

JUNCTION OPTIONS ASSESSMENT

DUNBOYNE LINK ROAD TO R157

Meath County Council

M1346

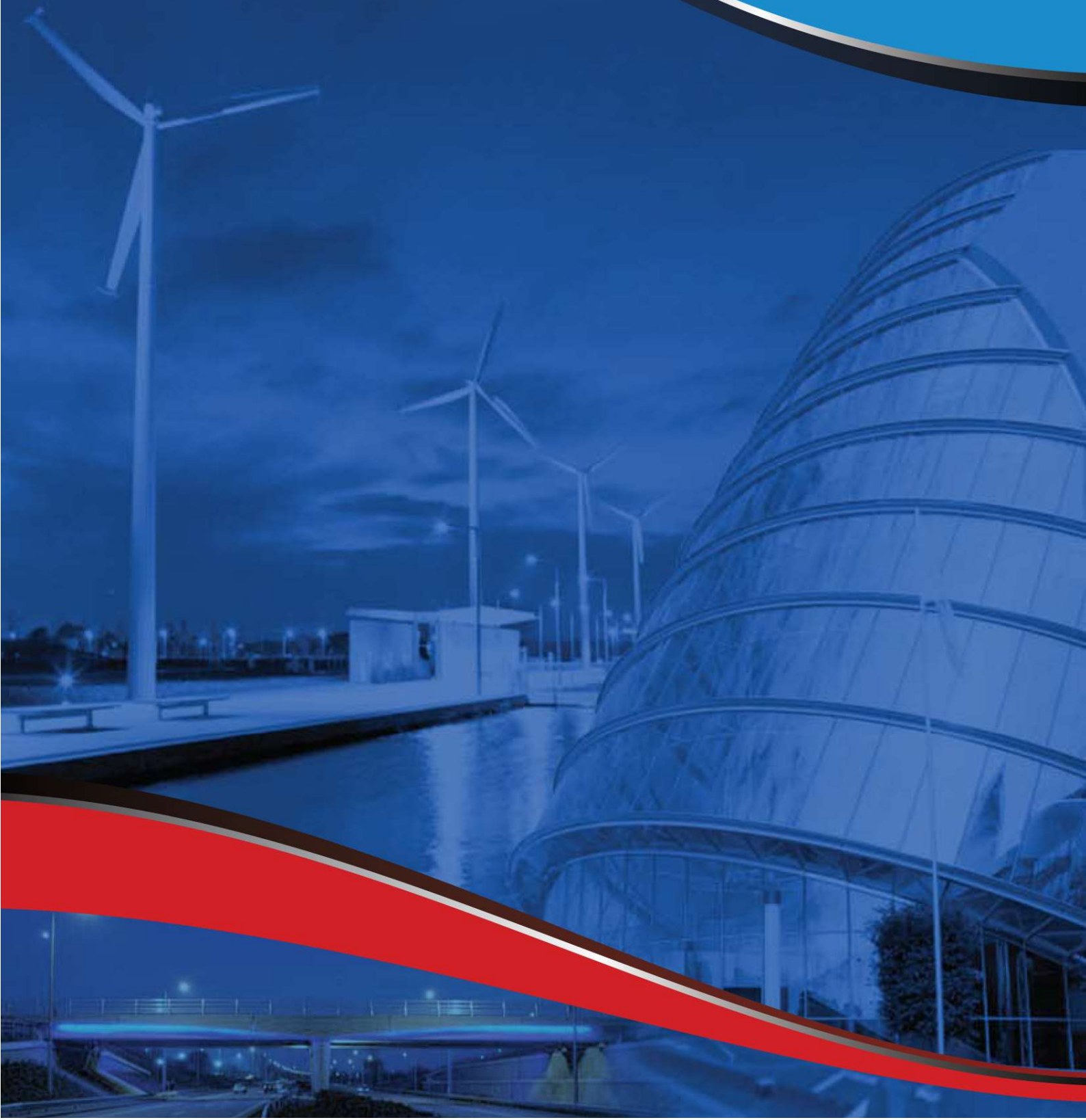
13 June 2022



OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers



JUNCTION OPTIONS ASSESSMENT

DUNBOYNE LINK ROAD TO R157



OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers

NOTICE

This document has been produced by O'Connor Sutton Cronin & Associates for its client, Meath County Council. It may not be used for any purpose other than that specified by any other person without the written permission of the authors.

