
Transport Infrastructure and Sustainability of Urban Development

Hendrik W. van der Kamp

Faculty of the Built Environment, Dublin Institute of Technology.

Introduction

There is an increasing degree of concern over the continuing sprawl of low density development outwards from the Dublin Region and the leapfrogging pattern of commuter-based housing development as urban centres some distance away from Dublin experience rapid development patterns in response to increases in metropolitan house prices. Interestingly, one contributing factor to this development pattern has been quoted as road infrastructure (Williams & Shiels, 1998). The construction of the M50 C-ring motorway and improvement of all of the national primary road corridors connecting to it, have contributed to a wider catchment area for commuters. In a way, the housing market in the region forms a reasonably accurate and transparent illustration of the traditional trade-off theory of land prices (Alonso, 1965) where house buyers base their locational choice on the trade-off between lower house prices with higher travel to work costs.

The further out from the city, the lower the house price needs to be in order to offset increased commuting costs. The irony of this, in many ways an undesirable and unsustainable pattern of development, is that a contributing factor to it seems to be the road construction programme. The improved roads, together with the delayed implementation of public transport projects (e.g. light rail), have resulted in a perverse application of the 'carrot and stick', or 'push and pull' approach to sustainable transport planning. This principle is based on simultaneously making transport by private car less attractive (push measures) while making the alternative of public transport (pull measures) more attractive. Instead, what has happened is that more attractive road infrastructure has facilitated the geographical expansion of the city while deteriorating public transport has acted as a push factor to 'drive' commuters into private cars.

The Question of Urban Form

These concerns have re-focused our attention on the question of the 'future urban form' of the Greater Dublin Area (GDA). Will it continue to be the low-density sprawling city that Dublin has been historically, or is an alternative urban form feasible? This question of urban form is one of the key strategic planning issues at present. It was examined in the Strategic Planning Guidelines study and is likely to feature in the National Spatial Strategy. Urban form is understood as the physical shape of the city in relation to its overall 'footprint' and population size. The issue of urban form is very relevant to sustainable urban development because of the potential impacts on mobility and modal split. For example, a compact city facilitates a reduced overall demand for travel while simultaneously facilitating the provision of better public transport, thereby achieving a more sustainable modal split between private and public transport.

Transport infrastructure has always been a critical component in decisions about urban form. Theoretical models of urban form such as Satellite Towns, the String of Pearls model (linear city along a transport axis) or even the Finger City, are generally based on the availability and geometric structure of transport networks.

While it is generally accepted that the process of urban sprawl is unsustainable and undesirable from a planning point of view, it is important to point out that it is too simplistic to refer to a pattern of development in outlying areas as automatically increasing travel to work distance. Within the GDA there are important employment concentrations at the edge of the city resulting in commuting distances from nearby towns, where significant development is happening, that are not much greater than within the built-up area of Dublin itself (see Table 1).

Table 1. Commuting in a Poly-nuclear City

Transport Corridor	Residential	Employment
N1	Balbriggan	Dublin Airport
M4	Enfield	Intel Leixlip
N7	Naas	City west
N/M11	Greystones	Sandyford Business Park

The first Bacon report on house prices (Bacon and Associates, 1998) appears to be too simplistic in referring to the 'one hour commuting time budget by car' in relation to the central city only, suggesting that this is the trip destination for most car commuters. The question of the future urban form for the GDA was examined in great detail in the Strategic Planning Guidelines (SPG) document where a number of alternative urban forms were analysed and considered as alternative optional strategies (Brady Shipman Martin et al, 1999). The chosen model was that of development centres on transport corridors with a strategic green belt area in between. This model has been criticised on the basis that it leads to too much long-distance commuting and the compact city model, achieved by densification and urban development within the C-Ring, has been suggested as a realistic alternative (McCarthy, 2000). Dublin's urban form is also undoubtedly going to be a key issue in the forthcoming National Spatial Strategy. This must address the issue of the overall growth of Dublin vis-a-vis the rest of Ireland and the relationship of GDA to towns in the areas that are becoming potential commuting zones to the city, such as the Midlands region.

