Comhairle Contae
Átha Cliath Theas
South Dublin County Council

Old Bawn to Ballyboden Active Travel Scheme

Phase 2 – Preliminary Consultation

Analysis of Proposed Junction Upgrade Options at Taylor's Lane

Introduction

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South Dublin County Council

As part of Phase 2 of the Old Bawn to Ballyboden Active travel Scheme, it is proposed to upgrade the Taylor's Lane Roundabout to improve walking and cycling facilities while minimising the negative impact on general traffic flows.

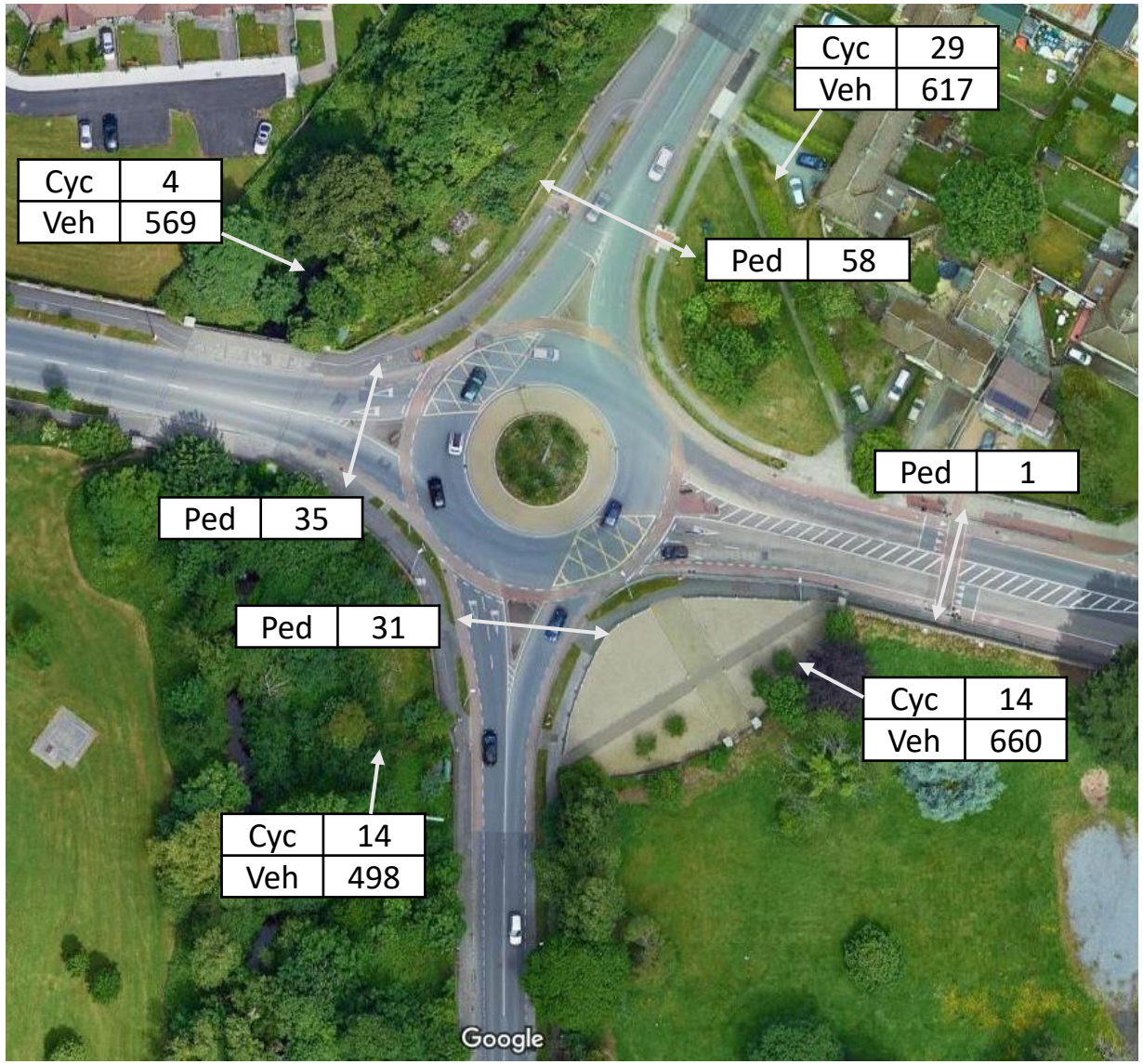
To determine the most appropriate form of upgrade, an extensive optioneering and modelling exercise was undertaken. The steps involved are outlined below:

- Traffic counts were conducted on all arms of the roundabout during consecutive weekdays
- Using the recorded traffic count data, a PTV VISSIM model was built and validated. The "level of service (LOS)*" for drivers was assessed and assigned.
- Comparing pre-works and post-works counts from the 2018 upgrades to the nearby Orlagh Roundabout, an estimated active travel (AT) growth factor was established. 150% growth in active travel users during the peak period was observed at the Orlagh Roundabout (2.5 times more active travel users post-works vs. pre-works).
- Five junction upgrade options were identified as having potential for the Taylor's Lane Roundabout. The five junction types were:
    1. Standard roundabout with shared-path and zebras
    2. Standard roundabout with shared-path and toucans
    3. Dutch style roundabout
    4. BusConnects style signalised junction
    5. CYCLOPS (**Cycl**e **O**ptimised **P**rotected **S**ignals) style signalised junction
- From an active travel perspective, the "quality of service (QOS)#" for the existing junction and each option was assigned.
- The model was run for the existing junction and each of the five upgrade options accounting for the 150% growth in AT in the peak period and included for increased public transport provision under the upcoming BusConnects network redesign and counted in the impact of under-construction or proposed large housing developments in the area on driver numbers. These were taken as the "baseline demands" for the existing junction and the five options. A LOS was assigned to general traffic for the existing junction and each option.
- The model was then rerun for each of the upgrade options with the number of drivers reduced to reach an acceptable LOS (LOS C or LOS D). This exercise gave an estimate of the traffic evaporation or modal shift required for each junction type to operate at an acceptable operating point from the point of view of drivers. When combined with each active travel QOS, this allowed the upgrade option which offered the best blend of minimised impact on drivers with improved function for pedestrians and cyclists to be identified.

*: Level of service (LOS) is a term used to qualitatively describe the operating conditions of general traffic on a roadway based on factors such as speed, travel time, manoeuvrability, delay, and safety. LOS is designated with a letter, A to F, with LOS A representing free flow conditions and LOS F representing high congestion levels. LOS C and D are preferable as the road is neither over-engineered or subject to congestion.

#: quality of service (QOS) is a measurement of the degree to which the attributes and needs of the active travel user are met. It describes the quality of the walking and cycling environment from A to D with QOS A being best from an AT point of view and QOS D being the worst.

