TRANSPORT DISADVANTAGE AND PUBLIC TRANSPORT NETWORK CHANGE IN BELFAST CITY

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ABSTRACT
The effect of transport disadvantage on levels of participation and access to goods and services is a key policy issue in the design of public transport networks. Development of metro networks and high frequency corridors can have a detrimental impact on transport disadvantaged sections of the population, especially when service reductions are experienced as a result of route restructuring. The City Bus public transport network in Belfast city has been transformed into a Metro network consisting of high frequency corridors. This transformation of the network was aimed at reducing the decline in bus patronage by improving accessibility to services. This paper using a GIS model examines the effect of network change on the city and the newly emerging patterns of transport disadvantage that have developed as a result. Findings from the GIS model are based on comparisons of the old bus network with the newer Metro service network, and present an assessment of the spatial impact of network change on different social groups in the city through the identification of transport deprived areas pre and post network change.

Keywords: Public Transport Network Change, Transport Disadvantage, Social Exclusion

1 INTRODUCTION
Development of Metro networks and high frequency corridors having a detrimental impact can promote transport disadvantages when service reductions in neighbourhood areas are experienced and where the benefits associated with higher frequencies routes are located at greater walking distances (SEU, 2001, 2003; Tyler, 2002). The public transport network of Belfast city was transformed into a Metro network dominated by high frequency corridors in response to Regional Transport Strategy (RTS) 2012 (Translink, 2004; DRD, 2009). This paper uses network analysis and spatial analysis tools within GIS to examine the effect of network change on the city and studies the newly emerging patterns of improved and destitute accessibility that have been experienced as a result. The paper presents findings from a GIS based comparison of old City Bus with the newer Metro Bus Service assess the spatial impact of network change on different social groups in the city pre, and post network change. The paper comprise of six sections.

Section 2 elaborates how changes in the transport network can inflict disadvantages and exacerbate social exclusion. Section 3 examines the case of Belfast city that has undergone transport network transformation. Section 4 describes the methodology adopted for the paper. Section 5 presents results. Section 6 concludes with a discussion of key findings and the prospects for future research.

2 PUBLIC TRANSPORT, TRANSPORT DISADVANTAGE AND SOCIAL EXCLUSION
The issue of transport disadvantage and social exclusion is a key policy area in the United Kingdom (UK) transport policy. The Transport White paper by Department of Transport (DfT, 1998) affirms that transport plays an important role in inclusion of individuals within society through better accessibility and mobility (Hine et al., 2003, SEU, 2003). Public transport system imposes negative externalities on social group within communities in form of isolation from jobs, education and training when it does not meet their travel needs. These negative externalities include...
inadequate public transport, reduced or poor accessibility to basic facilities, adverse impact of road traffic, and travel poverty (Raje et al., 2003; Lucas et al., 2001; SEU, 2003; Church et al., 2003; Nutley and Thomas, 1995). These adverse impacts of transport system lead to segregation and social exclusion of individuals and communities in the society. Social exclusion is a process, which causes individuals or groups not to participate in different activities offered by the society in which they would like to participate due to reasons beyond their control (Burchardt et al., 1999; Preston et al., 2007; Rajé, 2004). The notion of transport disadvantage and social exclusion is different from the concept of travel behaviour and attitude as it includes variables based on socio-economic, demographic, physical and cultural differentiations. These variables affect the travelling patterns of social groups (SEU, 2003; Witter, 2007; Miller, 2005).

Five key barriers serve as the main cause of public transport related social exclusion. These are availability and physical accessibility of public transport, cost of transport, services and activities location, safety, and travel horizons (SEU, 2003; Litman, 2003). A wide set of dimensions related transport disadvantages and social exclusion include physical exclusion, geographical exclusion, exclusion from facilities, economic exclusion, temporal exclusion, exclusion due to safety concerns, space exclusion (Church et al., 2001, 2003; Graffon et al., 2001; Hine and Mitchell, 2001). Kenyon, Rafferty and Lyons (2003) augmented the work executed by Graffon et al., (2001), Hine, and Mitchell (2001) by defining a new set of dimensions, which included both disadvantages because of transport itself and those in which transport acts as an essential sub-component but has no direct impacts. These included economic, living space, mobility, organized, personal, social networks, and loneliness, societal and temporal. The cumulative effects of these dimensions determine the level of transport disadvantage and exclusion experienced by people and communities (Litman, 2003).

Changes in the public transport network occur due to planning process i.e. transformation (network upgrade), land use, public transport operations, transport infrastructure, key event, critical incident and socio economic variables. Key events are major event in the personal life of an individual such as change in job or location. Key events can be an outcome of a change in transport network. Critical incident are immediate events that occur in daily life such as an accident or temporary closure of a service (Waerden et al., 2003). Critical incident refer to temporal exclusion.

Specific aims and objectives guide the design of a public transport network for optimal performance. Therefore, characteristics of the network are determined by a set of variables that include stop spacing, line spacing, information etc (Tahmassey et al., 2009). Changes in these variables also affect the performance of the transport network, which eventually affects the aims and objectives of the transport network resulting in transport disadvantage.

Three different types of process influence the connections between transport network and level of participation offered by it. These processes include nature of time-space organisation in households, nature of transport system and nature of time-space organisation of the facilities / opportunities individuals are seeking to access. Nature of these processes differs with respect to gender, age, cultural background, level of accessibility and economic circumstances (Hine et al., 2003; Church et al., 2001, 2003). The nature and quality of a public transport system therefore, mainly depends on the configuration of its network (Witter, 2007; Akosy and Gultekin, 2006).

3 THE CASE OF BELFAST CITY
Belfast, the capital of Northern Ireland and fifteenth largest city in United Kingdom has an extensive road network and is highly car dependent as a mode of transport for journey completion. 77% of all journeys in the city were made by car whereas only 11% were made by public transport according to 2001 census (NISRA, 2001). Pedestrians account for 6% in total journeys made by different mode. In 2001, 393 cars per thousand of population were available whereas in 2008 these figures rose to 627 cars per thousand of population, which is high in comparison to other cities in UK (NISRA, 2001, DRD, 2009). Census surveys are conducted after every ten years in Belfast city. The last census took place in 2001. Therefore, 2001 census data was used for research purpose. Although there are some midyear estimates but these estimates are made on,
higher spatial level i.e. wards. Wards consist of smaller spatial units. In order to cater the problem of zoning in GIS smaller spatial units were considered.

Belfast has a non de-regulated public transport system, which makes it unique from rest of UK areas where de-regulation took place under the 1985 Transport Act. The Northern Ireland Transport Holding Company (NITHC) solely operates bus and rail public transport services in Belfast under the group name Translink through three subsidiaries Metro Service (formal City Bus), Northern Ireland Railways and Ulster Bus. City Bus started in 1973 operated 60 different routes in Belfast city. The City Bus transformed in to Metro Service in 2005 when 12 quality bus corridors (QBCs) replaced its routes. The 12 QBC are along the main arterial roads into Belfast city centre. The aim of the transformation was to provide better access and higher frequency to facilities so that mode change from private to public transport can be achieved. In addition, the new service was aimed to increase social cohesion in the neighbourhood areas (Translink, 2004, 2005).

Statistics from recent travel survey highlights that network transformation has not been able to deliver its objectives. Car is still the main mode of travelling in the city. Marginal increase of 3% in the number of people who are able to get a bus from their nearest bus stops every 15 minutes is observed (DRD, 2009). Metro system has been unable to attract a high volume of passengers although the ridership has marginally increased over the years, which could be due to integration of the intercity Ulster Bus service routes with the Metro Service within Belfast city area. Ulster Bus service connects Belfast with the surrounding town and cities. Contrary to increase in ridership, the average distance travelled by people through Metro Service has decreased. The number of miles travelled per person by Metro Service has decreased from 32 miles per person per year to 28 miles per person per year as shown in Table 1. This could be either due to straightening of routes along main corridors having higher frequency or due to elimination of routes. This paper focuses on the network transmission and examines whether it has benefited the city or vice versa?


<table>
<thead>
<tr>
<th>Travel Mode</th>
<th>Miles per person per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>139</td>
</tr>
<tr>
<td>Bicycle</td>
<td>20</td>
</tr>
<tr>
<td>Car driver</td>
<td>3,162</td>
</tr>
<tr>
<td>Car passenger</td>
<td>1,698</td>
</tr>
<tr>
<td>Car undefined</td>
<td>10</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>31</td>
</tr>
<tr>
<td>Other private</td>
<td>389</td>
</tr>
<tr>
<td>City Bus / Metro</td>
<td>32</td>
</tr>
<tr>
<td>Ulster bus</td>
<td>261</td>
</tr>
<tr>
<td>Other bus</td>
<td>76</td>
</tr>
<tr>
<td>NIR</td>
<td>56</td>
</tr>
<tr>
<td>Black taxi</td>
<td>6</td>
</tr>
<tr>
<td>Taxi</td>
<td>68</td>
</tr>
<tr>
<td>Other public</td>
<td>-</td>
</tr>
<tr>
<td>undefined mode</td>
<td>1</td>
</tr>
<tr>
<td>All modes</td>
<td>5,951</td>
</tr>
</tbody>
</table>

4 METHODOLOGY

Various approaches are identified in the literature which can be used to measure transport related disadvantage. These approaches include accessibility indicator studies, qualitative studies, studies based on exploring the potential of virtual mobility and the activity based modelling approach.
Methodologies have also been developed to assess the impact of transport on the quality of life in an objective fashion, thus providing a platform to examine why, with whom, where and when activities are engaged in, and how activity engagement is related to the spatial and institutional organisation of an area (Kitamura et al., 1997; Carrasco and Miller, 2006). Wu and Hine (2003) utilised GIS to study hypothetical network changes in City Bus network in Belfast city through public transport accessibility levels (PTAL) approach. Four different hypothetical networks were compared in terms of the impact on population structure, car ownership and religious groupings. Analysis indicated that all four hypothetical networks have a disproportionate impact. Social groups experienced varying levels of accessibility during different hours of a day.

