and public transit capabilities** [emphasis added], and coordinating and integrating evacuation plans for all populations including for those individuals located in hospitals, nursing homes, and other institutional living facilities" (PKEMRA, 2006, p. 1407)).

Aside from this one mention, there is no other inclusion of the need for public transportation in evacuations, nor further elaboration on what such inclusion might entail. Further, all following mentions of unique transportation needs are in relation to individuals with special needs.

The use of "special needs" regarding transportation accommodations becomes particularly confusing throughout the act. The term is used ten times to refer to a population, four of which are in conjunction with planning for individuals with special needs (ex: "individuals with disabilities or other special needs" (PKEMRA, 2006, pp. 1402, 1404, 1407, 1428, 1431, 1447, 1452)). Other uses are in conjunction with "low-income" or "those individuals located in hospitals, nursing homes, and other institutional living facilities" (PKEMRA, 2006, pp. 1447, 1407). Unlike several other terms throughout the act, "special needs" is never defined. Despite lacking an explicit definition in the text, "special needs" is used broadly to refer to vulnerable

populations of various sorts. At no point within the text is their explicit recognition of low-mobility individuals that are not individuals with disabilities. Low-mobility is a broader category than individuals with disabilities and it is not used in PKEMRA. Nor is any term synonymous with "low-mobility" used within the text.

The more explicit recognition of vulnerabilities, excluding low-mobility individuals more broadly, can be seen in the text. There was an amendment made to section 308(a) of the Stafford Act, which is titled "NONDISCRIMINATION IN DISASTER ASSISTANCE" (Robert T. Stafford Disaster Relief and Emergency Assistance Act, 1974). The terms "disability" and "English proficiency" were added to the already existing categories of "race, color, religion, nationality, sex, age, or economic status" (PKEMRA, 2006; Robert T. Stafford Disaster Relief and Emergency Assistance Act, 1974). Here, individuals with disabilities, and/or those without English fluency are explicitly identified as vulnerable populations that need to be protected through non-discrimination actions. Since many low-mobility individuals fall under identities listed under the Stafford Act, it seems to be a violation of this non-discrimination to not properly plan for low-mobility populations in emergency management efforts. It is possible that emergency planners have operated under the false equivalence of low-mobility and individuals with a disability, in which they believe that planning for those with disabilities will sufficiently account for low-mobility needs. Such an assumption is flawed due to the difference in size between the population of low-mobility individuals and individuals with disabilities. There are several orders of magnitude more people unable to drive (children, elderly, non-car owners, etc.) than those who qualify under ADA determination of being an individual with a disability.

The recognition of other vulnerable populations continues in the appointment of a disability coordinator in FEMA. The disability coordinator reports directly to the Administrator

who is the highest authority within the Agency. Duties of the coordinator include "providing guidance and coordination on matters related to individuals with disabilities in emergency planning requirements and relief efforts", consulting with federal and nonfederal organizations "represent[ing] the interests and rights of individuals with disabilities about the needs of individuals with disabilities in emergency planning", and ensuring the development of training materials and best practices information regarding evacuation plans for individuals with disabilities and the dissemination of these resources to emergency planners (PKEMRA, 2006, p. 1408). There is an active advocate for proper planning of individuals with disabilities put in place with authority, and a mandate, to ensure that these vulnerable individuals are accounted for in emergency management processes. The explicit creation of an advocate for individuals with disabilities provides support to the hypothesis that policy makers are inappropriately assuming that planning for individuals with disabilities also adequately plans for all low-mobility individuals.

Review of the After Case Plans: "Seattle Disaster Readiness and Response Plan"

There is limited explicit discussion surrounding the transportation support of low-mobility individuals within the main after case plans in place during the Oso landslide. Transportation support does get referenced in the definition of Access and Functional Needs:

> Individuals with access and functional needs are defined as persons who may have additional needs before, during and after an incident in functional areas, including but not limited to: maintaining independence, communication, **transportation**, supervision, and medical care. Individuals in need of additional response assistance may include those who have disabilities; live in institutionalized settings; are seniors; are children; are from diverse cultures; have limited English proficiency or are non-English speaking; or are **transportation disadvantaged** [emphasis added] (Seattle Police Department, 2012, p. 96)

Much of the recognition of individuals who are low-mobility comes in the form of referencing individuals with access and functional needs, as described above. Uses of the term "access and

functional needs" tend to be used interchangeably with individuals with disabilities or as part of the "vulnerable populations" umbrella.

