5510-Projecxt

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Contents

How long did it take on average for the CFA brigade to respond to incidents in their own areas for hazard class 2 in Q4 2018/19 and Q4 2019/20? Also, this will be analyzed against the standard time (given in the data for each of the hazard classes). (CFA Emergency Response Time)

Introduction

There are three critical components of CFA delivery services: Response time: This is measured from when the brigade is alerted to an event to when the brigade arrives at the scene.

Brigade area: Each brigade has a defined brigade area, which specifies the operational footprint of the brigade.

Hazard classes: Hazard class defines the type of risk for a given area. Each brigade area may contain multiple hazard classes. However, each hazard class has a predefined service delivery standards.

In the data we have two variables that record the amount of time it CFA brigade to respond to incidents in specified areas:

- The time in which 90% of emergency incidents were responded to by any brigade; and,
- The time in which 90% of emergency incidents were responded to by the brigade within their own Brigade Area

The variable of interest for us is : The time in which 90% of emergency incidents were responded to by the brigade within their own Brigade Area. The reason is because we want to find out the mean time in which CFA brigade responded to incidents in their own brigade areas.

For this purpose, I did bit of data wrangling:

- renamed variables such that now we have a `TimeReponse` variable, and `TimeReponse_within`variable.
- mutate Number of incidents into a numeric vector.

- Changed the character variables to time using the contributed library chron.

For this specific question, we are going to analyze the data for ***Hazard Class 2*** that covers significant urban areas and is primarily residential including commercial centres, clusters of industrial and/or high density community services e.g. schools, correctional facilities, hospitals.

CFA has service delivery standards, which specify a response time target for a brigade to attend an emergency incident. The service delivery standard (response time) for Hazard Class 2 is **8 minutes**. Hence the analysis will be carried against this standard response time.

```
data_20 <- read.csv("~/5510_group_project/data/dat_q4_2020.csv")%>%
  rename(CFA_district = CFA.District)%>%
  rename(CFA_Brigade_Area = CFA.Brigade.Area)%>%
  rename(Number_of_incidents = `Number.of.emergency.incidents.within.the.Brigade.Area.for.the.reporting
  rename(TimeResponse = `The.time.in.which.90..of.emergency.incidents.were.responded.to.by.any.brigade`
  rename(TimeResponse_within = `The.time.in.which.90..of.emergency.incidents.were.responded.to.by.the.b
  mutate(`TimeResponse_within`= paste0("00:",`TimeResponse_within`))%>%
  mutate(TimeResponse = paste0("00:",TimeResponse))%>%
  mutate(Number_of_incidents = as.numeric(Number_of_incidents))

data_20
```

```
##     X CFA_district CFA_Brigade_Area Number_of_incidents TimeResponse
## 1   1            2          Bendigo                 71     00:06:51
## 2   2            2        Eaglehawk                 17     00:09:45
## 3   3            2    Golden Square                 21     00:07:45
## 4   4            2    Kangaroo Flat                 27     00:09:39
## 5   5            4         Portland                 12     00:06:30
## 6   6            5      Warrnambool                 86     00:07:28
## 7   7            7          Belmont                 61     00:06:49
## 8   8            7            Corio                105     00:07:51
## 9   9            7     Geelong City                117     00:06:40
## 10 10            7     Geelong West                 16     00:08:21
## 11 11            7             Lara                 36     00:11:00
## 12 12            7      Ocean Grove                 13     00:05:56
## 13 13            7          Torquay                 36     00:11:58
## 14 14            8          Berwick                 16     00:05:49
## 15 15            8     Carrum Downs                 27     00:10:30
## 16 16            8       Cranbourne                 91     00:08:26
## 17 17            8        Dandenong                171     00:08:17
## 18 18            8        Edithvale                 13     00:07:18
## 19 19            8        Frankston                143     00:07:19
## 20 20            8           Hallam                106     00:08:10
## 21 21            8     Hampton Park                 32     00:08:12
## 22 22            8       Langwarrin                 17     00:10:05
## 23 23            8       Mornington                 24     00:07:20
## 24 24            8         Mt Eliza                 13     00:08:29
## 25 25            8       Noble Park                 31     00:06:47
## 26 26            8         Pakenham                 28     00:09:19
## 27 27            8  Patterson River                 46     00:06:47
## 28 28            8          Rosebud                 25     00:06:13
##    TimeResponse_within
## 1             00:06:53
## 2             00:13:24
```

```
## 3             00:10:14
## 4             00:09:02
## 5             00:06:30
## 6             00:07:28
## 7             00:07:00
## 8             00:07:39
## 9             00:06:40
## 10            00:09:15
## 11            00:10:44
## 12            00:05:56
## 13            00:11:58
## 14            00:05:49
## 15            00:10:44
## 16            00:08:26
## 17            00:08:18
## 18            00:07:20
## 19            00:07:19
## 20            00:08:10
## 21            00:13:12
## 22            00:10:05
## 23            00:07:20
## 24            00:08:29
## 25            00:10:14
## 26            00:09:19
## 27            00:07:35
## 28            00:06:13
```

```
library(chron)

data_20$TimeResponse_within <- chron(times= data_20$TimeResponse_within)


data_20
```

```
##     X CFA_district CFA_Brigade_Area Number_of_incidents TimeResponse
## 1   1            2          Bendigo                  71     00:06:51
## 2   2            2        Eaglehawk                  17     00:09:45
## 3   3            2    Golden Square                  21     00:07:45
## 4   4            2    Kangaroo Flat                  27     00:09:39
## 5   5            4         Portland                  12     00:06:30
## 6   6            5      Warrnambool                  86     00:07:28
## 7   7            7          Belmont                  61     00:06:49
## 8   8            7            Corio                 105     00:07:51
## 9   9            7     Geelong City                 117     00:06:40
## 10 10            7     Geelong West                  16     00:08:21
## 11 11            7             Lara                  36     00:11:00
## 12 12            7      Ocean Grove                  13     00:05:56
## 13 13            7          Torquay                  36     00:11:58
## 14 14            8          Berwick                  16     00:05:49
## 15 15            8     Carrum Downs                  27     00:10:30
## 16 16            8       Cranbourne                  91     00:08:26
## 17 17            8        Dandenong                 171     00:08:17
## 18 18            8        Edithvale                  13     00:07:18
## 19 19            8        Frankston                 143     00:07:19
```

```
## 20 20            8           Hallam                 106     00:08:10
## 21 21            8     Hampton Park                  32     00:08:12
## 22 22            8       Langwarrin                  17     00:10:05
## 23 23            8       Mornington                  24     00:07:20
## 24 24            8         Mt Eliza                  13     00:08:29
## 25 25            8       Noble Park                  31     00:06:47
## 26 26            8         Pakenham                  28     00:09:19
## 27 27            8  Patterson River                  46     00:06:47
## 28 28            8          Rosebud                  25     00:06:13
##    TimeResponse_within
## 1             00:06:53
## 2             00:13:24
## 3             00:10:14
## 4             00:09:02
## 5             00:06:30
## 6             00:07:28
## 7             00:07:00
## 8             00:07:39
## 9             00:06:40
## 10            00:09:15
## 11            00:10:44
## 12            00:05:56
## 13            00:11:58
## 14            00:05:49
## 15            00:10:44
## 16            00:08:26
## 17            00:08:18
## 18            00:07:20
## 19            00:07:19
## 20            00:08:10
## 21            00:13:12
## 22            00:10:05
## 23            00:07:20
## 24            00:08:29
## 25            00:10:14
## 26            00:09:19
## 27            00:07:35
## 28            00:06:13
```

```
data_20$TimeResponse <- chron(times=data_20$TimeResponse)

data_20
```

```
##     X CFA_district CFA_Brigade_Area Number_of_incidents TimeResponse
## 1   1            2          Bendigo                  71     00:06:51
## 2   2            2        Eaglehawk                  17     00:09:45
## 3   3            2    Golden Square                  21     00:07:45
## 4   4            2    Kangaroo Flat                  27     00:09:39
## 5   5            4         Portland                  12     00:06:30
## 6   6            5      Warrnambool                  86     00:07:28
## 7   7            7          Belmont                  61     00:06:49
## 8   8            7            Corio                 105     00:07:51
## 9   9            7     Geelong City                 117     00:06:40
## 10 10            7     Geelong West                  16     00:08:21
```

```
## 11 11            7            Lara                36     00:11:00
## 12 12            7      Ocean Grove               13     00:05:56
## 13 13            7          Torquay               36     00:11:58
## 14 14            8          Berwick               16     00:05:49
## 15 15            8     Carrum Downs               27     00:10:30
## 16 16            8       Cranbourne               91     00:08:26
## 17 17            8        Dandenong              171     00:08:17
## 18 18            8        Edithvale               13     00:07:18
## 19 19            8        Frankston              143     00:07:19
## 20 20            8           Hallam              106     00:08:10
## 21 21            8     Hampton Park               32     00:08:12
## 22 22            8       Langwarrin               17     00:10:05
## 23 23            8       Mornington               24     00:07:20
## 24 24            8         Mt Eliza               13     00:08:29
## 25 25            8       Noble Park               31     00:06:47
## 26 26            8         Pakenham               28     00:09:19
## 27 27            8  Patterson River               46     00:06:47
## 28 28            8          Rosebud               25     00:06:13
##    TimeResponse_within
## 1             00:06:53
## 2             00:13:24
## 3             00:10:14
## 4             00:09:02
## 5             00:06:30
## 6             00:07:28
## 7             00:07:00
## 8             00:07:39
## 9             00:06:40
## 10            00:09:15
## 11            00:10:44
## 12            00:05:56
## 13            00:11:58
## 14            00:05:49
## 15            00:10:44
## 16            00:08:26
## 17            00:08:18
## 18            00:07:20
## 19            00:07:19
## 20            00:08:10
## 21            00:13:12
## 22            00:10:05
## 23            00:07:20
## 24            00:08:29
## 25            00:10:14
## 26            00:09:19
## 27            00:07:35
## 28            00:06:13
```

