Annex A: Propensity to Cycle Tool

A.1 The Propensity to Cycle Tool (PCT) is a freely-available online resource that has been designed to help with the strategic planning of cycling networks. The tool comprises an interactive map that shows the current and potential distribution of commuter cycling trips under different growth scenarios. It provides numerical and graphical outputs including estimated numbers of cyclists in an area, along straight 'desire' lines and along routes.

A.2 The tool can be found at: www.pct.bike

Scenarios

A.3 The PCT provides a scenario-based approach to cycle planning, enabling planners to visualise commuter cycling growth. As well as the base case, which is commuter cycling levels from the 2011 Census, scenarios include the following:

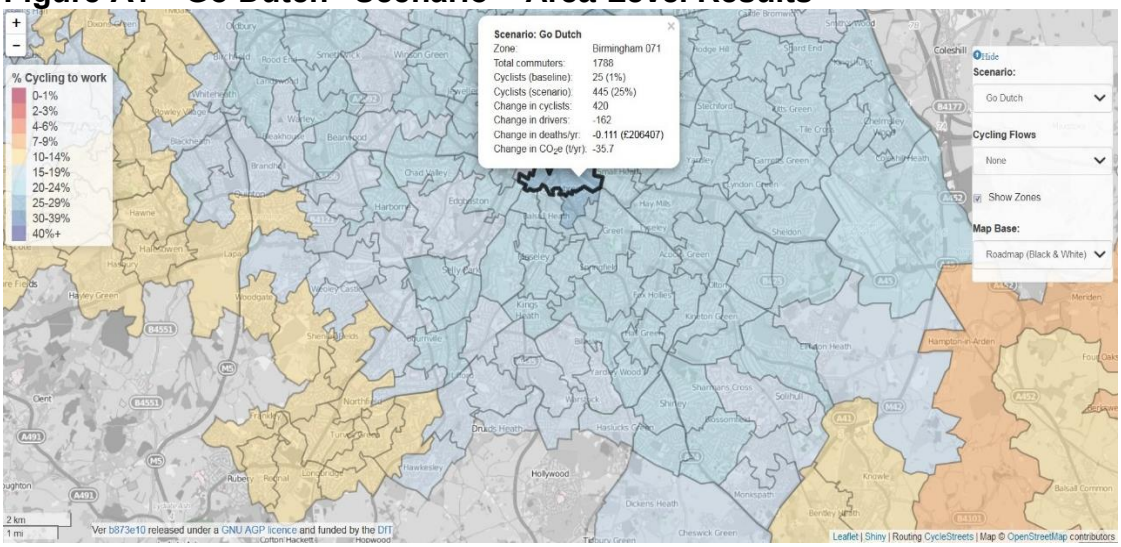
- **"Government Target"** scenario based on doubling cycling set out in the 2014 draft Cycling Delivery Plan/
- **"Gender Equality"** scenario in which women are as likely as men to cycle.
- **"Go Dutch"** scenario that uses Dutch propensities to cycle trips of particular length and hilliness.
- **"E-bike"** scenario that builds on the Go Dutch assumptions but also takes account of the role that electrically-assisted cycles can play in facilitating longer distances and hillier routes.

Areas, Desire Lines and Routes

A.4 The PCT can define the cycling potential in for commuter cycling four different ways:

