AECOM SEE.SENSE®

VELO-CITY 2019:
INVESTIGATING THE SERVICE QUALITY OF CYCLE INFRASTRUCTURE USING BIG DATA

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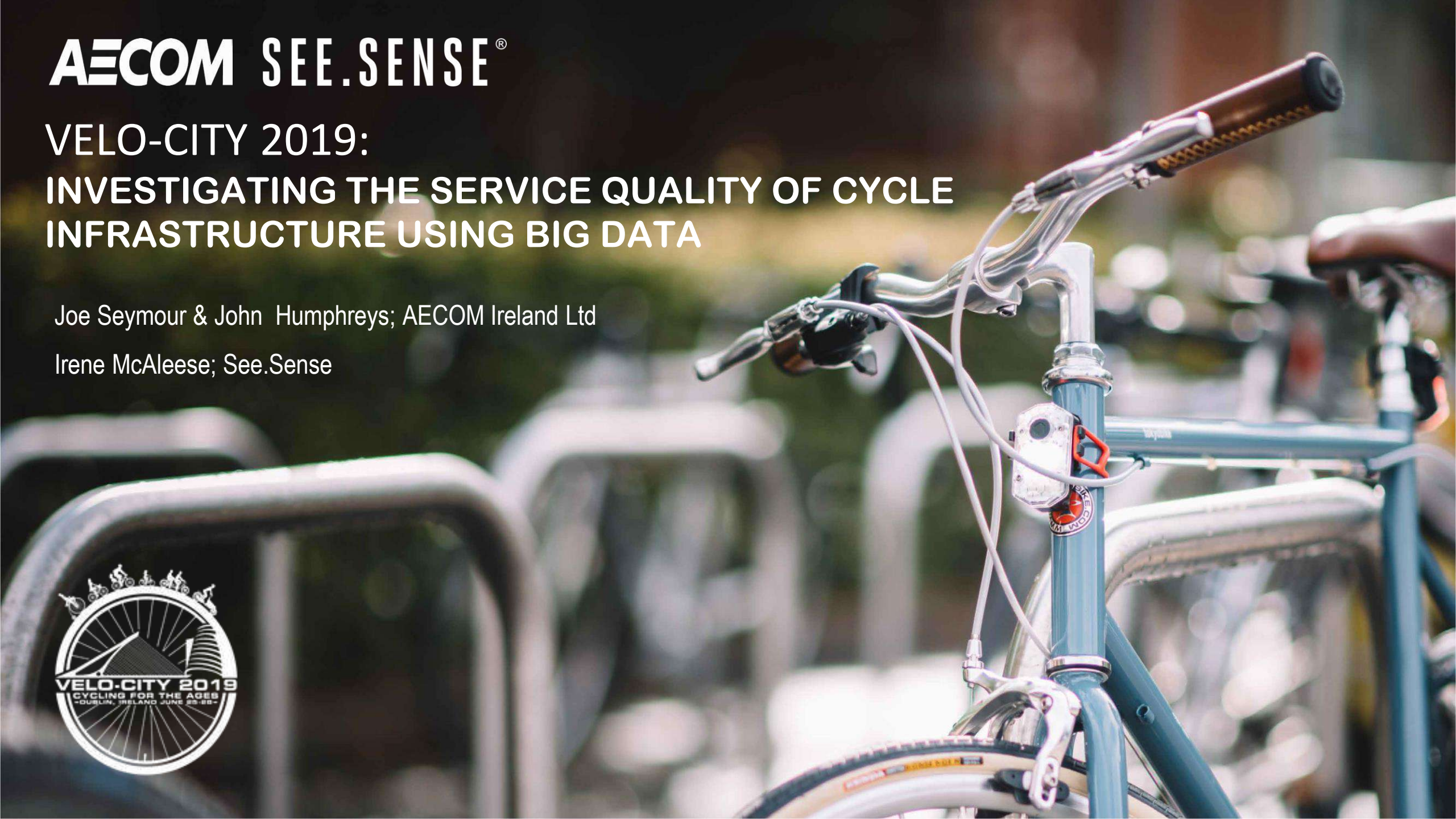
Irene McAleese; See.Sense



Overview

See.Sense and AECOM and have collaborated over recent years to see if the data collected from See.Sense bicycle lights can be used to generate useful information for use in the planning and maintenance of bicycle networks.

Challenge

Theme 1 : Technology, Intelligent Transport Systems and Data Analytics

- Can bicycles become part of the connected world providing useful information for users and planners of networks?
- Is Cycling data any good?
- Is it useful data or is it just more data to fill the Data Lake

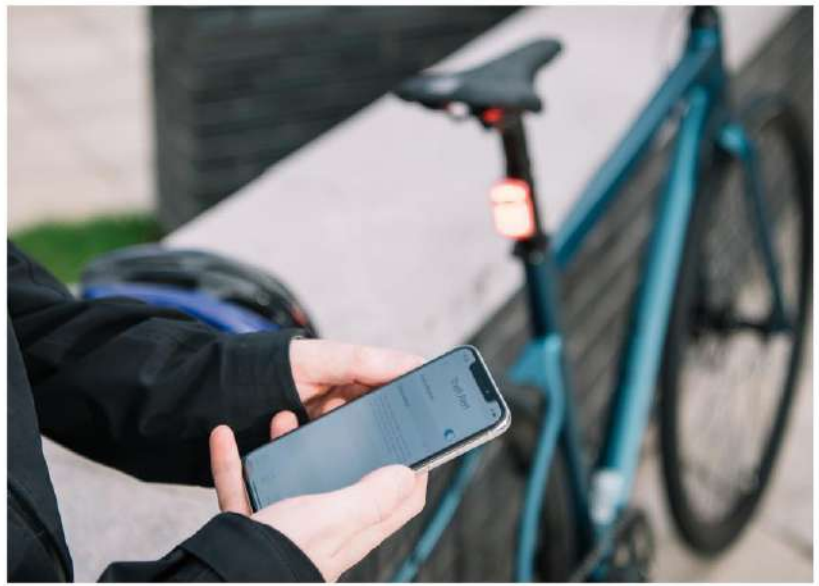
This presentation looks at how data collected from a “not so simple” bicycle light can be used to provide useful data that can improve cycling infrastructure in cities.

ABOUT SEE.SENSE

See.Sense technology can accurately detect where and how people are cycling, giving cities the data they need to transform their roads for cyclists. This data is gathered via our sensor and communication technology through:

BIKE SHARE INTEGRATION
Our technology can be embedded into existing bike share / scooter schemes.

INTELLIGENT BIKE LIGHTS
Our smart bike lights are used by 50,000 cyclists every day.



CONNECTED MOBILE APP
Our app allows all cyclists to share both qualitative and quantitative feedback on their journeys.

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INTRODUCING SEE.SENSE ACE

_ Most popular bike light ever on Kickstarter

_ Finalist Irish Design Awards

_ Voted Best Bike Light by The Telegraph

_ Contains patented See.Sense tech

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ACE REACTS TO ITS ENVIRONMENT, IMPROVING VISIBILITY OF THE CYCLIST

ROAD JUNCTIONS

ROUNDABOUTS

FILTERING IN TRAFFIC

CAR HEADLIGHTS

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ACE CONNECTS TO THE FREE SEE.SENSE APP

Use the app to control light settings.

Cyclists can OPT-IN to the See.Sense community to unlock additional features such as crash alert, theft alert, change settings and share aggregated ride insights with their city.

CRASH ALERT

THEFT ALERT

SETTINGS

SHARE RIDE INSIGHTS

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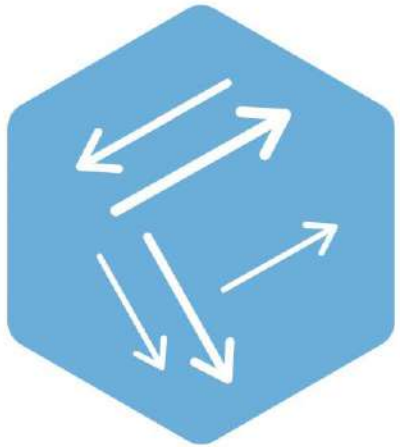
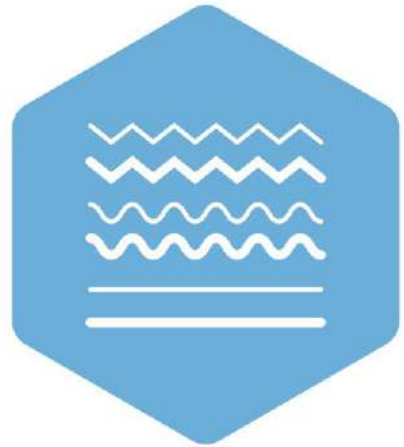
RIDE INSIGHTS COLLECTED FROM ACE SHOW

MOVEMENT PATTERNS

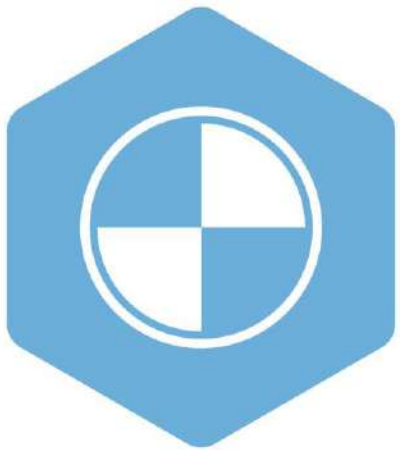


SPEED AND DWELL TIMES

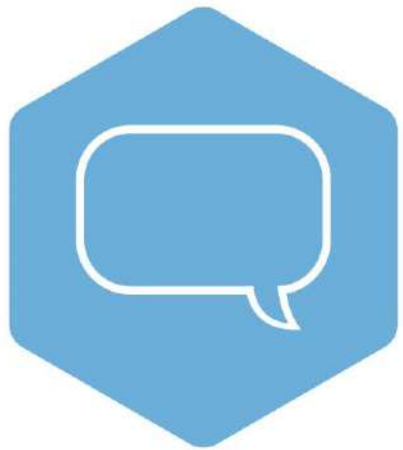
ROAD ROUGHNESS



COLLISION AND NEAR-MISS EVENTS



CYCLIST FEEDBACK



PROFILE DATA

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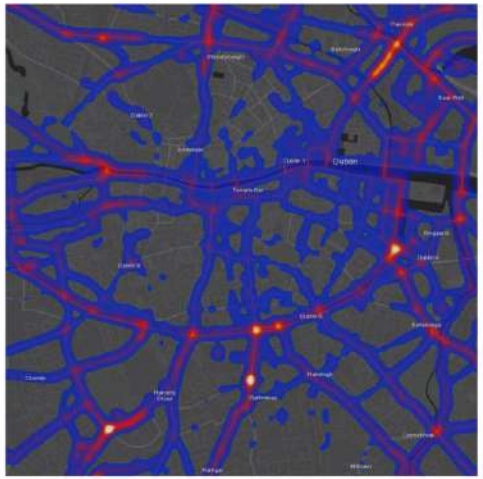
HOW OUR RIDE INSIGHTS ARE UNIQUE

LOW COST / HIGH REACH

Our solution is low cost to deploy in bike share schemes, while our light and app are something cyclists want to use on a daily basis as they improve their safety and enhance their riding experience. This leads to lower PR costs to launch and sustained engagement over time.

