Design Development Summary Report

Project: N28 Shannonpark Roundabout and Raffeen Junction Upgrades

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1. Introduction

This Report is to detail the development of the N28 Shannonpark Roundabout and Raffeen Junction Upgrade project during its planning, design and construction stages. The design changes during the various phases are also discussed in order to provide clarification as to why they occurred.

The objective for the upgrade to the Shannonpark Roundabout is to reduce traffic congestion and to increase the capacity of the junction in order to better service the national road network and associated commercial and residential developments in the short to medium term in advance of the M28 Cork to Ringaskiddy Project.

The objective for the Raffeen Junction upgrade is to improve safety at the junction by installing minor traffic calming works and facilities for pedestrians and cyclists, while maintaining flow on the national road network.

The two schemes are being constructed concurrently to get better value for money and best manage the site supervision and overall traffic.

To achieve these objectives, the project has undergone multiple iterations of preliminary design to obtain planning which was then followed by the subsequent optimisation of the design during the detailed assessments for construction. The following sections provide further information on the design development.

2. Overview

The N28 road is a national primary road, which forms part of the national road network that connects Cork City to Ringaskiddy Village. The N28 is part of the Trans-European Transport Network (TEN-T) that has been identified as a critical part of the road network supporting the core maritime Port of Cork in Ringaskiddy. In addition of the importance of providing a high quality corridor to the port, the N28 carries heavy volumes of traffic during peak hours due to the large residential community in Carrigaline and the major employment and industrial centres in Ringaskiddy.

The Shannonpark Roundabout is a junction on the N28 which also serves Carrigaline via the R611 regional road. See Figure 1 for an overview of the location of the Shannonpark Roundabout.

Figure 1: Location of the Shannonpark Roundabout

The Raffeen Junction is the junction of the N28 and the R610 regional road, approximately 1.4km east of the Shannonpark Roundabout in the townland of Raffeen. The R610 provides a link to Monkstown, Passage West and acts as an alternative route to Rochestown. See Figure 2 for an overview of the location of the Raffeen Junction.

