Cycling and the built environment – testing bicycle suitability indicators with actual route choices

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What are bicycle suitability indicators?

- Relate to multiple factors that can affect attractiveness of cycling (esp. safety)
- Distinct from bikeability indicators due to focus upon individual links and nodes
- Lowry et al. 2012 (definition)

Paths and streets

- Infrastructure in focus, rather than destination accessibility/greenness etc...
- Should consider topography/effort/time

Vector-based classification (segments)

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Bicycle Suitability (BLOS)
e.g.: Callister & Lowry 2013

Raster-based classification (layers)

[Image removed due to copyright restrictions.]

Bikeability (BikeScore)

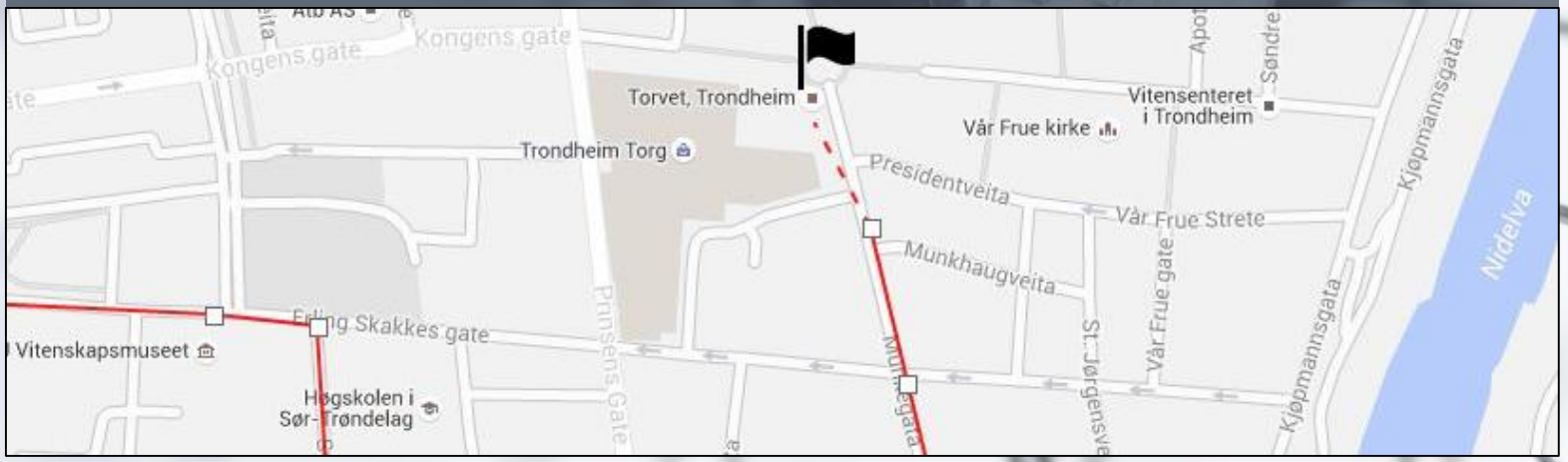
Research gap with BSIs

- BSI Metrics usually based on empirical data (with limitations)
- Study aims to “reverse engineer” the metrics with new empirical OD data
- Route-based data to sum characteristics over many streets/paths/intersections

Selection criteria

- Ability to apply at network level across all transport links
- Addresses both paths and streets

- Combination with intersections?



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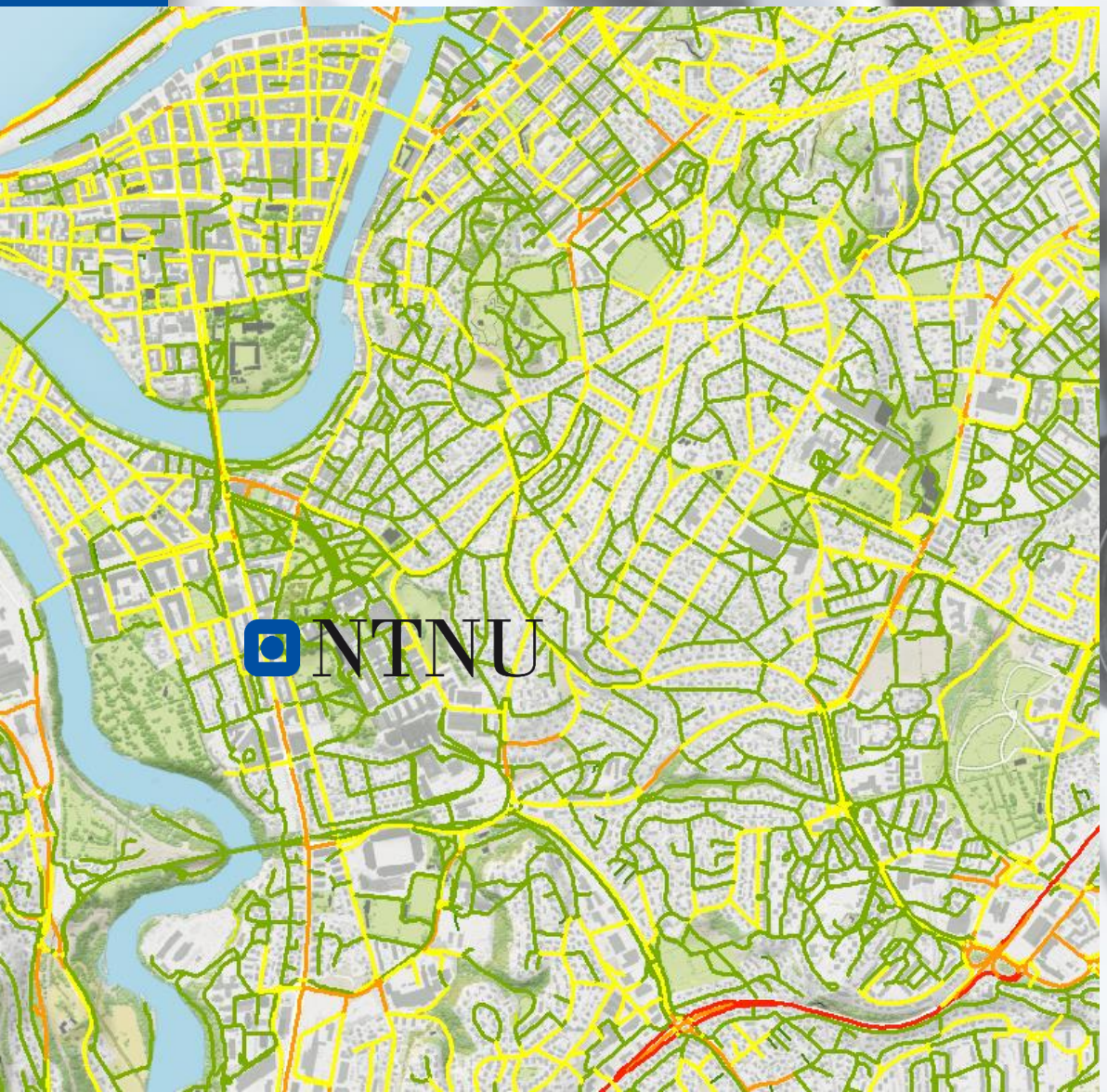
Bicycle Suitability Indicators

