

Find PM2.5 levels from highways

```
library("tidyverse")
```

— Attaching core tidyverse packages — tidyverse 2.0.0 —

```
✓ dplyr      1.1.1    ✓ readr      2.1.4
✓ forcats    1.0.0    ✓ stringr    1.5.0
✓ ggplot2    3.5.0    ✓ tibble     3.2.1
✓ lubridate  1.9.3    ✓ tidyr      1.3.0
✓ purrr      1.0.1
```

— Conflicts — tidyverse_conflicts() —

```
✗ dplyr::filter() masks stats::filter()
```

```
✗ dplyr::lag() masks stats::lag()
```

i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

```
library("terra")
```

terra 1.7.46

Attaching package: 'terra'

The following object is masked from 'package:tidyr':

extract

```
library("maptiles")
```

Make shapefile for Houston

```
#city centroid
cities<-read.csv("allcities_latlon.csv")

#get coordinate for city
df<-cities |>
  filter(Address=="Houston, TX") |>
  select(lon, lat)

#convert coordinates into a point shapefile
x <- vect(df, geom=c("lon", "lat"), crs="+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")

#light rail route shapefile
Transit_Map_GEO <- vect("G:/Shared drives/2022 FIRE-SA/ARCHIVED - SUMMER INTERNSHIP/Light Rail/DA
trans <- subset(Transit_Map_GEO, Transit_Map_GEO$route_long == "METRORAIL RED LINE")

char_lr<-aggregate(trans, dissolve=TRUE)
```

```

lr_project<-project(char_lr, "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")

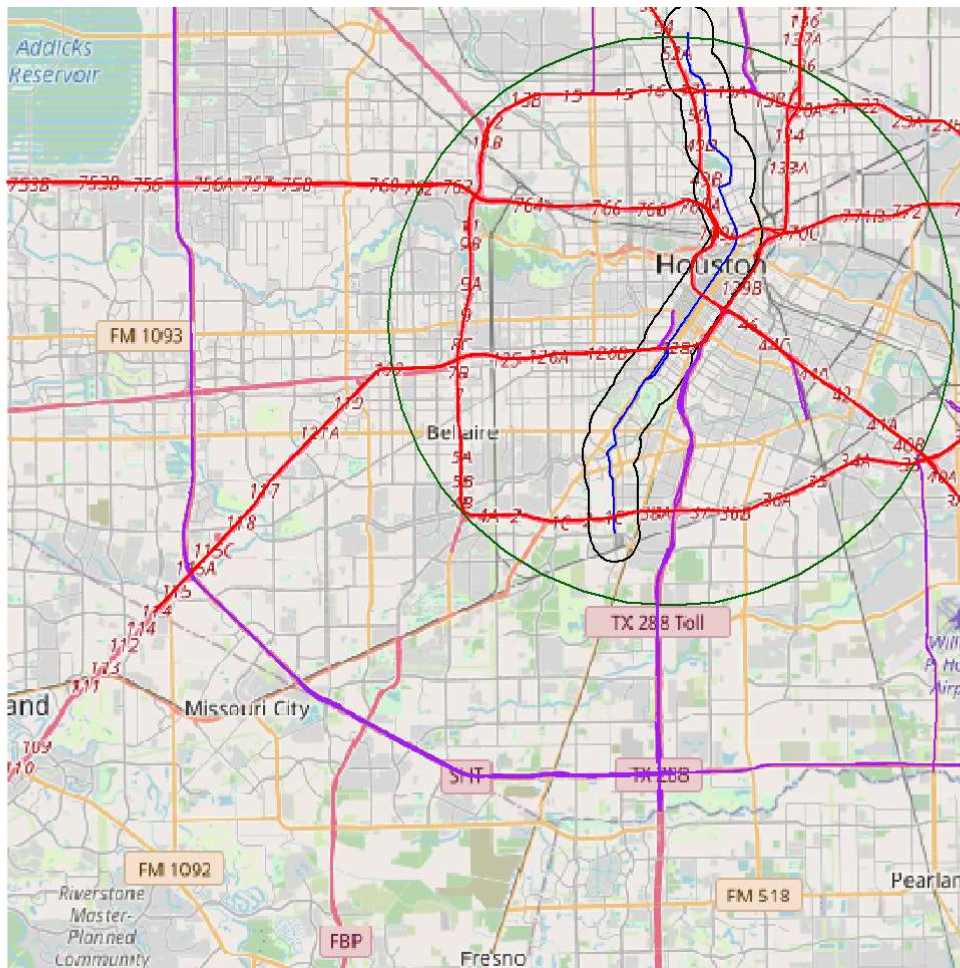
#make 10 km buffer around light rail centroid
lrc<-centroids(lr_project, inside=FALSE)