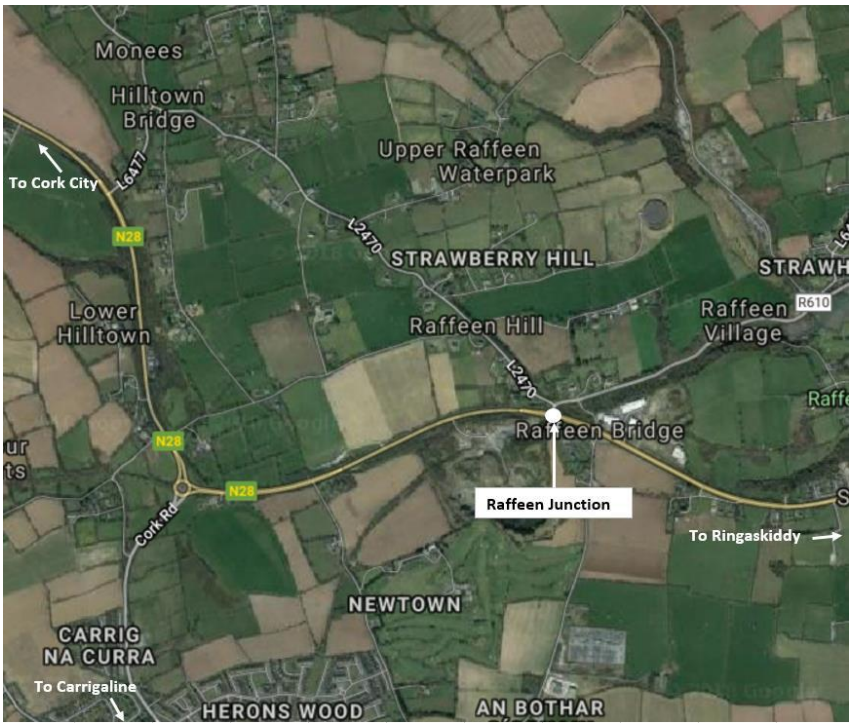

Figure 2: Location of the Raffeen Junction

3. Need for the Scheme

3.1. Shannonpark Roundabout

The roundabout at Shannonpark is a key junction on the N28 national primary route that links the R611 and the town of Carrigaline, with the N28 and subsequently the N40 South Ring Road/Cork City. It is also the gateway for the Strategic Employment Area of Ringaskiddy. This junction experiences severe delays at morning and evening peak periods as its capacity is exceeded.

The M28 Cork to Ringaskiddy Project is currently undergoing a judicial review in the High Court. This project is the medium-long term plan to upgrade the N28 and junctions on this route. This project will incorporate the Shannonpark Roundabout as part of the proposed interchange at this location. Any works associated with the upgrade of the Shannonpark Roundabout will be maintained in the long term also.

The upgrade of the roundabout is a short term measure to address the capacity issue at the junction. With increased capacity, the surrounding area can continue to grow either to meet the current demand for housing or the expansion of existing industrial developments. This in turn supports continued economic development for the region.

3.2. Raffeen Junction

The need for the works arises from regular assessments undertaken by Transport Infrastructure Irelands's (TII) Safety Section under GE-STY-01022 (formally HD/15) Network Safety Ranking standard. This ranking has highlighted the Raffeen Junction as a high accident location. The location is highlighted when it has a collision rate twice that of the average collision rate for the reference population and three or more collisions within the previous three years. Raffeen Junction has 8 reported accidents in the years 2015, 2016 & 2017 and a further 8 going back to 2012. Collisions occurred at or in the vicinity of the junction of the R610 with the N28, i.e. Raffeen Junction.

The existing layout at the junction contains an eastbound deceleration lane, an eastbound acceleration lane, a right turn lane for westbound traffic wishing to access the R610 and two through lanes, 1 eastbound and 1 westbound. While the junction contains public lighting, it is not to current public lighting standards.

When the collision types were examined, a large number of accidents occurred while doing a right turn manoeuvre from the R610 to the N28. A review of the junction on the ground indicates that with the deceleration lane present, through traffic does not have to slow down for a left turning vehicle and there is no opportunity to make a right turn out of the junction when this movement occurs. Also, given the existing width and radii of the junction drivers are not forced to reduce speed to undertake turning manoeuvres.

The existing infrastructure for pedestrians consists of a footpath on either side of the junction which extends east along the northern side of the N28. The wide carriageway width at the junction does not allow for pedestrian facilities along the southern side of the N28, with no hard shoulder or accessible verge. Cyclists are forced to remain in active carriageway lanes through the junction, with no protected crossings available.

4. Planning Permission

In accordance with the Planning and Development Regulations 2001 as amended by subsequent legislation, a Part 8 Planning Procedure is required for certain classes of development by, on behalf, or in partnership with local authorities. Part 8 procedure applies to the construction of a new road,

or the widening or realignment of an existing road where the length of the new road or of the widened or realigned portion of the existing road is 100 metres or more in an urban situation or 1000 metres in a rural location and also to any development other than those specified in paragraphs (a) to (j) where the estimated cost exceeds €126,000.00 (Part 8 – Section 80 (1)(k)). It was envisaged that all iterations of the schemes would have exceeded these limits and therefore required a Part 8 Planning Procedure.

The following sections summarises the iterations of planning applications for the Shannonpark Roundabout and the Raffeen Junction.

4.1. Part 8 Planning – Signalisation of Shannonpark Roundabout & Proposed Signalised T Junction at Shanbally

Following assessment by engineering consultants, a proposal to signalise the junctions at Shannonpark and Shanbally was advised as the best way to address the capacity issues experienced by users on a daily basis. In November 2013, Cork County Council applied for Part 8 Planning for the signalisation of the Shannonpark Roundabout and the replacement of the Shanbally Roundabout with a signalised T junction. The signalisation of both junctions would decrease traffic congestion and increase the vehicular capacity on the N28 and improve facilities for pedestrians and cyclists.

