Operational Vision:
A Fire Operations Intelligence System

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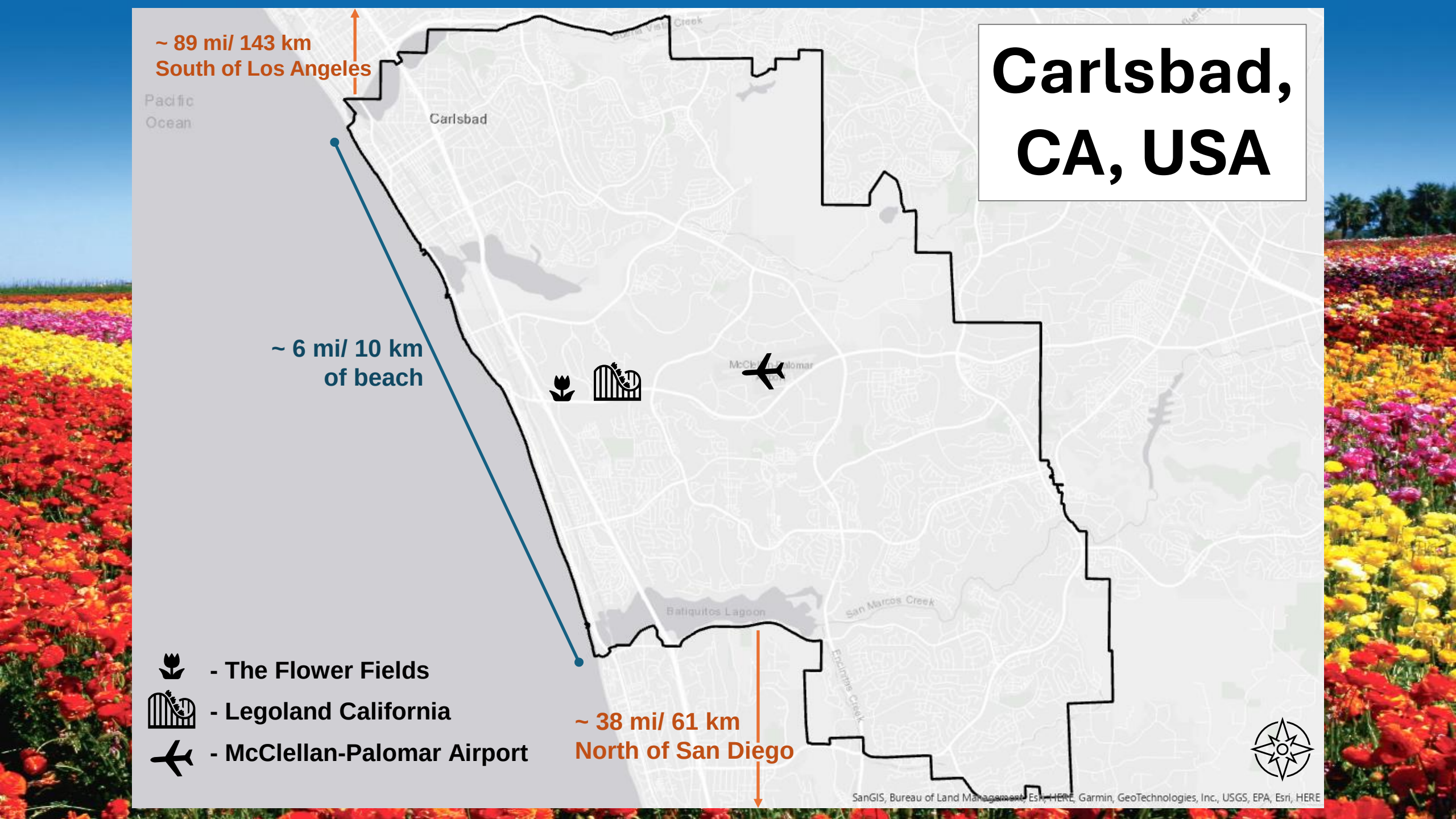
David van Gilluwe, Chief Data Officer
City of Carlsbad

July 16, 2024

City of Carlsbad

Carlsbad, CA, USA


~ 89 mi/ 143 km
South of Los Angeles
Pacific
Ocean
Carlsbad
Carlsbad,
CA, USA
~ 6 mi/ 10 km
of beach
Batiquitos Lagoon
San Marcos Creek
Encinitas Creek
- The Flower Fields
- Legoland California
- McClellan-Palomar Airport
~ 38 mi/ 61 km
North of San Diego
SanGIS, Bureau of Land Management, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, EPA, Esri, HERE

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

Home to Calloway, TaylorMade, Aldila


67 miles of trails and 51 miles of open space
CarlsbadCA.gov/GoHike

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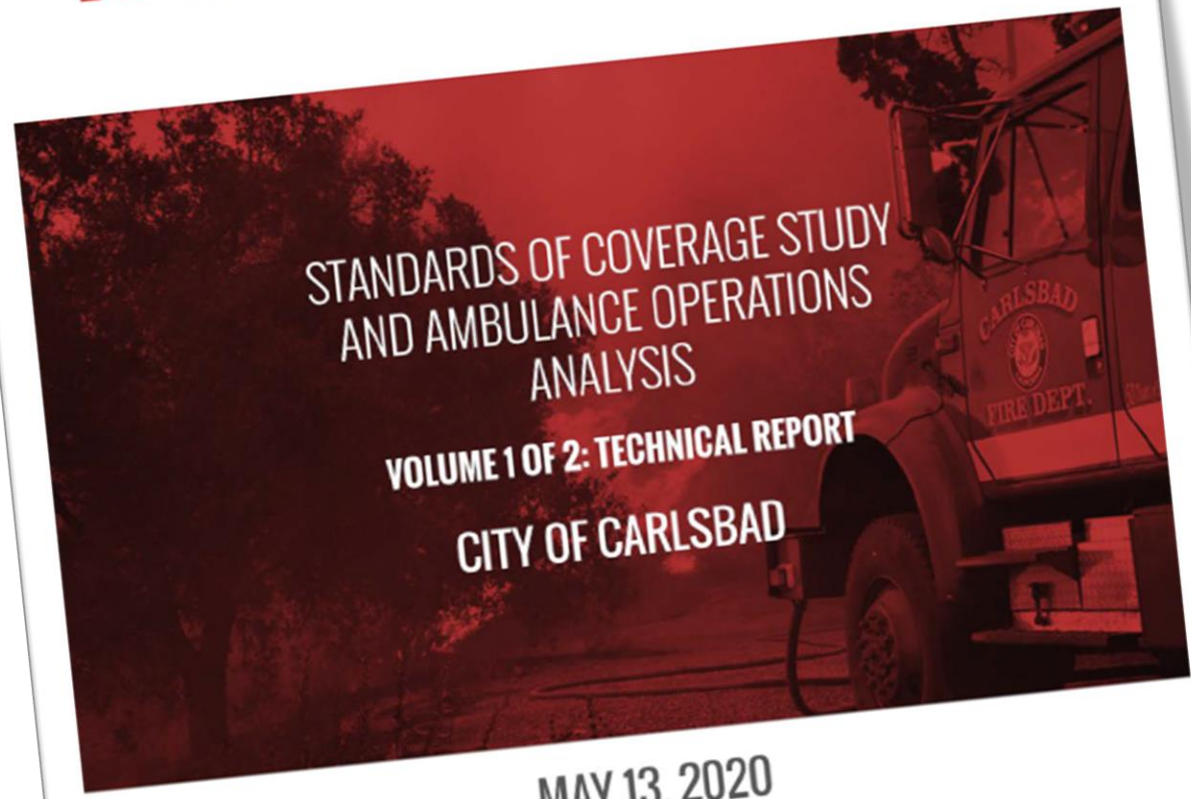
PUBLIC SAFETY SERVICES



STANDARDS OF COVERAGE STUDY AND AMBULANCE OPERATIONS ANALYSIS

VOLUME 1 OF 2: TECHNICAL REPORT

CITY OF CARLSBAD

MAY 13, 2020

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VOLUME 1 of 2—Technical Report (this volume)

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

periods of severe weather.

