NORTH BRAY & ENVIRONS LUTS

Dun Laoghaire Rathdown County Council, Wicklow County Council & Bray Town Council

Draft Final Report for Public Consultation

July 2006

Dun Laoghaire Rathdown County Council,
Wicklow County Council & Bray Town Council

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1. INTRODUCTION

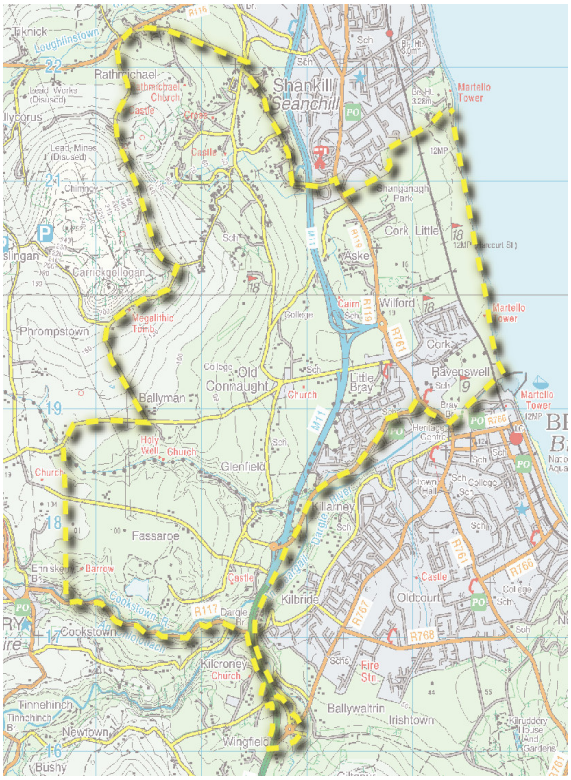
1. INTRODUCTION

1.1. Background

The preparation of a Land Use & Transportation Study (LUTS) for North Bray and Environs was commissioned jointly by Dun Laoghaire – Rathdown County Council, Wicklow County Council and Bray Town Council in January 2005. The area of the study is defined as a boundary encompassing Woodbrook, Rathmichael, Old Connaught, Fassaroe and North Bray, as well as the N11 as far as the junction with the Bray Southern Cross. The objectives of the commission were to ensure that the study area can cater for expected future levels of development as proposed throughout the Town and County Development Plans, by investigating a range of policies, infrastructural measures, and land use strategies.

1.2. Purpose of this Report

This Final Report presents an overview of the development of a comprehensive Land Use and Transportation Strategy for the area defined throughout this report as the Bray Environs.



The Final Report is supported by an Executive Summary document outlining the key features of the study, and builds on the Issues Paper published in May 2005 which facilitated the development of the key study proposals to address a defined set of issues. .

The development of this Land Use and Transportation Study has been fuelled by the commencement of the Local Area Plan (LAP) Process for the five localities within the Study Area, and has allowed individual Local Area Plan issues to be developed by considering all these areas in unison. This document therefore feeds into the Local Area Plan Process, and consultation on the various proposals and initiatives outlined in this document will be undertaken as part of the LAP process.

1.3. Report Structure

This report is structured as follows:

Chapter 2 Existing Conditions

This chapter includes a description of the existing traffic and transportation conditions throughout the study area. Existing transport infrastructure throughout the area is mainly along the eastern coastline, as a result of the skeletal pattern of development through the area. Chapter 2 outlines the key features of the existing environment and existing transportation difficulties, both of which guide the development of future proposals. A summary of the key issues of relevance to each stakeholder is provided at the end of Chapter 2.

Chapter 3 Preliminary Consultation

Initial consultation was carried out by means of local advertising and the issuing of letters to key stakeholders. The relevant submissions received during this consultation process are summarised in Chapter 3.

Chapter 4 The Traffic Model

A SATURN traffic model was developed to assist in the determination of future year traffic forecasting as a result of development proposals. This model was subsequently used for the purpose of testing and evaluating strategies, and hence assessing the effectiveness of the preferred strategy. A discussion of the development and application of the transport model is outlined.

Chapter 5 The Do-Nothing Option

In order to develop the design brief, an understanding of "Do-Minimum" or "Do-Nothing" future year conditions following development of the area is necessary. For this purpose, the traffic model was executed assuming that only committed road and public transport infrastructure was in place over the period to 2020. The output allows a definition of the hotspots in the network, and hence feeds into the identification of design options that will form part of the overall strategy.

Chapter 6 The Land Use Strategy

As part of the study, a review of land uses throughout the study area was necessary, to ensure that appropriate densities and mixed use patterns were being proposed in the various development areas. A summary of this process and the key findings are outlined.

Chapter 7 The Role of Rapid Transit

Chapter 7 provides an overview of how Rapid Transit can form part of the Land Use and Transportation Strategy. Any investment in Bus or Rail based Rapid Transit is significant, and requires a supporting population defined as part of a Land Use Strategy. Chapter 7 outlines the development of an appropriate and feasible Rapid Transit network which supports the Land Use proposals.

Chapter 8 The Transport Strategy

Chapter 8 presents the process of development of the Transport Strategy for the study area. The discussion outlines how the various elements of the strategy have been compiled to address specific issues of mobility, accessibility and economic growth, and how they all fit together into a mutually supporting strategy of measures for the study area.

Chapter 9 Strategy Evaluation

Chapter 9 examines the impact of the Transport Strategy on traffic flows over the period to 2020. Chapter 9 also describes the impact of the public transport proposals in terms of their impact in reducing delay and congestion throughout the road network.

Chapter 10 Phasing and Implementation

As with any strategy, the issue of phasing is crucial, particularly where a broader strategy is to be made up of a number of elements, which in turn will depend on the development of different land parcels. Chapter 11 discusses how the strategy can be phased in line with the development of the study area. The Risk Assessment process is also outlined, which defines the potential impact of the omission of individual elements of the strategy, and the supporting measures that would be required to mitigate any significant shortfalls in the overall quality of the strategy that could otherwise result.

Chapter 11 Conclusions

Chapter 11 presents the key conclusions of the study, and outlines the next steps that are required to ensure that the final strategy can be fully and successfully implemented over the study horizon.

2. EXISTING CONDITIONS

2. EXISTING CONDITIONS

2.1. Introduction

This Chapter describes the existing environment throughout the study area of relevance to the current study. This effectively represents a documentation of the existing issues and problems throughout the area, and is based on our assessment of existing movement patterns, road infrastructure, points of congestion and road safety issues. The current assessment is based on the observations and measurements made in the base year (2005), and focuses purely on understanding the existing situation as opposed to any consequences of future development.

The documentation of the existing environment is presented as a series of sections focusing on the different road users and stakeholders. A summary of the key issues of relevance to each stakeholder is provided at the end of each section.

2.2. Traffic Conditions

2.2.1. Existing Road Network

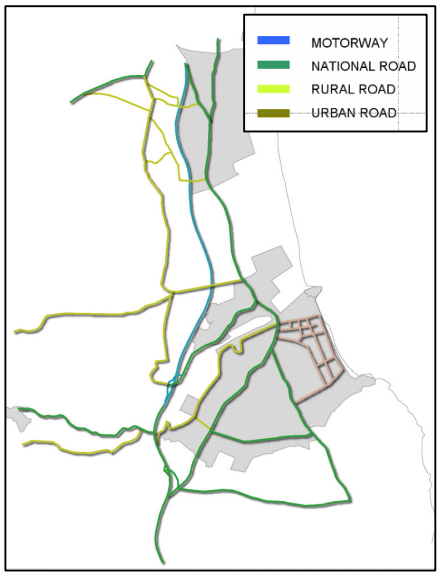
The study area is effectively an elongated strip of land stretching between Shankill and Bray, with the predominant provision of road infrastructure running north-south along a defined corridor. The main roads servicing the study area are the N11/ M11 from the Loughlinstown Roundabout north of Shankill to the Killarney Road Interchange in County Wicklow. This road, which has been developed/upgraded in stages since the early 1990's, provides a high capacity route running north-south through the area. There are three main interchanges along the N11/ M11 of relevance to the study area.

- The **Wilford** Interchange – this interchange connects the M11 and the Dublin Road near Woodbrook, providing access to Shankill, and Bray Town Centre. This is also the access point to the M11 from Old Connaught where direct access is not available.

- The **Fassaroe** Interchange – this standard dumbbell interchange gives access to lands in Fassaroe to the west and connects with Upper Dargle Road in the east, the Dargle Road being a main route into Bray Town Centre; and

- The **Killarney Road** Interchange – this interchange is fed by Kilcroney lane to the west and both Killarney Road and the Bray Southern Cross Route to the east. This is a busy interchange providing access by road to the significant residential and employment areas in the southern environs of Bray.

The Old Dublin Road runs parallel to the M11 between the Loughlinstown Roundabout and the Fassaroe Interchange, and was the existing main road between Dublin and Wicklow until the early 1990's. This road has now become a local distributor road, providing effectively local access between Shankill and Bray, and supporting development of residential and commercial interests along the old Dublin Road into Bray Town Centre.



A schematic diagram showing the existing structure of the road network is shown opposite.

In addition to the predominantly north-south routes, a small number of east-west routes are of importance. One such route is Old Connaught Avenue, which acts as a main feeder route to the Dublin Road and Bray Town Centre from the area to the west of the M11. The importance of this road has increased in recent years as it currently provides the only viable access route into development lands to the west of the study area.

2.2.2. Data Collection

A thorough process of data collection was undertaken in order to ensure that a full understanding of the current situation could be established. The process involved both quantitative and qualitative data collection methods to establish the following:

- The quality of existing road through the study area, including their condition, level and type of traffic activity, type and density of frontage, and any perceived road safety issues which were immediately apparent;

- Quantitative traffic flows through key junctions to feed into a database of existing traffic flows through the network. While this is a key input to the development of the traffic model, it is also useful to supplement the site observations with a robust measurement of the density of traffic movements through the network. Traffic flows for Light Goods Vehicles and Heavy Goods Vehicles for both the AM and PM peaks are a combination of flows surveyed in 2005, 2004 and 2003 (with flows from 2003 and 2004 being growthed based on NRA National Growth Rates to reflect 2005 conditions);

- Queue length observations during peak conditions to assess actual delays on site, which will be used to correlate a realistic model of the current conditions, and to identify the causes for these delays e.g. poor traffic management, high levels of parking, narrow road widths, poor sightlines etc; and

- A drive-through of all roads to establish free running speeds to assist in the development of the traffic model, and to further determine existing levels of service.

2.2.3. General Problems/ Issues

With the data collection complete, it quickly became clear that there are a number of broader issues of significance to the study that are common across all localities. As such, a schedule of these wider-reaching problems is first presented before detailed issues can be addressed. Such wider issues include the impacts of the pattern and scale of development in the study area, the effects of transport policy, and the interaction between different localities. The key issues can be defined as follows:

- The dominance of north-south accessibility through the study area, and the relatively poor provision for east-west movement to support this. As a result, the majority of local traffic is fed onto the Dublin Road, which is the only access road onto the M11, and is fed by a poor network of substandard east-west links;

- The rural nature of large parts of the area, leading to a car-based pattern of travel demand. This is an issue of key relevance in the consideration of transport policy, and will become a significant problem if such patterns of car dependency are retained with any future development of the area;

- The poor quality of the existing road network to the west of the M11, as a result of the difficult topography and historically low traffic volumes;

- The network-wide effects of isolated restraints in the local network, leading to increases in vehicle kilometres and hence environmental impact as drivers make long detours to save on journey time; and

- The limited entry points to the study area, such as the Wilford Interchange and the Killarney Road Interchange, through which the significant majority of vehicles must currently travel. Both locations suffer from delay during peak periods, and effectively choke the development of the area as a result of this restraint on entry during peak periods.

The above issues are therefore quite broad, and relate to the study area in its entirety. Whereas an understanding of these wider issues allows more appropriate consideration of the direction and outline of the final Transport Strategy, it is the detailed issues and problems that facilitate the generation of the design solutions. These are discussed below.

2.2.4. Detailed Problems/ Issues

Detailed issues reflect capacity constraints, road safety issues and unfavourable layouts at particular locations, and detailed remedial measures can be considered to overcome them. Further consideration of how such detailed problems will be impacted upon by future growth in the study area will be addressed later in this report. The relevant concerns are outlined below:

- Major queuing along the Dublin Road to and from Bray Town Centre during the peak periods. This results from the limited number of access routes into Bray Town Centre, and the high volume of car trips generated by the town. In addition, queuing at the Killarney Road Interchange which occurs during the PM Peak leads to increased traffic movements via the Dublin Road to access Bray town centre;

- Significant queuing and delay through the junction of Old Connaught Road and the Dublin Road, restricting access to Bray Town Centre not only from the N11, but from Old Connaught and areas further west;

- The requirement for vehicles to/from Old Connaught to route along the Dublin Road and through the junction with Old Connaught Avenue. This further exacerbates the traffic congestion problems at this junction;

- PM Peak queuing at the Killarney Road Interchange, stretching back onto the N11 and into the southbound carriageway. This queuing occurs as traffic leaving the N11 yields to traffic on the roundabout accessing the northbound carriageway from the Bray Southern Cross route. Queuing on the northbound exit also occurs during the AM Peak;

- Southbound queuing on the M11 during the PM Peak between the M50 and south of the Wilford Interchange. This queuing results from capacity limitations on the M11/N11, and from the impact of traffic merging from the M50.

- The poor alignment of the R117 (Twenty Bends Road), and the consequential road safety concerns due to its narrow alignment. Buses and heavy vehicles are also expected to use this route which is not ideally suited to large vehicles;

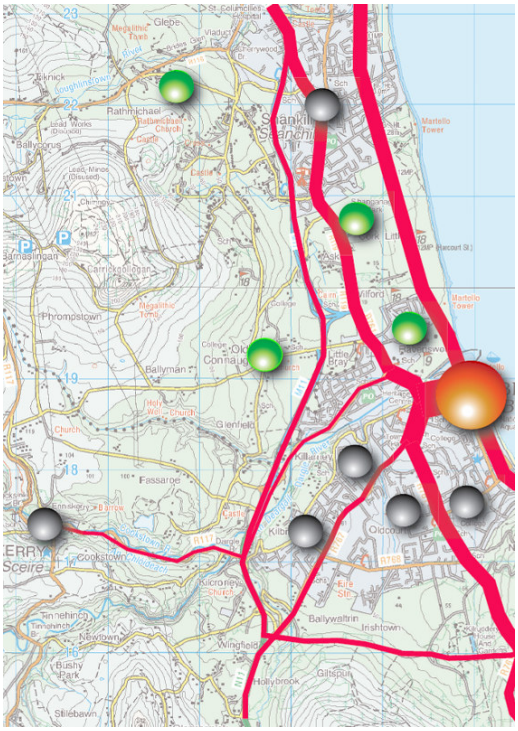
- The poor quality of the connection between Old Connaught and Fassaroe. Although a road is currently provided (Thornhill Road), it is of extremely poor quality, and would not be suitable for any appreciable level of traffic activity;

- The safety implications of any queuing and delay on the M11 or N11 where high vehicle speeds are normally expected. This is an issue at the Killarney Road Interchange where queuing commonly extends along the mainline carriageway, and southbound on the M11 during the PM Peak; and

- The occurrence of car parking associated with Park & Ride around the DART stations at Bray and Shankill, and the potential for such behaviour to materialise at the proposed Woodbrook DART station or indeed any future Light Rail stops. Such parking creates problems for pedestrian movement, residential parking and local business when not adequately managed;

2.3. Public Transport

2.3.1. Existing Public Transport Provision



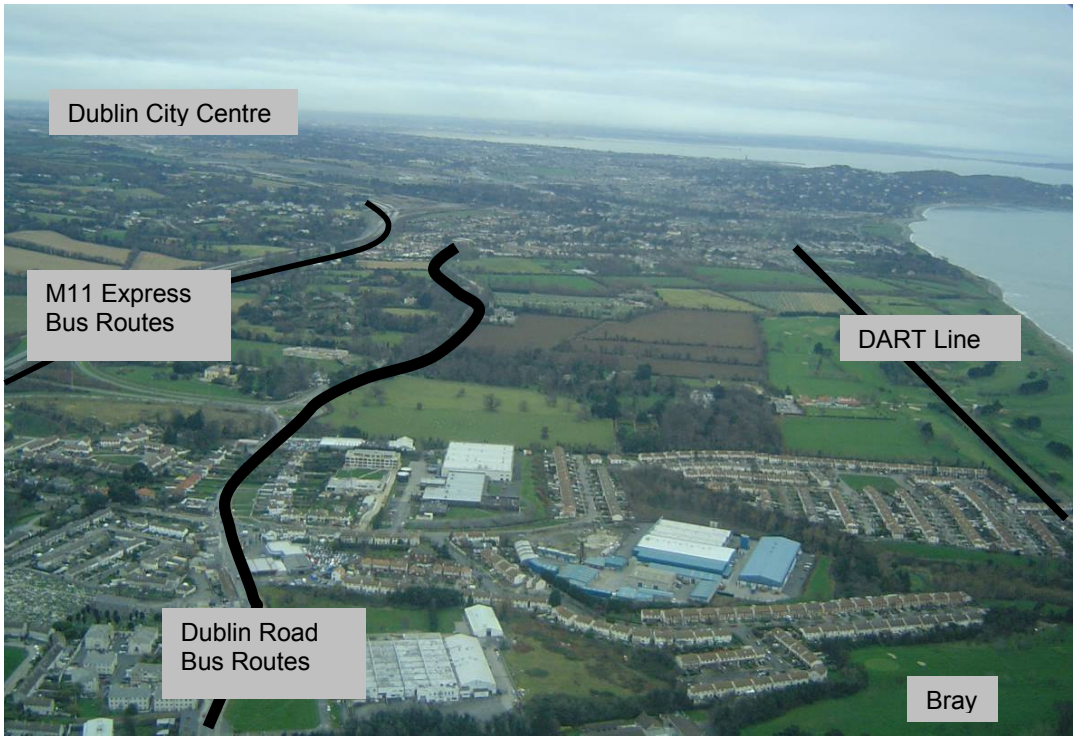
As with the road network, the main pattern of public transport services runs north-south along the eastern coastline. The DART line runs along the eastern coastline between Wicklow and Dublin, with the majority of users from Bray travelling to/from Dublin City Centre. This service is frequent between Bray and Dublin, with some services running further to Greystones, more so in the peak hours. Dublin Bus services mainly run along the Dublin Road, again between Bray and Dublin City Centre, while a further number of express services use the N11/ M11 bypassing Bray Town Centre. These north-south services tend to have both high frequencies and patronage during the morning and evening weekday peaks, ensuring the commercial viability of these services, even without any of the predicted future development in the study area. Other north-south routes include late night services run by both Dublin Bus and Finnegan's bus.

In addition to these north-south routes there are a number of services that run between Bray and areas other than Dublin City Centre. Some of these services are local shuttle services to connect relatively close by areas with the mains hubs of transportation in Bray, for example Finnegan's bus runs half hourly services between Bray DART station and the Bray Southern Cross Road. Other Dublin Bus services connect Bray with neighbouring residential areas such as Greystones, Enniskerry and Kilmaconogue and these services are somewhat successful in achieving access to Bray Town Centre for less frequent activities like shopping and leisure activities. These local services are, however, the only current public transport facilities serving Bray Town Centre to outlying areas south of the town, and can suffer from low levels of patronage and unreliable services due to poor bus priority provision.

A summary of all public transport services serving the Study Area is outlined below in Table 2.1. The table shows a combined peak frequency of some 13 buses/hour along the Dublin Road leading to/from Bray, and highlights the importance of this link in facilitating public transport access into Bray from the Greater Dublin Area.

Table 2.1: Existing Buses Serving the Study Area

Route	Details	Services/Hour (Peak)	Services/Hour (Off Peak)
Serving Bray to/from North via Dublin Road			
45	City Centre – Bray	4	3
45A	Dun Laoghaire - Bray	4	4
145	Dublin – Bray and Kilmacanogue	3	3
84	Dublin – Bray and Newcastle	2	1
Serving Other Parts of Study Area			
185	Bray – Enniskerry	3	2



2.3.2. Data Collection

Existing Public Transport data was collated from timetables and interviews with bus operators. Significant focus was also placed on undertaking local observations, thereby allowing a realistic viewpoint of the services, their frequency, reliability, patronage and generally their popularity to those living and working in the area.

2.3.3. General Problems/ Issues

During the data collection process it became apparent that there were a number of main issues with regards to the existing public transportation services available in the study area. These issues relate both to the study area itself, and its relationship with Bray Town Centre, Wicklow and Dublin. The key issues are listed below:

- The eastern coastal area is well serviced by high frequency public transport between Bray and Dublin City Centre along the Dublin Road and the N11/ M11, whilst west of the M11 no services are currently available. Currently the lands around Rathmichael, Old Connaught and Fassaroe have low-density developments. Consequently, the accessibility between these lands west of the M11 and Bray Town Centre is currently based on the use of the car, a situation that will be difficult to support if and when these lands are developed;

- As mentioned above there are many services running north-south between Bray and Dublin City Centre, and recent works to improve the level of bus priority along the N11 have greatly improved patronage along this corridor. The scope for such services to tap into other shopping, leisure and residential areas away from this corridor is, however, currently limited. Access from the Bray environs is focused on travel to/from Dublin, with further services providing limited local access into Bray. Improved access to alternative major trip generators in the Dublin Area will be crucial to avoid unwelcome increases in car use;

- The only existing public transport interchange in the study area is at Bray DART station between DART and bus services. This interchange is, however, somewhat constrained as a major local node in the public transport network. This is primarily due to traffic congestion through Bray Town Centre along the key bus access routes, and the inconvenient location for bus-bus interchange which requires a potentially significant route diversion for some services;

- The limited extent of bus priority through the area, and the impacts of this on bus journey times; and

- It is known that substantial amounts of people drive from Wicklow northwards to Dun Laoghaire – Rathdown and elsewhere throughout the Greater Dublin Area on a daily basis. At present, Park & Ride within the Study Area is occurring informally at Bray and Shankill DART stations, and is reducing on-street parking availability in residential and commercial areas. Such behaviour restricts accessibility to stations, and can inhibit community and economic activity if not adequately managed in an appropriate location. At present, no formal facility exists within the study area.

The issues outlined above therefore revolve heavily around the pattern by which public transport has grown in the Bray Environs area. Services are all confined along a specific corridor, and access from areas to the south of Bray to areas north can be difficult primarily as a result of traffic congestion.

2.3.4. Detailed Problems/ Issues

A closer look at the public transportation services brought a number of detailed problems to the fore, and these were particularly apparent on site visits and through discussions with users of these services. These detailed issues consider individual routes, delays experienced on them, certain shortcomings in routes that are available etc. and these are listed below:

- Many of the existing Dublin Bus services run along the Dublin Road but due to capacity constraints queuing occurs between the Wilford Roundabout and Bray Town Centre during both the Am and PM Peaks, and this reduces the efficiency of these services considerably;

- Some bus stops along the Dublin Road are positioned on footpaths that are narrow and therefore reduce the safety of awaiting and alighting passengers, especially during peak times.

- A length of inbound bus lane exists near Woodbrook where the Dublin Road is sufficiently wide. Nevertheless, this section of bus lane does not greatly improve travel times as congestion is not a particular problem here at present, although this would be expected to be of greater benefit to buses as traffic flows increase;

- The bus service to Enniskerry uses the R117 (Twenty Bends Road) which forms the only feasible access road into Enniskerry from the Bray area. The alignment of the R117 is poor and hence is not ideally suited to bus movement. Enniskerry is therefore relatively isolated from Bray, and there is limited opportunity to tap into the residential catchment there to support activity in Bray Town Centre;

- The Study Area is quite remote from Dublin City Centre. With any consideration of the provision of Luas, it must be considered that the Luas journey time to the City Centre could if not adequately designed, be significant, and competition with the DART for travel to the City Centre could be poor. As such, the Luas would act more as a facility to open up access to areas such as Sandyford and Dundrum to which existing DART services are not currently focused. This is a key consideration in the development of the Luas Line B2 options;

- Bus services that run to Bray DART station or further through Bray Town Centre experience delays as a result of general traffic congestion and on-street activity through Bray Town Centre. This introduces the effect of isolating the DART station not only from the Town Centre, but also from the local bus network;

- DART services recently approached capacity during peak commuter hours, although this has been addressed by platform extensions and lengthening of trains. With significant increases in future population and employment in the Bray Environs it is possible that these peak hour services could return to capacity levels.

- Parking in Bray Town Centre is structured such to facilitate an element of long-stay parking by commuters. This uses up significant parking space which leads to difficulties in parking for shoppers and visitors to the town. The availability of parking reduces the incentive for public transport trips during peak hours when services are at their most

frequent, hence reducing the viability of such services. Despite this, an unmanaged reduction in on-street parking provision can instead lead to illegal and inappropriate parking which results in delays to bus travel.

2.4. Pedestrians and Cyclists

2.4.1. Existing Pedestrian & Cyclist Infrastructure

In addressing pedestrian and cyclist issues, particular interest is given to user safety, not only in physical terms such as even surfaces, tactile paving etc., but also in social terms whereby users may feel threatened by their surroundings. Such deterrents can generally be overcome by lighting, people presence along routes, overlooking occupied buildings etc. It is known, for example, that the introduction of an exemplary cycleway is useless unless cyclists feel safe and do not feel threatened by using such a facility during dark evenings.

Pedestrian and cyclist facilities exist and are of reasonable quality along some sections of the Dublin Road, which is the main corridor for such movements. Despite the focusing of resources on this route, however, there are few safe crossing points. There are naturally no pedestrian and cyclist facilities on the M11 motorway and while a number of existing crossings over the motorway are available, there is a further pedestrian bridge currently being considered adjacent to the R117. Pedestrian and cyclist facilities deteriorate further inland and in many places do not exist, particularly in the areas of Fassaroe and Rathmichael/Ballyman.

2.4.2. Data Collection

Site visits, both on foot and by bicycle, were carried out to ascertain the existing services for both pedestrians and cyclists. These surveys were carried out during peak hours such that queuing was prevalent and its impact on cyclists and pedestrians was notable. As mentioned above particular emphasis was put on the safety of the facilities as they exist currently and issues relating to this were also noted.

2.4.3. General Problems/ Issues

Examining the study area in broad terms, the issues of relevance to both pedestrians and cyclists can be defined as follows:

- The crossing points across the M11 are limited, and the motorway acts as an effective barrier between the west of the study area, and the relatively built up eastern coastline. By limiting pedestrian and cyclist facilities a feeling of isolation develops, and this encourages car use for relatively short trips that would otherwise be made by other modes if facilities were available. High levels of car use in the study area are not sustainable, particularly given the future development proposals for the region;

- The Study area is comprised of predominantly rural roads. This combines with the pattern of rat running which is emerging along such roads as traffic conditions become more congested on the main strategic routes, and further reduces the attraction of the use of these minor roads to pedestrians and cyclists. Removing non-local traffic from such roads will be crucial to improving the pedestrian/cyclist environment on such rural routes; and

- With limited road widths, the provision of dedicated pedestrian and/or cycling infrastructure can be difficult due to constraints of topography and land availability. This can also hamper non-car uses as a means of travel thereby further increasing the traffic loading.

2.4.4. Detailed Problems/ Issues

There are also more defined problems with the cyclist and pedestrian facilities in the study area and these issues are listed below.

- As the Dublin Road approaches Bray Town Centre its width greatly decreases. This causes traffic to over-run on-street cycle lanes thus reducing the area available to cyclists and introducing the need for segregated cycle lanes. Queuing along these sections, and also on-street parking adds to this problem whereby stationary vehicles are positioned leaving no room for cyclists to pass;

- Ferndale Road and Thornhill Road are key routes providing access through the areas west of the M11. Despite this, they remain extremely narrow, which greatly reduces their appeal to both pedestrians and cyclists. The footpaths along these roads are substandard, if not non-existent and with future development and therefore higher levels of people movements through these areas these issues will need to be redressed;

- Ferndale Road and Thornhill road are heavily overgrown with foliage, and are not well lit. This decreases visibility and hence safety for pedestrians and cyclists, particularly during the winter months;

- Pedestrian facilities between Rathmichael and Crinken Lane, and thus to Shankill are poor, with little public lighting and limited provision of footways;

- Pedestrian access to/from Fassaroe and the Dargle valley can be extremely difficult, as all existing infrastructure is focused on road provision. There is a further pedestrian bridge across the N11 currently being considered adjacent to the R117.;

- The pedestrian environment along the Dargle Road and the Dublin Road can be quite poor as a result of traffic congestion, narrow footways, and difficulty in crossing the road; and

- The key approach to Bray Town Centre for pedestrians and cyclists is the Bridge on Castle Street, which suffers from narrow footways and a restricted road cross section. This leads to an unattractive environment for pedestrians and cyclists, thereby restricting access to the Town Centre.

2.5. Road Safety

2.5.1. Approach to Road Safety Assessment

Accident Statistics were taken between 1996 and 2002 for the study area so that an assessment of previous personal injury accidents could be undertaken. This information was taken from the NRA database of accident information, which allows accidents to be categorised by various parameters. This can assist in drawing conclusions as to the causes of the accidents that have occurred within the study area over the 6 year period. A discussion of the accident history based on this database and supported by site reports is provided below.

