

## LITERATURE REVIEW

As cities continue to propose transportation plans that encourage the use of bicycles as a sustainable alternative to the automobile, and bicycles become an increasingly popular form of transportation, planners and transportation researchers need to be aware of the growing opportunities for bicycle theft. The monetary value, availability, and utility of the bicycle have made it become a popular target for theft. Findings from the International Crime Victim Survey (ICVS) indicate that bicycle theft is the highest per bicycle owner in cities where bicycles are most popular and that from the 30 cities included in the study, cyclist are (slightly more than) four times as likely to be victims of bicycle theft than are automobile owners to be victims of automobile theft (van Dijk, van Kesteren, & Smit, 2007).

Gamman, Thorpe, and Willcocks (2004) claim that thefts are not properly recorded to the police because they are often seen as being a low crime priority. Johnson, Sidebottom, and Thorpe (2008) state that bicycle theft is a crime that frequently goes unnoticed and is largely unchallenged by authorities. Although no academic attention has been given to the underreporting of bicycle theft in the literature, many respondents in the Montreal Bicycle Theft Survey indicate that they did not report the crimes due to doubt that police would act on these instances of crime. Within the field of criminology, Routine Activity Theory explains that for most criminal acts to be committed likely offenders, suitable targets, and a lack of a capable guardian is required. This theory provides temporal predictions about when crime rates could be higher (L. Cohen & Felson, 1979). Survey participants made clear in their responses that bicycles are indeed suitable targets, and that police do not act as suitable guardians who actively protect against bicycle theft. A clear disconnect exists between cyclists' individual efforts to decrease instances of theft (i.e. by using strong locks, parking in well-lit areas, always taking their bicycle inside, etc.), and the apparently minimal effort by local police. While there is little academic research about bicycle-related crime, several studies have identified that bicycle theft is a problem for cycling communities (Bachand-Marleau, Larsen, & El-Geneidy, 2011; Gamman, et al., 2004; Sidebottom, Thorpe, & Johnson, 2009; Zhang, Messner, & Liu, 2007).

Within a Chinese context, Zhang et al. (2007) used data collected in the city of Tianjin to explore social and legal aspects of bicycle theft victimization. The authors focused on neighborhood deviance and crime levels, and found that neighborhood poverty level is a significant risk factor in bicycle theft victimization. Gamman et al. (2004) focused on the need for bicycle-specific and theft-preventing urban design in the UK and elsewhere in Europe. These authors suggested best practice policies to increase the security of bicycle parking facilities. Meanwhile, Sidebottom et al. (2009) conducted a study in London and Brighton, UK, aiming to understand whether instructional stickers placed on bicycle parking facilities would encourage cyclists to park and lock their bicycles more securely in public spaces. Bachand-Marleau et al. (2011), in their research on bicycle and transit integration in Montreal, found that 20% of surveyed Montreal cyclists reported a lack of appropriate parking facilities or mentioned fears about theft.

Many studies have assessed cycling behavior and cyclists' preferences of bicycle specific infrastructure (such as bicycle lanes, boulevards, and paths) (Aultman-Hall, Hall, & Baetz, 1997; Dill & Carr, 2003; Handy, Boarnet, Ewing, & Killingsworth, 2002; Larsen, Patterson, & El-Geneidy, 2011; Tilahun, Levinson, & Krizek, 2007; Winters, Brauer, Setton, & Teschke, 2010). However, the abovementioned studies are unique in identifying that with a rise in bicycle mode share comes and increase in the opportunity for bicycle theft, thereby increasing the need for secure bicycle parking facilities. This study specifically contributes to the literature by providing an analysis of the multifaceted problem of bicycle theft in Montreal and by evaluating cyclists' opinions about the security and availability of bicycle parking facilities in the region.

## DATA AND METHODOLOGY

The City of Montreal endeavors to increase cycling mode share in the region by developing bicycle facilities throughout the area (Division du Développement des Transports, 2008). According to the 2008 *Origine-Destination* (O-D) survey, which is a regional transportation survey that is conducted every five years, the mode share for cycling in the region of Montreal is 1.2% of all trips (Agence Metropolitaine de Transport (AMT), 2008). This mode share resembles the national average (Canada, 2010; Pucher & Buehler, 2005). To increase the overall mode share of bicycle trips, Montreal's 2008 Transportation Plan encourages cycling for basic transportation as a part of the development program for reinventing Montreal within the next ten years (Division du Développement des Transports, 2008). The city's transportation plan includes goals that involve interventions for both increasing the bicycle path network and improving bicycle parking facilities. These goals include doubling the length of the cities' bicycle paths, updating the existing cycling network, and increasing the number of bicycle racks by 500% by means of public-private partnerships. According to the *Service de police de la Ville de Montreal* (SPVM), the city's police department, an average of approximately 2,500 bicycles are reported stolen every year. The SPVM believes this number represents only a small proportion of all bicycle thefts taking place in the region (Tremblay & Letendre, 2011).

