

Galway County Council

R357/R446 Staggered Junction at
Creagh, Ballinasloe Town

Preliminary Design Report

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Executive Summary

The R357/R446 is a staggered crossroad junction located at Creagh, Ballinasloe Town, Co. Galway, and was identified as a high collision location by Galway County Council (GCC). The proposed scheme is a Road Safety Improvement Scheme and is intended to improve the poor collision rate at the junction.

The R357 Taghmaconnell to Shannonbridge Road intersects the R446 Athlone to Ballinasloe Road (formerly the N6 Dublin to Galway Road) at Creagh in Ballinasloe Town at a staggered T-junction. Following the opening of the M6 Motorway from Ballinasloe to Galway in 2010 the existing traffic signals on the Shannonbridge arm of the junction (R357 South) were turned off with the junction operating under a “Stop” priority control. In the intervening period there has been significant residential development on the R357 Creagh Road and increased traffic associated with the expanded Creagh National School on the R357 (South), in addition to traffic from existing commercial premises and the Church located close to the junction. There is also an IDA Business Park located on the R357 (North) which has grown in recent years further increasing traffic through the junction. This cumulative development has increased the demand at the R357/R446 staggered junction, which may be complicated by a number of physical constraints within the vicinity of the junction, including: -

- **Creagh Cemetery.**
- **Commercial Premises** - there are a number of commercial premises within the south-western quadrant of the junction.
- **Our Lady of Lourdes Church** and carpark is located in the south-eastern quadrant of the junction with vehicular access to the carpark provided from the R446 and the R357 (South).

Traffic surveys undertaken at the junction in October 2019 indicated that the 85th percentile speed on three of the four arms of the staggered junction are above the posted speed limit of 50kph with the exception being the R357 (South) which is below the posted speed limit, benefitting from existing traffic calming measures.

A Feasibility Study was undertaken to better understand the safety issues identified by GCC, which indicated rear-end-shunt and side-swipe collisions, and collisions involving pedestrians at the junction of the R446 and the R357 (North). The Feasibility Study also investigated design options to directly mitigate the safety issues identified, with particular focus on pedestrians. These options included: -

- **Do Nothing** (Option 1) – retain the current layout and operation at the staggered crossroad junction.
- **Do-Minimum** (Option 2) – consisting of footpath improvements on all arms, amendments to kerblines, provision of refuge islands and uncontrolled crossings on both R357 arms, removal of redundant signals at junction, refreshing roadmarkings within the junction, amending priority and layout at the R446/R357 (North) junction and re-signalisation of existing, although currently unused, pedestrian crossing on the R446.
- **Do Something – Partial Signalisation** (Option 3) – consisting of footpath improvements on all arms, amendments to kerblines, reducing traffic lane widths on the R446 by the provision of advisory cycle lanes, provision of a refuge island and uncontrolled pedestrian crossing within the R357 (South), removal of redundant signals at junction, re-signalisation of existing, although currently unused, pedestrian crossing on R446 and signalising the R446/R357 (North) arm of the staggered junction including signalised crossings on all arms.
- **Do-Something – Full Signalisation** (Option 4) - consisting of footpath improvements on all arms, amendments to kerblines, reducing traffic lane widths on R446 by the provision of advisory cycle lanes and signalising the full staggered junction incorporating pedestrian crossings on all arms.

Options 1 & 2 were not considered viable as they failed to address the safety issues identified at the junction. Both Option 3 & 4 were considered feasible, as they were determined to improve junction safety and mitigate the safety issues identified at the junction. Further analysis was undertaken using traffic modelling software to investigate the impacts that each option (Option 3 & 4) would have on the operational performance of the junction.

The Junction Capacity Analysis assessed the AM Peak Hour, PM Peak Hour and the Interpeak Period for the years 2020, 2025, 2035, and 2050. The analysis concluded that the junction would experience some congestion in 2035 and 2050, however, Option 3 offered greater efficiency than Option 4, with the junction continuing to operate within capacity outside of the Peak Hours beyond 2035. Option 3 was also found to generate significantly less queuing on the R357 (South) arm of the junction in all future years, which was a particular concern given the location of the Creagh National School and the increased traffic volumes on this arm at school drop-off and pick-up times.

Following the above analysis, Option 3 was selected as the Preferred Option, and would consist of: -

- Signalisation of the junction between the R446 and the R357 (North) including pedestrian crossings, using MOVA. The length of each signal stage will differ throughout the day depending on the traffic demand at the time.
- Renewed footpath on the approaches to, and within, the junction.
- 1m & 1.5m wide advisory cycle lanes on both sides of the R446 carriageway and R357 (North) carriageway respectively.
- Amended lane widths of 3.3m in accordance with DMURS.
- Pavement renewal (inlay) on the approaches to the new signals.
- Retention of the existing parking area outside the commercial premises on the R446 within the south-western quadrant of the R446/R357 (South) junction.
- New gullies connected to existing drainage.
- Traffic signs to be located on passively safe support posts.
- Retention of the existing public lighting provision.

The total cost of the Scheme including design costs, preliminaries, contingencies and VAT is estimated to be €639,000. Following an economic assessment, the proposed scheme is expected to generate a First Year Rate of Return of 18.28%.

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1 Scheme Outline

The R357/R446 is a staggered crossroad junction located at Creagh, Ballinasloe Town, Co. Galway, and was identified as a high collision location. A Feasibility Study was undertaken at this location between October 2019 and January 2020 (Report reference: P19-089-RP-001_2.0), and demonstrated that rear end shunt collisions, side swipe collisions and collisions involving pedestrians at the junction of the R446 and the R357 (North) were the main safety issues at this location.

Following the Feasibility Report, Galway County Council confirmed that the most appropriate solution would be to signalise the R446/R357 (North) arm of the staggered junction, including the provision of signalised pedestrian crossings on all arms, and to improve Non-Motorised Road User facilities within the entire junction. The Feasibility Study considered additional options which were subsequently ruled out.

Appendix A includes a drawing showing the scheme location.

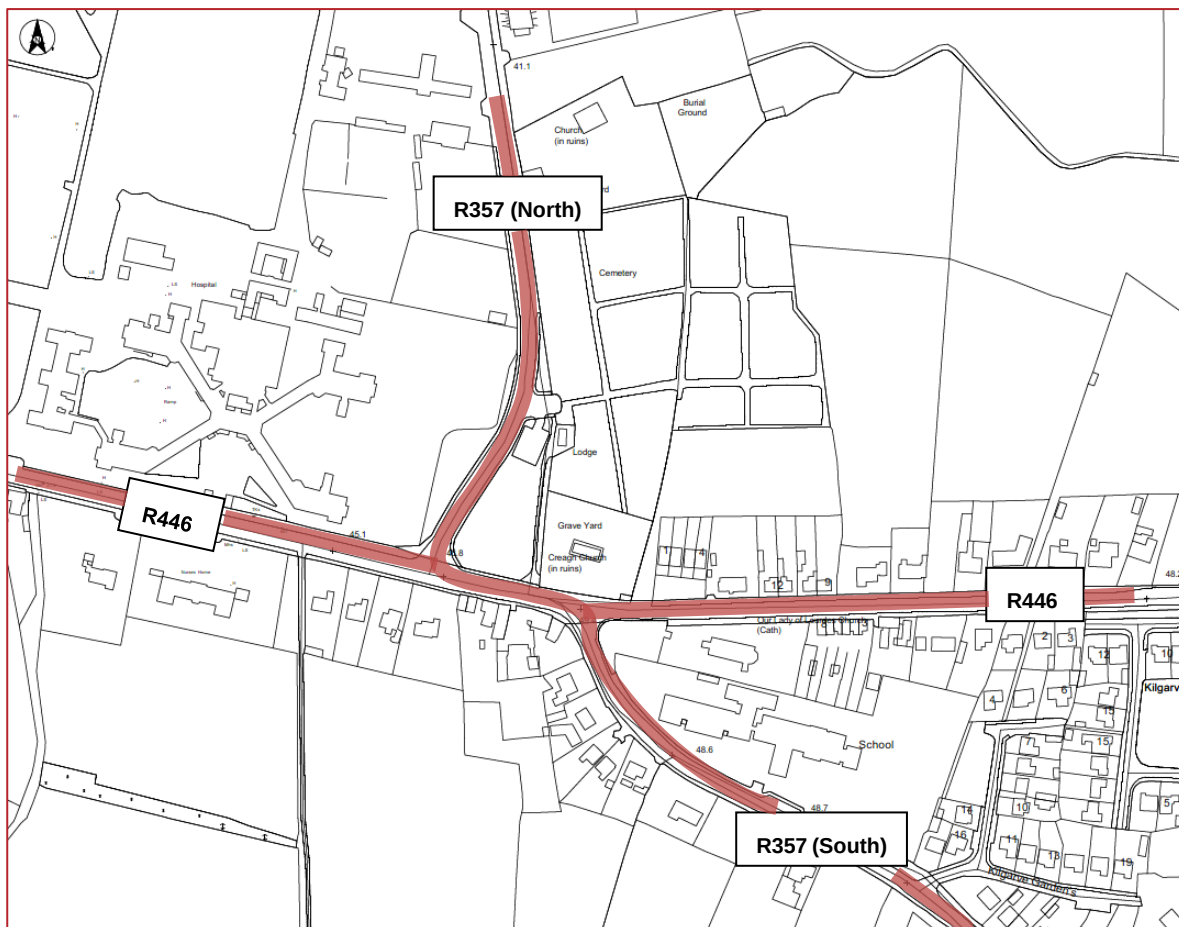


FIGURE 1-1: SITE LOCATION PLAN

1.1 Site Description

The R357 Taghmaconnell to Shannonbridge Road intersects the R446 Athlone to Ballinasloe Road (formally the N6 Dublin to Galway Road) at Creagh in Ballinasloe Town at a staggered crossroad junction. Following the opening of the M6 Motorway from Ballinasloe to Galway in 2010 the existing traffic signals on the Shannonbridge arm of the junction (R357 South) were turned off and the signal heads bagged amending junction control from traffic signals to priority (Stop) control.

In the intervening period there has been significant residential development on the R357 Creagh Road with increased traffic movements associated with an expanded Creagh National School on the R357 (southern arm) along with existing commercial premises and a Church located close to the junction. There is also an IDA Business Park located on the R357 (northern arm) which has grown in recent years further increasing traffic movements through the junction.

The R446, to the east of the junction, is a two-way single carriageway road with one traffic lane in each direction and a posted speed limit of 50kph. There is an entrance to a church car park directly from the R446 approximately 30m upstream of the junction. There are footpaths on both sides of the R446 to the east of the junction which directly serve a number of residential properties and residential housing developments on the approach to the junction, and a grassed verge on both sides of the carriageway between the kerb and footpath with trees within the verge at equal spacings.

Between the two junctions with the R357 Regional Road, the R446 consists of a single through traffic lane in each direction and right turn lanes at each junction. The footpaths continue westward on both sides of the R446, although the northern footpath is significantly narrower than its southern counterpart over this section.

West of the junction the carriageway reverts to a two-lane single carriageway with a dedicated eastbound left-turn lane at the junction with the R357 (North). In the current junction arrangement, eastbound left-turning drivers must give way to vehicles turning right from the R446 at the junction. A signalised pedestrian crossing is located approximately 80m west of the junction.

The R357 to the south of the junction is a two-lane single carriageway road with one traffic lane in each direction and a posted speed limit of 50kph. The Creagh National School is located on the R357. There is traffic calming provided by speed humps on the R357 and an existing signalised pedestrian crossing is located at the entrance to the National School. There is a footpath on both sides of the carriageway. There is also an access to the church car park from the R357 close to the junction with the R446. Despite signal poles being present at the junction with the R446, the junction operates under Stop control, with a Stop sign face mounted to the existing signal pole.

The R357 to the north of the junction is a wide two-way single carriageway road with one traffic lane in each direction. The southbound traffic lane widens into two lanes on the immediate approach to the junction, one for left-turners and one for right-turners. There is an existing Zebra crossing on the R357 approximately 30m from the junction and the entrance to the Creagh Cemetery is located on the eastern side of the R357 approximately 100m from the junction.

2 Need for the Scheme

The scheme is a Road Safety Improvement Scheme and is required to improve the poor collision rate at this junction by providing a range of junction improvements that will reduce collision numbers and severity.

The Feasibility Study determined that improvements in Non-Motorised Road User facilities at the junction were required as well as upgrades to improve vehicular travel through the R446/R357 (North) junction and relieve traffic congestion and reduce vehicle speeds.