Context

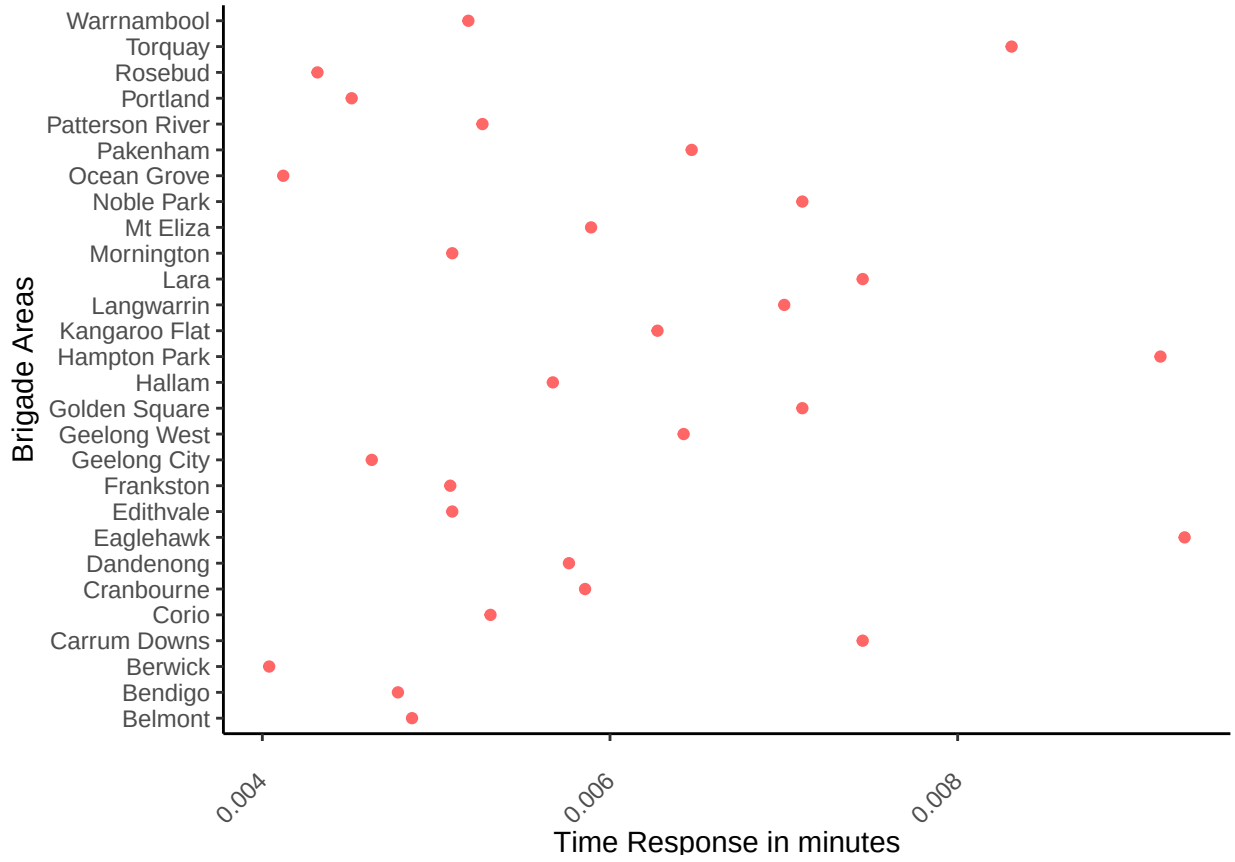
The most recent data from April to June 2020 showed CFA brigades responded to 9,120 incidents, of which 4,893 required an emergency response.

In 87 per cent of incidents that required emergency response, the community received a fire service within

the standard response time, which was broadly consistent with previous quarters.CFA News

Let's visualize the data first.

```
ggplot(data_20) +
  geom_point(data = data_20,
aes(x = TimeResponse_within,
y = CFA_Brigade_Area),
color = "red",
alpha = 0.6)+
  theme_classic()+
  theme(axis.text.x = element_text(angle = 45, vjust = 0.5, hjust=1), axis.title.x = element_text(vjust=
  labs(x = "Time Response in minutes",
y = "Brigade Areas")
```




```
data_20 %>%
  select(TimeResponse_within)%>%
  summary(data_20$TimeResponse_within)%>%
  kable() %>%
kable_styling(bootstrap_options = c("striped","hover"))
```

The mean time that it took CFA brigades to respond to incidents in their own CFA brigade areas is 0.0059838. This is very close to the target response time for brigades, which is eight minutes.

	TimeResponse_within
	Min. :00:05:49
	1st Qu.:00:07:14
	Median :00:08:14
	Mean :00:08:37
	3rd Qu.:00:10:07
	Max. :00:13:24

```
data20_avgRT <- function(TimeResponse_within){

  m = sum(TimeResponse_within)/length(TimeResponse_within)
  return(m)
}
data20_avgRT(data_20$TimeResponse_within)
```

```
## [1] 00:08:37
```

For the year 2018/19, we have used the data belonging to the year 2018/19, which was acquired from the CFA official site.

The most recent data set from July to September 2019 showed CFA brigades responding to 9,830 incidents, of which 5,013 required an emergency response.