DOCUMENT CONTROL & HISTORY

OCSC Job No: M1346	Project Code	Originator	Zone Volume	Level	File Type	Role Type	Number	Status / Suitability Code	Revision
	M1346	OCSC	XX	XX	RP	C	0001	S2	P04

Rev.	Status	Authors	Checked	Authorised	Issue Date
P04	S2	W Marais	P Raggett	A Horan	13/06/2022
P03	S2	W Marais	P Raggett	A Horan	5/05/2022
P02	S2	W Marais	P Raggett	A Horan	4/05/2022
P01	S2	W Marais	P Raggett	A Horan	26/04/2022

TABLE OF CONTENTS

1	PROJECT BRIEF.....	1
2	JUNCTION SURVEYS	2
3	METHODOLOGY	4
4	JUNCTION ASSESSMENT	5
	PRIORITY JUNCTION	5
	ROUNDBOUT.....	6
	SIGNALISED JUNCTION	7
	SUMMARY	8
5	APPROACH AND PHASING	9
6	VERIFICATION.....	10

APPENDICES

APPENDIX A MODEL RESULTS

LIST OF FIGURES

Figure 1: Site Location	1
Figure 2: R157/Business Park Link Road - AM Peak Projected Turning Volumes	2
Figure 3: R157/Business Park Link Road - PM Peak Projected Turning Volumes	3

LIST OF TABLES

Table 1: Priority Junction Analysis Results	5
Table 2: Level of Service (Exhibit 18-4, HCM 2010)	6
Table 3: Roundabout Analysis Results	7
Table 4: Signalised Junction Analysis Results	8

1 PROJECT BRIEF

Meath County Council (the Client) has appointed O'Connor Sutton Cronin (OCSC) to progress the Dunboyne Link Road – Dunboyne Business Park connection to R157 (Phase i to iv) from Options Selection / Preliminary Design, through the Statutory Process.

The site location is between the R157 and Dunboyne Business Park, as shown in Figure 1:



Figure 1: Site Location

The proposed development site involves the connection between the Dunboyne Business Park and the R157. The existing road serving as access to the Dunboyne Business Park has no link with R157 and to achieve this the proposed road will have approximately 500 m in length.

The purpose of this report is to investigate the junction layout required between the R157 and the Business Park Link. The layout will be assessed by means of the Junctions 9 and Transyt 15 software packages.

2 JUNCTION SURVEYS

As this junction does not exist currently and is a planned junction, existing junction and link surveys could not be used. Rather, the Transportation Study at Dunboyne & Environs was used, which was conducted in October 2018.

For this study, a Visum Macro Model was developed to look at current and future infrastructure in the Dunboyne Area. The modelling year chosen was 2025, although due to the extent of infrastructure incorporated into the model, it is likely that the scope exceeds the modelling year.

As part of this modelling exercise, the planned junction between the R157 and Dunboyne Business Park Link Road was also included. Projected turning volumes were sourced from this model, as the dynamically assigned Visum model provides the most accurate projections for this junction available. It should be noted that this model also includes the fully completed Eastern Distributor Road, which will make the Business Park Link Road a much more attractive option. As such, the projected turning volumes are conservative and robust.