lrc_buff<-buffer(lrc, width = 10000)

#make 1 km buffer around light rail route
#lr_buffer<-terra::buffer(lr_project, width = 1000)
#writeVector(lr_buffer, "Houston Shapefiles/lr_1km_buff", overwrite=TRUE)
lr_buffer<-vect("Houston Shapefiles/lr_1km_buff")

#get roads data
r<-vect("G:/Shared drives/2024 FIRE Light Rail/DATA/tl_2021_txharris_roads/tl_2021_48201_roads.shp")
r_project<-project(r, "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")
i<-subset(r_project, r_project$RTTYP=="I")
c<-subset(r_project, r_project$RTTYP=="C")
m<-subset(r_project, r_project$RTTYP=="M")
o<-subset(r_project, r_project$RTTYP=="O")
s<-subset(r_project, r_project$RTTYP=="S")

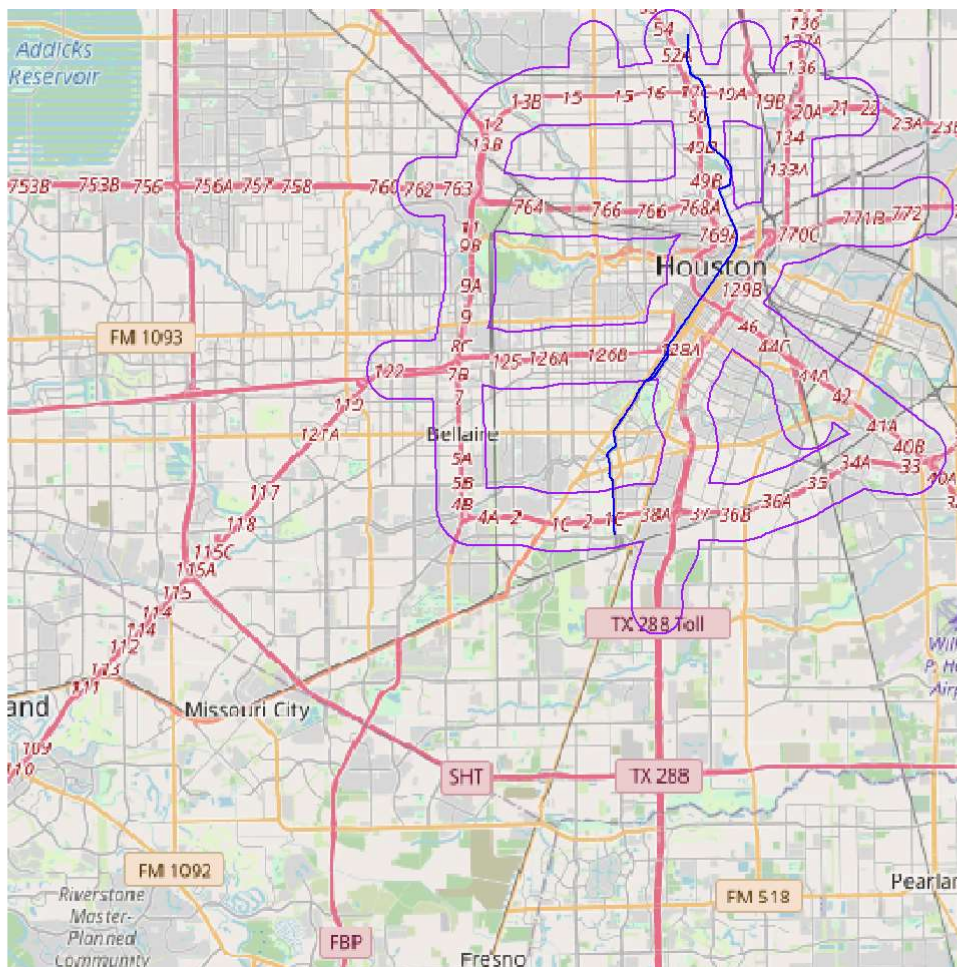
#make plot of houston and light rail buffer
bg <- get_tiles(ext(lrc_buff)) #choose a number that will give a good picture of the light rail area
plot(bg)
lines(lr_project, col="blue")
lines(lr_buffer, col="black")
lines(lrc_buff, col="darkgreen")
lines(s, col="purple")
lines(i, col="red")

```



```
#crop s and i highways that are within 10 km of the light rail centroid
sint<-crop(s, lrc_buff)
iint<-crop(i, lrc_buff)
u<-aggregate(rbind(sint, iint), dissolve=TRUE)

#make a buffer around major roads but take out areas that overlap with the light rail
u_buffer<-terra::buffer(u, width = 1000)
plot(bg)
lines(u_buffer, col="purple")
lines(lr_project, col="blue")
```



```
#writeVector(u_buffer, "Houston Shapefiles/roads_1km_buff", overwrite=TRUE)
```