HIGHLY ACCURATE DATA

Phone apps can take 5-10 readings / second. In contrast, our advanced sensor technology processes data at 800 times / second using edge processing and proprietary algorithms at speeds up to 16 million instructions / second.



MULTIPLE DATA TYPES

The accuracy we achieve means we can provide much deeper information beyond GPS including: road surface condition, collisions, near-miss events and acceleration / deceleration.

REPRESENTATIVE POPULATION

Data from both bike share integrations and our lights make our insights reflective of all types of cyclists. In particular, our lights are used by all rider types and account for the 'interested in cycling but concerned' group of cyclists that make up a large % of the population.

MADE IN UK

Our products are designed and manufactured in Northern Ireland (UK). This allows us to ensure high quality and control, and greater protection of IP. We use several factories across NI, so we can scale quickly to meet demand, producing thousands of devices per day.

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DUBLIN AND SEE.SENSE CYCLING DATA TRIAL

SEE.SENSE®

SMART DUBLIN

Comhairle Cathrach Bhaile Átha Cliath
Dublin City Council

HOW WE RECRUITED PARTICIPANTS

SEE.SENSE®

SMART DUBLIN

Create collateral

Lights offered at discounted rate of €20 (RRP is £65)

Over 1,500 applications received

500 selected who met profiled criteria of commuter cyclists

Lights delivered to Smart Dublin & Docklands Authority and cyclists collect.

Onboarding using video on Youtube

Go live in October

Coverage received my media outlets

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ENGAGEMENT OF PARTICIPANTS

1,500
cyclists apply

500
cyclists accepted

3
Months of data collection from Sep - Dec

2,027
annoyances recorded

6,862
Total number of journeys

33,942
Total distance covered (km)

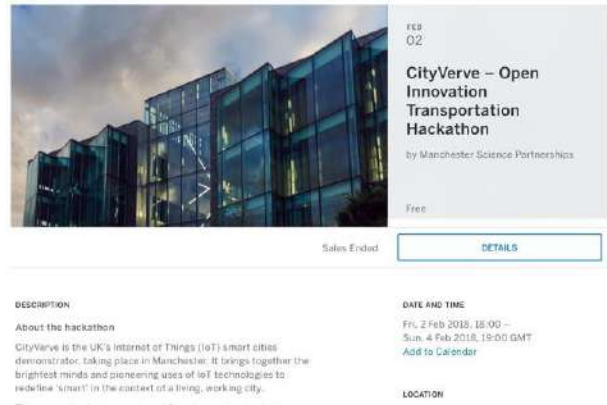
SMART CITIES // MANCHESTER

**MANCHESTER CITY TRIAL: THANK YOU! **

Thank you once again for your participation in the See.Sense Manchester City Trial, run in conjunction with BT and CityVerve.

Monthly Newsletter

Public Showcase



Hackathon

Participant Workshop

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SEE.SENSE DATA COVERAGE

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Useful Data?

Some aspects of the data that AECOM thought worth looking at are available from a few sources:

- Routing
- Speeds
- Delays

While the quality of the above data would vary from product to product the real attraction of the See.Sense product to AECOM was the unique data from the accelerometer within the lights which provides:

- Vibration for road surface condition; and
- Collision and Near-Miss Events.

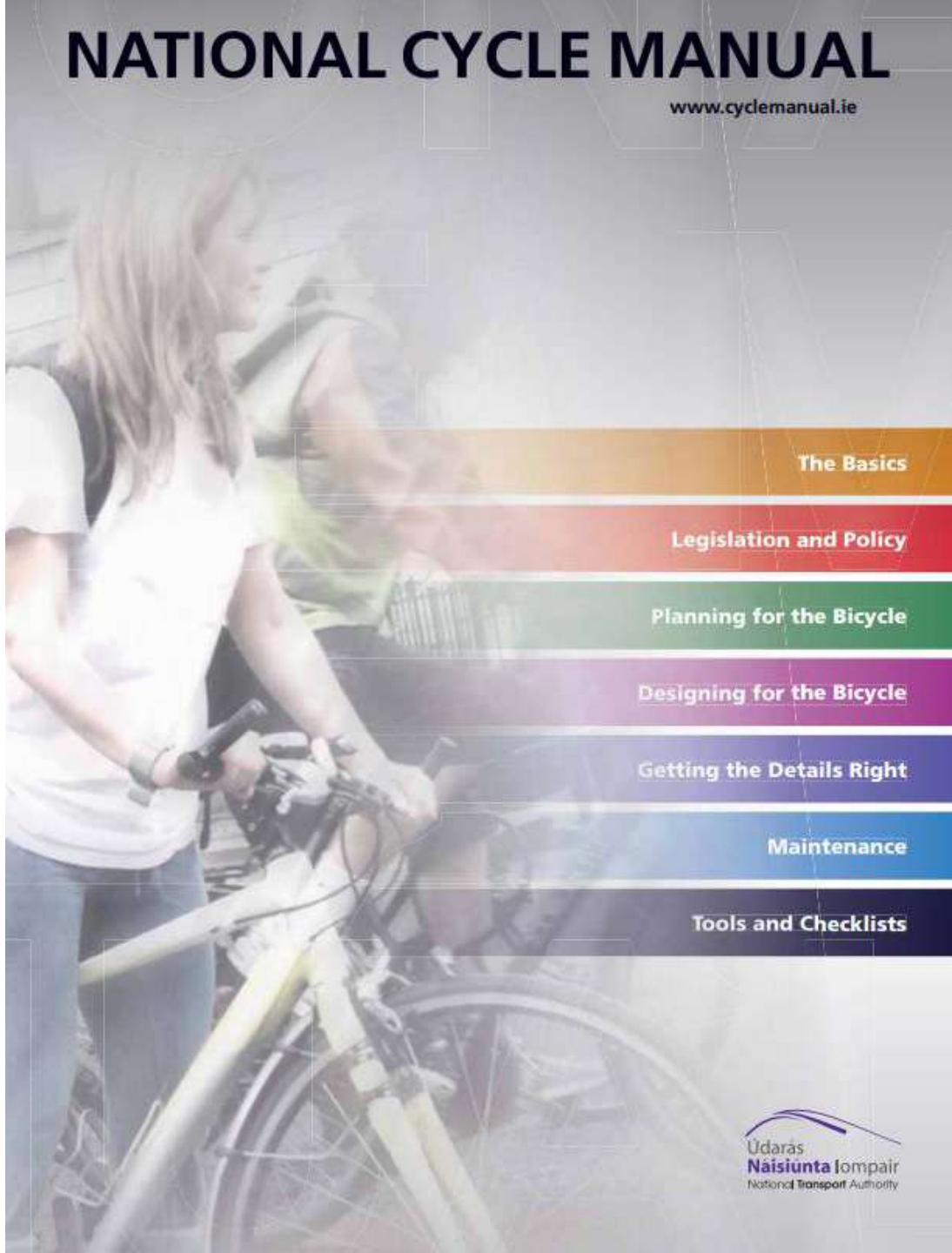
Quality of Service

The National Cycle Manual in Ireland uses Quality of Service ratings as a measure of the degree to which the 5 needs of a cyclists are met. The 5 needs are:

- Road Safety
- Coherence
- Directness
- Attractiveness
- Comfort

Quality of Service rating:

	Poor				Good
Level	D	C	B	A	A+



Why is it important?

Poor — Good

Confident Cyclist

Utility/Vulnerable Cyclists

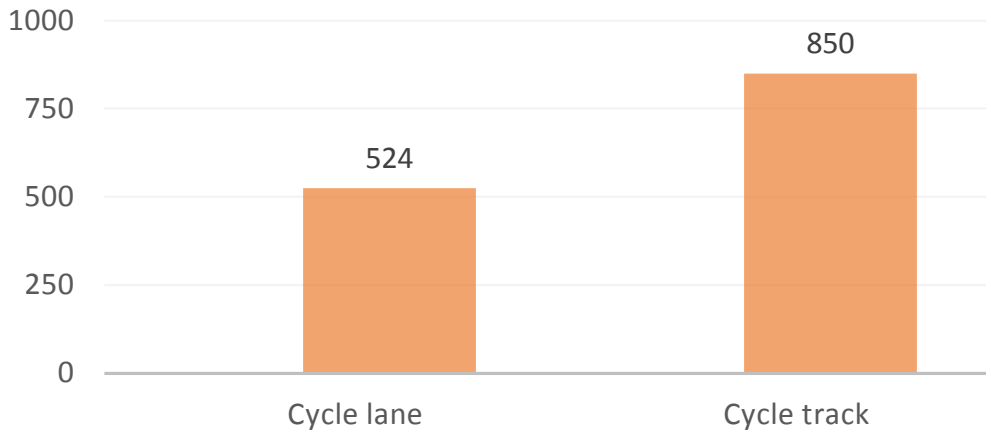
Why is it important?

