14 MATERIAL ASSETS – TRANSPORTATION

14.1 Introduction

This chapter of the EIAR reviews the current receiving environment in terms of existing road traffic characteristics and quantifies the associated baseline scenario whilst undertaking an assessment of the proposed development to identify its likely effects on the traffic environment.

The site is subject to Local Infrastructure Housing Activation Fund (LIHAF) funding that has been secured by Dun Laoghaire Rathdown County Council (DLRCC). This LIHAF funding incorporates the road access, Woodbrook Avenue, to the new DART Station and the upgrade of the existing Wilford roundabout at the junction of the R119 and the M11 slip roads adjacent Junction 5 of the M11. The design of the roundabout upgrade to traffic signals is being undertaken by DLRCC and will be delivered under Section 38 of the Road Traffic Act (1994).

The R119 Dublin Road is an established bus route carrying a significant quantum of peak hour and off-peak hour bus services, predominantly between Bray and the City Centre and Blackrock. These routes are subject to proposed improvements as part of the NTA's Bus Connects network redesign. Furthermore, the Dublin Road forms part of the BusConnects Core Bus Corridor 13 that is planned between Bray and UCD / City Centre.

The Bus Connect Core Bus Corridor is programmed for delivery by 2027 as part of the National Development Plan 2018 – 2027. The first phase of public consultation on Corridor 13 has been completed. The proposed development, in particular the design of the proposed junction on Dublin Road, that will serve as the main vehicular access to the site, has been designed to take account of the National Transport Authority's (NTA) design proposals for Corridor 13.

The site presents as a development wherein occupiers will be facilitated with a lifestyle that has direct access to high frequency bus and rail services and low dependency on car ownership and car usage. This opportunity is based on multi-faceted characteristics of the site and its location including the following aspects: -

- Woodbrook DART Station immediately adjacent the site.
- Dublin Road bus corridor and proposed Bus Connects bus and cycle route upgrades.
- Neighbourhood Centre, creche, primary school and open space provision within the site.
- Access to secondary schools, including Woodbrook College directly adjacent the site.
- Active and passive open space provision in the adjacent Shanganagh Park.
- Extensive pedestrian and cycle links through and within the site.
- Car club car provision.
- Extensive private and public cycle parking.

The transport planning aspects of the proposed site have been developed in close consultation between the Applicant, DLRCC, the NTA and Irish Rail. This consultation has included an extensive quantum of pre-planning meetings in the context of the proposed site layout, the LIHAF funding, the development of the design for the DART Station and temporary car park and the design of the Dublin Road junction.

In identifying the scope of this Traffic Chapter, further consultations were undertaken with Dun Laoghaire Rathdown County Council Roads Traffic Department. The Traffic and Transport Assessment process was issued to and agreed with Dun Laoghaire County Council in May 2018. This document has thus formed on the basis of the traffic and transport assessment as agreed with the Dun Laoghaire County Council. In general terms the scope of this assessment covers all transport related issues including private vehicles, pedestrian, cyclist and public transport access.

14.2 Assessment Methodology

The assessment methodology for the traffic and transport impact is consistent with the Transport Infrastructure Ireland's (TII) Traffic and Transport Assessments Guidelines. The methodology is summarised as follows: -

- Baseline Transportation Review: Undertaking of a desktop review of current planning policies and objectives, existing public transport services, walking and cycling network and existing and roads infrastructure. This also included a review of relevant committed developments adjacent the proposed development site.
- Baseline Traffic Flow Review: Undertake site visits to review current traffic conditions and to make observations on same. Identify key junctions where traffic count survey information is required.
- Future Transport Infrastructure Review: Undertake review of current transport policies, plans and strategy to identify future short, medium and long terms transport proposals which may have a material impact on the travel behaviour associated with the proposed development.
- Development Proposals Review: Review the proposed development in terms of provision for access by walking, cycling, public transport and car.
- Transport Characteristics Review: Undertake an assessment of the likely modal share, trip generation, assignment and distribution having regard to existing and potential future traffic patterns on the local road network.
- Identification of Local Road Network Proposals: Identify proposed junction works on the local road network in terms of new junctions, improvements for pedestrians, cyclists and traffic at existing junctions.
- Assessment of Road Impact: Undertake an assessment of the key junctions during the base year, opening year, opening year plus five and opening year plus fifteen assessment years for both 'without development' and 'with development' scenarios in order to determine future operation and any necessary mitigation measures required.

14.3 Receiving Environment

14.3.1 Site Location

The proposed development site comprises of lands to be served by the new DART Station within the Woodbrook Shanganagh Local Area Plan (LAP). The site location is as shown below. The development site will be served by a vehicular junction onto the Dublin Road, adjacent the existing Woodbrook Down junction.

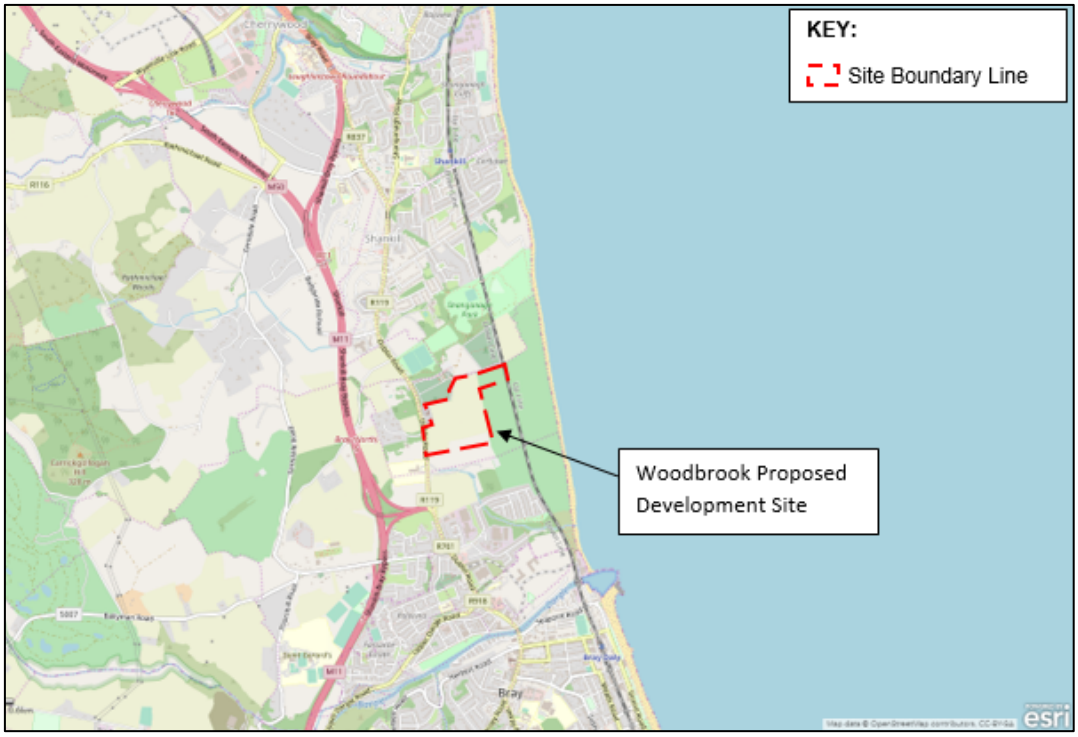

Figure 14.1: Site location.

14.3.2 Existing Public Transport

There are a number of existing public transport facilities available in vicinity of the proposed development site ranging from bus services to rail services. The Figure provided below illustrates these in the local context.

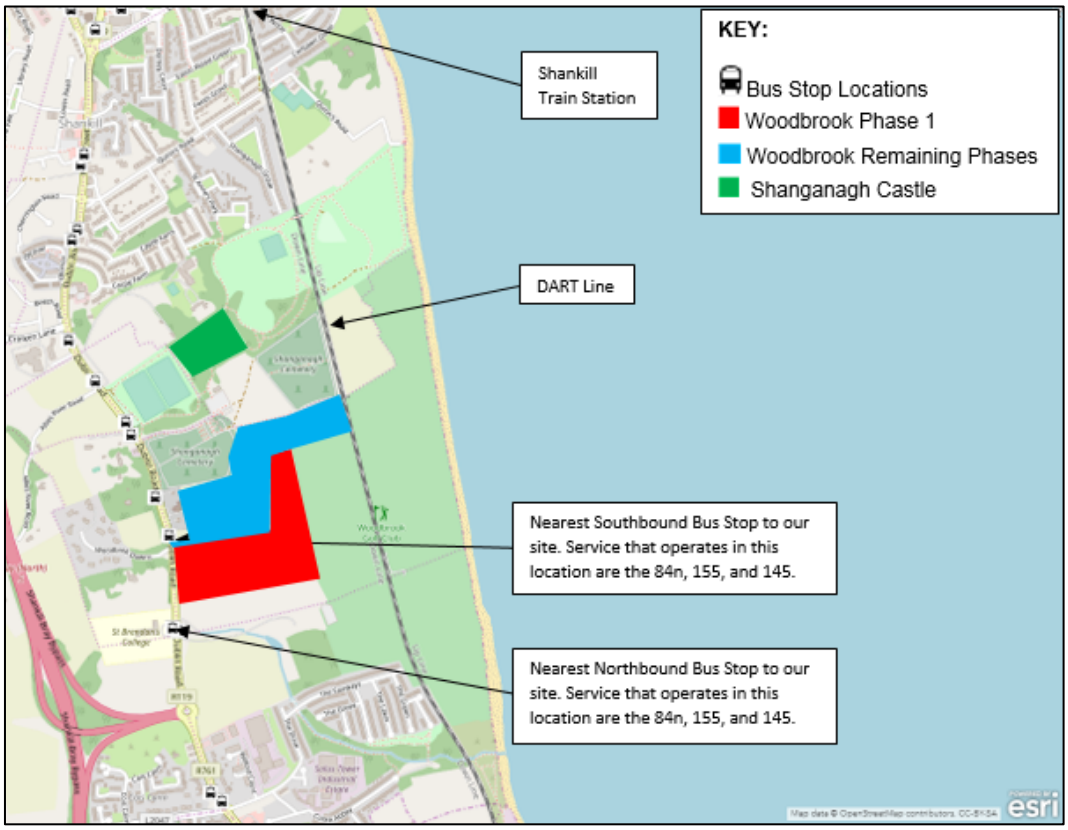

Figure 14.2: Existing Public Transport Provision.

14.3.2.1 Bus Routes and Services

- Route 84 – Newcastle to Blackrock: This commuter route, operated by Dublin Bus, runs from Newcastle towards Blackrock and vice versa with key stops at Newcastle, Kilcoole, Greystones, Bray, Woodbrook, Shankill, Cherrywood, Loughlinstown, Cabinteely, Deansgrange, Blackrock. This route operates with 20 no. southbound services and 21 no. northbound services daily during the week. With 15 no. southbound and 17 no. northbound services operating on a Saturday and likewise 12 no. and 14 no. southbound and northbound on a Sunday.
- Route 84a – Bray to Blackrock: This commuter route, operated by Dublin Bus, runs from Bray towards Blackrock and vice versa with key stops at Bray, Woodbrook, Shankill, Cherrywood, Loughlinstown, Cabinteely, Deansgrange, Blackrock. This route operates with 6 no. southbound services and 8 no. northbound services daily during the week. This service does not run at the weekend.
- Route 145 – Heuston Rail station to Ballywaltrim: This commuter route, operated by Dublin Bus, runs from Ballywaltrim to Heuston Rail Station and vice versa with key stops at Main Street Bray, Woodbrook, Shankill, Cherrywood, Loughlinstown, Cabinteely, Mount Merrion, UCD, Donnybrook, St. Stephens Green, City Centre. The route operates a service during weekdays every 10 to 15 minutes throughout the majority of the morning, interpeak and evening periods in both directions.

- Route 155 – Ikea (Ballymun) to Bray Rail Station: This commuter route, operated by Dublin Bus, runs from Bray Rail Station to Ikea (Ballymun). Key stops include Bray Main Street, Woodbrook, Shankill, Cherrywood, Loughlinstown, Cabinteely, Mount Merrion, UCD, Donnybrook, St. Stephens Green, O'Connell Street, Broadstone, DCU, Ballymun, Ikea. This route operates with 53 no. southbound services and northbound services daily during the week and a Saturday. With 47 no. southbound and northbound services operating on a Sunday.

It is considered that the proposed development is well located, granting opportunity to access both services and employment opportunities in the local and wider environs via public transport.

In a wider context there are also significant sustainable accessibility opportunities for commuter access to employment and education destinations in Dublin City.

14.3.2.2 DART Rail Services

In terms of heavy rail, the closest stations are Shankill circa 2.5km to the north and Bray also circa 2.5km to the south. Both stations serve both DART and Commuter Rail services. These stations facilitate services that allow for good connection to other onward destination both north and south, as illustrated in the graphic below.

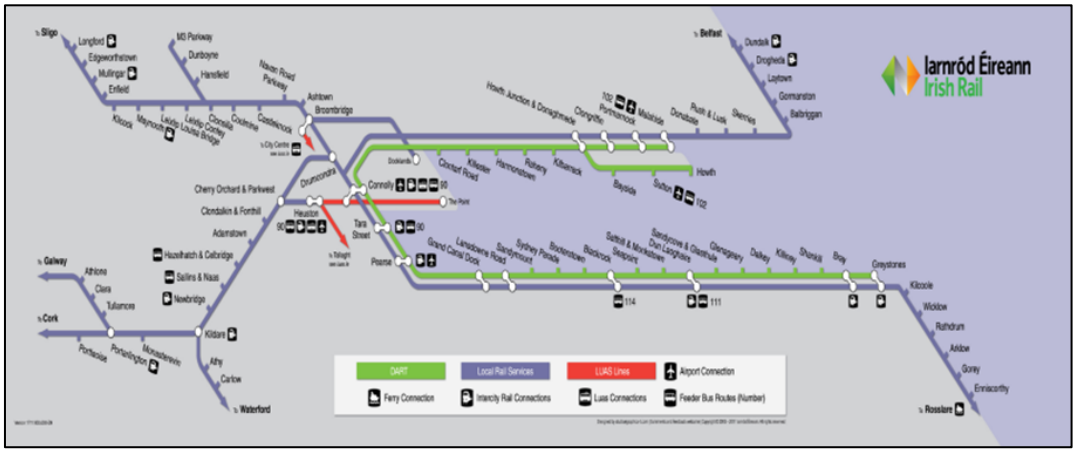

Figure 14.3: Rail Route Map.

Services generally operate with 10-minute frequencies during the peak hour morning and evening commuter periods. The future Woodbrook Dart station adjacent the development will make these services conveniently accessible to future residents.

14.3.2.3 Existing Road Network

The proposed development will access onto the R119 Dublin Road. The R119 Dublin Road is a single carriageway regional road with cycle lanes and bus lane provision provided along some sections of the route. In the vicinity of the development access junction the R119 is a single carriageway regional road with cycle lanes on both sides.

