Toronto Uber Movement and Transportation Tomorrow Survey (TTS) Datasets

Code

- Show All Code
- Hide All Code
-
- Download Rmd

Toronto Uber Movement and Transportation Tomorrow Survey (TTS) Datasets

Author

- Jordan Bell
- July 24, 2019
- https://jordanbell2357.github.io/TTS.nb.html


```
library(data.table)
library(dplyr)
library(sp)
library(sf)
library(ggplot2)
library(viridisLite)
library(viridis)
```

Uber Movement

Uber Movement

GeoJSON file

toronto_neighbourhoods.json

Dataset for Q2 of 2018

toronto-neighbourhoods-2018-2-All-MonthlyAggregate.csv

```
uber_nbds <- st_read("./toronto_neighbourhoods.json", stringsAsFactors=FALSE)
```

```
Reading layer `toronto_neighbourhoods' from data source `C:\Users\14165\Desktop\github noteb
Simple feature collection with 141 features and 2 fields
geometry type:  MULTIPOLYGON
dimension:      XY
bbox:           xmin: -79.63926 ymin: 43.581 xmax: -79.11524 ymax: 43.85546
epsg (SRID):    4326
proj4string:    +proj=longlat +datum=WGS84 +no_defs
```

```
str(uber_nbds)
```

```
Classes 'sf' and 'data.frame':  141 obs. of  3 variables:
 $ MOVEMENT_ID : chr  "1" "2" "3" "4" ...
 $ DISPLAY_NAME: chr  "York University Busway, York University Heights, North York, Toronto'
 $ geometry    :sfc_MULTIPOLYGON of length 141; first list element: List of 1
  ..$ :List of 1
  .. ..$ : num [1:530, 1:2] -79.5 -79.5 -79.5 -79.5 -79.5 ...
  ..- attr(*, "class")= chr  "XY" "MULTIPOLYGON" "sfg"
 - attr(*, "sf_column")= chr "geometry"
 - attr(*, "agr")= Factor w/ 3 levels "constant","aggregate",..: NA NA
  ..- attr(*, "names")= chr  "MOVEMENT_ID" "DISPLAY_NAME"
```

```
uber_nbds$ID <- as.integer(uber_nbds$MOVEMENT_ID)
```

```
uber_nbds$DISPLAY_NAME
```

```
  [1] "York University Busway, York University Heights, North York, Toronto"
  [2] "0 Hambly Avenue, The Beach, Old Toronto, Toronto"
  [3] "3400 Kingston Road, Scarborough Village, Scarborough, Toronto"
  [4] "100 Dunn Avenue, Parkdale, Old Toronto, Toronto"
  [5] "0 Carlaw Avenue, Leslieville, Old Toronto, Toronto"
  [6] "0 Acheson Boulevard, Port Union, Scarborough, Toronto"
  [7] "2800 Kingston Road, Cliffcrest, Scarborough, Toronto"
  [8] "0 Guildwood Parkway, Guildwood, Scarborough, Toronto"
  [9] "0 Avenue of the Island, Old Toronto, Toronto"
 [10] "4200 Lawrence Avenue East, West Hill, Scarborough, Toronto"
 [11] "400 Grandstand Entrance Road, Rexdale, Etobicoke, Toronto"
 [12] "100 Isabella Street, Downtown, Old Toronto, Toronto"
```

```
[13] "0 Rangoon Road, Eringate - Centennial - West Deane, Etobicoke, Toronto"
[14] "0 Duncairn Road, Don Mills, North York, Toronto"
[15] "0 McIntosh Street, Cliffside, Scarborough, Toronto"
[16] "300 Old Finch Avenue, Rouge, Scarborough, Toronto"
[17] "100 Fairlawn Avenue, Bedford Park, Old Toronto, Toronto"
[18] "100 Lascelles Boulevard, Midtown Toronto, Old Toronto, Toronto"
[19] "0 Station Road, Mimico, Etobicoke, Toronto"
[20] "100 Augusta Avenue, Downtown, Old Toronto, Toronto"
[21] "0 Norwood Road, Upper Beaches, Old Toronto, Toronto"
[22] "0 Pondsview Drive, Pleasant View, North York, Toronto"
[23] "500 Manning Avenue, Palmerston, Old Toronto, Toronto"
[24] "0 Brushwood Court, Parkwoods - Donalda, North York, Toronto"
[25] "0 Dolly Varden Boulevard, Woburn, Scarborough, Toronto"
[26] "0 Balmoral Avenue, Midtown Toronto, Old Toronto, Toronto"
[27] "0 Eaton Avenue, Riverdale, Old Toronto, Toronto"
[28] "0 Liscombe Road, Rustic, North York, Toronto"
[29] "0 Massey Square, Old East York, East York, Toronto"
[30] "0 Carlton Street, Downtown, Old Toronto, Toronto"
[31] "100 Wareside Road, Etobicoke West Mall, Etobicoke, Toronto"
[32] "1000 Dundas Street West, Trinity - Bellwoods, Old Toronto, Toronto"
[33] "0 Lappin Avenue, Wallace Emerson, Old Toronto, Toronto"
[34] "0 Ashbury Avenue, Oakwood Village, York, Toronto"
[35] "100 Rockwell Avenue, Earlscourt, Old Toronto, Toronto"
[36] "300 Horsham Avenue, Willowdale, North York, Toronto"
[37] "100 Eighth Street, New Toronto, Etobicoke, Toronto"
[38] "200 Lumsden Avenue, Woodbine - Lumsden, East York, Toronto"
[39] "100 Glengrove Avenue West, Midtown Toronto, Old Toronto, Toronto"
[40] "0 Densley Avenue, Brookhaven - Amesbury, North York, Toronto"
[41] "200 Saint Clarens Avenue, Brockton Village, Old Toronto, Toronto"
[42] "0 Erie Street, Maple Leaf, North York, Toronto"
[43] "1700 Gerrard Street East, Beach Hill, Old Toronto, Toronto"
[44] "200 Johnston Avenue, Lansing, North York, Toronto"
[45] "0 Apex Road, Yorkdale, North York, Toronto"
[46] "Mimico Creek Trail, Etobicoke, Toronto"
[47] "0 Navenby Crescent, Humber Summit, North York, Toronto"
[48] "0 Grenoble Drive, Flemingdon Park, North York, Toronto"
[49] "300 Bay Mills Boulevard, Tam O'Shanter, Scarborough, Toronto"
[50] "0 Ionview Road, Ionview, Scarborough, Toronto"
[51] "0 Allcroft Drive, Rexdale, Etobicoke, Toronto"
[52] "0 West Toronto Street, The Junction, York, Toronto"
[53] "100 Thorncliffe Park Drive, Thorncliffe Park, East York, Toronto"
[54] "500 Mortimer Avenue, Woodbine Heights, East York, Toronto"
[55] "0 Strathearn Road, Midtown Toronto, York, Toronto"
[56] "5300 Dundas Street West, Islington - City Centre West, Etobicoke, Toronto"
[57] "0 Chieftain Crescent, St. Andrew - Windfields, North York, Toronto"
