

Boston 311 Analysis Report

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using packages - tidyverse, tidyr

Step_1:read the excel file

```
boston311 <- read.csv("boston311.csv")
head(boston311)
```

	case_enquiry_id	open_dt	target_dt	closed_dt	on
		<dbl>	<fctr>	<fctr>	<f
1	101002767856	2019-01-01 00:04:32	2019-01-03 08:30:00	2019-01-02 02:22:29	On
2	101002767857	2019-01-01 00:08:52	2019-01-03 08:30:00	2019-01-02 02:22:11	On
3	101002767859	2019-01-01 00:50:00		2019-11-23 11:36:05	On
4	101002767861	2019-01-01 01:26:00		2019-05-17 12:27:07	On
5	101002767862	2019-01-01 01:33:09	2019-01-03 08:30:00	2019-01-02 02:28:35	On
6	101002767863	2019-01-01 01:56:00	2019-01-03 08:30:00	2019-01-02 02:20:25	On

6 rows | 1-7 of 30 columns

◀ ▶

Step_2:how many rows in the dataframe?

There is 259,496 rows in the dataframe boston311

```
nrow(boston311)
```

```
## [1] 259496
```

Step_3:filter the dataframe to precinct of 0401

```
Bt <- boston311 %>% filter(precinct == "0401")
```

Step4

a:convert the variable to date

The structure of the closed_dt is Factor. Therefore, we turn it into data structure.

```
str(Bt$closed_dt)
```

```
##  Factor w/ 222631 levels "", "2019-01-01 04:25:10", ... : 21 42 59 189 57 6322 179 162 221 212
... 
```

```
Bt$closed_dt <- as.Date(Bt$closed_dt)
```

b:create month column extract from closed_dt

```
Bt <- Bt %>% mutate(months = format(closed_dt, "%m"))
```

c:drop the NA row

```
sum(is.na(Bt["months"])) # 202 NA in month
```

```
## [1] 202
```

```
Bt1 <- Bt %>% drop_na(months)
nrow(Bt1)
```

```
## [1] 1575
```

The new dataframe has 1,517 rows

Step5:remove the column “open_dt”

```
Bt1 <- select(Bt1,-c(open_dt))
```

Step6:percentage of the case have a case_status of closed

The percentage of the case have a case status of closed is 100%.

Since in the previous step, I dropped all the rows that do not contain closed date. In a nutshell, I dropped all the rows that case status still open.

```
prop.table(table(Bt1$case_status))*100
```

```
##
## Closed    Open
##   100      0
```

```
prop.table(table(boston311$case_status))*100
```

```
##
## Closed    Open
## 86.63293 13.36707
```

Step7: See the six most common instances

```
count(Bt1, reason, sort = TRUE)
```

reason	n
<fctr>	<int>
Code Enforcement	342
Street Cleaning	318
Sanitation	197

reason	n
<fctr>	<int>
Enforcement & Abandoned Vehicles	150
Highway Maintenance	124
Trees	90
Street Lights	65
Signs & Signals	57
Building	48
Park Maintenance & Safety	46
1-10 of 23 rows	Previous 1 2 3 Next

1. Code Enforcement 342
2. Street Cleaning 318
3. Sanitation 197
4. Enforcement & Abandoned Vehicles 150
5. Highway Maintenance 124
6. Trees 90

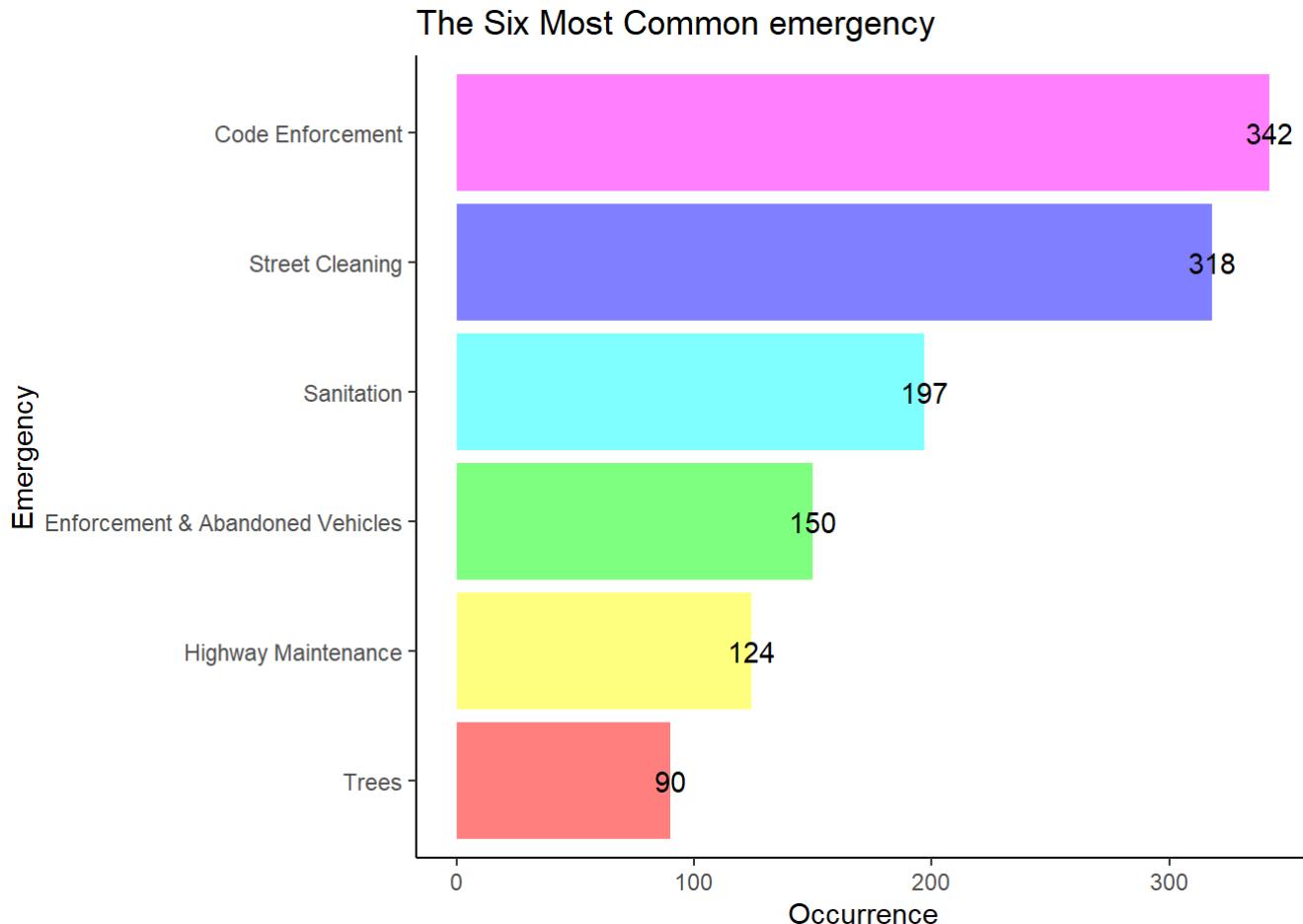
Step8:Create a dataframe that only contains data for six most commen instance of reason

```
Bt2<-Bt1%>%
  filter(reason %in% c("Code Enforcement","Street Cleaning","Trees","Highway Maintenance",
    "Enforcement & Abandoned Vehicles","Sanitation"))
```

Step9:Create a barplot that displays the number of occurrences for six most Emergency

In precinct of 0401 Boston MA, the six most occurred Emergency as below.

```
ggplot(Bt2,aes(x=fct_rev(fct_infreq(reason))))+
  geom_bar(fill=rainbow(n=6),alpha=0.5)+
  geom_text(stat='count',aes(label= ..count..))+
  xlab("Emergency")+ylab("Occurrence")+
  ggtitle("The Six Most Common emergency")+
  coord_flip()+
  theme(plot.title = element_text(size = 18, face = "bold"))+
  theme_classic()
```