To the south the R119 Dublin Road provides access to town centre of Bray, via the R761, and the M11 via the Wilford Interchange facilitating access to the M50 to the north & M11 to the south.

To the north the R119 Dublin Road connects through Shankill Village to the R837 facilitating access the N11 and thereby Cabinteely, Stillorgan, UCD and Donnybrook. Access is also provided to the north to Killiney, Dalkey, Sandycove and Dun Laoghaire, along the R119 Shanganagh Road.

The key junctions in the potential area of influence of the proposed development in terms of vehicular traffic impact are illustrated in the Figure below and described in the following sections.

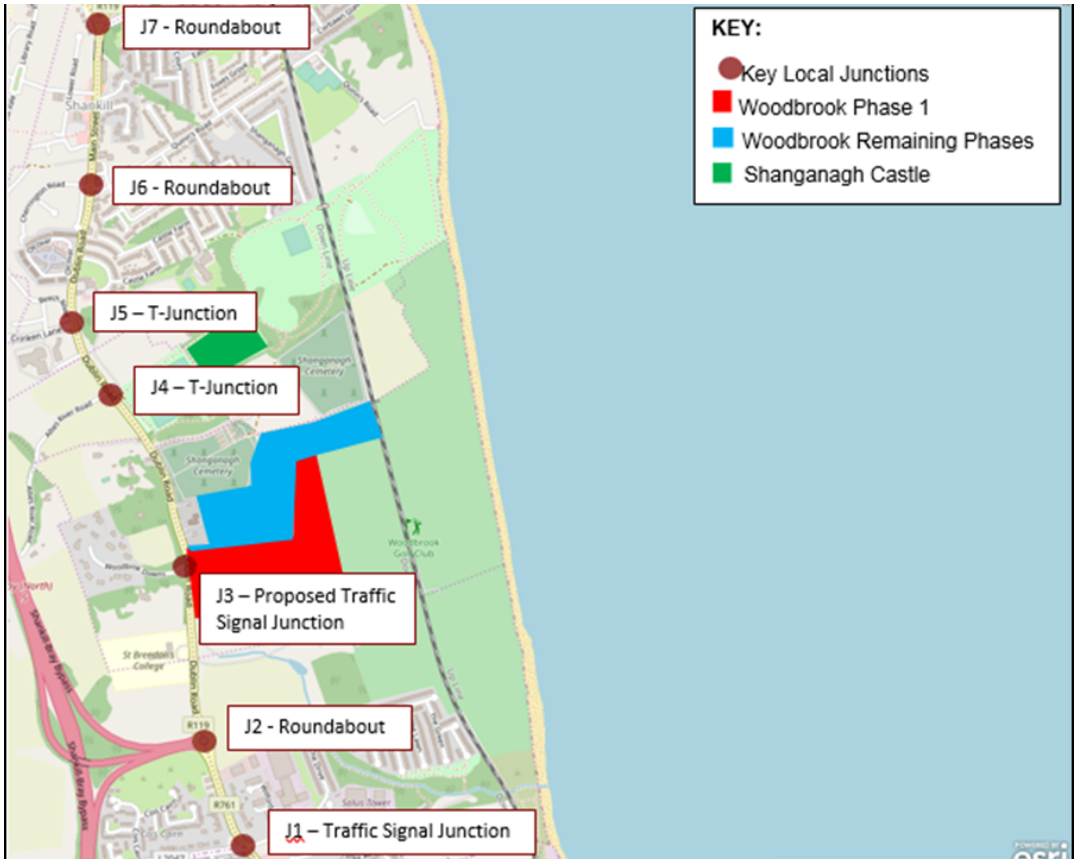

Figure 14.4: Local Road Network.

14.3.2.4 Junction 1 – Old Connaught Avenue / Corke Abbey Avenue / R761 Dublin Rd

Junction 1 is a Traffic Signal junction between the R761 Dublin Road and the side road arms of Old Connaught Avenue and Corke Abbey Avenue. Double lane approaches are provided on all arms for a short distance. Left slip lanes are provided on the northern Dublin Road arm and the Pedestrian crossing facilities are provided on the Old Connaught Avenue arm and the southern Dublin Road arm.

Figure 14.5: Junction 1 - Old Connaught Avenue / Corke Abbey Avenue / R761 Dublin Rd.

14.3.2.5 Junction 2 – Wilford Interchange Link Road / Dublin Rd (R119 / R761)

Junction 2 is a large three-arm roundabout between the M11 Wilford Interchange Link arm and the Dublin Road (R119 and R761). The approach along the western and southern arms accommodate double lane configuration whilst a single lane approach exists on the northern arm. The Figure below details the junction layout.

Figure 14.6: Junction 2 - Wilford Interchange Link Road / Dublin Rd (R119 / R761).

There are no pedestrian crossing facilities on any arm, however a cycle lane is provided on both sides of the northern arm and this continues northwards along the R119 Dublin Road.

There are proposals currently being prepared by DLRCC to redesign this junction as a Traffic Signal junction which will incorporate an additional right turning lane on the northern arm, a left slip on the southern arm and pedestrian crossing facilities. This layout is illustrated in the Figure below. Bus Connects will further advance this layout with the incorporation of north and southbound bus lanes.

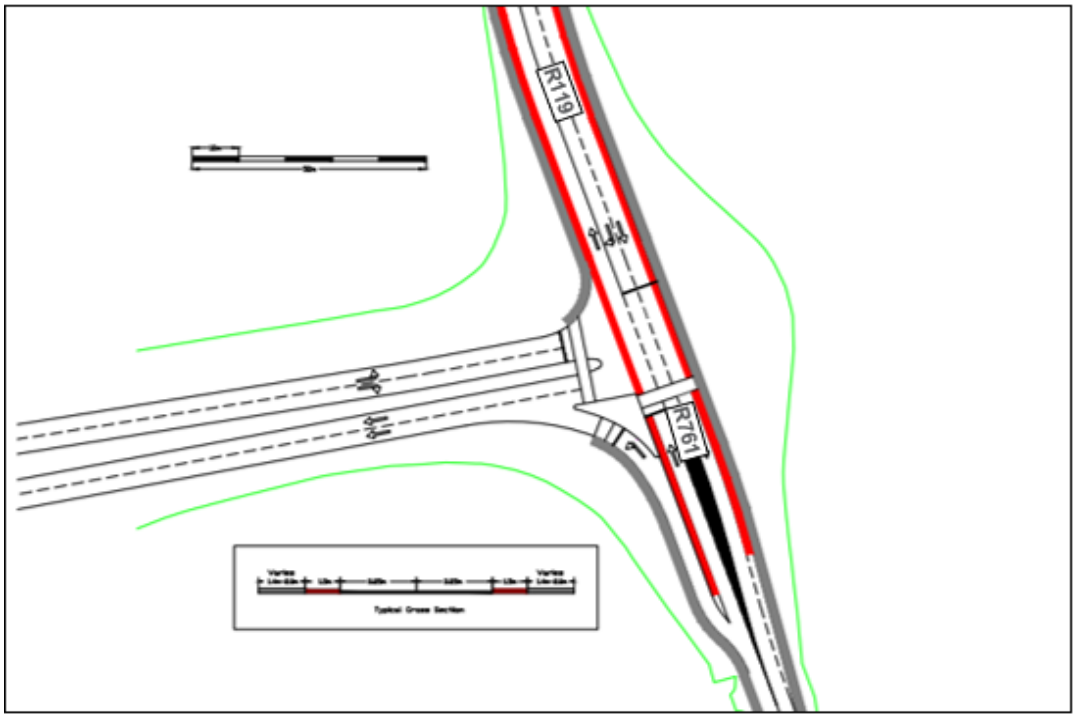

Figure 14.7: Wilford Interchange Link Road / Dublin Rd (R119 / R761) Proposed Upgrade.

14.3.2.6 Junction 3 – Woodbrook Downs / R119 Dublin Rd / Proposed Development Access

Junction 3 is a T-junction between the R119 Dublin Road and Woodbrook Downs and operates under priority control with Woodbrook Downs being the minor arm.

Figure 14.8: Junction 3 - Woodbrook Downs / R119 Dublin Rd / Proposed Development Access

There are currently no pedestrian crossing facilities provided other than dropped kerbs in vicinity of the Woodbrook Downs arm. However, footpaths and advisory cycle lanes are provided on both sides of the R119 Dublin Road. A bus lane is provided approximately 30m north of the junction. There is a southbound bus stop located some 40m north of the junction. The nearest northbound bus stop is located approximately 140m north of this junction

The proposed development will upgrade this junction to a Traffic Signal junction with pedestrian crossing facilities on all arms, footpath and cycle facilities retained along the Dublin Road and right turn lane and pedestrian and cycle facilities proposed along the development access arm.

14.3.2.7 Junction 4 – Shanganagh Park & Cemetery / R119 Dublin Road

Junction 4 is a T-junction between the R119 Dublin Road and the access road to Shanganagh Park and Cemetery. There are no pedestrian crossing facilities provided on any arms. A cycle lane is present on the eastern side on the Dublin Road, whilst a bus lane, incorporating a bus stop, is provided on the western side of the road. This layout is detailed in the Figure below.

Figure 14.9: Junction 4 - Shanganagh Park & Cemetery / R119 Dublin Road

14.3.2.8 Junction 5 – Crinken Lane / R119 Dublin Road

Junction 5 is a T-junction between the R119 Dublin Road and Crinken Lane. Pedestrian crossing facilities incorporating dropped kerbs and tactile paving are provided across Crinken Lane only. Advisory cycle lanes are present on both sides of the R119 Dublin Road. This layout is detailed in the Figure below.

Figure 14.10: Junction 5 - Crinken Lane / R119 Dublin Road.

14.3.2.9 Junction 6 – R119 Dublin Road / Cherrington Road / Quinn's Road

Junction 6 is a compact four-arm roundabout with the R119 Dublin Road as the main road arms whilst Cherrington Road and Quinn's Road serve as the western and eastern arms respectively. Single lane approaches are provided on all arms. This layout is detailed in the Figure below.

Figure 14.11: Junction 6 - R119 Dublin Road / Cherrington Road / Quinn's Road.

Pedestrian crossing provision is facilitated by dropped kerbs on all arms only with tactile paving being omitted. Advisory cycle lanes are present on the both sides of the southern Dublin Road arm.

14.3.2.10 Junction 7 – R119 Dublin Road / R837 Dublin Road / R119 Shanganagh / Corbawn Lane

Junction 7 is a four-arm roundabout between the R119 and R837 Dublin Road, the R119 Shanganagh Road and Corbawn Lane. Single lane approaches are provided on all arms. Pedestrian crossings provision is facilitated by dropped kerbs on all arms only with tactile paving being omitted. Advisory cycle lanes are present on both sides of the R837 Dublin Road. This layout is detailed in the Figure below.

Figure 14.12: Junction 7 - R119 Dublin Road / R837 Dublin Road / R119 Shanganagh / Corbawn Lane

14.3.3 Junction Turning Counts

Junction turning counts have been undertaken at 7 no. locations as shown on the figure below and described in Section 2. In addition, volume and speed surveys have also been undertaken at 3 no. locations along the R119 and R761. These traffic surveys have been undertaken by Tracsis, a specialist traffic survey contractor, during the month of May 2018. The results of these surveys are provided within Appendix 14.1 of this EIAR.

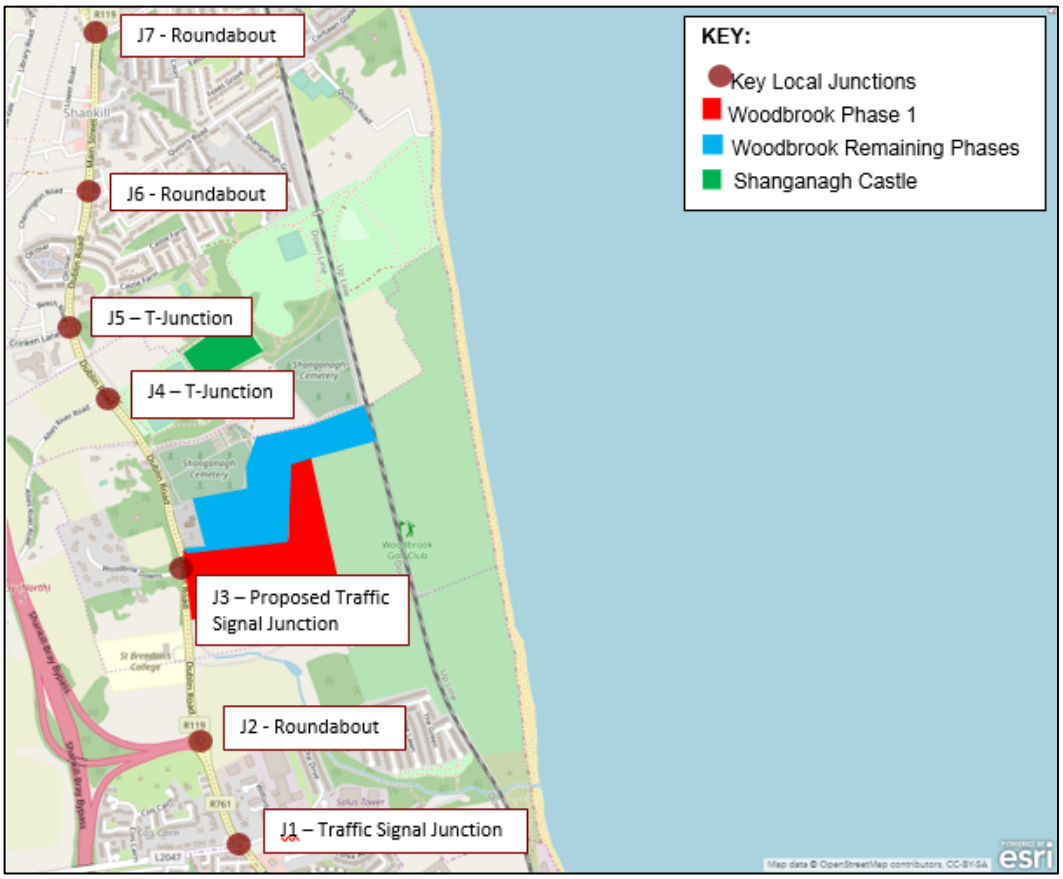

Figure 14.13: Local Road Network.

14.3.4 Future Transport Infrastructure

The Transport Strategy for the Greater Dublin Area (GDA) 2016-2035 sets out how transport and its associated infrastructure will be developed across the GDA region up to the year 2035. The following key transport proposals are specifically relevant to the proposed development.

14.3.4.1 Core Bus Corridor Network

The Transport Strategy identified a number of radial and orbital routes where demand for travel necessitates significant infrastructural investment. The main route of relevance to the proposed development is the core radial bus network route from Bray to the City Centre. The figure below illustrates the location of this route within the core bus network.