Make shapefile for Charlotte

```
#get coordinate for city
df<-cities |>
  filter(Address=="Charlotte, NC") |>
  select(lon, lat)

#convert coordinates into a point shapefile
x <- vect(df, geom=c("lon", "lat"), crs="+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")

#light rail centroid
char_lr <- vect("G:/Shared drives/2022 FIRE-SA/ARCHIVED - SUMMER INTERNSHIP/Light Rail/DATA/LYNX_I
char_lr<-aggregate(char_lr, dissolve=TRUE)
lr_project<-project(char_lr, "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")

lrc<-centroids(lr_project, inside=FALSE)
lrc_buff<-buffer(lrc, width = 15000)
#lr_buffer<-terra::buffer(lr_project, width = 1000)
#writeVector(lr_buffer, "Charlotte Shapefiles/lr_1km_buff", overwrite=TRUE)
lr_buffer<-vect("Charlotte Shapefiles/lr_1km_buff")

#get roads data
```

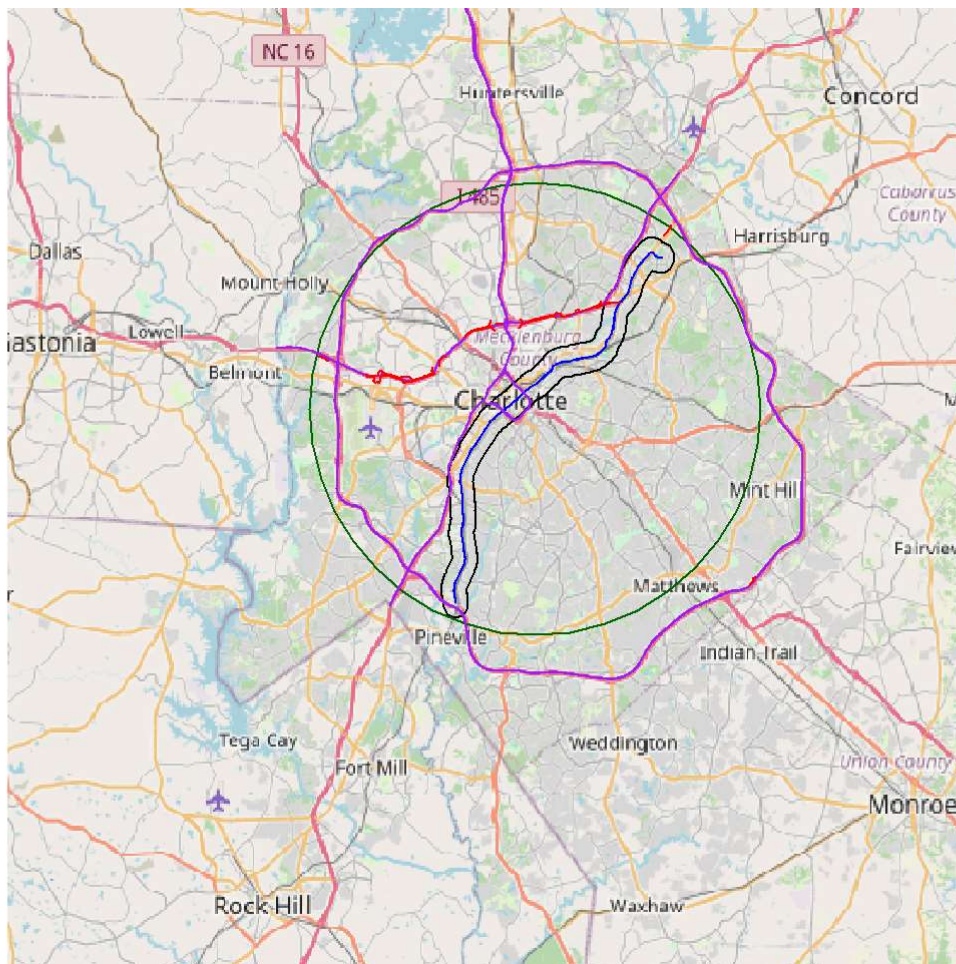


```

r<-vect("G:/Shared drives/2024 FIRE Light Rail/DATA/tl_2021_ncmecklenburg_roads/tl_2021_37119_roads.shp")
r_project<-project(r, "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")
i<-subset(r_project, r_project$RTTYP=="I")
c<-subset(r_project, r_project$RTTYP=="C")
m<-subset(r_project, r_project$RTTYP=="M")
o<-subset(r_project, r_project$RTTYP=="O")
s<-subset(r_project, r_project$RTTYP=="S")

#make plot of light rail buffer
bg <- get_tiles(ext(lrc_buff)) #choose a number that will give a good picture of the light rail area
plot(bg)
lines(lr_project, col="blue")
lines(lr_buffer, col="black")
lines(lrc_buff, col="darkgreen")
lines(i, col="purple")
lines(o, col="red")