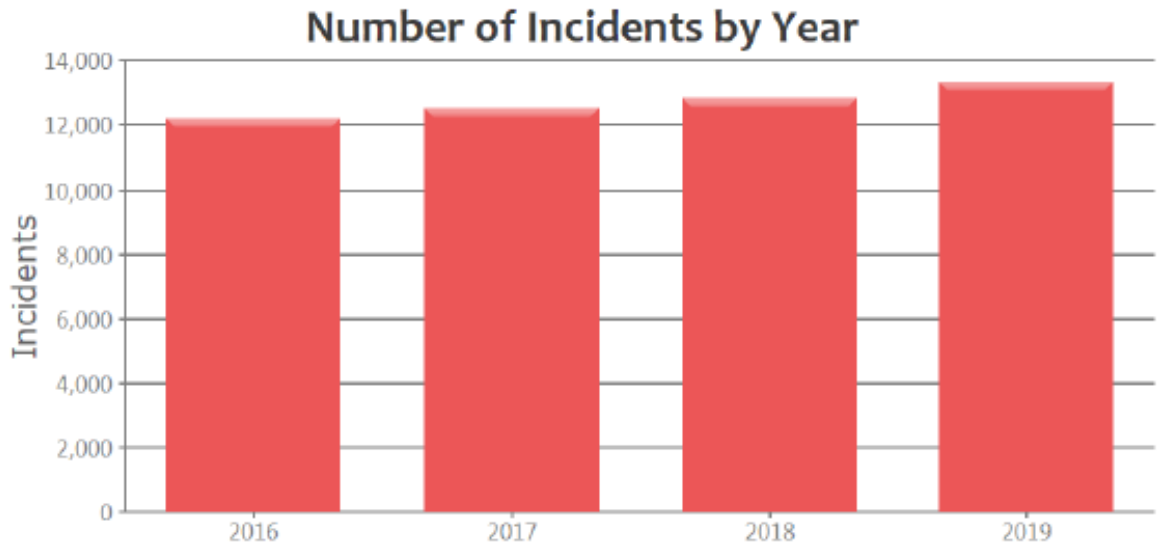
The following subsections provide summary statistical information regarding the Department and its services.

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.

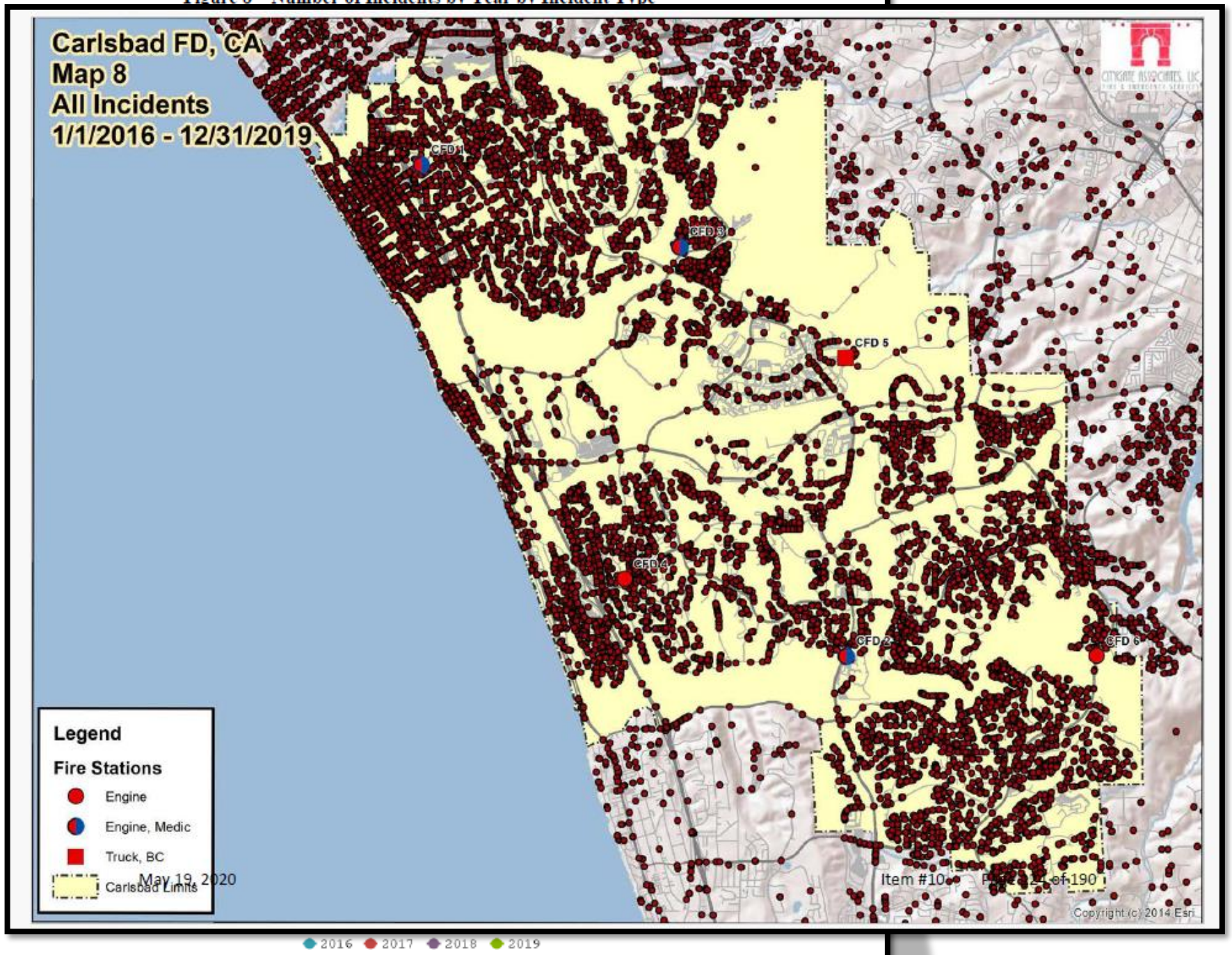
In 2019, the Department responded to 13,331 incidents. During this period, the Department had a daily demand of 36.52 incidents, of which 1.58 percent were to fire incidents, 65.43 percent were to EMS incidents, and 32.99 percent were to other incident types. As shown below, the growth year over year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