The turning volumes, as received from Meath County Council, are shown in the figures below:

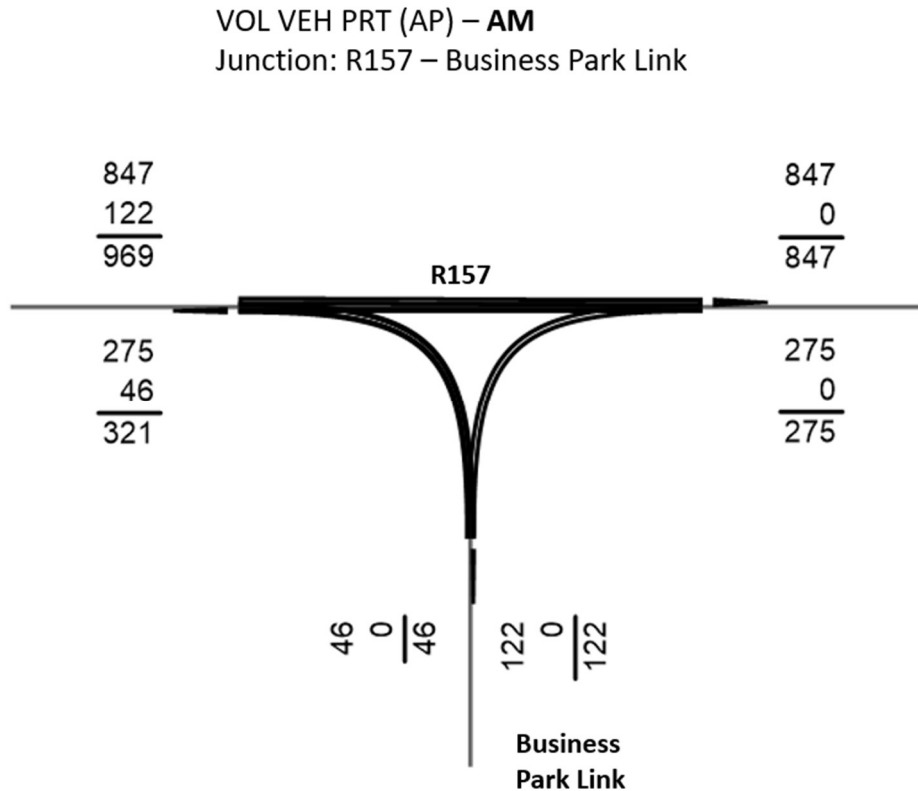


Figure 2: R157/Business Park Link Road - AM Peak Projected Turning Volumes

VOL VEH PRT (AP) – PM
Junction: R157 – Business Park Link

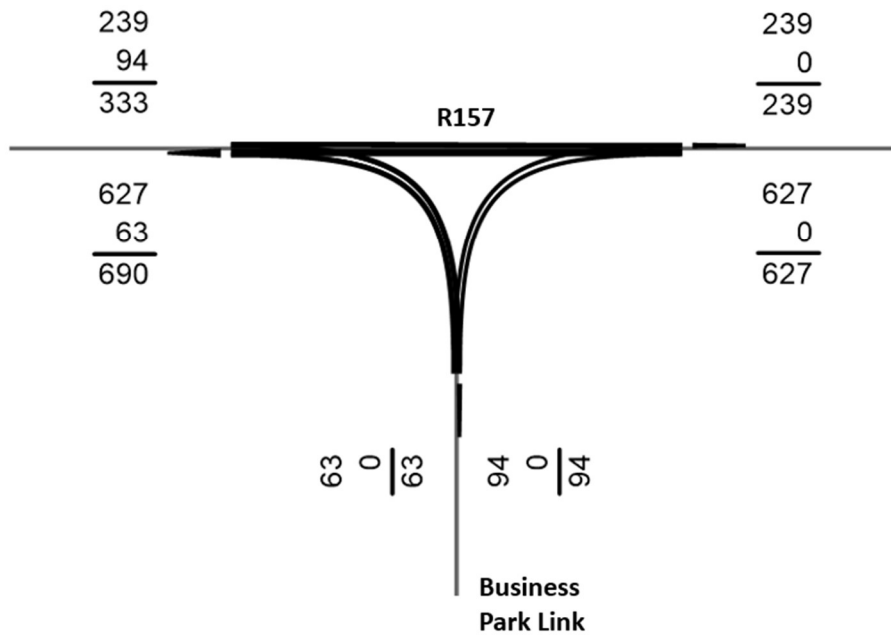


Figure 3: R157/Business Park Link Road - PM Peak Projected Turning Volumes

3 METHODOLOGY

To assess the required junction configuration, two software packages were used. These are:

- Junctions 9
- Transyt 15

Initially, the junction will be assessed with Junctions 9 to determine if a priority-controlled junction will be appropriate. Should the Degree of Saturation (DoS) not be within reasonable levels, a roundabout will be investigated, followed by a signalised junction will be investigated using Transyt 15.

4 JUNCTION ASSESSMENT

PRIORITY JUNCTION

As mentioned, the first step is to analyse the junction using Junctions 9 software as priority controlled, to determine if this configuration provides sufficient capacity to meet the demand.

As the R157 is a regional road carrying a relatively high volume of traffic, with a speed limit in the area of the junction of 80km/h, it was deemed appropriate to use a ghost island layout for this priority junction. This will remove right-turning vehicles from the through movement which will improve capacity and safety.

The junction analysis assumed the following geometry for this layout:

- Width of the carriageway (R157): 10.0 m
- Width of the right-turning lane: 3.0 m
- Length of the right-turning lane: 10.0 m
- Width of the minor road: 6.0 m

The worst performing movement at each approach, as well as the associated queue length, is shown in the table below.

Peak	Year	R157 (E)		Dunboyne Link (S)		R157 (W)	
		RFC	Queue	RFC	Queue	RFC	Queue
AM	2025	-	-	2.27	1793	0.94	60
Peak	Year	R157 (E)		Dunboyne Link (S)		R157 (W)	
		RFC	Queue	RFC	Queue	RFC	Queue
PM	2025	-	-	999999+	599999+	999999+	599999+

Table 1: Priority Junction Analysis Results

From the above table, it is evident that a priority junction will not have the capacity to accommodate the future demand at this junction. Especially in the afternoon peak period, which yields excessive results. It is clear from this assessment that tweaks to the geometry will not improve the results to within acceptable limits.

ROUNABOUT

The results of this junction analysis will be based on a Level of Service (LOS) measurement, which uses measured delay experienced by a vehicle at the junction and compares it to a scale of values defining the LOS. According to the National Roads Network Indicators 2019, published by TII, LOS is a quality measure describing operational conditions within a traffic stream and is a recognised international standard. The Level of Service (LOS) is based on the below, which has been taken from the Highway Capacity Manual (HCM) 2010. The type of junction affects the allowable delay in each LOS bracket resulting in different values for a traffic signal and non-signalized junction. An acceptable LOS is on a junction where a LOS D and above (A, B and C) is achieved. An unacceptable LOS is represented by an E and an F.

LOS	Signalized Junction	Unsignalized Junction
A	≤10 sec	≤10 sec
B	10–20 sec	10–15 sec
C	20–35 sec	15–25 sec
D	35–55 sec	25–35 sec
E	55–80 sec	35–50 sec
F	>80 sec	>50 sec

Table 2: Level of Service (Exhibit 18-4, HCM 2010)

The methodology required to analyse the two-lane roundabout results in having to use delays as the criteria, rather than demand and capacity.

For the roundabout analysis, the following geometric parameters were assumed:

- R157
 - Approach road half-width: 5.0 m
 - Entry width: 6.0 m
 - Entry radius: 20.0 m
 - Effective flare length: 15.0 m
 - Inscribed circle diameter: 45.0 m
- Link Road
 - Approach road half-width: 3.0 m
 - Entry width: 6.0 m
 - Entry radius: 20.0 m
 - Effective flare length: 15.0 m

- Inscribed circle diameter: 45.0 m

The geometry used for the roundabout was replicated from the junction between the L2228, R156 and R157, south of this location, as it is anticipated that a similar junction will be constructed should a roundabout option be desired.

