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Údarás Náisiúnta Iompair
National Transport Authority

Roundabout Retrofit

Including Rapid Build Options

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Active Travel Advice Note:

Roundabout Retrofit - Including Rapid Build Options

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1. Introduction

The purpose of this Advice Note is to provide guidance to Local Authorities and designers to develop retrofit options to improve the safety of existing roundabouts for Active Travel modes with a focus on rapid build, cost-effective construction methods and materials. Full junction redesign and construction options are also presented within this note.

Retrofitting roundabouts using rapid build methods involves infrastructure improvements to an existing roundabout which utilise lower cost interventions than traditional construction methods. This can result in significant savings in cost and programme while providing a facility that is durable and does not compromise on the effectiveness of the safety improvements. Interventions can range in scale for a given junction layout and setting, from light segregation to more robust construction methods and materials such as road markings, surface fixed kerbs, bollards and concrete overrun areas.

This note includes general information, design principles, key considerations and typical design elements for several types of roundabout retrofit options located within urban roads and streets (with a speed limit of 60 km/h or less).

This Advice Note should be read in conjunction with NTA Active Travel Advice Note: Rapid Build Active Travel Facilities (ATAN-2023-01)[1].

[1] NTA Publications available at: https://www.nationaltransport.ie/publications/?keywords=ATAN-2023-01&from=&to=&sort=desc

2. Policy Background

2.1. National Investment Framework for Transport in Ireland (NIFTI)

The Department of Transport published the NIFTI[2] to guide future investment in the land transport network and to prioritise investment that supports the delivery of the National Strategic Outcomes. Projects are required to demonstrate their alignment against NIFTI's four investment priorities for transport: Mobility of people and goods in urban areas; Protection and Renewal; Enhanced regional and rural connectivity; and Decarbonisation.

NIFTI includes two 'hierarchies' specifying the order in which transport investment should be prioritised: an 'Intervention Hierarchy' and a 'Modal Hierarchy'; both of which are shown in Figure 1.

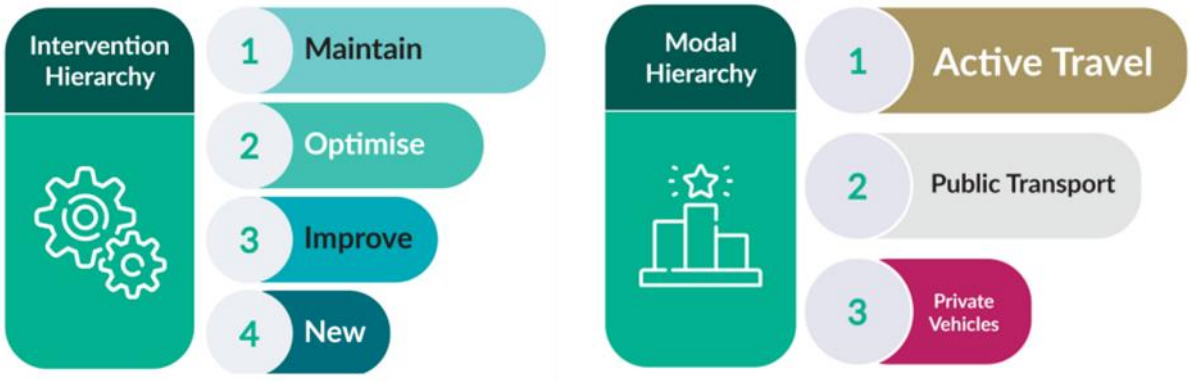


Figure 1: NIFTI intervention and modal hierarchies

The Intervention Hierarchy differentiates between the level of intervention proposed, and states that investment should firstly seek to 'maintain' existing infrastructure then to 'optimise' or 'improve' existing infrastructure and finally, if it is not possible to achieve an objective through previous steps, invest in providing 'new' infrastructure.

The aim of the Investment Hierarchy is to maximise the lifespan and value for money of past investments, and to ensure that more affordable and efficient options for achieving an objective are considered before investing in large-scale transport projects or programmes.

Roundabout rapid build retrofit schemes are aligned with level 2 and 3 of the intervention hierarchy namely, 'optimise' and 'improve'. While requiring new infrastructure in parts, the primary focus of these projects is to optimise and improve infrastructure by adjusting the existing road layout and junction space to be more efficient, sustainable and equitable.

The Modal Hierarchy differentiates between the modes of transport, and states that Active Travel (walking, wheeling and cycling) should be prioritised, followed by public transport, and lastly by private vehicles. Roundabout retrofit projects should follow this user hierarchy which seeks to rebalance space towards active modes.

[2] National Investment Framework for Transport in Ireland (NIFTI) Available at: https://www.gov.ie/en/publication/cfae6-national-investment-framework-for-transport-in-ireland-nifti/#national-investment-framework-for-transport-in-ireland

2.2. The Need for Roundabout Improvements

This Advice Note aims to provide guidance to improve the safety of all road users at roundabouts by reducing vehicular speeds and segregating cyclists, pedestrians and motor vehicles where possible.

Existing, well-designed roundabout junctions can operate very effectively for motor vehicles. However, in traditional style roundabouts – designed primarily to optimise vehicle capacity – wide entry lanes and wide circulatory lanes can lead to high speeds and reduced gap acceptance which can contribute to vehicle collisions. The most common vehicular collision types at roundabouts involve either a vehicle entering the roundabout into the path of a circulating vehicle, or nose to tail shunts on junction approaches. In addition, there is a need to improve the safety at existing roundabouts for Active Travel users. The Road Safety Authority (RSA) notes that when comparing road casualties at junctions for all road users, 15% of fatal and injury collisions occur at roundabouts in built up areas[3]. Furthermore, the RSA review of cyclist injury trends identified that 51% of cyclist injuries occurred at junctions, of which 8.9% occurred at roundabouts[4].

Research undertaken by University of Westminster on behalf of the Road Safety Trust in the UK in 2019 found that "both roundabouts and mini-roundabouts raised injury odds threefold" compared to other types of junctions."

The findings from the research noted that "high-quality infrastructure is most needed in contexts with higher existing risks. If roundabouts are to remain, higher-quality designs are needed, drawing on research from contexts such as the Netherlands where roundabouts are safer for cyclists than in the UK."[5]

Existing roundabouts with multi lane entries, wide entry and exit radii, and wide circulatory carriageways in busy urban areas are typically not suitable for active travel modes due to the speed that vehicles travel through the junction resulting in a large speed differential (difference in speed between modes), a hostile environment for cyclists travelling around the roundabout, and difficulty for pedestrians and cyclists in crossing the arms of the roundabout.

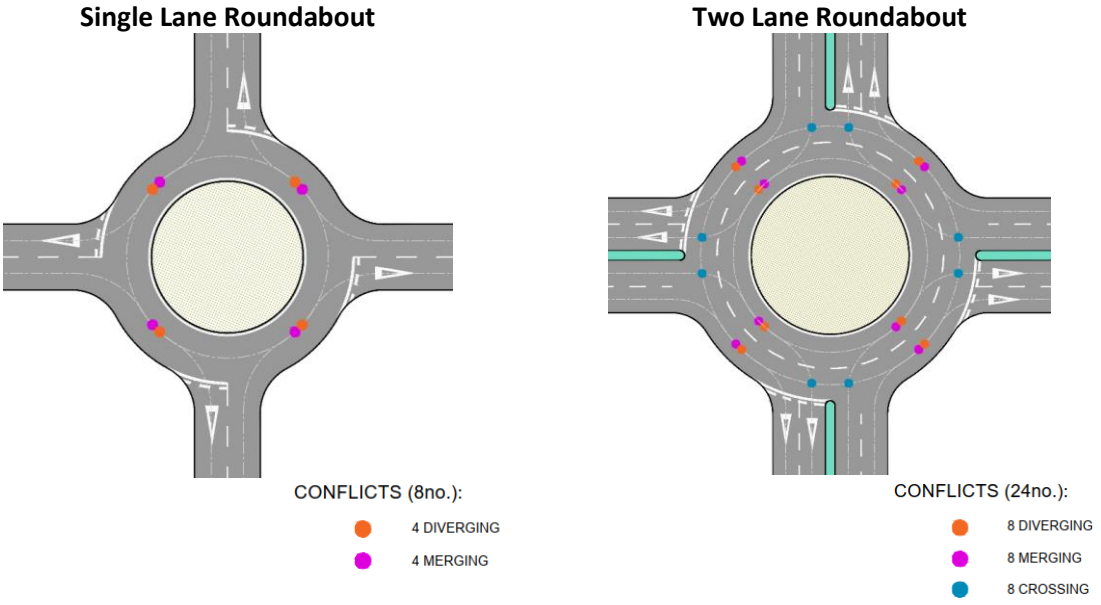


Figure 2: Types of conflicts at single lane roundabout and two-lane roundabout

[3] RSA, Road Casualties and Collisions in Ireland 2017 -Tables. (2021). Available at: https://www.rsa.ie/docs/default-source/road-safety/r2---statistics/road-collision-annual-reports/road-casualties-and-collisions-in-ireland-2017.pdf?Status=Master&sfvrsn=bebadb99_5

[4] RSA, Cyclist Injury Trends 2006-2018 (2020) Available at: https://www.rsa.ie/docs/default-source/road-safety/r4.1-research-reports/safe-and-healthy-modes-of-travel/cyclist-injury-trends-2006--2018.pdf?sfvrsn=3acf1fe8_5

[5] Reducing Cycling Injury Risk While Cycling Grows, 2019. Available at: https://static1.squarespace.com/static/61d570b3a2957b5f755587d2/t/622894ae4a39634a4c5d8aeb/1646826673931/ UoWestminster_98_Cycling_Injury_Risk%2BFinal%2BReport.pdf

3. Design Standards

This section presents an overview of current design standards and guidance, focusing on roundabout design and Active Travel improvements. The key design documents are:

- National Cycle Manual (NCM);
- Design Manual for Urban Roads and Streets (DMURS);
- Transport Infrastructure Ireland (TII) Publications; and
- Traffic Signs Manual (TSM).

3.1. National Cycle Manual (NTA, 2011)

The NCM[6] Chapter 4.8 (link) includes roundabout design guidance and outlines the types of roundabouts suitable in urban areas for cycling. The NCM states that multi-lane roundabouts are not safe for cyclists and where these are required for vehicular traffic, fully segregated cycle facilities should be considered to provide a safe cycling environment. The updated NCM due in 2023 will have a number of roundabout options for designers to consider, the design principles are the same as the current NCM, which are listed in **Section 5.4** below.

3.2. Design Manual for Urban Roads and Streets (DMURS)

DMURS[7] includes junction design guidance for roundabouts in section 4.4.3 (link), generally echoing the National Cycle Manual in stating that "Large roundabouts are generally not appropriate in urban areas. They require a greater land take and are difficult for pedestrians and cyclists to navigate, particularly where controlled crossings/cycle facilities are not provided, and as such, vehicles have continuous right of way. The use of large roundabouts (i.e. those with radii greater than 7.5m) should be restricted to areas with lower levels of pedestrian activity. Where large roundabouts currently exist, road authorities are encouraged, as part of any major upgrade works, to replace them with signalised junctions or retrofit them so that are more compact and/or pedestrian and cycle friendly, as is appropriate."

DMURS is the principal design standard for urban roads and streets. The application of the Design Manual for Urban Roads and Streets (DMURS) is set out in DMURS Chapter 1.3 (link). The use of alternative design standards shall not apply other than in exceptional circumstances (see Department of Transport Circular June 2022 (link) for further information).

[6] https://www.cyclemanual.ie/
[7] https://www.dmurs.ie/

3.3. Transport Infrastructure Ireland (TII) Publications

TII Publication: DN-GEO-03060 Geometric Design of Junctions[8] (link) sets out the standards and advice for the geometric design of roundabouts on national roads including guidance for:

- Geometric Design;
- Inscribed Circle Diameter;
- Circulatory Carriageway;
- Central Island;
- Entries/Exits;
- Visibility;
- Drainage; and
- Landscaping.

TII Standards should not be used in urban areas unless in exceptional circumstances and with written approval from the Oversight Authority (see Department of Transport Circular June 2022 (link) for further information).

3.4. Traffic Signs Manual (TSM)

The TSM[9] Chapters 5 and 7 (link) includes requirements on traffic signs and road markings at roundabouts.

4. Typical Scheme Objectives

The typical scheme objectives for a roundabout retrofit scheme are:

- Improve the safety of all road users;
- Reduce vehicular speeds;
- Reduce the risk of collisions by segregating cyclists, pedestrians and motor vehicles where possible, by minimising conflicts;
- Deliver the improvements using the appropriate level of infrastructure in line with NIFTI hierarchies; and
- Cost effectiveness.

[8] https://www.tiipublications.ie/library/DN-GEO-03060-03.pdf
[9] https://www.trafficsigns.ie/

5. Key Design Considerations

The following is a non-exhaustive list of key considerations when developing a retrofit design for an existing roundabout.

5.1. Safety

As part of a retrofit design the needs of all road users should be considered according to the road user hierarchy; pedestrians (first), cyclists, public transport, private motor vehicles (last) as described in DMURS Section 2.2.2.

A successfully implemented retrofit design should reduce traffic speed and provide segregation between modes, giving pedestrians, cyclists and motor traffic separate space through the junction where possible.

5.2. Pedestrian Crossings

Retrofit design should aim to improve the safety of pedestrians by providing segregated space and crossing facilities. Where traffic flows and speeds are appropriate, zebra crossings should be provided. The crossings should, where possible, be set back from junction entry/exits by 5.0m to enable vehicles to exit the circulatory carriageway and encounter the crossing at right angles, thus increasing visibility of pedestrians and allowing eye contact between users, and the crossing should be raised (max 75mm height on bus routes) to reduce vehicle speeds down to near stopping speed. Generally, zebra crossings are suitable to offer a controlled crossing over a single carriageway (i.e., one lane in each direction) but should not be used where two or more traffic lanes in either direction are to be crossed. Guidance on determining the appropriate level of pedestrian crossing facility is provided in TII publication number: DN-GEO-03084[10] (link).

5.3. Cyclist Segregation

Cyclists are vulnerable at standard roundabouts due to the risk of side swipe collisions when mixed with traffic. Therefore, a retrofit design should aim to segregate these modes where possible. Bollards and road markings provide the lowest level of segregation between cyclists and motor traffic. The preferred segregation infrastructure is a kerb or similar physical buffer separating both modes. Roundabouts with a narrow single circulatory lane (4.0m wide), low traffic volumes and low speeds (20 km/h up to 400 pcu/peak hour, or 30 km/h up to 200 pcu/peak hour) can accommodate cyclists mixed with traffic. Segregation is required where these metrics are exceeded.

5.4. Cycle Friendly Roundabouts Design Principles

The NCM, Chapter 4.8[11] outlines 6 key design principles when developing a cycle friendly roundabout design. In summary these are:

- Approaching traffic should be slowed (to stopping speed);
- Traffic speed on the roundabout should be controlled by a narrow circulatory lane;
- Approach arms should be aligned towards the centre point of the island and not deflected;
- Traffic lanes should approach roundabouts at right angles rather than obliquely, and without flares;
- Multi-lane approaches are not recommended; and
- Double or multiple circulatory lanes are not cycle friendly.

[10] TII publication number reference: DN-GEO-03084, The Treatment of Transition Zones to Towns and Villages on National Roads Available at: https://www.tiipublications.ie/library/DN-GEO-03084-02.pdf
[11] National Cycle Manual (NCM), Cycle Friendly Roundabouts Available at: https://www.cyclemanual.ie/manual/designing/4-8-roundabouts/

5.5. Stakeholders

Stakeholder consultation is a key step in developing retrofit schemes. There may be a number of stakeholders on these schemes which may include the Local Authority departments, TII (when retrofitting roundabouts on the national network/at motorway interchanges), utility owners and local residents/businesses within and near the scheme extents. Other stakeholders may be identified during the design process.

5.6. Spatial Constraints

A key constraint in retrofit design is the available space at the existing roundabout. Constraints can include limited carriageway space, existing walls, street lighting, footpath widths, traffic islands, drainage and services. Typically, existing roundabouts will have available space within the existing carriageway, including the entries and exits, to allow for the reallocation of space to narrow traffic lanes and allow the development of cyclist and pedestrian facilities.