Figure 7—Annual Service Demand by Year



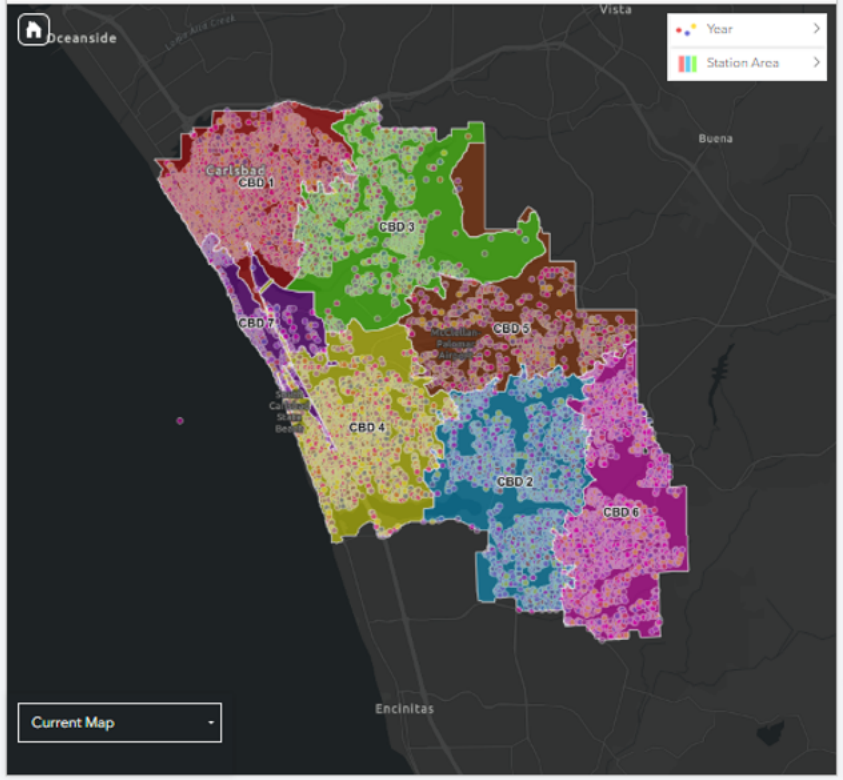
The following figure illustrates the number of incidents by incident type. The number of EMS incidents rose in each of the years, as did other incident types to a lesser degree, while fires remained fairly steady.

Figure 8—Number of Incidents by Year by Incident Type



Fire Operations Intelligence System: Incidents

Incidents in Carlsbad Jurisdiction



Filter: Year

Search for a value

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

Filter: Month

Search for a value

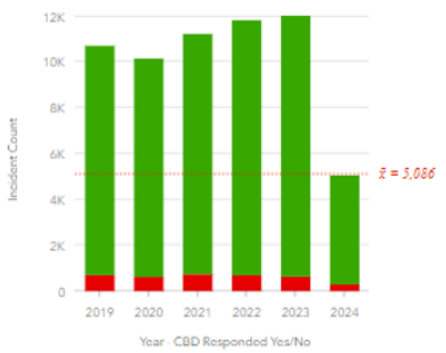
- Select All
- 01 - January
- 02 - February
- 03 - March
- 04 - April
- 05 - May

Filter: CBD Responded?

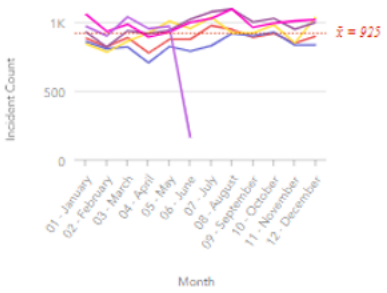
Search for a value

- Select All
- No
- Yes

Incidents by Year - Bar Chart



Incidents by Month



Incidents by Year

Year	Incident Count
2019	10,717
2020	10,161
2021	11,236
2022	11,832
2023	12,029
2024	5,053

Total 61,028

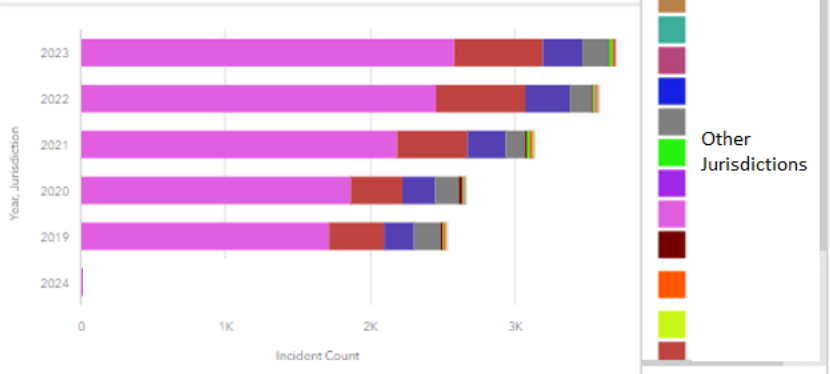
CBD Responded?

No Yes

Year

2019 2020 2021 2022

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

Total 74,413

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

Total 74,413

Fire Operations Intelligence System: Incidents by Responding Station

Responses in Carlsbad - by Unit Station

Statistics

Name	Value	Updated
Count of locations - FireCADJurisdictio...	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	1,607
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
- [x] 2024

