



# Operational Vision: A Fire Operations Intelligence System

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City of Carlsbad

July 16, 2024



# Carlsbad, CA, USA



~38 m / 61 km  
North of San Diego






# Carlsbad, CA, USA

~ 89 mi/ 143 km  
South of Los Angeles

~ 6 mi/ 10 km  
of beach

~ 38 mi/ 61 km  
North of San Diego

-  - The Flower Fields
-  - Legoland California
-  - McClellan-Palomar Airport



# 3 miles of surf and sun

Lifeguards use Survey123 to track beach conditions and incidents

# Two championship golf courses



ESRI

StoryMap

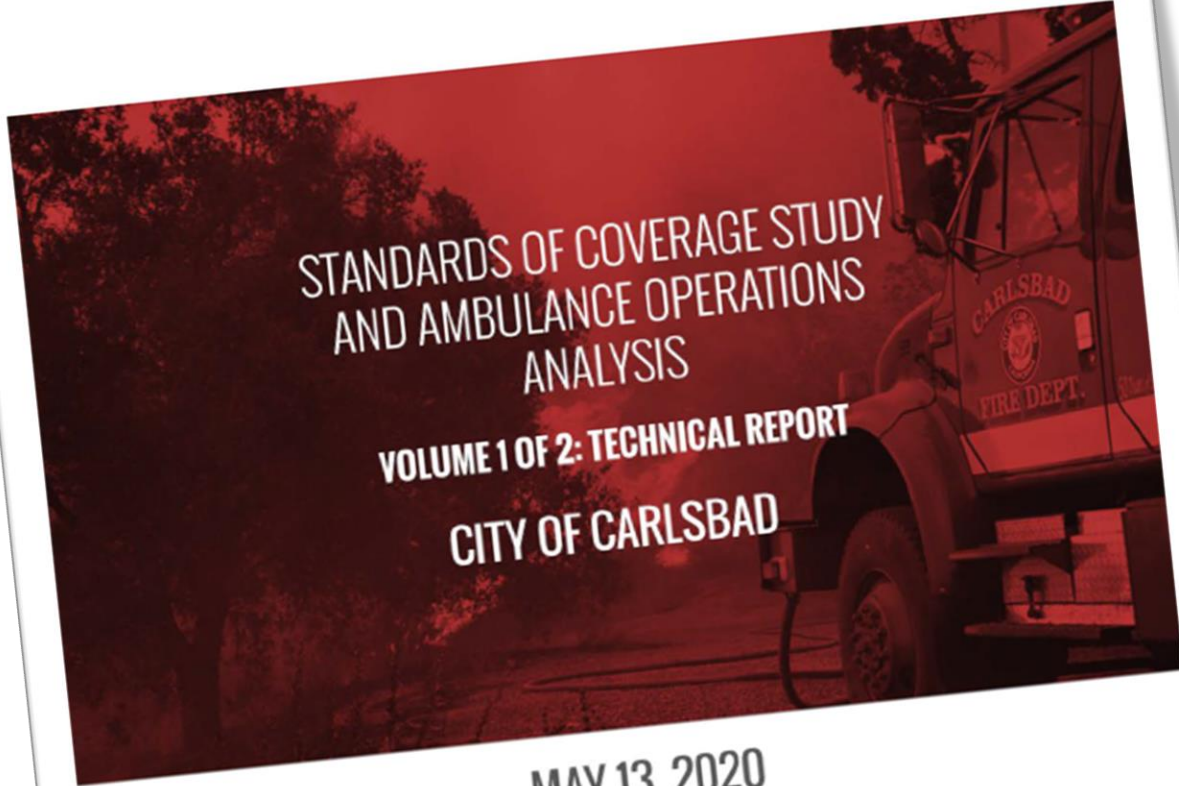
Esri StoryMap: [CarlsbadCA.gov/DoingBusiness](https://CarlsbadCA.gov/DoingBusiness)

Home to Calloway, TaylorMade, Aldila

67 miles of trails and 51 miles of open space



[CarlsbadCA.gov/GoHike](https://CarlsbadCA.gov/GoHike)



STANDARDS OF COVERAGE STUDY  
AND AMBULANCE OPERATIONS  
ANALYSIS

VOLUME 1 OF 2: TECHNICAL REPORT

CITY OF CARLSBAD

MAY 13, 2020

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Critically important data,  
only feasible to see every 4-5 years due to cost

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periods of severe weather.

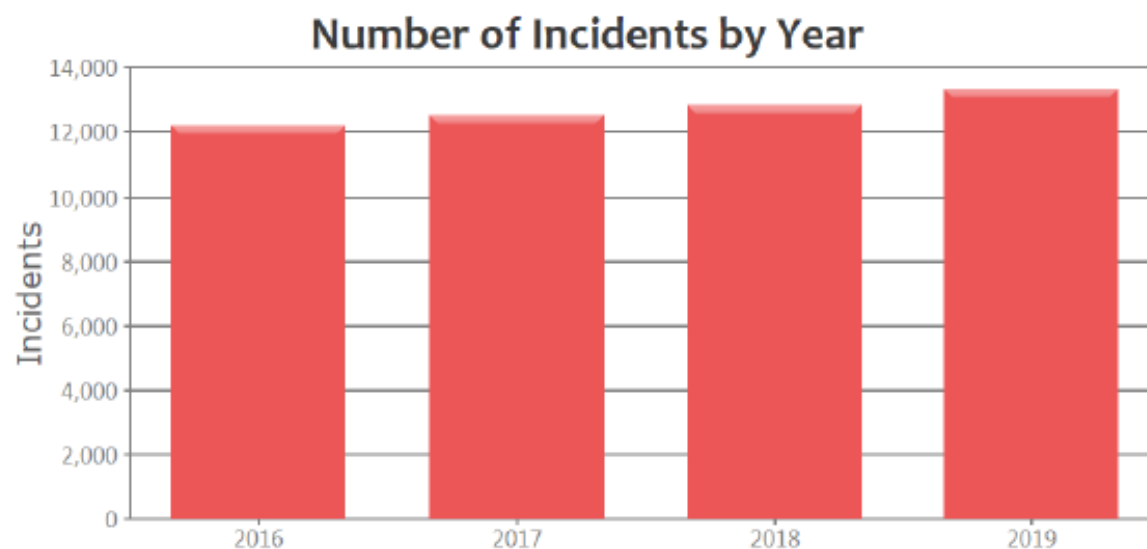
The following subsections provide summary statistical information regarding the Department and its services.

### 2.7.1 Demand for Service

The Department provided National Fire Incident Reporting System (NFIRS) 5 text files and a Microsoft Excel spreadsheet with apparatus response data for four years from January 1, 2016 through December 31, 2019. These two data sources were merged, providing 50,867 incidents and 96,711 apparatus response records.