5.7. Overrun Areas

Overrun areas are an extension of the central island, the purpose of an overrun area is to provide a compact roundabout, whilst facilitating occasional larger vehicular movements.

Overrun areas should ideally be constructed in concrete inclusive of a kerb upstand (50mm high), be mountable by longer vehicles, and coloured to increase contrast with the circulatory carriageway surface. Concrete overrun areas could include a coloured high friction (anti-skid) surface. Typically, a coloured hot screed polymer modified thermoplastic resin with high PSV aggregate material should be used if colour is to be applied.

Where such concrete construction is not possible or desirable for reasons of cost and timelines, ribbed road markings may be used to provide overrun areas. Ribbed road markings are not as effective as a raised overrun area and may not slow down or deflect vehicles to the same extent. Ribbed road markings are continuous line road markings with ribs at regular intervals, these road markings should provide an audible and vibratory warning to drivers. Ribbed road markings should only be used in creating overrun areas that are part of the central island of the roundabout and should not be used where the noise produced by over-running vehicles is likely to cause annoyance to nearby residents[12].

Overrun areas should be designed to accommodate large goods vehicles, however normal traffic should be deterred from utilising the overrun space to ensure adequate deflection. Overrun areas can be provided at the centre island, edge of carriageway (at entry or exit) or both, see **Section 9: Design Examples**.

Netherlands (GoogleMaps)

Monastery Road, Dublin, Ireland (GoogleMaps)

Figure 3: Example of overrun areas

[12]Traffic Signs Manual, Chapter 7: Road Markings. Available at https://www.trafficsigns.ie/tsm-cur

5.8. Vehicle Swept Path Analysis

Vehicle swept path analysis is a key step in roundabout retrofit design to ensure that the proposed geometry changes are appropriate. Vehicle type used should be appropriate to the predicted use of the junction and include emergency vehicles. As noted above overrun area space should be utilised by larger vehicles only.

5.9. Geometry

The geometric design of roundabouts is prescriptive and multifaceted. In general, geometric changes to the roundabout should aim reduce vehicular speed and reduce the risk of collisions by segregating cyclists, pedestrians and motor vehicles where possible.

Typical geometric changes may include:

- Reduction of lane widths to 3.0m - 3.25m where possible on approaches and exits;
- Reduction of circulatory carriageway width (single lane 4.0m wide where possible);
- Reducing roundabout entries and exits to single lane;
- Reduction of junction radii at entry and exits. Flared entries/exits should be removed;
- Provision of segregated cycle facilities on approach to the roundabout, where applicable; and
- Robust cycle segregation through the junction, where applicable.

At some roundabouts the existing geometry and crossfall profile (e.g. crown line dividing carriageway in the ratio of 1/3, 2/3) can give rise to HGV load shedding and overturning. This can be mitigated by design considerations including:

- Reduction of entry speeds;
- Provision of sufficient vehicle over run areas (see **Section 5.7: Overrun Areas**); and
- Minimising of crossfall changes and adverse crossfalls on circulatory sections.

5.10. Visibility

Adequate visibility is a key consideration in roundabout design. All vehicles approaching the roundabout must be able to see any potential hazard in the full width of the circulating lane.

The visibility of any pedestrian/cyclist crossing facilities must be considered in the design. Pedestrians and cyclists must be able to see, and be seen, by approaching traffic.

Excessive visibility over the central island can result in high entry speeds, potentially leading to collisions. To mitigate this, carefully designed landscaping within the central island can encourage slower vehicular speeds and improve road safety. Typically, the height of proposed landscaping should be at or above the eye level of a driver (approximately 1.05 m) and be passively safe.

5.11. Drainage

An assessment of the existing drainage regime should be undertaken as part of any design improvements. It should be the intention of a retrofit design to avoid alterations to the existing drainage regime as much as possible. This can be achieved by including gaps in segregation kerbs, retaining existing gullies or locally relocating gullies utilising existing leads. If drainage impact is unavoidable, the designer will need to consider any special requirements for surface drainage in the area.

Generally, the typical design parameters should include:

- Approach gradient maximum 2% (1 in 50) for a distance of 25m before entry;
- Crossfall along circulatory carriageway 2% (1 in 50). It should not exceed 2.5% (1 in 40);
- Longfall graded at minimum 0.5% (1 in 200) to avoid ponding; and
- Siting and spacing of gullies to prevent ponding.

5.12. Roundabout Capacity

In simple terms, the capacity of a roundabout is the maximum rate at which vehicles can enter the roundabout from an approach arm based on the traffic flow and road geometry. Below are approximate rules of thumb for traffic capacity at different types of roundabouts, see Table 5.1[13]. Typically, a roundabout retrofit scheme will aim to achieve a single lane junction arrangement as this provides the greatest safety benefits to pedestrians and cyclists. There may be instances where traffic capacity needs to be maintained, such as on arterial roads. In that case a reduction in lanes may not be achievable; however, other infrastructure interventions are available to improve the safety of all road users, see **Section 9: Design Examples**.

Table 5.1: Rules of thumb for traffic capacity at different types of roundabouts

Description	Approximate Traffic Capacity
Single lane roundabout, single lane entries and exits	<25,000 veh/day
Two lane roundabout, single lane entries and exits	30,000 veh/day
Two lane roundabout, two lane entries and exits	40,000 veh/day

[13] Roundabouts - Application and design, A practical manual, Section 3.3.1, page 19 (2009) Available At: https://nmfv.dk/wp-content/uploads/2012/06/RDC_Netherlands.pdf

5.13. Traffic Impacts

Irish case study examples of roundabout retrofit schemes have shown a reduction in vehicular speed and low impact to traffic queuing and waiting times. Slower speeds can encourage greater gap acceptance resulting in similar traffic capacity. Retrofitted roundabouts have resulted in an increase in the number of pedestrians and cyclists using the improved junction. Table 5.2 shows a summary of the key metrics recorded at several case study sites.

Table 5.2: A summary of case study information at Lucan, Navan and Dublin roundabout retrofit schemes.

Location	Infrastructure changes	85th Percentile Speed	Traffic Impact	Pedestrian Number	Cyclist Number
Lucan Castle Road Roundabout, AADT 12,339 (GoogleMaps) Griffeen Road Roundabout, AADT 10,783 (GoogleMaps)	• Narrow circulatory carriageway (overrun area introduced • Reduction of two lane entry to single lane entry • Zebra crossings • Shared Footpath	Approach speed decreased by 5-9%	Little or no change to overall AADT	Increase 37% - 96%	Increase 145% - 196%
Navan Railway St. Roundabout AADT 15,000 (GoogleMaps)	• Narrow circulatory carriageway (overrun area introduced • Zebra crossings • Shared Footpath	No Data	No Data	Increase 3.69%	Increase 22.5%
Dublin Monastery Rd/Woodford Hill Roundabout AADT: No Data (GoogleMaps)	• Narrow circulatory carriageway (overrun area introduced • Signal controlled crossing along pedestrian/cycling route • Improved footpath facilities • Improved cycling facilities (cycle track)	No Data	Little or no change to overall AADT Minor increase in queue length and delay RFC increase from 0.52-0.89 on main arm. Minor impacts to RFC on other arms	No Data	No Data

6. Retrofit Intervention Levels

There is a range of infrastructure interventions that can be applied in a retrofit roundabout scheme, with all striving to address the scheme objectives, see **Section 4: Typical Scheme Objectives**.

A range of materials are available for retrofit solutions and typically the materials selected will be based on the retrofit intervention level and construction approach.

In general, there are three levels of infrastructure intervention: **Level 1: Rapid build interim measures, Level 2: Rapid build permanent measures,** and **Level 3: Full redesign**. These are further outlined in Table 6.1.

Table 6.1: Summary of intervention levels 1 to 3

Intervention	Specific Measures	Level 1 Rapid build interim measures	Level 2 Rapid build permanent measures	Level 3 Full redesign
Traffic lane width reduction	Road marking, bollards	Yes		
	Kerbing, footpath buildouts, road marking		Yes	
	Kerbing, footpath buildouts			Yes
Circulatory carriageway width reduction	Road marking, bollards	Yes		
	Concrete overrun areas, road marking, kerbing changes		Yes	
	Kerbing, concrete overrun areas			Yes
Reduction in entry and exit radii	Road marking, bollards	Yes		
	Kerbing and footpath buildouts		Yes	Yes
Pedestrian crossing upgrades, controlled and uncontrolled crossings	Tactile paving, footpath improvements, controlled/uncontrolled pedestrian crossings where appropriate	Yes	Yes	Yes
Raised tables	Raised tables (subject to impact on drainage and utility services)	Yes	Yes	Yes
Segregated cycle lanes	Road marking, bollards, temporary kerbing (minor impacts to existing drainage)	Yes		
	Kerbing (impacts to existing drainage minimised)		Yes	
	Kerbing (some drainage interventions anticipated but should be kept to a minimum)			Yes
Drainage	Proposals should be limited to minor drainage interventions (existing gullies retained where possible)	Yes		
	Drainage interventions anticipated but should be kept to a minimum (gully relocation utilising existing gully leads where possible)		Yes	
	More significant drainage interventions anticipated but should be kept to a minimum			Yes
Sustainable Drainage Systems (SUDS)	Opportunities for SUDS and landscaping upgrades		Yes	Yes

7. Irish Case Study Examples

The following schemes show examples of different intervention types implemented.

7.1. Level 1: Rapid build interim measures

Wellington Road, Dublin 6

Scheme location: Wellington Road

Google maps Link
(53.306533, -6.320783)

Local Authority:
South Dublin County Council

Road Classification:
Intersection of Regional Road (R112) and Local Roads Wellington Road and Whitehall Road.

Roundabout ICD: 30m

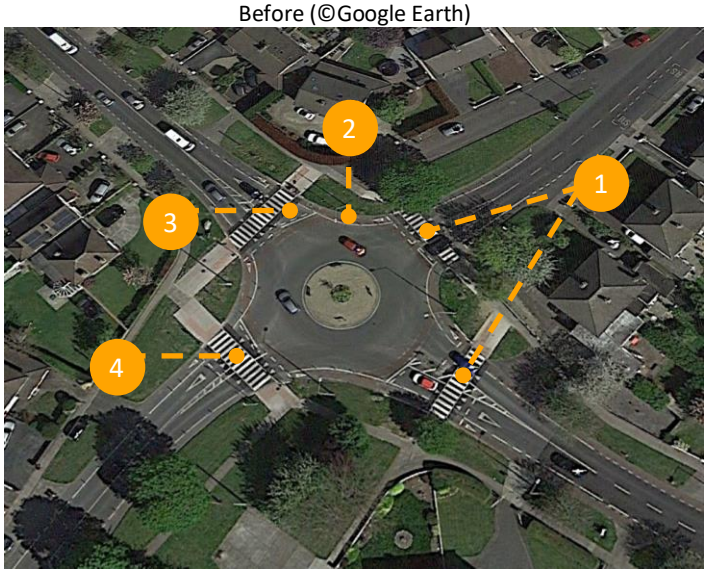
Existing conditions: Two lane entries, approximately 10m wide circulatory carriageway, uncontrolled pedestrian crossings, advisory cycle lanes on major approach arms and on circulatory carriageway.

Summary of interventions:

1. Raised tables at the entry and exit reduce traffic speed
2. Segregated cycle lanes leading to light segregation through bollards and lines (see Google Street View)
3. Multi-lane approaches/two lane entries have been reduced to one
4. Zebra Crossing (solar powered Belisha Beacons) installed improving pedestrian crossing facilities, cyclists informally utilise the crossing to navigate the junction segregated from traffic

Design note: Setting back all of the zebra crossings 5m would have been preferable but was not possible due to residential driveways.

Before (©Google Earth)



After (©Google Earth)

Before (©Google Street View 2019)

After (©Google Street View 2021)

7.2. Level 2: Rapid build permanent measures

Father Russell Rd, Co. Limerick

Scheme location: Father Russell Road

Google Maps Link (52.635436, -8.671922)

Local Authority:
Limerick City and county Council

Road Classification:
Intersection of Regional Road (R510 and R859) and Local Road Father Russell Road.

Roundabout ICD: 70m

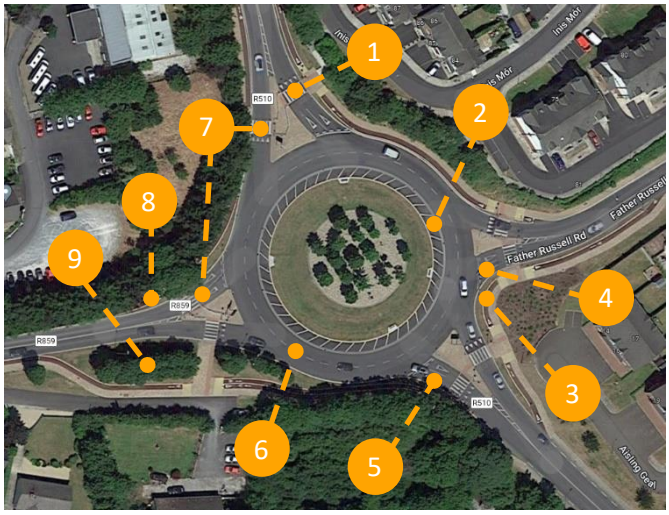
Existing conditions: Two lane entries, approximately 13m wide circulatory carriageway, uncontrolled pedestrian crossings on two arms, no pedestrian facilities on two arms, cycle track on footpath along west and north arms and narrow footpath widths.

Summary of interventions:

1. Raised tables at the entry and exit reduce traffic speed
2. Narrowing of circulatory lane achieved through overrun area (pavement build up, kerb and line marking)
3. Footpath buildouts and alteration to the existing islands adjusts the approach arm geometry. Traffic approaching the junction aligned towards the centre point of the roundabout and not deflected to the left
4. Entry and exit radii have been reduced, through footpath buildouts including concrete kerbs
5. Multi-lane approaches have been maintained with a short que length
6. Multiple circulatory lanes have been maintained, reduced in width with space reallocated to footpath /cycle tack and overrun area
7. Zebra crossing with raised tables
8. Segregated cycle lanes/cycle tracks
9. Existing planting and trees largely retained

Design note: Zebra crossings are not recommended across two lanes due to visibility issues where a vehicle on the inner lane stops for a pedestrian but the vehicle on the outer lane cannot see the pedestrian. In this case the lane flares to two lanes after the zebra crossing.

Before (©Google Earth)



After (©Google Earth)

Before (©Google Street View 2009)

After (©Google Street View 2022)

7.3. Level 3: Full redesign

Railway St. Roundabout, Navan

Scheme location: Railway Road

Google Maps Link (53.650459, -6.686498)

Local Authority:
Meath County Council

Road Classification:
Intersection of Regional Road (R161) and Local Roads Circular Road and Leighsbrook Lodge.

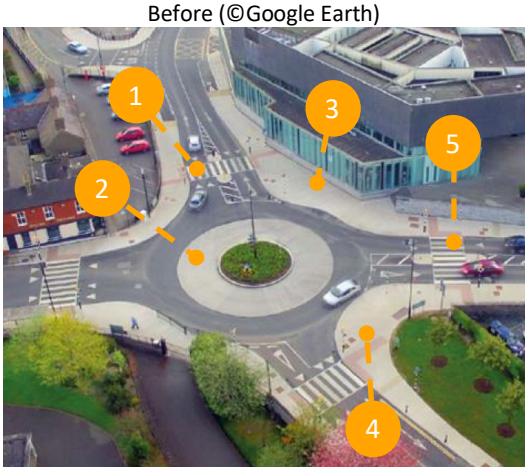
Roundabout ICD: 30m

Existing conditions: wide entry and exit radii, approximately 7-11m wide circulatory carriageway, controlled signalised pedestrian crossing on one arm, uncontrolled pedestrian crossings, narrow footpaths.

Summary of interventions:

1. Raised tables at the entry and exit reduce traffic speed
2. Narrowing of circulatory lane achieved through overrun area (concrete overrun area)
3. Footpath buildouts and alteration to the existing islands adjusts the entry, exit and circulatory lane geometry. Traffic approaching the junction aligned towards the centre point of the roundabout and not deflected to the left
4. Entry and exit radii have been reduced, through footpath buildouts including concrete kerbs
5. Zebra Crossings combined with raised tables and shared cycle and pedestrian areas

Before (©Google Earth)



After (NTA)

Before (©Google Street View 2017)

After (NTA)

8. Typical Costs

The intention of the below table is to provide an indicative typical cost range that may be used by Local Authorities to assist in selecting intervention levels see **Section 6: Retrofit Intervention Levels**.

