Road Traffic Injuries on Cycle Tracks: Bloor, Danforth, University, and Yonge Street in Toronto, Ontario, Canada from 2010 to 2022

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# Data

Collision data from 2010 to 2022 provided by the City of Toronto was used to calculate road user injuries for each street and cycling infrastructure type. Open cycling infrastructure data from 2001 to 2022 was downloaded from the City of Toronto’s Open Data Portal[[1]](#footnote-1) in January 2023. The cycling infrastructure data was manually verified, using Google Street View, Google Earth, and grey literature from the internet, for years of installation and upgrades of painted lane and cycle track infrastructure according to the Canadian Bikeway Comfort and Safety (Can-BICS) Classification System (Rothman et al., 2024; Winters et al., 2022). City boundary data was also downloaded and used to ensure that all collision location points were inside the City of Toronto. See Table 1 for a list of data sources and their purpose and time ranges.

Table . Data Sources for the City of Toronto.

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Source** | **Records** | **Time Range** | **Link** |
| All Collisions | 1,355,219 collisions | 2010-2022 | N/A |
| Cycling Network | 1,323 road segments | 2001-2022 | <https://github.com/rrwen/recovr-infracycle/blob/main/data/toronto-bikeways-preprocess-v3.geojson> |
| City Boundary | 1 city boundary | 2019 | <https://open.toronto.ca/dataset/regional-municipal-boundary/> |

# Methodology

The methodology consists of three steps involving data cleaning, spatial data processing, and injury rate calculations shown in Figure 1. The first step involves data cleaning to filter 1,323 road segments in the cycling network data to 16 road segments containing cycle tracks that existed between 2010 and 2022 at Bloor Street, Danforth Street, Danforth Avenue, University Avenue, or Yonge Street. Note that the filtered cycle tracks also contain cycling infrastructure changes throughout 2001 to 2022, such that they may have been upgraded to a cycle track from a road without cycling infrastructure or a road with painted lane infrastructure, during any of these years. The first step also filters the original 1,355,219 collisions to 170,462 collisions with coordinates in Toronto and only involving injured individuals (minimal, minor, major, and fatal), while classifying these injuries as driver-related (drivers and vehicle passengers), cyclist-related (cyclists and cycling passengers), and pedestrian-related. Refer to Table A1 and A2 for a full list of injury and individual involvement types. The next step uses spatial data processing to join 170,462 collisions to the filtered cycle track infrastructure if the collision coordinates are within 25 meters of the cycle tracks, resulting in 5,504 collision coordinates within 25 meters of the cycle tracks. Once the collisions are joined to the cycle tracks, the third step counts the number of injuries by road user, year, and cycling infrastructure types through 2010 to 2022 using the joined collisions. These counts are then used to compute the road user injury rate per kilometer-year for the streets of Bloor Street, Danforth Street/Avenue, University Avenue, and Yonge Street. Danforth Street and Danforth Avenue are treated as a single street for the purpose of these calculations. The road user injuries per kilometer-year for a street and cycling infrastructure type is calculated with Equation 1:

(1)

where is the road user injuries per kilometer-year for a street and cycling infrastructure type, is the number of years in the data, is the number of segments with the infrastructure type, is the total number of road user injuries for a years and segment , and is the length in kilometers of segment for year. The road user injuries per kilometer-year is calculated for every street (Bloor Street, Danforth Street/Avenue, University Avenue, and Yonge Street), infrastructure type (none, painted lane, and cycle track), and road user (driver-related, cyclist-related, and pedestrian-related). R code to reproduce the results of the methodology is available at <https://rrwen.github.io/recovr-eval/archive/collisions-bloorunidanyonge>.

A diagram of a flowchart

Description automatically generated

Figure . Methods for Calculating Injury Rates for Bloor, Danforth, University, and Yonge Streets.

# References

Rothman, L., Samsel, K., Howard, A., Zanotto, M., Winters, M., Hagel, B., Wen, R., & Batomen, B. (2024). *Pedaling forward: The evolution of bicycling infrastructure in 3 Canadian cities from 2010 to 2022*. BMJ Publishing Group Ltd. https://injuryprevention.bmj.com/content/30/Suppl\_1/A72.1.abstract

Winters, M., Beairsto, J., Ferster, C., Laberee, K., Manaugh, K., & Nelson, T. (2022). The Canadian bikeway comfort and safety metrics (CAN-BICS): National measures of the bicycling environment for use in research and policy. *Health Reports*, *33*(10), 3–13.

# Appendix

Table A1. List of Injury Codes and Types from Column “INJURY”.

|  |  |
| --- | --- |
| **Injury Code** | **Injury Type** |
|  | Blank |
| 0 | None |
| 1 | Minimal |
| 2 | Minor |
| 3 | Major |
| 4 | Fatal |

Table A2. List of Codes and Types of Individuals Involved.

|  |  |
| --- | --- |
| **Involvement Code** | **Involvement Type** |
|  | Blank |
| 1 | Driver |
| 2 | Passenger |
| 3 | Pedestrian |
| 4 | Cyclist |
| 5 | Cyclist Passenger |
| 6 | Motorcycle Driver |
| 7 | Motorcycle Passenger |
| 8 | Moped Driver |
| 9 | Moped Passenger |
| 10 | Vehicle Owner |
| 11 | Trailer Owner |
| 12 | Other Property Owner |
| 13 | Witness |
| 14 | Victim |
| 15 | Company |
| 16 | Animal |
| 99 | Other |
| 1A | Unknown - FTR |
| 1B | Runaway - No Driver |

1. https://open.toronto.ca [↑](#footnote-ref-1)