```



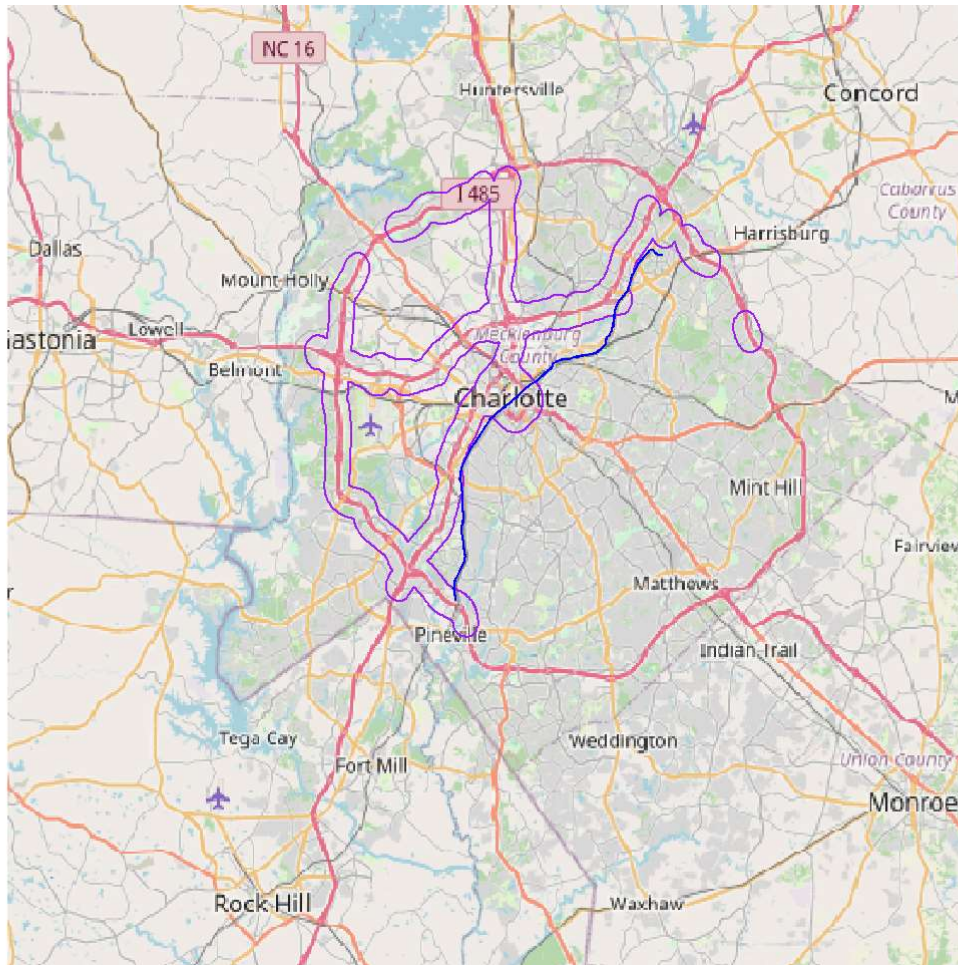
```

#crop s and i highways that are within 10 km of the light rail centroid
oint<-crop(o, lrc_buff)
iint<-crop(i, lrc_buff)
u<-aggregate(rbind(oint, iint), dissolve=TRUE)

#make a buffer around major roads but take out areas that overlap with the light rail

```

```
u_buffer<-terra::buffer(u, width = 1000)
plot(bg)
lines(u_buffer, col="purple")
lines(lr_project, col="blue")
```



```
#writeVector(u_buffer, "Charlotte Shapefiles/roads_1km_buff", overwrite=TRUE)
```