In 87 per cent of emergencies, the community received a fire service within the standard response time, which was broadly consistent with previous quarters.CFA News

For this part of the question, I repeated the same data cleaning steps as mentioned above.

```
data_19 <- read.csv("~/5510_group_project/data/dat_q4_2018_19.csv")%>%
  rename(CFA_district = CFA.District)%>%
  rename(CFA_Brigade_Area = CFA.Brigade.Area)%>%
  rename(Number_of_incidents = `Number.of.emergency.incidents.within.the.Brigade.Area.for.the.reporting
  rename(TimeResponse = `The.time.in.which.90..of.emergency.incidents.were.responded.to.by.any.brigade`
  rename(TimeResponse_within = `The.time.in.which.90..of.emergency.incidents.were.responded.to.by.the.b
  filter(TimeResponse_within != "NULL")%>%
  mutate(`TimeResponse_within`= paste0("00:",`TimeResponse_within`))%>%
  mutate(TimeResponse = paste0("00:",TimeResponse))%>%
  mutate(Number_of_incidents = as.numeric(Number_of_incidents))


data_19
```

```
##     X CFA_district CFA_Brigade_Area Number_of_incidents TimeResponse
## 1   1            2          Bendigo                  58     00:07:32
## 2   2            2       Castlemaine                 10     00:09:36
## 3   3            2         Eaglehawk                 16     00:09:23
## 4   4            2     Kangaroo Flat                 12     00:07:48
## 5   5            4          Portland                 19     00:07:00
## 6   6            5       Warrnambool                 44     00:07:13
## 7   7            6             Colac                 10     00:07:46
## 8   8            7           Belmont                 56     00:07:07
## 9   9            7             Corio                102     00:07:31
## 10 10            7      Geelong City                122     00:06:47
```

```
## 11 11            7             Lara                26     00:10:28
## 12 12            7      Ocean Grove                10     00:05:28
## 13 13            7          Torquay                15     00:11:55
## 14 14            8          Berwick                25     00:06:46
## 15 15            8     Carrum Downs                32     00:08:57
## 16 16            8       Cranbourne                78     00:09:51
## 17 17            8        Dandenong               126     00:09:13
## 18 18            8        Edithvale                13     00:06:52
## 19 19            8        Frankston               116     00:07:07
## 20 20            8           Hallam                71     00:07:23
## 21 21            8     Hampton Park                18     00:08:35
## 22 22            8       Mornington                38     00:07:07
## 23 24            8         Pakenham                27     00:08:13
## 24 25            8  Patterson River                29     00:07:33
## 25 26            8          Rosebud                17     00:07:27
## 26 27            8       Springvale                62     00:07:53
## 27 28           11       Bairnsdale                11     00:12:21
## 28 29           13        Bayswater                17     00:06:39
## 29 30           13          Boronia                46     00:06:17
## 30 31           13   Chirnside Park                14     00:08:57
## 31 32           13   Ferntree Gully                24     00:07:30
## 32 33           13         Lilydale                17     00:09:23
## 33 34           13         Montrose                16     00:06:49
## 34 35           13         Rowville                28     00:06:57
## 35 36           13         Scoresby                32     00:09:13
## 36 37           13      Warrandyte                 14     00:07:27
## 37 38           14 Caroline Springs                67     00:08:57
## 38 39           14      Craigieburn                52     00:09:43
## 39 40           14           Eltham                25     00:06:48
## 40 41           14           Epping                28     00:09:09
## 41 42           14        Greenvale                17     00:08:51
## 42 43           14 Hoppers Crossing                61     00:08:18
## 43 44           14           Melton                79     00:08:04
## 44 45           14           Mernda                12     00:08:35
## 45 46           14       Point Cook                37     00:09:33
## 46 47           14     South Morang                22     00:07:24
## 47 48           14           Sunbury               44     00:08:20
## 48 49           14         Werribee                20     00:07:13
## 49 50           15    Bacchus Marsh                20     00:10:22
## 50 51           15          Ballarat               25     00:08:03
## 51 52           15    Ballarat City                58     00:05:28
## 52 53           15       Sebastopol                16     00:08:45
## 53 54           15        Wendouree                36     00:09:47
## 54 55           16          Stawell                14     00:09:29
## 55 56           18          Mildura                48     00:06:38
## 56 57           22       Shepparton                79     00:07:13
## 57 58           23          Benalla                13     00:08:34
## 58 59           23       Wangaratta                21     00:05:41
## 59 60           24          Wodonga                40     00:07:45
## 60 62           27          Morwell                39     00:06:28
## 61 63           27        Traralgon                34     00:06:34
##    TimeResponse_within
## 1             00:07:30
## 2             00:09:36
```

```
## 3            00:14:45
## 4            00:07:52
## 5            00:07:00
## 6            00:07:13
## 7            00:09:02
## 8            00:08:05
## 9            00:07:56
## 10           00:06:47
## 11           00:10:28
## 12           00:05:28
## 13           00:12:59
## 14           00:06:39
## 15           00:09:21
## 16           00:09:51
## 17           00:09:13
## 18           00:07:13
## 19           00:07:18
## 20           00:08:24
## 21           00:12:16
## 22           00:07:07
## 23           00:07:51
## 24           00:08:20
## 25           00:07:27
## 26           00:08:49
## 27           00:12:23
## 28           00:06:39
## 29           00:06:27
## 30           00:10:30
## 31           00:09:45
## 32           00:09:23
## 33           00:09:07
## 34           00:07:49
## 35           00:12:51
## 36           00:10:31
## 37           00:11:32
## 38           00:09:43
## 39           00:06:48
## 40           00:10:36
## 41           00:11:31
## 42           00:08:18
## 43           00:08:04
## 44           00:08:37
## 45           00:09:33
## 46           00:07:24
## 47           00:08:20
## 48           00:10:03
## 49           00:12:11
## 50           00:10:29
## 51           00:05:27
## 52           00:11:18
## 53           00:16:38
## 54           00:09:29
## 55           00:06:38
## 56           00:07:13
```

```
## 57            00:08:34
## 58            00:06:15
## 59            00:07:45
## 60            00:06:28
## 61            00:06:26
```

```
library(chron)

data_19$TimeResponse_within <- chron(times= data_19$TimeResponse_within)



data_19
```

```
##     X CFA_district CFA_Brigade_Area Number_of_incidents TimeResponse
## 1   1            2          Bendigo                  58     00:07:32
## 2   2            2       Castlemaine                 10     00:09:36
## 3   3            2         Eaglehawk                 16     00:09:23
## 4   4            2     Kangaroo Flat                 12     00:07:48
## 5   5            4          Portland                 19     00:07:00
## 6   6            5       Warrnambool                 44     00:07:13
## 7   7            6             Colac                 10     00:07:46
## 8   8            7           Belmont                 56     00:07:07
## 9   9            7             Corio                102     00:07:31
## 10 10            7      Geelong City                122     00:06:47
## 11 11            7              Lara                 26     00:10:28
## 12 12            7       Ocean Grove                 10     00:05:28
## 13 13            7           Torquay                 15     00:11:55
## 14 14            8           Berwick                 25     00:06:46
## 15 15            8      Carrum Downs                 32     00:08:57
## 16 16            8        Cranbourne                 78     00:09:51
## 17 17            8         Dandenong                126     00:09:13
## 18 18            8         Edithvale                 13     00:06:52
## 19 19            8         Frankston                116     00:07:07
## 20 20            8             Hallam                71     00:07:23
## 21 21            8      Hampton Park                 18     00:08:35
## 22 22            8        Mornington                 38     00:07:07
## 23 24            8          Pakenham                 27     00:08:13
## 24 25            8   Patterson River                 29     00:07:33
## 25 26            8           Rosebud                 17     00:07:27
## 26 27            8        Springvale                 62     00:07:53
## 27 28           11        Bairnsdale                 11     00:12:21
## 28 29           13         Bayswater                 17     00:06:39
## 29 30           13           Boronia                 46     00:06:17
## 30 31           13    Chirnside Park                 14     00:08:57
## 31 32           13    Ferntree Gully                 24     00:07:30
## 32 33           13           Lilydale                17     00:09:23
## 33 34           13           Montrose                16     00:06:49
## 34 35           13           Rowville                28     00:06:57
## 35 36           13           Scoresby                32     00:09:13
## 36 37           13        Warrandyte                 14     00:07:27
## 37 38           14 Caroline Springs                  67     00:08:57
## 38 39           14       Craigieburn                 52     00:09:43
## 39 40           14             Eltham                25     00:06:48
```

```
## 40 41           14           Epping                28     00:09:09
## 41 42           14        Greenvale                17     00:08:51
## 42 43           14 Hoppers Crossing                61     00:08:18
## 43 44           14           Melton                79     00:08:04
## 44 45           14           Mernda                12     00:08:35
## 45 46           14       Point Cook                37     00:09:33
## 46 47           14     South Morang                22     00:07:24
## 47 48           14          Sunbury                44     00:08:20
## 48 49           14         Werribee                20     00:07:13
## 49 50           15    Bacchus Marsh                20     00:10:22
## 50 51           15         Ballarat                25     00:08:03
## 51 52           15    Ballarat City                58     00:05:28
## 52 53           15       Sebastopol                16     00:08:45
## 53 54           15        Wendouree                36     00:09:47
## 54 55           16          Stawell                14     00:09:29
## 55 56           18          Mildura                48     00:06:38
## 56 57           22       Shepparton                79     00:07:13
## 57 58           23          Benalla                13     00:08:34
## 58 59           23       Wangaratta                21     00:05:41
## 59 60           24          Wodonga                40     00:07:45
## 60 62           27          Morwell                39     00:06:28
## 61 63           27        Traralgon                34     00:06:34
##    TimeResponse_within
## 1             00:07:30
## 2             00:09:36
## 3             00:14:45
## 4             00:07:52
## 5             00:07:00
## 6             00:07:13
## 7             00:09:02
## 8             00:08:05
## 9             00:07:56
## 10            00:06:47
## 11            00:10:28
## 12            00:05:28
## 13            00:12:59
## 14            00:06:39
## 15            00:09:21
## 16            00:09:51
## 17            00:09:13
## 18            00:07:13
## 19            00:07:18
## 20            00:08:24
## 21            00:12:16
## 22            00:07:07
## 23            00:07:51
## 24            00:08:20
## 25            00:07:27
## 26            00:08:49
## 27            00:12:23
## 28            00:06:39
## 29            00:06:27
## 30            00:10:30
## 31            00:09:45
```

```
## 32            00:09:23
## 33            00:09:07
## 34            00:07:49
## 35            00:12:51
## 36            00:10:31
## 37            00:11:32
## 38            00:09:43
## 39            00:06:48
## 40            00:10:36
## 41            00:11:31
## 42            00:08:18
## 43            00:08:04
## 44            00:08:37
## 45            00:09:33
## 46            00:07:24
## 47            00:08:20
## 48            00:10:03
## 49            00:12:11
## 50            00:10:29
## 51            00:05:27
## 52            00:11:18
## 53            00:16:38
## 54            00:09:29
## 55            00:06:38
## 56            00:07:13
## 57            00:08:34
## 58            00:06:15
## 59            00:07:45
## 60            00:06:28
## 61            00:06:26
```

```
data_19$TimeResponse <- chron(times=data_19$TimeResponse)

data_19
```