Despite listing the responsibilities of the Seattle Department of Transportation (SDOT) in a detailed fashion, there is no inclusion of SDOT responsibilities regarding public transit in the base plan. SDOT is expected to "Clear streets of snow and ice", "manage debris clearance of City roadways", and "Oversee the repair and restoration of damage to roadway structures, traffic signals and road signs" (Seattle Police Department, 2012, p. 19). There are several clear ways that SDOT is meant to make roadways accessible and usable, but this list of responsibilities leaves out mention of the public transit system.

Though there is limited direct acknowledgement of low-mobility people, the 2012 plans have a significantly greater amount of acknowledgement of vulnerable populations more broadly. It is made explicit that "Vulnerable populations, including individuals with access and functional needs, are at greater risk of being significantly impacted by an incident" (Seattle Police Department, 2012, p. 44). The City plan discusses its incorporation of the Whole Community approach which "requires planning for the actual makeup of the community and meeting their needs, regardless of demographics, such as age, economic, or accessibility requirements" (Seattle Police Department, 2012, p. 4). Accommodating for such individuals and their unique needs is marked out as one of the City Strategic Goals for Response as "Supporting a response that accommodates vulnerable populations, including access and functional needs" (Seattle Police Department, 2012, p. 57).

There are some additional support systems set in place for some sub-groups identified vulnerable populations. The creation of plans that account for vulnerable populations is tied with the ADA, for the plan begins its "Vulnerable Populations" section by outlining that the city is

"committed to providing disaster related programs, services and activities that address the letter and spirit of the ADA" (Seattle Police Department, 2012, p. 47). Connections to disability related accommodations continue, for the plans identify the "Americans with Disabilities Act Toolkit for State and Local Government" as a guiding document regarding emergency management standards (Seattle Police Department, 2012, p. x). Throughout this project, this guiding resource will be referred to as "ADA toolkit" or "the toolkit" for brevity.

The incorporation of ADA toolkit guidance is seen in the participation "in a countywide program called 'Smart911' that allows residents to create a personal safety profile in a secure database, which can include medical or disability information, that is accessible to first responders in an emergency" (Seattle Police Department, 2012, p. 47). Other support specifically identified is ensuring that public messaging is made accessible to folks with access needs such as limited English proficiency (LEP) or deaf and hard of hearing individuals (Seattle Police Department, 2012). Additional resources like the TTY-TTD capability (specialized translation equipment) of the Fire Alarm Center are identified for deaf and hard of hearing folks to call if in need of assistance (Seattle Police Department, 2012).

Support for vulnerable populations and those who are displaced during disasters comes from what is called "Emergency Support Function Six". The group is abbreviated to ESF6 in plans, and is broadly responsible for "mass care, housing and human services" (Seattle Police Department, 2012, p. 27). In this larger emergency response group, the Department of Human Services (HSD) is responsible for establishing shelters, coordinating with other Emergency Support Function groups, arranging for interpreter serviced, requesting additional resources for sheltering and transportation of those in need of it, and coordinating with other departments such

as the Department of Transportation and the Parks Department (Seattle Police Department, 2012).

Actions of ESF6 and other Seattle Departments are guided by the Whole Community approach. The Whole Community approach is one developed by FEMA and "requires participation and collaboration from across the community" (Seattle Police Department, 2012, p. 45). Whole Community is recommended because "Disaster after disaster demonstrates that communities that are engaged prior to the event have a much better chance of recovering quickly and wholly from a disaster" (Seattle Police Department, 2012, p. 45) and this type of planning results in "planning for the actual makeup of the community and meeting their needs, regardless of demographics, such as age, economics, or accessibility requirements" (Seattle Police Department, 2012, p. 16). The City of Seattle has changed its planning strategy to ensure it incorporates voices of the community from all demographics and accounts for the different needs of individuals based on the guidance received from FEMA.