Make shapefile for Phoenix-Mesa, Arizona

```
#get coordinate for city
df<-cities |>
  filter(joint_address=="Phoenix-Mesa, AZ") |>
  select(lon, lat)

#convert coordinates into a point shapefile
x <- vect(df, geom=c("lon", "lat"), crs="+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")

Transit_Map_GEO <- vect("G:/Shared drives/2022 FIRE-SA/ARCHIVED - SUMMER INTERNSHIP/Light Rail/DA

trans <- subset(Transit_Map_GEO, Transit_Map_GEO$SYMBOLGY=="METRO")
char_lr<-aggregate(trans, dissolve=TRUE)
lr_project<-project(char_lr, "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")
lrc<-centroids(lr_project)
```

```

lrc_buff<-buffer(lrc, width = 20000)

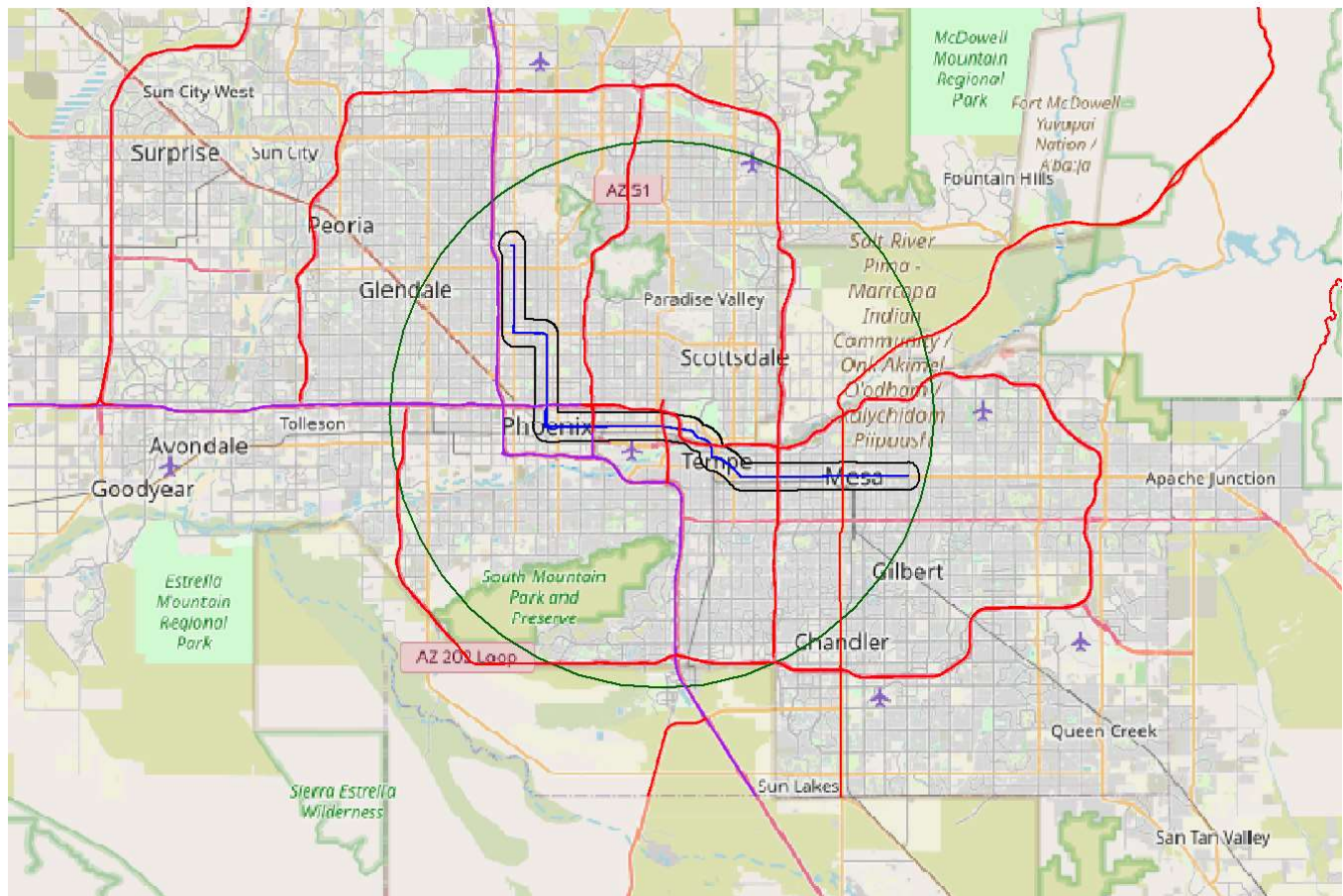
#lr_buffer<-terra::buffer(lr_project, width = 1000)

#bg <- get_tiles(ext(lrc_buff)) #choose a number that will give a good picture of the light rail
#plot(bg)
#lines(lr_project, col="blue")