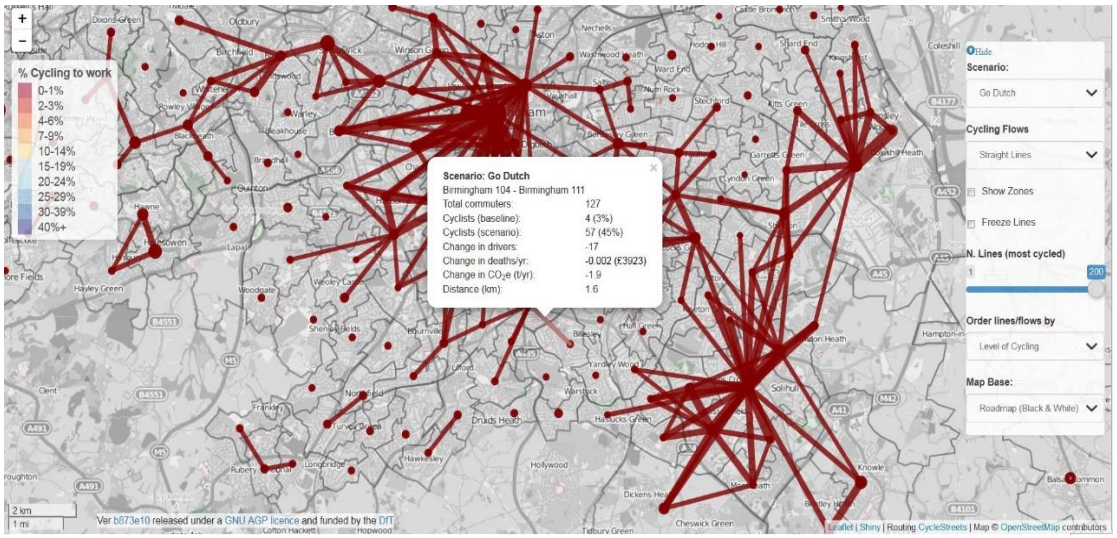
A.5 **Areas** - The PCT can show commuter cycling potential by Medium Super Output Areas (MSOAs), under different scenarios. By clicking on an individual MSOA, as indicated in Figure A1, information on the current and future levels of commuter cycling, as well as health and carbon benefits are shown.

Figure A1 "Go Dutch" Scenario – Area-Level Results



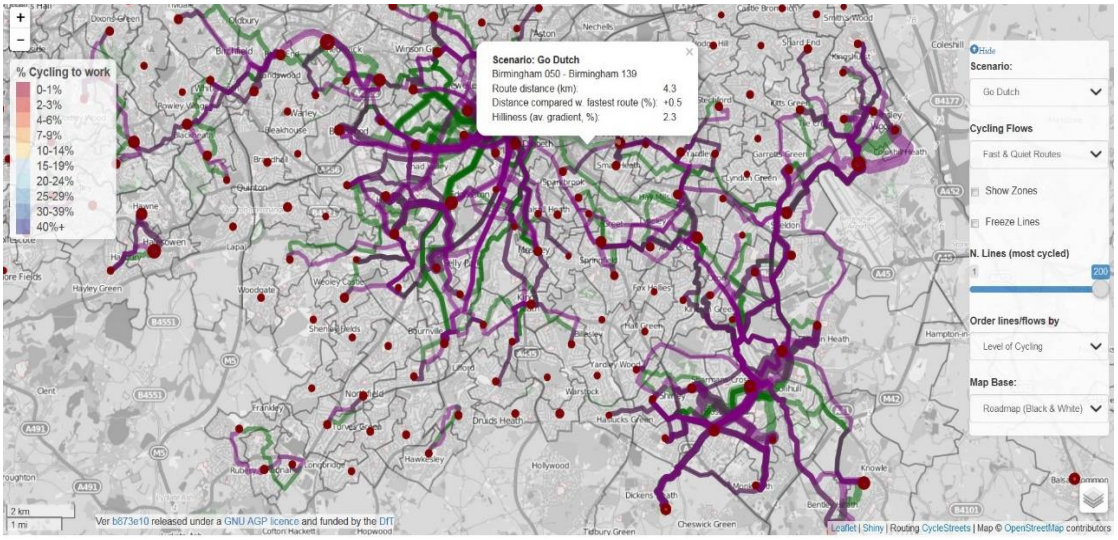
A.6 **Cycle Flows: Straight Lines** - As well as the area-level data, the PCT can map current cycling trips between origin and destination points, and model how cycling would change under the different scenarios. Straight 'desire' lines, as indicated in Figure A2, can be shown, with line thickness representing amount of cycle trips along the desire line. These are 'as the crow flies' lines between origin and destination points and do not link to existing roads or cycle routes.