Not only does the Whole Community approach allow for planning more appropriately to the communities being served, it also entails an emphasis on empowering communities to care for themselves and their neighbors in times of need. There is an assumption that disasters of a large scale will strain city resources, so Seattle has been "partnering with community members to increase self-sufficiency and improve their disaster preparedness" (Seattle Police Department, 2012, p. 175). In fact, the community level preparedness has become the assumed first stopgate for emergency preparedness. Community organizations are expected to handle small-scale emergencies and ESF6 will only mobilize when demands grow beyond the capacity of community organizations, e.g. the Red Cross and the Salvation Army (Seattle Police Department, 2012). Additionally, it is hoped that "As the neighborhood trainings expand, the

ability of neighborhoods to take care of a share of their own residents for at least the first 72 hours after a disaster will moderate the immediate demands on the City to provide food and water" (Seattle Police Department, 2012, p. 211). The broader City of Seattle planning is geared toward making neighborhoods capable of meeting their own needs for three days to allow time for City resources to get a handle on large scale emergencies.

Another extension of the community-based approach is the plan to locate emergency shelters in neighborhoods. The City of Seattle has learned from previous disasters "that people who have alternatives do not normally go to shelters. Most families would prefer to stay at or near their own home" (Seattle Police Department, 2012, p. 211). Based on this lesson about the wants and needs of the community, "Seattle Emergency Management is working to develop capacity in the City's neighborhoods to offer displaced families the option of being supported within their neighborhood" (Seattle Police Department, 2012, p. 211). When disasters occur on a scale that demands sheltering outside of one's home, support for shelters will be brought, or come from, neighborhoods themselves. The proximity of shelters to homes where people will need to evacuate from will be small enough to be in walking distance, for the large-scale evacuation level "assumes limited to no transporting people to shelters, assumes having shelter capacity within a moderate walking distance from most housing units in the City" (Seattle Police Department, 2012, p. 186). By focusing on the Whole Community approach, the City of Seattle is shifting to a model that would limit the need to transport people at all. Of note, however, there was no discussion found about transporting individuals from their neighborhoods when the disaster warrants the evacuation from the neighborhood itself.

As mentioned previously, the main plans contain very little explicit reference to public transportation use during disasters. That said, there are several more tangible and explicit

mentions and actions listed in the “EARTHQUAKE INCIDENT ANNEX”. In the earthquake annex, planners recommend that responders consider proximity to transit routes when establishing shelters (Seattle Police Department, 2012). Such a recommendation was not included in the main document but does prioritize public transportation accessibility quite clearly.

The trend of including more guidance on public transportation use and availability in an annex than in the base plans continues in the “SNOWSTORM INCIDENT ANNEX”. Where the SDOT responsibilities in the main plan exclusively discuss transportation management in terms of roadways, the responsibilities in the winter annex actually have several references to public transportation. In the event of a snowstorm, SDOT is expected to “Provide to Seattle Office of Emergency Management an analysis, based on the weather forecast, of potential impacts to Transportation Department service delivery and impacts to public transit in Seattle and region” (Seattle Police Department, 2012, p. 365). Not only is there more guidance on the role of SDOT in public transportation access, but there is actually recognition of the critical nature of public transportation for vulnerable populations. Recognition of this is seen through the responsibility of SDOT to “Monitor transportation systems that support vulnerable populations and notify City Emergency Operations Center of developing issues” (Seattle Police Department, 2012, p. 368). Further, the City acknowledges that “The loss of, or reduction in, public transportation services may especially impact the elderly and disabled who depend upon taxi or bus services for transportation to medical appointments, the pharmacy and the grocery store” (Seattle Police Department, 2012, p. 358). There is a staggering difference between the recognition of public transportation in emergency situations for vulnerable populations in the base plan and the annexes from the Seattle Office of Emergency Management.

Overview of the ADA Compliance Toolkit: Emergency Management Under Title II of the ADA

In the after case plans for Oso, the ADA Compliance Toolkit was identified as a guiding resource. Following that identification, the portion of the toolkit regarding emergency management practices was reviewed in-depth as an additional primary resource that would shed light on the preparations made for low-mobility populations. As such, the prior included timeline needs to be updated to the version included in Figure 7 below to indicate both the PKEMRA and the ADA Compliance Toolkit as guidance that impacted how Oso plans may differ from Nisqually.