Poor — Good

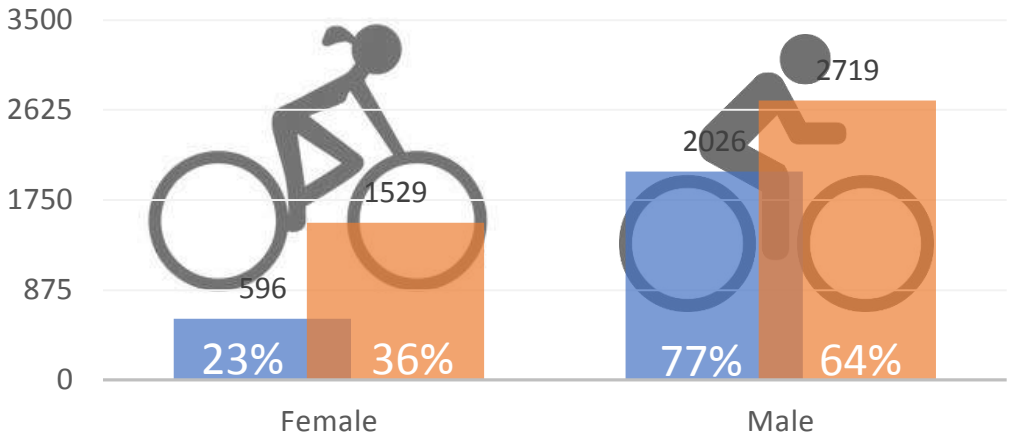
Eastbound from Rathmines Road to Baggot Street, off peak.

Why is it important?

Volume split of cycle routes between 8-10am



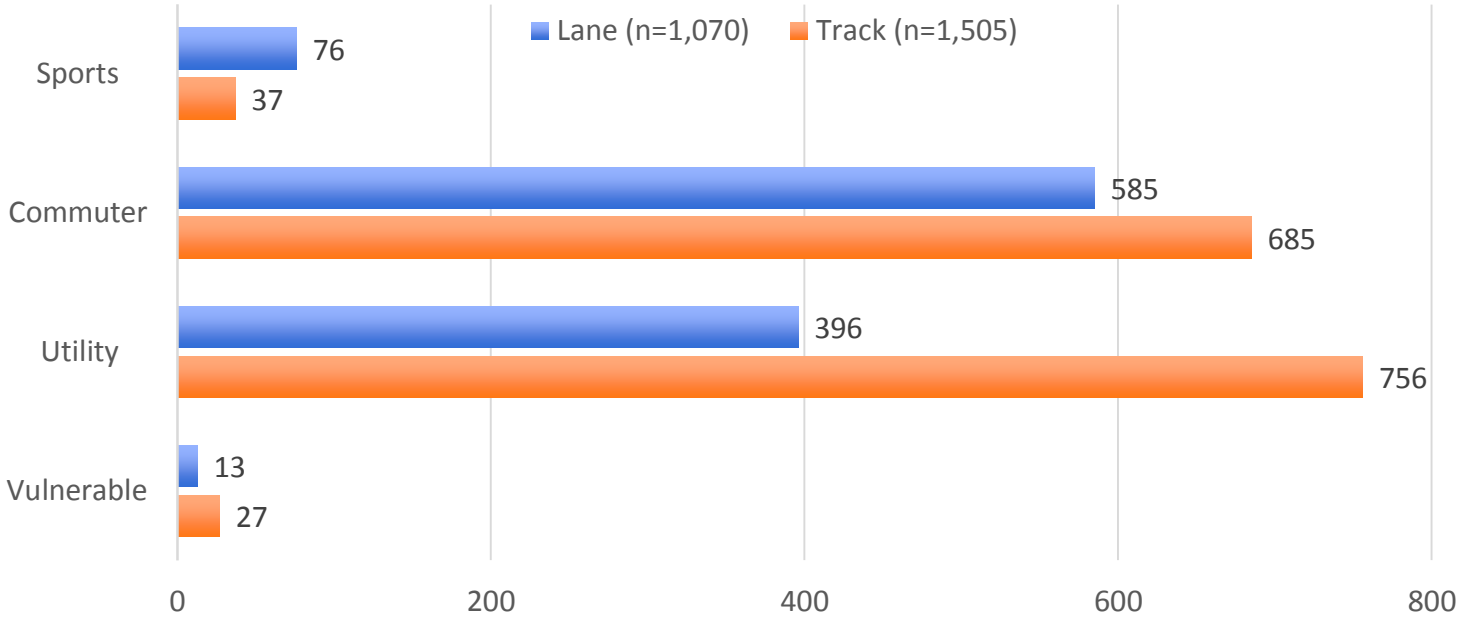
Gender split of each route



Research by Eoin O'Mahony and Matthew Richardson (AECOM/TCD)

Why is it important?

User-type profile for each route



Research by Eoin O'Mahony and Matthew Richardson (AECOM/TCD)

Project:
CYCLE NETWORK PLAN FOR THE GREATER DUBLIN AREA

Title:
PRIMARY NETWORK: QUALITY OF SERVICE
DUBLIN CITY CENTRE
SHEET Q1

Údarás Náisiúnta Iompair
National Transport Authority

AECOM
Roughan & O'Donovan

Grand Canal House,
Upper Grand Canal Street,
Dublin 4
Tel: +353 (0)1 238 3100
Fax: +353 (0)1 238 3199
www.aecom.com

Date: November 2012
Drg No: QOS-001 Rev A
Created: DB Approved: AOB
Checked: SMG

Quality of Service

The QoS is measured through the following 5 characteristics of infrastructure which can be related back to the 5 Needs of Cyclists:

- Pavement Condition
- Number of adjacent Cyclists
- Number of conflicts per 100m of Routes
- Journey Time Delay
- HGV Influence

Quality of Service	Pavement condition (PCI range)	Number of adjacent cyclists	Number of conflicts per 100m of route	Journey time delay (% of total travel time)	HGV influence (% of total traffic volume)
Level A+	86 – 100	2 + 1	0 – 1	0 – 5%	0-1%
Level A	66 – 85	1 + 1	0 – 1	6– 10%	0-1%
Level B	51 – 65	1 + 1	1 – 3	11 – 25%	2 – 5%
Level C	41 – 50	1 + 0	4 – 10	26 – 50%	6 – 10%
Level D	20 – 40	1 + 0	>10	>50%	>10%

QoS Parameters
Pavement Condition

Poor — Good

Severe undulations, very poor ride quality, cyclists experiences jolts, due to concrete aprons and/or very poorly maintained surface.

High quality, well maintained surface. No manholes, gullies or other iron works

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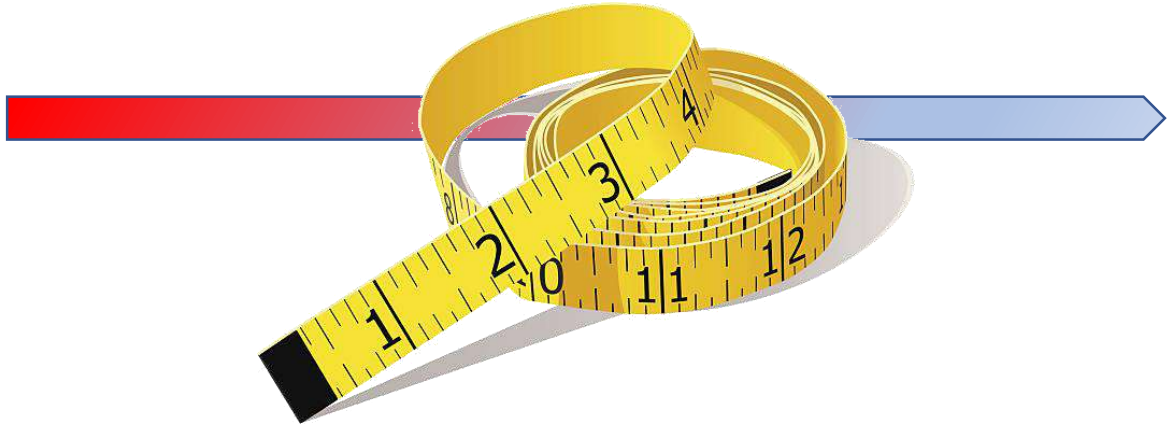
Can the accelerometer be used to provide reliable data to classify road surfaces condition?

QoS Parameters
Number of Adjacent Cyclists

Poor — Good

Rating	D	C	B	A	A+
Width	<1.5m	1.5 to 1.8m	1.8 to 2.0m	2 to 2.5m	>2.5m

Mixed traffic without appropriate traffic regime and heavy traffic

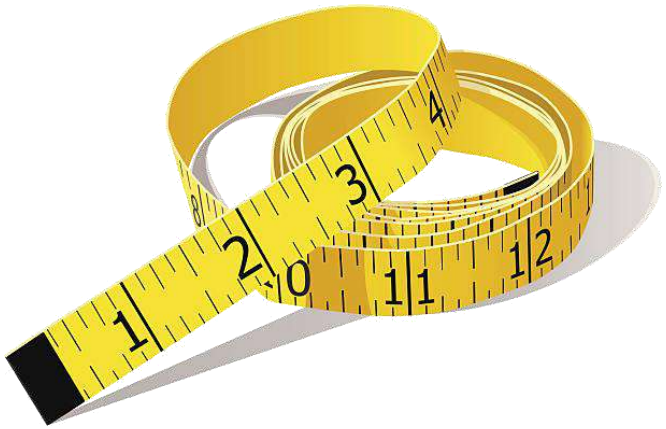


Facility with sufficient width to allow side by side cycling and overtaking

QoS Parameters
Number of Conflicts

Poor → Good

Rating	D	C	B	A	A+
Conflicts (per 100m)	>10	4-10	2-3	<1	



QoS Parameters
Junction Delays

Poor — Good

Cyclists stopped at regular intervals with significant wait times

Cyclist experience little or no delays at junctions, crossings etc.