The proposed works included:

- New traffic signal heads and controllers;
- New road signs and road markings;
- New Slip Road to facilitate Cork to Ringaskiddy traffic at Shannonpark;
- New pedestrian crossings, cycling facilities; and
- Other necessary associated works.

Following a review of the submissions received, the Manager's Report recommended the signalisation of Shannonpark but reverted to the existing layout at Shanbally. The Part 8 Planning was not progressed beyond the Area Roads meeting.

4.2. Signalised Junction at Shannonpark Roundabout

In February 2015, further discussions were undertaken for the signalisation of the Shannonpark Roundabout. The signalisation of the junction would decrease traffic congestion and increase the vehicular capacity on the N28 and improve facilities for pedestrians and cyclists.

The proposed works included:

- New traffic signal heads and controllers;
- New road signs and road markings;
- New Slip Road to facilitate Cork to Ringaskiddy traffic at Shannonpark;
- New pedestrian crossings, cycling facilities; and
- Other necessary associated works.

The Part 8 process did not progress.

4.3. Part 8 Planning – N28 Shannonpark Roundabout Scheme

In June 2017, Cork County Council applied for Part 8 Planning for the upgrade of the roundabout (see Section 5.1 below).

The project description of the preliminary design consisted of:

- Widening of approach lanes to the roundabout to improve capacity at the junction;
- Provision of a separate slip lane for east-bound Ringaskiddy traffic from Cork;
- Realignment of footpaths as necessary; and
- Other necessary associated works.

The Part 8 Planning was approved in October 2017.

4.4. Part 8 Planning – N28 Raffeen Junction Safety Scheme

In April 2018, Cork County Council applied for Part 8 Planning for the N28 Raffeen Junction Safety Scheme (see Section 5.2 below). The project description of the preliminary design consisted of:

- Minor traffic calming works to reduce the speed of traffic through the junction and to improve the safety of right turn movements onto the N28;
- Provision of cycle facilities through the junction;
- Provision of uncontrolled crossings for pedestrian and cycle use; and
- Other necessary associated works.

The Part 8 Planning was approved in June 2018.

5. Preliminary Design

The preliminary design is developed in order to reach a sufficient level of detail for the purpose of determining the extent of land that is required for the construction and operation of the works (i.e. if land acquisition is required), that the project objective is being met and what environmental impact the project will have. The preliminary design is utilised as the initial design to gain planning permission with further development of the design then taking place in order to have the design detailed to the level required for tendering and construction.

The reason why all designs aren't developed to the detailed design phase for gaining planning permission, is to provide an important opportunity for landowners, stakeholders, local representatives and the public to give their input and be consulted with about the project at an early stage so that feedback can be included. In addition, it also ensures that funds are not unduly spent progressing with a design that will not gain planning.

5.1. Shannonpark Roundabout

Given that the two planning applications for the upgrade of the Shannonpark Roundabout to a signalised junction in 2013 and 2015 did not progress through Part 8 planning, consultants were appointed by Cork County Council in 2016 to carry out an assessment of alternative improvement options for the Shannonpark Roundabout with the key objective of improving its operational performance. The use of a signalised junction, which would provide the largest capacity improvement for the junction, was not advanced during this assessment as it was rejected twice previously. The assessment identified a preferred option, which underwent a preliminary design for the purposes of being brought through the Part 8 planning process in 2017.