Name of Method	Acronym	Reference	Reference Date
Bicycle Safety Index Rating	BSIR	Davis	1987
Bicycle Stress Level	BSL	Sorton and Walsh	1994
Road Condition Index	RCI	Epperson	1994
Interaction Hazard Score	HIS	Landis	1994
Bicycle Suitability Rating	BSR	Davis	1995
Bicycle Level-of-Service	BLOS	Botma	1995
Bicycle Level-of-Service	BLOS	Dixon	1996
Bicycle Suitability Score	BSS	Turner et al	1997
Bicycle Applied Model	BAM	Landis	1997
Bicycle Compatibility Index	BCI	Harkey et al	1998
Bicycle Suitability Assessment	BSA	Emery and Crump	2003
Rural Bicycle Compatibility Index	RBCI	Jones and Carlson	2003
Compatibility of Roads for Cyclists	CRC	Noel et al	2003
Bicycle Level-of-Service	BLOS	Zolnik and Cromley	2007
Denmark Bicycle Level-of-Service	DBLOS (segments)	Jensen	2007
Bicycle Level-of-Service	BLOS	Petritsch et al	2007
Bicycle Environmental Quality Index	BEQI	SFDPH	2009
Bicycle Quality Index	BQI	Birk et al	2010
Bicycle Level-of-Service	BLOS	HCM2010	2010
Level of traffic stress	LTS	Mekuria	2012
Infrastructure-based bikeability index	IBBI	Van Acker	2012
Denmark Bicycle Level-of-Service	DBLOS (intersections)	Jensen	2013
Place syntax bike network analysis	PSyn	Manum	2013
MMLOS- bike	MMLOS	HCM6	2016

