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Article

Sustainable Development and Airport Surface Access: The Role of Technological Innovation and Behavioral Change

Tim Ryley [1,*], Jaafar Elmirghani [2,3], Tom Budd [1], Chikage Miyoshi [4], Keith Mason [4], Richard Moxon [4], Imad Ahmed [2], Bilal Qazi [2] and Alberto Zanni [1]

[1] Transport Studies Group, School of Civil & Building Engineering, Loughborough University, Loughborough, UK; E-Mails: T.Budd@lboro.ac.uk (T.B.); A.M.Zanni@lboro.ac.uk (A.Z.)

[2] School of Electronic and Electrical Engineering, University of Leeds, Leeds, UK; E-Mails: J.M.H.Elmirghani@leeds.ac.uk (J.E.); Eliea@leeds.ac.uk (I.A.); B.R.Qazi@leeds.ac.uk (B.Q.)

[3] Department of Electrical and Computer Engineering, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia

[4] Department of Air Transport, School of Engineering, Cranfield University, Cranfield, UK; E-Mails: C.Miyoshi@cranfield.ac.uk (C.M.); K.Mason@cranfield.ac.uk (K.M.); R.Moxon@cranfield.ac.uk (R.M.)

***** Author to whom correspondence should be addressed; E-Mail: T.J.Ryley@lboro.ac.uk; Tel.: +44-1509-223-422; Fax: +44-1509-223-981.

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Abstract: Sustainable development reflects an underlying tension to achieve economic growth whilst addressing environmental challenges, and this is particularly the case for the aviation sector. Although much of the aviation-related focus has fallen on reducing aircraft emissions, airports have also been under increasing pressure to support the vision of a low carbon energy future. One of the main sources of airport-related emissions is passenger journeys to and from airports (the surface access component of air travel), which is the focus of this paper. Two aspects associated with the relationship between sustainable development and airport surface access are considered. Firstly, there is an evaluation of three technological innovation options that will enable sustainable transport solutions for surface access journeys: telepresence systems to reduce drop-off/pick-up trips, techniques to improve public transport and options to encourage the sharing of rides. Secondly, the role of behavioral change for surface access journeys from a theoretical perspective, using empirical data from Manchester airport, is evaluated. Finally, the contribution of technology and behavioral intervention measures to improvements in sustainable development are discussed.

Keywords: sustainable development; surface access; technology; behavior

1. Introduction

Sustainable development reflects an underlying tension between achieving economic growth and addressing environmental challenges, and this is particularly the case for the aviation sector. Although the sector is largely considered to be economically and socially sustainable, it also generates environmental concerns because of climate change impacts from aviation-related emissions. Despite a dip due to the current economic recession, United Kingdom air travel has increased over the last ten years. There were 219 million terminal passengers at UK airports in 2011 compared with 167 million in 1999 [1]. There is also likely to be a further long-term growth in demand with a knock-on impact on emissions such as carbon dioxide (CO_2). Although much of the aviation-related focus has fallen on reducing aircraft emissions, airports have been under increasing pressure to support the vision of a low carbon energy future. In particular, in recent years there has been a focus on reducing the share of emissions from surface access journeys to and from the airport.

This paper contains an initial review of the issues surrounding sustainable development and airport surface access. It focuses on two aspects: an evaluation of the technological innovation options that will enable sustainable transport solutions for surface access trips, and a discussion of the role of behavioral change for these journeys from a theoretical perspective using empirical data from Manchester airport. Finally, the potential contribution of technology and behavioral intervention measures to improvements in sustainable development relating to surface access is discussed.

This paper presents findings from one of a series of Airport Operations projects (funded by the United Kingdom Research Councils' Energy Programme), the 'ABC project: Airports and Behavioural Change: towards environmental surface access travel'. The project aims to encourage better environmental behavior of individuals travelling to and from airports (the surface access component of air travel), and has a focus on sustainable transport solutions for the year 2020, a mid-term timescale. A unique aspect of the ABC project is that is brings together two components, surface transport and air travel, as each transport component has environmental imperatives to reduce both travel demand and carbon emissions.

1.1. Sustainable Development and Airport Surface Access

Climate change has had an increased role over time within the environmental aspects of sustainable development, as shown by its prominence within the 2005 UK Sustainable Development Strategy [2]. Transport is a major contributor to greenhouse and pollutant emissions, and transport is one of the only sectors where emissions have been increasing [3]. This is especially the case for aviation. While it is estimated that commercial air travel currently accounts for around 2% of global CO_2 emissions [4], it is expected that this figure will rise given the projected growth of the sector in the future.

