



Transportation resilience in the Global South: A post-Haiyan investigation in Tacloban, Philippines

Iderlina Mateo-Babiano

The University of Melbourne

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Abstract

Environmental disasters reveal the fragile condition of transport systems, particularly its capacity to address mobility and accessibility needs of people and communities immediately after an extreme event. This fragility surfaces particularly in resource poor regions, exposing the limited governance capabilities of formal institutions to effectively respond to challenges associated with people's mobility and accessibility requirements after a disaster. Post-Haiyan offers a unique opportunity to study the transport dimension of disaster governance in the post-disaster recovery phase. By conducting systematic reviews, this study provided insights into how transport poverty is experienced by people and communities in Tacloban, Philippines as a result of a weakened transport system as well as the extent to which transport resilience is manifested in remobilization efforts. Moreover, the study tried to comprehend the extent to which mobility and accessibility challenges within the context of post-disaster recovery initiatives have been addressed and adequately mitigated. Results show that remobilization efforts can still be vastly improved to achieve a more resilient transport system. These insights are vital to better address mobility and accessibility needs, realize more resilient systems, and improve local level disaster planning and governance in future disaster scenarios.

Keywords: Transport · Vulnerability · Climate Change Adaptation · Disaster · Resilience · Philippines

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Corresponding Author:
Iderlina Mateo-Babiano
imateo@unimelb.edu.au

Introduction

Environmental disasters reveal the fragile condition of a city, including its transportation system. Particularly in a developing city setting, when transport infrastructure is heavily damaged after a disaster, disruptions may manifest in different forms (Mattsson & Jenelius, 2015). It can be minor such as the temporary interruption of transport services, or major such as isolating communities from the rest of the world (Lum & Margesson, 2014). These situations create a series of stresses, compounding the already heightened disaster impacts, particularly of those who in the first place are already transport-poor and disadvantaged (World Bank, 2001; Carruthers, Dick & Saurkar, 2005).

In 2013, Super Typhoon Haiyan (local name: Yolanda), one of the strongest tropical cyclones to impact the Philippines, made landfall in Tacloban City. The city was one of the hardest hit areas, hence offers an important lens with which to examine the Haiyan experience. This paper is the first to investigate the transport dimension in disasters in an attempt to understand how transport challenges were addressed during rehabilitation and recovery to promote community resilience (Cutter et al., 2008).

The paper, therefore, evokes important questions on the performance of transport and how a tropical cyclone demobilizes and remobilizes individuals and communities. It asks how people and communities were demobilized, as they move from their homes to safer places, as a result of the paralyzation of the transportation sector; and how they were remobilized through efforts initiated by various actors and agencies, both at the national and local levels. Creating such understanding contributes towards a better comprehension about people's mobility needs (i.e. refers to the ability to move goods and people) and access options (i.e. ability to reach desired opportunities, including activities, destination, goods and services), two key functions of transport, within the context of disasters (Litman, 2003). At the same time, it helps inform the development of a new framework to enhance disaster planning and post-disaster recovery processes, and the transformation of transport into a more (ecologically) resilient system (Reggiani, Nijkamp & Lanzi, 2015), filling an important and critical knowledge gap and producing an original albeit different lens with which to understand the post-Haiyan experience.

Transport Resilience in Disaster Context: A Framework for Analysis

Engineering versus Ecological Perspective of Transport Resilience

Current scholarly work on transportation in disaster context is scant. But there is exciting yet still fragmented scholarly work that is starting to emerge in the extant literature which explores the capability of transportation systems to facilitate better movement in disaster contexts (Mattsson & Jenelius, 2015; Wang, 2015; Marsden, Anable, Shires & Docherty, 2016),

through the improvement of connectivity and accessibility (Reggiani et al., 2015), better access to lifesaving facilities, and demonstrating the potential of transport in ameliorating vulnerabilities and enhancing spatial resilience during extreme events (Cummings, 2011).

Litman (2006) has called for the need for resilience to be built into planning and policymaking processes of communities. However, it was Wang (2015) who clearly framed resilience thinking within the domain of transport planning. Wang (2015) purports that current disaster transport planning has narrowly focused on infrastructure solutions to address transport stresses brought about by a weakened transport infrastructure (Regmi & Hanaoka, 2011). Often, the intent of post-disaster recovery strategies is to restore systems into pre-disaster conditions to produce "efficient, constant and predictable" systems in the face of disruption (Holling, 1973; Murray-Tuite, 2006; Holling, 1996; Walker & Salt, 2006; Walker, Anderies, Kinzig & Ryan, 2006; Reggiani, 2013). Wang (2015), however, cautioned that defining resilience mainly on engineering grounds will not only restrict recovery processes to achieve pre-disaster functional condition but may lead to a reduction in resilience from other dimensions. Further echoed by Marsden et al. (2016), and Mattsson and Jenelius (2015), both groups of authors argued that a critical aspect of comprehensive resilience is the ability for a system to transform into a form, which may lead to a completely different system but with a more desirable equilibrium state" (Wang, 2015, p.190), or what is known as "ecological resilience". Ecological resilience encourages a more holistic rehabilitation of the transportation network to support effective disaster recovery. It is a kind of recovery that goes beyond the technical, but is more concerned with the need for social and ecological rehabilitation to restore the vitality of communities (Tobin, 1999; Xu, Marinova & Guo, 2015) particularly in addressing poverty in transport (Carruthers et al., 2005) after an environmental disaster, to achieve more effective recovery, reliability and sustainability of communities.