2.5.2. Site Observations

Site visits, by car, bicycle and foot were carried out during different peak times, and these were used to assess the safety of all concerned. Many issues with the current infrastructure became apparent, some more serious than others, and these are listed below:

- The sharp turn from Brides Glen to Rathmichael Road
- The proximity of busy retail units to the Dublin Road in Shankill
- The lack of lighting along the mainly residential Ferndale Road, with no footways, and sometimes poor road surfacing
- The lack of pedestrian crossings along Dublin Road
- Thornhill Road is very narrow with sharp bends and steep hills, with no lighting or footpath.
- Poor pedestrian facilities along Ballybride Road, which joins Rathmichael to Shankill
- The high volumes of traffic at the junction between the Dublin Road and the Upper Dargle Road, where there is a steep decline into Bray Town Centre.
- The restricted width of the Dublin Road in the vicinity of Bray Town Centre, which hampers cycling.
- The lack of pedestrian priority within Bray Town Centre, including at the bridge over the Dargle
- Queuing from the Killarney Road Interchange backing onto the N11
- The narrow and bendy R117 which serves reasonable volumes of traffic travelling between Enniskerry and the M11
- The proximity between interchanges on the N11 near Bray, especially between Killarney Interchange, R117 and the Fassaroe Interchange.
- The lack of crossings over the M11/N11 for pedestrians and cyclists

2.5.3. Accident Statistics

Accident data was analysed according to four different classifications to attempt to identify any particular patterns of accident activity, or clusters which would indicate a particularly unsafe arrangement currently exists. These classifications are discussed below.

Lighting Conditions

Accidents were classed according to the lighting condition (i.e. day or night) at the time of the accident. This showed that approximately 40% of the accidents recorded between 1996 and 2002 occurred during the night time. Of those that occurred during the night time only four were recorded in unlit areas.

While most of the accident clusters have an even spread of daytime and night time accidents, a number of exceptions exist which suggest particular dangers exist during the hours of darkness, the most notable of which is the accumulation of night time accidents occurring where queuing backs onto the N11 from the Killarney Road Interchange. Another cluster of night time accidents is visible around the Wilford roundabout, and it can be seen later that this is accounted for mostly by collisions with pedestrians. A further cluster of night time accidents is evident in the vicinity of Bray DART station, although the cause for this is unclear.

Multiple Vehicle Collisions

Another defining character of accidents is the number of vehicles involved, and provides some information regarding the nature of the accident. This information highlights areas with potentially difficult vehicle-vehicle conflicts.

Again the areas of concern are to the south of the study area, between the Killarney Road Interchange and the R117, with four accidents involving three or more vehicles. All other interchanges along the M11 also have a number of multiple vehicle collisions, with all three interchanges having at least one 3+ Vehicle accident. A high number of 2 Vehicle accidents are shown along the Dublin Road between Old Connaught Avenue and Upper Dargle Road, with concentrations on the Wilford Roundabout and at the Upper Dargle Road junction. The concentration of multiple vehicle collisions at the Killarney Road junction of the N11 suggests that the current queuing on the M11 is leading to significant safety problems.

Severity

Accidents are categorised as Fatal, Serious and Minor injuries, such that the severity of accident clusters can be highlighted. The first notable impact of this is the alarming number of fatal injuries at the Killarney Road junction, where 25% of accidents have resulted in a fatality, with a further 25% resulting in a serious injury. There is also another fatal injury at the Enniskerry Road junction.

Elsewhere, accidents are all relatively minor, with the only exceptions again being at the Wilford Roundabout and the Upper Dargle Road junction where a higher than average proportion of serious injuries results. Other accidents, serious and minor, occur in less confined areas along the Dublin Road between Shankill and Wilford, and in Rathmichael.

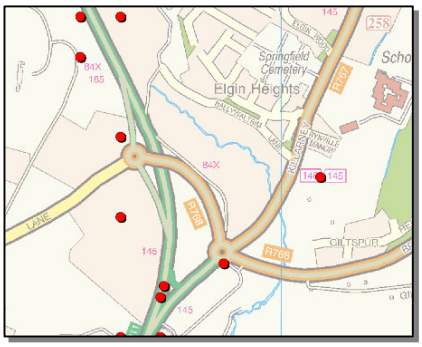
Pedestrian Accidents

Pedestrian accidents have also been highlighted to define any areas of particular difficulty along pedestrian desire lines. The assessment yields three main areas of pedestrian injury, namely the Wilford Roundabout, the Upper Dargle Road junction with the Dublin Road, and in Shankill Village. It is noted that the data reflects the period following the introduction of traffic calming measures in Shankill in 1998, and hence confirms that road safety remains an issue through Shankill village. Further accidents are noted at the junction with Enniskerry Road and at the Killarney Road interchange.

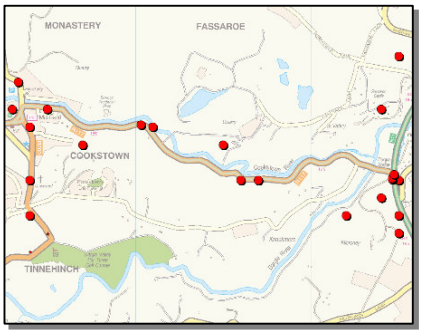
2.5.4. Safety Issues

By correlating all of the above accident data and the information obtained from the site visits it becomes apparent that the main areas of safety concern are as follows:

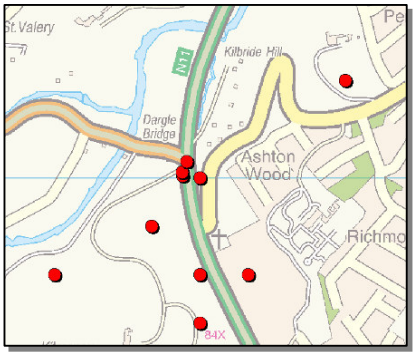
Killarney Road Interchange
A number of fatal and serious injuries generally occurred during the night time, involving 2 or more vehicles. Queuing backs onto the M11 from this interchange and this, in conjunction with poor visibility is assumed as the main cause of these accidents.



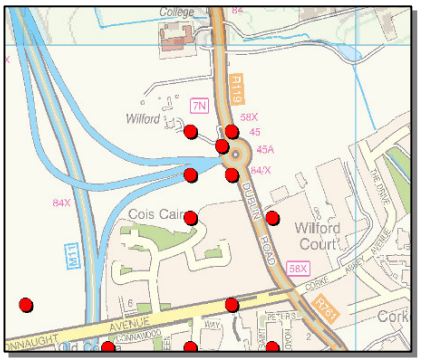
R117
This road is winding and narrow, and reasonable volumes of traffic use it to access the M11. The R117 itself is known locally as an accident blackspot, and a number of multiple vehicle collisions have been recorded, although no serious accidents are noted over the period 1996-2002. More recent data suggests that this trend is continuing, despite a reduction in the speed limit to 50kph in 2002.



Priority junction between R117 and M11
The proximity between this junction and the Fassaroe Interchange results in vehicles merging along a short stretch of the N11. The analysis identified a cluster of 3 accidents over the 6-year period, with two of these occurring during daylight hours. One accident was reported to involve a pedestrian. The short length for weaving between the Killarney Road Interchange and the R117 places a higher mental loading on drivers, and this is likely to contribute to the higher risk of accidents at this location.



Wilford Roundabout
Both daytime and night time accidents have been reported at this location, with only one such accident resulting in a serious injury. A notable proportion of accidents at this location were reported to involve pedestrians, and can be explained by the lack of pedestrian facilities through the roundabout.



Old Connaught Avenue
Many daytime accidents happened near the slip road from the M11 onto Old Connaught Avenue, two of which were serious.

Ferndale Road
This narrow, windy road, with single dwellings along its length, carries relatively high volumes of traffic between Rathmichael and Old Connaught. Two accidents occurred on this road between 1996 and 2002, one of which resulted in a serious injury.

Rathmichael Road
Two serious and one minor accident are recorded involving two vehicles in each accident at the junction between the Rathmichael Road and Brides Glen. The sharp turn from Brides Glen not only greatly reduces visibility for drivers, but also exposes vehicles turning left towards Rathmichael as they are required to swing out into opposing traffic. The priority has recently been changed at this junction and may lead to a reduction in future accidents.

Shankill
The cluster of accidents in Shankill is evident in the town centre, almost all of which occurred during the daytime. A considerable amount of these accidents involved pedestrians resulting in minor injuries. There is a central shopping area on the Dublin Road in Shankill and high numbers of pedestrians and vehicles are present. However, traffic calming measures and pedestrian crossings were introduced in 1998 throughout the Shankill area. Nevertheless, accidents continue to occur through Shankill, although there does not appear to be any dominant factor or type of collision, and there is no particular dominance of pedestrian injuries.

Upper Dargle Road
A number of serious and minor accidents occurred near the junction between the Upper Dargle Road and the Dublin Road, although no single accident type was evident from the data. The Dublin Road steeply declines from the junction with the Upper Dargle Road and the Dublin Road, and as such the visibilities to/from the south of this junction are restricted. Additionally this junction carries high volumes of vehicles, cyclists and pedestrians, and also includes an entrance to a school opposite the Upper Dargle Road.

2.6. Land Use and Development Patterns

2.6.1. Description of Environment

The Study Area can effectively be segregated into four main areas. These are:

- The areas between the M11 and the railway line, which are currently the focus of activity through the study area. Although developed to different densities, and with a number of different uses, this area is effectively suburban in nature, with a mixture of industrial, commercial and low density residential units. The area is both a trip generator and attractor, funnelling additional home based traffic onto the Dublin Road and M11, and attracting trips to employment from throughout the Greater Dublin Area;

- Bray Town Centre, to the south of the Study Area, which supports development along the Dublin Road corridor. Bray is a major local destination for shopping and work trips, and all transport infrastructure along the Study Area is focused into it. The area is typically of higher density, and the boundary between the Town Centre and the outlying areas is well defined by the River Dargle;

- The areas to the west of the M11, which are rural in nature, predominantly undeveloped save for limited low density residential use, and where topographical constraints and poor transport provision have limited development of the lands to date. Such lands extend from Rathmichael in the north to Fassaroe in the south, and are the subject of significant future development proposals; and

- The areas to the east of the railway line, which are currently Greenfield, and to which access is heavily restricted. The Woodbrook Golf Course covers a significant proportion of these lands

With the current pattern of development in the area, transport patterns are easily definable through the Study Area, and result from the connection between a focused number of origins and destinations. For the area in question, the movement pattern is effectively between the three populated areas as defined above (i.e. excluding the land to the east of the railway line). In addition, however, two further patterns of movement exist between the Dublin Area and Bray, and between the Dublin area and areas to the south.

2.6.2. General Problems/ Issues

In examining the existing patterns of movement, it is clear that the main demands are those with an origin or destination within the Study Area. Traffic which travels north-south through the area invariably uses the M11/N11, and hence the impact on the Study Area is minimal. As such, the consideration of such traffic is of limited importance, save for an understanding of traffic flows in the design of any potential junction upgrades. In examining existing land use and travel demand, a number of key issues can be flagged for consideration as part of the current strategy. These are:

- The concentration of retail, and employment facilities in Bray Town Centre, and hence the requirement for the outlying areas to travel into Bray for relatively straightforward activities which cannot be undertaken locally. This leads to increased travel demand;

- The provision of schools in quite rural areas of Old Connaught and Rathmichael which generate significant volumes of peak hour traffic on unsuitable roads. These schools are remote from the more densely populated residential areas and access other than by car can be difficult. The key schools of concern are; Aravon School on Ferndale Road and St. Gerard's School on Thornhill Road;

- The low density pattern of development along the Dublin Road, and the requirement for future residential development to therefore take place in areas with significantly less transport provision, such as Fassaroe, for which planning permissions have been refused on this basis;

- The existing focus of transport provision in serving the Dublin Area as opposed to focusing on Bray Town Centre. This has led to the bypassing of Bray by a number of Public Transport services, and hence the loss of attraction of Bray as a shopping and employment destination;

- The somewhat low level of development in the vicinity of Bray DART station and along the railway line leading into the town, and the effect that this has in masking the railway line from its catchment, leading to a loss in perceived accessibility; and

- The low densities that currently exist within the study area mean that high quality public transportation services are not sustainable. High frequency bus services, the Luas etc. are only sustainable if there is a high density of users available and therefore the current densities of developments along the western side of the M11 make it unrealistic for these services to access these areas.

There are therefore a number of issues which deserve consideration in the future development of the area which allow a parallel consideration of land use and transport requirements. Although firm proposals have already been tabled regarding development of the Study Area, there remains significant potential to guide this development in such a way that these issues can be successfully tackled.

3. PRELIMINARY CONSULTATION

3. PRELIMINARY CONSULTATION

3.1. Introduction

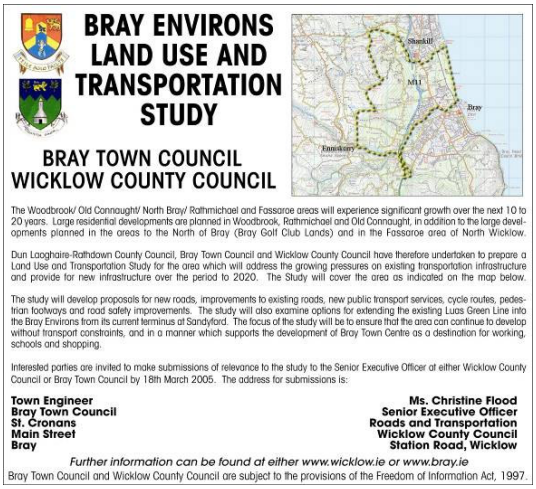
As part of the data collection process a period of initial consultation was undertaken, which informed local residents, business, councillors' etc. of the objectives and scope of the current study. This process was intended to generate a general awareness amongst stakeholders providing an opportunity to respond in submissions thereby supporting the understanding of relevant issues by the study team.

3.2. Consultation Process

The consultation process was carried out separately for Dun Laoghaire – Rathdown and Wicklow/Bray as advised by each respective council. The form of consultation as undertaken is outlined below.

Dun Laoghaire – Rathdown

Letters were sent out to a list of residents associations, community associations, councillors, and some government bodies as specified by Dun Laoghaire – Rathdown County Council. The letters invited submissions from parties involved, and led to a high level of response from invited parties.



BRAY ENVIRONS LAND USE AND TRANSPORTATION STUDY

BRAY TOWN COUNCIL
WICKLOW COUNTY COUNCIL

The Woodbrook/ Old Connaught/ North Bray/ Rathmichael and Fassaroe areas will experience significant growth over the next 10 to 20 years. Large residential developments are planned in Woodbrook, Rathmichael and Old Connaught, in addition to the large developments planned in the areas to the North of Bray (Bray Golf Club Lands) and in the Fassaroe area of North Wicklow.

Dun Laoghaire-Rathdown County Council, Bray Town Council and Wicklow County Council have therefore undertaken to prepare a Land Use and Transportation Study for the area which will address the growing pressures on existing transportation infrastructure and provide for new infrastructure over the period to 2020. The Study will cover the area as indicated on the map below.

The study will develop proposals for new roads, improvements to existing roads, new public transport services, cycle routes, pedestrian footways and road safety improvements. The study will also examine options for extending the existing Luas Green Line into the Bray Environs from its current terminus at Sandyford. The focus of the study will be to ensure that the area can continue to develop without transport constraints, and in a manner which supports the development of Bray Town Centre as a destination for working, schools and shopping.

Interested parties are invited to make submissions of relevance to the study to the Senior Executive Officer at either Wicklow County Council or Bray Town Council by 18th March 2005. The address for submissions is:

Town Engineer
Bray Town Council
St. Cronans
Main Street
Bray

Ms. Christine Flood
Senior Executive Officer
Roads and Transportation
Wicklow County Council
Station Road, Wicklow

Further information can be found at either www.wicklow.ie or www.bray.ie

Bray Town Council and Wicklow County Council are subject to the provisions of the Freedom of Information Act, 1997.

Wicklow/ Bray

In this case public advertisements were shown in local papers, namely The Wicklow Times, The Wicklow People and The Bray People. As in Dun Laoghaire – Rathdown this advertisement was supplemented by a webpage on the Wicklow County Council website, inviting submissions from the public with regards to the project. Again, a significant level of response was achieved covering a broad range of issues.

3.3. Submissions

A good deal of response was achieved during the initial consultation process, and a broad range if issues were raised. As expected, there was a high level of overlap, with many submission touching on common issues, and this allowed a better understanding of the importance of the different issues amongst the various stakeholders within the communities. It was noted that a number of submissions addressed perceived problems with proposals being put forward by others that were not at that stage under consideration within the current study. This was nevertheless useful information in understanding likely public response to the individual measures within the final strategy.

A summary of the main issues and suggestions raised in the submission material is outlined below, with material grouped into relevant categories as appropriate.

Study Area

- Reduce the need to travel by encouraging a range of mixed land uses;
- Minimise the use to the private car by encouraging the use of public transport, cycling and walking;
- All new roads, cycleways, bus corridors etc. should include high quality, sustainable planting schemes;
- Impacts arising from the Bray Golf Club lands and Industrial Yarns site will have detrimental effects on traffic flows within the town centre area.
- Woodbrook/Shanganagh and Fassaroe developments further contribute to congestion especially at Upper Dargle Road Junction and Wilford Roundabout.
- Adequate open space should be required within new developments; and
- Concerns regarding noise levels from existing and future roads.

Corke Abbey

- Proposed pedestrian footways into Bray will encourage 'anti social behaviour';
- Proposed 4 storey buildings will overlook existing estate;
- Proposed road (through Corke Abbey) will be used to bypass the congested parts of the town and used as a gateway to the harbour, including HGV traffic;
- Proximity between the proposed road (Corke Abbey) and the Old Connaught Junction, together with traffic generated by new developments proposed in the area, would only exacerbate current congestion problems;
- Alternative junction at Ravenswell would provide direct route to M11/M50 along Upper Dargle Road;
- Request "to protect and preserve Trees and Woodlands"; and
- Developers should contribute financially to local community facilities.

Woodbrook/ Shanganagh

- Existing mature trees should be retained;
- Re-alignment of Dublin Road is required to improve capacity in the area;
- Dublin Road is already congested prior to further developments, especially towards Shankill in the morning;
- Right hand lanes, bus lanes, cyclelanes etc. are required along Dublin Road at Woodbrook to facilitate development;
- Divert unnecessary commuter traffic going through Shankill;
- Pedestrian lights should be installed on Dublin Road opposite Shanganagh Cemetery;
- Integrated transport hub should be provided within the Woodbrook/ Shanganagh local area; and
- Shanganagh Park should be preserved in its entirety to provide a buffer between Shankill and proposed developments at Woodbrook.

Wilford

- A new slip road from the Wilford Roundabout to facilitate traffic into estates at Corke Abbey and Woodbrook Glen

Old Connaught

- Upgrade the connection between Old Connaught Avenue and M11/N11;
- Interchange upgrades will impact on Christian Brothers Lands;
- Rearrange Wilford Roundabout to relieve Old Connaught Avenue;
- Direct access should be given to M11 to discourage the use of Ferndale Road;
- Closing the present slip road from the M11 northbound onto Old Connaught Avenue;
- Provide road signage to route all through-traffic onto a ring road south of Old Connaught Avenue;
- Keep all but local traffic off Old Connaught Avenue;
- Introduce traffic calming along Old Connaught Avenue including improved pedestrian and cyclist facilities;
- Footpath provision and traffic lights to enable access to/from Festina Lente on Old Connaught Avenue;
- Thornhill Road is narrow and dangerous and impossible to improve;
- Increase in local traffic due to developments will destroy the character of the area;
- Traffic must be rerouted away from the Village Green area;
- Provide local shops centrally to proposed developments; and
- Infrastructure should be improved prior to opening the proposed developments.

Fassaroe

- Proximity of this area to M11 and M50 make it well located for industry and employment centres;
- Planned works at Enniskerry Junction will contribute to the area's development potential;
- Fassaroe developments are too close to Enniskerry, reducing the buffer zone between Enniskerry and Bray;
- Development of Fassaroe is not regarded as acceptable or important, and should be done so as a last resort should all other development opportunities be exhausted;
- Excessive road infrastructure may compromise the setting of Enniskerry as a rural town with natural protection from the development of the north Wicklow region. Significant improvements to accessibility would threaten this situation; and
- It is thought after the opening of the M50 the R117 relief road will not be needed.

Rathmichael

- Retain rural environment in this area;
- Overdevelopment proposed for this rural area;
- Restrict development above 90m contour line;
- Buffer zone between high density development and the country side;
- Ferndale Road and Ballybride Road should not be widened, as this will increase speeding;
- If widening is essential it should be done on one-side only to retain as many hedgerows as possible;
- Construction of parallel roads rather than road widening to protect existing trees;
- Restrict traffic volumes along Ferndale Road;
- A significant traffic reduction is expected on Ferndale Road after the opening of the M50;
- Roads should be resurfaced after the opening of the M50, and restrictions should be put in place to prevent large goods vehicles using these roads afterwards;
- Ballybride Road has no speed limit signs;
- Closure of Lordello Road to through traffic should be considered;
- Divert traffic from future developments in Rathmichael directly on/off the M11;
- Provide bus services from Rathmichael to DART/Luas/QBC;
- Montessori and playschools are on both Ferndale and Ballybride Roads;
- Require pedestrian links to Shankill village centre;
- Installation of footpaths and public lighting to improve pedestrian safety in this popular walking area; and
- Keep heritage trail to Puck's Castle.

Woodbrook DART station

- Woodbrook DART should be operational by the time work begins at the Woodbrook site;
- Woodbrook DART station should be fully accessible for physically handicapped persons;
- This service should incorporate an integrated transport ticket;
- A feeder bus should connect DART station with Shanganagh Castle, Castle Farm and Crinken Lane;
- Call for a taxi rank at the proposed Woodbrook DART station; and
- Park & Ride adjacent to the DART / Luas station at Woodbrook.

Bus

- Existing QBC should be extended as far as Wilford roundabout;
- Provision of loading and parking on Dublin Road alongside and QBC proposals;
- New bus services are required to run east-west across the study area;
- Regular feeder bus system linking Old Connaught with the QBC along the Dublin Road, DART stations and Bray Town Centre;
- Increase in the 45A service;
- Extension of the 7B service; and
- All buses servicing the area should have low floors.

Luas

- Envisage the Luas extending from Cherrywood to Rathmichael, Old Connaught and onto Woodbrook/Old Bray Golf Club;
- Luas is completely uncalled for, the area is already sufficiently serviced by the DART and buses;
- Luas is welcomed in the Rathmichael area to facilitate new developments;
- Integrate the Luas with the DART at Woodbrook; and
- Pedestrian walkways for physically impaired should be put in place over/under rail/tracks.

Cycle Routes

- New cycleways should be provided as part of a greenway network;
- Cycleways should be surfaced in different coloured material; and
- Cycle parking facilities should be provided at proposed Woodbrook station.

Pedestrian Footpaths

- Footpath system in new residential areas should minimise walking distances;
- Footpaths should link estates to schools, communities and retail facilities;
- Greenways should link parks and green spaces within study area;
- New footpath should be sufficiently wide for two buggies to pass;
- Dished pavements with gentle gradients should be provided for mobility-impaired users; and
- Coastal walk should be provided.

Traffic Calming

- Traffic calming should be incorporated into new residential areas and adequate speed and safety signage provided; and
- Traffic calming along Old Connaught Avenue, including permanent weight restriction.

3.4. Summary

The feedback from the consultation process was therefore substantial, and provided input to the study at all levels of detail. The key message was the requirement for development of the area in a manner that could be sensitive to existing rural setting, but whilst ensuring that general transport accessibility is improved. These issues have therefore been incorporated into the transport strategy as will be demonstrated later in this report.

4. THE TRAFFIC MODEL

4. THE TRAFFIC MODEL

4.1. Introduction

This chapter presents an overview of the modelling approach used to develop the traffic forecasts for the Study area for the period up to 2020. The traffic forecasts allow a good understanding of potential traffic flows and patterns throughout the network over the future years, thereby allowing particular solutions to be developed and assessed in terms of their impact in addressing expected demands.

4.2. Forecasting Approach

A comprehensive transportation demand forecasting model has been developed by the Dublin Transport Office (DTO) to provide a useful planning tool for the Greater Dublin Area. The model was developed from an extensive survey of travel behaviour conducted across the Greater Dublin Area, and has been successfully validated as a forecasting tool. The model was developed as part of the development of the 'Platform for Change' Strategy, extending from Drogheda in the north to Arklow in the South, and Kildare in the west, with an increasing level of detail and accuracy as one travels further into Dublin City Centre. For the Bray area, the model has been constructed at a reasonable level of detail, although some further work was necessary to improve the model as a forecasting tool for use in the current study.

The basic structure of the DTO Model is as follows:

Trip Generation: Estimates the number of trips that will be made within the study time period (i.e. AM Peak Hour).

Trip Distribution: Links the trip productions and attractions to determine origin to destination travel flows.

Mode Split: Determines the travel mode for each origin to destination flow. A multinomial logit model is used to determine the breakdown by mode.

Trip Assignment: Determines the trip route through the given transportation system for each origin to destination flow.

In recognition of the interaction between the four components of travel behaviour, equilibration is achieved by iterating through the three stages of trip distribution, modal split and trip assignment until a reasonable level of conformity is achieved between assumed and actual highway travel speeds.

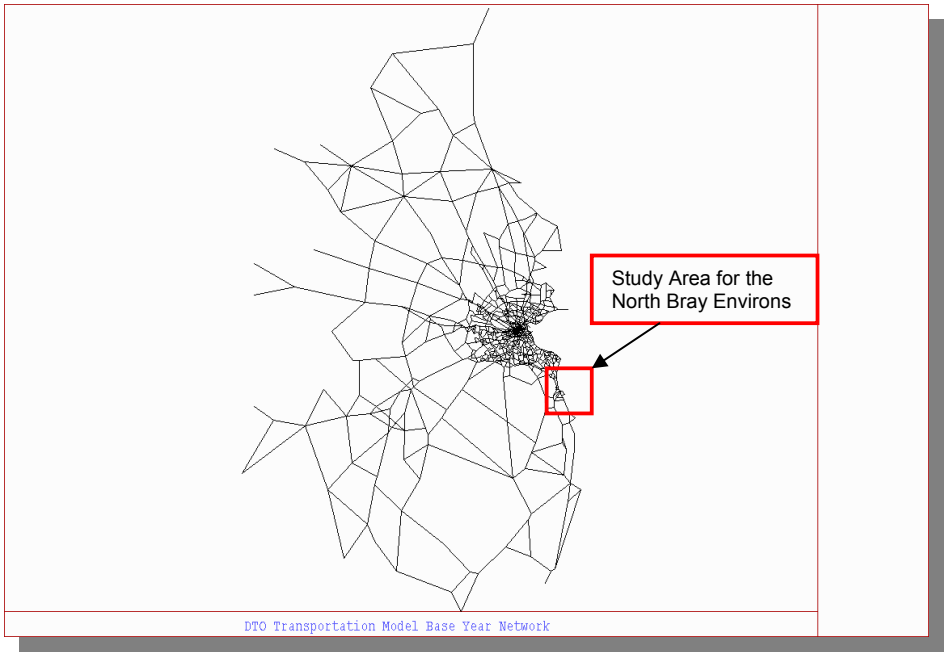


Figure 5-1: DTO Transportation Model Extent of Network

4.3. Local Area Modelling

As already stated, the level of detail of the DTO Model in the Bray area is not sufficiently refined for use as part of the current study, and hence some further enhancement was necessary to improve the quality of the model. Given the strategic nature of this network and the nature of the proposed developments in and around Bray, it was concluded that the most effective means of assessing the impacts of these developments would be to develop a Local Area Model (LAM), using the broader DTO model as a donor. The process by which this was achieved is known as *Cordoning*, and this process is undertaken within the SATURN software suite. Essentially, the cordoning process is used to extract the relevant network and zone definitions from a Full Area Model (FAM), by cutting a continuous screenline across the defined study area of interest. This achieves a number of purposes:

- Model run times are significantly reduced given a smaller network definition.
- The risk of assignment 'quirks' or 'model noise' can be minimised within a smaller analysis area.
- The local area network and zoning system can be improved to reflect more local conditions that would normally be appropriate for a strategic model.

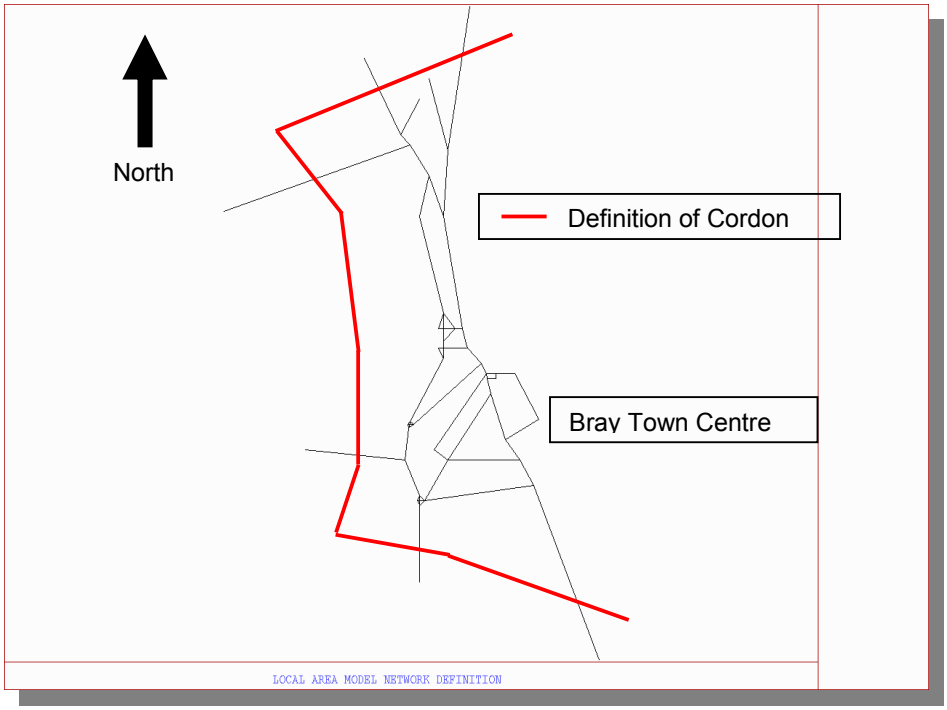


Figure 5-2: LAM Network Cordon

4.4. Refinement of the Zone System

The DTO Model incorporates some 542 zones across the Greater Dublin area. These zones define the demand for travel in terms of origins and destinations within the model trip matrices. The cordoning process described above resulted in a set of trip matrices for Heavy Vehicles and Light Vehicles comprising 57 zones, of these:

- 8 are External Zones, and;
- 14 are Internal Zones.