The below table is not an exhaustive list and does not cover all items involved in retrofit schemes. The below table should only be used as a high level tool and not be used to replace deliverables outlined in the NTA Cost Management Guidelines NTA Cost Management Guidelines (Updated 2023) - National Transport

Rates Excludes Preliminaries - Typically, lower 10%: Median 15%: Upper 20% (Including Traffic Management)

Item	Unit	Typical Cost* €	Comment
Bollard and fixing Excluding retention socket	1no.	120-180	Approximate cost for bollard
Retention Sockets	1no.	250-480	Assumed rate for retention socket (76mm dia)
Road Marking	m	1.5-4	Approximate rate for continuous line marking.
Cycle Track Surfacing	m^2	50-60	Approximate rate for cold applied High friction road surface
Carriageway Resurfacing	m^2	50-60	Approximate rate for resurfacing
Bolt Down Kerb (cycle segregation kerb)	m	300 - 415	Approximate rate per metre (depending on linear metre ordered and supplier)
Extruded Concrete Kerb (cycle segregation kerb)	m	35-55	Approximate rate per metre (depending on linear metre ordered, cross section and contractor)
Temporary Footpath Buildouts/ Traffic Islands Bolt down kerb and backfill (Sand, flexible surface)	m^2	480-590	Approximate rate per metre (depending on linear metre ordered, cross section and contractor)
Footpath Buildouts Concrete kerb and backfill (concrete footpath)	-	6,000-25,000	Approximate rate per facility based on corner footpath buildouts
Gully Relocate locally, utilizing existing gully leads	1no.	530-870	Approximate rate per gully relocation (depending on trapped or untrapped gully)
Lighting Columns Relocate locally	1no.	2,000-2700	Cost of new lighting column, based on existing power supply being utilised (6m high column)
Raised Table (Including localised gully relocation utilizing existing gully leads)	1no.	30,000 – 50,000	Approximate rate per facility (Ramps €5,000 - €10,000)
Overrun Area (concrete and coloured surfacing)	m^2	180-300	Approximate rate per m^2
Uncontrolled Crossing (tactile pathing, kerb upgrade, localised footpath resurfacing)	1no.	5,000-10,000	Approximate rate per facility
Controlled crossing, **Solar Powered Zebra Crossing** (road marking, tactile pathing, kerb upgrade, localised footpath resurfacing, solar belisha beacons)	1no.	20,000-30,000	Approximate rate per facility
Controlled crossing, **Zebra Crossing** (road marking, tactile pathing, kerb upgrade, localised footpath resurfacing, belisha beacons, ducting and chambers)	1no.	30,000	Approximate rate per facility
Controlled crossing, **Toucan Crossing** (road marking, tactile pathing, kerb upgrade, localised footpath resurfacing, traffic signal upgrades, ducting and chambers)	1no.	100,000-150,000	Approximate rate per facility
Controlled crossing, **Signalised Pedestrian Crossing** (road marking, tactile pathing, kerb upgrade, localised footpath resurfacing, belisha beacons, ducting and chambers)	1no.	100,000-150,000	Approximate rate per facility

***Figures Exclude VAT**

9. Design Examples

The following design examples show a range of infrastructure interventions that can be applied in a retrofit roundabout scheme.

These examples show on a variety of existing roundabouts with different characteristics such as Inscribed Circle Diameter (ICD), road classification and traffic volume. General arrangement drawings for each example are provided in **Appendix A**.

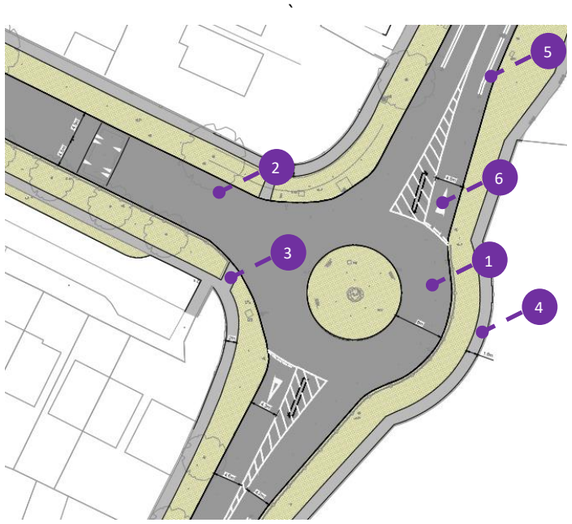
The three intervention levels are:

- Level 1: Rapid build interim measures;
- Level 2: Rapid build permanent measures; and
- Level 3: Full redesign.

9.1. Design Example 1

Road Classification: Local Road
Roundabout ICD: 30 m
Existing conditions: This roundabout is located in a urban residential area with a posted speed limit of 50 km/h. The location is on a bus route. AADT approximately 8000.

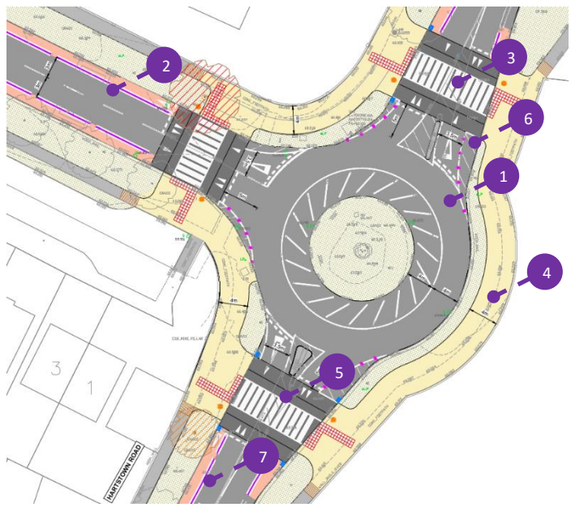
Existing Roundabout Arrangement



Summary of existing arrangement:

1. Wide circulatory lane
2. Wide approach lane width
3. Uncontrolled pedestrian crossing/ no crossing facilities across mainline
4. Narrow footpaths
5. Segregated cycle lanes recently installed on major arm approaches
6. Cyclists mixed with other traffic at the roundabout
7. Land take not possible/requirement to work within road boundaries

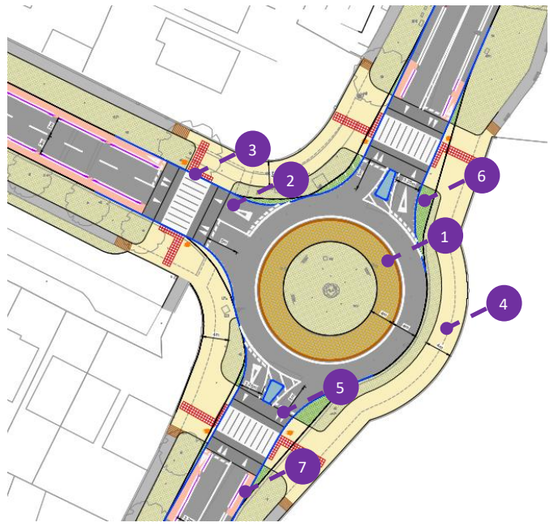
Level 1
Rapid build interim measures



Summary of interventions:

1. Narrowing of circulatory lane (ribbed road markings to minimise drainage impacts at overrun area)
2. Approach lane width reduced
3. Controlled pedestrian crossing as necessary considering traffic and pedestrian number (Zebra Crossing with raised table, set back 5.0m)
4. Footpath widening to facilitate pedestrian priority shared areas
5. Raised tables to reduce traffic speed.
6. Verge buildouts and minor alterations to the existing islands (bollard and road markings to minimise drainage impacts)
7. Segregation between cyclist and traffic on approach (segregation kerb with gaps to minimise drainage impacts)

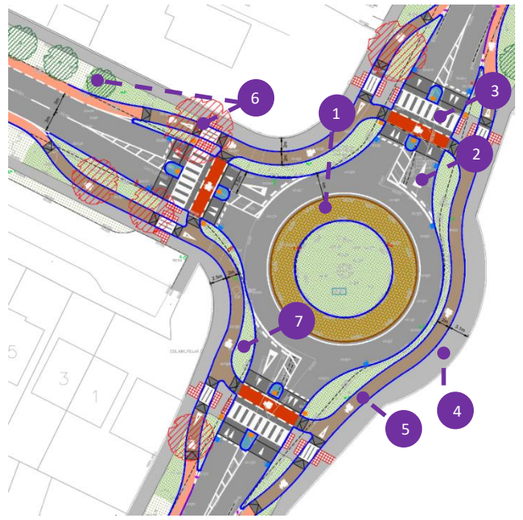
Level 2
Rapid build permanent measures



Summary of interventions:

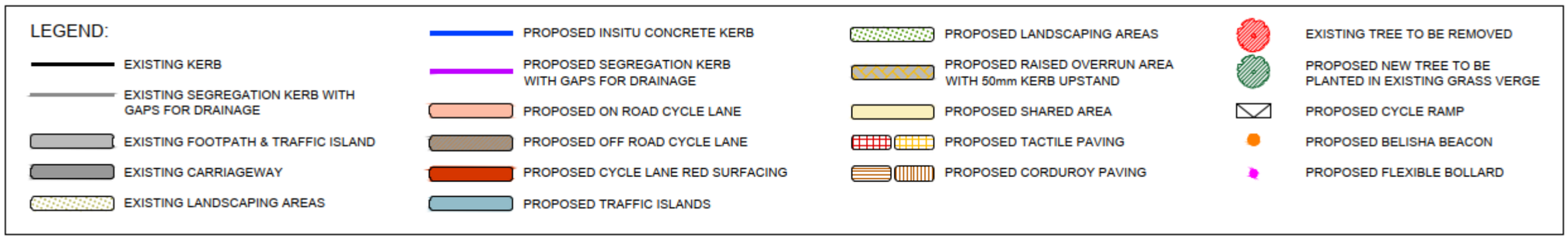
1. Narrowing of circulatory lane (concrete overrun area)
2. Approach lane width reduced
3. Controlled pedestrian crossing as necessary considering traffic and pedestrian number (Zebra Crossing with raised table, set back 5.0m)
4. Footpath widening to facilitate pedestrian priority shared areas
5. Raised tables to reduce traffic speed.
6. Verge buildouts and minor alterations to the existing islands
7. Segregation between cyclist and traffic on approach (segregation kerb with gaps to minimise drainage impacts)

Level 3
Full redesign



Summary of interventions:

1. Narrowing of circulatory lane (concrete overrun area)
2. Approach lanes reduced
3. Raised controlled pedestrian zebra crossing followed by parallel cycle zebra crossing on major arms (Zebra Crossing with raised table)
4. Footpath widening
5. Segregated cycle tracks
6. Tree removal and replacement
7. SUDS / public realm greening opportunities.



9.2. Design Example 2

Road Classification: Local Road
Roundabout ICD: 30 m
Existing conditions: This roundabout is located in a urban residential area with a posted speed limit of 50 km/h. The location is on a bus route. AADT approximately 7500.

Existing Roundabout Arrangement

Summary of existing arrangement:

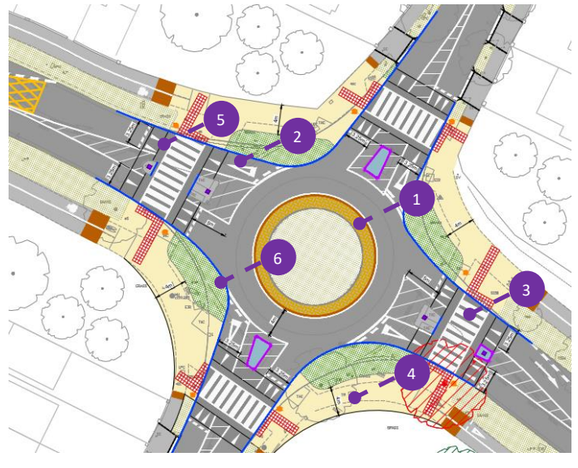
1. Wide circulatory lane
2. Wide approach lane width
3. Uncontrolled pedestrian crossings
4. Narrow footpaths
5. Shared footpath arrangement for pedestrians and cyclists (segregated cycle/footpath on approach line marking on footpath)
6. Land take not possible/requirement to work within road boundaries

Level 1
Rapid build interim measures

Summary of interventions:

1. Narrowing of circulatory lane (ribbed road markings to minimise drainage impacts at overrun area)
2. Approach lane width reduced
3. Zebra Crossings with raised table, set back 5.0m from circulatory carriageway
4. Footpath widening to facilitate shared area
5. Raised tables to reduce traffic speed
6. Verge buildouts (bollard and road markings to minimise drainage impacts)

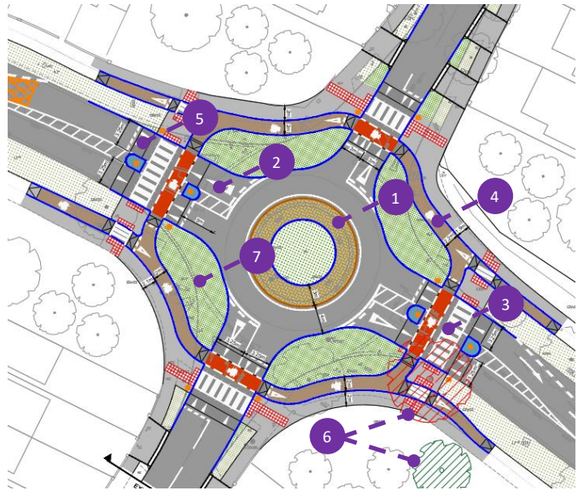
Level 2
Rapid build permanent measures



Summary of interventions:

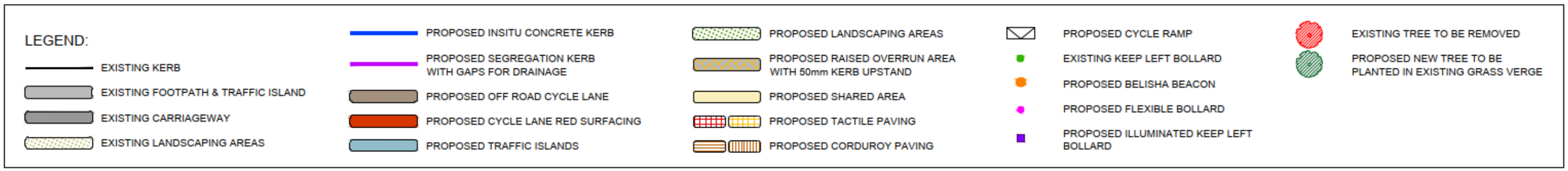
1. Narrowing of circulatory lane (concrete overrun area)
2. Approach lane width reduced
3. Zebra Crossings with raised table, set back 5.0m
4. Footpath widening to facilitate shared area
5. Raised tables to reduce traffic speed
6. Verge buildouts

Level 3
Full redesign



Summary of interventions:

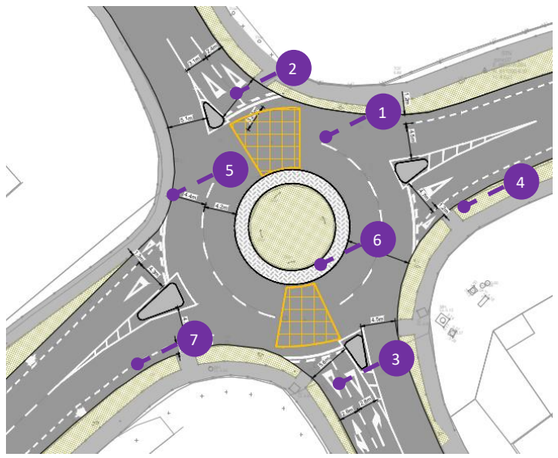
1. Narrowing of circulatory lane (concrete overrun area)
2. Approach lanes width reduced
3. Raised controlled pedestrian zebra crossing followed by parallel cycle zebra crossing on major arms (Zebra Crossing with raised table)
4. Segregated cycle tracks
5. Raised tables to reduce traffic speed
6. Tree removal and replacement
7. SUDS / public realm greening opportunities.