To better understand bicycle theft in and around Montreal, a bilingual online survey was conducted in the region.<sup>1</sup> Given the limitations of online surveys, particularly for overrepresentation of certain groups, a variety of media were used to ensure a broad cross-section of the public was reached. The survey was publicized through a combination of email newsletters, mailing lists, several newspaper articles in French and English, a radio interview, and various social networking media. Flyers advertising the survey were distributed to several bicycle shops throughout the region. These measures, as recommended by Dillman, Smyth and Christian (2009), allowed for a broader exposure and presumably reduced sample bias that can be associated with online surveys. Due to the title of the survey, the Montreal Bicycle Theft Survey, the

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<sup>1</sup> A copy of the survey is available online at: <http://tram.mcgill.ca/Teaching/srp/documents/Dea.pdf>

survey may have attracted more victims than non-victims of bicycle theft (50% of the respondents had at least one bicycle stolen). However, previous research, unrelated to theft, also found that 50% of cyclists had been victims of bicycle theft (Bachand-Marleau, Lee, & El-Geneidy, 2011). The survey was available online for approximately one month in the late spring of 2012, and it yielded a total sample of 1,922 usable responses from 2,039 individuals. This is slightly higher than the count of bicycle-riding adults in the regional travel survey, which samples 5% of the region's population (Agence Metropolitaine de Transport (AMT), 2008). Table 1 highlights the demographic characteristics of participants both in the Montreal Bicycle Theft Survey and the O-D survey and includes both percentage and count figures. In this table, the total number per cell does not always add up to the total number because participants always had the option of leaving the question blank.

**TABLE 1: MONTREAL BICYCLE THEFT SURVEY AND ORIGIN-DESTINATION SURVEY PARTICIPANTS**

|                    | 2012 Bicycle Theft Survey |         |         |       |     |       | 2008 Origin-Destination Survey (Adult) |         |     |          |
|--------------------|---------------------------|---------|---------|-------|-----|-------|--|---------|-----|----------|
|                    | All Survey<br>Respondents |         | Logit   |       |     |       |  |         |     |          |
|                    |                           |         | Victims |       | All |       |  |         |     |          |
|                    |                           |         |         |       |     |       | Bicyclists                             |         | All |          |
| GENDER             |                           |         |         |       |     |       |  |         |     |          |
| Male               | 58%                       | (1,037) | 60%     | (233) | 60% | (612) | 65%                                    | (1,029) | 47% | (58,890) |
| Female             | 42%                       | (738)   | 40%     | (155) | 40% | (400) | 35%                                    | (548)   | 53% | (65,563) |
| AGE                |                           |         |         |       |     |       |  |         |     |          |
| Average Age        | 37                        |         | 38      |       | 38  |       | 42                                     |         | 48  |          |
| 18-29              | 30%                       | (542)   | 27%     | (104) | 29% | (290) | 24%                                    | (372)   | 16% | (19,750) |
| 30-39              | 37%                       | (658)   | 37%     | (143) | 36% | (362) | 22%                                    | (343)   | 16% | (20,182) |
| 40-49              | 17%                       | (301)   | 16%     | (64)  | 17% | (167) | 25%                                    | (395)   | 21% | (25,929) |
| 50-64              | 14%                       | (254)   | 18%     | (68)  | 17% | (167) | 24%                                    | (371)   | 28% | (34,983) |
| 65+                | 2%                        | (41)    | 2%      | (9)   | 2%  | (25)  | 6%                                     | (96)    | 19% | (23,609) |
| HOUSEHOLD SIZE     |                           |         |         |       |     |       |  |         |     |          |
| One                | 21%                       | (369)   | 22%     | (82)  | 19% | (190) | 22%                                    | (346)   | 15% | (18,203) |
| Two                | 43%                       | (755)   | 40%     | (153) | 44% | (433) | 34%                                    | (539)   | 38% | (47,008) |
| Three              | 19%                       | (335)   | 18%     | (70)  | 19% | (184) | 20%                                    | (310)   | 19% | (24,121) |
| Four               | 12%                       | (213)   | 14%     | (55)  | 13% | (130) | 17%                                    | (270)   | 19% | (23,788) |
| Five or More       | 6%                        | (100)   | 5%      | (20)  | 6%  | (56)  | 7%                                     | (112)   | 9%  | (11,333) |
| OCCUPATION         |                           |         |         |       |     |       |  |         |     |          |
| Employed Full-time | 64%                       | (1,133) | 66%     | (253) | 65% | (653) | 59%                                    | (935)   | 52% | (64,439) |
| Employed Part-time | 7%                        | (130)   | 9%      | (33)  | 7%  | (71)  | 9%                                     | (135)   | 6%  | (7,105)  |
| Student            | 21%                       | (370)   | 18%     | (68)  | 20% | (202) | 13%                                    | (200)   | 8%  | (9,872)  |
| Retired            | 3%                        | (50)    | 2%      | (9)   | 3%  | (29)  | 11%                                    | (181)   | 25% | (31,057) |
| Other              | 6%                        | (100)   | 5%      | (21)  | 5%  | (47)  | 8%                                     | (126)   | 10% | (11,936) |
| INCOME (household) |                           |         |         |       |     |       |  |         |     |          |
| <\$20,000          | 14%                       | (245)   | 10%     | (38)  | 12% | (118) | 15%                                    | (186)   | 12% | (10,217) |