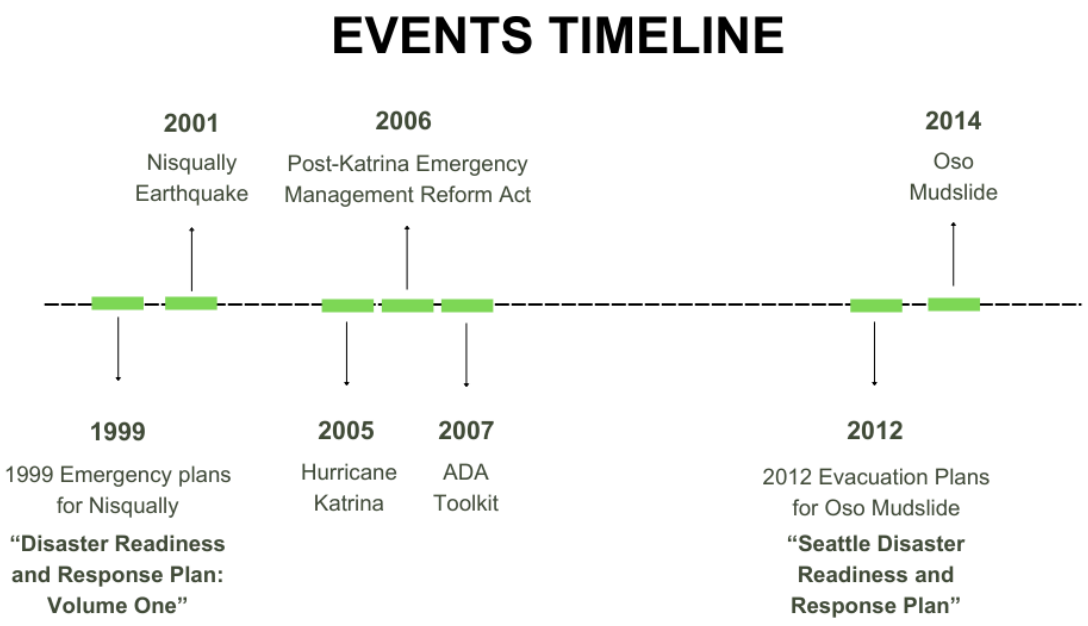

Figure 7. Chronological timeline of important events including publishing year of primary documents reviewed and natural disasters discussed

The toolkit begins with broad tenets of emergency planning to identify what is necessary for effective planning. It is broadly important to prepare for disaster, but the toolkit marks out how advanced planning is uniquely important for individuals with disabilities, for "Equal access requires advance planning. During emergencies and disasters, people with disabilities sometimes

have different, disability-related needs than other individuals. Many of these needs cannot be met during emergencies and disasters without advance planning." (Civil Rights Division, 2007b, p. 1). And, the focus on equal access is explicitly extended beyond individuals with disabilities, as a driving goal of the resource is making emergency management "accessible to everyone, including people with disabilities" (Civil Rights Division, 2007c, p. 1). The recommendations included will not just benefit those with disabilities as identified by the ADA, but are meant to create equitable access to necessary resources for everyone. The last tenet identified was the incorporation of community voice to properly meet the needs of the community: "On an on-going basis, seek and use input from people with different types of disabilities (i.e., mobility, vision, hearing,cognitive, psychiatric, and other disabilities) regarding all phases of your emergency management plan" (Civil Rights Division, 2007c, p. 8). Not every individual with a disability is going to need the same accommodations, and the people best equipped to identify where planning efforts fall short are those who would have to rely on those resources in cases of emergency.

Where PKEMRA mandated the creation of certain emergency managing processes and procedures, the toolkit provides more tangible recommendations and best practices that can be directly implemented. Instead of just stating that transportation plans should account for unique needs, the toolkit identifies the specifics of that accommodation: "Some people with disabilities will need accessible transportation. Identify accessible modes of transportation, such as wheelchair lift-equipped school buses, transit buses, paratransit vehicles, and taxis that will be available to evacuate people with disabilities during an emergency" (Civil Rights Division, 2007c, p. 10). With such specificity in how to account for the various needs of some people, there is direct mention of looking at transit buses which are a part of the public transportation

infrastructure. Other more tangible practices include having "a list of accessible transportation and lodging resources that can be used in an emergency for evacuation, return home following an evacuation, and/or temporary lodging and housing" (Civil Rights Division, 2007a, p. 2). A promulgated list of accessible transportation in case of evacuation is a directly actionable item that planners can easily identify if they have included it or not in planning documents.