The Role of Interchanges

Modern successful cities function as elements in international networks of cities. Dublin is a good example of how this international dimension (European Capital) has contributed to its success in economic and cultural terms. In turn, this international role has contributed to population growth, urban re-generation and employment investment. The EU has recognised the importance of a high quality transport infrastructure throughout its area by developing the Trans-European Networks (TEN) (European Commission, 1996a). Guidelines developed from this research were approved in 1996 with the objective to create an integrated land, sea and air transport network by 2010. Article 2 of the Guidelines refers to the purpose to:

“ensure the cohesion, interconnection and interoperability of the trans-European transport network, as well as access to that network.” Under the TEN policy, a high speed railway network is being constructed and, with the advent into operation of the Channel Tunnel, such networks have had a major impact on the international role of cities and on the regions affected by the networks. However, it has also been recognised that constructing high-quality international trans-European networks is insufficient to achieve development in the cities and regions where the infrastructure is located. The European Spatial Development Perspective recognises the need for “strengthening secondary transport networks and their links with TENs, including development of efficient regional public transport systems” (European Commission, 1999, 27). This means in practice that the interchanges between local and regional networks with the Trans European Networks, become of critical importance. These are the so-called multi-modal interchanges.

Interconnection of long-distance networks with local/regional networks was the topic of the CARISMA European study project (1997). Through case-studies, meetings, on-site visits and technical workshops, it investigated interconnection and inter-modality, the ability to transfer between different transport modes. This project provided a thorough basis for understanding of the relevant issues and the importance of interchanges for urban development. Not surprisingly, its findings show that technical difficulties in designing a successful interchange form only part of the overall difficulties in achieving high quality interconnections and inter-modality. At least as important are institutional issues (e.g. different competing operators), administrative issues (e.g. integrated ticketing) or information issues (e.g. lack of real-time information about other modes).

In order to achieve multi-modality, interchanges are critical. The interesting aspect of interchanges is that where people or goods transfer between modes of transport, an opportunity arises to achieve ‘added value’. Examples of this can range from the coffee shop at a bus station to retailing activities at an airport. Where people change between modes of transport, the attractiveness of the interchange will be increased with enhanced comfort and the scope to undertake additional activities in order to reduce time loss etc. The more attractive the interchange in this respect, the more likely is the success of the multi-modal transport solutions in terms of transport policy objectives. The same concept of ‘added value’ applies to freight transport where a logistical node can provide an opportunity for additional manufacturing activities in the logistics chain of goods (e.g. customising goods).

The most successful example of how a transport interchange can contribute to urban and regional development is provided by Lille, where the provision of a station on the high speed railway was grasped as a strategic opportunity for the development of the city. By bringing all of the local and national transport modes close to the new high-speed railway network the required degree of integration was achieved. As a result, the city and its surrounding region was able to turn around from a peripheral region of declining industry and high unemployment to a highly successful city profiling its central location within the core of Europe. A similar policy of creating an inter-modal connection point around a high speed railway station is currently being launched by the City of Rotterdam where the masterplan for its city-centre railway station has been prepared by an international firm of architects. Both projects are presented as high profile urban design projects and intended to achieve urban regeneration and significant economic impacts on the region.

Interchanges are the points where the different networks meet and people and goods switch from one mode of transport to another. Multi-modal transport is also important for sustainability because there is not a single mode that achieves well on all criteria of transport, and the key to sustainable transport solutions is to make use of the most environmentally efficient mode of transport available depending on the type of trip, distance travelled, etc. However, using different modes of transport as part of a single journey (so-called chain approach) creates difficulties where the transfer from one mode to the other is difficult either because of delays, no guaranteed connection, lack of comfort, time loss and paucity of secure car parking etc. The quality of the interchanges, the points where passengers or goods switch from one mode to another, is key to the success of the multi-modal transport solution.

The need for a 'seamless' interconnection between modes of transport has been clearly illustrated in the latest document of the Dublin Transportation Office (Dublin Transportation Office (DTO), 2000). Whilst a multi-modal approach already formed the basis for the Dublin Transportation Initiative (DTI) (Dublin Transportation Initiative, 1995), the document '*Platform for Change*' (2000) has further emphasised a public transport network which is based on the integrated operation of four distinct modes of transport: bus, suburban heavy rail services (both electrified DART and diesel), light rail (Luas) and the proposed metro. The strategy is based on integration between these systems in order to achieve two objectives which can function as sustainability indicators:

- 1) Most people in the GDA will live within 10 minutes walking distance of high quality public transport.
- 2) It will be possible to make almost all journeys on the public transport networks with just one interchange, either intra-modal (e.g. bus to bus) or inter-modal (e.g. bus to rail).