Transport Poverty and Resilience

The alternative concept of poverty, which has been reconceptualized and advanced by Sen (1981), places emphasis on the individual's multiple capabilities. To date, its application in transport has not been fully articulated, yet there is a mutual concern of the far-reaching negative consequence of the lack of transport on individuals and communities in both developed and developing contexts (Lucas, Mattioli, Verlinghieri & Guzman, 2016). Multiple capabilities approach posits that people require a larger scope of capabilities, beyond enjoying adequate income, to effectively function in society.

This paper presents a pioneering attempt to articulate the impact of transport on community in a disaster setting. Translating Sen's capabilities approach to examine transport poverty, or the level of vulnerability, will help highlight our understanding

of ecological transport resilience. To date, several definitions of transport poverty have been put forward by various researchers in an attempt to create a common and consistent understanding of the term in both academia and policy (Currie & Delbosc, 2011; Lucas, Mattioli, Verlinghieri & Guzman, 2016; Jeekel & Martens, 2018) yet within these extant literature, the notion of transport poverty, inequality and disadvantage within a disaster setting is non-existent. Table 1 integrates and defines several authors' conceptualization of transport poverty, as manifested in four key transport poverty dimensions: affordability, availability, accessibility and acceptability, and its opportunities to demonstrate resilience in disaster.

Summary

Transport, a derived demand, depends on a person's desire to access opportunities. In the context of disaster, transport that supports the mobility of disaster victims and makes them access crucial destinations is vital to achieving transport resilient systems. This desire should be pitted with a suitable transport service provision. Although consensus exists that strengthening the transport system reduces post disaster impacts (Hoffman, 2014), knowledge gaps still persist in a system's ability to

withstand transport vulnerabilities, and in the degree to which these systems can recover (or level of transport resilience). Hence, there remain two key barriers to achieving ecologically resilient transport: (1) the continued mismatch between disaster-affected people's transport requirements and the transport being supplied; and (2) the limited understanding on how the transport system is affected by disaster events, which results in increased vulnerability. As such, this section introduces transport poverty, broadly defined as a person's lack of resource to satisfy their (daily) basic activity needs and opportunities (Lucas et al., 2016), a framework to potentially explain community vulnerability and resilience due to transport in disaster context.

Methodological Design

Systematic reviews (SR) were conducted to address this paper's objective of evaluating the performance of transport in disaster context. SRs enabled a comprehensive literature search of important sources of information beyond the published literature and scholarly databases. The approach included government reports, media coverage, unpublished studies and thesis dissertations.

Table 1. Dimensions of transport poverty in disaster context

Poverty Dimension	Expressions of Transport Poverty	Expressions of Transport Resilience	References
Accessibility	This describes the difficulty of reaching certain activities and opportunities both for people and goods, e.g. disaster emergency response services (health and medical services), basic needs (food, shelter), economic and social opportunities (education, jobs, health services, retail/commercial) at practical cost, ease, time.	Ease with which all categories of passengers can have improved access to health, medical services, basic needs, and economic and social opportunities; hence also refers to the ability of transport to be equitable and inclusive.	Lucas et al. 2016
Affordability	This refers to the financial aspect of one's journey which places either the person or household in a position of making sacrifices in order to travel, or the extent to which they do not have adequate financial resources to travel when and where they want to.	Increased capability and resources to be able to afford to travel via several transport options if and when one wants to.	Carruthers et al., 2005; Litman, 2017; Lucas et al., 2016
Availability	This refers to the general lack of transport (in terms of mode, frequency, route, timing or ease in getting information about travel options) creating difficulties to one's need for mobility and limiting the use of transport, often connected to a lack of service or non-working infrastructure during or right after disasters.	State of improved mobility provides freedom to do something or go somewhere.	Lucas et al., 2016
Acceptability	The quality of public transport as a function of travelers' standards based on cultural and/or social appropriateness or one's personal preference. For instance, passengers may be discouraged from using public transport because of personal safety on buses and trains; socially/culturally unacceptable way of traveling.	Increased ability of transport system to be socially, culturally, economically and environmentally responsive.	Carruthers, 2005; UN-Habitat, 2013

Firstly, search parameters and criteria were defined to guide the collation of information from different sources. Several systematic searches were iterated using the following keywords “Yolanda” or “Haiyan”; and “Leyte” “Tacloban”; and “transport” “travel” “mobility” “access” “cycling” “walk” “ride” “road”. Secondly, the databases in which search were conducted included scholarly databases such as Google Scholar, Scopus, Social Science Citation Index, Transportation Research Information Service, and Web of Science; online media articles from Inquirer.net and Global Media Arts (GMA) News online; policy documents from both Philippine government agencies and local government units (LGUs); online reports issued by international non-government organizations (NGOs); and unpublished studies, thesis and dissertations. These materials were then analyzed on how these documents answered the paper’s objective.