The UK Government's commitment to reduce CO_2 emissions by 80% by 2050 over 1990 levels, with an interim target of a 34% reduction by 2020 [5], has put the issue of aviation related emissions into focus. Given the projected growth in the sector, it is likely that aviation will take an increasingly significant proportion of any carbon budget [6]. The UK Government forecasts growth in UK aviation, hence doubling carbon emissions from approximately 9 million tonnes of carbon (MtC) in 2000 to 17.4 MtC in 2050 [7].

It should be noted that there are many significant environmental impacts of air transport including, amongst others, the development of airports and associated infrastructure; noise and vibration from aircraft (and surface access); water pollution (e.g., surface run-off); local air quality pollutants (e.g., CO, NO_X); solid waste (scrapped aircraft, waste oil/tires); other waste for disposal; energy and water consumption; and complex land-based supply chain operations. This paper considers the role of the airport developing in a sustainable manner. One of the immediate necessities to initiate this process by conducting research which helps understand the key challenges facing airports, and to facilitate the development of solutions. A challenging objective for airports is to develop in a sustainable manner, increase airport capacity and economic performance, while simultaneously minimizing environmental impact.

While surface access emissions are relatively low in comparison to those from aircraft, they are one of the primary sources of emissions that airports have the ability to influence. Hence this paper, and the underlying research project from which it stems, focuses on surface access journeys to and from airports.

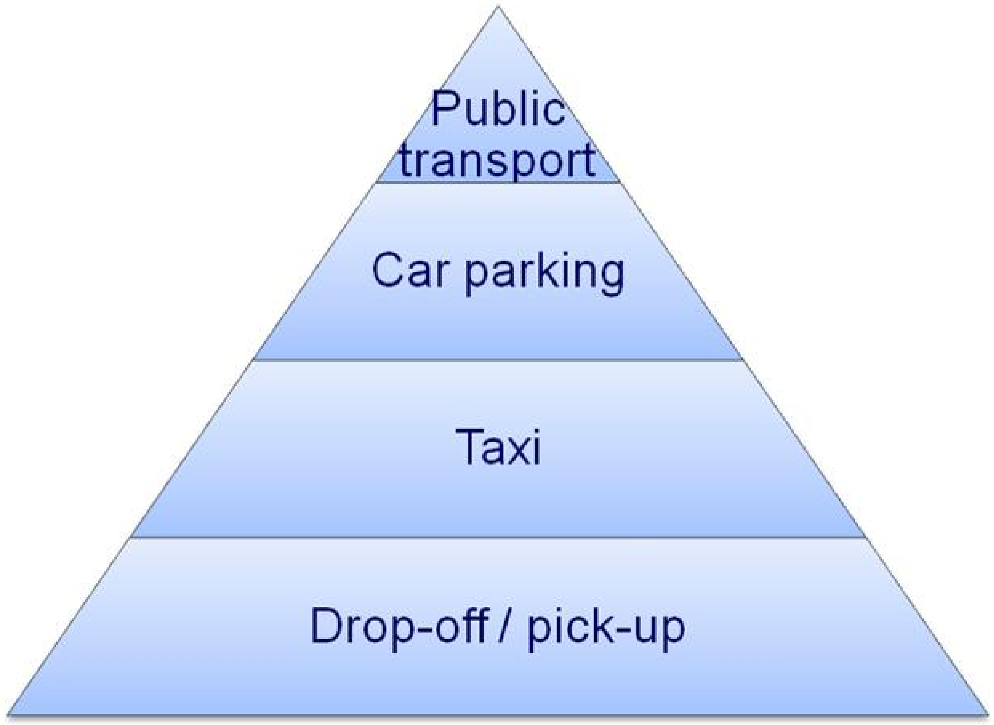
Access to airports is an essential part of airport operations as well as being of particular importance for travellers. It is estimated that 65% of journeys to large airports in Europe and the US are made by private cars, with this figures rising up to 99% for smaller regional airports [8,9]. Importantly, previous studies have demonstrated that the Value of Access Time is considerably higher than the estimated value of time spent travelling normally for commuters e.g., [10]. The reason for this appears to be the risk of missing flights, which increases when travel time to airport increases [11]. In addition, it is important to analyze the arrival time of passengers and their respective flight departure times. This is estimated to depend, in particular, on whether: 1) the passenger is flying for business or leisure, with business travellers preferring to arrive later at airport; 2) the passenger is in employment or retired, the frequency of flights in the past; and 3) the passenger is travelling with any luggage or not [10]. On the other hand, airport managers face a difficult task with regards to reconciling congestion and environmental pressures to reduce private vehicle trips with the substantial commercial importance of car parking revenues [12].