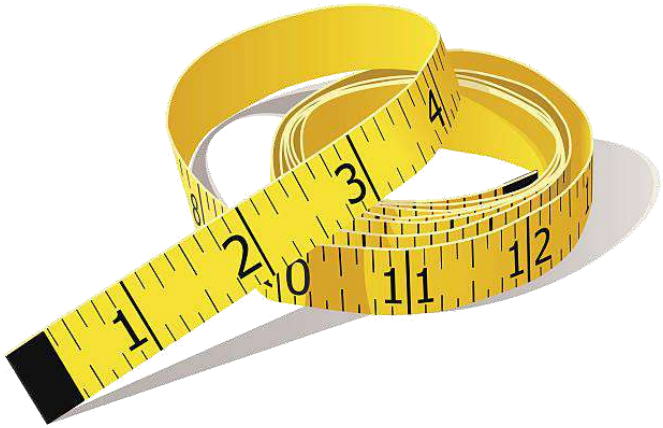
SEE.SENSE®

Can the location data be used to estimate delays at junctions along a route so as junction delay can be estimated?

QoS Parameters
HGV Influence

Poor — Good

Rating	D	C	B	A	A+
Width	>10%	6 to 10%	2 to 5%	0 to 1%	<1%



Quality of Service

Therefore See.Sense bicycle light might be able to provide information on the more challenging, and time consuming, aspects of assessing the QoS for an urban area.

AECOM used available information for Dublin, gathered as part of the Smart Dublin programme to look at the following areas :

- **Pavement Condition**
- **Journey Time Delay**

Dublin City
Baile Átha Cliath

SMART DUBLIN

Pavement Quality

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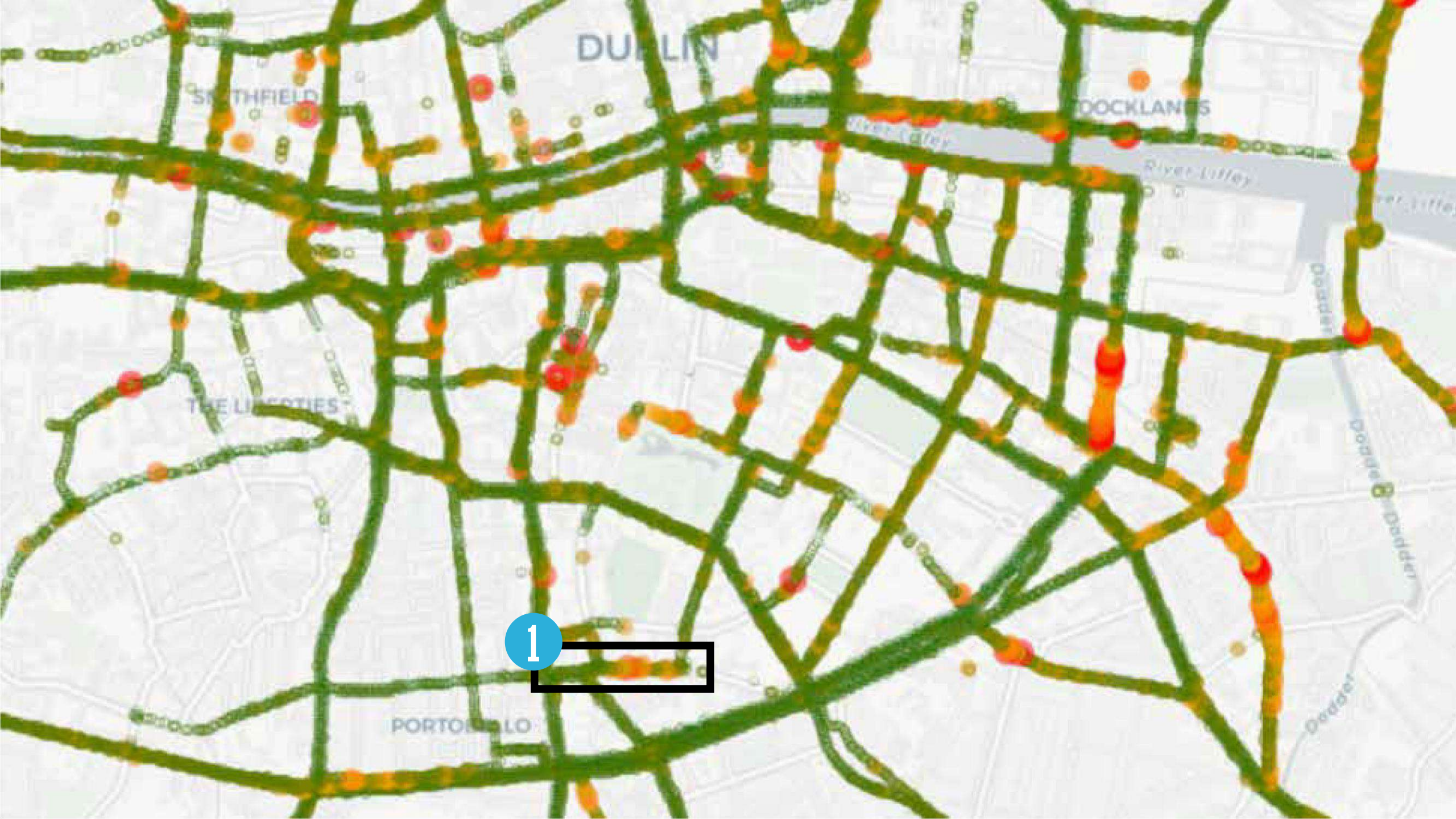
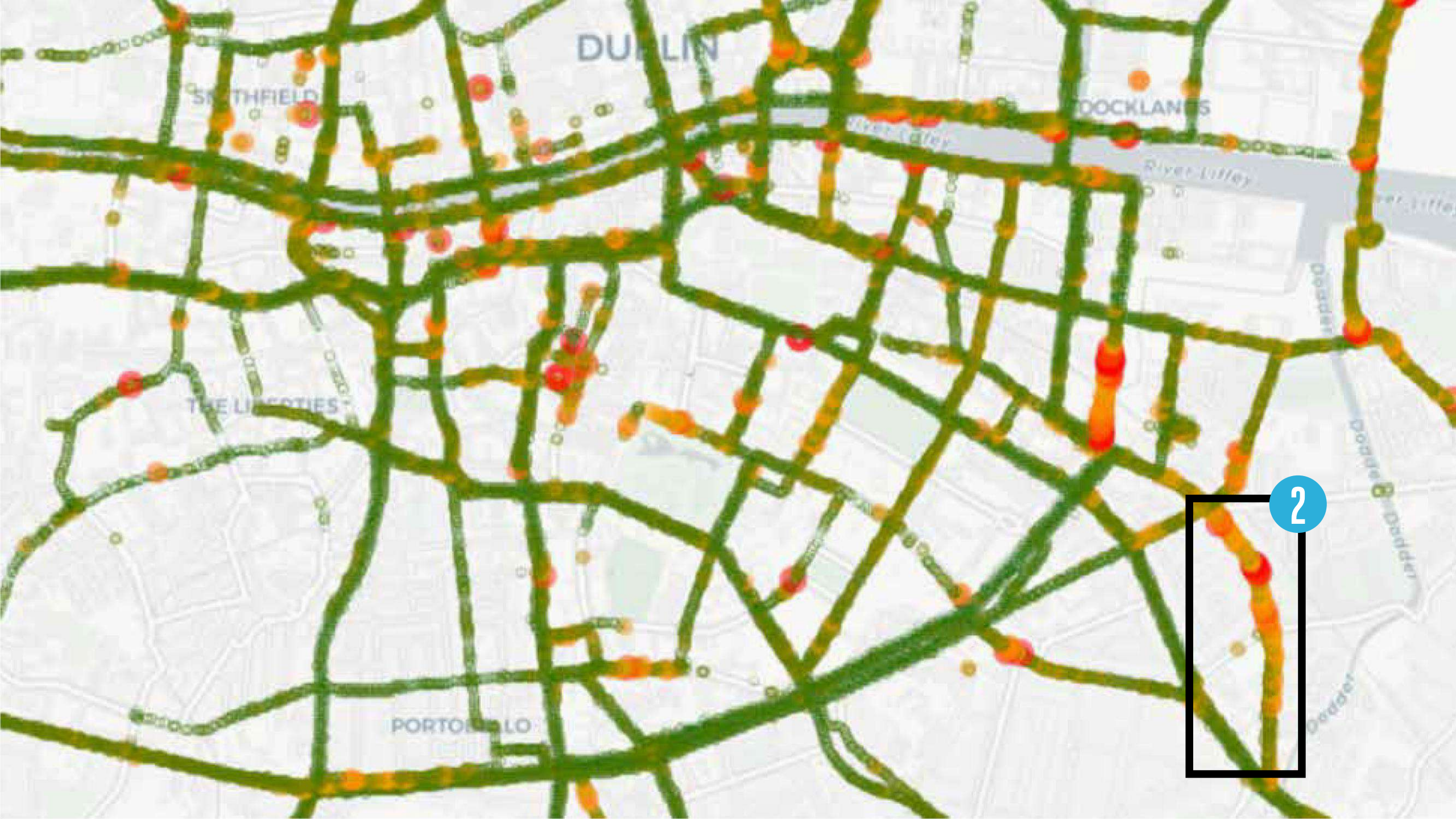