3 Objectives of the Scheme

The main objectives of the scheme are: -

- To reduce vehicle speeds on the approaches to the junction;
- To reduce traffic congestion and unsafe vehicular movements at the junction, especially during peak times;
- To reduce the number of rear end shunts and side swipe collisions at the junction, particularly at the R446/R357 (North) junction, and to reduce the number of collisions involving pedestrians throughout the junction;
- To improve Non-Motorised Road User facilities, and Non-Motorised Road User safety, on the approaches to, and through, the junction;
- To provide a road surface free of defects within, and on the approaches to, the junction; and
- To simplify the road layout and junction priority at the R446/R357 (North) junction.

4 Existing Traffic Conditions

Automatic Traffic counts (via pneumatic tubes) were carried out on all arms on the approach to the junction for a 7-day period and a Junction Turning Count was undertaken at the junction for a 12-hour period. Both surveys were carried out in October 2019.

Table 4-1 summarises the traffic volumes in each direction for each arm of the junction while Table 4-2 details the vehicle speeds at this location at the time of the traffic surveys.

TABLE 4-1: SUMMARY OF TRAFFIC VOLUMES AS RECORDED BY THE ATC SURVEYS

ATC Location	Direction	22 nd Oct.	23 rd Oct.	24 th Oct.	25 th Oct.	26 th Oct.	27 th Oct.	28 th Oct.	Total	7-Day Mean
R446 (East)	Eastbound	3,703	3,869	3,968	4,179	3,521	2,613	2,786	24,639	3,520
	Westbound	3,565	3,595	3,787	3,960	3,410	2,517	2,538	23,372	3,339
R446 (West)	Eastbound	6,285	6,478	6,521	6,933	5,654	4,246	4,208	40,325	5,761
	Westbound	6,277	6,414	6,441	6,956	5,808	4,229	4,014	40,139	5,734
R357 (South)	Northbound	2,145	2,258	2,241	2,474	1,875	1,445	1,334	13,772	1,967
	Southbound	2,062	2,060	2,149	2,249	1,679	1,384	1,319	12,902	1,843
R357 (North)	Northbound	2,625	2,695	2,738	2,574	1,820	1,454	1,398	15,304	2,186
	Southbound	2,601	2,636	2,703	2,544	1,841	1,414	1,382	15,121	2,160

TABLE 4-2: SUMMARY OF SPEED SURVEY RESULTS

ATC Location	Direction	Speed Limit (km/h)	Number of Vehicles	No. of Vehs. Exceeding Speed Limit	% of Veh. Exceeding Speed Limit	Mean Speed (km/h)	85 th ile Speed (km/h)
R446 (East)	Eastbound	50kph	17,810	13,799	77.5%	56.4kph	65.16kph
	Westbound	50kph	17,085	10,894	63.8%	53.1kph	61.65kph
R446 (West)	Eastbound	50kph	23,063	17,721	76.8%	56.2kph	64.98kph
	Westbound	50kph	25,786	17,355	67.3%	53.7kph	61.74kph
R357 (South)	Northbound	50kph	11,401	1,277	11.2%	40.7kph	48.51kph
	Southbound	50kph	10,276	671	6.5%	38.6kph	45.99kph
R357 (North)	Northbound	50kph	12,446	11,223	90.2%	61.7kph	71.28kph
	Southbound	50kph	11,761	10,787	91.7%	63.1kph	73.53kph

The results of the speed survey indicates that the 85th percentile speeds on three of the four arms of the staggered junction are above the posted speed limit of 50kph with the exception being the R357 (South) which is below the posted speed limit, benefitting from existing traffic calming measures.

5 Collision History

The Feasibility Report for the proposed Scheme included an analysis of historical collisions between 2005 and 2016 using records reported to/by An Garda Síochána and collated/validated by the Road Safety Authority (RSA) which are published on the www.rsa.ie website.

Appendix B summarises the collisions analysed. The collated historical collision information was compared to control data which consisted of information on collision occurrence on the Irish road network as a whole contained in the publication “Road Casualties and Collisions in Ireland 2015” published in December 2018 by the Road Safety Authority, which is the most up to date validated collision data available at the time of the assessment.

A Chi² analysis demonstrated that the number of rear end shunt collisions occurring at the site between 2005 and 2016 was greater than recorded in the control data.

Collisions involving pedestrians, while not deviating to a statistically significant degree from the control data, accounted for 21.4% of the total number of collisions at the site.

Of the 28 collisions recorded at the site, twelve (c. 42.8%) occurred at, and on the approaches to, the junction of the R446 and the R357 (North). This included six rear end shunts, two side swipe collisions, three pedestrian collisions and one collision whose type was not specified. These collisions are shaded in the table in Appendix B.

A Chi² analysis was also undertaken for the collision types for the twelve collisions recorded at this location only. The analysis demonstrated that rear end shunts and side swipe collisions occurring at this location occurred more frequently in comparison to the control data. A total of 50% of the collisions within this cluster were rear end shunts, significantly greater than the control data which recorded rear end shunts as 16.2% of the total collisions occurring in 2015. Similarly, side swipe collisions accounted for 16.67% of collisions at this location but only 5.56% of collisions within the control data. A total of 25% of the collisions recorded at this particular junction involved a pedestrian.

6 Design Speed

Both the R446 and R357 at this location have a posted speed of 50kph given its location in the vicinity of an urban town centre, Ballinasloe. The results of the speed survey, described in Section 4, indicate that the 85th percentile speed on the approach to the junction on each arm is as follows: -

- R446 (East) – 61.65kph;
- R446 (West) – 64.98kph;
- R357 (South) – 48.51kph; and
- R357 (North) – 73.53kph.

Despite the high 85th percentile speed, a design speed of 50kph has been retained for the R446 and R357 due to the junction’s location close to Ballinasloe Town Centre, and the proximity of the junction to the Creagh National School, on the R357 (South), and the entrance to the Creagh Cemetery, on the R357 (North).

7 Options Considered

Four options for safety improvements at this junction were considered in the Feasibility Study. In brief, the options considered were as follows: -

- **Do Nothing** – retain the current layout and operation at the staggered crossroad junction;
- **Do-Minimum** – consisting of footpath improvements on all arms, amendments to kerblines, provision of refuge islands and uncontrolled crossings on both R357 arms, removal of redundant signals at junction, refreshing roadmarkings within the junction, amending priority and layout at the R446/R357 (North) junction and re-signalisation of existing, although currently unused, pedestrian crossing on R446;
- **Do Something – Partial Signalisation** – consisting of footpath improvements on all arms, amendments to kerblines, reducing traffic lane widths on the R446 by the provision of advisory cycle lanes, provision of a refuge island and uncontrolled pedestrian crossing within the R357 (South), removal of redundant signals at junction, re-signalisation of existing, although currently unused, pedestrian crossing on R446 and signalising the R446/R357 (North) arm of the staggered junction including signalised crossings on all arms; and
- **Do-Something – Full Signalisation** - consisting of footpath improvements on all arms, amendments to kerblines, reducing traffic lane widths on R446 by the provision of advisory cycle lanes and signalising the full staggered junction incorporating pedestrian crossings on all arms.

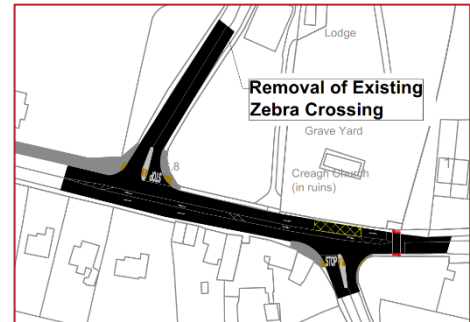


FIGURE 7-1: DO-MINIMUM OPTION

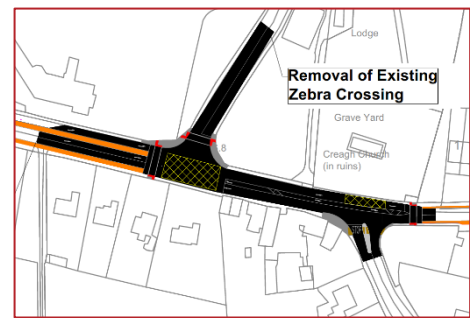


FIGURE 7-2: DO-SOMETHING - PARTIAL SIGNALISATION

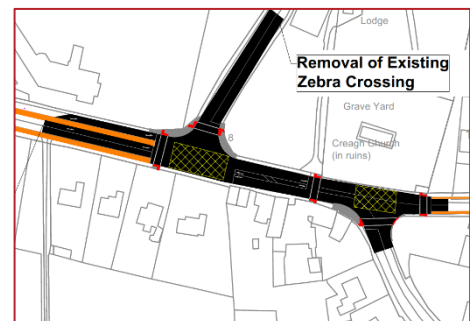


FIGURE 7-3: DO-SOMETHING - FULL SIGNALISATION

Following consultation with Galway County Council, the Do-Nothing and Do-Minimum Options were not considered viable in addressing all of the safety issues raised at the junction.

Both Do-Something Options were considered to be feasible options to improve the safety of the junction and to address the safety issues raised. These Options were however analysed further using traffic modelling software to assess the impacts their implementation would have on the operational performance of the junction.

7.1 Traffic Modelling of Do–Something Options

Junction Capacity Analysis, using the data recorded from the classified junction turning count survey, was undertaken at the junction to evaluate and compare the traffic impacts associated with each of the ‘Do–Something’ options. The capacity of the surveyed junction was assessed using the Transport Research Laboratory’s (TRL) computer programme Junctions 9 for the AM Peak Hour, PM Peak Hour and the Interpeak Period for the years 2020, 2025, 2035, and 2050.

While both models indicated that the junctions would experience congestion in future years (2035 and 2050), the Do–Something–Partial Signalisation option, would result in the junction performing within capacity for a longer period than fully signalising the junction, and would result in the junction continuing to operate within capacity outside of the Peak Hours beyond 2035. It would also result in significantly less queuing on the R357 (South) arm of the junction in all future years, which was a particular concern given the location of the Creagh National School and the increased traffic volumes on this arm at school drop-off and pick-up times.

Following this analysis, the ‘Do Something–Full Signalisation’ option was no longer considered a suitable option for improvement and was subsequently ruled out, leaving the signalisation of the western junction and improvements to the junction layout and Non-Motorised Road User facilities as the preferred design option.

The results of the junction capacity analysis are summarised in Appendix D.

8 Constraints

8.1 Creagh Cemetery

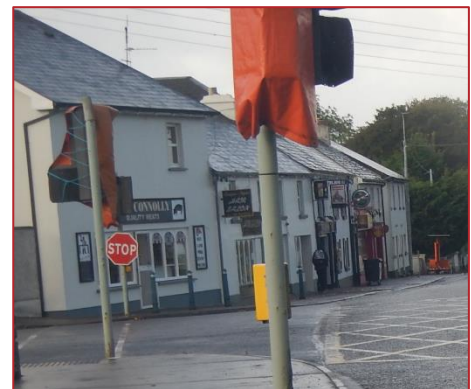
The entrance to the Creagh Cemetery is located on the R357 (North) approximately 100m from the junction with the R446. The southern boundary of the cemetery also borders the northern footpath on the R446, where the footpath narrows. It is not possible to claim land from the cemetery and, as a result, works to improve the Non-Motorised Road User facilities at this location, particularly the narrow footpath, must be within the existing carriageway footprint, without encroachment into the land to the north.



**FIGURE 8-1: CREAGH CEMETERY
BOUNDARY WITH R446**

8.2 Commercial Premises

There are a number of commercial premises within the south-western quadrant of the junction including a Butcher Shop, a Public House and a Fast Food Takeaway. While improvements to the footpath are proposed at this location it is not possible to amend the levels at the entrances to these premises. As a result, footpath improvements must not impact on the existing levels at the rear of this footpath.



**FIGURE 8-2: COMMERCIAL PREMISES
ADJACENT R446/R357 (SOUTH)
JUNCTION**

8.3 Our Lady of Lourdes Church

The Our Lady of Lourdes Church, and carpark, is located in the south-eastern quadrant of the junction with vehicular access to the carpark provided from the R446 and the R357 (South). It is not possible to encroach into these lands and so all proposed improvements must be within the footprint of the existing road layout.

It is proposed to provide an uncontrolled crossing inset into the R357 (South) close to the existing entrance to the carpark at this location. This proposed crossing, including appropriate tactile paving, will not negatively impact on the existing uncontrolled crossing of the carpark access, including the associated tactile paving, nor on the vehicular access to the rear of the commercial premises at this location.



FIGURE 8-3: OUR LADY OF LOURDES CHURCH ADJACENT R446/R357 (SOUTH) JUNCTION

9 Pavement

The carriageway is to be resurfaced within the full extents of the junction. This will require the milling out of the existing surface course and providing pavement inlay within the full extent of the junction, and on all of its approaches. High Friction Surfacing is also proposed on all approaches to signals at the junction.