Geographical Information System (GIS) has emerged as a key tool for measuring accessibility. GIS has played an important role in two parallel development paths; the spatial perspective and that of transport planning and modelling (Berglund, 2001, Lyborg 2000). Two interdependent spatial categories are applicable to accessibility problems in GIS. These measurable categories are topological accessibility and contiguous accessibility. Topological accessibility refers to measuring accessibility in a system of nodes and paths i.e. a transport network. Contiguous accessibility measures accessibility over a space. It is a measurable attribute of location, while considering space in a proximate manner (Rodrigue et al., 2006). Network analysis serves as an excellent tool to measure topological accessibility whereas spatial analysis can be used to measure contiguous accessibility. These functionalities of GIS make it one of the most preferable tools for accessibility analysis. For an efficient transport system, it is important that it fulfil the requirements of individuals and communities on both levels (topological and contiguous accessibility).

Using GIS, the paper assesses the impact of network transformation on accessibility levels in Belfast city. It integrates the statistical data for different social groups. Areas, which have improved accessibility, and those, which experienced transport disadvantages within the city, are identified. Figure 1 outlines the methodology adopted.
Selection of the spatial unit of analysis is important for describing space and testing of spatial function. Northern Ireland Statistics and Research Agency (NISRA) have defined different spatial units for census data collection and presentation. These are Output Areas or Enumeration Districts, Super Output Areas, Wards, Local Government Districts and Boards. Output Areas (OA’s) are the lowest geographical unit considered in 2001 Census by NISRA. The second lowest geographical unit defined by NISRA are Super Output Areas (SOA’s). Output Areas were selected as spatial unit of analysis for the older people, men, women, and young adults’ social groups whereas SOA’s were used for low-income household as shown in Figure 2 and Figure 3. SOAs were selected for low-income households due to two reasons. Firstly, the poverty data referring economic activity for the household is only available on SOAs geographical level. Secondly, SOAs provided better sample size and transport deprivation depiction for the low-income households. 

Socio-economic data were selected to generate the appropriate indicators from secondary data sources. Table 2 presents the selected indicators for the analysis.

Table 2 - Indicators used for analysis

<table>
<thead>
<tr>
<th>Social Group</th>
<th>Domain</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young Adults</td>
<td>Car Availability</td>
<td>Car Density in Output Area</td>
</tr>
<tr>
<td>Old People</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>Car Availability</td>
<td>Car Density in Super Output Area</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Income Household</td>
<td>Population Density</td>
<td>Car Density in Super Output Area</td>
</tr>
<tr>
<td>Young Adults</td>
<td>Economic Density</td>
<td>Population Density age 16 – 25 years</td>
</tr>
<tr>
<td>Women</td>
<td>Economic Density</td>
<td>Population Density age 25 - 60 years</td>
</tr>
<tr>
<td>Men</td>
<td>Economic Density</td>
<td>Population Density age 25 - 64 years</td>
</tr>
<tr>
<td>Older people</td>
<td>Demography</td>
<td>Population Density age 60 – 74 years</td>
</tr>
<tr>
<td>Low Income Household</td>
<td>Population Density</td>
<td>Population Density of Households</td>
</tr>
<tr>
<td>Young Adults</td>
<td>Economic Activity</td>
<td>Economic Density age 16 - 25 years</td>
</tr>
<tr>
<td>Women</td>
<td>Economic Activity</td>
<td>Economic Density age 25 - 59 years</td>
</tr>
<tr>
<td>Men</td>
<td>Economic Activity</td>
<td>Economic Density age 25 - 64 years</td>
</tr>
<tr>
<td>Older people</td>
<td>Pension Claimaint</td>
<td>Pension Claimaint Density age 60 - 74 years</td>
</tr>
<tr>
<td>Low Income Household</td>
<td>%age of household</td>
<td>%age of household in Relative Poverty</td>
</tr>
</tbody>
</table>

1 Car density refers to total number of cars available per unit area
2 Population Density refers to number of people in a spatial unit of analysis
Car density was selected as an indicator because there is a clear difference in license holding between sexes at all age groups although the overall percentage of people holding driving licence in Belfast has remain constant around 70%. In 2002 – 2004, 59% of young males and 54% of young females aging 17 to 29 years held full driving licences whereas in 2005 – 2007 there number fell down as 34% of young males and 29% of young females held a full driving licence. Although high numbers of individuals hold, a driving licence but they may not have access to car. 52% of the households in Belfast have access to one or more cars (DRD, 2004; DRD, 2007). In addition, Belfast has an aging population. Over the years, the number of pensioners has increased (NISRA, 2009). Translink provides free travel pass to elderly people of age 60 years or above. Elderly people prefer public transport than private means because of free travel pass, health issues etc. Thus, elderly people use public transport but they may hold a driving licence.

Combined data sets, which include statistical data of all social groups, are used in previous studies (Hurni, 2005; NIMDM, 2001, 2005). These combined data sets can influence the results of a particular social group. Therefore, spatial units were attributed with statistical data relevant to each social group, which also aided in measuring relative deprivation among the groups in the city. Densities were calculated through raster calculator. Subsequently, public transport network of City Bus and Metro Service were drawn to develop the public transport system of Belfast city as shown in Figure 4 and Figure 5.

![Figure 4 - City Bus Service Network](image1.png)

![Figure 5 - Metro Service Network](image2.png)

Access zones were defined around the bus stops for both City Bus service and Metro Service using buffer analysis according to the bus stop access distance defined by Department for Transport (DfT) shown in Table 3. Distance of 400 meter was used as bus stop access distance for low-income households, women, men and young adults whereas for older people distance of 150 meter was used as access distance around the bus stop for both the networks. This is because older people cannot walk long distance.

<table>
<thead>
<tr>
<th>Table 3 - Recommended Distance Limit without a Rest – DfT, (2000a)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low-income households, women, men and young adults</strong></td>
</tr>
<tr>
<td><strong>Distance Limit</strong></td>
</tr>
<tr>
<td><strong>City Bus Service</strong></td>
</tr>
<tr>
<td>400 meter</td>
</tr>
<tr>
<td><strong>Metro Service</strong></td>
</tr>
<tr>
<td>150 meter</td>
</tr>
</tbody>
</table>

Economic density refers number of economically active people per unit area
Pension claimant density refers to number of per people claiming pension per unit area
<table>
<thead>
<tr>
<th>Social group</th>
<th>Recommended distance limit without a rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Individuals</td>
<td>400 m</td>
</tr>
<tr>
<td>Wheelchair users</td>
<td>150 m</td>
</tr>
<tr>
<td>Visually impaired</td>
<td>150 m</td>
</tr>
<tr>
<td>Mobility impaired using stick</td>
<td>50 m</td>
</tr>
<tr>
<td>Mobility impaired without walking aid</td>
<td>100 m</td>
</tr>
</tbody>
</table>

In the case of Belfast, access zones are important as changes in public transport network affected the provision of bus stop in the city. During transformation of the network, new routes were allocated and old routes were either altered or eliminated. New stops were defined for QBC’s and stops on the altered routes were either eliminated or relocated with result of affecting the accessibility of user groups. Therefore, respective stops for both networks were drawn to define access zones. These access zones helped in defining exclusion and inclusion zones. Areas surrounding the public transport network can be sub divided into inclusion zones and exclusion zones considering the access distance to the stop. The inclusion zone is the area around a stop that is reachable and the exclusion zone is the inaccessible area as shown in the Figure 6.

In the table above, different social groups are categorized by their mobility status and the recommended distance limit that they can travel without a rest. Normal individuals have the highest recommended distance limit of 400 m, followed by wheelchair users at 150 m, visually impaired individuals at 150 m, those using a stick at 50 m, and those without a walking aid at 100 m.

![Figure 6 - Inclusion and Exclusion Zone around a Bus Stop – Accessibility and the Bus System (Tyler, 2002)](image)

Service area of public transport system is defined by its frequency, speed and length of road network on which it operates. A public transport system can serve large area but social groups approach the system only through bus stop around their desired activity location. These bus stops serve as exit and entry point. Accessibility offered by a public transport system not only depends on its service area but also on user’s ability to reach network through access zones. Buffer analysis usually used to generate buffers around bus stops is not appropriate because it does not consider Euclidian distance. Distance is covered on roads rather in space. In addition, service area refers to composite accessibility (accessibility on a broader scale such as regional level). For individual accessibility (on local neighbourhood level), it is important to examine accessibility offered by the transport system at its entry and exit point. Therefore, this study integrates service area with the bus stop access zone to define actual accessible area of a transport network.

Service areas were generated for each network. Service area polygons were then geo-processed with access zones around bus stops to define actual accessible area for each network. These accessible service areas of both networks were again geo-processed with each other to drive improved and deprived areas due to network change. Accessible service areas for both the networks are shown in Figure 8 and 9.
Socio-economic indicators relating to demography, car availability and economic activity for social groups were spatially analysed by assigning weights to the indicators through a common scale of values. Indicator values were classified into five classes having numeric evaluation score from 1 to 5. 1 represented the least value whereas 5 represented the highest value. The class scale values for all the indicators are shown in the Table 4.