#lines(lr_buffer, col="black")
#lines(lrc_buff, col="darkgreen")
#writeVector(lr_buffer, "Phoenix Shapefiles/lr_1km_buff", overwrite=TRUE)
lr_buffer<-vect("Phoenix Shapefiles/lr_1km_buff")

#get roads data
r<-vect("G:/Shared drives/2024 FIRE Light Rail/DATA/tl_2021_azmaricopa_roads/tl_2021_04013_roads.
r_project<-project(r, "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")
i<-subset(r_project, r_project$RTTYP=="I")
c<-subset(r_project, r_project$RTTYP=="C")
m<-subset(r_project, r_project$RTTYP=="M")
o<-subset(r_project, r_project$RTTYP=="O")
s<-subset(r_project, r_project$RTTYP=="S")

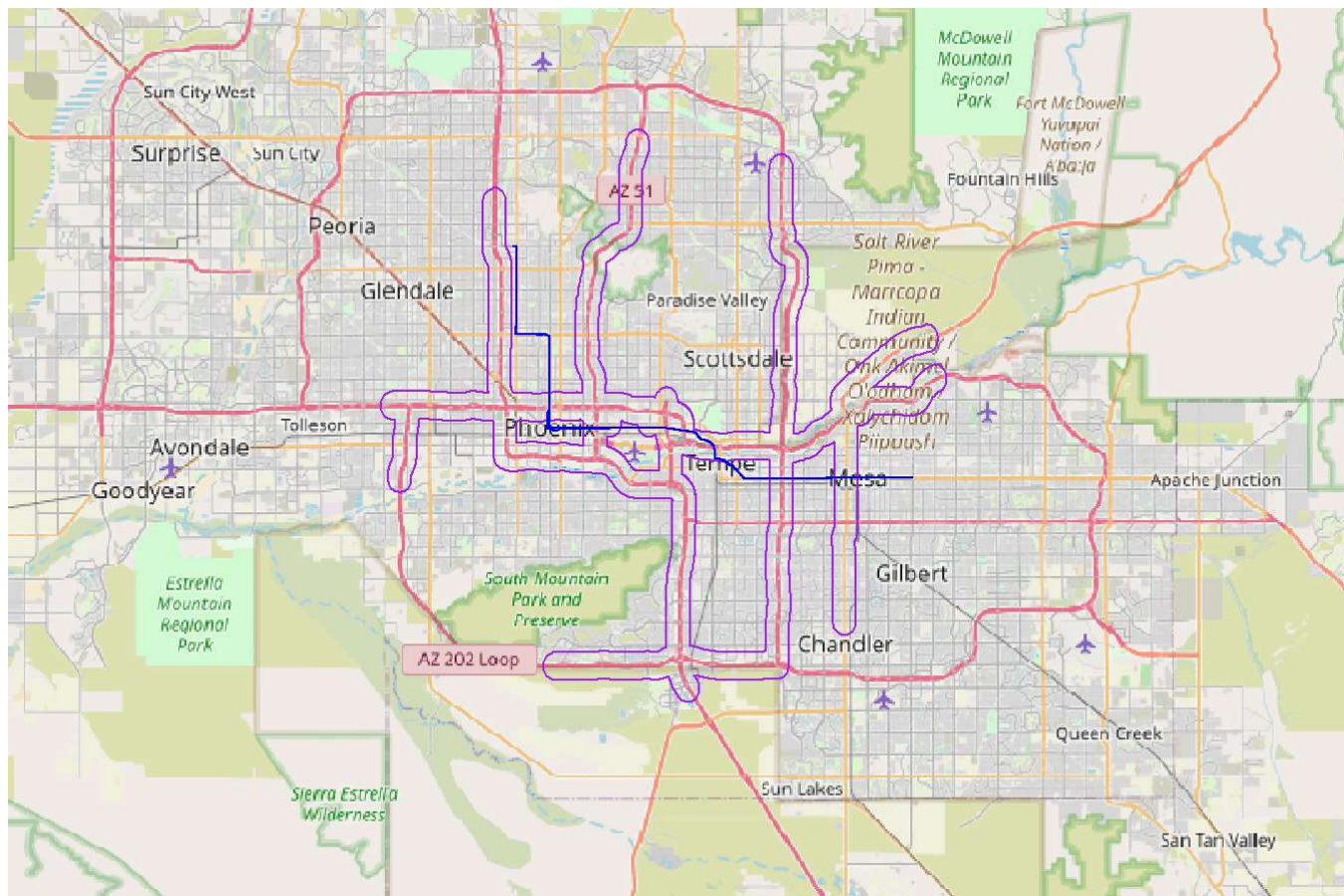
#make plot of light rail buffer
bg <- get_tiles(ext(lrc_buff)) #choose a number that will give a good picture of the light rail a
plot(bg)
lines(lr_project, col="blue")
lines(lr_buffer, col="black")
lines(lrc_buff, col="darkgreen")
lines(i, col="purple")
lines(s, col="red")