10 Geometric Features

10.1 R446

The traffic lanes on the R446 are to be amended. The following lane widths will be provided to the east of the junction of the R446 and the R357 (South) and are indicated on Drawing P19-089-PSW1-P-DG-XS-001 in Appendix A: -

- A 1m wide advisory cycle lane on both sides of the carriageway; and
- A 3.3m wide through traffic lane in each direction.

The following lane widths will be provided to the west of the junction of the R446 and the R357 (North) and are indicated on Drawing P19-089-PSW1-P-DG-XS-001 in Appendix A: -

- A 1.5m wide advisory cycle lane on both sides of the carriageway;
- A 3.0m wide left turn lane for traffic turning into the R357 (North); and
- A 3.3m wide through traffic lane in each direction.

The following lane widths will be provided on the R446, between the R357 northern and southern arms and are indicated on Drawing P19-089-PSW1-P-DG-XS-003 in Appendix A: -

- A 3.0m wide right turn lane for traffic turning right into the R357 (North). The results of the traffic modelling indicated that a length of 50m would be required to accommodate the maximum future vehicle queue lengths and to prevent queued vehicles extending into the westbound traffic lane;
- A 3.0m wide ghost island right turn lane for traffic turning right into the R357 (South). A hatched area will be provided between the 50m long (minimum) westbound right-turn lane and the remaining available space between the R357 side roads will be afforded to the eastbound right-turn lane at the priority-controlled junction with the R357 (South); and
- A 3.3m wide through traffic lane in each direction.

10.2 R357

The traffic lanes on the R357 are also to be amended and are indicated on Drawing P19-089-PSW1-P-DG-XS-002 in Appendix A.

On the R357 (South) one 3.8m wide traffic lane will be provided in each direction with the carriageway widening at the junction with the R446, while on the R357 (North), one 3.5m wide traffic lane will be provided in each direction. The existing two-lane approach to the junction with the R446 is to be removed in favour of a single traffic lane on the approach to the proposed signals. Advisory cycle lanes, measuring 1.5m, will be provided on both sides of the R357 (North) between its junction with the R446 and just north of the entrance to the Creagh Cemetery.

The corner radii at the junctions of the R357 and the R446 are also to be amended to provide increased footpath width around the corner of the junction, but also to better define the junction layout. The Design Manual for Urban Roads and Streets (DMURS) was consulted when designing the revised junction radii. While a radius of 6m is preferred in DMURS, this radius would not allow for HGVs to safely turn at these junctions without encroaching onto the footpath or opposing traffic lane. Figure 4.4.3 of DMURS allows for up to 9m radii where larger vehicle turning movements is considered frequent. However, this relates to a typical junction arrangement where the junction is at 90 degrees. The angle of the side roads (R357) within the Scheme is not 90 degrees and so the corner radii have been designed as the minimum possible to allow for the safe swept path of turning HGVs.

As a result, a 10m junction radius will be provided in the north-western quadrant and a 15m junction radius in the north-eastern quadrant of the R357 (North)/R446 junction. At the R357 (South)/R446 junction, a 15m junction radius will be provided in the south-western quadrant and an 11m junction radius in the south-eastern quadrant.

These junction radii can accommodate the movement of HGVs at each junction, as demonstrated in the Swept Path Analysis drawings (P19-089-PSW1-P-DG-SP-001 – 003) in Appendix A.

11 Safety Barrier Risk Assessment

The design and posted speed of the R446 and R357 is 50kph and the site of the proposed safety improvement works is within an urban environment with footpaths on both sides of the carriageway and advisory cycle lanes proposed on the R446 and R357 (North). No hazards were identified within the extents of the proposed scheme that would require a vehicle restraint system. It is therefore not proposed to provide any vehicle restraint system as part of the proposed works. All signage provided within the Scheme will be located on passively safe support posts.

12 Drainage Requirements

The existing road drainage system is to be used. New gullies will be provided at the junction where kerb works are proposed, and to collect surface water flowing down the R446. This is likely to be particularly relevant to the south-western quadrant of the R446/R357 (South) junction where ponding was noted on site. All new gullies will be connected to existing manholes or tapped into existing carrier drains.

13 Traffic Signs and Road Marking Requirements

13.1 Traffic Signs

Although a 'Traffic Signals' warning sign (TSM reference W 042) is not required on roads with a speed limit less than 60kph, due to the high vehicle speeds recorded at this location in the ATC survey, Sign W 042 is proposed on the R446's westbound approach to the proposed signalised junction, on the eastbound approach to the proposed signalised pedestrian crossing, and on the R357 (North) southbound approach to the proposed signalised junction.

Currently, a Stop sign face is mounted to the redundant signal pole at the R446/R357 (South) junction. The signal poles at the junction will be removed and replaced with a Stop sign (TSM reference RUS 027) on a passively safe support post.

'Cyclists' warning signage (TSM reference W 143) will be provided on the R446 and R357 (North) at the start of the advisory cycle lane. Repeater signs will also be provided facing both directions downstream of the R357 junctions.

All existing signage within the scheme extents that are not associated with the R446/R357 junction will be retained. Damaged sign faces will be replaced and, where not already provided, passively safe sign supports will be provided and the existing non-frangible posts removed.

13.2 Road Markings

Road markings have been designed in accordance with the Traffic Signs Manual, published in 2019 by the Department of Transport, Tourism and Sport, and includes the following key proposals:

- 1) The R357 (South) will have a Stop line (RRM 017), Stop text road markings (M 114) and centreline (RRM 001) as far as the scheme extents.
- 2) All Stop lines associated with signalised junctions (RRM 017) and signalised pedestrian crossings (M 131) will be provided on the R446, at the signalised pedestrian crossing and at the proposed signalised junction with the R357 (North), and on the R357 (North) at the proposed signalised junction.
- 3) Parking Restriction Markings (RRM 008), double yellow lines, will be provided on the R446 and R357 on the approaches to the junctions within the extents of the Scheme.
- 4) A white line (RRM 022) will be provided between the advisory cycle lanes and the adjacent traffic lanes on the R446 and R357 (North). A cycle symbol road marking (M 116) will be provided in the advisory cycle lanes, at its commencement and at intervals of 100m where necessary.
- 5) 2No left turn arrows (RRM 005) will be provided within the left-turn lane on the R446 at its junction with the R357 (North). These will be supplemented by straight-ahead arrows (RRM 004) in the adjacent through traffic lane at the same location. Similarly, 2No right turn arrows (RRM 006) will be provided in the right turn lane on the R446 at its junction with the R357 (North) and 1No right turn lane will be provided in the ghost island right turn lane on the R446 at its junction with the R357 (South). These will also be supplemented by straight-ahead (RRM 004) arrows in the adjacent through traffic lane at the same location.
- 6) Two yellow box markings (RRM 020) will be provided, one within the proposed R446/R357 (North) signalised junction and one in the R446 eastbound traffic lane opposite the R446/R357 (South) priority-controlled junction.
- 7) Diagonal hatch road markings (RRM 021) will be provided between the back-to-back right turn lanes on the R446 between its junctions with the R357 and between the ghost island right turn lane at the R446/R357 (South) junction and the stop line at the signalised pedestrian crossing.
- 8) Road studs will not be required as the junction is lit.

14 Junction Treatment

14.1 R446/R357 (North) Junction

The current priority-controlled junction of the R446 and the R357 (North) will be replaced with a MOVA-controlled signalised junction with pedestrian crossings on all arms of the junction. Two traffic lanes will be provided on both R446 approaches, a through traffic lane and a dedicated turning lane, right on the westbound approach and left on the eastbound approach, for drivers entering the R357 (North).

The proposed eastbound left turn lane at the signalised junction will replace the existing left turn lane at the current priority junction and the Yield control at this location removed and the left turn lane incorporated into the signalised junction.

The necessary feeder pillar and communication chambers will be provided within a footpath adjacent the junction where they will be located so as not to obstruct Non-Motorised Road Users or restrict the tactile paving provision at pedestrian crossings.

The proposed signal phases are indicated in Figure 14-1 below.

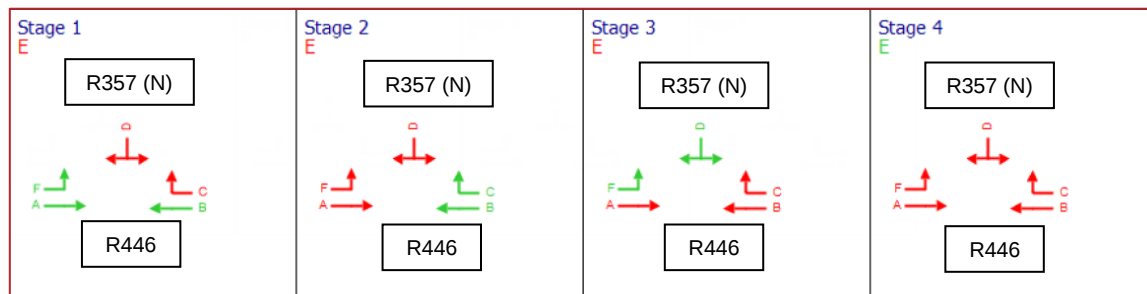


FIGURE 14-1: PROPOSED SIGNAL PHASING

As shown in Figure 14-1, the signalised junction will operate on a 4-stage cycle which will last a total of 120 seconds. The length of each Stage will differ throughout the day depending on the traffic demand at the time. The proposed timings for the AM and PM Peak Hours for the year 2020 are indicated in Table 14-1 and Table 14-2 respectively to demonstrate the varying phase timings. The 9 seconds provided for the pedestrian phase is considered sufficient time for an average pedestrian to cross the carriageway. These phase timings will be refined at the Detail Design stage to provide the optimum timings for each phase.

TABLE 14-1: SIGNAL PHASING TIMES FOR THE PROPOSED SIGNALISED JUNCTION DURING THE AM PEAK (2020)

Stage	Phases in this Stage	Stage Start (s)	Stage End (s)	Inter-Green (s)	Stage Duration minus Inter-Green (s)
1	A, B, F	0	37	5	37
2	B, C	42	69	5	27
3	F, D	74	101	5	27
4	E (Pedestrian)	106	115	5	9

TABLE 14-2: SIGNAL PHASING TIMES FOR THE PROPOSED SIGNALISED JUNCTION DURING THE PM PEAK (2020)

Stage	Phases in this Stage	Stage Start (s)	Stage End (s)	Inter-Green (s)	Stage Duration minus Inter-Green (s)
1	A, B, F	0	41	5	41
2	B, C	46	62	5	16
3	F, D	67	101	5	34
4	E (Pedestrian)	106	115	5	9

14.2 R446/R357 (South) Junction

The R446/R357 (South) junction will be retained as a priority-controlled junction under Stop control. The redundant signals will however be removed and the road markings on the R446 approaching the junction refreshed to formalise, and better define, the junction's form and control. A ghost island right turn lane will be provided on the R446 for drivers turning right into the R357 (South).

15 Utilities

MOVA-controlled signals require ducting for 90m upstream of the stop line on all arms of the junction where the first set of upstream detection loops are to be provided on the carriageway. The appropriate ducting, and chambers, for a MOVA-controlled signalised junction will be provided on all arms of the signalised junction.

16 Requirement for Non-Motorised Road Users

The safety of Non-Motorised Road Users within the junction will be improved through the following measures:

- The remainder of the carriageway cross-section on the R446 (not provided to motorised vehicles or cyclists), to the east and west of, and within, the junction will be combined with the existing footpath and a new wider footpath provided;
- Footpaths at the corner radii of junctions will also be widened through amendments to the existing junction radii;
- The existing zebra crossing on the R357 (North) will be removed and a new crossing of the R357 (North) incorporated into the proposed signalised junction;
- The existing signalised pedestrian crossing on the R446 to the west of the R446/R357 (North) junction will be removed and a new crossing of the R446 incorporated into the signalised junction;
- The existing signalised pedestrian crossing of the R446 to the east of its junction with the R357 (South) will be upgraded to an on-demand pedestrian crossing;
- The existing signalised crossing on the R357 (South) at the Creagh National School, approximately 135m from the R446, will be retained;
- An uncontrolled pedestrian crossing will be provided on the R357 (South) which will be inset into the side road to reduce the length of carriageway to be crossed and thus a Non-Motorised Road User's exposure to vehicular traffic. This crossing will not negatively impact on either the vehicular access on the western side of the R357 (South) at this location or the carpark access, and uncontrolled crossing, on the eastern side of the R357 (South); and
- Advisory cycle lanes will be provided on both sides of the R446 carriageway, measuring 1.5m to the west of the R446/R357 (North) junction and 1m to the east of the R446/R357 (South) junction.
- Advisory cycle lanes will be provided on both sides of the R357 (North) carriageway, measuring 1.5m, between its junction with the R446 and just north of the entrance to the Creagh Cemetery.