Step10: Fill the bars based on the season of the year

```
Bt2_Seasons <- Bt2 %>%
  mutate(season = ifelse(months %in% c("01","02","03"), "Winter",
                        ifelse(months %in% c("04","05","06"), "Spring",
                               ifelse(months %in% c("07", "08","09"), "Summer",
                                      ifelse(months %in% c("10","11","12"), "Fall", "Error"
))))
```

```
ggplot(Bt2_Seasons,aes(x=reason,fill=season))+  

  geom_bar() +  

  geom_text(stat="count",aes(label= ..count..), position = position_stack(vjust = 0.5),color='navy')+ # fix label overlap  

  scale_x_discrete(labels = function(x) stringr::str_wrap(x, width = 5))+ # fix the x label overlap  

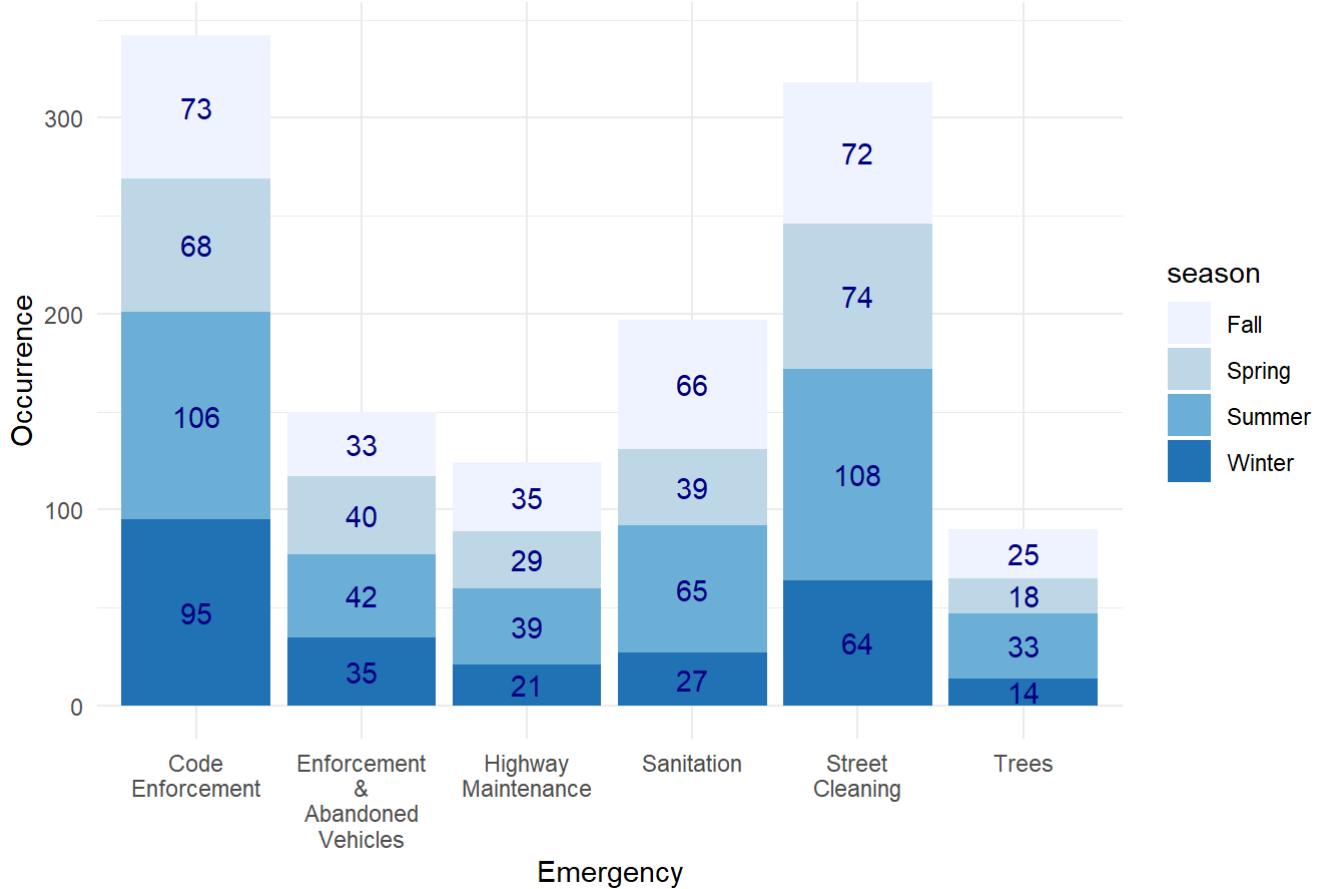
  scale_fill_brewer(palette="Blues") +  

  xlab("Emergency") + ylab("Occurrence") +  

  ggtitle("Six Most Common Emergency by Seasons") +  

  theme_minimal()
```