Figure A2 "Go Dutch" Scenario – Straight 'Desire' Lines



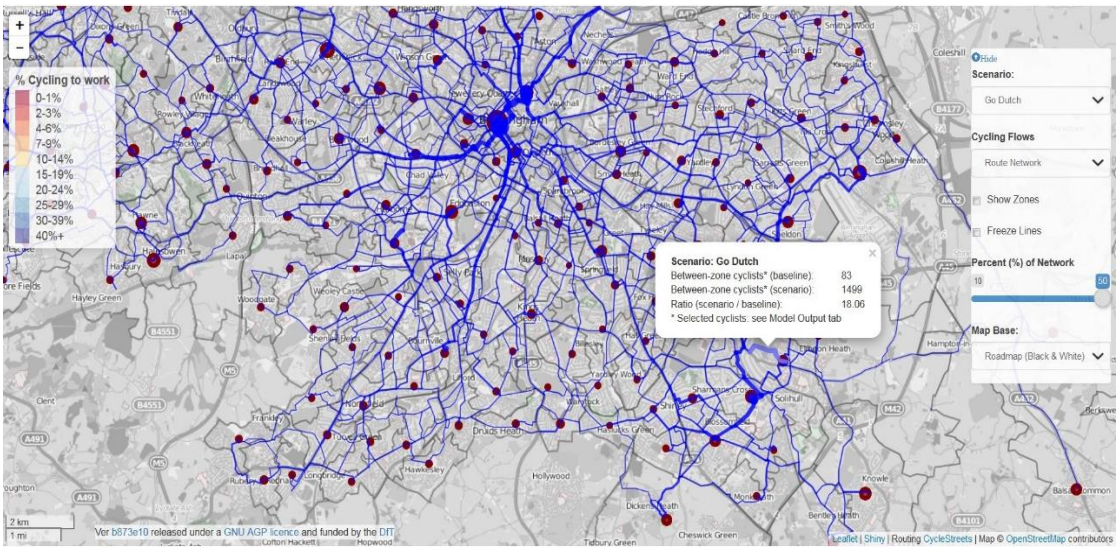
A.7 **Cycle Flows: Fast and Quiet Routes** - The PCT can also assign cycle flows to specific routes, as illustrated in Figure A3. In displaying route-level information, the PCT prioritises the 'fastest' route (shown in purple) as recommended by the Cyclestreets journey planner, which takes account of the time taken to cycle between points regardless of the volume of motor traffic. For comparison, the PCT also displays the 'quieter' route (shown in green) as recommended by Cyclestreets.

Figure A3 "Go Dutch" Scenario - Cycle Routes



A.8 **Route Network** - The PCT has the ability to aggregate individual 'faster' routes to generate a route network, as illustrated in Figure A4, with the thicker lines representing route sections with higher commuter cycling potential. This allows planners to think about where to prioritise improvements to cycling network.

Figure A4 "Go Dutch" Scenario - Route Network



A.9 Only around two thirds of all commuter cyclists are included in the straight lines, routes, and the route network estimates[1]. For instance, the lines, routes and route networks excludes those living and working within the same zone. All commuters are included in the area-level MSOA estimates.

Outputs

A.10 Both geographical and non-geographical files, covering area-based and line, route and route network data can be downloaded. The downloads include the observed travel patterns at baseline and scenario estimates for cycling uptake, mode shift from car driving and walking, and the health and carbon impacts.

[1] This proportion is lower in large cities like London: see the 'Model Output' tab on the PCT interface for details

A.11 Case studies available on the PCT website provide examples of the type of outputs that can be generated.

Supporting Local Cycling and Walking Infrastructure Plans

A.12 The preparation of Local Cycling and Walking Infrastructure Plans (LCWIPs), and delivery of improvements to local cycling and walking infrastructure, form a vital part of the Government's strategy to increase the number of cycling and walking trips.

A.13 A LCWIP is a long-term plan for developing cycling and walking networks at the local level, ideally over a 10-year period. By taking a strategic approach to improving conditions, LCWIPs will enable Local Authorities (LAs) to identify cycling and walking infrastructure schemes for future investment in the short, medium and long term.

A.14 The PCT can assist with the preparation of LCWIPs at a number of different stages including:

- Planning the cycle network:
  - Mapping trip origins and destinations (trip generation).
  - Identifying desire lines for cycle trips (trip distribution).
  - Allocating trips to specific routes (trip assignment).
- Defining potential demand for cycling across the geographical area cover by LCWIPs, under different scenarios.
- Assisting with scheme prioritisation.

A.15 The PCT will be of particular assistance in defining potential demand for cycling, identifying routes and areas for investment, and estimating future capacity needs for route and area-based measures.