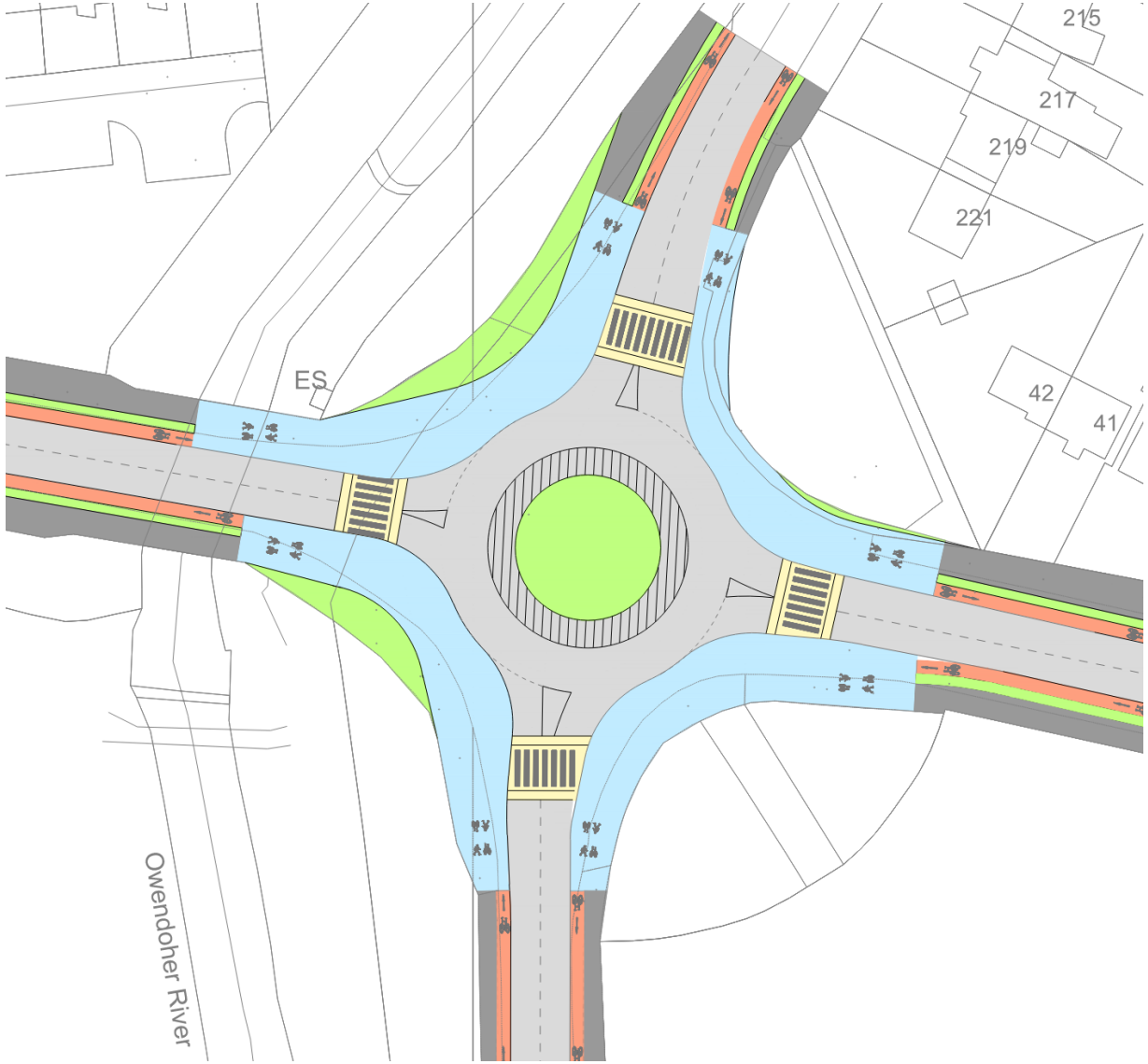
Existing Junction



Existing junction

- Drivers:
  - Two lane entry from all arms and two-lane circulation. High level of priority for drivers
  - Painted cycle track on outside of the roundabout can cause confusion for drivers as to where cyclists intend to go.
- Active travel users:
  - Some pedestrian priority has been provided, with a signalised pedestrian crossings on the northern and eastern arms. These are significantly set back from the junction to minimise disruption to drivers and result in significant deviations from desire lines.
  - People with additional visual or mobility needs are very poorly served
  - There is no priority for cyclists through the junction. Cyclists share space with drivers.
  - Pedestrians can wait several minutes to cross the road
  - QOS D
  - Two serious injuries to cyclists were reported in the sample period (2017-2019).

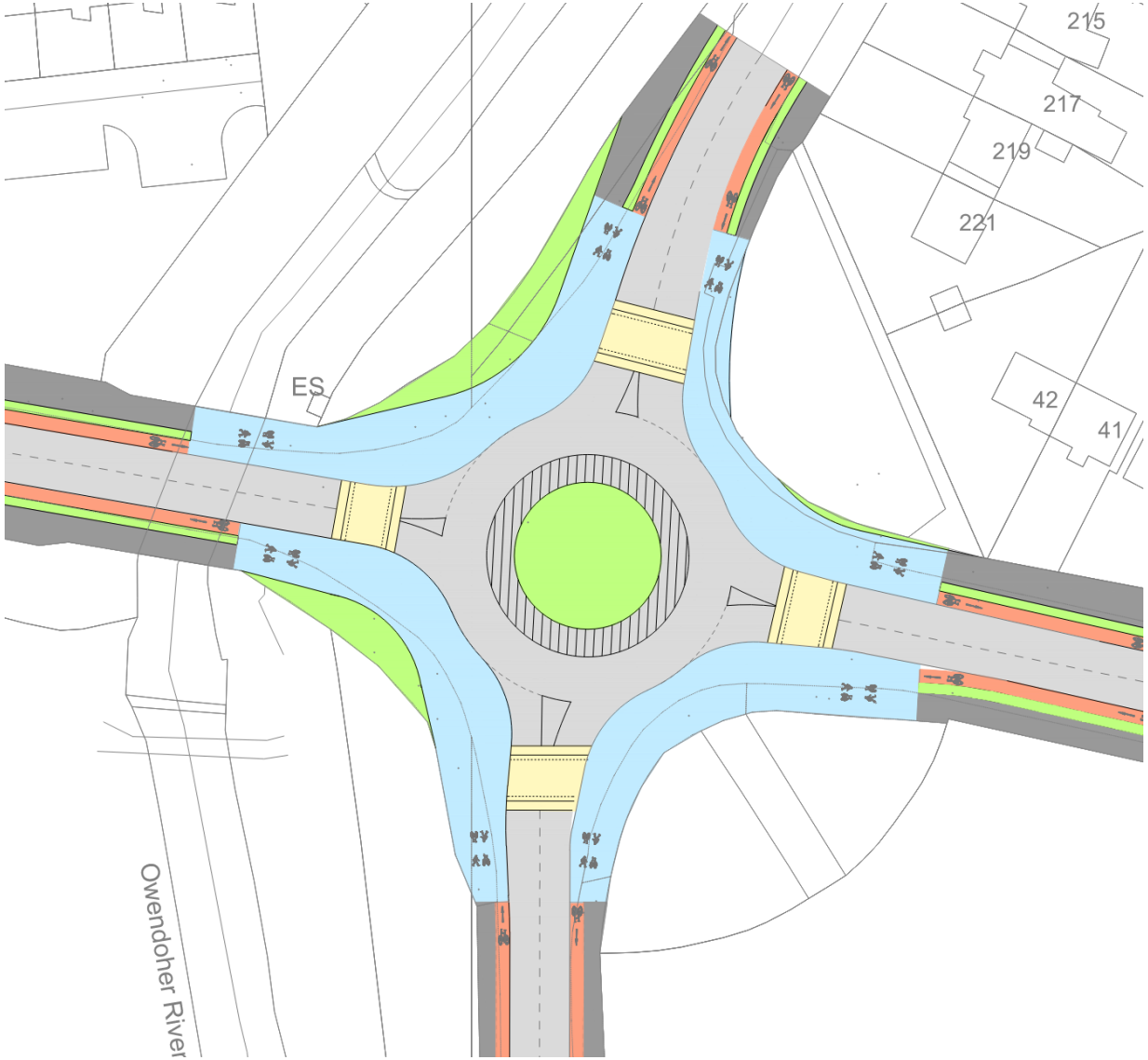
Upgrade Options



Option 01: Standard roundabout with a shared-path and zebras

- Drivers:
  - Standard roundabout with single lane entry, circulation, and exit
  - Pedestrians and cyclists segregated from drivers
  - Drivers yield to pedestrians at zebra crossings
  - If no pedestrians or cyclists are crossing, drivers are not delayed
- Active travel users:
  - No segregation between pedestrians and cyclists who share space
  - Design gives priority to pedestrians over drivers at crossings
  - Deviations from desire lines for pedestrians
  - No delay for pedestrians or cyclists
  - Left turning cyclists do not interact with drivers or signals/crossings
  - Tight corner radii for cyclists leaving shared space to cross arms
  - Comparatively low QOS for active travel users in order to minimize impact on traffic.
  - QOS C

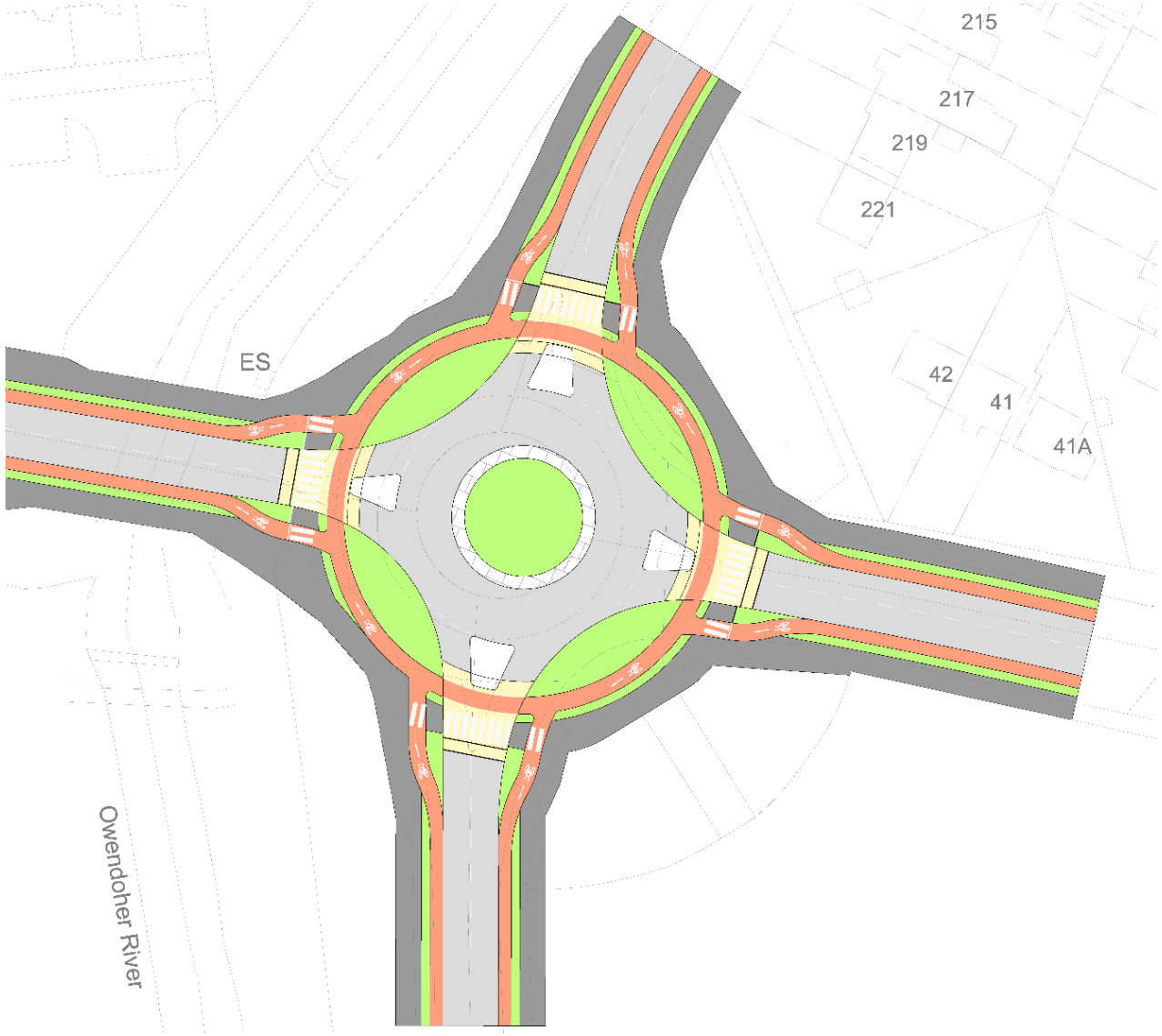
Upgrade Options



Option 02: Standard roundabout with a shared-path and toucans (push button traffic signals)