[58] "0 Habitant Drive, Emery, North York, Toronto"
```

```
 [59] "0 Cosburn Avenue, Old East York, East York, Toronto"
 [60] "0 Leagrove Crescent, Clairlea, Scarborough, Toronto"
 [61] "200 Linden Avenue, Kennedy Park, Scarborough, Toronto"
 [62] "0 Nairn Avenue, Earlscourt, York, Toronto"
 [63] "0 Abinger Crescent, Princess - Rosethorn, Etobicoke, Toronto"
 [64] "500 Spadina Road, Midtown Toronto, Old Toronto, Toronto"
 [65] "0 Sparkhall Avenue, Riverdale, Old Toronto, Toronto"
 [66] "600 Roselawn Avenue, Midtown Toronto, Old Toronto, Toronto"
 [67] "100 Donald Avenue, Silverthorn, York, Toronto"
 [68] "100 Eddystone Avenue, Jane and Finch, North York, Toronto"
 [69] "100 Torbrick Road, East Danforth, Old Toronto, Toronto"
 [70] "1700 Eglinton Avenue East, North York, Toronto"
 [71] "0 Corwin Crescent, Wilson Heights, North York, Toronto"
 [72] "Finch Corridor Recreational Trail, Newtonbrook, North York, Toronto"
 [73] "0 Maple Branch Path, Kingsview Village, Etobicoke, Toronto"
 [74] "0 Beardmore Crescent, Newtonbrook, North York, Toronto"
 [75] "0 Glenfield Crescent, Woodbine Gardens, East York, Toronto"
 [76] "0 Evelyn Avenue, High Park North, Old Toronto, Toronto"
 [77] "0 Four Oaks Gate, Old East York, East York, Toronto"
 [78] "200 Russell Hill Road, Midtown Toronto, Old Toronto, Toronto"
 [79] "0 Queen Marys Drive, The Kingsway, Etobicoke, Toronto"
 [80] "500 Windermere Avenue, Runnymede, Old Toronto, Toronto"
 [81] "100 Parkway Forest Drive, Henry Farm, North York, Toronto"
 [82] "100 Hazelton Avenue, Midtown Toronto, Old Toronto, Toronto"
 [83] "0 Chudleigh Road, Fairbank, York, Toronto"
 [84] "0 Fabian Place, Humber Heights - Westmount, Etobicoke, Toronto"
 [85] "100 Sorauren Avenue, Parkdale, Old Toronto, Toronto"
 [86] "Wyatt Avenue, Downtown, Old Toronto, Toronto"
 [87] "100 Saint George Street, University, Old Toronto, Toronto"
 [88] "0 Loganberry Crescent, Hillcrest Village, North York, Toronto"
 [89] "0 Emmett Avenue, Mount Dennis, York, Toronto"
 [90] "1400 Kennedy Road, Dorset Park, Scarborough, Toronto"
 [91] "0 Darlingbrook Crescent, Edenbridge - Humber Valley, Etobicoke, Toronto"
 [92] "300 Connaught Avenue, Newtonbrook, North York, Toronto"
 [93] "0 East Liberty Street, Liberty Village, Old Toronto, Toronto"
 [94] "400 Todd Baylis Boulevard, Beechborough - Greenbrook, North York, Toronto"
 [95] "200 Ellis Avenue, Swansea, Old Toronto, Toronto"
 [96] "400 Jones Avenue, Riverdale, Old Toronto, Toronto"
 [97] "0 Calverley Trail, Highland Creek, Scarborough, Toronto"
 [98] "5000 Finch Avenue East, Agincourt, Scarborough, Toronto"
 [99] "100 Newport Avenue, Oakridge, Scarborough, Toronto"
[100] "0 Scholfield Avenue, Midtown Toronto, Old Toronto, Toronto"
[101] "1900 Lawrence Avenue East, Wexford, Scarborough, Toronto"
[102] "2500 Midland Avenue, Agincourt, Scarborough, Toronto"
[103] "0 Trudelle Street, Eglinton East, Scarborough, Toronto"
[104] "0 Briarglen Court, Bridlewood, Scarborough, Toronto"
```

```
[105] "0 Cove Drive, Rexdale, Etobicoke, Toronto"
[106] "0 Ridgevale Drive, Englemount - Lawrence, North York, Toronto"
[107] "100 Wilmington Avenue, Bathurst Manor, North York, Toronto"
[108] "400 Rimilton Avenue, Alderwood, Etobicoke, Toronto"
[109] "1200 Brimley Road, Bendale, Scarborough, Toronto"
[110] "0 Genthorn Avenue, Rexdale, Etobicoke, Toronto"
[111] "100 Garratt Boulevard, Downsview, North York, Toronto"
[112] "0 Raymond Avenue, Lambton Baby Point, York, Toronto"
[113] "Saint Basil Lane, Bay Cloverhill, Old Toronto, Toronto"
[114] "0 Secroft Crescent, Black Creek, North York, Toronto"
[115] "200 Princess Avenue, Willowdale, North York, Toronto"
[116] "0 Silverstone Drive, Rexdale, Etobicoke, Toronto"
[117] "300 Passmore Avenue, Armdale, Scarborough, Toronto"
[118] "Yen Lane, Downtown, Old Toronto, Toronto"
[119] "0 Forman Avenue, Midtown Toronto, Old Toronto, Toronto"
[120] "0 Belsize Drive, Midtown Toronto, Old Toronto, Toronto"
[121] "0 Wallasey Avenue, Humberlea, North York, Toronto"
[122] "0 Playter Boulevard, The Danforth, Old Toronto, Toronto"
[123] "0 Callowhill Drive, Richview, Etobicoke, Toronto"
[124] "0 Tally Lane, Bayview Village, North York, Toronto"
[125] "300 Brooke Avenue, Nortown, North York, Toronto"
[126] "0 Goodview Road, Don Valley Village, North York, Toronto"
[127] "400 Rockcliffe Boulevard, Rockcliffe - Smythe, York, Toronto"
[128] "200 Queen Street East, Downtown, Old Toronto, Toronto"
[129] "0 Braemore Gardens, Midtown Toronto, Old Toronto, Toronto"
[130] "400 Lawrence Avenue East, Scarborough, Toronto"
[131] "0 Macdonald Avenue, Weston, York, Toronto"
[132] "100 Gladstone Avenue, Little Portugal, Old Toronto, Toronto"
[133] "0 Ash Crescent, Long Branch, Etobicoke, Toronto"
[134] "100 Wedgewood Drive, Newtonbrook, North York, Toronto"
[135] "100 Mammoth Hall Trail, Malvern, Scarborough, Toronto"
[136] "200 Mill Road, Markland Wood, Etobicoke, Toronto"
[137] "0 Treerun Avenue, Milliken, Scarborough, Toronto"
[138] "0 Livonia Place, Morningside, Scarborough, Toronto"
[139] "0 Rolph Road, Leaside, East York, Toronto"
[140] "900 York Beltline Trail, Briar Hill - Belgravia, York, Toronto"
[141] "Water's Edge Promenade, Downtown, Old Toronto, Toronto"
```