A.16 This will include estimating the number of potential cyclists that could (a) start their journeys in particular localities and (b) use specific routes.

Further Information

A.17 Further information about using the PCT, including a user manual, introductory video and case studies, is available at: www.pct.bike.

A.18 There is also an open-access peer-reviewed journal article describing the methods used to develop the PCT: Lovelace R, Goodman A, Aldred R*, et al.* The Propensity to Cycle Tool: An open source online system for sustainable transport planning. *Journal of Transport and Land Use* In press. doi: 10.5198/jtlu.2016.862. Available at https://www.jtlu.org/index.php/jtlu/article/view/862/826

Acknowledgement

A.19 The PCT was funded by the DfT and has been developed by an academic team based at four universities: Cambridge, Leeds, Westminster and the London School of Hygiene and Tropical Medicine.

A.20 The PCT uses a number of open source software products, such as Leaflet and Shiny, and is based on the statistical programming language R. CycleStreets (www.cyclestreets.net) is used to identify possible routes.

Annex B: Route Selection Tool

B.1 To help assess and compare potential routes for inclusion in a cycling network, a Route Selection Tool (RST) has been developed.

B.2 The primary function of the tool is to assess the suitability of a route in its existing condition against the core design outcomes and then compare it with the potential future state, if improvements were made. It also enables the merits of alternative routes to be easily compared.

Route Selection Tool Criteria

B.3 The RST is a spreadsheet that uses a range of criteria to assess how well a route meets the core design outcomes for cycling ranging from 5, being the highest, and 0, being the lowest. The criteria are:

- directness
- gradient
- safety
- connectivity
- comfort

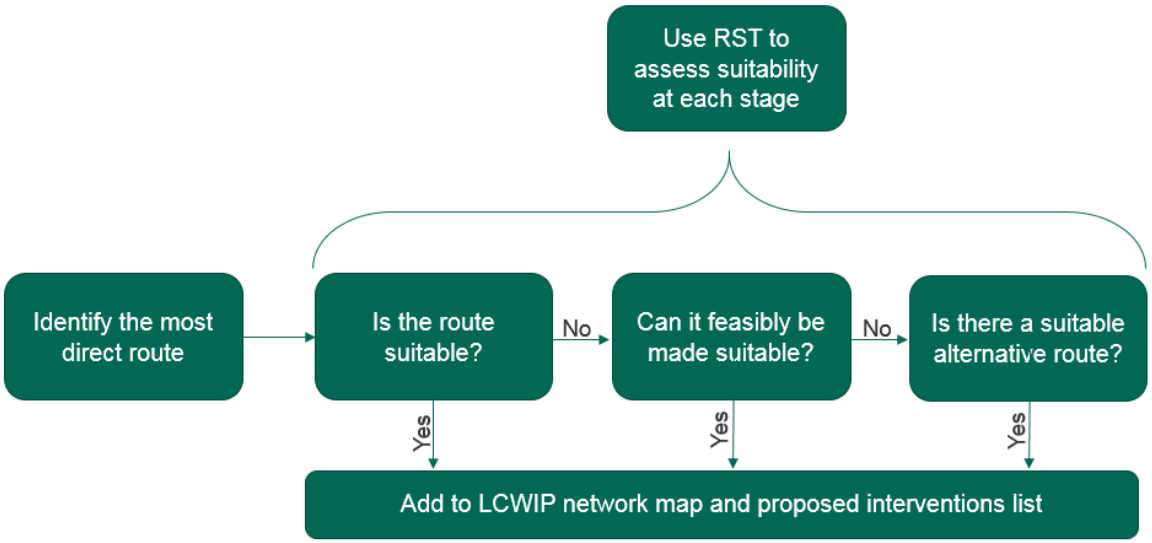
B.4 The number of 'critical junctions' are also recorded to enable a high-level evaluation of both links and junctions to be undertaken using one tool. A 'critical junction' is defined as one that has characteristics that are hazardous for cyclists e.g. high traffic volumes, lack of priority or segregation, crossing high speed on-off slip roads or large roundabouts.

B.5 Gradient has been added as it is an important factor in the choices that cyclists make when considering route options. Attractiveness is not included in the RST as it is not deemed to be a key deciding factor between routes.

B.6 Where possible, local user views should be sought to supplement site observations and ensure the best possible routes and solutions are identified.