It will be noted that the external zones include all trips into and out of the cordoned area from the remainder of the Greater Dublin Area.

In analysing the internal zones within the LAM, it was concluded that specific zones could be further disaggregated into smaller zones to more accurately reflect current and future local conditions. In cases where new zones were created, the trip distribution characteristics of adjacent zones of a similar land-use was applied to the new zone trip generation and attractions. The revised zone system definition and percentage contribution to the relevant DTO model zone is detailed in Table 5-1.

Table 5-1: Recoded LAM Zone System & Numbering

Old Zones	New Zones	%	Old Zones	New Zones	%
50458	50458	100%	51566	5661	50%
				5662	50%
50459	4591	75%			
	4592	25%	51567	5671	17%
				5672	18%
50519	50519	100%		5673	25%
				5674	20%
51561	561	100%		5675	20%
51563	5631	10%	81235	9351	5%
	5632	30%		93511	5%
	5633	15%		93512	5%
	5634	5%		93513	5%
	5635	15%		93514	5%
	5636	25%		9352	25%
				9353	20%
51564	564	85%		9355	10%
	5641	15%		9354	20%
51565	5651	35%	81103	803	60%
	56531	4%		8031	40%
	56532	4%			
	56561	15%	81104	804	100%
	56562	15%			
	56563	3%	81105	805	100%
	5654	5%			
	5657	4%	81106	806	100%
	56521	3%			
	56522	3%	81232	932	100%
	56551	3%			
	56523	3%			
	56552	3%			

** A dummy zone 9991 has also been added but set to zero*

The result of this process is that the LAM incorporates 57 zones, of which 8 are external zones, and 49 are internal zones.

4.5. Changes to the Highway Network

In analysing the cordon model network, it was concluded that a number of additional road links would need to be added to the LAM to more accurately reflect local conditions, these are:

- M50 Interchange at Cherrywood (Note that this facility opened in August 2005, and was excluded from the base year model calibration)
- Cherrywood Road, Falls Road and Stonebridge Road in Loughlinstown
- Ballybride Road, Crinken Lane and Ferndale Road in Rathmichael
- Old Connaught Avenue, Ballyman Road and Thornhill Road in Old Connaught/Fassaroe
- Lower Dargle Road and various local distributor roads in Bray.

The inclusion of these links ensured that the impact of the development proposals on the general area could be fully understood as part of the Traffic Forecasting process. Figure 5-3 highlights where these additional links have been incorporated into the LAM network.

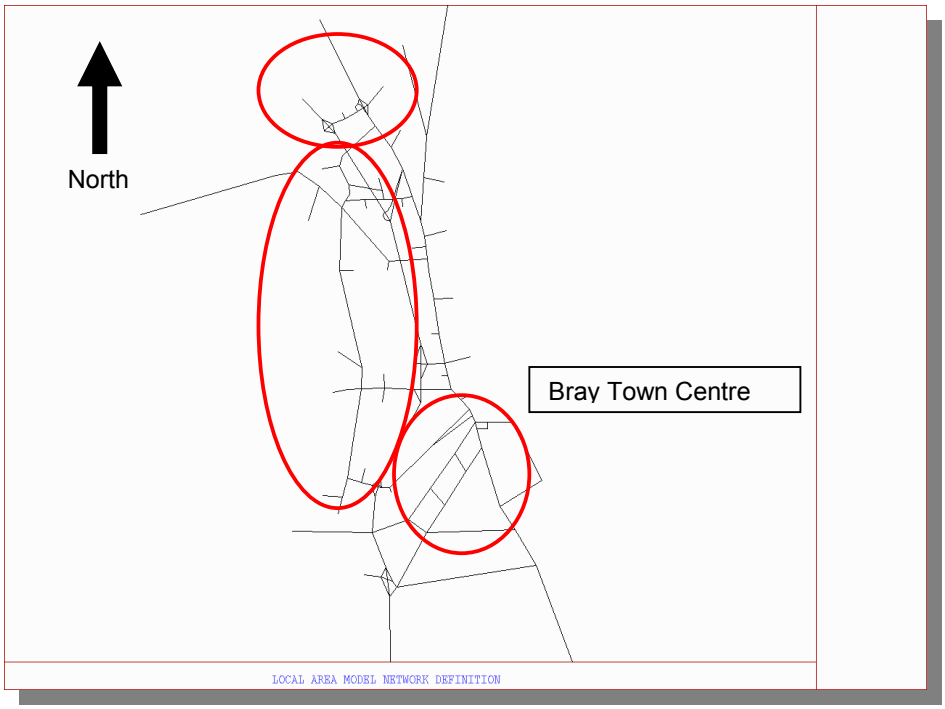


Figure 5-3: Routes added to the LAM Highway Network

4.6. Adopted Traffic Assignment Method

The SATURN suite of programs contains a number of assignment techniques that can be used within the modelling process. The DTO SATURN model assigns traffic according to a Stochastic Equilibrium Assignment, which is the default assignment traffic technique within SATURN. This assignment method is based on Wardrop's Principle of Traffic Equilibrium, which states:

"Traffic arranges itself on congested networks such that the cost of travel on all routes used between each O-D pair is equal to the minimum cost of travel and all unused routes have equal or greater cost"

The stochastic element of the assignment process allows for a degree of variability in route choice, in that not all assigned vehicles will necessarily pick the shortest or lowest cost route between origin and destination zone. This technique is believed to more accurately reflect driver behaviour in reality, and is considered appropriate for the purposes of this study.

For consistency with the DTO model, this Stochastic Equilibrium Assignment Method was also adopted for the Local Area Model.

4.7. Local Area Model Specification

The LAM derived from the donor DTO Transportation Model incorporates the following:

- 53 Priority Junctions
- 10 Traffic Signal Controlled Junctions
- 20 Roundabouts
- 22 Bus Routes
- 657 Assignment Nodes
- 987 Assignment Links
- 57 Zones

An overview of the zone connections to and from the highway network is presented below in Figure 5-4.

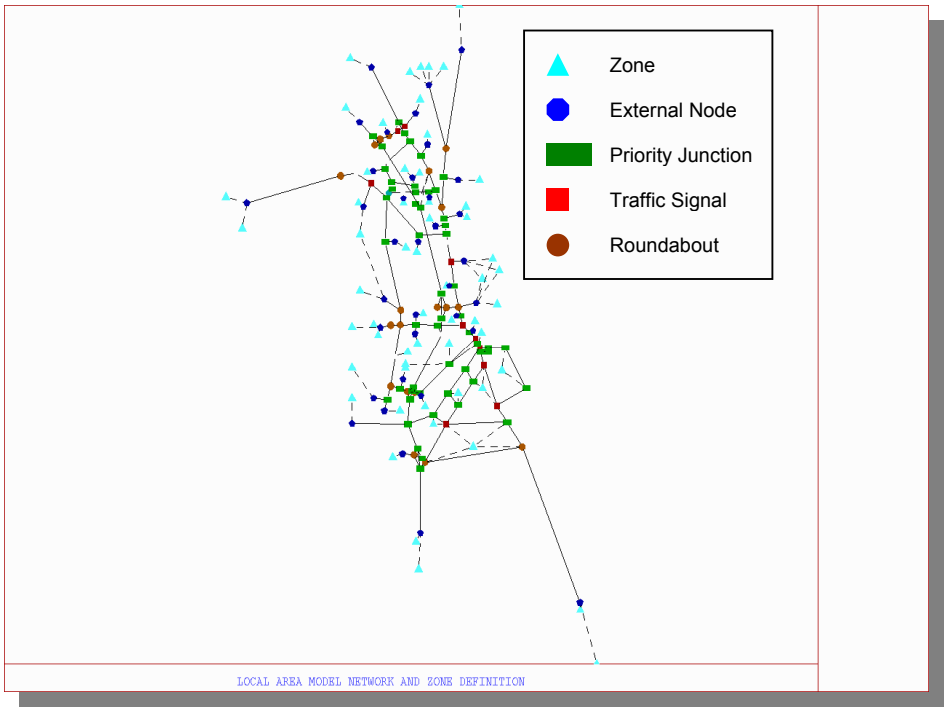


Figure 5-4: Local Area Model Network and Zone Definition

The trip matrices derived from the DTO Transportation Model reflect 2001 AM peak conditions. Separate matrices are available for Heavy Vehicles and Light Vehicles, with summary information for each outlined in Table 5-2.

Table 5-2: 2001 Cordon Matrix Demand

Vehicle Class	2001 AM
Heavies	956
Lights	10607
% HGV	8%

4.8. Data Collection

The DTO Transportation Model used as a basis for this study was developed to reflect a Base Year of 2001. For the purposes of this assessment, it was necessary to update the Local Area Model to reflect operating conditions for the year 2005 and which would represent the starting point for subsequent analysis. In order to do this, it was necessary to collate a database of available traffic count information for the area, review the data, and factor the information to reflect a typical AM and PM peak hour for the year 2005.

This data collection programme required two tasks. Firstly, to establish the extent of useful existing traffic data in the area held within the databases of the Dun Laoghaire / Rathdown County Council, the NRA and Bray Local Council, and secondly to supplement this data with new surveys where appropriate. This process is described below.

4.9. Available Traffic data

Traffic data was available for a number of locations within the study area, from local sources, as listed below:

- Dublin Road/ Crinken Lane
- Dublin Road/ Wilford Interchange Roundabout
- Dublin Road/ Old Connaught Avenue
- Dublin Road/ Upper Dargle Road
- Dublin Road/ Lower Dargle Road
- Vevay Road/ Killarney Road
- King Edward Road/ Killarney Road

- R117 Enniskerry Road/ M11

4.10. New Traffic Surveys

In order to supplement the existing traffic information in the area, some additional traffic surveys were undertaken at the following locations:

- Loughlinstown Roundabout – Dublin Road/ M11/ N11/ Parknasilla Rise
- SEM overbridge/ Rathmichael Road/ Ferndale Road/ Ballybride Road
- Lordello Road/ Ferndale Road
- Wilford M11 Interchange
- Slip off M11 onto Old Connaught Avenue
- Fassaroe M11 Interchange
- Dublin Road/ Shanganagh Road/ Corbawn Road
- Old Connaught Avenue/ Ballyman Road/ Ferndale Road/ Thornhill Road
- Herbert Road/ Main Street/ Castle Street/ Quinsborough Road
- Killarney Road/ Boghall Road
- Killarney Road – M11 Interchange

These supplementary surveys were undertaken during February 2005, and a. summary of the traffic count locations is shown in Figure 5-5.

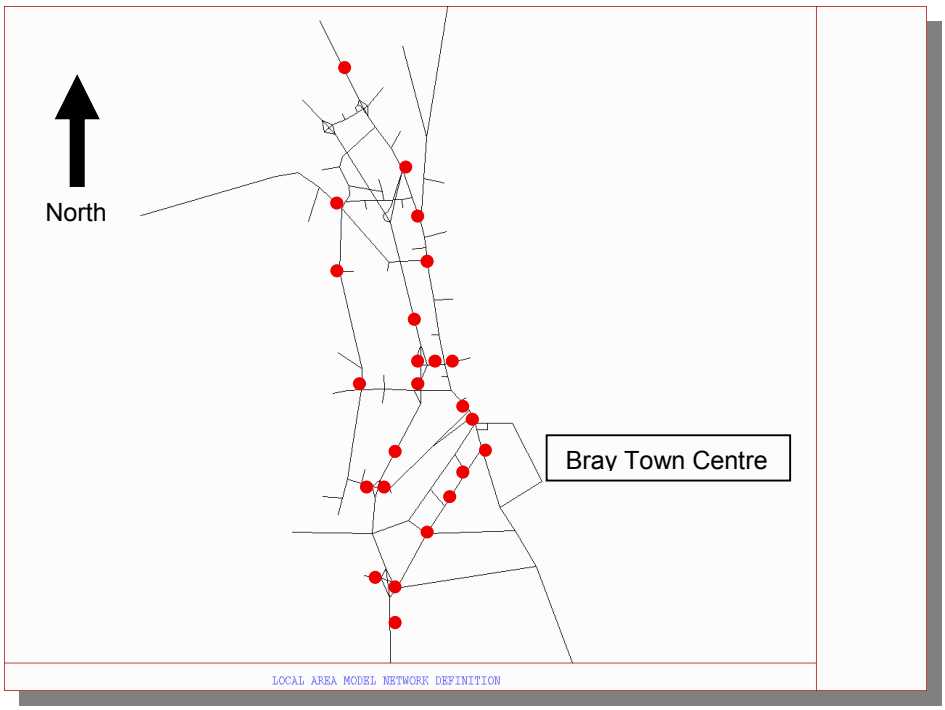


Figure 5-5: Location of Traffic Counts

4.11. Calibration & Validation

The methodology adopted in calibrating and validating the LAM has been undertaken in line with the guidelines presented in the DMRB (Design Manual for Roads and Bridges) Volume 12. This is an internationally recognised standard for traffic model development, and is in line with the protocols of the Dublin Transport Office (DTO).

4.12. Future Year Traffic Models

In order that any strategies can be adequately evaluated, it was necessary to prepare traffic models that would reflect the relevant future years. The two years selected for the current study were 2020 as the study horizon, and 2010 as an interim year. Future year traffic models were developed for both these years that reflected the expected level of development that would be expected to occur over the relevant periods. The future year traffic models were developed as follows:

- Expected future development within each zone in the study area was compiled from zoning maps, planning information, and assumptions regarding the pace of development in the different localities throughout the study area. This process was undertaken for both 2010 and 2020. This development was translated into a set of Trip ends using appropriate trip generation rates;

- The additional trips were distributed throughout the study area and the external zones based on existing trip distribution patterns in adjacent zones. Where such information was not available or realistic, trips were distributed based on a gravity model technique. This process produced a single matrix comprising internal - internal trips and internal – external trips;

- External – external trip growth for the future year models was established by growthing existing external trip ends according to an annualised growth rate that was interpolated from observed growth across the screenlines in the DTO model from 2006 to 2016. These additional external – external trips were also compiled into a matrix.

- Both matrices were added to the base year matrix to reflect 2010 and 2020. The result was a future year matrix that reflected both growth in traffic within the study area, and recognised the growth in traffic travelling through the study area.

In addition, the M50 opening also needed to be incorporated in to the future year models. This was undertaken by a manual redistribution of trips between the M11 and M50. .

4.13. Conclusion

The above process has therefore led to the development of a base and future year Local Area Highway Model that has been adequately calibrated and validated, and is therefore a robust tool upon which to develop a Transportation Strategy for the Bray Environs.

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5. THE DO-MINIMUM OPTION

5. THE DO-MINIMUM OPTION

5.1. Assessment Years

In order to understand the requirements of the Transportation Strategy, a future year assessment has been undertaken that assumes the full pattern of development has been constructed, but with no provision of additional road or public transport infrastructure. This is the first step in the development of the Transportation Strategy and allows the future pressures on the network to be established such that the strategy can address these particular pressures. This is known as the Do-Minimum Option, and is discussed in this section of the report.

5.2. Future Year Land Use Forecasts

The key input to the future year forecasting exercise is the development of a set of land use forecasts upon which future year travel demand can be based. In developing the future year forecasts, an initial forecast year (2010) was selected which reflected the current horizon of the development plan, and a further longer term forecast year some ten years beyond this (2020). The selection of a forecast year beyond the development plan horizon reflects the significant investment required in the development of any transport infrastructure proposals, and hence the requirement to assess the need for such infrastructure over a longer time period. The following forecast years were therefore adopted:

- 2010: The current horizon for the Dun Laoghaire Rathdown Development Plan and the population forecasts of the Regional Planning Guidelines; and

- 2020: A long-term forecast of development based on an assessment of developable lands, and the long term projections of the National Development Plan.

The land use forecasts were prepared as zonal totals, using a total of 49 zones within the study area. These zones reflect the zones adopted in the transport model and are a further refinement of the larger zones used by the Dublin Transportation Office in their forecasting work. The forecasts were developed in discussion with the Planning Departments of Dun Laoghaire Rathdown County Council, Bray Town Council and Wicklow County Council, and where definitive information was not available, estimations of the likely type and scale of development was made. This allowed the development of a robust set of forecasts that reflected the projections of the Regional Planning Guidelines for the Bray area.

For 2010, it was first considered that all of the zonings in the development plan could be fully developed, and that all associated travel activity should therefore be included in the forecasts for 2010. In reality, the level of development expected in areas such as Old Connaught, Rathmichael and Fassaroe is such that full development over the period to 2010 is not seen as realistic. Instead, a phasing of development for these areas over the period to 2020 was instead assumed in order that a more practical set of land use forecasts could be established.

In 2020, it is firstly assumed that all lands as zoned in the current County Development Plan will be fully developed according to committed zoning. Some account must, however be taken of the potential for further development following the publication of the next Development Plan. This requires careful consideration of the overall pattern of development expected over that period, but without pre-judging any particular development sites that may or may not arise as a result of the 2010 Plan. The process for establishing land-use forecasts post-2010 has been broadly based on long term projections in the Regional Planning Guidelines, distributed amongst those areas within the study area that are either undeveloped or developed to low densities. This leads to the development of the 2020 land use scenario, and thereby allows the current study to account for transport demand over the next 15 years. It is noted that the 2020 projections represent only a single scenario of development beyond the life of the current development plans, and do not reflect any current planning or development objectives of any of the Local Authorities.

5.3. Future Year Do-Nothing Network

At the time of development of the base year traffic model, the opening of the South Eastern Motorway was some months away, and some account of this important element of infrastructure was required in any future year assessment. The South Eastern Motorway was therefore assumed to be a committed element of infrastructure, and was therefore included in the future year models. This reflects the use of the term “Do Minimum” for the future year, which assumes

that only infrastructure that is currently committed will be assumed to exist in 2010 and 2020. The following transport infrastructure schemes are assumed to be committed and therefore form part of the Do-Minimum scenario:

- The M50 South Eastern Motorway;
- Metro connection to Dublin Airport via the City Centre;
- Luas Line C1 connection to The Point Depot;
- Luas Connection to Lucan;
- All Quality Bus Network proposals;
- Demand Management Strategy for the Greater Dublin Area; and
- No Eastern Bypass or Dublin Outer Orbital.

5.4. The Future Year Demand Matrix

The future year SATURN model was developed by converting the future year land use forecasts into a set of trip-ends and distributing these trip ends amongst internal and external zones according to the existing trip distribution of similar nearby zones. In cases where new zones were created, the trip distribution characteristics of adjacent zones of a similar land-use was applied to the new zone trip generation and attractions.

Trip end information was then developed from first principles for each of the development zones for 2010 and 2020, and these trips were added to each zone for distribution throughout the network. This was also supplemented by growth in traffic along external links leading into and out of the study area such that the full pattern of background and development related traffic growth could be incorporated.

The Future Year Demand Matrix was then assigned to the Future Year Road Network to establish the particular points of congestion and delay that would occur throughout the network under the Do-Minimum scenario. This provided a valuable resource to the Study Team and assisted in the development of strategy options to address such problems.

5.5. Summary of Issues

The Do-Minimum model was run for 2010 during the AM and PM Peaks, and a summary of the key issues is outlined below:

5.5.1. 2010 AM Peak

The main impact in 2010 is the development of the land in Woodbrook, on the Bray Golf Club lands, and in the Old Connaught area, and these lead to a substantial additional loading throughout the local network. The main issues as noted from the Do-Minimum modelling are as follows:

- A significant rise in congestion through the Old Connaught/Dublin Road junction, as a direct result of traffic accessing the main north-south roads from the Old Connaught Area. The level of queuing is extremely high, and there is significant delay on all approaches of up to 10 minutes;

- With the congestion at Old Connaught Ave/Dublin Road, traffic from Old Connaught reassigns to alternative routes. Traffic to/from the South Eastern Motorway continues to use the Old Connaught Avenue junction and the M11 via the Wilford interchange, while traffic to/from the N11 diverts via Ferndale Road and either Stonebridge Road or Cherrywood Road. This places an excessive load on relatively inappropriate routes;

- Increased delay through the junction of Upper Dargle Road/Dublin Road. This would appear to be mainly as a result of the strong increase in traffic flows approaching the study area from the south on the N11;

- A strong traffic demand along Thornhill Road, due to traffic congestion along Old Connaught Avenue. Thornhill Road becomes a more attractive route between Old Connaught and areas south, and from Rathmichael/Sorohans to the employment areas in Fassaroe;

- An increase in traffic along Old Connaught Ave to the order of 40%, although this is constrained by congestion. The increase on other parallel routes is more evident as other capacity is taken up. Such increases are strongest on Stonebridge Road (60%) and Crinken Lane (350%); and

- A 50% increase in traffic using the Dublin Road south of the Wilford Interchange, which contributes to delay through the junction with Old Connaught and at the Upper Dargle Road, and is a result of the development of the Golf Club lands and the Woodbrook area.

The key impacts in 2010 during the AM Peak are therefore a significant restriction on east-west capacity from the newly developed areas to the west of the M11, and worsening conditions on the Dublin Road approach into Bray.

5.5.2. 2010 PM Peak

During the PM Peak, the various traffic problems broadly reflect AM peak issues. The main impacts are as follows:

- Congestion through the Old Connaught Avenue/Dublin Road junction, which remains the primary access point to the areas west of the M11, and leading to delays on all approaches of up to 10 minutes. Traffic flows on this road are some 1000 vph west of the M11, with significantly lower volumes to the east;

- Traffic to the Old Connaught area from the north uses Ferndale Road and Stonebridge Road/Crinken Lane as opposed to travelling via the Dublin Road/Old Connaught Avenue junction. This places a high loading of over 1000 vph on these routes which are not appropriate for such movements;

- Increased delay through the junction of Upper Dargle Road/Dublin Road. The traffic flows through this junction are increased considerably by the Bray Town Centre development, and the congestion further to the north encourages Dublin bound traffic to use the Upper Dargle Road and Fassaroe Interchange to access the M11; and

- Traffic flows on the Dublin Road north of the Wilford interchange are in excess of 2000 vph. This is clearly substantial, and is a result of the high levels of residential development proposed along the Dublin Road.

The key impacts in 2010 during the PM Peak also therefore describe a significant restriction on east-west capacity from the newly developed areas to the west of the M11, and worsening conditions on the Dublin Road approach into Bray. The PM Peak also highlights some long routings by traffic to avoid areas of congestion at Old Connaught Avenue and along the Dublin Road.

5.6. Conclusion

The 2010 model therefore provides a good representation of what will be the key problems with the road network at that time, and is based on an assessment using projected development in the various zones throughout the study area. The development of the strategy options will not only attempt to manage the road based demand by providing additional road infrastructure, but will feed this information back into the Land Use considerations to ensure that a sustainable pattern of development can be proposed, which can better spread the traffic loading throughout the network, and which can minimise the requirement for longer-distance car-based trips.

6. THE LAND USE STRATEGY

6. THE LAND USE STRATEGY

6.1. Introduction

As part of the development of the Bray Environs Land Use and Transportation Study, a consideration of the interaction between Land Use and Transportation issues was necessary. There is a considerable volume of development lands within the study area, and the development of these lands will lead to a considerable increase in transport demand over future years. The management of this transport demand requires a transport strategy that communicates with an effective land use pattern such that each supports the other. The study has examined current zonings and drawn conclusions as necessary regarding the mix and scale of development that is appropriate in the different development areas such that sustainable transportation objectives can be complimented.

The main areas of development potential within the study area are outlined below. All areas with the exception of Fassaroe, either have planning permission, have specific Local Area Plans, or have development proposals already prepared.

- *Woodbrook/ Shanganagh:* A significant new development is planned at this location north of Bray, accommodating high density residential development; offices and a small element of other employment uses; all supported by a new DART station. The area comprises 11 hectares at Shanganagh Castle and 21 hectares at Woodbrook.

- *Bray Golf Club Lands:* The area comprises 22.6 hectares and is zoned for residential use (3.6 hectares) and retail/office/commercial use (19 hectares);

- *Industrial Yarn Site*: This site is located just north of the Town Council boundary and comprises 5 hectare. The site is zoned for “Major Town Centre” uses;

- Old Connaught: These lands north of Fassaroe comprise 50 hectares and are zoned for residential use;

- *Wilford Interchange*: The lands around this interchange north of Bray comprise 3.2 hectares and are zoned for employment use;

- *Rathmichael*: 60 hectares of land at Rathmichael are zoned for residential use;

- *Shankill/Cherrywood*: The Bray Environs Land Use and Transportation Study takes into consideration 25 hectares for residential use and 35 hectares for employment use at Shankill/Cherrywood; and

- *Fassaroe*: The Wicklow County Development Plan provides for the zoning of approximately 125 hectares of land at this location, currently zoned for employment use.

In essence, the current zonings throughout most of the study area reflect an acceptable development pattern for the study area, and can be readily supported from within the transportation strategy. Fassaroe, however, continues to be presented with obstacles to development as a centre of employment, primarily as a result of the difficulty in providing appropriate transport links into low density development lands. Unlike Cherrywood, Wilford and Bray Town Centre, this employment designation is not supported by any residential activity, and hence is not appropriate for development in its current form. As such, it was considered appropriate to undertake a detailed analysis of the land use potential of Fassaroe. The future development of Fassaroe will have a key bearing on the development of north Wicklow and south Dun Laoghaire Rathdown and the current exercise will serve to understand such effects.

The assessment was prepared on basis of the provisions in the National Spatial Strategy, the Regional Planning Guidelines for the Greater Dublin Area, and the Wicklow County Development Plan 2004-2010. A number of assumptions were made in the development of different scenarios for Fassaroe upon which the assessment could be based, with these assumptions derived from past experience with similar framework plans undertaken throughout the Greater Dublin Area.

6.2. Statutory Context

6.2.1. National Spatial Strategy

The National Spatial Strategy (NSS) for Ireland is a 20 year planning framework designed to achieve a better balance of social, economic, physical development and population growth between the regions. It is designed to improve the effectiveness of public investment in infrastructure and other relevant services around the country.

The NSS recognises the pivotal role of the Greater Dublin Area to the overall economic wellbeing of Ireland and provides for all future population increase to be accommodated within existing settlements.

Bray is located within the Metropolitan Area of the Greater Dublin Area (GDA). It is the policy of the NSS to physically consolidate Dublin, supported by effective land use policies for the urban area and an effective public transport system. This should be achieved, however, in a manner that does not compromise the sustainability of local communities, a particular consideration in the case of the development of Fassaroe in close proximity to Bray Town Centre.

6.2.2. Regional Planning Guidelines for the Greater Dublin Area 2004-2016

The Regional Planning Guidelines (RPGs), a review of the Strategic Planning Guidelines for the GDA, set out a 12-year strategic policy for the region. They provide a regional context to the National Spatial Strategy and the individual Development Plans contained within the GDA.

The RPGs effectively implement the National Spatial Strategy, whilst providing more detail and establishing a development and spatial framework that can be used to strengthen Local Authority Development Plans and other planning strategies at county, city and local level.

The settlement strategy of the RPGs divides the Region into two areas. The Metropolitan Area and the Hinterland Area. The Metropolitan Area consists of Dublin City, south Fingal (Donabate, Swords, Blanchardstown, Mulhuddart), south east Meath (Dunboyne) north east Kildare (Kilcock, Celbridge, Maynooth, Leixlip), South Dublin County Council, Dun Laoghaire-Rathdown County Council, and north east Wicklow (Bray and Greystones). The Hinterland Area comprises lands between the edge of the Metropolitan Area and the outer boundary of the GDA.

The strategy for the Metropolitan Area is to consolidate the urban centres located within it, and the provision and facilitation of an integrated public transport system. The strategy for the Hinterland Area focuses on the development of selected large and moderate growth centres to be self-sustaining in terms of employment provision, and housing demands. Small growth towns and villages will be developed in a more sustainable manner, to ensure that a higher proportion of residents of the towns and villages are employed locally.

Bray is identified as a Metropolitan Consolidation Town within the Metropolitan Area, and together with Greystones/Delgany forms a Primary Development Cluster. The RPGs provide that Bray should be developed to a relatively large scale as part of the strategy for the consolidation of the Metropolitan Area. The Guidelines define a population range of 40,000 to 100,000 for Metropolitan Consolidation Towns and identify their economic function as, inter alia, attracting major investment.

6.2.3. Wicklow County Development Plan 2004-2010

The County Settlement Strategy seeks to promote the concentration of development into Bray and Greystones/Delgany as the two Metropolitan Area Settlements in the County, with the objectives to:

- Consolidate development within this area;
- Promote increased densities; and
- Thereby facilitate the provision of a considerably enhanced public transport system and facilitate and encourage a shift to public transport.

The Development Plan seeks to achieve a compact urban form relative to the size of the population and reduce the overall need to travel. It projects a population for Bray and Environs of 32,012 in 2010 and 35,000 in 2016. While the Plan does not expect all towns to reach their indicative populations by 2016, it is intended to put the necessary physical infrastructure into

place to cater for the future need. The Plan acknowledges the shortfall of available land within the confines of Bray Town Council, which necessitates the accommodation of a majority of the projected growth of Bray within its environs.

Fassaroe, immediately to the west of the town, is suitably located to serve this expected growth of the Bray area. It is located in an Area of Outstanding Natural Beauty as well as within an Area of Geological and Geomorphological Interest. The latter is evident in the location of a quarry within the area.