Interviews with a range of surface managers at an early stage of the ABC project revealed a wide variety of surface access issues and management policies [13]. The need to reduce the share of passenger journeys made by private car and to increase public transport use was identified as a key issue, with a particular focus on reducing 'drop-off/pick-up' journeys. However, it was also found that while reducing private car journeys may yield environmental benefits, such strategies are largely at odds with substantial commercial pressures to maximize the revenue potential of airport parking. Particular focus was paid to the problem of changing current surface access travel behavior among airport users. UK airport surface access managers are reliant on a range of external stakeholders, whom the airport has little direct control over, such as operators of key infrastructure and train companies. Whilst in many cases the airport—stakeholder relationship is shown to be mutually beneficial, airports are still in a vulnerable position.

Surface access to airports has a key aspect of reducing access by motorized transport, particularly where alternative modes could easily be utilized. Surface access modes under consideration include a range of public transport options such as taxi, bus and rail. The travel behavior issues for surface access are different from other transport contexts; for instance, when accessing airports individuals will often not use public transport as they have to carry luggage with them, and hence the need for sufficient luggage storage capacity on board public transport that is visible throughout the journey, or, where appropriate, off-site luggage drop-off facilities.

The types of people who use airports can be seen primarily as passengers and employees. For passengers, there is a particular concern with the drop-off/pick-up of air travellers, typically by a family member or friend. This type of journey, together with those by taxi, is twice the number of vehicle trips than by a passenger who travels by car and parks at the airport. Where possible, airports will try to reduce these trips in favor of driving and parking and, ultimately, public transport. Employee surface access issues can vary considerably from those for passengers. Generally, there is very high reliance on private car journeys for airport employees, who typically need to access the airport regularly, reliably, cost effectively and at times of the day that are not always well served by public transport. In the UK, airport employees typically have their parking subsidized or paid for by their employer. Figure 1 shows a hierarchy of preferred surface access modes for passengers, from the least environmentally sustainable of drop-off / pick-up to the most environmentally sustainable of public transport. It has been adapted from the Manchester Airport Surface Access Strategy [14].

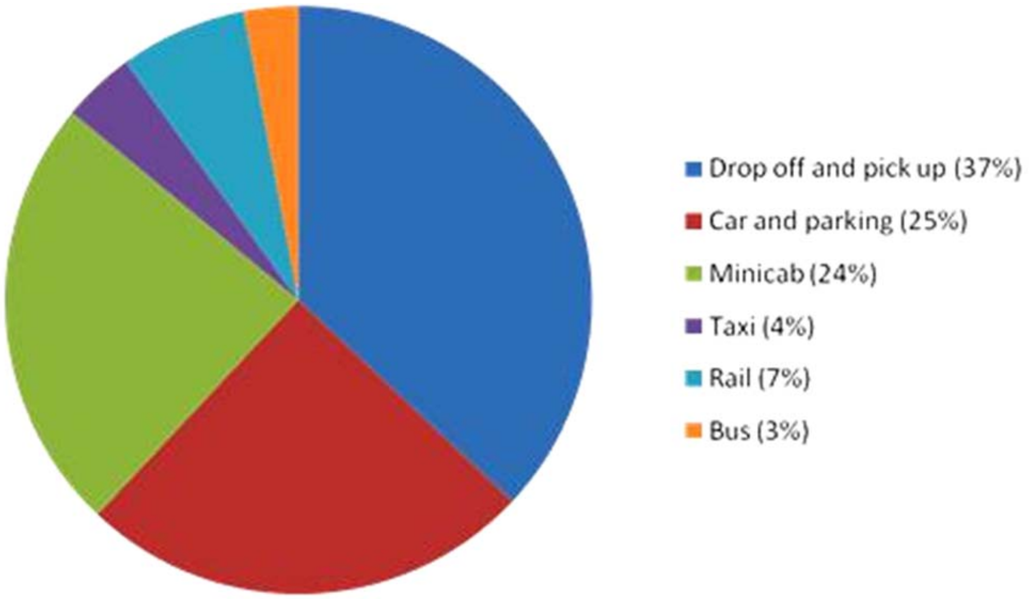
Figure 1. A hierarchy of surface access modes in order of environmental sustainability (from public transport the most environmentally sustainable to drop-off / pick-up the least environmentally sustainable) Source: [14] (figure should be centered).



