

Cycling and Luas Cross City

Assessment of cycling feasibility on the Luas Cross City route

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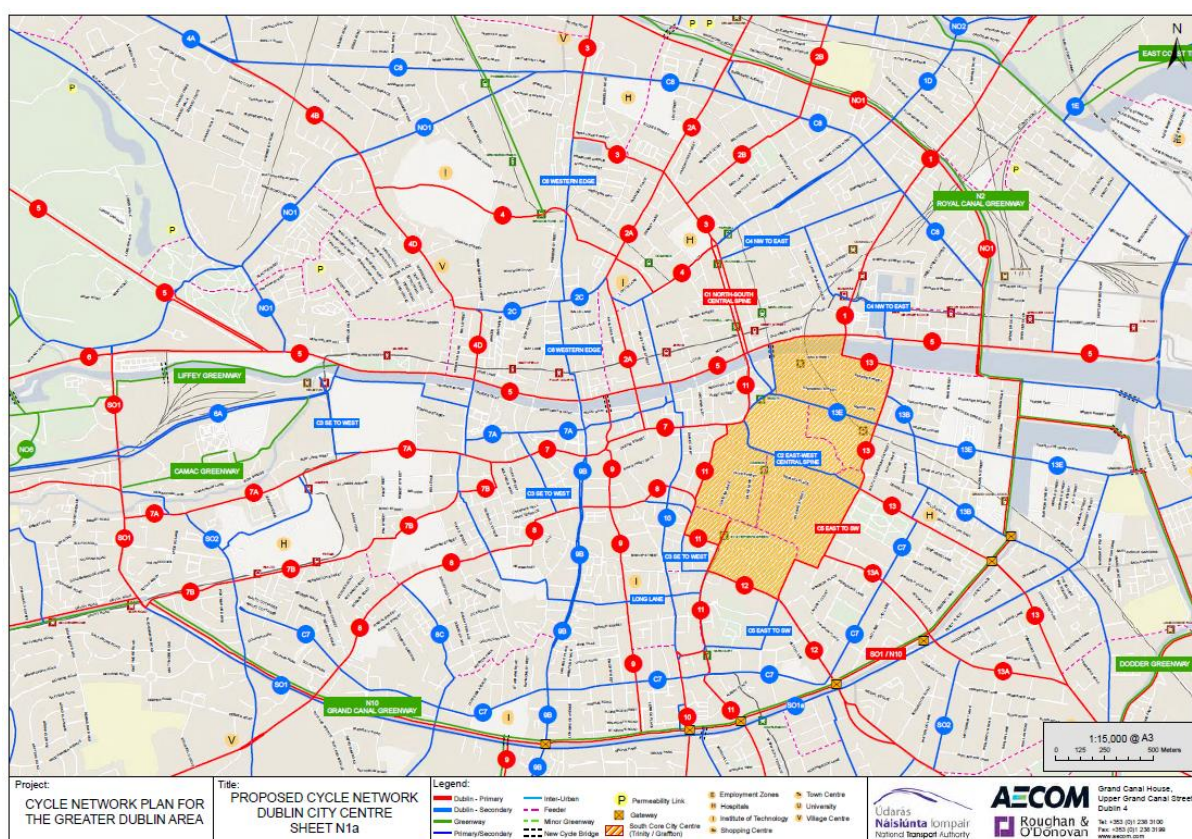
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Introduction

Luas Cross City (LCC) connects the northern end of the Luas Green Line at St. Stephen's Green to Broombridge station in Cabra, intersecting with the Luas Red Line at O'Connell Street and Abbey Street. Between St. Stephen's Green and Broadstone Station the route runs on-street. The alignment includes a number of streets that form part of the city centre cycle network (see below), with other cycle network routes crossing the LCC route at junctions.

The *Greater Dublin Area Cycle Network Plan* (NTA, 2013) (GDACNP) is the primary reference document for the identification of higher volume cycle routes. However, the nature of urban cycling is such that all roads are likely to attract cyclists to some degree unless it is specifically precluded (one-way streets, pedestrian streets with no marked cycle facility, etc.).

The GDACNP proposed the following cycle network for the city centre (Sheet N1a):



The written report for the proposed cycle network for Dublin City Centre includes the following commentary regarding Luas:

3.1.2 Dublin City Centre - Context for the Cycle Route Network

In the city centre sector there is considerable competition for road space between the various modes of transport of bus, light rail, car, truck, bicycle and pedestrian. Only the widest streets have sufficient width to potentially accommodate all of these modes with their own appropriate space, e.g. Westmoreland Street. On most streets choices have to be made as to which mode should receive priority, if any, or more likely that all modes must share the space at a suitably low speed.

Light Rail Tram Lines

Ideally, the light rail mode would be segregated from the cycling mode. The proposed network of designated cycle routes is intended to minimise close interface with light rail lines (existing and planned). However, in some city centre locations, the lack of viable alternative routes suggests it will be necessary to share the street between light rail and bicycles. The new Cross-City Luas line coincides with some of the main north-south and east-west cycle desire lines through the heart of the city centre. While there would appear to be street space for cyclists to avoid cycling closely alongside or across the light rail rails, there will be pinch points such as Nassau Street, Lower Grafton Street and Parnell Square South, where the bike, light rail and other vehicles will be required to share the street area.

The NTA has commissioned consultants to propose technical solutions (including surface infrastructure in use in other cities) to provide a street layout that is suitably safe for light rails, other public transport, and cyclists. If no acceptable solution can be found, the cycle network for the city will be revisited, to direct cyclists away from difficult light rail sections.

Consideration of Cycling in the Detailed Design Process

In 2013, The Railway Procurement Agency (now Transport Infrastructure Ireland) commissioned Aecom consultants to produce a report called 'Light Rail Transit & Cyclists – a guidance note for developers of Light Rail Transit'. Aecom were also commissioned to produce a report titled 'Application of the Guidance Note Light Rail Transit and Cyclists to Luas Cross City'. To date, the detailed design approach for cycling and Luas Cross City by Transport Infrastructure Ireland has been guided by the recommendations of these reports.

In the three years from 2013 to 2016, the volume of cyclists crossing Dublin's canal cordon increased by 33% (cyclist volumes have doubled between 2010 and 2016). Construction of Luas Cross City infrastructure is substantially complete, and trams are now running on the streets for driver training purposes. Cyclists are also interacting with the new infrastructure and operating environment.

It is appropriate at this stage to review how the interaction between cyclists and Luas Cross City infrastructure is operating in practice, to appraise if any modifications to the design proposals are appropriate and revisit the city cycle network as indicated above.

Current Situation

To date, no satisfactory solution has been identified to the NTA that would provide a hazard-free surface, while accommodating significant tram movements as well as considerable bus traffic. While installing a rubber or similar insert into a standard grooved rail has been trialled abroad, those trials have not been successful, with the material becoming ripped and dislodged by the tram wheels during tram operation.

Accordingly, the balance of this report considers the reality of the presence of the tram lines, the likely tram and traffic operating environment, and appropriate cycle network proposals in light of the Luas Cross City route.