9.3. Design Example 3

Road Classification: Roundabout is located at the intersection between a regional and local road
Roundabout ICD: 32 m
Existing conditions: This roundabout is located in a transitional location where regional road intersects with a residential area. The posted speed limit is 50 km/h. The location is on a bus route. AADT information not available.

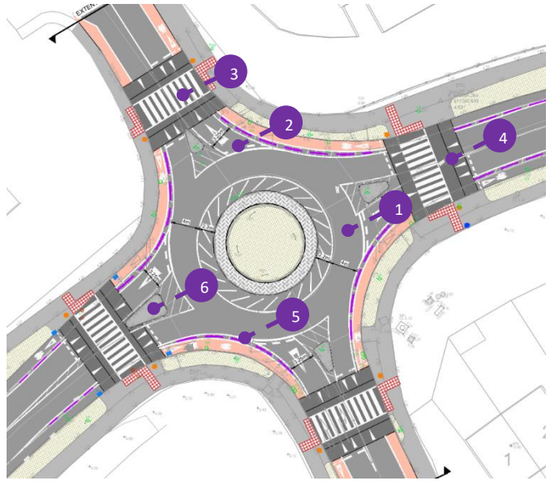
Existing Roundabout Arrangement



Summary of existing arrangement:

1. Wide two lane circulatory lanes
2. Wide approach lanes
3. Multi lane entries
4. Uncontrolled pedestrian crossings
5. Narrow footpath width
6. Existing overrun area
7. Advisory cycle lanes (road marking) on major arms, cyclists mixed with other traffic at the roundabout
8. Land take not possible/requirement to work within road boundaries

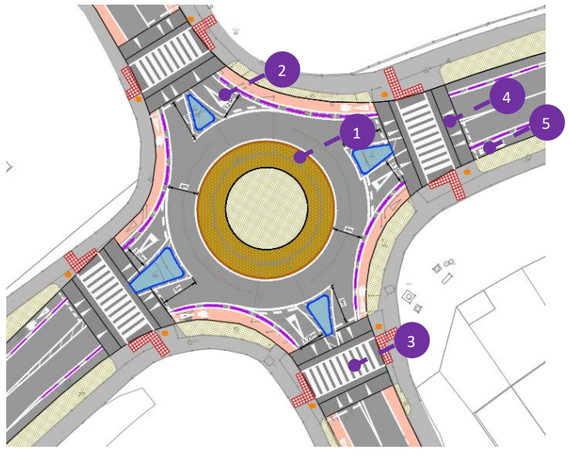
Level 1
Rapid build interim measures



Summary of interventions:

1. Narrowing of circulatory lane (ribbed road markings to minimise drainage impacts at overrun area).
2. Approach lane widths reduced, Multi lane entries removed
3. Zebra Crossing with raised table, set back 5.0m from circulatory carriageway
4. Raised tables to reduce vehicular speeds
5. Segregated cycle Lanes (kerb with gaps to minimise drainage impacts)
6. Existing traffic islands retained to minimise works to existing street lighting

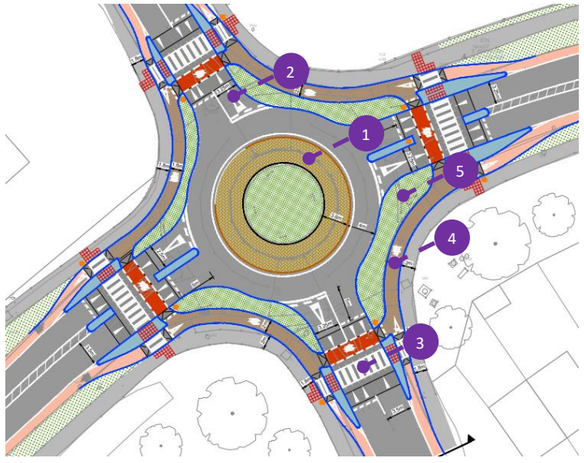
Level 2
Rapid build permanent measures



Summary of interventions:

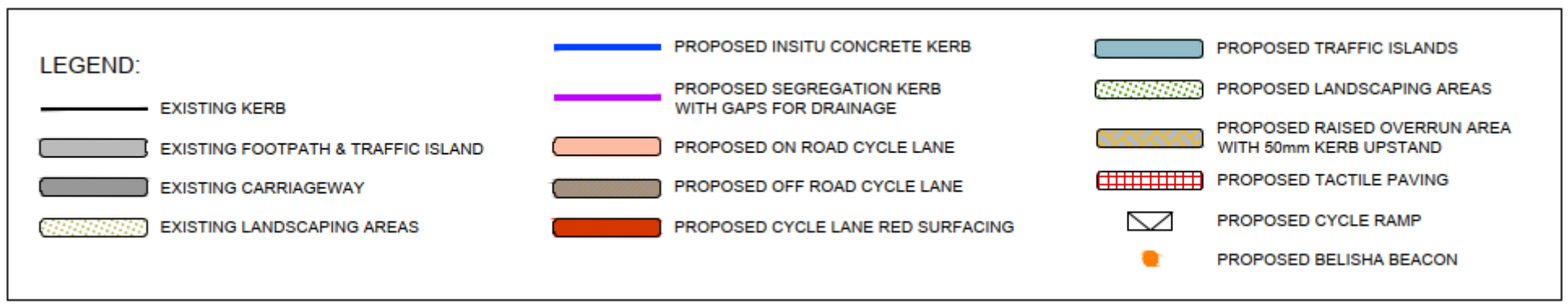
1. Narrowing of circulatory lane (concrete overrun area).
2. Approach lane widths reduced, Multi lane entries removed
3. Zebra Crossing with raised table, set back 5.0m
4. Raised tables to reduce vehicular speeds
5. Segregated cycle lanes (kerb with gaps to minimise drainage impacts)

Level 3
Full redesign



Summary of interventions:

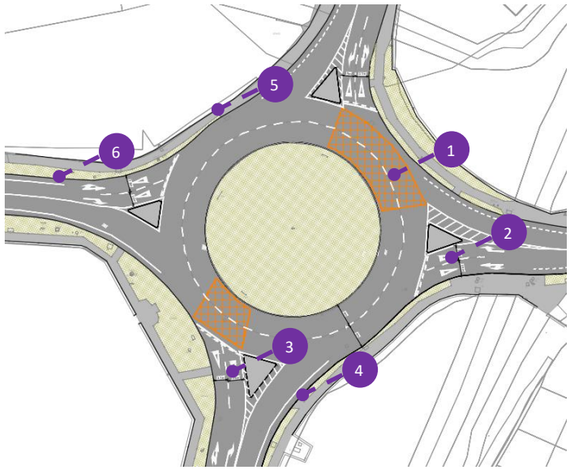
1. Narrowing of circulatory lane (concrete overrun area)
2. Approach lane widths reduced, Multi lane entries removed
3. Raised controlled pedestrian zebra crossing followed by parallel cycle zebra crossing on major arms (Zebra Crossing with raised table)
4. Segregated cycle tracks
5. SUDS / public realm greening opportunities.



9.4. Design Example 4

Road Classification: Regional roads
Roundabout ICD: 60 m
Existing conditions: This roundabout is located at the intersection between two regional roads, bordered by both residential and commercial zone. The posted speed limit is 50 km/h. The location is on a bus route. AADT information not available.

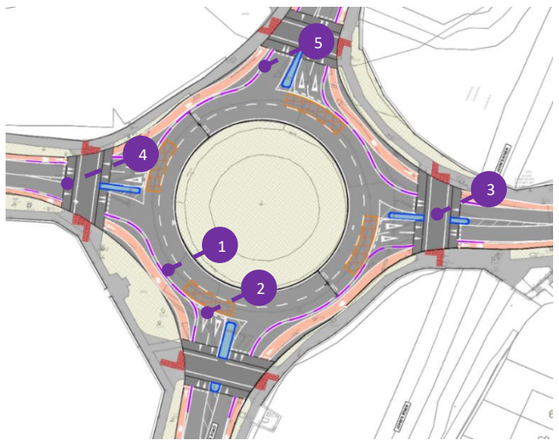
Existing Roundabout Arrangement



Summary of existing arrangement:

1. Wide two lane circulatory lanes
2. Wide approach lanes
3. Multi lane entries
4. Uncontrolled pedestrian crossings
5. Narrow footpath width
6. Cycle lanes (road marking) on major arms, cyclists mixed with other traffic at the roundabout
7. Land take not possible/requirement to work within road boundaries

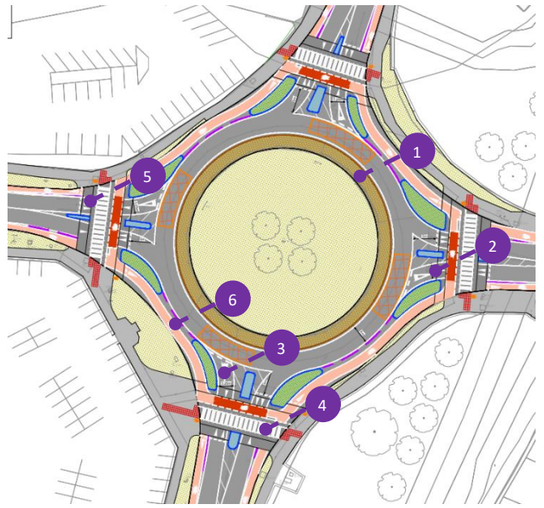
Level 1
Rapid build interim measures



Summary of interventions:

1. Narrowing of circulatory lanes (reallocating space to cycle lanes)
2. Approach lane width reduced
3. Toucan Crossing on all arms
4. Raised tables reduce traffic speed
5. Segregated cycle lanes (kerb with gaps to minimise drainage impacts)
6. Safety improvements without significant impacts on traffic capacity

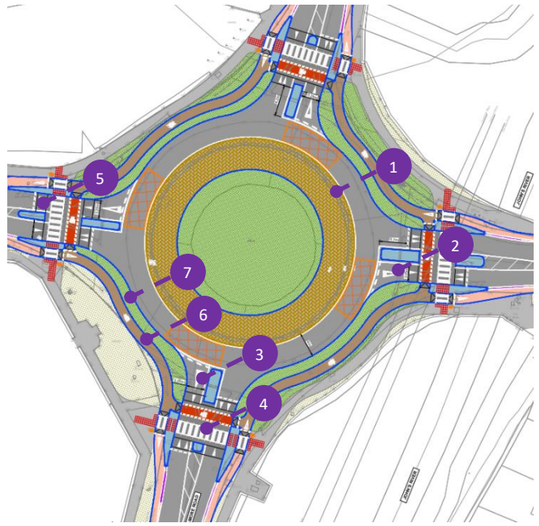
Level 2
Rapid build permanent measures



Summary of interventions:

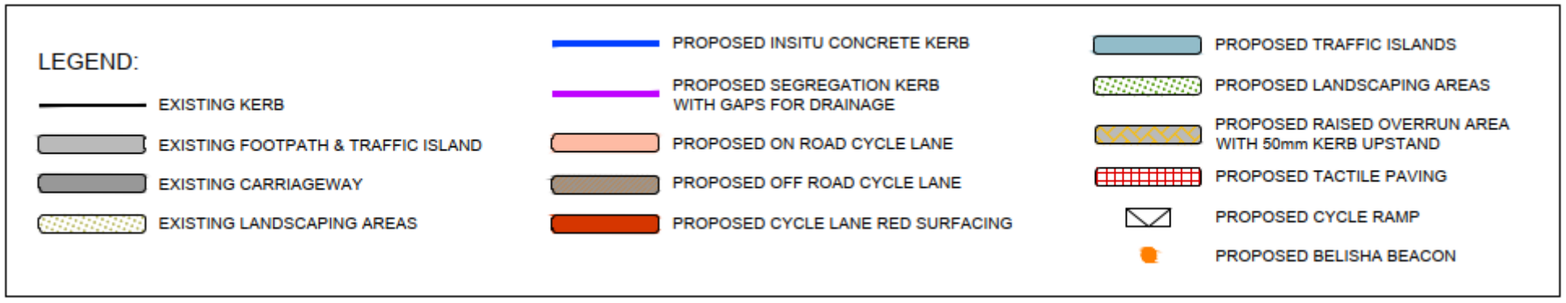
1. Narrowing of circulatory lanes (reallocating space to cycle lanes and concrete overrun area)
2. Approach lane width reduced
3. Multi lane entries removed
4. Raised controlled pedestrian zebra crossing followed by parallel cycle zebra crossing on major arms (Zebra Crossing with raised table)
5. Raised tables reduce traffic speed
6. Segregated cycle lanes (kerb with gaps to minimise drainage impacts)

Level 3
Full redesign



Summary of interventions:

1. Circulatory carriageway reduced from two lanes to one lane (concrete overrun area with 50mm upstand kerb and reallocation of road space to segregated cycle tracks)
2. Approach lanes reduced to single lane
3. Multi lane entries removed
4. Raised controlled pedestrian zebra crossing followed by parallel cycle zebra crossing on major arms (Zebra Crossing with raised table)
5. Raised tables reduce traffic speed
6. Cyclists are segregated form traffic and pedestrians.
7. SUDS / public realm greening opportunities.



Appendix A. Design Example Drawings

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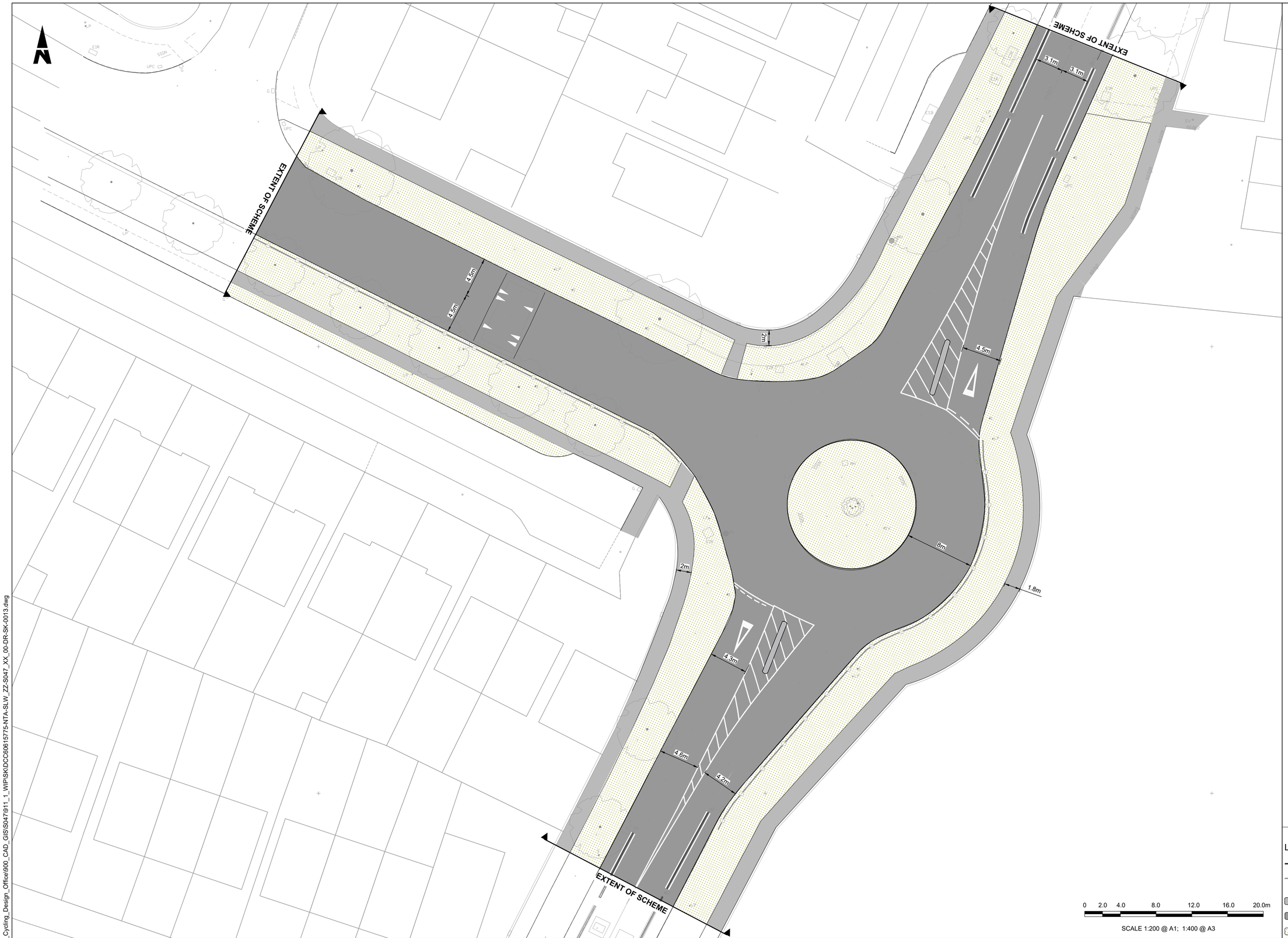