- Drivers:
  - Standard roundabout with single lane entry, circulation, and exit
  - Pedestrians and cyclists segregated from drivers
  - Drivers only stop for pedestrians and cyclists on red signal
  - If no pedestrians or cyclists are crossing, drivers are not delayed
- Active travel:
  - No segregation between pedestrians and cyclists who share space
  - Pedestrians and cyclists must press push button and wait for red signal for drivers to cross
  - Frequency of toucan signal limited which causes delays to pedestrians and cyclists on each crossing
  - Increased certainty that drivers will stop at red signal vs. zebra
  - Deviations from desire line for pedestrians
  - Left turning cyclists do not interact with drivers or signals/crossings
  - Tight corner radii for cyclists leaving shared space to cross arms
  - Comparatively low QOS for active travel users in order to minimize impact on traffic
  - QOS C

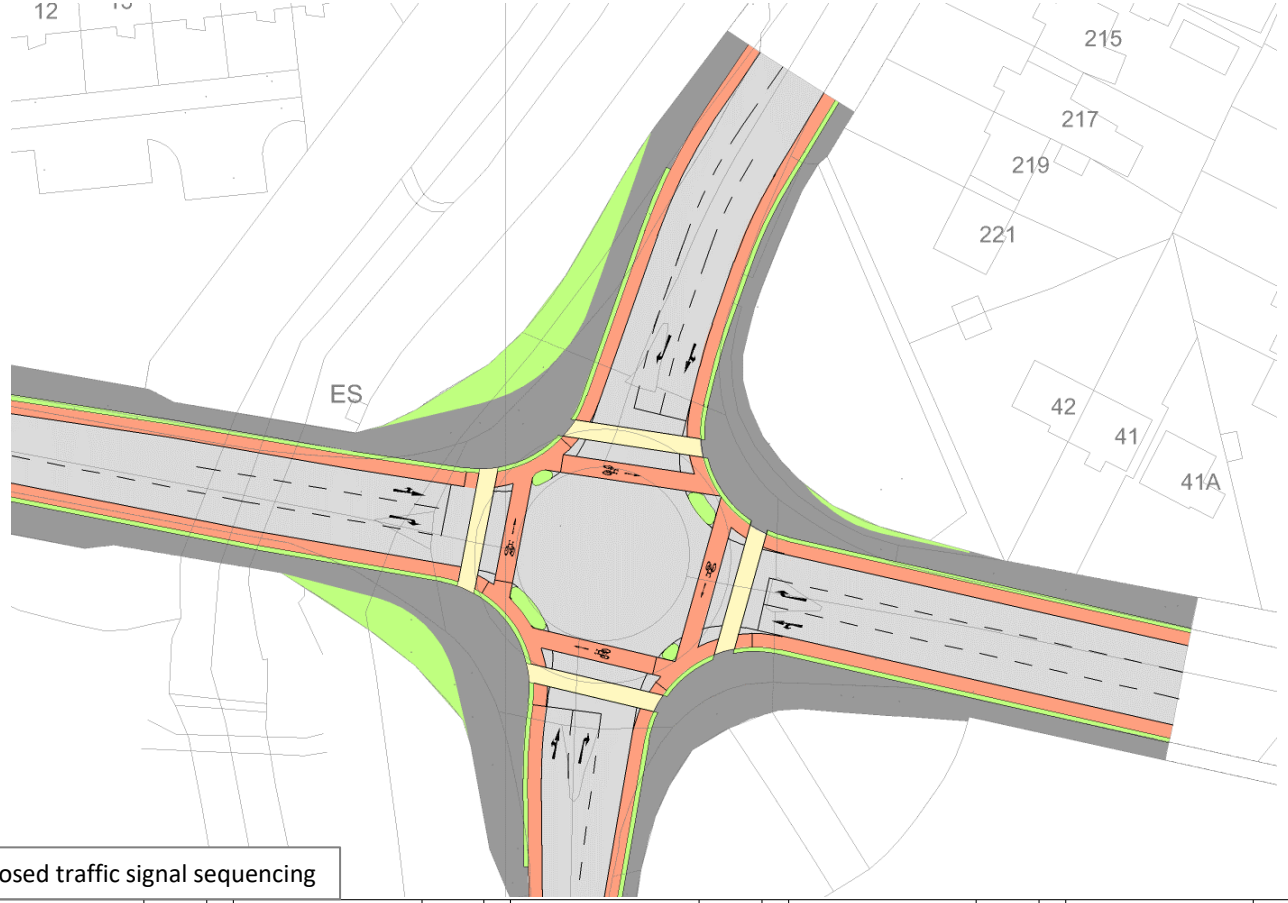
Upgrade Options



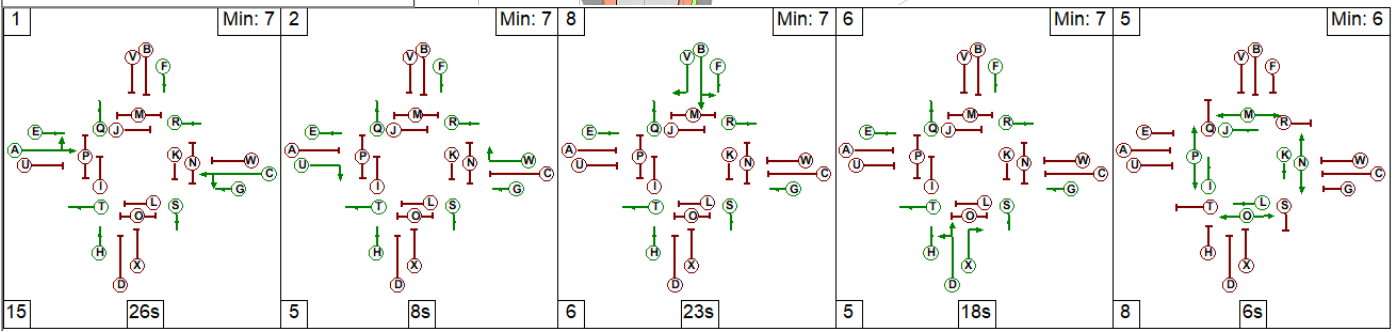
Option 03: Dutch style roundabout

- Drivers:
  - Roundabout with single lane entry, circulation, and exit
  - Pedestrians and cyclists segregated from drivers
  - Drivers yield to pedestrians and cyclists at crossings
  - If no pedestrians or cyclists are crossing, drivers are not delayed
- Active travel:
  - Full segregation between pedestrians, cyclists, and drivers
  - Where cyclists cross footpath, cyclists must yield to pedestrians
  - Design gives priority to pedestrians and cyclists over drivers at crossings
  - Large corner radii for cyclists to join or leave the cycle roundabout
  - Deviations from desire line for pedestrians
  - No delay for pedestrians or cyclists
  - Left turning cyclists do not interact with drivers or signals/driver crossings
  - High QOS for walkers and cyclists with priority over drivers and no wait times
  - QOS A