The result from the roundabout analysis is shown in the table below with the worst-performing movement at each approach, as well as the associated queue length provided. As the layout assessed is a dual-lane roundabout, a slightly different modelling methodology was used to simulate this. The methodology results in delays being used as the criteria, rather than capacity. A level of service A to D are acceptable delays.

Peak	Year	R157 (E)		Dunboyne Link (S)		R157 (W)	
		LOS	Queue	LOS	Queue	LOS	Queue
AM	2025	F	34.3	A	0.2	F	69.6
Peak	Year	R157 (E)		Dunboyne Link (S)		R157 (W)	
		LOS	Queue	LOS	Queue	LOS	Queue
PM	2025	E	10.4	A	0.1	B	3.9

Table 3: Roundabout Analysis Results

From the analysis, it can be concluded that a two-lane roundabout will not be able to accommodate the demand at this junction. This is due to unbalanced flows at this junction resulting in excessive delays.

SIGNALISED JUNCTION

Using Transyt 15, the junction was assessed using a signalised layout. For this layout, similar to the priority junction, a ghost island layout was used with a 10m right-turn lane from the R157 to the Dunboyne Link Road.

A 2-phase configuration was used with a right-turn filter phase. One phase is allocated to the R157 with the second phase allocated to the Dunboyne Link Road. A cycle time of 90 seconds was used for the analysis.

The geometry used for this assessment is similar to that of the priority junction, with the addition of traffic signals.

The worst performing movement at each approach, as well as the associated queue length, is shown in the table below.

Peak	Year	R157 (E)		Dunboyne Link (S)		R157 (W)	
		DoS	Queue	DoS	Queue	DoS	Queue
AM	2025	0.58	11.16	0.70	4.78	0.67	15.03
Peak	Year	R157 (E)		Dunboyne Link (S)		R157 (W)	
		DoS	Queue	DoS	Queue	DoS	Queue
PM	2025	0.51	7.36	0.65	4.29	0.53	9.20

Table 4: Signalised Junction Analysis Results

The above table indicates that the junction will function adequately using a traffic signal layout, with all DoS values within acceptable limits. This layout is the preferred option for this junction.

SUMMARY

The analysis for this junction considered the following layouts:

- Priority Controlled
- Roundabout
- Signal Controlled

From the results, it is evident that the priority-controlled and roundabout configurations will lead to excessive delays and demand readily exceeding capacity. The best solution for this junction would be a signalised configuration with a short right-turn lane implemented by means of a ghost island to remove right-turning vehicles from the R157 through traffic stream. This configuration will also provide some spare capacity for future traffic growth.

It should be noted that the Road Safety Impact Assessment for this scheme prefers the roundabout option due to the safety aspects related to it, as well as the cohesion of junction operations along the R157, however, the RSA did not consider capacity.

5 APPROACH AND PHASING

The majority of the demand at this junction, in future, will be due to the construction and linking of the Eastern Distributor Road. Prior to this, this junction will mainly be used as a more readily accessible entrance to the Dunboyne Business Park. During this phase, the demand at this junction will be low.

Due to this, the following phasing is proposed for the junction layout:

- Prior to the construction of the Eastern Distributor Road: Priority junction with right-turn lane onto link road, set out by means of a ghost island. This means the geometric layout of the priority junction will replicate what would be required in future for the signalised junction.
- Subsequent to construction of the Eastern Distributor Road: Upgrading of the priority junction to a signalised junction. Since the layout will already be in place, the extent of the works will entail erecting traffic signals and modification of road markings.

It is anticipated that this approach will prove to be the most cost-effective option, while still ensuring capacity is sufficient to accommodate the demand.

6 VERIFICATION

This report was compiled and verified by:

Wian Marais BE (US), BE (Hons) (UP), Professional Engineer (ECSA)

Civil Engineer

O'Connor Sutton Cronin & Associates





OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers

9 Prussia Street
Dublin 7
Ireland

T | +353 (0)1 8682000
W | www.ocsc.ie

Dublin | Belfast | Birmingham | Cork | Galway | London