LEGEND:

- EXISTING KERB
- EXISTING SEGREGATION KERB WITH GAPS FOR DRAINAGE
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS

Project Ireland 2040 Building Ireland's Future

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P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: **NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE**

Drawing Title: EXISTING ARRANGEMENT DESIGN EXAMPLE 1

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code
XXXX	NTA	S047

Drawing File Name	Sheet Number	Status	Rev
DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0013	1 OF 1	B2	P01

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EXTENT OF SCHEME

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0 2.0 4.0 8.0 12.0 16.0 20.0m

SCALE 1:200 @ A1; 1:400 @ A3

SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANE (RIBBED ROAD MARKINGS TO MINIMISE DRAINAGE IMPACTS AT OVERRUN AREA
2. APPROACH LANE WIDTH REDUCED
3. CONTROLLED PEDESTRIAN CROSSING AS NECESSARY CONSIDERING TRAFFIC AND PEDESTRIAN NUMBER (ZEBRA CROSSING WITH RAISED TABLE, SET BACK 5.0M)
4. FOOTPATH WIDENING TO FACILITATE PEDESTRIAN PRIORITY SHARED AREAS
5. RAISED TABLES TO REDUCE TRAFFIC SPEED.
6. VERGE BUILDOUTS AND MINOR ALTERATIONS TO THE EXISTING ISLANDS (BOLLARD AND ROAD MARKINGS TO MINIMISE DRAINAGE IMPACTS)
7. SEGREGATION BETWEEN CYCLIST AND TRAFFIC ON APPROACH (SEGREGATION KERB WITH GAPS TO MINIMISE DRAINAGE IMPACTS

LEGEND:

- EXISTING KERB
- EXISTING SEGREGATION KERB WITH GAPS FOR DRAINAGE
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- PROPOSED SEGREGATION KERB WITH GAPS FOR DRAINAGE
- PROPOSED ON ROAD CYCLE LANE TO TIE IN WITH EXISTING PROTECTED CYCLE LANE
- PROPOSED SHARED AREA
- PROPOSED RAISED TABLE
- PROPOSED TACTILE PAVING
- PROPOSED CORDUROY PAVING
- PROPOSED FLEXIBLE BOLLARD
- PROPOSED BELISHA BEACON

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Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: **CYCLING DESIGN OFFICE**

Project Title: **NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE**

Drawing Title: LEVEL 1: RAPID BUILD INTERIM MEASURES DESIGN EXAMPLE 1

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
XXXX	NTA	S047	DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0001	1 OF 1	B2	P01

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EXTENT OF SCHEME

EXTENT OF SCHEME

EXTENT OF SCHEME

3.2m
3.2m
3m
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3.2m

0 2.0 4.0 8.0 12.0 16.0 20.0m

SCALE 1:200 @ A1; 1:400 @ A3

SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANE (RIBBED CONCRETE OVERRUN AREA)
2. APPROACH LANE WIDTH REDUCED
3. CONTROLLED PEDESTRIAN CROSSING AS NECESSARY CONSIDERING TRAFFIC AND PEDESTRIAN NUMBER (ZEBRA CROSSING WITH RAISED TABLE, SET BACK 5.0m)
4. FOOTPATH WIDENING TO FACILITATE PEDESTRIAN PRIORITY SHARED AREAS
5. RAISED TABLES TO REDUCE TRAFFIC SPEED.
6. VERGE BUILDOUTS AND ALTERATIONS TO THE EXISTING ISLANDS
7. SEGREGATION BETWEEN CYCLIST AND TRAFFIC ON APPROACH (SEGREGATION KERB WITH GAPS TO MINIMISE DRAINAGE IMPACTS)

LEGEND:

- EXISTING KERB
- EXISTING SEGREGATION KERB WITH GAPS FOR DRAINAGE
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- PROPOSED SEGREGATION KERB WITH GAPS FOR DRAINAGE
- PROPOSED ON ROAD CYCLE LANE TO TIE IN WITH EXISTING PROTECTED CYCLE LANE
- PROPOSED TRAFFIC ISLANDS
- PROPOSED LANDSCAPING AREAS
- PROPOSED RAISED OVERRUN AREA WITH 50mm KERB UPSTAND
- PROPOSED SHARED AREA
- PROPOSED RAISED TABLE
- PROPOSED TACTILE PAVING
- PROPOSED CORDUROY PAVING
- PROPOSED FLEXIBLE BOLLARD
- PROPOSED BELISHA BEACON

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P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE

Drawing Title: LEVEL 2: RAPID BUILD PERMANENT MEASURES DESIGN EXAMPLE 1

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code
XXXX	NTA	S047

Drawing File Name	Sheet Number	Status	Rev
DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0014	1 OF 1	B2	P01

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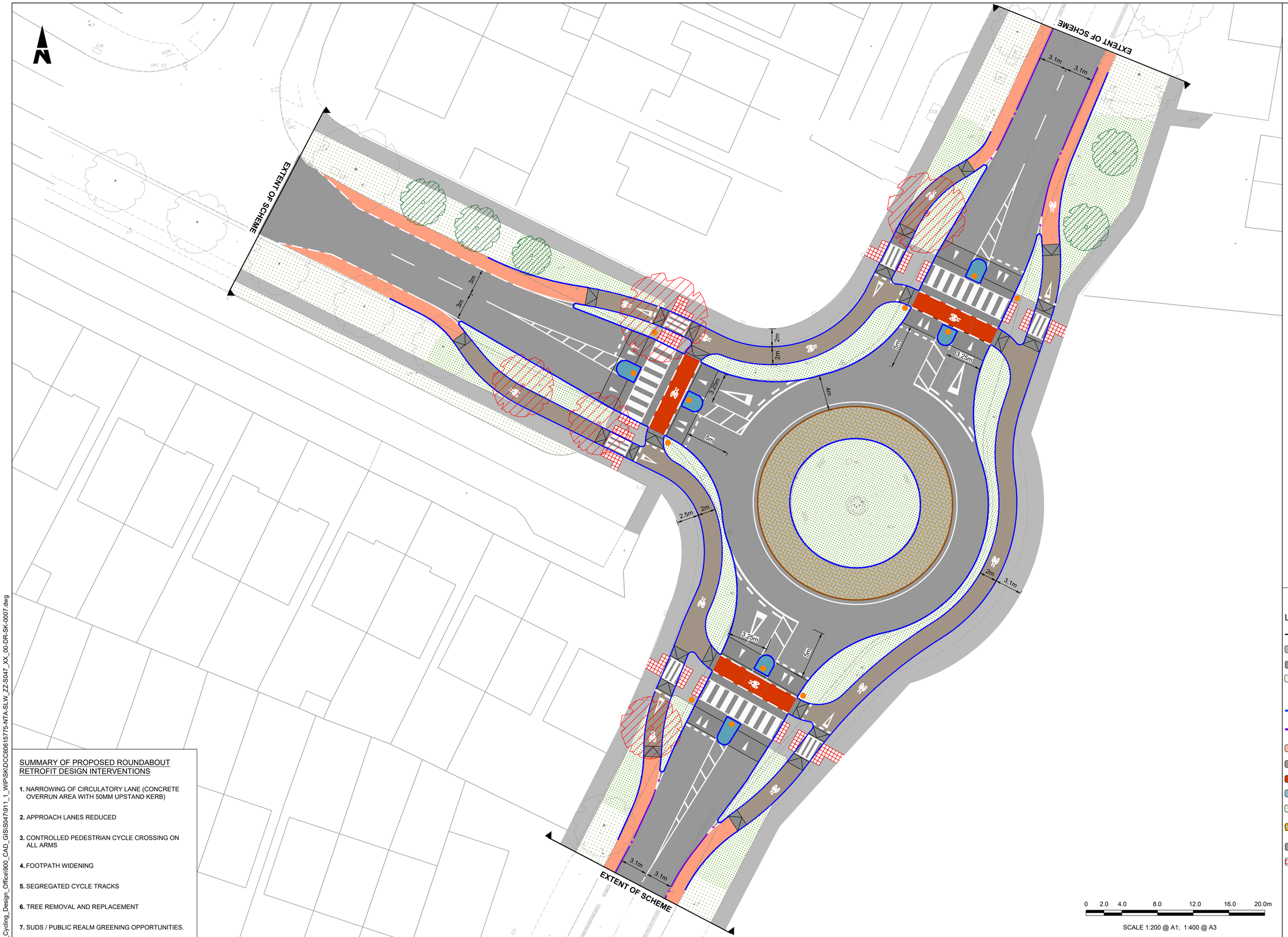

SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANE (CONCRETE OVERRUN AREA WITH 50MM UPSTAND KERB)

2. APPROACH LANES REDUCED

3. CONTROLLED PEDESTRIAN CYCLE CROSSING ON ALL ARMS

4. FOOTPATH WIDENING

5. SEGREGATED CYCLE TRACKS

6. TREE REMOVAL AND REPLACEMENT

7. SUDS / PUBLIC REALM GREENING OPPORTUNITIES.

LEGEND:

- EXISTING CARRIAGEWAY KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- EXISTING TREE TO BE REMOVED
- PROPOSED INSITU CONCRETE KERB
- PROPOSED SEGREGATION KERB WITH GAPS FOR DRAINAGE
- PROPOSED ON ROAD CYCLE LANE
- PROPOSED OFF ROAD CYCLE LANE
- PROPOSED CYCLE LANE RED SURFACING
- PROPOSED TRAFFIC ISLANDS
- PROPOSED LANDSCAPING AREAS
- PROPOSED RAISED OVERRUN AREA WITH 50mm KERB UPSTAND
- PROPOSED RAISED TABLE
- PROPOSED TACTILE PAVING
- PROPOSED CYCLE RAMP
- PROPOSED NEW TREE TO BE PLANTED IN EXISTING GRASS VERGE
- PROPOSED BELISHA BEACON
- PROPOSED FLEXIBLE BOLLARD

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority	Engineering Designer: CYCLING DESIGN OFFICE	Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE	
Date: 26.04.2023	Scale: 1:200 1:400	Drawn: RH	Checked: SD / Approved: MD
Project Code: XXXX	Originator Code: NTA	QMS Code: S047	Drawing Title: LEVEL 3: FULL REDESIGN DESIGN EXAMPLE 1
Drawing File Name: DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0007	Sheet Number: 1OF1	Status: B2	Rev: P01

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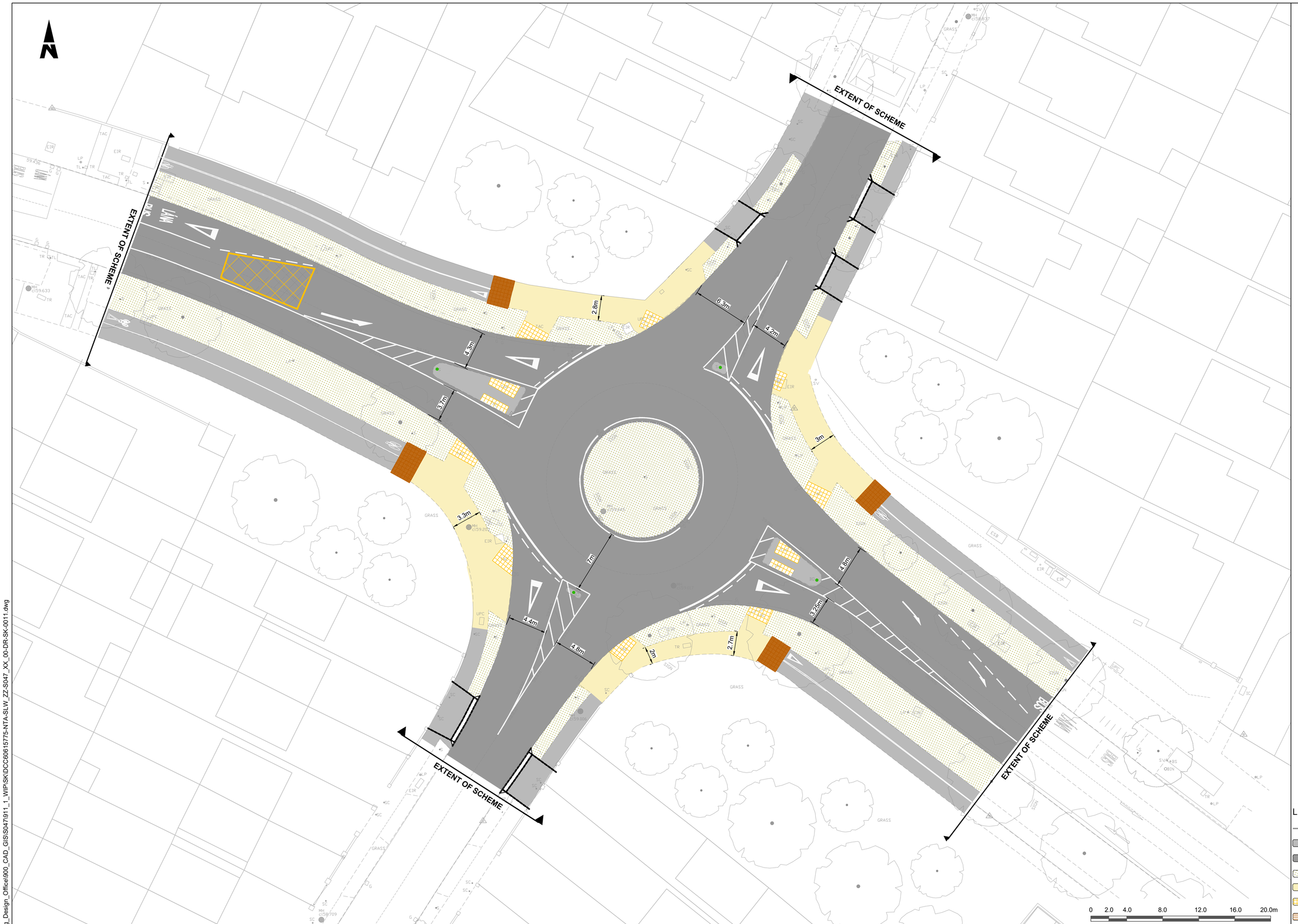
FOR INFORMATION ONLY



LEGEND:

- EXISTING KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- EXISTING SHARED AREA
- EXISTING TACTILE PAVING
- EXISTING CORDUROY PAVING
- EXISTING KEEP LEFT BOLLARD

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code
XXXX	NTA	S047

Project Title: **NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE**

Drawing Title: EXISTING ARRANGEMENT DESIGN EXAMPLE 2

Drawing File Name	Sheet Number	Status	Rev
DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0011	1 OF 1	B2	P01