Upgrade Options



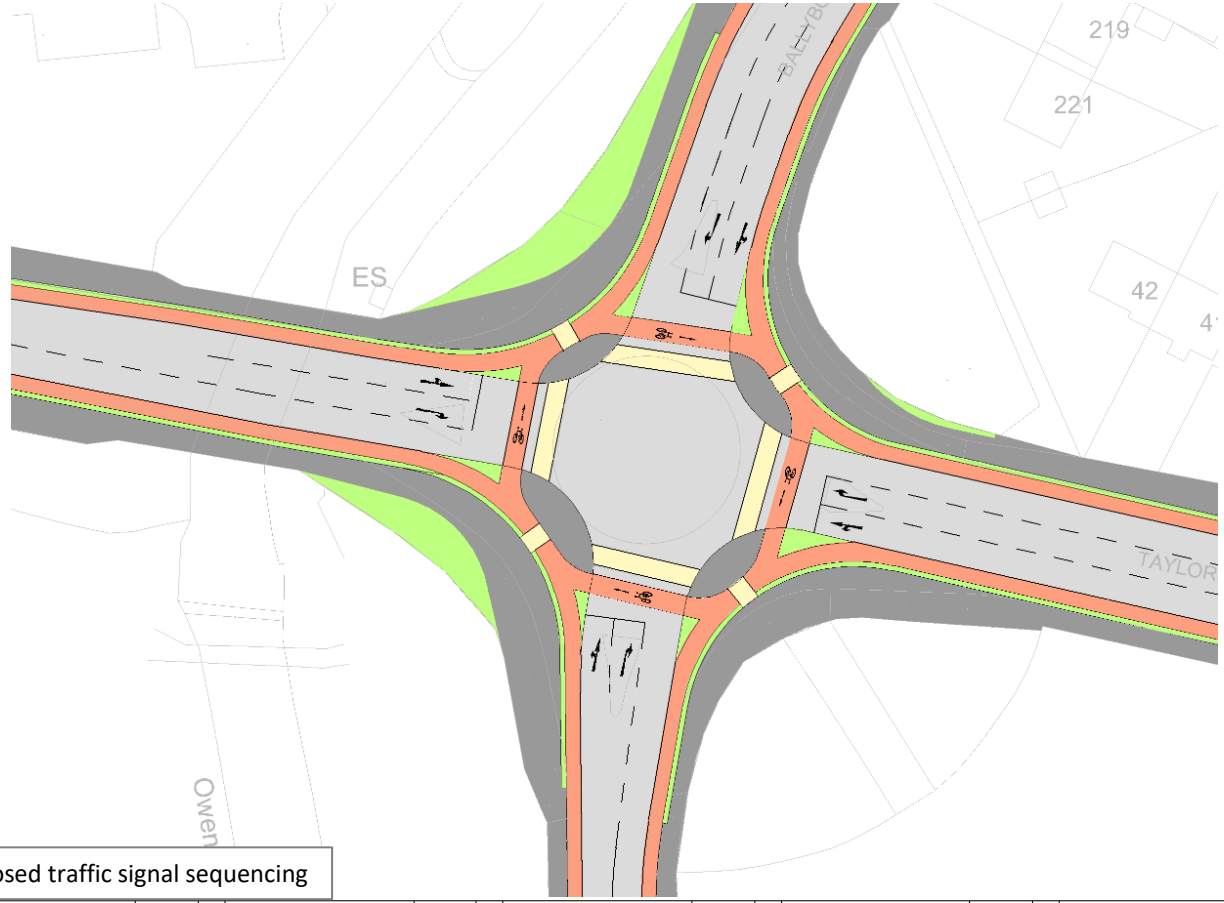
Proposed traffic signal sequencing



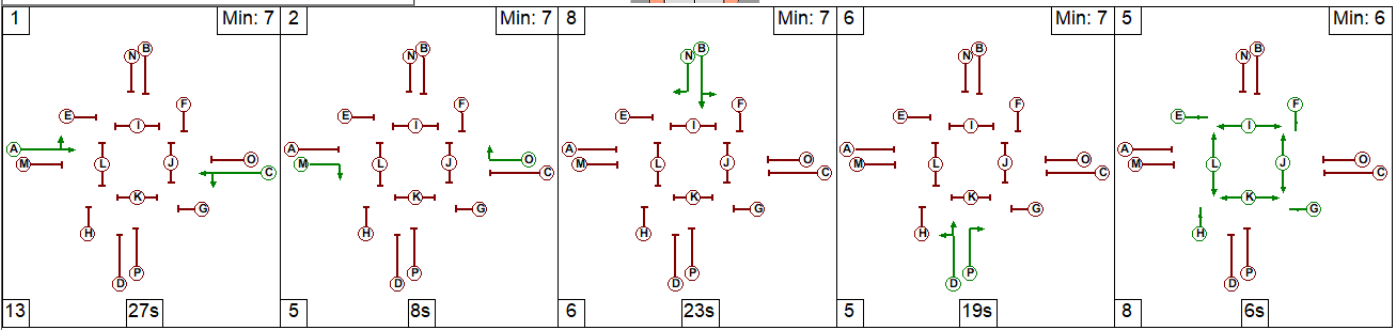
Option 04: BusConnects style signalised junction

- Drivers:
  - Signalised junction. All driver movements controlled by traffic signals regardless of whether cyclists or walkers present
  - Near junction, road widens to straight ahead/left lane and dedicated right turn lane on each arm
  - Drivers, cyclists, pedestrians each have separate phases
  - Pedestrians and cyclists segregated from drivers
  - Increased control of junction through use of signals can be seen as a benefit during peak hours but a disadvantage during off peak hours
- Active travel:
  - Full segregation between pedestrians, cyclists, and drivers
  - Pedestrian/cyclist interaction controlled by traffic signals
  - Pedestrians and cyclists must cross driver lanes on green signal which causes delays to pedestrians and cyclists on each crossing
  - Large corner radii for cyclist movements
  - Relatively small deviation from desire lines for pedestrians
  - Left turning cyclists are within signals and can potentially be stopped twice
  - QOS for walkers and cyclists good from segregation and safety points of view but poor from attractiveness and convenience perspective
  - QOS B

Upgrade Options



Proposed traffic signal sequencing



Option 05: CYCLOPS (Cycle Optimised Protected Signals) style signalised junction

- Drivers:
  - Signalised junction. All driver movements controlled by traffic signals regardless of whether cyclists or walkers present
  - Near junction, road widens to straight ahead/left lane and dedicated right turn lane on each arm
  - Drivers and combined cyclist/pedestrian have separate phases
  - Pedestrians and cyclists segregated from drivers
  - Increased control of junction through use of signals can be seen as a benefit during peak hours but a disadvantage during off peak hours
- Active travel:
  - Full segregation between pedestrians, cyclists, and drivers
  - Where cyclists cross footpath, cyclists must yield to pedestrians. Interaction is outside signals
  - Pedestrians and cyclists must cross driver lanes on green signal which causes delays to pedestrians and cyclists on each crossing
  - Large corner radii for cyclist movements
  - Small deviation from desire lines for pedestrians; shorter crossing distances; opportunity to have diagonal pedestrian phase
  - Left turning cyclists do not interact with drivers or signals/driver crossings
  - QOS for walkers and cyclists good from segregation and safety points of view but poor from a convenience perspective
  - OS B

Modelling Assumptions

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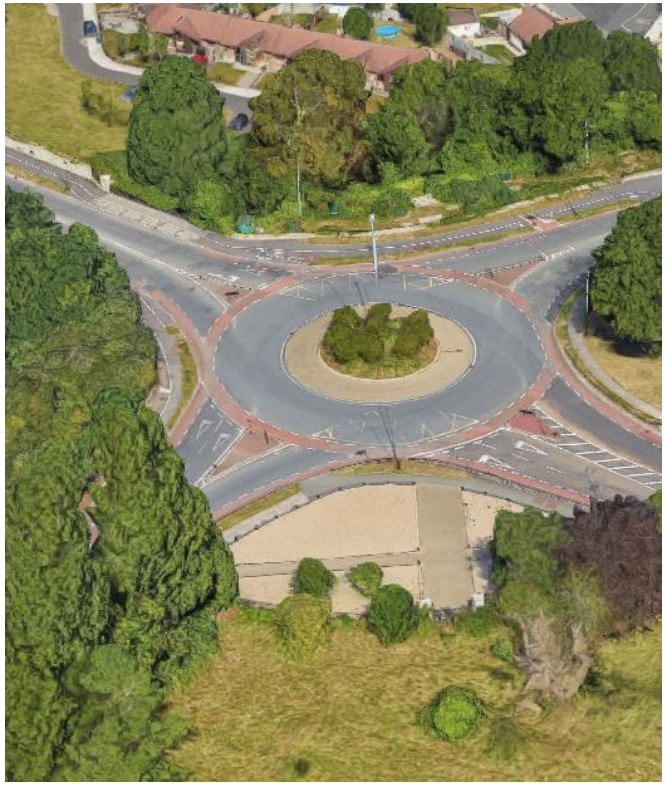
For each option, the first model run used the “baseline demand” scenario. The baseline demand is the observed existing walking, cycling, driving, and public transport user numbers with growth and/or reduction factors applied to account for the anticipated level and type of usership once the upgrade works are completed. As can be seen in the figure overleaf the following assumptions for the evening peak period (1700 – 1800) were made:

- The number of people walking and cycling will be 2.5 times greater as a result of the improved safety and attractiveness for active travel users following the upgrade works. This figure was arrived at by comparing counts undertaken at the Orlagh Roundabout before and after that roundabout was upgraded to improve walking and cycling facilities.
- The number of bus services post works will be 55% higher than at present due to an increase from 18 to 28 buses through the junction during the peak hour under the BusConnects network redesign. More destinations will also be served under the network redesign. It was assumed that each bus had 20 passengers
- Due to the increased number of bus services and destinations served, it was assumed that 200 people would shift from private car to bus during the peak hour. Taking a car occupancy of 1.1 people per car, this would result in 182 fewer cars during the peak hour.
- Based on analysis of traffic impact assessment reports submitted as planning and pre-planning documentation for under construction, approved, or proposed large scale developments, it was calculated that these developments would contribute 122 private cars through the junction during the evening peak.

Allowing for these assumptions, the baseline user numbers for the evening peak, expressed as a percentage of the existing demands, are as follows:

- Pedestrians: 250% (+150% growth)
- Cyclists 250% (+150% growth)
- Bus users 155% (+55% growth)
- Drivers 97% (-3% reduction)



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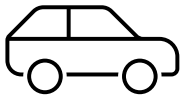
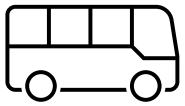
Existing Demands (taken from traffic counts)



2,308 light vehicles
(assumed average if 1.1 people per light vehicle)



18 buses
(assumed 20 people per bus)

125 pedestrians

92 cyclists

122 more cars (committed local developments)

182 fewer cars (with BusConnects)

BUS CONNECTS

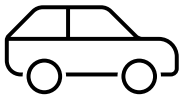
200 people reassigned to buses

10 additional buses per hour (with BusConnects)

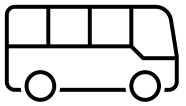
× 2.5* pedestrians

× 2.5* cyclists

Baseline Demands (Post option construction)



2,248 light vehicles (**97%** of existing light vehicles)
(assumed average if 1.1 people per light vehicle)



28 buses
(assumed 20 people per bus)

313 pedestrians

230 cyclists

** Based on observed increase in active travel post works at Orlagh Roundabout, there were 2.5 times as many people using active travel during the peak period*

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To perform the VISSIM analysis, for the existing roundabout and each of the five proposed options (6 baseline scenarios), a significant quantity of traffic count data, along with the geometric design of each layouts, was input into the model.

