

# Toronto motor vehicle collisions can be reduced by installing more red cameras\*

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## Abstract

Vehicle collisions occur constantly in big cities. They sometimes could be severe issues when resulting in damage in public and personal properties, injuries, or even death. This report aims to investigate the motor vehicle collisions in Toronto that result in injuries or deaths from 2006 to 2020. By exploring the trend of these traffic collisions in respect of number and location, I find that .... Implies that ... The data used in this report is obtained from the City of Toronto Open Data Portal, and .

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\*Code and data are available at: <https://github.com/Alicia-y/Telling-stories-with-data>.

# 1 Introduction

As one of the busiest and most modern city in Canada, Toronto constantly faces a large number of citizens, and, inevitably, heavy traffic. The road condition in Toronto is busy most of the time. The vast majority of roads and buildings under construction that take place almost everywhere narrow the roadway of vehicles and turn off traffic lights. Heavy traffic is likely to be one of the main reasons behind car accidents, because it increases the road rage and encourages the vehicle drivers to make dangerous moves to save time. Vehicle collisions have always brought large financial costs to the involving parties, and even more, they even brought injuries and deaths.

The Motor Vehicle Collisions data of Toronto provides a record of the past severe vehicle collisions in Toronto, and with the help of statistical data analysis, it can possibly offer insights on the ways to reduce this type of accident. This report investigates the motor vehicle collisions in Toronto from 2006 to 2020, with a focus on the ones result in injuries or deaths. In Section 2, the Motor Vehicle Collisions dataset is introduced and organized to visualize and explain the change in the annual number of accidents, and the frequency of the accidents by district and by type.

However, numbers of annual motor vehicle collisions demonstrate a generally descending trend from 2006 to 2020.

You can and should cross-reference sections and sub-sections. For instance, Section 2. R Markdown automatically makes the sections lower case and adds a dash to spaces to generate labels, for instance, Section 5.1.

## 2 Data

To investigate the motor vehicle collisions in Toronto, I obtained the dataset “Motor Vehicle Collisions involving Killed or Seriously Injured Persons” from the Toronto Open Data Portal. Provided by the Toronto Police Service, this dataset includes all vehicle collisions occurred in Toronto between 2006 and 2020 that result in injuries or deaths. It contains 16840 observations of collisions and 54 variables with all kinds of information of each collision. This report focuses on five of these variables which are: year, accident location, district, street1(of the collision occurred), and street2(of the collision occurred). By using R packages “tidyverse” (Wickham et al. 2019a), “janitor” (Firke 2021), “kableExtra” (Zhu 2021) and “knitr” (Yihui Xie 2021), an extract of the dataset (Table 1) is shown below.

Table 1: Extracting the first ten rows from the Motor Vehicle Collisions data

Year	Street1	Street2	Collision location	District
2006	BLOOR ST W	DUNDAS ST W	At Intersection	Toronto and East York
2006	BLOOR ST W	DUNDAS ST W	At Intersection	Toronto and East York
2006	MORNINGSIDE AVE	SHEPPARD AVE E	At Intersection	Scarborough
2006	MORNINGSIDE AVE	SHEPPARD AVE E	At Intersection	Scarborough
2006	EGLINTON AVE E	COMMONWEALTH AVE	NA	Scarborough
2006	EGLINTON AVE E	COMMONWEALTH AVE	NA	Scarborough
2006	EGLINTON AVE E	COMMONWEALTH AVE	NA	Scarborough
2006	OSSINGTON AVE	DUNDAS ST W	At Intersection	Toronto and East York
2006	OSSINGTON AVE	DUNDAS ST W	At Intersection	Toronto and East York
2006	ISLINGTON AVE	DIXON RD	At Intersection	Etobicoke York

Table 1 shows the first ten rows of the Motor Vehicle Collisions data. Variable “Year” indicates the year in which the accident occurs. Variables “Street1” and “Street2” provides the name of the street where the accident takes place. Variable “District” indicates its district. Variable “Collision location” includes 8 types:

at intersection, intersection related, at/near private drive, laneway, non intersection, overpass or bridge, trail, and underpass or tunnel.