B.7 The process to follow when using the tool is shown in **Figure B1**.

Figure B1: **Route Selection Process**



How to use the RST

B.8 The spreadsheet is colour coded based on either user inputs or its role within the calculations:

- Orange: these fields require data to be inputted for reference and show how data in the yellow fields have been derived.
- Yellow: these fields require scores to be calculated using data from the orange fields and by referring to the blue scoring tables.
- Blue: these fields contain the data for scoring.

B.9 For some of the criteria it is necessary to consider the route in sections of similar characteristics up to 1km in length, for others, the route as a whole is considered.

B.10 The RST summary allows assessors to describe the improvements that would be needed to bring the route up to an acceptable standard for cycling, as well as the indicative cost. Details on assessing the cost of cycling improvements is provided in Chapter 7 of the LCWIP guidance.

B.11 The aim is to choose routes that have the potential to be brought up to a score of at least 3, ideally with no critical junctions.

Route Selection Tool Guidance

B.12 The following section describes what is required for each of the six criteria.

Directness

Directness is measured by comparing the length of the overall cycle route to the shortest motor vehicle route. In most cases directness will not vary between the existing and potential situation, but in some cases it may be possible to construct short cuts.

Sections to be completed:

- Existing and potential **motor vehicle route length**
- Existing and potential **cycle route length**

The ratio is automatically calculated once the motor vehicle route length and cycle route length is inputted. This then provides a directness score for the route.

The **motor vehicle route length** is the shortest distance travelled by car between the route start and end points.

The **cycle route length** is the shortest distance travelled by cycle between the route start and end points.

This may change between existing and potential route if shortcuts are created.

	Existing Route	Potential Route
Motor Vehicle Route Length (km)	3.29	3.29
Cycle Route Length (km)	3.29	3.29
Ratio	1.00	1.00
Directness Score for Route	5	5

Upon completion of this section the directness score for the route is automatically calculated and added to the route summary.

A score of 5 is the most desirable as it means that the route for cyclists is either equal to or shorter than the route for motor vehicles.

Gradient

Gradient is assessed by comparing the maximum gradient in each section of route with the length at which it is climbed. In most cases gradient will not vary between the existing and potential situation, but in some cases it may be necessary, for example, to introduce zig-zags to reduce gradients.

Sections to be completed:

- Existing and potential **section length**
- Existing and potential **maximum slope**
- Existing and potential **maximum grade**
- Existing and potential **score**

The **section length** must be less than 1km. Routes should be split into sections based on similar characteristics.

The **maximum slope** is the distance for which the maximum grade is travelled for in metres (m).

			Existing Route				Potential Route			
Section Number	Section start point	Section end point	Section Length (km)	Maximum Slope (m)	Max grade (%)	**Score**	Section Length (km)	Maximum Slope (m)	Max grade (%)	**Score**
1	Northfield	Manor Park u-turn	0.615	38.4	4.9	4	0.615	38.4	4.9	4
2	Manor Park u-turn	Bournville Lane	0.618	14	8.2	2	0.618	14	8.2	2
3	Bournville Lane	Weoley Pk Rd	0.856	80	2.9	5	0.856	80	2.9	5
4										
5										
6										
7										
8										
9										
10										

Gradient Score for Route	Existing	Potential
	3.82	3.82

Upon completion of this section the gradient score for the route is automatically calculated and added to the route summary.

A score of 5 is the most desirable as it means that the gradient at which a cyclist climbs is either for a short time or the gradient climbed is not considerably steep.

By calculating the maximum grade and maximum slope a **score** can be calculated using the blue table. For both measurements the numbers should be rounded up to the next category.

The **maximum grade** is the steepest elevation on each section of the route. Google Earth elevation profile can be used to assess this.

Safety

Safety is assessed by looking at motor speed and volume (if present) and the degree of separation between cyclists and general traffic. It also considers the safety aspects of lighting.

Sections to be completed:
- Existing and potential **section length**
- Existing and potential **speed**
- Existing and potential traffic **volume**
- Existing and potential **score**

The **section length** must be less than 1km. Routes should be split into sections based on similar characteristics.

The **motor traffic speed** is the speed recorded at the 85th percentile, if known, or otherwise the speed limit. Where there is physical separation from motor vehicles or the route is off highway completely record as 'not applicable'.