All pedestrian crossings, controlled and uncontrolled, will include dropped kerbs and the appropriate tactile paving necessary for the type of crossing. The existing tactile paving at current pedestrian crossings will be removed/upgraded as necessary and the footpath on all approaches to, and within the junction, for a minimum distance of 100m, will be improved.

The inclusion of a refuge island within the R357 (South) carriageway at its junction with the R446, and the provision of an uncontrolled crossing closer to the junction mouth, and thus closer to the pedestrian desire line, was investigated, however the proposed refuge island was determined to impede on the swept path of HGVs entering, and exiting, the R357 (South).

17 On-Street Parking

There is an existing unofficial area within the footpath outside the commercial premises on the R446 within the south-western quadrant of the R446/R357 (South) junction, where vehicles park when visiting the commercial premises. Existing bollards delineate this parking area from a section of footpath which is for Non-Motorised Road Users only. It is proposed to retain this area for parking and to retain the delineation between this area and the Non-Motorised Road User route at the rear of the footpath. A dropped kerb (25mm high) will be provided at the edge of the carriageway throughout the length of this parking area to permit vehicular entry and exit when parking.



FIGURE 17-1: UNOFFICIAL PARKING AREA ON THE R446 TO BE RETAINED

On-street parking elsewhere within the extents of the Scheme will be prohibited with road markings provided to advise of the restrictions.

18 Public Lighting

The existing public lighting provision is to be retained within the extents of the Scheme.

19 Relaxations and Departures Proposed

No Relaxations or Departures from Standard are proposed as part of this scheme.

20 Economics

20.1 Scheme Costs

Table 20-1 below summarises the cost of the proposed scheme.

TABLE 20-1 - SUMMARY OF COSTS FOR THE PROPOSED SCHEME

Item	Costs Estimates
Preliminaries/Contingencies etc.	€ 73,000
Site Clearance	€ 14,000
Traffic Signs & Roadmarkings	€ 12,000
Electrical Work (Ducting, Comms, Feeder Pillars etc.)	€ 18,000
Pavement (including High Friction Surfacing)	€ 252,000
Kerbs, Footways and Paved Areas	€ 60,000
Drainage	€ 9,000
Traffic Signals (including pedestrian crossings)	€ 45,000
Pelican Crossing	€ 20,000
Stage 1 & 2 and Stage 3 Road Safety Audits	€ 5,000
Design Costs	€ 50,000
Sub-Total	€ 558,000
VAT	€ 81,000
Total (including VAT)	€ 639,000

Appendix E contains a detailed breakdown of the line items indicated in Table 20-1.

20.2 First Year Rate of Return

A First Year Rate of Return (FYRR) has been calculated for the proposed Scheme. The parameters used to calculate the FYRR were: -

- Collision Modification Factors (CMF) are based on solutions that predominantly reduce the severity or likelihood of a collision. The CMF values used have been determined from the PRACT repository, the CMF Clearing House or Austroads;
- The collision rate is the number of injury collisions divided by the period of assessment;
- The collision cost is the average cost of a Fatality, Serious Injury and Minor Injury taken from the TII standard PE-PAG-02030-01; and
- The costs of construction for each Option have been estimated using the NRA Schedule of Rates Version 2019.

The FYRR is calculated as:

$$\frac{(1-\text{CMF}) \times \text{Historical Collision Rate} \times \text{Average Collision Cost} \times 100}{\text{Option Cost}}$$

Table 20-2 and Table 20-3 indicate the CMFs used in calculating the FYRR and the parameters for the FYRR calculation respectively.

TABLE 20-2: COLLISION MODIFICATION FACTORS FOR THE PROPOSED SCHEME

	Proposed Alteration	CMF	CMF Reference	Combined CMF
Proposed Scheme	Install Traffic Signals	0.85	CMF Clearing House	0.69
	Provide Improved VRU Facilities	0.81	CMF Clearing House	

TABLE 20-3: FYRR PARAMETERS AND RESULT

	Estimated Collision Savings	Collision Rate (collisions/year)	Collision Cost (€)	Scheme Cost (€)	FYRR (%)
Proposed Scheme	0.31	2.33	€160,674.45	€639,000	18.28%

21 Road Safety Audit

A Stage 1 & 2 Road Safety Audit will be undertaken upon completion of the detailed design.

22 Drawings

Refer to Appendix A.

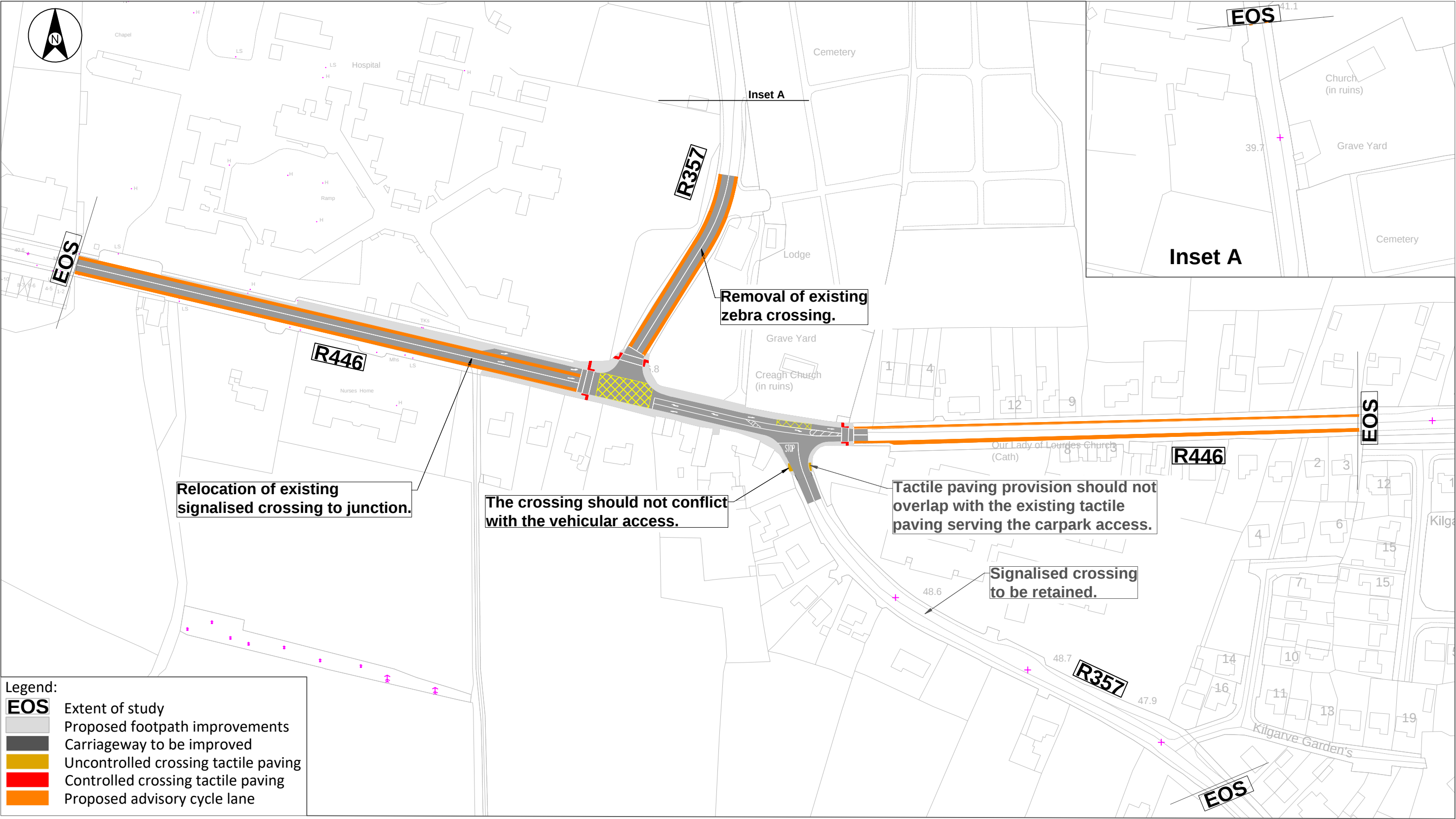
23 Photographs

Refer to Appendix C.