I'm interested in finding the trend of motor vehicle collisions from 2006 to 2020. It reveals the traffic control in Toronto, and possibly the quality and knowledge of vehicle owners throughout these years.

```
ggplot(mapping = aes(x = year), data=vehicle_collision) +  
  geom_bar(color="black", fill = "#122451")+theme_light()+ylab("number of motor vehicle collisions")
```

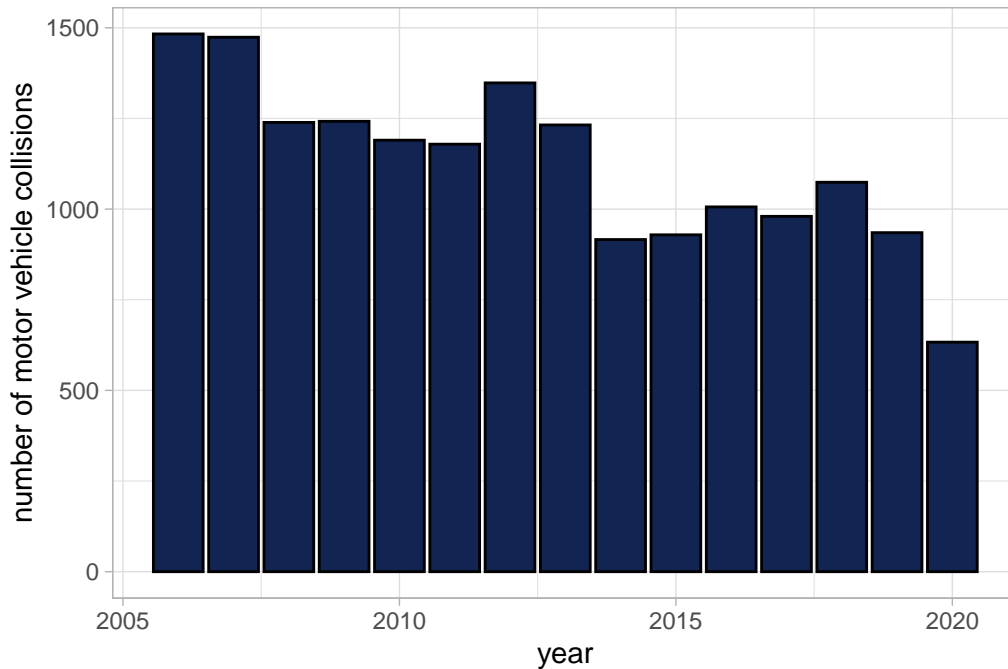


Figure 1: Comparing the number of traffic collisions each year from 2006 to 2020

Data cleaning

```
vehicle_collision <- vehicle_collision %>%  
  drop_na(street1) %>%  
  drop_na(street2) %>%  
  drop_na(accloc) %>%  
  drop_na(district)
```

```
ggplot(mapping = aes(x = year, fill=accloc), data=vehicle_collision) +  
  geom_bar()
```

```
## Warning: It is deprecated to specify `guide = FALSE` to remove a guide. Please  
## use `guide = "none"` instead.
```

Talk more about it.

Also bills and their average (Figure 4). (Notice how you can change the height and width so they don't take the whole page?)

```
## Warning: It is deprecated to specify `guide = FALSE` to remove a guide. Please  
## use `guide = "none"` instead.
```

Talk way more about it.