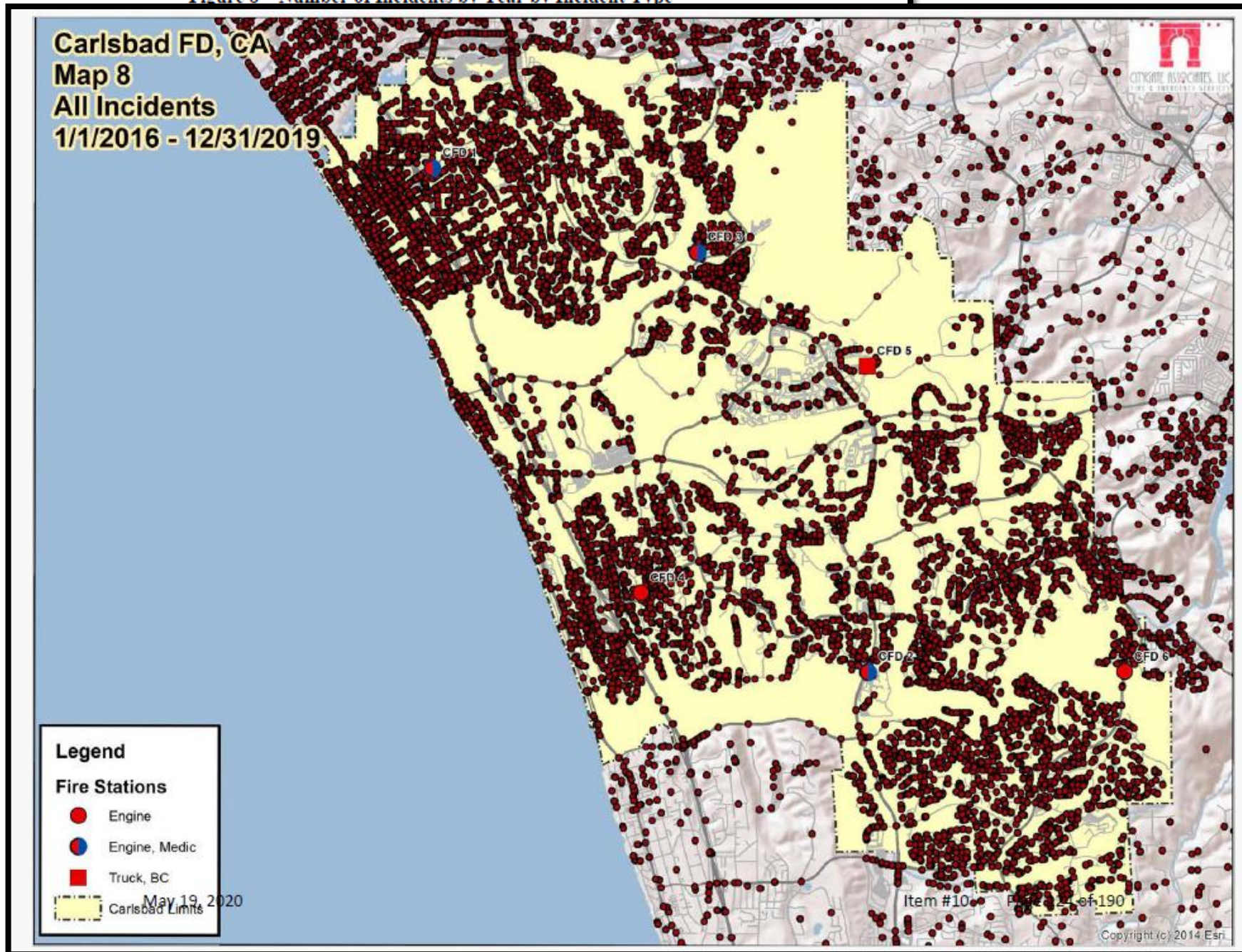
In 2019, the Department responded to 13,331 incidents. During this period, the Department had a daily demand of 36.52 incidents, of which 1.58 percent were to fire incidents, 65.43 percent were to EMS incidents, and 32.99 percent were to other incident types. As shown below, the growth year over year is modest, but steady.

**Figure 7—Annual Service Demand by Year**



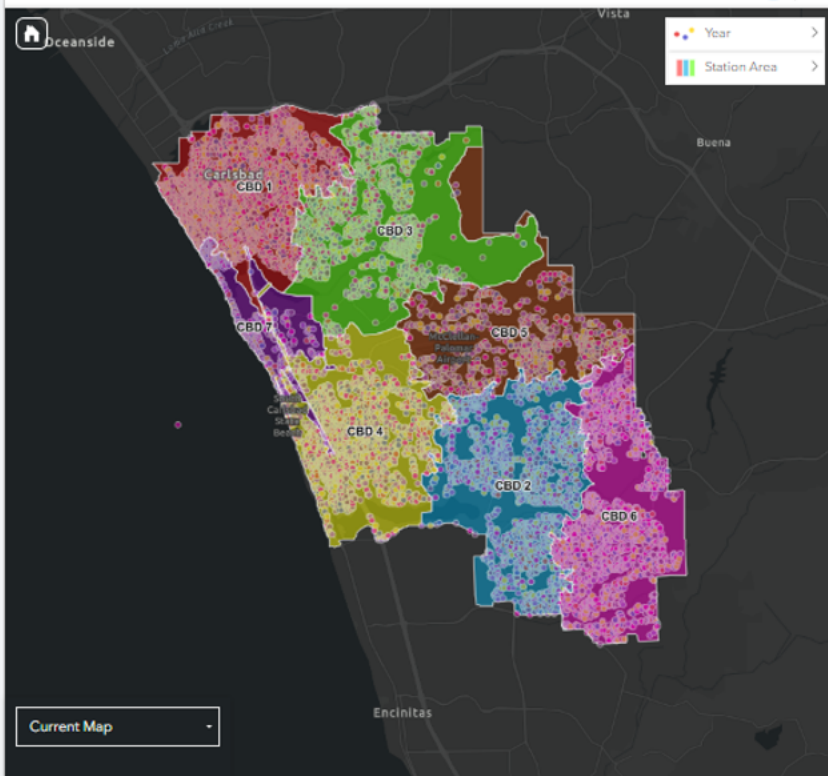
The following figure illustrates the number of incidents by incident type. The number of EMS incidents rose in each of the years, as did other incident types to a lesser degree, while fires remained fairly steady.

Figure 8—Number of Incidents by Year by Incident Type



● 2016 ● 2017 ● 2018 ● 2019

Incidents in Carlsbad Jurisdiction



**Filter: Year**

Search for a value

- Select All
- 2019
- 2020
- 2021
- 2022
- 2023

**Filter: Month**

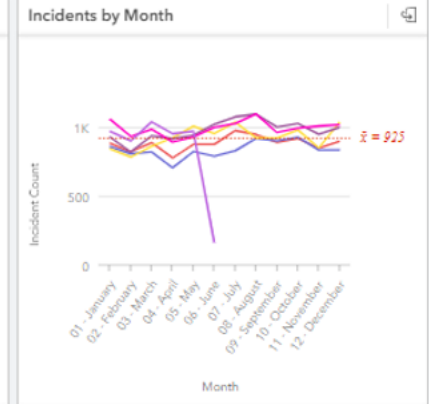
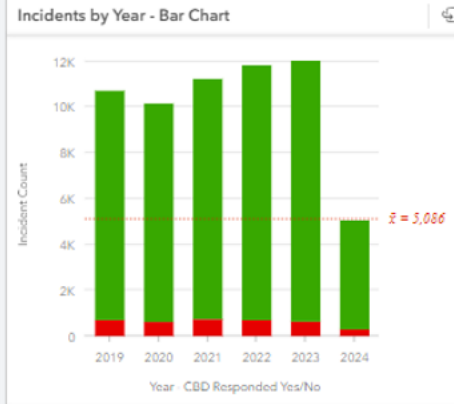
Search for a value