			Existing Route				Potential Route			
Section Number	Section start point	Section end point	Section Length (km)	Motor Traffic Speed (mph)	Motor Traffic Volume (AADT)	**Score**	Section Length (km)	Motor Traffic Speed (mph)	Motor Traffic Volume (AADT)	**Score**
1	Northfield	Manor Park u-turn	0.615	30	4000	2	0.615	30	2000	4
2	Manor Park u-turn	Bournville Lane	0.618	20	3500	3	0.618	20	3000	4
3	Bournville Lane	Weoley Pk Rd	0.856	20	3000	4	0.856	20	3000	4
4										
5										
6										
7										
8										
9										
10										

Safety Score for Route	Existing	Potential
	3.12	4.00

Upon completion of this section the safety score for the route is automatically calculated and added to the route summary.

A score of 5 is the most desirable as cyclists are separated from traffic, though reducing speed and volumes to an appropriate level for cyclists also scores highly.

The **motor traffic volume** is the Average Annualised Daily Traffic (AADT), two ways on single carriageways and one way on dual carriageways. Where there is physical separation from motor vehicles or the route is off highway completely record as 'not applicable'.

The **score** is calculated using the blue tableIf there is physical separation from motor vehicles or the route is off highway completely it scores a 5. Deduct one point from the score if the route is unlit.

Connectivity

The connectivity score is based on the number of points at which a route can be joined, for example side roads or entry on to a towpath. In areas where there is little activity adjacent to the route it may be appropriate to not include this indicator.

Sections to be completed:

- Existing and potential **section length**
- Existing and potential **total connections**
- Existing and potential **connections per km**
- Existing and potential **score**

The **section length** must be less than 1km. Routes should be split into sections based on similar characteristics.

The **score** is calculated using the blue table and the number of connections per kilometre.

			Existing Route				Potential Route			
Section Number	Section start point	Section end point	Section Length (km)	Total Connections (No.)	Connections per km	**Score**	Section Length (km)	Total Connections (No.)	Connections per km	**Score**
1	Northfield	Manor Park u-turn	0.615	2	3.3	4	0.615	4	6.5	5
2	Manor Park u-turn	Bournville Lane	0.618	2	3.2	4	0.618	5	8.1	5
3	Bournville Lane	Weoley Pk Rd	0.856	3	3.5	4	0.856	5	5.8	5
4										
5										
6										
7										
8										
9										
10										

Connectivity Score for Route	Existing	Potential
	4.00	5.00

Upon completion of this section the connectivity score for the route is automatically calculated and added to the route summary.

A score of 5 is the most desirable as it means that the route is accessible from many locations along its length.

The **total connections** is the number of accesses to the section of route that are barrier free and suitable for cycling.

The number of **connections per kilometre (km)** is calculated by dividing the total number of connections in each section by the section length.

Comfort

The comfort score the space allocated for cycling and the quality of the surface material.

Sections to be completed:
- Existing and potential **section length**
- Existing and potential **surface type**
- Existing and potential **width**
- Existing and potential **score**

The **section length** must be less than 1km. Routes should be split into sections based on similar characteristics.

The **surface type** is a description of the surface provided for cyclists. This is populated by a drop-down list corresponding to the categories in the blue table.

			Existing Route				Potential Route			
Section Number	Section start point	Section end point	Section Length (km)	Surface Type	Available Width (m)	**Score**	Section Length (km)	Surface Type	Available Width (m)	**Score**
1	Northfield	Manor Park u-turn	0.615	Smooth, Machine-laid bituminous or similar	1.7	3	0.615	Smooth, Machine-laid bituminous or similar	2.5	5
2	Manor Park u-turn	Bournville Lane	0.618	Hand-laid bituminous or similar	1.9	3	0.618	Hand-laid bituminous or similar	2.2	4
3	Bournville Lane	Weoley Pk Rd	0.856	Hand-laid bituminous or similar	1.9	3	0.856	Hand-laid bituminous or similar	2.2	4
4										
5										
6										
7										
8										
9										
10										

Comfort Score for Route	Existing	Potential
	3.00	4.29

The **score** is calculated using the blue table.