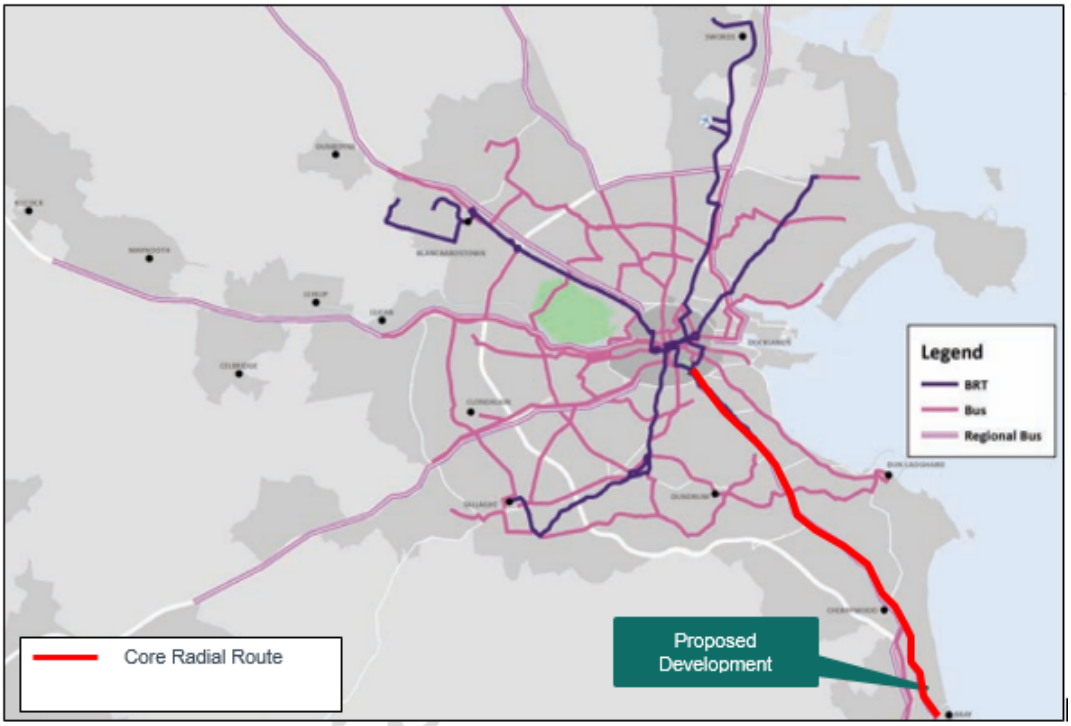

Figure 14.14: Core Bus Network.

14.3.4.2 Bus Connects

Bus Connects is the further development of the bus services as set out in the Transport Strategy. This project is currently being progressed by the NTA to implement both network and bus corridor improvements to overhaul the current bus system in Dublin. These initiatives consist of the following key elements of relevance to the proposed development.

14.3.4.3 Core Bus Corridor Project

One of these initiatives is taking forward the Core Bus Corridor Project as identified in the Transport Strategy. In November 2018 the NTA commenced the public consultation on the radial corridors. The public consultation process was broken into three phases with Route 13 from Bray to City Centre being included in Phase 3. This went to public consultation on 28th February 2019. This public consultation process ended on the 31st May 2019.

The Figure below illustrates the location of Route 13 in relation to all other proposed routes within the core bus network. The route proposals in the vicinity of the proposed development are contained in Appendix 14.2 of this EIAR.

Figure 14.15: Core Bus Corridor Project

The applicant has liaised directly with the NTA on Route 13. Consultation was undertaken in terms of ensuring the proposed development access junction on the Dublin Road would not prejudice the delivery of the bus corridor. In order to confirm this the applicant prepared a proposed junction layout that would incorporate an upgrade of the proposed development junction in order to incorporate the bus corridor route proposals as set out in the public consultation. The NTA has confirmed these proposals are appropriate and would facilitate Bus Connects.

14.3.4.4 Bus Network Redesign

The existing bus network is undergoing a redesign to accommodate the growth of Dublin City. This redesign will also reduce the complexity of the network. As currently proposed, the redesign in Bray, Enniskerry and Shankill aims to replace a complex network of overlapping routes with a simpler network. Direct services to the city centre will be provided ex Bray DART Station via Dublin road, adjacent the proposed development, on spine route E1. Services will operate at least every ten minutes frequency in the peak hour.

Figure 14.16: Extract from Bus Connects Network Redesign.

14.3.4.5 Cycle Network

The Greater Dublin Area Cycle Network Plan proposes to expand the urban cycle network to over 1,485 kilometres in length and will provide over 1,300 kilometres of new connections between towns in the rural areas of the GDA. The network is intended to provide a quality of service sufficient to attract new cyclists, as well as catering for the increasing numbers of existing cyclists. The proposed routes of relevance to the proposed development are as follows;

Primary Route 12 / 12A – Bray to City Centre. This route extends from Bray to the City Centre via Woodbrook and traverses the R119, the R837, the N11 and the R138.

Greenway Route 14 / W11 / N5 – Wicklow Town to Dublin City Centre. This route forms part of the southern East Coast Trail. In vicinity of the proposed development the route will extend from Bray to Dún Laoghaire onwards.

The figure below is an extract from Sheet N20 of the Cycle Network Plan highlighting the proposed cycling facilities directly adjacent the proposed development.

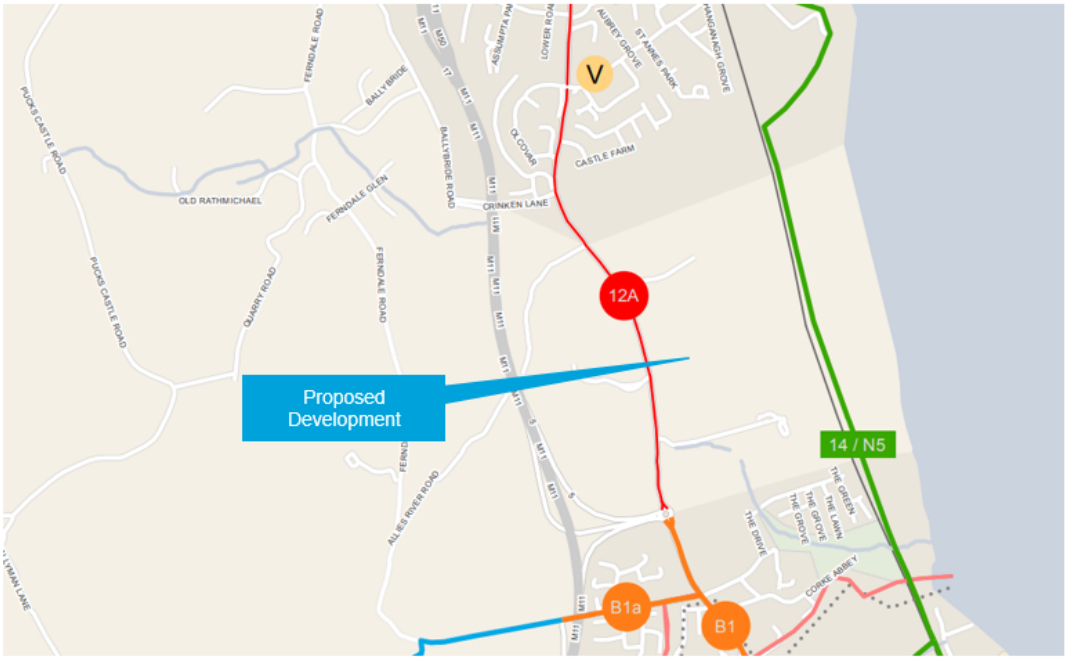

Figure 14.17: Extract from the National Cycle Plan.

Provision of the above routes along with the wider network of routes in the area will greatly assist in encouraging cycling for all trip purposes. Route 12A, upgraded from current cycling provisions along Dublin Road, is currently planned to be delivered as an integral element of Bus Connects Route 13.

14.3.4.6 Proposed DART Station and Temporary Car Park

The Transport Strategy outlines the need for a number of additional stations to be added to the network in developing areas which have a sufficient level of demand to support the provision of a train station. This includes specifically for Woodbrook on the South-Eastern DART Line.

Thus the proposed development facilitates the development of a new DART Station on the masterplan lands. This station is being delivered by the NTA and Irish Rail. It has been agreed with the NTA and DLRCC that the station will be completed in tandem with the completion of the subject Phase 1 proposed development. The design of the station, to be fully integrated to the proposed development site, has been the subject of direct consultations between Irish Rail, the NTA, DLRCC and the Applicant.

The proposed development includes for the provision of a 164 no. space temporary station car park to be delivered in Phase 1 via the completion of Woodbrook Avenue, the main spine route through the site from the Dublin Road. Irish Rail has commenced design work on the station with a view to lodging a planning application in the final quarter of 2019.

The Transport Strategy outlines the objective to develop a strategic park and ride site in the Woodbrook area. The strategic site will be developed by the NTA on a site yet to be determined. At that time the temporary park and ride will be subsumed as residential development within the Woodbrook site.

14.4 Characteristics of the Proposed Development

In overall master planning terms, the development at Woodbrook is to consist of two phases: -

- **Phase 1:** 685 no. residential units and a crèche facility. Phase 1 development incudes for the proposed traffic signal-controlled development access junction on Dublin Road and Woodbrook Avenue, the main access route through the development. Phase 1 also includes a temporary park and ride car park to serve the proposed DART Station immediately adjacent the lands. The DART Station is subject to a planning application that is currently being prepared by Irish Rail.
- **Phase 2:** 803 no. residential units, a neighbourhood retail centre and a primary school. The full build out of Phase 2 will include the removal of the DART Park and Ride car park which will be replaced by strategic park and ride site to be delivered by the NTA.

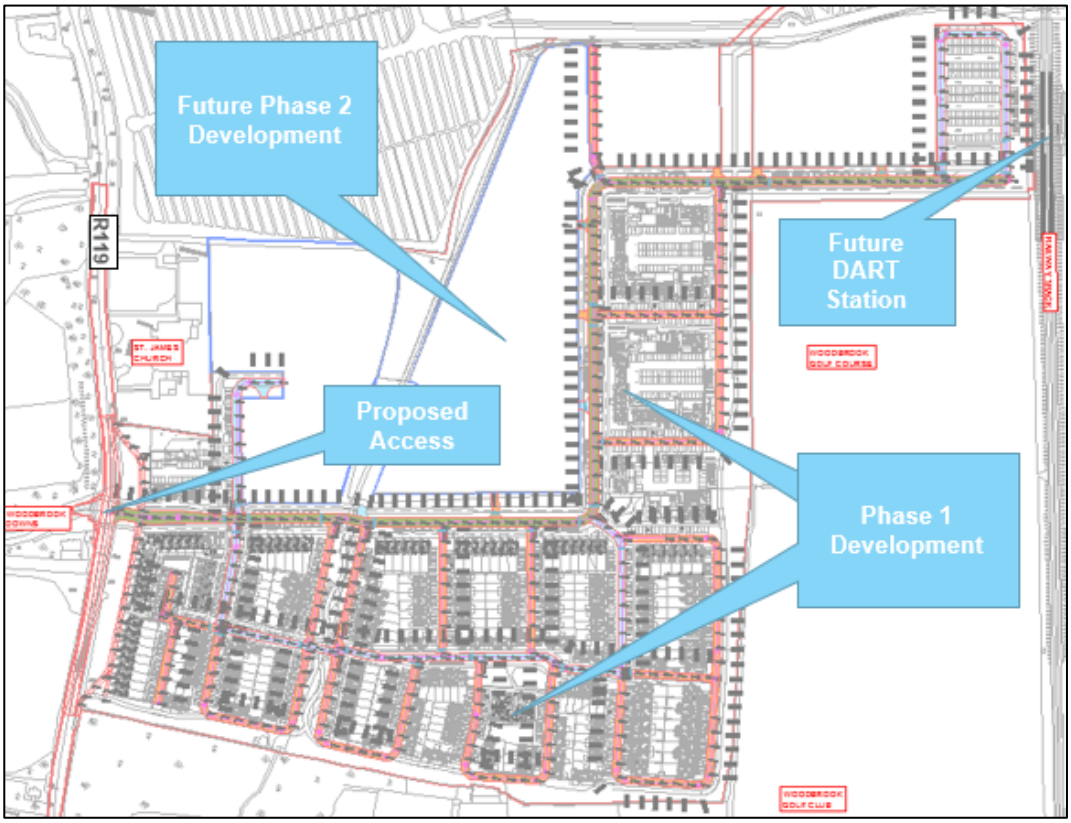

Figure 14.18: Phase 1 Site Layout.

In terms of vehicular traffic, the development will be served by a single access junction located along the site frontage on Dublin Road. The form of this junction has been carefully considered in terms of the requirements as follows:

- Provision for the safe movement of all users with appropriate priority for the movement of pedestrians and cyclists.
- Appropriate retention of existing trees and boundary wall along the Dublin Road frontage in accordance with Objective WB23 of the Local Area Plan.
- Provision of appropriate traffic carrying capacity at the junction.
- Potential for the upgrade of the junction to facilitate Bus Connects Core Bus Corridor 13.

Development Access Junction: Option 1

Cycle tracks are incorporated on both sides of Dublin Road. In order to maintain the maximum number of trees along Dublin Road, the cycle track and footpath on the eastern side of the road are indented behind the existing trees and boundary wall and adjacent to the building line and residential frontages of the proposed development. Cyclists are accommodated on segregated cycle tracks on both sides of the road as opposed to the current integrated advisory cycle lane provision.

Right turn lanes are incorporated to facilitate right turning traffic into the proposed development and in to Woodbrook Downs. The existing inline bus stop on the eastern side of the Dublin Road will be relocated slightly further northwards from the signalised junction. This relocated bus stop will be provided as an inline bus stop.

This is the preferred form of junction presented on the planning application drawing 5154251/HTR/DR/0100 and detailed in the Figure below. It optimises the number of trees that can be retained, 34 in total, and minimises the impact on the existing historic boundary wall whilst affording appropriate facilitates for pedestrians and cyclists whilst also providing appropriate traffic carrying capacity.

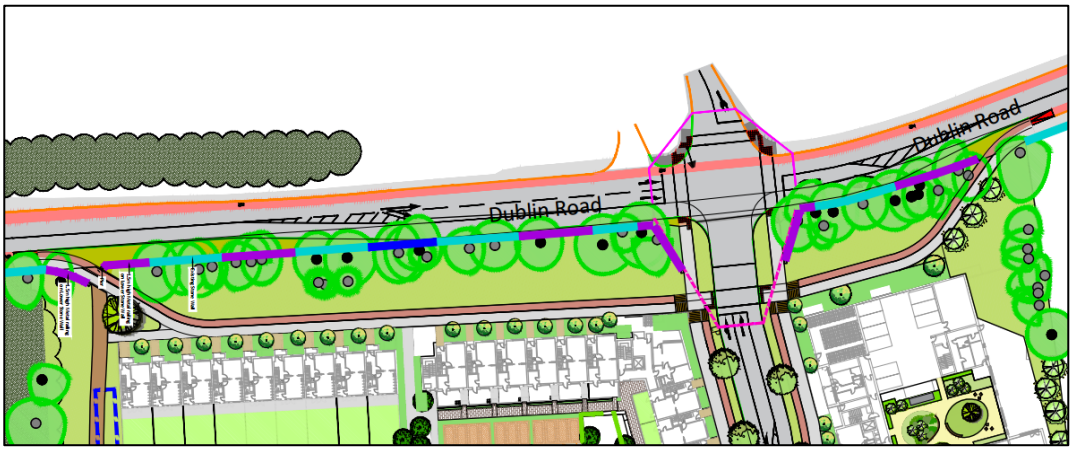

Figure 14.19: R119 Dublin Road Development Access Junction Option 1.