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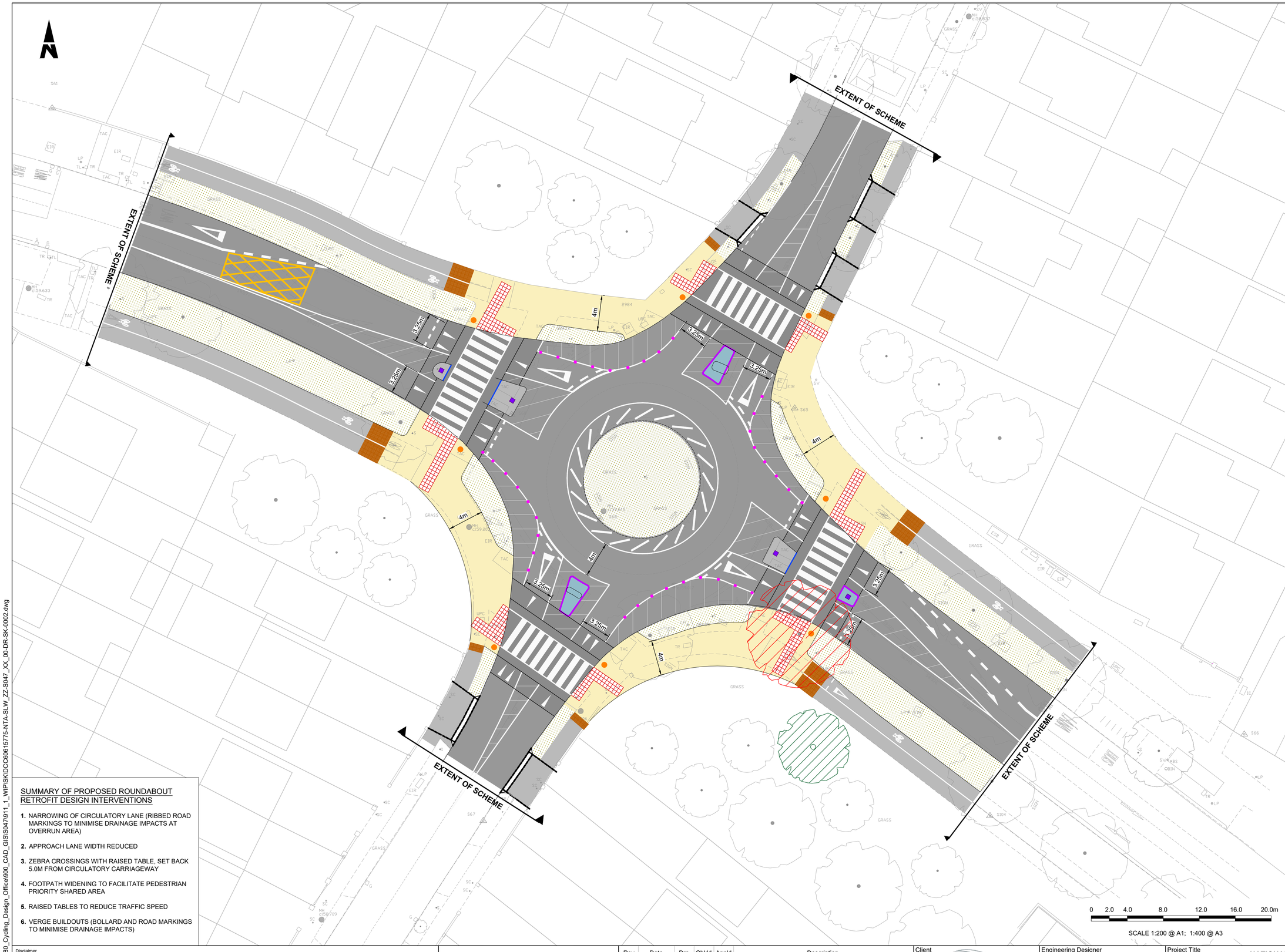

LEGEND:

- EXISTING KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- EXISTING TREES IN CONFLICT LOCATIONS
- PROPOSED INSITU CONCRETE KERB
- PROPOSED PRECAST SURFACE FIXED KERB
- PROPOSED SHARED AREA
- PROPOSED RAISED TABLE
- PROPOSED TRAFFIC ISLANDS
- PROPOSED TACTILE PAVING
- PROPOSED CORDUROY PAVING
- PROPOSED FLEXIBLE BOLLARD
- PROPOSED BELISHA BEACON
- PROPOSED ILLUMINATED KEEP LEFT BOLLARD
- PROPOSED NEW TREE TO BE PLANTED IN EXISTING GRASS VERGE

SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANE (RIBBED ROAD MARKINGS TO MINIMISE DRAINAGE IMPACTS AT OVERRUN AREA)
2. APPROACH LANE WIDTH REDUCED
3. ZEBRA CROSSINGS WITH RAISED TABLE, SET BACK 5.0M FROM CIRCULATORY CARRIAGEWAY
4. FOOTPATH WIDENING TO FACILITATE PEDESTRIAN PRIORITY SHARED AREA
5. RAISED TABLES TO REDUCE TRAFFIC SPEED
6. VERGE BUILDOUTS (BOLLARD AND ROAD MARKINGS TO MINIMISE DRAINAGE IMPACTS)

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code
XXXX	NTA	S047

Project Title: **NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE**

Drawing Title: LEVEL 1: RAPID BUILD INTERIM MEASURES DESIGN EXAMPLE 2

Drawing File Name	Sheet Number	Status	Rev
DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0002	1 OF 1	B2	P01

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FOR INFORMATION ONLY

EXTENT OF SCHEME

EXTENT OF SCHEME

EXTENT OF SCHEME

EXTENT OF SCHEME

3.25m

4m

5m

LEGEND:

- EXISTING KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- EXISTING TREES IN CONFLICT LOCATIONS
- PROPOSED INSITU CONCRETE KERB
- PROPOSED PRECAST SURFACE FIXED KERB
- PROPOSED SHARED AREA
- PROPOSED RAISED TABLE
- PROPOSED TRAFFIC ISLANDS
- PROPOSED LANDSCAPING AREAS
- PROPOSED RAISED OVERRUN AREA WITH 50mm KERB UPSTAND
- PROPOSED TACTILE PAVING
- PROPOSED CORDUROY PAVING
- PROPOSED BELISHA BEACON
- PROPOSED ILLUMINATED KEEP LEFT BOLLARD
- PROPOSED NEW TREE TO BE PLANTED IN EXISTING GRASS VERGE

0 2.0 4.0 8.0 12.0 16.0 20.0m

SCALE 1:200 @ A1; 1:400 @ A3

SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANE (RAISED CONCRETE OVERRUN AREA)
2. APPROACH LANE WIDTH REDUCED
3. ZEBRA CROSSINGS WITH RAISED TABLE, SET BACK 5.0m FROM CIRCULATORY CARRIAGEWAY
4. FOOTPATH WIDENING TO FACILITATE PEDESTRIAN PRIORITY SHARED AREA
5. RAISED TABLES TO REDUCE TRAFFIC SPEED
6. VERGE BUILDOUTS (CONCRETE KERB AND FOOTPATH BUILDOUT TO REDUCE PEDESTRIAN CROSSING DISTANCE)

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE

Drawing Title: LEVEL 2: RAPID BUILD PERMANENT MEASURES DESIGN EXAMPLE 2

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
XXXX	NTA	S047	DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0012	1 OF 1	B2	P01

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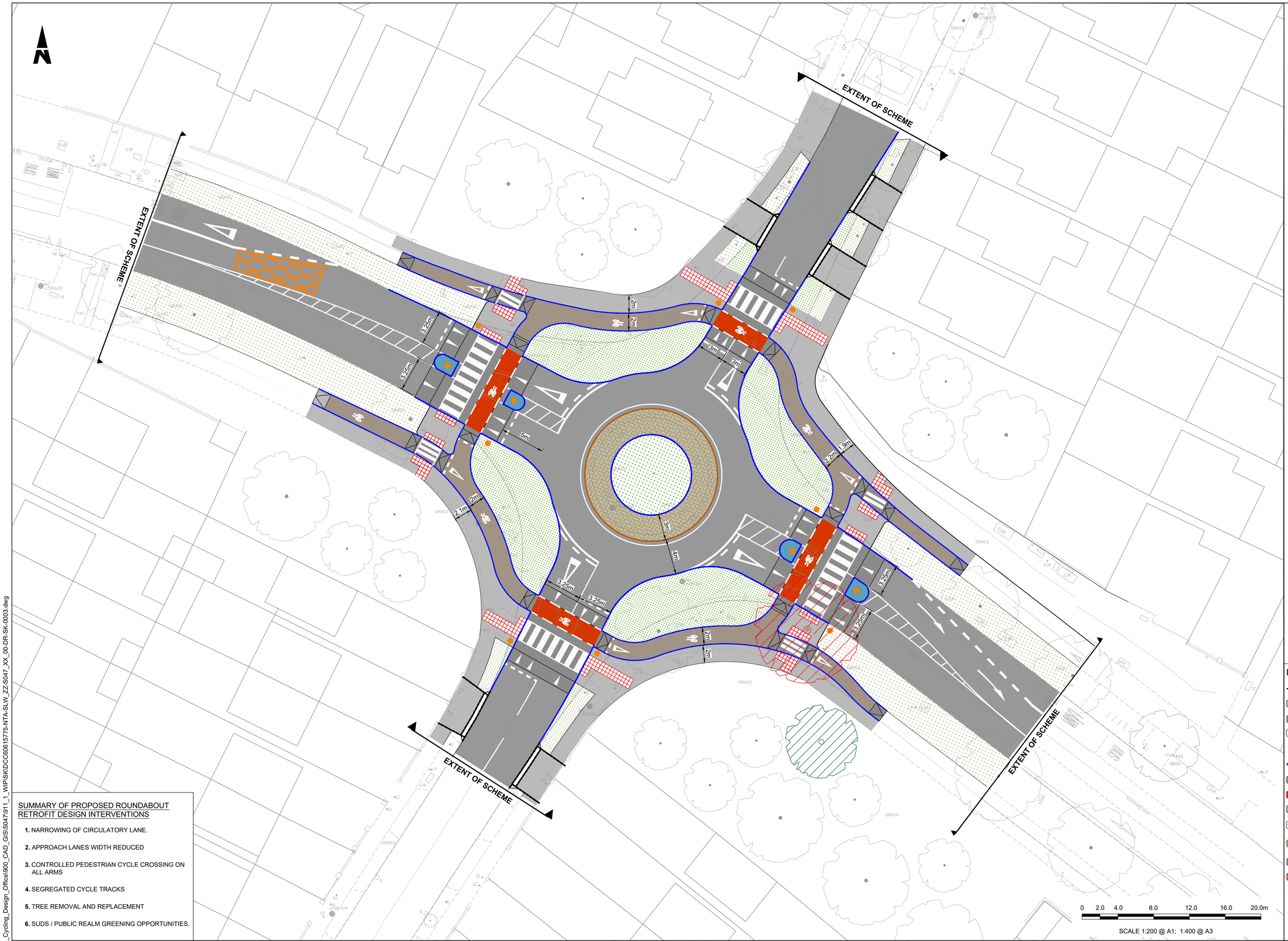
FOR INFORMATION ONLY



SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANE.
2. APPROACH LANES WIDTH REDUCED
3. CONTROLLED PEDESTRIAN CYCLE CROSSING ON ALL ARMS
4. SEGREGATED CYCLE TRACKS
5. TREE REMOVAL AND REPLACEMENT
6. SUDS / PUBLIC REALM GREENING OPPORTUNITIES.

LEGEND:

- EXISTING CARRIAGEWAY KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- EXISTING TREE TO BE REMOVED
- PROPOSED INSITU CONCRETE KERB
- PROPOSED OFF ROAD CYCLE LANE
- PROPOSED CYCLE LANE RED SURFACING
- PROPOSED TRAFFIC ISLANDS
- PROPOSED LANDSCAPING AREAS
- PROPOSED RAISED OVERRUN AREA WITH 50mm KERB UPSTAND
- PROPOSED RAISED TABLE
- PROPOSED TACTILE PAVING
- PROPOSED CYCLE RAMP
- PROPOSED NEW TREE TO BE PLANTED IN EXISTING GRASS VERGE
- PROPOSED BELISHA BEACON

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair / National Transport Authority	Engineering Designer: CYCLING DESIGN OFFICE	Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE	
Date: 26.04.2023	Scale: 1:200 1:400	Drawn: RH	Checked: SD / Approved: MD
Project Code: XXXX	Originator Code: NTA	QMS Code: S047	Drawing Title: LEVEL 3: FULL REDESIGN DESIGN EXAMPLE 2
Drawing File Name: DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0003	Sheet Number: 1 OF 1	Status: B2	Rev: P01

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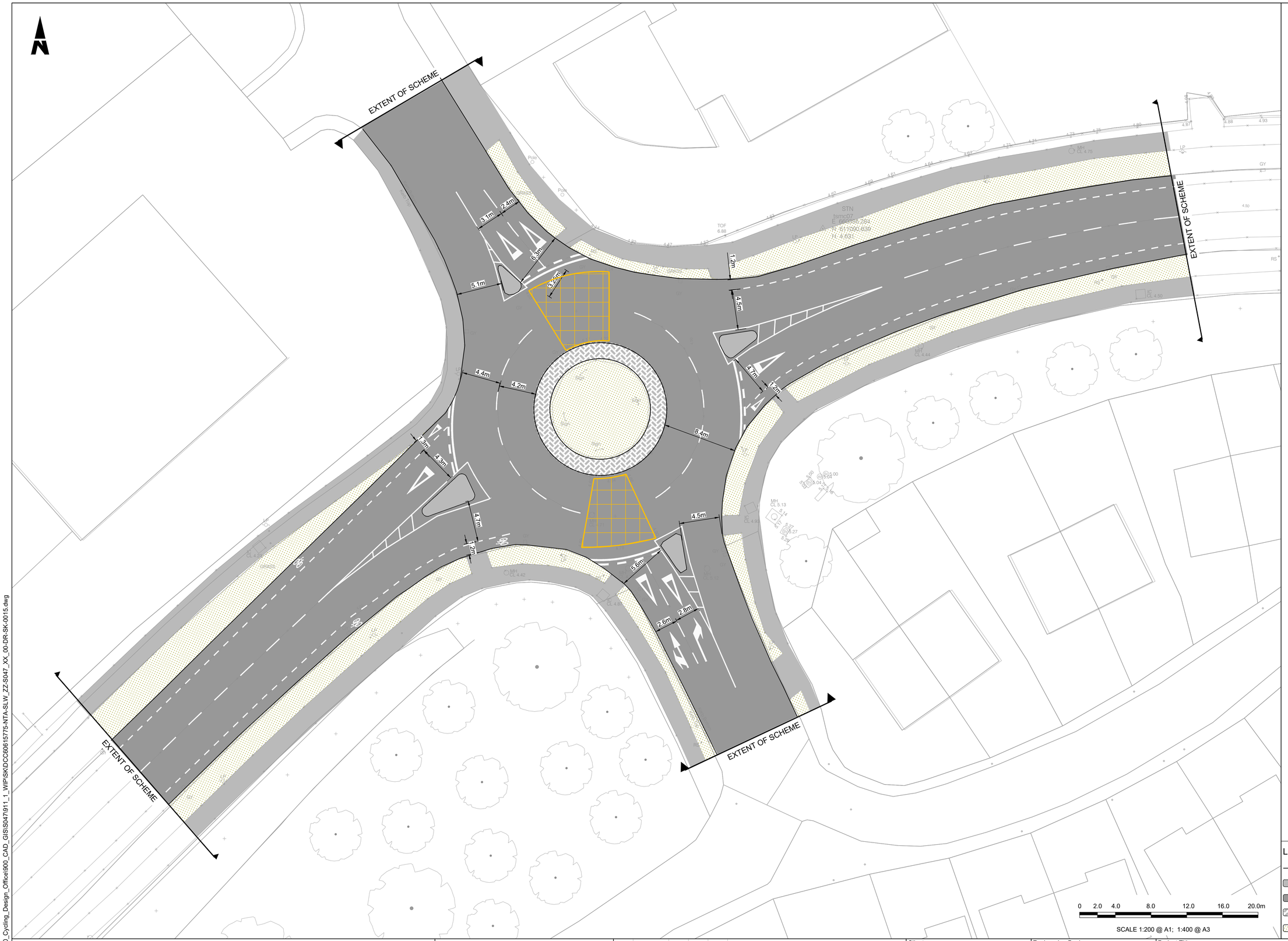

FOR INFORMATION ONLY

LEGEND:

- EXISTING KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING OVERRUN
- EXISTING LANDSCAPING AREAS

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE

Drawing Title: EXISTING ARRANGEMENT DESIGN EXAMPLE 3

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
XXXX	NTA	S047	DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0015	1 OF 1	B2	P01

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SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