Six Most Common Emergency by Seasons

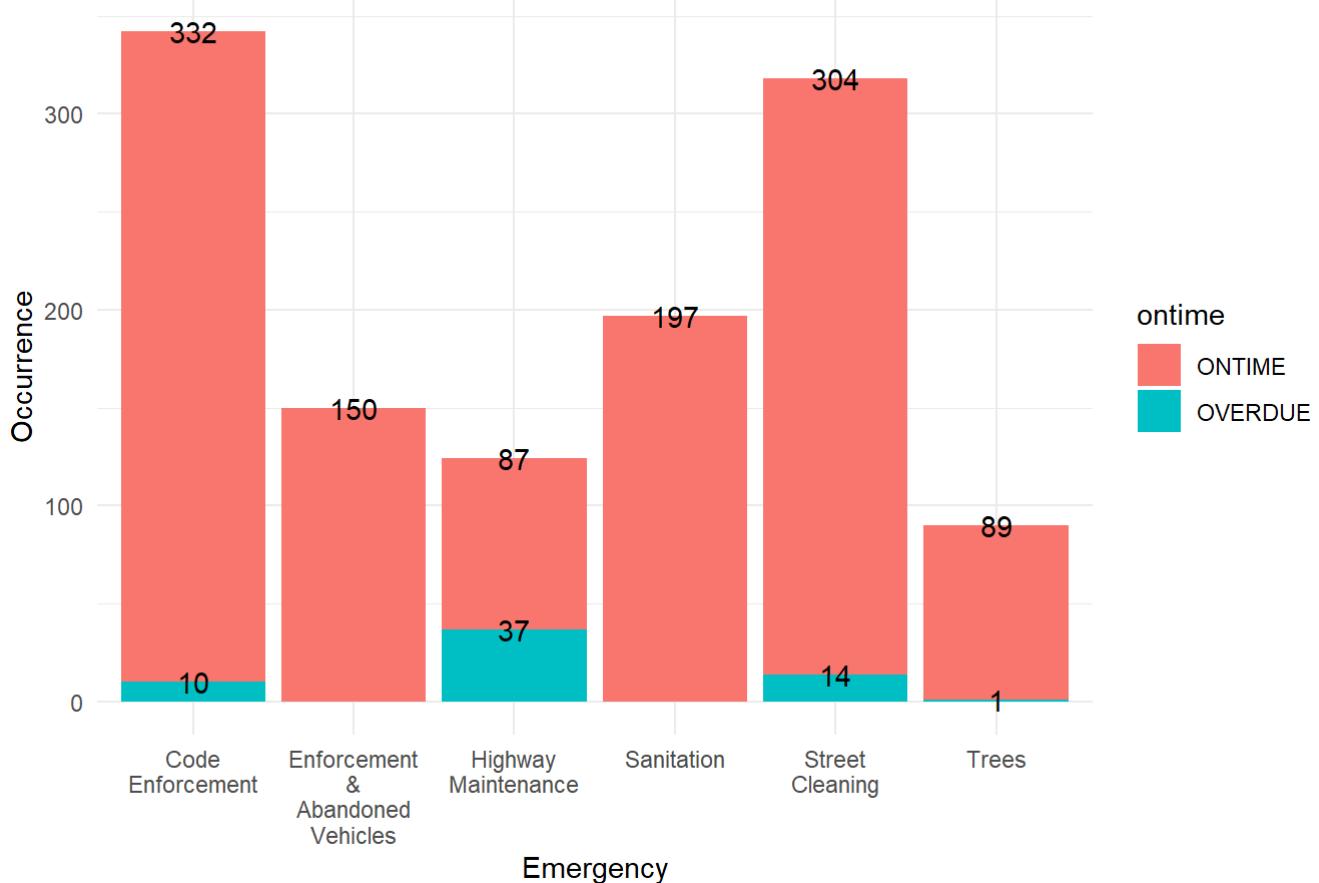


From the chart, we know that 311 got more call for “Code Enforcement” and “Sanitation” in summer and winter than fall and spring, for “Enforcement & Abandoned Vehicles” and “Highway Maintenance”, weather seems not be an issue. Both “Street Cleaning” and “Trees” appear a different amount in summer than other seasons.

Step11: Does the case finished on time?

```
ggplot(Bt2,aes(x=reason,fill=ontime))+  
  geom_bar() +  
  geom_text(stat="count",aes(label= ..count..), position = position_stack()) +  
  scale_x_discrete(labels = function(x) stringr::str_wrap(x, width = 5)) +  
  xlab("Emergency") + ylab("Occurrence") +  
  ggtitle("Six Most Common Emergency by Finish time") +  
  theme_minimal()
```

Six Most Common Emergency by Finish time



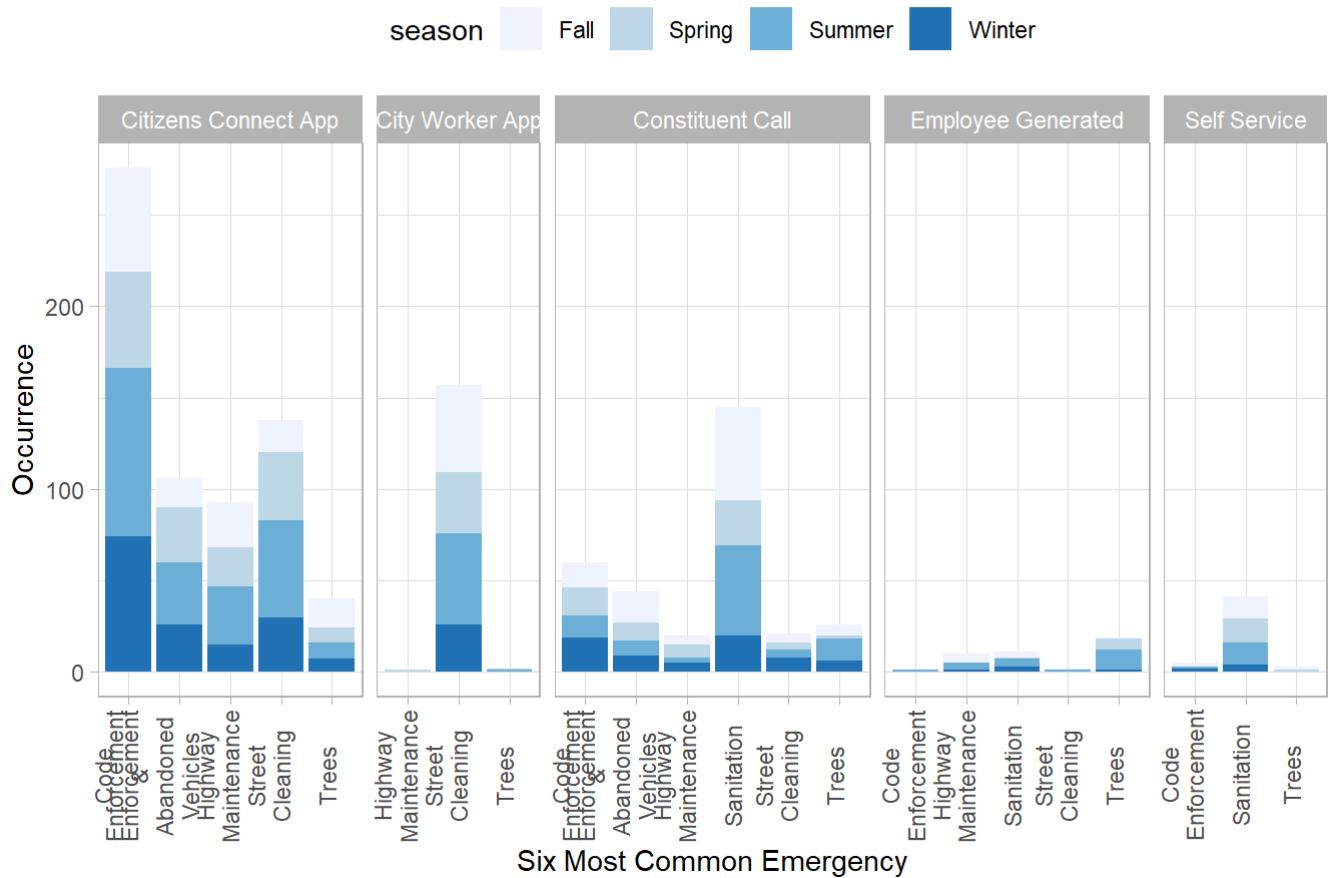
It's clear that most of the case closed on time, only few cases in "Code Enforcement", "Street Cleaning", and "Trees" overdue, and the "Highway Maintenance" has higher overdue cases.

Step12:Cases from different sources

As we can see in the chart that shows the numbers of top 6 Emergency in the each source divided by season. The chart does not show the reason that does not happen.

```
ggplot(Bt2_Seasons,aes(x=reason,fill=season))+  
  geom_bar() +  
  facet_grid(.~source,space = "free",scales = "free") +  
  scale_x_discrete(labels = function(x) stringr::str_wrap(x, width = 5)) +  
  scale_fill_brewer(palette="Blues") +  
  xlab("Six Most Common Emergency") + ylab("Occurrence") +  
  ggtitle("Six Most Common Emergency of each source by season") +  
  theme_light() +  
  theme(legend.position="top",  
        axis.text.x=element_text(angle = 90,vjust=0.2))
```

Six Most Common Emergency of each source by season



From the chart, we can see that most of the emergency call from “Citizens Connect App”, follow by “Constituent Call” and “City Worker App”. Most of the “Code Enforcement” emergency come from “Citizens Connect App” especially summer and winter, the “Street Cleaning” emergency are split from “Citizens Connect App” and “City Worker App” where summer and fall are having the higher amount of calls. Most of “Sanitation” are come from “Constituent Call”, follow by “Self Service”. It’s noticeable that although “Citizens Connect App” is the most popular source, there has no “Sanitation” call at all. Another thing is the “City Worker App” only used to report “Street Cleaning”.