The Development Plan provides for a number of zonings in the Fassaroe area:

- Approximately 40 hectare are zoned Objective "I2" - To provide for appropriate industrial, warehouse and wholesale warehousing, including the development of the area for business, office, and science / technology park. Where appropriate, extensive landscaping shall be carried out and the entire development shall be laid out to a high architectural standard of layout and building design;

- Approximately 80 hectare are zoned Objective "I4" - To provide for appropriate industrial, warehouse, wholesale and large scale retail warehousing uses or alternatively to provide for the development of a single undivided employment unit, either a business, office, light industrial, science and technology park set in open parkland with extensive landscaping, a high architectural standard of layout and building design, with provision to link into the public transportation routes and provide cycle and pedestrian circulation routes. Permitted uses shall include within this category data processing, software development, technical and consulting, commercial laboratory, health care, research and development, media recording and general media associated uses, training, publishing, financial, administrative headquarters, film production, telemarketing, tele-servicing, light industry, offices, enterprise centre, office services, hotel/conference building, sports/recreational buildings and related activities. It may also provide for a small scale retail/commercial section which shall be used solely to provide for the needs of the development and not to serve the surrounding area and shall specifically exclude shopping centres/grocery stores or retail units involved with higher order goods. In addition, a very small element of residential development may be permitted where it is shown that it exists solely to serve/meet the needs of the development itself, will be operated and held in singe ownership by the management company (or other similar structure) and shall not be let, sold or otherwise leased on the open market to individual or other purchasers. Provision shall be made to link this entire employment area to the business area zoned G3 to the south of this site;

- Approximately 3.2 hectares are zoned Objective "G3" – To provide for greenbelt uses with an option for the life of the plan to provide for a single high tech employment use compatible with the adjacent business park. Such a development shall be set in open parkland with extensive landscaping, a high architectural standard of layout and building design with low site coverage and shall be physically linked to the business park to the north of the site;

- Approximately 1.5 hectares are zoned Objective "R3" – To provide for new residential development at one house to the acre; and

- A small area of land along Berryfield Lane is zoned Objective "R1" – *To protect and/or improve residential amenities.*

The current zoning of Fassaroe for low density employment is not considered either suitable or sustainable land use management in the context of its location so close to the growth centre of Bray, in view of the consolidation objectives for the Greater Dublin Area and the County policies to promote higher densities and public transport.

6.3. Land Uses in Fassaroe

In view of the context of the area and the regional policies a number of different development scenarios have been prepared for Fassaroe. These scenarios are defined as follows:

Scenario E: *Development in compliance with the zoning objectives in the County Development Plan, i.e. low density employment uses.*

Scenario R: *Development of a new residential neighbourhood, at low to medium densities.*

Scenario M: *Mixed use development with high density employment and high density residential uses.*

6.3.1. Scenario E: Employment Use

The development of low density employment uses in accordance with the County Development Plan is not in the interest of sustainable land use management: At an approximate site coverage of 0.3 – 0.4 for warehousing and industry respectively, and assuming that warehousing will dominate on the lands due to current economic trends (e.g. 80 per cent warehousing, 20 per cent industry), approximately 4,800 jobs[1] could be created in Fassaroe.

This would create a total of 18,400 additional jobs in Bray and Environs up to 2020. Compared with an additional population of 41,000 this constitutes an underprovision, which will further increase commuting into Dublin, which is undesirable. Due to the low density nature of the employment use, public transport facilities will not be viable, and the reliance on the private car will continue, which is further aggravated by the location of the employment use remote from residential areas.

The location of low density employment at this location in the Environs of Bray is therefore incongruous to the assigned role for the settlement, particularly in light of the policies set out in the RPG's.

6.3.2. Scenario R: Residential Use

The development of a new residential neighbourhood in Fassaroe also cannot be considered sustainable. The lands can be considered as "Greenfield", and, following the Residential Density Guidelines, densities between 35 and 50 units per hectare should be encouraged. This would result in 4,200 to 6,000 no. residential units on the 120 hectare site, which could provide for 10,080 to 14,400 people[2].

This constitutes a substantial population increase, which would result in a total of 51,080 to 55,400 additional people living in Bray and Environs in 2020. This population would be grossly underprovided for with employment opportunities, commuting to Dublin would be seriously inflated, and the existing social infrastructure would come under severe pressure. This scenario will not contribute to creating a self-sufficient settlement.

Since most trips to and from the area will take place into one direction only, depending on the time of the day, a high capacity public transport system like LUAS will not be viable.

6.3.3. Scenario M: Mixed Use

The most sustainable option, which would contribute to Bray achieving its assigned regional role, is to create a high density mixed use scheme. Such a scheme will reduce the need to travel and make an efficient public transport system in the area viable. The development of a Mixed Use pattern reflects the situation in Cherrywood, Shankill, and in Bray Town Centre where a strong employment centre is underpinned by a strong element of residential activity. The inclusion of a critical mass of residential development is important in ensuring that such areas do not become 'dead' in the late evening as a result of low levels of activity – hence leading to a hostile environment.

Below, a total of three potential mixed use scenarios are described, assuming varying residential densities and mixes of employment type. This gives a range of potential population and jobs to be created in Fassaroe and allows for an informed judgement in terms of the Bray Environs LUTS. The scenarios also make provision for schools, open space and retailing.

The following assumptions are common to all three scenarios:

[1] Assuming an occupancy rate of 1 no. employee per 50 sq m for industrial use and 1 no. employee per 100 sq m for warehousing.
[2] Assuming a household size of 2.4.

- A minimum of 9,600 people, either working or living within one kilometre, are needed to allow consideration of Light Rail. For the purpose of this exercise it is assumed that a minimum of 9,600 people will live or work in the Fassaroe area itself;
- The residential densities assumed are gross densities;
- A household size of 2.4 is assumed;
- A minimum of 2 hectares open space per 1,000 population is assumed;
- The population in primary school going age is assumed to be 11 per cent of the total population;[3]
- The population of the secondary school going age is assumed to be 8.26 per cent of the total population;[4]
- Generally, 2 hectares landtake per school are assumed;
- In all scenarios 2 hectares are reserved for retailing, assuming a minimum provision of a retail facility that would provide a 3,500 sq m supermarket, unit shops and a number of associated services such as a clinic;
- Site Coverage Assumptions:
  - Industrial: 0.4
  - Warehousing: 0.3
  - Office: 0.7
  - Retail: 0.5

- Occupancy Rates:
  - Industry: 1 no. employee per 50 sq m
  - Warehousing: 1 no. employee per 100 sq m
  - Office: 1 no. employee per 32.5 sq m
  - Retailing: 1 no. employee per 50 sq m

- The schools have not been taken into account in calculating the number of jobs potentially created in Fassaroe;
- It is assumed that a proposed development at Fassaroe could be built and occupied at the earliest in 2009, assuming that planning permission will be given in 2007; and

6.4. Development Scenarios for Fassaroe

As a starting point, it has been assumed that the split between population and employment is 50:50. This provides the ideal balance between land uses, and will ensure that the employment uses in Fassaroe are underpinned by a strong residential base. This will lead to the establishment of a community with round-the-clock activity in the area, and will reduce external commuting trips as a result of the local catchment.

6.4.1. Scenario M1

Scenario M1 assumes a gross residential density of 50 units per hectare, and 50 per cent of the lands for employment use are dedicated for offices, and 25 per cent each for industry and warehousing. As a result of the population provided for under Scenario M1, one primary school for 720 students (3x8 classes at 30 pupils), and one secondary school for 540 students (3x6 classes at 30 pupils) have to be provided in Fassaroe. Both schools have capacity to accommodate future needs. Table 5.1 below summarises Scenario M1.

6.4.2. Scenario M2

Scenario M2 assumes a gross residential density of 70 units per hectare, and 70 per cent of the lands for employment use are dedicated for offices, and 20 per cent for industry and 10 per cent for warehousing. As a result of the population provided for under Scenario M2, two primary schools for 480 students each (2x8 classes at 30 pupils), and one secondary school for 720 students (4x6 classes at 30 pupils) have to be provided in Fassaroe. All schools have capacity to accommodate future needs. Table 5.1 below summarises Scenario M2.

[3] Based on projections for 2016 in Table R of "Population and Labour Force Projections 2001-2031", CSO, 1999.

[4] Based on projections for 2016 in Table R of "Population and Labour Force Projections 2001-2031", CSO, 1999.

6.4.3. Scenario M3

Scenario M3 assumes a gross residential density of 100 units per hectare within 500 metres of the LUAS terminus (assumed to be 50 per cent of the future residential population), and 70 units per hectare outside of 500 metres from the LUAS terminus. All employment under Scenario M3 is office based. As a result of the population provided for under Scenario M3, two primary schools have to be provided at Fassaroe, one for 480 students (2x8 classes at 30 pupils) and one for 720 students (3x8 classes at 30 pupils). Also, one secondary school for 900 students (5x6 classes at 30 pupils) has to be provided. All schools have capacity to accommodate future needs. Table 6.1 below summarises Scenario M3.

Table 6.1 Mixed Use Scenarios for Fassaroe

Land Uses	Scenario M1	Scenario M2	Scenario M3
Residential			
Units	2,177	3,356	3,953
Population	5,226	8,055	9,488
Additional Pop. in LUTS area	46,226	49,055	50,488
Total Pop. Bray & Environs (2020)	77,177	80,006	81,439
Employment			
Sq m Office	194,153	251,712	348,837
Jobs in Offices	5,974	7,745	10,733
Sq m Industry	51,774	38,356	0
Jobs in Industry	1,035	767	0
Sq m Warehousing	38,831	14,384	0
Jobs in Warehousing	388	144	0
Sq m Retail	10,000	10,000	10,000
Jobs in Retail	200	200	200
Total Jobs in Fassaroe	7,598	8,856	10,933
Additional Jobs in LUTS area	21,198	22,456	24,533
Other Land Uses			
Open Space in Hectare	10.5	16.1	19.0
Primary School Students	575	886	1044
No. of Primary Schools	1	2	2
Secondary School Students	432	665	784
No. of Secondary Schools	1	1	1

All three scenarios result in a total population for Bray and Environs within the population range of 40-100,000 people for Metropolitan Consolidation Towns as per the Regional Planning Guidelines for the Greater Dublin Area.

6.4.4. Variations on Scenario M3

As outlined above, the initial scenarios have been developed on the basis of a 50:50 split between population and employment. It is recognised, however, that the existing zoning in Fassaroe is for employment, and whilst it is necessary to introduce an element of mixed use into the area, any major loss in employment space would need to be provided elsewhere in County Wicklow. Given the strategic location of Fassaroe, and the possibility of providing good transport connections as outlined later in this report, there is a justification for retaining a high degree of employment in this area insofar as is possible, but without leading to an over-emphasis on employment use that would compromise the establishment of a sustainable residential community.

A scenario for alternative splits in population and employment is outlined below. They are all based on variations of Scenario M3, and assuming similar population and employment densities.

Table 6.2 Mixed Use Scenarios for Fassaroe

Land Uses	Scenario M3a	Scenario M3b	Scenario M3c
Population:Employment	***40:60***	***35:65***	***30:70***
Residential			
Units	3,274	2,916	2,545
Population	7,857	6,998	6,107
Additional Pop. in LUTS area	48,857	47,998	47,107
Total Pop. Bray & Environs (2020)	79,808	78,949	78,058
Employment			
Sq m Office	433,287	477,774	523,877
Jobs in Offices	13,332	14,701	16,119
Sq m Industry	0	0	0
Jobs in Industry	0	0	0
Sq m Warehousing	0	0	0
Jobs in Warehousing	0	0	0
Sq m Retail	10,000	10,000	10,000
Jobs in Retail	200	200	200
Total Jobs in Fassaroe	13,532	14,901	16,319
Additional Jobs in LUTS area	27,132	28,501	29,919
Other Land Uses			
Open Space in Hectare	15.7	14.0	12.2
Primary School Students	864	770	672
No. of Primary Schools	2	2	1
Secondary School Students	649	578	504
No. of Secondary Schools	1	1	1

In examining the Table, it is noted that as the residential population decreases, the self-sustainability of the area is eroded. It is the opinion of the Study Team that scenario M3c represents the lower limit of population and the upper limit of employment, and is achievable only with the high densities proposed under Scenario M3. Any reduction of the densities would require the population employment split to be revisited, to ensure that a sufficient population base can be retained.

6.5. Fassaroe in the Context of the Bray Environs

Before continuing, it is necessary to assess these development proposals against existing population and employment projections for the area, and how they compare with growth projections for Wicklow County.

As stated in the County Wicklow Development Plan as well as in the Bray Town Development Plan 2005-2011 the area of the Town Council is physically constrained by the lack of available lands in the town and by the pattern of the existing urban form. The functional urban area therefore extends significantly beyond the administrative boundary of the Town Council. Rapid population growth in the last decades was mainly focused on the Environs area, as evident in Table 6.3.

Table 6.3 Population in Bray and Environs 1991-2002

	1991	1996	Change '91-'96	2002	Change '96-'02
Bray Town	25,096	25,252	0.6%	26,244	3.9%
Bray Environs	1,857	2,671	43.8%	4,707	76.2%
Total	26,953	27,923	3.6%	30,951	10.8%
Fassaroe	130	149	14.6%	156	4.7%

Source: CSO, Census 1991, 1996, 2002

This population growth has resulted in increased pressure on existing physical and social infrastructure, the insufficiency of which has inhibited development taking place in some areas of the Environs. Notwithstanding this, the area is projected to continue to grow significantly in the future. A number of areas in the Bray Environs have been identified by Dun Laoghaire Rathdown County Council and Wicklow County Council, which are to accommodate a majority of the projected growth:

- *Woodbrook/ Shanganagh;*
- *Bray Golf Club Lands;*
- *Industrial Yarn Site;*
- Old Connaught;
- *Wilford Interchange;*
- *Rathmichael*.; and
- *Shankhill/Cherrywood.*

The statutory documents detailed in Section 6.2 have made population projections with regard to Bray and Environs. The North Bray and Environs Land Use and Transportation Study outlines future population and employment levels in the area up to 2020, based on information supplied by the respective Local Authorities. These projections are summarised in Table 6.4.

Table 6.4 Population Projections for North Bray and Environs

	2002	2010/11	2016	2020	Actual Increase 2002-2016/20
Bray Town DP[5]	26,244	30,000	31,000	/	+4,756
Wicklow County DP	30,951	32,012	35,000	/	+4,049
RPGs	30,951	/	40-100,000	/	+9,050-69,049
Bray Environs LUTS[6]	30,951	52,500	/	72,000	+41,000

It should be noted that projections by Wicklow County Council for Bray and Environs probably do not include for the area of the environs under the authority of Dun Laoghaire Rathdown County Council. However, the population projections in the County Development Plan and the Bray Town Development Plan appear to be conservative, even if the Dun Laoghaire Rathdown area is excluded, in view of the regional role assigned to Bray as a Metropolitan Consolidation Town in the Regional Planning Guidelines, which provide for a population of 40-100,000 in such a settlement. They are also somewhat contradictory and inconsistent in that the County Development Plan projects less growth for Bray and Environs up to 2016 as the Town Plan for Bray town itself. The projected population for Bray town of 30,000 in 2011, which the Town Plan acknowledges cannot be met in the Town Council area alone, has already been exceeded.

It is evident, therefore, that the assumptions made in this report are more in line with the RPGs. This requires a policy change in the respective councils, which deviate significantly from the projections made in the Wicklow County Plan and the Bray Town Plan. It reflects an objective to develop Bray into a self-sufficient settlement, which is capable of providing the critical mass to attract national and international investment and to sustain and significantly upgrade the

[5] Figures in this row refer to the Town Council area only.

[6] The figures in this row exclude projections for the Fassaroe area, and only take into account projections for the remainder of Bray and Environs. It also assumes that there will be only marginal growth in the Bray Town Council, with the majority of future growth taking place in the Environs area.

social and technical infrastructure. It is also based on the overall aim to reduce the need to travel and to encourage sustainable modes of transport.

This growth of Bray and Environs suggested throughout this report, including the possible residential population in Fassaroe will potentially result in Wicklow County exceeding the population populations outlined in the Regional Planning Guidelines. Recent government policy announcing a new LUAS link to the Bray area means, however, that these projections are now outdated. The advent of the LUAS link necessitates a greater residential and worker population in Fassaroe, and indeed north Wicklow, to ensure its viability. This additional growth resulting purely from the provision of LUAS must be reflected in the forthcoming review of the Regional Planning Guidelines.

6.6. Summary

The key finding of the review of the Land Use Strategy for the Study area is therefore the unsuitability of the lands at Fassaroe for development as they are currently zoned. There is significant potential to increase the intensity of development in this area, and in such a manner so as to improve the viability of high quality public transport infrastructure. A number of scenarios of mixed use development have been proposed for Fassaroe, all with varying levels of development potential, and it is concluded that any of these three scenarios will support the objectives of the current study. Nevertheless, with an increase in the level of employment in Fassaroe, it is necessary to ensure that a critical mass of population is retained.

In terms of employment, the North Bray and Environs LUTS seeks to provide for approximately 13,600 additional jobs in Bray and Environs up to 2020, excluding the Fassaroe area. Under scenario M3c, the total expected increase in employment will be some 30,000 jobs, with in excess of 50% of this provision in Fassaroe.

7. THE ROLE OF RAPID TRANSIT

7. THE ROLE OF RAPID TRANSIT

7.1. Introduction

The role of Rapid Transit in supporting the development of the study area is a key consideration and has been a core feature of the current work. The prospect of Luas serving the Bray area has been a realistic vision since the opening of the Luas Green Line into Sandyford, and will be a step closer following the forthcoming Line B1 extension to Cherrywood. The recently published *'Transport 21'* describes a high quality Light Rail system connecting the City Centre with the Bray area. Such a proposal will be considered throughout this section, in terms of how it should be provided, the route of such a link, and how it can integrate with the remainder of the transport network. In addition, the capacity of Line B is already under pressure, and the scope to increase the capacity of this line is an important consideration.

Dun Laoghaire Rathdown Council, Bray Town Council and Wicklow County Council all see the termination of the Green Line on the northern fringes of the current Study Area as being of limited benefit to the Bray Environs, and recognise that an extension of this existing line into the area could have significant benefits in achieving a sustainable pattern of land use development through the area, providing better links between the different land parcels, and onward into the City Centre.

The Land Use Strategy has made a number of proposals for the development of the Study Area, a number of which focus strongly on the benefits of Rapid Transit to/from the Greater Dublin Area. As such, any proposal to include Rapid Transit will not only facilitate the development of the area, but this increased level of development will in itself facilitate the successful operation of such a service.

This section of the report provides a discussion as to the potential for Rapid Transit in the Bray Environs, connecting the new development areas with the Greater Dublin Area, with Bray Town Centre, and between Luas and DART. The various types of system are discussed, and alternative alignment options are considered. Finally, the Rapid Transit network is developed based on the needs and demands of users within the Study Area.

7.2. Type of Rapid Transit

In essence, the main proposal under consideration is the extension of the existing Luas Green Line from its currently committed terminus at Cherrywood into the Bray Environs, whether this be Bray Town Centre, Fassaroe, or indeed both. In all cases, the issue of an interchange with DART has been the topic of much of the route selection and assessment process.

The placing of a constraint on the alignment such as the need to provide a connection with DART leads to a significant reduction in the range and type of alignment options that are available, and therefore may preclude other options that are achievable at reduced cost. On the other hand, the omission of any connection with DART leads to the risk that the final network will not be adequately integrated, and that public transport users are confined to travelling along either the DART corridor or the Luas corridor, along which they are required to undertake all trips. This may lead to a ribbon pattern of development radiating out from the Greater Dublin Area, and with little interaction between adjacent development strands.

All these issues can be addressed by the development of a network of Rapid Transit for the study area. Rapid Transit is different to traditional transport links in that it provides a strong and reliable transport link, thereby effectively defining a corridor and attracting a good level of interchange from feeder trips. Examples include Heavy Rail Rapid Transit such as DART, Light Rapid Transit (LRT) such as that provided by Luas, and Bus Rapid Transit (BRT). Below this there is the Quality Bus Corridor Concept with which we are highly familiar. Although providing significantly less priority and prominence than BRT, the QBC option is achievable at much lower cost, a feature that has led to a high level of implementation of such schemes in the Dublin Area over the past 8 years.

At present, BRT is not an established form in Ireland, although there are good examples abroad of using Buses to perform the role of a Rapid Transit connection. It is generally effective when the implementation of LRT is not feasible on grounds of cost effectiveness, and where lower levels of passenger capacity are acceptable. Recent work in the UK has suggested that with a well designed system, BRT can attract up to 90% of the patronage of an equivalent LRT system, but at significantly reduced cost.

For the current study, it is therefore appropriate that BRT should be considered as a transport tool for managing the development of the Bray Environs, particularly where high quality connections are necessary, where the catchment population can support the economics of such a service, but where the development of Light Rail is not immediately feasible.

In the simplest terms, an overview of the form of Rapid Transit that is most appropriate for a given corridor can be addressed in terms of the line carrying capacity that will be required. Whereas traditional bus services provide adequate capacity for 1-way flows of up to 1000 passengers/hour, the adoption of Bus Rapid Transit becomes more appropriate for passenger flows of up to 2,500 passengers/hour requiring a vehicular headway of some 4 minutes. Between 2,500 and some 7,500 passengers per hour, LRT tends to become more cost effective given the opportunity for longer vehicles and hence lower operating costs. Above 7,500 passengers per hour, LRT headways would need to be significantly reduced, and Metro or Heavy Rail becomes a viable option as it delivers extremely high capacities along segregated track. Note that these figures relate to forecast patronage on the busiest section of a public transport corridor, and not necessarily the catchment within any particular area.

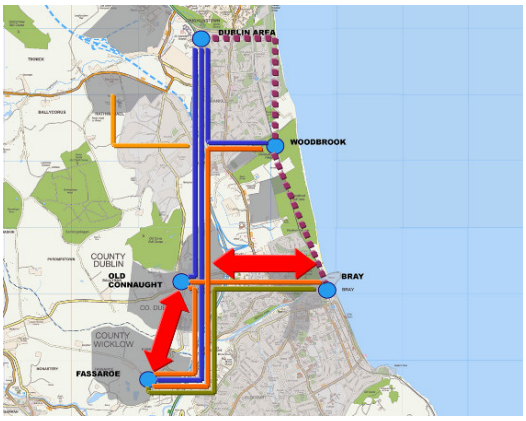
Notwithstanding this, the choice of service also depends on the type of trip being undertaken, and the length of route. For example, a route length of 20km with a daily passenger flow of 5,000 passengers per hour in the peak direction may be ideal for an LRT scheme, but for an isolated route length of 2km this would not be as attractive due to the significant fixed cost required to establish an LRT scheme. This therefore suggests that longer lines or extensions to existing lines are significantly more cost effective than stand-alone schemes, and this is an important consideration for the current study.

7.3. Assessment of Future Travel Needs

The first task to establishing the potential for Rapid Transit through the Study Area involved an assessment of the key desire lines for movement through the area, and onto the Greater Dublin Area. This mapping of the key demands allows the strongest movement corridors to be established, and along which the potential for Rapid Transit can be subsequently assessed. Given that existing development through the Study area is concentrated along the coastal strip, and public transport is facilitated along this strip by DART, the mapping of future demands can focus on the new developments that will take place away from the existing development corridor. The key demands are therefore as follows:

- From Fassaroe, Old Connaught and Woodbrook to the Greater Dublin Area;
- From Fassaroe, Old Connaught and Woodbrook into Bray Town Centre;
- From Fassaroe to Woodbrook or Bray for interchange with DART; and
- From Rathmichael to the Greater Dublin Area and Bray.

Examining the resulting mapping, it becomes clear that a strong desire line for movement exists north-south through the area of Old Connaught and Fassaroe, leading onward to the Greater Dublin Area. A secondary effect is the demand for trips from Fassaroe and Old Connaught into Bray Town Centre. This therefore raises the problem that all the desire lines cannot be served by a single linear link, and that some form of complimentary services will be required. This effect can be best explained by first describing the different links required of the final system as follows:



- A high capacity link as far as Old Connaught, most likely provided for by an extension to Luas Line B1 from Cherrywood;
- An onward connection from Old Connaught to Fassaroe; and
- An onward connection from Old Connaught to Bray.

In reality, the Luas connection to Old Connaught would ideally form one of these onward links to either Fassaroe or Bray, with a secondary link providing the connection on the other spur. The question that arises is therefore whether the Luas should continue to Bray Town Centre, or whether it should connect onto Fassaroe.

Following a review of the issues at stake, it has been concluded that the provision of a link to Fassaroe is significantly more achievable and feasible than the link into Bray. This conclusion is based on a number of supporting reasons as follows:

- The development of the Fassaroe area will facilitate a strong level of financial contribution to the construction of the service. The connection into Bray will not serve as significant a volume of future development, and therefore would not be in a position to raise a similar level of funding;

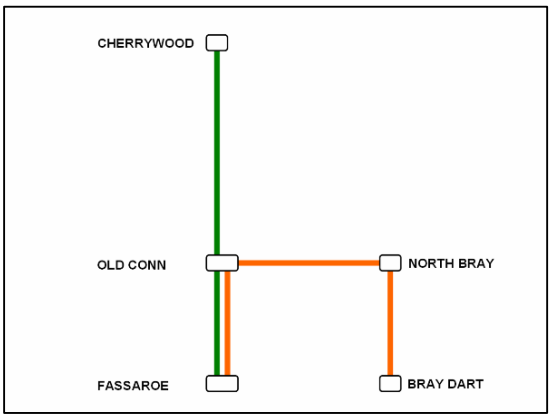
- The Fassaroe option will ensure a direct link from Fassaroe into the City, thereby facilitating the development of the area. High density development of the Fassaroe area would not be achievable should there by no high quality and direct links into the City Centre;

- The connection into Bray would be difficult to construct and at significantly higher cost as a result of the land acquisition that would be necessary. In addition, travel speeds could be reduced as a result of the requirement to cross additional roads at-grade. This could also preclude a later upgrade of this system to Metro standard;

- Public Transport Accessibility from Bray to the GDA is already quite high as a result of the provision of the DART Link. To connect the Luas into Bray would improve connectivity into Bray Town Centre, but with limited increased patronage as a result of the inability to develop Fassaroe due to inadequate transport infrastructure; and

- Bray DART Station serves only a limited residential catchment in the Bray area, with access required by car or bus for a high proportion of residents of the town. Routing the Luas to Fassaroe could capture a significant volume of households in the western suburbs of Bray Town Centre, and hence the actual catchment of the line for those in Bray would be of limited difference. Furthermore, access by bus from the southern suburbs and environs of Bray to Fassaroe could be significantly easier than access by bus to the DART by using the high capacities available along the N11.

The assessment therefore suggests a strategic connection from the Greater Dublin Area into Fassaroe, with a supporting connection from Fassaroe into Bray via Old Connaught. Whereas the connection into Fassaroe can be best provided by an extension of the existing LUAS Green Line, it is not proposed that LRT should form the connection into Bray. Instead, it is proposed that a BRT system be implemented as a much more feasible and cost effective option for this short link. The BRT system would run parallel to the LUAS between Fassaroe and Old Connaught, before heading east and connecting with Bray Town Centre and DART.



Both of these services will be discussed below in turn, addressing the issues of Route Selection, service characteristics, and supporting infrastructure.

7.4. Connection to the Greater Dublin Area (LUAS Line B2)

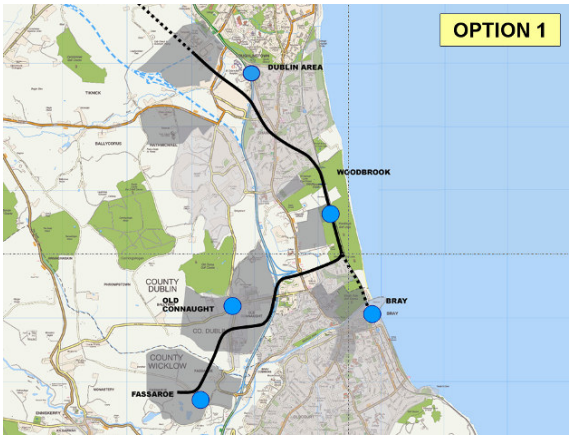
7.4.1. The Objective

In examining Luas options, an outline Route Selection Study has been undertaken as part of the current study. The Route Selection process has examined routes that are feasible in both engineering and practical terms, with the aim of initially producing a shortlist of options that could be evaluated in further detail. Having established that the route would run from Cherrywood to Fassaroe, a route selection exercise has been undertaken as part of the North Bray and Environs LUTS Study to determine the appropriate routing for such an alignment. Such an exercise has been carried out in parallel with the work being undertaken separately by the RPA, but with the ultimate objective of jointly identifying a preferred alignment for Line B2. This route selection exercise is outlined below.

7.4.2. Route Selection

In undertaking the route selection process, the constraints study revealed that a total of three routes were feasible in providing the connection from Cherrywood to Fassaroe. Whilst all different, all three alignments were common in that they routed from Cherrywood via the Wilford Interchange to Old Connaught and onwards to Fassaroe. The key differences lay in the alignment between Cherrywood and Wilford, with all three alignments sharing the same routing between Wilford and Fassaroe. The three options and a discussion of the evaluation process are outlined below:

Alignment Option 1

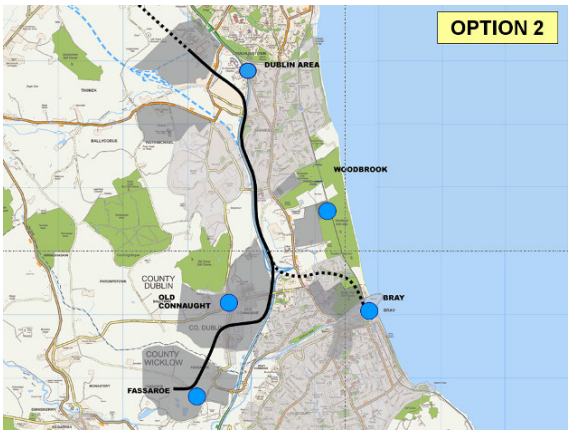


Option 1 comprises some 6.5km of new track, running from Cherrywood via Shankill to Woodbrook, where an interchange facility could be accommodated at a potential new DART station. The alignment continues southwards before turning west at the boundary of the Woodbrook Golf Links to cross the M11 south of the Wilford Interchange. Beyond this, the alignment will serve the planned developments at Old Connaught and Fassaroe, and connect with a Park & Ride site at Fassaroe. In the longer term, a spur connection to Bray Town Centre can be considered.