1.2. Surface Access at Manchester Airport

Initial work included qualitative interviews at Manchester Airport (together with some at Robin Hood Doncaster Sheffield Airport). The interviews showed that passengers most likely to drop-off/pick-up, or drive and park, are: holidaymakers, those in groups and/or those with a lot of luggage. Passengers and employees also mentioned the lack of public transport in the early mornings. There has also been some analysis of Manchester airport secondary data from the Civil Aviation Authority (CAA) and employers on the airport site. Figure 2 shows the travel mode share for surface access at Manchester Airport in 2009. It demonstrates the dominance of private transport, which increased from 80% in 1996 to 90% in 2009.

Figure 2. Travel mode share for passenger surface access to Manchester Airport in 2009 (source: [15]).



Passenger carbon emissions (grams per passenger km in 2009) from CAA data estimated at Manchester Airport, by transport mode [16], shows:

- Highest emissions were from car users, particularly 'Drop-off / pick-up' (221 g/km–7% of total emissions) & 'taxi' (229 g/km) passengers;
- Emissions per passenger km of 'car and park' (96 g/km) are lower; and
- Rail (77 g/km) and bus (50 g/km) emissions per passenger are the lowest.

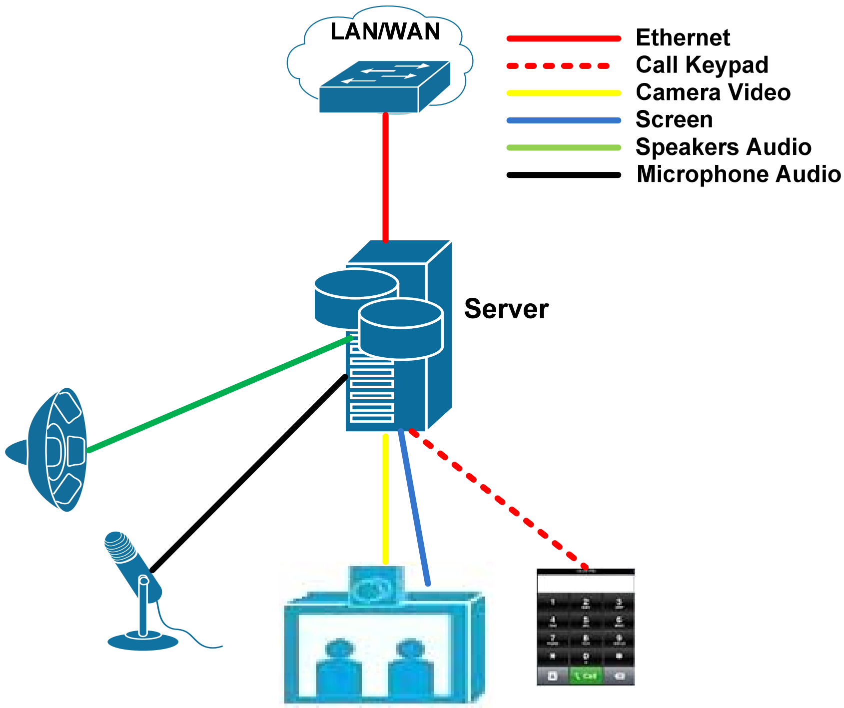
Figures for leisure passengers were lower than for business travellers due to higher load factors per car mode.

2. An Evaluation of Technological Innovation Options

In this section a range of technological innovation options are evaluated that aim to reduce carbon emissions for airport surface access journeys. The following three technology options are evaluated in turn: telepresence (to reduce drop-off / pick-up), techniques to encourage public transport use (e.g., RFID tagging of luggage) and techniques to encourage sharing rides (e.g., software development).

There are technologies to provide home telepresence that can reduce the number of surface access trips that involve drop-off/pick-up of passengers. Communications and software tools can be developed to provide a telepresence experience at home using Internet Protocol, home broadband and home sound surround systems. An illustration of a telepresence system that could be installed at an airport is shown in Figure 3.

Figure 3. Illustrated telepresence system to be installed at an airport.