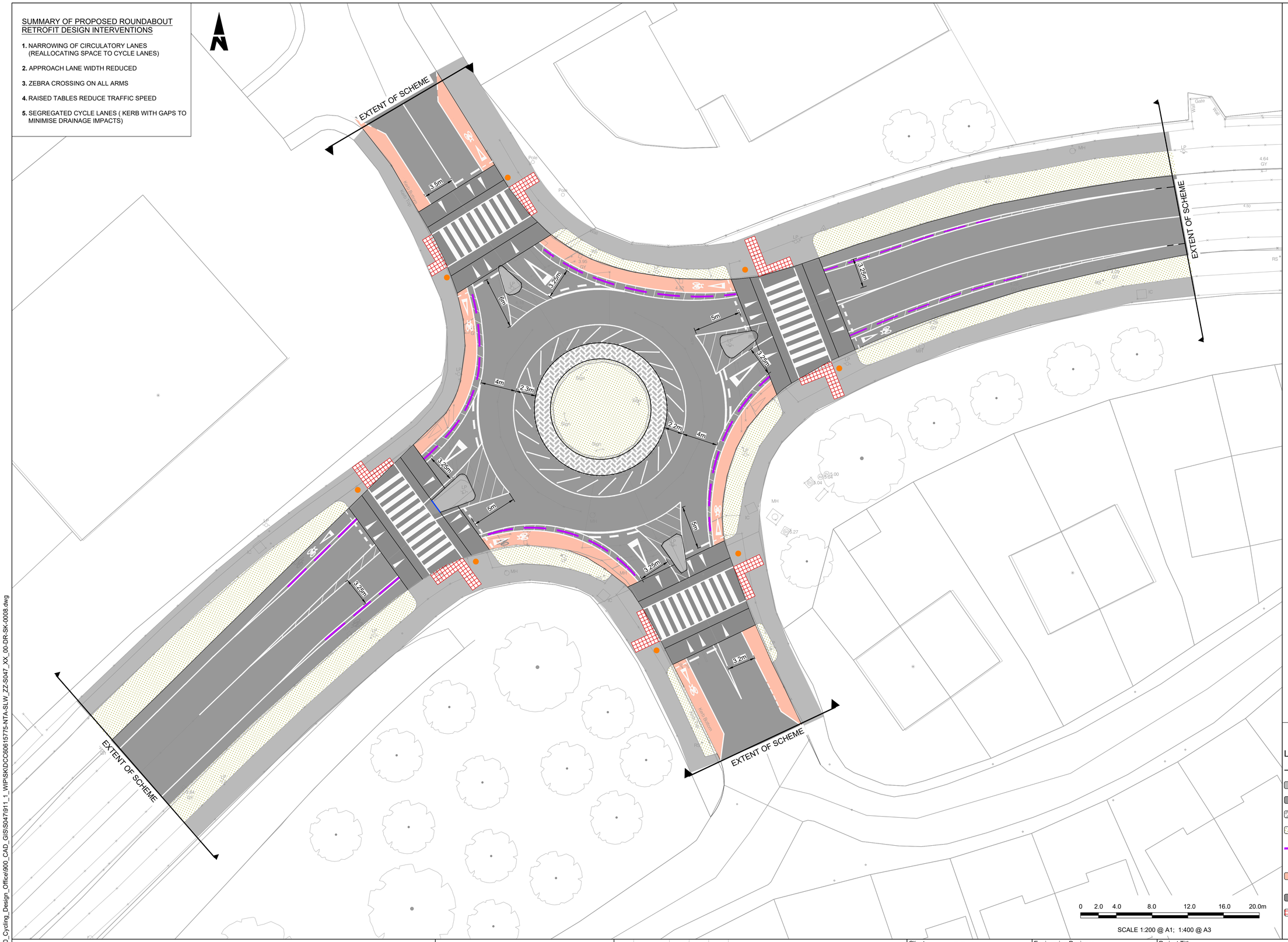
1. NARROWING OF CIRCULATORY LANES (REALLOCATING SPACE TO CYCLE LANES)

2. APPROACH LANE WIDTH REDUCED

3. ZEBRA CROSSING ON ALL ARMS

4. RAISED TABLES REDUCE TRAFFIC SPEED

5. SEGREGATED CYCLE LANES (KERB WITH GAPS TO MINIMISE DRAINAGE IMPACTS)



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FOR INFORMATION ONLY

LEGEND:

- EXISTING KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING OVERRUN
- EXISTING LANDSCAPING AREAS
- PROPOSED ADDITIONAL SEGREGATION KERB WITH GAPS FOR DRAINAGE
- PROPOSED ADDITIONAL ON ROAD CYCLE LANE TO TIE IN WITH EXISTING PROTECTED CYCLE LANE
- PROPOSED RAISED TABLE
- PROPOSED TACTILE PAVING
- PROPOSED BELISHA BEACON

0 2.0 4.0 8.0 12.0 16.0 20.0m

SCALE 1:200 @ A1; 1:400 @ A3

Project Ireland 2040 Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority	Engineering Designer: CYCLING DESIGN OFFICE			
Date: 26.04.2023	Scale: 1:200 1:400	Drawn: RH	Checked: SD	Approved: MD
Project Code: XXXX	Originator Code: NTA	QMS Code: S047		

Project Title: **NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE**			
Drawing Title: LEVEL 1: RAPID BUILD INTERIM MEASURES DESIGN EXAMPLE 3			
Drawing File Name: DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0008	Sheet Number: 1 OF 1	Status: B2	Rev: P01

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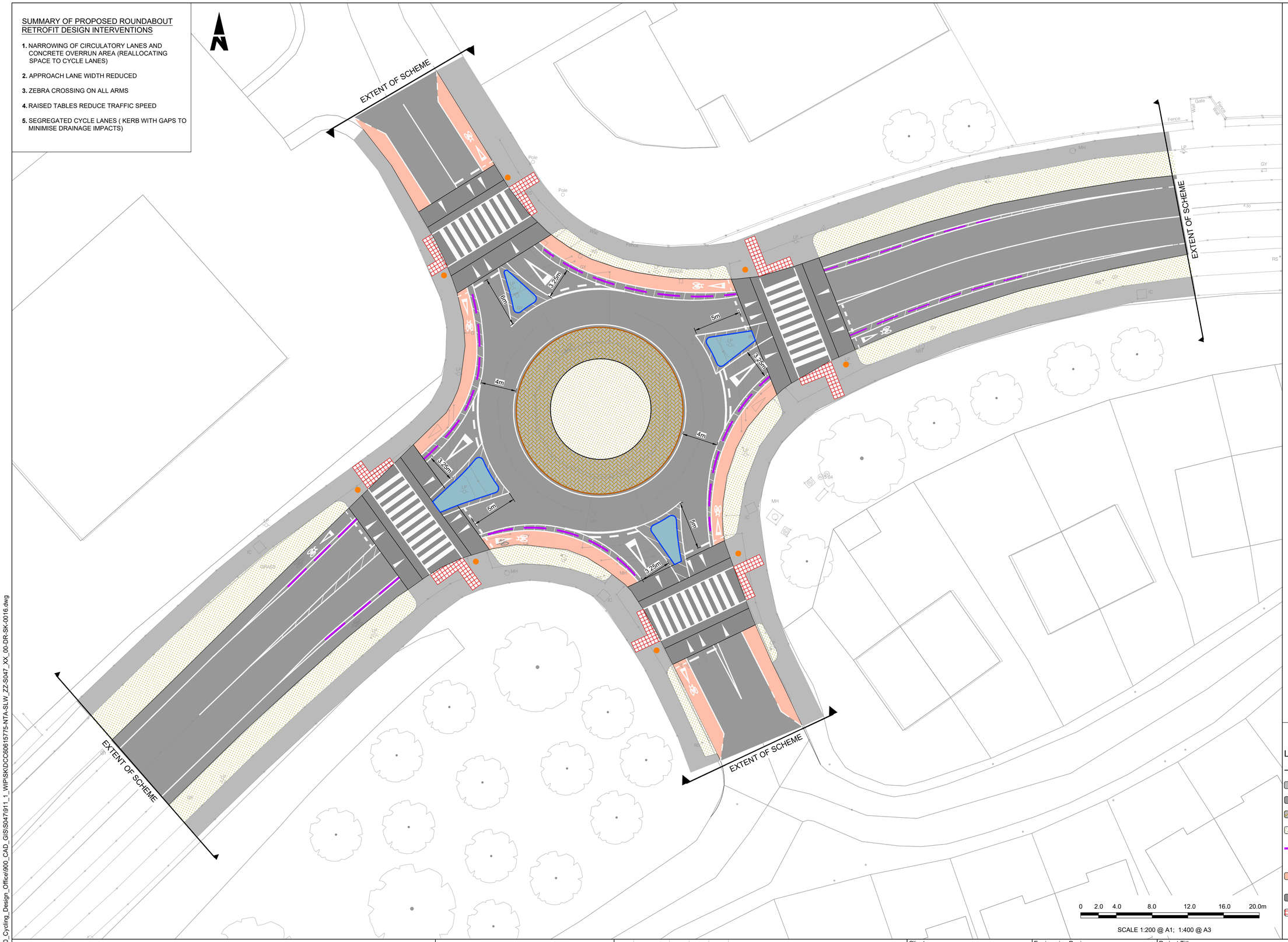
SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANES AND CONCRETE OVERRUN AREA (REALLOCATING SPACE TO CYCLE LANES)
2. APPROACH LANE WIDTH REDUCED
3. ZEBRA CROSSING ON ALL ARMS
4. RAISED TABLES REDUCE TRAFFIC SPEED
5. SEGREGATED CYCLE LANES (KERB WITH GAPS TO MINIMISE DRAINAGE IMPACTS)



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FOR INFORMATION ONLY

LEGEND:

- EXISTING KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING OVERRUN
- EXISTING LANDSCAPING AREAS
- PROPOSED ADDITIONAL SEGREGATION KERB WITH GAPS FOR DRAINAGE
- PROPOSED ADDITIONAL ON ROAD CYCLE LANE TO TIE IN WITH EXISTING PROTECTED CYCLE LANE
- PROPOSED RAISED TABLE
- PROPOSED TACTILE PAVING
- PROPOSED BELISHA BEACON

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair / National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE

Drawing Title: LEVEL 2: RAPID BUILD PERMANENT MEASURES DESIGN EXAMPLE 3

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code
XXXX	NTA	S047

Drawing File Name	Sheet Number	Status	Rev
DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0016	1 OF 1	B2	P01

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SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANE (CONCRETE OVERRUN AREA WITH 50MM UPSTAND KERB)

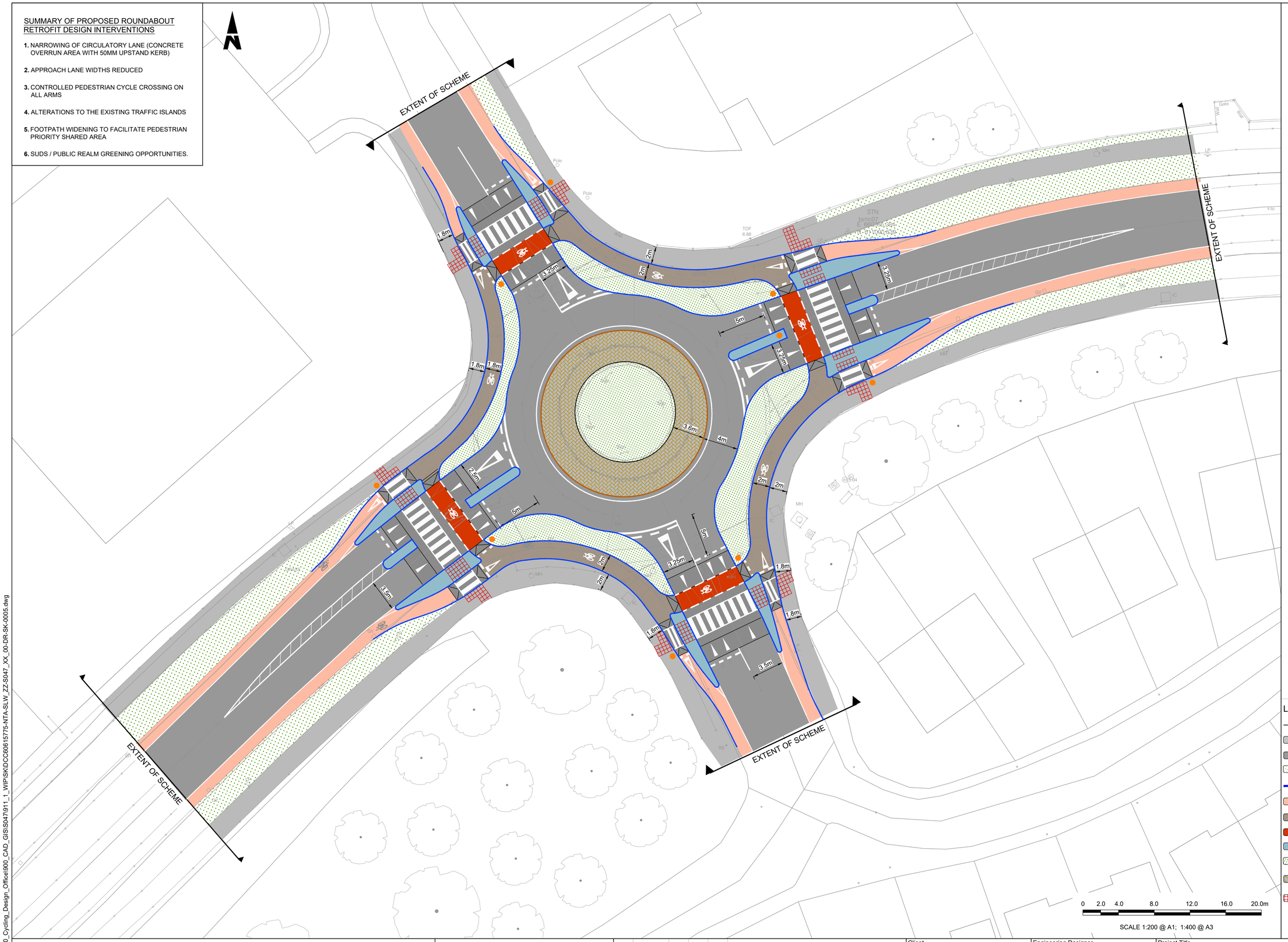
2. APPROACH LANE WIDTHS REDUCED

3. CONTROLLED PEDESTRIAN CYCLE CROSSING ON ALL ARMS

4. ALTERATIONS TO THE EXISTING TRAFFIC ISLANDS

5. FOOTPATH WIDENING TO FACILITATE PEDESTRIAN PRIORITY SHARED AREA

6. SUDS / PUBLIC REALM GREENING OPPORTUNITIES.



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FOR INFORMATION ONLY

LEGEND:

- EXISTING CARRIAGEWAY KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- PROPOSED INSITU CONCRETE KERB
- PROPOSED ON ROAD CYCLE LANE
- PROPOSED OFF ROAD CYCLE LANE
- PROPOSED CYCLE LANE RED SURFACING
- PROPOSED TRAFFIC ISLANDS
- PROPOSED LANDSCAPING AREAS
- PROPOSED RAISED OVERRUN AREA WITH 50mm KERB UPSTAND
- PROPOSED TACTILE PAVING
- PROPOSED CYCLE RAMP
- PROPOSED BELISHA BEACON

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair / National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE

Drawing Title: LEVEL 3: FULL REDESIGN DESIGN EXAMPLE 3

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:200 1:400	RH	SD	MD

Project Code	Originator Code	QMS Code
XXXX	NTA	S047

Drawing File Name	Sheet Number	Status	Rev
DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0005	1 OF 1	B2	P01

