PARK'N' ROLL
Identifying and prioritizing locations for new bicycle parking in Quebec City, Canada

Marie-Pier Veillette
Emily Grisé
Ahmed M. El-Geneidy
School of Urban Planning, McGill University

TRAM
Transportation Research at McGill

ABSTRACT

Bicycle parking has been identified as an important factor in increasing bicycle usage. The perceived risk of bicycle theft and vandalism can deter individuals from cycling, which is why it is important to **invest in short and long term bicycle parking**.

The purpose of paper:
- To develop an easy-to-reproduce GIS-based method to identify and prioritize locations to install new short term and long term bicycle parking in Quebéc City, Canada.

The results of this study:
- Estimate the demand for short and long term bicycle parking and identify priority areas for their installation
- Recommend number of new parking spaces

STUDY AREA

In 2016, **Quebec City** launched its Bicycle Vision to encourage a modal shift toward cycling. In 2017, cycling infrastrure in the study area consisted of the following characteristics:

- **424 km** of bicycle lanes and cycle paths
- **480 short term bicycle parking facilities** of either 3, 5, or 7 spaces each
- Nearly **3,784** public bicycle **parking spaces** available for cyclists

Public Bicycle Parking Spaces Density
Low — High
Bicycle network
Green Space
Borough

0 0.5 1 Km

Data sources: TRAM, Quebec City, Réseau de transport de la Capitale (RTC), Statistics Canada

APPROACH

We developed **a multi-criteria approach** to prioritize the location of new short and long term bicycle parking. The flow chart illustrates the main steps of our analysis:

Priority index for short and long term bicycle parking
- High frequency bus stops
- OD Existing cyclists
- OD Potential cyclists

110 Priority grid cells

Priority index for long term bicycle parking
- Stolen bicycles
- Proportion of trips for the purpose of work or school

Existing bicycle parking

Output
- Recommended number and location of short term bicycle parking
- Recommended number and location of long term bicycle parking

DATA

Table 1 : Sources and indicators used to create our index

Indicator	Source
Bicycle racks location	City of Quebec
Stops location served by high frequency buses	Réseau de transport de la Capitale (RTC)
Existing cyclists trips	
Potential cyclists: short-distance non-cycling trip (less than 5.8 km) which could be converted into a bicycle trip.	Québec 2011 OD Survey
Proportion of trips made for the purpose of work or school.	
Location and number of stolen bicycle	Quebec City Bicycle Travel Survey

CONCEPTS

Type of bicycle parking facilities

Free-standing rack, generally located outside

Bike storage, locker or shed with restricted access provided for a fee

METHODOLOGY & RESULTS

Index 1 — Prioritization Index for new bicycle parking

Using the fishnet tool in ArcGIS, a grid (300 by 300 meters) coverering our study area was created.

This first index is comprised of three indicators

- Existing Cyclists: **5,918 trips** (after expansion factor)
- Potential Cyclists: **337,928 trips** (after expansion factor)
- Bus Stops: **231** high-frequency bus stops (one direction)

Each indicator was **standardized using Z-Score and aggregated** to the grid cells

Combined and Weighted Index

$$3 \times \text{Existing Cyclists} + 1.5 \times \text{Potential Cyclists} + 1 \times \text{Bus Stops}$$

High priority Areas and Recommended number of spaces

Number of bicycle spaces needed, we summed the **existing cyclists trips + 10% of potential cyclists trips**

Priority locations for new bicycle parking
Recommended number of parking spaces to add
- 6 - 30
- 31 - 55
- 56 - 85
- 86 - 115
- 116 - 175
- 176 - 310
- 311 - 520
Bicycle Network
Bicycle Parking Surplus
Area Excluded from Analysis
Green Space
Borough

0 1 2 Km

Data sources: Quebec City, Réseau de transport de la Capitale (RTC), Statistics Canada, Ministère des Transports

Index 2 — Prioritization Index for long term bicycle parking

From the high priority bicycle parking locations, a priority index for long term bicycle parking was created.

This second index is composed of three indicators

- Stolen bicycle: Stolen bicycles per grid cell
- Existing Cyclists: $\dfrac{\text{Trips to school or work}}{\text{All trips for all other purposes}}$
- Potential Cyclists: $\dfrac{\text{Trips to school or work}}{\text{All trips for all other purposes}}$

Each indicator was **standardized using Z-Score and aggregated** to the grid cells

Combined and Weighted Index

$$3 \times \text{Stolen bicycle} + 2 \times \text{Existing Cyclists} + 1.5 \times \text{Potential Cyclists}$$

High priority Areas and Recommended number of spaces

Number of bicycle spaces needed, we summed the **existing cyclists trips + 10% of potential cyclists trips**

Priority locations for long-term bicycle parking
A) Stolen Bicycles
B) Ratio of existing cyclists commuting to work or to school
C) Ratio of potential cyclists commuting to work or to school

Recommended number of long-term parking spaces to add
45 60 105 130 170 215
Bicycle Network
Area Excluded from Analysis
Borough
Priority Level: High — Low

Data sources: Quebec City, Statistics Canada, Ministère des Transports, TRAM

DISCUSSION

- Our methodology proceeded under the assumption that **long-term bicycle parking** will be provided **for free** to users.
- The strength of our method lies in **its flexibility** and ability to account for long term demand for bicycle parking.
- This work must be followed by a more **detailed analysis to locate bicycle parking spaces** within the identified grid cells.
- The **number and the type of indicators utilized could be tailored** to other regions according to data availability and policy goals.
- The **weighting scheme** could be modified according to **different contexts** and local planning goals and priorities.

ACKNOWLEDGEMENTS

CIRRELT   McGill