The performance of a junction varies throughout the day, typically with higher demand pressure in the morning and evening peaks. In order to compare each option at a time when flows are most sensitive to change, the modelled scenarios were run for the evening peak, from 1700 – 1800.

The model was then run for the six baseline scenarios, and the performance for each was assessed. The LOS for each option was developed based on the performance of the option under peak conditions in the model. Factors such as junction capacity, delay, and queue length were used to quantitively assign a LOS for each option.

For each option, the QOS from an active travel perspective was qualitatively assigned based on the five needs of the active travel user: road safety; coherence; directness; attractiveness; comfort.

The model was run for the six baseline scenarios (existing junction + five options at 97% of existing driver demand and 250% of active travel demand). The driver LOS for each baseline scenario was quantitively assigned. The qualitatively assigned active travel QOS remains constant regardless of the driver or active travel demand.

The modelling showed that the increased active travel demand, as well as the geometric, priority, and sequencing characteristics of each option has a negative impact on the driver LOS. As second modelling assessment was carried out for each of the five options whereby the driver demand through the junction was reduced to a point at which an acceptable driver LOS for each option was achieved. These were termed the “reduced driver demand” scenarios. As with the baseline demand scenarios, the active travel QOS was not impacted by the changes in driver demand and therefore remained unchanged.

To distil the model output into a digestible format, a summary sheet was created for the existing junction and each of the five options. The first summary sheet is for the existing junction and compares the modelled performance of the existing junction under existing demands vs. the baseline demands (97% of existing driver demand and 250% of active travel demand). This is in order to give context to the impact demand changes can have on junction performance. Panel EJ B from the existing junction summary sheet has been carried forward to the summary sheet for each upgrade option for use as a comparison tool.

The summary sheet for each of the upgrade options is set up to give a brief description of the performance of that option under both scenarios against the baseline demand performance for the existing junction (Panel A). Panel B shows the performance of the option under the baseline demands, and Panel C shows the performance under the reduced driver demand scenario. Each panel contains graphics taken from the model as well as some key characteristics for the performance under the scenario: driver demand and active travel demand, driver LOS performance and active travel QOS characteristics (both colour coded – see legend to right), and a brief commentary on the junction performance.

LOS Colour Code	
LOS A	
LOS B	
LOS C	
LOS D	
LOS E	
LOS F	

QOS Colour Code	
QOS A	
QOS B	
QOS C	
QOS D	

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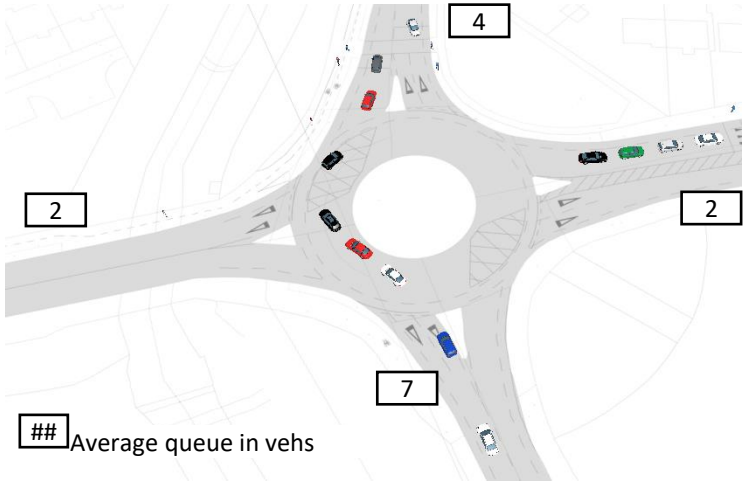
Existing junction

Panel EJ A shows the performance of the existing roundabout under existing driver and active travel demands.
Panel EJ B shows the performance of the existing roundabout under the baseline demands

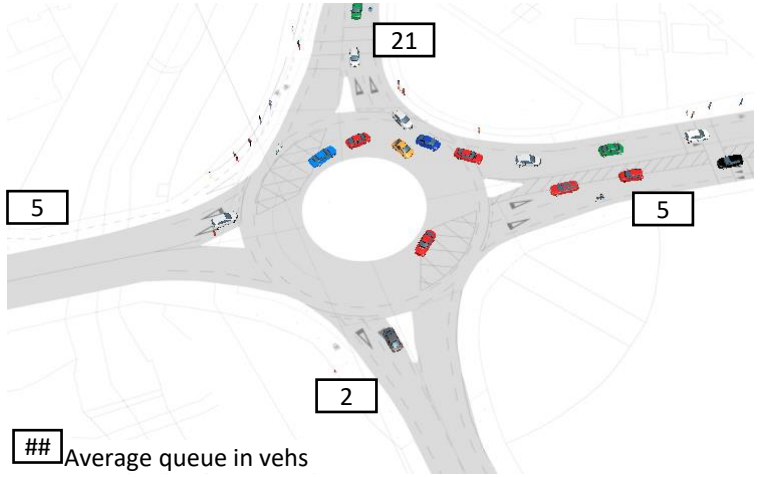
Panel EJ A



Existing junction – existing demands

- Scenario modelled at **100%** of current driver, cyclist, and pedestrian demand
- Active travel QOS D
- Driver LOS B

Panel EJ B



Existing junction – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS D
- Driver LOS C
- This scenario is to establish a modelling baseline only. Without active travel improvements, an increase in walking and cycling is highly unlikely and based on the recorded accident record, is not desirable.

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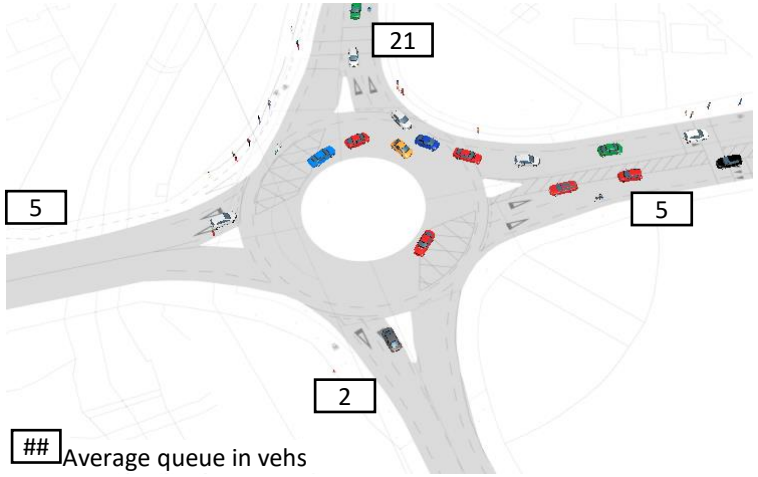
Option 01: Standard roundabout with a shared-path and zebras

Panel 01A shows the performance of the existing roundabout under the baseline demands.

Panel 01B shows the performance of Option 01 under the baseline demands 97% of current driver demand and 250% of current active travel demand. Under these conditions, Option 01 performs at a LOS F for drivers and a QOS C for active travel

Panel 01C works backwards to assess the level of modal shift or traffic evaporation in driver numbers for Option 01 to operate at an acceptable LOS. If driver numbers reduced from 97% of existing to 75% of existing, Option 01 would achieve a LOS D for drivers while remaining at a QOS C for walking and cycling.

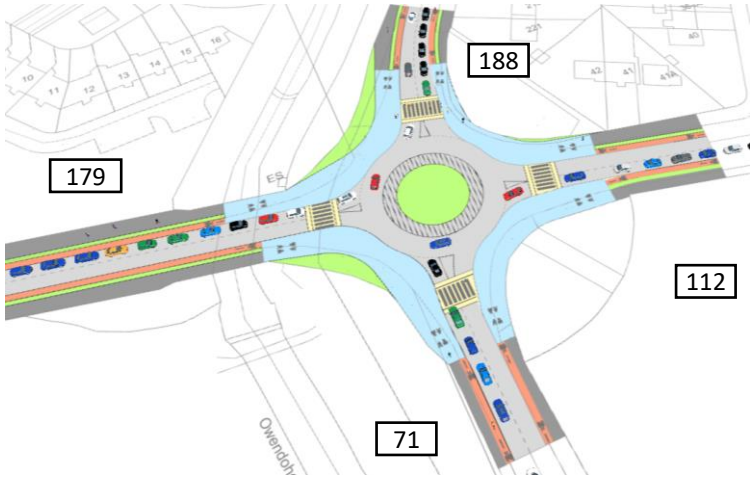
Panel 01A



Existing junction – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS D
- Driver LOS C

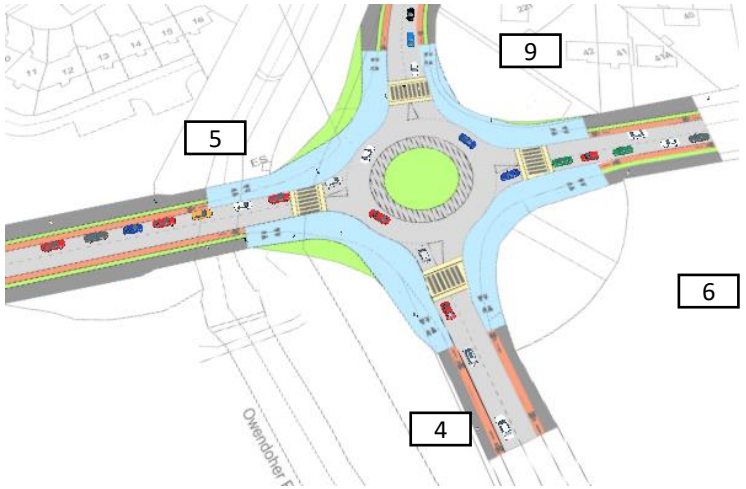
Panel 01B



Option 01: Standard roundabout with a shared-path and zebras – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS C
- Driver LOS F