Design guidance

This report examines the alignment of the LCC in order to determine the feasibility of accommodating cycling along the route. (The construction phase is not part of this assessment.)

The basis for this assessment is the *National Cycle Manual* (www.cyclemanual.ie NTA, 2011); in particular, Section 1.1 'Sustainable Safety'¹. The Five Principles of Sustainable Safety (which are relevant to all road users, not just to cyclists) are:

1. Functionality
 - Street design that is fit for purpose is safer, taking account of the full range of functions of a street.
2. Homogeneity

¹ https://www.cyclemanual.ie/manual/thebasics/sustainable_safety/

- Reducing the relative speed, mass and directional differences of different road users sharing the same space increases safety. Where the relative speed, mass or direction is not homogenous, different road users may need to be segregated.
3. Legibility
 - A road environment that all road users can read and understand is safer. A legible design will be self-evident, self-explanatory, and self-enforcing.
 4. Forgivingness
 - Environments that contribute to benign outcomes of accidents are safer.
 5. Self-awareness
 - Where road users are aware of their own abilities and limitations to negotiate a road environment, the environment is safer.

In addition, the *Design Manual for Bicycle Traffic* (CROW [NL], 2007) was consulted for specific guidance on providing for cycling in a light rail environment. Section 5.5.2 'Bicycles and tram/light rail' includes the following key points and recommendations:

- *Combining trams and cycling in the same carriageway is generally not recommended;*
- *A safe tram speed for conflict situations is around 20 km/h (the braking distance of a tram moving at 30 km/h is comparable to that of a car moving at 50 km/h);*
- *Tram rails make it considerably harder to cycle as cyclists have to make sure they do not cross the rails at too small an angle (particularly in wet weather), concentrating on tram rails can distract cyclists from other dangers, and tram rails can limit the possibilities for evasive action by cyclists;*
- *A tramway should be physically separated from other traffic;*
- *If physical separation is not possible, the following considerations apply:*
 - *Cyclists should ride to the left* of the tram (*to the right in The Netherlands);*
 - *A tramway should be physically or, at a minimum, visually 'screened off' by means of e.g. vertical segregation, paving materials or conspicuous road markings;*
 - *If required, a cyclist should be able to cross the rail at an angle of at least 45 but preferably 60 degrees; and*
 - *The cycle connection should be 2.50m wide.*

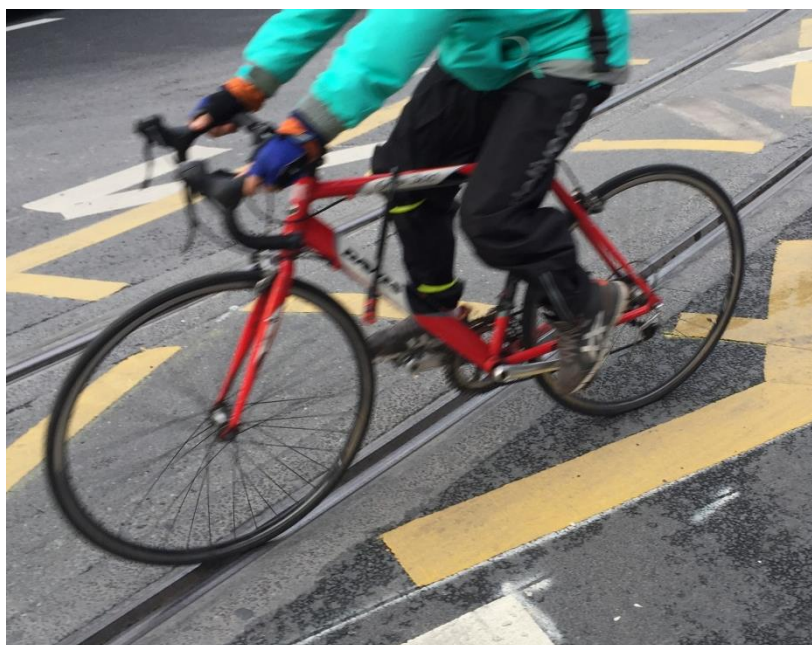
Options Development

In the following report, various options have been considered in assessing the possibility for cycling along the Luas Cross City corridor.

For parallel cycling along a light rail corridor, three options exist, namely cycling

1. between nearside kerb and rail;
2. between a pair of rails; and
3. between opposing pairs of rails.

Following the application of the CROW guidance outlined above to the specific circumstances of the LCC alignment, only the first of these was deemed to satisfy the Principles of Sustainable Safety, due primarily to the shallow angle of crossing of the rails at points of access/egress and the width available between rails, which would appear to be too narrow based on all available guidance.



Furthermore, whilst not explicitly stated in the CROW guidance, the angle at which cyclists cross a tram line relates to a straight-line trajectory. A situation where cyclists are required to turn as they cross a tram line should be avoided as this compounds the risk (due to the cyclist leaning into the turn).

It should also be noted that the CROW guidance does not address pedestrian-cyclist interaction. On busy streets, pedestrians generally cross the road while looking out to avoid oncoming motorised vehicles. However, these crossing pedestrians tend to expect oncoming cyclists to deflect to avoid

the pedestrian standing in the road – however such deflection may be hazardous in the vicinity of tram tracks.

Nor does the CROW guidance address the specific maximum intensity level of bus and taxi that might improve the acceptability of shared running with bicycles along sections of the tram route.

These issues are considered in the analysis below.

Methodology

The route assessment is in two parts, based on direction:

- Part A: route assessment from south to north, from Saint Stephen's Green to Broadstone; and
- Part B: route assessment from north to south, from Broadstone to St. Stephen's Green.

This approach addresses the fact that the Luas Cross City operates on different streets in each direction within the central area, and the cross-section and cycling challenges are different in each direction.

Each link and junction is examined in sequence; in-line, lateral and turning movements are addressed for each direction.

Quality of Service Assessment

The National Cycle Manual states: *Quality of Service is a measurement of the degree to which the attributes and needs of the cyclist are met. In other words it describes the quality of the cycling environment.*

Quality of Service is measured by considering five criteria:

Pavement Condition Index (PCI): the physical integrity of the cycling surface

Number of adjacent cyclists: the capacity for cycling two abreast and/or overtaking.

Number of conflicts: the potential interruptions to a cyclist per 100m

Junction time delay: the actual time delay at junctions as a percentage of the overall journey time

HGV influence: the number of HGVs and buses adjacent to cyclist.

At this stage, it is not possible to finalise a Quality of Service (QOS) determination for the various routes, as many of these criteria are yet to be determined. As an alternative, for this report, the links and junctions were considered under three general headings for all cycle movements under examination:

- Acceptable;
- Acceptable With Modifications; and
- Not Acceptable.

Recommendations for Cycling

Following the assessment of each section, the report proposes measures to address shortcomings, where feasible. For locations where it is deemed that cycling cannot be properly accommodated either in the current design or by means of proposed amendments, alternative cycling alignments are identified along with measures required to ensure they cater adequately for the mode.