Bay Street Corridor

Bay Street Corridor is City of Toronto Neighbourhood 76. This is Uber Neighbourhood 113. We hold fixed this neighbourhood and examine travel times whose destination is to this neighbourhood.

```
uber_movement <- fread("toronto-neighbourhoods-2018-2-All-MonthlyAggregate.csv")
```

```
str(uber_movement)
```

```
Classes ‘data.table’ and 'data.frame':  54366 obs. of  7 variables:
 $ sourceid                              : int  3 135 15 18 53 14 46 16 130 51 ...
 $ dstid                                 : int  65 21 130 100 11 140 4 120 123 31 ...
 $ month                                 : int  5 5 5 5 5 5 5 5 5 5 ...
 $ mean_travel_time                      : num  1675 1861 1778 467 2087 ...
 $ standard_deviation_travel_time        : num  388 424 413 288 800 ...
 $ geometric_mean_travel_time            : num  1635 1815 1732 379 1984 ...
 $ geometric_standard_deviation_travel_time: num  1.24 1.25 1.26 2.02 1.35 1.42 1.66 1.35 1.
 - attr(*, ".internal.selfref")=<externalptr>
```

Introduction to data.table

```
uber_source_113 <- uber_movement[dstid == 113, .(MEAN_TRIP_DURATION = mean(mean_travel_time)
```

```
str(uber_source_113)
```

```
Classes ‘data.table’ and 'data.frame':  141 obs. of  2 variables:
 $ ID                : int  131 68 54 109 105 4 119 51 110 88 ...
 $ MEAN_TRIP_DURATION: num  2260 2583 1163 1880 1927 ...
 - attr(*, ".internal.selfref")=<externalptr>
```

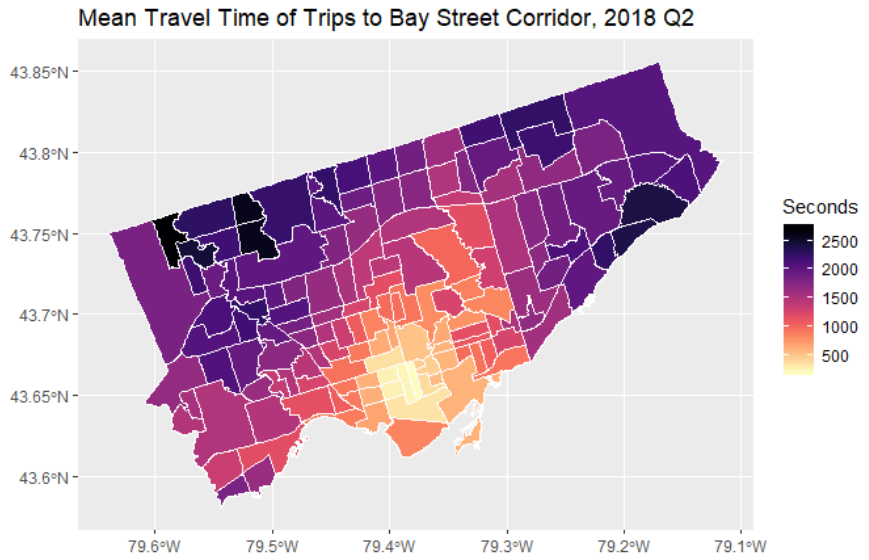
Robin Lovelace, Jakub Nowosad, and Jannes Muenchow, Geocomputation with R. Chapter 3: Attribute data operations

```
uber_source_113_nbds <- left_join(uber_nbds, uber_source_113, by = "ID")
```

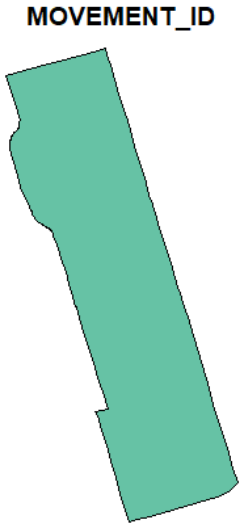
```
str(uber_source_113_nbds)
```

```
Classes ‘sf’ and 'data.frame':  141 obs. of  5 variables:
 $ MOVEMENT_ID       : chr  "1" "2" "3" "4" ...
 $ DISPLAY_NAME      : chr  "York University Busway, York University Heights, North York, To
 $ ID                : int  1 2 3 4 5 6 7 8 9 10 ...
 $ MEAN_TRIP_DURATION: num  2235 941 2259 899 612 ...
 $ geometry          :sfc_MULTIPOLYGON of length 141; first list element: List of 1
  ..$ :List of 1
  .. ..$ : num [1:530, 1:2] -79.5 -79.5 -79.5 -79.5 -79.5 ...
  ..- attr(*, "class")= chr  "XY" "MULTIPOLYGON" "sfg"
 - attr(*, "sf_column")= chr "geometry"
 - attr(*, "agr")= Factor w/ 3 levels "constant","aggregate",..: NA NA NA NA
  ..- attr(*, "names")= chr  "MOVEMENT_ID" "DISPLAY_NAME" "ID" "MEAN_TRIP_DURATION"
```

```
ggplot(uber_source_113_nbds) +
   geom_sf(aes(fill = MEAN_TRIP_DURATION), color = "white") +
  labs(title = "Mean Travel Time of Trips to Bay Street Corridor, 2018 Q2") +
  scale_fill_viridis(option="magma", name="Seconds", direction=-1)
```




```
plot(uber_nbds[113,1])
```



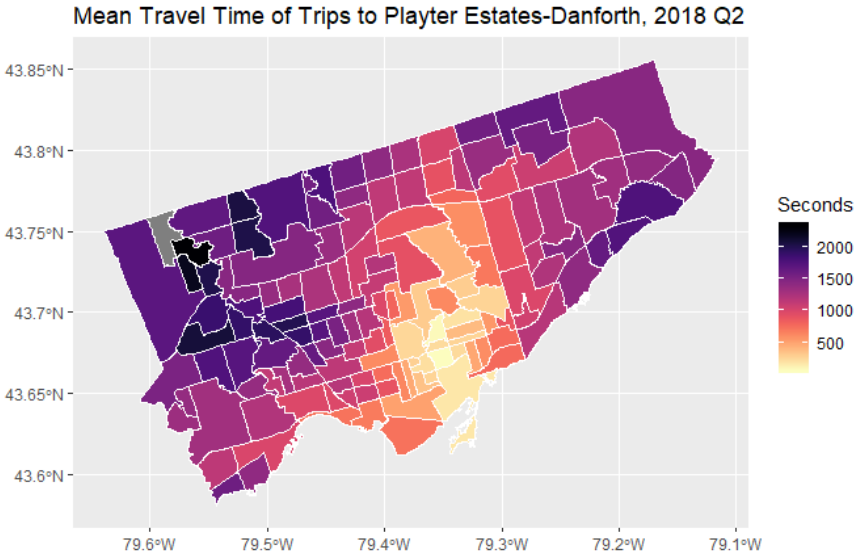
Playter Estates-Danforth

Playter Estates-Danforth is City of Toronto Neighbourhood 67 and Uber Movement Neighbourhood 122.