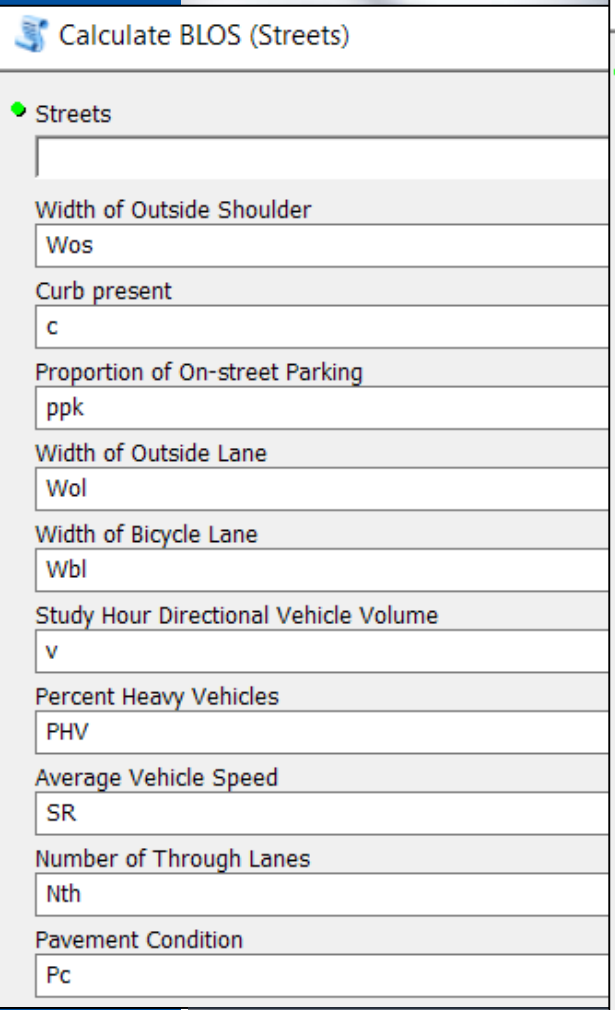
Example: Bicycle Stress Level

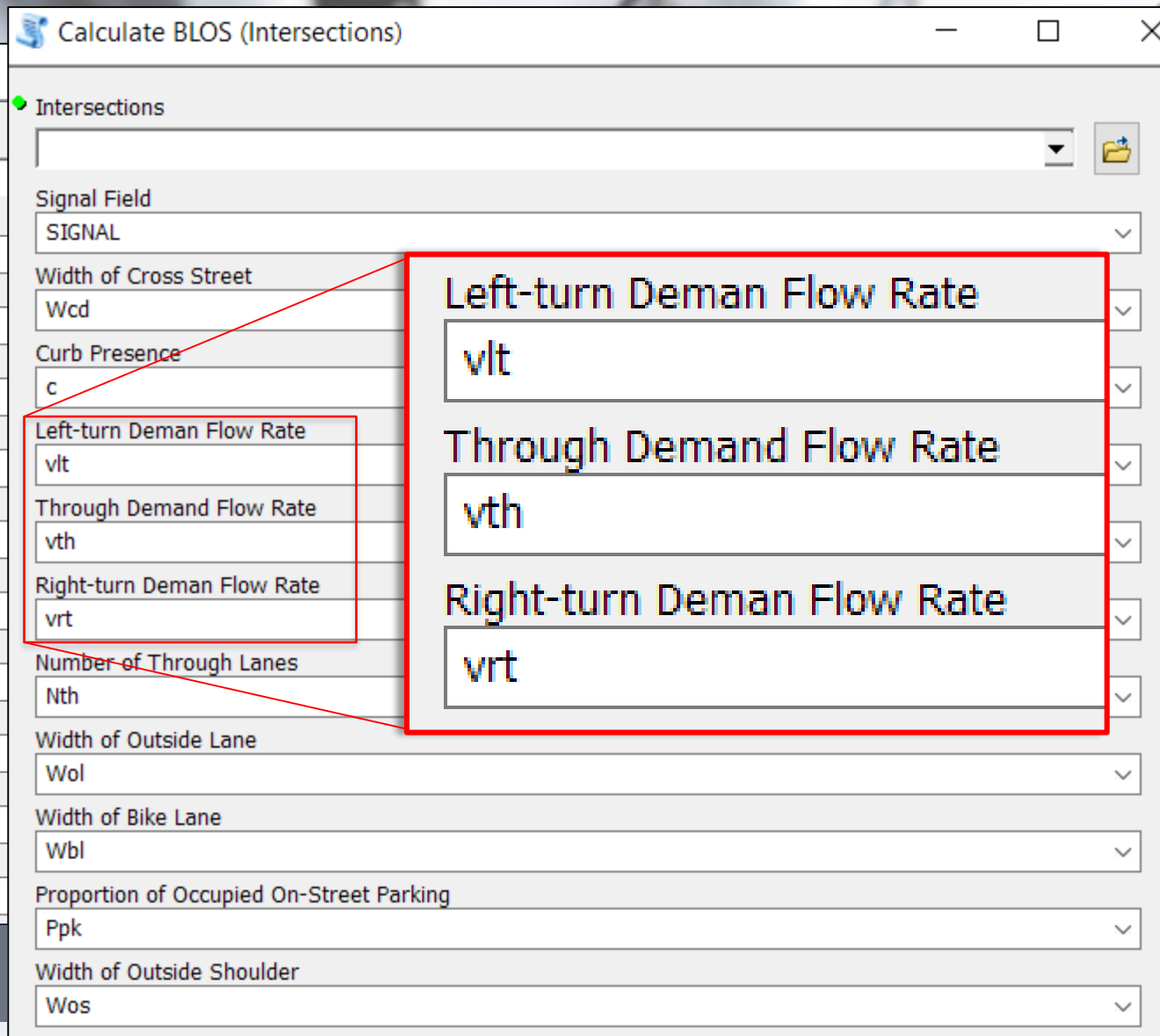


A function of:

- Traffic volume
- Speed
- Width of outside lane
- But.. no paths, intersections

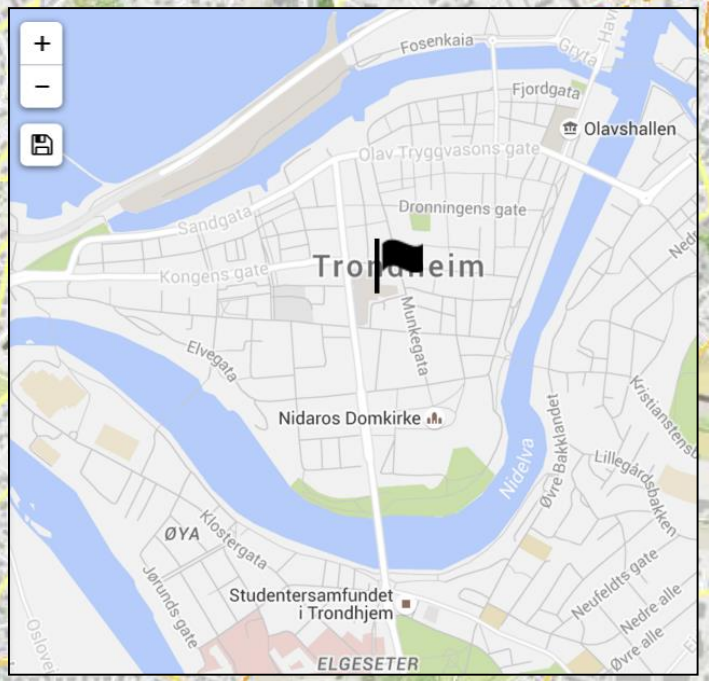
Example: Highway Capacity Manual – BLOS



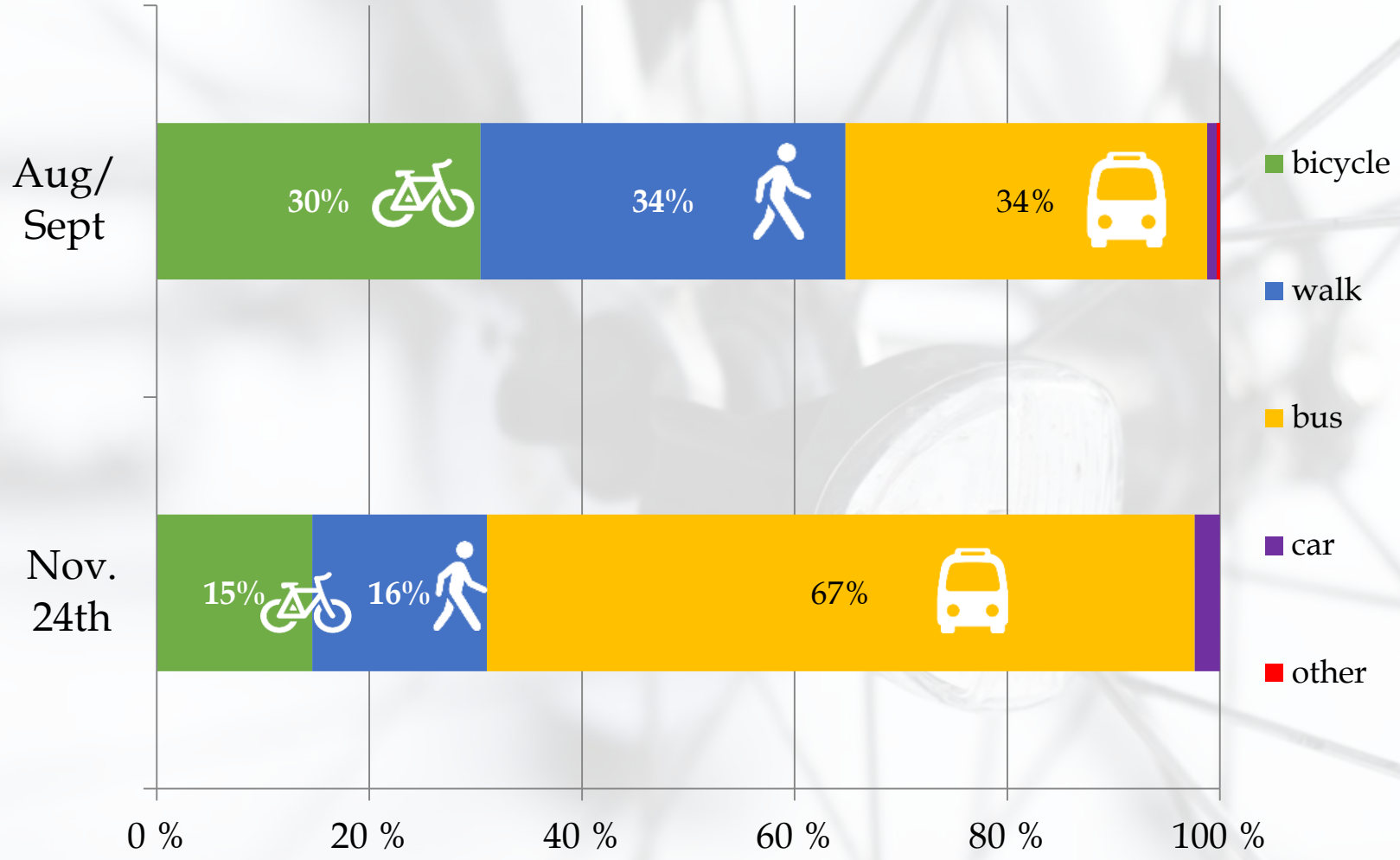


(ArcGIS plugin from Lowry et al. 2013)