Table 4 - Enumeration Scale Values

<table>
<thead>
<tr>
<th>Social Group</th>
<th>Data Set</th>
<th>Cell Value Range</th>
<th>Class Scale Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demography</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>Population Density</td>
<td>0- 699</td>
<td>1</td>
</tr>
<tr>
<td>Low Incomehouse Hold</td>
<td></td>
<td>700 - 1499</td>
<td>2</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td>1500- 2099</td>
<td>3</td>
</tr>
<tr>
<td>Young Adults</td>
<td></td>
<td>2100 - 2700</td>
<td>4</td>
</tr>
<tr>
<td>Older People</td>
<td></td>
<td>2800 and above</td>
<td>5</td>
</tr>
<tr>
<td><strong>Car Availability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>Car Density</td>
<td>0- 699</td>
<td>5</td>
</tr>
<tr>
<td>Low Incomehouse Hold</td>
<td></td>
<td>700 - 1499</td>
<td>4</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td>1500- 2099</td>
<td>3</td>
</tr>
<tr>
<td>Young Adults</td>
<td></td>
<td>2100 - 2700</td>
<td>2</td>
</tr>
<tr>
<td>Older People</td>
<td></td>
<td>2800 and above</td>
<td>1</td>
</tr>
<tr>
<td><strong>Economic Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women, Men,Young Adults</td>
<td>Economic Density</td>
<td>0- 699</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>700 - 1499</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1500- 2099</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2100 - 2700</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2800 and above</td>
<td>5</td>
</tr>
<tr>
<td>Older People</td>
<td>Pension Claimaint Density</td>
<td>0- 699</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>700 - 1499</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1500- 2099</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2100 - 2700</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2800 and above</td>
<td>5</td>
</tr>
<tr>
<td>Low Incomehouse Hold</td>
<td>Percentage in Poverty</td>
<td>0- 19</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 - 39</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 - 59</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60 - 89</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>90 - 100</td>
<td>5</td>
</tr>
</tbody>
</table>
Employment and access to facilities are equally important to overcome exclusion phenomena. It is also not the areas, which experience deprivation within city. It is the individuals, which experience deprivation as they reside in those areas. Thus, individuals form communities, which experience deprivation so population is as important as employment density and car density. In addition, the underlying research focuses on transport variations in Belfast city not on the socio economic variations of the social group. For socio economic variations of the social groups, weights are important as they become more sensitive. Therefore, equal weights were considered for all data sets. The weighted overlay tool was used to assign weights to each indicator, which resulted in socio economic value for each spatial unit as shown in Figure 7. The impact of weights on the results was tested using sensitivity analysis. All the data sets economic density, population density and car density had same influence as per their assigned weights. This was because the spatial units, which had high population density, also had high car density and economic density.

![Figure 7 - Socio Economic Value for Social Groups](image)

OA’s attributed with socio economic values were then geo-processed with transport improved and deprived areas. Low, medium and high areas on basis of socio-economic values were defined to highlight social group’s spatial distribution within the newly emerging patterns of accessibility. Percentage of population experiencing affects of network change was calculated.

5 RESULTS

Metro Service follows the old City Bus network on major roads in the city but within the residential estates, some of the routes are altered and some are eliminated. Old City Bus routes have been eliminated along the Newtownards Road in Knock ward, White Rock Road, Duncrue Street. Under new Metro Service Springfield Road route is also realigned which has reduced accessibility of areas between White Rock Road and Springfield Road. OA’s along these roads are shown in Figure 10. Table 5 highlight the different areas which have been excluded from Metro Service but were served by the old City Bus with respect to each social group.

The network transformation has improved accessibility of social groups too. Two new routes are defined in Island Ward and Sydenham Ward. This has improved accessibility in output areas along Sydenham By pass, Annadale Avenue in Rosetta Ward and Upper Springfield Road in Falls Ward shown in Figure 10. Previously these areas were not served by old City Bus service. Table 6 highlights different areas with respect to each social group that have improved accessibility under transformation.
Figure 10 - Transport Deprived Areas due to Network Change
### Table 5 – Disadvantage Areas with respect to Social Groups

<table>
<thead>
<tr>
<th>Social Group</th>
<th>Deprivation Level</th>
<th>OAs / SOAs</th>
<th>Status in Transport Network</th>
<th>Affect on Accessibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>City Bus</td>
<td>Metro Service</td>
</tr>
<tr>
<td>Women</td>
<td>Low</td>
<td>Glencarn, Whiterock, Duncrue</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Falls</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Knock</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td>Men</td>
<td>Low</td>
<td>Glencarn, Falls, Duncrue</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Whiterock</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Knock</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td>Young Adults</td>
<td>Low</td>
<td>Glencarn, Falls, Duncrue</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Whiterock, Knock</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td>Low Income Household</td>
<td>Low</td>
<td>Glencarn, Duncrue</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Falls, Whiterock</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Knock</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td>Elderly People</td>
<td>Low</td>
<td>Glencarn, Falls, Duncrue, Knock</td>
<td>Included</td>
<td>Excluded</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Whiterock, Knock</td>
<td>Included</td>
<td>Excluded</td>
</tr>
</tbody>
</table>

### Table 6 – Improved Accessibility Areas with respect to Social Groups

<table>
<thead>
<tr>
<th>Social Group</th>
<th>Inclusion Level</th>
<th>OAs / SOAs</th>
<th>Status in Transport Network</th>
<th>Affect on Accessibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>City Bus</td>
<td>Metro Service</td>
</tr>
<tr>
<td>Women</td>
<td>Low</td>
<td>Sydenham, Island</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Rosetta</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td>Men</td>
<td>Low</td>
<td>Sydenham, Island</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Rosetta</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Rosetta</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td>Young Adults</td>
<td>Low</td>
<td>Sydenham, Island</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Rosetta</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Rosetta</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td>Elderly People</td>
<td>Low</td>
<td>Sydenham, Island, Rosetta</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td>Low Income Household</td>
<td>Low</td>
<td>Sydenham, Island</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Rosetta</td>
<td>Excluded</td>
<td>Included</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Rosetta</td>
<td>Excluded</td>
<td>Included</td>
</tr>
</tbody>
</table>

### Table 7 – Rank of Output Areas as per NIMDM, 2005 – NISRA, 2009

<table>
<thead>
<tr>
<th>OA / SOA Name</th>
<th>Rank of OA according to NIMDM 2005*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duncairn</td>
<td>9</td>
</tr>
<tr>
<td>Falls Road</td>
<td>24</td>
</tr>
<tr>
<td>Falls Park</td>
<td>52</td>
</tr>
<tr>
<td>Glen Road</td>
<td>4</td>
</tr>
<tr>
<td>Whiterock_2</td>
<td>18</td>
</tr>
<tr>
<td>Whiterock_2</td>
<td>40</td>
</tr>
<tr>
<td>Whiterock_3</td>
<td>53</td>
</tr>
<tr>
<td>Whiterock_3</td>
<td>38</td>
</tr>
</tbody>
</table>

*1 represents the lowest value and most deprived area

Identified transport deprived output areas along Whiterock Road, Falls Road, and Duncrue Street are also among underprivileged areas. Northern Ireland Multiple Index of Deprivation (NISRA,
2008) classified output areas in Belfast as underprivileged areas to measure social exclusion levels in the city. The study used a number of domain measures like income, employment, health facilities, education opportunities, skills and training, proximity to services, the living environment, and crime and disorder. This aggregates the isolation of the social groups in these neighbourhoods. Table 7 highlights the rank of deprived areas as per Northern Ireland Multiple Deprivation (NIMDM) study. Transport disadvantaged output areas along Knock Road have high ranks. These areas are classified as well-off areas according to NIMDM (2005). Social groups in these areas use either Metro Service or private means of transport. Contrary to option of public hired taxis on Falls Ward, social groups in Knock Ward depend on private means of transport (car or private hired taxi) if Metro Service is not available to them. Women, men, elderly people, young adults and low income households’ social groups spatial distribution in transport deprived areas is highlighted in Figure 11, 12, 13, 14, and Figure 15 respectively.

Figure 11 - Spatial distribution of Women in Transport Deprived Areas
Figure 12 - Spatial distribution of Men in Transport Deprived Areas

Figure 13 - Spatial distribution of Elderly People in Transport Deprived Areas

Figure 14 - Spatial distribution of Young adults in Transport Deprived Areas
Figures 11 - 15 reveal that social groups are spatially scattered in the transport-deprived areas. In the Knock Ward along the Newtownards Road, all social groups except older people have experienced exclusion due to network transformation. Women and low-income households on the Whiterock Field Road in the Whiterock Ward have also experienced disadvantages compared to other groups in the area due to network change. Network transformation has also reduced accessibility to Duncrue street industrial area in the north of city. Being an employment hub, the area provides jobs and serves as a transit junction for freight delivery in the whole region. Table 8 highlights the percentage of population experiencing transport disadvantages according to each social group in OAs and SOAs. Low medium and high-deprived areas were classified based on socioeconomic values within GIS. Low deprived areas refers to those areas where accessibility levels are least affected by transport network transformation. The Most deprived areas include total population of social groups in the neighbourhood areas that indicates that certain social groups have experience deprivation more as compared to other groups in the OA neighbourhoods.

Elderly people, women, young adults, men, and low income households’ social groups spatial distribution in improved accessibility areas is highlighted in Figure 16, 17, 18, 19, and Figure 20 respectively.
Figure 16 - Spatial distribution of Elderly People in Improved Accessibility Areas

Figure 17 - Spatial distribution of Women in Improved Accessibility Areas

Figure 18 - Spatial distribution of Young Adults in Improved Accessibility Areas
Figures 16 - 20 reveal that improved areas were not served previously by City Bus service. Their inclusion within new Metro Service system has improved accessibility of various social groups in these areas. Table 9 highlights the percentage of population experiencing improved accessibility according to each social group in spatial units of analysis. High-improved areas are those areas where new routes or realignment of old City Bus routes has improved accessibility of social groups. Some social groups are more advantageous comparatively to others groups in these output areas, which refers to the fact that advantages due to network change are relative among social group. This raises the need of further qualitative study that should examine the transport needs of different social groups. Social groups except older people in Ballynafeigh Ward along Annadale Avenue are benefited by network change as they experience improved accessibility. The network transformation has not affected older people’s social group much as they are spatially distributed around city centre area. City centre area being the origin and destination of all trips is least affected from network change. Old people prefer walking and easy access to their local activity spaces therefore they prefer to live near or in city centre areas.
In some areas of Belfast city, stage carriage known as public hired taxis or Black Taxis also exists. Political and sectarian conditions, which prevailed in the city, had led to its development (O’Hearn and Tomlinson, 2001). Transport disadvantages due to network change have further promoted social groups in the Falls Ward, Springfield Ward and Whiterock Ward to rely on this alternative means of transport. Currently Belfast city has more than 300 private taxi companies in the city along with a well-established network of public taxis on the Falls Road, Springfield Road and Whiterock Road. These public taxis operate along the Metro service on corridors and links the neighbourhoods. The research study by Time Associates on behalf of West Belfast Taxi Association (WBTA) has revealed that people make more journeys through shared taxis than bus in the west of city where a strong network of shared taxis is present. Out of 3,508 journeys recorded during the survey in west of Belfast more than 3,231 journeys were made by Black Taxis. Average number of journeys per week per person by Black Taxis approximates to 7.7 and for bus the same was equal to 0.5 (WBTA, 2009). Their frequency is also higher than bus service in peak hours and passengers ride from their neighbourhoods. Around 50% of people who use Black Taxis prefer them because they are next available mode of transport. Black Taxis also serve area along Upper Springfield Road, which was not served by old City Bus. This indicates that during times of trouble when bus service was often removed, taxis serve as lifeline for groups in these areas.