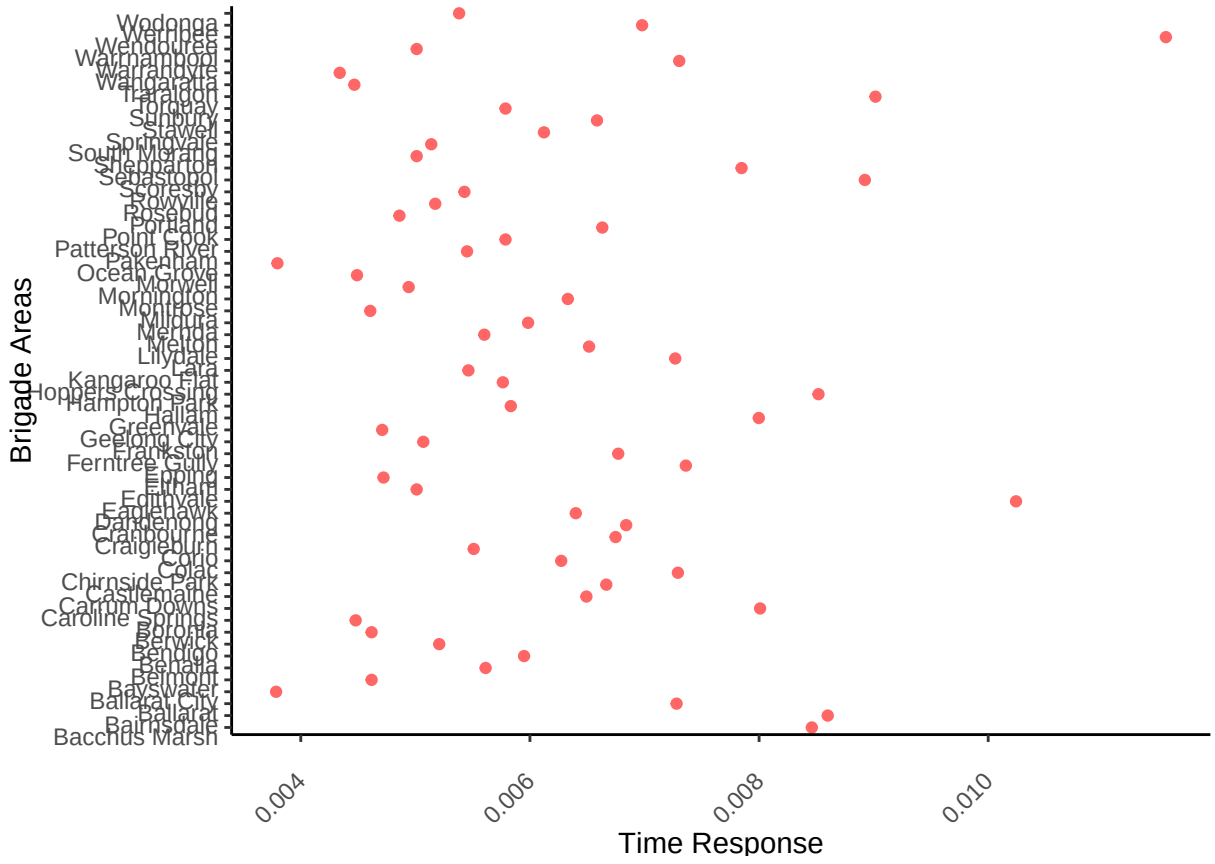
```
##     X CFA_district CFA_Brigade_Area Number_of_incidents TimeResponse
## 1   1            2          Bendigo                  58     00:07:32
## 2   2            2       Castlemaine                 10     00:09:36
## 3   3            2         Eaglehawk                 16     00:09:23
## 4   4            2     Kangaroo Flat                 12     00:07:48
## 5   5            4          Portland                 19     00:07:00
## 6   6            5       Warrnambool                 44     00:07:13
## 7   7            6             Colac                 10     00:07:46
## 8   8            7           Belmont                 56     00:07:07
## 9   9            7             Corio                102     00:07:31
## 10 10            7      Geelong City                122     00:06:47
## 11 11            7              Lara                 26     00:10:28
## 12 12            7       Ocean Grove                 10     00:05:28
## 13 13            7           Torquay                 15     00:11:55
## 14 14            8           Berwick                 25     00:06:46
## 15 15            8      Carrum Downs                 32     00:08:57
## 16 16            8        Cranbourne                 78     00:09:51
## 17 17            8         Dandenong                126     00:09:13
## 18 18            8         Edithvale                 13     00:06:52
```

```
## 19 19            8        Frankston                116     00:07:07
## 20 20            8           Hallam                 71     00:07:23
## 21 21            8     Hampton Park                 18     00:08:35
## 22 22            8       Mornington                 38     00:07:07
## 23 24            8         Pakenham                 27     00:08:13
## 24 25            8  Patterson River                 29     00:07:33
## 25 26            8          Rosebud                 17     00:07:27
## 26 27            8       Springvale                 62     00:07:53
## 27 28           11       Bairnsdale                 11     00:12:21
## 28 29           13        Bayswater                 17     00:06:39
## 29 30           13          Boronia                 46     00:06:17
## 30 31           13   Chirnside Park                 14     00:08:57
## 31 32           13   Ferntree Gully                 24     00:07:30
## 32 33           13          Lilydale                17     00:09:23
## 33 34           13          Montrose                16     00:06:49
## 34 35           13          Rowville                28     00:06:57
## 35 36           13          Scoresby                32     00:09:13
## 36 37           13       Warrandyte                 14     00:07:27
## 37 38           14 Caroline Springs                 67     00:08:57
## 38 39           14      Craigieburn                 52     00:09:43
## 39 40           14           Eltham                 25     00:06:48
## 40 41           14           Epping                 28     00:09:09
## 41 42           14        Greenvale                 17     00:08:51
## 42 43           14 Hoppers Crossing                 61     00:08:18
## 43 44           14           Melton                 79     00:08:04
## 44 45           14           Mernda                 12     00:08:35
## 45 46           14       Point Cook                 37     00:09:33
## 46 47           14     South Morang                 22     00:07:24
## 47 48           14           Sunbury                44     00:08:20
## 48 49           14          Werribee                20     00:07:13
## 49 50           15    Bacchus Marsh                 20     00:10:22
## 50 51           15          Ballarat                25     00:08:03
## 51 52           15    Ballarat City                 58     00:05:28
## 52 53           15       Sebastopol                 16     00:08:45
## 53 54           15        Wendouree                 36     00:09:47
## 54 55           16          Stawell                 14     00:09:29
## 55 56           18          Mildura                 48     00:06:38
## 56 57           22       Shepparton                 79     00:07:13
## 57 58           23          Benalla                 13     00:08:34
## 58 59           23       Wangaratta                 21     00:05:41
## 59 60           24          Wodonga                 40     00:07:45
## 60 62           27          Morwell                 39     00:06:28
## 61 63           27        Traralgon                 34     00:06:34
##    TimeResponse_within
## 1             00:07:30
## 2             00:09:36
## 3             00:14:45
## 4             00:07:52
## 5             00:07:00
## 6             00:07:13
## 7             00:09:02
## 8             00:08:05
## 9             00:07:56
## 10            00:06:47
```

```
## 11           00:10:28
## 12           00:05:28
## 13           00:12:59
## 14           00:06:39
## 15           00:09:21
## 16           00:09:51
## 17           00:09:13
## 18           00:07:13
## 19           00:07:18
## 20           00:08:24
## 21           00:12:16
## 22           00:07:07
## 23           00:07:51
## 24           00:08:20
## 25           00:07:27
## 26           00:08:49
## 27           00:12:23
## 28           00:06:39
## 29           00:06:27
## 30           00:10:30
## 31           00:09:45
## 32           00:09:23
## 33           00:09:07
## 34           00:07:49
## 35           00:12:51
## 36           00:10:31
## 37           00:11:32
## 38           00:09:43
## 39           00:06:48
## 40           00:10:36
## 41           00:11:31
## 42           00:08:18
## 43           00:08:04
## 44           00:08:37
## 45           00:09:33
## 46           00:07:24
## 47           00:08:20
## 48           00:10:03
## 49           00:12:11
## 50           00:10:29
## 51           00:05:27
## 52           00:11:18
## 53           00:16:38
## 54           00:09:29
## 55           00:06:38
## 56           00:07:13
## 57           00:08:34
## 58           00:06:15
## 59           00:07:45
## 60           00:06:28
## 61           00:06:26
```