Case Study: Tacloban City

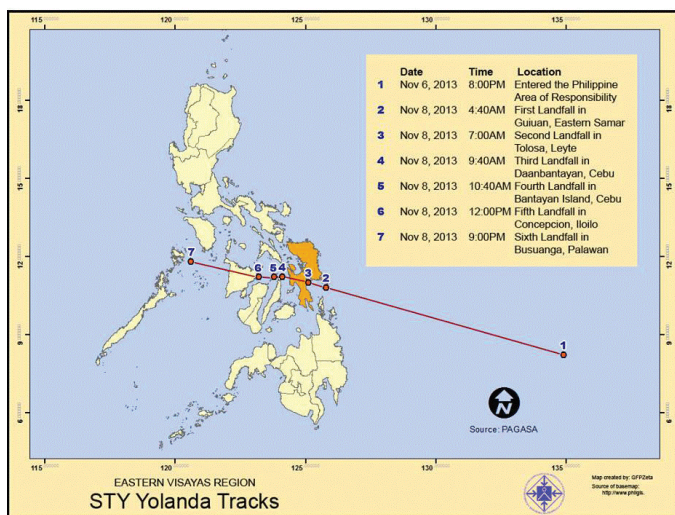


Figure 1. Location map of Tacloban City, Philippines, indicating the track of Typhoon Yolanda (Paragas, Rodil & Pelingon, 2016)

The Philippines is an archipelagic country which is situated within the so-called “Ring of Fire”. Considered as one of the most disaster-prone nations (see Figure 1), there are about 20 cyclones entering its area of responsibility on an annual basis (United Nations University Institute for Environment and Human Security [UNU IEHS], 2011). In 2013, an exceptionally strong typhoon with the international name Haiyan and a storm strength equivalent to Category 5 arrived within the Philippine’s Area of Responsibility. It made landfall in Tacloban City, the capital of Eastern Visayas. With wind speeds of up to 378 km/hr, it resulted in storm surges of 4 to 6 meters high. Sherwood, Bradley, Rossi, Guiam and Mellicker (2015) estimate that the country suffered about 7,000 deaths, approximately 4 million people displaced and USD 36 billion in damages. Figure 1 shows the location of Tacloban City in relation to the Philippines, the different climate impacts that the city experienced,

which include landslide, storm surge, flooding and drought, and the track of Typhoon Haiyan (Figure 2).

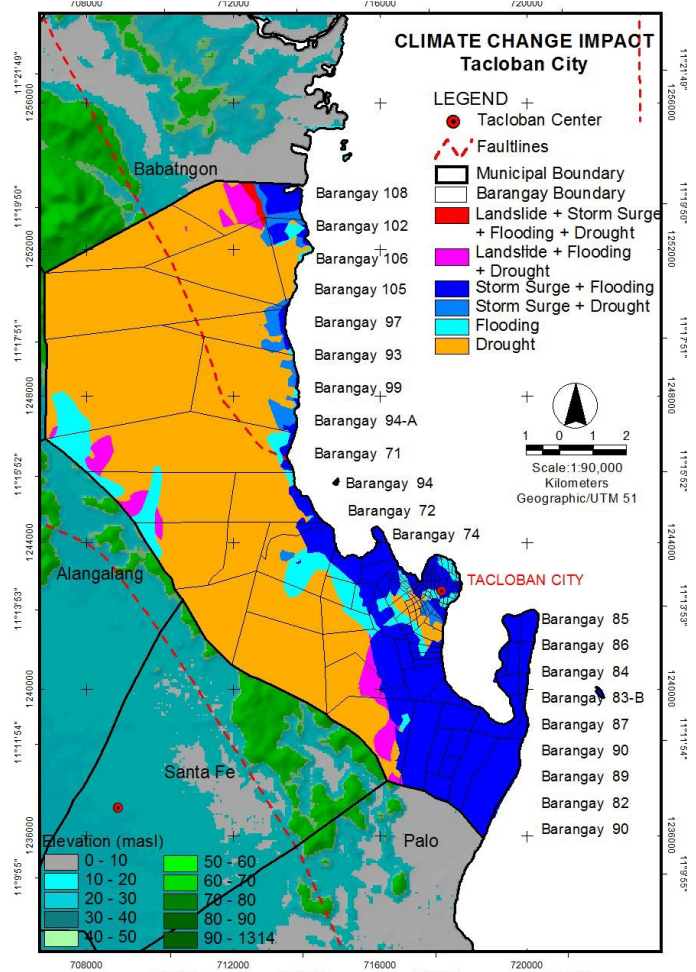


Figure 2. Tacloban City’s climate change impacts (Yap and Garcia, 2014)