After the transformation, walking has also emerged as an important alternate mode of transport other then private cars and public taxis. The number of people who prefer to walk has risen from 16 % to 25 % (DRD, 2009). Deprivation of areas due to transport network change can be one of the reasons for this change. This should be examined through future assessments so that reasons for the change can be established and those areas where walking has emerged as alternate mode of transport, should be provided with adequate infrastructure.

So far, the aims of the transformation have not been achieved in real spirit. Network change and new QBCs has further augmented the prevailing exclusion patterns in the city. Network transformation has resulted in further deprivation of those areas, which are also classified as underprivileged areas by NIMDM 2005 (NISRA, 2009). Transport can serve as an important tool for redevelopment of these deprived areas. To achieve the planned aims of transformation and to enhance the efficiency of the Metro service, it is important to carry out a composite accessibility assessment. The assessment should investigate both objective

Table 9 - Percentage of Population Experiencing Improved Accessibility as per Social Group
and subjective nature of transport disadvantages due to network change. Objective nature of the assessment will help in establishing the number of people that have experienced disadvantages whereas subjective nature will help in addressing the transport needs of social groups. The methodology adopted in the paper to identify areas can be considered to address the objective nature of transport disadvantages whereas qualitative assessment in the deprived areas can help in studying the impacts of transport deprivation in social group’s life. Policy makers can follow the methodology to examine the impacts of network change but due considerations should be made to socio-economic variables as different regions have different socio-economic variables.

6 CONCLUSION

Societies are characterised by interactions among different social groups through a layers of spatially dispersed networks. Transport is one of these prevailing networks in the society connecting people with the locations. The configuration of the transport network within society affects the levels of accessibility offered by the system itself. This is due to the reason that transport manipulates pattern of exclusion experienced by social groups. The spatial impact of the network changes is clearly shown by mapping the City Bus network and Metro Service network in Belfast. The network change and creation of high frequency corridors in Belfast city has dual affect on social groups. In some areas of city, it benefited social groups whereas in other parts it reduced their accessibility. The network transformation has also promoted the prevailing exclusion patterns in the city. This is because the areas on west side of the city, which have experienced disadvantages, are also among the most underprivileged areas as measured by NIMDM – 2005 (NISRA, 2005). The deprived areas on the east side although are not among underprivileged areas but have no other means of public transport to rely on. Social groups either depend on private cars or hire taxis in these areas. This may enforce them to make tradeoffs among their amenities of life thus leading them to social exclusion from their desired activities.

Although there has been a marginal increase in the number of people, who are able to get a bus from their nearest bus stops but so far, better access to facilities is not fully achieved. The affects of network change is relative among social groups. Social groups other than older people in OAs of Knock Ward along Newtownards Road are among the high-deprived areas due to elimination of the routes in their neighbourhoods. Women’s social group living along the Whiterock Road in Whiterock Ward and Falls Ward are the most disadvantaged group. Men, women and young adults are benefited due to network change in Ballynafeigh area as they have better access to transport.

Social groups within deprived areas also rely on other modes of transport to access their activity spaces. To enhance the ridership of public transport network and to shift the trend from private transport to public transport in the Belfast city, it is important to define a robust policy framework focused towards accessible public transport delivery. A comprehensive qualitative accessibility assessment is required, which should address transport needs of social group by examining the transport disadvantage inflicted by the network change. Based on the results of this paper, qualitative research in progress will help in addressing the research issue of public transport network change and social exclusion in Belfast City.

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TEACHING OF TRANSPORT PLANNING AT THIRD LEVEL FROM AN ENVIRONMENTAL PERSPECTIVE

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ABSTRACT

This paper is based on a research project funded by the Irish Environmental Network in 2009-2010 on the Teaching of Transport Planning at Third Level in Ireland. The content of courses was reviewed. In particular the following questions were asked: Is the issue of whether growth in GDP, mobility and transport emissions can or cannot be decoupled addressed? Are the wider social and urban design functions of streets addressed? How is the management of risk on roads addressed? How is design for walking and cycling addressed? How are the links between transport and land-use planning and induced demand by interventions addressed? The paper will review the results of the review and follow-up interviews and make proposals to build links between transport researchers at university, professional institutions and the environmental sector.

Keywords: Environmental education, Sustainable transport, Transport research.

1 INTRODUCTION

This report tabulates what third level courses teach transport planning in the Republic of Ireland. The programme manual and course notes for selected courses have been reviewed in detail, and relevant academics have been interviewed.

Transport is not taught as a standalone subject, but as part of architecture, planning or engineering degrees. These are broad fields, as is transport itself. It is not surprising that all transport modules do not cover all the points which have been identified in the literature review as being of interest to ENVIRONMENTAL NGO’S. Nevertheless, the diversity of courses on offer means that different courses are strong in different areas, with all points of interested covered somewhere.

Due to the specialised nature of transport and the professional formation of architects, engineers and planners, much of the learning occurs on-the-job after graduation. This research could be broadened out to include networking with professional institutions. Academics are interested in circulating an Environmental Research Ideas Website where environmental NGO members could post ideas for student theses. Recommendations have been included.

It is intended to extend this research by reviewing a wider range of courses and interviewing more academics. Comments and suggestions from academics are welcome.

2 LITERATURE REVIEW

2.1 Introduction

Transport planning is both a broad subject area, and one that falls between different disciplines such as: engineering, architecture, urban design, geography and economics. It is not the intention of this section to review the sustainability of transport in general, or relevant theories; but rather to introduce some of the issues, which will then be referred to in the remainder of this project.

Transport can be divided up into the transport of people and freight. A further division is whether the context is local, national or international. The island nature of Ireland is obviously crucial for international transport.

2.2 Sustainable Transport

Transport and the environment

Environmentalists are increasingly split between those who favour strong sustainability, where there are real reductions in environmental impacts (Jackson 2009, Douthwaite et al. 2006); and those who favour weak sustainability where impacts per unit of output are reduced (Lomborg 2001, Department of the Taoiseach 2008). These issues are particularly to the fore in transport. Banister (2005), in a standard text on the sustainability of transport, comprehensively shows that shows that current transport policy and indicators are inherently unsustainable. Although, in some cases, the transport intensity (transport use per unit of GDP) is falling, the general trend is that transport use and transport carbon emissions are coupled to GDP (Gross Domestic Product) growth. He concludes with a vision for the future, but
concedes that it will only achieve ‘weak sustainability’, i.e. it is a package of measures that achieves improvements in sustainability without compromising economic objectives. The hope is that success with the weak sustainability vision may facilitate a future debate on strong sustainability. Others go further and outline a vision for strong sustainability (Whitelegg 1993). Also, many projects at a micro level are delivering significant improvements (European Local Transport Information Service 2008). The contradictions above are reflected in official policy. The EU White Paper on Transport (European Commission 2001) irrationally hopes, against the past evidence that it reviews, that sustainable transport and GDP growth can be reconciled by technological innovation. This technological optimism is reflected in the weak sustainability vision for Ireland’s Smart Economy (Department of the Taoiseach 2008). Nevertheless statistics show that the transport sector has performed worse than any other with continuous growth in emissions (SEIA 2009 Section 4.2).

Smarter Travel (Department of Transport 2008) promises a more pragmatic approach. It recognises the ‘apparently conflicting goals’ of economic growth and sustainable transport and sets out a range of actions. Nevertheless the policy assumes average growth rates of 3%. The ambitious but achievable actions, if achieved up to 2020, might lead to the debate on the long-term model hoped for by Banister (2005).

- Does the course cover transport indicators at a macro level?
- Does the course recognise the lack of concrete evidence for absolute decoupling of growth and transport emissions?
- Are alternative socio-economic models considered?

**Transport and Society**

In many parts of Ireland the poor are stuck in a trap where they are dependent on cars to work, access services and socialise; but do not have access to their own car. Others are spending a large percentage of their income on running a car (Wickham 2006). Public transport rather than private motoring should be considered the ‘default transport system’, and this system should be accessible to all (Tyler 2002). Accessibility must consider trips from door-to-door and include access information on the system. For example, public transport can be inaccessible to the elderly (Wasfi & Levinson 2007a), and people with developmental difficulties (Wasfi & Levinson 2007b). In the UK Sustrans have begun campaigning about ‘transport poverty’ (Taylor & Sloman). Wickham (2006) discusses how nature of the public transport system shapes society, and encourages or discourages the development of the public realm. Conversely, he highlights the difference between consumers and citizens, and how the needs of citizens can shape the public transport system. Adams (2001) shows that improvements in road safety have not been uniform. The relative safety of car occupants has increase compared to that of pedestrians and cyclists. The negative effects of car use are often concentrated in areas where local residents are poorer and less likely to use cars.

- Does the design of projects consider the wider social aspects or only economic and technical factors?
- Is accessibility and social justice considered in the appraisal of projects or just the financial or economic case for the project?