Step13:Filter the 5 most common types

```
count(Bt2_Seasons$type, sort = TRUE)
```

type	n
<fctr>	<int>
Improper Storage of Trash (Barrels)	245
CE Collection	156
Parking Enforcement	148
Requests for Street Cleaning	140
Missed Trash/Recycling/Yard Waste/Bulk Item	120
Unshoveled Sidewalk	63
Tree Maintenance Requests	53
Schedule a Bulk Item Pickup	48

type <fctr>	n <int>
Sidewalk Repair (Make Safe)	44
Empty Litter Basket	29
1-10 of 27 rows	Previous 1 2 3 Next

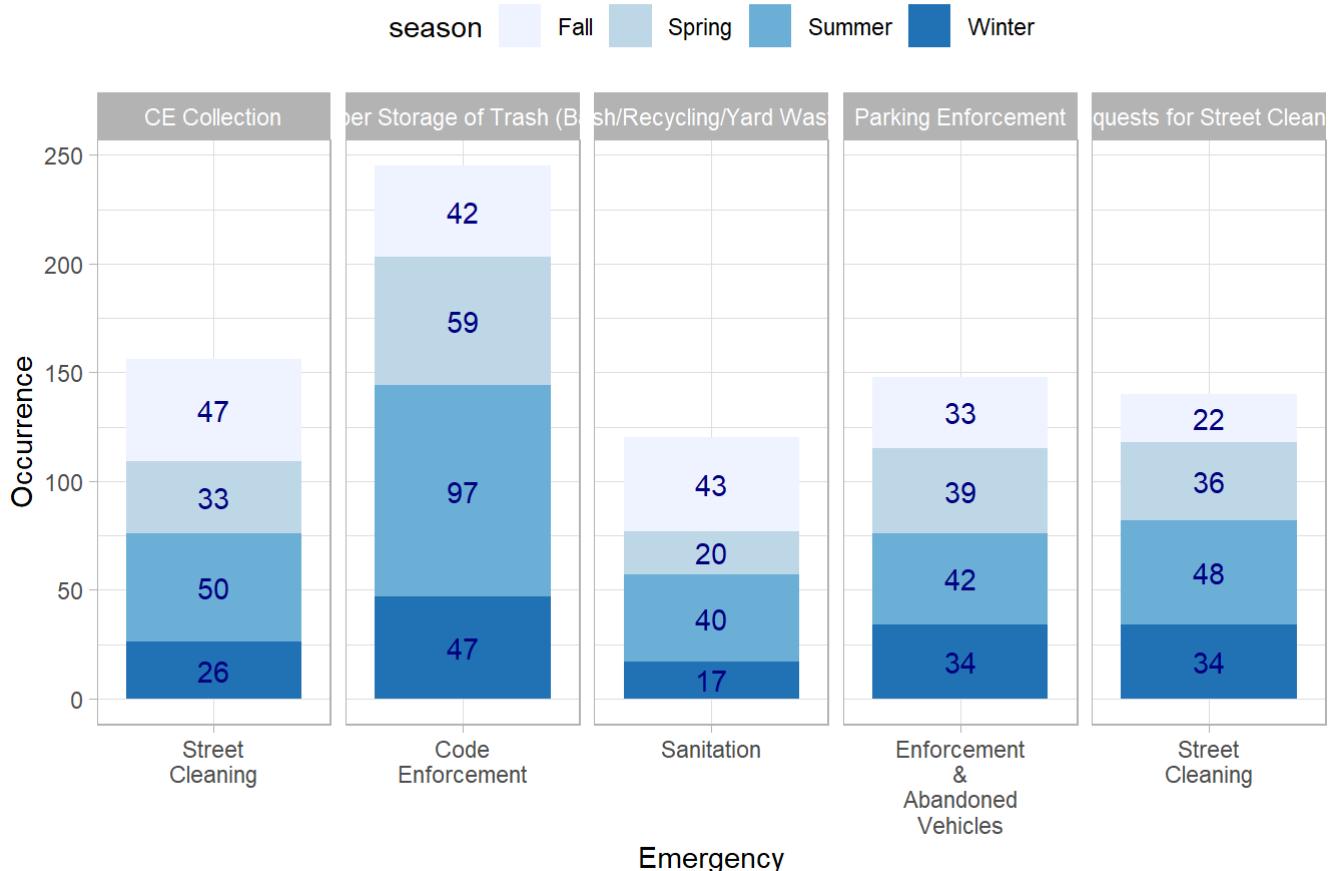
```
Bt3_Seasons <- Bt2_Seasons %>%
  filter(type %in% c("Improper Storage of Trash (Barrels)","CE Collection","Parking Enforcement","Requests for Street Cleaning","Missed Trash/Recycling/Yard Waste/Bulk Item"))
```

Step14:The Top Five Types

It shows the chart of the 4 Emergency occured in each types divided by season.

```
ggplot(Bt3_Seasons,aes(x=reason,fill=season))+
  geom_bar()+
  geom_text(stat="count",aes(label= ..count..), position = position_stack(vjust = 0.5),color='navy')+
  scale_x_discrete(labels = function(x) stringr::str_wrap(x, width = 5))+
  facet_grid(~type,space = "free",scales = "free")+
  scale_fill_brewer(palette="Blues")+
  xlab("Emergency")+ ylab("Occurrence")+
  ggtitle("The Six Most Common Emergency by Five Types occurred the Most")+
  theme_light()+
  theme(legend.position="top")
```

The Six Most Common Emergency by Five Types occurred the Most



The type of “Improper Storage of Trash (Barrels)” in “Code Enforcement” has the most cases among all types, especially in the summer. “CE Collection” and “Requests for Street Cleaning” in the “Street Cleaning” have similar cases, but in winter “CE Collection” has double cases than the other. “Parking Enforcement” remain a similar cases in all season, and “Missed Trash/Recycling/Yard Waste/Bulk Item” has more case in fall and summer.

Step15:table()& droplevels()