The key features of the Option 1 alignment are:

- Direct route to Woodbrook through Shankill
- LUAS/DART Interchange at Woodbrook
- Connectivity with the proposed development nodes at old Connaught and Fassaroe
- Park & Ride at Fassaroe for commuters to Bray and the Greater Dublin Area

Alignment Option 2



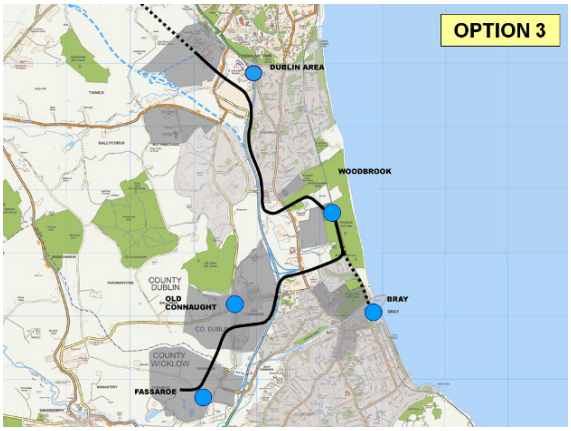
Option 2 comprises some 5.5km of new track, running from Cherrywood in a southerly direction adjacent to the eastern boundary of the M11 corridor. The route will cross the northern slip lanes of the Wilford Interchange, and link with the Option 1 alignment before crossing the M11 and onto Old Connaught and Fassaroe. This route would utilise some of the land along the M11 currently required to make up the eastern embankment, and hence major reconstruction work would be required. As in Option 1, a spur connection to Bray Town Centre can be considered as a longer term addition, connecting with the main line at Wilford.

The key features of the Option 2 alignment are:

- Alignment follows the most direct link south to Wilford Interchange
- Proposed tram stop at Crinken Lane
- Connectivity with the proposed development nodes at old Connaught and Fassaroe
- Park & Ride at Fassaroe for commuters to Bray and the Greater Dublin Area

Alignment Option 3

Option 3 comprises some 7km of new track, running from initially Cherrywood along the same alignment as Option 2. At the southern boundary of Shankill (Crinken Lane), the alignment heads in an easterly direction across the Shanganagh Park, to link with the potential DART station at Woodbrook. For the remainder of the route, Option 3 follows the same alignment as Option 1. This alignment also makes use of land along the M11, and would therefore require significant reconstruction of the existing eastern embankment.



The key features of the Option 3 alignment are:

- Proposed tram stop at Crinken Lane
- LUAS/DART Interchange at Woodbrook
- Connectivity with the proposed development nodes at old Connaught and Fassaroe
- Park & Ride at Fassaroe for commuters to Bray and the Greater Dublin Area

7.4.3. Evaluation of Alignments

In comparing the relative benefits of the 3 alignment options, a qualitative assessment has been carried out based upon a multi- criteria analysis established by the RPA. Each option has been evaluated against the following criteria:

1. Environment and Quality of life
2. Safety
3. Operational Efficiency
4. Constructability
5. Policy and Transport Integration
6. Meeting future transport needs
7. Practicality and public support
8. Upgradeability to metro
9. Cost

A summary of this evaluation process is outlined in this section, describing the various sub-headings beneath each of these criteria, and the performance of each of the Alignment options against these criteria. A summary of this process is outlined below:

Table 7.1 Assessment Criteria

Criterion	**Sub-Headings**	**Outcome**
Environmental and Quality of Life	• Noise • Air Quality • Water • Biodiversity • Agriculture • Geology • Townscape / Landscape • Visual Impact • Heritage • Sustainability • Construction Impact	The results of this analysis indicate that Option 2, which runs along a largely rural corridor, would be expected to have a lower environmental impact than Options 1 and 3.

Safety	• Accident Risk • Personal Security	It was concluded that all 3 LUAS options would be likely to lead to a potential reduction in road accidents as a result of a transfer of private car trips to the tram. It has been assumed that any extension to the existing LUAS network would include the provision of CCTV at the LUAS stops and on board the trams, and as a result a positive safety benefit would be expected.
Operational Efficiency	• Route Length • Catchment • Patronage / Demand • Run Time • Route Service Benefits	In assessing the operations of the 3 options, it will be noted that the routes, whilst ultimately serving a similar area, there are differences in the length of route and number of trams stops which will have implications on the operations of the system. Taking cognisance of all these factors, it was concluded that Option 1 provides the best balance between speed, passenger catchment and service level.
Constructability	• Alignment and Gradient • Structures • Public utilities • Depot Site • Construction Impact • Work Space Requirements • Geotechnical	In general, all 3 options would be expected to have negative construction impacts, but given that Option 2 follows a route generally avoiding residential areas, and is the shortest of the three alternatives, it is concluded that this option would be the easiest to construct.
Policy and Transport Integration	• Consistency with Local Transport Policy • Policy Integration – Land Use Planning • Interchange Potential – DART • Interchange Potential – Bus • Integrated Ticketing	The assessment of Policy and Transport Integration has been based upon the core assumption that to best achieve the objective of supporting modal shift, the LUAS option should seek to serve the largest potential catchment and fully integrate with other transport modes. It is for this reason that Options 1 and 3 have been chosen.
Meeting Future Transport Needs	• Employment / Job Opportunities • Regeneration support • Business Impact • Developer Contributions	Closely linked with the Policy and Land Use Integration, this aspects considers the potential of the LUAS extension options to further stimulate opportunities along the alignment corridor. In this regard, it has been concluded that Options 1 and 3, with more extensive catchments would promote more positive benefits than Option 2.

Practicality and Public Support	• Practicality • Public Support	At this stage in the process, the LUAS options have not been presented to the public as part of a consultation exercise. For this reason, consideration of this aspect between the options has been limited to the likelihood of the scheme being constructed, which would be related a range of issues including, cost and availability of land and the level of political support. Overall, it is concluded that Option 2 could be the most straightforward to implement.
Upgrade to Metro	• Potential for Segregation • Geometrical Constraints	It has been concluded that all of the options would have the potential to upgrade to heavy rail in the future, it is however likely that Option 3 would be more difficult to convert, given the longer and more sensitive alignment, particularly across Shanganagh Park / Cemetery.

7.4.4. Summary & Ranking

A summary of the assessment is presented below, outlining the most positive performers under each of the criteria. In essence, the assessment demonstrates that Option 3 performs quite poorly, with the key benefits being the higher catchment that it serves, and the provision of a connection with DART.

Table 7.2 Summary of Assessment Results

Criteria	**Option 1**	**Option 2**	**Option 3**
Environmental & Quality of Life		X	
Safety	X	X	X
Operational Efficiency	X		
Constructability		X	
Policy & Transport Integration	X		X
Meeting Future Transport Needs	X		X
Practicality & Public Support		X	
Upgradeability to Metro	X	X	

For Options 1 and 2, it can be seen that both perform better under the Assessment than Option 3, and both can therefore be seen as more viable options for providing the link to Fassaroe. It is noted that the concept of weighting has not been elaborated on in the above summary table, and hence the result could be viewed as somewhat subjective. Notwithstanding this, the inclusion of scoring and weighting includes a high degree of uncertainty to the final result, and the making of decisions based on such an approach is not appropriate. Instead, a full examination of the issues at stake and the objectives of alignment options is considered such that an informed decision as to the final alignment can be made.

In this assessment, it would appear that either Option 1 or 2 will be most beneficial, and hence Option 3 can be discounted. The key benefit of Option 1 is the integration with DART and the ability to achieve an alignment with high speed and a good level of segregation. The drawback, however, is the impact on the many landowners along the route and the additional cost of such a route. Option 2 on the other hand, whilst providing a good alignment, does not integrate with DART and passes through a number of undeveloped areas along the M11 corridor between Cherrywood and Old Connaught. Note that scheme cost has not yet entered the assessment.

7.4.5. Scheme Costs

In order to develop a preferred option, further consideration of the cost of each scheme is necessary. The relative cost of the different options has been developed by considering the length of the alignment, the proportion of the land that is under private ownership, and the potential for developer contributions to offset capital costs.

Whereas all capital costs will be considerable, the assessment focuses on the *marginal* cost of construction over the least expensive option. In this way, the additional costs of construction can be traded off against the higher benefits as outlined above.

The marginal costs are summarised as follows:

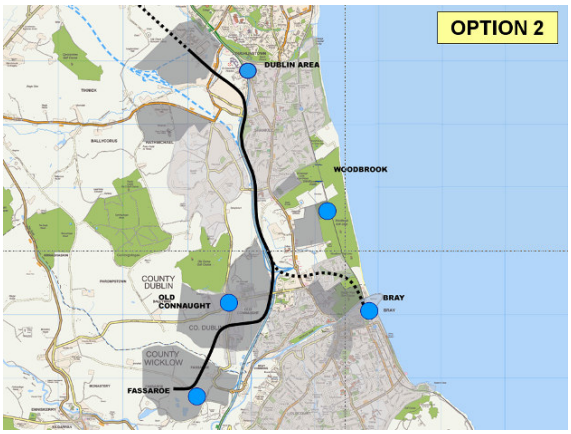
Table 7.3 Marginal Costs for Route Options

Criteria	**Option 1**	**Option 2**	**Option 3**
Capital Cost	Low	Medium	Medium
Land Costs	Very High	Medium	Medium
Developer Contributions	Medium	Low	Medium
Operational Costs	Low	Low	Medium
Total Costs	**High**	**Low-Medium**	**Medium**

7.4.6. Recommendation

The additional cost of option 1 is evident from the above table, and demonstrates that there is an additional price for the benefits of interchanging with DART and serving the additional catchment area of Shankill and Woodbrook. This additional cost is likely to be significant, as a result of the higher level of land acquisition and the large number of land owners along the corridor from Shankill to Woodbrook.

The key outcome is therefore a choice between Option 1 at higher cost, or the alternative of Option 2, but with a lower price tag. The difference in cost between Option 1 and Option 2 has been estimated to be in the region of €100m, and this difference in cost is the price for incorporating an interchange at Woodbrook into the scheme.



Discussions with the various departments of Dun Laoghaire Rathdown County Council, and with Bray Town Council and Wicklow County Council have led to the conclusion that Route Option 2 represents the preferred option arising out of the current study.

The selection of Route Option 2 is based on the following key benefits:

- The significantly lower cost of Route Option 2 as compared to Route Option 1, where the additional €100m required for Route Option 1 will be difficult to recoup by means of further Section 49 planning levies;

- The high number of individual land owners associated with Route Option 1, which would increase project risk and the timescale required for planning and design;
- The ability of the Fassaroe Busway to provide a high quality link from Luas to DART. This will be described later in this chapter; and
- The future development potential of the M11 corridor, and the support that Route Option 2 would lend to such development.

As such, Route Option 2 is selected for the proposed Luas Link from Cherrywood to Fassaroe and that this proposal is adopted throughout the Local Area Plan process. Whereas an outline design for the alignment is presented as a recommendation of this study, the final alignment will be subject to a Preliminary Design process to be undertaken by the Railway Procurement Agency.

Despite the above findings, it is noted that the selection and development of any Light Rail alignment is the ultimate responsibility of the Railway Procurement Agency. The RPA is expected to commence a more formal consultation exercise in the immediate future with a view to finalising the alignment for Line B2. Nevertheless, such an exercise will follow the same broad principles that have guided the North Bray and Environs LUTS Study, and similar conclusions are therefore expected to be drawn. Whereas Route Option 2 can be adopted by Dun Laoghaire Rathdown and Wicklow County Council as the preferred route, this will require subsequent adoption by the RPA following their consultation process.

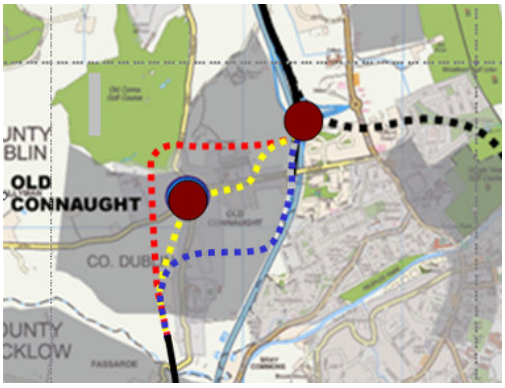
7.5. Sub-Options on Alignment Option 2

In recommending the adoption of Alignment Option 2, it is now possible to examine the routing of this alignment option in greater detail to examine how it can interact with the major land holdings along the route. Whereas the alignment for Option 2 is relatively fixed between Cherrywood and the Wilford Interchange, a number of sub-options present themselves for the route between the Wilford Interchange and Fassaroe. Before the alternatives can be identified and assessed, the sub-objectives relevant to the different sub-alignments can be set out:

- They should be able to maximise catchment areas along their route;
- They should be able to provide segregated running, with no requirement for on-street, as this would render the provision of metro-style services unfeasible in the longer term;
- They should be able to provide appropriate radii such that good running speeds can be maintained; and
- They should take consideration of existing topographical and archaeological constraints.

Various options have been assessed for the alignment through the Old Connaught area, and will be reiterated here. Essentially the argument comes down to the question as to whether the alignment should pass north or south of Old Connaught, or should use Old Connaught Avenue. A number of options are presented here for consideration.

The Yellow option was presented to the Study Team during the initial consultations, and involves an alignment running on-street along Old Connaught Avenue, with single track operation along much of its length. This option has been dismissed for a number of reasons. Firstly, the use of on-street running leads to lower running speeds, precludes any possibility of a subsequent upgrade to metro levels of service, and hence could lead to significantly increase journey times into the Dublin Area. In addition, it would introduce significant operational difficulties, reduce reliability, and severely inhibit the operation capacity of the system.



The Red option traverses the northern boundary of Old Connaught, and turns south through the edges of the Old Conna Golf Course. This option is achievable, and penetrates much of the development land in Old Connaught, passing within some 300m of the village.

The Blue option traverses the southern boundary of Old Connaught, with much the same level of benefit as per the red option. The access to the lands south of Old Connaught is achieved using of land released as a result of the closure of the Old Connaught Slip from the M11. This option rejoins the Western Link Road corridor some 300m south of Old Connaught village.

In selecting a preferred option, it is clear that a number of additional benefits can be achieved by the Blue Option, with reference to the Fassaroe Busway discussed below. The Blue option can also act as a transport corridor for the Fassaroe Busway, which continues on via Old Connaught Avenue, and in to Bray Town Centre. Whereas the Blue option provides an ideal route onto Old Connaught Avenue, the Red route would require a long detour for the Bus Rapid Transit that is proposed to run alongside this section of the LRT. Alternatively it would require the BRT to use of common traffic lanes through Old Connaught. This would reduce the attractiveness and/or reliability of the service and act against the objectives of the current study. Should the Red option be chosen, it would be recommended that a separate BRT alignment would be retained along the Blue route for the purposes of BRT operation (see below).

7.6. Connection to Bray Town Centre

7.6.1. The Objective

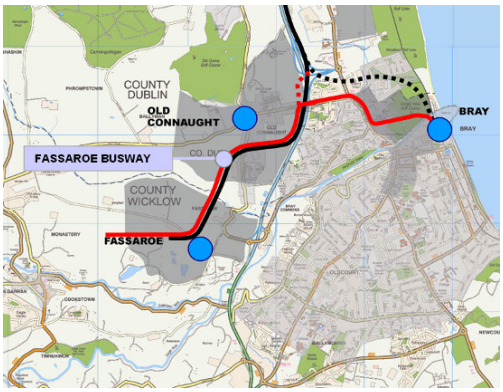
As discussed earlier in this report, a distinct choice has been made to ensure that the Fassaroe area is developed in a manner that it should support growth and economic development in Bray, and hence a strong connection between Fassaroe and Bray is necessary. The provision of local bus services would not be seen as an appropriate mechanism for providing such a link, and instead a high quality link is necessary that will compete strongly with the car, and provide a quick and reliable link into Bray where the majority of local services are located.

Likewise, the development of Old Connaught will lead to a high demand for residential-based trips accessing local services. The provision of a link into Bray will ensure that such trips will not be made by car to other district centres, and that the development of this area will have a real positive benefit on the local economy.

7.6.2. The Proposal

The proposed means of providing the connection between Fassaroe, Old Connaught and Bray is the development of a high quality Busway linking Fassaroe with Bray Town Centre via Old Connaught. This Busway would be developed to a high standard allowing reliable and frequent transit along a corridor with significant development proposals, and with a journey time of some 10 minutes from the terminus at Fassaroe to Bray Town Centre. This design philosophy is knows as Bus Rapid Transit (BRT), and is an emerging technology throughout the world where the high infrastructural costs of LRT are not suited to any particular project.

The route would be known as the Fassaroe Busway. It would commence in Fassaroe, travelling north along a dedicated busway into the Old Connaught area. It is proposed that the busway would traverse along the southern boundary of Old Connaught, connecting with Old Connaught Avenue immediately to the west of the M11. At this point, the bus would turn onto Old Connaught Avenue towards the Dublin Road, which as a result of the proposals outlined earlier would be closed to general traffic. At the Dublin Road, the bus would turn south and make use of the continuous bus lanes as far as the access to the proposed Bray Town Centre development. The service would then turn into the Bray Town Centre development (North Bray) and through the site via a dedicated bus lane to the River Dargle adjacent to the railway bridge.



At this point, it is proposed that the service would continue across the river via a new public transport bridge and continue along a dedicated bus link to Bray DART Station where the service would terminate. This connection onto the DART Station is an important element of the service, in that it ensures that the bus provides an onward rail connection from Fassaroe and Old Connaught, and terminates in a location where an existing confluence of transport services exists.

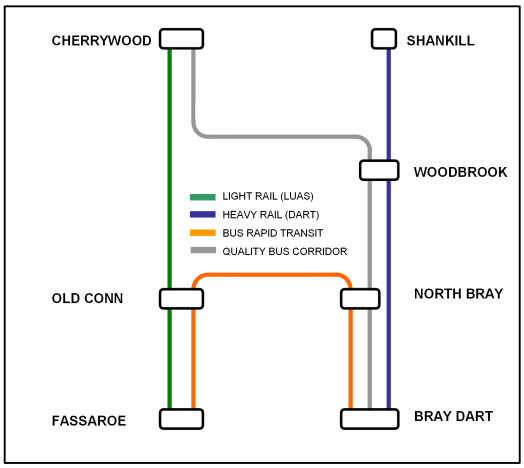
In circumnavigating the centre of Old Connaught, it is important that good links between the service and the main hub of activity in Old Connaught will be necessary such that the service will adequately penetrate the development lands there. Nevertheless, it is recognised that the focus of development in Old Connaught will change in the coming years, and this may well focus itself on the location of the rapid transit corridors, thereby further supporting the preferred alignment.

The Fassaroe Busway would be branded and marketed as a service unique to the Bray area, and providing a high quality connection between Bray Town Centre and the residential areas that support it. A key feature of the service is its ability to connect an area of significant population not only with the new Bray Town Centre development, but with all the services that Bray has to offer, including a significant public transport interchange at Bray DART Station. The service would serve a residential/employment catchment population of some 25,000 persons to the west of the M11, and would be the main means of access between these areas.

The quality and marketing of this service would be crucial, and it is proposed that the catchment population is sufficient to support a host of features that would further improve its profile. Such would include the provision of real time passenger information at stops, ticket machines and good shelter, the use of smaller and more frequent vehicles, and the use of GPS satellite tracking to ensure that constant headways can be maintained.

As with any bus service, the selection and management of the fare structure will be crucial to achieving successful patronage levels. Should the service be privately operated without subsidy, a simple fare structure would be imperative, with the service fully integrated with public transport ticketing for the Greater Dublin Area. An obvious extension to this concept is the operation of a free service, funded by either ongoing developer contributions, or by contributions to the Mobility management Fund described later in this report under the heading of Mobility Management. The adoption of a free service has been shown worldwide to great increase patronage, particularly for short-distance trips, although experience to date has been predominantly for loop services in town and city centres.

7.7. The Resulting Rapid Transit Network



The combination of LRT serving the Greater Dublin Area, and the Fassaroe BRT connecting Fassaroe and Old Connaught with Bray Town Centre will provide a high quality of public transport connectivity through the North Bray and Environs. The network will be further supported by the development of the N11 QBC into Bray Town Centre to be discussed later. Transport services will be of high quality throughout the area, leading to a step change away from reliance on traditional bus services to facilitate development of an area. The adoption of BRT requires a significant commitment to infrastructural spending and will require further discussions

on how such a service can be commissioned, overseen and influenced by the key decision makers at local government level. Whilst Luas will provide good access to the Dublin Area, this must be well balanced by good public transport access to Bray, ensuring its important position within the local economy, and further strengthened by the additional population catchment provided in its surrounding catchment.

7.8. Future Development of Rail serving the Study Area

In concluding the discussion of the Rapid Transit Strategy, some mention is warranted of ht future upgradeability of Luas to full segregation along its length from Fassaroe to the City Centre, such that a metro-style level of service can be achieved. This is likely to become a requirement in the future as a result of strong increases in patronage and a continuing implementation of Demand management in the City Centre to increase the public transport mode share. In recognising this future requirement, the following proposals are made:

- The design of Luas between Cherrywood and Fassaroe should take into account the longer term requirements of upgradeability to metro style operation. This has been accounted for throughout the development of this study, and can be provided along the full length of the proposed route. Construction will use the permanent way of the existing railway between Cherrywood and the M11, whilst grade separation of the route through the Wilford Roundabout is proposed as part of the redevelopment of this junction; and

- The future requirements of the Luas between Sandyford and Cherrywood will require consideration should on-street running become insufficient for the levels of patronage that are experienced. It may therefore be prudent to identify the requirements of such an upgrade at this point, such that any additional lands can be protected. The RPA have produced a report that outlines the feasibility of upgrading the line north of Cherrywood, and a number of constraints are evident. These constraints should be ideally addressed prior to the preparation of the next Development Plan.

8. THE TRANSPORTATION STRATEGY

8. THE TRANSPORTATION STRATEGY

8.1. Introduction

This chapter of the report outlines the Transportation Strategy that is proposed to support the development of the study area over the period to 2020. It is pointed out at this stage that the Transportation Strategy is not a Roads Strategy, but draws on the potential for achieving a balanced and integrated transportation network that serves the needs and demands of all transport modes. The strategy therefore incorporates:

- The provision of a reasonable level of accessibility to and throughout the study area for car users;
- A public transport strategy to facilitate a high level of accessibility along all major desire lines through the study area;
- The development of a network of pedestrian and cycle routes that provide for a short distance trips along direct routings, for example trips to schools, to public transport interchanges, and local employment;
- The provision for integration of different transport modes, and interchange between them;
- Consideration of the safety and security of all road and public transport users;
- The protection of areas by means of heavy goods vehicle restrictions and/or road closures; and
- A set of measures that compliments local and national policy objectives.

The Transportation Strategy has been developed to support the findings and recommendations of the Land Use Strategy outlined in the pervious chapter. In fact the Transportation Strategy plays a key role in facilitating the Land Use Strategy itself, by ensuring that development areas are supported by appropriate transport links, such that a proper balance of demand across modes is achieved.

The various elements of the Transportation Strategy are outlined throughout the remainder of this section under a number of key headings that relate to the key transport modes. All proposals assume the implementation of the Rapid Transit network as outlined previously.

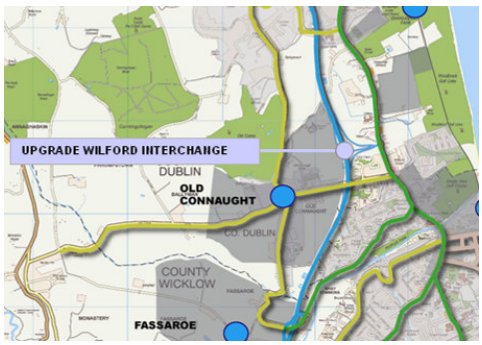
8.2. Roads Proposals

A number of key road improvements are proposed in order to facilitate the expected traffic growth that will result from the proposed development across the study area. The assessment has included traffic growth expected as a result of trips between different zones within the study area, between the study area and external zones, and external to external trips passing through the study area. The consideration of all these demands is necessary in order to ensure a system which functions adequately and takes into account all external influences. The key proposals of the road strategy are as follows:

8.2.1. M11 Wilford Interchange

The Problem

At present, Wilford Interchange has east-facing slip roads only, and hence provides access to/from the Dublin Road. This inhibits access to/from areas to the west of the M11, and all traffic is required instead to travel via the Old Connaught Avenue/Dublin Road junction. This leads to significant queuing and congestion along the Dublin Road, a problem that will increase significantly over future years as the area develops.



Proposed Works

A key proposal of the current strategy is to upgrade this motorway interchange to a full-movement junction such that access between the M11 and areas to the west can be facilitated. This upgraded interchange will tie-into a proposed Link Road connecting the interchange with

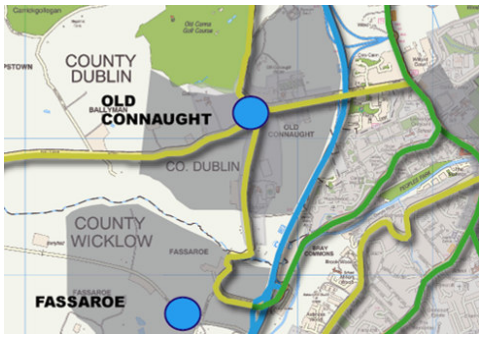
Old Connaught village via Ferndale Road, and onwards to Fassaroe via the Western Link Road described later.

The Benefits

This work will significantly relieve traffic demand and congestion along Old Connaught Avenue and the Dublin Road, providing direct access to the M11, and providing a better vehicular route into Bray Town Centre via the Wilford Interchange, and the Wilford Roundabout on the Dublin Road. It is noted that this proposal to upgrade the Wilford Interchange is cornerstone to the roads strategy, as it feeds a number of supporting proposals outlined throughout the remainder of this section. This scheme would therefore be required early in the phasing of the project and would provide immediate significant relief throughout the locality by reducing existing demands along Old Connaught Avenue.

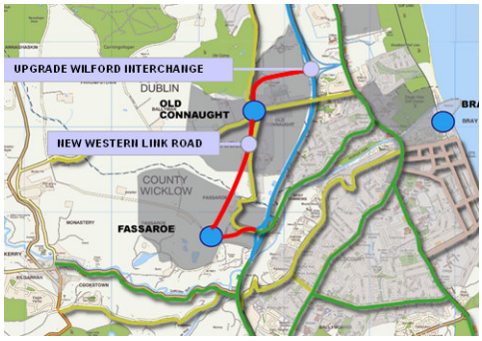
8.2.2. Western Link Road

The Problem

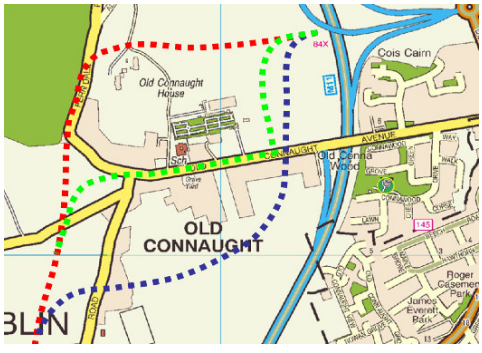


Whereas a significant volume of development is proposed for Fassaroe and Old Connaught, the form of the road connection between them and onward connection into Bray Town Centre also requires consideration. While both Fassaroe and Bray are located along the M11, the use of the motorway as a local link connecting these areas would be contrary to proper planning, and would significantly increase the volume of local traffic using what is effectively a strategic link. Furthermore, there will be a significant volume of local interaction between Fassaroe and Old Connaught associated with retail, employment and school trips, and the use of the M11 for trips of this nature would not be appropriate.

Proposed Works



The demand generated by local development west of the M11 is best catered for by the designation of a new north-south route parallel to the M11, but serving a predominantly local function. This road would act as the main distributor road serving the development of this area, and would connect with the motorway interchanges at both Wilford and Fassaroe, providing onward routes for longer distance strategic trips.



It is noted that there are many constraints in achieving a successful road improvement through Old Connaught Avenue, the primary function of which will be to ensure that Old Connaught Avenue remains a local road serving local residents – with all through-traffic displaced onto the proposed Western link Road. In identifying alignments, a number of options are possible, such as those shown below. Although the red alignment has been highlighted throughout this report, the actual alignment may be any of those shown here, and will be the subject of further investigation through the development of the Local Area Plan.

The Benefits

Such a proposal would reduce the impact of the development of these lands on the M11 in terms of the volume of traffic generated. It also ensures that the M11 is not used for trips between these development lands and Bray Town Centre, which are, in effect, local trips, and

should not make use of strategic routes. It will also ensure that Old Connaught Avenue will no longer be the main access route into Bray, thereby significantly reducing the volume of traffic that would be expected to travel along Old Connaught Avenue.

8.2.3. Old Connaught Avenue

The Problem

The upgrade of the Wilford Interchange will create a new vehicular route from Fassaroe and Old Connaught onto the M11 and through to Bray Town Centre. This will alleviate existing congestion along Old Connaught Avenue and through its junction with the Dublin Road, but raises a new problem of segregation between the areas to the east and west of the motorway, particularly pedestrians and cyclists should they be required to travel through this new interchange. It would also be of questionable benefit to the Dublin Road should traffic continue to use Old Connaught Avenue for accessing Bray Town Centre, as it will not address the issues of traffic congestion at the junction of Old Connaught and the Dublin Road.