Finally, the ADA toolkit proposes a registry that would allow easier support of those with support needs. The voluntary registry would be confidential and allow for more individualized care for persons with disabilities, and "requires that procedures be implemented to ensure that the registry is voluntary, confidentiality is protected, and information is updated as needed" (Civil Rights Division, 2007c, p. 4). It is clear that the ADA toolkit provided more tangible plan characteristics than PKEMRA to help planners create more socially equitable emergency plans.

Events of the After Case: Oso Landslide

On Saturday morning, March 22, 2014, just before 11:00 am, one of the worst landslides in U.S. history occurred near Oso, Washington (SR 530 Landslide Commission, 2014). Within one minute, about one square mile was covered in debris and mud which blocked the Stillaguamish river, causing major evacuations due to ongoing flooding concerns for the surrounding area (SR 530 Landslide Commission, 2014). These evacuation efforts were complicated by the blocking of State Route 530 (SR 530 Landslide Commission, 2014) which is a major access point to the affected communities. There were 43 casualties as a result of the disaster, however, air assistance in the form of helicopters from the Navy, National Guard, and Snohomish County were critical in quick evacuation of fifteen stranded survivors from 11:37 am to 3:53 pm and the later recovery of those who lost their lives during the landslide (SR 530 Landslide Commission, 2014).

Figure 8. "Washington Department of Fish & Wildlife Police transport search & rescue teams to the 530 slide" (SR 530 Landslide Commission, 2014, p. 17)

On that first day, Snohomish County proclaimed an emergency and the Washington Governor proclaimed a State of Emergency, as the start of a 38 day activation of the Washington State Emergency Operations Center (SR 530 Landslide Commission, 2014). Additionally, the Seattle Office of Emergency Management activated at a "Coordination" level that same day and remained as such for the following 27 days (Seattle Office of Emergency Management, 2020b, p. 7). A couple weeks after the activations on the 22nd, on April 2nd, the President of the United States declared the landslide a "major disaster" under the Stafford Act which permits federal support of recovery efforts for the disaster (SR 530 Landslide Commission, 2014, p. 1).

While helicopters provided by other groups in the region were invaluable in saving lives in the initial hours following the disaster, other resources and support were severely delayed. Only emergency crews from nearby Skagit County were able to respond on the first day due to the Highway 530 road closure (SR 530 Landslide Commission, 2014). This delay in resources from transportation challenges created a disconnect between local efforts and the official

response until about the third day of the response when officials, like Sieloff, realized that they could put local knowledge and resources to good use by integrating them into the organized official response (SR 530 Landslide Commission, 2014). Effective use of the local community helped in identifying unmapped logging backroads, extra volunteer searchers, housing and food for responders, and machinery to create roads and clear debris (SR 530 Landslide Commission, 2014). The community response was a critical component according to the responders on scene, but it is important to note that many worked without proper safety equipment "on the edge of safety" (only two minor injuries fortunately) and that proper decontamination supplies were not available until a regional search and rescue team brought in supplies days into the response effort (SR 530 Landslide Commission, 2014, p. 8).

Through the importance of community support in response efforts, Oso makes it clear that the community planning approach can have significant pay-offs. Community support had a major impact, even without being properly resourced or informed on emergency management support. One can only imagine how much more the community could have aided in the disaster response had they been properly equipped and prepared as the Whole Community approach sets out to accomplish.

Discussion

Hurricane Katrina awoke planners and policy makers in the United States to the reality that disaster planning efforts at the time were insufficient to handle large-scale disasters, or at the very least, that not all cities were properly prepared. This realization prompted conversations about standardization and created a more formalized community across the nation that worked to define what it means to be properly prepared for disasters through PKEMRA. Basic understanding of the necessity of accounting for individuals with transportation support needs

was present at the time of the Nisqually Earthquake, but evolutions in emergency planning were not prioritized until the promulgation of ADA guidance and mandates put forth by PKEMRA.