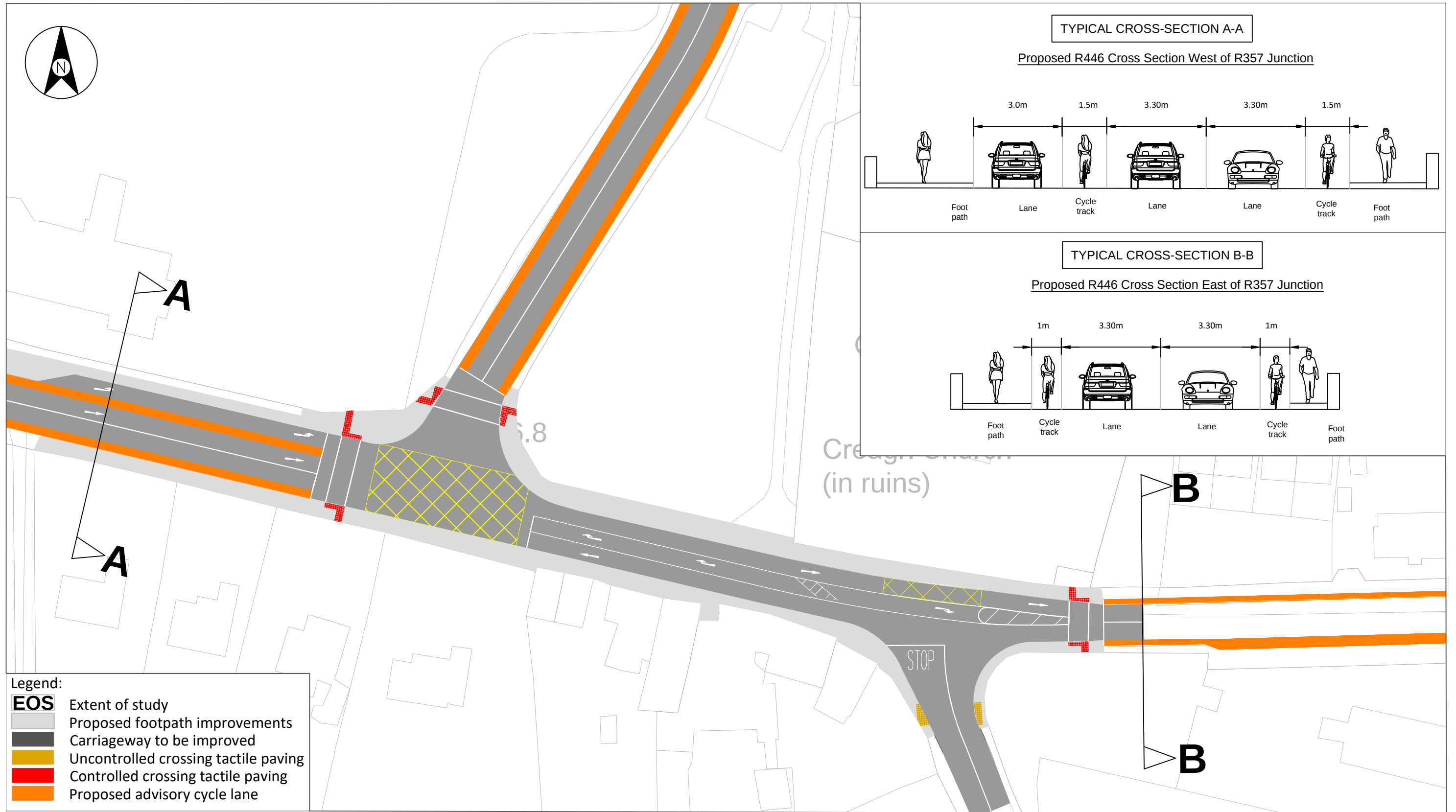
Appendix A – Drawings



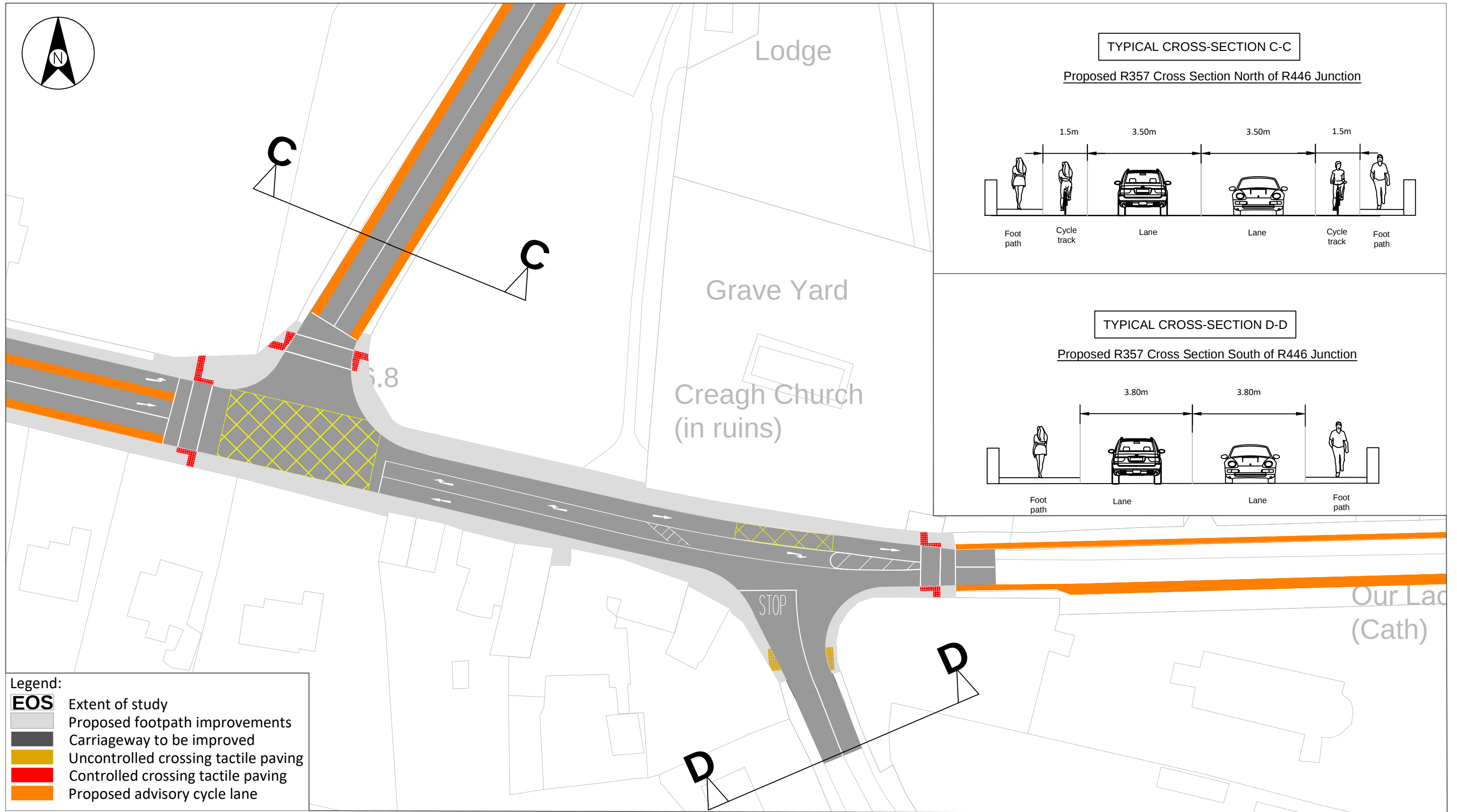
PMCE PMCE Ltd. Mona Villa Lower Commons Road Brownsbarn Dublin 22 Tel: + 353 (1) 464 3041 Fax: + 353 (1) 459 1836 Email: info@pmce.ie Web: www.PMCE.ie	Client:				Notes: 1 Do Not Scale - use figured dimensions only. 2. Drawing is the property of PMCE Ltd.	Project: R357/R446 Creagh Ballinasloe Town	Drawn: AP	Date: 01/07/2020			
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		2.0	Revised Draft	04/06/20		Drawing No: P19-089-PSW1-P-DG-LP-001					
		1.0	Draft	01/04/20							



PMCE PMCE Ltd. Mona Villa Lower Commons Road Brownsbarn Dublin 22 Tel: + 353 (1) 464 3041 Fax: + 353 (1) 459 1836 Email: info@pmce.ie Web: www.PMCE.ie	Client:			Notes: 1 Do Not Scale - use figured dimensions only. 2. Drawing is the property of PMCE Ltd.	Project: R357/R446 Creagh Ballinasloe Town	Drawn: AP	Date: 01/07/2020	
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		2.0	Revised Draft	04/06/20				
		1.0	Draft	01/04/20				
		Rev.	Comment	Date				



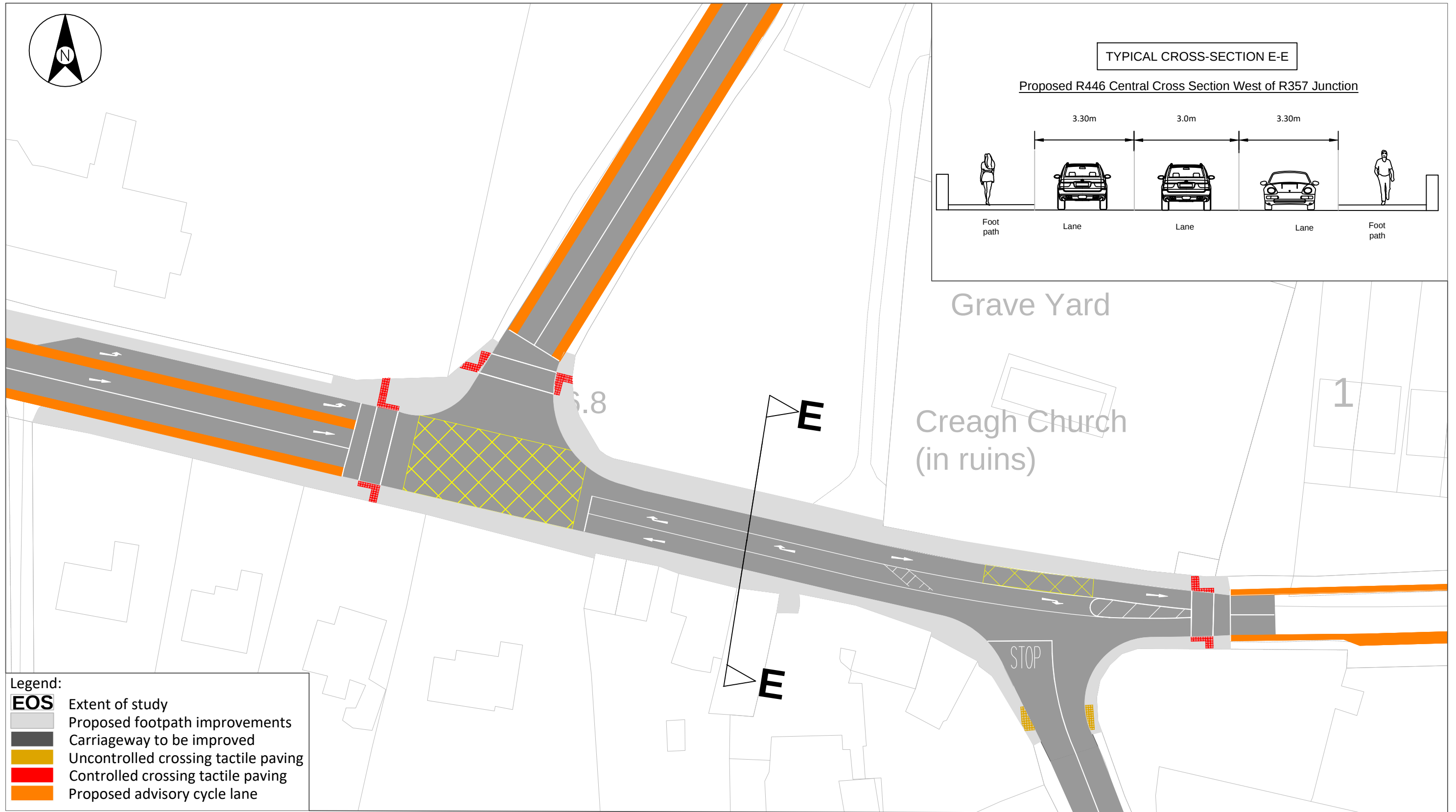
PMCE PMCE Ltd. Mona Villa Lower Commons Road Brownsbarn Dublin 22 Tel: + 353 (1) 464 3041 Fax: + 353 (1) 459 1836 Email: info@pmce.ie Web: www.PMCE.ie	Client:			Notes: 1 Do Not Scale - use figured dimensions only. 2. Drawing is the property of PMCE Ltd.	Project: R357/R446 Creagh Ballinasloe Town	Drawn: AP	Date: 01/07/2020		
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		1.0	Draft			01/04/20	Drawing No: P19-089-PSW1-P-DG-XS-001		
		Rev.	Comment			Date			



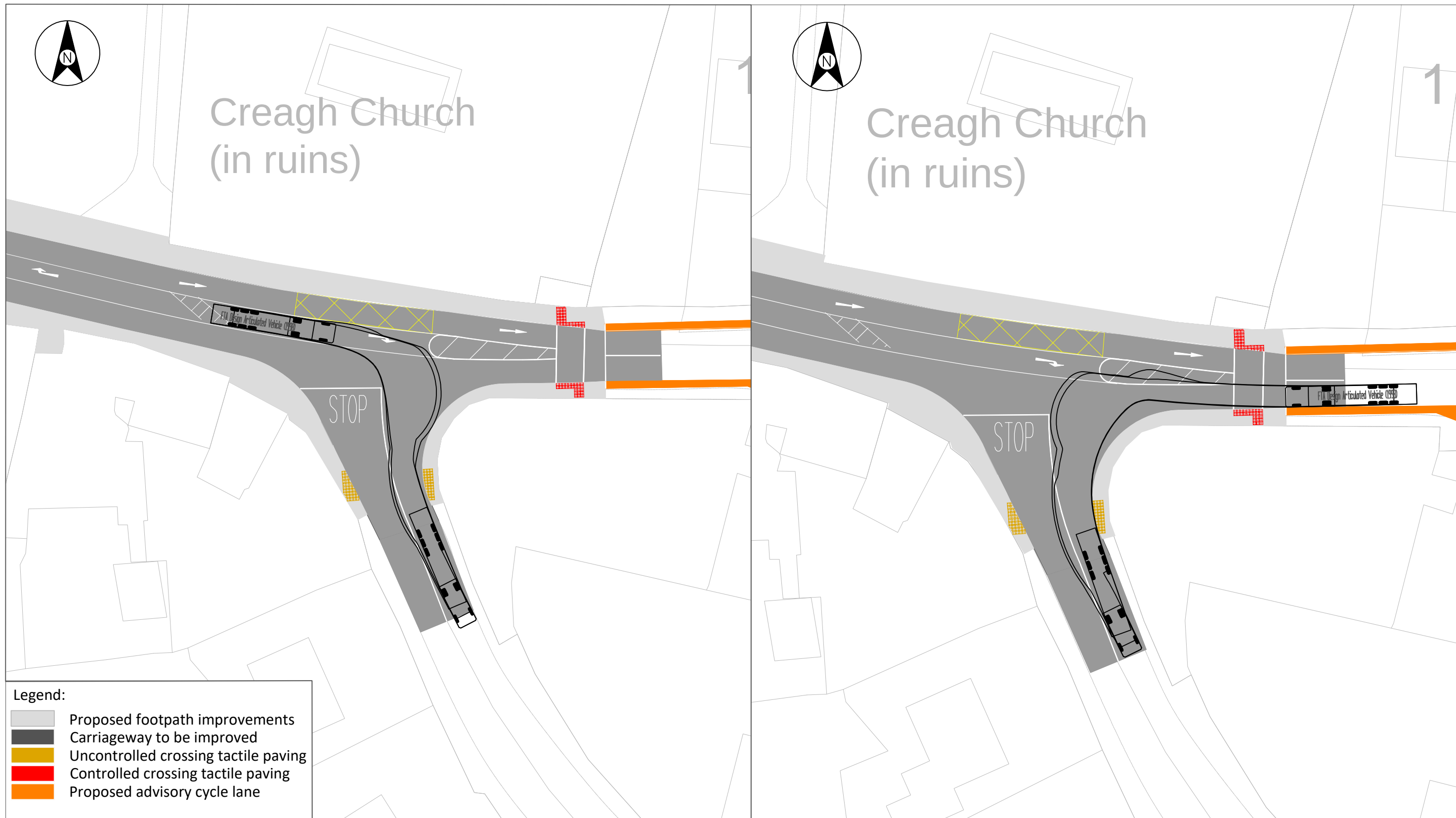
Legend:

- EOS** Extent of study
- Proposed footpath improvements
- Carriageway to be improved
- Uncontrolled crossing tactile paving
- Controlled crossing tactile paving
- Proposed advisory cycle lane