Development Access Junction: Option 2

This option incorporated the cycle and footpath provision adjacent the road edge of Dublin Road together with right turn lane provisions on Dublin Road. In order to facilitate this option, only 8No. trees would be retained along the site frontage along Dublin Road. The majority of the boundary wall would be removed and replaced with a new wall constructed from material salvaged from the existing wall.

This loss of the existing mature trees and the impact on the existing wall determined that this layout was less preferable to Option 1, the proposed form of junction. However, the Applicant would defer to An Bord Pleanála's Opinion on the impact of the loss of trees and would accept a planning condition to accommodate Option 2 as the junction layout to be adopted. This option is detailed in the Figure below.

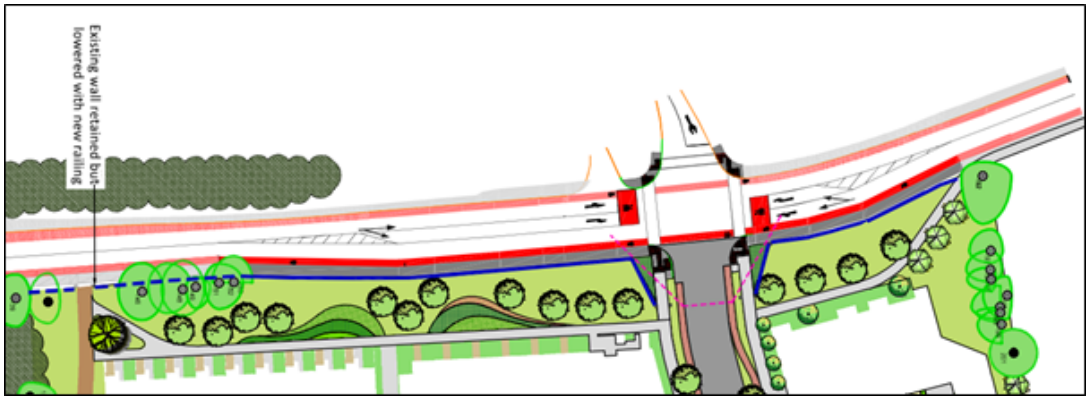

Figure 14.20: R119 Dublin Road Development Access Junction Option 2.

Development Access Junction: Future Facilitation of Bus Connects

This option was developed in order to future proof the development of the Bus Connects bus corridor along Dublin Road. The layout was developed based on the proposed layout for the bus corridor that was presented during the recent public consultation on this bus corridor. Therein the proposed development access was indicated. The bus connect layout, incorporating right turn lanes on Dublin Road, is presented purely for illustrative purposes and without prejudice to the ongoing consultation and design process for the bus corridor. However, DLR and the NTA have confirmed that the illustrated layout is appropriate in terms of the general layout and bus priority that would be afforded.

This layout would result in the loss of all existing trees along Dublin Road. The full extent of the existing boundary wall would be removed, and a new boundary wall would be formed, constructed from material salvaged from the existing wall. As such, this potential loss of trees and existing boundary wall would be addressed during the planning application stage of the Bus Connects project. This option is detailed in the Figure below.

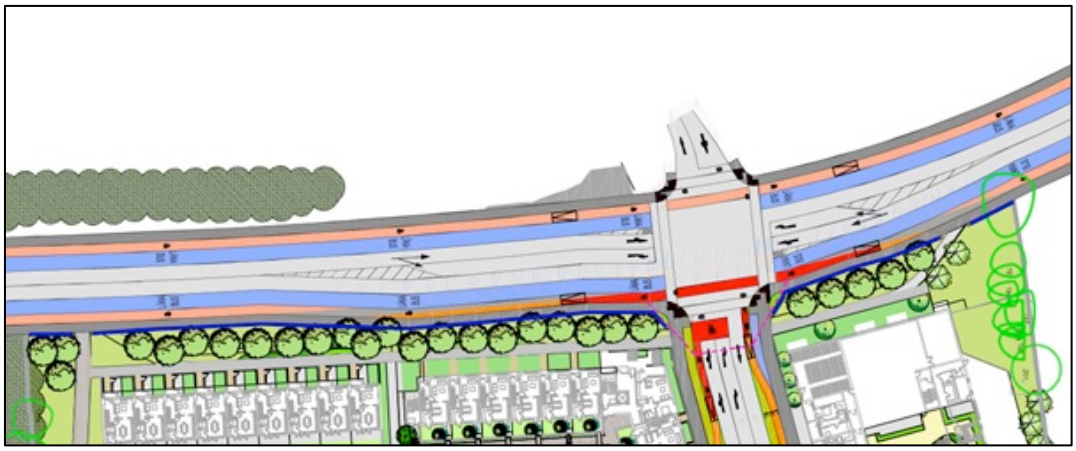

Figure 14.21: R119 Dublin Road Development Access Junction BusConnects Option.

It should be noted that the illustrated Bus Connects junction layout presents a worst-case scenario in terms of land take on the applicant's site. The layout is based on the assumption that there will be no land take on the other side of the road and that therefore this section of the Bus Connects corridor could be entirely accommodated with the applicant's land.

Further details of the transportation aspects of the proposed development such as the Internal Street Layout and Car Parking are described within the Traffic and Transportation Assessment Report.

14.4.1 Proposed Development

The Proposed Woodbrook Development, Phase 1 subject of this planning application, consists of 685 no. residential units, creche and park and ride for the DART station comprising: -

- 207no. Housing units.
- 48no. Duplexes units.
- 430no. Apartment units.
- 429m^2 Childcare Facility.
- 164no. space Temporary Rail Station Car Park.

14.4.1.1 Construction Stage

All construction activities will be managed and directed by a Construction Traffic Management Plan (CTMP). The details of the CTMP will be agreed with the roads department of the Local Authority in advance of construction activities commencing on-site.

The objective of the CTMP is to ensure that the impacts of all related construction activities generated during the construction phase of the proposed development upon both the public (off-site) and internal (on-site) construction workers environments are fully considered and proactively managed and scheduled with full consideration of the requirements of key stakeholders. This will ensure that the safety, health and well-being of both the public's and construction workers is maintained at all times.

14.4.1.2 Operational Stage

Assessment Years and Traffic Growth

The following assessment years are identified to inform the Traffic and Transport Assessment.

- Opening Year 2020
- Opening Year +5 2025
- Opening Year +15 2035

The recorded traffic count survey was collected in 2018. This data has been factored to 2020, 2025 and 2035 forecast traffic flows using the TII Project Appraisal Guidelines Unit 5.3 'Travel Demand Projections'. 'Low Growth' growth factors have been applied. The factors used are associated with Region 1 'Dublin'. Given the future arrival of BusConnects and Irish Rail Dart Station, the application of low growth rates is considered appropriate. An extract of the traffic growth rates applied are contained within Appendix 14.3 of this EIAR.

Total Person Trip Rates

A trip rate estimation exercise has been undertaken using TRICS (Trip Rate Information Computer System) to determine total person trip rates for both phases of the development.

The exception to this is the temporary DART park and ride car park proposed within Phase 1. Traffic generation for this facility has been determine by undertaking traffic count surveys at the park and ride car park at Shankill in order to estimate localised empirical trip rates. This is considered to be appropriate particularly as TRICS does not contain any trip rate information on such land uses.

The total person trip rates estimated from the TRICS database are summarised below with further details contained within Appendix 14.4 of this EIAR.

Use	Units	Period	Arrivals	Departures	2-way
Houses Privately Owned	Beds	AM	0.073	0.269	0.342
		PM	0.227	0.115	0.342
Apartment Privately Owned	Beds	AM	0.049	0.226	0.275
		PM	0.163	0.066	0.229
Duplex	Beds	AM	0.049	0.226	0.275
		PM	0.163	0.066	0.229
Creche	m^2	AM	7.097	4.516	11.613
		PM	3.594	5.346	8.94
Neighbourhood Centre	m^2	AM	12.007	11.988	23.995
		PM	13.178	14.435	27.613
School	No. Pupils	AM	1.15	0.338	1.488
		PM	0.043	0.084	0.127

Table 14.1: Total Person Trip Rates.

In order to determine an appropriate mode share associated with private vehicles arriving and departing the proposed development a review of the Central Statistics Office (CSO) Census 2016 was undertaken. This exercise has been undertaken to identify mode share potentials in two scenarios namely, Pre-DART Station and Post-DART Station.

It is assumed that the Pre-DART Station will align with the Opening Year assessment period whilst the Post-DART Station will align with the Opening + 5 and Opening +15 assessment periods.

Mode Share

In terms of the Pre-DART Station Scenario, the 'Small Areas' utilised are all located in close proximity to the proposed site and in particular are all located adjacent to the R119 Dublin Road and thus the bus route that operates along same. Care was taken not to utilise sites close to a DART stations as these would not be representative of the relevant Opening Year scenario at Woodbrook, until the proposed DART Station is open and operational. In addition, sites were also chosen on the basis of having good public transport mode shares as these are considered to align with the transport characteristics of the proposed development. The areas chosen are detailed further in the Traffic and Transport Assessment. The amalgamation of the small areas chosen are presented in the following table.

Means of Travel	Total	%
Active Travel	180	18%
Public Transport	277	28%
Car Driver	348	36%
Car Sharer	133	14%
Other	40	4%
Total	978	100%

Table 14.2: Pre DART Station Scenario Modal Share

As such for the relevant Opening Year scenario, a mode share of 36% has been applied to the total people trip rates to derive vehicle trip rates.

In terms of the Post DART Station case, the 'Small Areas' utilised are all located in close proximity to the Bray and Blackrock DART Station. These locations have been chosen as they represent locations with access to both high frequency bus and train services. As such it is considered that these travel characteristics align well with the post DART scenario associated with the proposed development. The areas chosen are detailed further in the Traffic and Transport Assessment.

Whilst the selected areas adjacent to Bray DART Station do represent strong travel characteristics that are comparable with the proposed development site, it is considered that the proposed development goes further in providing additional travel mitigation than the sites adjacent to Bray DART Station do not provide such as: -

- Dublin Road bus corridor and proposed Bus Connects bus and cycle route upgrades.
- Neighbourhood Centre, creche, primary school and open space provision within the site.
- Access to secondary schools, including Woodbrook College directly adjacent the site.
- Active and passive open space provision in the adjacent Shanganagh Park.
- Extensive pedestrian and cycle links through and within the site.
- Car club car provision.
- Extensive private and public cycle parking.

As such it is considered that the potential for a higher public transport mode share is possible. In this respect a review has been undertaken of a location adjacent to Blackrock DART Station. The area chosen is detailed further in the Traffic and Transport Assessment.

The comparison of the mode shares for the 'Small Areas' for Bray DART and the site at Blackrock DART are presented in the following Table: -

Means of Travel	**Shankill**		**Clongrifffin**	
	Total	**%**	**Total**	**%**
Active Travel	160	24%	21	15%
Public Transport	203	31%	60	44%
Car Driver	191	29%	27	20%
Car Sharing	58	9%	11	8%
Other	48	7%	17	13%
Total	660	100%	136	100%

Table 14.3: Comparative Post DART Station Scenario Modal Share

As can be seen from the above comparison, the mode shares for the amalgamated Bray Small Areas indicate a public transport mode share of 31% whilst the car driver mode share equates to 29%. The review of the Blackrock area indicates that potentially the public transport mode share can increase to 44% whilst car driver can reduce to 20%.

Based on these comparisons it was considered appropriate to assess the proposed development as a blended mode share of the Bray and Blackrock sites. Therefore, the following mode shares were applied.

Means of Travel	Proposed Mode Share %
Active Travel	20%
Public Transport	38%
Car Driver	25%
Car Sharer	9%
Other	8%
Total	100%

Table 14.4: Post DART Station Scenario Mode Share

As such for the relevant Opening +5 and Opening +15 Year scenarios, a mode share of 25% has been applied to the total people trip rates to derive localised vehicle trip rates.

Vehicle Trip Rates

Taking the Multimodal trip rates and applying the pre DART mode split for Active Travel , Public Transport and Private Vehicles results in the following trip rates as presented in the Table below.

Use	Units	Period	Active Travel		Public Transport		Private Vehicle	
			Arrival	Depart	Arrival	Depart	Arrival	Depart
Houses Privately Owned	Beds	AM	0.013	0.050	0.021	0.076	0.026	0.096
		PM	0.042	0.021	0.064	0.033	0.081	0.041
Apartment Privately Owned	Beds	AM	0.009	0.042	0.014	0.064	0.017	0.080
		PM	0.030	0.012	0.046	0.019	0.058	0.023
Duplex	Beds	AM	0.009	0.042	0.014	0.064	0.017	0.080
		PM	0.030	0.012	0.046	0.019	0.058	0.023
Creche	m2	AM	1.306	0.831	2.010	1.279	2.525	1.607
		PM	0.661	0.984	1.018	1.514	1.279	1.902

Table 14.5: Pre-DART Vehicle Trip Rates.

Use	Units	Period	Active Travel		Public Transport		Private Vehicle	
			Arrival	Depart	Arrival	Depart	Arrival	Depart
Houses Privately Owned	Beds	AM	0.018	0.065	0.026	0.094	0.018	0.067
		PM	0.054	0.028	0.079	0.040	0.057	0.029
Apartment Privately Owned	Beds	AM	0.012	0.054	0.017	0.079	0.012	0.057
		PM	0.039	0.016	0.057	0.023	0.041	0.017
Duplex	Beds	AM	0.012	0.054	0.017	0.079	0.012	0.057
		PM	0.039	0.016	0.057	0.023	0.041	0.017
Creche	Beds	AM	01.703	1.084	2.484	1.581	1.774	1.129
		PM	0.863	1.283	1.258	1.871	0.899	1.337
Neighbourhood Centre	Beds	AM	2.882	2.877	4.202	4.196	3.002	2.997
		PM	3.163	3.464	4.612	5.052	3.295	3.609
School	Beds	AM	0.276	0.081	0.403	0.118	0.288	0.085
		PM	0.010	0.020	0.015	0.029	0.036	0.039

Table 14.6: Post-DART Vehicle Trip Rates.