Proposed Works

The upgrade of the Wilford Interchange allows Old Connaught Avenue to be used for other means, and the strategy takes advantage of this by using Old Connaught Avenue as the main route from Old Connaught to Bray for buses, pedestrians and cyclists. Old Connaught Avenue will therefore be closed to all vehicles with the exception of buses and local traffic. This gated closure can be achieved by either vehicle actuated traffic signals, rising bollards activated by a transponder or GPS, or by signing and lining. The final system will be a balance of cost, effectiveness, and ease of implementation.

The Benefits

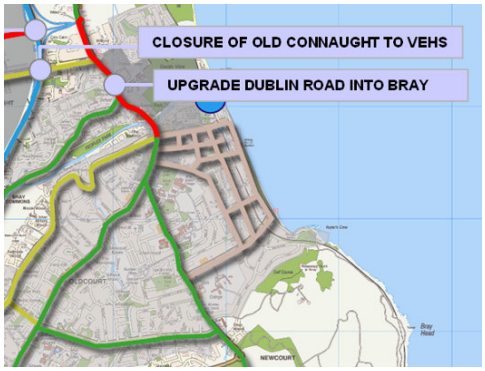
This measure will retain a good pedestrian and cycle link between Old Connaught and Bray, and will greatly support the public transport proposals outlined later in this Chapter. It addresses issues of segregation across the motorway, and also will reduce delay along the Dublin Road as a result of the minimal volume of traffic that will be emerging from Old Connaught Avenue onto the Dublin Road. The closure of Old Connaught Avenue will also reduce the volume of traffic travelling through Old Connaught Village to access Bray Town Centre, as such traffic will now use the new Link Road and the Wilford Interchange.

8.2.4. Dublin Road

The Problem

The Dublin Road currently serves as the main road access into Bray from the Dublin Area, accessed via the Wilford Roundabout or Shankill Village. Traffic flows along Dublin Road are considerable, and have increased dramatically in recent years in tandem with the general growth in the Bray area. The Dublin Road is used as the main access route to the town centre, and also to the suburbs to the south of the town centre. Traffic would appear to use this route as an alternative to the Killarney Road interchange as a result of the queuing and delay through that junction as described above.

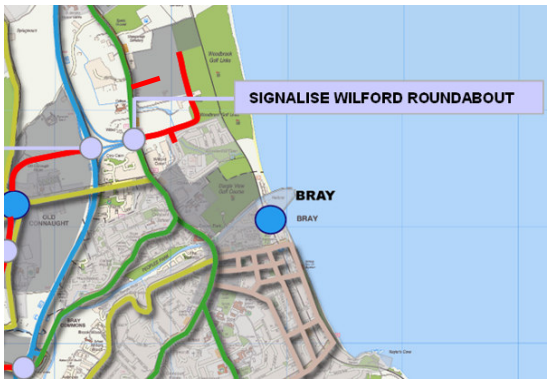
Proposed Works



It is proposed that Dublin Road be upgraded to serve the future needs of access into Bray Town Centre, and to the proposed development at Bray Golf Club on the banks of the River Dargle. The upgrade will focus mainly on formalising parking and loading, and ensuring a reasonable level of road capacity through the various junctions providing access to the proposed development site at the Golf Club and at Industrial Yarns. The closure of Old Connaught Avenue to general traffic would also relieve much of the future delay along this road generated by new developments west of the M11. The upgrading works will focus heavily on providing for bus, pedestrian and cycle movement, as will be described later in this chapter.

In providing access to the development lands at Woodbrook, a number of detailed scenarios were tested to ascertain the traffic impacts on the Dublin Road and through the junction at the Wilford Roundabout. In testing these scenarios, it became clear that the best approach in capacity terms requires the provision of two access points. Firstly, a 4th arm on the Wilford Roundabout is required, along with the provision of an additional access to the Dublin Road some 100m north of the roundabout. Further benefits are achieved by connecting this 4th arm into the Woodbrook Glen Estate to reduce congestion at the existing access to Corke Abbey. It is noted that this arrangement will provide a dual-access to Woodbrook, but the implementation of a right-turn restriction for traffic exiting the site from the northern access will be important in reducing the impact of northbound traffic routing via Shankill village. For southbound traffic, the route via the M11 would be easy, given the ability to introduce a left-slip through the Wilford junction onto the Dublin Road. This avoids delay through the Wilford junction and hence increases the attraction of the M11 route as an alternative to the Shankill route, and as such no left turn restriction for traffic entering Woodbrook from the north is suggested at this stage.

In addition, it is proposed that the Wilford Roundabout be reconstructed as a traditional signalised junction with full pedestrian and cycle facilities. This will allow better management of queuing through this roundabout, placing a higher priority on managing traffic from the M11 thereby reducing the likelihood of any queuing propagating back onto the motorway. It will also address a particular safety issue highlighted during the road safety assessment, and can be undertaken as part of the development of the 4th arm at this junction.



The Benefits

The proposed works along Dublin Road will lead to a more formalised road alignment with limited potential for delay as a result of inappropriate loading and parking. The upgrade will also facilitate some of the expected growth that will occur as a result of the development of the Golf Club Site, although further measures are required in order to accommodate such activity as will be described below.

The signalisation of the Wilford junction returns significant capacity benefits and integrates well into the overall strategy for the LUTS Study. In addition to general improvements in junction capacity, the signalisation of this junction leads to a number of additional benefits:

- It facilitates a safer crossing layout for pedestrians, with the provision of pedestrian signals across all approach arms. Refuge islands can also be included in the design to reduce crossing widths and limit the reduction in junction capacity;

- It significantly increases safety for cyclists, who are extremely vulnerable through roundabouts. This will therefore support the cycle track proposals along the Dublin Road that feeds into the Wilford Junction;

- It will address the existing road safety issue at this location, where a cluster of pedestrian related accidents has been identified;

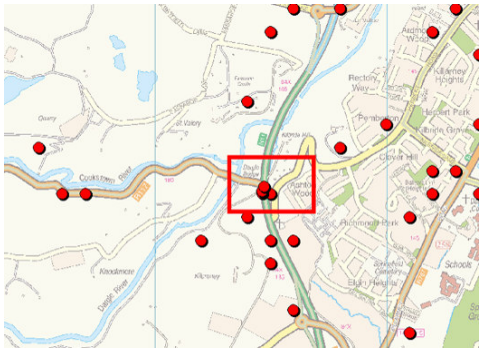
- It will facilitate better bus priority by allowing bus lanes to be continued to the stop line at the signals, as opposed to a setting back of the bus lane which would otherwise lead to higher bus journey times; and

- The provision of the fourth arm onto the existing Wilford junction will better control the impact of development in Woodbrook on Shankill Village, by encouraging key traffic movements to route via the M11. In addition, it will provide a good level of relief to the existing junction serving Corke Abbey, by attracting some of this traffic through the new connection to the signalised junction at Wilford.

Finally, the implementation of traffic signals allows better control of queuing through the junction by adjustment of the traffic signals either at the controller or by means of a UTC system. The protection of the link road to the M11 against queuing propagating back onto the motorway is a critical issue, and is only achievable with the use of traffic signals.

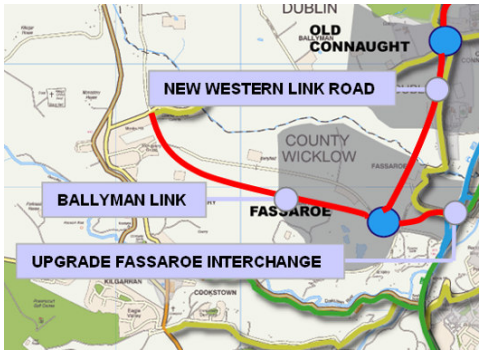
8.2.5. Connection to Enniskerry (Ballyman Link Road)

The Problem



The road connection to Enniskerry from the M11 and Bray area has been identified as of poor quality, and has been the site of a significant number of personal injury accidents, both on the R117 (Twenty Bends Road) and at its junction with the N11. Whereas this could suggest the requirement for an upgrading of the R117, this is balanced against the clear feedback during consultation which indicated that the isolation of Enniskerry supported its charm, and to provide a high level of road accessibility into the area could compromise this setting.

Proposed Works



In order to address the existing safety issues on the R117, while retaining the isolation of Enniskerry, it is proposed to alter the main access route into Enniskerry. With the upgrade of the Wilford Interchange, access from Enniskerry to the M11 is available via the Ballyman Road and the full-movement interchange at Wilford. In addition, access from Enniskerry to the Fassaroe Interchange is also possible via the proposed Ballyman Link Road. This provides good access options to Enniskerry from both Old Connaught and Fassaroe, and allows the existing R117 to be closed at its junction with the N11. The existing Enniskerry bus service would also route via Fassaroe and the new Ballyman Link Road, providing an additional bus connection to Fassaroe en-route via the Dargle Road.

The Benefits

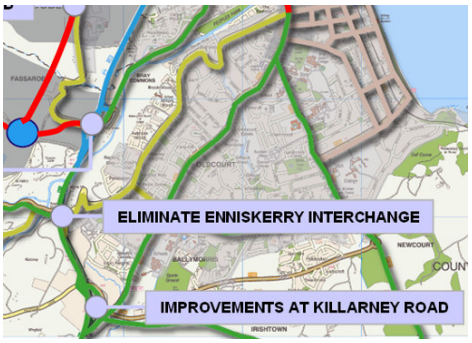
These proposals will lead to a more isolated setting for residents along this road, and addressing a serious road safety issue at the R117/N11 junction described earlier in this report. It will also reduce the volume of u-turning traffic volumes through the Killarney Road Interchange, currently necessary as a result of the left-in and left-out arrangement onto the R117.

8.2.6. Killarney Road Interchange

The Problem

A number of existing problems were noted throughout this study at the Killarney Road Interchange. Whereas the key problem is the capacity of the existing roundabouts at the interchange, this manifests itself in queuing that blocks back onto the N11, and leads to a significant road safety issue. A solution was required that addressed the issues of capacity and road safety through this junction, thereby ensuring a reasonable level of vehicular access to the southern environs of Bray.

Proposed Works



The proposals at the Killarney Road Interchange are both short-term and long-term. In the short-term, a signalisation of the eastern roundabout at this interchange is proposed. The signalisation will involve a removal of the existing roundabout and its replacement with a traditional 4-way signalised junction with facilities for pedestrians as appropriate. A similar arrangement is proposed on the western roundabout, where existing queuing occurs on the off-slip of the N11. In the longer term, a new off-slip can be constructed from the N11 southbound onto the eastern roundabout that will remove the conflict leading to the existing queuing. This longer-term solution will involve reinstatement of the circulating carriageway, although given the cost of such works and the effectiveness of the signals the requirement for the long term solution can be questionable.

The Benefits

The introduction of traffic signals will address the significant queuing on both the northbound and southbound off-slips from the N11. This will not only reduce the level of congestion and delay through the junction, but will lead to a significant reduction in the safety risk at this location.

8.2.7. N11 and M11 Upgrade

The Problem

The M11 is the main strategic north-south connection through the study area, providing the main access for longer distance traffic into Bray, and forming an important connection between the Dublin Area and Wicklow/Wexford. With increasing traffic flows, further increases in congestion are expected at the junction of the M11/M50 over the period to 2020, and an increased incidence of flow breakdown and congestion is expected throughout the day as link flows approach capacity. Traffic congestion already occurs on the M11 between the M50 and the Killarney Road Interchange during the PM Peak Period, resulting from a complex process of flow breakdown and reduction in lane running capacities as a result of the forced southbound merging of M11 and M50 traffic, and the reduction in the free-flow speed through the southbound transition from the M11 onto the N11.

Proposed Works

With increasing traffic flows on the M11, and the proposal to introduce a new access to the Southern Environs of Bray from the Fassaroe Interchange, it is appropriate that a widening of the southbound carriageway of the M11 to 3-lanes is proposed from the M50 to the Fassaroe Interchange. The purpose of this widening is primarily to improve the merging between the M11 and M50 by reducing the need for all M11 traffic to merge into the running lanes on the M50. In addition, it provides an additional level of southbound capacity through Wilford and Fassaroe.

Also proposed is the consideration of a system of Variable Speed Limits to manage and control traffic during congested conditions. Variable speed limits work effectively to manage traffic flows in near-capacity conditions, reducing stop-start driving and flow breakdown, and can also lead to significant road safety benefits. The Variable Speed Limit area would operate from Cherrywood and Loughlinstown to Fassaroe, indicating speed limits of between 80kph and 120kph depending on traffic volumes. Variable Speed Limits could prove a short-term solution to queuing and congestion along the M11, although the effectiveness would require a more detailed investigation into the mechanics of merging and flow breakdown along this section of the M11. This system requires legislation to be implemented in a statutory fashion, and whilst this should not be treated as a barrier to implementation, there is a possibility for it to be implemented as advisory signing in the interim.

The Benefits

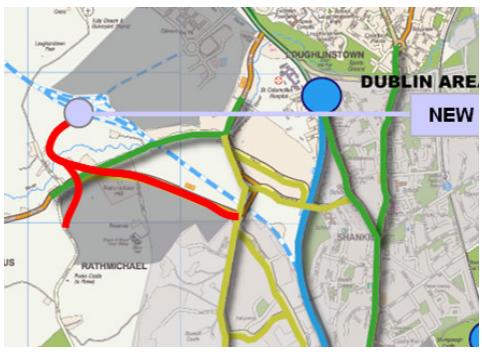
The M11 and N11 widening would facilitate an improved merge between the M11 and M50, where traffic currently reduces from four to two lanes, and would mitigate existing and future traffic bunching south of the Wilford Interchange. This widening would also ensure improved access to the Fassaroe and Killarney Road Interchanges from the north, thereby ensuring that Dublin Road does not remain the only feasible alternative for access to Bray Town Centre.

8.2.8. Rathmichael Road Upgrade and Cherrywood Link Road

The Problem

The Rathmichael area is currently dominated by low density housing served by Rathmichael Road and by Ferndale Road, with access to the strategic road network either by either Cherrywood Road/Stonebridge Road or via Old Connaught Avenue. It would be inappropriate to facilitate any significant increase in vehicular traffic through this area under the current situation for a number of reasons. Firstly, narrow road widths on Rathmichael Road and Ferndale Road lead to concerns should any notable increase in traffic be introduced. Secondly, the scope for introducing appreciable levels of public transport into this area is difficult via these existing links. Widening of Ferndale Road to facilitate access to/from Old Connaught Avenue would be difficult as it would require land acquisition from a number of property owners fronting the road. In any case, the M11 provides the main north-south route for traffic to/from Cherrywood and Loughlinstown, and the benefits of significant works along Ferndale Road are questionable.

Proposed Works



In order to facilitate the development of zoned lands it is proposed that there will be a new link into the Cherrywood Interchange from Rathmichael Road, supported by the upgrading of Rathmichael Road to take it to a standard that is appropriate for facilitating access to the development lands in the northern area of Rathmichael.

The Benefits

The connection to the Cherrywood interchange and the upgrading of Rathmichael Road will lead to a good quality and safe road access route into the Rathmichael area from the M50 via the Cherrywood Interchange and from Bray via

Stonebridge Road. It will also ensure that no major widening works are necessary along Ferndale Road which would lead to a requirement for considerable land acquisition and local disruption. Furthermore, the provision of a connection to Cherrywood will allow the Rathmichael area to take advantage of the high levels of public transport accessibility that will be available through the Cherrywood area, a benefit that cannot be otherwise achieved without significant difficulty using existing road infrastructure.

8.2.9. Road Safety Measures

The Problem

A number of areas were identified during the Road Safety Assessment where the accident history suggested a particular road safety issue. As part of the development of the current strategy, addressing these existing road safety problems was necessary. The three key areas where road safety improvements were required are:

- *Killarney Road Interchange :* A number of fatal and serious injuries generally occurred during the night time, involving 2 or more vehicles. Queuing backs onto the M11 from this interchange and this, in conjunction with poor visibility is assumed as the main cause of these accidents;

- *R117 :* This road is winding and narrow, and reasonable volumes of traffic use it to access the M11. The R117 itself is known locally as an accident blackspot, and a number of multiple vehicle collisions have been recorded, although no serious accidents are noted over the period 1996-2002;

- *Priority junction between R117 and M11 :* The proximity between this junction and the Fassaroe Interchange results in vehicles merging along a short stretch of the N11. The analysis identified a cluster of 3 accidents over the 6-year period, with two of these occurring during daylight hours. One accident was reported to involve a pedestrian; and

- *Wilford Roundabout :* Both daytime and night time accidents have been reported at this location, with only one such accident resulting in a serious injury. A notable proportion of accidents at this location were reported to involve pedestrians, and can be explained by the lack of pedestrian facilities through the roundabout.

Proposed Works

Works to address the road safety issues at these locations have been incorporated into the broader strategy. The following measures have been incorporated:

- *Killarney Road Interchange :* Upgrading of this interchange to remove queuing from the N11 to Killarney Road. The removal of queuing blocking back onto the N11 is expected to address a significant safety issue at this location;

- *R117 :* It has been proposed that the connection from the R117 to the N11 is closed, and that vehicles are instead required to use Ballyman Road and the Wilford Interchange to access Bray from the Enniskerry area. This will significantly reduce traffic volumes along the R117;

- *Priority junction between R117 and M11 :* Again, the closure of the link from the R117 to the N11 will remove traffic conflicts resulting from traffic emerging from the R117; and

- *Wilford Roundabout :* A more defined pedestrian route through this roundabout is proposed. The main proposal in this regard is to signalise this roundabout, with an additional 4th arm serving the Corke Abbey area. The use of traffic signals will better manage queuing and delay, and facilitate a much safer pedestrian environment.

The Benefits

These localised improvements, along with the general improvement in pedestrian, cycle and road infrastructure, will greatly improve road safety throughout the study area. This mitigation of road safety issues is of crucial requirement going forward, given the expected increases in

traffic volumes that will occur over the period to 2020, and the potential increase in road accidents that could otherwise occur.

8.2.10. Traffic Calming

The Problem

As part of the development of the Fassaroe and Old Connaught areas, road access has been facilitated by improvements to the Wilford Interchange, Ballyman Road, and the Fassaroe Interchange. There is, however, a risk that existing roads through Rathmichael may be used for strategic traffic movements to/from the M50, particularly during the peak periods. Such movements would use Crinken Lane, Ballybride Road and Ferndale Road to access the M50 via the proposed interchange at Cherrywood. This issue is relevant for both cars and for heavy Vehicles, and would lead to a significant safety issue on road which are wholly unsuitable for large increases in traffic volumes.

Proposed Works

A programme of traffic calming is therefore proposed throughout the Rathmichael area, to cover Ferndale Road and Crinken Lane. The traffic calming proposals would be such that mean speeds would be reduced to approximately 30kph. Traffic calming would incorporate the construction of raised footways to maintain a narrow carriageway width of approximately 6.0m, supported by localised pinch points, raised pedestrian crossings (particularly near schools), ramps as necessary and other horizontal deflections to break-up longer stretches of carriageway that may induce higher speeds. It is accepted that these roads are not currently attractive to through-traffic in their current form. Despite this, they are not suitable for pedestrian movement, and proposals are outlined in this strategy to gradually improve pedestrian access. In certain cases, the introduction of footways can lead to higher traffic speeds as a result of an increase in the general cross section of a roadway. It will, therefore be important that traffic speeds can continue to be managed effectively as such works are progressed. A weight restriction of 7.5t should also be introduced throughout Rathmichael. Finally, it is proposed that Thornhill Road be closed, as north-south access will be available via the new Western link Road.

The Benefits

Restraining through-traffic from the Rathmichael area will ensure that increasing traffic volumes do not lead to an unacceptable increase in the safety risk along these roads. This will also ensure that maximum benefit is derived from the proposed works in the vicinity of the Wilford Interchange, at the Fassaroe Interchange, and along the M11.

8.3. Public Transport Proposals

It was recognised at an early stage of the study that a robust and effective Public Transport Strategy would be key to the sustainable development of the Bray Environs in a manner that would not be focused on car use as the dominant means of transport. The Bray area currently suffers from significant congestion, and this is most notable on those roads leading to/from Bray Town Centre. Significant capacity improvements to these roads would be difficult, and hence an alternative transportation strategy is necessary to support future growth in the area. It was established during the calibration of the base year traffic model that the current level of car use in the Bray area is quite high, and there is therefore good scope to reduce this existing level of car dependence. This would therefore allow significant growth with the focus of infrastructure delivery including a significant public transport element, thereby achieving the objectives of the current study and meeting local and national transport policy objectives.

This section of the report outlines the Public Transport Strategy that has been developed to achieve this. The Public Transport Strategy has been developed based on a number of guiding principles that include:

- The delivery of a system that provides good connectivity throughout the Study Area, connecting residential areas with places of work, education and shopping;
- The development of a network that facilitates a high quality of service along defined corridors, and with all necessary infrastructure identified from the outset;
- Consolidation of land uses along key service corridors to further support services, and ensure that critical patronage levels can be achieved;
- The maximising of public transport catchments by facilitating good interchange between different services; and
- The development of a system that competes effectively with the car as a mode of transport for the majority of trips within the study area.

As such, the Land Use Strategy has formed an important element of the Public Transport Strategy, in that it plays a key role in ensuring the feasibility of the Public Transport Proposals. This will be discussed later under the heading of “Risk Management”.

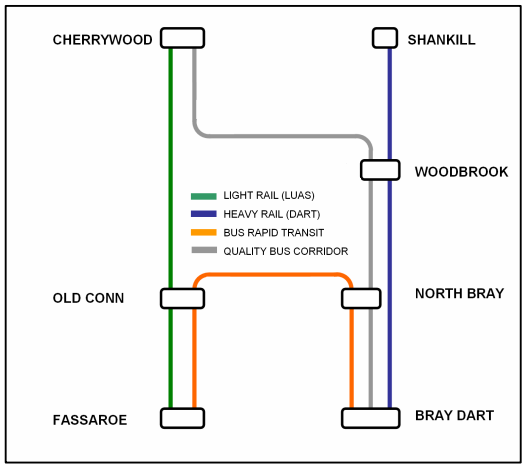
8.3.1. Rapid Transit Network

The Objective

The development of the Rapid Transit network was discussed in Chapter 7, and is made feasible by the specific pattern and scale of development that is being proposed. The role of Rapid Transit in supporting the development of the study area is therefore a key consideration and has been a core feature of the current work.

The Proposal

The final Rapid Transit Strategy incorporates a total of four lines that include the existing DART service. These are the Luas Line B from the City Centre to Fassaroe, the Fassaroe Bus Link connecting Fassaroe with Bray Town Centre via a segregated busway, the existing DART service linking Greystones and Bray with Dublin City Centre with a new dart station at Woodbrook, and the N11 QBC connecting the Bray Area with Woodbrook, Cherrywood and onward to Stillorgan and the City Centre. This strategy ensures a system that serves the full local area using technology that is appropriate to the catchment area of each element of the final system. The use of the Fassaroe Bus Link ensures a high level of connectivity between the relatively parallel Luas and DART services, thereby improving overall connectivity through the local network.



A strategic connection between Woodbrook and the N11 QBC is feasible using the Public Transport Link to be developed through the Woodbrook Lands, allowing some passing services to serve the residential development within Woodbrook and the DART station along a practical routing. This could provide improved connections between Cherrywood and the DART, and will be discussed later.

The Benefits

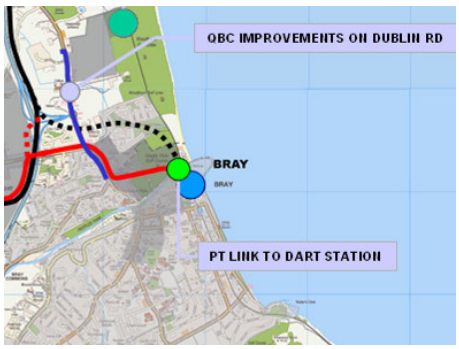
The proposed sys tem effectively provides a fully integrated public transport network in the Bray area that is founded on a small number of services along defined transport corridors. The adoption of the proposed pattern of land use and development outlined in Chapter 6 is of crucial importance in ensuring the feasibility of this network, that is equally balanced between access to the Greater Dublin Area and to Bray Town Centre, and hence achieves a number of objectives to consolidate and support the economy of Bray Town Centre as a location for shopping, working, and leisure.

8.3.2. Dublin Road Quality Bus Corridor

The Objective

Access to Bray Town Centre is of critical importance to the town, and in particular access into the town along Dublin Road, which is the main approach corridor from the Dublin Area. Dublin Road alr eady carries a significant volume of bus patronage between to and from Bray and Dublin via the N11, and significant patronage increases have been experienced following the commissioning of additional QBC works along this corridor in 2004. This reaction to improved public transport journey times and reliability confirms the extent of latent demand for public transport along this corridor, and further such improvements will serve to strengthen this effect.

The Proposal



With continuing increases in demand for access to Bray, and the limited scope for major increases in road capacity, it is therefore proposed that the upgrading of the Dublin Road between the Wilford Roundabout and Bray Town Centre would focus on the provision of a continuous bus lane providing unimpeded access from Shankill and the M11 into Bray Town Centre. This would be achieved by a widening of the Dublin Road to two lanes in each direction, with a further lane in each direction being reserved for bus use. Furthermore, the closure of Old Connaught Avenue to general traffic would reduce the impact of Old Connaught Avenue on traffic using the Dublin Road, thereby further reducing the delay to bus movement. Proposals to reconstruct the Wilford Roundabout as a traditional signalised junction have already been described and will support the general measures for bus movement along this corridor.

A facility for buses to access Woodbrook DART Station and the Woodbrook estate from the Shanganagh prison lands has also been proposed. This could see some buses along the Dublin Road diverting specifically into the Woodbrook lands with a potential set-down area at Woodbrook DART Station for those buses not continuing into Bray Town Centre. This link would not be available to general traffic, and hence would protect the environmental amenity along this link. Such a restriction would be enforced typically by a system of automatic bollards, and would reflect the technology employed at Old Connaught Avenue as part of the closure across the M11. Further improvements are proposed along the Dublin Road at Industrial Yarns and at the Lower Dargle Road to facilitate bus movement to/from Bray Town Centre while recognising the requirement for vehicular access to the new developments along this corridor.

The Benefits

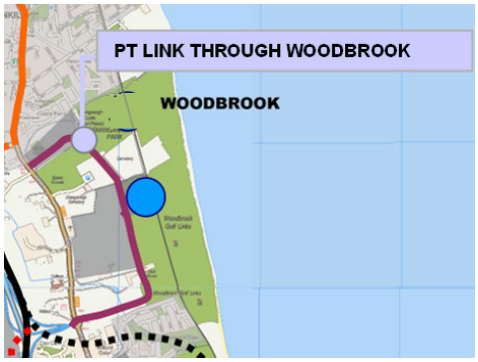
The proposed introduction of bus lanes along the Dublin Road would extend from the Wilford junction as far as Bray Town Centre, and would fully protect bus movement along this stretch of road. Future significant development north of Woodbrook with access onto the Dublin Road will require an extension of this widening to be considered in the longer term to ensure that the protection to buses is retained thereby tying into the village improvement works through Shankill and the Bus Gate already provided at Woodbrook. This proposal will ensure that bus users avoid any possible congestion already experienced along the Dublin Road during peak periods, and will further support the position of bus services in catering for the future need of transport accessibility into Bray. It also plays an important role in facilitating the high quality transport link from Fassaroe and Old Connaught as will be discussed below. It is also stressed that any introduction of new signalised junctions north of the Wilford junction will require a northbound extension of this bus priority to ensure that journey times can be protected. Full continuous bus lanes in each direction would be necessary.

8.3.3. Woodbrook Public Transport Link

The Objective

Despite the location of Woodbrook an the DART corridor, and served by a new DART station, it will be necessary to provide some bus linkages from the N11. This will be required to ensure that access is available to/from areas such as Cherrywood, Stillorgan, Donnybrook and other parts of the City Centre, and would reduce the sole reliance on DART for serving the Woodbrook catchment.

The Proposal



As part of the development of the Woodbrook lands, there has been discussion of a road link from the Shanganagh Prison site through to the Woodbrook site. This road would be available as a public transport, pedestrian and cycle route, and would facilitate better access into Woodbrook by Public Transport.

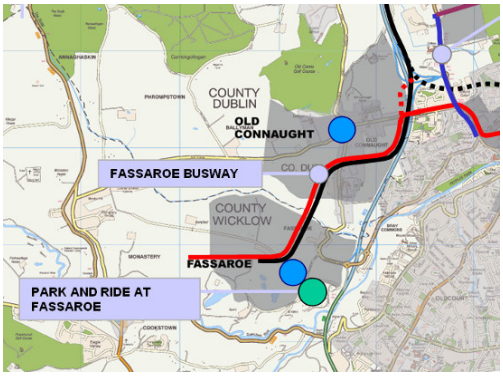
This proposal is included in the current strategy in that it will allow some of the passing services on the N11 and Dublin Road to serve the Woodbrook development and Woodbrook DART station without requiring any significant diversion or backtracking. For example, southbound services would leave the Dublin Road at Shanganagh Prison and travel through the housing development proposed for that site. They would then cross the Public Transport Link to Woodbrook, serve the DART station, and exit back onto the Dublin Road directly from the Woodbrook lands. Services could either be through-running, or could terminate in Woodbrook. There may be a justification for only selected services to follow the route through Woodbrook, in order to avoid excessive inconvenience for other bus users travelling through to Bray. Access through the Public Transport link would be controlled by a system similar to that proposed for Old Connaught Avenue, where operation as a Public Transport Link is also proposed.

The Benefits

The provision of this connection will not only provide a more feasible routing for through-services connecting with Woodbrook, but introduces a new strategic connection between the DART at Woodbrook and the LUAS at Cherrywood. Notwithstanding this, the connectivity is not of the quality envisaged for the Bus Rapid Transit in Fassaroe, and would not be expected to compete aggressively with that service. The attraction of passing services into Woodbrook will be important in reducing the undesirable impacts of high levels of car use that could materialise from this site.