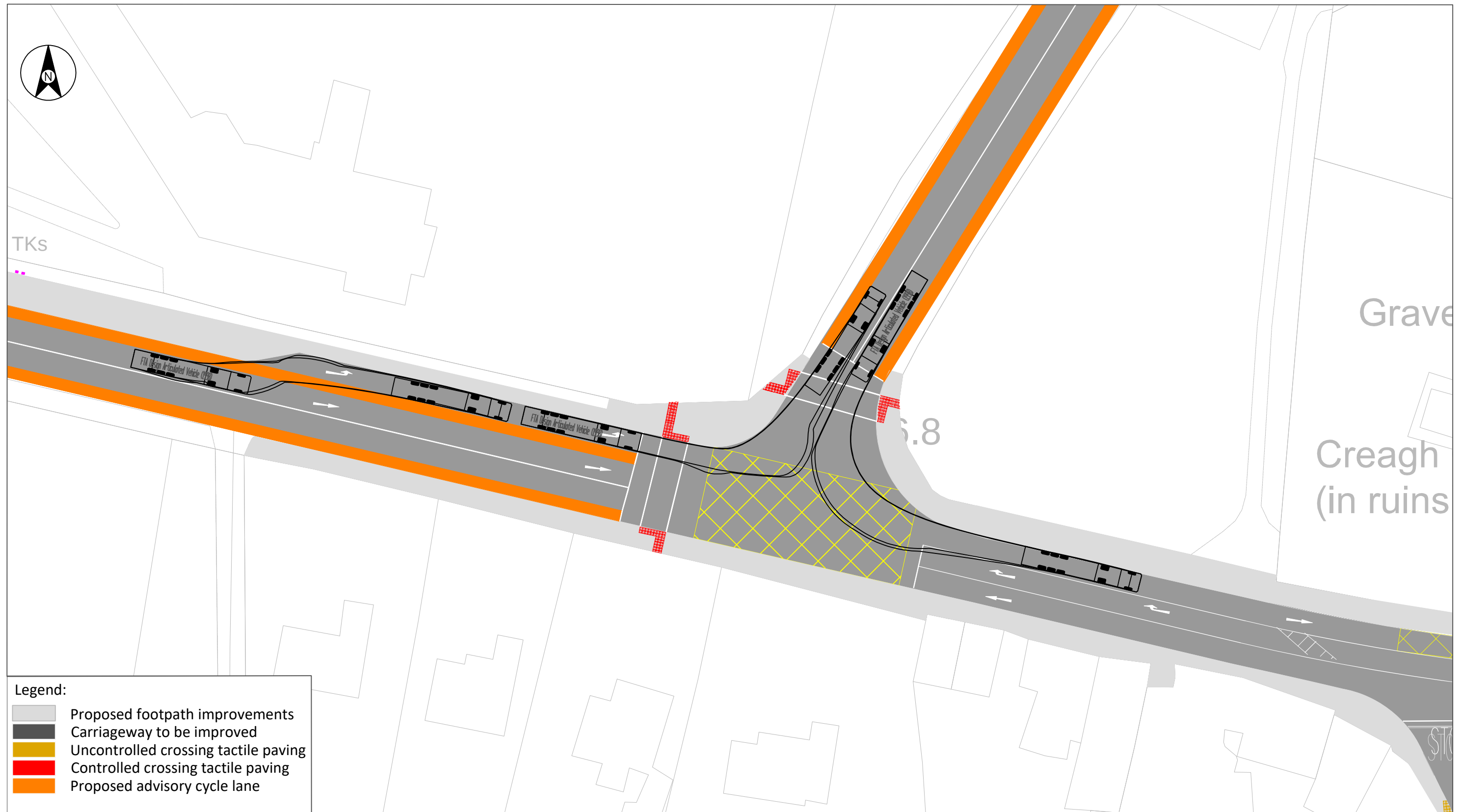
P▲M▲C▲E PMCE Ltd. Mona Villa Lower Commons Road Brownsbarn Dublin 22 Tel: + 353 (1) 464 3041 Fax: + 353 (1) 459 1836 Email: info@pmce.ie Web: www.PMCE.ie	Client:				Notes: 1. Do Not Scale - use figured dimensions only. 2. Drawing is the property of PMCE Ltd.	Project: R357/R446 Creagh Ballinasloe Town	Drawn: AP	Date: 01/07/2020		
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		Rev.	Comment	Date						

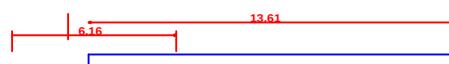


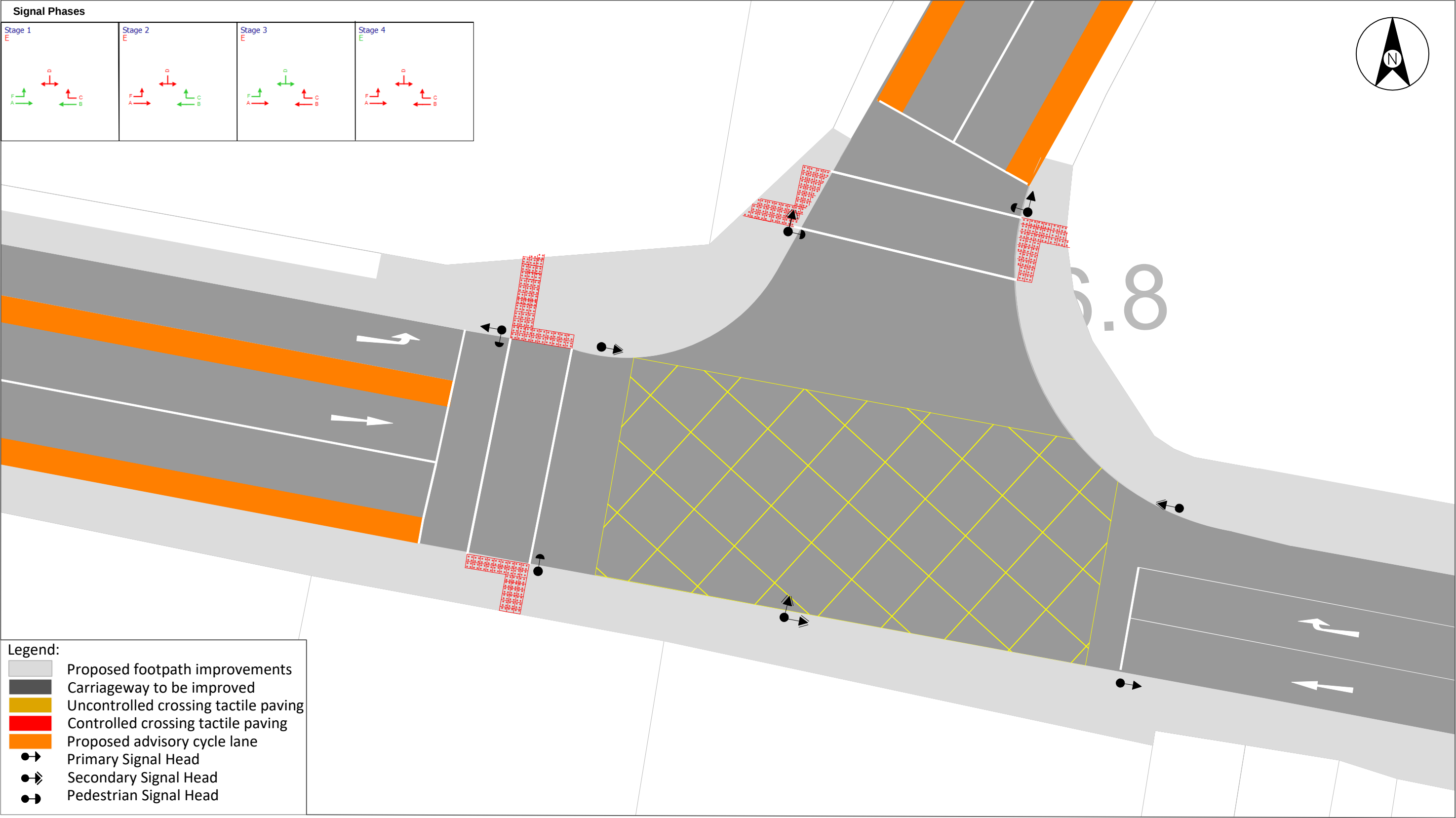
PMCE PMCE Ltd. Mona Villa Lower Commons Road Brownsbarn Dublin 22 Tel: + 353 (1) 464 3041 Fax: + 353 (1) 459 1836 Email: info@pmce.ie Web: www.PMCE.ie	Client:				Notes: 1. Do Not Scale - use figured dimensions only. 2. Drawing is the property of PMCE Ltd.	Project: R357/R446 Creagh Ballinasloe Town	Drawn: AP	Date: 01/07/2020	
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		2.0	Revised Draft	04/06/20					
		1.0	Draft	01/04/20					
		Rev.	Comment	Date					



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		3.0	Final	01/07/20			Drawing Title: Swept Path Analysis Arrivals R357 South	Approved: PJM	Status: FINAL	Revision: 3.0
		2.0	Revised Draft	04/06/20				Drawing No: P19-089-PSW1-P-DG-SP-002		
		1.0	Draft	01/04/20						
	Rev.		Comment	Date						



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		2.0	Revised Draft	04/06/20				Drawing No: P19-089-PSW1-P-DG-SP-003		
		1.0	Draft	01/04/20						
	Rev.	Comment	Date							



PMCE PMCE Ltd. Mona Villa Lower Commons Road Brownsbarn Dublin 22 Tel: + 353 (1) 464 3041 Fax: + 353 (1) 459 1836 Email: info@pmce.ie Web: www.PMCE.ie	Client:				Notes: 1 Do Not Scale - use figured dimensions only. 2. Drawing is the property of PMCE Ltd.	Project: R357/R446 Creagh Ballinasloe Town	Drawn: AP	Date: 01/07/2020	
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		2.0	Revised Draft	04/06/20					
		1.0	Draft	01/04/20					
		Rev.	Comment	Date					

Appendix B – Summary of Historical Collisions

Reference No.	Severity	Year	Vehicle	Circumstances	Day of Week	Time	No. of Casualties
1	Minor Injury	2005	Car	Rear end, Left turn	Wednesday	10:00-16:00	2
2	Minor Injury	2006	Car	Rear end, Right turn	Thursday	07:00-10:00	1
3	Minor Injury	2006	Car	Head-on	Wednesday	19:00-23:00	4
4	Minor Injury	2006	Car	Single vehicle	Sunday	10:00-16:00	2
5*	Minor Injury	2006	Car	Pedestrian	Wednesday	10:00-16:00	2
6*	Minor Injury	2006	Car	Rear end, straight	Monday	10:00-16:00	2
7*	Minor Injury	2006	Car	Rear end, straight	Thursday	10:00-16:00	2
8	Minor Injury	2006	Car	Pedestrian	Thursday	10:00-16:00	2
9*	Minor Injury	2007	Car	Rear end, straight	Saturday	10:00-16:00	2
10	Minor Injury	2007	Car	Head-on	Thursday	16:00-19:00	3
11	Minor Injury	2007	Car	Rear end, straight	Monday	19:00-23:00	4
12	Minor Injury	2008	Car	Rear end, straight	Saturday	10:00-16:00	2
13*	Minor Injury	2008	Car	Rear end, straight	Wednesday	07:00-10:00	1
14*	Minor Injury	2008	Car	Rear end, straight	Friday	23:00-03:00	5
15*	Minor Injury	2008	Car	Pedestrian	Wednesday	10:00-16:00	2

Reference No.	Severity	Year	Vehicle	Circumstances	Day of Week	Time	No. of Casualties
16	Minor Injury	2008	Car	Angle, both straight	Sunday	19:00-23:00	4
17	Fatal	2008	Undefined	Pedestrian	Wednesday	10:00-16:00	2
18*	Serious Injury	2009	Undefined	Pedestrian	Saturday	19:00-23:00	4
19	Minor Injury	2009	Car	Rear end, straight	Friday	10:00-16:00	2
20	Minor Injury	2009	Motorcycle	Single vehicle	Wednesday	07:00-10:00	1
21*	Serious Injury	2011	Car	Rear end, straight	Sunday	10:00-16:00	2
22	Minor Injury	2012	Goods Vehicle	Pedestrian	Thursday	16:00-19:00	3
23*	Minor Injury	2013	Car	Angle, right turn	Thursday	07:00-10:00	1
24	Minor Injury	2013	Car	Rear end, straight	Friday	16:00-19:00	3
25	Serious Injury	2015	Car	Head-on	Friday	19:00-23:00	4
26*	Minor Injury	2016	Car	Angle, right turn	Friday	10:00-16:00	2
27*	Minor Injury	2016	Bicycle	Other	Friday	10:00-16:00	2
28	Minor Injury	2016	Car	Single vehicle	Thursday	07:00-10:00	1