Note: While the junctions have been assessed for a range of movements, both those currently permitted and others not currently permitted, it is recommended that the Six-Way Check² outlined in the NCM is carried out for each junction.

² <https://www.cyclemanual.ie/manual/tools/six-way-check/>

Part A: North-bound Assessment

Saint Stephen's Green to Broadstone

1.1) St Stephen's Green Luas stop to Dawson Street

Prior to the LCC construction works, cycling was not permitted north-bound on St. Stephen's Green West on the link from York Street to Grafton Street. (Cycling is permitted south-bound). This link was identified in the GDACNP as a primary route terminating at Grafton Street.

A contra-flow cycle route was initially proposed as part of the LCC construction but has been postponed as it needs to be considered as part of a separate public realm scheme for the local area.



Eastbound view, from Grafton Street looking towards Dawson Street

Recommendation: The future public realm scheme in the area is to examine the options for cycling, including northbound access to South King Street from York Street, and elsewhere as may be feasible and desirable.

1.2) Junction of St Stephen's Green North and Dawson Street

Vehicular and cycle traffic from the east (i.e. from the Shelbourne Hotel) may turn right to Dawson Street or travel straight towards Grafton Street. The crossing angle of the north- and south-bound rails is poor for cyclists turning right. Options for the right turn include providing a Toucan crossing and jug-handle waiting area on the south side of the junction, precluding the right turn and guiding cyclists via Kildare Street and Molesworth Street (on a contra-flow cycle facility), or permitting cycling cautiously through the right turn.

Recommendations: Right turning cyclists from St. Stephen's Green to Dawson Street will also be provided with a Slippery Rails warning sign. DCC and NTA will progress a scheme to facilitate a contra-flow cycle facility on Molesworth Street to provide cycle access to Dawson Street. Cyclists from St. Stephen's Green North will be signposted via Kildare Street and Molesworth Street as part of this scheme.

Cyclists travelling straight along Stephen's Green North should be guided across the rails by means of road markings.



Recommendation: This movement should be monitored following completion of construction, to assess its adequacy.

1.3) Dawson Street, from St Stephen's Green to Duke Street/Dawson Lane

From the junction north to the Duke Street-Dawson Lane off-set crossroads, there is sufficient space between the north-bound rails and the kerb/parking for cycling in mixed traffic.

The situation will be monitored to assess the suitability of this environment for cycle access to Dawson Street and its side streets. Road markings would be required to guide cyclists across the rails as close to 90 degrees as possible into Molesworth Street, and between Duke Street and Dawson Lane.

Recommendations: On-going monitoring of the traffic mix to determine suitability for cycling. Road markings to ensure a perpendicular crossing of the rails at Molesworth Street, Duke Street and Dawson Lane.

1.4) Dawson Street, from Duke Street to Nassau Street

The platforms at the Dawson Luas stop restrict space north of Duke Street-Dawson Lane. The remaining road space, including the otherwise generous space between the north-bound and the south-bound rails, should not be used for cycling due to poor crossing angles over the tram rails, and conflicts with trams and buses.



Recommendation: Advise against cycling on this link.

A Cyclists Dismount sign³ will be erected at the Duke Street junction on Dawson Street to advise against cycling north of this junction, including along the Luas line on Nassau Street and Grafton Street Lower.

1.5) Junction of Dawson Street and Nassau Street

There is insufficient space available to accommodate cycling at this location. In addition, cycling is not advised on the Dawson Street northbound approach (see section 1.4) or the Nassau Street eastbound approach (see section 2.21).

Recommendation: Advise against cycling.

Provide a north-bound contra-flow cycle route for the full length of Kildare Street – the current north-bound bus lane will address this requirement. Consideration will be given by the NTA and DCC to develop a scheme for west-bound cycling on Nassau Street between Kildare Street and Dawson Street.

1.6) Nassau Street, from Dawson Street to Grafton Street

The space between the kerb and the west-bound rail is insufficient to accommodate cycling. There is no opportunity to set back the kerb and widen this space.

Recommendation: Advise against cycling on this link- see point 1.4 above.

1.7) Lower Grafton Street, from Nassau Street to Dame Street

The space between the kerb and the north-bound rail is insufficient to accommodate cycling. There is no opportunity to set back the kerb and widen this space.

Recommendation: Advise against cycling on this link- see point 1.4 above.

³ A standardised “cyclists dismount” advisory sign will be developed.

1.8) College Green

It is proposed to provide a dedicated two-way cycle track from Dame Street to College Green. This will be sufficient to accommodate cycling safely.

Recommendation: Nothing further required.

1.9) Westmoreland Street

There is adequate space for cycling in mixed traffic from Dame Street to the Fleet Street junction. However, a marked cycle lane would improve legibility and aid safety of cyclists, and would be unlikely to impact on vehicular capacity. The right turn into Fleet Street (East) is adequate, but would benefit from road markings to guide cyclists to cross the rails as close to 90 degrees as possible. (Alternatively, a jug / box turn may be appropriate).

Recommendation: Designs for improvements for cyclists in the area including Westmoreland Street, D'Olier Street and College Street will be developed separately by DCC and the NTA.

1.10) O'Connell Bridge, including Junction of Westmoreland Street and Aston Quay, and Junction of O'Connell Street and Bachelors Walk

The current cycling arrangements on Westmoreland Street, while not particularly attractive, are not significantly impacted by LUAS on the Western side of the road.

However, the angle of the LUAS track departing Westmoreland Street means that it is unsuitable for cyclists to attempt to enter the right-turn facility on O'Connell Bridge.



Provision for cyclists on the bridge deck is sufficient if they do not depart from a left hand kerbside position. Provision of a box turn at Bachelors Walk would allow cyclists to turn right without the need to cross traffic lanes, and without any significant risk of crossing the tramlines at a poor angle.

Recommendations: Designs for improvements for cyclists on O'Connell Bridge will be developed separately by DCC and the NTA. Right turn for cyclists from O'Connell Bridge to Eden Quay by means of right-turn lane to be banned and a box turn to be provided at Bachelors Walk as an alternative.

1.11) O'Connell Street Lower

Cycling is accommodated in an advisory cycle lane from the quays to Abbey Street.

Recommendation: No intervention required.

1.12) Junction of O'Connell Street and Abbey Street

At this junction, cyclists can turn left or go straight ahead. In both cases the left turning rail, which has been installed for servicing purposes rather than for passenger tram running, is a potential hazard for cycling through the junction. While a set-back kerb line might improve provision for left turning cyclists to avoid the rail, the layout of the rails (in close proximity to the Red Line tram rails) is such that it is not possible for north-bound cyclists to avoid crossing them even with a set-back kerb. The best angle of approach for cyclists to cross the tracks is from the kerbside position. Cyclists turning into Middle Abbey Street have limited kerbside space to make the turn, and will need to reduce speed and expect pedestrians encroaching.



Recommendation: The operation of the O’Connell Street-Abbey Street engineering link will be reviewed in terms of cyclist safety after commencement of Luas operations. Protection of the cycle lane (with bollards etc.) may be required if the approach is impeded by parking or loading. For now, no measures are proposed in the short term, unless monitoring indicates an intervention is required.

