
University of Glasgow
The use of crowdsourced cycling data for cycling analyses (Strava)
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Urban Big Data Centre
An ESRC Data Investment

Background

- Large benefits (e.g., reduced congestion and emissions, improved health, etc)
- Quite a lot of car trips are short trips (<2km)
- Transport Scotland wants 10% of journeys to be made by bicycle by 2020; with cities responsible for achieving this

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Background

- Several interventions have been applied (e.g., four cycling infrastructure investments before, during and after the Commonwealth Games)
- Understanding cycling behaviour and evaluating the effectiveness of interventions are difficult due to the lack of data
- Manual/Automatic counts take place on specific links/points, but these are expensive and hence infrequent

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Research Questions

1) Can crowdsourced cycling data be utilised for cycling behaviour studies?

2) Where commuting cyclists travel and what are influential factors for their route choice?

3) Do the new cycling infrastructure investments in Glasgow produce effective impacts?

Data and variables

- 2013-2016 Strava data

Data are provided as:

- Origins and destinations with route information (at output area level)
- Minute-by-minute link counts of cycling flows
- Information about waiting times at junctions
- Aggregate demographic information

- Manual counts of cyclists from a cordon count carried out in Glasgow in 2013-2015 (38 locations, 2 days per year)

- Glasgow cycling infrastructure data

Data and analytical approach

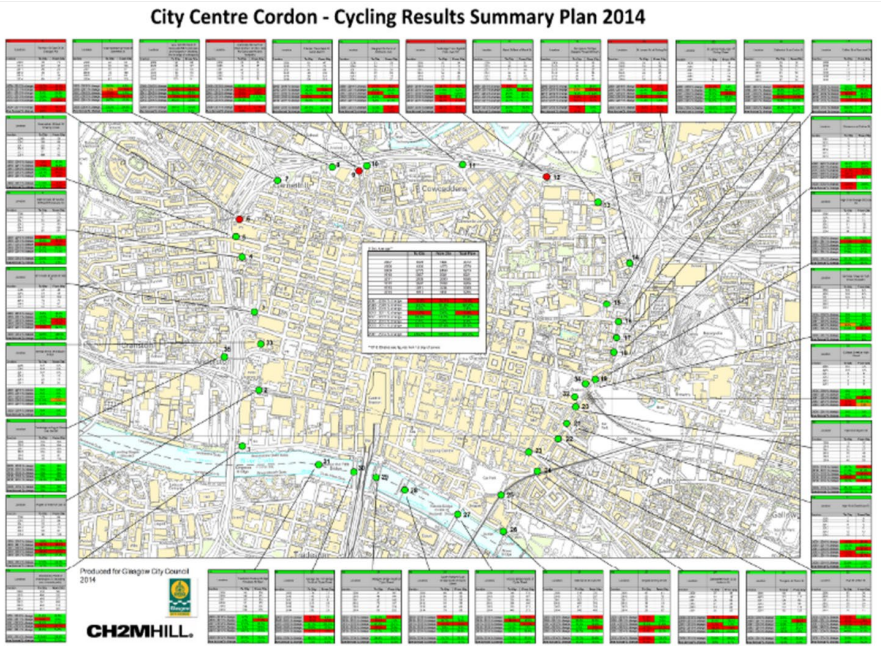
Research question 1

- Data: 2013-15 Strava data and 2013-15 cordon count data
- Analyses: Correlation analysis and simple linear regression

$$y_i \sim N\left(\alpha + \beta_{Strava_{cyc}} x_{stava_{cyci}}, \sigma\right),$$
$$for\ i = 1, \ldots, 684\ (38\ locations$$
$$* 3\ time\ periods\ * 2\ days\ * 3 years)$$

y_i:# cyclists from cordon counts;

$x_{stava_{cyci}}$: # of Strava cycling trips



Data and analytical approach

Research question 2

- Data: 2016 Strava data

- Analyses:
    - Compare the routes taken by commuting cyclists with the route they would take if they minimised their travel distance in the city of Glasgow (traffic assignment model)
    - Use Google Maps and local knowledge