Table 2 illustrates the number of affected people, the level of damage to properties of the regions in the Philippines which suffered the highest number of fatalities and damaged houses. Compared with other Haiyan-affected regions, the lower average income and the higher poverty levels reported in Region VIII have further aggravated Haiyan’s impacts on households and individuals. In Tacloban City alone, 2,524 were declared dead and 594 people were missing (equivalent to 1.22% of the city’s population and 44% of the fatalities in Region VIII) while a total of 28,734 houses were totally damaged and 17,643 were partially damaged (Tacloban Recovery and Sustainable Development Group [TRSDG], 2014).

The annual population growth rate of Tacloban is 2.73% and its average household size is 4.13. The land area of Tacloban City is approximately 97.06 sq.km. The city has a total of 138 barangays, with 17 in rural and 121 in urban areas. A notable spatial change was observed in Tacloban City’s population

Table 2. Post-Haiyan number of affected people, property damages, income, and poverty incidence by region

Region	Affected people ²	No. of casualties ¹	Displaced people ²	Damaged houses ²	Damage & loss (Transport) ³	Average income (PhP) ⁴	Poverty incidence ⁴
XIII	69,956		22	6704		219,000	43.9%
IV-B	450,930	19	1,960	33,510		141,000	29.8%
VI	3,796,092	294	2,242,958	482,280		159,000	30.5%
VII	5,881,352	74	205,937	120,694		184,000	30.5%
VIII	3,797,471	5,785	1,537,932	492,095		160,000	47.3%
IX	5,000		0	21		166,000	39%
TOTAL	14,000,801	6,172	3,988,809	1,135,304	6,251.10		

Source: ¹(DSWD, 2014a); ²(DSWD, 2013); ³(National Economic and Development Authority [NEDA], 2013a); ⁴(Philippine Statistics Authority [PSA], 2015)

before and after Haiyan (Mas et al., 2015). Tacloban's population prior to Haiyan was 255,301 (2012 Comprehensive Land Use Plan estimate) and went down to 188,828 (2014 figures), implying that Tacloban's overall population decreased by 26% (66,473). The city's coastline and downtown area, which is also surrounded by bodies of water on three sides, experienced a decrease in population while northern Tacloban, the identified resettlement area, saw an increase in population (Department of Social Welfare and Development [DSWD], 2014b).

Haiyan brought in its wake a myriad of challenges, including the massive destruction of critical transport infrastructure systems. Roads and bridges were severely destroyed causing congestion at key transport hub (such as ports, airports and ferry crossings), limiting access, hindering humanitarian response, and presenting significant challenges to manage waste more effectively.

Results

Demobilities and Remobilities: Transport Infrastructure Performance

This section discusses the way transport became incapacitated post-Haiyan. Typhoon Haiyan affected more than 170 cities and municipalities in 6 regions (see Table 2). The Eastern Visayas region, which mainly consists of the provinces of Leyte and Samar, incurred massive transport-related loss and damage. This was magnified by the storm surge, making recovery and reconstruction a very challenging exercise. The Reconstruction Assistance on Yolanda, the strategic plan to guide recovery and reconstruction in Haiyan-affected areas in the country, reported that 42% of the total length of national primary arterial roads (6,728 km), 36% of the total length of national secondary roads (5,583 km) and 38% of the total length of local roads (65,000 km) were affected at varying degrees (NEDA, 2013b). This would mean that local roads including those which provide

critical local access to barangays or villages as well as farm-to-market roads, municipal roads, city roads and provincial roads were damaged, in poor condition, and virtually impassable with piles of debris and waste materials littering the streets and clogging the drainage (TRSDG, 2014). This has hampered the movement of people and goods within as well as into and out of communities or barangays. Barangays are considered the smallest political and administrative unit in the Philippines. Moreover, at the national level, about 3,357 bridges (approximately 42% of the national total) were structurally stressed, referring to the level of physical damage that may cause serious disruptions to area-wide mobility and access (NEDA, 2013a). The Department of Public Works and Highways (DPWH) estimated that the structural damages to road networks and bridges amount to approximately PHP 202,674,000.00 (=USD 4,034,116) (TRSDG, 2014).

However, the typhoon only slightly damaged San Juanico Bridge, considered as the longest-bridge in the Philippines which connects the provinces of Samar and Leyte. San Juanico Bridge demonstrated strong "engineering" resilience during and after post-disaster Haiyan. Because of this, it also served multiple roles: as gateway for community access and humanitarian intervention and an important transportation backbone linking Leyte and Samar province along the Pan-Philippine highway, hence demonstrating "ecological" resilience.