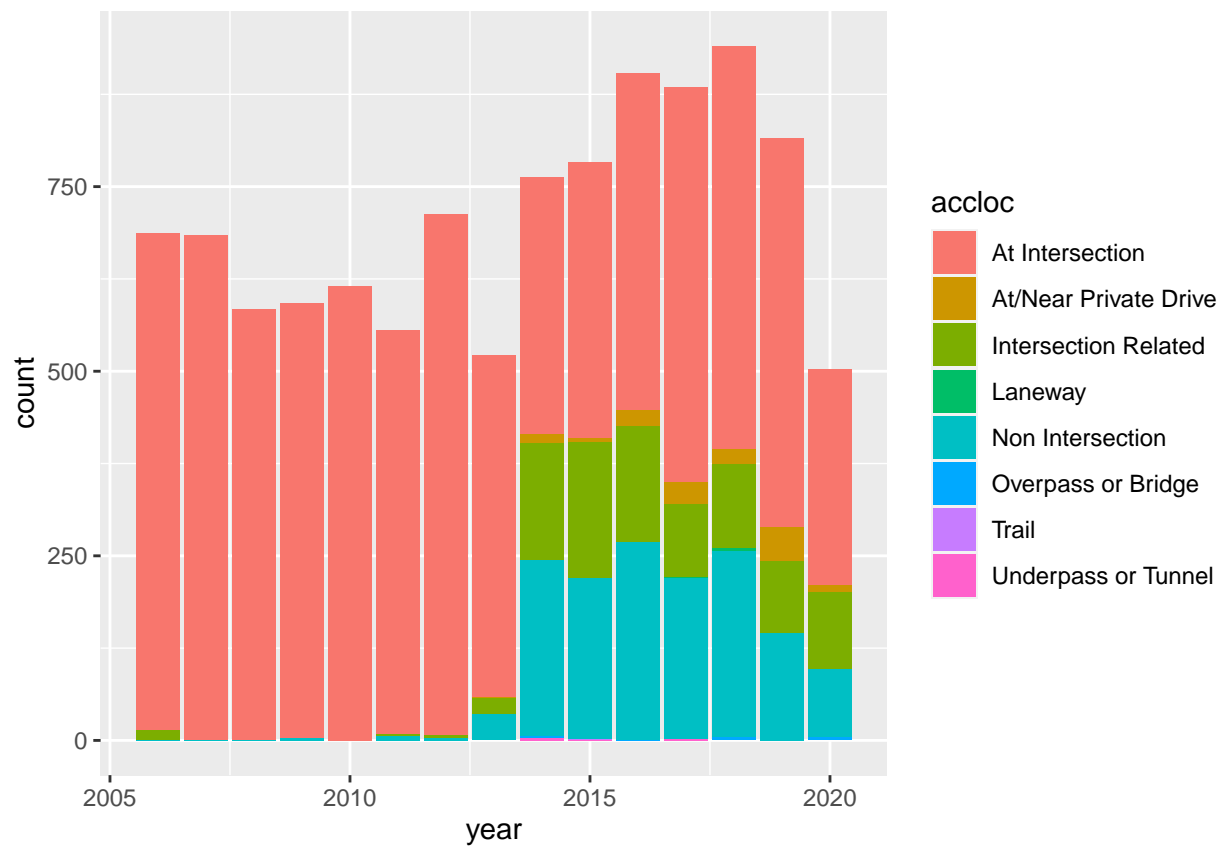


Figure 2: Comparing the location of traffic collisions each year from 2006 to 2020

