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Exploring association between perceived importance of travel/traffic information and travel behaviour in natural disasters: A case study of the 2011 Brisbane floods

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A B S T R A C T

A sound understanding of travellers' behavioural changes and adaptation when facing a natural disaster is a key factor in efficiently and effectively managing transport networks at such times. This study specifically investigates the importance of travel/traffic information and its impact on travel behaviour during natural disasters. Using the 2011 Brisbane flood as a case study, survey respondents' perceptions of the importance of travel/traffic information before, during, and after the flood were modelled using random-effects ordered logit.

A hysteresis phenomenon was observed: respondents' perceptions of the importance of travel/traffic information increased during the flood, and although its perceived importance decreased after the flood, it did not return to the pre-flood level. Results also reveal that socio-demographic features (such as gender and age) have a significant impact on respondents' perceptions of the importance of travel/traffic information. The roles of travel time and safety in a respondent's trip planning are also significantly correlated to their perception of the importance of this information.

The analysis further shows that during the flood, respondents generally thought that travel/traffic information was important, and adjusted their travel plans according to information received. When controlling for other factors, the estimated odds of changing routes and cancelling trips for a respondent who thought that travel/traffic information was important, are respectively about three times and seven times the estimated odds for a respondent who thought that travel/traffic information was not important. In contrast, after the flood, the influence of travel/traffic information on respondents' travel behaviour diminishes. Finally, the analysis shows no evidence of the influence of travel/traffic information's on respondents' travel mode; this indicates that inducing travel mode change is a challenging task.

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1. Introduction

Information plays a vital role in everyday trip-making decisions and changes. Travellers use such information to reduce their travel time, cost, and other undesirable factors by adjusting their choice of departure time, route and mode. In extreme events, the role of information is crucial because travellers often face great uncertainties during such events, and safety (rather than comfort or a reduction in travel time or cost) becomes their primary concern.

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Travel/traffic information can be broadly categorised into two classes: en route information and pre-trip information. En route information is mostly concerned with regulatory traffic information (e.g., speed limit, lane closure or toll) and with downstream traffic conditions (e.g., a major incident, congestion or road closure). En route traffic information allows drivers to control their speed, lane change and, in some circumstances, route change. These are instances of real time travel information that allow traffic engineers to manage traffic operation to provide significant benefits in improving traffic network performance (For more information on en route traffic information, see Ben-Akiva et al., 1991; Pan and Khattak, 2008). In contrast, pre-trip information is provided for, or accessed by travellers prior to their trips through media such as newspapers, television, radio, telephone, websites, and smart phone apps, and can influence the trip maker to change most aspects of their journey (including departure time, route, mode, or destination), or even to cancel their trip (Jou, 2001; Mannering et al., 1994).

A sound understanding of travellers' behavioural changes and adaptation when facing a natural disaster is a key factor in efficiently and effectively managing transport networks at such times. Travellers are likely to make judgements about these changes and adaptations based on the information they collect from different sources. In normal operating conditions, travellers' day-to-day travel experiences of network conditions are the primary source of their information. During a natural disaster, however, travel conditions can change and, in most cases, people affected by the disaster do not rely on their previous travel experiences; rather, they turn to other sources of information such as television, radio, newspapers, the internet and word of mouth.

Information plays a significant role during an extreme situation by providing those affected with an understanding of the overall situation and a sense of confidence in their decision making. Although the use of travel/traffic information to influence travel behaviour is widely studied and significant progresses have been made (see Literature Review), most of these studies focused on hurricane evacuation and very few studies were based on floods that did not cause a large-scale evacuation. Furthermore, no studies explicitly measured perceived importance of information and its linkage to behavioural changes during a natural disaster. This study fills this research gap by qualitatively and quantitatively analysing perceptions of the importance of travel/traffic information and its potential impact on travel behaviour during the 2011 Brisbane floods.

The state of Queensland (Australia) experienced a series of floods from December 2010- January 2011 – the second largest flood event in the past 100 years. About three quarters of the state was affected, and more than 200 000 people were affected. The flood also had a major impact on transport facilities: Over 9000 km of roadway and over 3000 km of Queensland rail track across the state were affected (Queensland Transport, 2012); ferry services on the Brisbane River were shut down completely from January 10, 2011 and partially resumed on February 14, 2011. Public transport services in South East Queensland were suspended for two days at the height of the flood event (Brown et al., 2011), and this disrupted the travel behaviour of residents in the flood-affected regions.

Brisbane city region was one of the areas in Queensland that were severely hit by the flood. Before the flood, Brisbane City Council (BCC) undertook a series of initiatives to raise awareness in the community regarding the increased risk of flooding, including the implementation of an Early Warning Alert Service. However, very few residents registered for the service. This changed during the flood as many residents sought the latest information on the flooding and traffic situation. Public information about the flooding was provided and accessed through a variety of channels including television, radio, print media, newsletters, the council's Call Centre, website, and social media (Brisbane City Council, 2011). This provided an excellent opportunity for investigating two critical but rarely studied issues: residents' perceptions of the importance of travel/traffic information when facing great risks and uncertainties associated with a natural disaster, and the potential impact of such perceptions on their travel behaviour.

Taking the 2011 Brisbane flood as a case study, therefore, this research focuses on residents' various information sources and needs, and their travel behaviour adjustments at different stages of the flood, and scrutinises the relationships between perceptions of the importance of travel/traffic information, changes in travel mode and route, and socio-demographics factors. Insights gained from the study can be used to design more effective travel information systems and to develop more efficient traffic management strategies, two critical components of disaster response systems. Note that when used hereafter in this paper, 'information' refers to travel/traffic information, unless otherwise stated.

The remainder of the paper is organised as follows. Section 2 reviews previous related studies; Section 3 provides details of the survey data collection process; Section 4 qualitatively analyses respondents' information sources and their perceptions of the importance of information at the various stages of the flood; Section 5 models changes in respondents' perceptions of the importance of information, and its linkage to their mode and route choices; and Section 6 concludes the paper by summarising major findings.

2. Literature Review

Natural disasters often force travellers to immediately adjust their travel behaviours in and around the disaster-affected areas or to evacuate the disaster area in worst cases (Homberger, 1990; Giuliano and Golob, 1998). In the situations where a large-scale evacuation is not warranted, travel behaviour adjustments are mostly limited to changes in trip schedule and route. Based on 70 case studies of road capacity reduction, Cairns et al. (2002) conclude that in response to a network degradation, people change mode, consolidate trips for different purposes, and visit alternative destinations; however, the most universal adjustment is the changing of route and departure times. Similar findings are observed in Ye et al. (2012), Zhu et al. (2010), Tilahun and Levinson (2009), and Giuliano and Golob (1998). Two opposite situations were observed in the aftermath