Park and Ride Trip Rates

A site-specific traffic survey was undertaken at Shankill Train Station Park & Ride over a three day mid-week period from the 4th December 2018 to the 6th December 2018. The resultant count data was reviewed, and a mean arrival and departure volume determined for the AM and PM peak hours of 08:00 to 09:00 and 17:00 to 18:00 respectively. This volume was equated to the number of parking spaces at the site, 170 no. car parking spaces in total, to estimate the relevant trip rates. The trip rates estimated are presented in the Table below.

Use	Units	Period	Arrival	Departure
Park & Ride	No. Spaces	AM	0.437	0.251
		PM	0.222	0.361

Table 14.7: Park and Ride Private Vehicle Trip Rate.

The above trip rate estimates have thus been utilised to determine traffic attraction associated with the proposed temporary DART Station car park at Woodbrook.

Neighbourhood Centre - External Pass-By Trips

In terms of local shops and neighbourhood centres both Shankill to the north and Bray to the south are well served by existing retail services. There are numerous local shops situated within Shankill village centre with a notable mixture in facilities consisting of pharmacies, restaurants, convenience stores, food outlets, hair salons, clothes outlets and post office. Similarly, in Bray, there are numerous local shops and facilities together with larger food stores such as Supervalu and Lidl on the northern side of the Dargle River. All of these facilities are adequately catered for with convenient parking.

Given the low scale and limited mixture of facilities proposed within Woodbrook, and the extent of existing retail services in the general area, the proposed retail element will predominantly cater for day to day convenience shopping needs of future residents of the proposed development and thus has limited ability to attract external trips. It can therefore be considered that a significant majority of trips attracted to the proposed retail element are internal trips which would have no impact on the proposed development access junction. This characteristic is further reinforced by the fact that the development is effectively a vehicular cul-de-sac and therefore the Neighbourhood Centre will not benefit from general pass by traffic.

These internal trips will be made up of primary trips directly attracted from the associated residential elements or secondary trips associated with residents bringing their children to creche, school or on their way to and from the DART Station or bus services on the Dublin Road. These trips are most likely to be walking and cycling trips however there may be some nominal trips made by car. These short journey trips will however be made within the confines of the proposed development and thus will not impact on local road network or the proposed development access junction.

Given the small scale and limited mix of the proposed retail element, no new primary external trips will be attracted to the proposed retail element. Any vehicular trips from the external road network will be secondary trips that are associated with one of the following: -

- Secondary trips associated with primary trips attracted to the train station.
- Secondary trips associated with primary trips attracted to the primary school.
- Secondary trips associated with primary trips attracted to the creche.
- Secondary pass by trips.

In terms of the first three secondary external trips, the primary trip element of each of those land uses are already taken account of via the associated traffic generation assigned to the network and thus there is no need to apply these separately to the network.

In terms of secondary external pass-by trips, whilst the potential for these trip types are highly limited due to the reasons mentioned above, it has been robustly assumed that 30% of traffic likely to be generated by the proposed Neighbourhood Centre will divert into the proposed development from existing traffic passing by the site along the Dublin Road. This is considered to be a worst-case scenario.

Primary School - External New Trips

In order to determine the level of external trips associated with the proposed primary school, a review was undertaken of CSO data of three similar locations which are served by existing primary schools. Specifically, the percentage of children of primary school going age (i.e. between 5 and 13 years old) within in each area was determined. The specific sites reviewed were as follows.

- Holywell, Swords (Educate Together National School).
- Adamstown, Lucan (Adamstown Castle Educate Together National School, Esker Educate Together N.S., St. John the Evangelist National School).
- Hansfield, Ongar (Educate Together National School, Castaheany Educate Together NS, Benedicts National School).

This review indicated the following: -

- 16% of the population within Holywell are children aged between 5 – 13.
- 24% of the population within Adamstown are children aged between 5 – 13.
- 19% of the population within Hansfield are children aged between 5 – 13.

In order to ensure that a robust assessment has been undertaken, the worst-case scenario is assumed and therefore the percentage population of children of school going to be applied to Woodbrook is 16% as per the site at Holywell.

The future total development population of Woodbrook is determined to be an average of 2.5 people per household. There are proposed to be 1399 no. units within the total Woodbrook development. However, 11% of these are 1 bed apartments and for the purpose of this calculation, these units have been omitted as these units will not cater for families. As such this equates to a equates to a future population of 3,113 people (i.e. 1399 x (1.00-0.11) x 2.5).

The estimated number of children of primary school going age within Woodbrook can then be estimated as being 498 no. children or pupils (i.e. 3,113 x 16%).

Taking into account that the proposed school will provide spaces for up to 720no. pupils it is conservatively estimated that the proposed primary school could attract up to 222no. external pupils.

As such, the trip rates estimated from TRICS have been applied to this number of pupils to determine the volume of external trips that can be reasonably assumed to be generated by the primary school associated with the proposed Phase 2 of the Woodbrook development.

Traffic Generation

The traffic generation volumes taking into account, the trip rates, modal splits and an ancillary assumptions as discussed in the foregoing paragraphs, are presented in the Tables below for the Phases and Scenarios associated with the Proposed Woodbrook Development.

Use	Units	Period	Active Travel		Public Transport		Private Vehicle	
			Arrival	Depart	Arrival	Depart	Arrival	Depart
Houses Privately Owned	Beds	AM	10	36	15	55	19	69
		PM	30	15	46	23	58	29
Apartment Privately Owned	Beds	AM	7	31	10	47	13	59
		PM	22	9	34	14	43	17
Duplex	Beds	AM	1	5	2	8	2	10
		PM	4	1	5	2	7	3
Creche	m^2	AM	6	4	9	5	11	7
		PM	3	4	4	6	5	8
Total Phase 1		AM	14	23	75	35	115	44
		PM	35	59	30	90	46	113

Table 14.8: Woodbrook Phase 1 (Pre – DART) Traffic Generation.

Use	Units	Period	Active Travel		Public Transport		Private Vehicle	
			Arrival	Depart	Arrival	Depart	Arrival	Depart
Houses Privately Owned	Beds	AM	13	46	18	68	13	48
		PM	39	20	57	29	41	21
Apartment Privately Owned	Beds	AM	9	40	13	58	9	42
		PM	29	12	42	17	30	12
Duplex	Beds	AM	1	6	2	9	1	7
		PM	5	2	7	3	5	2
Creche	m^2	AM	7	5	11	7	8	5
		PM	4	6	5	8	4	6
DART Station Temporary Car Park	No. Space	AM	Traffic Surveys Recorded Vehicle Counts Only				73	42
		PM					37	60
Total Phase 1		AM	30	97	44	142	104	143
		PM	76	39	111	57	116	100

Table 14.9: Woodbrook Phase 1 (Post – DART) Traffic Generation

Trip Distribution and Assignment

The trip distribution of vehicles originating and terminating at the proposed development has been based on the distribution of traffic arriving and departing the local road as defined by the traffic survey locations agreed as part of the TTA scoping exercise. The distribution percentages for each entry and exit point to this local road network has been calculated from the available traffic turning proportions from the January 2018 traffic surveys. These distribution percentages are presented in the Table below.

Zone		AM				PM			
ID	Description	In	Out	%In	%Out	In	Out	%In	%Out
1	Dublin Road - R119	486	617	14%	18%	524	355	16%	11%
2	Corbawn Lane	199	100	6%	3%	135	188	4%	6%
3	Quinns Road	177	69	5%	2%	101	146	3%	5%
4	Shanganagh Castle	0	0	0%	0%	0	0	0%	0%
5	Shanganagh Cemetry	8	33	0%	1%	22	27	1%	1%
7	Corke Abbey Avenue	331	143	10%	4%	221	235	7%	7%
7	Dublin Road - R761	853	650	25%	19%	689	802	20%	25%
8	Old Connaught Avenue	340	188	10%	6%	376	157	11%	5%
9	Wilford Interchange	462	901	13%	26%	543	814	16%	25%
10	Woodbrook Downs	6	5	0%	0%	4	6	0%	0%
11	Crinken Lane	118	99	3%	3%	88	93	3%	3%
12	Cherrington Road	29	12	1%	0%	11	24	0%	1%
13	Dublin Road – R837	418	594	12%	17%	656	356	19%	11%
Total		3427	3410	100%	100%	3370	3202	100%	100%

Table 14.10: Generation Woodbrook Trip Distribution Percentages

In terms of traffic assignment at junctions, these have been applied logically through manual assignment. The trip distribution and assignment of vehicular traffic is illustrated on the following Figures.

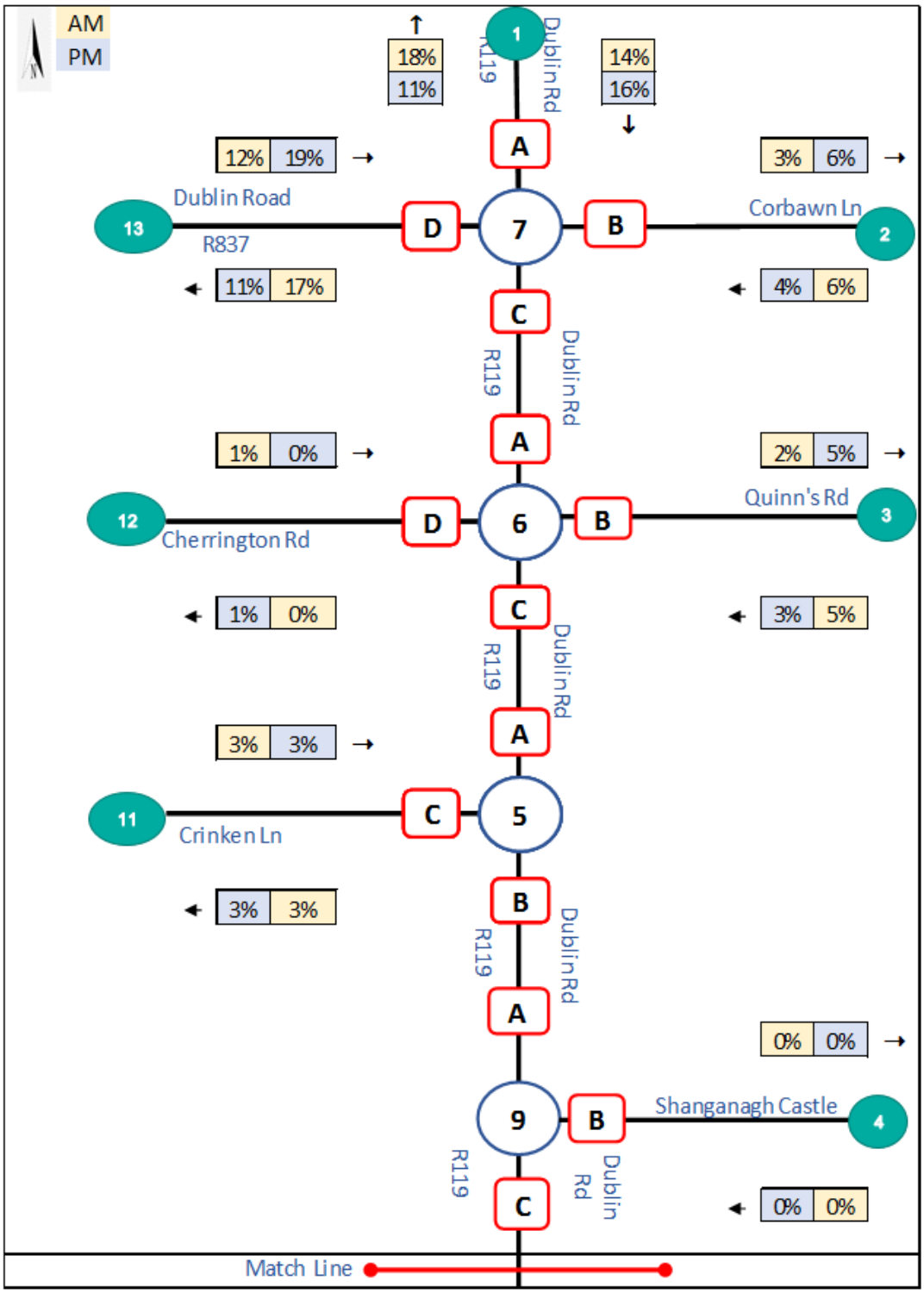

Figure 14.22: Trip Distribution and Assignment – Part 1

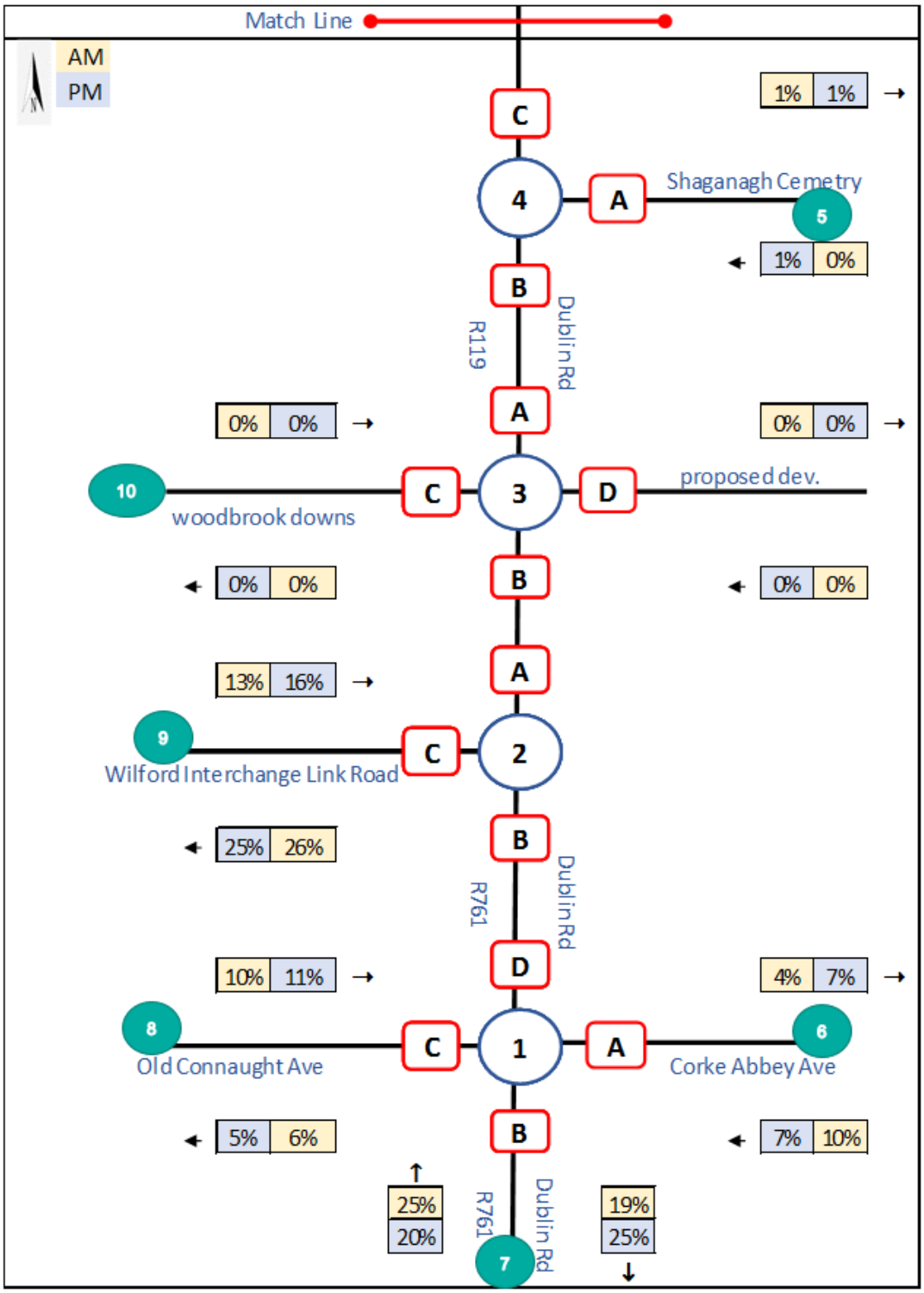

Figure 14.23: Trip Distribution and Assignment – Part 2.