Aside from roads and bridges, the city's three major transportation facilities - airport, seaport and public transport terminal, which also served as key entrepôts to the city - were severely damaged and barely operational immediately after the disaster. Daniel Z Romualdez Airport covers 45 hectares of land and accommodates approximately 12 flight trips per day (TRSDG, 2014). The airport was heavily destroyed by the storm surge, which rose to 4.2 meters (Lagmay et al., 2014) from both sides of the peninsula. After the typhoon, the airport was opened mainly for aid deployment and passengers leaving Tacloban (GMA, 2013a). The 5.3-hectare seaport was

immediately opened 10 days after Haiyan's aftermath although it also sustained some damage. The main port area was spared of any major structural damage and became an important post-disaster hub. It was extensively used mainly for the deployment of relief goods and other humanitarian efforts including ferrying people who assisted in the relief operations and moving the residents out of the city immediately after the disaster. The Abucay Tacloban Bus Terminal served as the key land-based transportation hub for the city, the province, and the region. It catered to multiple transport and mobility needs accommodating not only inner city and inter-city routes but also inter-provincial and inter-regional transport movements (connecting Luzon and Mindanao to the Eastern Visayas region). It became the busiest transport hub for the city and the province. While the facility was severely damaged following the typhoon, it nevertheless continued to move goods and people in and out of the city but was also temporarily used as a dumpsite.

Through these major transport facilities, it was possible to observe intra-regional movement, including the transport mode used by land, sea or air. Migration Outflow Desks were strategically located at key intra-regional entry as well as exit points of Cebu, Guiuan, Manila, Roxas, Ormoc, and Tacloban by the International Organization for Migration and DSWD. This was open a week after Haiyan until middle of December when outflows went back to pre-disaster levels. Moreover, because the Visayas Region is composed of several islands, movements were via air and water, rather than land. Between 15 and 22 November, a week after Haiyan's landfall, about 17,000 person-trips were generated (and recorded) as the Philippine military provided free air flights into Manila from disaster-affected areas (Protection Cluster Philippines, 2013). On a daily basis, out of the 5,000 recorded person-trips moving out of Eastern Visayas, approximately 30% (1,500 person-trips) were by air leaving Tacloban City while others took the "roll-on roll-off" interisland transport from severely affected islands. According to the Port Authority, approximately 5,000 people were crossing daily with the majority of people coming from the city of Tacloban (Assessment Capacities Project, 2014). While most individuals originating from Tacloban travelled to Manila or Cebu, residents from Guiuan (site of the first Haiyan landfall) tended to move to Tacloban or Cebu, indicating that these intra-regional movements were largely dictated by the transport mode and transport services available at the disposal of these individuals.

Extreme events impose significant physical stresses to a city, including its transport networks. The identification of priority infrastructures to be reconstructed is as important as gaining an improved understanding of the extent to which a weakened infrastructure can increase vulnerability of those who are already disadvantaged by the transportation system. Examining the dimensions of transport poverty help shed light on how to ameliorate transport poverty.

Assessing Transport Poverty and Resilience in Disasters

This section describes how an already disadvantaged population

was further affected by a weakened transportation system in the context of the Haiyan experience. Mobility can place a significant impact on individuals and communities. This impact may be gleaned from the four dimensions, namely: accessibility, availability, affordability, and acceptability.

Transport Accessibility

Transport accessibility is described as the extent to which all categories of passengers can participate in emergency response activities; opportunities to access basic needs and provisions (food, shelter); the movement of goods to reach the most disadvantaged sector; and during the recovery period, the extent to which individuals can access economic and social opportunities (education, jobs, health care, shopping/grocery) within reasonable ease, time and cost.

Forced evacuation is a mechanism employed by the government to prepare for a disaster as well as in post-disaster recovery. A day prior to Haiyan's landfall, the national government ordered the forced evacuation of residents in high risk danger zones such as those in flood-prone and landslide-prone areas (GMA, 2013b). In the wake of Haiyan, rising waters prompted the evacuation and relocation of people to temporary shelters. However, there was unavailability of public transport to ferry people to shelters. This was compounded by the fact that almost everyone, including public transport drivers and operators, became disaster victims. In the first instance, they had to care for themselves and their immediate families. Majority of the road networks was damaged from the storm surge. They were blocked because of flooding with piles of debris on roads which severed access (Gelineau & Teves, 2014). Vehicles were made inoperable due to the storm surge further aggravating the already existing vulnerabilities.

Similarly, post-Haiyan experience further demonstrated Tacloban residents' "access-poverty". Drawing from Sherwood et al. (2015), the study used stratified sampling (considering residential location, poverty level and damage caused by Haiyan) in identifying 4,518 survey respondents who are most vulnerable residents of Region VIII (Sherwood et al., 2015). During the survey, 75% of the respondents were reported to be internally displaced persons, 52% experienced some form of tenure insecurity, and the rest experienced economic hardship.