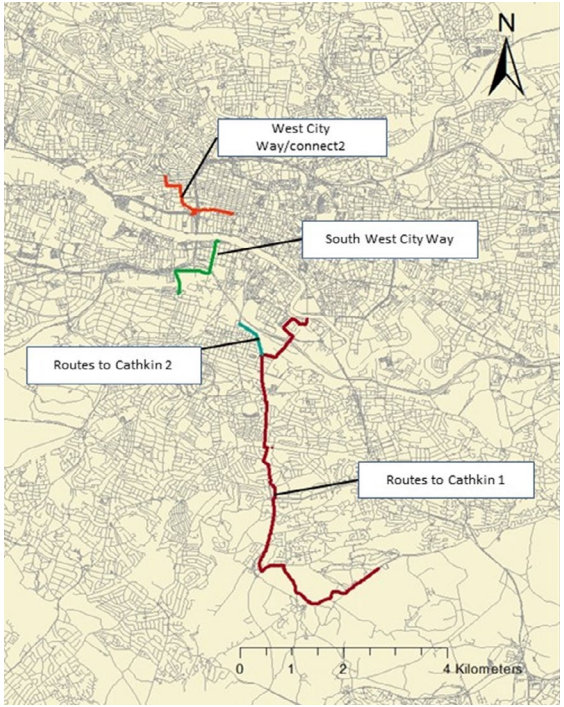
Data and analytical approach

Research question 3

- Data: 2013-15 Strava data and cycling infrastructure data
- Analysis: Fixed effect Poisson panel regression

$$log\lambda_{it} = \beta_{infra1}x_{new\ infra1} + \beta_{infra2}x_{new\ infra2} + \beta_{infra3}x_{new\ infra3} + \beta_{infra4}x_{new\ infra4} + \mu_i + \tau_t, \quad for\ \mathrm{i} = 1, \ldots, 13309\ (\text{output area})\ \&\ \text{for}\ \mathrm{t} = 1, \ldots, 36\ (\text{month})$$

λ_{it}: # Strava cycling trips in area i in month t
$\mu_i \& \tau_t$: an out-area-specific effect and series of month fixed effects, respectively

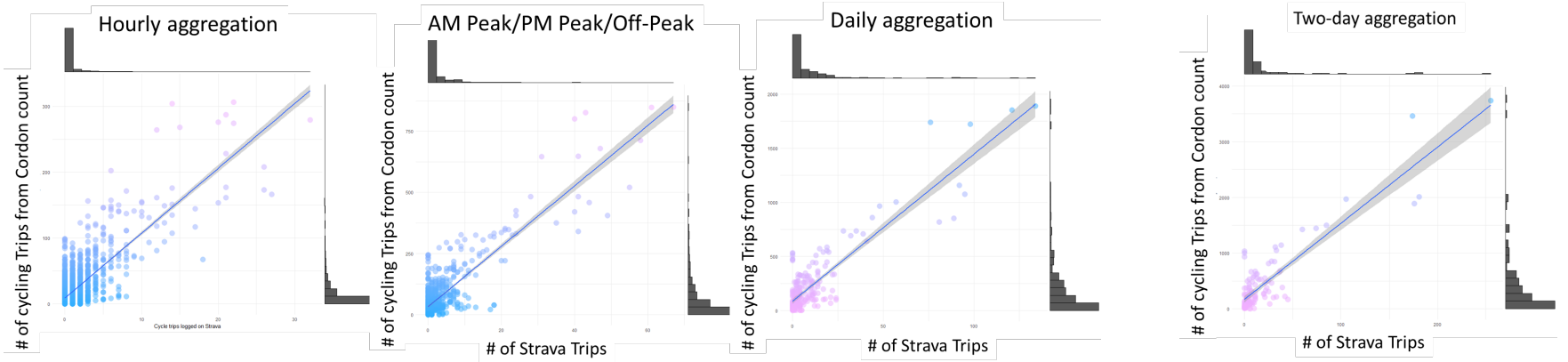


Results

Correlation (# of cordon count vs. # of Strava count) and linear regression analysis (Research Q1)

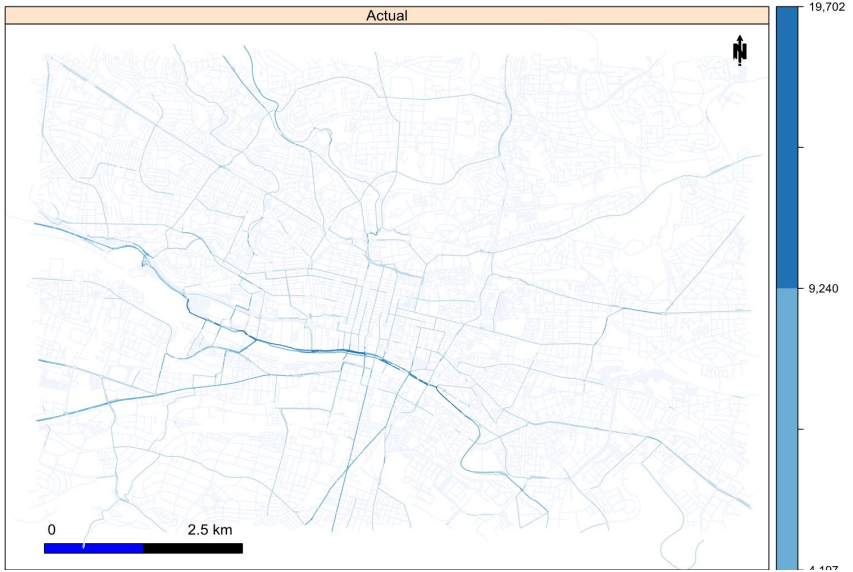
Level of aggregation	Sample size	Correlation
Hourly	3192	0.781
AM peak, PM peak, off-peak	684	0.861
One day	228	0.882
Two days	114	0.887