DUBLIN
DOCKLANDS
River Liffey
Dodder
1

ADELAIDE ROAD

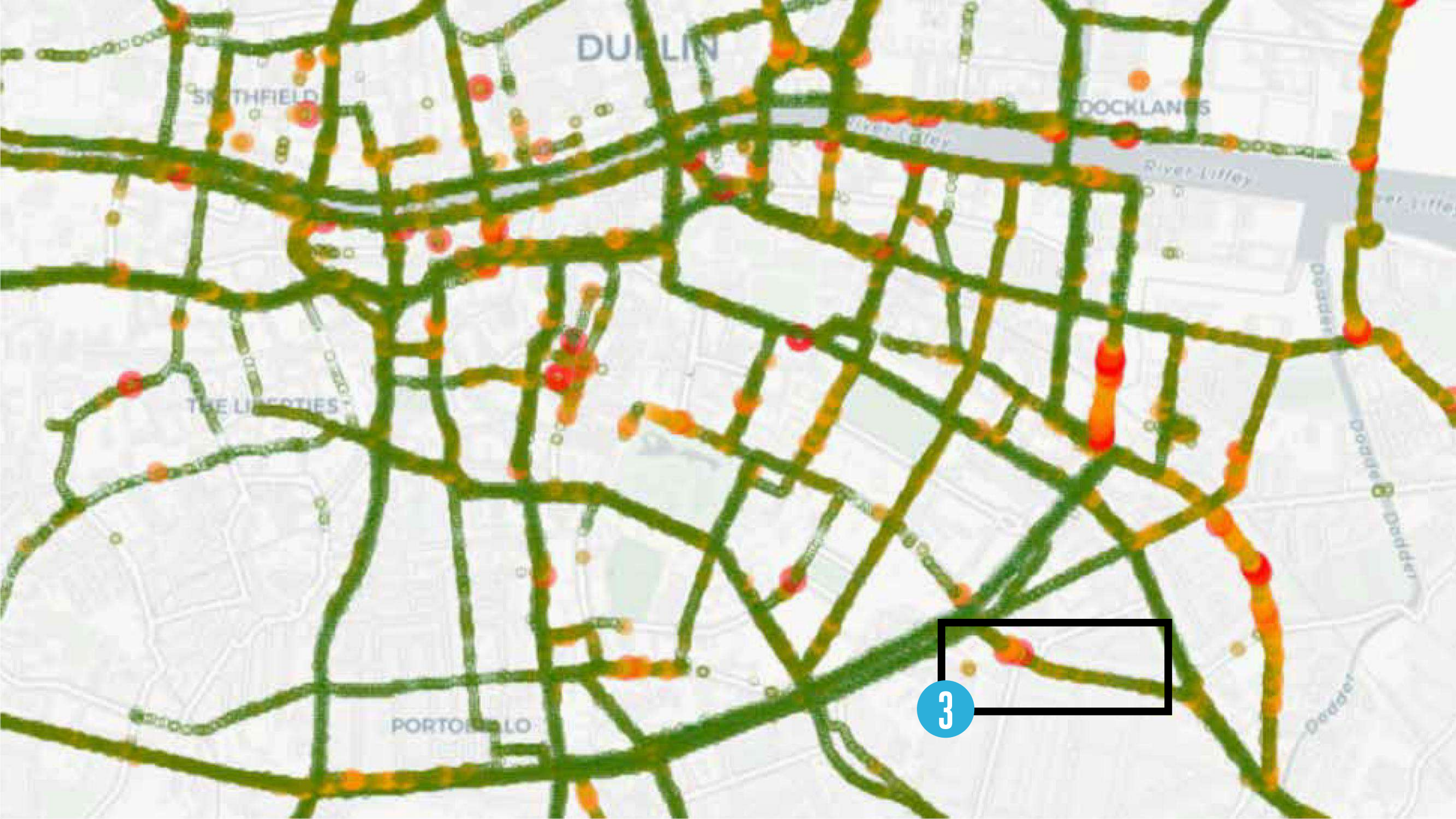
ADELAIDE ROAD

Source: Google Maps

1


DUBLIN
SMITHFIELD
DOCKLANDS
River Liffey
River Liffey
THE LIBERTIES
PORTOBELLO
Dodder
Dodder
Dodder
2

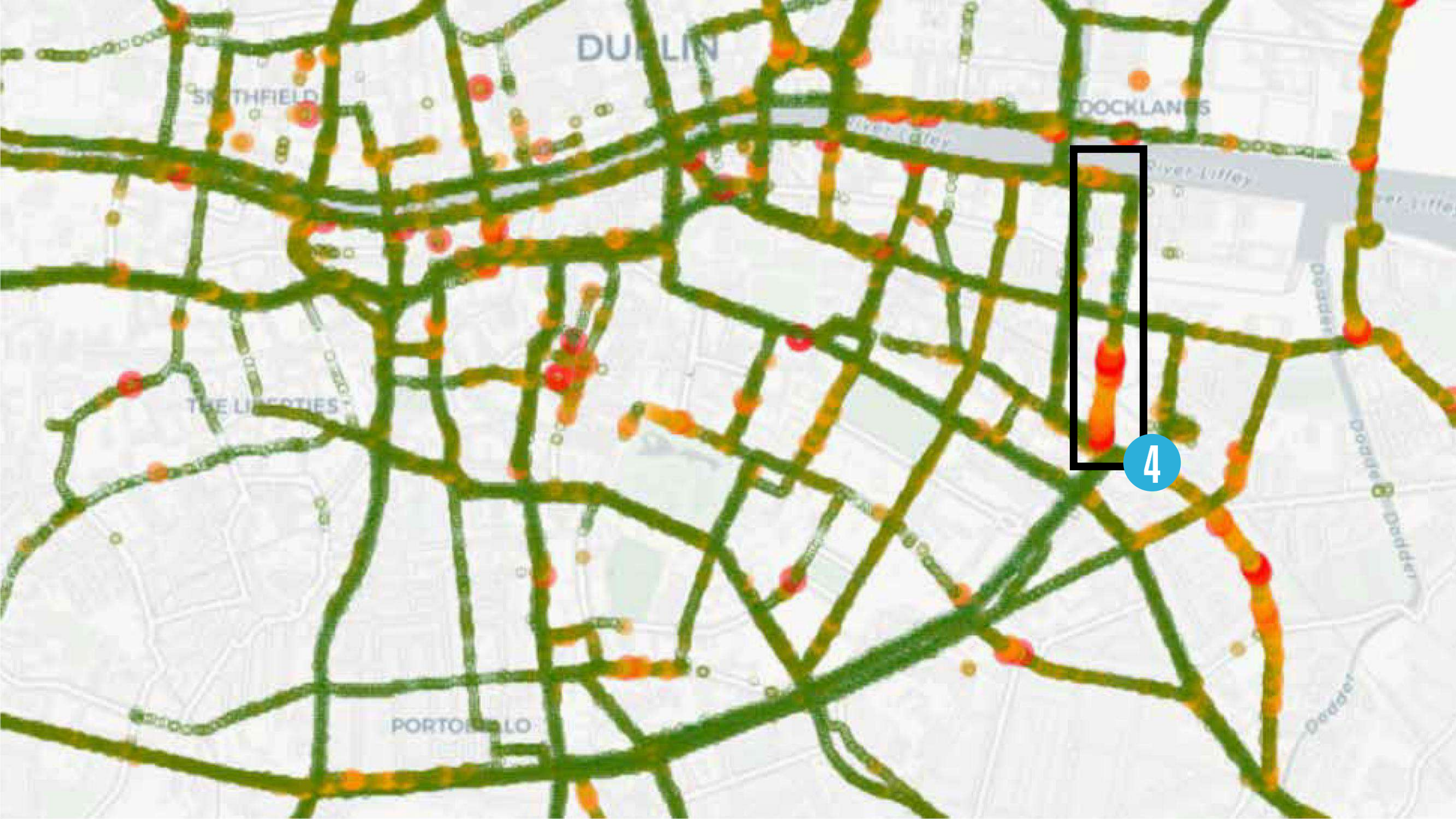
SHELBOURNE ROAD


DUBLIN
SMITHFIELD
DOCKLANDS
River Liffey
River Liffey
THE LIBERTIES
PORTOBELLO
Dodder
Dodder
Dodder
3

BAGGOT STREET

BAGGOT STREET

Source: Google Maps


DUBLIN
DOCKLANDS
River Liffey
4

GRAND CANAL QUAY
4

GRAND CANAL QUAY

Clontarf - Eastbound (Outbound): Speed >0

Surface Quality Rating

- Category B (SSRI: 15-29)
- Category C (SSRI: 30-44)
- Category D (SSRI: 45+)
- Category A - Aggregated Points

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Clontarf - Eastbound (Outbound): Speed >0

Surface Quality Rating

- Category B (SSRI: 15-29)
- Category C (SSRI: 30-44)
- Category D (SSRI: 45+)
- Category A - Aggregated Points