1.13) O’Connell Street, from Abbey Street to Parnell Street

As the rail is adjacent to the median for the length of O’Connell Street, cycling in the advisory cycle lane/bus lane is sufficient provision.

Recommendation: No intervention required.

1.14) Junction of O'Connell Street and Parnell Street

Sufficient space exists between the kerb and the kerbside rail for cyclists to turn left at this corner.

Recommendation: Monitor cyclist safety after commencement of Luas operations. No measures proposed in the short term. If space is insufficient, consider setting back the kerb line.



Left turn from O'Connell Street to Parnell Street

1.15) Parnell Street, from O'Connell Street to Parnell Square West

West-bound cycling is provided for in an advisory cycle lane at the left hand kerb. Vehicles turning right into Parnell Square West are intended to drive on the rails. However, this is unsuitable for cycling. A separate right turning lane has been provided for vehicles (shared with the northbound tram), but the angle of turn across the rails is too acute for cycling.

Recommendation: A new dedicated cycle or Toucan crossing for cyclists moving from Parnell Square South to Parnell Square West, is to be developed by DCC and NTA as a separate scheme. During the

initial period of Luas operations, cyclists will be advised to dismount and cross at the south-north pedestrian crossing.



Parnell Street west-bound turning into Parnell Street West (unsuitable for cyclists)

1.16) Parnell Street, from Parnell Square West to Dominick Street

West-bound cycling is permitted away from the LUAS alignment.

Recommendation: The interaction for cyclists with other traffic and the revised street environment will be monitored, with additional cycling facilities to be designed and delivered if required.

1.17) Junction of Parnell Street and Dominick Street

As the current proposal advises against north-bound cycling on Dominick Street (see below), there are no proposals to cater for crossing cycle movements or turning movements in this junction.

Recommendation: No intervention required.

1.18) Dominick Street Lower

North-bound cycling is not proposed on this link and there are alternative routes in the vicinity.

Recommendation: No intervention required.



Dominick Street Lower, facing north

1.19) Dominick Street Upper

North-bound cycling is discouraged on this link and there are alternative routes in the vicinity.



Recommendation: Slippery Rail signage to be installed.

1.20) Junction of Dominick Street and Western Way (Temple Cottages)

North-bound cycling is not proposed on this link and there are alternative routes in the vicinity.



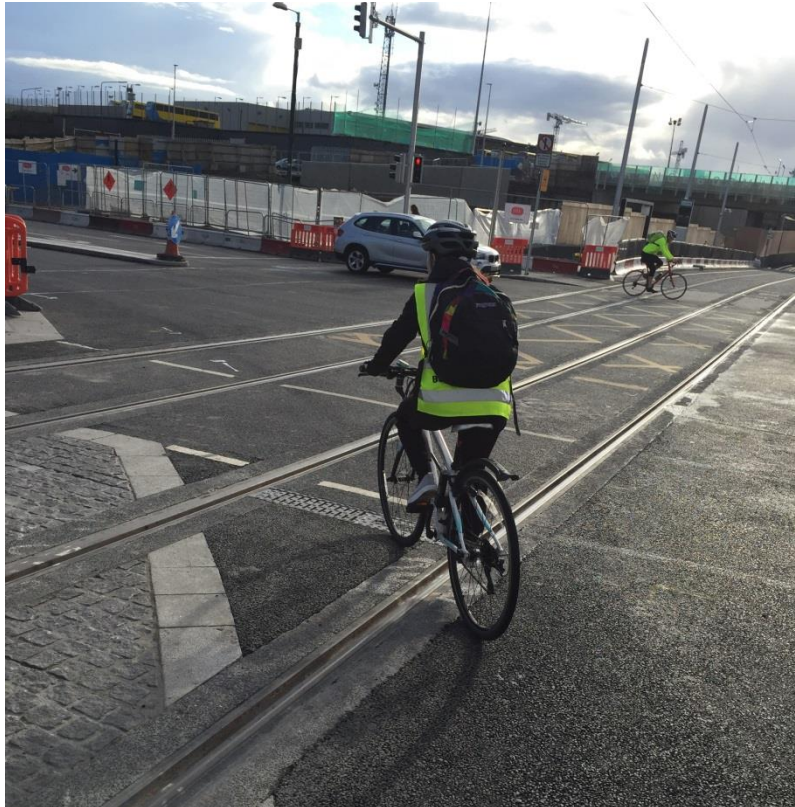
Recommendation: No intervention required.

1.21) Junction of Western Way and Constitution Hill

Cyclists on Constitution Hill travelling north cross the rails close to 90 degrees. The right turn into Western Way requires a cyclist to cross three lanes of traffic and might be unattractive to risk-averse cyclists. In addition, cyclists leaving the DIT campus plaza should be catered for in crossing Constitution Hill.

However, cyclists emerging from Western Way turning left towards the Liffey do not have an attractive angle to cross the tram tracks.

Recommendation: Cyclist movements at Broadstone Plaza-Constitution Hill-Western Way are to be reviewed separately by DCC and the NTA to ensure cyclist desire lines to and from the plaza are safely provided for.



Cycling from Western Way to Constitution Hill

Part B: South-bound Assessment

Broadstone to Saint Stephen's Green

2.1) Junction of Western Way and Constitution Hill

Comments set out in 1.21 above apply here.

Recommendation: Cyclist movements at Broadstone Plaza-Constitution Hill-Western Way are to be reviewed separately by DCC and the NTA to ensure cyclist desire lines to and from the plaza are safely provided for.

2.2) Junction of Dominick Street and Western Way (Temple Cottages)

There is a facility for some traffic to join Dominick Street from Western Way, in addition to southbound trams. Space between the tracks and the left hand kerb is very limited, and the surface is textured and not attractive for cycling.



Recommendation: A Slippery Rails sign is to be erected to warn cyclists entering Dominick Street Upper from Western Way. Further monitoring will be required in this area, to determine cyclists' and traffic usage of the street space.

2.3) Dominick Street Upper

There is very limited space for south-bound cycling between the kerb and the kerbside tram rail. The road is not expected to be busy with additional shared traffic.

The kerbside space narrows further on the approach to Mountjoy Street, and between Mountjoy Street and Dorset Street. Left turning cyclists from Palmerston Place do not cross the rails. The right turn from Palmerston Place is banned and should remain so as north-bound cycling is not accommodated (see North-bound assessment above).



Recommendation: Slippery rails signs to be erected. Further monitoring will be required in this area, to determine cyclists' and other traffic usage of the street space.

2.4) Junction of Dominick Street and Upper Dorset Street/Bolton Street

Cycle movements from north to south do not interact with the rails. Cyclists turning right from Upper Dominick Street into Bolton Street and turning right from Bolton Street into Lower Dominick Street should be catered for by means of box turn facilities. Turns into the north-bound carriageway should not be accommodated as north-bound cycling is not permitted.

Recommendation: Box turns for right turns into and out of Bolton Street.