Mixed traffic streets with less than 2500 vehicles per day should be assessed as two-way tracks with available width greater than 3.5m. Mixed traffic streets with more than 2500 vehicles per day score zero.

If the path is shared use the score should be reduced:
- By 1 when the pedestrian flows exceed 100 per hour
- By 2 when the pedestrian flows exceed 300 per hour

Upon completion of this section the comfort score for the route is automatically calculated and added to the route summary.

A score of 5 is the most desirable as it means that the surfaces and space provided for cyclists is adequate and there is little or no conflict with

The **available width** is the width provided for cyclists. Identify whether the provision for cyclists is one-way or two-way and the available width of this. If it is a mixed traffic street record as 'not applicable'.

Critical Junctions

Critical junctions should be counted for the entire route. To bring the route up to a suitable standard the amount of critical junctions should be significantly reduced or, if possible, removed completely

Sections to be completed:
- Existing and potential **critical junctions**

The existing and potential **critical junctions** should be added for the entire route. This section can be used to identify where interventions are needed in order to provide a safer and more comfortable route for cyclists.

	Existing	Potential
Critical Junctions/Crossings	No. of Junctions	No. of Junctions
Cycle movements in potential conflict with heavy motor traffic flows (>5000 vpd, or HGV/Bus >500 per day)	3	1
Cycle movements mixed with or crossing traffic stream with 85th percentile speed >60kph		
Cycles need to cross more than one traffic lane to complete a movement (where the road has moderate or heavy traffic flows and where no refuge is provided)	3	2
Cycle movement crosses very wide or flared side road junction, radii >9m, multi-lane entry, merge and diverge slip road, or acceleration and deceleration lanes	1	
Pinch points (widths between 3.2m and 3.9m inclusive) on junction entry or exit lanes		
Poor surface quality within path of cycle movement due to drainage grating, adverse camber, road debris, or poor reinstatement/maintenance		
Congested conditions restriction visibility to cyclists passing stationary traffic	1	
Any type of roundabout with >8000 vpd where cycles mix with traffic or cross without priority		
Multi-lane roundabout where cycles mix with traffic		
Number of Critical Junctions/Crossings on Route with critical features requiring improvement	8	3

Upon completion of this section number of critical junctions and crossings is automatically calculated and added to the route summary.

To bring the route up to a suitable standard the amount of critical junctions should be significantly reduced or, if possible, removed completely.

Summary

Upon completion the summary page will be populated with the performance score for each criteria.

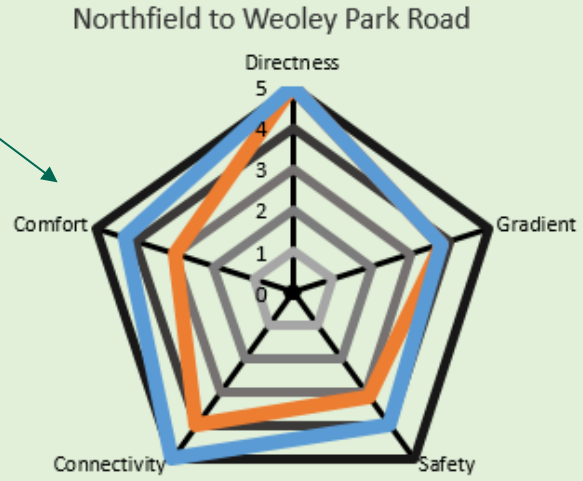
The **performance scores** section is automatically populated to show the information from the sheets for each criteria.

Route Name	Northfield to Weoley Park Road
Overall Length	3.29km
Name of Assessor(s)	L.Bradshaw
Date of Assessment	12 October 2016

Performance Scores

Criterion	Existing	Potential
Directness	5.00	5.00
Gradient	3.82	3.82
Safety	3.12	4.00
Connectivity	4.00	5.00
Comfort	3.00	4.29

The **diagram** shows a visual comparison between the route in its current condition (orange) and following potential improvements (blue).



The number of **critical junctions** is automatically populated following completion of the relevant sheet.