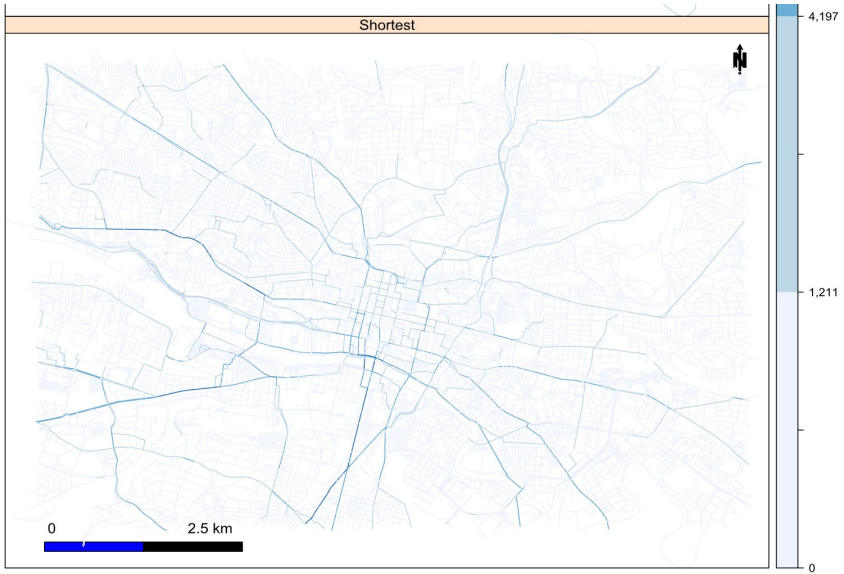
Regression	Estimate	SE	P-value
Intercept	32.43	2.34	<2e-16
# Strava trips	12.35	0.28	<2e-16
$Adjusted\ R^2$	0.74		



Results

Comparison between shortest routes and actual routes (Research Q2)