An interesting feature of the DTO (2000) document is its promotion of potential multi-modal interchanges. These interchanges present an opportunity to develop high volume transfers of passengers between the various transport modes such as bus, suburban rail, DART etc. An example of such a location at the periphery of Dublin is Porterstown to the north west of the city adjacent to the expanding area of Blanchardstown. If present plans are completed, this location would be serviced by Dublin Bus, Suburban Rail, DART and eventually the suggested Metro System. Within the city existing interchanges will have their present role strengthened. For example, one of Dublin's main central railway stations, Heuston, will develop from its present interchange between rail and bus to an interchange between rail, bus, DART and Luas.

The Dutch ABC policy of increasing urban densities around points of high accessibility, has been quoted as an example of how to build successfully on the correlation between high population, density and reduced distances travelled. This policy seeks to match the mobility needs of businesses and other activities with the accessibility characteristics of urban locations. An A-business with a high worker and visitor intensity should be guided to an A-location with high accessibility on the public transport network, while C-locations with high accessibility to motorway junctions should be reserved for C-businesses with high dependence on road freight (European Commission, 1996b).

The interesting consequence of this policy is that it enables the systematic identification of

A, B and C-locations within a city region. In the Dublin context, examples of A-locations are probably Heuston and Connolly Stations while typical C-locations are the interchanges on the M50 C-ring motorway. Under the DTO (2000) proposals, it can be argued that a significant number of additional A-locations will be created. Most of these will be located within the C-ring. Some of the A-locations provide very interesting challenges for urban development opportunities which have yet to be fully explored. Examples are at Porterstown in Fingal County and Clondalkin in South Dublin County. Another example of a new A-location within the existing city area is the Broadstone interchange. This interchange will provide a link between the new Luas and Metro networks with Quality Bus Corridors in the vicinity and the location will provide an excellent opportunity to develop as a multi-modal interchange.

Transport infrastructure in the form of multi-modal interchanges can provide opportunities for a more sustainable urban form for the city. Opportunities are created for employment concentrations and high-density residential development at A-locations, as well as opportunities for land uses generating heavy vehicle movements such as logistics companies, large-scale manufacturing operations and freight transfer facilities. These examples are explored in this paper to illustrate the implication for urban planning policies. Examples shown include interchanges within the city area, at the edge of the city and outside the city.

Case Study 1: Interchange within Dublin city

Under the DTO proposals, Broadstone will become an important node on the public transport system for Dublin providing an interchange between the Metro and Luas networks close to Quality Bus Corridors. The development of Broadstone as a multi-modal interchange, in combination with the existence of the nearby Grangegorman complex provides a strategic opportunity of urban densification in the context of a compact urban form for Dublin. What might be achieved with such a location as a result of the provision of public transport infrastructure as planned, was explored as part of a report examining the implications of Grangegorman as a campus for the Dublin Institute of Technology (DIT). This report, prepared by an internal working group in DIT, concluded that the site provides a strategic opportunity for 'city building' that goes beyond the creation of simply a third-level education facility. The concept proposed in the report was that of linking 'knowledge infrastructure' with 'transport infrastructure' to create a DIT campus which could be seen as "social infrastructure that is of potential benefit not only to the student population but also the general public" (Faculty of the Built Environment, DIT, 2000). For example, library, restaurant and conferencing facilities are all potential contributors to urban regeneration of this part of Dublin. Indeed, the report recognised the synergistic value that could be achieved by integrating and combining these elements of the campus with the multi-modal interchange. This would achieve a location of activities with highest worker and visitor intensity closest to the public transport network and also achieve the added value to the logistical node by providing urban activities including restaurants and conferencing facilities. These policies would not only be in line directly with the Dutch ABC policy but also contribute to the potential success of the public transport networks themselves.

Case Study 2: Interchange at the Edge of Dublin City

Park and Ride (P+R) facilities form a main component of transport infrastructure to achieving

greater sustainable urban development. P+R facilities are examples of interchanges. A difficulty in relation to P+R facilities is to determine the correct location. A location that is too close to the city reduces the impact on reducing congestion, a location too far out may actually contribute to longer distance commuting as commuters accept a place to live further out from the city on the basis that part of the journey will be by public transport. In that way, P+R infrastructure may actually contribute to more dispersed pattern of settlement instead of a more compact urban form.

An example of how interchanges between car and public transport can function successfully in a city is formed by the transfer points approach. This is a policy adopted in the Netherlands and was highlighted in the CARISMA project. The Transfer Points, or '*Transferia*' policy, is based on the concept of inter-modal interchange points located at strategic points near highways where drivers can conveniently change onto high quality public transport to arrive at their destinations quickly. *Transferia* are meant to make a combined car/public transport trip a serious competitor of a unimodal car trip. The *transferia* concept is a progression of the much older Park and Ride concept. The main difference between *transferia* and P+R is that P+R is mainly meant for a better accessibility of railway and subway stations, whereas *transferia* are meant actively to induce car drivers to make a transfer onto public transport.