8.3.4. Park and Ride

The Objective



The use of Park & Ride as a strategic transport planning tool has long been recognised as an effective means of improving the catchment area of public transport services along suburban corridors. The fundamental theory is that whereas a transport corridor will serve an immediate catchment in the vicinity of it, this catchment can be extended by facilitating car access and parking in the vicinity of key points along the corridor. The main drawback of park & Ride, however, is that an increased provision for parking by commuters leads to a lower capacity for developing land in the vicinity of railway stations, and hence leads to a lower immediate catchment area. As such, the use of Park & Ride is most common on land that is otherwise redundant, and would not necessarily be fit for development. This is reflective of the DTO Park & Ride Strategy that states that such sites should be ideally located along the major commuting corridors and access to such sites should have minimal impact on local communities. Under the current study, the extremely low population densities outside the study area would suggest that park and ride is essential to ensuring that the proposed measures will provide real benefits for the wider area, and hence some consideration of sites is necessary. In developing Park & Ride proposals, consideration has also been given as to how the existing high level of Park & Ride demand in the vicinity of Bray DART Station can be accommodated elsewhere.

The Proposal

The provision of Park & Ride has become common as part of the development of the Light Rail Network throughout the Greater Dublin Area, with facilities currently at Sandyford and the Red Cow, and a future site at Carrickmines forming part of the Railway Order application for Line B1. Nevertheless, the use of land in close proximity to a high capacity public transport corridor leads to benefits for a small number of individuals, and is not considered good economic return on land that could otherwise be developed at higher densities. Current travel patterns throughout the Greater Dublin Area show that rail-based Park & Ride is under heavy demand where no parking fees are payable. Where parking fees are charged, demand drops considerably, and this has been shown from recent experience in Sandyford. In essence, the imposition of charges removes opportunistic Park & Ride, and retains those who have a genuine requirement for the facility.

The question therefore arises as to whether sites should be set aside for large-scale Park & Ride given the poor return on the investment, on the basis that high parking charges are required for an appreciable return to be achieved, and hence the low demand that would be expected. For fee-free Park & Ride, it is reasonable to assume that any level of provision will be filled, as this simply acts to compete with local buses, cycling and walking for access to railway stations. The basis for the current study has therefore been to provide a nominal level of Park & Ride that can be more easily integrated into the development of key sites, and that can be effectively managed by the imposition of reasonable parking fees. This will ensure that car-based trips to railway stations are not encouraged, and that Park & Ride is available for those with a genuine need for such a facility.

Fassaroe is highly accessible to the N11 and with the arrival of Luas would be likely to experience some demand for Park & Ride. Although subject to a Masterplanning exercise, it is likely that there will be some car parking facility adjacent to the Fassaroe Interchange to serve the Fassaroe area, and this car park will be in close proximity to the Luas terminus. Up to 500 Park & Ride spaces are proposed at this location, which would not only serve as an important facility for those accessing the Dublin Area, but could also act as an out-of-town car park for Bray Town Centre to support events and festivals that may be planned in the town over the summer months.

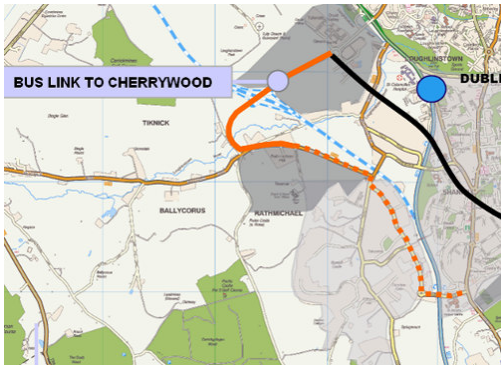
The Benefits

The provision of 500 spaces will have two key effects. It will attract some of the Park & Ride demand from Bray Town Centre and Bray DART Station to the new facilities, but it will also lead to the generation of a significant volume of new Park & Ride trips that do not currently occur as a result of the existing constraints at DART stations. This therefore necessitates an appropriate charging mechanism such that users who are already within the catchment area of a particular service will not use their car to access them.

It is noted that much of the existing Park & Ride activity in Bray is generated by the residential areas along the southern suburbs of the town for which public transport links to the DART (or subsequently Luas) are of poor quality. Although services do exist, they are relatively skeletal and suffer from considerable traffic congestion during peak periods. Whereas access to Fassaroe may become a more feasible alternative for this catchment, this would need to be addressed in the form of a broader Public Transport Study for the Bray area.

8.3.5. Rathmichael Public Transport Links

The Objective



As the current study progressed, it began to become apparent that the Rathmichael area would retain a relatively isolated status from the rest of the study area and from the urban areas of Bray in general. This is not only reflective of the difficulty in improving access roads into and through Rathmichael, but also responds to the currently rural setting of the area that could be compromised by the implementation of major infrastructural upgrades. As such, some form of providing public transport access to Rathmichael is necessary, but in a manner that does not lead to the Rathmichael area becoming a major through route for general traffic travelling from the Fassaroe/Old Connaught to Cherrywood and the M50. This is particularly relevant given the proposal to develop a residential community on the northern fringes of the Rathmichael area along the Rathmichael Road.

The Proposal

The key proposal that will impact on the Rathmichael area is the provision of a connection from Rathmichael Road to the M50 and Cherrywood as described earlier. It is proposed that this link would be developed in a manner that would consider this new crossing of the M50 by buses serving the Rathmichael area in addition to general vehicular traffic. As such, the residents of Rathmichael will be in a position to take advantage to the high levels of public transport accessibility that will exist at Cherrywood. This can be achieved by means of the extended running of some buses into Rathmichael that would otherwise terminate at Cherrywood, and by facilitating a pedestrian route to the Cherrywood Luas stop.

The Benefits

This simple consideration for buses across the new link road will therefore greatly improve public transport accessibility into the Rathmichael area from the north. This removes the need to develop a high capacity road alignment from the developing areas of Rathmichael into Bray that would be likely to lead to a strong increase in traffic travelling north-south through Rathmichael.

8.3.6. Shankill Traffic Management

The Objective

The existing road alignment through Shankill is relatively constrained, and is typical of a town centre street. The Old Dublin Road through Shankill does, however, support significant bus activity, and any increase in congestion along this route will have a notable impact on bus journey timnes along this corridor, given the limited availability for introducing bus priority. With the current study, the potential for an increase in traffic volumes through Shankill does exist, primarily as a result of the increase in the level of development along the Dublin Road. Furthermore, since the introdution of the current traffic calming scheme in 1998, the level of accidents remains significant through the village, and further attention is therefore necessary to reduce speeds, improve traffic safety, and reduce the potential for through traffic.

The Proposal

This study proposes a review of the existing traffic management through Shankill with a view to strengthening the existing scheme, and reducing traffic speeds to a maximum of 30kph. Details should be worked up as part of such a scheme, and should be based on a thorough and specific review of the accident data available for this area. Proposals may include speed ramps, environemtnal treatments, shared surfaces, width restrictions, bus gates and other measures as necessary.

The Benefits

Whereas there are obvious road safety benefits associated with reductions in speeds through Shankill, one significant public transport related benefit is the reduction in through traffic that would result from such an initiative. This would reduce the level of congestion through the village and lead to improvements for bus operations, thereby protecting this route as the main public transport corridor leading into the Bray area.

8.4. Pedestrian and Cycle Proposals

8.4.1. The Objectives

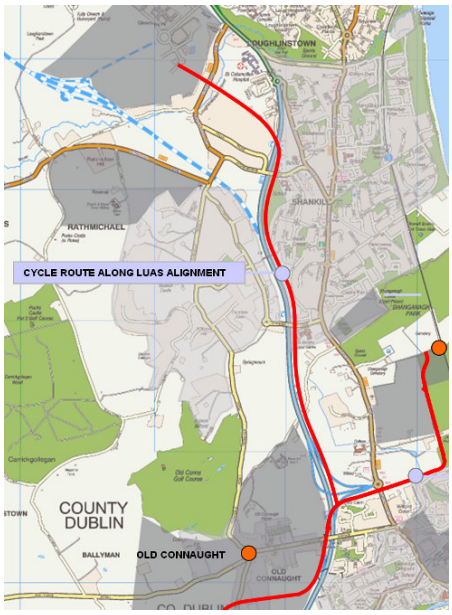
In the development of the Transportation Strategy, the consideration of “Slow Modes” is always an important feature of the package of measures. Slow Modes typically refer to cycling and walking, and form a significant proportion of trips undertaken in any urban area. Without adequate consideration of such requirements, the dependence on Slow Modes reduces, and leads to a corresponding increase in car use. As such, provision of a safe and convenient environment for pedestrians and cyclists is an important element in the overall management of motorised travel demand.

In order to begin the process of developing strategic pedestrian and cycle proposals, it was first required to assess the particular desire lines for such movement. During this process, an understanding of the type of activity associated with different users is necessary, and normally adopts the rule of thumb that the majority of walking trips are less than 1km in length, whereas cycling trips are typically for distances of less than 5km. Where walking or cycling is a form of leisure, journeys tend to seek out routes of higher environmental attraction, and hence these distances increase. The main theme of the current strategy has been to develop commuting routes that are more typical of leisure routes such that acceptable walking and cycling distances can be maximised, and that they offer a real alternative to travel by car.

8.4.2. The Proposals

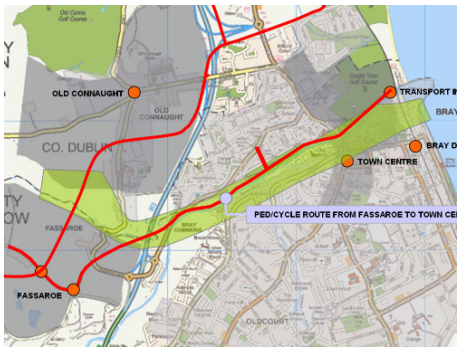
Following an assessment of the particular needs of pedestrians and cyclists, a series of measures has been developed that forms part of the overall Transportation Strategy. These are outlined below.

- Luas Cycle/Pedestrian Route



The Luas route from Cherrywood into Fassaroe brings with it an opportunity to develop pedestrian and cycle links along the alignment to strengthen the alignment not only as a corridor for Luas operation, but as a broader transport corridor serving local pedestrian activity, and longer distance cycling trips. Such a facility would also take advantage of the high level of segregation to be provided along the Luas alignment, and the various environmental improvements that support it. It would therefore be a highly attractive cycle and pedestrian route connecting the various local centres of Cherrywood, Old Connaught and Fassaroe, with links via Old Connaught Avenue to Bray Town Centre. The inclusion of this route will ensure that the Luas alignment can be developed as 'Public Space'. This compares with the alignment north of Stillorgan which, although providing a high level of service along a segregated corridor, is not available for use by other users such as cyclists, and hence the land is effectively unused as a public realm.

- Dargle Valley Amenity Area



The Land Use Strategy has set out how considerable levels of development can be achieved in Fassaroe and can be supported by high levels of public transport accessibility by introducing Rapid Transit concepts linking the area with the Greater Dublin Area and Bray Town Centre. Topographical constraints and poor levels of service on existing roads can serve to isolate Fassaroe from Bray, and hence it has been important throughout the study to ensure that good connections between Fassaroe and Bray can be achieved. The means of achieving this by road and by public transport have already been outlined. Nevertheless, whereas Fassaroe lies only 2km from Bray Town Centre, the current route along the Dargle Road is neither attractive nor convenient for either walking or cycling, and this contributes to a sense of isolation.

Examining the location of Fassaroe, it is evident that the most direct route into Bray is via the attractive Dargle Valley. At present however, access to the river along this valley is limited, and development actively fronts away from the valley and onto the Dargle Road. It is therefore proposed that the Dargle valley be designated as a High Amenity Area, and that works are undertaken to construct a footway/cycleway along the banks of the river between the Fassaroe Interchange and the Dublin Road. The route would require some reconstruction of the river bank to accommodate the alignment, and would provide an extremely direct route into the Town from all areas along its alignment.

These works would be supported by an improved route through the Fassaroe Interchange on the M11, which can be tied into the reconfiguration of this interchange

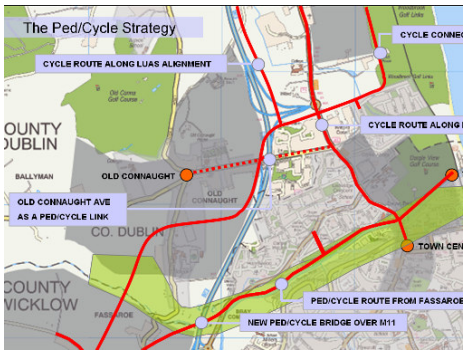
proposed earlier. Downstream, the route would pass under an arch of the Dublin Road Bridge at a low level before connecting into the lower walkway being proposed as part of the development of the Golf Club Site. This would therefore provide direct access not only to the Town Centre, but to the development at the Golf Club Site, and onwards to the DART Station via the proposed Public Transport bridge at the eastern end of this development. Between the Peoples Park and the new bridge, the walkway would be at a low level that would allow for flooding during times of high rainfall. The route under the bridge arch would be constructed in the form of a slatted wooden boardwalk that would not impede water flow under the bridge.

- Dublin Road Improvements

With good access available from Old Connaught to the Dublin Road, the provision of further improvements along the Dublin Road connecting Old Connaught Avenue with Bray Town Centre is seen as providing this last link. The good space that is available along the Dublin Road would suggest that cycle tracks can be achieved from Woodbrook and the Wilford Roundabout as far as Bray Town Centre, connecting via the Golf Club lands to the new Dargle Bridge and onto Bray DART Station. The cycle track would connect the Town Centre with Old Connaught Avenue, with St Brendan's School, with the proposed development at Woodbrook, and with the Luas cycle route crossing the Dublin Road as discussed above.

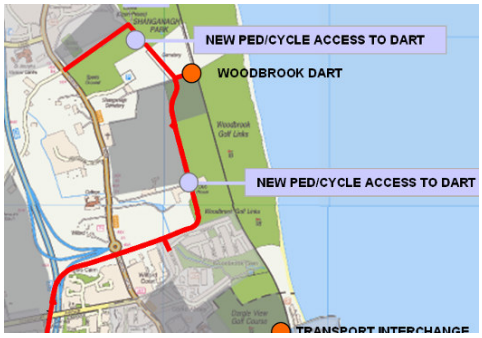
In addition to the provision of cycle tracks, it is proposed that the existing Wilford Roundabout be signalised to improve safety for pedestrians and cyclists, as well as providing the ability to manage any risk of traffic queuing back onto the M11 during the Peak Periods.

- Old Connaught Avenue



The upgrading of the Wilford Interchange provides an opportunity to re-examine the function of Old Connaught Avenue in providing local access through the Study Area. The proposal to restrict Old Connaught Avenue to buses, cyclists and pedestrians at a point crossing the M11 has already been described, and there are significant benefits in terms of ensuring rapid bus journey times. This proposal can also be extended to include for cyclists movement across the motorway, and therefore avoids the necessity for cyclists travelling into Bray to travel through the Wilford Interchange, the layout of which would not be suitable for cyclist activity.

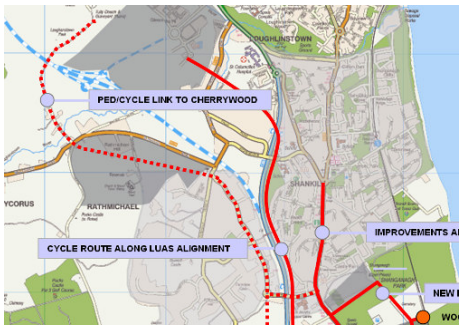
- Woodbrook Pedestrian and Cycle Access



Pedestrian and cycle access to Woodbrook will be provided from Dublin Road to the north and south of the development lands, and recognises the potential for the new Woodbrook DART Station to attract walk-in and cycle-in trips. The corridor proposed will connect from the Wilford junction via Woodbrook Golf Course, and along the DART alignment to connect with Woodbrook DART Station. Continuing north, an additional route is proposed that will travel through the Shanganagh Prison site and across open field to Woodbrook via a specially designated public transport link. This will provide a continuous connection from Shankill Village via Woodbrook and the Dublin Road into Bray Town Centre, connecting onwards to Fassaroe via the Dargle Valley. Cycle routes through Woodbrook and connecting into Bray Town Centre will be referred to later as the East Coast Cycle Route.

A facility for buses to use this link can also be incorporated in to the link connecting Shanganagh with Woodbrook DART Station, and could see some buses along the Dublin Road diverting specifically into the Woodbrook lands with a potential set-down area at Woodbrook DART Station. Note that the pedestrian and cycle link would also provide a connection into The Drive in Woodbrook Glen.

- Tully Lane Link

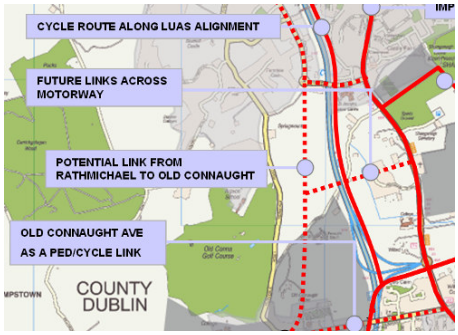


The provision of a vehicular connection into Cherrywood via the Cherrywood Interchange has already been discussed. Whereas this will provide a good vehicular link across the M50, it does not represent a particularly attractive nor safe route for cyclists or pedestrians. An alternative route across the M50 is available via Tully lane and Heronford lane, and this would provide a good connection into Cherrywood from Rathmichael. Such a link could be tied into a segregated 2-way cycle track along the alignment of Rathmichael Road as part of the development of the Sorohan's site, and onward to Ballybride Road. This route would also tie into the linear park being developed through Cherrywood and Cabinteeley.

- Rathmichael Pedestrian/Cycle Route

Some further proposals to improve pedestrian and cycle access and safety into and through Rathmichael. The main impact on pedestrian and cycle access into Rathmichael arises as a result of the proposed link to Cherrywood, which will facilitate pedestrian and cycle activity to local services in Cherrywood, and to Luas. In addition, it is proposed that a new pedestrian and cycleway is implemented from Old Connaught to Crinken Lane, running along the eastern boundary of the Rathmichael area. This will connect with an onward route along Ballybride Road that is more suitable for such activity than Ferndale Road, and will provide a continuous north-south alignment from Fassaroe to Cherrywood without any requirement to travel via the Dublin Road. Such a route would also cater for cyclist traffic from the Bray area to Cherrywood along an attractive rural route with limited interaction with general traffic.

- East-West Linkages



A key shortfall in east-west accessibility for pedestrians and cyclists remains between Old Connaught Avenue and Crinken Lane, and effectively isolates the land to the west of the M11 between these two points. Whilst not considered in the current study, it is possible that the lands to the west of the M11 immediately north Old Connaught Avenue will be developed in the longer term. As part of any development of these lands, additional linkages in the form of pedestrian/cycle bridges across the M11 will be imperative to ensure adequate connectivity with the Bray area and hence reduce the isolation of this land bank.

8.4.3. The Benefits

The above proposals therefore comprise a comprehensive network of pedestrian and cycle linkages throughout the Study area, facilitating the commuter and the leisure cyclist. It is intended that cycling will therefore represent a real alternative to travel by car, particularly for trips to and from Bray Town Centre, where cycle and pedestrian routes from Fassaroe are shorter than equivalent routes by car. From Old Connaught a network of segregated routes provides access throughout the Study Area, whereas Woodbrook DART station is well served by cycle routes from all the main residential areas. The Bray Town Centre site at Bray Golf Course serves as a key node for all cycling into the town. The route from Shankill and Old

Connaught along the Dublin Road route will connect directly into the northern side of the Golf Club development with onward access to the new Dargle Bridge, whereas the Dargle Valley route from Fassaroe will enter Bray along the southern promenade of the Golf Club, also connecting with the new Dargle Bridge. The Dargle Bridge therefore acts as the main feeder to the Dart Station and Bray Seafront, and is an important element of infrastructure serving a multitude of users.

8.5. Other Supporting Measures

In order to complete the Strategy, a number of further measures are required to address specific problems that are either existing or would be expected to materialise as a result of general growth through the area. These supporting measures consider areas such as parking, Goods Vehicle management, Access to Schools, Signing etc, and are outlined below:

- HGV Management

  The management of Goods Vehicles is an important part of any strategy, as the impact of Goods Vehicles on any area can be significant. For the current study, the main generators of goods vehicles are the various commercial and retail centres around Bray Town Centre, as well as the light industrial sites along the Dublin Road. In all cases, access is predominantly achieved from the M11 via Wilford Interchange and the Dublin Road. It is expected that future widening of the Dublin Road will improve general traffic safety. Nevertheless, with generally increasing traffic volumes there is potential for Heavy Goods Vehicles to divert to less suitable routes in order to access Bray Town Centre. The main concern is on Crinken Lane/ Ballybride Road, where an increased level of traffic flow may result from the provision of a new link to the M50 at Cherrywood. There is also potential for Heavy Goods traffic to use Ferndale Road and to a lesser extent Thornhill Road to access the M50 at Cherrywood from Fassaroe/Old Connaught. A HGV restriction is therefore proposed for Crinken Lane/ Ballybride Road, Ferndale Road and Thornhill Road, supported by traffic calming to reduce speeds along this road to a target mean of some 30kph.

  On Dublin Road, servicing of the existing retail premises is an existing problem that can lead to significant delay to general traffic. This will be addressed by the introduction of dedicated loading bays across these premises as part of the road widening scheme. The loading bays would operate during the AM Peak only, and would revert to short-stay Pay & Display Parking bays thereafter.

  A Signing Strategy would also be beneficial in managing HGV movement into and out of Bray Town Centre. Signing would commence on the M11 and M50 and would guide vehicles through the Wilford Interchange and Dublin Road to Bray. This would assist in reducing unsuitable traffic on the Dargle Road and through Shankill village.

- Parking Policy

  The provision of car parking in Bray Town Centre, although outside the geographical boundary of the current study area, has a notable impact on traffic patterns in the vicinity of Bray. Parking has for some time become accepted as a key tool to manage traffic demand, and the implementation of an effective parking control policy has the potential to positively support the current study. The Town Centre development at Bray Golf Club will unless restrained provide a significant parking volume, and this would consequently lead to a large road-based traffic demand to the centre. This has the potential to strangle the Dublin Road thereby restraining what is the main arterial road into Bray Town Centre. It is therefore important that a parking policy is implemented that will address these particular proposals as well as the remaining areas of Bray Town Centre. A number of key elements of an effective parking control policy are:

  - The active discouragement of long-stay commuter parking by physical restrictions, or by appropriately structured charging mechanisms. This restraint should be supported by an effective public transport strategy which has been proposed earlier in this chapter and supported by a comprehensive strategy of parking management and provision in the town;

  - Focusing provision of parking for short-stay shopping where use of the car is at times unavoidable. Nevertheless, charging should also be appropriately

structured, such that the car is used only as needed, and that the public transport alternatives are promoted as more attractive;

- The consideration of a parking levy to fund public transport services. For example, with a typical town centre housing some 10,000 parking spaces, an hourly levy of 10c per parking space could generate some €2.5m per year, which could fully fund a free public transport service. This level of funding could support the Fassaroe Busway plus an additional service into the southern environs of Bray. The fare-free service would further strengthen the use of public transport;

- The restriction of car parking provision to levels more consistent with town centre use. The Bray Town Centre car parking standards promote high levels of parking provision, and this will lead to excessive levels of car use. These levels of parking are unnecessary given the high public transport access that is being developed through this strategy, and will potentially lead to unmanageable volumes of traffic using the Dublin Road. A significant relaxation in the car parking standards for Bray is therefore recommended, with surplus funds used to support the public transport strategy. It is noted that with the adoption of an effective parking control policy, the availability of parking in Bray Town Centre will increase for shoppers and short-stay users. Displaced commuter parking will avail of the new public transport services and the available park & ride facility at Fassaroe; and

- A parking guidance system where appropriate to manage access to the main car parks. This could, for example, guide vehicles into Bray either via the Wilford Interchange, or the Fassaroe Interchange, and can provide additional travel information as necessary to manage traffic flow through the town.

- Access to Schools

The addressing of travel patterns to schools is an important element of transport strategy in any urban area, as such trips contribute to a significant level of traffic during the morning peak period. There are five existing schools within the study area, and with three further schools likely to be required as part of the subject development proposals. These schools are:

1.	St. Brendan's Community College	Dublin Road
2.	St. Philomena's School	Dublin Road
3.	St Peter's School	Dublin Road
4.	Aravon School	Ferndale Road
5.	St. Gerard's School	Thornhill Road
6.	Proposed Woodbrook School	Dublin Road
7.	Proposed Old Connaught School	Old Connaught Avenue
8.	Proposed Fassaroe School	Fassaroe

St Brendan's College, St. Philomena's School, St Peter's School, and the proposed Woodbrook School are all located along the Dublin Road along an axis stretching from Shankill to Bray Town Centre. As such, the widening of the Dublin Road will provide benefit to these schools, predominantly as a result of the improved pedestrian and cycle links being developed from Woodbrook to Bray Town Centre. This scheme will also connect with the pedestrian/cycle link via Old Connaught Avenue to the areas west of the M11, and will hence provide connectivity throughout the Study Area. This will ensure that access on foot and by bicycle is available for the significant majority of students within the catchment area for these schools, and that the level of car-dependency is thereby reduced. Bus access to the schools will also be strengthened as a result of the proposed improvements to public transport along the Dublin Road and indeed throughout the Study Area.

Aravon School is situated off Ferndale Road in an existing rural setting which currently has no pedestrian or cycle links. The Rathmichael area is expected to develop incrementally over the period of the study, and the opportunity has been taken as part of this development to introduce a continuous pedestrian footway along Ferndale Road. It is, however, recognised that this will take some time to deliver, and hence Aravon school will remain a car-dependant destination for some time. Nevertheless, traffic

generated by this school is limited and this is not expected to impact significantly on traffic conditions throughout the Study Area.

St. Gerard's School currently has no pedestrian and cycle links and is accessed from Thornhill Road only. Thornhill Road will become redundant as a through-route following the development of the Western Link Road, and hence will become a more attractive environment for walking and cycling. This road will also play a key role in supporting access through the developing Old Connaught area from the Western Link Road and Old Connaught village, and the function will therefore change significantly. In any case, the provision of pedestrian and cycle links into the Western Link Road and to Old Connaught Village along Thornhill Road will be important to achieving connectivity throughout the Study Area, and will be a requirement of any Masterplan for this area. In addition, Old Connaught Avenue is proposed as local access only which will greatly improve its attraction as a pedestrian/ cycle link between Old Connaught and the Dublin Road.

Finally the proposed school(s) in Fassaroe will be located in an area from which they are expected to draw the significant majority of their catchment, and as such the consideration of access to these schools will focus on local links only. This can be effectively achieved within the Masterplanning process for these lands, but will be supported by the strong links along the Western Link Road into Old Connaught/Rathmichael, and via the Dargle Valley into the suburbs of Bray Town Centre. .

- Mobility Management

The issue of Mobility Management and Mobility Management Plans (MMP) has grown considerably in Ireland over recent years, and is now a key consideration of how the impact of development can be managed at a local level. The concept of Mobility management is that a particular organisation can manage the travel behaviour of the individuals travelling to/from a particular site, such that the broader traffic and transport impact can be minimised.

In order for Mobility Management to work effectively, there must be clear benefits to be achieved by the organisation, and such benefits should be ongoing. For example, the undertaking of a Mobility Management Plan as a condition of planning will only work if the process can be continuous. For example, at planning stage the submission of the MMP may have the immediate benefit that a developer will achieve planning permission, but there are no clear ongoing benefits to maintaining such a Plan, and hence the process fails. Similarly, an ongoing Plan will not be effective without a demonstrable benefit to the organisation of reducing car use. Such benefits could be reduction in overcrowding of car parks, faster journey times for individuals, or a lower initial capital expenditure for developers on facilitating high levels of car use. No MMP will operate successfully without restriction on road and car parking costs or availability, and the implementation of a successful MMP will always recognise this.

While the principles of Mobility management Plans are well understood, the key difficulty has been in ensuring that there can be commitment by organisations on a long-term basis, and this is achieved by identifying a defined stream of benefits to the organisation. Some means for achieving this continuity are:

At Planning Application Stage:

- Introducing a scheme of contributions based on the quantum of car parking provided in commercial developments. This would be in addition to the initial planning levies and could be in the form of an annual contribution per car parking space. Such a measure would encourage developers to reduce parking provision, and would raise substantial funds for non-car infrastructure;

- Permitting reductions in car parking provision for new developments, on the basis that mobility can be effectively managed and car demand managed;

- Requiring charging in any application for on-site car parking, to be applied to both staff and visitors alike;

- The requirement for Mobility Management to be progressed following opening and settling-in of a development. This is a crucial measure and allows defined and specific measures to be employed based on actual travel behaviour.

For Existing Organisations:

- Provision of advice and guidance to organisations on the benefits of Mobility Management Plans, and the commitment of the Local Authority to such Plans;

- To facilitate a working group or individual within the Local Authority that can facilitate partnerships between different organisations within the same locality, so that resources can be pooled for providing for staff travel needs;

- Permitting reductions in car parking provision for organisations wishing to intensify development on a particular site, on the basis that mobility can be effectively managed and car demand restrained through such a transition;

- Railway Capacity on Luas Green Line

  Although only recently completed, passenger demand on the Luas Green Line is already running close to capacity during peak periods. In addition to the significant development expected throughout the current Study Area, further development is expected in Cherrywood, Sandyford and in Cabinteeley/Carrickmines. This will lead to an obvious increase in the demand for Luas services travelling into St. Stephens Green. At present, there remains good scope for increasing capacity by reducing vehicular headways and increasing tram length. Nevertheless, the quantum of development proposed along this corridor is such that such an increase in itself may not be sufficient to cater for future demand, and more radical upgrading of this line may be necessary.