*the collisions highlighted in the table above indicate those that occurred at, or on the approaches to the R446/R357 (North) junction

Appendix C – Photographs



Figure C1: R446 Regional Road facing West on Eastern side of R357 (South) Junction



Figure C2: R357 (South) Regional Road facing North towards R446



Figure C3: R446 Regional Road facing East on Western side of R357 (North) Junction



Figure C4: R357 (North) Regional Road facing South away from the R446



Figure C5: R446/R357 (South) Junction (Eastbound Approach)



Figure C6: R446/R357 (South) Junction (Westbound Approach)



Figure C7: R446/R357 (South) Junction (R357 Approach)



Figure C8: R446/R357 (North) Junction (Eastbound Approach)



Figure C9: R446/R357 (North) Junction (Westbound Approach)



Figure C10: R446/R357 (North) Junction (R357 Approach)

Appendix D – Summary of Traffic Modelling Results

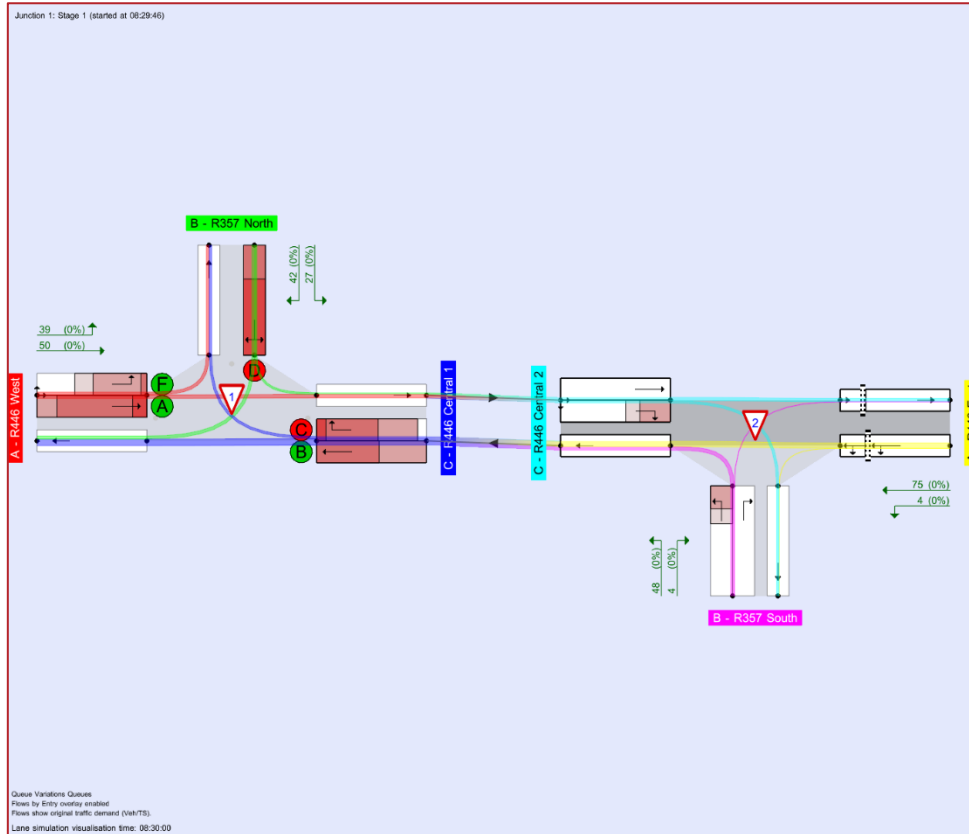


Figure D1: Do-Something – Partial Signalisation Schematic Diagram

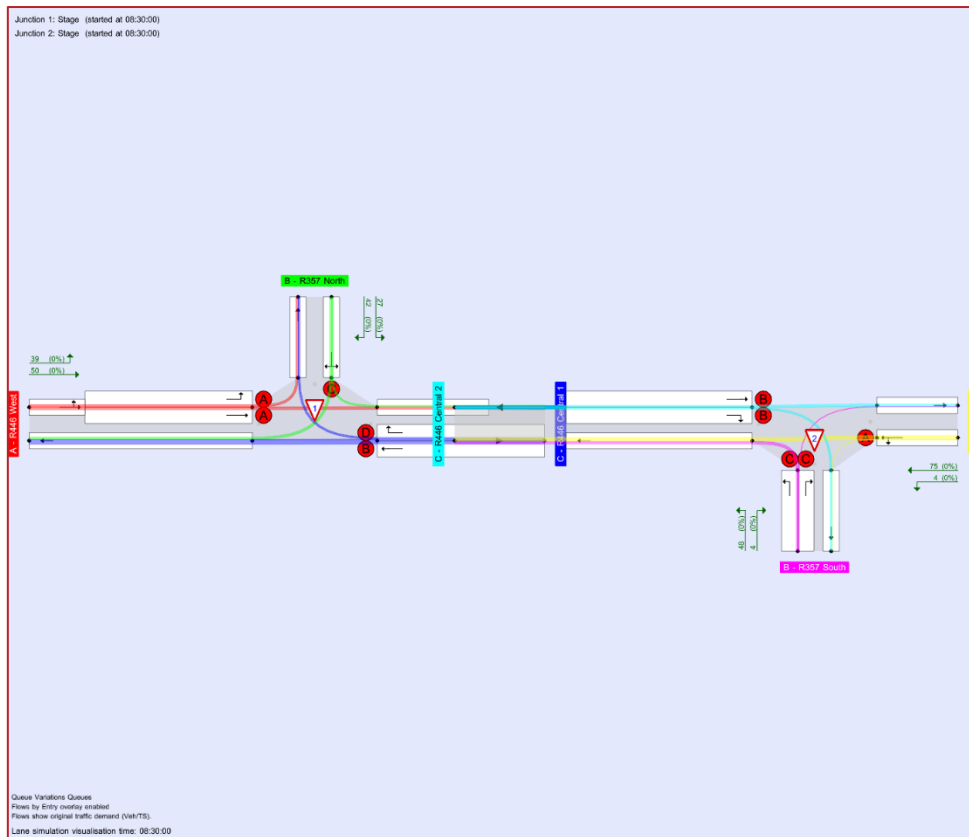


Figure D2: Do-Something – Full Signalisation Schematic Diagram

Do-Something – Partial Signalisation

TABLE D1: 2020 AM PEAK

	AM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	9.5	31.11		C
1 - R357 North	6.9	41.84		D
1 - R446 East	5.9	18.79		B
2 - R446 East	0.0	0.14		A
2 - R357 South	1.7	13.38		B
2 - R446 West	0.8	5.95		A

TABLE D2: 2020 PM PEAK

	PM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	1.1	9.10		A
1 - R357 North	8.4	38.56		D
1 - R446 East	5.6	20.69		C
2 - R446 East	0.0	0.06		A
2 - R357 South	0.6	8.94		A
2 - R446 West	0.2	2.89		A

TABLE D3: 2020 INTER-PEAK

	IP			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	9.9	34.15		C
1 - R357 North	6.3	40.69		D
1 - R446 East	4.6	17.84		B
2 - R446 East	0.0	0.07		A
2 - R357 South	0.3	7.05		A
2 - R446 West	0.8	4.12		A

Do-Something – Full Signalisation

TABLE D4: 2020 AM PEAK

	AM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	11.5	39.22		D
1 - R357 North	6.8	40.89		D
1 - R446 East	6.6	21.95		C
2 - R446 East	9.1	31.87		C
2 - R357 South	8.4	42.29		D
2 - R446 West	3.2	12.51		B

TABLE D5: 2020 PM PEAK

	PM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	12.7	33.97		C
1 - R357 North	8.1	36.05		D
1 - R446 East	8.3	31.57		C
2 - R446 East	6.1	20.89		C
2 - R357 South	5.2	31.72		C
2 - R446 West	5.1	15.83		B

TABLE D6: 2020 INTER-PEAK

	IP			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	13.8	40.01		D
1 - R357 North	5.8	40.38		D
1 - R446 East	5.4	19.60		B
2 - R446 East	5.8	28.63		C
2 - R357 South	3.9	36.84		D
2 - R446 West	4.0	12.81		B

Do-Something – Partial Signalisation

TABLE D7: 2025 AM PEAK

	AM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	6.4	25.63		C
1 - R357 North	5.7	39.37		D
1 - R446 East	6.9	20.43		C
2 - R446 East	0.5	1.42		A
2 - R357 South	4.1	29.81		D
2 - R446 West	0.4	5.00		A

TABLE D8: 2025 PM PEAK

	PM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	16.4	46.02		D
1 - R357 North	10.4	42.18		D
1 - R446 East	6.4	20.60		C
2 - R446 East	0.1	0.67		A
2 - R357 South	2.9	24.67		C
2 - R446 West	1.5	8.68		A

TABLE D9: 2025 INTER-PEAK

	IP			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	11.2	38.49		D
1 - R357 North	7.5	42.90		D
1 - R446 East	4.5	17.50		B
2 - R446 East	0.0	0.07		A
2 - R357 South	0.4	7.64		A
2 - R446 West	0.6	4.34		A

Do-Something – Full Signalisation

TABLE D10: 2025 AM PEAK

	AM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	9.8	35.46		D
1 - R357 North	8.7	44.57		D
1 - R446 East	8.3	22.01		C
2 - R446 East	11.3	34.24		C
2 - R357 South	11.6	48.21		D
2 - R446 West	3.4	13.43		B

TABLE D11: 2025 PM PEAK

	PM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	17.0	46.76		D
1 - R357 North	9.7	40.35		D
1 - R446 East	9.8	36.59		D
2 - R446 East	6.9	21.61		C
2 - R357 South	6.0	32.28		C
2 - R446 West	6.0	15.56		B

TABLE D12: 2025 INTER-PEAK

	IP			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	15.4	44.70		D
1 - R357 North	7.3	41.72		D
1 - R446 East	6.0	19.57		B
2 - R446 East	7.3	29.30		C
2 - R357 South	4.0	37.04		D
2 - R446 West	3.8	12.55		B

Do-Something – Partial Signalisation

TABLE D13: 2035 AM PEAK

	AM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	14.0	48.46		D
1 - R357 North	10.3	51.92		D
1 - R446 East	7.2	18.61		B
2 - R446 East	0.4	1.12		A
2 - R357 South	7.9	48.23		E
2 - R446 West	1.8	8.53		A

TABLE D14: 2035 PM PEAK

	PM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	12.3	34.94		C
1 - R357 North	8.1	37.88		D
1 - R446 East	8.0	24.67		C
2 - R446 East	0.4	2.39		A
2 - R357 South	1.9	22.50		C
2 - R446 West	0.9	4.71		A

TABLE D15: 2035 INTER-PEAK

	IP			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	18.3	57.22		E
1 - R357 North	9.3	48.61		D
1 - R446 East	5.7	17.91		B
2 - R446 East	0.0	0.17		A
2 - R357 South	0.7	9.00		A
2 - R446 West	0.8	4.89		A

Do-Something – Full Signalisation

TABLE D16: 2035 AM PEAK

	AM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	13.1	40.61		D
1 - R357 North	7.3	42.59		D
1 - R446 East	9.1	22.29		C
2 - R446 East	14.7	47.04		D
2 - R357 South	15.1	60.79		E
2 - R446 West	4.3	15.15		B

TABLE D17: 2035 PM PEAK

	PM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	22.0	57.94		E
1 - R357 North	13.0	49.26		D
1 - R446 East	13.1	44.21		D
2 - R446 East	8.8	28.63		C
2 - R357 South	7.3	36.86		D
2 - R446 West	7.8	19.85		B

TABLE D18: 2035 INTER-PEAK

	IP			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	23.4	67.74		E
1 - R357 North	8.8	45.50		D
1 - R446 East	6.4	20.02		C
2 - R446 East	8.3	30.70		C
2 - R357 South	4.9	37.08		D
2 - R446 West	4.9	16.02		B

Do-Something – Partial Signalisation

TABLE D19: 2050 AM PEAK

	AM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	43.5	147.84		F
1 - R357 North	16.9	89.84		F
1 - R446 East	7.6	18.51		B
2 - R446 East	0.5	2.18		A
2 - R357 South	37.3	169.04		F
2 - R446 West	2.5	11.42		B

TABLE D20: 2050 PM PEAK

	PM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	193.3	736.64		F
1 - R357 North	30.6	108.04		F
1 - R446 East	7.3	20.68		C
2 - R446 East	0.4	1.41		A
2 - R357 South	3.9	31.75		D
2 - R446 West	2.0	6.90		A