A pilot study is currently underway in the Netherlands where a number of transfer points at different locations in the country are being monitored in terms of the effect on modal interchange. The most interesting example from a Dublin point of view is the *transferium* that has been built underneath the Ajax soccer stadium south of Amsterdam where drivers are encouraged to leave the A2 motorway, park the car and continue the journey on a rail corridor combining a metro track and mainline rail. This transfer node was opened in 1996 and has a capacity of 500 to 2000 vehicles. A transfer shuttle bus is provided between parking and the nearby railway station.

It is suggested that the M50 cordon around the city provides a suitable location for transfer points, particularly if at some stage a system of inner-city road pricing were to be introduced. A report on road pricing concluded that optimal performance will be achieved where charges are integrated with, *inter alia*, opportunities to provide park and ride facilities (Oscar Faber, 1999). The study concluded that a cordon arrangement for the city centre with peak period charges could produce significant traffic reductions in the central area while the traffic impact could be increased if the cordon charged were extended to include a second cordon inside the M50.

The M50 C-ring seems an appropriate location for such a private car/public transport transfer facility, not only in the context of future road pricing, but also because of the DTI policy not to increase radial road capacity within the C-Ring. This policy was re-affirmed in the National Development Plan (Government of Ireland, 1999). As the capacity of the national road network outside the C-Ring is still being improved, congestion is likely to occur as motorists heading for the city centre cross the M50 cordon. Telematics can play an important role in the successful operation of transport interchanges. The motorist listening to the car radio would be alerted to heavy congestion on the road ahead. At the same time of hearing this real-time information on the car radio, a Variable Message Roadside Sign could display the capacity of available spaces in the transfer facility and the time of the next bus departing to

the city centre. This information would provide the motorist with the ability to make an instant decision to switch travel mode. This concept of instant decision (rather than a pre-planned journey plan) is fundamental to the *transferium* infrastructure concept and sets it apart from the Park and Ride concept which is based on the already converted motorist. Telematics are generally underdeveloped in Ireland and, where provided, the applications tend to be limited to the internal operation of a particular mode of transport. As a result there are no network applications in place or planned (van der Kamp, 1999).

Case Study 3: Interchange outside the City

The poor quality of the national rail network and services and the predominantly radial nature of the network focused on Dublin, has resulted in a weak service network of travel by train between medium-sized Irish towns. Nonetheless, it is interesting to note that of the 23 towns with a population greater than 10,000, 20 towns are served by a railway station connecting the town to the mainline railway network. Towns in the Greater Dublin Area that are not served include Leixlip, Swords and Navan. However, in the case of Leixlip and Swords, the towns are very close to other towns with railway stations and in the case of Navan a railway station is currently proposed.

It is arguable that proper connectivity between urban centres by public transport will be an important requirement to achieve a satisfactory degree of sustainable urban development. With regard to proposals for development lands in the Midlands region adjacent to Dublin, a study was carried out into the impact of the construction of a new section of railway line between Portarlington and Mullingar. Such a railway line would link the southern part of the mainline network with the Dublin-Sligo corridor. The building of such a section of railway could achieve a better degree of connectivity between the northern and southern elements of the national railway network and could be seen as a valuable tool towards achieving a greater degree of 'regional balance', a stated objective of the National Spatial Strategy (DoELG, 2000). However, such an infrastructure element could also result in the creation of an inter-modal interchange between the national road and rail networks. If seen in the context of the construction of the new N6 to be routed north of Tullamore, the railway line would interconnect with this new motorway at a location in the Midlands region where there are ample development opportunities. Again, in the context of the ABC policy framework, it would be important that such a location of high accessibility would not lead to a further exacerbation of the sprawl in western direction of the Dublin commuter belt. However, as an inter-modal interchange providing interconnection between national road and rail infrastructure where development opportunities exist, it could be highly significant. From a strategic planning point of view for, e.g. inward investment of employment, or the development of a freight depot serviced by a rail link to Dublin Port as currently being examined by the task force that was launched by the Minister for the Marine and Natural Resources. While the task force is likely to examine freight depots near the city there is no strategic reason why the transfer of freight from trucks to rail could not take place at another location in the country provided it is well connected to Dublin Port and the national road network.