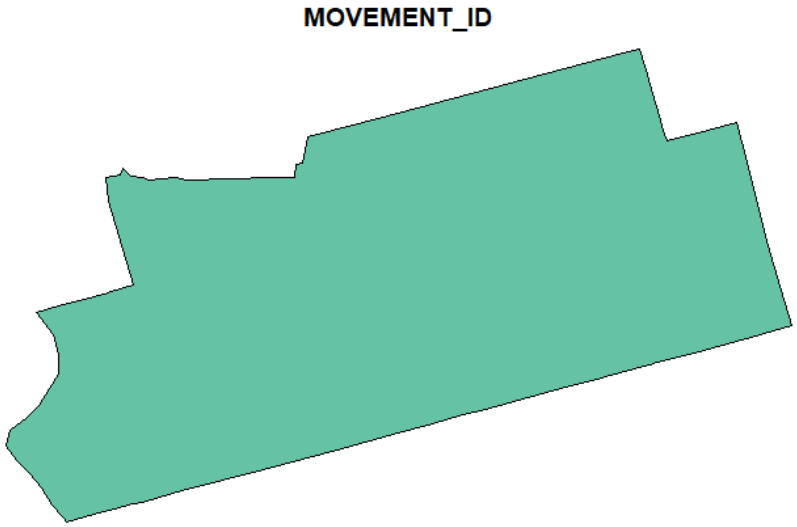
```
uber_source_122 <- uber_movement[dstid == 122, .(MEAN_TRIP_DURATION = mean(mean_travel_time)
```

```r
uber_source_122_nbds <- left_join(uber_nbds, uber_source_122, by = "ID")

ggplot(uber_source_122_nbds) +
   geom_sf(aes(fill = MEAN_TRIP_DURATION), color = "white") +
  labs(title = "Mean Travel Time of Trips to Playter Estates-Danforth, 2018 Q2") +
  scale_fill_viridis(option="magma", name="Seconds", direction=-1)
```




```r
plot(uber_nbds[122,1])
```



TTS 2016

Data Management Group, University of Toronto Transportation Research Institute

2016 TTS, City of Toronto: http://www.dmg.utoronto.ca/csv/tts/tts2016_ward_Toronto.csv

Government of Ontario, Transportation Tomorrow historical survey data

tts_dataset.zip

1986 TTS, 1991 TTS, 1996 TTS, 2001 TTS, 2006 TTS, 2011 TTS, 2016 TTS

Data Manipulation and Variable Selection

```
TTS2016_csv <- fread("tts2016_ward_Toronto.csv")
```

```
str(TTS2016_csv)
```

```
Classes 'data.table' and 'data.frame':  419 obs. of  46 variables:
 $ Region : chr  "Total Number of households" "Number of houses" "Number of apartments" "Num
 $ Toronto: chr  "1112970" "343197" "704502" "65271" ...
 $ Ward 1 : chr  "17876" "5607" "10049" "2220" ...
 $ Ward 2 : chr  "20025" "8047" "10628" "1350" ...
 $ Ward 3 : chr  "20081" "10098" "8798" "1185" ...
 $ Ward 4 : chr  "21460" "10060" "10716" "684" ...
 $ Ward 5 : chr  "30650" "11774" "17741" "1135" ...
 $ Ward 6 : chr  "32584" "9256" "21946" "1382" ...
 $ Ward 7 : chr  "17181" "7190" "8713" "1278" ...
 $ Ward 8 : chr  "17926" "3614" "11596" "2716" ...
 $ Ward 9 : chr  "16466" "7321" "8449" "696" ...
 $ Ward 10: chr  "25736" "7386" "17803" "547" ...
 $ Ward 11: chr  "24924" "8551" "15243" "1130" ...
 $ Ward 12: chr  "21407" "7825" "13394" "188" ...
 $ Ward 13: chr  "26523" "9023" "16673" "827" ...
 $ Ward 14: chr  "25279" "3928" "20494" "857" ...
 $ Ward 15: chr  "23780" "7706" "15123" "951" ...
 $ Ward 16: chr  "21412" "11570" "9685" "157" ...
 $ Ward 17: chr  "17706" "8982" "7562" "1162" ...
 $ Ward 18: chr  "22614" "3417" "17795" "1402" ...
 $ Ward 19: chr  "33809" "4736" "26232" "2841" ...
 $ Ward 20: chr  "52384" "2269" "48583" "1532" ...
 $ Ward 21: chr  "22825" "6566" "15619" "640" ...
 $ Ward 22: chr  "36313" "7100" "28551" "662" ...
 $ Ward 23: chr  "42571" "9863" "30910" "1798" ...
 $ Ward 24: chr  "25796" "9136" "15058" "1602" ...
 $ Ward 25: chr  "24009" "12025" "10868" "1116" ...
```

```
 $ Ward 26: chr  "25593" "4372" "20390" "831" ...
 $ Ward 27: chr  "51060" "3397" "46278" "1385" ...
 $ Ward 28: chr  "41607" "1137" "38415" "2055" ...
 $ Ward 29: chr  "20537" "9094" "11199" "244" ...
 $ Ward 30: chr  "24213" "8069" "13558" "2586" ...
 $ Ward 31: chr  "21776" "9248" "12010" "518" ...
 $ Ward 32: chr  "24770" "10873" "12474" "1423" ...
 $ Ward 33: chr  "22817" "6132" "13936" "2749" ...
 $ Ward 34: chr  "23338" "5986" "15192" "2160" ...
 $ Ward 35: chr  "23976" "7963" "14257" "1756" ...
 $ Ward 36: chr  "21169" "9972" "10387" "810" ...
 $ Ward 37: chr  "23052" "10278" "11361" "1413" ...
 $ Ward 38: chr  "24574" "7689" "15961" "924" ...
 $ Ward 39: chr  "16945" "6649" "8106" "2190" ...
 $ Ward 40: chr  "25342" "6857" "15741" "2744" ...
 $ Ward 41: chr  "19253" "10855" "5991" "2407" ...
 $ Ward 42: chr  "22136" "10218" "6923" "4995" ...
 $ Ward 43: chr  "19469" "7160" "10705" "1604" ...
 $ Ward 44: chr  "20009" "14199" "3390" "2420" ...
 - attr(*, ".internal.selfref")=<externalptr>
```

