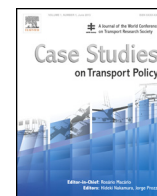




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The role of transport information in extreme weather events: A scenario based experiment

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ABSTRACT

Extreme weather events present serious threats to existing transport systems. Events such as flooding, extreme heat or cold, heavy snowfalls or high winds, have the ability to destroy, disrupt, and disable vital transport links. Such disruptions can lead to individuals being unable to travel in their normal fashion. Advances in digital technologies, especially smartphone applications and mobile internet, present new opportunities to provide individuals with transport information in the uncertain circumstances caused by extreme weather events. As much of this information collection is either funded by the service provider or by the tax payer, it is important that the largest possible proportion of individuals have access to it and derive a benefit from this information.

This paper presents the results of a survey conducted in the Greater Dublin Area (GDA) to determine what proportion of individuals seek out transport information during extreme weather events, and also to identify where they source it from. The results arising from this research demonstrate both the demand for such information during extreme events, and diversity of sources used to access it. It is also clear that the methods individuals use to source such information differs considerably depending on whether or not they have begun their trip, and whether they tend to seek out information under normal circumstances. From the perspective of service providers and policymakers it is important to consider that how individuals' access to information may vary with regard to the mode they are using. It is clear, in an Irish context at least, that important transport information is being retrieved from a wide variety of sources, suggesting the need for a more centralised system. While this study specifically examined the role of transport information during extreme weather events, the findings arising from this study can be applied to other events that cause large scale disruptions such as political protests, natural disasters, security disturbances, and transport related industrial action.

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1. Introduction

The frequency of severe weather events appears to be increasing due to changes in the global climate (IPCC, 2007). Such events have the ability to place considerable strain upon existing transport networks. Within an Irish context the heavy snowfall arising from the cold weather experienced in winters of 2009–2010 and 2010–2011 caused severe transport disruptions (Met Éireann, 2012). Similarly, heavy rains in 2013 and 2014 (Met Éireann, 2014) lead to major delays on both the road and rail networks within the GDA. Internationally events such as the Queensland (Australia) flooding of 2011–2012, Hurricane Katrina,

the Northern European windstorms Lothar and Martin have wreaked havoc upon the transport networks of their respective regions.

Transport disruptions limit individuals' abilities to make necessary trips due to congestion or unavailable services which can lead to economic losses (Jahn, 2015). Various extreme weather events have the ability to create varying problems for existing systems. Precipitation events can cause routes to become blocked and impassable, extreme low temperatures can freeze surfaces reducing grip for vehicles, while high winds can destroy vital infrastructure such as overhead power lines (Love et al., 2010). While extreme weather events may cause direct impacts to transport systems, human actions, such as deciding to travel or driving in an unsuitable manner for the conditions, can often exacerbate problems (Jahn, 2015). Therefore, it is important that individuals are provided with adequate information to allow them

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to travel and act in such a manner that enables them to minimize the knock on effects of extreme weather. While research is being carried out in this field, passenger adaptation and the role of information during extreme events are not yet well understood (Papangelis et al., 2016).

2. Transport information

With advances in digital technology such as satellite navigation and mobile internet platforms, there now are numerous sources of transport information available to individuals, both before they travel and when they are on the move. These range from traditional sources such as printed timetables and traffic updates via the radio, to newer technologies such as journey planning websites and at stop or on road variable message signs, through to smartphone applications and in car devices. These services are designed to provide individuals with information to allow them to make more effective transport choices. Therefore, it is worth considering how such information may impact upon behaviour in an everyday setting, before considering their role during extreme weather events.