**Transport and the Economy**

The need to invest in transport for economic reasons is often stressed. However, the numerical nature of Cost Benefit Ratios often suggests that this is a more exact science that it is. Economic models have been discussed above and the goals at which investment is aimed at. Even the narrow goal of maximising GDP is complex due to the issue of competitiveness. What sort of transport network will make Ireland competitive? Are the links to specific development sites important? Or is it the wider quality of life for employees, which the transport network supports (Demongeot 2007)? These issues, and the related issues of prestige and image, are valid for consideration. However they must be rationally addressed and fit into a decision making process (Wickham 2005). For example, Myers (2006) highlights that the UK has an aging population many of whom increasingly will not want to drive. To remain economically competitive, shopping centres will need to provide high quality public transport access, to attract these ‘silver shoppers’.

Similarly, claims are often made for the job creation potential of particular investment options without any supporting analysis, or comparison with other investment options within and beyond the transport sector (Harley 2009). How does investment affect the balance of payments and energy security (DCENR 2007)?
Does the course consider the job-creation potential of different investment options compared or should it be considered at all?
Does the course consider the secondary economic effects of transport investment options, and the inherently political nature of decision making?

2.3 Various Issues

Peak Oil
That oil supplies will soon peak is now generally accepted (DCENR 2007). Strategies to address it range from resignation and adaptation (Lomborg 2001, Orlov 2008); to optimistic proposals to address it while renewing our society (Green New Deal Group 2008); to business as usual optimism about the potential of technology to address the issue (Department of the Taoiseach 2008).

- Does the course address peak oil?
- Is the wider sustainability of solutions such as biofuels and and electric vehicles considered?
- Or the ability to scale them up to fuel global transport demand?

Cost Benefit Analysis
The use and application of Cost Benefit Analysis is controversial. Firstly, the reduction of social, environmental and economic costs and benefits to monetary values assumes the inter-changeability of these different types of resource. Advocates of strong sustainability reject this. Secondly, there are difficulties with respect to social justice around the choice of ‘willingness to accept’ and ‘willingness to pay’ values, which are used to estimate social and environmental costs. If willingness-to-accept values are used then it is often difficult to create workable models. If willingness to pay values are used the models are often unjust (Adams 2001).

Guidelines on Cost Benefit Analysis often address these issues by stressing that the analysis is a tool in decision-making processes and not a substitute for qualitative judgement (Department of Transport 2007, Goodbody Economic Consultants 2004). However, in practice Cost Benefit Analysis is often used to justify projects after the decisions have been made (Harley 2009).

- Does the course address the assumptions which underly Cost Benefit Analysis?
- Does the course cover the need to consider fair alternatives as set out in the Department of Transport Guidelines? (Department of Transport 2007, Goodbody Economic Consultants 2004)
- Is there any comparison of energy per passenger km or per euro invested between different transport investment options?

Smarter Travel
Is the Smarter Travel Policy covered and how are any of the actions specifically addressed? (Department of Transport 2008)

National Travel
Is the induced demand for extra trips and car based sprawl caused by motorway construction addressed?
Are demand reduction measures covered or are the measures based on the traditional predict-and-provide approach?

Local Travel
Does the course address the trade off between competition and integration in urban transport? (White 2003)
Are the benefits of the ‘network effect’ of investing in integration rather than stand-alone projects considered?
Is the National Cycle Policy Framework covered and how are any of the actions addressed? (Department of Transport 2009)
Is the urban design of streets and designing for walking covered?

International Travel
Is the lack of any alternative to kerosene as a large-scale aviation fuel addressed?
Are overland or sea alternatives for freight and passenger transport addressed?

Links between Land-Use and Transport
Are the interactions between transport and land-use policy addressed?
Is the current system for collecting contributions for rail projects from developers considered? Is there a consideration of how this might cause transport projects to follow the contributions rather than the needs for the wider transport network?
Is Land Value Taxation addressed?

Freight
Is the key role that modern distribution systems play in the design of transport networks and urban design in general discussed?
Is rail freight covered?
Is the planning of ports and their integration with transport networks covered?
3 METHODOLOGY

The research was carried out by a combination of literature review and unstructured interviews.

3.1 Internet Research to Identify Courses

The websites of the third level institutions were reviewed to create a table of courses which address transport planning, with relevant details.

3.2 Review of Course Material

The prospectuses, course manuals and module notes for various courses and modules were reviewed in detail.

The documents were obtained online, from the institutions or through the interviews.

The documents were reviewed against the questions posed in the literature review above, as well as specific issues highlighted by the interviews.

In some cases, the outcome of the reviews was used to inform the interviews cases. In other cases, the material was received following the interviews.

3.3 Unstructured Interviews

Due to the relatively small number of courses on offer, and the variety and complexity of the questions; it was decided to carry out interviews rather than surveys. These were carried out in person or by telephone.

As well as the general questions on transport planning, the following specific questions were relevant:

- In what departments or schools is transport addressed?
- What content do engineers or planners in general cover?
- What content do engineers or planners who specialise in transport cover?
- What opportunities are there to choose options to learn more about sustainable transport?
- Is there any way which Environmental NGO’s could support academic staff or students?

Structured interviews were rejected due to the different roles of the interviewees and the diversity in the types of courses offered. Instead, unstructured interviews were carried out. In some cases follow-up interviews were carried out following review of the initial material obtained.

Not all questions were asked of all interviewees. Some were not relevant to the particular interviewee; others had already been answered by the literature review.

4 REVIEW OF COURSES

4.1 UCD

UCD has introduced a system of modularisation where students have more flexibility to pick and choose modules within their own school and outside it. The key information to review is therefore what the content of the transport related modules is, and who must or can study them.

Civil Engineering: BE (Civil)

Civil Engineers study two transport modules by Dr. Aoife Ahern, one in third year and one in forth year. The degree is a general one in Civil Engineering, not Transport Engineering. The transport modules are elective.

The third year Transport Module is half on policy and half on design. The policy half covers:
- Mobility vs. Accessibility
- Car dependence and its causes
- Four stage modelling theory
- Predict-and-provide versus demand management
- Externalities
- Social exclusion (including a case study)

The design half of the module covers highway and junction design.

The fourth year Transport Module covers:
- Interactions and feedbacks between transport and land-use.
- The link between mobility and density, theory and outcomes
- Land-use modelling
- Traffic modelling
- Four-stage modelling including problems with the assumptions which underly the theory. i.e. they don’t address induced demand or links with land-use planning and are based on utility maximisation.

Both modules include three case studies that the students must research.

Masters in Regional and Urban Planning

The UCD School of Geography, Planning and Environmental Policy runs a two years Masters in Regional and Urban Planning.

In Year 1 there are two transport modules.

Dr. William Hynes and Dr. Enda Murphy deliver the Module PEP40210: Transport and the Environment. It covers:
• Integrated transport and land-use planning
• The effects of transport on the environment, including externalities
• The theory of four-stage modelling
• Demand management
• Integration and multi-modal transport
• Rural transport
• European and national policy.

Module PEP40240: Urban and Regional Economics by Dr. Brendan Williams and Dr. Aisling Reynolds Feighan also addresses the links between transport and urban form, in the context of economic theory. In Year 2 there is not a specific transport module. Transport is addressed in Module PEP40250: Urban and Regional Development by Dr. Brendan Williams as well as in course work, with the possibility of choosing relevant electives.

4.2 UCC
Dr. Jerry Murphy is responsible for the Transport elements of the degree in Civil Engineering in UCC. There are two modules CE4011 and CE4012.

CE4012 Traffic and Highways
This module is a relatively traditional module on Highway Design that covers:
• Traffic engineering.
• Traffic studies (land use, volume, speed, travel time, parking).
• Road safety engineering.
• Urban traffic management including traffic signal systems.
• Geometric design of roads and intersections.
• Road and traffic law.

CE4011 Energy in Transportation
This second module is a newer one with an objective to ‘To give a detailed understanding of sustainable transportation policies, including for energy minimization in transportation through the use of public transport (trains, metros, light rail and buses), biofuels and electric vehicles.’ As well as the above it considers:
• Energy use in transport in Joules per passenger km.
• Cycling
• Land use planning

4.3 TCD
Degree in Civil Engineering
Third year students study Module 3A7: Transportation and Highway Engineering. Part 1 by Prof. Margaret O’Mahony covers the physical design of pavements and the geometric design of highways and is not relevant to this report.

Part 2 by Dr. Brian Caulfield addresses the following:
• Traffic flow and modelling
• Road safety design and driver behaviour
• Traffic signal design
• Solutions for urban congestion.

The material on the final point stresses the need for debate on different solutions, and the interdisciplinary nature of the solutions.

Fourth year students can study the elective module 4A8 Transportation by Dr. Brian Caulfield. ‘The emphasis is on the societal, economic, environmental, political, ethical and business aspects of transport problems.’ It addresses the following:
• The economics of transport. What creates demand for mobility?
• Road pricing theory and practice
• Project appraisal including ethical, social and environmental considerations.
• Signal design
• The transportation planning process
• Transportation modelling
• Railway design

A large quantity of course notes have been downloaded from TCD’s website. A further review of the content of these would be of further use.

MSc in Civil Engineering
There are four elective modules relating to transport in the MSc in Civil Engineering course. Module B3: Introduction to Transportation Engineering is coordinated by Dr. Bidisha Ghosh.

Content includes:
• Develop an overview of transportation and traffic engineering
• Develop an understanding of queuing models and traffic paradoxes
• Discuss and design the layout of a traffic junction
• Design and evaluate the fixed-time traffic signal plan of a junction
• Implement land-use models to manage traffic demand
• Develop knowledge and understanding of urban transportation management policies
• Evaluate the impact of public transport policies

Module B7: Transport Modelling is coordinated by Dr. Brian Caulfield. Content includes:
• Evaluate transport networks using the four-stage model
• Discuss how transport networks are designed
• Apply discrete choice models to transportation problems
• Understand the theory of planned behaviour
• Apply VISSIM to simulate a real-life transport network

Module C1: Highway Engineering is coordinated by Dr. Margaret O’Mahony. The content covers technical aspects of highway design. Road safety and environmental impacts are addressed.