Filter: Month

Search for a value

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

Filter: Unit Station

Search for a value

- [x] Select All
- [x] CBD 1
- [x] CBD 2
- [x] CBD 3
- [x] CBD 4
- [x] CBD 5

Filter: CBD Responded

Search for a value

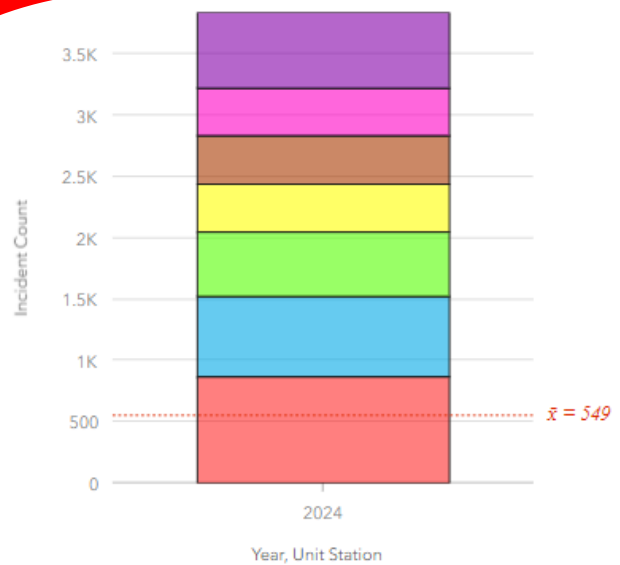
- [x] Select All
- [x] No
- [x] Yes

Filter: Station Area

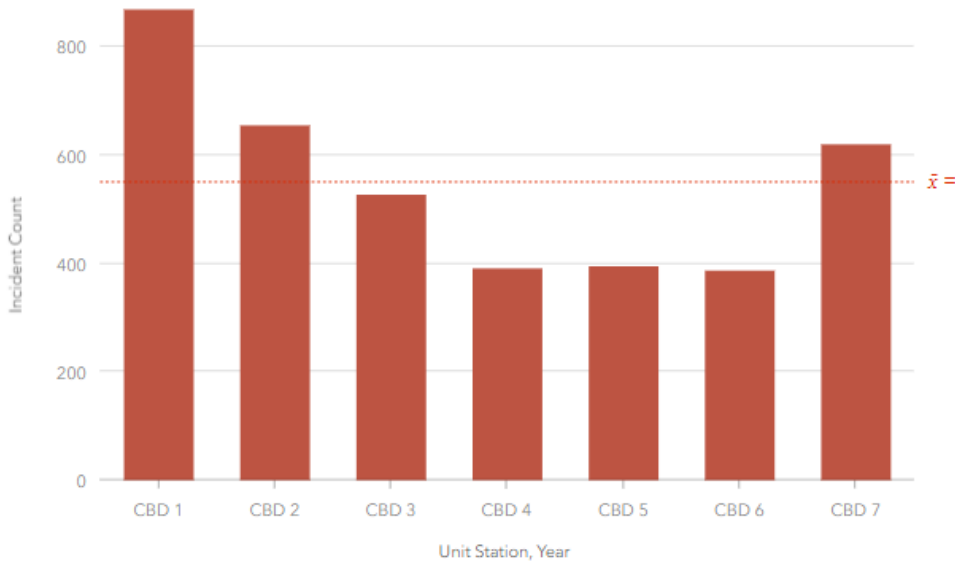
Search for a value

- [ ] Select All
- [x] CBD 1
- [x] CBD 2
- [x] CBD 3
- [x] CBD 4
- [x] CBD 5

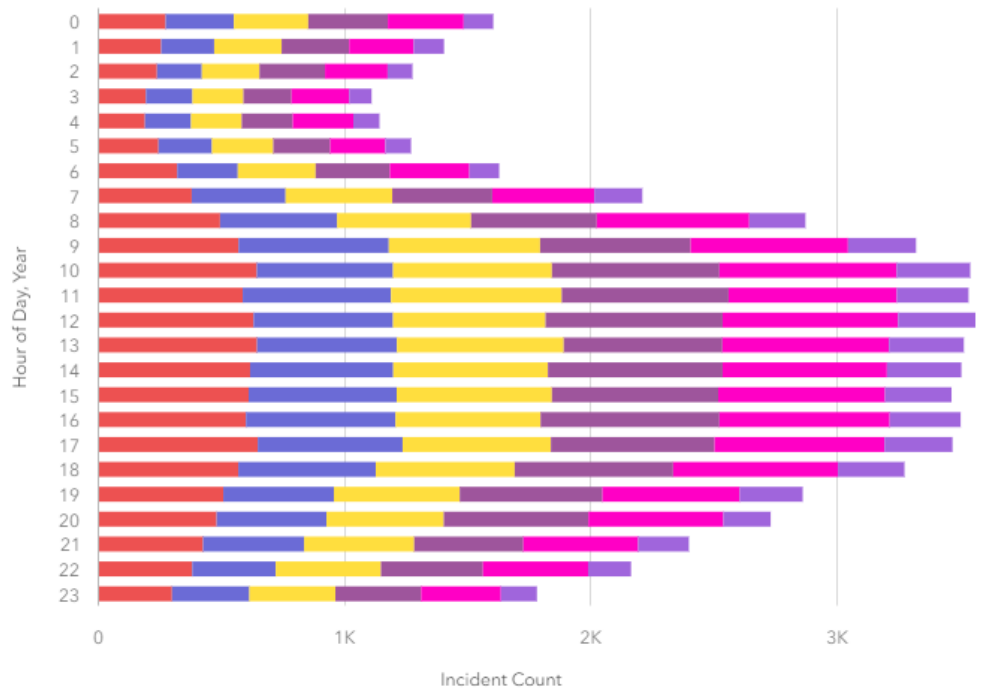
Incidents by Year, Unit Station



Incidents by Unit Station, Year

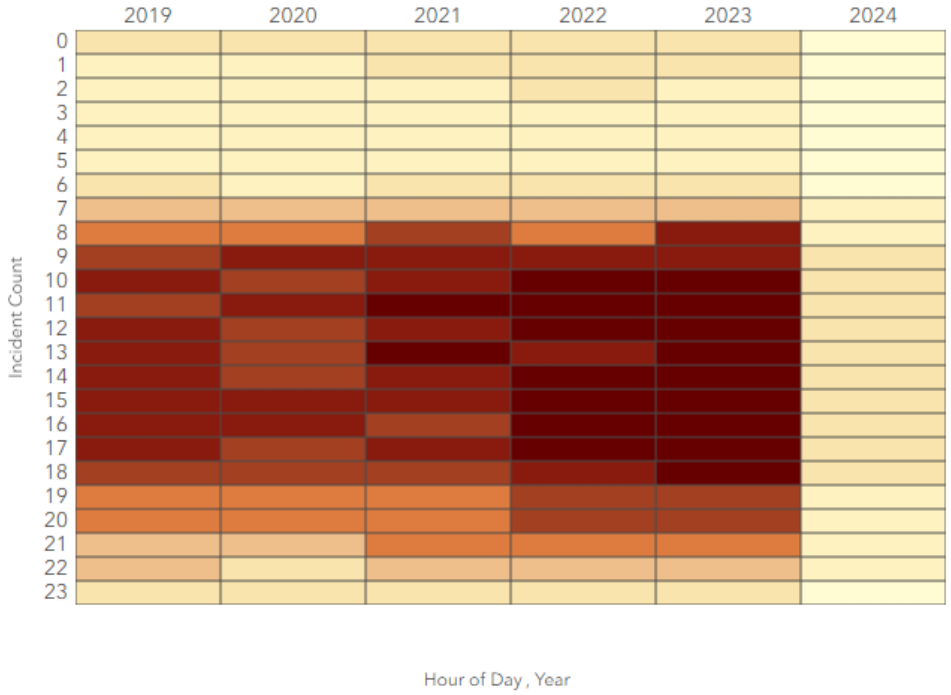


Incidents by Hour of Day - Bar Chart



2019 2020 2021 2022 2023 2024

Incidents by Hour of Day - Heat Map

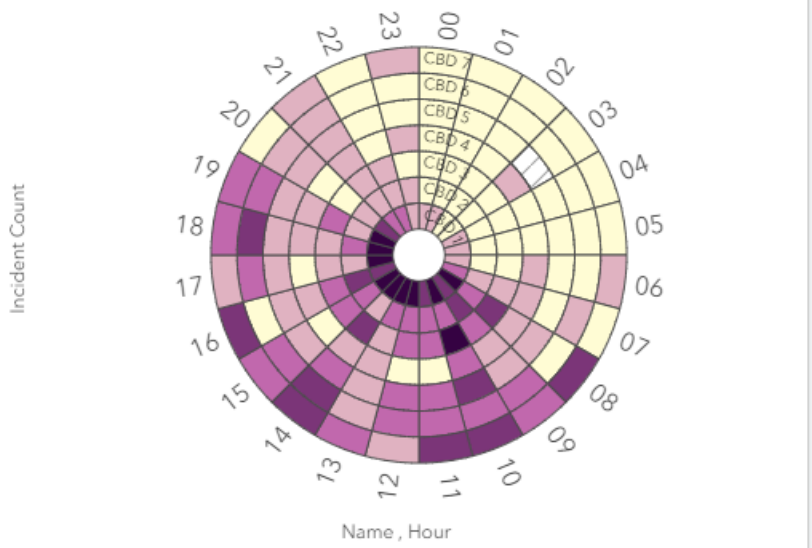


> 645 - 726 > 589 - 645 > 511 - 589 > 433 - 511 > 349 - 433
> 256 - 349 > 146 - 256 91 - 146