This gap analysis provided useful information on specific "transport disruptions" (80%) and clarity on "meeting transport needs" of the sample populace (100%) (Sherwood et al., 2015). Table 3 compares the self-reported information on the accessibility and availability of basic services for both displaced and non-displaced subgroups, before and after Haiyan while Table 4 presents explanations for the difficulty in accessing basic goods and services.

As reflected in Table 3, results from the focus groups of residents in relocation sites and bunkhouses showed their concern on the limited accessibility and availability of basic

Table 3. Availability and accessibility of basic goods and services pre/post-Haiyan*

BASIC SERVICES	Before		TOTAL	After		TOTAL
	YES	NO		YES	NO	
Availability (displaced)	242,467	10,377	252,844	242,248	10,596	252,844
Percent (%)	95.90	4.10	100	95.81	4.19	
Availability (not displaced)	82,821	1,033	83,854	82,533	1,321	83,854
Percent (%)	95.90	4.10	100	98.42	1.42	100
Accessibility (displaced)	238,197	14,467	252,844	237,001	15,843	252,844
Percent (%)	94.21	5.79	100	93.73	6.27	100
Accessibility (not displaced)	80,136	3,718	83,854	78,372	5,482	83,854
Percent (%)	95.57	4.43	100	93.46	6.54	100

*Adopted from Sherwood et al. (2015)

services. This was more of a problem for those located in remote relocation sites. For those who were not displaced, a difference of 288 participants reported that basic goods/services became unavailable after the typhoon while an additional of 1764 participants said that goods/services became inaccessible after the typhoon. For those individuals who were displaced, 219 reported that basic goods/services became unavailable after the typhoon and 1196 more reported that goods/services were inaccessible after the typhoon.

In the study of Sherwood et al. (2015), focus group discussion (FGD) participants reported that in one of the transitional shelters, free bus transport to Tacloban City was provided but the service was stopped only after a short period. When posed with the question on the reasons for difficulty in accessing basic services, majority (93.36%) of those surveyed reasoned “lack of money” while only 3.68% considered basic services as “too far” to access (refer to Table 4). Coastal residents have been resettled far from their place of origin, limiting their opportunities to seek for temporary work, or gain access to basic and critical services. These individuals (who originally worked as fishermen prior to Haiyan) lamented that “the sea was now too far and too expensive to access, forcing them to face another form of readjustment” (see Sherwood et al., 2015 for the complete survey results).

Organizations and institutions heavily rely on effective transport networks to enable them to conduct search and rescue operations, deliver emergency supplies, and transport victims to hospitals or temporary shelters. Weakened or non-existent transportation has severely inhibited and physically hindered the institutions from immediately responding to the needs of affected communities (Gonzalez, Hidalgo & Barabasi, 2008).

The extensive damage brought about by the super typhoon on the transport system has severely limited the access of several organizations responding to the needs of highly affected areas,

Table 4. Participant explanation for the difficulty in access to basic services*

Reasons Provided	Population Estimates	Per Cent
Lack of money	191,462	93.36
Too far	7,543	3.68
Lost home/land due to typhoon	1,970	0.96
Old age or illness	1,288	0.63
Political affiliation	1,205	0.59
Others	770	0.38
Newcomers	539	0.26
Religious affiliation	124	0.06
Don't know	184	0.09
TOTAL	205,085	100%

*Adopted from Sherwood et al. (2015). This question was posed to participants who responded that they had difficulty in accessing services.

particularly those in isolated communities. This was further exacerbated by the archipelagic nature of Leyte, placing severe constraints on ensuring more responsive logistical operations. Another layer of challenge was in the collation of information and communication of condition of transport infrastructure during and after the disaster, overall hampering relief efforts, limiting the capacity and capability of humanitarian groups to provide for the logistical requirements to support more effective disaster response. This has caused a complex web of congestion of and stretched capacities in various parts of the transport network particularly at key hubs such as ferry crossings, airport terminals, and ports (Philippines Humanitarian Country Team, 2013).

Transport Availability

Ensuring accessibility and mobility service options are vital requisites for an effective disaster management response. For instance, mobility-related post-disaster recovery strategies must be explicitly identified at the tactical, operational and organizational levels. However, the lack of clear mandate on planning and management to adequately address disasters of major catastrophic scale has reinforced transport mobility and accessibility issues in Haiyan's aftermath. Also, a systematic rationalization of transportation's supportive but critical role has been sorely absent from disaster planning and governance tools in Tacloban.

Individual mobility was severely hampered as people had to move within their communities or be relocated to evacuation centers. The main reasons for this were that road network were blocked due to the piles of debris on roads and majority of the road network were damaged from the storm surge (Gelineau & Teves, 2014).