2.5) Dominick Street Lower

There is a full traffic lane south-bound, which accommodates cycling in mixed traffic. Cyclists turning right into Dominick Lane would benefit from a box turn at the head of Dominick Place to promote perpendicular crossing of the rails. (A route via Dominick Lane to King's Inns Street is an important alternative means of accessing Parnell Street, particularly given the layout of the Dominick Street-Parnell Street junction- see below.) Movements between Dominick Place and Dominick Lane are perpendicular to the rails. Road markings should be provided for cyclists turning right from Dominick Lane to Lower Dominick Street to identify a perpendicular crossing route.

Recommendations: Box turn for right turns into Dominick Lane and signage to identify this route as the preferred route south-bound for cyclists, connecting to King's Inns Street.

NTA and DCC to separately consider cycle road markings/lanes along the recommended route.

Road markings for right turns from Dominick Lane to Lower Dominick Street to encourage crossing close to 90 degrees.

2.6) Junction of Dominick Street and Parnell Street

The angle of crossing of the rails is not so favourable for cyclists. Cyclists should be advised by means of warning signage.

Recommendation: No revisions to junction required. Discourage south-bound cyclists by means of the recommended route in 2.6 above. A Slippery Rails sign is to be erected to warn cyclists who wish to proceed down Dominick Street Lower and cross the tracks.



Junction of Dominick Street and Parnell Street, facing south

2.7) Parnell Street, from Dominick Street to Parnell Square West

East-bound cycling is in mixed traffic with a kerb to the left. The right turn into Moore Street is catered for in a right-turn lane. The left turn into Parnell Square West crosses the rails, but the angle is acceptable.

Recommendation: No intervention required.

2.8) Parnell Street, from Parnell Square West to O'Connell Street

Cycling is precluded from this Tram Only link.

Recommendation: No intervention required.

2.9) Junction of Parnell Street, Parnell Square East/Cavendish Row and O'Connell Street

This is a complex junction for all cycle movements from Cavendish Row (Parnell Square East) and from Parnell Street.

a) From Parnell Square East/Cavendish Row: the left turn to Parnell Street crosses the rails at an acute angle; the straight ahead movement crosses two rails, one of which is perpendicular; the right turn crosses two rails, both at acute angles.

Recommendation: For the left turn from Cavendish Row, cyclists are to be guided with signage to use Gardiner Row, Denmark Street Great and Hill Street to access Parnell Street East and therefore bypass this left turn crossing.

NTA and DCC to investigate if a contra flow cycle facility can be provided for cyclists wishing to access Parnell Street East from North Great George's Street.

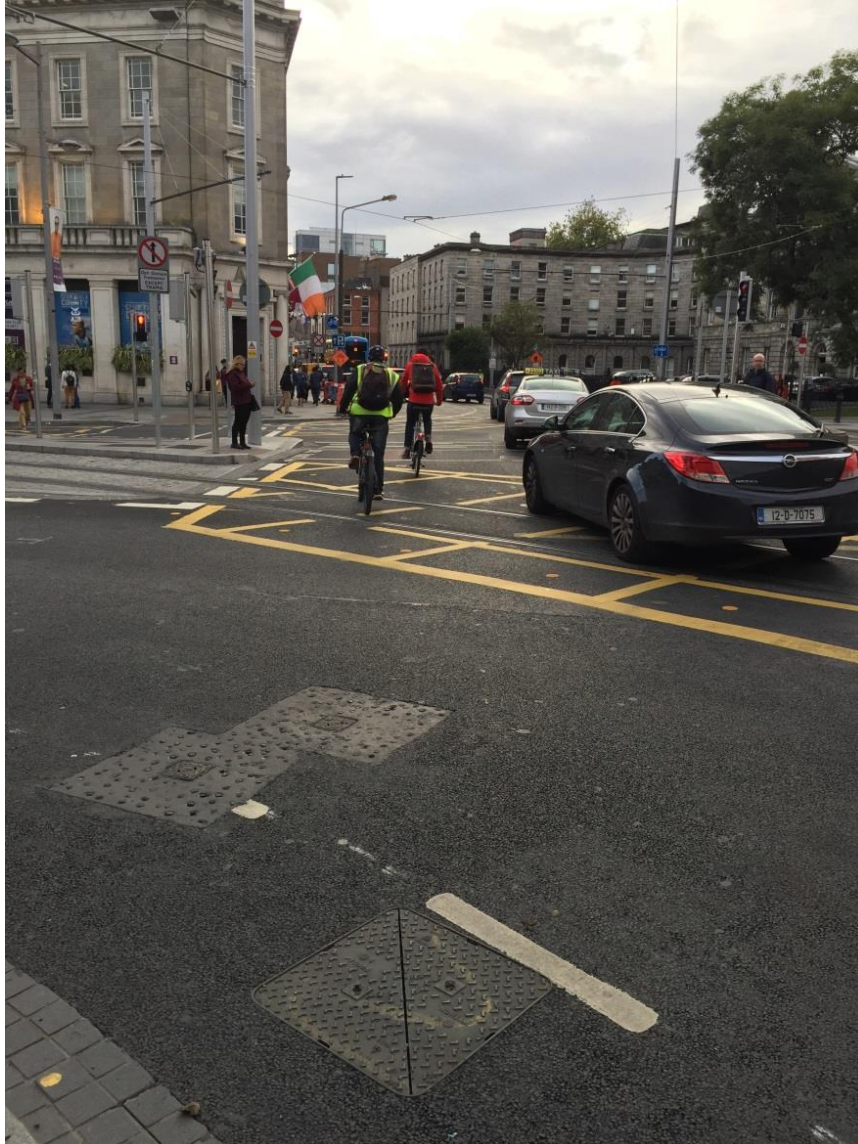
A Slippery Rails sign is to be erected to warn cyclists who choose to make the left turn from Cavendish Row.

For the right turn from Cavendish Row to Parnell Street West, guidance markings are to be placed on the ground to show a minimum of a 45 degree crossing angle, and more than that if possible.

For the straight ahead movement to O'Connell Street, cyclists are to be provided with road markings to cross the rails at an appropriate angle as close to 90 degrees as is practical.



b) West-bound from Parnell Street: the left turn is banned (conflict with pedestrian crossing); the straight ahead movement crosses two rails, the latter at a poor angle.



Recommendation: A subsequent specific recommendation will be made for this movement, from the NTA and DCC.

It is recommended that the overall operation of the junction, its layout and its approaches should be monitored, and any additional required measures identified and implemented.

2.10) Parnell Street, from Parnell Square East/Cavendish Row to Marlborough Street

While access to this link is problematic from the west, cycling is to the right of the rail in mixed traffic and is relatively safe. However, given the issues listed at Point 2.9 (above) and Point 2.11 (below), a route via e.g. Gardiner Row and North Great George's Street or Hill Street would provide a reasonable alternative means of accessing the Summerhill and Gardiner Street area.

Recommendation: Signage for alternative route.

2.11) Junction of Parnell Street and Marlborough Street

The right turn from Parnell Street into Marlborough Street is banned for all traffic including cyclists. The left turn into Marlborough Street requires an acute angle rail crossing. However, Marlborough Street could be accessed from the east by a route along Cumberland Street North and Sean McDermott Street and from the west by a route along Cathal Brugha Street (subject to the junction difficulties itemised at 2.9 above being resolved).