14.4.2 Cumulative – Woodbrook

The Cumulative Woodbrook Development, Phase 2, is envisaged to consist of the 803no. residential units, school and neighbourhood centre, this allows for full build out of the site with the removal of the temporary dart station carpark: -

- 53no. Housing units.
- 53no. Duplexes units.
- 697no. Apartment units.
- 1,200m^2 Local Centre.
- 720no. pupil Primary School.

14.4.2.1 Construction Stage

See Section 14.4.1.1.

14.4.2.2 Operational Stage

The traffic generation volumes taking into account, the trip rates, modal splits and an ancillary assumptions as discussed in Section 14.4.1.2, are presented in the Tables below for the Phases and Scenarios associated with the Cumulative Woodbrook Development.

Use	Units	Period	Active Travel		Public Transport		Private Vehicle	
			Arrival	Depart	Arrival	Depart	Arrival	Depart
Houses Privately Owned	Beds	AM	3	10	4	15	3	11
		PM	9	4	13	6	9	5
Apartment Privately Owned	Beds	AM	14	64	20	93	14	66
		PM	46	19	67	27	48	19
Duplex	Beds	AM	2	7	2	11	2	8
		PM	5	2	8	3	6	2
Local Centre	m2	AM	35	35	50	50	11	11
		PM	38	42	55	61	12	13
School (external pupils only)	m^2	AM	82	24	120	35	85	25
		PM	10	11	15	16	11	11
Total Phase 2	m^2	AM	135	140	197	204	115	120
		PM	108	78	157	113	85	51
Total Phase 1 Without Temporary Car Park	No. Space	AM	30	97	44	142	31	102
		PM	76	39	111	57	79	41
Total Phase 1+2		AM	165	237	240	346	146	222
		PM	184	117	269	170	164	91

Table 14.11: Woodbrook Phase 2 (Post – DART) Traffic Generation.

Trip Distribution and Assignment is also as per Section 14.4.1.2.

14.5 Potential Impact of the Proposed Development

Proposed Scenarios

In order to appropriately assess the traffic impact of the proposed development a number of scenarios have been developed.

Scenario	Development	Mode Split
Opening Year without development	No development	n/a
Opening Year with development	Woodbrook Phase 1	Pre-DART Mode Split
Opening +5 Year without development	No development	n/a
Opening +5 Year with development	Woodbrook Phase 1	Post-DART Mode Split
Opening +15 Year without development	No development	n/a
Opening +15 Year with development	Woodbrook Phase 1 and 2	Post-DART Mode Split

Table 14.12: Proposed Development Scenarios.

Phase 1 of the proposed development was considered fully in the 2020 Opening Year. It is unlikely that Phase 1 would be fully operational by the Opening Year, however this allows for a comprehensive assessment to be undertaken particularly in the context of the existing mode share being applied that is reflective of surrounding existing residential areas close to the R119 Dublin Road in vicinity of the proposed development site.

In the 2025 Opening Year +5, it is assumed that, in addition to the Phase 1 development being fully operational, the proposed DART Train Station and temporary park and ride will also be fully operational. This assumption is based on the NTA DART station program which anticipates the planning application for the station being lodged in Q1 2020 (see NTA letter Appended to TTA) and therefore the station can reasonably be assumed to be operational by 2025.

In the 2035 Opening Year +15, the entire Woodbrook development lands are considered. In this scenario it assumed that the temporary park and ride will be replaced by the NTA planned strategic park and ride which will be located on another site. The temporary park and ride will be replaced on the Woodbrook site by an assumed quantum of residential units.

Based on the derived traffic distribution, traffic turning movement diagrams of all scenarios for all junctions are provided within Appendix 14.5 of this EIAR.

Traffic Impact on the National Road Network

The proposed development will result in additional movements on the M11 mainline carriageway. To assess the proportion of additional development traffic which is likely to use the strategic national road network relevant to the proposed development, mainline flows from May 2018 for the M11 and the were obtained from the TII Traffic Data Site.

In order to ensure a robust assessment has been undertaken, the traffic generation based on the full buildout of Woodbrook has been utilised and this has been divided by the baseline background traffic flows along the mainline M11 carriageways to determine the worst-case increase in traffic movements on the M11.

The percentage increase in traffic has been calculated as follows: -

Road	Direction	Weekday AM		Weekday PM	
		Dev Vol / Back-ground Vol	Percentage Increase	Dev Vol / Back-ground Vol	Percentage Increase
M11 Arrivals	From North	20 / 4256	0.5%	26 / 5717	0.5%
	From South	15 / 3808	0.4%	18 / 5946	0.3%
M11 Departures	To North	29 / 7314	0.4%	12 / 3689	0.4%
	To South	29 / 7907	0.4%	12 / 4080	0.3%

Table 14.13: Percentage Traffic Increase on the National Road Network

The increase in movements on the mainline carriageways in both the weekday AM and PM peak hours are minimal and as such are considered to have a negligible impact in terms of traffic safety and operation on the M11.

Percentage Traffic Impact

An initial assessment was undertaken to quantify the additional traffic from the proposed development that will be distributed onto the local road network. In order to determine what level of increase is considered acceptable, reference has been made to the TII Traffic and Transport Assessment Guidelines (May 2014). This document outlines the following thresholds:

- Traffic to and from the development exceeds 10% of the traffic flow on the adjoining road.
- Traffic to and from the development exceeds 5% of the traffic flow on the adjoining road where congestion exists, or the location is sensitive.

Where the percentage traffic increase exceeds 5%, these junctions have been considered for further detailed junction assessment. In order to identify these junctions, the traffic increase resulting from the proposed development have been calculated and are presented in the Table below.

Junction		Period	Development Traffic	Existing Traffic	Traffic Increase
ID	Description				
J1	Old Connaught Ave / Corke Abbey Ave / Dublin Road R761	AM	61	2069	2.96%
		PM	65	1939	3.34%
J2	Wilford Interchange Link Road / Dublin Road (R119 & / R761)	AM	105	1998	5.28%
		PM	98	1950	5.00%
J3	Woodbroook Downs / Dublin Road R119 / Proposed Development	AM	189	853	22.14%
		PM	171	912	18.73%
J4	Shanganagh Cemetery / Dublin Road R119	AM	83	869	9.57%
		PM	73	952	7.67%
J5	Crinken Lane / Dublin Road R119	AM	82	1000	8.16%
		PM	72	1065	6.74%
J6	Dublin Road R119 / Cherrington Rd / Quinns Rd	AM	76	1537	4.95%
		PM	67	1464	4.03%
J7	Dublin Road R119 / Corbawn Lane / Shanganagh Road R119	AM	70	1734	4..03%
		PM	60	1725	3.50%

Table 14.14: Percentage Traffic Increase on Key surrounding Junctions

The junctions wherein the increase in traffic due the development does not exceed 5% are: -

- Junction 1 – Old Connaught Ave / Corke Abbey Ave / Dublin Road R172.
- Junction 6 – Dublin Road R119 / Cherrington Rd / Quinns Rd.
- Junction 7 – Dublin Road R119 / Corbawn Lane.

The junctions wherein the increase in traffic due the development does exceed 5% are: -

- Junction 2 - Wilford Interchange Link Road / Dublin Road (R119 & / R761).
- Junction 3 - Woodbroook Downs / Dublin Road R119 / Proposed Development.
- Junction 4 - Shanganagh Cemetery / Dublin Road / R119.
- Junction 5 - Crinken Lane / Dublin Road R119.

These four junctions have been brought forward to detailed assessment.

Confirmation of Junctions for Detailed Analysis

Notwithstanding Bus Connects, all junctions were assessed in their current form except for Junction 2, the Wilford Junction and Junction 3, the proposed development access junction.

- Junction 2 – Wilford Junction: The Wilford Junction was modelled in its current form as a Roundabout Junction for the Opening Year Scenario only. This junction will be subject to an upgrade as a Traffic Signal Junction as part of LIHAF funding associated with the proposed development prior to BusConnects. As such this junction, as per the DLRCC design, is modelled as a Traffic Signal Junction during the Opening +5 Year and Opening +15 Year Scenarios.
- Junction 3 – Proposed Development Access Junction: The development access junction is proposed to be a Traffic Signal Junction. There are two forms of this prosed junction. One that does not incorporate bus lanes as proposed by Bus Connects and one that does incorporate bus lanes as proposed by Bus Connects. As there is no definite timeframe for Bus Connects, it is assumed that the with bus lane design would not become operational within the next ten years. As such, the without bus lane Traffic Signal junction was modelled during the Opening Year and Opening +5 Year Scenarios whilst the with bus lane design was modelled during the Opening +15 Year Scenario.
- All remaining junctions have been modelled on their existing layouts.

Junction Assessment Terminology

All junctions assessed on the local road network are either traffic signal, roundabout, or priority-controlled junctions. All roundabout and priority-controlled junctions have been assessed using TRL JUNCTIONS software programme. Specifically, roundabouts have been assessed using the ARCADY module and priority-controlled junctions have been assessed using the PICADY module of this programme. As both modules are developed by TRL within the same programme, the terminology for results of roundabout and priority junction analysis are the same.

Traffic signal junctions have been assessed using JCTs LINSIG software programme during the Opening Year and Opening +5 Year. PTVs software programme VISSIM, which is a micro simulation tool, has been utilised to model and assess the Opening +15 Year for the proposed development access junction. The requirement to utilise VISSIM during the Opening Year +15 is to allow for the accurate modelling of the Vehicle Actuation system necessary for the bus priority elements of the proposed junction layout.

The terminology for results associated with traffic signal junction differs between the software programme being used. The following terminology and descriptions should therefore be referenced when interpreting the assessment results: -

Priority / Roundabout Junctions – JUNCTIONS 9

- RFC: This is the ratio of demand flow to capacity. The practical capacity threshold is normally 0.85. An RFC below 0.85 represents a junction which is operating in an efficient and stable condition. An RFC of between 0.85 and 1 represents variable operation, and may be said to be operating adequately, if the queueing and delay are deemed acceptable. RFC values in excess of 1 represent an oversaturated condition.
- Max Queue Length: This represents the maximum queue length of vehicles waiting to enter the junction on each arm.
- Average Delay: This shows the average amount of traffic delay at the junction per vehicle over the peak hour period.
- PCU: Passenger Car Unit. 1 car / LGV equals 1 PCU, 1 Medium HGV equals 1.5 PCU, 1 Bus equals 2.0 PCU, 1 Large HGV equals 2.3 PCU. 1 PCU equals 5.75m.

Traffic Signal Junctions - LINSIG

- DOS: This is the ratio of demand flow to capacity on a link. The saturation level is normally 90%. A degree of saturation below 90% represents a junction that is operating in an efficient and stable condition. If a link has a degree of saturation of between 90% and 100% it may still be operating to an adequate standard depending on the acceptability of queuing and delay. A degree of saturation of above 100% is considered to be overcapacity.
- Mean Maximum Queue: The sum of the maximum queue on a link (including uniform, random and oversaturation queues) averaged over all the cycles in the modelled time period.
- Average Delay: The average delay for each passenger car unit (pcu) on the lane averaged over the modelled time period.

Traffic Signal Junctions - VISSIM

- Average Queue Length: This represents the average queue length of vehicles waiting to enter the junction on each arm. Queue counting begins when a vehicle's speed drops below 5 km/h and ends when that vehicle's speed exceeds 10 km/h. It is measured in passenger car units (pcus) where 1 pcu = 5.75m.
- Mean Maximum Queue: The sum of the maximum queue on a link (including uniform, random and oversaturation queues) averaged over all the cycles in the modelled time period.
- Average Delay: This shows the delay experienced, on average, by each vehicle during the examined time period. Note that some vehicles will experience more delay, and some will experience less. It is measured in seconds.

14.5.1 Proposed Development

14.5.1.1 Construction Stage

The likely traffic impact of the construction works will be short-term in nature. The number of staff on site will fluctuate over the construction phase of the subject development. Based on previous experience of similar developments, it is envisaged that on average there would be in the order of 60-70 staff on site on a typical day. It should be noted that construction workers will typically make use of shared transport thereby reducing traffic generation. Consequently, it is expected that the typical two-way vehicle traffic generation during the construction phase would be of a low level, of the order of 30- 50 arrival during the AM and the same departure trips during the PM periods over the construction period of the works.

However given the scale of the proposed development, during the peak of construction the level of staff on site could ramp up to approximately 250 - 350 staff. As such this peak level of construction activity could equate to approximately 150 – 210 arrival trip during the AM and the same during the PM. In terms of arrivals and departure times, on-site employees will typically arrive before 08:00 and will generally depart shortly after 16:00. These arrival and departure times are offset and outside of the commuter AM and PM peak hours, therefore further reducing the impact of the construction phase. Note, that the total operational stage vehicle trips during the AM and PM are in the order of 220-250 with these occurring during the peak commuter hours.

Consequently, given the shared use of transport and the offset arrival and departure times inherent with construction worker travel characteristics, the level of traffic impact on the adjacent local road network during the construction stage, even during the peak construction phase, will be significantly less than during the operational stage.

The main construction accesses to and from the proposed Golf Course Holes Site will be preferably via the R119 and the Shanganagh Cemetery access road, alternative access proposals are via the R119 and Quinn's Road (for light vehicles) and the R119 and Corbaun Lane / Corbaun Drive (for heavy vehicles).

All access routes along with further information are detailed in the Design Process Traffic Management Plan.

The construction assess routes will be agreed with DLRCC prior to the generation and submission of the Construction Stage Traffic Management Plan.

At construction stage the traffic volumes will be, at their peak, notably less than the traffic volumes predicted for the completed development. In this context the existing junctions and the proposed development junctions will have adequate capacity to accommodate the relatively modest traffic volumes anticipated during the construction stage.

Therefore, the potential impact during the construction phase is considered to have a short-term slight impact on the surrounding network. The implementation of the CTMP and active management of traffic generated by construction worker and deliveries will reduce these potential impacts to have imperceptible impact on the adjacent local and strategic road network.