In the context of disaster, the capability of a transportation system to enable people's mobility and access is crucial to be able to achieve effective disaster management response. However, it is also true that in disaster events, there is the possibility that one or more transport options would not work. In this case, it is important to provide a variety of mobility options, or what is called redundant transport (Wang, 2015). The provision of alternative modes in the instance that the main transport failed is an important part of any disaster plan. Moreover, it became clear that, at least in the Haiyan experience, active transport like walking and bicycling, is vital as it may sometimes serve as the only viable means for individuals to move around immediately after a disaster (Osaragi, 2013; Litman, 2010). As public transport modes were unavailable and roads were blocked, people could only walk, ride a bicycle or use cycle rickshaws (pedicabs) as means of mobility within areas. While it would take longer relative to other transport modes for people to go where they needed to go, it was still the only reliable and viable means. Walking and riding the bicycle are not dependent on fuel availability, flexible, as people could meander through different routes as well as inclusive, as anyone who was physically able to walk or ride the bicycle regardless of age, gender or socio-economic status can participate in walking. Several studies have already examined walking, one of which is Osaragi (2012) who examined people's walking behavior as a result of the temporary closure of the public transport system in the aftermath of the 2011 Tokyo earthquake.

Transport Affordability

Intensifying the vulnerability of individuals and communities is the unaffordability of travel. The financial burden of journeying puts one in a position of having to make sacrifices in other parts of their lives just to travel. In the first few days after Haiyan struck, public transportation fares increased more than double in Tacloban and the rest of the province. Operators and drivers were overcharging passengers. This was, again, a complex web of cause and effect as fare increases were largely

a response to high fuel costs resulting from limited fuel supply. Immediately after the disaster, fuel rationing was imposed in areas that were hardest hit. While, 83 of 128 petrol stations within the area were operational, there was a cap placed by the Energy Department. Its Director reported that sales were limited to PHP500 (=USD9.93) per transaction as a strategy to extend availability (Sydney Morning Herald, 2013).

Although the Land Transportation Office in coordination with the Land Transportation Franchising and Regulatory Board monitored erring public utility vehicle drivers who overcharge passengers (DVM, 2013), still, this did not deter operators and drivers to exploit immediate opportunities. This has placed several households in a position that they did not have adequate financial resources to travel when they want to, which was a key problem among disaster victims, and then survivors were relocated to sites that were further away from their place of work. Transportation costs skyrocketed. In a study undertaken by Sherwood et al. (2015), respondents reported that their children had to temporarily stop schooling because of the steep transport costs. This lack of educational opportunities forced some young individuals to leave school and move to another urban center such as Manila. While in one resettlement village, households must spend an exorbitant amount, about PHP 100 per day (=USD 1.99), to be able to get to school. This became unsustainable particularly to families who lack stable income or source of livelihood (Sherwood et al., 2015).

Transport Acceptability

The need for transport to be culturally and/or socially appropriate, hence acceptable, to its users has long been recognized as an important attribute of disaster response efforts. Col (2007) cautioned that a mismatch between vulnerability realities and planning may result in an evacuation process that is significantly flawed (Col, 2007). This was demonstrated when disaster planners in New Orleans before Hurricane Katrina's landfall approximated that about 100,000 up to 130,000 people would have no access to private transportation (Wolshon, 2002) but incorrectly assumed in the emergency plan for New Orleans that these individuals would evacuate using their own private transport. Sheller (2013), writing on the Haiti earthquake of 2010, recognized that the impacts of transport system failures would be different among various groups, but would somehow have greater impact on the poor and marginalized sectors of society who generally have lower network capital while those who have higher network capital can flee the disaster zone.

There is an acknowledgment that resilient transportation is a key, albeit missing pre-requisite in integrated, holistic disaster risk management. Wang (2015) suggested that the need for an integrated suite of transport options that goes beyond the engineering aspects, captures social-ecological aspects, ensures that mobility needs of the community for the movement of both passenger and goods, within the context of an extreme event happening, would adequately and appropriately addresses future climatic situations (Amdal & Swigart, 2010).

Discussion and Conclusion: Achieving Transport Resilience

This paper's knowledge contribution is two-fold: first, it was able to develop and introduce the concept of and articulate transport poverty and resilience within a disaster setting, highlighting the vital role that transportation plays in terms of individual as well as community mobility and access; and two, it was able to comprehensively examine the fragile condition of transport within a disaster scenario by drawing upon demobilization of individuals and communities as well as the remobilization strategies employed by various actors, immediately after the super Typhoon Haiyan had made its landfall.