Plans in the Oso case were invaluable to contextualizing the content of Seattle's emergency response plans due to their citing of the ADA toolkit as a guiding resource. Through review of the policies, planning documents, and reality of the disasters, it is clear that preparations for low-mobility populations are in the form of accommodations for individuals with disabilities. This connection would have been almost impossible to identify without explicit reference to the guiding documents that were used by the authors of the Oso emergency plans.

Further, it is fortunate for the goals of this project that the ADA Best Practices Tool Kit for State and Local Governments was published in a year between the two cases identified for analysis of the impacts of Katrina. The cases investigated were selected based on their scale of impact and the fact that they necessitated evacuations. Disability accommodations were not present in the broader literature on Katrina evacuations, nor were they identified as a motivator for public transportation inclusion in emergency plans. My critical finding is that ADA compliance drove accommodations for low-mobility individuals, and it is unlikely I could have come to that conclusion without the toolkit being published in the time period I analyzed.

Based on my analysis, it appears that when planning for low-mobility populations, people are treated as an exception to be accounted for as opposed to the majority of individuals in any given emergency. This reality seems connected to the use of “special needs”, “support needs” and other related terms as synonymous with the needs of those identified as individuals with disabilities by ADA, instead of a broader recognition of the large number of individuals reliant on public transportation.

VII. Implications for Policy and Research

Analysis of Nisqually and Oso as case studies of evacuations in the Seattle area reveal that the city has improved its preparedness for the evacuation of low-mobility populations through the recognition of the unique needs of disabled individuals and other vulnerable populations. However, if residential reliance on public transportation is going to reach sufficient numbers to meaningfully decrease fossil fuel emissions, emergency plans will need to accommodate a significantly larger population of individuals who will be classified as "low-mobility" than the number currently accounted for.

It should be mandated that the city be responsible for actively managing and communicating public transportation access during disasters just as much as it does for private transportation. Just as it can be written in planning documents that the Seattle Department of Transportation (SDOT) is responsible for designating emergency traffic routes, it can be written that SDOT is responsible for providing additional bus routes if public trains are incapacitated. The proper responsibilities listed on the plans will be dependent on the public transportation types available in a city, and the kinds of disasters frequently faced. The need to rely on public transportation to address climate change necessitates active and explicit planning for those transportation methods during disasters.

Suggestions for Policy Makers

Research has shown that certain social vulnerabilities like being economically disadvantaged, elderly, homeless, or disabled can put people at a greater risk of harm in the case of natural disasters (Dhakal et al., 2021; Wailoo et al., 2010). Mandating the Whole Community approach and incorporating public transportation support into emergency planning has made strides to support these socially vulnerable populations, but more can be done. The PKEMRA

and the Stafford Act should have low-mobility added to their non-discrimination sections to ensure more legal requirements to plan for individuals without personal vehicles beyond the overlap with individuals with disabilities. Effectiveness of federal requirements in PKEMRA can be seen in how the explicit language of non-discrimination regarding individuals with disabilities in PKEMRA contributed to tangible resources for planners and explicit directives in Seattle emergency plans to support individuals with disabilities in the event of disaster. Such effective policy should be extended to include low-mobility individuals and create a larger mandate for support of public transportation in emergency situations. A federal amendment to PKEMRA and the Stafford act should be made to add "mobility challenged" or "low-mobility" individuals as a non-discrimination category.

The addition of low-mobility individuals may appear redundant due to overlap between that category of individuals and the already existing non-discrimination categories in the policies. I argue that low-mobility is an important stand-alone characteristic because not all individuals who are at risk in an evacuation by lacking a personal car fall under the current categories. Many people do not own a car due to financial constraints which qualify them under the "economic status" term, but this is not a universal rule. As climate change worsens, more people are expected to rely on public transportation by choice. Individuals choosing to reduce their carbon footprint – as their leaders and scientists are asking them to – are not currently covered by any of the non-discrimination terms present in PKEMRA or the Stafford Act. Achieving social equity under the changing climate conditions requires a mandate to support all low-mobility individuals, not just those that happen to fall under a pre-existing non-discrimination category.