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Journey Time Delay

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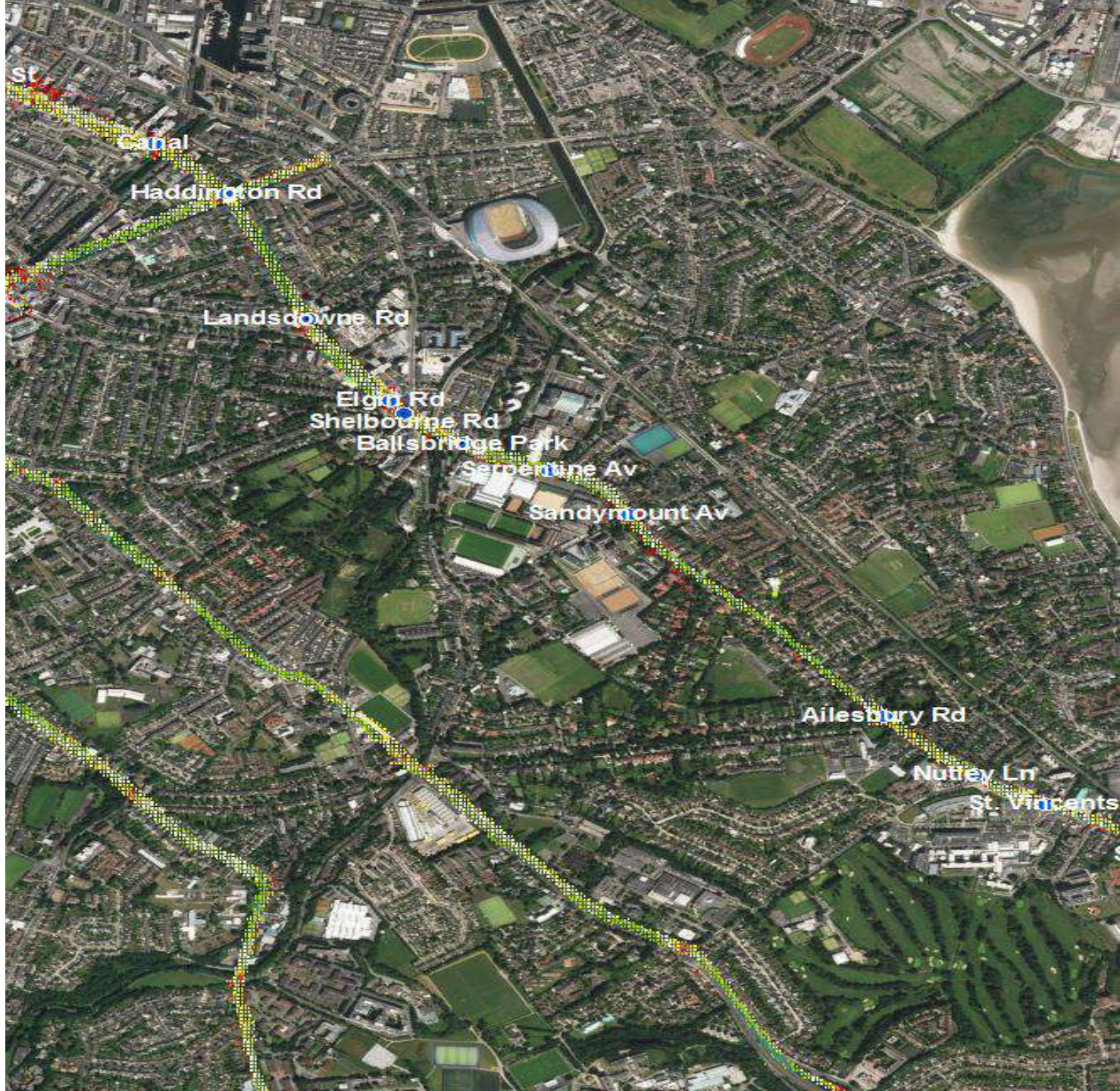
AVERAGE SPEED

Co-ordinated Points

Outbound (NS-EW) - All Routes

Summarised Points - Average Speed

- 0 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 25
- 26 - 30
- 31 - 50

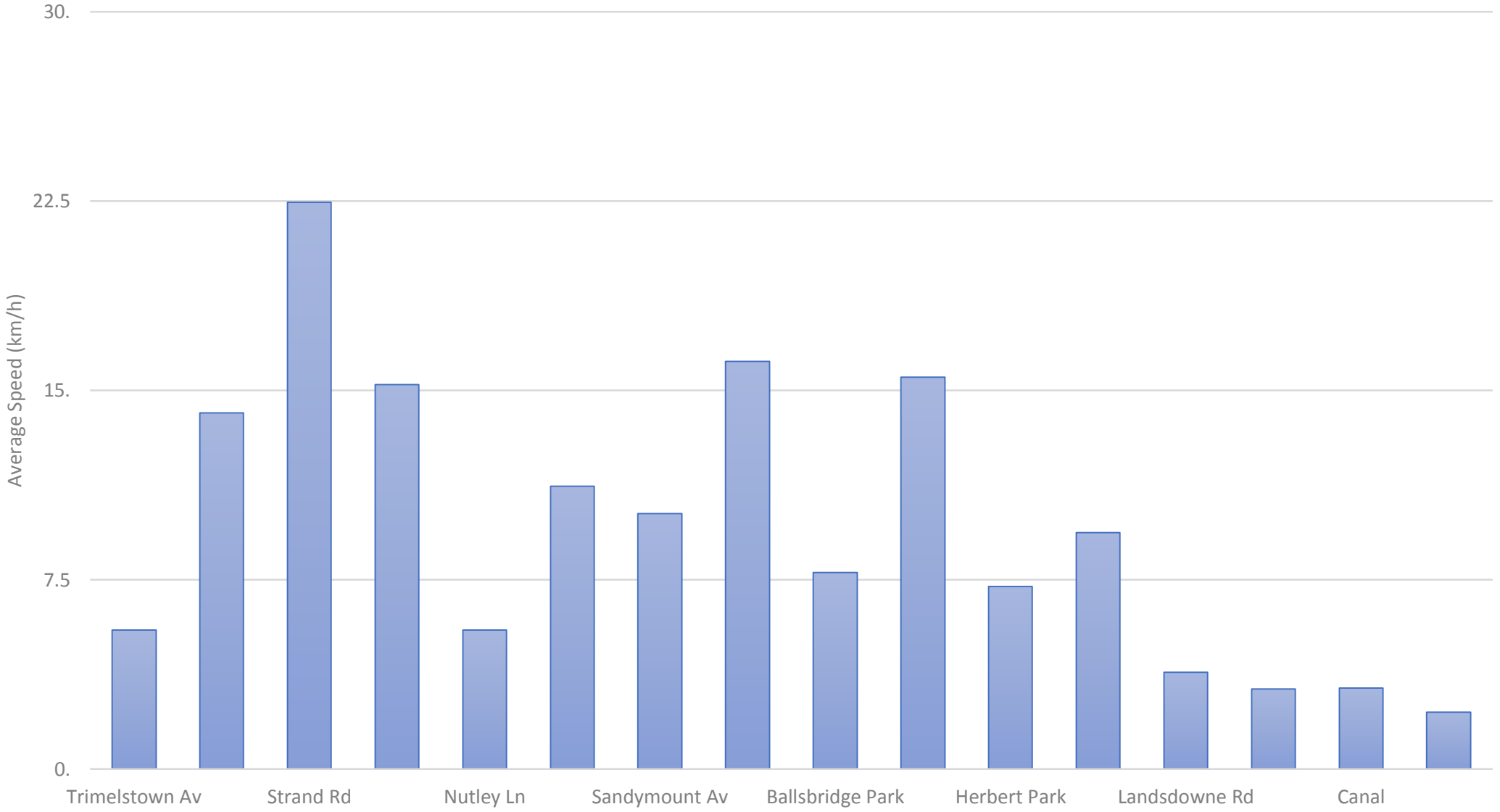


JUNCTION ANALYSIS

10 Metre Buffer Applied Around Stop Lines

JUNCTION ANALYSIS (Inbound)