Module C2: Applied Transportation Analysis is coordinated by Dr. Bidisha Ghosh. Content includes:
• Travel behaviour prediction using activity based modelling
• Understand and design public transport management and scheduling studies
• Develop parking models
• Forecast traffic demand using statistical techniques
• Develop a basic understanding of Intelligent Transportation Systems
• Implementation and development of incident management schemes for urban and freeway environments

A large quantity of course notes have been downloaded from TCD’s website. A further review of the content of these would be of further use.

4.4 DIT

Module FFPL9014
The three master’s courses in Sustainable Development, Community and Local Development and Spatial Planning (DT118, DT121 and DT123 respectively) include a common module on Transport Planning (FFPL9014) by Dr. Henk van der Kamp. The author of this report has completed this module as part of a Masters in Sustainable Development (2009).

From an environmental perspective this is a very comprehensive module that covers:
• The un-sustainability of current transport policy.
• Links between transport and land-use policy, including density.
• Predict-and-provide versus demand management.
• Changing objectives from mobility to accessibility.
• Four-stage traffic modeling theory.
• Networks and interchange
• Environmental traffic planning

Course DT122
The Masters in Spatial Planning (DT122) does not include the same transport module as the other three masters. Instead transport is included within the three modules: SSPL9016, SSPL9018 and SSPL9022.

Module SSPL9016: Planning Practice 1 by Paul Lawlor covers the planning system in general including:
• The making of Development Plans, Local Area Plans and Regional Planning Guidelines.
• Planning applications and appeals.
• Developer contributions.

Module SSPL9022: Planning Practice 2 by Henk van der Kamp follows on from Planning Practice 1 looking at policy and procedures in further detail including:
• Protected structures and planning applications
• Oral hearings
• Strategic Development Zones
• Government Planning Guidelines and Directives
• Development Contribution Schemes

Module SSPL9018: Spatial Planning by Paraic Fallon is a broader module looking at general theory and practice of urban design including:
• Urbanisation, economic development and globalisation. Sustainability and the city.
• Metropolitan governance and spatial planning.
• Urban design theory – the urban landscape; spaces and culture, public uses and democracy, typologies, aesthetics.
• Irish and European urban design projects.

More detailed information such as course notes of follow up interviews with the lecturers would be useful to assess how these modules specifically address transport.

SSPL3019: Transport and Urban Design
The undergraduate planning courses complete the module SSPL3019: Transport and Urban Design by Dr. Henk van der Kamp and Dave O’Connor. This appears to be a simpler version of Module FFPL9014.

‘The module examines the potential contribution of integrated land use planning, urban design, infrastructure design and smarter travel initiatives towards achieving a reduction in travel demand, a change in modal split towards more sustainable modes of transport and healthier neighbourhoods.’
It covers the following areas, which appear to give a comprehensive introduction to the subject. It would be useful to obtain the course notes to review further.

- Sustainable Transport
- Integrated land-use and transport planning
- Infrastructure and policy
- Parking and telematics
- Transport assessment
- Mobility management planning
- Transport and urban design
- Non-motorised transport

5 INTERVIEWS

5.1 Introduction

Much of the content of the interviews has already been covered in the review of courses in the section above. Relevant comments will be summarised by theme below.

5.2 Scope of Study

A number of interviewees noted the importance of the training that architects and engineers receive on the job in the first few years following graduation. This is particularly so for those who undergo a scheme of formal training to become Chartered Engineers or Architects.

It was noted that many of the transport modules are elective and due to the breadth of engineering and planning courses, students will often only get an introduction to the concepts. Even the transport modules are broad themselves, and students within transport often specialise further. Therefore students’ deeper understanding and philosophy is often formed after graduation when they start to work in the transport sector.

There is scope for Environmental NGO’s to network with organisations such as Engineers Ireland, AAI, RIAI and the Irish Planning Institute to review post-graduate on the job training. This would be a useful follow-up study.

5.3 Idea for Environmental Research Ideas Website

There was general support for the idea of a website with ideas for research posted by Environmental NGO Members. Lecturers said that they would be happy to circulate the website to their students.

Dr. Brian Caulfield and Dr. Dave O’Connor noted that it took a lot of time develop thesis proposals with large numbers of students.

The Smarter Travel division in the Department is keen to form partnerships with other organisations to promote the Smarter Travel policy.

5.4 Guest Lectures from ENVIRONMENTAL NGO Members

There was interest in the idea of inviting guest lecturers in from Environmental NGO members. However, there was not support for introducing a formalised system for this. Due to the small numbers of academics involved it would be better to organise on an informal basis. The other proposals for networking in this report should build links and contacts that would facilitate guest lectures.

6 CONCLUSIONS

6.1 Courses

- Courses are diverse, although this is in many respects positive. There are opportunities to influence the content of some of the modules on a case-by-case basis through networking with the lecturers.
- The proportion of time devoted to transport planning is generally small due to the broad nature of engineering and planning. Within transport the area is broad; therefore students often specialise further so that students often only get an introduction to concepts which Environmental NGO members would wish to see covered.
- Due to specialism much of the work is done as theses and course work. There is considerable freedom here, depending on what the student and supervisor decides to study.
- Many students end up forming their opinions not during university, but in the first few years of their work. This is beyond the scope of this study but some suggestions for further networking will be made.

6.2 ITRN: Irish Transport Research Network

- Universities are generally interested in the work Environmental NGO’s are doing and in networking.
- The recent formation of the ITRN is a good opportunity for networking between Environmental NGO’s and the Institutions.

6.3 Research Ideas Website

- There was general interest in the idea of a Environmental NGO’s Transport Research Ideas Website.
7 RECOMMENDATIONS

Recommendations for Future Study
- Carry out a comparative study with foreign courses.
- Include a wider range of courses and institutions. E.g. geography, graphic design, economics.
- Network with professional institutions regarding professional development after graduating.

Recommendation for On-The-Job Training
- Review and influence core objectives in training programmes.
- Encourage volunteering.
- Review sustainability objectives in training programmes.
- Investigate if there are barriers to engineers and architects doing ‘pro bono’ work for NGO’s.

Influencing the Content of Courses
There is scope to improve and influence the content of courses. Due to the relatively small number of people involved this can best be achieved through informal contact. Specific recommendations are:
- Circulate this report to the relevant academics.
- Cross-circulate documents between the ITRN and Environmental NGO’s.
- Encourage the use of Environmental NGO contacts as guest lecturers.

Recommendations for networking:
- James Nix is represented on the new Department of Transport Freight Forum
- Seek Environmental representation on new ITRN
- James Leahy is a member of the Engineers Ireland Roads and Transportation Society.
- James Leahy is involved in the UCD School of Architecture Summer School.

Reaching Individual Students
Create a simple website where Environmental NGO members can post ideas for theses.
- This can be promoted on a yearly basis and will provide an impetus to maintain contacts between Environmental NGO’s and the ITRN.
- It will introduce students to Environmental NGO’s
- It will facilitate Environmental NGO’s to produce rigorous research.
- It will help students to pursue research which is relevant to the real world.
- Environmental NGO’s can help disseminate the results of the research.

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REFERENCES


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Notes
1. The table is not exhaustive. It is planned to expand it further to include more courses at certificate and diploma level, more courses in Institutes of Technology and more courses where transport is addressed but is not the dominant part of a course.
2. All information and contact details are published on the institution’s website or in their prospectus.

Figure 1: List of courses which address transport.
EXPLORING THE SOCIAL DIMENSIONS OF URBAN CYCLING CULTURE

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ABSTRACT

This paper outlines the initial stage of doctoral research on cycling culture. The policy context is the National Cycle Policy Framework. The literature on cycling in the social sciences has grown in recent years with new academic networks established. The research has thus far probed two related topics: one, a potential relationship between deepening a cycling culture and changing the social nature of streets; the other, exploring how systems change (towards more cycling friendly transport systems) can occur, drawing on the work of sociologists of technology. Work is now underway in defining the precise research topic to be pursued. This may straddle both of the above topics.

Keywords: bicycle, cycling, social, culture, community, citizenship, civilized, city, streets, research methods, transport, systems

1 INTRODUCTION

This paper outlines the initial stages of doctoral research examining some of the social dimensions of having and developing an urban cycling culture. The research is being conducted in the Sociology Department of Trinity College Dublin under the supervision of Prof. James Wickham. It is being undertaken by Damien Ó Tuama who spent the last 10 years in transport consultancy specialising in cycling policy. The policy context for the research is the National Cycle Policy Framework (Department of Transport, 2009).

The aim of the research is to contribute towards a richer appreciation of the potential social value of developing a cycling culture and, more broadly, towards a deeper understanding of how systems change occurs – in this case changing the currently unsustainable transport system towards a lower energy model, of which the bicycle plays an important role.

The aim of this paper, written at a very early stage of the research, is to describe the process undertaken thus far to define the core research questions in the context of existing academic research. The purpose of presenting so early in the research process – when the research design has not yet fully crystallised - is to invite critical feedback from a multi-disciplinary audience at the inaugural Irish Transport Research Network conference.

Section 2 of this paper provides the context to the research topic and Section 3 provides a brief summary of the academic literature on cycling within the social sciences field. Section 4 discusses the emerging central research questions that are proposed to be explored, while Section 5 describes the theoretical frameworks within which the ideas may be located. A short conclusion is provided in Section 6.

2 BACKGROUND

2.1 Policy and Targets

After decades of being overlooked in many European states, the bicycle is now re-emerging on the urban transport policy agenda (European Commission, 1999). In the Irish transport policy context, the principal target of the National Cycle Policy Framework is stated on page 11 as follows (Department of Transport, 2009):

A culture of cycling will have developed in Ireland to the extent that by 2020, 10% of all trips will be by bike.

To put this target in context, in the year of the most recent Census, 2006, the national modal share for...
cycling to work was 1.9%²; cycling to primary school, 0.9%³; cycling to secondary school, 2.4%⁴; and cycling to college, 4.2%⁵ (CSO Ireland, 2007).

For comparison, the national modal share for cycling for all trips in the Netherlands is 27% (Ministry of Transport, 2009). Therefore in order to meet a target of 10% of all trips by 2020 in Ireland, there needs to be quantum leap in the proportion of trips made by bicycle and, therefore, a transformation of transport policy to achieve this.