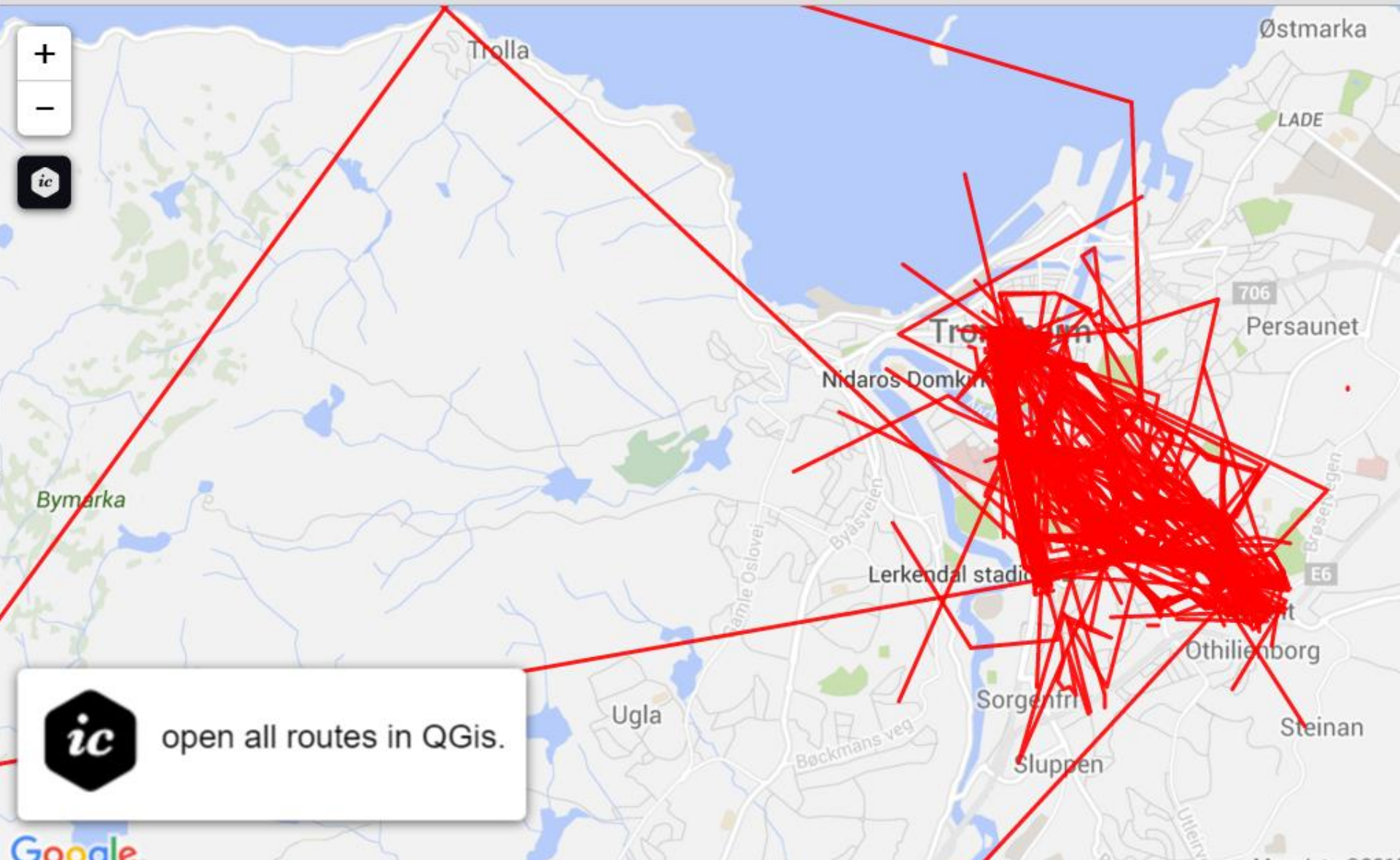
Study design: mapping of preferred path along restricted OD pairs in Trondheim



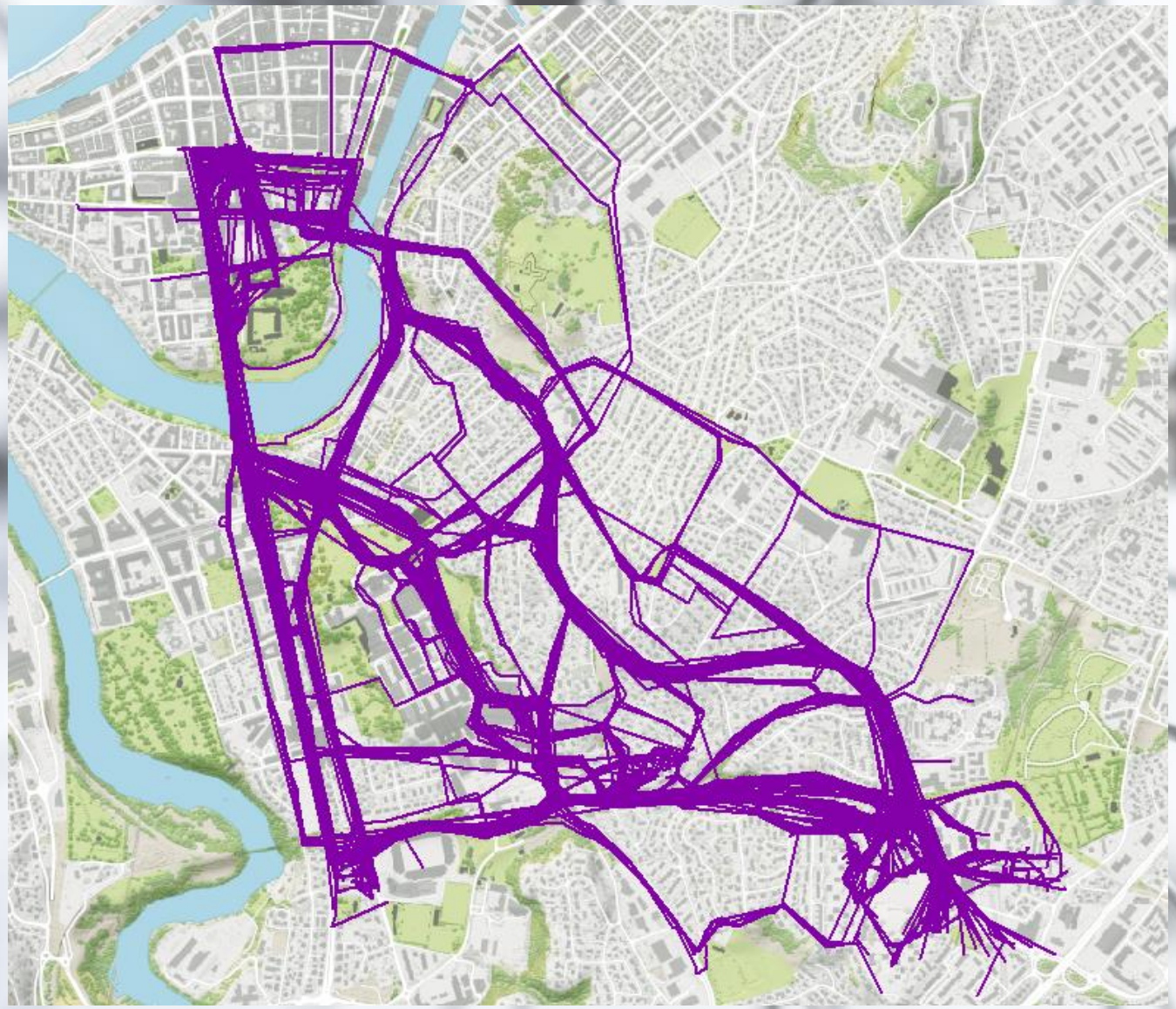
Modal split Moholt student village (n=336)