- [55] "Total Number of persons"
- [79] "Number of persons without a driver's licence"
- [80] "Number of persons with a driver's licence"
- [84] "Number of persons with a TTC metro pass"
- [85] "Number of persons without any transit pass"
- [147] "Total number of trips made by residents in 24-hour"
- [156] "Number of trips by residents by walk mode in 24-hour"
- [157] "Number of trips by residents by bicycle in 24-hour"
- [416] "Number of transit trips made by residents with TTC Subway/RT"
- [417] "Number of transit trips made by residents with TTC Bus/Streetcar"

```
TTS2016_selected <- TTS2016_csv[c(55,79,80,84,85,147,156,157,416,417),]

TTS2016_transpose <- transpose(TTS2016_selected)

v <- as.vector(as.matrix(TTS2016_transpose)[1,])

str(v)
```

```
 chr [1:10] "Total Number of persons" "Number of persons without a driver's licence" ...
```

```
TTS2016_table <- TTS2016_transpose[-c(1:2),]

colnames(TTS2016_table) <- v

TTS2016_df <- as.data.frame(TTS2016_table)

for (y in v){
  TTS2016_df[,y] <- as.numeric(TTS2016_df[, y])
}

str(TTS2016_df)
```

```
'data.frame':   44 obs. of  10 variables:
 $ Total Number of persons                                          : num  58143 57366 52165
 $ Number of persons without a driver's licence                     : num  25473 22845 15209
 $ Number of persons with a driver's licence                        : num  31764 33277 36399
 $ Number of persons with a TTC metro pass                          : num  5584 4608 3764 556
 $ Number of persons without any transit pass                       : num  47216 45986 44290
 $ Total number of trips made by residents in 24-hour               : num  89018 100340 11073
 $ Number of trips by residents by walk mode in 24-hour             : num  10159 4003 5242 38
 $ Number of trips by residents by bicycle in 24-hour               : num  242 265 850 665 16
 $ Number of transit trips made by residents with TTC Subway/RT     : num  6468 7344 11422 12
 $ Number of transit trips made by residents with TTC Bus/Streetcar: num  16396 17390 14248
```

```
TTS2016_df$SCODE_NAME <- c(1:44)

str(TTS2016_df)
```

```
'data.frame':   44 obs. of  11 variables:
 $ Total Number of persons                                          : num  58143 57366 52165
 $ Number of persons without a driver's licence                     : num  25473 22845 15209
 $ Number of persons with a driver's licence                        : num  31764 33277 36399
 $ Number of persons with a TTC metro pass                          : num  5584 4608 3764 556
 $ Number of persons without any transit pass                       : num  47216 45986 44290
 $ Total number of trips made by residents in 24-hour               : num  89018 100340 11073
 $ Number of trips by residents by walk mode in 24-hour             : num  10159 4003 5242 38
 $ Number of trips by residents by bicycle in 24-hour               : num  242 265 850 665 16
 $ Number of transit trips made by residents with TTC Subway/RT     : num  6468 7344 11422 12
 $ Number of transit trips made by residents with TTC Bus/Streetcar: num  16396 17390 14248
 $ SCODE_NAME                                                       : int  1 2 3 4 5 6 7 8 9
```

```
TTS2016_df$TRIPS_PER_DAY <- TTS2016_df$`Total number of trips made by residents in 24-hour`/
  TTS2016_df$`Total Number of persons`

TTS2016_df$DRIVERS_LICENCE <- TTS2016_df$`Number of persons with a driver's licence`/
  TTS2016_df$`Total Number of persons`
```

```
TTS2016_df$TTC_PASS <- TTS2016_df$`Number of persons with a TTC metro pass`/
  TTS2016_df$`Total Number of persons`

TTS2016_df$WALKS_PER_DAY <- TTS2016_df$`Number of trips by residents by walk mode in 24-hour
  TTS2016_df$`Total Number of persons`

TTS2016_df$BIKES_PER_DAY <- TTS2016_df$`Number of trips by residents by bicycle in 24-hour`/
  TTS2016_df$`Total Number of persons`
```

Plotting by Wards

City of Toronto Wards

```
wards <- st_read("C:/Users/14165/Desktop/Shapefiles/May2010_WGS84/icitw_wgs84.shp", stringsA
```

```
Reading layer `icitw_wgs84' from data source `C:\Users\14165\Desktop\Shapefiles\May2010_WGS8
Simple feature collection with 44 features and 10 fields
geometry type:  POLYGON
dimension:      XY
bbox:           xmin: -79.63927 ymin: 43.58101 xmax: -79.11525 ymax: 43.85547
epsg (SRID):    4326
proj4string:    +proj=longlat +datum=WGS84 +no_defs
```

```
str(wards)
```

```
Classes ‘sf’ and 'data.frame':  44 obs. of  11 variables:
 $ GEO_ID    : int  14630026 14630028 14630024 14630027 14630035 14630029 14630036 14630037
 $ CREATE_ID : int  63519 63519 63519 63519 63519 63519 63519 63519 63519 63519 ...
 $ NAME      : chr  "Scarborough-Rouge River (41)" "Scarborough East (44)" "Scarborough-Roug
 $ SCODE_NAME: chr  "41" "44" "42" "39" ...
 $ LCODE_NAME: chr  "EA41" "EA44" "EA42" "EA39" ...
 $ TYPE_DESC : chr  "Ward" "Ward" "Ward" "Ward" ...
 $ TYPE_CODE : chr  "CITW" "CITW" "CITW" "CITW" ...
 $ OBJECTID  : int  1 2 3 4 5 6 7 8 9 10 ...
 $ SHAPE_AREA: num  0 0 0 0 0 0 0 0 0 0 ...
 $ SHAPE_LEN : num  0 0 0 0 0 0 0 0 0 0 ...
 $ geometry  :sfc_POLYGON of length 44; first list element: List of 1
  ..$ : num [1:410, 1:2] -79.3 -79.3 -79.3 -79.3 -79.3 ...
  ..- attr(*, "class")= chr  "XY" "POLYGON" "sfg"
 - attr(*, "sf_column")= chr "geometry"
 - attr(*, "agr")= Factor w/ 3 levels "constant","aggregate",..: NA NA NA NA NA NA NA NA NA
  ..- attr(*, "names")= chr  "GEO_ID" "CREATE_ID" "NAME" "SCODE_NAME" ...
```

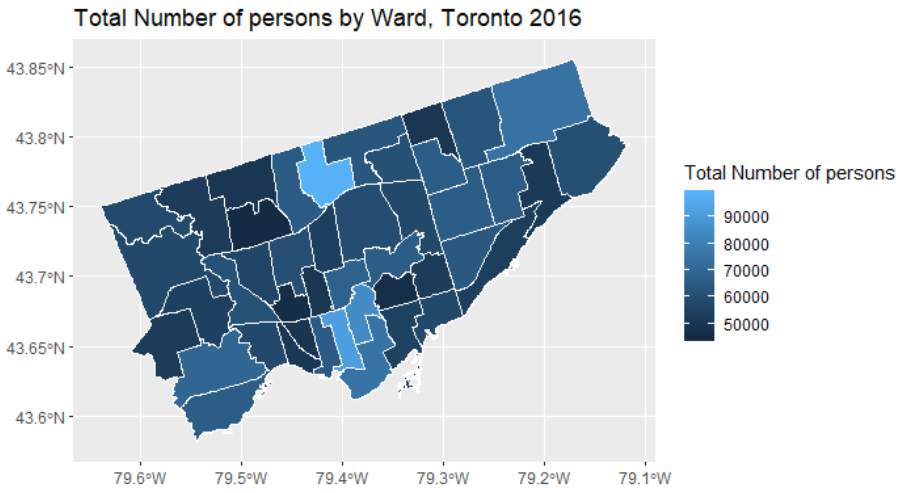
```
wards$SCODE_NAME <- as.integer(wards$SCODE_NAME)
```

```
TTS2016_wards <- left_join(wards, TTS2016_df, by = "SCODE_NAME")
```