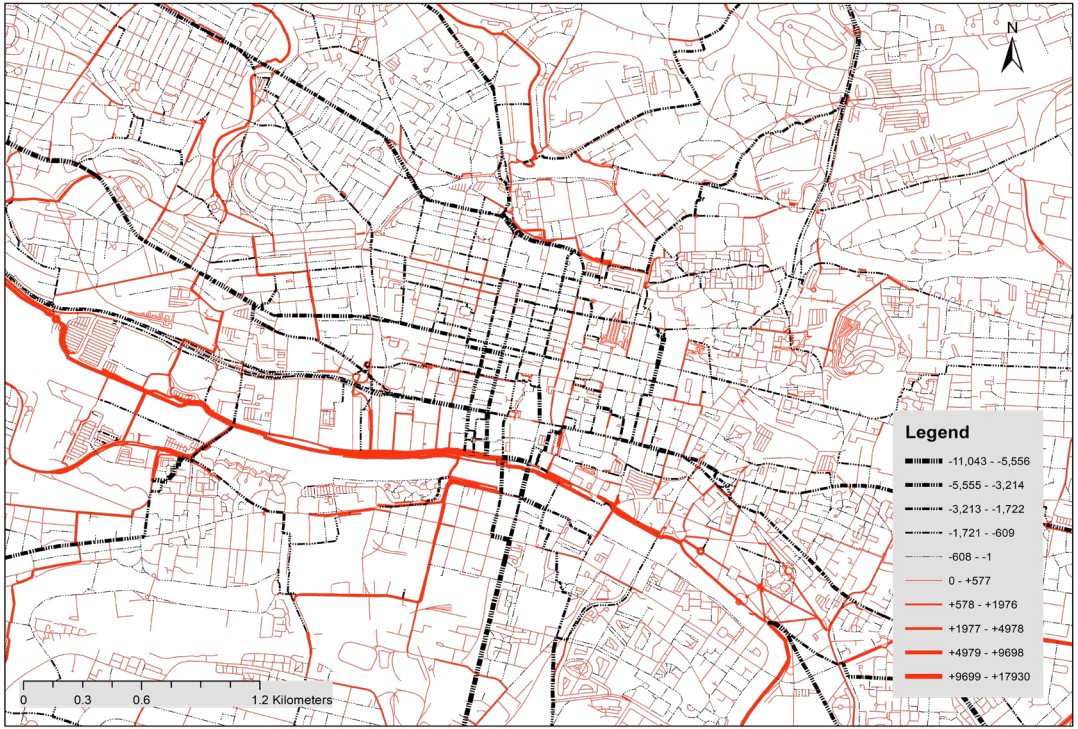




Results

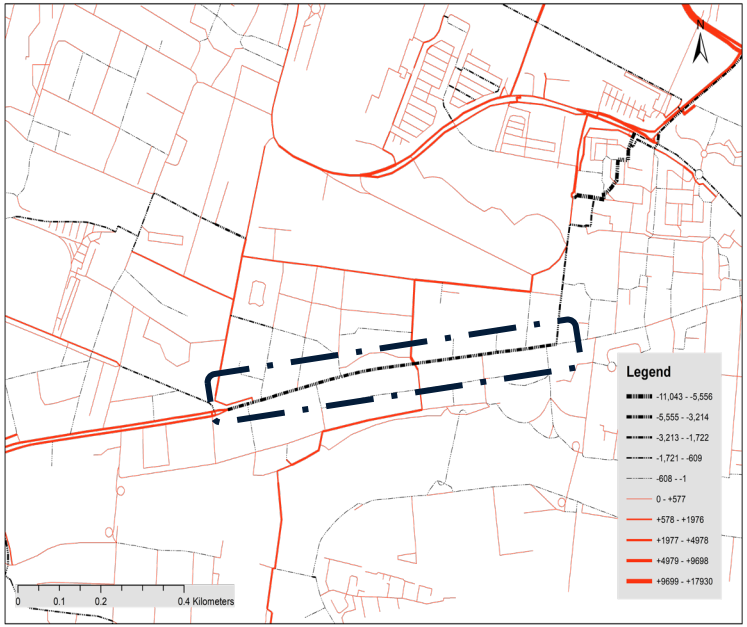
Comparison between shortest routes and actual routes (Research Q2)

Difference between observed flows and predicted flows



Results

Why less popular? (Research Q2)

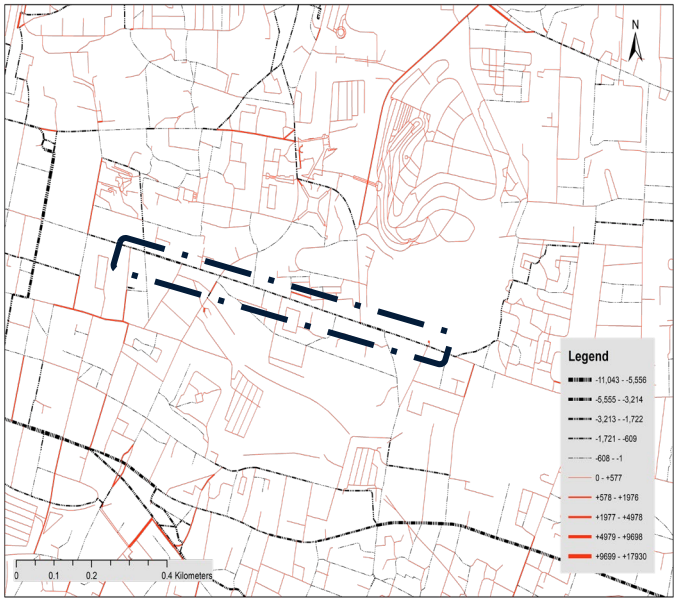


- Bus stops, traffic lights with a pedestrian crossing, street parking, no cycling infra

Results

Why less popular? (Research Q2)

This road has cycling infrastructure



- Shared cycle/bus lane, street car parking, built environments (derelict properties – this area is one of the most deprived areas with a high crime rate)

Results

Fixed effects Poisson panel regression (Research Q3)

	Overall effect			Separate effects		
	Estimate	SE	P-value	Estimate	SE	P-value
New Infrastructure (yes= 1)	0.01	0.04	0.85			
Routes to Cathkin 1				-0.10	0.05	0.05
Routes to Cathkin 2				**0.08**	**0.02**	**0.00**
South West City Way				**0.12**	**0.03**	**0.00**
West City Way/Connect 2				**0.13**	**0.04**	**0.00**

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Thank you. Any questions ?