Let's visualize the data for the year 2018/19.

```
ggplot(data_19) +
  geom_point(data = data_19,
aes(x = TimeResponse_within,
y = CFA_Brigade_Area),
color = "red",
alpha = 0.6)+
  theme_classic()+
  theme(axis.text.x = element_text(angle = 45, vjust = 0.5, hjust=1), axis.title.x = element_text(vjust
  theme(axis.text.y =  element_text(angle = , vjust = 1, hjust=1), axis.title.y =  element_text(vjust=-
labs(x = "Time Response",
y = "Brigade Areas")
```




```
data_19%>%
  select(TimeResponse_within)%>%
  summary(data_19$TimeResponse_within)%>%
  kable() %>%
kable_styling(bootstrap_options = c("striped","hover"))
```

Using the summary function, we can see that the mean time taken by the CFA brigades to respond to the incidents in their own areas was 0.0062073. This is agian very close to the target standard which was eight minutes.

```
data19_avgRT <- function(TimeResponse_within){
```

	TimeResponse_within
	Min. :00:05:27
	1st Qu.:00:07:13
	Median :00:08:24
	Mean :00:08:56
	3rd Qu.:00:10:03
	Max. :00:16:38

```
  m = sum(TimeResponse_within, na.rm = TRUE)/length(TimeResponse_within)
  return(m)
}
data19_avgRT(data_19$TimeResponse_within)
```

```
## [1] 00:08:56
```

Analysis

Keeping it brief, we can state that CFA brigades' performance against standard time of eight minutes for the hazard class 2 was achieved successfully, since we see a little variation in terms of amount of time taken by the CFA.

Which of the CFA brigade areas have had the highest number of incidents across Hazard classes for the reported period (2019/20) (four quarters). (CFA Emergency Response Time)

Introduction

In this question, we have one variable that records the number of incidents across all hazard classes for all the specified districts. There are three predefined hazard classes: 2, 3 and 4.

- Hazard class 2 (Medium Urban): This includes significant urban areas which are primarily residential including commercial centres, clusters of industrial and/or high density community services e.g. schools, correctional facilities, hospitals. (8 minutes SDS).
- Hazard Class 3 (Low Urban): This includes all urban areas that are not included in Hazard Class 2 and includes predominantly residential occupancies and small industries. (10 minutes SDS).
- Hazard Class 4 (Rural): This includes primarily the natural surroundings in terms of bush and grassland, but also involves isolated dwellings and structures within those areas.

The variable of interest for us is : Number_Incidents_total.