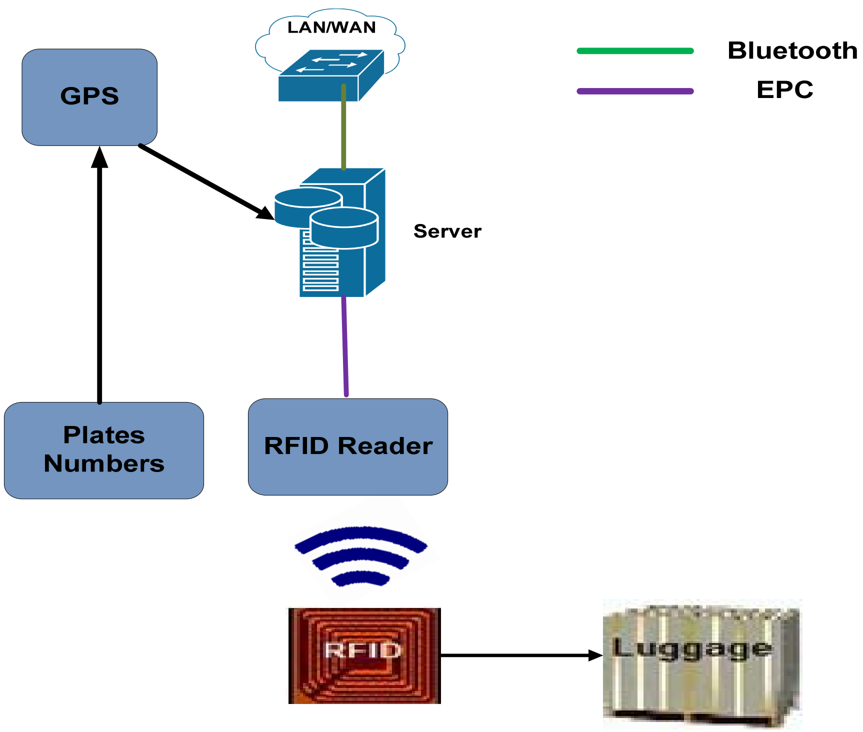
Rather than travel to an airport to drop-off and pick-up a passenger, relatives or friends could order an on-demand event to say goodbye to the traveller where telepresence can offer a realistic experience. Remote meeting solutions can reduce carbon emissions by cutting the number of travellers and vehicles' users. Many companies currently use tele-conferencing as an alternative to face-to-face meetings. However, remote meeting solutions can suffer from a lack of natural human sense and network quality of service. Telepresence provides an alternative solution by facilitating real-time connections, face-to-face interactions and lifelike size. The lack of natural human sense is minimized and thus this new technology supports people in learning, play, work and meetings with a high quality of service while they are at different locations. Telepresence offers a more 'three-dimensional' experience than standard television viewing. Although some consumers currently use packages such as Skype and iPad facetime, due to the large number of (potential) customers and low bandwidth of the internet user, such applications fail to provide the required quality of service. Telepresence works on dedicated high bandwidth connections, which means that the level of experience is not comparable.

In addition, relatives or friends at multiple locations could join the event. An increased Internet Protocol television and broadband service penetration is an important enabler for this approach. Airports could offer telepresence suites that include dynamic video, motion sensitive cameras and surround sound, not only for business use but also for the general traveller. Indeed, telepresence is being introduced at some large airports to assist passengers with way-finding see [17]. This demonstrates that it is a feasible application as a substitute for drop-off / pick-up journeys. Telepresence is at the first level of development and application (there are currently several telepresence providers e.g. Cisco), and so over time is likely to have higher market penetration ratio and lower cost. It could, therefore, be a feasible technological application for use at airports in the year 2020.

An important consideration, like other technological innovations, is the extent to which passengers will embrace this particular technology, and their willingness to pay for it. The recent growth of personal video communication via smart phones and tablet computers presents both cause for optimism and caution with this regard. This technology is being investigated within the ABC project in terms of a hypothetical network of base stations within an airport terminal to support telepresence. In an airport environment, passengers act as mobile nodes, moving in random ways and could initiate telepresence. There could be a number of base stations installed to enable high-definition broadband services and good signal coverage for passengers, but this would be at a certain cost.

There are technologies to encourage use of public transport (coach or rail). Given that carrying luggage is a significant barrier that can put off passengers from taking public transport for surface access journeys, a remote check-in system could be of assistance. A remote check-in system would be particularly attractive if passengers were able to track and locate their luggage along the journey. To facilitate luggage tracking and identification RFID (radio-frequency identification) technology can be implemented. An illustration of the RFID system that could be installed in trains and/or coaches is shown in Figure 4.

Figure 4. Illustrated radio-frequency identification (RFID) system to be installed in trains/coaches.