The paper highlighted that while LGUs are mandated to be the first responders immediately after an extreme event, the experience of Tacloban illustrated that they were unable to effectively take on this directive due to two main reasons: one, because they were disaster victims themselves, and therefore exposed to the same transport-related stresses like others after the disaster; and two, their overall capabilities to effectively respond to transport-related stresses after a disaster may already be limited, hence a solid framework to address such challenges must be put in place. This became much more challenging when considered within a large-scale environmental disaster, as what was experienced in Tacloban in 2013. Although preparations were undertaken both by the national and local governments, the intensity of its impact left communities much more unprepared. In the context of increasing disaster impacts, this paper recommends that governments, at different levels, along with humanitarian agencies, should provide solid planning frameworks earmarked to tackle issues of transport mobility and accessibility, which can serve as vital lifelines in critical disaster situations.

In the case of Tacloban, institutional and regulatory frameworks to enhance resilience to disasters have already been put in place yet its articulation of how transport can be made more resilient remains limited, particularly at the tactical and operational levels. For instance, there is the Tacloban Recovery and Rehabilitation Plan (TRRP), which is a key document that can help guide the development of policy and planning processes as well as improve disaster governance and planning. TRRP envisions a "resilient, vibrant and liveable city". The slogan of building back better guides the implementation of the TRRP. In fact, post-disaster rehabilitation and recovery strategies have mainly focused on the improvement of existing transport assets and infrastructure as well as the proposal of new infrastructure, but not clearly understanding the type of transport services that would be most effective in supporting community resilience when the next disaster occurs. Therefore, results from this study could help improve our understanding that post-disaster rehabilitation and recovery is not about the return to earlier forms of infrastructure, but more importantly, provide guidance on how to achieve more effective transport services through better access and mobility strategies during post disaster scenarios, a fact recognized and acted upon in

previous disasters (e.g. Tōhoku earthquake and tsunami in 2011, hurricane Katrina in New Orleans in 2005).

In Haiyan's aftermath, one key program prioritized by the national government is resettlement for displaced families. The TRRP identified Tacloban North, an area which is 16 kilometers north of Tacloban downtown, as the city's planned resettlement area that would cater for more than 16,000 families. While Tacloban North's urban master plan is yet to be finalized, the implementation of resettlement projects has already been ongoing, yet this has been incremental and piecemeal. These relocation sites therefore are beset with challenges, while those relocated continue to be insecure and are mostly concerned about how they would earn their living. Through this study, it is important to highlight that resettlement is not only about the provision of shelter but it is also about the provision of safe and secure communities for its residents, who will have access to critical social infrastructures, economic opportunities and basic social services. Transportation could play an enabling role in such situations.

As a recommendation, the design of a post disaster recovery plan must always place people first in the agenda and provide them with a diverse set of transport options. As it has been shown, transport mobility and accessibility needs must be initially addressed as part of a holistic post-disaster recovery program. Thus, the current TRRP display limitations but also provide a platform for opportunities. In addition, by using the concept of transport resilience, remobilization efforts of formal institutions were examined to comprehend the extent to which mobility and accessibility challenges within the context of post-disaster recovery initiatives have been addressed and adequately mitigated by recovery plans. However, results show that remobilization efforts can still be vastly improved to achieve a more resilient transport system.

The current approach demonstrated by post-Haiyan in Tacloban primarily focused on the recovery phase, thus, calls for opportunities for a more proactive disaster management, which would strengthen current mitigation and preparedness strategies, in the understanding of a more intense and more frequent environmental disasters. These insights are vital to: better addressing mobility and accessibility needs, realizing more resilience, and improving local level disaster planning and governance in future disaster scenarios.

While this paper has demonstrated useful insights into the topic of disaster and mobility, there are some limitations. First, time and resources were key constraints. Second, there has not been much research on the specific issue of individual and community mobility in a disaster context, particularly in developing cities.

As a next step, results of this study could be enhanced when supplemented by primary data collection:

1. Interviews of persons affected by the disaster to further understand transport demand;

2. An audit of transportation networks to understand how to improve transport supply (e.g. blocked road networks, alternative modes during disasters);
3. Appraisal of pre-, actual and post-disaster transport infrastructure conditions may be undertaken as part of a rapid damage assessment (see for instance, Mas et al., 2015, which used satellite imagery); and
4. Documentation and breakdown of the transport modes that international, national and NGOs used for mobility of goods and passengers.

As a result of climate change impacts, more and more disasters are expected to occur and could affect urban areas in different ways and at different scales. Understanding mobility and accessibility needs in a disaster context must be a priority and an important focal topic of cities. As such, there is therefore a need to fund more research on this issue especially in developing Asia, the most disaster-prone region worldwide. The dynamics of disaster recovery focuses on the “gaps”, “speed” within the context of unmet needs (in terms of scale as well as level of recovery) and “timeliness” (relates to the swiftness of recovery). The potential to recognize recovery as a pathway to resilience building, is therefore crucial, particularly in understanding the role of transport as derived from the reported need of demobilized people and goods. Remobilization efforts by governments, private sector and civil society, must listen to the voice of the community, adhering to their needs. Purposes, scales of movement, and needs vary. Acknowledging these needs and motivations for travel is critical if we aim to promote more resilient communities.

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