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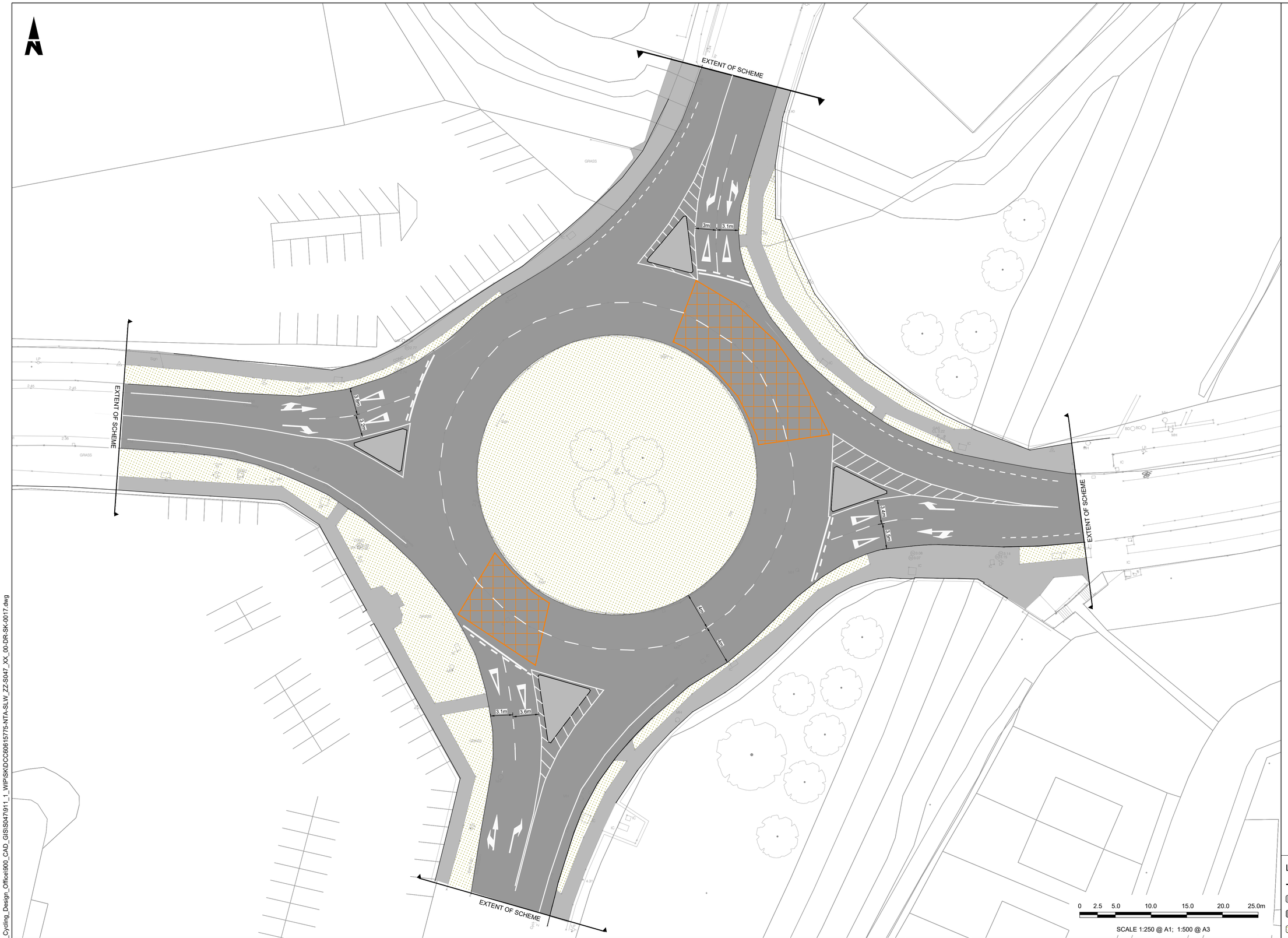
FOR INFORMATION ONLY



LEGEND:

- EXISTING KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS

Project Ireland 2040 Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
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Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE

Drawing Title: EXISTING ARRANGEMENT DESIGN EXAMPLE 4

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:250 1:500	RH	SD	MD

Project Code	Originator Code	QMS Code
XXXX	NTA	S047

Drawing File Name	Sheet Number	Status	Rev
DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0017	1 OF 1	B2	P01

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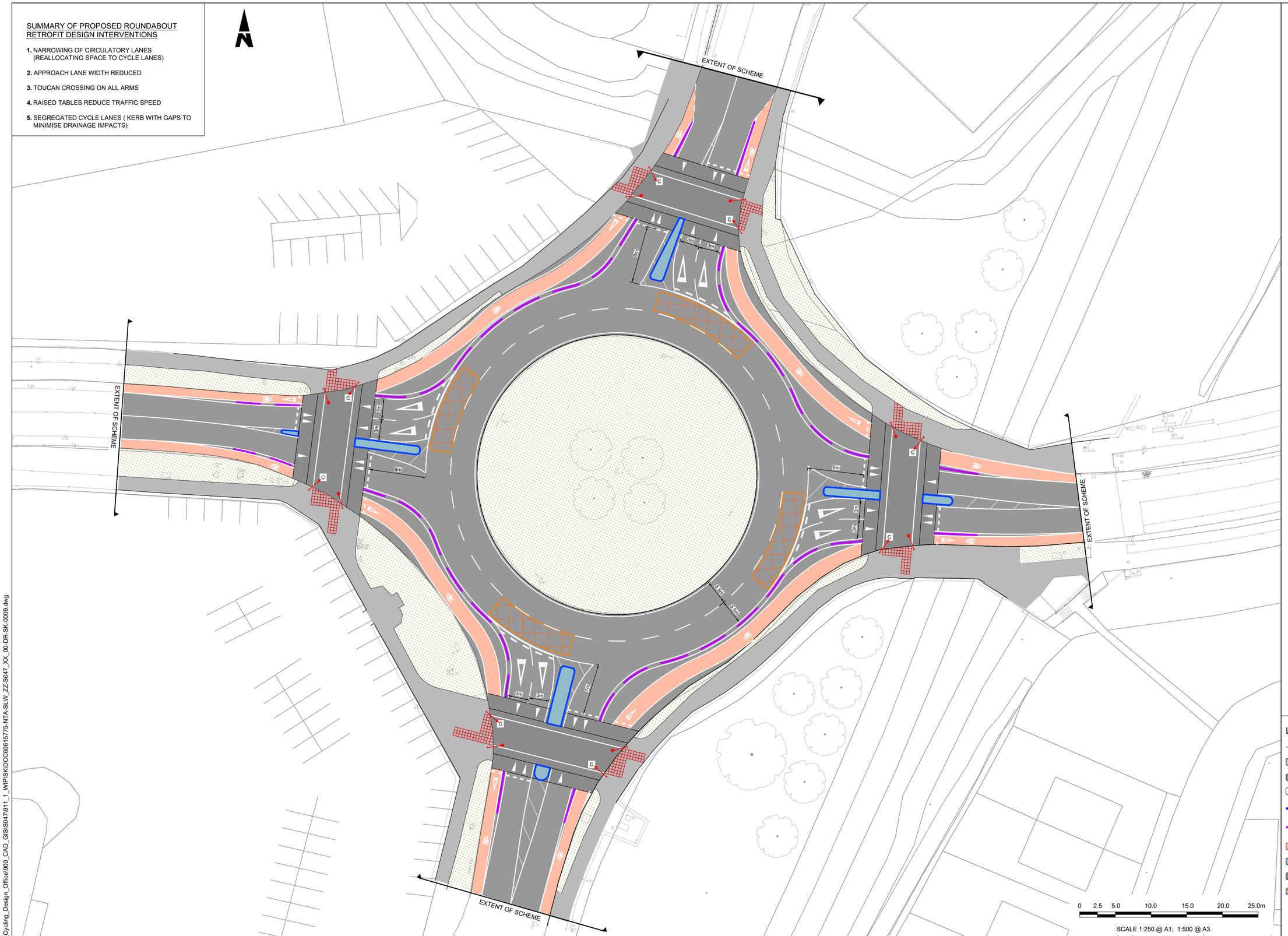
SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANES (REALLOCATING SPACE TO CYCLE LANES)
2. APPROACH LANE WIDTH REDUCED
3. TOUCAN CROSSING ON ALL ARMS
4. RAISED TABLES REDUCE TRAFFIC SPEED
5. SEGREGATED CYCLE LANES (KERB WITH GAPS TO MINIMISE DRAINAGE IMPACTS)



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FOR INFORMATION ONLY

LEGEND:

- EXISTING CARRIAGEWAY KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- PROPOSED INSITU CONCRETE KERB
- PROPOSED SEGREGATION KERB WITH GAPS FOR DRAINAGE
- PROPOSED ON ROAD CYCLE LANE
- PROPOSED TRAFFIC ISLANDS
- PROPOSED RAISED TABLE
- PROPOSED TACTILE PAVING
- PEDESTRIAN SIGNAL HEAD WITH PEDESTRIAN DEMAND UNIT
- C CYCLE SIGNAL HEAD WITH

0 2.5 5.0 10.0 15.0 20.0 25.0m

SCALE 1:250 @ A1; 1:500 @ A3

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Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE

Drawing Title: LEVEL 1: RAPID BUILD INTERIM MEASURES DESIGN EXAMPLE 4

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:250 1:500	RH	SD	MD

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
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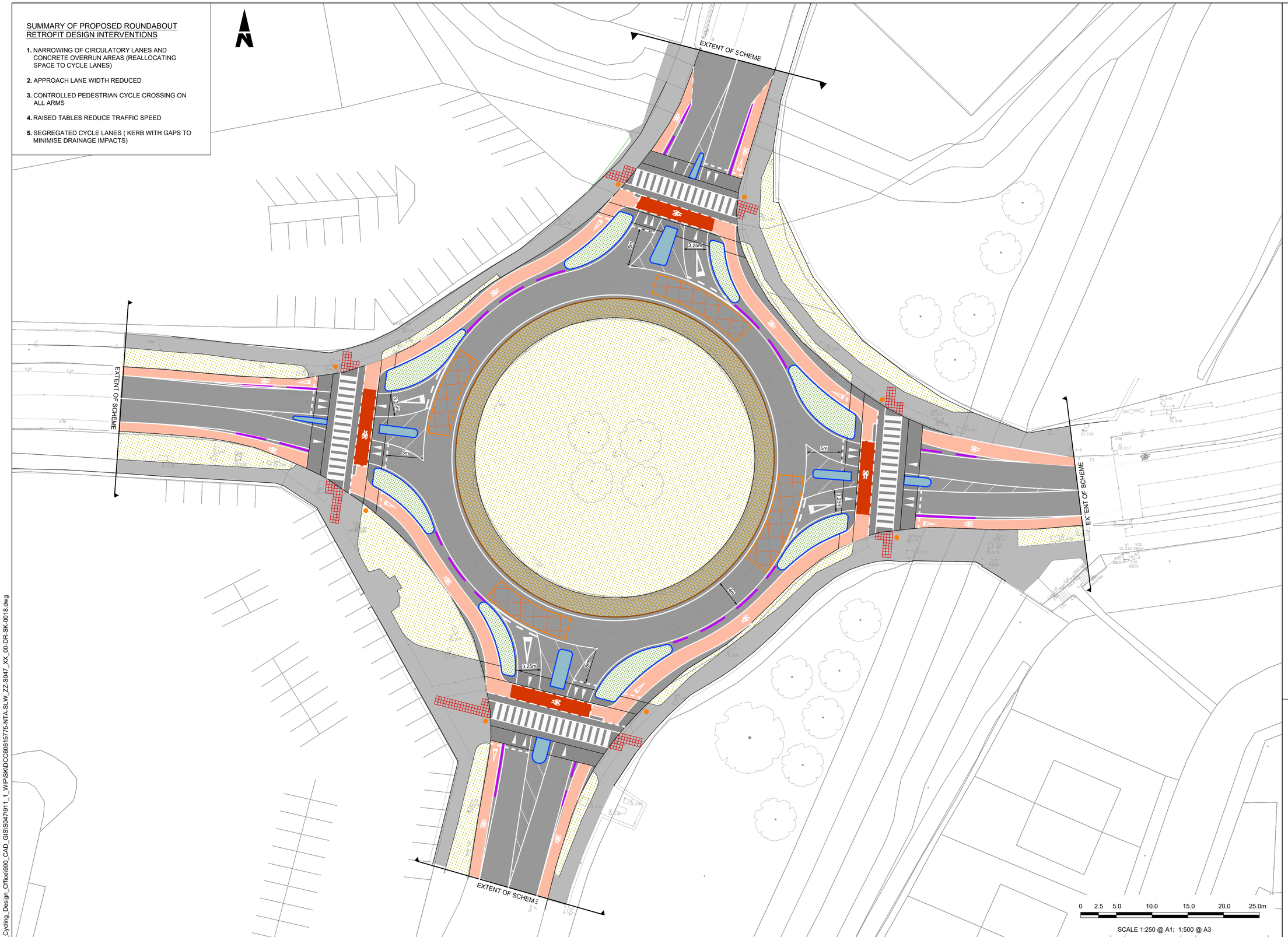
SUMMARY OF PROPOSED ROUNDABOUT RETROFIT DESIGN INTERVENTIONS

1. NARROWING OF CIRCULATORY LANES AND CONCRETE OVERRUN AREAS (REALLOCATING SPACE TO CYCLE LANES)
2. APPROACH LANE WIDTH REDUCED
3. CONTROLLED PEDESTRIAN CYCLE CROSSING ON ALL ARMS
4. RAISED TABLES REDUCE TRAFFIC SPEED
5. SEGREGATED CYCLE LANES (KERB WITH GAPS TO MINIMISE DRAINAGE IMPACTS)



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FOR INFORMATION ONLY

LEGEND:

- EXISTING CARRIAGEWAY KERB
- EXISTING FOOTPATH
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- PROPOSED INSITU CONCRETE KERB
- PROPOSED SEGREGATION KERB WITH GAPS FOR DRAINAGE
- PROPOSED ON ROAD CYCLE LANE
- PROPOSED TRAFFIC ISLANDS
- PROPOSED RAISED TABLE
- PROPOSED LANDSCAPING AREAS
- PROPOSED RAISED OVERRUN AREA WITH 50mm KERB UPSTAND
- PROPOSED TACTILE PAVING
- PROPOSED BELISHA BEACON

0 2.5 5.0 10.0 15.0 20.0 25.0m

SCALE 1:250 @ A1; 1:500 @ A3

Project Ireland 2040 Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority	Engineering Designer: CYCLING DESIGN OFFICE	Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE	
Date: 26.04.2023	Scale: 1:250 1:500	Drawn: RH	Checked: SD / Approved: MD
Project Code: XXXX	Originator Code: NTA	QMS Code: S047	Drawing Title: LEVEL 2: RAPID BUILD PERMANENT MEASURES DESIGN EXAMPLE 4
Drawing File Name: DCC60615775-NTA-SLW_ZZ-S047_XX_00-DR-SK-0018	Sheet Number: 1 OF 1	Status: B2	Rev: P01

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FOR INFORMATION ONLY

EXTENT OF SCHEME

EXTENT OF SCHEME

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EXTENT OF SCHEME

3.25m

5m

3.25m

5m

3.25m

5m

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5m

4m

0 2.5 5.0 10.0 15.0 20.0 25.0m

SCALE 1:250 @ A1; 1:500 @ A3

SUMMARY OF PROPOSED ROUNDABOUTS RETROFIT DESIGN INTERVENTIONS

1. CIRCULATORY CARRIAGEWAY REDUCED FROM TWO LANES TO ONE LANE (CONCRETE OVERRUN AREA WITH 50MM UPSTAND KERB AND REALLOCATION OF ROAD SPACE TO SEGREGATED CYCLE TRACKS)
2. APPROACH LANES REDUCED TO SINGLE LANE
3. CONTROLLED PEDESTRIAN CYCLE CROSSINGS ON ALL ARMS
4. FOOTPATH /VERGE BUILDOUTS AND ALTERATIONS TO THE EXISTING TRAFFIC ISLANDS
5. CYCLISTS ARE SEGREGATED FORM TRAFFIC AND PEDESTRIANS.
6. SUDS / PUBLIC REALM GREENING OPPORTUNITIES.

LEGEND:

- EXISTING CARRIAGEWAY KERB
- EXISTING FOOTPATH & TRAFFIC ISLAND
- EXISTING CARRIAGEWAY
- EXISTING LANDSCAPING AREAS
- PROPOSED INSITU CONCRETE KERB
- PROPOSED SEGREGATION KERB
- PROPOSED ON ROAD CYCLE LANE
- PROPOSED OFF ROAD CYCLE LANE
- PROPOSED CYCLE LANE RED SURFACING
- PROPOSED BUILDOUTS
- PROPOSED LANDSCAPING AREAS
- PROPOSED RAISED OVERRUN AREA WITH 50mm KERB UPSTAND
- PROPOSED TACTILE PAVING
- PROPOSED CYCLE RAMP
- PROPOSED BELISHA BEACON

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P01	26.04.2023	RH	SD	MD	ISSUED FOR INFORMATION

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: CYCLING DESIGN OFFICE

Project Title: NATIONAL TRANSPORT AUTHORITY (NTA) ROUNDABOUT RETROFIT TECHNICAL NOTE

Drawing Title: LEVEL 3: FULL REDESIGN DESIGN EXAMPLE 4

Date	Scale	Drawn	Checked	Approved
26.04.2023	1:250 1:500	RH	SD	MD

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