Continuous information about luggage location would be available through a web interface or text service. When an air passenger gets to the train (or coach) station on a specified travel date, a Bluetooth auto message would provide the train/coach options to synchronize the passenger and their luggage for the surface access journey. There could be a synchronized loading of the luggage onto the train/coach and collection by baggage handlers (or passengers) at the airport. To avoid security problems, passengers and their luggage could travel on the same coach/train. RFID technology could help to minimise difficulties associated with large numbers of passengers and volumes of luggage at the airport. After the luggage drop-off, RFID will enable passengers and staff to keep track of their luggage during the journey to the airport. This type of system has already been deployed at Hong Kong International Airport, where RFID tags on boarding passes and luggage are utilized for safety, security and travel arrangement purposes.

There are technologies to encourage vehicle sharing. It is common for travellers to form groups when using taxis or (mini) buses for surface access journeys. This simple idea could impact upon carbon emissions for surface access trips. When an individual books air travel, there could also be a choice for them to share surface travel to and/or from the airport, perhaps with people not known to them. An alternative (or complementing system) is for the development of a software tool owned by the airport that would send messages (email or text) to other passengers within a given geographic radius of each other and with compatible journey times. Confidential personal information would be removed to establish willingness to share a surface access journey. Optimum scheduling and route selection software would then match passenger requirements and inform the travellers selected.

3. Understanding Behavioral Change Options

It is important to gain a deeper understanding of the factors that determine passenger behavior for journeys to and from airports, and there is a need to examine the relative importance of psychological and situational factors as determinants of mode choice. A questionnaire survey of 860 departing air passengers at Manchester Airport was conducted in June-July 2011 to measure psychological constructs pertaining to two well established theories of attitude-behavior relations, namely the Theory of Planned Behavior [18] and the Norm-Activation Model [19]. In addition, situational variables relating to various aspects of the passenger’s trip, background information about their general travel behavior, and socio-demographic information were also elicited.

Psychological behavioral models such as the Theory of Planned Behavior and the Norm-Activation Model have been used extensively in travel behavior research in recent years. A central assumption of the Theory of Planned Behavior is that the concept of behavioral intention is *the* key antecedent of actual behavior. It assumes that if alternative behaviors exist a choice is made based on the relative strengths of the intentions to perform each alternative [20]. The Norm-Activation Model [19] takes a very different perspective on behavior [21]. While the Theory of Planned Behavior stresses personal-utility, the Norm-Activation Model focuses on the role of personal morals. The central assumption of the Norm-Activation Model is that feelings of personal moral obligation (known as personal norms) are the only causal determinants of behavior [22].

The Theory of Planned Behavior has been shown to be most suited to decisions that are motivated by personal utility maximization, whereas the Norm-Activation Model is more suited to behaviors that contain a moral element. Consequently, mode choice is a decision that can involve both of these factors. A number of mode choice studies have employed a joint model that incorporates elements of both theories.

Initially, the Theory of Planned Behavior and the Norm-Activation Model were tested against the data using structural equation modeling; a statistical technique used to test the structural validity of theoretical models. Results of the analysis indicate that public transport use is determined predominantly by behavioral intentions, as posited in the Theory of Planned Behavior, rather than personal moral obligations, as suggested in the Norm-Activation Model.

This informed the next stage of analysis where two combined models, containing constructs from both the Theory of Planned Behavior and the Norm-Activation Model, were tested. In addition, these models also included constructs relating to descriptive norm (perceptions of what is 'normal' behavior in a population), efficacy (perceptions of what can be achieved) and anticipated feelings of guilt if one were to always use their car to get to the airport instead of using public transport. They were included to see to what extent they improved the predictive power of the models. Results of the structural equation modeling procedure show that, overall, the combined models are useful determinants of public transport use but the additional constructs do not add to their predictive ability.

It is difficult for behavioral models to fully take into account the multitude of situational and socio-demographic variables that affect behavior. Regarding surface access travel, for example, the purpose of a passenger's trip has been identified as an important influence on mode choice. Business passengers may place a higher value on their time than leisure passengers [23,24], but a lower value on the cost of their trip [25]. Leisure passengers may also be more likely to be carrying heavy luggage with them than business passengers [26], which may affect their choice of mode.