Since I filter the top five types in the previous steps, the df now only contain the top five levels. Utilized droplevels() to remove any unused levels in the dataframe.

```
table(Bt3_Seasons$type)
```

```
##          Abandoned Bicycle
##          0
##          Abandoned Building
##          0
##          Abandoned Vehicles
##          0
##          Aircraft Noise Disturbance
##          0
##          Alert Boston
##          0
##          Animal Found
##          0
##          Animal Generic Request
##          0
##          Animal Lost
##          0
##          Animal Noise Disturbances
##          0
##          Automotive Noise Disturbance
##          0
##          Bed Bugs
##          0
##          Bicycle Issues
##          0
##          Big Buildings Online Request
##          0
##          Big Buildings Recycling (INTERNAL)
##          0
##          Billing Complaint
##          0
##          Breathe Easy
##          0
##          Bridge Maintenance
##          0
##          Building Inspection Request
##          0
##          BWSC General Request
##          0
##          BWSC Pothole
##          0
##          Carbon Monoxide
##          0
##          Catchbasin
##          0
##          CE Collection
##          156
##          Cemetery Maintenance Request
##          0
##          Chronic Dampness/Mold
##          0
##          City/State Snow Issues
##          0
##          Construction Debris
##          0
##          Contractor Complaints
##          0
```

```
##          Contractors Complaint          0
##          Cross Metering - Sub-Metering      0
##          Dumpster & Loading Noise Disturbances    0
##          Egress                          0
##          Electrical                     0
##          Empty Litter Basket            0
##          Equipment Repair              0
##          Exceeding Terms of Permit       0
##          Fire Hydrant                  0
##          Fire in Food Establishment     0
##          Food Alert - Confirmed        0
##          Food Alert - Unconfirmed      0
##          General Comments For a Program or Policy 0
##          General Comments For An Employee      0
##          General Lighting Request        0
##          General Traffic Engineering Request 0
##          Graffiti Removal             0
##          Ground Maintenance           0
##          Heat - Excessive Insufficient    0
##          Heat/Fuel Assistance          0
##          Illegal Auto Body Shop        0
##          Illegal Dumping              0
##          Illegal Occupancy            0
##          Illegal Posting of Signs      0
##          Illegal Rooming House         0
##          Illegal Use                  0
##          Illegal Vending              0
##          Improper Storage of Trash (Barrels) 245
##          Install New Lighting          0
```

```
##          Item Price Missing
##                               0
##          Knockdown Replacement
##                               0
##          Lead
##                               0
##          Litter Basket Maintenance
##                               0
##          Loud Parties/Music/People
##                               0
##          Maintenance - Homeowner
##                               0
##          Maintenance Complaint - Residential
##                               0
##          Major System Failure
##                               0
##          Mechanical
##                               0
##          Mice Infestation - Residential
##                               0
##          Misc. Snow Complaint
##                               0
##          Missed Trash/Recycling/Yard Waste/Bulk Item
##                               120
##          Missing Sign
##                               0
##          Mosquitoes (West Nile)
##                               0
##          Municipal Parking Lot Complaints
##                               0
##          Needle Pickup
##                               0
##          New Sign Crosswalk or Pavement Marking
##                               0
##          New Tree Requests
##                               0
##          News Boxes
##                               0
##          No-Tow Complaint Confirmation
##                               0
##          No Price on Gas/Wrong Price
##                               0
##          No Utilities - Food Establishment - Electricity
##                               0
##          No Utilities - Food Establishment - Flood
##                               0
##          No Utilities - Food Establishment - Sewer
##                               0
##          No Utilities - Food Establishment - Water
##                               0
##          No Utilities Residential - Electricity
##                               0
##          No Utilities Residential - Gas
##                               0
##          No Utilities Residential - Water
##                               0
##          Notification
##                               0
```

```
##          Occupying W/Out A Valid CO/CI
##                      0
##          Overcrowding
##                      0
##          Overflowing or Un-kept Dumpster
##                      0
##          Park Improvement Requests
##                      0
##          Parking Enforcement
##                      148
##          Parking Meter Repairs
##                      0
##          Parking on Front/Back Yards (Illegal Parking)
##                      0
##          Parks General Request
##                      0
##          Parks Lighting/Electrical Issues
##                      0
##          Pavement Marking Inspection
##                      0
##          Pavement Marking Maintenance
##                      0
##          Pest Infestation - Residential
##                      0
##          Phone Bank Service Inquiry
##                      0
##          Pick up Dead Animal
##                      0
##          Pickup/Clear Conduit
##                      0
##          Pigeon Infestation
##                      0
##          Planting
##                      0
##          Plumbing
##                      0
##          Poor Conditions of Property
##                      0
##          Poor Ventilation
##                      0
##          Private Parking Lot Complaints
##                      0
##          Product Short Measure
##                      0
##          Protection of Adjoining Property
##                      0
##          Public Events Noise Disturbances
##                      0
##          Public Works General Request
##                      0
##          PWD Graffiti
##                      0
##          Rat Bite
##                      0
##          Recycling Cart Inquiry
##                      0
##          Recycling Cart Return
##                      0
```

```
##          Rental Unit Delivery Conditions          0
##          Request for Litter Basket Installation  0
##          Request for Pothole Repair              0
##          Request for Recycling Cart             0
##          Request for Snow Plowing                0
## Request for Snow Plowing (Emergency Responder) 0
## Requests for Directional or Roadway Changes   0
## Requests for Street Cleaning                  140
## Requests for Traffic Signal Studies or Reviews 0
##          Roadway Repair                      0
##          Rodent Activity                     0
## Rooftop & Mechanical Disturbances          0
##          Scanning Overcharge                 0
##          Schedule a Bulk Item Pickup         0
##          Schedule a Bulk Item Pickup SS       0
##          Sewage/Septic Back-Up               0
##          Short Measure - Gas                0
##          Sidewalk Cover / Manhole            0
##          Sidewalk Repair                   0
##          Sidewalk Repair (Make Safe)        0
##          Sign Repair                      0
##          Sign Shop WO                     0
##          Snow/Ice Control                 0
##          Space Savers                   0
##          Squalid Living Conditions        0
##          Sticker Request                 0
##          Street Light Knock Downs        0
##          Street Light Outages            0
##          StreetLight Pole WO             0
```

```
##          Student Move-in Issues          0
##          Student Overcrowding          0
##          Traffic Signal Inspection      0
##          Traffic Signal Repair          0
##          Transportation General Request 0
##          Trash on Vacant Lot          0
##          Tree Emergencies            0
##          Tree in Park              0
##          Tree Maintenance Requests    0
##          Undefined Noise Disturbance 0
##          Unit Pricing Wrong/Missing   0
##          Unsafe Dangerous Conditions 0
##          Unsanitary Conditions - Employees 0
##          Unsanitary Conditions - Establishment 0
##          Unsanitary Conditions - Food      0
##          Unsatisfactory Living Conditions 0
##          Unsatisfactory Utilities - Electrical Plumbing 0
##          Unshoveled Sidewalk            0
##          Upgrade Existing Lighting     0
##          Utility Call-In              0
##          Utility Casting Repair        0
##          Valet Parking Problems        0
##          Walk-In Service Inquiry       0
##          Work Hours-Loud Noise Complaints 0
##          Work w/out Permit            0
##          Working Beyond Hours         0
##          Zoning                      0
```

Remove any unused levels in the dataframe.

```
Bt3_Seasons <- droplevels(Bt3_Seasons)
```

Only the top five remained.

```
table(Bt3_Seasons$type)
```

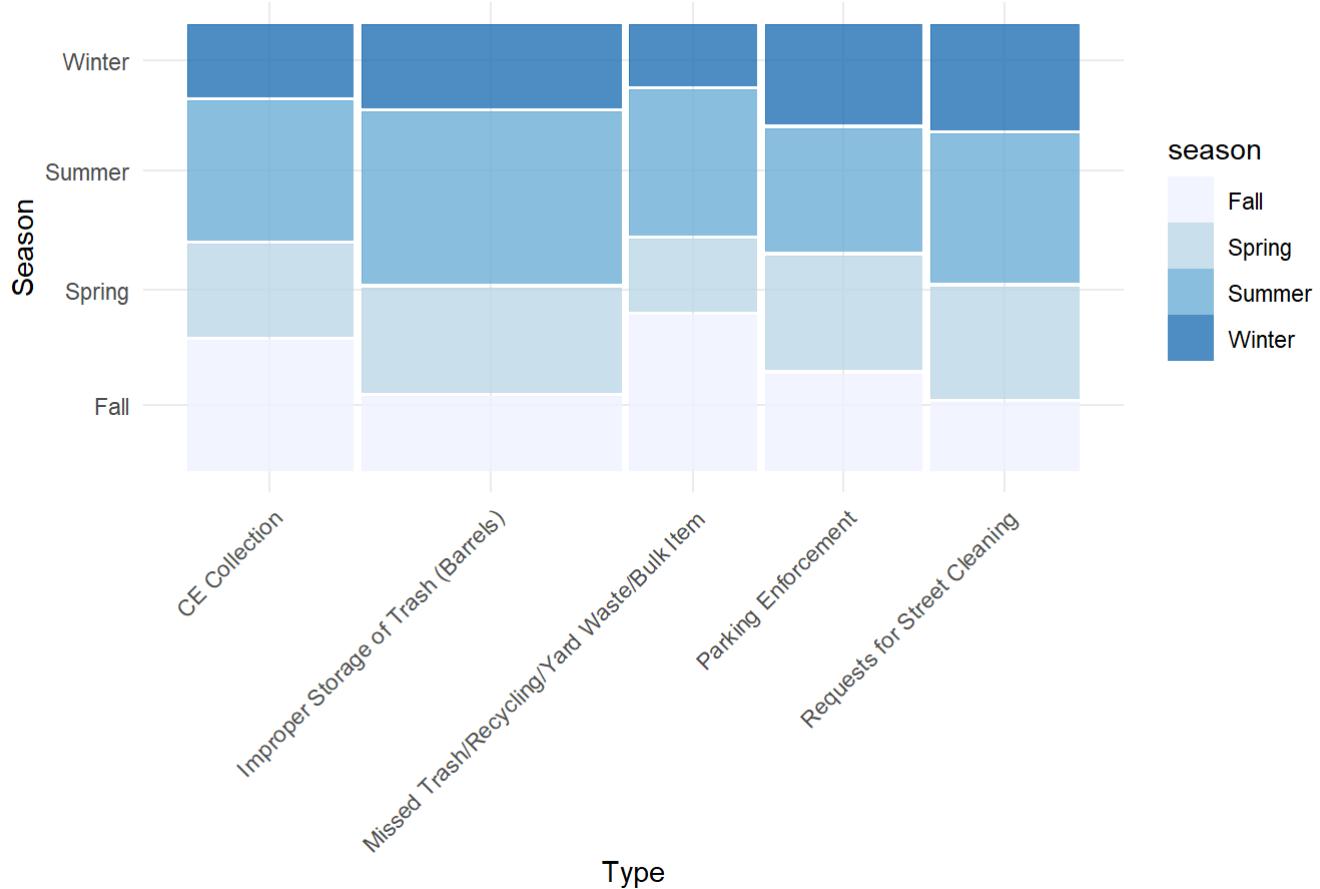
```
##                                     CE Collection
##                                     156
## Improper Storage of Trash (Barrels)
##                                     245
## Missed Trash/Recycling/Yard Waste/Bulk Item
##                                     120
## Parking Enforcement
##                                     148
## Requests for Street Cleaning
##                                     140
```