14.5.1.2 Operational Stage

It should be noted that both the 'Do-Nothing' and the 'Do -Something' scenarios are assessed within this section as the 'Without development' and 'With Development' scenarios for the Opening Year and Opening Year +5 assessment years.

Opening Year Assessment

Detailed results of the Opening Year Assessment for all junctions is provided within Appendix 14.6 of this EIAR. Summary results are outlined below.

Junction 2

Scenario	Arm / Stream	AM			PM		
		Max Queue (PCU)	Average Delay (S)	RFC	Max Queue (PCU)	Average Delay (S)	RFC
Without Development	A	0.5	3.58	0.33	0.8	4.22	0.45
	B	2.4	7.28	0.70	1.1	4.71	0.52
	C	0.5	3.68	0.34	0.3	3.02	0.26
	A	0.6	3.90	0.38	0.9	4.52	0.47

With Development	B	2.7	8.03	0.73	1.3	5.05	0.56
	C	0.5	3.75	0.34	0.4	3.23	0.27

Table 14.15: 2020 Opening Year Assessment – Junction 2.

In the Opening Year Scenario the Wilford Junction has been modelled as per its current layout as a Roundabout Junction.

The Without Development Scenario operates well within capacity during both the AM and PM peak hour. The AM peak hour is the more critical of the two peak periods, where an RFC of 0.70 is experienced. This is below the 0.85 design threshold. In addition, queuing and delay results are all of an acceptable and stable level.

During the With Development Scenario the critical RFC during the Am peak hour is increased to 0.73. This is a minimal increase and the associated queueing and delays experienced are also of minimal increase and are of an acceptable and stable level.

The above reported impact represents a long term not significant negative effect.

Junction 3

Scenario	Arm / Lane	AM			PM		
		Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)	Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)
With Development	A (1/1+1/2)	31.6	58.6%	11.3	41.1	82.6%	19.9
	D (2/1+2/2)	62.6	55.1%	2.9	62.4	31%	1.3
	B (3/1+3/2)	20.9	44.8%	8.6	22	50%	5.7
	C (7/1)	63.7	5.1%	0.2	62.8	3.2%	0.1

Table 14.16: 2020 Opening Year Assessment – Junction 3.

The Opening Year Scenario proposed development access junction was modelled as a Traffic Signal Junction without the Bus Connects bus lanes.

During the AM and PM with Development Scenario all arms of this junction are operating within capacity with a maximum DOS of 82.6% occurring on the Dublin Road southbound arm during the PM peak hour. The resultant queueing and delay experienced are all of an acceptable level.

Junction 4

Scenario	Arm / Stream	AM			PM		
		Max Queue (PCU)	Average Delay (S)	RFC	Max Queue (PCU)	Average Delay (S)	RFC
Without Development	Stream B-C	0.0	6.64	0.01	0.0	7.49	0.02
	Stream B-A	0.0	10.67	0.01	0.0	11.90	0.04
	Stream A-BC	0.0	6.34	0.03	0.0	6.90	0.02
With Development	Stream B-C	0.0	6.71	0.01	0.0	7.66	0.03
	Stream B-A	0.0	11.19	0.01	0.0	12.75	0.04
	Stream A-BC	0.0	6.42	0.04	0.0	7.12	0.03

Table 14.17: 2020 Opening Year Assessment - Junction 4

The Shanganagh Cemetery / Park junction is a Priority Controlled Junction. The majority of proposed development traffic will pass straight though the junction as the Shanganagh Cemetery / Park arm is a no through road and thus does not attract significant levels of traffic.

In all scenarios this junction is operating well below capacity with minimal queueing and delay experienced.

The above reported impact represents a long term not significant negative effect.

Junction 5

Scenario	Arm / Stream	AM			PM		
		Max Queue (PCU)	Average Delay (S)	RFC	Max Queue (PCU)	Average Delay (S)	RFC
Without Development	Stream A-B	0.2	7.86	0.15	0.1	6.86	0.12
	Stream A-C	0.2	15.07	0.18	0.1	14.87	0.11
	Stream C-AB	0.4	5.32	0.16	0.6	4.69	0.22
With Development	Stream A-B	0.2	8.22	0.16	0.1	7.03	0.12
	Stream A-C	0.2	16.27	0.19	0.1	15.70	0.13
	Stream C-AB	0.4	5.37	0.17	0.7	4.62	0.23

Table 14.18: 2020 Opening Year Assessment – Junction 5.

The Crinken Lane junction is a Priority Controlled Junction. The majority of proposed development traffic will pass straight though the junction as the Crinken Lane arm is only a local access road and thus does not attract significant levels of traffic.

In all scenarios this junction is operating well below capacity with minimal queueing and delay experienced.

The above reported impact represents a long term not significant negative effect.

Opening Year + 5 Assessment

Detailed results of the Opening +15 Year Assessment for all junctions is provided within Appendix 14.6 of this EIAR. A summary of the results is set out below.

Junction 2

Scenario	Arm / Stream – Lane Numbers	AM			PM		
		Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)	Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)
Without Development	A (5/1+5/2)	43.0	85.7%	7.7	36.1	76.2%	9.6
	B (3/2+3/1)	28.2	87.9%	19.6	27.7	73.3%	10.7
	C (1/1)	32.7	23.3%	2.2	27.7	4.1%	0.4
	C (1/2)	63.9	88.5%	12.8	43.0	74.1%	9.8
With Development	A (5/1+5/2)	44.3	92%	9.2	35.7	78.4%	10.5
	B (3/2+3/1)	41.5	94.4%	28.1	30.8	81.3%	11.6
	C (1/1)	34.4	27.8%	2.5	30	8.7%	0.8
	C (1/2)	78.1	92.7%	14.5	50.5	80.6%	10.7

Table 14.19: 2025 Opening Year +5 Assessment – Junction 2.

During the Opening +5 Year Scenario and beyond, the Wilford Junction has been modelled as per the DLRCC designed Traffic Signal Junction.

During the Without Development Scenario this junction operates below capacity during both the AM and PM peak hour. The AM peak hour is the more critical of the two peak periods, where a DOS of 88.5% is experienced. This is below the 90% design threshold. Notwithstanding, it is noted that the associated queuing and delay results are all of an acceptable and stable level, with a maximum delay of 63.9 s/pcu, and thus it is considered that the junction is operating to a satisfactory level.

During the With Development Scenario wherein the proposed development traffic generation is distributed onto the junction, there is a slight increase in the DOS, queueing and delay experienced at the junction. The maximum DOS experienced is 94.4, however the corresponding delay of 41.5 is acceptable. All other increases are considered minimal and it is evident that the proposed development does not have a significant impact on the junction operation itself.

It should however be noted that given this is an urban junction, with enhanced facilities for pedestrians, it is generally considered acceptable, as promoted in DMURS, for there to be an element of congestion experienced at such junctions.

The above reported impact represents a long term slight negative effect.

Junction 2 Sensitivity Analysis

Low growth rates have been applied to grow background traffic from 2018 Base Year volumes to Opening Year, Opening +5 Year and Opening +15 Year volumes.

However, given the proposals for BusConnects and the new DART Station, combined with an appropriate finite road capacity along an urban road such as the R119 Dublin Road and limited potential for future development within the area it is considered that the application of any growth rate is unnecessary. It is considered that the potential of such a 'No Growth' scenario is more realistic and is particularly relevant in the context of the new DART Station and future BusConnects provisions which will not only reduce the volume of proposed development traffic but also reduce the volume of background traffic by way of mode shift from private car to public transport and active travel modes.

Therefore a sensitivity analysis has been undertaken, wherein a 'No Growth' factor has been applied to Junction 2. The results of this analysis for the With Development Opening +5 Year Scenario of Junction 2 are outlined below.

Scenario	Arm / Stream – Lane Numbers	AM			PM		
		Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)	Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)
Without Development	A (5/1+5/2)	41.6	79.9%	7	34.4	71.4%	8.7
	B (3/2+3/1)	24.2	82%	14.9	26.4	68.6%	9.5
	C (1/1)	32.5	21.6%	2	27.7	3.9%	0.4
	C (1/2)	54	82.4%	10.9	40.5	69.4%	8.9
With Development	A (5/1+5/2)	42.7	86.8%	8.4	34.2	73.8%	9.4
	B (3/2+3/1)	29.3	88.4%	17.7	28.5	75.9%	10.2
	C (1/1)	34.1	26.1%	2.3	29.9	8.2%	0.7
	C (1/2)	61.4	86.4%	11.6	46.2	75.4%	9.5

Table 14.20: 2025 Opening Year +5 Assessment - Junction 2 Sensitivity Assessment

As can be seen, through comparison of the results associated with the With Development Scenario for both the 'Low Growth' and 'No Growth' Scenarios, the junction would operate substantively better, below capacity with a Maximum DOS of 88.4 and a maximum delay experienced of 61.2 s/pcu. particularly in relation to experienced queueing and delay.

The above reported impact represents a long term not significant negative effect.

Junction 3

Scenario	Arm / Stream	AM			PM		
		Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)	Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)
With Development	A (1/1+1/2)	32.5	64%	12.9	45.4	86.7%	22.2
	D (2/1+2/2)	67.4	60.5%	3.1	70	54.3%	2.4
	B (3/1+3/2)	22.7	49.2%	9.1	22.1	51.7%	6.0
	C (7/1)	63.7	5.1%	0.2	62.8	3.2%	0.1

Table 14.21: 2025 Opening Year +5 Assessment - Junction 3

In the Opening Year +5 Scenario the proposed development access junction was modelled as a Traffic Signal Junction without the BusConnects bus lanes.

During the AM and PM with Development Scenario all arms of this junction are operating within capacity with a maximum DOS of 86.7% occurring on the Dublin Road southbound arm during the PM peak hour. The resultant queueing and delay experienced are all of an acceptable level.

Junction 4

Scenario	Arm / Stream	AM			PM		
		Max Queue (PCU)	Average Delay (S)	RFC	Max Queue (PCU)	Average Delay (S)	RFC
Without Development	Stream B-C	0.0	6.73	0.01	0.0	7.65	0.03
	Stream B-A	0.0	11.01	0.01	0.0	12.43	0.04
	Stream A-BC	0.0	6.43	0.04	0.0	7.05	0.03
With Development	Stream B-C	0.0	6.88	0.01	0.0	7.90	0.03
	Stream B-A	0.0	11.83	0.01	0.0	13.37	0.05
	Stream A-BC	0.0	6.61	0.04	0.0	7.29	0.03

Table 14.22: 2025 Opening Year +5 Assessment - Junction 4

In all scenarios this junction is operating well below capacity with minimal queueing and delay experienced.

The above reported impact represents a long term not significant negative effect.

Junction 5

Scenario	Arm / Stream	AM			PM		
		Max Queue (PCU)	Average Delay (S)	RFC	Max Queue (PCU)	Average Delay (S)	RFC
Without Development	Stream A-B	0.2	8.09	0.16	0.1	7.02	0.12
	Stream A-C	0.2	15.93	0.19	0.1	15.66	0.12
	Stream C-AB	0.4	5.34	0.18	0.7	4.73	0.24
With Development	Stream A-B	0.2	8.57	0.17	0.1	7.26	0.13
	Stream A-C	0.3	17.73	0.22	0.2	16.85	0.14
	Stream C-AB	0.5	5.31	0.19	0.8	4.70	0.26

Table 14.23: 2025 Opening Year +5 Assessment - Junction 5

In all scenarios this junction is operating well below capacity with minimal queueing and delay experienced.

The above reported impact represents a long term not significant negative effect.

14.5.1.3 Do-Nothing Impact

See Section 14.5.1.2.

14.5.2 Cumulative – Woodbrook

14.5.2.1 Construction Stage

See Section 14.5.1.1.

14.5.2.2 Operational Stage

It should be noted that both the 'Do-Nothing' and the 'Do -Something' scenarios are assessed within this section as the 'Without development' and 'With Development' scenarios for the Opening Year +15 assessment year.

Opening Year + 15 Assessment

Detailed results of the Opening +15 Year Assessment for all junctions is provided within Appendix 14.6 of this EIAR. A summary of the results is set out below.

Junction 2

Scenario	Arm / Stream – Lane Numbers	AM			PM		
		Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)	Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)
Without Development	A (5/1+5/2)	43.9	90.3%	8.3	37.9	79.9%	10.5
	B (3/2+3/1)	35.5	92.3%	26.1	29.3	78.0%	12.1
	C (1/1)	32.8	24.9%	2.3	27.7	4.3%	0.4
	C (1/2)	79.6	93.7%	15.6	45.6	77.9%	10.7
With Development	A (5/1+5/2)	78.7	103.0%	16.2	40.4	84.9%	12.0
	B (3/2+3/1)	105.2	102.6%	65.0	35.0	87.8%	14.6
	C (1/1)	34.9	31.0%	2.8	30.1	10.7%	1.0
	C (1/2)	107.0	98.1%	18.7	55.4	84.7%	11.8

Table 14.24: 2035 Opening Year +15 Assessment - Junction 2

During the Without Development Scenario this junction operates above capacity during both the AM and PM peak hour. The AM peak hour is the more critical of the two peak periods, where a DOS of 93.7% is experienced. This is somewhat above the 90% design threshold. Notwithstanding, it is noted that the associated queuing and delay results are all of an acceptable and stable level, maximum delay of 79.6 s/pcu, and thus it is considered that the junction is operating to a satisfactory level.

During the With Development Scenario wherein the proposed development traffic generation is distributed onto the junction, there is a modelled notable increase in the DOS, queueing and delay experienced at the junction.

It should however be noted that given this is an urban junction, with enhanced facilities for pedestrians, it is generally considered acceptable, as promoted in DMURS, for there to be an element of congestion experienced at such junctions.

The above reported impact represents a long term moderate negative effect.

Junction 2 – Sensitivity Analysis

As in the Opening Year + 5 scenario a 'No Growth Rate' sensitivity analysis was carried out for Junction 2.

Scenario	Arm / Stream	AM			PM		
		Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)	Delay (S/PCU)	Deg Sat	Mean Max Queue (PCU)
Without Development	A (5/1+5/2)	41.6	79.9%	7.0	34.4	71.4%	8.7
	B (3/2+3/1)	24.2	82.0%	14.9	26.4	68.6%	9.5
	C (1/1)	32.5	21.6%	2.0	27.7	3.9%	0.4
	C (1/2)	54.0	82.4%	10.9	40.5	69.4%	8.9
With Development	A (5/1+5/2)	42.9	88.0%	9.1	35.4	76.4%	9.6
	B (3/2+3/1)	34.5	91.4%	21.2	29.7	78.3%	10.5
	C (1/1)	35.5	28.7%	2.5	30.1	10.0%	0.9
	C (1/2)	73.5	90.7%	12.9	46.2	75.4%	9.5

Table 14.25: 2035 Opening Year +15 Assessment - Junction 2 Sensitivity Analysis

As can be seen, through comparison of the results associated with the With Development Scenario for both the 'Low Growth' and 'No Growth' Scenarios, the junction would operate substantively better, particularly in relation to experienced queueing and delay, when considering a 'No Growth' scenario. Maximum DOS experienced is just at capacity at 90.7% whilst the corresponding delay is significantly reduced to 73.5 s/pcu.