The preliminary design consisted of a number of measures to cumulatively increase the capacity at the roundabout such as widening the approach lanes to the roundabout and provision of a separate slip lane for east-bound Ringaskiddy traffic from Cork. To undertake this work, the existing footpaths would be affected and therefore would also require realignment to ensure that access was maintained. The preliminary design met the objectives of the scheme, ensuring that a cost effective solution was developed which would improve the capacity issue at the junction in the short term,

with the final solution being the M28 Cork to Ringaskiddy Project. The plan layout of the development is included in Appendix 1.

This preliminary design was brought through Part 8 planning and then further detailed prior to construction.

5.2. Raffeen Junction

To enhance the safety of all road users at the Raffeen Junction, the preliminary design consisted of a range of traffic calming measures. Central island gateways were proposed to cause a natural reduction of vehicle speeds and make drivers aware of the approaching junction. The physical presence of the central islands acts to narrow the perceived space available although 3.5m wide through-lanes will be provided. This results in a reduction in speed of users traversing the road at this location. In addition, with acceleration and deceleration lanes removed, traffic speeds are further reduced to facilitate left and right turning vehicles. The sightlines from the junction to approaching vehicles are also improved by the removal of these lanes.

To protect the vulnerable road users (pedestrians and cyclists), uncontrolled crossings were included in the design using dropped kerbs at the central islands, in addition to a shared path through the junction. Uncontrolled crossings are used so that those wishing to cross the road will do so one lane at a time and the onus is on them to wait until there is a gap in traffic to negotiate a crossing. Budget constraints limit the facilities for pedestrians and cyclists to the extent of the works currently being provided.

Vehicle speed on approach to the junction, the existing deceleration lane, traffic volume and overall junction layout have been identified as contributory factors to the cause of collisions. The preliminary design addressed all these issues except for traffic volume which will reduce upon the completion of the M28 Cork to Ringaskiddy Project as a percentage of through traffic will be removed from the local road network. The plan layout of the development is included in Appendix 2.

This preliminary design was brought through Part 8 planning and then further detailed prior to construction.

6. Detailed Design

Following the planning approval, technical advisors were appointed to prepare the detailed design for the scheme in order to progress the design to the level required for tender and construction.

The detailed design is formulated by undertaking detailed surveys, site visits and liaison with utility providers and other specialists. Using this information, the design undergoes detailed assessment that accounts for all design aspects including pavement, drainage, lighting, signage and road marking, landscaping, foot/cycle path, geometry, construction methodology, earthworks, site clearance, etc. The relevant design standards are adhered to, the TII standards and publications are all publicly available on the TII website.

Any changes from the Part 8 planning process that may arise from submissions are reviewed and incorporated. In addition, any changes to the design from the Road Safety Audit are also made at this stage of the project, see Section 7 for further detail.

The detailed design uses the preliminary design as a basis but a large number of components are considered and added during the detailed design which would not be undertaken as part of the preliminary design. Both junctions have benefitted by additional works also being developed outside

of the core objectives of each junction which includes the upgrade of the public lanterns to LEDs, upgrade and provision of new drainage, improved shared lane facilities for pedestrians and cyclists, improved sightlines by removal of obstacles/overgrowth, upgrade of signage, removal of hazardous trees, new road pavement and upgraded safety barriers. The specification of these works can lead to slight changes to the original preliminary design but all of which are of benefit to the users of the junctions.

The detailed design, as issued for the tendering process for the Shannonpark Roundabout and the Raffeen Junction can be seen in Appendix 3 and Appendix 4 respectively.

The following sections outline specific design elements of the project which details any change that has occurred since the Part 8 planning was approved.

6.1. Shannonpark Roundabout – Segregated Left Turn Lane

As part of development of the design, newly published road design standards, including those published by TII, have to be reviewed and incorporated to ensure that the design is to the latest and highest possible levels of design, which includes for the safety of both motorised and non-motorised road users. The preliminary design included a physically segregated left turn lane on the roundabout which would then have to yield to eastbound traffic exiting the roundabout. This design was developed from the design standard as referenced in TII Publication DN-GEO-03045 (TD 51) which was withdrawn during 2017.