Panel 01C



Option 01: Standard roundabout with a shared-path and zebras – reduced driver demand

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **75%** of current traffic demand
- Active travel QOS C
- Driver LOS D
- If 1 in 4 drivers didn't drive during the peak period, this option would have an acceptable LOS for drivers

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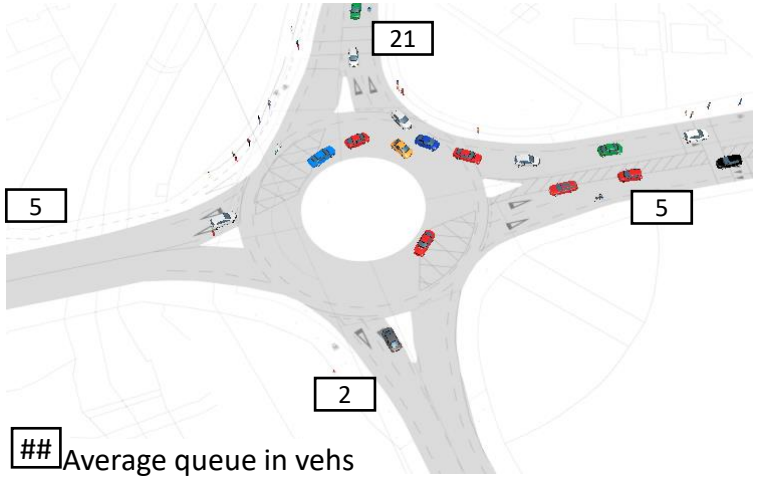
Option 02: Standard roundabout with a shared-path and toucans

Panel 02A shows the performance of the existing roundabout under the baseline demands.

Panel 02B shows the performance of Option 02 under the baseline demands 97% of current driver demand and 250% of current active travel demand. Under these conditions, Option 02 performs at a LOS F for drivers and a QOS C for active travel

Panel 02C works backwards to assess the level of modal shift or traffic evaporation in driver numbers for Option 02 to operate at a desirable LOS. If driver numbers reduced from 97% of existing to 70% of existing, Option 02 would achieve a LOS D for drivers while remaining at a QOS C for walking and cycling.

Panel 02A

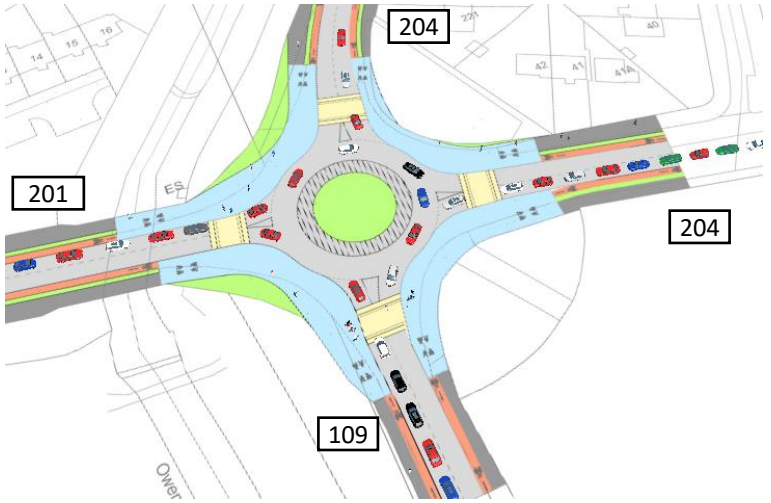


Average queue in vehs

Existing junction – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS D
- Driver LOS C

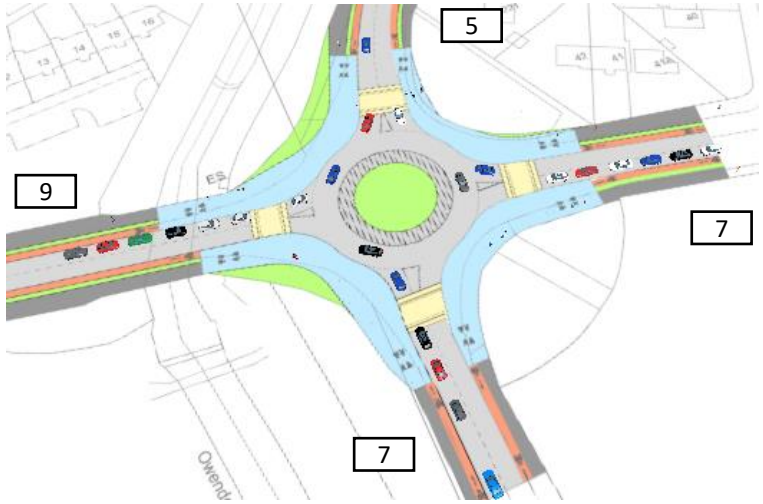
Panel 02B



Option 02: Standard roundabout with a shared-path and toucans – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS C
- Driver LOS F

Panel 02C



Option 02: Standard roundabout with a shared-path and toucans – reduced driver demand

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **70%** of current traffic demand
- Active travel QOS C
- Driver LOS D
- If 1 in 3 drivers didn't drive during the peak period, this option would have an acceptable LOS for drivers

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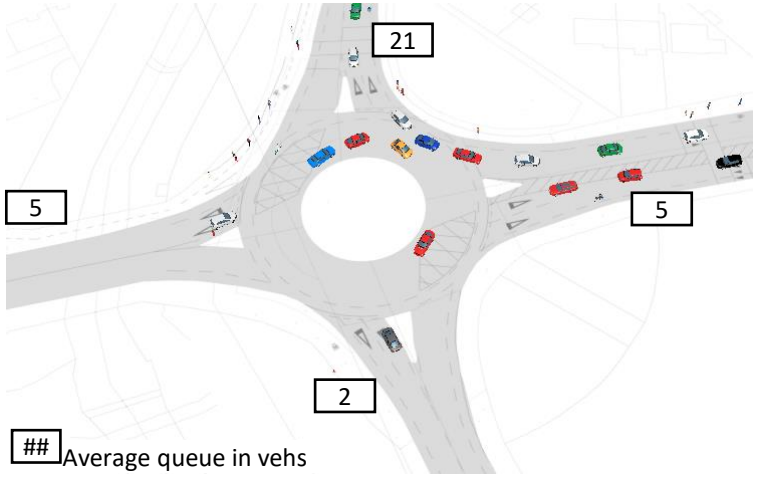
Option 03: Dutch style roundabout

Panel 03A shows the performance of the existing roundabout under the baseline demands.

Panel 03B shows the performance of Option 03 under the baseline demands 97% of current driver demand and 250% of current active travel demand. Under these conditions, Option 03 performs at a LOS F for drivers and a QOS C for active travel

Panel 03C works backwards to assess the level of modal shift or traffic evaporation in driver numbers for Option 03 to operate at an acceptable LOS. If driver numbers reduced from 97% of existing to 75% of existing, Option 01 would achieve a LOS D for drivers while remaining at a QOS C for walking and cycling.

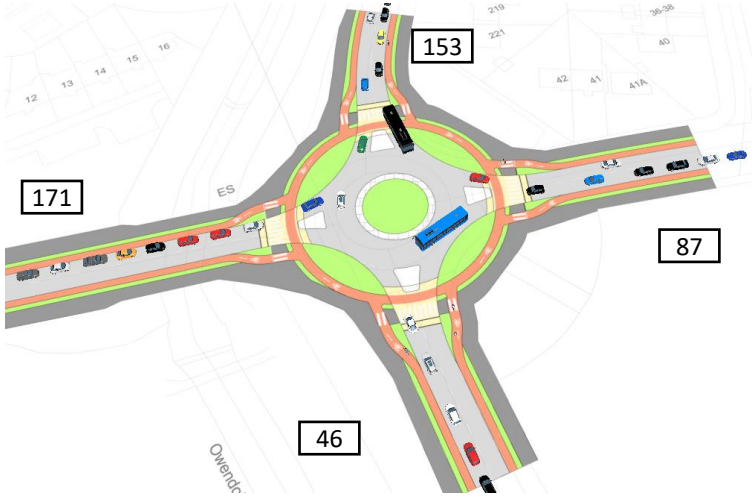
Panel 03A



Existing junction – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS D
- Driver LOS C

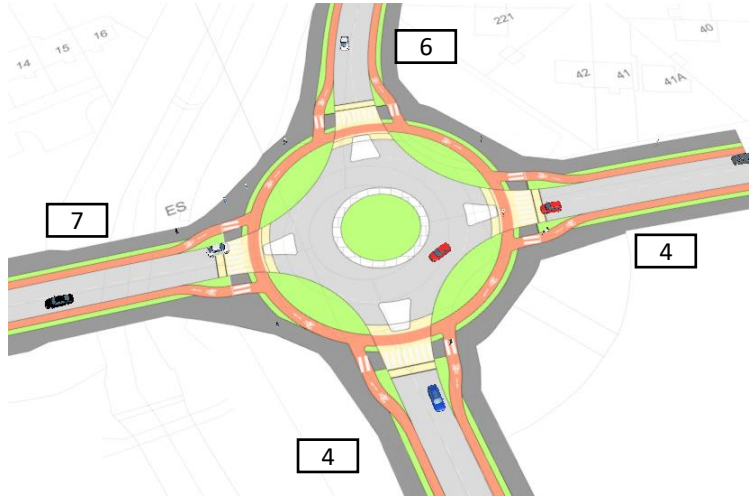
Panel 03B



Option 03: Dutch style roundabout – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS A
- Driver LOS F