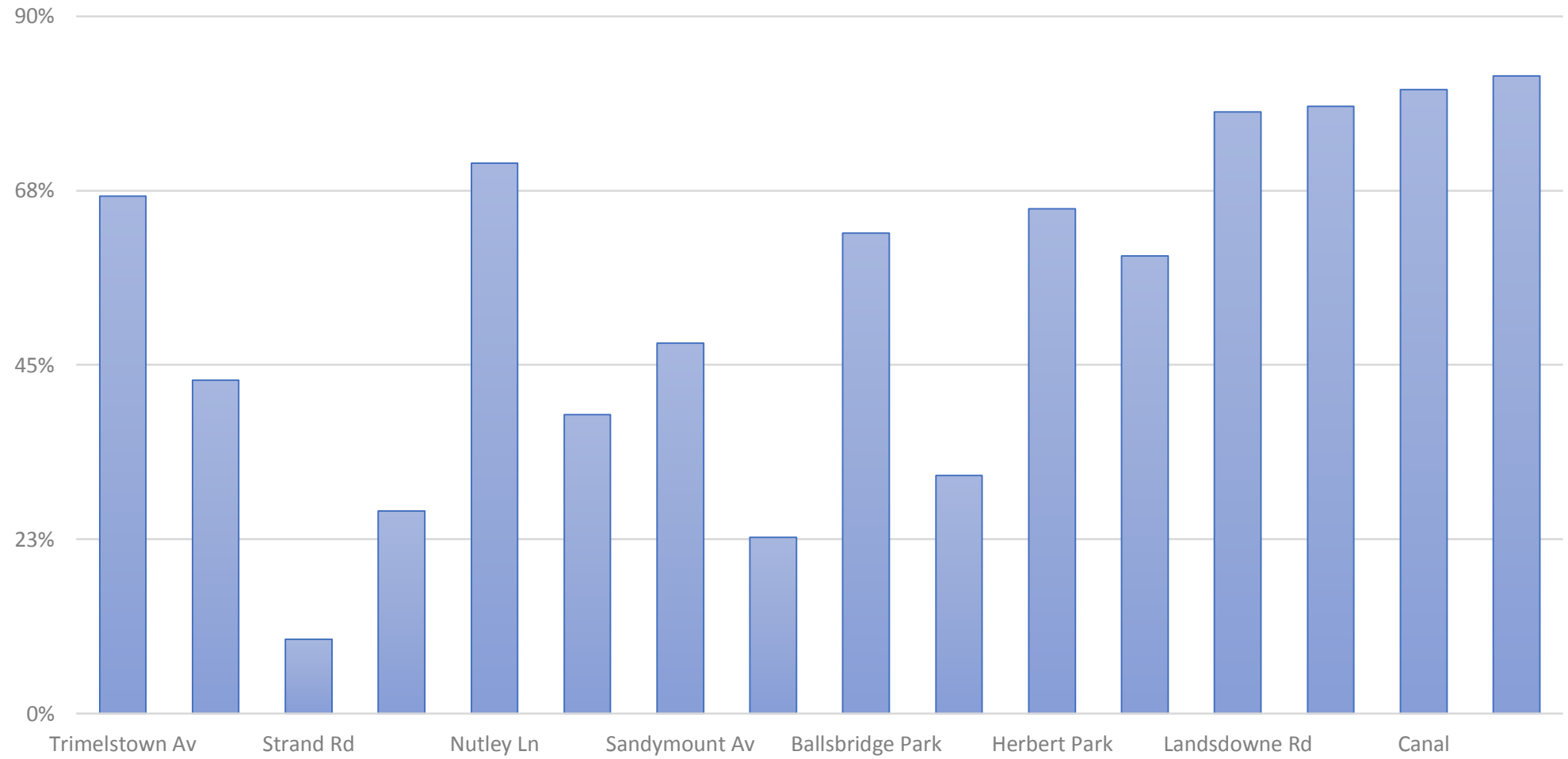
Speed Profile at Junctions



JUNCTION ANALYSIS

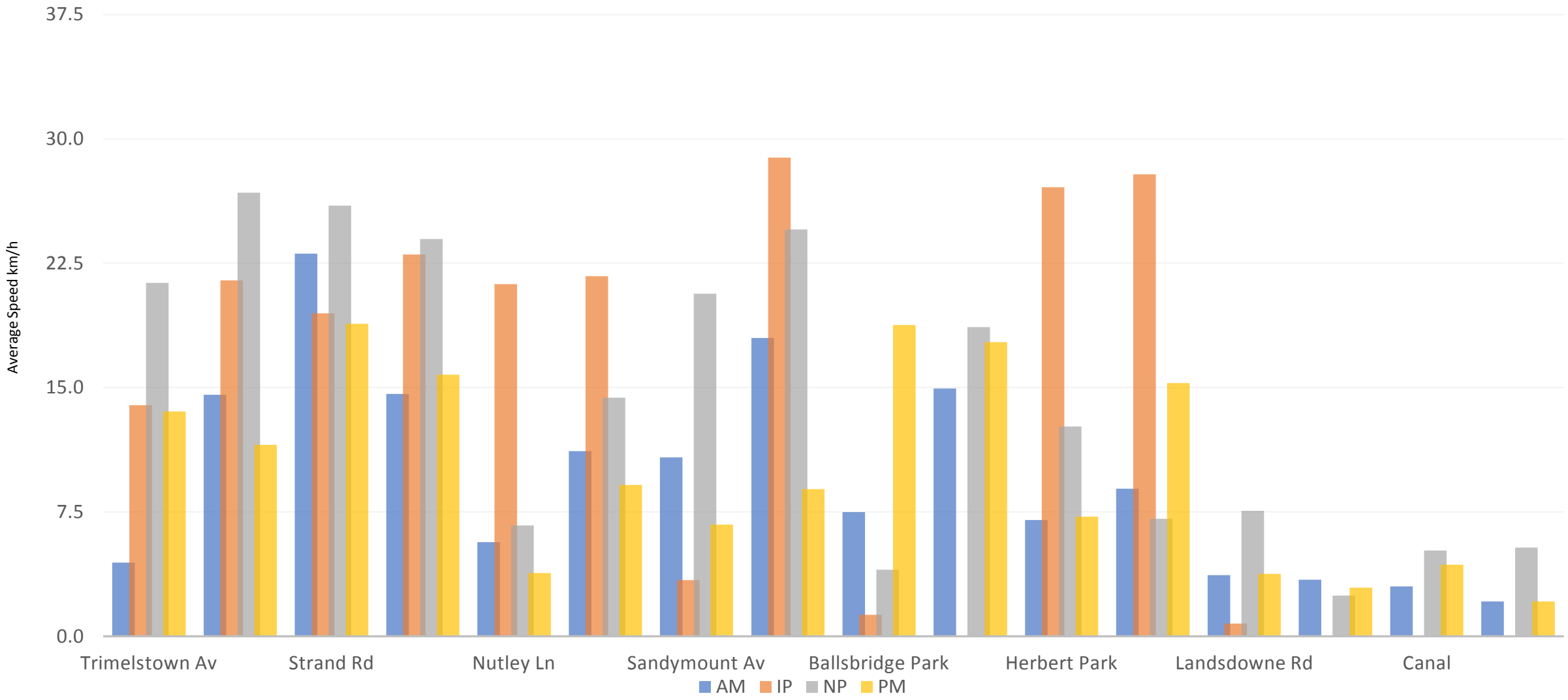
Delay at Junctions (% results with speed <5kph)