Road design standards undergo regular review and update to ensure that the latest technology, best practice and safest designs are incorporated. The new standard for the TII Publication DN-GEO-03060 *Geometric Design of Junctions* does not allow for the incorporation of segregated left turn lanes at roundabouts unless they form the introduction of a lane gain arrangement. A lane gain arrangement is the provision of the merge lane as a secondary lane to the existing i.e. the creation of two lanes going eastbound.

The segregated left turn lane which formed part of the preliminary design that was proposed in the Part 8 planning could therefore not be progressed as it was removed/changed in the standards due to merging vehicles being sideswiped by accelerating vehicles exiting the roundabout. While an additional queuing length would be gained due to the segregated lane being longer in length, eastbound vehicles would still have to yield to vehicles exiting the roundabout. Equivalent to yielding to vehicles on the roundabout in the final design.

The option of providing the lane gain arrangement was explored during the detailed design, however the impacts would have been dramatically increased due to the additional road width that would have to be provided. The lane gain would require the compulsory purchase of land, structural support for the road, impacts on a stream, removal of trees and utility diversions as a minimum. Additionally, the existing pedestrian/cycle path and crossing would be impacted and would provide a more difficult arrangement for crossing the road due to the constant flow of vehicles at speed.

An additional lane was therefore added to the southbound approach to the Shannonpark Roundabout in order to allow for the increase in capacity of the vehicles moving through the roundabout to achieve the objectives of the scheme. This change to the design also provided the opportunity to improve the shared cycle and footpath facilities which will now no longer be crossed by another lane of potentially fast-moving traffic. The benefits of the proposed design, in addition to conforming with the current design standard, allows for the free flow of the traffic to be kept and the increased capacity of the roundabout to be achieved. In the old design, users of the slip lane would have had to have yielded to any traffic exiting the roundabout eastbound which would have

not provided for any actual lane gain or added benefits above the current design, which is safer for all road users.

6.2. Shannonpark Roundabout – Capacity Improvements

As the primary objective for the upgrade to the Shannonpark Roundabout is to increase its operational performance in the short term, both the preliminary and the detailed design had to meet this criteria by providing improvement measures.

The Shannonpark Roundabout experiences long delays during the evening peak period approaching from the Ringaskiddy direction. To address this issue, the upgrade proposals will significantly enhance capacity for traffic leaving Ringaskiddy in the evening by the provision of an additional lane at the roundabout and an additional lane on the approach. The modifications from the preliminary design to the detailed design do not impact on this improvement measure.

From the Cork direction, capacity improvements were also provided for on approach to the Shannonpark Roundabout although it was acknowledged during the design that much of the queuing on this approach is associated with restrictions in the approaching link capacity and in particular the interaction with traffic entering and exiting the local junctions to Maryborough Hill, Hilltown and the local petrol station. This queuing phenomena is quite evident from site visits where traffic moves more freely directly approaching the roundabout having past the conflicting turning movements associated with the petrol station/local junctions, see Figure 3.