- Select All
- 01 - January
- 02 - February
- 03 - March
- 04 - April
- 05 - May

**Filter: CBD Responded?**

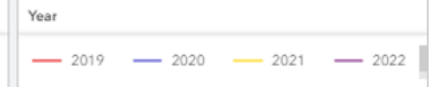
Search for a value

- Select All
- No
- Yes

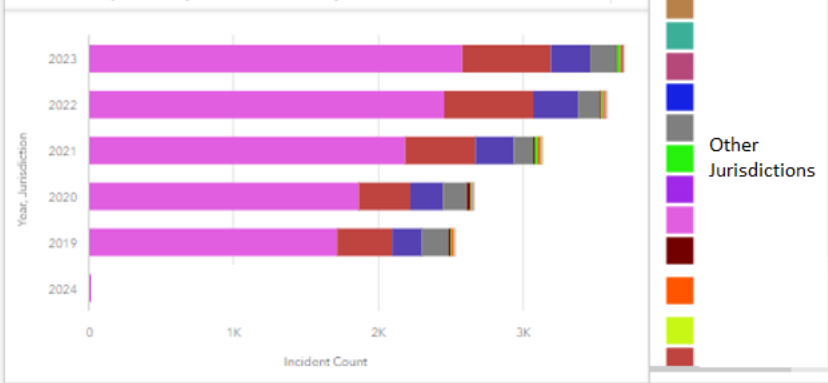


**Incidents by Year**

Year	Incident Count
2019	10,717
2020	10,161
2021	11,236
2022	11,832
2023	12,029
2024	5,053
<b>Total</b>	<b>61,028</b>



Incidents responded by Carlsbad - Chart by Jurisdiction



Incidents responded by Carlsbad - by Jurisdiction

Year	Jurisdiction	Incident Count
2019		2
		10,018
		4
		184
	Other Jurisdictions	6
		1
		1,711
		13
		13
		381
		5
<b>Total</b>		<b>74,413</b>

Carlsbad Response - by Year

Year	Count of Incidents by Year
2019	12,546
2020	12,200
2021	13,630
2022	14,714
2023	15,095
2024	6,228
<b>Total</b>	<b>74,413</b>

### Responses in Carlsbad - by Unit Station

#### Statistics

Name	Value	Updated
Count of locations - FireCADJurisdiction...	7	38 second(s) ago
CBD 1	1	
CBD 2	1	
CBD 3	1	
CBD 4	1	
CBD 5	1	
CBD 6	1	
CBD 7	1	
Out		

Count of locations - Unit Station	Value
CBD 1	258
CBD 2	165
CBD 3	227
CBD 4	109
CBD 5	131
CBD 6	292
CBD 7	425

#### Attribution

SanGIS, California State Parks, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, USFWS