Recommendation: Use advisory route signage to direct cyclists to alternative alignment via Cumberland Street North and Sean McDermott Street. A Slippery Rails sign will be provided to warn cyclists who choose to turn left into Marlborough Street from Parnell Street East.

2.12) Marlborough Street, from Parnell Street to Abbey Street

Cycling along Marlborough Street is in mixed traffic (segregated from the tram) and is relatively safe. Most lateral movements and turns to and from side roads are safe as currently designed, with the following exceptions: road markings for left turns into Marlborough Street are required at Sean McDermott Street, Talbot Street and Marlborough Place to identify locations for rail crossings close to 90 degrees; the left turn into Sean McDermott Street should be discouraged or should be catered for by means of a left-turning box turn (box turns are usually for right turns), as the current provision places left turning vehicles on the rails.

Sackville Place provides a very useful connection to O'Connell Street and O'Connell Bridge for south-bound cyclists, particularly in light of the issues at the Abbey Street junction (see point 2.13 below), and should be well signposted.

Recommendations: Road markings for left turns into Marlborough Street.

A Slippery Rails sign will be provided to warn cyclists on Marlborough Street in advance of moving into the left turn lane for Sean Mac Dermott Street.



Slippery Rails signage required for cyclists turning left into Sean Mc Dermott

Cycle logos (and other signage/lines as required) to be placed in Lane 2, to encourage cyclists to use the non-tram lane.

Signage to be installed directing south-bound cyclists to access O'Connell Street via Sackville Place.

2.13) Junction of Marlborough Street and Abbey Street

East-bound cyclists travelling along Lower Abbey Street cross the rails at an angle close to 90 degrees.

For all other cycle movements, this is an otherwise quite difficult junction for cyclists to negotiate due to the arrangement of rails on the approaches to and within the junction. Cycling should therefore be discouraged and accommodated on alternative routes.



Recommendations: South-bound cyclists on Marlborough Street will be guided with signage to use Sackville Place and O'Connell Street to avoid the low angle rail crossings at the Abbey Street Junction. South-bound cyclists will then travel across O'Connell Bridge.

East-bound cyclists would turn left onto Abbey Street from O'Connell Street and proceed towards Beresford Place in the short term. DCC and NTA will investigate if a cyclist left turn can be facilitated to Eden Quay from O'Connell Street (this movement is currently banned for all vehicles).

2.14) Marlborough Street, from Abbey Street to Eden Quay

South-bound cycling is safe. North-bound cycling is precluded and should remain so.

Recommendation: No intervention required.

2.15) Rosie Hackett Bridge, including Junction of Marlborough Street and Eden Quay, and Junction of Hawkins Street and Burgh Quay

Cycling south on the bridge deck and on to Hawkins Street is relatively safe. Turning movements onto and off the bridge (where permitted) are safe, with the exception of the right turn onto Burgh Quay from the Eastern cycle lane on the bridge, where a box turn should be provided. East-west movements on both quays cross the rails at (or close to) 90 degrees and so are relatively safe.

Recommendation: Box turn for right turns from bridge to Burgh Quay.

2.16) Hawkins Street, from Burgh Quay to Townsend Street

Cycling is in mixed traffic and is relatively safe. The left turn into Townsend Street has no rail crossings or conflicts with traffic and is safe.

Recommendation: No intervention required.

2.17) Hawkins Street, from Townsend Street to College Street

The road layout beyond Townsend Street and the overall junction complex will need further examination by DCC and the NTA to explore the possibility of box turns to accommodate cyclists (e.g. at the mouth of Pearse Street).

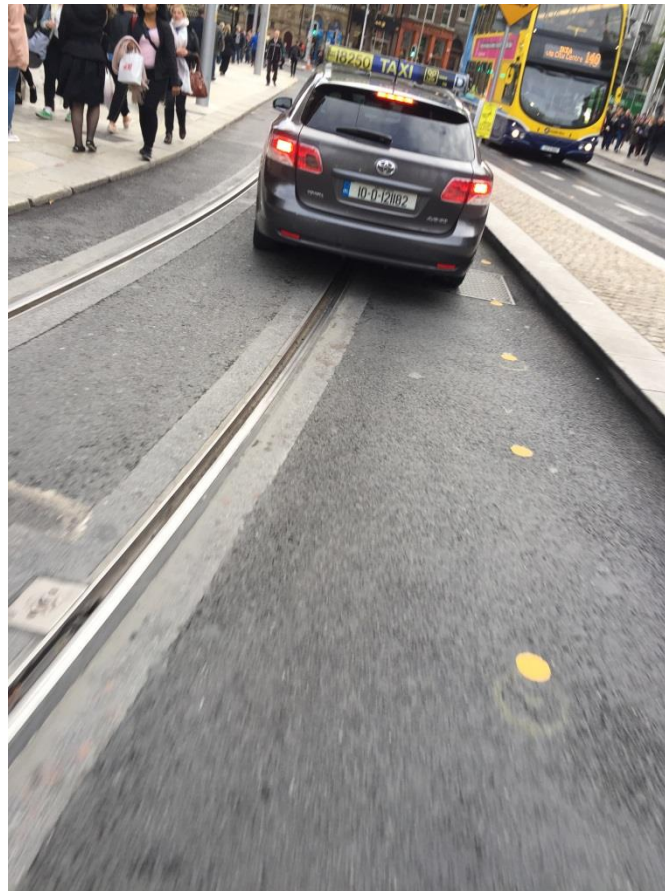
In particular, access to the proposed cycle track on the north side of College Street (2.18 below) from the adjacent street network will be important, to preclude cyclists from choosing the Luas alignment through the Trinity stop.



Recommendation: Further detailed junction design, for box turns. Ensure good access from approach streets to the College Street cycle track.

2.18) College Street, from Hawkins Street to Westmoreland Street

A segregated cycle track on the north side of the street, connecting to the proposed two-way cycle track at the Old Parliament (Bank of Ireland), is proposed. Due to very restricted space, merging onto tramlines at shallow angles, and the presence of platforms, cycling should not be permitted on the southern (Trinity College) side of College Street.



Access to the segregated cycle track from Pearse Street requires crossing the rails and multiple traffic lanes.

A dedicated cycle crossing from the south (Trinity College) side to the north side of College Street would provide a safe means of accessing the cycle track.

Recommendation: DCC and NTA to develop and implement a segregated cycle track and associated directional signage for cyclists in the area, as well as provision of dedicated crossing points from Pearse Street and the other street linkages.

2.19) College Green

A segregated two-way cycle track on the Old Parliament (Bank of Ireland) side is proposed; this was constructed recently and currently operates as a one-way track. Cycling should be discouraged on the rail alignment due to limited space and the high volume of public transport vehicles proposed through this link.

Recommendation: Advise against cycling on the roadspace shared with tram lines on College Green. Implement the two-way segregated cycle track.