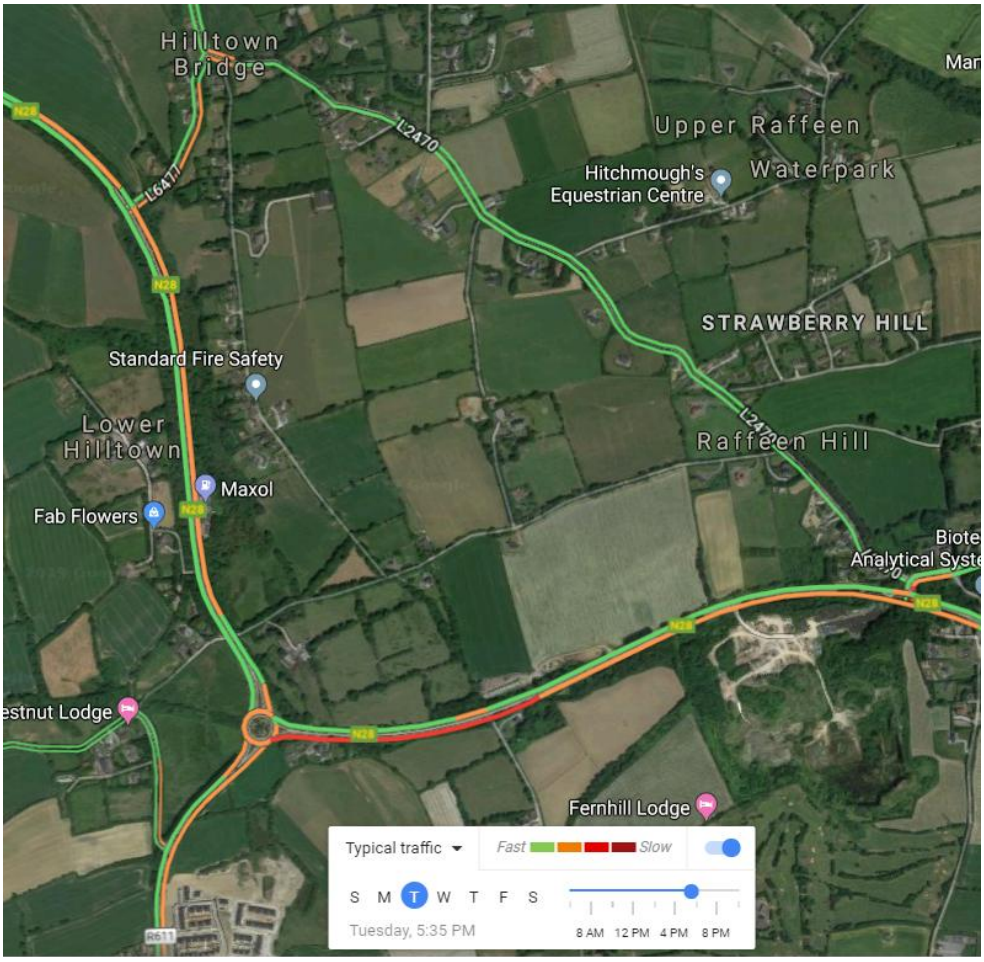

Figure 3: Typical evening peak traffic at Shannonpark Roundabout as shown on Google Maps

The preliminary design for the Cork approach to the Shannonpark Roundabout, which included a dedicated left turn slip lane, was proposed to accommodate both traffic growth and any possible surge in traffic should traffic conditions at the petrol station improve and release greater traffic flows towards the roundabout. The modification to this original proposal which replaced the dedicated left turn slip lane with a shorter left turn lane on the approach to the roundabout (as detailed in Section 6.1) continues to improve capacity for traffic travelling from the Cork direction and will result in minimal difference in terms of operational performance at the roundabout stop line as the key bottleneck on the Cork approach is the link constraints as noted previously at the petrol station.

6.3. Shannonpark Roundabout – Extension of Additional Lane on Ringaskiddy Approach

As part of the development of the design, site visits at peak hours were undertaken in order to view the capacity issues and associated driver behaviour at the junctions. It was observed that vehicles approaching the Shannonpark Roundabout on the N28 Ringaskiddy approach were illegally utilising the hard shoulder in order to take the Carrigaline exit, effectively bypassing the traffic queue caused by vehicles taking the Cork City exit. Vehicles using the hard shoulder for this purpose pose a danger to other users of the hard shoulder (pedestrians and cyclists), in additional to other vehicles who are entering and exiting their residential properties.

While the use of the hard shoulder is prohibited, there is sufficient width in the hard shoulder to provide an additional lane approaching the roundabout. The provision of a new lane was assessed and then incorporated into the design in order to provide a designated road lane for the Carrigaline exit incorporating lining, signage and road widths to the current road standards. The increase in the available capacity on the approach to the junction will be beneficial for reducing the queuing length and will allow drivers to undertake the manoeuvre in a safe manner.