|                      | 2012 Bicycle Theft Survey |          |           | 2008 Origin-Destination Survey (Adult) |                     |
|----------------------|---------------------------|----------|-----------|--|---------------------|
|                      | All Survey Respondents    | Logit    |           | Bicyclists                             | All                 |
|                      |                           | Victims  | All       |  |                     |
| \$20,000 - \$40,000  | 18% (305)                 | 19% (69) | 17% (157) | 24% (310)                              | 22% (19,849)        |
| \$40,000 - \$60,000  | 18% (313)                 | 18% (68) | 17% (164) | 22% (278)                              | 21% (18,877)        |
| \$60,000 - \$80,000  | 14% (234)                 | 16% (58) | 15% (138) | 16% (203)                              | 16% (14,502)        |
| \$80,000 - \$100,000 | 13% (216)                 | 13% (47) | 13% (126) | 10% (131)                              | 11% (10,186)        |
| >\$100,000           | 23% (391)                 | 24% (90) | 26% (245) | 13% (166)                              | 17% (15,009)        |
| <i>N*</i>            | 1,922                     | 388      | 1,012     | 1,577                                  | 124,453 (all modes) |

*\*The total number of survey participants was 2,039. Of these responses 1,922 were usable. Almost all of the usable responses came from current cyclists. The total number of current cyclists was 1,896.*

As mentioned earlier, this paper tries to answer several questions in relation to bicycle theft. The first question asks *who* the victims of bicycle theft are. This question is answered through a description of the survey participants and the differences between cycling theft victims and non-victims. Basic socio-demographic information about the survey participants is presented through a series of summary statistics. This is followed by a binary logit model, which incorporates variables pertaining to socio-demographic status, commuting habits, and bicycle and lock characteristics, and which is used to demonstrate which of these factors most influence survey participants' likeliness to have had their bicycle stolen. Similarly to Zhang et al. (2007), this logit model helps to better understand the risk and protective factors for bicycle theft.

The second question concerns *where* bicycle theft occurs most frequently, and *where* is it perceived to occur most frequently. Answering this question involves using a geographic information system (GIS) software to highlight experienced and expected bicycle theft locations on the Island of Montreal. Details about the methodology that was used to better understand where bicycle theft occurred and where it is perceived to occur more frequently is further explained in the section titled 'Where.' This is followed by a short discussion about the differences between actual and perceived instances of theft. Cyclists' perceptions and preferences about bicycle parking facilities are also analyzed.

The third, fourth and fifth questions attempt to understand *what* kinds of bicycles are most commonly stolen, *how* bicycles are most commonly stolen, and *when* bicycles are most likely to be stolen, respectively. These questions are answered through a series of descriptive statistics. Figures are used to highlight key findings and to better understand relationships between variables. Also, a brief examination of bicycle recovery is included as are suggestions to improve the security and availability of bicycle parking. The paper concludes with recommendations and suggestions for further research.