2.2 Benefits of Developing a Cycling Culture

The arguments underpinning the policies to increase cyclists’ share of trips are manifold but are usually captured under the broad headings of ‘Economy’ and ‘Environment’.

The economic benefits of increasing cycling numbers include: the efficiencies in the use of limited urban space and decongestion benefits

The environmental benefits include: reduced use of finite resources, especially fossil fuels; reduced (greenhouse gas and other) emissions; lower noise levels and lower casualties compared to the use of motorised transport – see, for example, Illich (1974) and Cox (2010).

The social benefits of developing a cycling culture have received less attention in academic and other literatures, the main exceptions being: the individual health benefits of cycling (see, for example, Cavill, 2007); the social inclusion benefits – i.e. improving access to jobs, education and other opportunities (Interface for Cycling Expertise, 2000); and the contribution it makes to increasing the liveability of cities (Gehl, 2006).

A core aim of the research being presented in this paper is to explore other potential social dimensions of developing an urban cycling culture – for example, investigating a potential relationship between cycling levels and the levels of sociability of streets, or between cycling levels and levels of social connectedness amongst citizens. The questions that are proposed to be explored are discussed in Section 4 below.

3 CYCLING IN ACADEMIC LITERATURE

The subject of cycling in academic literature can be divided into four main fields: (i) historical perspectives; (ii) the sociology of sport; (iii) engineering, design and planning (which includes cycling policy); and (iv) medical approaches to cycling. Besides these four main areas, according to Rosen et al (2007), “academic interest in cycling feels much more piecemeal and disjointed”.

A small number of papers – relative, for example, to the numbers of papers addressing the claims and counterclaims over the benefits of bicycle helmets – have been published in the area of social and

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² 36,306 of a total of 1,898,787 persons, males and females at work aged 15 years and over, usually resident in the State, classified by means of travel to work at Census 2006 (Table 1)
³ 4087 of a total of 448,367 children at school aged between 5 and 12 years, usually resident in the State, classified by sex and means of travel to school at Census 2006 (Table 2)
⁴ 7377 of a total of 304,563 students aged between 13 and 18 years, usually resident in the State, classified by sex and means of travel to school at Census 2006 (Table 3)
⁵ 6190 of a total of 148,508 students aged 19 years and over, usually resident in the State, classified by sex and means of travel to school or college at Census 2006 (Table 4)
cultural geography, the sociology of technology, and the politics of the bicycle and cycling.

3.1 Cycling in the Social Sciences

In the area of social and cultural geography, Aldred (2010) contributes to debates on citizenship and transport, building on Wickham’s contributions ((2006a), (2006b)) which concentrate on motorised public and private transport, rather than on cycling. Aldred’s work⁷, based on interviews carried out with cyclists over the course of her fieldwork in Cambridge, England, is of particular relevance to this researcher’s proposed subject area as it deals with the social benefits for the individual and for society at large.

Another active researcher in the field, Justin Spinney, explores the experiential dimensions of cycling and he explores the notion that:

we create meaning and belong in a place according to how we are in a place…. [and] that our movements in and through a place ultimately define our engagement with it and constitute it as a place (2006).

He continues:

As we travel through a landscape we see and feel it in many different ways and yet little work has been done regarding the relations of embodied movement, place, and meaning (Ibid).

While the paper above and Spinney’s other paper entitled “Cycling the City: Non-Place and the Sensory Construction of Meaning in a Mobile Practice” (in the “Cycling and Society” collection of papers (Rosen et al., 2007)) explore our relationship with the physical spaces while riding a bicycle, neither paper fully considers the nature of how the cyclist interacts with other people – either those with whom they are aquainted or with strangers.

3.2 Cycling Sub-cultures

There is a significant academic literature on cycling sub-cultures, especially of bicycle messengers and the ‘critical mass’ movement. These sub-cultures of cycling can be contrasted with a ‘culture of cycling’ where cycling is a normal and everyday part of the culture.

Kidden (2006) probes the subject of the construction of messenger identities through participation in illegal street races (known as ‘alley cats’) which he maintains act as “Durkheimian rituals” together with their use of bicycles, messenger bags, and other objects which become sacred symbols within the ritualization process. Fincham (2008), on the other hand, examines the formation of identity and the culture of bicycle messengers and proposes that the messenger identity extends well beyond activities during paid working hours.

Linked to some degree to bicycle messenger culture is the phenomenon of ‘Critical Mass’. The

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⁷ Dr. Rachel Aldred was one of the main presenters at the “Ethnography for Cycling” Workshop in Lancaster University in December 2009 and her presentation covered other urban areas such as York, Oxford and the borough of Hackney: www.lancs.ac.uk/fass/centres/cemore/event/2982/
collection of essays “Critical Mass: Bicycling’s Defiant Celebration” (Carlsson, 2002) explores the contested meanings of the international phenomenon. This collection is edited by Chris Carlsson, a writer and founding member of the Critical Mass movement in San Francisco. Udvarhelyi’s recent paper (2009) argues that Critical Mass is the single most powerful grassroots movement that has emerged in Hungary since the 1989 change of regimes. The paper also provides a helpful, up-to-date bibliography of papers on the phenomenon.

3.3 Bicycle Politics

In the field of the politics of the bicycle, Horton (2006) argues that the bicycle:

as an object both utilised discursively in green talk and texts, and actually ridden by green practitioners, powerfully enables the articulation of an alternative society, a green vision of sustainability (2006).

The theme of bicycle politics will be explored in the Centre for Mobilities Research (CeMoRe) at Lancaster University in September 2010 when the first “Bicycle Politics Symposium and Workshop” (Horton, 2010a) will be hosted.

4 RESEARCH QUESTIONS

The overarching question which this research aims to inform is: how does the process of change towards a more bicycle friendly system occur? This is obviously a deep and broad topic and is the subject matter of many separate studies, especially over the last two decades. The topic cuts across the fields of, inter alia, urban planning, transport planning, traffic engineering, sociology and urban studies.

Sections 4.1 and 4.2 below trace the two separate strands of thinking currently being pursued in advance of finally defining the central research question to be tackled.

4.1 Community, Social Capital and Behaviour in Public Spaces

The initial research questions arose from casual observation, conversations with many transport users, and other anecdotal evidence garnered mainly, but not exclusively, in an Irish context. Some of the questions considered are discussed here.

Is there a correlation between cyclist numbers and the degree of social connectedness experienced by users of urban streets and neighbourhoods? Could increasing cyclist numbers lead to a greater number of spontaneous social interactions on the street, both amongst cyclists and between cyclists and pedestrians? See Figures 2 and 3 below.

Or, on the contrary, could more cyclists on the road create a more menacing atmosphere on the streets?

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9 Estimates for the size of the critical mass ride in Budapest in Spring 2008 range from 60,000 to 80,000 – the largest in the world. [http://criticalmass.wikia.com/wiki/Budapest](http://criticalmass.wikia.com/wiki/Budapest)

10 The event will cover topics such as: cycling and political economies and ideologies; the politics of cycling ‘promotion’; critiques of cycling; cycling and discriminations; cycling and inequalities; cycling, social control, freedom and deviance; cycling, space and the politics of space; cycling, social movements and social change; cycling and identity; cycling and the politics of representation; feminist perspectives on cycling; cycling and the law. [www.lancs.ac.uk/fass/centres/cemore/event/3299](http://www.lancs.ac.uk/fass/centres/cemore/event/3299)

especially for pedestrians? How might the processes by which strangers – i.e. those who are not acquainted at all with one another - interact in public places change if more citizens cycled rather than commuted in private cars or public transport? Might the sociability of public spaces be enhanced? If this was the case, could the bicycle be interpreted – in the tradition of technological determinism\textsuperscript{12} - as a community-building machine?

Other critical factors in such considerations are likely to be: the nature of the road (e.g. the effect of there being front gardens adjoining houses); levels of (motorised) traffic on the road; the personalities of cyclists versus other road users (i.e. might there be a self-selecting dimension to the choice of transport mode adopted in that more sociable individuals might cycle rather than drive alone?); the levels of experience of cyclists (as this would influence the cyclist’s ability to communicate with others while cycling; the degree to which a cyclist might ‘zone out’ while cycling which would mitigate against being sociable. Furthermore another consideration might be a need to differentiate between being seen on a bike and seeing people. It is clear at this point that there are many variables which would need to be controlled if pursuing an investigation of the questions in the previous paragraph.

It appears though, from the initial literature review, that there is an absence of empirical research exploring the above questions. It appears as if the subject could be ripe for exploration.

4.2 Cycling Systems and Systems Change

The fundamental question underpinning the choice of topic for this research is that of the nature systems change – i.e. how does the process of change towards a (more) cycling friendly culture or system occur? Culture in this case comprises the physical infrastructure, laws, values and norms.

If the cycling culture can be thought of as (part of) a socio-technical system (Figure 4), can we illuminate how the current unsustainable urban transport system might be at least partially replaced by urban cycling systems through an examination of the evolution of other socio-technical systems? That is, if we view the bicycle as a technological artefact, to what extent could it be fruitful to explore the application of models and theories of socio-technical systems change to the subject of the development of cycling culture?

The classic texts on the sociology of technology (E.g. Hughes, 1983) offer models of how technological systems and socio-technical systems evolved and migrated from the cities in which they first started life to other locations. They describe how wider social processes both determine, and are determined by, the development of technology and new socio-technical systems (such as Edison’s electric lighting systems).

\textsuperscript{12} See Section 5.2 below.
beginning of a significant shift in the transport system? Could this change, intriguingly, be viewed as a re-adoption of an older technology or as part of a process of demodernization\(^\text{13}\)? And, if so, what other precedents are there in a modern advanced Western society and economy for the adoption of ‘less advanced’ technologies? Do such events only take place as available energy supplies diminish?

5 THEORETICAL FRAMEWORKS

Within which theoretical frameworks in the social sciences can ideas on (i) the social dimensions of developing a cycling culture, and (ii) ideas on systems change be best located? In the following sections, a brief overview is provided of the main frameworks being examined.