There is an existing entrance on the Ringaskiddy approach that provides access to a number of residential properties south-east of the junction. Access to the entrance when travelling eastbound from Shannonpark Roundabout is through a dedicated right turn lane which with the provision of the new Carrigaline lane will have to cross an additional lane of traffic. Following consultation with local residents, an assessment determined that the provision of a yellow staggered box would be suitable and beneficial in assisting with the access and egress from the residential entrance on the Ringaskiddy approach, particularly when the westbound lanes are congested or moving at different speeds. The staggered box is required (as opposed to a square/rectangle shape) so as to ensure that any vehicle entering or exiting will have sufficient visibility to see and be seen by vehicles travelling in both westbound lanes.

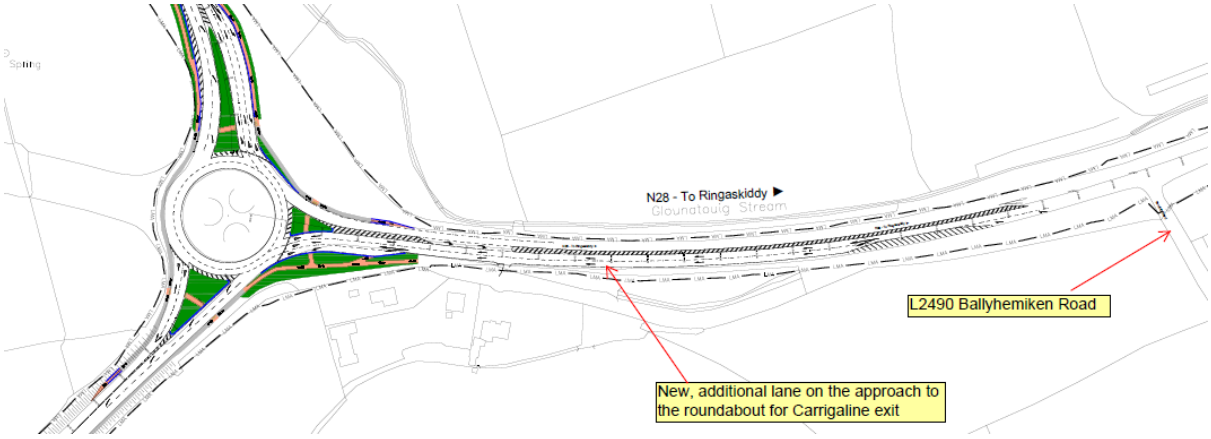

Figure 4: Provision of new lane on the Ringaskiddy approach to the Shannonpark Roundabout

New hatching will also be provided at the end of the acceleration lane for the L2490 Ballyhemiken Road, which can be viewed in Figure 4. The proposed hatched road markings between the L2490 and the Shannonpark Roundabout will assist in deterring road users from driving through the acceleration and deceleration lane at the L2490 junction in order to gain access to the Carrigaline lane faster. Currently, there is no hatching at this location.

6.4. Shannonpark Roundabout & Raffeen Junction – Landscaping Works

As part of the detailed design, the landscaping to be undertaken for the project was assessed. There were numerous existing issues with overgrown vegetation at both junctions which were having a negative effect on road safety, this included: blocking of sightlines from minor junctions onto the N28, reduced visibility of pedestrians and cyclists on the Shannonpark Roundabout central islands, encroachment of vegetation on pedestrian and cycle facilities, trees encroaching on lighting columns and trees causing a hazards to road users in the event of breakage. The landscaping undertaken resolved all of these issues. The removal of any vegetation is only undertaken where absolutely necessary and primarily for safety reasons.