Panel 03C



Option 03: Dutch style roundabout – reduced driver demand

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **80%** of current traffic demand
- Active travel QOS A
- Driver LOS D
- If 1 in 5 drivers didn't drive during the peak period, this option would have an acceptable LOS for drivers

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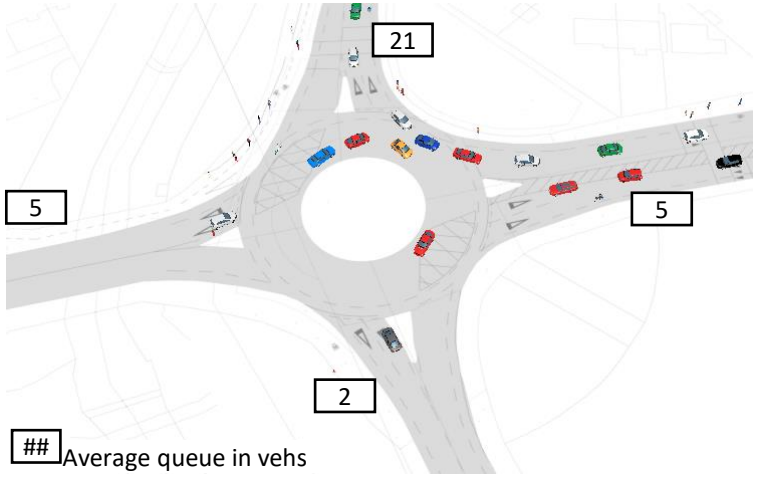
Option 04: BusConnects style signalized junction

Panel 04A shows the performance of the existing roundabout under the baseline demands.

Panel 04B shows the performance of Option 04 under the baseline demands 97% of current driver demand and 250% of current active travel demand. Under these conditions, Option 04 performs at a LOS F for drivers and a QOS B for active travel

Panel 04C works backwards to assess the level of modal shift or traffic evaporation in driver numbers for Option 04 to operate at an acceptable LOS. If driver numbers reduced from 97% of existing to 65% of existing, Option 04 would achieve a LOS D for drivers while remaining at a QOS B for walking and cycling.

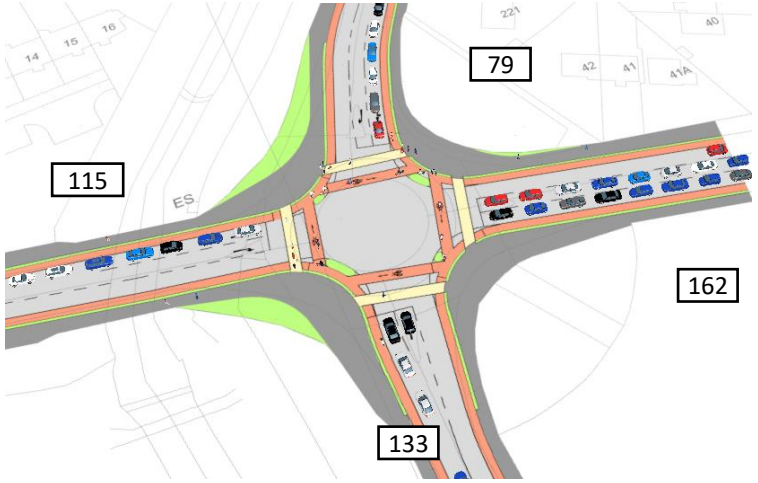
Panel 04A



Existing junction – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS D
- Driver LOS C

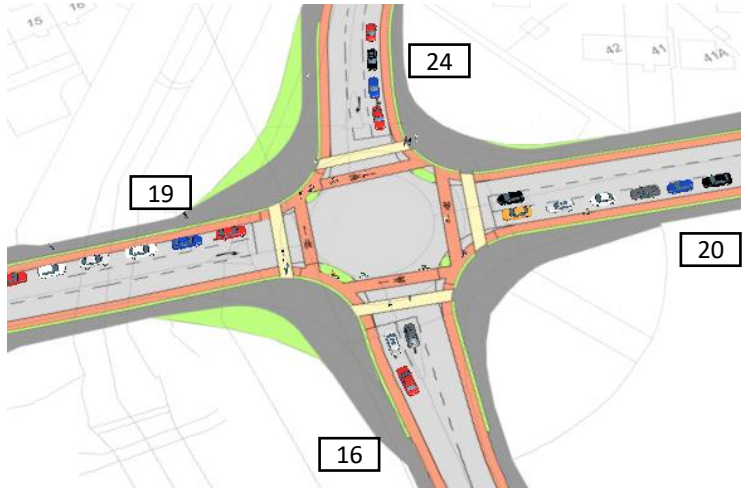
Panel 04B



Option 04: BusConnects style signalized junction – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS B
- Driver LOS F

Panel 04C



Option 04: BusConnects style signalized junction – reduced driver demand

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **65%** of current traffic demand
- Active travel QOS B
- Driver LOS D
- If 1 in 3 drivers didn't drive during the peak period, this option would have an acceptable LOS for drivers

Modelling Assessment

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South Dublin County Council

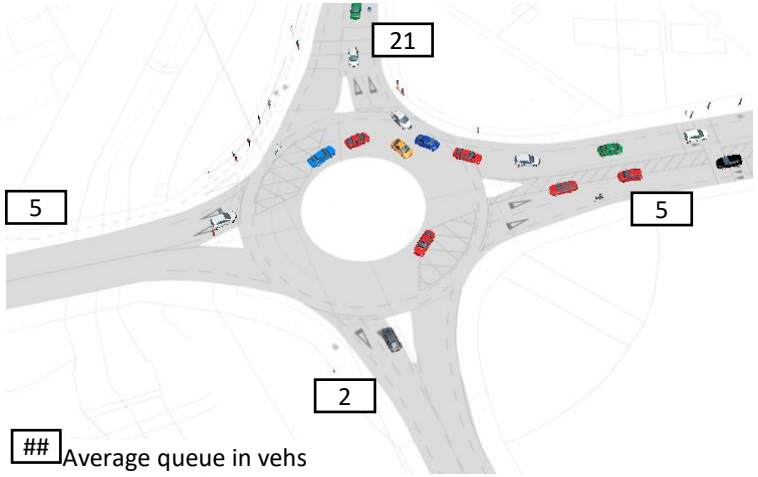
Option 05: CYCLOPS style signalized junction

Panel 05A shows the performance of the existing roundabout under the baseline demands.

Panel 05B shows the performance of Option 05 under the baseline demands 97% of current driver demand and 250% of current active travel demand. Under these conditions, Option 05 performs at a LOS F for drivers and a QOS B for active travel

Panel 05C works backwards to assess the level of modal shift or traffic evaporation in driver numbers for Option 05 to operate at an acceptable LOS. If driver numbers reduced from 97% of existing to 65% of existing, Option 05 would achieve a LOS D for drivers while remaining at a QOS B for walking and cycling.

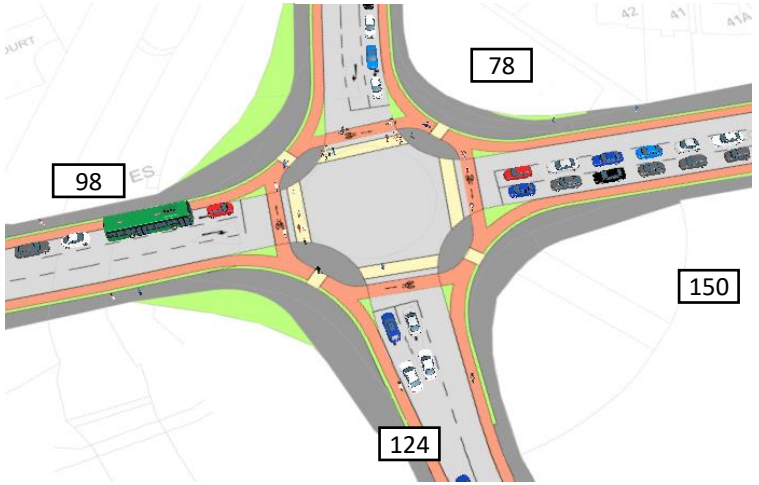
Panel 04A



Existing junction – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS D
- Driver LOS C

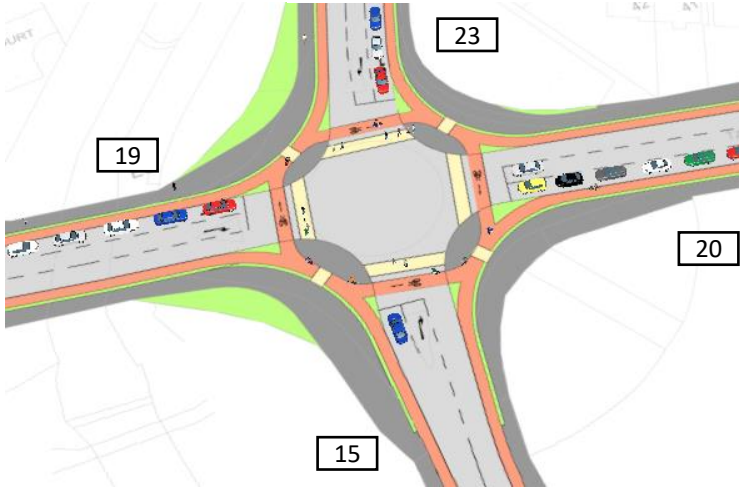
Panel 04B



Option 05: CYCLOPS style signalized junction – baseline demands

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **97%** of current driver demand
- Active travel QOS B
- Driver LOS F