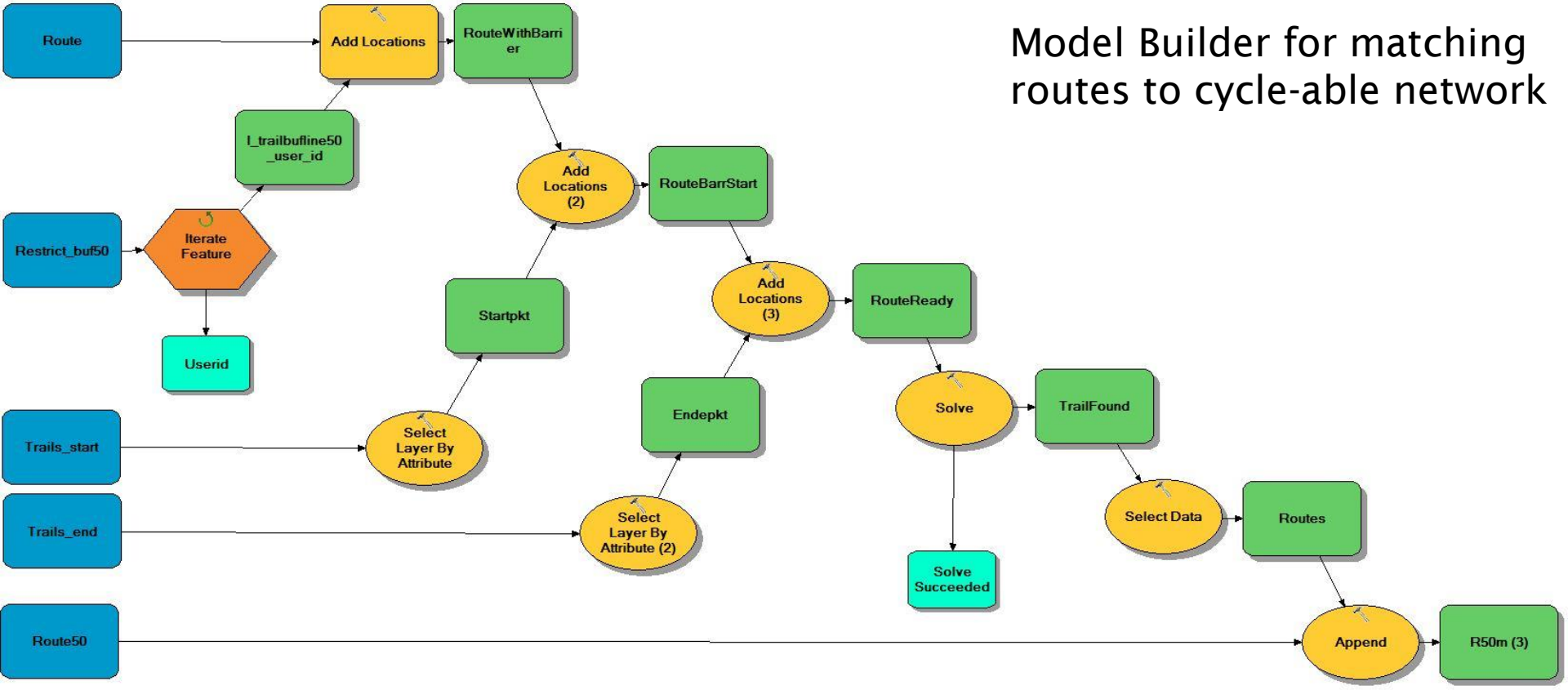
Early raw data was sub-optimal…



Revised instructions and some cleaning helped ($n_{valid} = 467$)