Seattle planners should ensure that items regarding public transportation plans are incorporated in the main base plan and not tucked into remote annexes. The main Seattle plans lack specific guidance for public transportation systems, despite having specific guidance for maintaining roads and informing roadway drivers of changes. In the Earthquake and Winter Storm annexes, however, there were several instances of support for public transportation being referenced explicitly. The role of public transportation in disasters is not limited to winter weather and earthquakes, so this reality should be reflected in the formal documents. Even directly taking the language in the already existing plans and shifting them into the main plans would be an improvement for the support of low-mobility individuals in cases of disaster that are not earthquakes or winter storms.

Advancements in accommodating low-mobility populations can be largely attributed to the community-centered approach, but Katrina illustrated the potential downfalls of this method. Research on Hurricane Katrina revealed that guidance like "go with a neighbor, friend, or relative…if you need a ride" fell short of supporting vulnerable populations in times of disaster (Wailoo et al., 2010, p. 29). When people who lack necessary resources are geographically and socially proximate to one another, it is likely that their friends and neighbors are just as likely to lack the necessary resources. If emergency response is focused on the community level without a recognition that not every community has the same access to resources, social inequality is perpetuated by a community-centered approach. Planners of all areas should ensure that they create resource support to the most vulnerable in conjunction with any planning effort that is dependent on community-level support.

Success in Oso recovery efforts was partially attributable to community involvement and the effective use of community resources. Such success was only possible because the

community of Oso had the necessary knowledge and resources to aid responders and make up for the delay in formal federal and state resources arriving on scene. A well-informed and prepared community is necessary to achieve an equitable emergency response.

Suggestions for Future Research

Based on my results, I suggest two future research avenues: an investigation into the broader emergency planning and the influence of the ADA on the evacuation plans of other metropolitan areas. Disasters are nuanced events that give no recognition to political boundaries. For an undergraduate thesis, and the reality of the disasters reviewed in this project, the scope had to be limited to the Seattle area and the city level plans that dictated City of Seattle actions. That said, there are county, state, regional and national plans[5] that should be reviewed in-depth, and in conversation with one another, to better understand the full response to disasters of a Katrina level scale. Nisqually and Oso were major disasters, but did not require the same mobilization of resources that would be needed for an event the size of Katrina. Such mobilization would likely invoke response and implementation of plans at all levels of governance. Planning documents can only be so extensive and may not fully reflect all of the official knowledge and preparations for disaster. Therefore, in addition to research at the larger scale and connections of planning, there should be investigation on the smaller scale that includes city department plans and training efforts that already exist. It is possible that there are more explicit preparations for low-mobility populations at other levels of governmental planning

[5] County plans: https://kingcounty.gov/en/dept/executive-services/governance-leadership/emergency-management/plans/comprehensive-emergency-management
State plans: https://mil.wa.gov/plans
Regional plans: “Pacific Northwest Emergency Management Arrangement (PNEMA)” https://mil.wa.gov/logistics-and-resources
National plans: https://www.fema.gov/emergency-managers/national-preparedness/frameworks/federal-interagency-operational-plans

that simply need to be brought more into the city-wide planning documents. Lastly, plans were reviewed based on their connection to a specific disaster. There are more modern editions of the Seattle plans that should be reviewed to see how the incorporation of public transportation has continued to evolve.

Within equity and vulnerability literature, there is a strong understanding that accommodations for those with disabilities can often benefit even those who are able-bodied (Civil Rights Division, 2007b, p. 7). Clearly, ADA guidance has allowed for plans to accommodate low-mobility populations, including those who simply do not have a car but are otherwise able-bodied, but this connection did not appear in my review of transportation and planning focused academic materials. While there is presumably literature discussing emergency plans for those with disabilities within Disability Studies, such material was not reviewed in this work since it was not incorporated into the original focus of my research. Other researchers should work to bridge the gap between emergency planning literature more broadly and Disability Studies literature to properly interrogate the connections between the two disciplines.

VIII. Conclusion

Climate change is increasing disaster severity and frequency (Yazdani et al., 2020), which puts low-mobility populations at increased risk when emergency plans do not account for their unique needs (Wailoo et al., 2010). Hurricane Katrina made it clear to the nation that emergency planning insufficiently accounted for low-mobility populations due to the disproportionate harm that those without cars experienced. As a result, PKEMRA was passed and planners have begun to better incorporate knowledge of social vulnerabilities – like mobility challenges – into their planning efforts.