2.20) Lower Grafton Street, from Dame Street to Nassau Street

The space between the kerb and the south-bound rail is insufficient to accommodate cycling. There is no opportunity to set back the kerb and widen this space.

Recommendation: Advise against cycling on this link. A Cyclists Dismount sign will be erected to advise against cycling on Lower Grafton Street.

2.21) Nassau Street, from Grafton Street to Dawson Street

The space between the kerb and the south-bound rail is insufficient to accommodate cycling. There is no opportunity to set back the kerb and widen this space.

Recommendation: Advise against cycling on this link.

2.22) Dawson Street, from Nassau Street to St Stephen's Green

Dawson Street is intended to be "Tram Only" in a south-bound direction (except between Duke Street and Molesworth Street). The space between the kerb and the south-bound rail is insufficient to accommodate cycling, especially at the tram stop. There is no opportunity to set back the kerb and widen this space.



Recommendation: No Entry signs for all non-tram traffic at this location. No cycle-specific signage required.

2.23) Junction of Dawson Street and St Stephen's Green North

Dawson Street is intended to be Tram Only in a south-bound direction. See Point 1.2 (above) for junction discussion.

2.24) St Stephen's Green North, from Dawson Street to St Stephen's Green Luas stop

Cycling is in mixed traffic on this link. From Dawson Street to the College of Surgeons, the west-bound traffic lane will be adequate for the volume of cycling expected, given the low volume of vehicular traffic in the area. (See Point 1.2 [above] for discussion of rail crossing).

Summary of Recommendations

North-bound:

There are some key locations on the north-bound alignment where accommodating cycling may be difficult or inappropriate. These locations are detailed in Part A of this report, and include:

- St Stephen's Green North, between Grafton Street and Dawson Street (pending Public Realm Design)
- St Stephen's Green at Dawson Street junction
- Northern end of Dawson Street (from Duke Street to Nassau Street)
- Nassau Street (from Dawson Street to Grafton Street)
- Lower Grafton Street
- Parnell Street-Parnell Square West junction
- Dominick Street

Where there is no space on links to accommodate cycling, cycling should be advised to dismount and alternative alignments identified and developed.

Where crossing angles are too acute, box turn crossings at or close to 90 degrees should be provided or, if this is not possible, cycling should not be accommodated. Alternative routes should be developed and signed.

South-bound

There are some key locations on the south-bound alignment where accommodating cycling may be difficult or inappropriate. These locations are detailed in Part B of this report, and include:

- Dominick Street Upper
- Parnell Street (between Parnell Square west and O'Connell Street, in front of the Rotunda)
- Parnell Street-Cavendish Row-O'Connell Street junction (certain movements)
- Parnell Street-Marlborough Street junction
- Marlborough Street-Abbey Street junction
- College Street

- Lower Grafton Street
- Nassau Street (Grafton Street to Dawson Street)
- Dawson Street

Where there is no space on links to accommodate cycling, cycling should be advised to dismount and alternative alignments identified and developed.

Where crossing angles are too acute, box turn crossings at or close to 90 degrees should be provided or, if this is not possible, cycling should not be accommodated.

Alternative Routes

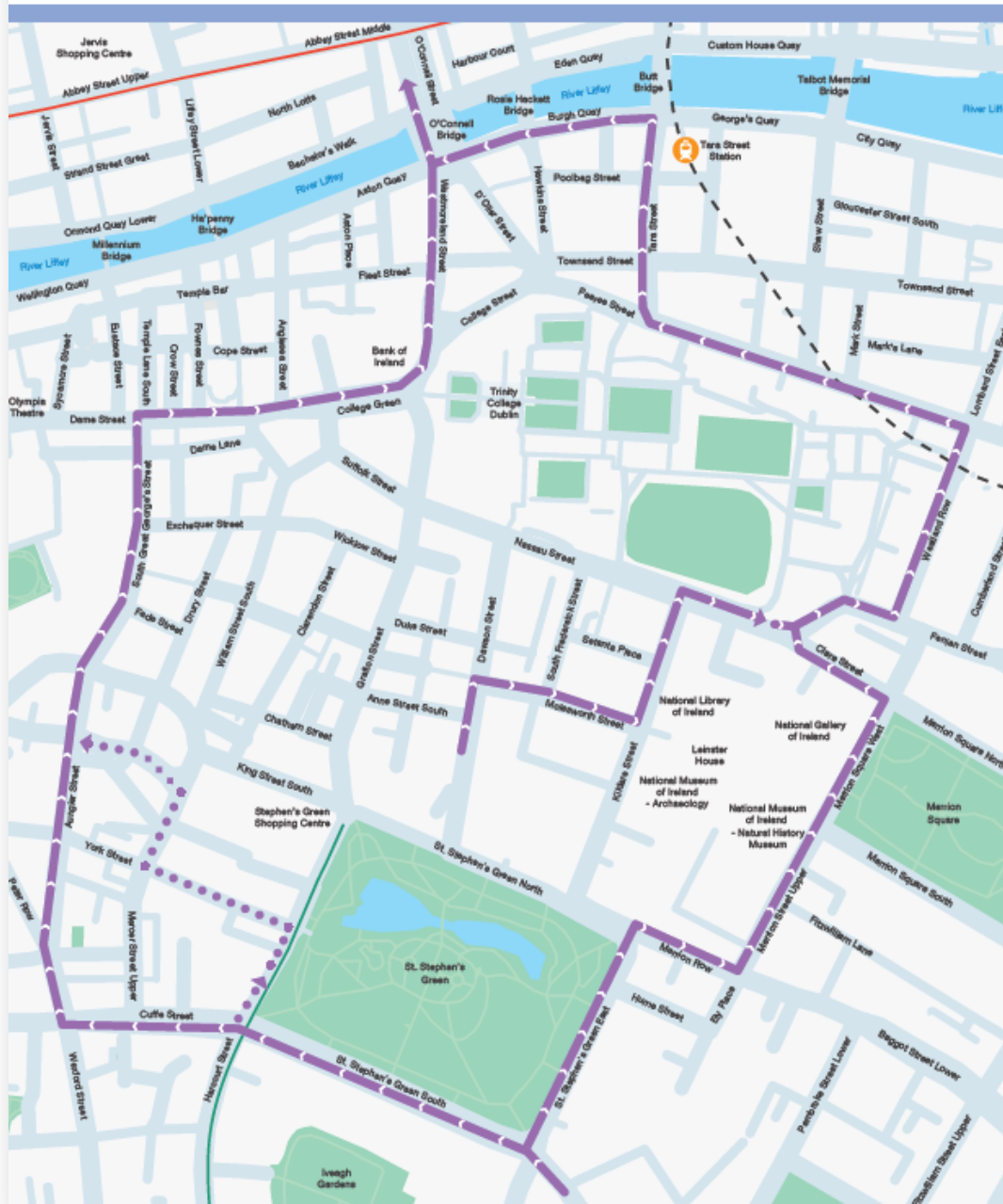
The introduction of LUAS Cross City has generated some space restraints in the areas of Dawson Street, Nassau Street and Lower Grafton Street, and around Parnell Street.