Journey time delay (% of total travel time)
0 – 5%
6– 10%
11 – 25%
26 – 50%
>50%

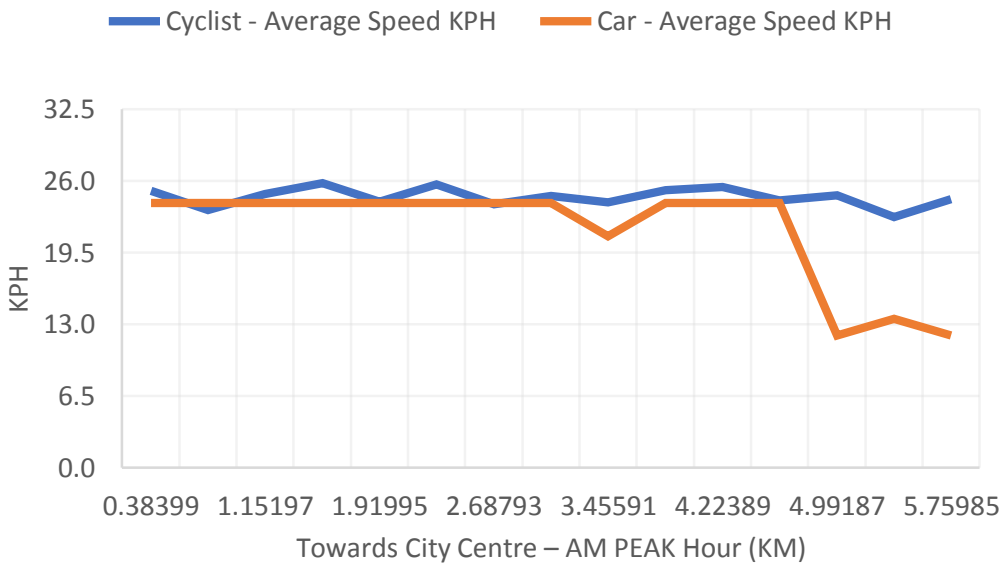


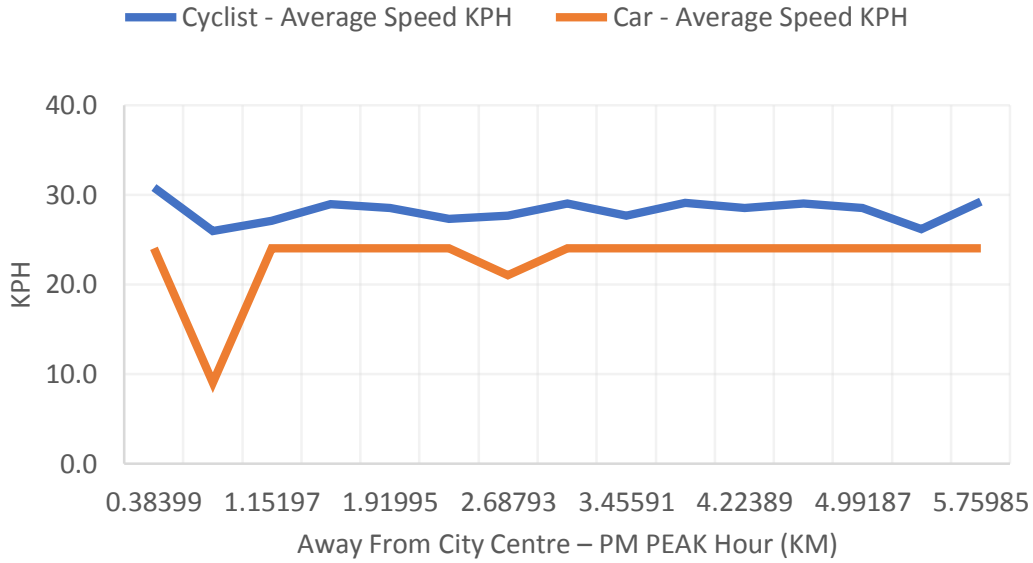
JUNCTION ANALYSIS

Inbound – Average Speed Throughout the Day



Journey Time Delay





Routing

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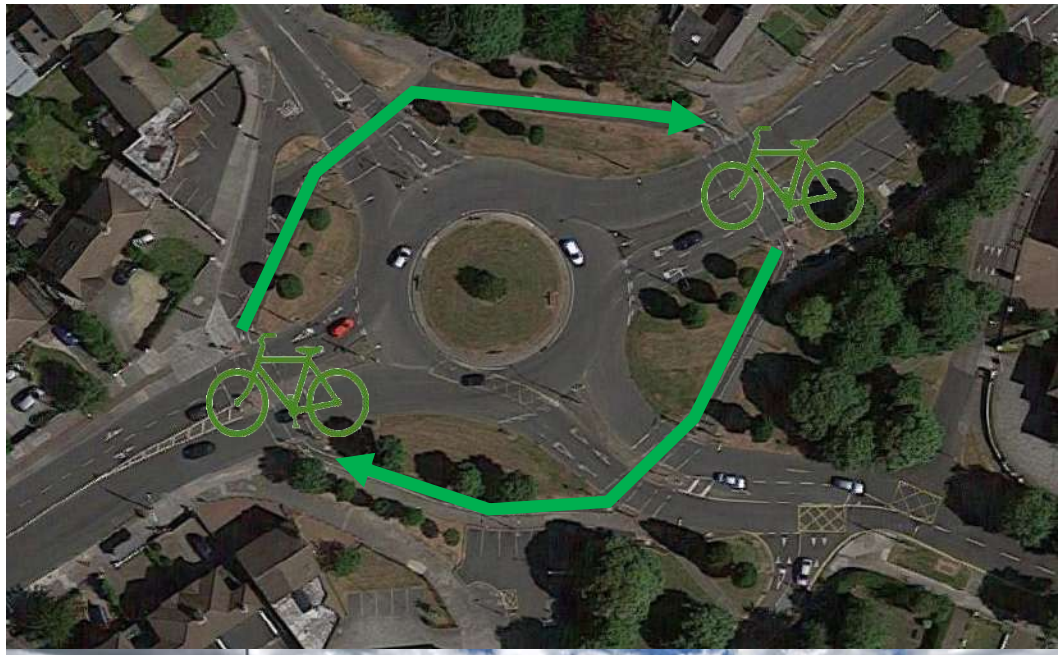
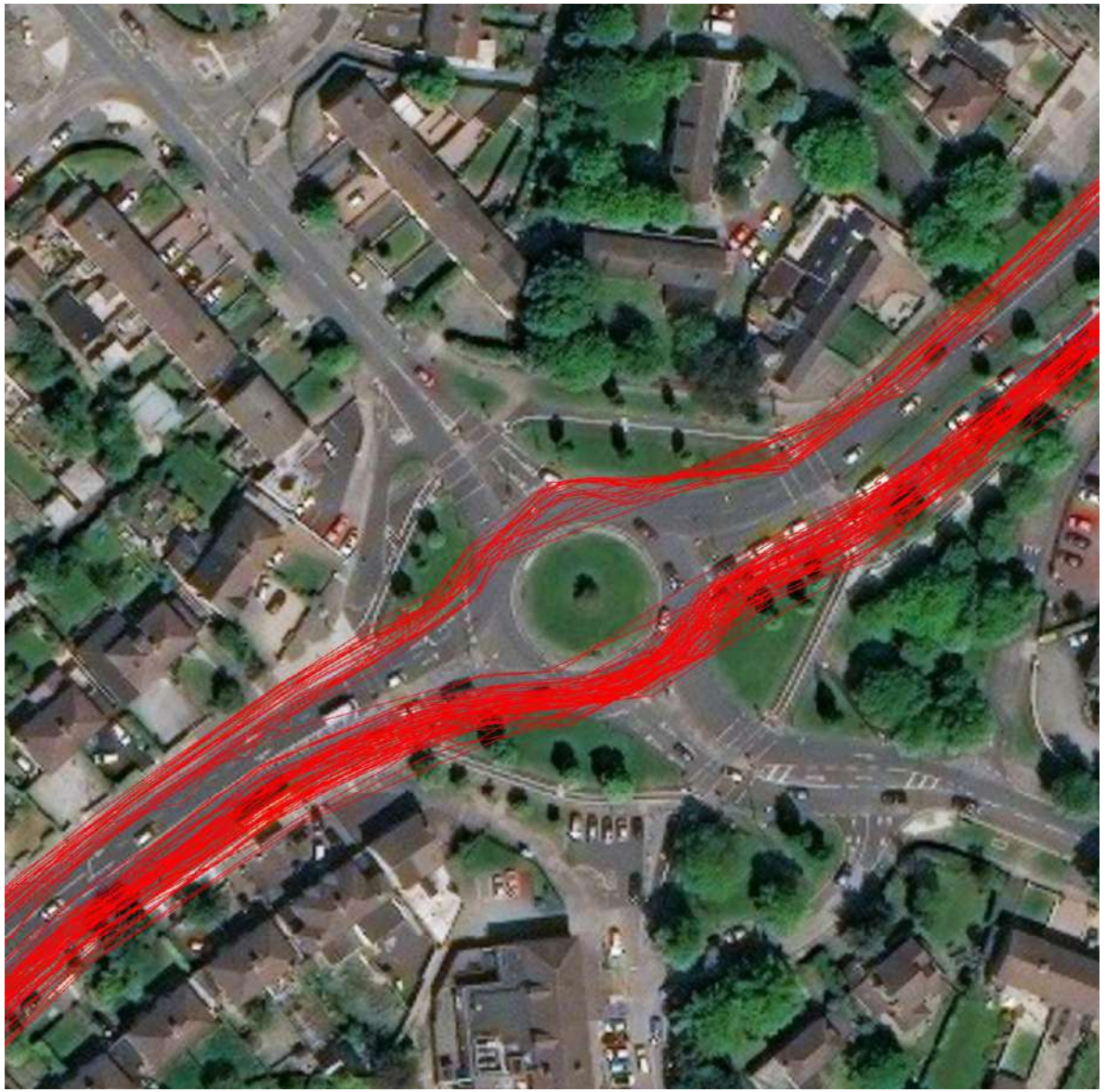
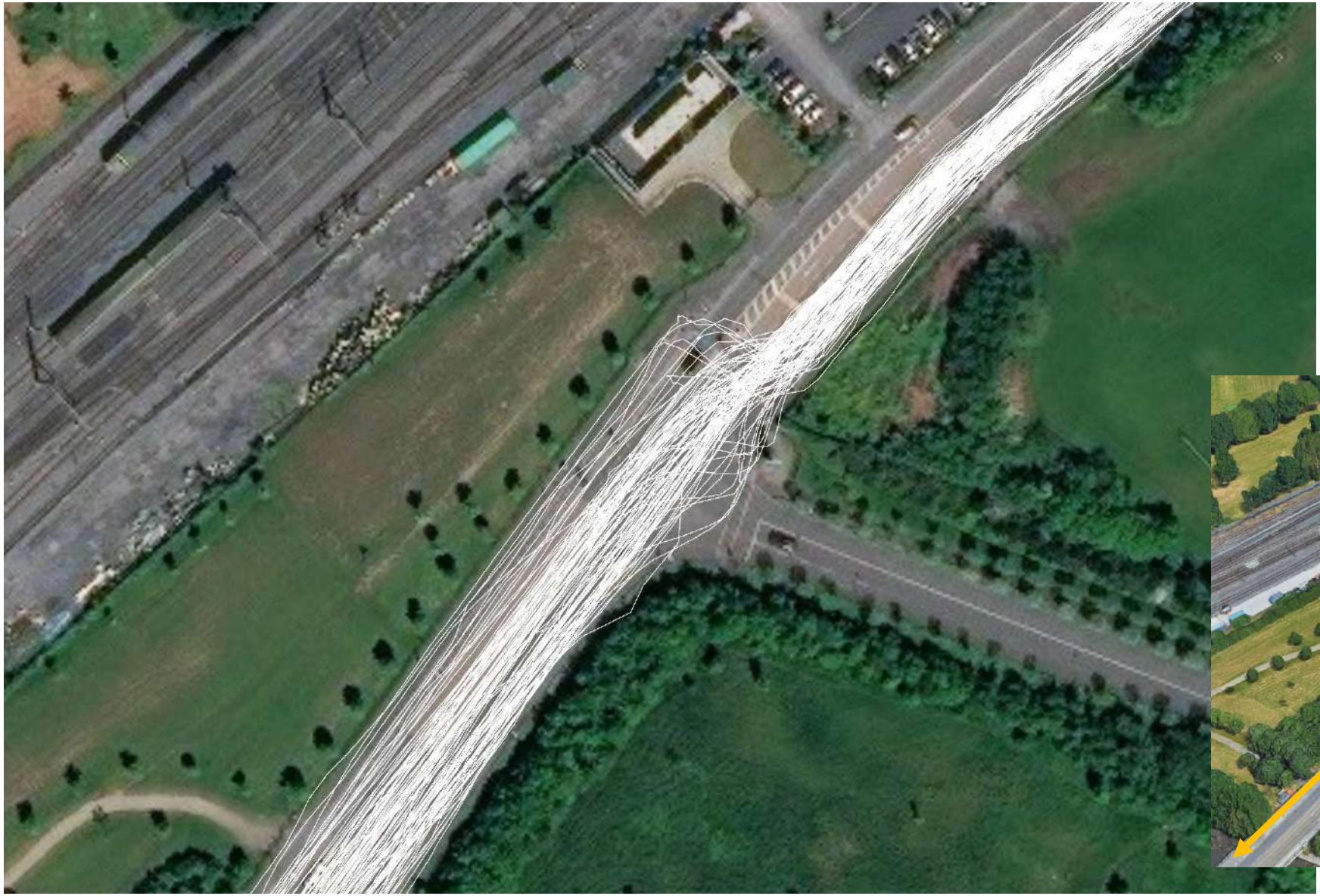
Routing

Routing





Routing



Conclusion

AECOM SEE.SENSE®

Conclusion

Data recorded by the See.Sense bicycle lights can be used to get a better understanding of a cities cycle network in terms of:

- **Pavement Condition;**
- **Junction Delay; and**
- **Desire Lines.**

While not looked at in detail for this paper there is also good quantitative and qualitative information in regard to Conflicts.

The data provided by the lights is a useful tool for planners to develop cycle networks and also identify maintenance priorities. However its usefulness and accuracy will be dependent on the number of lights in use and the demographic of the users.

CYCLISTS CAN OPTIONALLY CREATE PROFILE INFORMATION

Our project participants have a facility in the app to provide information on their profile, allowing data to be disaggregated by:

_ Age
_ Gender
_ Cycling Experience level
_ Type of bike

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PARTNER TO BRITISH CYCLING
FOR BOTH BIKE LIGHTS & CROWDSOURCED DATA INSIGHTS

Our partnership aims to help British Cycling's work to:

_ Promote active travel
_ Improve cycling infrastructure
_ Better advocate for funding based on concrete data
_ Transform Britain into a cycling nation

HSBC UK BRITISH CYCLING | SEE.SENSE®
OFFICIAL CROWDSOURCED DATA & INSIGHT SUPPLIER TO BRITISH CYCLING

HSBC UK BRITISH CYCLING | SEE.SENSE®
OFFICIAL BICYCLE LIGHT SUPPLIER TO BRITISH CYCLING

"The more insight we gain on where people ride within our towns and cities the more help we can provide to build safer places to ride bikes. What the See.Sense team are doing is truly amazing."

Martin Merryweather - Head of Strategy, British Cycling

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