Current Map

#### Filter: Year

Search for a value

- Select All
- 2020
- 2021
- 2022
- 2023
- 2024

#### Filter: Month

Search for a value

- Select All
- 03 - March
- 04 - April
- 05 - May
- 06 - June
- 07 - July

#### Filter: Unit Station

Search for a value

- Select All
- CBD 1
- CBD 2
- CBD 3
- CBD 4
- CBD 5

#### Filter: CBD Responded

Search for a value

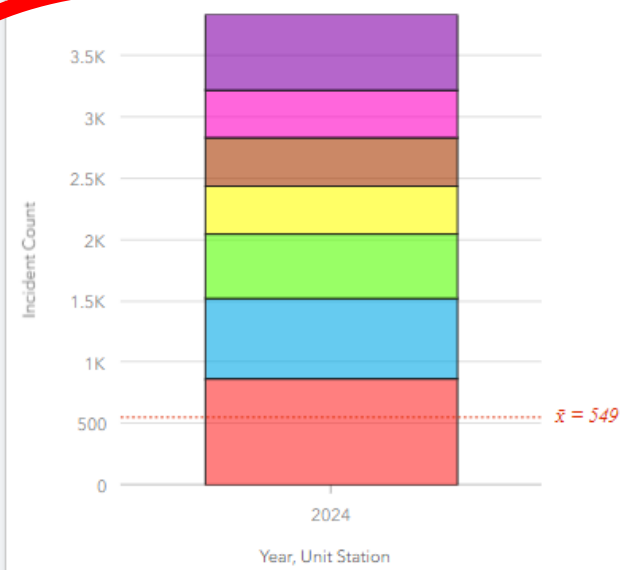
- Select All
- No
- Yes

#### Filter: Station Area

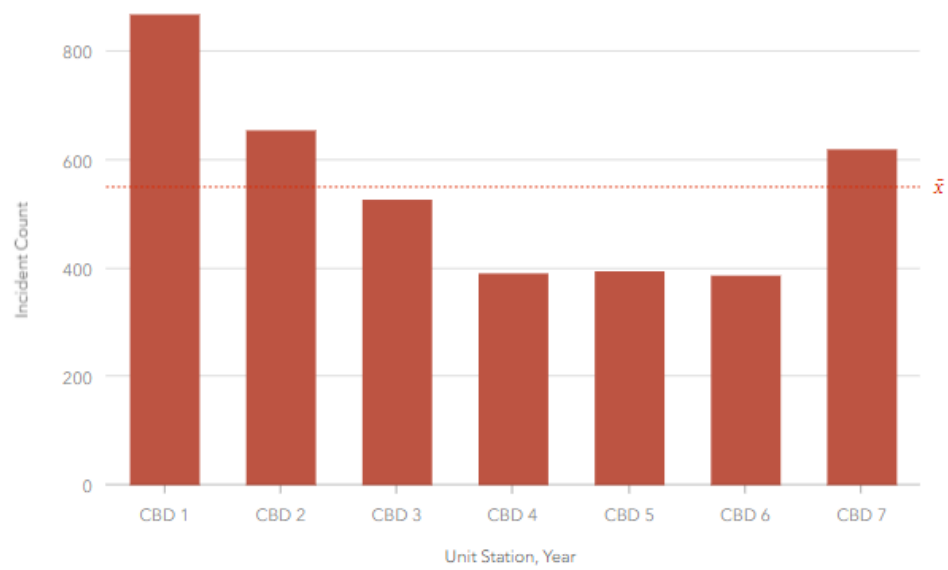
Search for a value

- Select All
- CBD 1
- CBD 2
- CBD 3
- CBD 4
- CBD 5

Incidents by Year, Unit Station

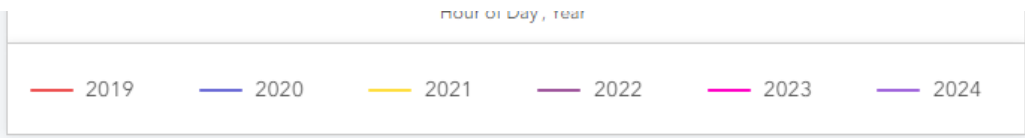
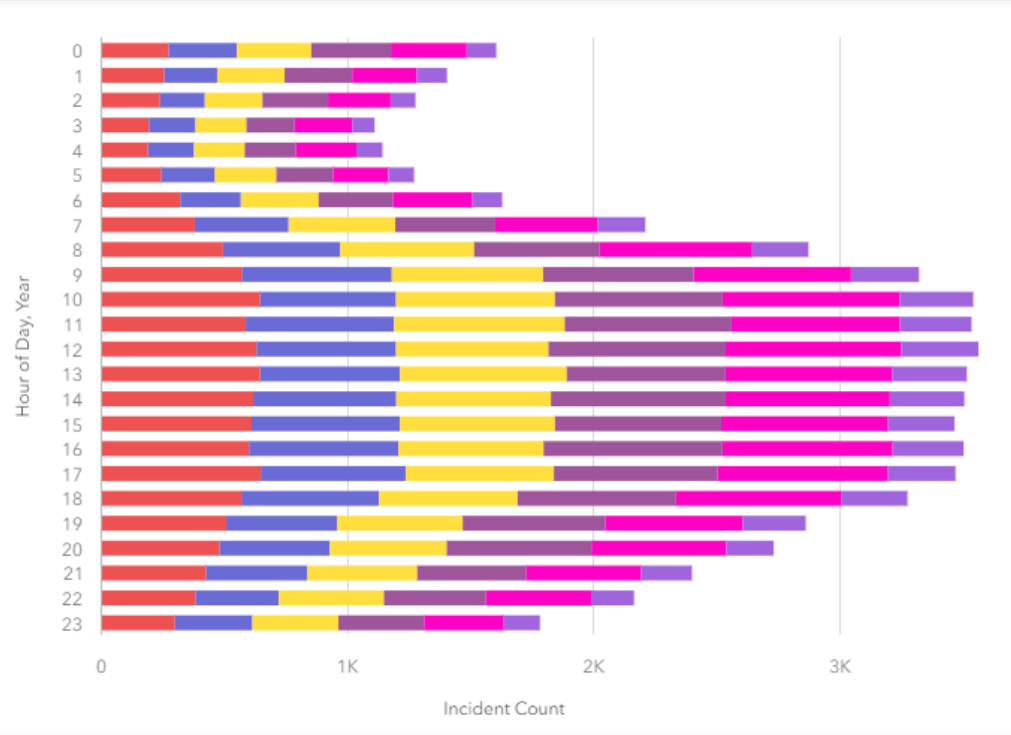


Incidents by Unit Station, Year

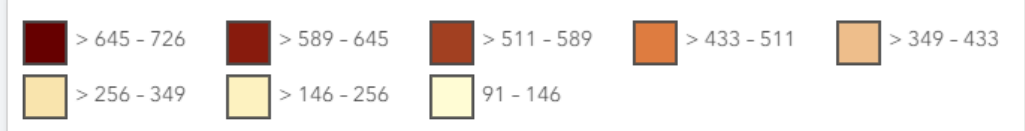
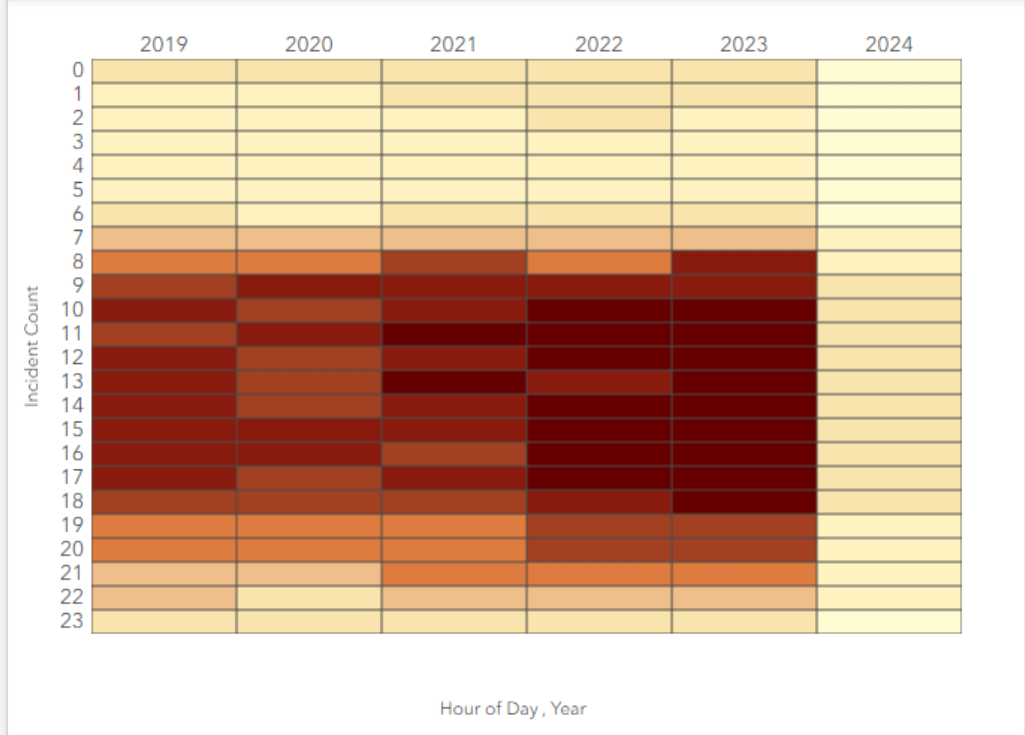




Incidents by Hour of Day - Bar Chart

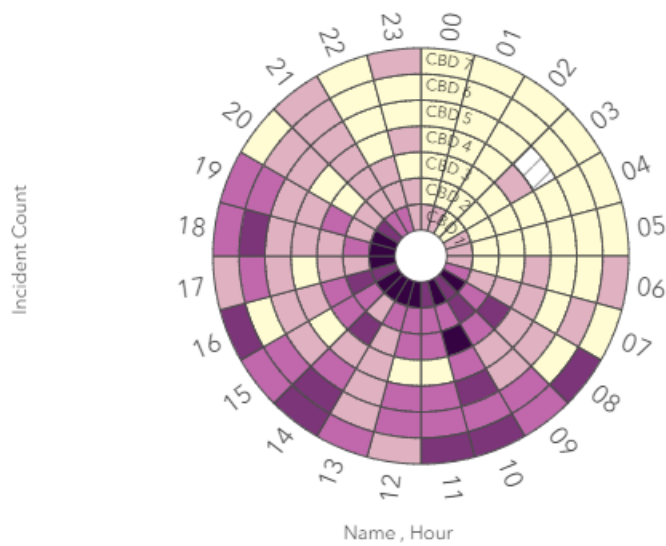


Incidents by Hour of Day - Heat Map



	13	641
	14	613
	15	607
	16	596
	17	644
	18	565
	19	504
	20	477
	21	422
	22	378
	23	296
2020	0	277
	1	215
	2	182
	3	189
	4	187
	5	217
	6	246
	7	381
	8	475
	9	610
	10	553
	11	602
	12	566
	13	568
	14	581
		<b>Total 61,028</b>

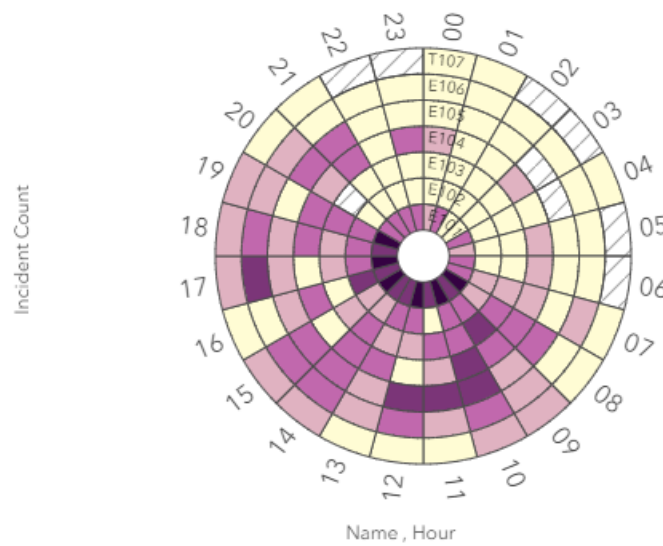
Station Hour Utilization - Response Count