While the city centre remains generally accessible to the bicycle, these changes may inconvenience the bicycle mode to some degree for cross-city trips. For cyclists who wish to traverse the city centre, the attached maps indicate alternative available routes. Cyclists between St. Stephen's Green and O'Connell Street have two principal options, namely the South Great George's Street alignment, via College Green, and the Merrion Square / Westland Row alignment. The Northbound and Southbound versions of these routes are attached (see maps "Cycle Route – St. Stephen's Green to O'Connell Bridge", and "Cycle Route – O'Connell Bridge to St. Stephen's Green").



Cycle Route

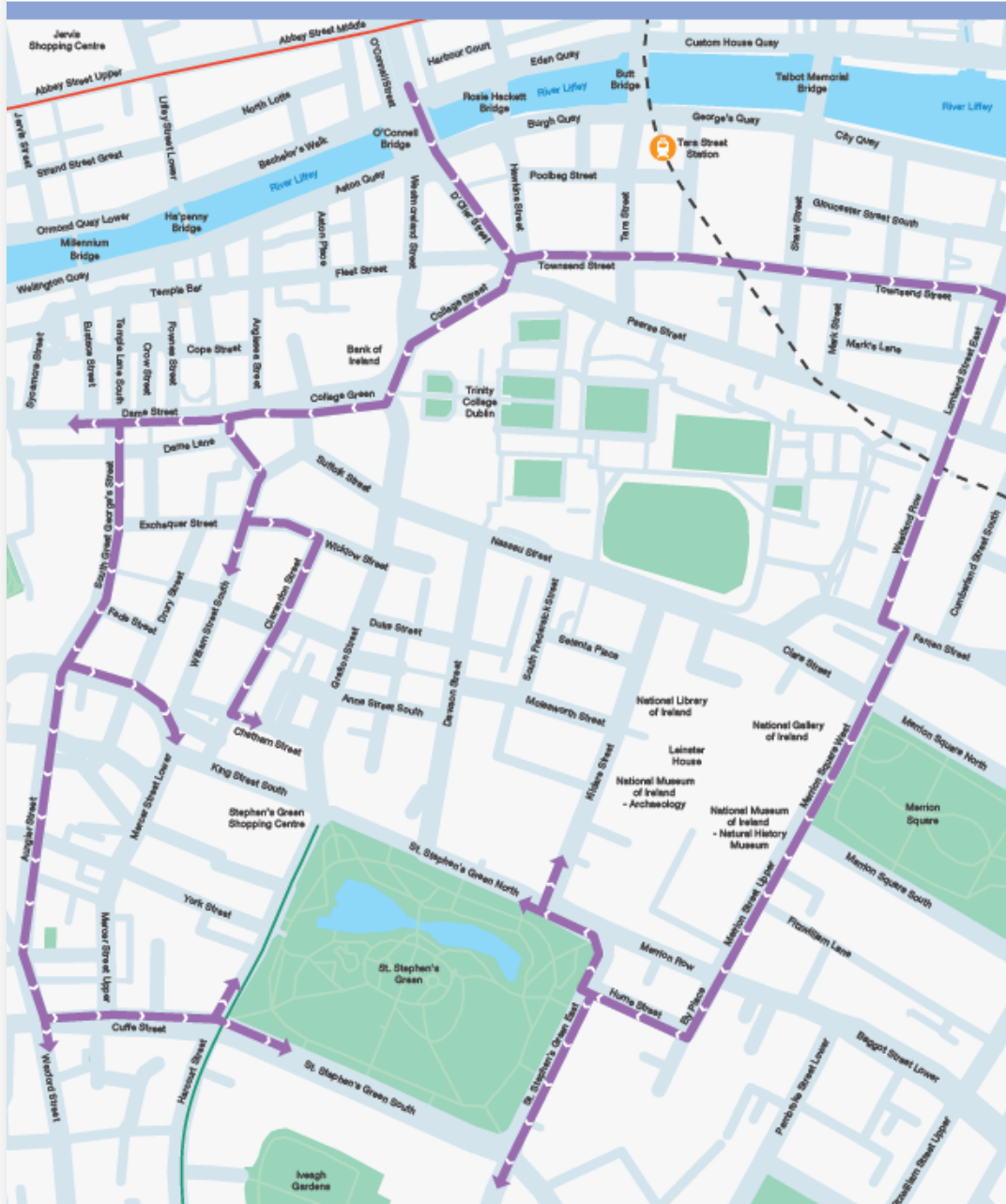
St. Stephen's Green » O'Connell Bridge





Cycle Route

O'Connell Bridge » St. Stephen's Green



Development of Additional Proposals

The NTA and DCC are examining the potential for cycling capability as follows:

- (i) cycling in both directions from Dame Street through College Green to Westmoreland Street;
- (ii) a segregated cycle track on College Street, facilitating access to the wide cycle track on College Green in front of the Old Parliament Building (this cycle track to become two-way between the pedestrian crossings at Westmoreland Street and College Green);
- (iii) contraflow cycling on South William Street (with logical connections to adjacent streets and College Green), to provide a parallel cycle route to Grafton Street on the Western side;
- (iv) contraflow cycling on Nassau Street from Kildare Street to the Dawson Street junction.

The above proposals are subject to further analysis.

Tabular Summary of main recommendations / considerations

1. Contra-flow cycle facility from Glover's Alley to Grafton Street to be considered as part of the future public realm scheme in the area;
2. Contra-flow cycling on Kildare Street, and prepare proposals for contraflow cycling on the western end of Molesworth Street;
3. Prepare proposals for contra-flow cycling on Nassau Street between Kildare Street and Dawson Street;
4. Advise against cycling along the LCC alignment between Duke Street/Dawson Lane and College Green in both directions;
5. Provide for two-way cycling in College Green, connecting Dame Street to Westmoreland Street;
6. Prepare proposals for a segregated cycle track on College Street, connecting D'Olier Street / Hawkins Street / Pearse Street to Westmoreland Street;
7. Provide for box turns at O'Connell Bridge;
8. Monitor / Review cyclist use at O'Connell Street / Middle Abbey Street and propose intervention(s) if required;
9. Provide a cycle crossing for turning right from Parnell Street to Parnell Square West;
10. Cyclist movements at Broadstone Plaza - Constitution Hill - Western Way – DIT Grangegorman to be reviewed to ensure cyclists are adequately provided for;
11. Advise an alternative cycle route for cyclists approaching the Dominick Street-Parnell Street junction (south-bound);
12. Advise an alternative cycle route to the left turn into Parnell Street from Cavendish Row;
13. Review the overall O'Connell Street / Parnell Street / Cavendish junction operation and layout;
14. Advise an alternative cycle route to the left turn into Marlborough Street from Parnell Street;
15. Advise alternative routes to cycling in the Marlborough Street - Abbey Street junction;
16. Prepare proposals for contraflow cycling on South William Street;
17. Install box turns at various locations;
18. Provide road markings for guidance at various locations to ensure rail crossings are undertaken by cyclists as close to 90 degrees as possible.