Step16:mosaic plot

It's more easier to compare proportions across groups where the the bigger box means the larger proportions.

```
ggplot(Bt3_Seasons)+  
  geom_mosaic(aes(x=product(type),fill=season))+  
  scale_fill_brewer()  
  xlab("Type") + ylab("Season") +  
  ggtitle("The Top Five Types by Season") +  
  theme_minimal()  
  theme(axis.text.x=element_text(angle= 45, hjust=1))
```

The Top Five Types by Season



The “Improper Storage of Trash (Barrels)” in summer has the most cases in among all.

Step17:instal & library leaflet pakage to

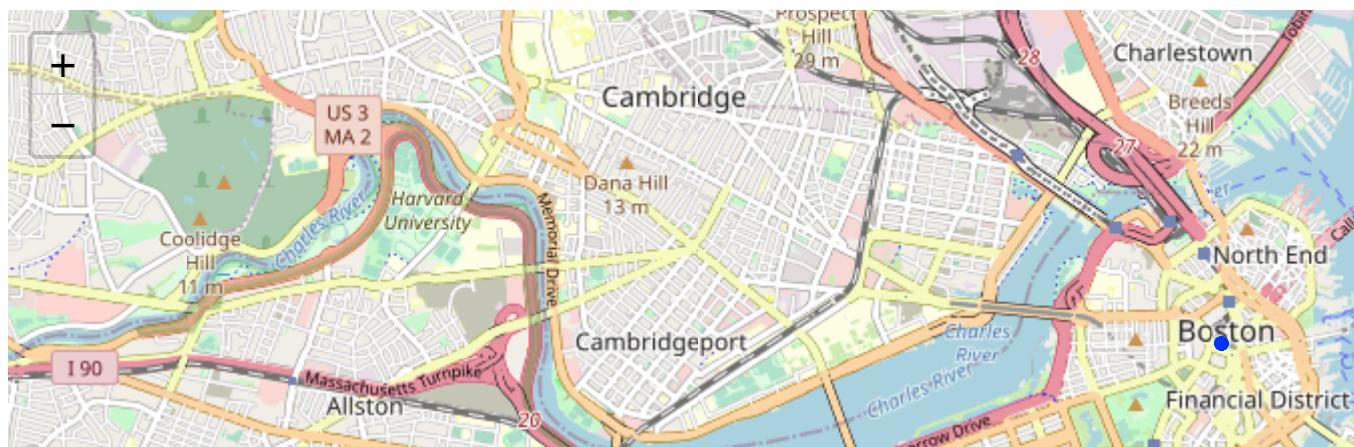
```
library(leaflet)
```

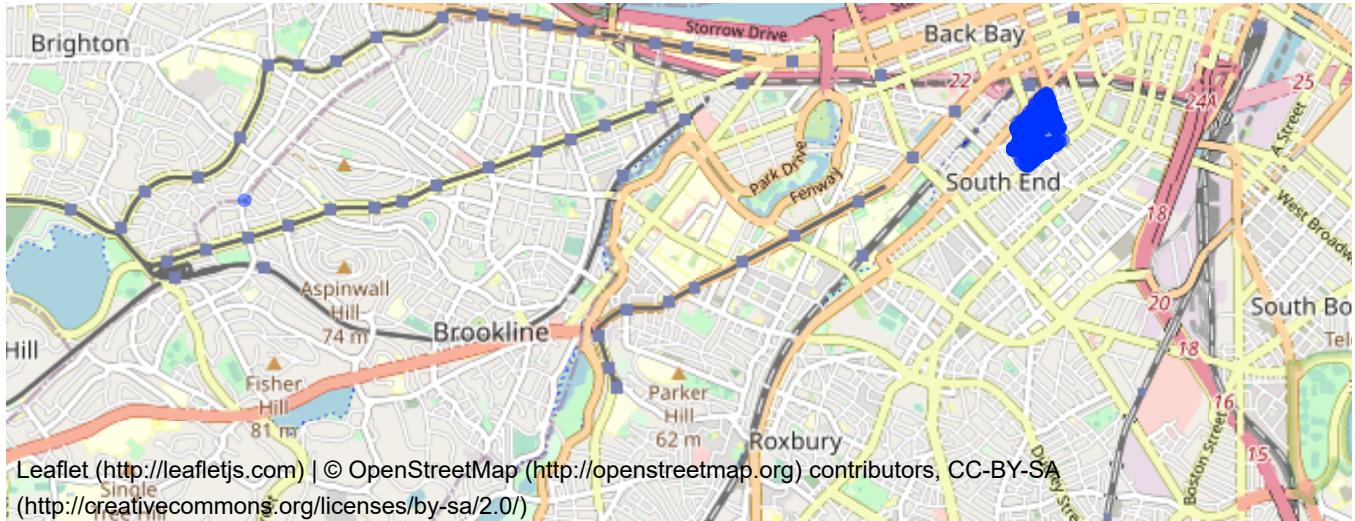
```
## Warning: package 'leaflet' was built under R version 3.6.2
```

Setp18: Have a look of the precinct of 0401

```
Bt3_Seasons %>% leaflet() %>% setView(lng = -71.105, lat = 42.35, zoom = 13) %>%  
addCircles %>% addTiles()
```

```
## Assuming "longitude" and "latitude" are longitude and latitude, respectively
```