For this purpose, I did bit of data wrangling:

- renamed variables such that now we have a `CFA_Brigade_Area` variable, and `Number_Incidents_total`variable in each data set. (I had four datasets for Quarters 1, 2, 3,and 4)
- mutate Number of incidents into a numeric vector.
- Join data using bind_rows

Context

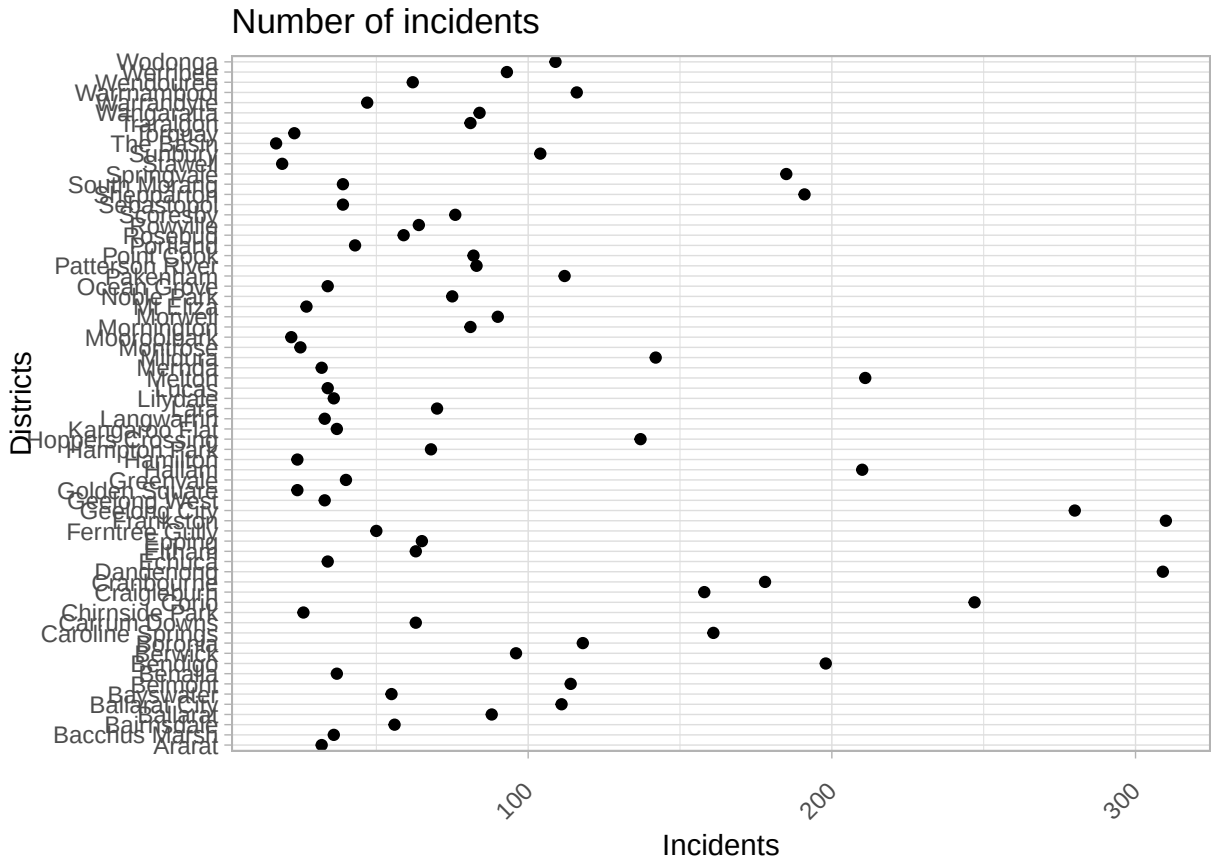
In this question we are concerned with district that has had the highest number of incidents across all hazard classes in the year 2019/20.

Let's first visualize data from each data set for the quarters 1, 2, 3 and 4 for the year 2019/20.

```
dat_Q1_2020 <- read_csv("~/5510_group_project/data/dat_Q1_2020.csv") %>%
  rename(Number_Incidents_total =`Number of incidents within the Brigade Area for the reporting period a
  rename(CFA_Brigade_Area = `CFA Brigade Area`)

dat_Q1_2020
```

```
## # A tibble: 68 x 4
##       X1 `CFA District` CFA_Brigade_Area Number_Incidents_total
##    <dbl> <chr>          <chr>                              <dbl>
##  1     1 02             Bendigo                              198
##  2     2 02             Golden Square                         24
##  3     3 02             Kangaroo Flat                         37
##  4     4 04             Portland                              43
##  5     5 05             Hamilton                              24
##  6     6 05             Warrnambool                          116
##  7     7 07             Belmont                              114
##  8     8 07             Corio                                247
##  9     9 07             Geelong City                         280
## 10    10 07             Geelong West                          33
## # ... with 58 more rows
```

```
ggplot(dat_Q1_2020, aes( x = Number_Incidents_total,
                         y = CFA_Brigade_Area)) +
geom_point() +
  theme_light() +
  theme(axis.text.x = element_text(angle = 45, vjust = 0.5, hjust=1), axis.title.x = element_text(vjust=
  theme(axis.text.y =  element_text(angle = , vjust = 0.5, hjust=1), axis.title.y =  element_text(vjust=

  xlab("Incidents") +
 ylab("Districts") +
  ggtitle("Number of incidents")
```



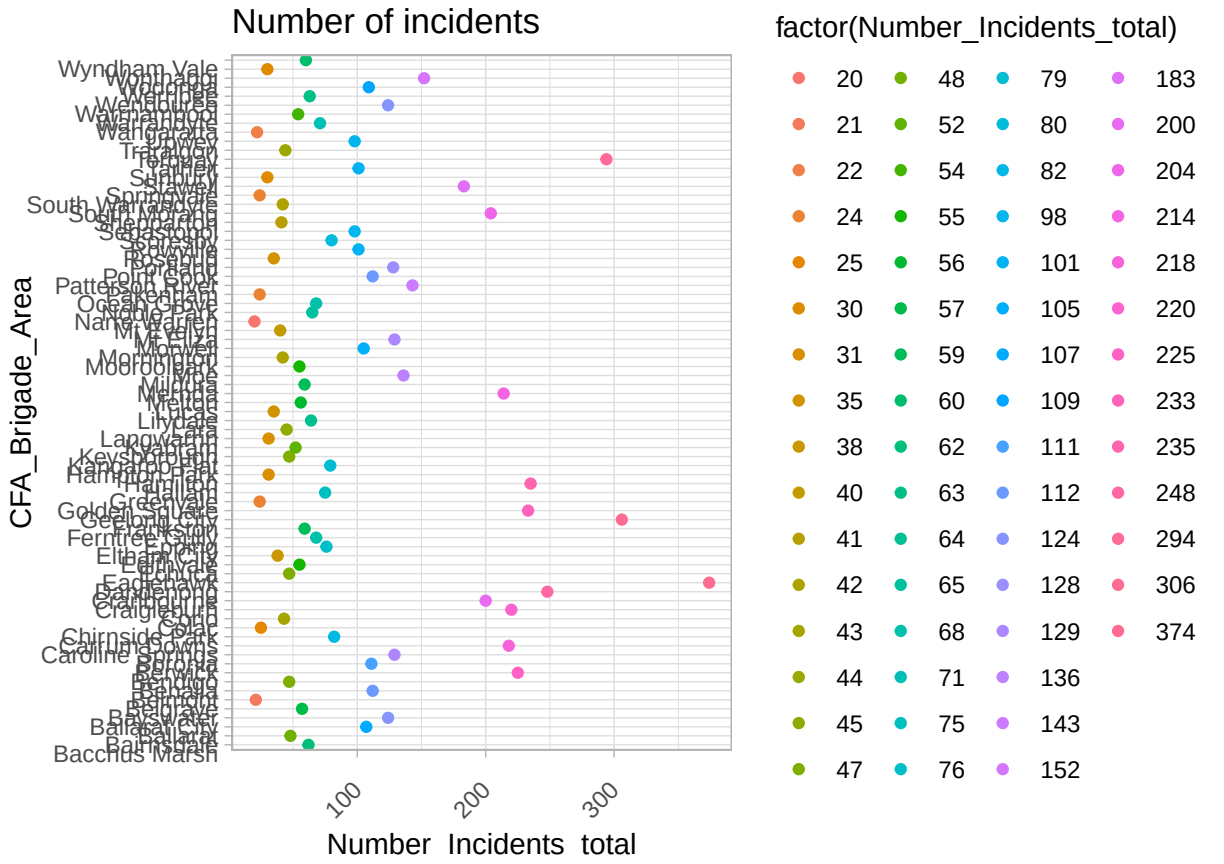
The above plot shows us the number of incidents for the first quarter 2019/20. On the x-axis we have number of incidents and the y-axis we can see the names of districts.

```
dat_Q2_2020 <- read_csv("~/5510_group_project/data/dat_Q2_2020.csv")%>%
  rename(Number_Incidents_total = `Number of incidents within the Brigade Area for the reporting period
  rename(CFA_Brigade_Area = `CFA Brigade Area`)

dat_Q2_2020
```

```
## # A tibble: 77 x 4
##       X1 `CFA District` CFA_Brigade_Area Number_Incidents_total
##    <dbl> <chr>          <chr>                              <dbl>
##  1     1 02             Bendigo                              225
##  2     2 02             Eaglehawk                             47
##  3     3 02             Golden Square                         24
##  4     4 02             Kangaroo Flat                         47
##  5     5 04             Portland                              35
##  6     6 05             Hamilton                              31
##  7     7 05             Warrnambool                          124
##  8     8 06             Colac                                 43
##  9     9 07             Belmont                              112
## 10    10 07             Corio                                220
## # ... with 67 more rows
```

```
ggplot(dat_Q2_2020, aes(x = Number_Incidents_total ,
                        y = CFA_Brigade_Area,
```

```
                          colour = factor(Number_Incidents_total)))+

  geom_point() +
  theme_light() +
  theme(axis.text.x = element_text(angle = 45, vjust = 0.5, hjust=1), axis.title.x = element_text(vjust=
  theme(axis.text.y =  element_text(angle = , vjust = 1, hjust=1), axis.title.y =  element_text(vjust=-
  ggtitle("Number of incidents")
```