As a result, items in the survey were included to elicit information relating to various situational variables and socio-demographic information. Situational variables included: the purpose of the passenger's journey, the geographical origin of their surface access trip, whether they had started their journey from home, their place of work, how many bags they were carrying with them and the size of their travel party. Information about the number of flights the passenger had taken in the previous twelve months was included, in addition to background information about general travel behavior. Socio-demographic information relating to passenger age, nationality and residence was also collected. One item was included to determine willingness to share a ride to the airport with other passengers in the future. This item was designed specifically to link in with the evaluation of technologies for increasing ride sharing, which was discussed in the previous section. A small but sizeable proportion of respondents stated that they would be likely or very likely to choose to share a ride with a fellow passenger (not in their travel group) to get to the airport: 25% to share their own private car (if owned), 34% to share someone else's car, and 37% to share a taxi. Reasons put forward by respondents against sharing included unwillingness to share with a person not known to them (often due to personal safety) and a lack of convenience.

In conjunction with the various attitudinal data, this information was entered into a cluster analysis in order to identify a set of homogenous market segments of respondents, based on their surface access behavior, attitudes, situational characteristics and socio-demographic information. By establishing segments of passengers who share similar attitudes and characteristics, future policies can be targeted specifically to the groups where they are likely to stand the greatest chance of success.

Eight distinct groups were identified. These related to six groups who claimed to have regular access to a car in the UK, and two groups without car access. Each group is given a name based on the general attitudes and characteristics of the group. The two 'non-car access' groups were identified *a priori*, as access to a car inevitably heavily outweighs attitudinal or situational considerations when deciding how to travel to the airport. The eight groups are listed in Table 1, together with a very brief summary of each group's general outlook.

Table 1. A summary of the cluster profiles.

Cluster	Car access	Description
Devoted drivers (21.2%)	Yes	Very positive attitude towards car use, feel social pressure to do so. Negative view of public transport.
Remorseless motorists (17.6%)	Yes	Do not consider car access to airports to be a problem, and do not feel guilty about using their car.
Public transport avoiders (12.9%)	Yes	Not a particularly favourable attitude towards car use, but a very negative attitude towards public transport.
Frustrated drivers (11.1%)	Yes	Aware of the impacts of car use, but feel that using public transport is too difficult for them and would not make much of a difference to the overall problem.
Drop-offs (10.9%)	Yes	Very positive attitude towards being dropped-off at the airport, perceive large barriers to using public transport.
Conscientious 'greens' (4.6%)	Yes	Keenly aware of the negative effects of car use, have a positive attitude towards public transport and feel under social pressure to use it.
Riders of necessity (16.4%)	No	Neither a positive or negative attitude to public transport nor a relatively weak intention to use it in the future. More positive attitude towards taxi use.
Car-less crusaders (5.3%)	No	Very strong positive attitude towards public transport, perceive few barriers to using it, and feel that their own actions can make a difference.

The results of the cluster analysis revealed a wide range of attitudes and perceptions in the survey. As expected, the groups representing car users and people being dropped-off at the airport represented the largest share of the sample. From a policy perspective, it is important to target policies at groups where they are likely to stand the greatest chance of success. For example, policies to increase public transport use may be more effective when targeted at the 'Frustrated drivers' group than the 'Devoted drivers' group. The former are aware of the problem of car access to airports, but perceive large barriers to using public transport. In comparison, the 'Devoted drivers' have a very positive attitude towards using their car coupled with a negative view of public transport. A possible focus of policy in this case, for example, could be to try and reduce the perceived barriers to using public transport by the 'Frustrated drivers' group.

This also highlights an important point about travel behavior and modal choice, namely that people may act in the same way but for different reasons. For example, the 'Devoted drivers' and 'Public transport avoiders' groups both exhibit high private car use, but their reasons for this choice appear to be different. While the former have a positive attitude towards car use and value the comfort and convenience it provides, the latter appear to choose to use their cars because they actively dislike public transport, and want to avoid using it. This has important implications when formulating policy.

While significant attention is paid to increasing public transport use, it is equally important that strategies are implemented to ensure that there is not a mode shift in the 'wrong' direction. The 'Riders of necessity' group, for example, exhibit a higher than average use of public transport. It would seem that this not because of their positive view of public transport, but a result of their lack of access to a car. Indeed, attitudes to taxi and drop-off are more favorable than public transport use for this group. From an environmental perspective, it is important that there is not a significant shift towards taxi or drop-off use in this group, who represent the third largest segment in the analysis.