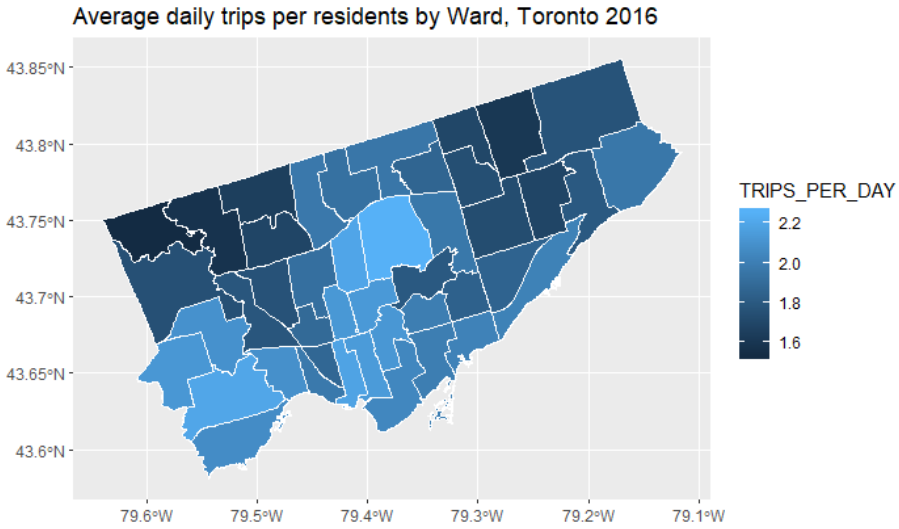
```
str(TTS2016_wards)
```

```
Classes ‘sf’ and 'data.frame':  44 obs. of  26 variables:
 $ GEO_ID                                                          : int  14630026 14630028
 $ CREATE_ID                                                       : int  63519 63519 63519
 $ NAME                                                            : chr  "Scarborough-Rouge
 $ SCODE_NAME                                                      : int  41 44 42 39 24 40
 $ LCODE_NAME                                                      : chr  "EA41" "EA44" "EA4
 $ TYPE_DESC                                                       : chr  "Ward" "Ward" "War
 $ TYPE_CODE                                                       : chr  "CITW" "CITW" "CIT
 $ OBJECTID                                                        : int  1 2 3 4 5 6 7 8 9
 $ SHAPE_AREA                                                      : num  0 0 0 0 0 0 0 0 0
 $ SHAPE_LEN                                                       : num  0 0 0 0 0 0 0 0 0
 $ Total Number of persons                                         : num  62727 60284 74745
 $ Number of persons without a driver's licence                    : num  22154 19940 29530
 $ Number of persons with a driver's licence                       : num  38138 39345 43774
 $ Number of persons with a TTC metro pass                         : num  5506 4224 7331 457
 $ Number of persons without any transit pass                      : num  51887 46662 61305
 $ Total number of trips made by residents in 24-hour              : num  100898 118075 1319
 $ Number of trips by residents by walk mode in 24-hour            : num  6792 6594 7408 611
 $ Number of trips by residents by bicycle in 24-hour              : num  487 438 365 518 68
 $ Number of transit trips made by residents with TTC Subway/RT    : num  9317 6974 10692 78
 $ Number of transit trips made by residents with TTC Bus/Streetcar: num  18141 15936 25233
 $ TRIPS_PER_DAY                                                   : num  1.61 1.96 1.77 1.7
 $ DRIVERS_LICENCE                                                 : num  0.608 0.653 0.586
 $ TTC_PASS                                                        : num  0.0878 0.0701 0.09
 $ WALKS_PER_DAY                                                   : num  0.1083 0.1094 0.09
 $ BIKES_PER_DAY                                                   : num  0.00776 0.00727 0.
 $ geometry                                                        :sfc_POLYGON of length 44
  ..$ : num [1:410, 1:2] -79.3 -79.3 -79.3 -79.3 -79.3 ...
  ..- attr(*, "class")= chr  "XY" "POLYGON" "sfg"
 - attr(*, "sf_column")= chr "geometry"
 - attr(*, "agr")= Factor w/ 3 levels "constant","aggregate",..: NA NA NA NA NA NA NA NA NA
  ..- attr(*, "names")= chr  "GEO_ID" "CREATE_ID" "NAME" "SCODE_NAME" ...
```

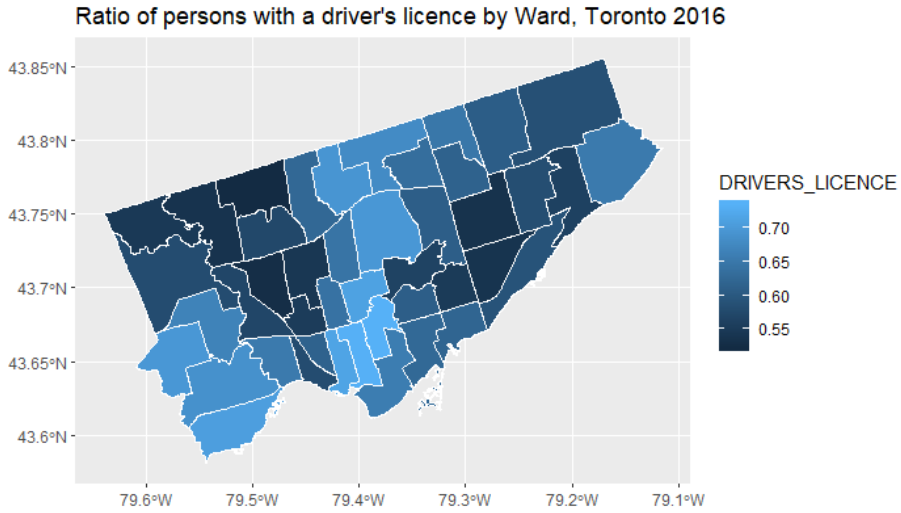
```
ggplot(TTS2016_wards) +
   geom_sf(aes(fill = `Total Number of persons`), color = "white") +
  labs(title = "Total Number of persons by Ward, Toronto 2016")
```