TABLE D21: 2050 INTER-PEAK

	IP			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	47.1	133.15		F
1 - R357 North	12.3	62.93		E
1 - R446 East	6.5	17.69		B
2 - R446 East	0.0	0.24		A
2 - R357 South	0.7	10.72		B
2 - R446 West	1.2	6.02		A

Do-Something – Full Signalisation

TABLE D22: 2050 AM PEAK

	AM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	48.8	160.17		F
1 - R357 North	15.1	74.28		E
1 - R446 East	11.1	22.98		C
2 - R446 East	31.9	96.64		F
2 - R357 South	26.7	99.38		F
2 - R446 West	5.1	14.95		B

TABLE D23: 2050 PM PEAK

	PM			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	78.6	234.00		F
1 - R357 North	25.7	88.77		F
1 - R446 East	16.0	58.60		E
2 - R446 East	20.1	104.56		F
2 - R357 South	12.8	112.33		F
2 - R446 West	8.6	19.61		B

TABLE D24: 2050 INTER-PEAK

	IP			
	Queue (Veh)	Delay (s)	RFC (DOS)	LOS
1 - R446 West	50.8	151.51		F
1 - R357 North	12.0	56.90		E
1 - R446 East	7.9	20.74		C
2 - R446 East	10.1	32.76		C
2 - R357 South	5.6	38.43		D
2 - R446 West	5.2	16.79		B

Appendix E – Detailed Economic Breakdown

Item	Cost Estimates
Preliminaries/Contingencies etc.	€ 73,000
Site Clearance	€ 14,000
Traffic Signs & Roadmarkings	€ 12,000
Electrical Work (Ducting, Comms, Feeder Pillars etc.)	€ 18,000
Pavement (including High Friction Surfacing)	€ 252,000
Kerbs, Footways and Paved Areas	€ 60,000
Drainage	€ 9,000
Traffic Signals (including pedestrian crossings)	€ 45,000
Pelican Crossing	€ 20,000
Road Safety Audits	€ 5,000
Design Costs	€ 50,000
VAT @ 23% (Design)	€ 13,000
VAT @ 13.5% (Construction)	€ 68,000
Total	€ 558,000
Total (incl. VAT)	€ 639,000

CC-RMP-00700 Pavements									
Sub-base, Granular Type B to Clause 804, 150mm thick in carriageway, hardshoulder and hardstrip			22.5		0	22.5	20	30	
Road base					0				
Pavement, Base, Close Graded Bitumen, 40mm thick in roadway	6.375				0	6.375	5.5	9	
Pavement, Base, AC 32 Dense base 40/60 recipe mix, 100mm thick in carriageway, hardshoulder and hardstrip	15.625				0	15.625	13.5	22	
Pavement, Base, AC 32 Dense base 70/100 recipe mix, 100mm thick in carriageway, hardshoulder and hardstrip	16				0	16	14	22	
Pavement, Base, AC 32 Dense base 70/100 recipe mix, 130mm thick in carriageway, hardshoulder and hardstrip	21				0	21	18	30	
Pavement, Base, AC 32 Dense base 70/100 recipe mix, 200mm thick in carriageway, hardshoulder and hardstrip	31.5				0	31.5	28	42	
Binder Course					0				
Pavement, Binder Course, AC 20 Dense bin 40/60 recipe mix, 55mm thick in carriageway, hardshoulder and hardstrip	9.125				0	9.125	7.5	14	
Pavement, Binder Course, AC 20 Dense bin 40/60 recipe mix, 80mm thick in carriageway, hardshoulder and hardstrip	13				0	13	11	19	
Pavement, Binder Course, AC 20 Dense bin 70/100 recipe, 60mm thick in carriageway, hardshoulder and hardstrip	13				0	13	11	19	
Pavement, Binder Course, AC 20 Dense bin 70/100 recipe, 110mm thick in carriageway, hardshoulder and hardstrip	17.75				0	17.75	15	26	
Surface Course					0				
Pavement, Surface Course, HRA 30/14 F surf 40/60, 45mm thick in carriageway, hardshoulder and hardstrip	42.5	4845			205912.5	42.5	40	50	
Pavement, Surface Course, SMA, 40mm thick in carriageway, hardshoulder and hard strip	10.125				0	10.125	8.5	15	
Regulating					0				
Regulating in accordance with Clause 907	81.25				0	81.25	75	100	
Tack Coat: to comply with B.S. 594987 in accordance with Clause 920	0.625				0	0.625	0.5	1	
Ans - skid surfacing	0				0				
Milling pavement not exceeding 50mm deep (including disposal/re-use of arisings)	27.5	1250			24375	27.5	25	35	
Milling pavement not exceeding 75mm deep (including disposal/re-use of arisings)	23.75	4845			11506.875	23.75	1.5	5	
Milling pavement not exceeding 100mm deep (including disposal/re-use of arisings)	3				0	3	2	6	
30% increase in pavement works when undertaken at night	4				0	4	3	7	
	75538.3125				0	75538			
CC-RMP-01100 Kerbs, Footways and Paved Areas									
Footways, Concrete, 100mm thick to clause 1106 on 100mm subbase to clause in accordance with RCD/1100/5	26	1745			45370	26	23	35	
Precast Flat Kerb 200mm x 500mm, curved not exceeding 12m radius	19.25				19.25	17	27	26	
Precast Concrete Kerb, Type C, straight or curved exceeding 12m radius in accordance with RCD/1100/1	22.5	315			7087.5	22.5	20	30	
In-Situ Concrete Drop Kerb Grade C40, unreinforced kerb 6 mm upstand; straight or curved exceeding 12m radius, in accordance with RCD/1100/2	20.25	40			810	20.25	18	27	
305mm radius half batter quadrant kerb (traffic islands)	28.5				0	28.5	24	42	
Paved Area, Block on roundabout island, 80mm thick, Cobblelock, Surfaces sloping at 10 degrees or less to the horizontal in accordance with RCD/1100/6/8	46.25				0	46.25	40	65	
Paved Area, Block on roundabout island, 80mm thick, Cobblelock, Surfaces sloping at more than 10 degrees to the horizontal in accordance with RCD/1100/6/8/8	57.5				0	57.5	50	80	
Tactile paving to pedestrian crossing	62.5	105			6562.5	62.5	55	85	
30% increase in footpath works when undertaken at night	17949				0	17949			
CC-RMP-01200 Traffic Signs and Road Markings									
Permanent traffic signs (small)	255.5			8	2044	255.5	231	329	
Permanent traffic signs, Retroreflective, TSM Fig 6.30, exceeding 2m2 but not exceeding 3m2 in area on two tubular steel post or equal and approved Class ref 2	1233.75				0	1233.8	1155	1470	
Permanent traffic signs, Retroreflective, Non Lit exceeding 10m2 but not exceeding 11m2 in area on three tubular post Class ref 2	4196.75				0	4196.8	3929	5000	
Road Markings					0				
Road markings, all		600			1395	2.275	1.3	5.2	
Road Markings, Ancillary line, Chevrons, White	17.25				0	17.25	15	24	
Road Markings, Triangles, 1875mm in size, Yield	35				0	35	31	47	
Road Markings, Circles, 2800mm in size, "No entry" Circle	219.5				0	219.5	194	296	
Road Markings, Circles, 3750mm in size, "No entry" Circle	315.75				0	315.75	279	426	
Road Markings, Circles, 2800mm in size, "Stop" Circle	219.5	1			219.5	219.5	194	296	
Road Markings, Arrows, 8000mm in size, Bifurcation arrow	159.75				0	159.75	141	216	
Road Markings, Arrows, 3600mm in size, Turning right arrow	63.5	10			635	63.5	56	85	
Road Markings, Symbol, 2500mm x 1000mm in size, Box/Junction, Yellow	2	1925			2	3850	1700	2600	
Road Markings, Symbol, 4000mm x 8000mm in size, Box Junction, Yellow	246.75				0	246.75	218	333	
Hatched areas	7.725	440			3399	7.725	6.8	10.5	
Retroreflecting road studs	16.5				0	16.5	14.5	22.5	
Junction Definition posts - non-illuminated green / white 1m High	314.5				0	314.5	272	442	
Take up or down and remove to tip off Site existing kerb	78.75				0	78.75	55	150	
CC-RMP-01300 Road Lighting Columns and Brackets									
Galvanised steel Road lighting columns and brackets, 8m nominal height, bracket arm 2m projection, 150w cut off lantern and photo cell switch	1127.5				0	1127.5	990	1540	
Galvanised steel Road lighting columns and brackets, 10m nominal height, bracket arm 2m projection, 400w cut off lantern and photo cell switch	1582.5				0	1582.5	1395	2145	
CC-RMP-01400 Electrical Work for Road Lighting and Traffic Signs									
Locating buried road lighting and traffic sign cable	1.25				0	1.25	1	2	
Trench for cables, depth exceeding 1.5m but not exceeding 2m, 900mm wide, in carriageways, footways and bridge decks and paved areas	14.75	300			4425	14.75	12	23	
Cable Joints and Cable Terminations					0				
Cable termination, to road lighting columns, feeder pillars and subway lighting, 2mm x 10mm Cables	20.25				0	20.25	18	27	
Feeder Pillars					0				
Galvanised steel feeder pillar including marine plywood baseboard and all internal electrical equipment, Type K13	875	2			1750	875	550	1850	
Fuse, terminate, and connect galvanised steel or copper earth electrodes, 1.2m long, 22mm diameter within feeder pillar base, or in separate enclosure	51.25				0	51.25	45	70	
UPVC Service Duct, 100mm Internal Diameter 2 way, depths to invert not exceeding 2m; average depth 1m, Type A, construction to trench, in side slope cuttings or side slopes of embankments in accordance with RCD/500/62	27.75	350			9712.5	27.75	22	45	
UPVC Service Duct, 100mm Internal Diameter 2 way, depths to invert not exceeding 2m; average depth 1m, Type C, construction to trench, in side slope cuttings or side slopes of embankments in accordance with RCD/500/62	21				0	21	18	30	
Comms Chambers as per RCD / 1500 / 15	975	2			1950	975	800	1500	
Miscellaneous									
Permanent Bollards	160				0	160	160	160	
Permanent Bollards	160				0	160	160	160	
Pelican Crossing	20000	1			20000	20000	20000	20000	
Zebra Crossing	15000				0	15000	30000	15000	
3 Arm Signalised junction	45000	1			45000	45000	45000	45000	
4 Arm Signalised junction	45000				0	45000	45000	45000	
Height barrier	10000				0	10000	10000	10000	
CCTV	25000				0	25000	25000	25000	
8 Vehicles Charging point	30000				0	30000	30000	30000	
Contingency	5				0	5	5	5	

[illegible]

First Year Rate of Return for the R446/R357 Creagh Junction

Step 1 - Obtain Collision Costs from TII PAG

Table 6: Collision Costs (Factor Costs, 2011 Prices)

Collision Type	Value (€)
Fatal	2,310,500
Serious Injury	331,400
Slight Injury	31,100
Damage only	2,500

From PE-PAG-02030

28/08/2019

Fatal	€ 2,310,500.00
Serious	€ 331,400.00
Minor	€ 31,100.00
Damage only	€ 2,500.00

Table 7: Value of Collisions Growth Factors

Year	Annual Growth Factor
2010 – 2014	1.014
2015 - 2019	1.036
2020 - 2024	1.022
2025 - 2030+	1.023

2010-2014	1.014	
2015-2019	1.036	2015
2020-2024	1.022	
2025-2030	1.023	

Step 2 - Determine the Collisions costs for 2019, applying the PAG growth Factors

	Fatal	Serious	Minor
2011	€ 2,310,500.00	€ 331,400.00	€ 31,100.00
2019	2,874,872.67	412,349.19	38,696.62
Total number of collisions for 2015 (Road Collision Facts Ireland 2015)	155.00	727.00	4,949.00
	€ 445,605,264.50	€ 299,777,861.36	€ 191,509,571.64
	€ 160,674.45		

Step 3 - use Collision cost in FYRR calculation.

Number of Collision	28
Period of Assessment (years)	12

Cluster 1

A. Est Collision Savings	B. Collision Rate	C. Collision Cost	D. Option Cost	E. FYRR
0.3115	2.333333333	€ 160,674.45	€639,000	18.28%

Where, A. Collisions savings are estimated by the engineer using CMFs, and represent the options effectiveness at reducing collisions.

B. Where collision rate is the no of collisions divided by the period of assessment (28/12) = 2.333

C. Collision Cost as above

D. Option Cost as per Scheme Cost Option - Summary Tab

E. FYRR % = (A*B*C*100)/D

CMF

Provide Improved VRU Facilities

Install Traffic Signals

CMF

0.81 CMF Clearing House

0.85 CMF Clearing House

0.6885