2.1. Role of transport information

When assessing the role of information is important to understand why it is deployed in the first place. Lyons (2006, Page 200) argues that transport information plays three important roles: “1. make the individual aware of the travel options available to them for a particular journey; 2. Empower the individual to make more fully informed travel choices; and 3. assist the individual in being able to successfully undertake and complete the journey”. While transport information has been available since the days of the earliest printed timetables for steam powered railways, relatively recent advances in digital technologies have opened up a wide range of opportunities to provide individuals with more up to date and route specific transport information. Information relating to public transport, such as online journey planners and transport specific smartphone applications, have the ability to reduce the perceived unreliability of a service (Watkins et al., 2011), reduce perceived waiting times (Warman, 2003), and reduce at stop anxiety (Schweiger, 2003). All of these benefits can be achieved with relatively little in terms of resource outlays (Watkins et al., 2011). Similarly, by providing drivers with real time traffic information it is possible to reduce congestion and the resulting carbon dioxide emissions, without resorting to costly infrastructure investments (Cebon and Samson, 2011).

While the provision of transport information may offer an innovative method of improving transport experiences, it appears that use of such information varies widely across user groups and demographics, with notable difference in information access across age groups (Brazil and Caulfield, 2013). Information may at times not be sought as individuals are engaging in habitual behaviours for trips which they regularly undertake (Kenyon and Lyons, 2003). In such cases there is less of a need to seek out information, as the cognitive effort involved with the process of searching for information outweighs the perceived rewards (Gao et al., 2011). While this may be true for habitual trips such as commuting and shopping trips, where the individual has a good knowledge of the system and there are relatively low levels of variation in travel times, trips taken or planned during extreme weather events can be considered to be outside of the normal range of events by their very definition. In such cases users are unlikely to already possess the necessary information to undertake their trip in the most effective and safest manner, due to the extreme and unfamiliar conditions they may encounter, and the adaptations that may be required of them.

2.2. Role of weather information

Previous studies have examined the role that weather information can play on the transport actions of individuals. Kilpelainen and Summala (2007) looked at the role of weather forecast on driver behaviour in Finland and found that drivers who acquired information made more changes to their travel plans. Research by Cools and Creemers (2013) has shown that changes in weather forecasts have the ability to influence individuals travel behaviours and that various media such as internet, television, and radio are used to access such information.

2.3. Information during disruption

While it has been argued that variability is a characteristic of transport systems in general (Bonsall, 2004), extreme weather can exacerbate this issue by disrupting services or making certain routes impassable. When examining the influences on individuals' decision making for long distance trips during extreme weather events, Zanni and Ryley (2015) highlighted the role of information sources such as radio, mobile internet, television, and satellite navigation devices. Similarly, work by Zheng et al. (2015), analysing the role of transport information during the Brisbane flood of 2011, found that travel information was considered to be important during an extreme weather event, but that in that case, changing mode still remained a difficult task. Other interesting findings from this study were that some individuals switched primary information sources during the event, and the study also highlighted the possibility for extreme events to introduce transport information sources to those who had never previously used them. When examining the role transport information in rural areas during disruptions Papangelis et al. (2016) highlighted both the potential role that real time information can play during periods of uncertainty, and also the specific challenges faced by rural areas that often go overlooked.

2.4. Potential impacts of information in extreme events

As stated previously, the individuals' behaviour during an extreme event has the ability to exacerbate the impact of extreme events by undertaking unsuitable actions (Jahn, 2015). While transport information may not be able to address the root causes of disruptions, such as flooded train lines or impassable roads, it does have the ability to reduce the indirect effects. Actions that can be taken based upon transport information may include: deciding not to travel, taking an alternative mode or route, deciding to postpone a trip, or being more cautious in their behaviour (e.g. walking, cycling, driving). While this may not be applicable to all cases, as some trips may be unavoidable, it does represent an ability to reduce these impacts, and therefore add more resilience to the system.

2.5. Transport information in Dublin

To provide context for the research presented in this paper it is important to consider the current transport information landscape within the GDA. At present there are a wide range of sources of transport information available to individuals across multiple platforms. These services are provided by organisations such as local civic councils, road operators and public transport authorities, as well as private sector firms and freelance software developers.

Table 1 outlines some of methods of information provision currently used in the GDA. While this table cannot claim to be an exhaustive list of transport sources, it does highlight that there are

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