Station Hour Utilization Summary

Name	% Utilized	Incident Count
CBD 1	29.09	332
CBD 2	19.36	
CBD 3	15.49	
CBD 4	6.51	
CBD 5	7.62	144
CBD 6	14.12	171
CBD 7	11.23	202

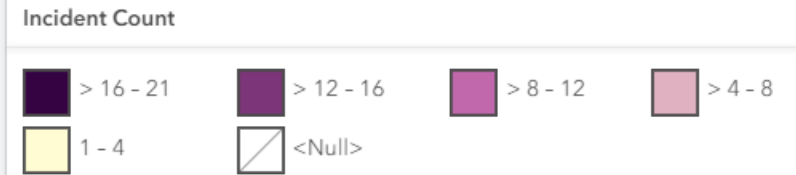
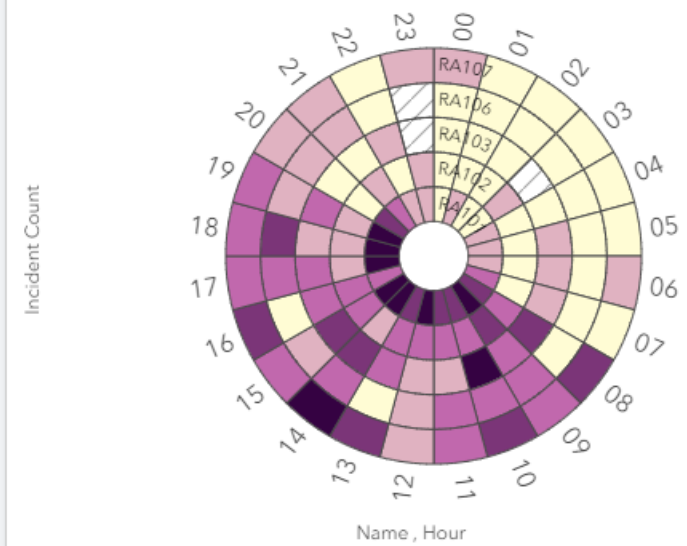
Engine Unit Hour Utilization - Response Count



Unit Hour Utilization - Engine Companies Summary

Name	% Utilized	Incident Count
E101	14.21	315
E105	7.13	143
E106	6.2	126
T107	2.71	11

EMS Unit Hour Utilization - Response Count



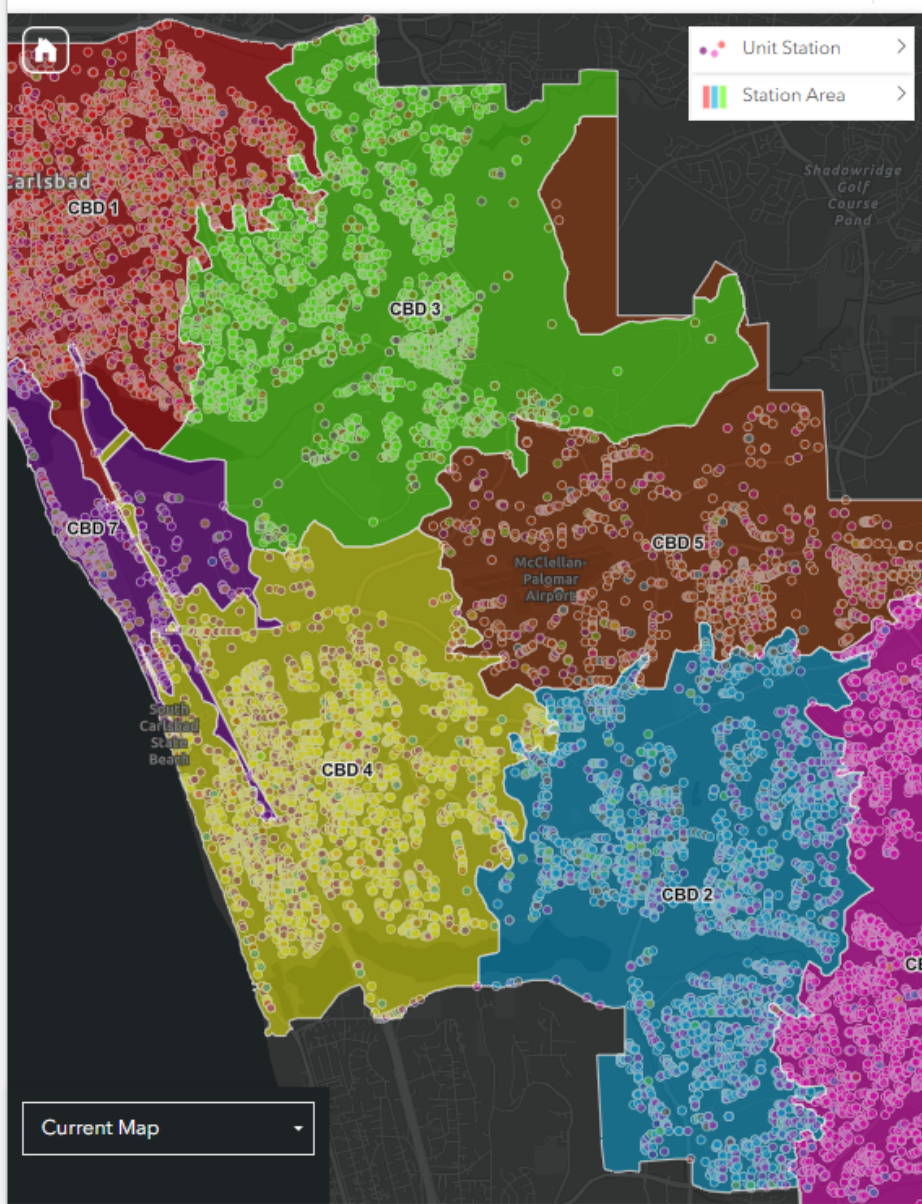
Unit Hour Utilization - EMS Companies Summary