Number of Existing Critical Junctions/Crossings	8
Number of Potential Critical Junctions/Crossings	3
Description of Improvements	Introduction of shared footway and stepped track for part of the route and junction improvements
Indicative Cost	£1.5 million

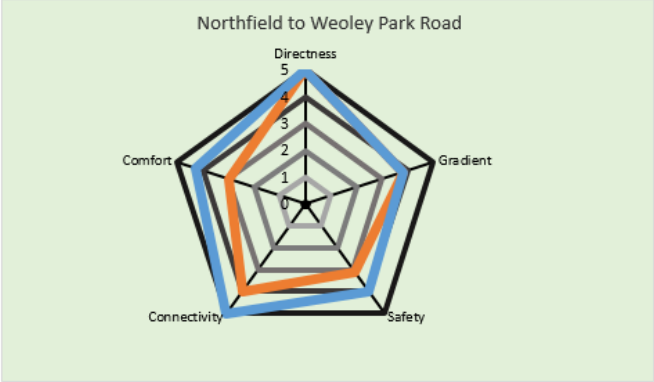
Details of the improvements, deliverability and cost can be added to provide a summary of the interventions needed.

Route Comparison

Routes and improvements can be compared by using two different spreadsheets.

Route Name	Northfield to Weoley Park Road
Overall Length	3.29km
Name of Assessor(s)	L.Bradshaw
Date of Assessment	12 October 2016

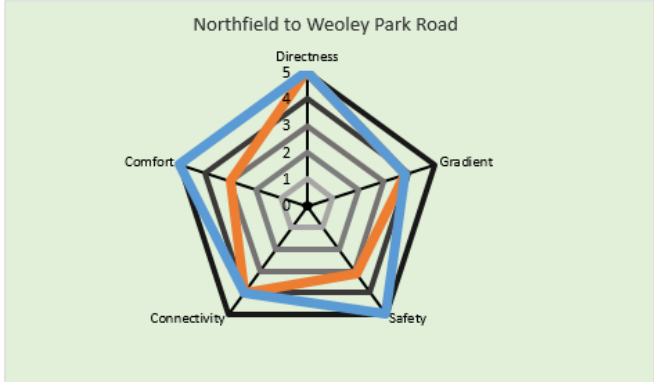
	Performance Scores	
Criterion	**Existing**	**Potential**
Directness	5.00	5.00
Gradient	3.82	3.82
Safety	3.12	4.00
Connectivity	4.00	5.00
Comfort	3.00	4.29



Number of Existing Critical Junctions/Crossings	8
Number of Potential Critical Junctions/Crossings	3
Description of Improvements	Introduction of shared footway and stepped track for part of the route
Indicative Cost	£1.5 million

Route Name	Northfield to Weoley Park Road
Overall Length	3.29 km
Name of Assessor(s)	L.Bradshaw
Date of Assessment	19 October 2016

	Performance Scores	
Criterion	**Existing**	**Potential**
Directness	5.00	5.00
Gradient	3.82	3.82
Safety	3.12	5.00
Connectivity	4.00	4.00
Comfort	3.00	5.00



Number of Existing Critical Junctions/Crossings	8
Number of Potential Critical Junctions/Crossings	1
Description of Improvements	Introduction of a lightly segregated cycle track on each side of the road and introduction of 20 mph zone throughout route
Indicative Cost	£2.6 million

Annex C: Walking Route Audit Tool

C.1 The Walking Route Audit Tool (WRAT) was developed as part of the Welsh Active Travel Design Guidance[2] to assist Local Authorities in the auditing of walking routes.

C.2 The WRAT is a spreadsheet based tool that requires the auditor to score the route against five core design outcomes for pedestrian infrastructure.

C.3 The criteria are:

- attractiveness
- comfort
- directness
- safety
- coherence

C.4 The criteria are scored using the following scale:

- 0 for poor provision,
- 1 for provision which is adequate but should be improved if possible
- 2 for good quality provision

C.5 A score of 70% (i.e. a score of 28 out of a potential 40 points) should normally be regarded as a minimum level of provision overall. Routes which score less than this, and factors which are scored as zero should be used to identify where improvements are required.

C.6 As the scoring is sometimes qualitative the tool also allows the auditor to add comments explaining their score allocation. The actions column allows auditors to record solutions to any of the issues identified on the route e.g. removing redundant street clutter to improve its attractiveness.

Acknowledgement

C.1 The WRAT was developed by Local Transport Projects Ltd and was published as part of the Welsh Active Travel Design Guidance.

[2] www.gov.wales