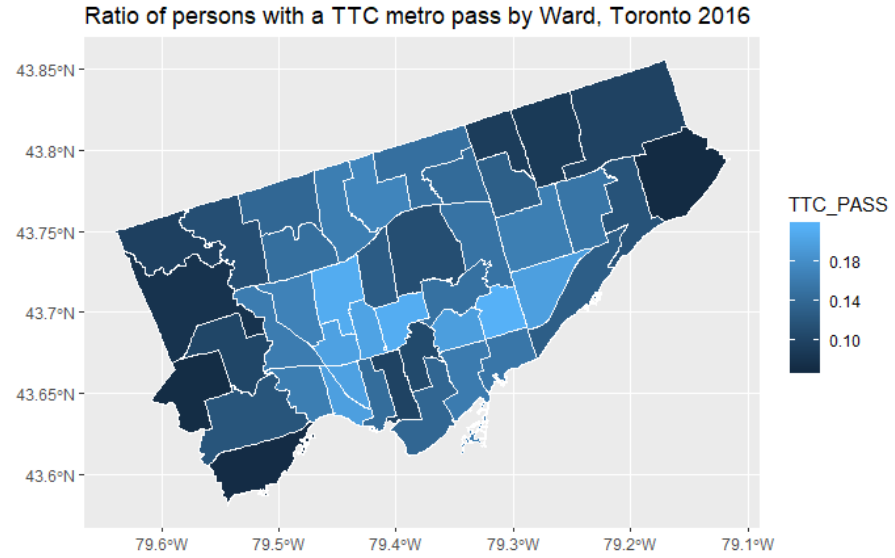

```
ggplot(TTS2016_wards) +
   geom_sf(aes(fill = TRIPS_PER_DAY), color = "white") +
  labs(title = "Average daily trips per residents by Ward, Toronto 2016")
```



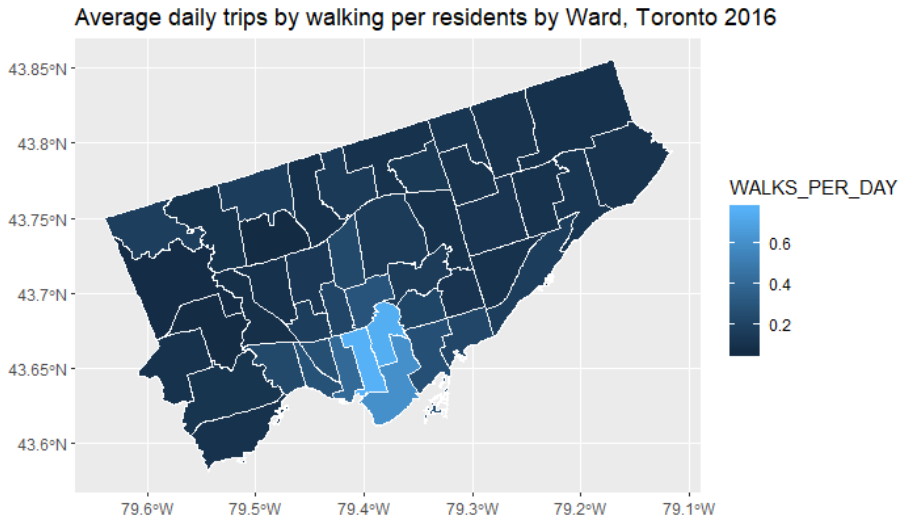

```
ggplot(TTS2016_wards) +
   geom_sf(aes(fill = DRIVERS_LICENCE), color = "white") +
  labs(title = "Ratio of persons with a driver's licence by Ward, Toronto 2016")
```



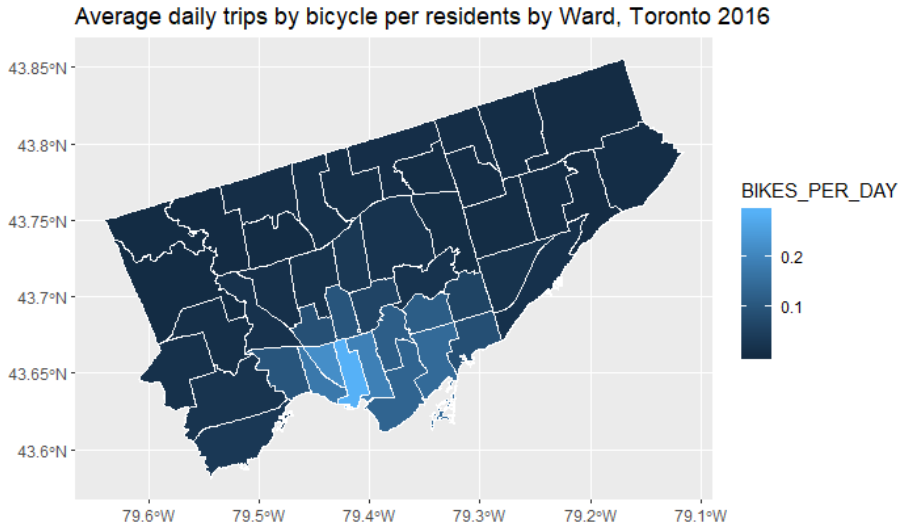

```
ggplot(TTS2016_wards) +
   geom_sf(aes(fill = TTC_PASS), color = "white") +
  labs(title = "Ratio of persons with a TTC metro pass by Ward, Toronto 2016")
```




```
ggplot(TTS2016_wards) +
   geom_sf(aes(fill = WALKS_PER_DAY), color = "white") +
  labs(title = "Average daily trips by walking per residents by Ward, Toronto 2016")
```




```
ggplot(TTS2016_wards) +
   geom_sf(aes(fill = BIKES_PER_DAY), color = "white") +
  labs(title = "Average daily trips by bicycle per residents by Ward, Toronto 2016")
```



Wellbeing Toronto

Wellbeing Toronto - Transportation

WB-Transportation.xlsx

```
nbds <- st_read("C:/Users/14165/Desktop/Shapefiles/neighbourhoods_planning_areas_wgs84/NEIGH
```

```
Reading layer `NEIGHBORHOODS_WGS84' from data source `C:\Users\14165\Desktop\Shapefiles\neig
Simple feature collection with 140 features and 2 fields
geometry type:  POLYGON
dimension:      XY
bbox:           xmin: -79.63926 ymin: 43.581 xmax: -79.11524 ymax: 43.85546
epsg (SRID):    4326
proj4string:    +proj=longlat +ellps=WGS84 +no_defs
```

```
nbds$AREA_S_CD <- as.integer(nbds$AREA_S_CD)
```

```
WB <- read.csv("WB-Transportation.csv")
```

```
str(WB)
```

```
'data.frame':   140 obs. of  6 variables:
 $ AREA_S_CD             : int  1 2 3 4 5 6 7 8 9 10 ...
 $ TTC_Stops             : int  338 70 45 40 29 70 81 58 63 61 ...
 $ Non_Traffic_Collisions: int  727 224 109 62 63 105 80 27 39 49 ...
 $ Traffic_Collisions    : int  778 154 69 96 70 74 179 54 150 78 ...
 $ Road_Kilometres       : num  165 33.9 27.9 25.2 17.1 ...
 $ Daily_Road_Volume     : num  5957 3514 3545 7621 4116 ...
```