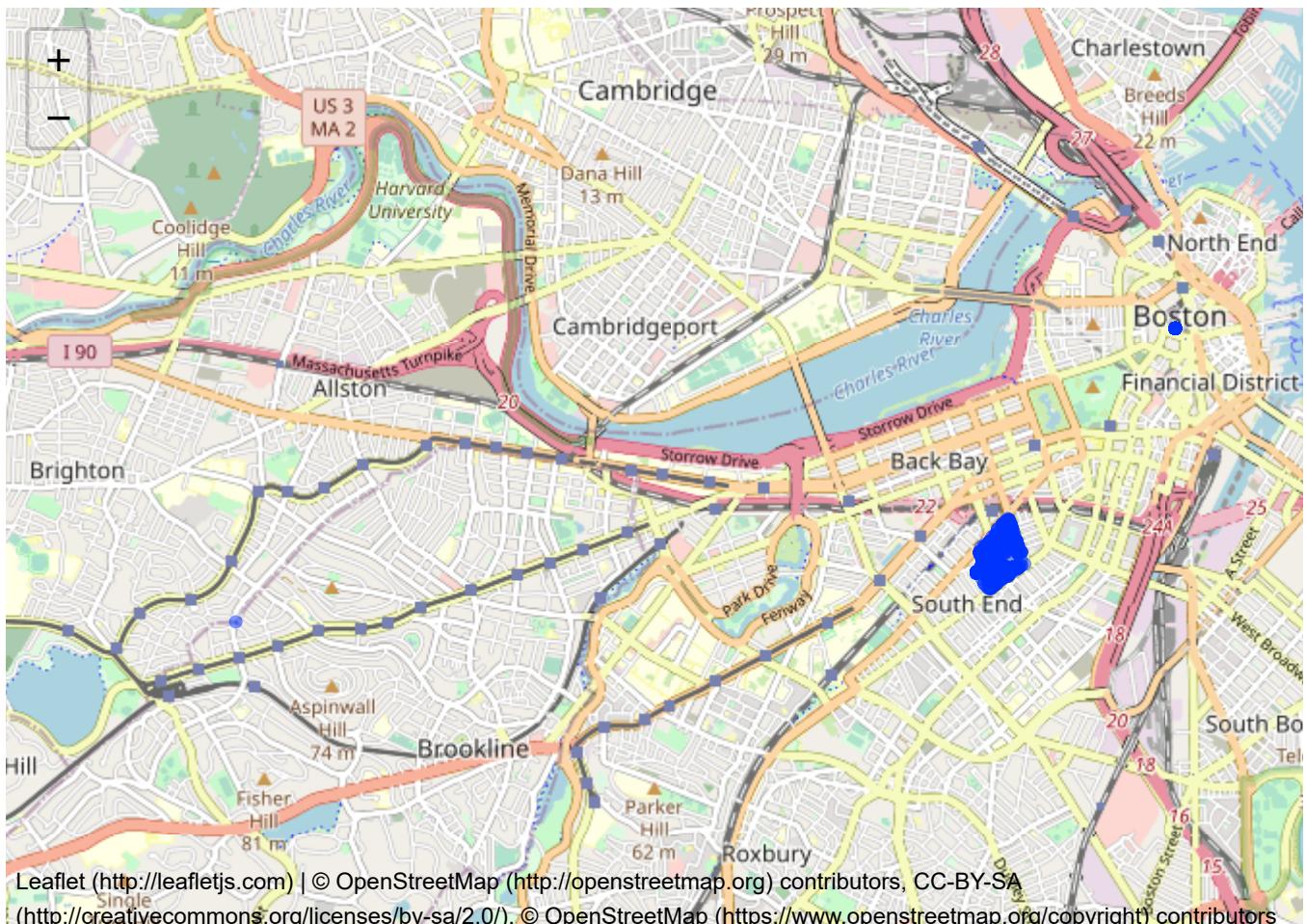




Step19:

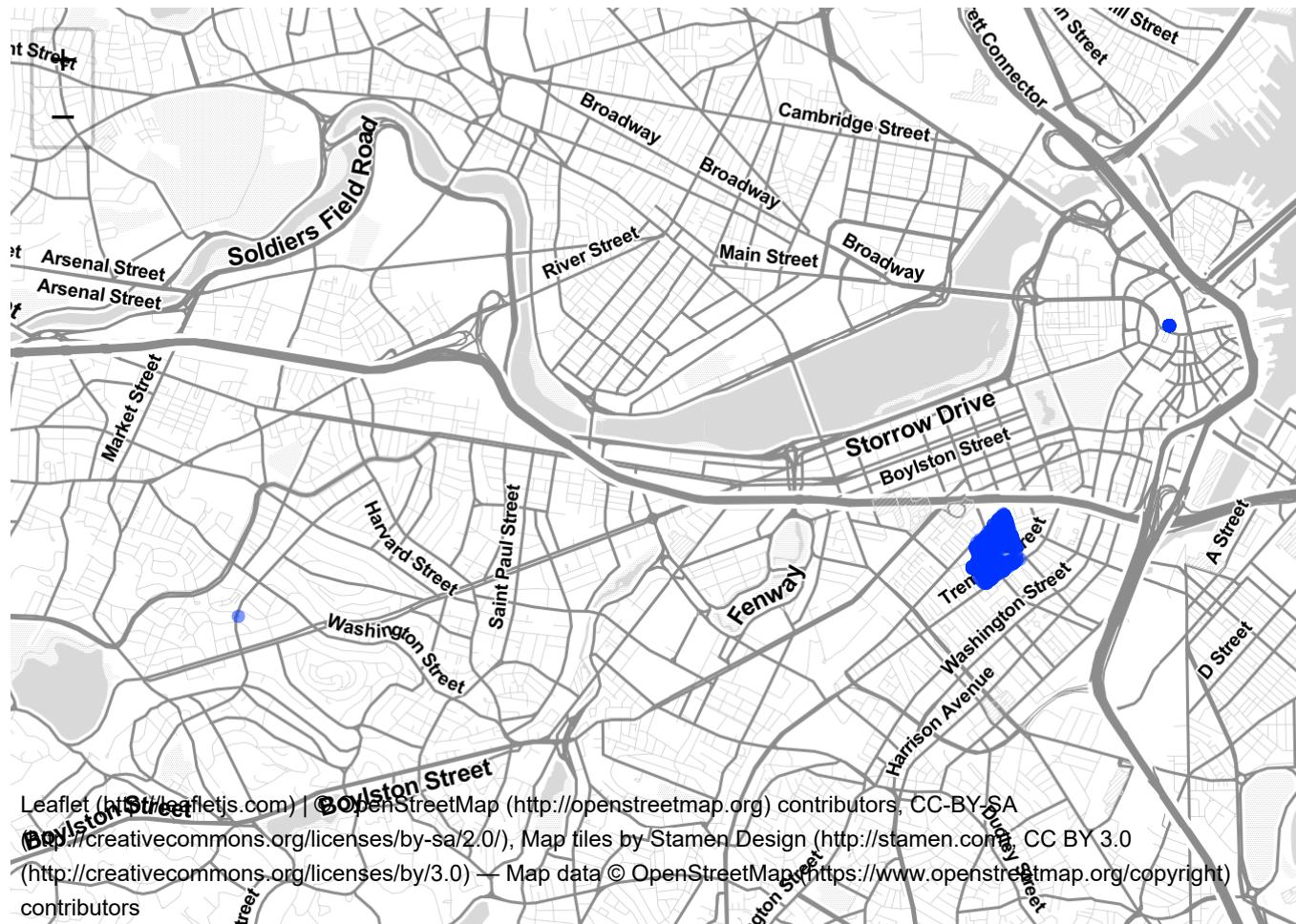
```
Bt3_Seasons %>% leaflet() %>% setView(lng=-71.105, lat=42.35, zoom=13) %>%
  addCircles %>% addTiles() %>% addProviderTiles(providers$OpenStreetMap)
```

```
## Assuming "longitude" and "latitude" are longitude and latitude, respectively
```