	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
		Total 61,028

Fire Operations Intelligence System: Station & Unit Hour Utilization

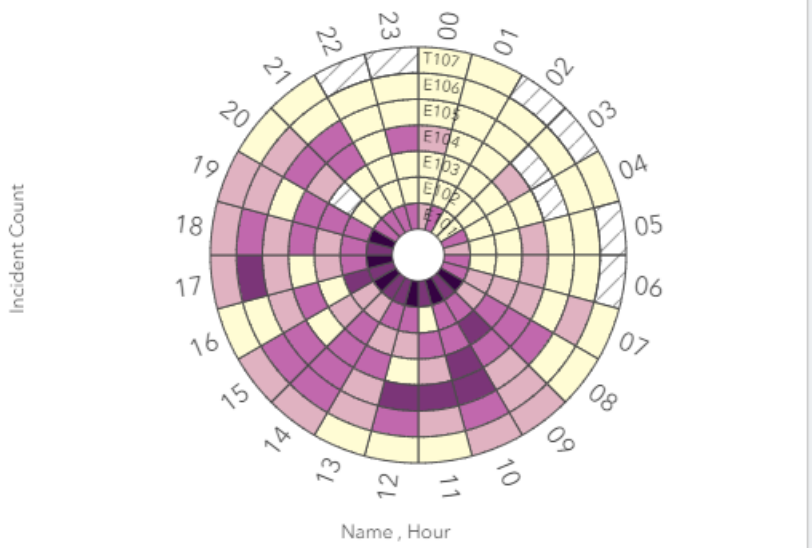
Station Hour Utilization - Response Count



Incident Count

> 17 - 22 | > 13 - 17 | > 9 - 13 | > 5 - 9 | 1 - 5 | <Null>

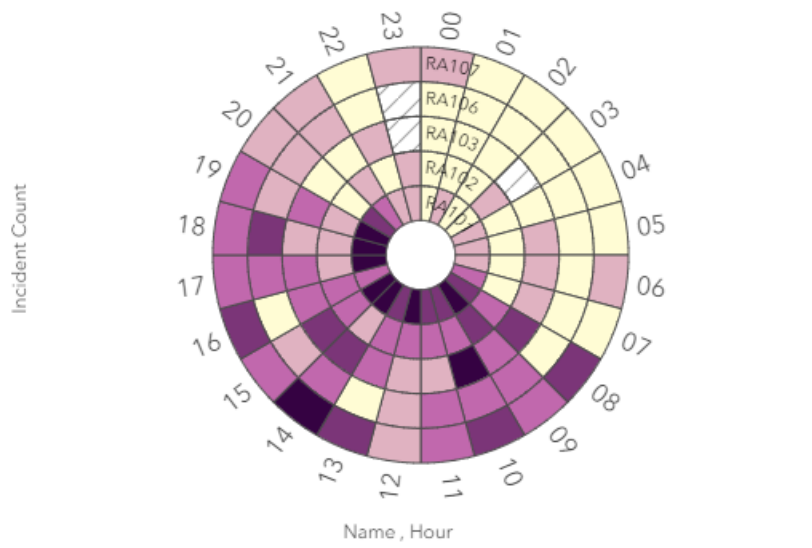
Engine Unit Hour Utilization - Response Count



Incident Count

> 18 - 24 | > 11 - 18 | > 7 - 11 | > 4 - 7 | 1 - 4 | <Null>

EMS Unit Hour Utilization - Response Count



Incident Count

> 16 - 21 | > 12 - 16 | > 8 - 12 | > 4 - 8 | 1 - 4 | <Null>

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

Unit Hour Utilization - Engine Companies Summary

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

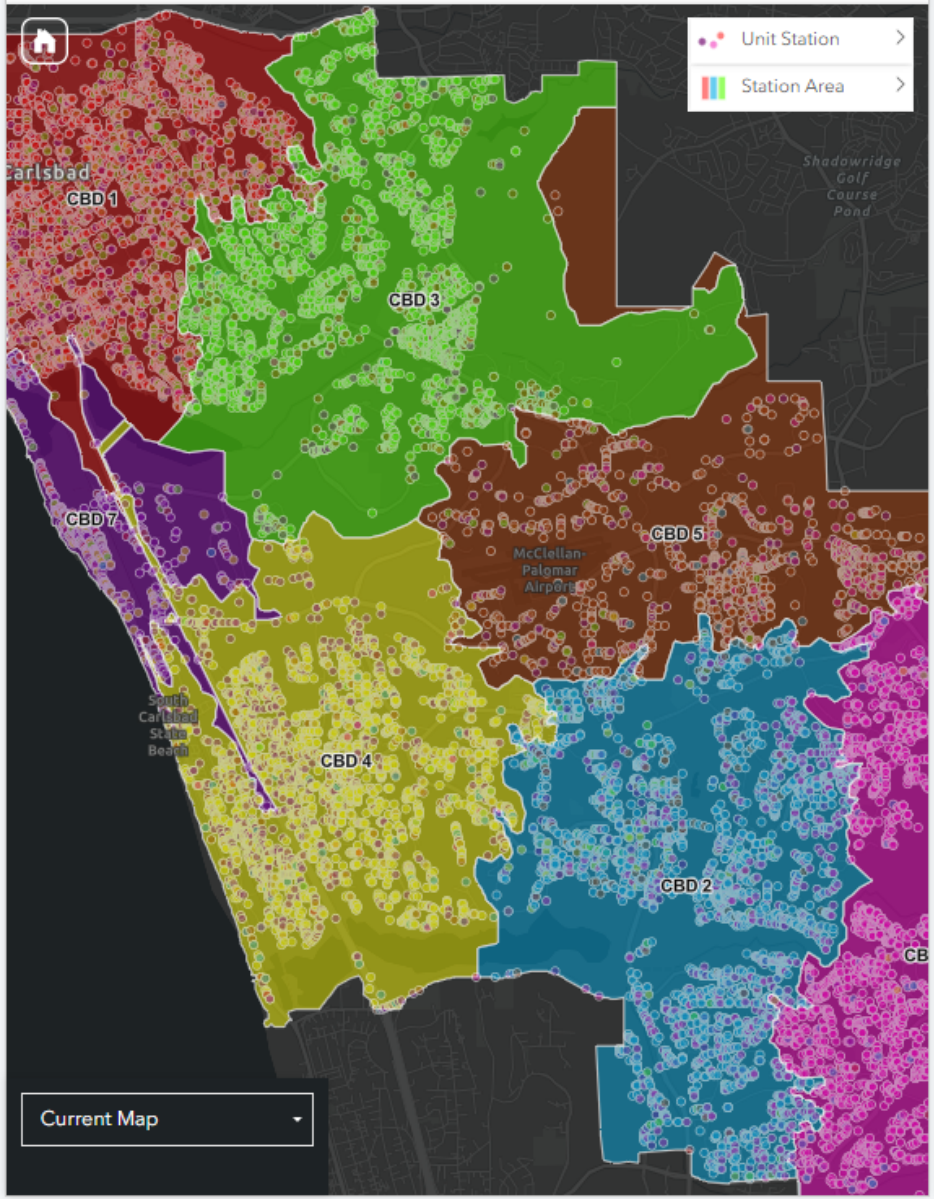
Unit Hour Utilization - EMS Companies Summary