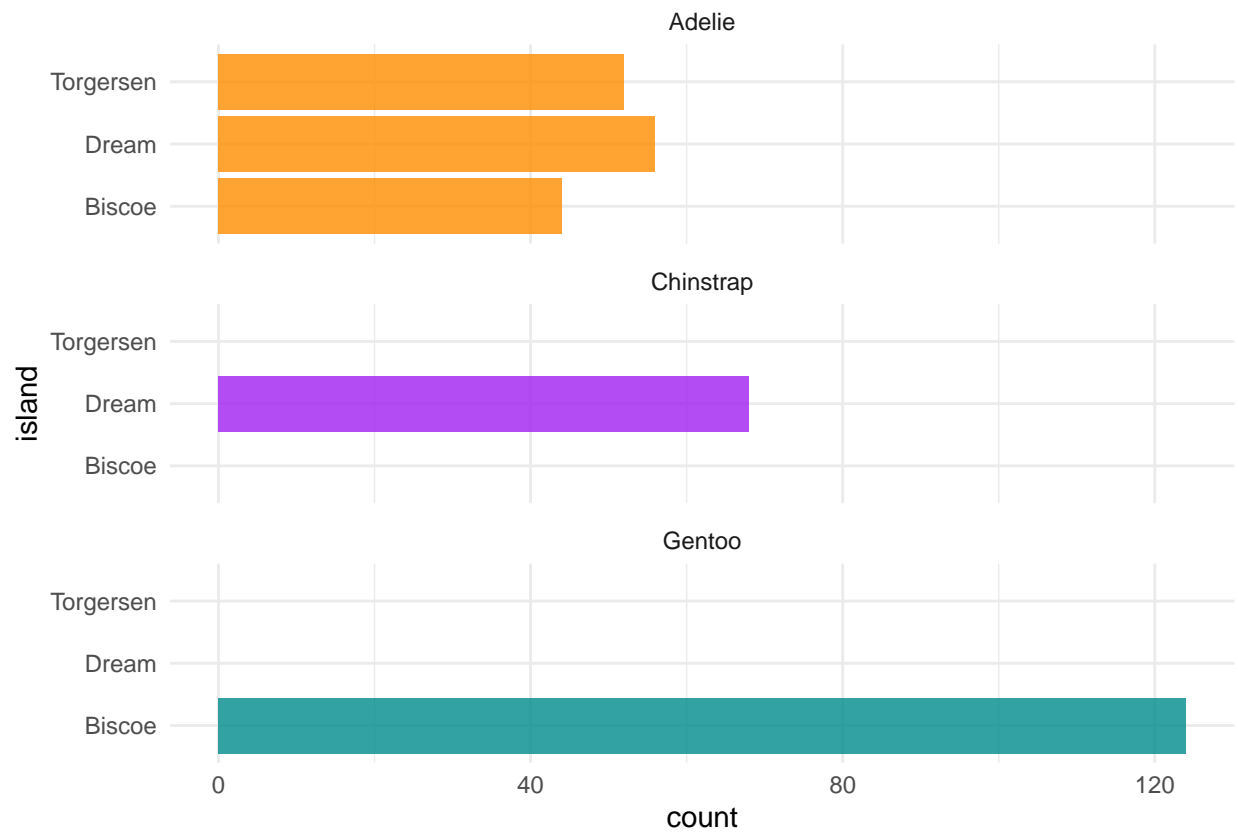


Figure 3: Bills of penguins

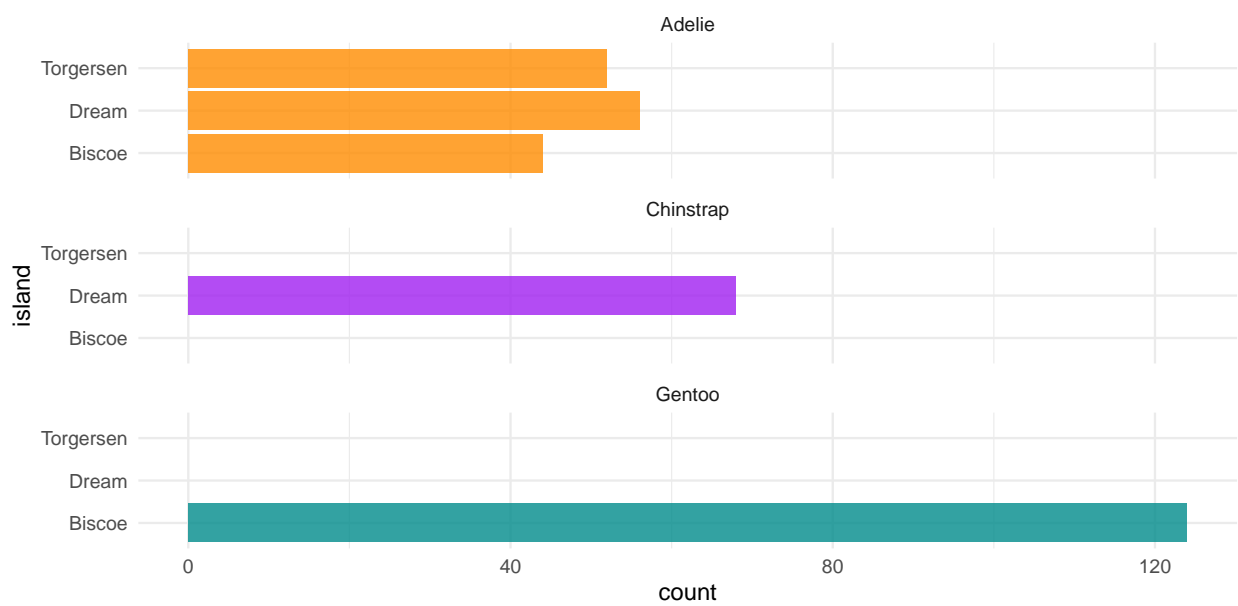


Figure 4: More bills of penguins

### 3 Model

$$Pr(\theta|y) = \frac{Pr(y|\theta)Pr(\theta)}{Pr(y)} \tag{1}$$

Equation (1) seems useful, eh?

Here's a dumb example of how to use some references: In paper we run our analysis in `R` (R Core Team 2020). We also use the `tidyverse` which was written by Wickham et al. (2019b) If we were interested in baseball data then (???) could be useful.

We can use maths by including latex between dollar signs, for instance  $\theta$ .

### 4 Results

### 5 Discussion

#### 5.1 First discussion point

If my paper were 10 pages, then should be at least 2.5 pages. The discussion is a chance to show off what you know and what you learnt from all this.

#### 5.2 Second discussion point

#### 5.3 Third discussion point

#### 5.4 Weaknesses and next steps

Weaknesses and next steps should also be included.

## Appendix

### A Additional details

## B References

Yihui Xie (2021). knitr: A General-Purpose Package for Dynamic Report Generation in R. R package version 1.37.

<https://newcanadianlife.com/why-does-toronto-have-so-much-traffic/>

Firke, Sam. 2021. *Janitor: Simple Tools for Examining and Cleaning Dirty Data*. <https://github.com/sfirke/janitor>.

R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D’Agostino McGowan, Romain François, Garrett Golemund, et al. 2019a. “Welcome to the tidyverse.” *Journal of Open Source Software* 4 (43): 1686. <https://doi.org/10.21105/joss.01686>.

———. 2019b. “Welcome to the tidyverse.” *Journal of Open Source Software* 4 (43): 1686. <https://doi.org/10.21105/joss.01686>.

Zhu, Hao. 2021. *KableExtra: Construct Complex Table with ‘Kable’ and Pipe Syntax*.