It is considered, based on the sensitivity analysis, that the junction operation during the Opening +15 Year scenario is acceptable for a typical urban junction.

The above reported impact represents a long term slight negative effect.

Junction 3

It is assumed that the proposed development access junction will be upgraded to incorporate bus lanes as proposed under the BusConnects Bus Corridor Upgrade project. The bus facilities proposed at this junction will incorporate bus priority traffic signals so as to ensure that no delay will be experienced by buses. In order to model this accurately it was considered appropriate to develop a VISSIM microsimulation model. The following outlines the construction methodology of the VISSIM model incorporating bus priority.

VISSIM Construction Methodology

The proposed layout was coded in VISSIM based on the proposed design incorporating the BusConnects measures as discussed in Chapter 3. This included all geometry, reduced speed areas, lane restrictions, vehicle routes, traffic signals, conflict areas etc. The traffic signals were coded using VisVAP, an add-on to VISSIM which allows for simulation of vehicle actuation. Vehicle detection loops were included at the stop lines for general traffic and at stop lines and on the approach to the junction for bus lanes. Control logic was programmed to only stages when demanded by the presence of a vehicle on a loop. In addition, the control logic includes for ending the currently running stage if there is a gap of more than 3 seconds in vehicle detections for that stage. This more accurately reflects the operation of a vehicle actuated system on the ground, where stages are only called as required.

The maximum allowable length of each stage varies depending on what other stages have been called in the current cycle, with the length reducing as additional stages are called. Once the maximum green time for a stage is reached, that stage is ended on the interstage regardless of demand. In this way, the average cycle time is kept at or below 120 seconds. At the end of each cycle, the maximum allowable green times are reset and are determined by the demands in the current cycle only.

Buses were programmed to run every 4 minutes in both directions as per the proposed Bus Connects frequency for the corridor. This results in a bus travelling in one direction or the other every two minutes with some small variation between arrival times included. The inductive loop set back from the junction in the bus lanes detects a bus approaching, ends the current stage regardless of what stage it is and calls the bus only stage, giving the approaching bus its own green signal (all other signals are red in this stage).

The exception to this is when the bus approaches during the pedestrian only stage where the bus will have to wait for that stage to end before switching to its own stage. In practice this generally means that the bus only green signal is on as the bus reaches the stop line, thus effectively eliminating delays for the bus. This bus only stage has a green time of 7 seconds, after which the controller will switch back to the stage that was running prior to the bus interrupt call if the total green time for that stage in the cycle is still less than the maximum allowable (otherwise it will switch to the following stage). A pedestrian only stage is included in 2 of every 3 cycles to simulate anticipated pedestrian demand. Every third cycle, additional green time arising from the lack of a pedestrian only stage is distributed to the vehicle stages.

Vehicle inputs were taken from the proposed traffic volumes at the junction in the +15 year scenario with development in place. This were routed through the junction in accordance with the calculated turning movements for this scenario. The model was run 5 times with varying random seeds to simulate daily variations in traffic patterns and the results collected. The use of VisVAP and the controller logic proposed more accurately models the real-world ability of junction controllers to adapt to changing traffic conditions while also being able to model the bus priority stage in a more realistic way.

The results of the modelling exercise are presented below.

Movement	Average Queue (pcu)	Mean Max Queue (pcu)	Average Delay: General Traffic (ss)	Average Delay Bus (s)	Average Queue (pcu)	Mean Max Queue (pcu)	Average Delay: General Traffic (ss)	Average Delay Bus (s)
	AM				PM			
Arm A – Dublin Road Southbound								
Straight/Left	5.15	14.26	30.53	12.78	11.22	25.18	32.12	12.43
Right	0.00	0.00	0.00	N/A	0.02	0.23	52.35	N/A
Arm B – Dublin Road Northbound								
Straight/Left	2.19	8.45	15.68	12.54	1.29	5.56	13.13	13.34
Right	1.22	3.14	52.19	N/A	1.23	3.22	49.97	N/A
Arm C – Woodbrook Downs								
All Movements	0.13	0.32	58.51	N/A	0.09	0.25	69.45	N/A
Arm D – Proposed Development								
Straight/Left	1.97	4.74	54.33	N/A	0.83	2.27	51.93	N/A
Right	1.57	4.08	54.70	N/A	0.38	1.24	49.08	N/A
Overall Junction								
All Movements	1.42	5.00	30.94	12.66	1.81	5.42	29.84	12.88

Table 14.26: 2035 Opening Year +15 Assessment - Junction 3

As can be seen from the above results, delay has been minimised on both the straight through general traffic lanes and the bus lanes as associated with the northbound and southbound arms of the Dublin Road. In particular, bus delay is minimised with bus priority ensuring average bus delays are of the order of only 13 seconds which is acceptable.

In terms of traffic arriving to the junction along Dublin Road, the right turn lanes on the Dublin Road into the proposed development access arm and the Woodbrook Downs arms incur the longest delays but of an order that would not warrant vehicles to wait through more than one cycle. In addition, queuing associated with these right turns would be contained within the lengths of the right turn lanes and therefore would have no impact on the adjoining straight through lanes.

The proposed development access arm will endure delay of an order that would not warrant vehicles to wait through more than one cycle and performance of this arm is therefore acceptable, with short queue lengths.

In overall terms that the proposed development access junction during the Opening +15 year scenario operates within capacity and to a satisfactory level.

Junction 4

Scenario	Arm / Stream	AM			PM		
		Max Queue (PCU)	Average Delay (S)	RFC	Max Queue (PCU)	Average Delay (S)	RFC
Without Development	Stream B-C	0.0	6.83	0.01	0.0	7.83	0.03
	Stream B-A	0.0	11.46	0.01	0.0	13.03	0.05
	Stream A-BC	0.0	6.55	0.04	0.0	7.21	0.03
With Development	Stream B-C	0.0	6.92	0.01	0.0	8.15	0.03
	Stream B-A	0.0	13.09	0.02	0.1	14.58	0.05
	Stream A-BC	0.1	6.8	0.04	0.0	7.56	0.03

Table 14.27: 2035 Opening Year +15 Assessment - Junction 4

In all scenarios this junction is operating well below capacity with minimal queueing and delay experienced.

The above reported impact represents a long term slight negative effect.

Junction 5

Scenario	Arm / Stream	AM			PM		
		Max Queue (PCU)	Average Delay (S)	RFC	Max Queue (PCU)	Average Delay (S)	RFC
Without Development	Stream A-B	0.2	8.37	0.17	0.1	7.17	0.13
	Stream A-C	0.3	17.01	0.21	0.2	16.58	0.13
	Stream C-AB	0.5	5.36	0.19	0.8	4.77	0.27
With Development	Stream A-B	0.2	9.16	0.18	0.2	7.49	0.13
	Stream A-C	0.3	20.28	0.26	0.2	18.41	0.16
	Stream C-AB	0.6	5.36	0.22	1.0	4.75	0.29

Table 14.28: 2035 Opening Year +15 Assessment - Junction 5

In all scenarios this junction is operating well below capacity with minimal queueing and delay experienced.

The above reported impact represents a long term slight negative effect.

14.5.2.3 Do-Nothing Impact

See Section 14.5.1.2.

14.5.2.4 Cumulative Impact – Shanganagh

A cumulative impact assessment has been undertaken of the proposed development access junction, incorporating the potential Bus Connect upgrades, in the Opening Year +15 Scenario.

Plans currently being progressed by DLRCC associated with the future Shanganagh Castle development are not fully developed at the time of writing this Chapter. However, the potential level of development has been confirmed by DLRCC as being in the order of approximately 630 no. residential units.

The scenario being considered consists of the cumulative traffic impact of Shanganagh Castle in combination with the full development of Woodbrook assessed during the 2035 Opening +15 Year during the AM and PM peak hours.

The traffic generation volumes estimated for the future Shanganagh Castle development was determined based on multi-modal trip generation rates, mode shares, vehicle trip rates, trip distribution and assignments as previously detailed in Section 14.4.1.2. The resultant traffic generation is as follows: -

Type	Period	No. Units	No. Beds	Arrivals	Departures	Two way
Houses / Duplexes	AM	148 Dwelling	342	9	33	42
	PM			28	14	42
Apartments	AM	482 Dwellings	820	14	66	81
	PM			48	19	67
Total Shanganagh Castle			AM	23	99	122
			PM	76	33	109
Total Woodbrook Development			AM	290	361	651
			PM	279	205	484
Total LAP Cumulative Development			AM	313	460	773
			PM	355	238	593

Table 14.29: 4 LAP Cumulative Development Traffic Generation

As per the Opening +15 year Scenario, Junction 3 was modelled with the VISSIM software programme during the Cumulative Opening +15 year scenario.

The results of the modelling exercise are presented below.

Junction 3

Movement	Average Queue (pcu)	Mean Max Queue (pcu)	Average Delay: General Traffic (ss)	Average Delay Bus (s)	Average Queue (pcu)	Mean Max Queue (pcu)	Average Delay: General Traffic (ss)	Average Delay Bus (s)
	AM				PM			
Arm A – Dublin Road Southbound								
Straight/Left	5.62	15.11	30.00	12.18	11.63	25.83	32.36	13.71
Right	0.00	0.00	0.00	N/A	0.06	0.42	51.28	N/A
Arm B – Dublin Road Northbound								
Straight/Left	2.33	9.10	16.32	16.39	1.40	6.22	13.26	11.90
Right	1.31	3.33	55.71	N/A	1.22	3.29	49.73	N/A
Arm C – Woodbrook Downs								
All Movements	0.10	0.32	57.40	N/A	0.07	0.25	59.39	N/A
Arm D – Proposed Development								
Straight/Left	1.97	4.94	55.69	N/A	0.81	2.26	50.48	N/A
Right	1.61	3.89	57.40	N/A	0.40	1.17	52.16	N/A
Overall Junction								
All Movements	1.47	5.24	31.46	14.29	2.06	5.63	29.65	12.80

Table 14.30: Cumulative Assessment - Junction 3

As can be seen from the above results, delay has again been minimised on both the straight through general traffic lanes and the bus lanes as associated with the northbound and southbound arms of the Dublin Road. Bus delay is minimised with bus priority ensuring average bus delays are of the order of only 13 seconds which is acceptable

The right turn lanes on the Dublin Road into the proposed development access arm and the Woodbrook Downes arms do endure some delay not of an order that would warrant vehicles to wait through more than one cycle. In addition, queuing associated with these right turns is contained in the length of the right turn lanes and would have no impact on the adjoining straight through lanes.

The proposed development access arm will also endure some delay but not be of an order that would warrant vehicles to wait through more than one cycle. The arm operates within capacity within short queue lengths

In overall terms it is considered that the proposed development access junction during the Cumulative Opening +15 year scenario operates to a satisfactory level.

The above reported impact represents a long term slight negative effect.

14.6 Ameliorative, Remedial or Reductive Measures

14.6.1 Proposed Development

14.6.1.1 Construction Stage

The following mitigation measure shall apply: -

- All construction activities will be managed and directed by a Construction Traffic Management Plan (CTMP). The details of the CTMP will be agreed with the roads department of the Local Authority in advance of construction activities commencing on-site.

14.6.1.2 Operational Stage

The proposed development is consistent with all national, regional and local policies. In particular those policies and objectives aligned with active and sustainable travel and transportation. Specific mitigation measures proposed include the following: -

- Woodbrook DART Station is located on the eastern site boundary. The adjacent park and ride car park contains bus stop facilities to facilitate bus to rail interchange.
- The entire site is within 800m walking distance of the DART Station and Dublin Road bus corridor.
- The proposed development specifically facilitates the development of Woodbrook DART Station through the provision of Woodbrook Avenue, the main access route, together with the temporary park and ride car park.
- The site facilitates the upgrade of the Dublin Road bus corridor per the NTA plans for Bus Connects Core Bus Route 13.
- The development is adjacent and accessible to Routes 12A and 14 /N5 Greater Dublin Area Cycle Network Plan
- The development incorporates extensive pedestrian and cycle routes that link the site to the Dublin Road on the western boundary, Shanganagh Park on the northern boundary, Woodbrook DART Station on the eastern boundary and facilitation for future connections across the southern site boundary.
- The site is planned in the context of a Mobility Management Plan based on the physical infrastructure provisions of walking and cycling links and access to public transport bus and DART rail services.
- Demand Management is also underpinned by the co-location of residential, education, local retail and leisure and amenity facilities.
- The propensity for car ownership and car use is managed through measures that include reduced residential parking provision and increased cycle parking provision in line the 'Design Standards for New Apartments'. The provision of car club parking spaces will facilitate a lower level of car ownership.
- The development contains the required infrastructure to provide electric charging to all car parking spaces.

14.6.2 Cumulative – Woodbrook

14.6.2.1 Construction Stage

See Section 14.6.1.1.

14.6.2.2 Operational Stage

See Section 14.6.1.2.

14.7 Residual Impact of the Proposed Development

14.7.1 Proposed Development

14.7.1.1 Construction Stage

There will be a slight negative impact due to construction traffic. However, this impart will be short term. This will be mitigated by the introduction of a construction traffic management plan.

14.7.1.2 Operational Stage

During the Pre-DART operation of the proposed development (Opening Year) there will be a long term, slight to moderate negative impact due to increased traffic flows. This will be mitigated by travel planning measures.

During the Post-DART operation of the proposed development (Opening Year + 5) there will be a long term, moderate to significant positive impact due to improved access to buses due to Bus Connects and the Woodbrook DART Station which will offer an increased level of service in terms of higher frequency and capacity. This will positively impact the proposed development and reduce the dependency on car travel.

Additionally, during operation there will be an increase in pedestrian and cyclist movements, due to BusConnects, this will have a long term, slight to moderate positive impact. This will positively impact the proposed development and reduce the dependency on car travel.

14.7.1.3 Worst Case Impact

The worst-case scenario is that the proposed development, i.e. 'Woodbrook Phase 1', is built and occupied prior to the opening of the DART station.

This worst-case scenario has been modelled in the Opening Year Assessment (Section 14.5.1.2 Operational Stage of this Chapter) period and it is demonstrated that there is sufficient capacity within the local road network to cater for the additional traffic generated as a result of this worst-case scenario.

14.7.2 Cumulative – Woodbrook

14.7.2.1 Construction Stage

See Section 14.7.1.1.

14.7.2.2 Operational Stage

See Section 14.7.1.2.

14.7.2.3 Worst Case Impact

See Section 14.7.1.3.

14.8 Monitoring

Not applicable for this Chapter.

14.9 Reinstatement

Not applicable for this Chapter.

14.10 Difficulties Encountered

There were no difficulties encountered in undertaking the assessment discussed within this Traffic Chapter.