Name	% Utilized	Incident Count
RA101	24.75	284
RA107	14.99	191

Now updated hourly, instead of every five years

Fire Operations Intelligence System: Incidents by Responding Station

Responses in Carlsbad - by Unit Station



Filter: Year

Search for a value

- [x] Select All
- [x] 2019
- [x] 2020
- [x] 2021
- [x] 2022
- [x] 2023

Filter: Month

Search for a value

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

Filter: Unit Station

Search for a value

- [x] Select All
- [x] CBD 1
- [x] CBD 2
- [x] CBD 3
- [x] CBD 4
- [x] CBD 5

Filter: CBD Responded

Search for a value

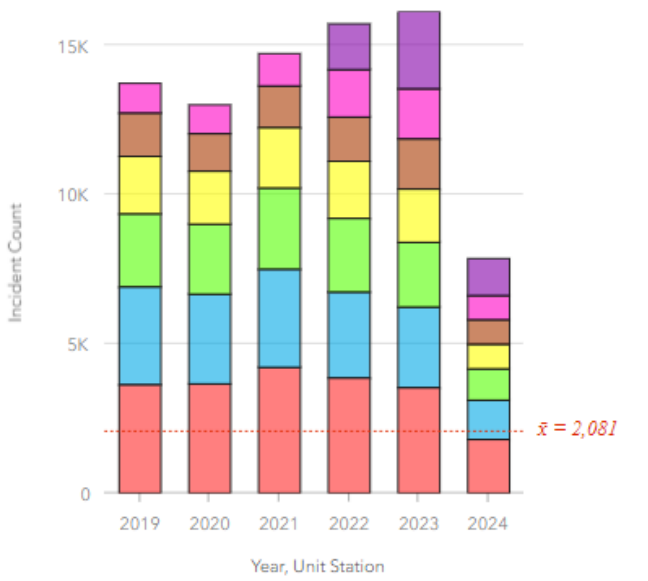
- [x] Select All
- [x] No
- [x] Yes

Filter: Station Area

Search for a value

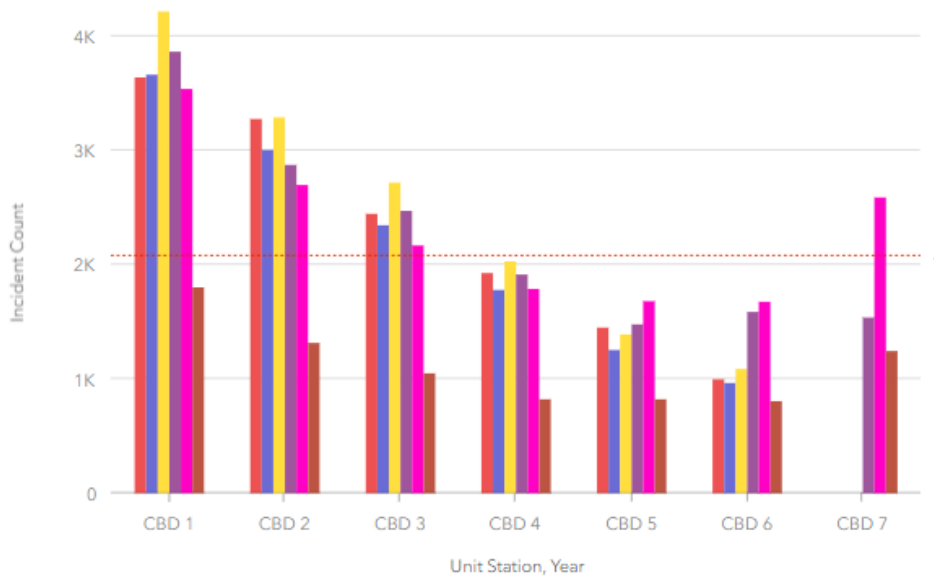
- [ ] Select All
- [x] CBD 1
- [x] CBD 2
- [x] CBD 3
- [x] CBD 4
- [x] CBD 5

Incidents by Year, Unit Station



CBD 1 CBD 2 CBD 3 CBD 4
CBD 5 CBD 6 CBD 7

Incidents by Unit Station, Year

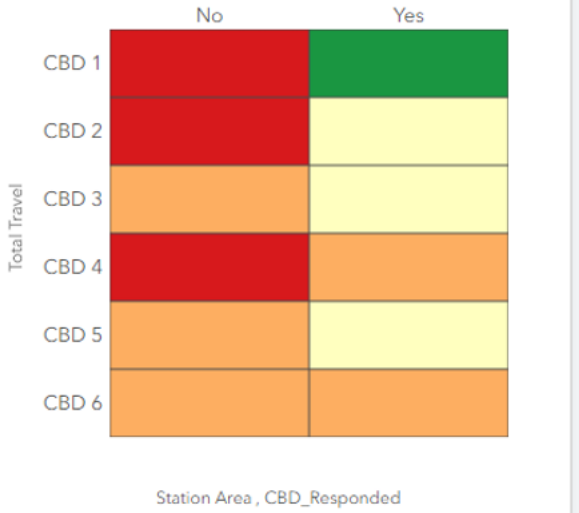


Year

2019 2020 2021 2022 2023

Fire Operations Intelligence System: Distribution Travel Analysis

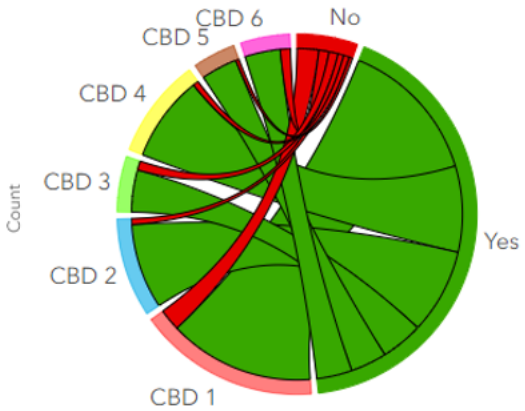
Travel Time by CBD Response - Heat Chart