Spatial Planning: Integrating Land Use and Transportation Planning

Using transport infrastructure in order to achieve sustainable urban development requires an integrated approach between the infrastructure and the land-use policies surrounding the infrastructure. However, a major failure of the Irish planning system has been the lack of

adequate integration of land-use and transport planning. Instead, there has been a propensity for the planning studies of the GDA alternatively to investigate the strategic development of land uses, to be followed independently by a transport study only after the land use study had been completed. This pattern of leapfrogging has continued even after the DTI reported in 1995, which had been by many seen as a watershed in terms of an integrated approach to transport (see Table 2).

Table 2. Leap-Frogging of Land Use and Transportation Planning in Dublin

Title of Study	Type	Year of Publication
Myles Wright Dublin Region Report	Land Use	1967
Dublin Transportation Study (DTS)	Transportation	1971
ERDO Strategy (revised)	Land Use	1988
DTI Final Strategy	Transportation	1994
Strategic Planning Guidelines for the Greater Dublin Area	Land Use	1999
A Platform for Change	Transportation	2000

Even though the terms of reference for the Strategic Planning Guidelines document were wider than for the previous Eastern Region Development Organisation (ERDO, 1985) strategy, the treatment of transportation in relation to land use was still limited because it required the study team to make recommendations about the transportation infrastructure required for the implementation of the planning strategy. It is clear therefore that the SPG document is primarily a planning policy for the location of land use. The subsequent DTO document states on the first page that it has been prepared to support and complement the strategic land-use planning framework described in the Strategic Planning Guidelines for the GDA.

From this it is clear that the SPG document deals primarily with land use, while the DTO document deals primarily with transport. Because it raises issues of great interest in terms of potential locations for dense urban development near interchanges, it essentially confirms the process of leapfrogging between land use and transport policies that has been with us since the Myles Wright Report (1967).

The kind of policies referred to in this paper illustrate what is possible in terms of sustainable urban development if land use and transport (and other) infrastructure is looked at in an integrated fashion. The creation of a range of interchanges in a sophisticated network of public transport will present the planners in the GDA with challenges for spatial planning policies which truly achieve the integration between transport and land use planning that has not been achieved to date.

References

- Alonso, W. (1964) *Location and Land Use*, Harvard UP, Cambridge, Mass.
- Bacon P. & Associates (1998) *An Economic Assessment of Recent House Price Developments*, Government Publications, Dublin.
- Brady Shipman and Martin et al (1999) *Strategic Planning Guidelines for the Greater Dublin Area*, Brady Shipman and Martin & Associates, Dublin.
- Department of the Environment and Local Government (DoELG) (2000) *The National Spatial Strategy: Scope and Delivery*, Department of the Environment and Local Government, Dublin.
- Dublin Transportation Initiative (DTI) (1995) *Final Report*. Government Publications Office, Dublin.
- Dublin Transport Office (DTO) (1996) *Report to the Minister for the Environment*. Government Publications Office, Dublin.
- Dublin Transport Office (DTO) (2000) *Strategy 2000-2016, A Platform for Change*, Dublin Transportation Office, Dublin.
- Eastern Region Development Organisation (ERDO) (1985) *Eastern Region Development Strategy 2011*. Eastern Region Development Organisation, Dublin.
- European Commission (EC) (1996a) *Decision no 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network*, Official Journal of the European Communities, no L228.
- European Commission (EC) (1996b) *European Sustainable Cities*, Expert Group on the Urban Environment, European Commission, Brussels.
- European Commission (EC) (1999) *ESDP European Spatial Development Perspective, Towards Balanced and Sustainable Development of the Territory of the European Union*, European Commission, Luxembourg.
- Faculty of the Built Environment, DIT (2000) *Final report of the Faculty of the Built Environment Advisory group on Grangegorman*. Dublin Institute of Technology, Dublin.
- Government of Ireland (1999) *Ireland, National Development Plan 2000-2006*, Government of Ireland, Dublin, Stationery Office.
- McCarthy, C. (2000) Paper delivered to the annual conference of the Irish home Builders Association, as reported in *The Irish Times*.
- Oscar Faber (1999) *A Study of Road Pricing in Dublin*, Executive Summary.
- Van der Kamp, H. W. (1999) *The role of Telematics in the Interconnection of Transport Operations, Management and Services: Activities in Ireland*, report to the CARISMA Concerted Action meeting, Barcelona, 14 October 1999.
- Williams, B. and Shiels, P. (1998) *Demographic Change, Economic Growth and Their Implications for the Dublin Regional Settlement Pattern*, Paper presented to Conference on the future of housing in Ireland at DIT Bolton Street, 9/10/98.