5.1 Community, Public and Private Spheres, and Civilizing Processes

5.1.1 Appleyard, Jacobs and Putnam

The fields of community building and social cohesion have a vast literature but three landmark studies are noteworthy for this researcher’s investigations: “Livable Streets” (Appleyard et al., 1981); “The Death and Life of Great American Cities” (Jacobs, 1962); and, “Bowling Alone: The Collapse and Rise of American Community” (Putnam, 2001).

Appleyard’s comparative study of three residential streets in San Francisco demonstrated that the residents of the lightly trafficked street had three times as many friends and twice as many acquaintances residing on the street as those living on the heavily trafficked street. This he explained by suggesting that as traffic volumes increased, one’s own exchange space diminished\(^\text{14}\). This classic study was replicated in Bristol in 2008 (Hart, 2008) and again it demonstrated that levels of car use through a street impact directly on social cohesion.

There are several (somewhat conflicting) studies examining the relationship between the walkability of neighbourhoods and levels of social cohesion. Leyden’s results (2003) concur with Jacob’s experiences and indicate that persons living in walkable, mixed-use neighbourhoods have higher levels of social capital and were more likely to know their neighbours, participate politically, trust others, and be socially engaged than their counterparts in non-walkable neighbourhoods. However the analysis by du Toit et al (2007) from an Australian sample showed only a modest association between the walkability of a neighbourhood and sense of community. These papers seek to identify relationships between the urban form and levels of social connectedness, as distinct from potential relationships between users of different travel modes in a given urban environment and levels of social connectedness. It is this latter relationship which is a potential area of enquiry for me. See Section 6.

5.1.2 Sennett, Elias and Simmel

Richard Sennett offers an alternative conceptual framework to understand behaviour in public places in “The Fall of Public Man” (1977). On the one hand Jacobs’ main argument is that diverse, mixed-use neighbourhoods give rise to busy, vibrant and sociable streets in which one gets to know ones neighbours through informal regular contacts. Sennett, on the other hand, argues that we now undervalue the community relations of strangers and the rituals of behaving towards them. Both of their insights and theories may be very relevant in developing an understanding of the processes at work when the cyclist rides in urban areas and interacts with the public.

Elias’ “The Civilizing Process” (1994) provides a further framework to explain the behaviour between strangers, and this may be applicable to the behaviour between different road users. According to Elias, it is essentially manners and rules which guide our change in behaviour, and his ideas may also help illuminate the subject of cyclists’ (sometimes bad) behaviour. His ideas will be revisited over the course of this research.

Simmel’s theory of the blasé attitude of the modern individual, as expounded in his 1903 essay The Metropolis and Mental Life (in Frisby, 1997), is founded on the idea that the urban dweller can

\(^{13}\) While the ordinary bicycle is an older technology, the Dublin Bikes public bikes scheme and electric bikes both rely on advances in telecommunications and other technologies.

\(^{14}\) These ideas have been advanced and applied in a practical setting in Australian cities by ENGWICHT, D. 1999. Street Reclaiming - Creating Livable Streets and Vibrant Communities, New Society Publishers. David spoke in Dublin on Friday 28/ May 2010, details on www.dublincycling.ie
handle only so much stimulation and so many encounters before a bodily mechanism sets in that prevents the person from assimilating further information. As the cyclist is inundated with stimulation in a bustling urban environment - as described by Spinney in the “Cycling and Society” volume (Rosen et al., 2007) - Simmel’s theories on stimulations and assimilations in the urban context could feed into any new theories developed on the cyclist’s social experience of riding along the street.

5.2 Sociology of Technology and Socio-technical Systems

5.2.1 Technological Determinism, SCOT and the Social Shaping of Technology

The field of the sociology of technology provides another lens with which to examine the relationship between cycling and society. Viewing the bicycle as a technological artefact opens up many further theories of relevance: e.g. technological determinism, the social construction of technology and the social shaping of technology.

The collection of essays by Smith and Marx (1994) provides a range of definitions of technological determinism and a number of critiques: it is the theory of technology being the driving force of society and the initiating agent of change; it is the theory of technology as having transformative power; it is the driving force of history - it even determines history itself. The belief in technology as a key governing force in society dates back to at least the early stages of the Industrial Revolution but it is twentieth century scholars that refer to this belief as ‘technological determinism’. The belief is tied up with technology being seen as a symbol of progress especially during the period when industrial capitalism gained a grip on the American economy. The growing advertising industry, working on behalf of various industries, had a vested interest in promoting the idea that technology shapes society, and not vice versa. (Smith and Marx, 1994).

Could research questions regarding the potential of the bicycle to determine the sociability of streets be framed in terms of the theory of technological determinism? Perhaps, but it immediately invites critiques of the theory, especially from theories of the social shaping of technology. These theories are the generic names for “those accounts which suggest that the capacity of the technology is equivalent to the political circumstances of its production” (Grint, 1997). The shaping may be economic, state, science or even technology shaping technology.

The social constructivist representation of how technological change takes place is developed in detail in Bijker’s “Of bicycles, bakelites, and bulbs: toward a theory of socio-technical change” (1995). The bicycle is one of the three detailed case studies presented in which the authors combine empirical research and theoretical modelling to produce a theory of socio-technical change - the Social Construction of Technology (SCOT). The main relevance is with the presentation of new concepts such as ‘relevant social groups’, ‘interpretive flexibility’ and ‘stabilization and closure’ forming the SCOT model. These concepts could potentially be of relevance in explaining how further evolutions of the bicycle may take place, or even in explaining how particular types of bicycles are becoming increasingly popular. I.e. As the bicycle is interpreted by different social groups - e.g. parents of young children or city centre businesses requiring deliveries from other central locations - as having separate meanings, thus it follows that the technology evolves to respond to these separate meanings. E.g. The bicycle becomes a child-carrying vehicle thus having baby seats etc., or becomes a cargo bike respectively.

5.2.2 Davison, Hughes and Illich

Davison (2004), in his social history of automobility in Melbourne in the decades after World War II, discusses several themes of potential relevance to a study of cycling policy and culture. He locates the trend towards greater automobility as being tied umbilically to the Liberals’ modernist ideals of progress, freedom and independence. While he has little to say about bicycles per se, his insights into the growth of social movements opposing urban freeway schemes link with other studies such as Horton’s (2006) documenting the centrality of the bicycle in the environmental movement. Davison also provides original important reflections (with conflicting conclusions), on the effects of automobilization on the emancipation of women. Given the strongly uneven split between men and women cycling in
Ireland\textsuperscript{15}, Davison’s observations on the gender issues may be relevant to any analysis of this topic at a later stage of my work.

Another important theme in the literature of the sociology of technology which is relevant to the development of bicycle culture is the process of technology transfer. Davison observes how the “gospel of automobility” and freeway building spread in the 1950’s from the US through, inter alia, sending “practical, hard working, [Australian] countryboys” to Yale University in the US to be trained in the teachings of those academics who were also in the business of freeway design on a consultancy basis. This theme of technology transfer and, more broadly, socio-technical systems change is examined in far greater detail in “Networks of Power - Electrification in Western Society”, 1880-1930 (Hughes, 1983) and in “The Railway Journey: the Industrialization and Perception of Time and Space in the 19th Century” (Schivelbusch, 1986). The former text emphasises the holistic nature of a socio-technical system – i.e. the system includes not only the physical hardware but also the alliances with financiers and legal professionals etc., together with a supportive regulatory framework (which can be changed). These insights are valuable in reflecting on how systems change may take place in the context of the bicycle.

Hughes’ insights also highlight that there are crucial differences between large scale, capital and energy intensive, electric power systems, and the more modest supports that the bicycle requires. Ivan Illich captures the difference well in “Energy and Equity”:

“Man on a bicycle can go three or four times faster than the pedestrian, but uses five times less energy in the process………The bicycle is the perfect transducer to match man’s metabolic energy to the impedance of locomotion. Equipped with this tool, man outstrips the efficiency of not only all machines, but all other animals as well” (Illich, 1974).

The “Mobilities” field, capturing phenomena as diverse as the movement of capital, large scale migrations, the movement of information as well as more localized travel patterns and modes is one to be re-examined at a later point in the research

6 CONCLUSIONS AND NEXT STEPS

This doctoral research is at an early stage with the initial literature review revealing an emerging cross-disciplinary field, led in particular by UK based researchers. The literature on cycling in the social sciences has grown with and since the publication of the Cycling and Society collection of papers (Rosen et al., 2007), and with the hosting of the annual Cycling and Society symposia in the UK\textsuperscript{16}. A new interdisciplinary network – the Scientists for Cycling Network\textsuperscript{17} – has recently been established and this network aims to facilitate coordination between researchers.

One potential avenue for this researcher is to continue to inquire into the nature of a potential relationship between deepening an urban cycling culture and changing the social aspects of urban streets. As noted above, it is clear at this point that there are many variables to be considered in formulating a workable research design to explore this topic.

The other potential avenue is to explore how systems change (towards more cycling friendly and sustainable systems) can occur. Such an investigation could draw on the work of sociologists of technology. It is this latter avenue investigating the nature of the process of social change that may be the most intriguing. Any light thrown on this topic could be transferable more widely – i.e. beyond the subject of cycling culture – and therefore be more valuable.

The next stage of work, currently underway, will define the exact research questions to be pursued and research design to be followed. It may be

\textsuperscript{15} Of the 36,306 persons cycling to work in 2006, 27948 (77%) were male and 8358 (23%) women (CSO IRELAND, C. S. O. I. 2007. 2006 Census Report: Volume 12 Travel to Work, School and College.)

\textsuperscript{16} This year's Cycling and Society symposium will take place in Oxford in September 2010. Details are available at: \url{www.tsu.ox.ac.uk/events/100906/} [Accessed on Sat 24/July/2010]

\textsuperscript{17} See \url{http://www.ecf.com/3686_1} [Accessed on Sat 24/July/2010]
possible to pursue an area that straddles the two avenues noted above. It is hoped that this will be informed by feedback received at the ITRN and other conferences.

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