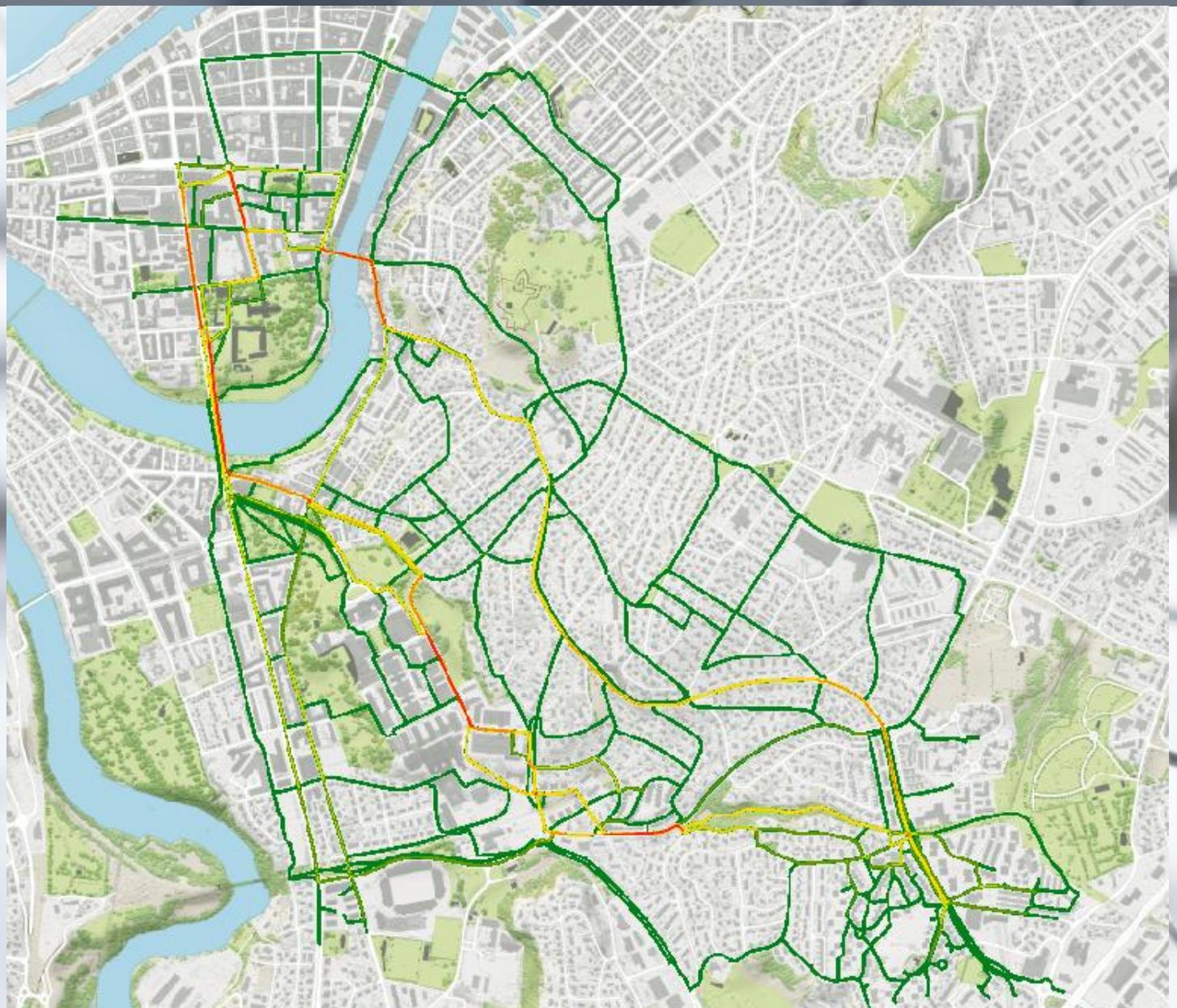


Map-matching in ArcGIS

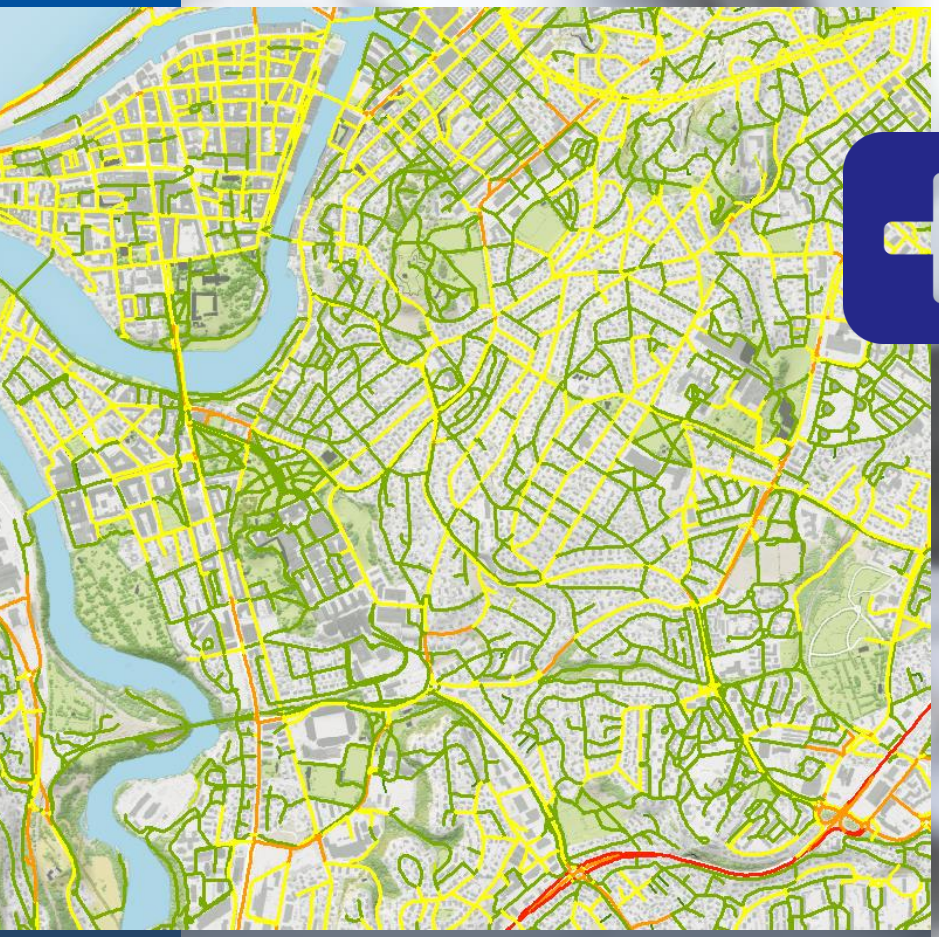


Model Builder for matching routes to cycle-able network

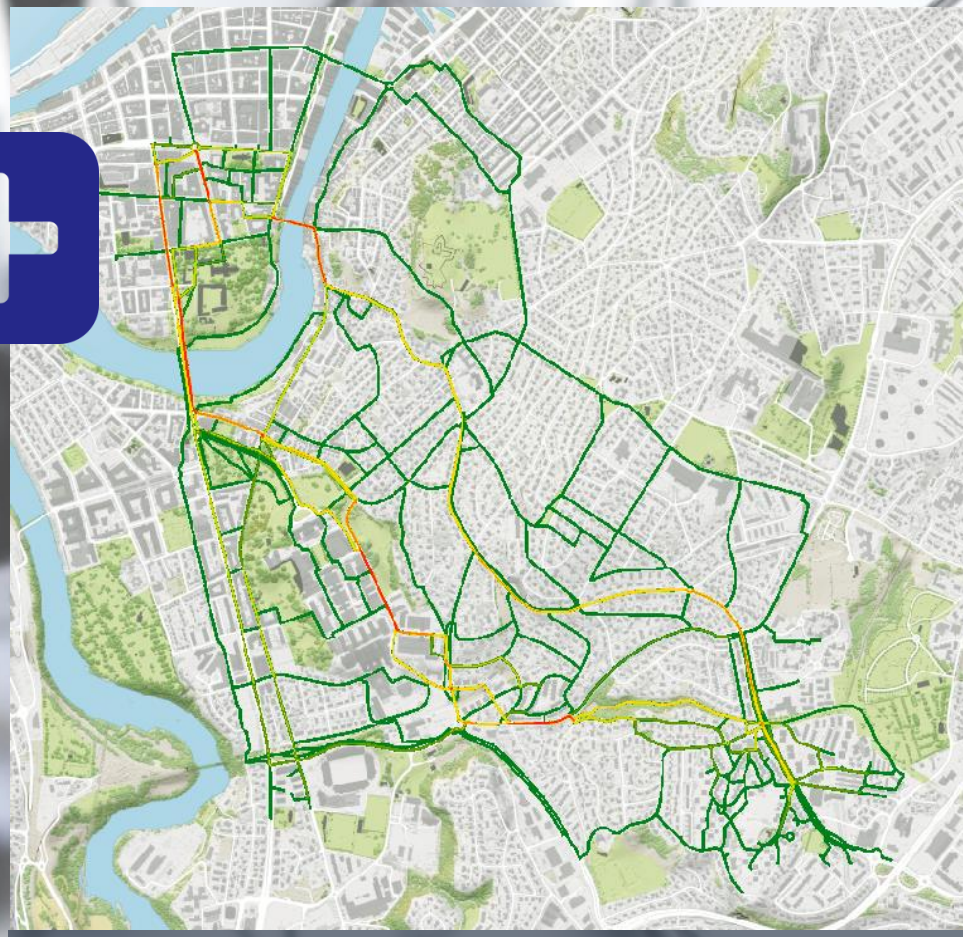
Network link popularity heatmap



Correlated? Which BSI is best?



Bicycle Suitability Indicator(s)



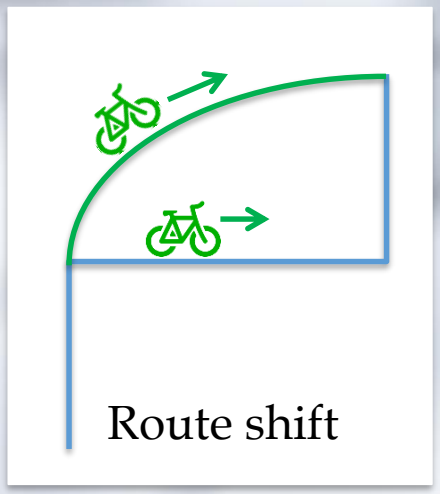
Route choice popularity

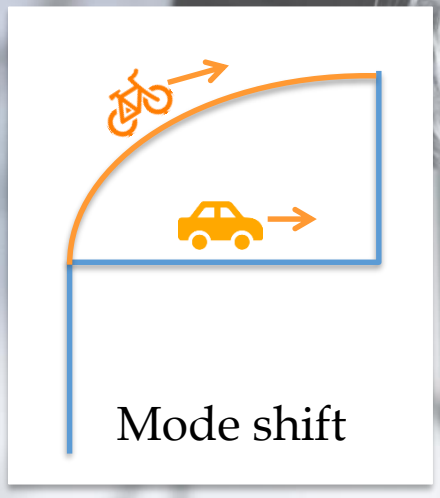
Before this can be answered…

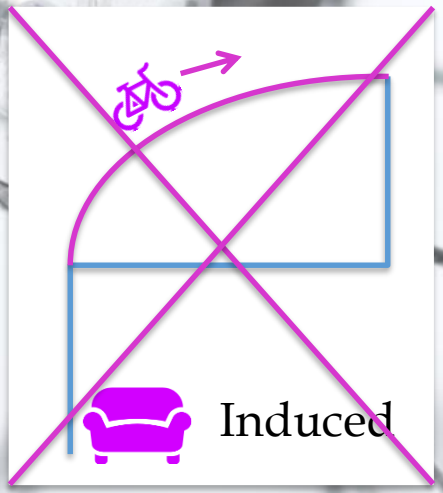
- More detailed metrics to compare
- Impedance at intersection
- Data for the metrics (like signal timing at traffic lights)
- Statistics – also related to respondent attributes

The bigger picture

- Cycling infrastructure affects mode, route and induced shift
- But how to distinguish between the different types of change?







Future studies should consider

- Broader target group
- Faster methods for map-matching
- Revealed preference comparison?

Summary

- Stated preference – current and future cyclists
- Need to distinguish route from mode choice
- Preferences and impressions of cyclists and future cyclists are very different

Thanks!

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