Name	% Utilized	Incident Count
RA101	24.75	284
RA107	14.99	191

Now updated hourly, instead of every five years



Responses in Carlsbad - by Unit Station



Filter: Year

Search for a value

- Select All
- 2019
- 2020
- 2021
- 2022
- 2023

Filter: Month

Search for a value

- Select All
- 01 - January
- 02 - February
- 03 - March
- 04 - April
- 05 - May

Filter: Unit Station

Search for a value

- Select All
- CBD 1
- CBD 2
- CBD 3
- CBD 4
- CBD 5

Filter: CBD Responded

Search for a value

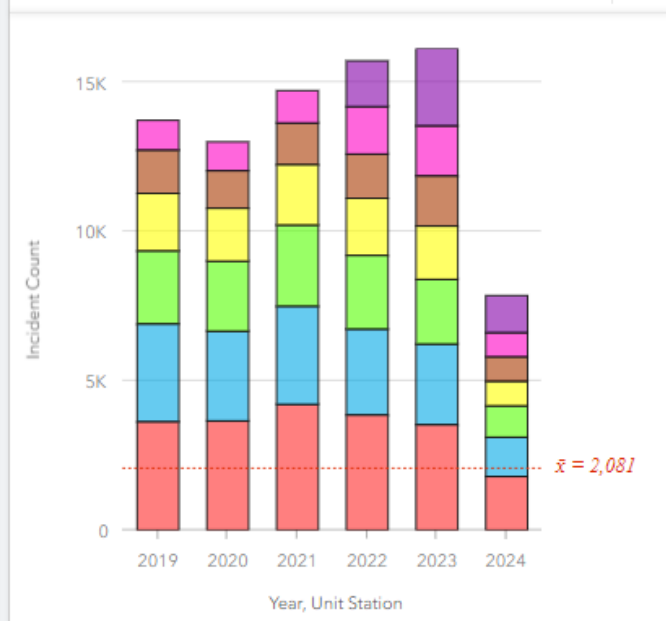
- Select All
- No
- Yes

Filter: Station Area

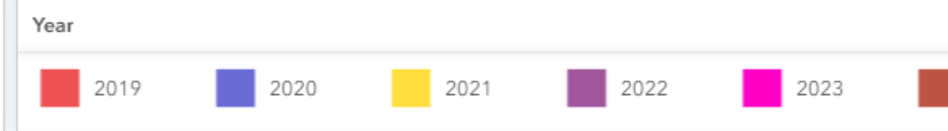
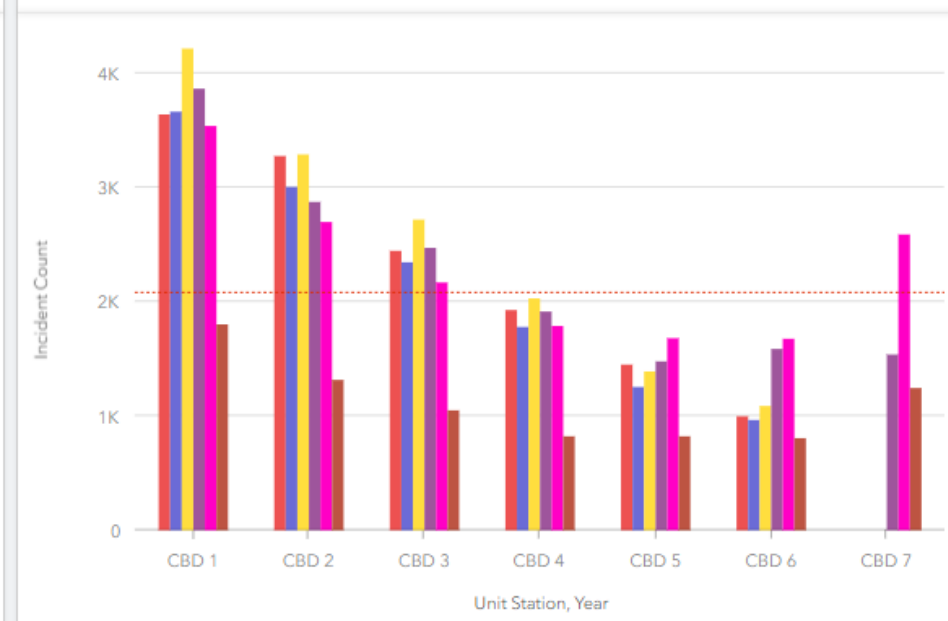
Search for a value

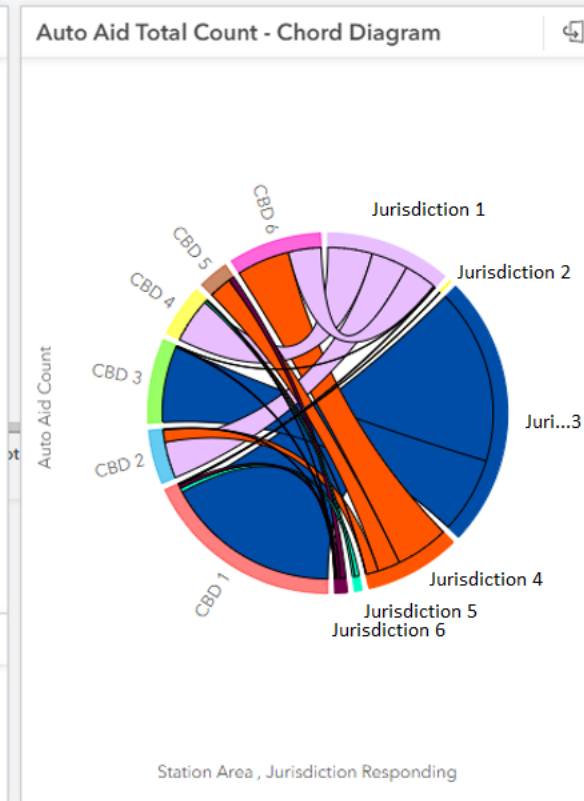
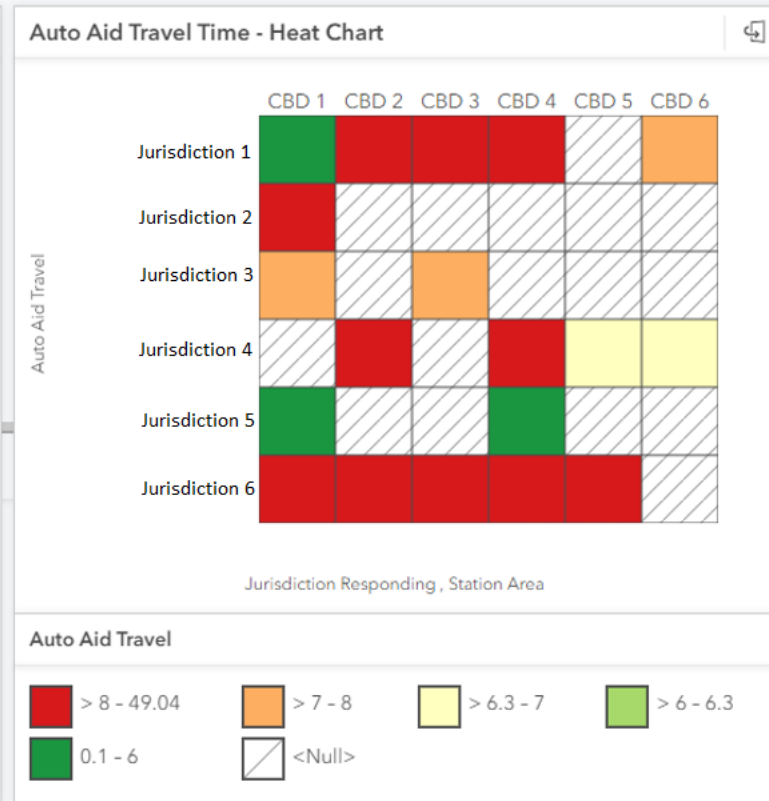
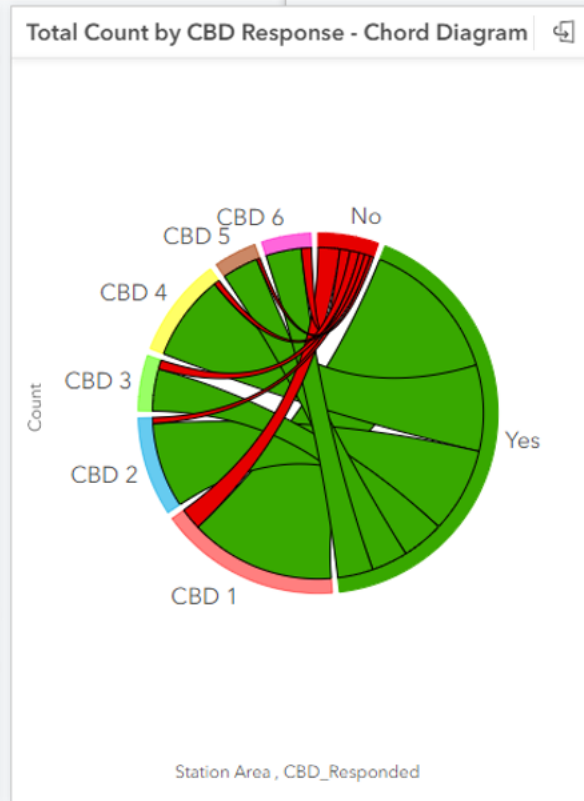
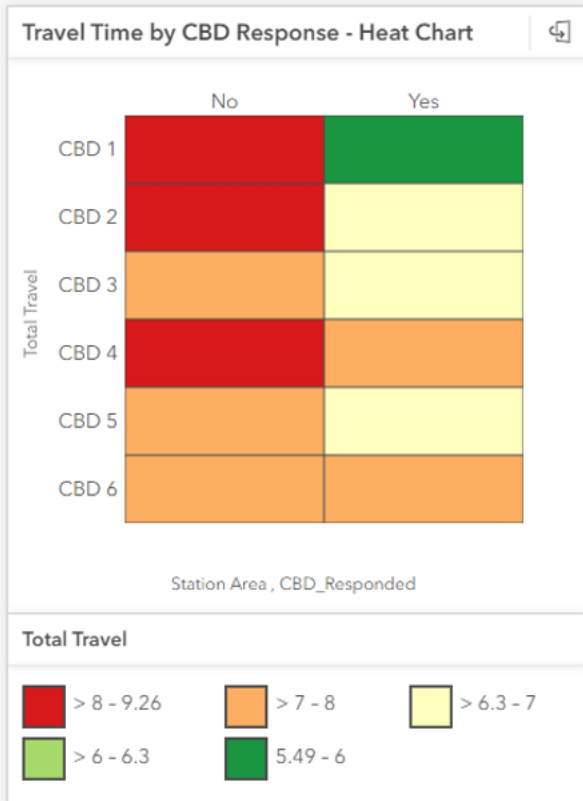
- Select All
- CBD 1
- CBD 2
- CBD 3
- CBD 4
- CBD 5