An earthen berm was also created on the southern side of the N28, west of the Raffeen Junction which serves multiple purposes: to provide a clear area free of hazards for cyclists, to utilise excess topsoil and to cover tree stumps in a visually pleasing manner.

The overall improvements to both junctions will allow for an ease of maintenance which is also important to consider. The landscaping on the Shannonpark Roundabout central island itself was not changed and will continue to be maintained by the sponsoring company.

7. Road Safety Audit

A Road Safety Audit (RSA) involves the evaluation of road schemes during design and construction to identify potential hazards to all road users. While a RSA is required under the EU Directive on Road Infrastructure Safety Management (EU RISM), it has been incorporated into TII Publications since 2001, the latest version of which is GE-STY-0124. A RSA is to be carried out on all new national road infrastructure projects and on all schemes which result in a permanent change to the existing road or roadside layout, thus a RSA has been undertaken on the N28 Shannonpark Roundabout and Raffeen Junction Upgrade project.

A RSA is carried out at different stages of an infrastructure project. A RSA is a check for safety issues within a scheme rather than an identification of non-compliance with design standards.

During a RSA the audit team looks at the scheme from the point of view of all road users, with particular attention being paid to the needs of vulnerable road users. The RSA team identifies potential safety problems within the scheme and makes recommendations to the designer to minimise future collision occurrence and severity.

The RSA team is independent of the road design team. The audit team is approved by the overseeing organisation, which is TII in the case of national road schemes.

A Stage 1 RSA of the preliminary design and a Stage 2 RSA of the detailed design have been undertaken which involved the examination of the plans and additional information available, in conjunction with site visits. A number of recommendations made by the auditors have been incorporated into the project with the design updated to allow for their inclusion.

A Stage 3 RSA will be undertaken at the completion of construction. The RSA team must visit the site for a Stage 3 audit in daylight and darkness. The RSA team walks, drives and, where appropriate, cycles the scheme to identify potential hazards to all road users.

Upon completion of the RSA, the project will have been reviewed for road safety issues throughout the development of the design and following construction to ensure that the highest levels of safety are being met in order to design out potential hazards to road users.

8. Tender & Construction

The project was issued for tender in October 2018, with appointment of the winning Contractor in February 2019. The design is further developed during the construction stage as information becomes available which could not be foreseen until works begin. Examples of which are the discovery of unknown services discovered during road excavation works, other construction works being undertaken in the vicinity and existing drainage being damaged and requiring repair. This is a common occurrence during construction projects in non-greenfield sites which has existing infrastructure in place.

Liaison with the public on progress and the proposed works was ongoing throughout the construction period by letter notification, phone calls, house calls, Variable Message Signs, newspaper adverts, Cork National Road Office website and weekly email updates. Complaints, comments and queries were dealt with swiftly as they arose by the contractor, resident engineers or Cork National Road Office staff. The works were programmed so the least amount of disruption was caused to road users and local residents by ensuring that flow on the road network was maintained during peak hours and by installing traffic management and undertaking the pavement resurfacing works at night.

The project was due for completion in June 2019 and is largely on target with the majority of the works substantially complete. Additional tasks have caused an extension of the works by a few weeks, however good progress was made on both sections of the project.

9. Summary

In summary, the upgrade objectives of both junctions are being met by the works undertaken.

The objective for the Shannonpark Roundabout is to increase the capacity through the roundabout which is being met by the provision of additional lanes on the approach to the roundabout.

The objective for the Raffeen Junction is to address the safety concerns by reducing speed without the use of a speed limit, as it is in a rural area. It is designed to physically narrow lanes and produce a

visual effect that reduces a driver's speed. Experience has shown that this type of scheme will reduce speed without introducing a speed limit.

Additional works are also being undertaken at both junctions to further improve the facilities for vehicles, pedestrians and cyclists. By ensuring that the latest design standards are being utilised, the design incorporates the industry best practice and safest design for all road users, providing a cost effective upgrade to the existing junctions.