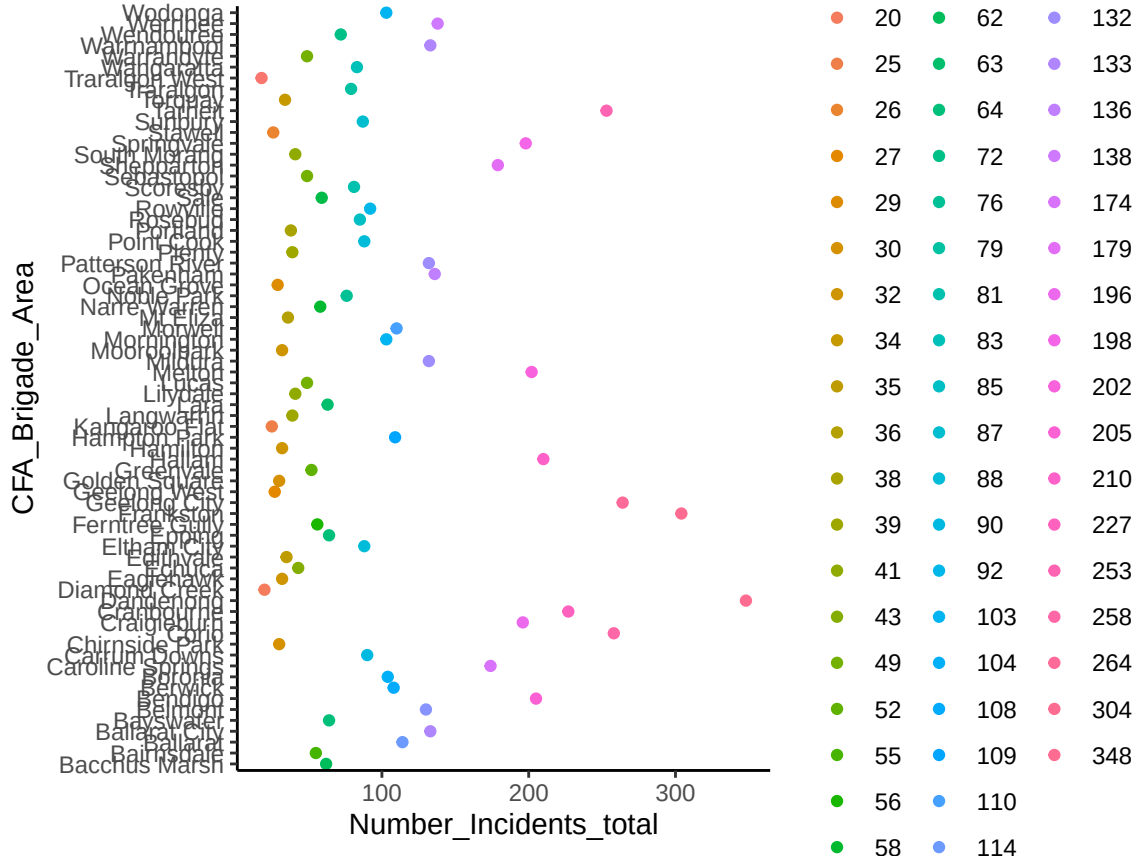
Similiar to the plot above, this plot shows us the number of incidents for the second quarter 2019/20. On the x-axis we have number of incidents and the y-axis we can see the names of districts.

```
dat_Q3_2020 <- read_csv("~/5510_group_project/data/dat_Q3_2020.csv") %>%
  rename(Number_Incidents_total = `Number of incidents within the Brigade Area for the reporting period
  rename(CFA_Brigade_Area = `CFA Brigade Area`)


dat_Q3_2020
```

```
## # A tibble: 70 x 4
##       X1 'CFA District' CFA_Brigade_Area Number_Incidents_total
##    <dbl> <chr>          <chr>                              <dbl>
##  1     1 02             Bendigo                              205
##  2     2 02             Eaglehawk                             32
##  3     3 02             Golden Square                         30
##  4     4 02             Kangaroo Flat                         25
```

```
##  5     5 04             Portland                          38
##  6     6 05             Hamilton                          32
##  7     7 05             Warrnambool                      133
##  8     8 07             Belmont                          130
##  9     9 07             Corio                            258
## 10    10 07             Geelong City                     264
## # ... with 60 more rows
```

```
 ggplot(dat_Q3_2020) +
geom_point(aes(x = Number_Incidents_total,
y = CFA_Brigade_Area,
colour = factor(Number_Incidents_total)))  +
  theme_classic()
```