Incidents by Year, Unit Station



Incidents by Unit Station, Year





### Auto Aid Travel Time & Incident Count

Year	Station ...	Jurisdiction Responding	Auto Aid Tr...	Auto Aid Count
2019	CBD 1	Jurisdiction 1	3.29	3
		Jurisdiction 2	8.24	1
		Jurisdiction 3	7.57	413
		Jurisdiction 5	0.05	10

### Yearly Auto Aid Travel Time

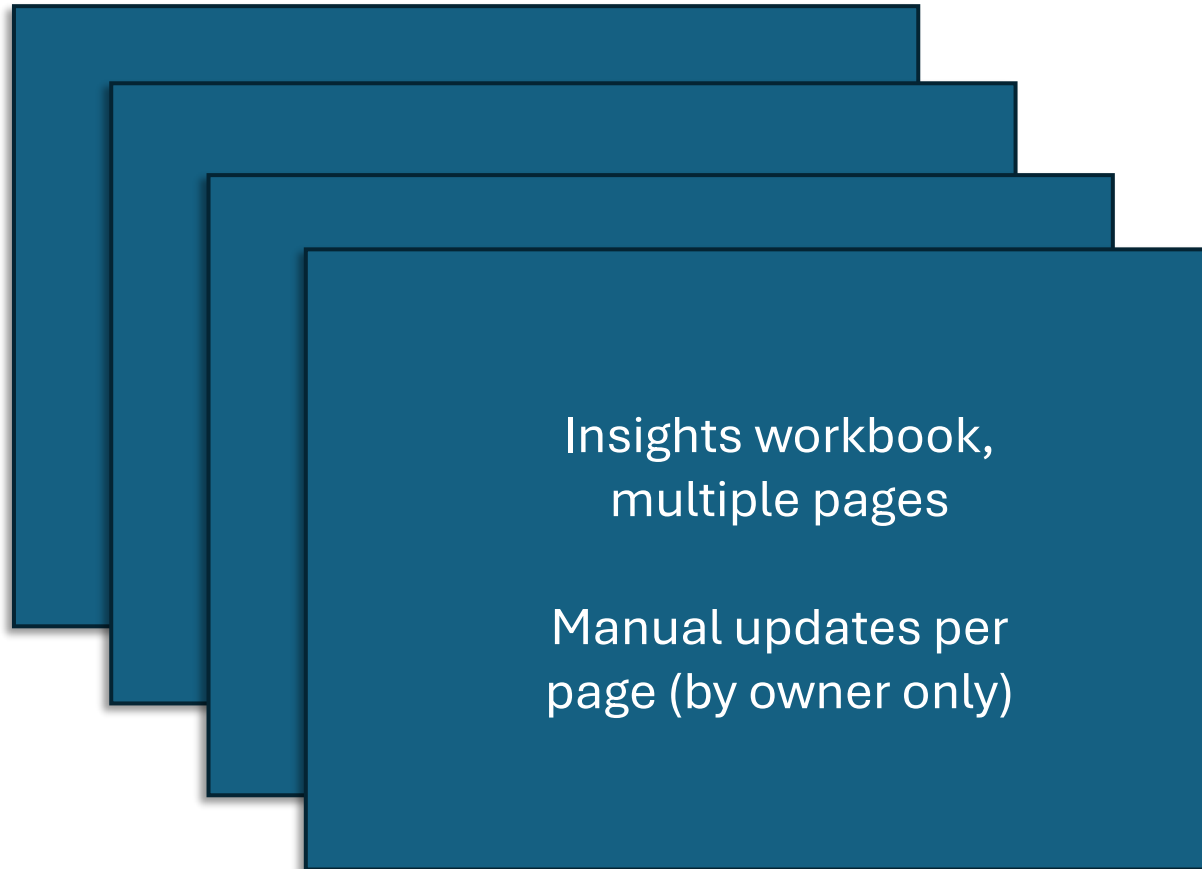
Year	Jurisdiction Respon...	Auto Aid Tr...	Auto Aid Count
2019	Jurisdiction 1	8.18	272
	Jurisdiction 2	8.24	1
	Jurisdiction 3	7.49	592
	Jurisdiction 4	7.10	208



# Technical challenges and solutions

- Development opportunities with Insights
- Challenges & Solutions
  - Sharing Insights
  - Duration Format
- Product upgrades/improvements – and use case
  - ESRI Listens

# The Challenge: Sharing Insights



- Sharing is view only
- Data refresh can only be done manually by owner
- Need for real-time data refreshes

# The Solution: Sharing Insights



- Experience Builder Wrapper that allows for showing multiple report pages as they are updated
- Avoids manual update of every page by owner
- Hourly updates of the data in the product

# The Challenge: Duration Format

- Need duration in the specific format of minute(s).second(s)

Fire Operations Intelligence System: Distribution Travel Analysis

Travel Time by CBD Response - Heat Chart | Total Count by CBD Response - Chord Diagram | Auto Aid Travel Time - Heat Chart | Auto Aid Total Count - Chord Diagram

Station Area, CBD\_Responded

### Auto Aid Travel Time & Incident Count

Year	Station ...	Jurisdiction Responding	Auto Aid T...	Auto Aid Count	Yearly Au
2019	CBD 1	Jurisdiction 1	3.29	3	2019
		Jurisdiction 2	8.24	1	
		Jurisdiction 3	7.57	413	