```

```
#crop s and i highways that are within 10 km of the light rail centroid
sint<-crop(s, lrc_buff)
iint<-crop(i, lrc_buff)
u<-aggregate(rbind(sint, iint), dissolve=TRUE)

#make a buffer around major roads but take out areas that overlap with the light rail
u_buffer<-terra::buffer(u, width = 1000)
plot(bg)
lines(u_buffer, col="purple")
lines(lr_project, col="blue")
```

```
#writeVector(u_buffer, "Phoenix Shapefiles/roads_1km_buff", overwrite=TRUE)
```

Make shapefile for Twin Cities, MN

```
#get coordinate for city
df<-cities |>
  filter(Address=="Minneapolis-St. Paul, MN") |>
  select(lon, lat)

#convert coordinates into a point shapefile
x <- vect(df, geom=c("lon", "lat"), crs="+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")

Transit_Map_GEO <- vect("G:/Shared drives/2022 FIRE-SA/ARCHIVED - SUMMER INTERNSHIP/Light Rail/DA
trans <- subset(
  Transit_Map_GEO,
  Transit_Map_GEO$route_url == "https://www.metrotransit.org/route/blue" |
  Transit_Map_GEO$route_url == "https://www.metrotransit.org/route/green")
char_lr<-aggregate(trans, dissolve=TRUE)
lr_project<-project(char_lr, "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")
lrc<-centroids(lr_project, inside=FALSE)
lrc_buff<-buffer(lrc, width = 10000)

#lr_buffer<-terra::buffer(lr_project, width = 1000)
```

