Does one bicycle facility type fit all?

Evaluating the stated usage of different types of bicycle facilities among cyclists in Quebec City, Canada

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ABSTRACT

Bicycle facilities with greater separation from motorized traffic are recognized to be preferred by a large number of cyclists, but the construction of these facilities generally requires higher capital investments than other facility types. It is therefore essential to ensure that the best design is implemented to encourage cycling trips and increasing the safety of cyclists.

Purpose:

- To evaluate **what facilities cyclists have reasonable access to** during their commute to work or school and compare this to which facility types each cyclist reported using, in order to measure which facility types are not well used by cyclists.

- To **segment cyclists** according to their behaviour, attitudes, and preferences

- To **evaluate cyclists' usage** of various types of bicycle facilities.

OVERALL APPROACH

Spatial analysis

2015 Quebec City bicycle travel survey home - work locations
↓
Calculated shortest on-street path
↓
Generated a varying sized network buffer: *10% of shortest path*
↓
Determined bicycle infrastructure located within buffer

Segmentation of cyclists

Principle component analysis
9 FACTORS
↓
K-means cluster analysis
6 CLUSTERS

Logistic regression analysis
Assessing the odds of using each of the following infrastructure:

Recreational bicycle path | Bi-directional path | Painted lanes

NETWORK BUFFER METHOD

Example of a Network buffer

Projection: NAD 1983 MTM 7

- Origin
- Destination
- Shortest route
- Street network
- Bicycle facilities
- Network buffer

Data sources: TRAM, Quebec City

DESCRIPTIVE STATISTICS

Usage of each bicycle facility type by cluster group

	Recreational path	Bi-directional path	Painted bicycle lane
THE URBAN CYCLIST N =141	50.4 / 30.5	29.1 / 53.9	61.7 / 23.4
BENEFIT-SEEKING CYCLIST N =166	51.2 / 30.1	25.3 / 59.6	59.6 / 25.9
THE HAPPY CYCLIST N = 91	61.5 / 28.6	25.3 / 62.6	57.1 / 35.2
THE PICKY-EFFICIENCY SEEKER N =114	43.0 / 35.1	27.2 / 44.7	64.0 / 20.2
CHILDHOOD INFLUENCED N =202	57.4 / 31.7	30.7 / 57.4	54.5 / 37.1
THE INDIFFERENT CYCLIST N =163	58.9 / 27.6	27.0 / 60.1	54.0 / 37.4

- Reported usage of facility type
- Have access and did not report using it

ANALYSIS

1 **Principle component analysis** was used to identify factors of highly correlated variables.

- Time efficiency
- Effort
- Peer & institution encouragement
- Weather
- Cycling experience
- Raised in the city
- Cyling is enjoyable
- Family encouragement
- Positive benefits of cycling

2 *K*-means cluster analysis was used to segment the respondents.

THE URBAN CYCLIST [16%] | BENEFIT-SEEKING CYCLIST [19%] | THE HAPPY CYCLIST [10%] | THE PICKY-EFFICIENCY SEEKER [13%] | CHILDHOOD INFLUENCED CYCLIST [23%] | THE INDIFFERENT CYCLIST [19%]

3 **Logistic regression analysis** was used to predict the odds that each cyclist will use each bicycle facility type

Variable	Odds Ratio		
	Recreational path	Bi-directional path with median	Painted lane
Presence of infrastructure within route buffer†	3.49 ***	1.42	1.72 **
Cyclist segmentation			
1. The urban cyclist†	1.26	1.05	0.84
2. Benefit-seeking cyclist†	1.40	0.91	0.73
3. The happy cyclist†	1.56	0.69	0.59 *
5.Childhood influenced cyclist†	1.45	0.98	0.53 **
6.The indifferent cyclist†	2.13 ***	1.10	0.61 *
Ref : The picky efficiency seeker†	-	-	-
Trip and neighbourhood characteristics			
Length of work/school commute (km)	1.08 ***	1.10 ***	1.05 **
Ratio of bicycle facilities to street length within route buffers	1.04 **	1.04 **	1.06 ***
Perceived neighborhood as cycle-friendly	2.05 ***	1.47 **	0.92
Personal characteristics			
Age below 35 years old†	0.63 *	0.72	0.90
Age between 35 to 54 years old†	0.74	0.68	1.05
Ref Age 64 years and above	-	-	-
Gender - Female†	0.92	0.57 ***	0.89

Dependent variable: Reported usage (1 = used and 0 = not used)
† Represents a binary dummy variable
* 90% significance level | ** 95% significance level | *** 99% significance level

Recreational bicycle path
The odds of a cyclist using this facility type are **3.49 times higher** than a user without reasonable access.

Bi-directional path
Having reasonable access to a bi-directional bicycle path is **not a predictor** of whether or not an individual will use that facility.

Painted bicycle lane
The odds of a cyclist using this facility type are **1.72 times higher** than a user without reasonable access.

DISCUSSION

- Our results highlight the **importance of thinking critically about what type of bicycle infrastructure** is preferable to build according to a specific urban context and the typology of cyclists present in a region.

- Cyclists have a **strong preference** for the use of **off-street recreational paths**, which is the facility type that offers the greatest separation from traffic in Quebec City.

- 52% of bi-directional lanes in Quebec follow streets with motorized speeds limits of 60 km/h, which may explain the lower than expected usage of these facilities.

RECOMMENDATIONS

- Future studies could also **examine the impact of using different diversion rates** on their results.

- Future research should verify **how cycling usage differs between physically separated bi-directional and uni-directional lanes** in a city where both types are available.

- Not only **facility design but also characteristics of adjacent streets, and neighborhood characteristics** should be considered when deciding which facility type is best suited.

- Planners should **engage in a dialogue** with cyclists, both novice and more experienced cyclists, to collect information about **safety and stress levels** when using different facilities, with the goal of identifying optimal cycling facilities for future investments.

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