3 Minutes, 29 Seconds

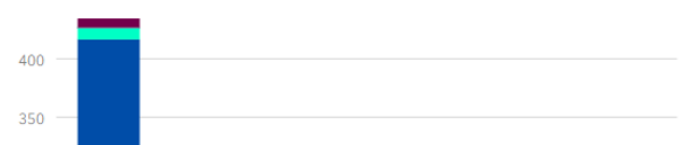
Auto Aid Travel Time & Incident Count

Year	Station ...	Jurisdiction Responding	Auto Aid	Auto Aid Count
2019	CBD 1	Jurisdiction 1	3.29	3
		Jurisdiction 2	8.24	1
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Yearly Auto Aid Travel Time

Year	Jurisdiction Respon...	Auto Aid Tr...	Auto Aid Count
2019	Jurisdiction 1	8.18	272
	Jurisdiction 2	8.24	1
	Jurisdiction 3	7.49	592
	Jurisdiction 4	7.10	208

Auto Aid Received and Arrived by CBD



# The Solution: Duration Format

- Start with time in seconds
- Then use ArcGIS Insights to calculate 90th percentile
- Finally, convert the 90th percentile seconds to minute.second format

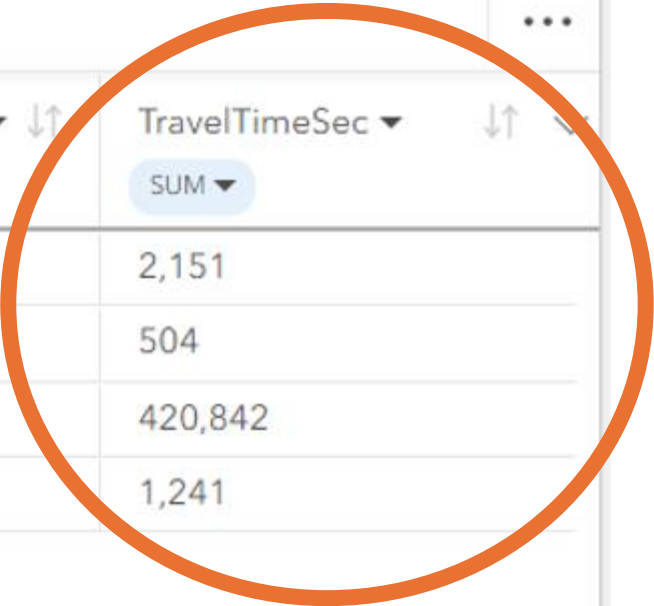
- Calculation example:

```
IF(traveltimesec_percentile < 60, VALUE(IF((ROUND(traveltimesec_percentile) < 10, "0.0" & ROUND(traveltimesec_percentile), "0." & ROUND(traveltimesec_percentile))), VALUE(CONCATENATE(FLOOR(IF(ROUND(traveltimesec_percentile) > 60, ROUND(traveltimesec_percentile) / 60)), ".", CONCATENATE(IF((ROUND(ROUND(traveltimesec_percentile) - (FLOOR(IF(ROUND(traveltimesec_percentile) > 60, ROUND(traveltimesec_percentile) / 60)) * 60))) < 10, "0"), (ROUND(ROUND(traveltimesec_percentile) - (FLOOR(IF(ROUND(traveltimesec_percentile) > 60, ROUND(traveltimesec_percentile) / 60)) * 60)))))))))
```

# The Solution: Duration Format

Start with seconds

Year ▼ ↓↑	Station Area: ↑	Jurisdiction Responding ▼ ↓↑	TravelTimeSec ▼ ↓↑
2019	CBD 1	Jurisdiction 1	2,151
		Jurisdiction 2	504
		Jurisdiction 3	420,842
		Jurisdiction 4	1,241
			<b>Total 424,738</b>





# The Solution: Duration Format

Insights calculates 90th Percentile

Year ▼	Station Area: ↑	Jurisdiction Responding ▼	TravelTimeSec ▼
2019	CBD 1	Jurisdiction 1	614.6
		Jurisdiction 2	504
		Jurisdiction 3	608
		Jurisdiction 4	334.1

The table displays data for the year 2019 in the CBD 1 area, showing travel times for four jurisdictions. The 'TravelTimeSec' column is currently set to '90 PCTL', which is highlighted with an orange circle. The values are 614.6 for Jurisdiction 1, 504 for Jurisdiction 2, 608 for Jurisdiction 3, and 334.1 for Jurisdiction 4.

# The Solution: Duration Format

Getting the final format

+ Field **fx** PCTL TravelTimeSec) > 60, ROUND(90 PCTL TravelTimeSec) / 60))\*60)))))) ✓ Run

Year	Jurisdiction Re	Station Area	90 PCTL Travel...	TravelTime (mi...
2019	Jurisdiction 1	CBD 1	614.6	10.15
2019	Jurisdiction 2	CBD 1	504	8.24
2019	Jurisdiction 3	CBD 1	608	10.08
2019	Jurisdiction 4	CBD 1	334.1	5.34

Selected Records: 0 Total Records: 4

# The Solution: Duration Format

- If time is less than a minute,
  - Check to see if it is less than 10 seconds. When less than 10 seconds, add "0.0" before time; otherwise, add "0." prefix
    - 15 seconds = 0.15 and 7 seconds = 0.07

*IF(traveltimesec\_percentile < 60,  
VALUE(IF((ROUND(traveltimesec\_percentile)) < 10, "0.0" & R  
OUND(traveltimesec\_percentile), "0." & ROUND(traveltimesec  
\_percentile))),*

# The Solution: Duration Format

- If time is a minute or more,
  - Calculate minutes

*VALUE(CONCATENATE(FLOOR(IF(ROUND(traveltimesec\_percentile) > 60, ROUND(traveltimesec\_percentile) / 60)), ".")*

# The Solution: Duration Format

- If time is a minute or more,
  - After calculating minutes, run the previous under-minute calculation with any remaining seconds
    - 614.6 seconds = 10 minutes & 15 seconds = 10.15

```
CONCATENATE(IF((ROUND(ROUND(traveltimesec_percentile)
-
(FLOOR(IF(ROUND(traveltimesec_percentile) > 60, ROUND(trav
eltimesec_percentile) / 60)) * 60))) < 10, "0"), (ROUND(ROUND(tr
aveltimesec_percentile) -
(FLOOR(IF(ROUND(traveltimesec_percentile) > 60, ROUND(trav
eltimesec_percentile) / 60)) * 60))))))
)
```

# The Solution: Duration Format

Final format					...
Year ▼	↕↑	Station Area ▼↕↑	Jurisdiction Responding ▼↕↑	TravelTime (min.sec) ↓	^
2019		CBD 1	Jurisdiction 1	10.15	
			Jurisdiction 2	8.24	
			Jurisdiction 3	10.08	
			Jurisdiction 4	5.34	
				<b>Total</b>	33.81

# ESRI Listens to its customers

- ESRI Insights updates (new goodies)
  - Dynamic filters allow for new field values to be added & used in filtering
  - Manual classification types in heat charts & data clocks

Filter: Year

Filter type  
Dynamic

Field  
SOCInsigh...

Year

Cancel Update



# ESRI Listens to its customers

- ESRI Events
  - Talking to the dev team at the Insights booth





# ESRI Advantage Program

- Access to development collaboration with the pros!
  - Project Scoping
  - Personalized design workshopping
  - Technical consultation along the way

# TAKEAWAYS

- Organizations don't need more data, they need more **insights**
- Demonstrating ESRI GIS is maps+data is key for organizational value
- ESRI Insights creates rich insights from spatial and non-spatial data, in a low-code development platform
- Give feedback and seek answers, ESRI listens to its users



# Thank you!

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