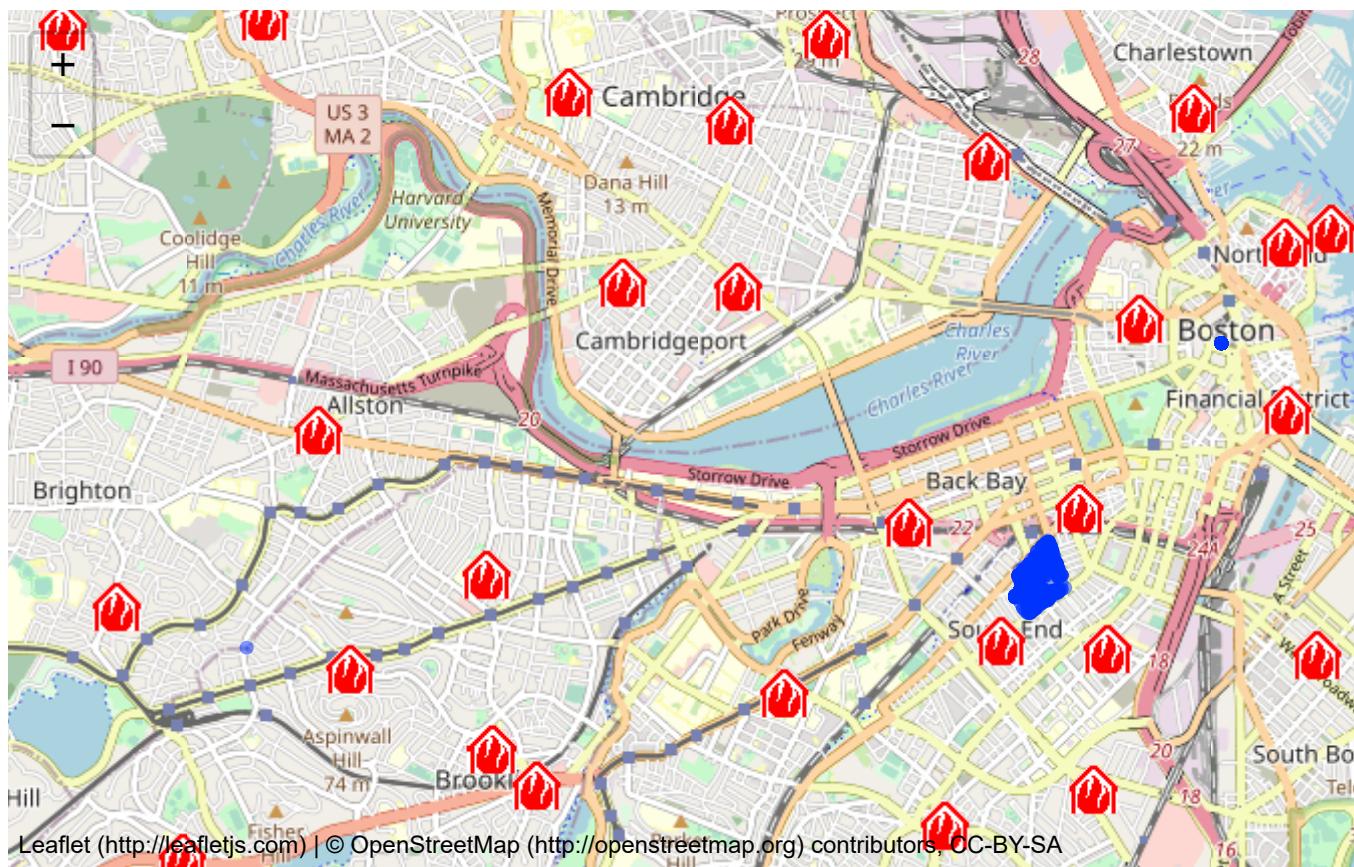
```
Bt3_Seasons %>% leaflet() %>% setView(lng=-71.105, lat=42.35, zoom=13) %>%
  addCircles %>% addTiles() %>% addProviderTiles(providers$Stamen.TonerLite)
```

```
## Assuming "longitude" and "latitude" are longitude and latitude, respectively
```



```
Bt3_Seasons %>% leaflet() %>% setView(lng=-71.105, lat=42.35, zoom=13) %>%
  addCircles %>% addTiles() %>% addProviderTiles(providers$OpenFireMap)
```

```
## Assuming "longitude" and "latitude" are longitude and latitude, respectively
```

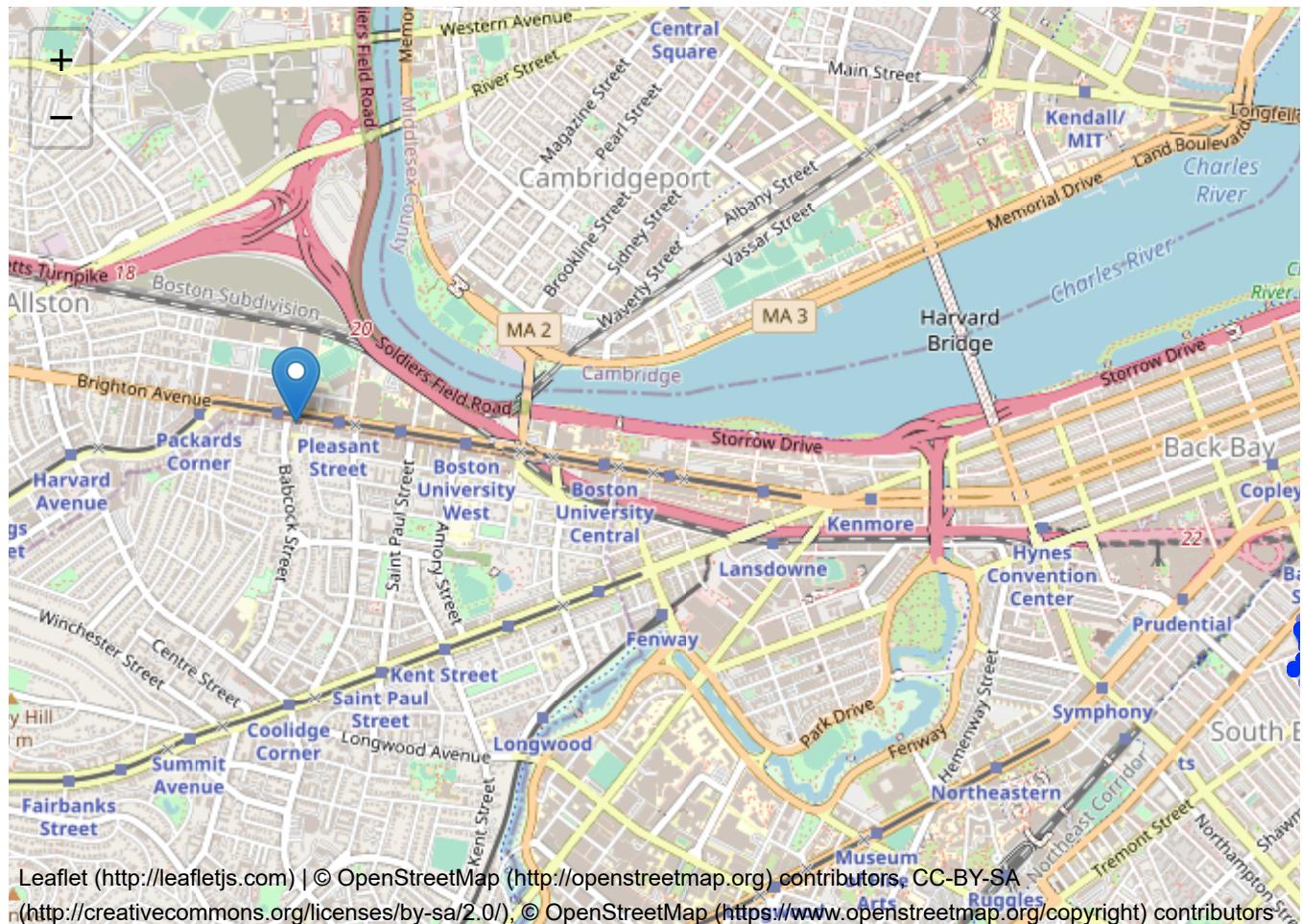


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Step20:how far is the precinct “0401” from Boston University?

```
Bt3_Seasons %>% leaflet() %>% setView(lng=-71.105, lat=42.35, zoom=14) %>% addCircles %>%
  addTiles() %>%
  addProviderTiles(providers$OpenStreetMap) %>% addMarkers(lng=-71.120996, lat=42.351444, pop
up="BU")
```

```
## Assuming "longitude" and "latitude" are longitude and latitude, respectively
```



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