Comparing Nisqually and Oso offers insight into how Seattle has incorporated planning for low-mobility populations into city evacuation plans. I surprisingly found recognition of vulnerable populations in the plans for Nisqually, prior to Katrina. Many of these formal accommodations and procedures supported non-transportation vulnerabilities like non-English fluency. Despite a lack of formal plans for it, support for transportation of vulnerable individuals was included in reports on the earthquake when city buses were sent to pick up individuals unable to leave on their own.

It was revealed that after Katrina, PKEMRA was passed to reform emergency management practices and mandate public transit support. Mentions of public transit were minor in the act, but support for those with disabilities was far more robust with an appointed disability coordinator and several references to those with "special needs", which was used synonymously with "individuals with disabilities". Guidance for compliance with ADA in emergency management provided more tangible recommendations than PKEMRA.

Downstream effects of ADA-related guidance was seen in the Oso case through accommodations for low-mobility individuals and an incorporation of the Whole Community approach to emergency planning. Plans at the time of Oso used "access and functional needs" interchangeably with "disabilities," and incorporated more accommodations for vulnerable populations more broadly. Most prominently, there are several public transportation-specific duties of the SDOT found in the Earthquake and Winter Storm annexes of the Seattle plans. The ADA toolkit was referenced as an explicit guiding resource in plans, as was the Whole Community approach which advised planning for communities in collaboration with the communities that will be affected. Community-based plans move away from the need to transport far to evacuation centers by locating them near residents forced to displace. Success of

community support was clearly seen through the critical role that locals had in early response efforts to the landslide.

It is clear that the City of Seattle and planners more broadly have learned from mistakes made before and during hurricane Katrina. From having little inclusion of vulnerable populations and public transportation at all, to having the Whole Community approach and several direct expectations of SDOT, low-mobility populations and their transportation needs have significantly improved. As seen in the recommendations listed prior, there is still room for improvement to ensure that cities are not just accounting for low-mobility individuals as a minority, but planners may be on the right track to helping residents rely on public transportation to address climate change without severely sacrificing their own personal safety in case of disasters. The future of emergency planning cannot be centered solely around personal transit, and recognition of that reality is clear in the documents reviewed.

As described above, disasters are nuanced events which are difficult to directly compare. That said, Seattle was selected as a representable case of planning by DHS, making it a clear case for other metropolitan areas to look at in regards to how their area has planned for disasters regarding low-mobility individuals. Similar analytical approaches could be undertaken in other areas to investigate if they have similarly approached incorporating public transportation, or if there are lessons to be learned from other cities. Seattle by no means represents a perfectly comparable case for other municipalities, but broader lessons can be learned from this analytical approach to reveal the role that non-emergency policies can play in how emergency planning is conceived and accomplished.

IX. Appendix

Qualitative Tag Tracker

Reminder: Tags are not exhaustive of the potential references, but are viewed in the context of the document being reviewed. For example, the entire ADA toolkit could be tagged as "vulnerable populations", but this tag was only applied to excerpts where other tags were applied within that document.

Code/Tag	Brief Description	# of Uses	Use status
Beyond Seattle	Seattle as part of a greater region	23	In-use
City Action	Planned or direct action taken by the City of Seattle	78	In-use
Community	Role of communities in preparing for, and responding to, disasters	31	In-use, added later
Displacement	Evacuation, relocation, or other movement of people	132	In-use
Emergency Management Practices	Referring to guides, policies, and the knowledge base of how to properly plan for emergencies	191	In-use
External Resource Support	Non-City of Seattle resource requests and aid	21	In-use
Low-mobility	Populations that require unique support in evacuations	12	In-use
Nisqually Timeline	Key Nisqually events	73	In-use
Oso Timeline	Key Oso events	50	In-use
Personal Responsibility	Individual responsibility in disaster response	12	In-use
Policy Reference	Referencing specific policies	33	In-use
Public Service	Use of "public service" in referencing resources	3	In-use
Referencing a Disaster	References to specific disasters, typically as focusing events	5	In-use
Transportation	Transportation plans, methods and responsibilities	121	In-use
Vulnerable Populations	Broader than "low-mobility" to include all those at increased danger and vulnerability to disasters	128	In-use

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