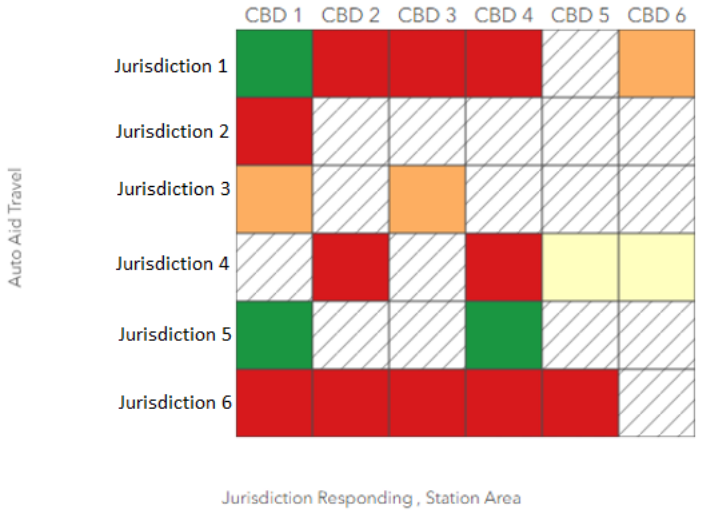
Total Travel

- > 8 - 9.26
- > 7 - 8
- > 6.3 - 7
- > 6 - 6.3
- 5.49 - 6

Total Count by CBD Response - Chord Diagram



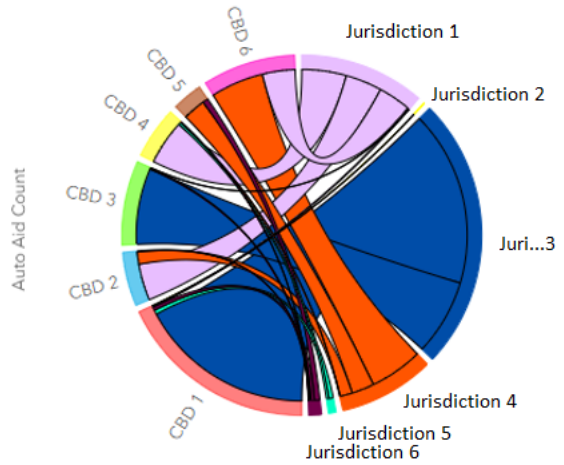
Auto Aid Travel Time - Heat Chart



Auto Aid Travel

- > 8 - 49.04
- > 7 - 8
- > 6.3 - 7
- > 6 - 6.3
- 0.1 - 6
- <Null>

Auto Aid Total Count - Chord Diagram



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

Auto Aid Received and Arrived by CBD

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

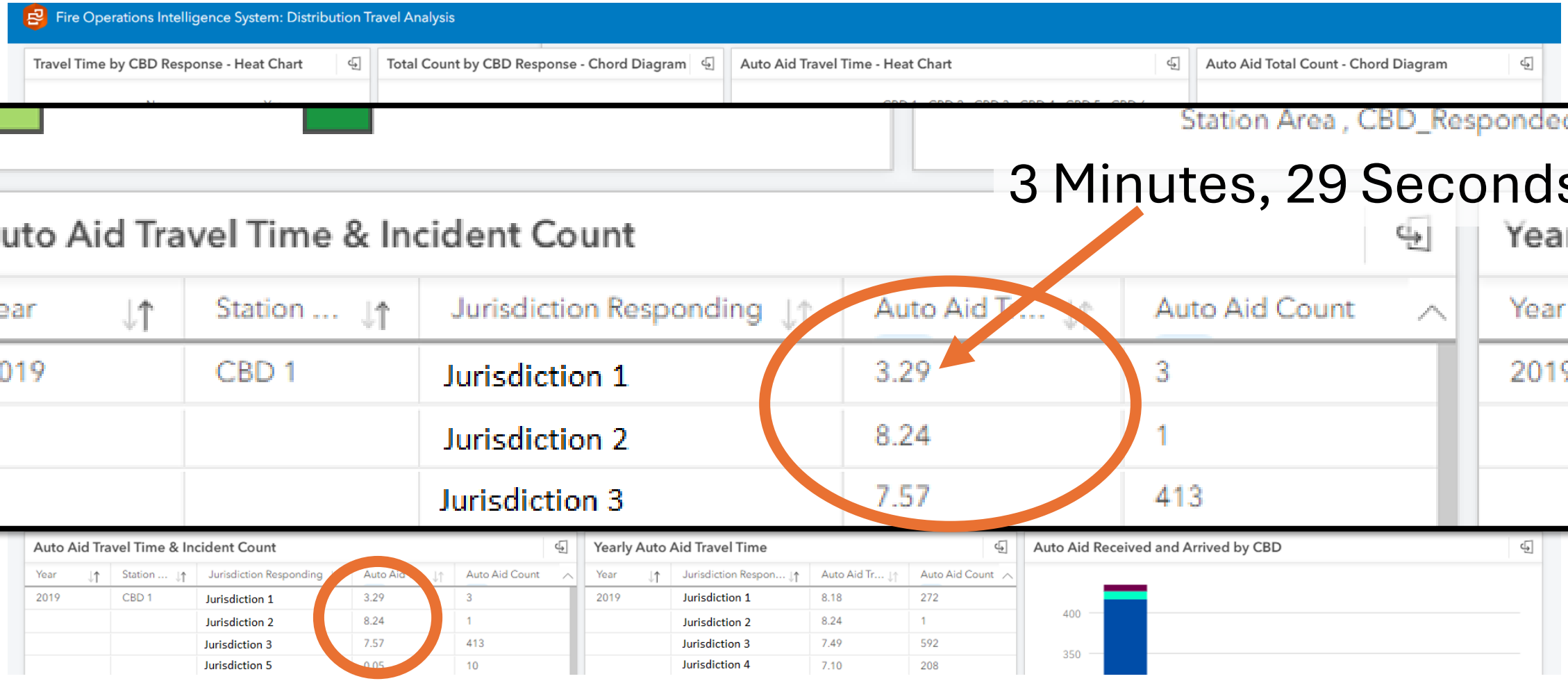
- Sharing is view only
- Data refresh can only be done manually by owner
- Need for real-time data refreshes

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)