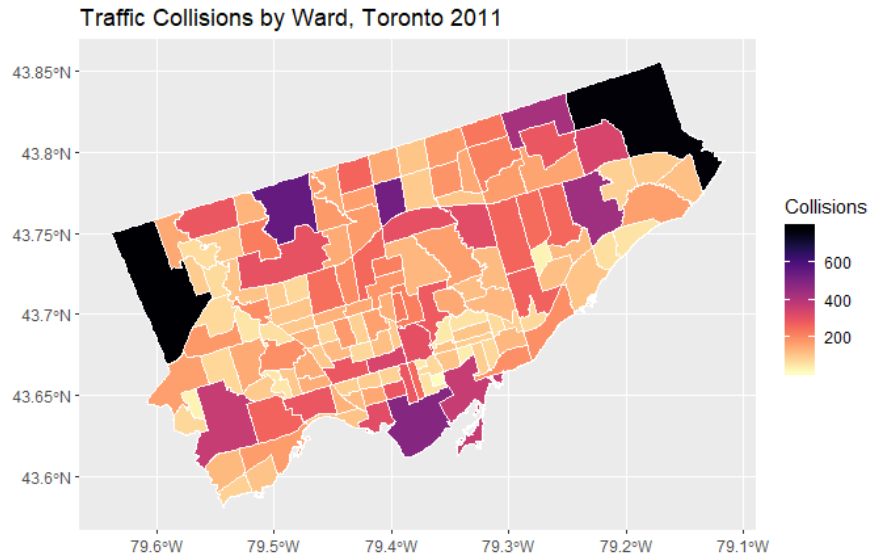
```
WB_nbds <- left_join(nbds, WB, by = "AREA_S_CD")
```

```
str(WB_nbds)
```

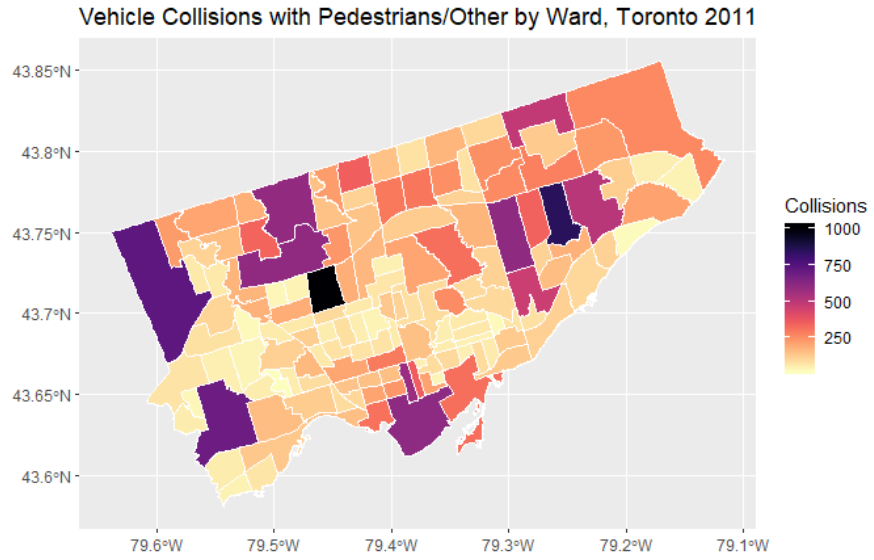
```
Classes ‘sf’ and 'data.frame':  140 obs. of  8 variables:
 $ AREA_S_CD             : int  97 27 38 31 16 118 63 3 55 59 ...
 $ AREA_NAME             : chr  "Yonge-St.Clair (97)" "York University Heights (27)" "Lansi
 $ TTC_Stops             : int  28 235 44 155 106 55 44 45 62 53 ...
 $ Non_Traffic_Collisions: int  58 598 142 1007 155 260 131 109 256 67 ...
 $ Traffic_Collisions    : int  99 548 173 246 265 171 193 69 154 106 ...
 $ Road_Kilometres       : num  12.8 67.6 39.3 49.7 84.6 ...
 $ Daily_Road_Volume     : num  7116 5546 6920 4194 7115 ...
 $ geometry              :sfc_POLYGON of length 140; first list element: List of 1
  ..$ : num [1:93, 1:2] -79.4 -79.4 -79.4 -79.4 -79.4 ...
  ..- attr(*, "class")= chr  "XY" "POLYGON" "sfg"
 - attr(*, "sf_column")= chr "geometry"
 - attr(*, "agr")= Factor w/ 3 levels "constant","aggregate",..: NA NA NA NA NA NA NA
  ..- attr(*, "names")= chr  "AREA_S_CD" "AREA_NAME" "TTC_Stops" "Non_Traffic_Collisions" ..
```

Plotting by Neighbourhoods

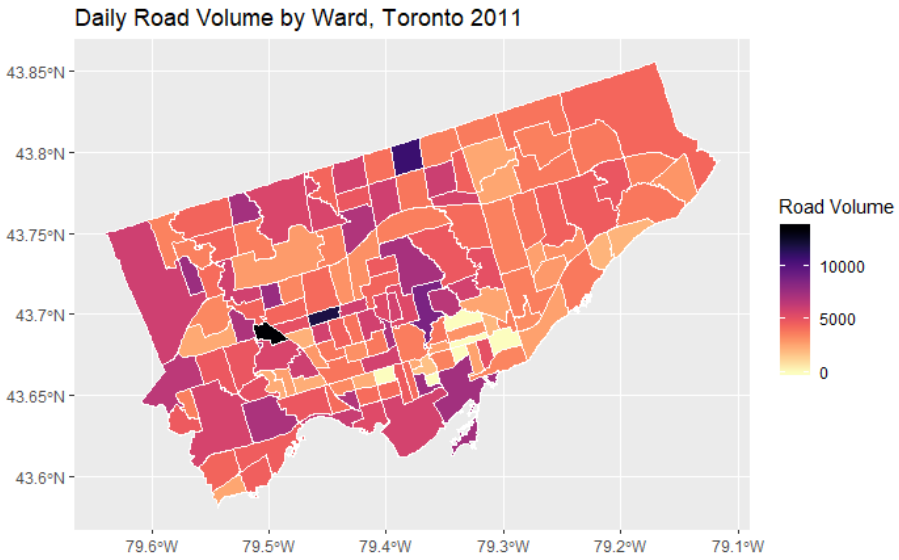
```
ggplot(WB_nbds) +
   geom_sf(aes(fill = Traffic_Collisions), color = "white") +
  labs(title = "Traffic Collisions by Ward, Toronto 2011") +
  scale_fill_viridis(option="magma", name="Collisions", direction=-1)
```




```
ggplot(WB_nbds) +
   geom_sf(aes(fill = Non_Traffic_Collisions), color = "white") +
  labs(title = "Vehicle Collisions with Pedestrians/Other by Ward, Toronto 2011") +
    scale_fill_viridis(option="magma", name="Collisions", direction=-1)
```




```
ggplot(WB_nbds) +
   geom_sf(aes(fill = Daily_Road_Volume), color = "white") +
  labs(title = "Daily Road Volume by Ward, Toronto 2011") +
    scale_fill_viridis(option="magma", name="Road Volume", direction=-1)
```



LS0tDQp0aXRsZTogIlRvcm9udG8gVWJlciBNb3ZlbWVudCBhbmQgVHJhbnNwb3J0YXRpb24gVG9tb3Jyb3