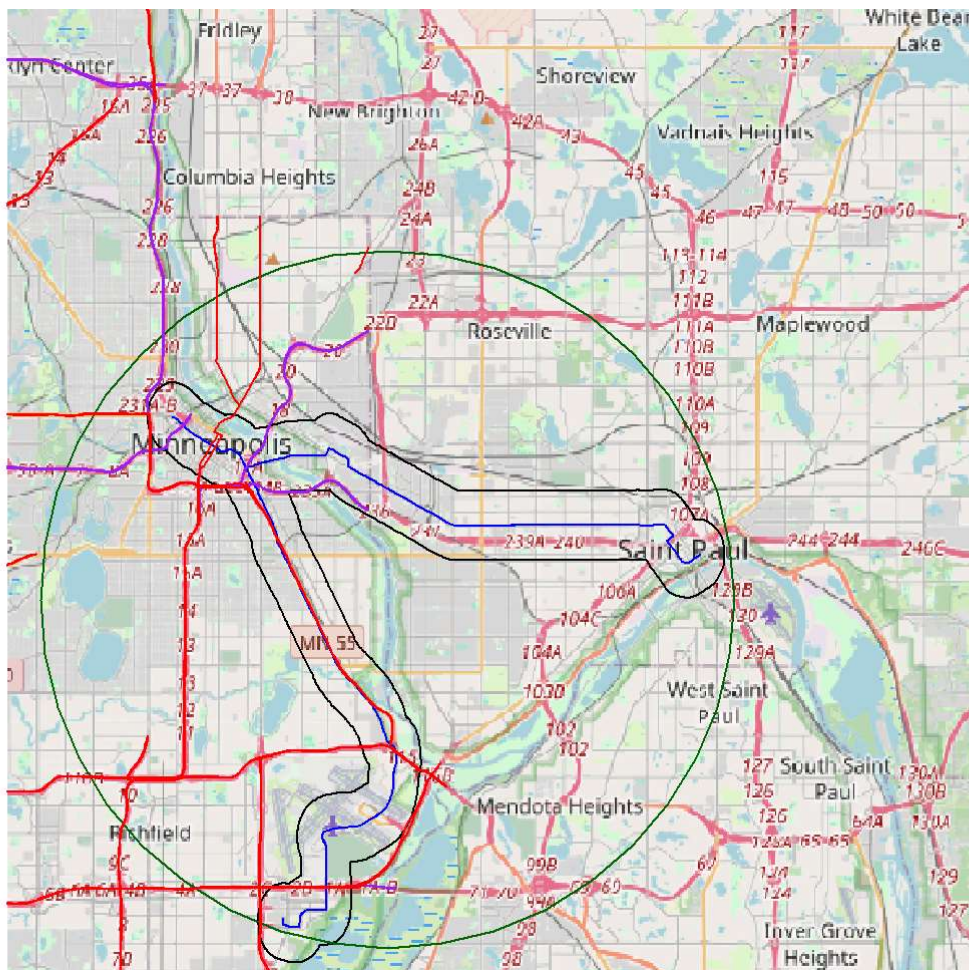
```

#bg <- get_tiles(ext(lrc_buff)) #choose a number that will give a good picture of the light rail
#plot(bg)
#lines(lr_project, col="blue")
#lines(lr_buffer, col="black")
#lines(lrc_buff, col="darkgreen")
#writeVector(lr_buffer, "Twin Cities Shapefiles/lr_1km_buff", overwrite=TRUE)
lr_buffer<-vect("Twin Cities Shapefiles/lr_1km_buff")

#get roads data
r<-vect("G:/Shared drives/2024 FIRE Light Rail/DATA/tl_2021_mnhennepin_roads/tl_2021_27053_roads.
r_project<-project(r, "+proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs ")
i<-subset(r_project, r_project$RTTYP=="I")
c<-subset(r_project, r_project$RTTYP=="C")
m<-subset(r_project, r_project$RTTYP=="M")
o<-subset(r_project, r_project$RTTYP=="O")
s<-subset(r_project, r_project$RTTYP=="S")

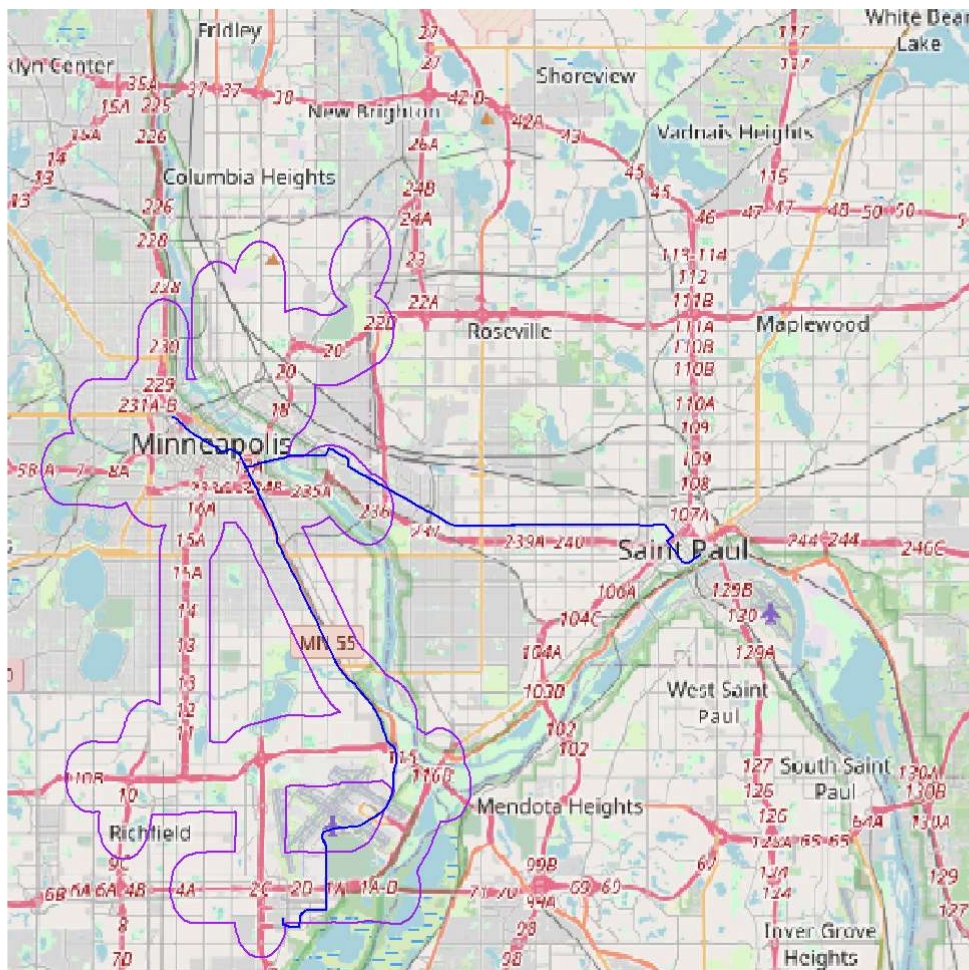
#make plot of light rail buffer
bg <- get_tiles(ext(lrc_buff)) #choose a number that will give a good picture of the light rail a
plot(bg)
lines(lr_project, col="blue")
lines(lr_buffer, col="black")
lines(lrc_buff, col="darkgreen")
lines(i, col="purple")
lines(s, col="red")

```



```
#crop s and i highways that are within 10 km of the light rail centroid
sint<-crop(s, lrc_buff)
iint<-crop(i, lrc_buff)
u<-aggregate(rbind(sint, iint), dissolve=TRUE)

#make a buffer around major roads but take out areas that overlap with the light rail
u_buffer<-terra::buffer(u, width = 1000)
plot(bg)
lines(u_buffer, col="purple")
lines(lr_project, col="blue")
```

```
#writeVector(u_buffer, "Twin Cities Shapefiles/roads_1km_buff", overwrite=TRUE)
```