  In the design and construction of the Green Line, a facility has been made for future upgrading to Metro by ensuring a high level of segregation, a wider track spacing, and appropriate spacing of stops. The future development of Line B1 will, however, not achieve a similar level of segregation as Line B1, and may therefore introduce a future constraint in to further capacity improvements.

  The RPA are currently progressing studies that focus on the Line B2 proposals outlined in this report. It is crucial that an early indication can be provided that describes whether any capacity difficulties will arise as a result of future increases in demand, and how this may impact on the development of the Bray area.

8.6. Other Relevant Issues

The issue of the Dublin Road providing the main access to Bray from areas north has been highlighted. The level of reliance on the Dublin Road is significant to the extent that without some relief, further development of Bray Town Centre as a destination will be severely hampered by the lack of transport capacity. As a result, some alternative means of facilitating access to the Bray area is necessary, both to address existing access difficulties and to facilitate the development of the Golf Club site.

The key issue in essence is the lack of transport corridors leading into the Bray area. Although the Wilford Interchange and Fassaroe Interchange both provide access from the M11, they both feed traffic over the bridge on Castle Street, and along Bray Main Street. This area is a significant capacity restraint and leads to notable queuing and delay. The other main approach is via the Killarney Road Interchange, although this provides access mainly to the southern fringes of Bray and to Greystones, and experiences significant congestion. The large residential banks between Bray Town Centre and the Southern Cross therefore have limited opportunities to access the M11 without leading to significant traffic impact throughout the Bray area, which has consequential impacts on the journey times and reliability for buses. This leads to a situation whereby the general access to these areas is constraining access to the employment and retail services within Bray Town Centre. Future development along these routes, such as at the Bray Golf Club, will further constrain access to Bray Town Centre.

Although not within the scope of this study, some options for improving access into the residential areas south of Bray Town Centre is important. Some options have been examined throughout this Study, and have included the consideration of new connections across the River Dargle between the Dargle Road and Herbert Road. A modelling exercise demonstrated that

such a link would attract significant traffic volumes, reassigned predominantly from the Dublin Road. The displacement of this traffic from the Dublin Road would therefore greatly support development proposals in Woodbrook and on the Golf Club site. It would also greatly support access from the southern environs of Bray to employment opportunities in Woodbrook, and to the proposed Park & Ride at Fassaroe.

Such connections are, however, difficult and would be extremely costly to implement. Alternatively, an improvement to the junction of Herbert Road and the N11, supported by appropriate signing may provide some short-term relief.

9. STRATEGY EVALUATION

9. STRATEGY EVALUATION

9.1. Introduction

This section of the Report assesses the impact of the various measures on the local and strategic road network, and in generating public transport patronage. The assessment will examine the patterns and scale of traffic growth across the road network, and will also demonstrate the impact of the various public transport proposals in reducing the demand for travel by car. Public Transport patronage on the various Rapid Transit Proposals has also been examined by aggregating the demand between key transport nodes and applying a modal split function to the net person demand between them.

The evaluation is presented as a series of strategies, with each representing a possible scenario of providing for future transport demand. Comparison of the output from each scenario can allow the relative benefits of each to be highlighted. The scenarios are as follows:

Strategy A: Do Minimum	The development of all the future land use proposals, but with no provision of additional road or public transport infrastructure. This is therefore the base case against which subsequent scenarios can be benchmarked
Strategy B : Road Infrastructure	Strategy A with the provision of the roads proposals only, and no significant public transport infrastructure. It is, however, assumed that some local bus services will operate through the development areas.
Strategy C : With Public Transport	This is Strategy B, but with the additional provision of the public transport proposals. Strategy C is therefore the proposed strategy, and will demonstrate the additional benefits of the public transport proposals in reducing traffic volumes and delay on the road network.

9.2. Strategy A: Do Minimum

The ongoing development of the Study Area without further investment in roads or public transport has been addressed in Chapter 6 of this report. The discussion outlined a significant increase in traffic delay along the Dublin Road, and a further deterioration in traffic conditions along the M11 between the M50 junction and Fassaroe by 2010. This assessment was used as the starting point in the development of the Transportation Strategy to allow the study team to begin to understand the areas where problems would exist, and hence the specific measures that would be required to address them. The main issues of note by 2010 were:

- A significant rise in congestion through the Old Connaught/Dublin Road junction, as a direct result of traffic accessing the new development in the Old Connaught Area. The level of queuing is extremely high, and there is significant delay on all approaches;

- With the congestion at Old Connaught Ave/Dublin Road, traffic from Old Connaught reassigns to alternative routes. Traffic to/from the M11 continues to use the Old Connaught Avenue junction and the M11 via the Wilford interchange, while traffic to/from the N11 diverts via Ferndale Road and either Stonebridge Road or Cherrywood Road. This places an excessive load on relatively inappropriate routes;

- Significant delay through the junction of Upper Dargle Road/Dublin Road. This would appear to be mainly as a result of the strong increase in traffic flows approaching the study area from Fassaroe;

- A strong traffic demand along Thornhill Road, due to traffic congestion along Old Connaught Avenue. Thornhill Road becomes a more attractive route between Old Connaught and areas south, and from Rathmichael to the employment areas in Fassaroe;

- An increase in traffic along Old Connaught Ave to the order of 40%, although this is constrained by congestion. The increase on other parallel routes is more evident as other capacity is taken up. Such increases are strongest on Stonebridge Road (60%) and Crinken Lane (350%); and

- A 50% increase in traffic using the Dublin Road south of the Wilford roundabout, which contributes to delay through the junction with Old Connaught and at the Upper Dargle Road, and is a result of the development of the Golf Club lands and the Woodbrook area.

The key impacts in 2010 are therefore a significant restriction on east-west capacity from the newly developed areas to the west of the M11, and worsening conditions on the Dublin Road approach into Bray. A summary of the key performance indicators based on Strategy A is outlined below.

Table 9.1: Strategy A: Do Minimum

Summary of Car Trips	**2005 AM Peak**	**2010 AM Peak**	**2020 AM Peak**
Summary Statistics			
Total Network Trips Made	11,675 trips	18,694 trips	24,529 trips
Total Network Distance Travelled	78,722 km	116,591 km	139,164 km
Average Network Speed	40.4 kph	31.7 kph	20.2 kph
Total Fuel Consumption	5,961 Litres	9,561 Litres	14,515 Litres
Total Network Travel Time	1,946 hours	3,672 hours	6,901 hours
Link Flow Summary (2-way)			
M11 : M50 to Wilford	3,384	6,873	8,672
M11 : Wilford to Fassaroe	3,596	5,737	8,044
Dublin Road : South of Old Connaught	1,356	2,510	2,707
Upper Dargle Rd: East of Fassaroe	515	985	2,243
Crinken Lane	233	427	1,328
Old Connaught Avenue	546	455	761
Ferndale Road	476	790	1,508
Rathmichael Road	301	943	969
Cherrywood Road	166	275	460
Stonebridge Road	233	1,074	1,291

9.3. Strategy B: Road Infrastructure

The natural extension to Strategy A is to include the various road proposals that have been proposed earlier in this report. The road proposals are incorporated into the 2010 and 2020 Future year networks to address the traffic issues outlined above, and lead to a significant improvement in traffic conditions.

Despite the high level of road infrastructure provision however, the performance of the network remains unsatisfactory. This is primarily as a result of the inability to reduce car dependency throughout the Study Area, and hence the proportional increase in car use that accompanies growth in development. As such, with the implementation of the roads proposals, the full extent of development will not be achievable, and hence some constraints would be necessary.

A summary of the key performance indicators in 2010 and 2020 with the adoption of Strategy B is outlined below.

Table 9.2: Strategy B: Road Infrastructure

Summary of Car Trips	2005 AM Peak	2010 AM Peak	2020 AM Peak
Summary Statistics			
Total Network Trips Made	11,675 trips	18,694 trips	24,529 trips
Total Network Distance Travelled	78,722 km	114,278 km	139,737 km
Average Network Speed	40.4 kph	35.3 kph	23.6 kph
Total Fuel Consumption	5,961 Litres	9,018 Litres	13,031 Litres
Total Network Travel Time	1,946 hours	3,235 hours	5,917 hours
Link Flow Summary			
M11 : M50 to Wilford	3,384	7,009	8,430
M11 : Wilford to Fassaroe	3,596	5,401	7,141
Dublin Road : South of Old Connaught	1,356	2,304	2,567
Upper Dargle Rd: East of Fassaroe	515	789	1,038
Crinken Lane	233	235	376
Old Connaught Avenue	546	338	519
Ferndale Road	476	711	1,121
Rathmichael Road	301	831	1,153
Cherrywood Road	166	251	298
Stonebridge Road	233	1,056	1,200

The summary shows significant reductions in traffic volumes along the local roads in the western part of the study area, in particular Ferndale Road, Crinken Lane, Old Connaught Avenue and Cherrywood Road.

9.4. Strategy C: Road and Public Transport Infrastructure

The preferred Strategy encompasses both the Road infrastructure proposals and a supporting network of Rapid Transit in the form of Luas Line B2 and the Fassaroe Busway. The Public Transport proposals will actively address car dependency in Old Connaught, Fassaroe, Woodbrook and Bray Town Centre, and are made feasible by the nature and pattern of development that is being proposed. A summary of the key performance indicators is outlined below:

Table 9.3: Strategy C: Road and Public Transport Infrastructure

Summary of Car Trips	2005 AM Peak	2010 AM Peak	2020 AM Peak
Summary Statistics			
Total Network Trips Made	11,675 trips	17,579 trips	23,025 trips
Total Network Distance Travelled	78,722 km	109,498 km	137,171 km
Average Network Speed	40.4 kph	36.9 kph	26.4 kph
Total Fuel Consumption	5,961 Litres	8,474 Litres	11,788 Litres
Total Network Travel Time	1,946 hours	2,966 hours	5,189 hours
Link Flow Summary			
M11 : M50 to Wilford	3,384	6,786	8,233
M11 : Wilford to Fassaroe	3,596	5,162	6,701
Dublin Road : South of Old Connaught	1,356	2,150	2,378
Upper Dargle Rd: East of Fassaroe	515	735	1,006
Crinken Lane	233	332	425
Old Connaught Avenue	546	244	468
Ferndale Road	476	467	895
Rathmichael Road	301	804	1,127
Cherrywood Road	166	245	267
Stonebridge Road	233	963	1,136

The results show a broad reduction throughout the network as a result of the public transport proposals. The key reductions are on the routes to/from the Greater Dublin Area such as Ferndale Road and the M11. The net reduction in vehicular trips throughout the Study Area as a result of the Public Transport Strategy is in the region of 15,000 vehicular trips per day.

9.5. Public Transport Patronage

Public Transport Patronage has been forecast on the new public transport services. This process has been based on the determination of existing modal splits for each sector within the study area, and the future modal splits that will apply as a result of the public transport strategy. The process can be summarised as follows:

- Aggregate the 57 zones in the highway model into a set of sectors. A total of 6 sectors have been developed, with an additional 8 external zones;
- Determine the existing modal split for these sectors, thereby allowing relative car and public transport use to be determined given that car totals are determinable directly from the highway model;
- Produce a public transport matrix of trips between sectors. This is public transport demand without the public transport strategy;
- Undertake a similar process with the public transport strategy, assuming new modal splits based on the increase in accessibility to high quality public transport services; and
- Assign the public transport matrix to a skeletal public transport network reflecting the rapid transit schematic diagram established earlier. Line flows on the different services can be read directly from the outputs.

Although the forecasting has been developed for the AM Peak Hour, traffic counter data has been used to justify the assumption that AM Peak hour flows represent 10% of daily trip totals. The following passenger flows are forecast on Luas Line B2 and the Fassaroe Busway in 2010 and 2020. It is noted that these flows are outline only, and would be subject to more rigorous patronage studies as part of their implementation.

One key assumption in the development of the forecasts is that in the absence of the Public Transport Strategy set out, there would be a general provision of bus services through the new areas, comprising low frequency services with limited bus priority. This provision has been assumed for the do-minimum to ensure that realistic travel patterns can be established in the absence of any defined public transport strategy. As such, the introduction of the public transport proposals will attract the patronage from these notional services, in addition to attracting those who would otherwise travel by car. As a result, the actual patronage of the new public transport services will be higher than the 15,000 trips per day attracted from the car as described above.

Table 9.4: Public Transport Patronage (2020 : Full Strategy)

Summary of Public Transport Trips through Study Area	**2020**
Luas Line B2	
AM Peak Hour Trips	1,700
Annual Passenger Trips	4.9 million
Fassaroe Busway	
AM Peak Hour Trips	2,000
Annual Passenger Trips	5.7 million
DART	
AM Peak Hour Trips (excluding through-trips)	2,000
Annual Passenger Trips	5.9 million

The significant patronage achievable on the Fassaroe busway is noted, especially when compared against patronage forecasts on the Luas and DART. This strong patronage arises out of its use as a key connection into Bray Town centre from Old Connaught and Fassaroe for connection with DART, and the interaction between the uses in Fassaroe, Old Connaught and Bray. It is stressed that patronage forecasts on the Luas will increase strongly with further development of the lands along the M11 corridor. Such development would be expected to occur during the later period covered by this study, and could increase Luas Line B2 patronage by a further 3 million passengers per annum to some 8 million passengers. This will have obvious implications on the requirement to provide line capacity and potentially support the suggested connection of the Luas Green Line to the Airport metro via an underground connection between Ranelagh and St. Stephens Green.

9.6. Conclusions

The evaluation therefore demonstrates the notable patronage that can be captured by the proposed system, and the impact that it has on reducing traffic flows through the study area road network. This confirms the value of adopting an integrated strategy of both road and public transport proposals in facilitating future development in the Bray Environs, and in a manner that meets the objectives set out for the current study.

Finally, the potential for a complimenting public transport strategy for the southern environs of Bray has already been discussed. Such a strategy would take advantage of the additional public transport accessibility offered at Fassaroe, and properly executed, could lead to a further strengthening of patronage levels on the services proposed above. Such a study is an inherent recommendation of this report.

10. PHASING AND IMPLEMENTATION

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10.1. Local Area Benefits

Throughout this report, two forecast years have been adopted. 2010 represents the horizon of the current Dun Laoghaire Rathdown County Development Plan, and represents an initial forecast year where the level of proposed development is well understood. The 2020 forecast year is included in view of the significant potential of the area to develop further beyond 2010 and the requirement to consider how current proposals will integrate into the longer term provision of transportation through the Study Area.

With the definition of two horizons within a single Land Use and Transportation Strategy, the question arises as to how the different infrastructural measures can be allocated amongst the different forecast years. In this section, the different Local Area Plans will be outlined, and the various infrastructural schemes that will benefit each will be presented. A summary is outlined below in Table 10.2

10.2. Interpretation of Results

Although Table 10.2 describes the relative benefits of each element of infrastructure, this can also be interpreted as the requirement for such infrastructure. In essence, where the benefit is described as 'High', it can be assumed that such infrastructure is necessary for the development of such an area to proceed, as the evolution of sustainable transport patterns require such infrastructure to be in place from an early stage of the development. Where the benefit is described as 'Medium', it is feasible for the development to proceed without such infrastructure, with the relevant item of infrastructure following at a later stage of the development.

10.3. Phasing of Development

The ultimate phasing of the development of the Study Area over the period to 2020 can therefore be informed by Table 10.2. Essentially, it is most likely that the development of Old Connaught and Fassaroe will be constrained until the full implementation of the Rapid Transit proposals, and hence this will be the main constraint on development over the initial years of the study horizon.

Earlier in this report, a set of development assumptions were outlined which described the pattern of development of the area to 2010 and 2020. It is still felt that this is an appropriate and realistic pace of development of the area, and hence an outline schedule for the implementation of the Transportation Strategy has therefore been devised to compliment this. The implementation schedule is outlined in Table 10.3.

In the phasing of the development, it is imperative that the appropriate phasing of public transport provision is considered. The completion of large areas of residential and/or employment without appropriate public transport links will lead to unsustainable car-dependant travel patterns from the outset. As a result, the introduction of supporting public transport proposals is required in advance of the development that it supports. For 2010, this suggests that the Fassaroe Busway should be commissioned in advance of the development of Old Connaught and Fassaroe. Beyond 2010, further links with Cherrywood are necessary along the Luas Line B2 alignment. Given the level of activity required to construct Line B2, it is expected that a supplementary bus service connecting Fassaroe and Old Connaught with Cherrywood via the M11 and M50 would suffice in the short-term. In any case, the avoidance of car-dependence at any stage of development with the Study Area is crucial. Early implementation of public transport services can be facilitated by means of a contribution acquired from developers to cover the operating costs for the initial 3-year to 5-year period. Phasing of Public Transport infrastructure is outlined in Table 10.3.

10.4. Construction Costs

A schedule of costs for the various infrastructural elements has been prepared based on standard rates and past experience of similar work. Although costs have been provided, it is stressed that such costs are based on a limited understanding of the final design, of ground conditions, and of expected construction cost inflation over the coming years. A schedule of costs in 2005 prices and values has been presented in Table 10.4.

A Risk Assessment is also presented, which defines the overall impact on the strategy should this measure not be implemented. Various alternatives for managing this risk are presented to support the study.

10.5. Planning Levies

The Section 49 Development Contribution scheme has recently been implemented for the construction Luas Line B1 from Sandyford to Cherrywood. In essence, the scheme is based on a contribution per Hectare of development land that is located within a 1km catchment of the Luas system, and recognises the increased value of this development land as a result of the provision of Luas.

An assessment has been made of the potential for Section 49 Development Contributions to fund the Luas Line B2 extension to Fassaroe. In undertaking such an assessment, it is recognised that the previous levy of €250,000 per Hectare for residential land and €570,000 per Hectare for commercial land is likely to be reviewed, as this takes no account of increasing densities on such lands. As such, the calculation was based on a unit-based contribution, and a site area-based contribution. The assessment yielded the following results:

Table 10.1: Potential for Development Contributions

Basis of Contribution	Total Levies
€250,000 per hectare of residential development €570,000 per hectare of commercial development	€67m
€5,000 per unit of residential development (average based on Line B1) €570,000 per hectare of commercial development	€87m
€10,000 per unit of residential development €570,000 per hectare of commercial development	€140m

The assessment therefore shows that the Section 49 contributions can cover between 30% and 70% of the capital cost of the scheme cost of €197m (see Table 10.1). This is clearly substantial, and is a strong case for the feasibility of developing Luas Line B2 to serve the Bray Environs.

Table 10.2: Infrastructural Benefits on Local Areas

Measure	Benefit on Local Area					
	Woodbrook	North Bray	Rathmichael	Old Connaught	Fassaroe	Bray Environs
Public Transport Proposals						
Woodbrook DART Station	High	Medium	Low	Medium	Medium	Medium
Luas Cherrywood – Fassaroe	Low	Medium	High	High	High	High
Fassaroe Busway	Low	High	Low	High	High	High
Dublin Road QBC	High	High	Low	High	High	High
Rathmichael Public Transport Links	Low	Low	High	Low	Low	Low
Fassaroe Park & Ride	Low	Low	Low	Low	Medium	Medium
Roads Proposals						
Wilford Interchange	Medium	High	Medium	High	High	High
Western Link Road	Low	Low	Medium	High	High	High
Signalisation of Wilford Roundabout	High	High	Low	Medium	Low	Medium
Old Connaught Avenue Closure	Low	High	Low	High	Medium	Medium
Ballyman Road Upgrade	Low	Low	Low	Medium	Medium	Low
Killarney Road Interchange	Low	Medium	Low	Low	Low	High
Dublin Road Widening	High	High	Low	Medium	Medium	High
Fassaroe Interchange	Low	Medium	Low	Medium	High	High
M11 Upgrade	Medium	Medium	Low	Medium	Medium	High
Rathmichael Road Upgrade	Low	Low	High	Low	Low	Medium
Cherrywood Link Road	Low	Low	High	Low	Low	Medium
Pedestrian/Cycle Proposals						
Luas Pedestrian/Cycle Route	High	Low	Low	High	High	High
Dargle Valley	Low	High	Low	Low	High	High
Old Connaught Cycle Route	Low	Medium	Medium	High	Low	High
Dublin Road Cycle Route	High	High	Medium	High	Low	High
East Coast Cycle Route	High	High	Low	Low	Low	Medium
Rathmichael Cycle Links	Low	Low	High	High	Medium	Medium
Other Measures						
Public Transport Bridge in Bray	Low	High	Low	High	High	High
HGV Management	Low	Low	High	Medium	Low	High
Parking Policy	Medium	High	Low	Medium	Medium	High
Access to Schools	High	Medium	High	Medium	Medium	High

Table 10.3: Phasing of Development and supporting Infrastructure

Horizon	Land Use Scenario	Transport Measures
2010 Short Term	All zonings in the current development plan will be developed. Full development will be achieved in Woodbrook, North Bray and Old Connaught, but with only 20% of the potential development of Fassaroe.	• **Fassaroe Busway** • **Woodbrook DART Station** • **Dublin Road QBC** • Public Transport Strategy for Bray • M11 Upgrade • Signalise Wilford Roundabout • Rathmichael Public Transport Links • Wilford Interchange Upgrade • Western Link Road • Old Connaught Avenue Closure • Killarney Road Interchange • Dublin Road Widening • Rathmichael Road Upgrade • Cherrywood Link Road • Luas Pedestrian/Cycle Route • Old Connaught Cycle Route • East Coast Cycle Route • Rathmichael Cycle Links • HGV Management • Parking Policy • Access to Schools
2020 Long Term	All lands as zoned in the current development plan will be fully developed according to committed and proposed zoning. This includes the full development of Fassaroe, and assumes a level of further development post-2010 following the publication of the next Development Plan.	• **Luas Line B2** • Park & Ride at Fassaroe • Ballyman Road Upgrade • Fassaroe Interchange • Dargle Valley

***Note**: Highlighted Text indicates Public Transport Measures that should be in place prior to the commissioning of any of the development that they support.*

Table 10.4a: Costs and Risk Assessment

Measure	Capital Cost €m	Phase	Impact of Non-Completion
Public Transport Proposals			
Woodbrook DART Station	€2.0	2010	Compromise development in Woodbrook
Luas Cherrywood – Fassaroe	€197	2020	Compromise development in Fassaroe and Old Connaught.
Fassaroe Busway	€9.5	2010	Poor links with Bray, and consequential impact on local economy with trade and employee catchment lost to Dublin Area.
Dublin Road QBC	€14	2010	Restriction of public transport access to Bray, and consequential increase in car use, further exacerbating negative impacts.
Rathmichael Public Transport Links	€0.5	2010	Car dependency in Rathmichael area, and higher traffic impact through Cherrywood.
Park & Ride Fassaroe	€3	2020	Limited access to public transport services from north Wicklow, leading to increasing traffic demand on M11
Roads Proposals			
Wilford Interchange	€15.9	2010	Limited access to western environs, and hence restriction on development of Old Connaught and Rathmichael. Reduction in bus access to Fassaroe
Western Link Road	€31.2	2010	Limited access through western environs, and hence significant restriction on movement due to isolation of Fassaroe. Knock-on impact on bus access.
Ballyman Road Upgrade	€4.1	2020	Poor access to Enniskerry. The Twenty Bends Road would need to be retained
Killarney Road Interchange	€5.0	2010	Continuing poor road safety record at this junction, and restricted access into southern suburbs of Bray.
Dublin Road Widening	€7.2	2010	Restricted capacity into Bray Town Centre, and consequential impact on local economy.
Fassaroe Interchange	€2.6	2020	Limited access to Fassaroe and loss of links into the Dargle Valley, leading to reduction in development quantum.
Signalisation of Wilford Roundabout	€1.0	2010	Future year congestion through the roundabout with risk of queuing propagating back onto M50. Also would expect a continuance of poor safety record.
M11 Upgrade	€61.0	2010	Increasing traffic congestion for traffic travelling through the Study Area on the M11 and M50/M11.
Rathmichael Road Upgrade	€1.20	2010	Limited development potential of Rathmichael due to dominance on car for local movement.
Cherrywood Link Road	€8.50	2010	Limited development potential of Rathmichael due to dominance of car for local movement, and high traffic impact on Dublin Road and Cherrywood Road.

Table 10.4b: Costs and Risk Assessment

Measure	Capital Cost €m	Phase	Impact of Non-Completion
Pedestrian/Cycle Proposals			
Luas Pedestrian/Cycle Route	€12.8	2010	Limitation on the cycle network, leading to a reduction in cycling trips, and a consequential increase in short-distance car trips.
Dargle Valley	€6.7	2020	Limitation on the cycle network, leading to a reduction in cycling trips, and a consequential increase in short-distance car trips between Fassaroe and Bray.
Old Connaught Cycle Route	€0.8	2010	Isolation of Old Connaught from Bray due to requirement to travel via Wilford Interchange, or along a busy Old Connaught Avenue.
Dublin Road Cycle Route	€5.5	2010	Poor cycling conditions into Bray Town Centre, increasing dependence on cars, and thereby increasing short-distance car trips.
East Coast Cycle Route	€0.1	2010	Loss of amenity for Dun Laoghaire Rathdown.
Rathmichael Cycle Links	€6.1	2010	Poor north-south access for trips west of the M11, leading to an increase in short distance car trips.
Other Measures			
Public Transport Bridge in Bray	€1.1	2010	Isolation of Golf Club Development from DART Station and hence public transport services. Consequential reduction in visitors and/or increase in car use.
HGV Management	€0.1	2010	Limited additional environmental impact on local areas, and increased road accidents on unsuitable roads.
Parking Policy		2010	High dependency on car use, and difficulties in parking in Town Centre. Consequential impact on trade in Bray.
Access to Schools	€0.1	2010	Reduction in car-based school trips to schools along Dublin Road and through Old Connaught.
Old Connaught Avenue Closure	€0.1	2010	Reduction in level of bus priority achievable, and increase in congestion at junction of Old Connaught Avenue with Dublin Road
Traffic Calming in Rathmichael	€1	2010	Erosion of Road Safety and environment in Rathmichael as a result of roads being used as a through route from Old Connaught/Fassaroe to the M50 at Cherrywood.

11. CONCLUSIONS

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11.1. General

The preparation of a Land Use & Transportation Study (LUTS) for the Bray Environs was commissioned jointly by Dun Laoghaire – Rathdown County Council, Wicklow County Council and Bray Town Council in January 2005. The area of the study is defined as a boundary encompassing Woodbrook, Rathmichael, Old Connaught, Fassaroe and North Bray, as well as the N11 as far as the junction with the Bray Southern Cross. The objectives of the commission were to ensure that the study area can cater for expected future levels of development as proposed throughout the Town and County Development Plans, by investigating a range of policies, infrastructural measures, and Land Use strategies.

11.2. Findings

The current report has outlined a range of Land Use and Transportation proposals to support the development of the Bray Environs over the period to 2020: The various measures form part of an overall integrated strategy to ensure sustainable development patterns, appropriate levels of car dependency, and ensure the economic vitality of Bray as a regional town centre over the study period. The following proposals have been recommended for inclusion in the final strategy:

- The intensification of development in Fassaroe and hence alteration of the current zoning. Various land use strategies have been outlined for Fassaroe which will support the provision of appropriate levels of accessibility;

- A Rapid Transit Strategy incorporating a Luas extension from Cherrywood to Fassaroe, and a Bus Rapid Transit link from Fassaroe and Old Connaught to Bray Town Centre. The Rapid Transit Network will support the existing DART corridor and N11 QBC thereby providing good accessibility and connectivity throughout the Study Area;

- A Public Transport Strategy, comprising the Rapid Transit network, and supported by Park & Ride at Fassaroe, the provision of a Quality Bus Corridor along the Dublin Road, and the development of new transport links into Rathmichael from Cherrywood;

- A scheme of road improvements focused on improving access into the areas west of the M11, and into Bray Town Centre via the Dublin Road. The roads strategy also rationalises access to the M11/N11 by consolidating access to three key interchanges along the route, and improving interchanges at Wilford, Fassaroe and Killarney Road. Variable Speed Limits are also proposed for consideration on the southbound carriageway of the M11;

- The development of a cycle network connecting Fassaroe, Old Connaught, Woodbrook and Rathmichael with Bray Town Centre, Cherrywood and DART. The cycle network makes use of the corridors that will emerge with the introduction of Luas, and is a key element of the development of the Dargle Valley as an area of High Amenity; and

- A range of supporting measures to manage traffic activity, improve road safety, manage goods vehicles, provide parking policy, improve access to schools, and highlight the importance of a Public Transport Strategy for the southern environs of Bray.

The proposed strategy will lead to significant reductions in traffic volumes and delay throughout the Study Area road network, and will generate some 17 million public transport trips annually in 2020. Strong patronage forecasts are returned for both the Fassaroe Busway (5.7 million passengers per annum) and Luas (4.9 million passengers per annum), along with a strong demand for DART trips at Bray and Woodbrook (5.9 million passengers per annum).

11.3. The Next Steps

The report of the Bray Environs Land Use and Transportation Study is proposed for adoption by Dun Laoghaire Rathdown County Council, Bray Town Council and Wicklow County Council. Adoption by all three Local Authorities is essential to facilitate the development of an overall strategy for the area, and recognises the high level of interaction between the different land holdings.

Following adoption, the development of road and rail infrastructure will take place in tandem with the development of the major land holdings, and the allocation of the different elements of infrastructure between developments can be informed by Table 10.1 earlier in this report. The implementation of Luas Line B2 will be the responsibility of the Railway Procurement Agency, and significant discussion has taken place with the RPA during the development of the preferred alignment.

Whereas the development of the infrastructure for the Fassaroe Busway will be relatively straightforward, the operation of this service will require further consideration, and the mechanism for achieving this may be strongly influenced by upcoming developments in the form of bus regulation.