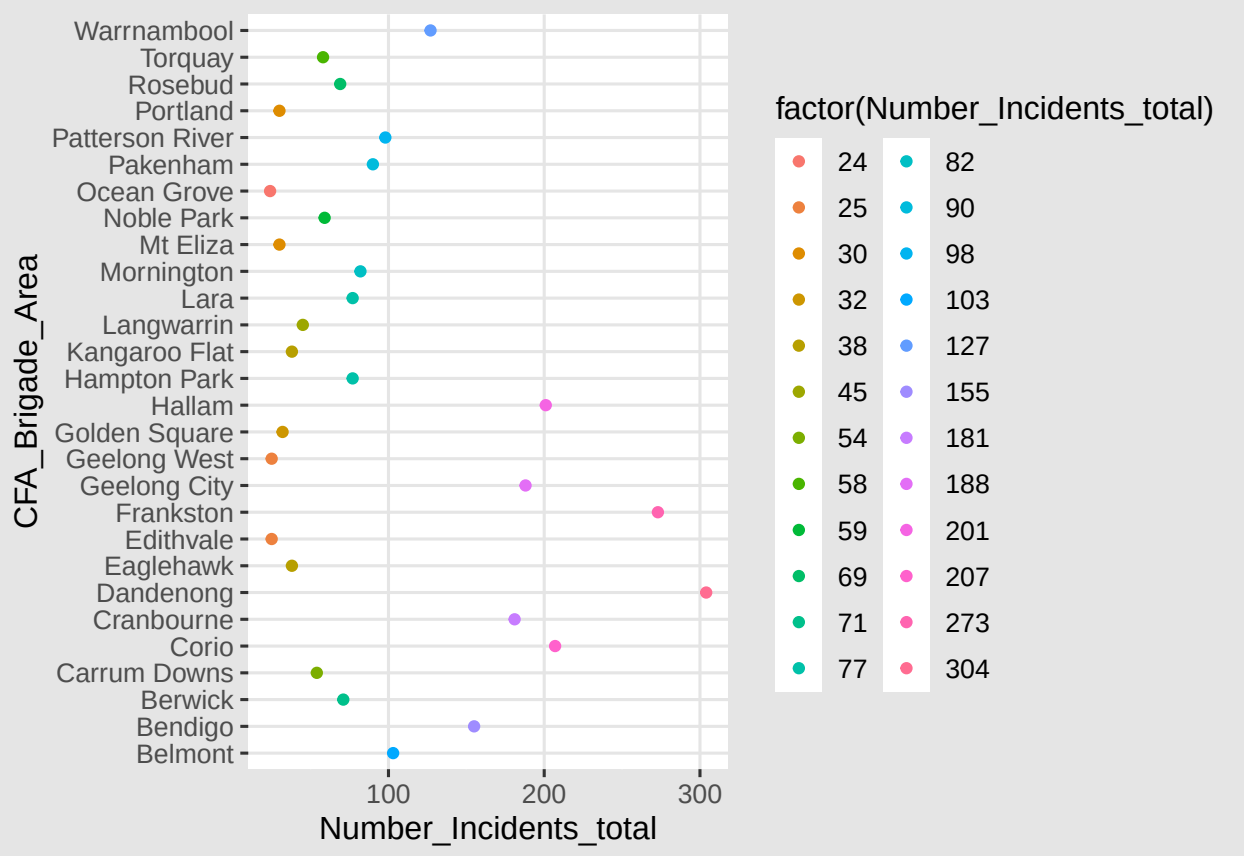
The above plot shows us the number of incidents for the third quarter 2019/20. On the x-axis we have number of incidents and the y-axis we can see the names of districts.

```
dat_Q4_2020 <- read_csv("~/5510_group_project/data/dat_2020Q4.csv")%>%
  select(`CFA District`, `CFA Brigade Area`, `Number of incidents within the Brigade Area for the repor
  rename(Number_Incidents_total = `Number of incidents within the Brigade Area for the reporting period
    rename(CFA_Brigade_Area = `CFA Brigade Area`)

dat_Q4_2020
```

```
## # A tibble: 28 x 3
```

```
##    'CFA District' CFA_Brigade_Area Number_Incidents_total
##    <chr>          <chr>                            <dbl>
##  1 02             Bendigo                            155
##  2 02             Eaglehawk                           38
##  3 02             Golden Square                       32
##  4 02             Kangaroo Flat                       38
##  5 04             Portland                            30
##  6 05             Warrnambool                        127
##  7 07             Belmont                            103
##  8 07             Corio                              207
##  9 07             Geelong City                       188
## 10 07             Geelong West                        25
## # ... with 18 more rows
```

```
ggplot(dat_Q4_2020) +
geom_point(aes(x = Number_Incidents_total,
y = CFA_Brigade_Area,
colour = factor(Number_Incidents_total))) +
  theme_igray()
```



The above plot shows us the number of incidents for the fourth quarter 2019/20. On the x-axis we have number of incidents and the y-axis we can see the names of districts.

```
binding_data <- bind_rows(dat_Q1_2020,dat_Q2_2020,dat_Q3_2020,dat_Q4_2020)

binding_data
```

Table 1: Summary of the incidents.

	Num_incdents1	Num_incdents2	Num_incdents3	Num_incdents4
	Min. : 23.0	Min. : 24.0	Min. : 25.0	Min. : 24.0
	1st Qu.: 63.0	1st Qu.: 52.0	1st Qu.: 76.0	1st Qu.: 54.0
	Median : 83.0	Median :101.0	Median :108.0	Median : 77.0
	Mean :125.5	Mean :126.8	Mean :134.2	Mean :110.1
	3rd Qu.:185.0	3rd Qu.:183.0	3rd Qu.:198.0	3rd Qu.:181.0
	Max. :310.0	Max. :374.0	Max. :348.0	Max. :304.0

```
## # A tibble: 243 x 4
##       X1 `CFA District` CFA_Brigade_Area Number_Incidents_total
##    <dbl> <chr>          <chr>                              <dbl>
##  1     1 02             Bendigo                              198
##  2     2 02             Golden Square                         24
##  3     3 02             Kangaroo Flat                         37
##  4     4 04             Portland                              43
##  5     5 05             Hamilton                              24
##  6     6 05             Warrnambool                          116
##  7     7 07             Belmont                              114
##  8     8 07             Corio                                247
##  9     9 07             Geelong City                         280
## 10    10 07             Geelong West                          33
## # ... with 233 more rows
```

Analysis

Using the summary function we can see the maximum number of incidents across all hazard classes for specified districts for the given time frame. Data used here is the merged data of the four data sets, using bind_rows function.

```
DataQ1_4 <-  read_csv("~/5510_group_project/data/Question_3_dat_2.csv")%>%
  rename(Num_incdents1=`Number of incidents within the Brigade Area for the reporting period across all
  rename(Num_incdents2=`Number of incidents within the Brigade Area for the reporting period across all
  rename(Num_incdents3=`Number of incidents within the Brigade Area for the reporting period across all
  rename(Num_incdents4=`Number of incidents within the Brigade Area for the reporting period across all
```

```
DataQ1 <- DataQ1_4 %>%
  select(Num_incdents1,
         Num_incdents2,
         Num_incdents3,
         Num_incdents4)%>%
  summary()%>%
  kable(caption = "Summary of the incidents.") %>%
  kable_styling(bootstrap_options = c("striped", "hover"))

DataQ1
```

In the above table, we can see the summary for number of incidents in each quarter; we see that the highest number of incidents was recorded as 374 in the second quarter.

The data used here is the merged data that contains information on all four quarters. For the next steps, we will use the binding_data from above.

Table 2: This is the summary of number of incidents across all hazard classes

	Number_Incidents_total
	Min. : 17.00
	1st Qu.: 39.50
	Median : 71.00
	Mean : 95.96
	3rd Qu.:125.50
	Max. :374.00

Table 3: Dandenong district has the highest number of incidents across all hazard classes in all of the four quarters.

CFA_Brigade_Area	Number_Incidents_total
Dandenong	374

```
 Highest_NumberIncidents <- binding_data%>%
  select(Number_Incidents_total)%>%
summary()%>%
  kable(caption = "This is the summary of number of incidents across all hazard classes") %>%
  kable_styling(bootstrap_options = c("striped", "hover"))

Highest_NumberIncidents
```

We can see that highest number of incidents are 374, so now using the filter function. let's see which district has 374 incidents.

```
binding_data%>%
  select(-X1,
         -`CFA District`)%>%
  filter(Number_Incidents_total == "374" )%>%
  kable(caption = "Dandenong district has the highest number of incidents across all hazard classes in a
  kable_styling(bootstrap_options = c("striped", "hover"))
```

From the table we can see that Dandenong has had the highest number of incidents.

Conclusion

As per the analysis for question on the performance of the brigade, it is safe to say that CFA brigades performed well against the standard delivery service time of eight minutes for the hazard class two incidents. And as per the analysis for the question on the number of incidents, we can see that Dandenong appears to be the area that had highest number of incidents across all hazard classes.