The two non-car owning clusters ('Riders of necessity' and 'Car-less crusaders') present an opportunity for change through technological innovation precisely because they do not have access to a car (*i.e.* a structural opportunity), whereas for the six car access clusters the opportunity relates more to altering their behavior (*i.e.* attitudinal opportunity). It can be assumed that the groups with the lowest propensity to use other modes ('Devoted drivers' and 'Remorseless motorists'), are also least likely to consider the use of alternative technologies. They are the clusters most likely to have established fixed patterns and routines with little consideration for other modes. That said, technology is arguably most important for the clusters dominated by drop-off / pick-up, and to a lesser extent car users, given that these trips are the least environmentally sustainable and the technologies (telepresence especially) are specifically aimed at reducing the use of these modes. There are three groups, 'Public transport avoiders', 'Frustrated drivers' and 'Drop-offs', that could be persuaded to use either public transport or share rides to reach airports. These groups, if facilitated with better routes and services such as RFID's on their luggage, could have confidence increased in public transport and hence take the next step and use it. Table 2 shows the three technological innovations and the clusters most appropriate for their application.

Table 2. A summary of the clusters appropriate for each of the three technological innovations.

Cluster \ **Technological innovation**	**Telepresence system**	**Public transport**	**Sharing rides**
Public transport avoiders	*	*	*
Frustrated drivers	*	*	*
Drop-offs	*	*	*
Conscientious 'greens'	*		
Riders of necessity	*		
Car-less crusaders	*		

Note: * = The technological innovation could be appropriate for this cluster.

4. Discussion and Conclusions

Listing the surface access transport modes according to their environmental impact highlights the importance of the shift from motor car based trips to public transport. Initial investigation, incorporating the surface access transport mode 'pyramid' classification, has also shown the importance of distinguishing between 'double' trips (drop-off/pick-up and taxi) verses 'single' trips (car/park) to and from the airport. Using this framework to examine the sustainable development performance of surface access trips, the contribution of technology and behavioral intervention measures has been evaluated.

Although not the only solution, or a quick fix to the surface access problem, technology could have a role in reducing the carbon emissions generated from airport trips, particularly when the focus is on airports in the year 2020. Telepresence represents a technology that could reduce the level of drop-off / pick-up trips to the airport, as market presence increases and the costs of installation and usage decrease. Perhaps the use of technologies to encourage car share could also reduce drop-off / pick-up journeys, the most carbon emission generating method of travelling to and from airports. The Manchester airport survey has shown that a small but sizeable proportion of passengers would be willing to car share. A separate technological solution, the use of RFID tagging, could help to overcome the difficulty of taking luggage on public transport to access airports.

The behavioral element to the surface access problem has been examined using psychological-based theories and models. The link between intention and use of public transport has been confirmed; segmentation could be utilized to target particular population groups with the greatest propensity to use public transport, such as the 'Frustrated drivers' within the Manchester airport survey. The clusters generated can be linked to likelihood of using the technological innovations. In terms of marketing messages, it would not be effective to encourage individuals to use public transport for journeys to and from the airport using arguments that relate to moral feelings of guilt or efficacy. Although much of the focus here has been on the modal shift from the motor car to public transport, it has to be acknowledged that passengers can move in the opposite direction (from public transport to the motor car), and airports need to be aware of this.

The results of this study need to be placed in a wider context. Surface access transport journeys are dominated by motor car trips. Therefore, sustainable development gains are likely to be small in scale, and any improvements to the sustainable transport modal shares are likely to be only a few percentage points. These insights also need to be placed in an airport-related context. From the initial review it is evident that airports are not in control of all associated surface access operations, with a range of stakeholders with vested interests (e.g. public transport operators and third party tenants at the airport). In addition, as airports differ greatly in terms size and function, some of the solutions suggested here may not work in certain situations. For example, the technological solutions presented in this paper require an airport terminal of a sufficient size and passenger volume in order to be financially viable, and so may only work in the larger airports.

The work presented here will be developed to incorporate airport trips for employees and associated policy abatement methods such as car sharing schemes, working at home and incentives for using public transport. The research has also demonstrated (and as highlighted in [8]) that there is a further requirement to improve data collection at airports, such as the monitoring of emission targets in order to generate a clearer evidence base for emission improvements.

Much of the emphasis within this paper has been on environmental improvements (e.g. through carbon emission reductions), and as such the findings should also be placed in an economic context. Given that airports tend to be financially vulnerable and that there are current recessionary pressures, many of the proposed solutions within the paper need to be set in a medium- to long-term timeframe, say for the year 2020 and beyond.

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Conflict of Interest

The authors declare no conflict of interest.

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Ryley, Tim

MDPI

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