Panel 04C



Option 05: CYCLOPS style signalized junction – reduced driver demand

- Scenario modelled at **250%** of current pedestrian and cycle demand
- Scenario modelled at **65%** of current traffic demand
- Active travel QOS B
- Driver LOS D
- If 1 in 3 drivers didn't drive during the peak period, this option would have an acceptable LOS for drivers

Option Analysis

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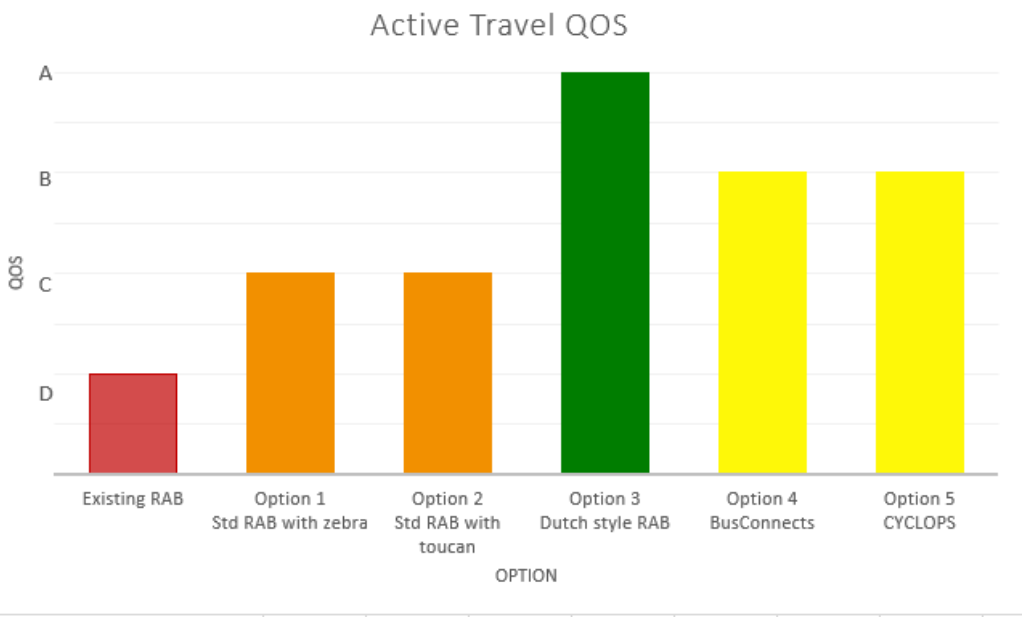
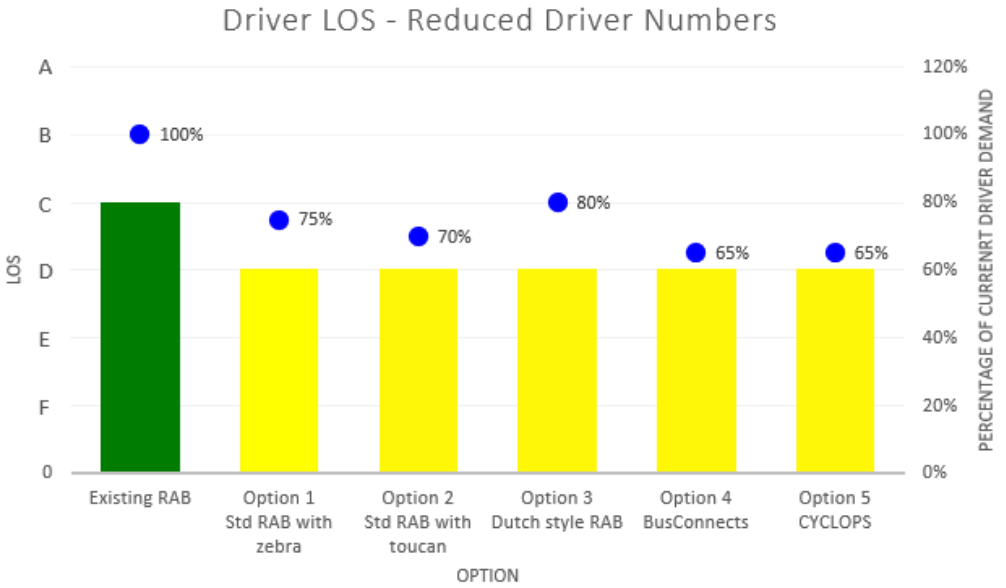
South Dublin County Council

The modelling exercise, in combination with the LOS and QOS scoring, was used to compare each of the proposed options to assess the optimum upgrade to provide safe, efficient, and attractive active travel improvements, while at the same time limiting potential negative impacts on traffic. The model runs were carried out factoring in an increase in active travel use based on real world numbers for active travel growth at the nearby Orlagh Roundabout, provision of increased bus services through the junction under BusConnects, and population increases from under-construction, approved, or proposed large housing developments.

From an active travel perspective, the chart below gives a graphical comparison of the QOS for each option. It can be seen that Option 03: Dutch style roundabout has the largest positive effect for active travel.

When considering the options from the point of view of drivers, negative impacts were seen across the board in the baseline scenario.





One of the main goals of this scheme is to encourage some people who currently drive to switch to walking and cycling for some of their journeys. With this in mind, an analysis was performed to assess, what reduction in driver numbers at peak times would be needed in order for each junction option to perform at an acceptable LOS for drivers.

The chart above shows what percentage of current peak driver trips could be maintained to provide a LOS D for each option. Of the five proposed upgrade options, Option 03, the Dutch-style roundabout can maintain the largest percentage of existing driver trips during the peak hour and still perform at an acceptable LOS.

Option Analysis

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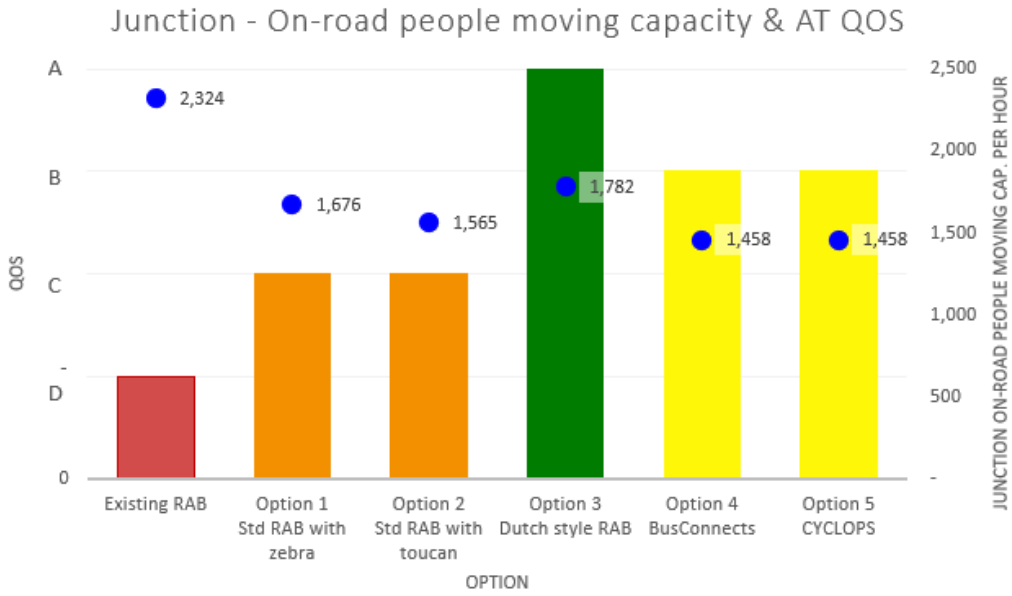
Based on the characteristics of their design, the model is able to calculate the theoretical capacity of each option. When the number of bus journeys is factored in (based on an assumed 20 people per bus) and assigning an average of 1.1 people per other vehicle, the theoretical number of people that can pass through each option on the road in an hour can also be calculated.

This is shown for each option in the chart beside. The theoretical capacity for each option for walking and cycling is not displayed as, due to the significantly greater space efficiency for both walking and cycling compared to driving, this would obscure the relative comparison for on-road movement. Instead, the qualitative QOS for active travel for each option is shown in the chart.

It can be seen that for the five proposed upgrade options, the option with the greatest on-road people moving capacity is the Dutch style roundabout.



Preferred Option Selection

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Following development of a short-list of options for a junction upgrade to improve the safety, convenience, and attractiveness of walking and cycling at the Taylor's Lane Roundabout as part of Phase 2 of the Old Bawn to Ballyboden Active Travel Scheme, an extensive modelling exercise was carried out. Additionally, each option was assigned a quality of service (QOS) giving a qualitative score from an active travel point of view.

The combination of the traffic modelling, which accounted for anticipated increases in driving, public transport, walking, and cycling numbers and the qualitive analysis allowed the impact of the options on traffic flows to be assessed.

The modelling and analysis showed that the option which provided the highest QOS for walking and cycling, while minimising disruption to drivers was Option 03: Dutch-style roundabout.

It is proposed that this option be progressed to the next stage of design and be included in the Part VIII process.