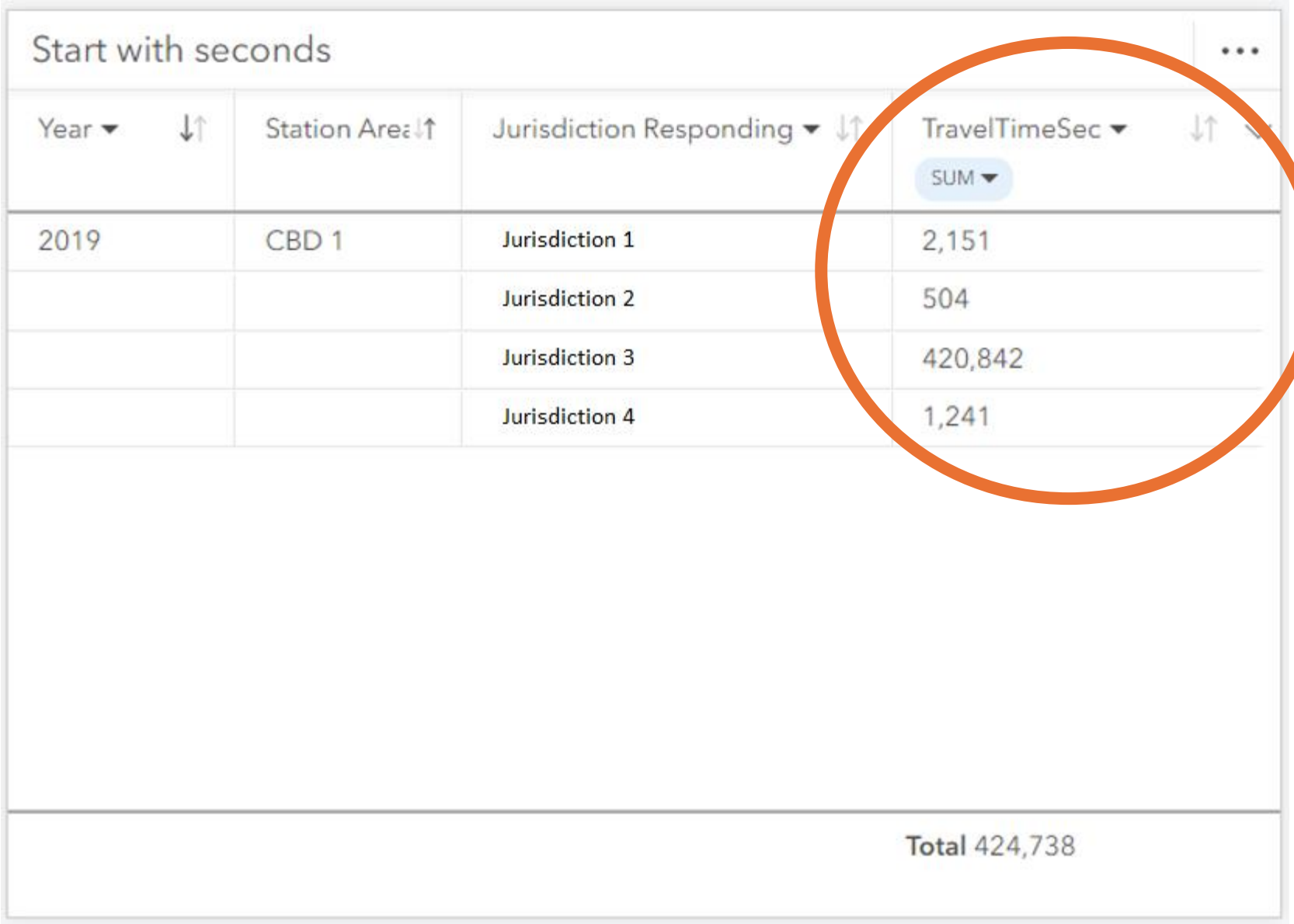


The Solution: Duration Format

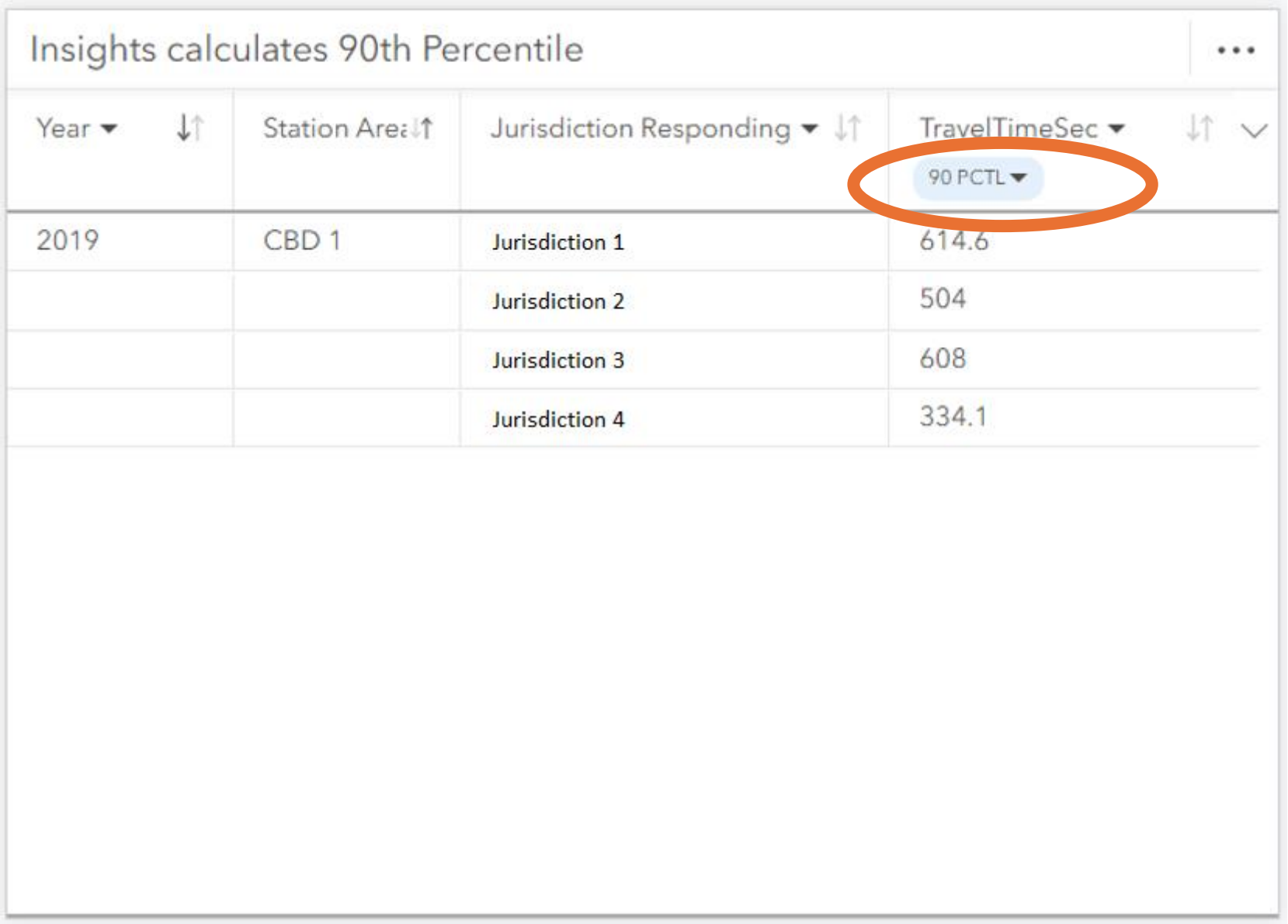
- Start with time in seconds
- Then use ArcGIS Insights to calculate 90th percentile
- Finally, convert the 90th percentile seconds to minute.second format
  - Calculation example:

```
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)))))))
```

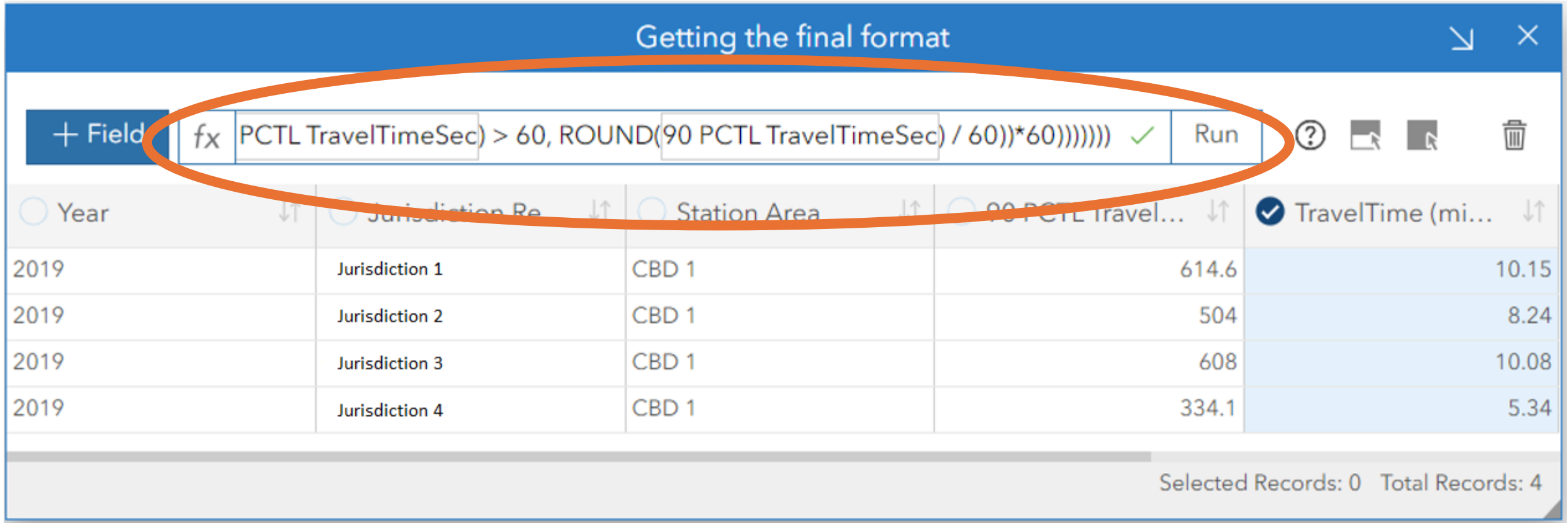
The Solution: Duration Format



The Solution: Duration Format



The Solution: Duration Format



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" & ROUND(traveltimesec_percentile),"0." & ROUND(traveltimesec_percentile))),

The Solution: Duration Format

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

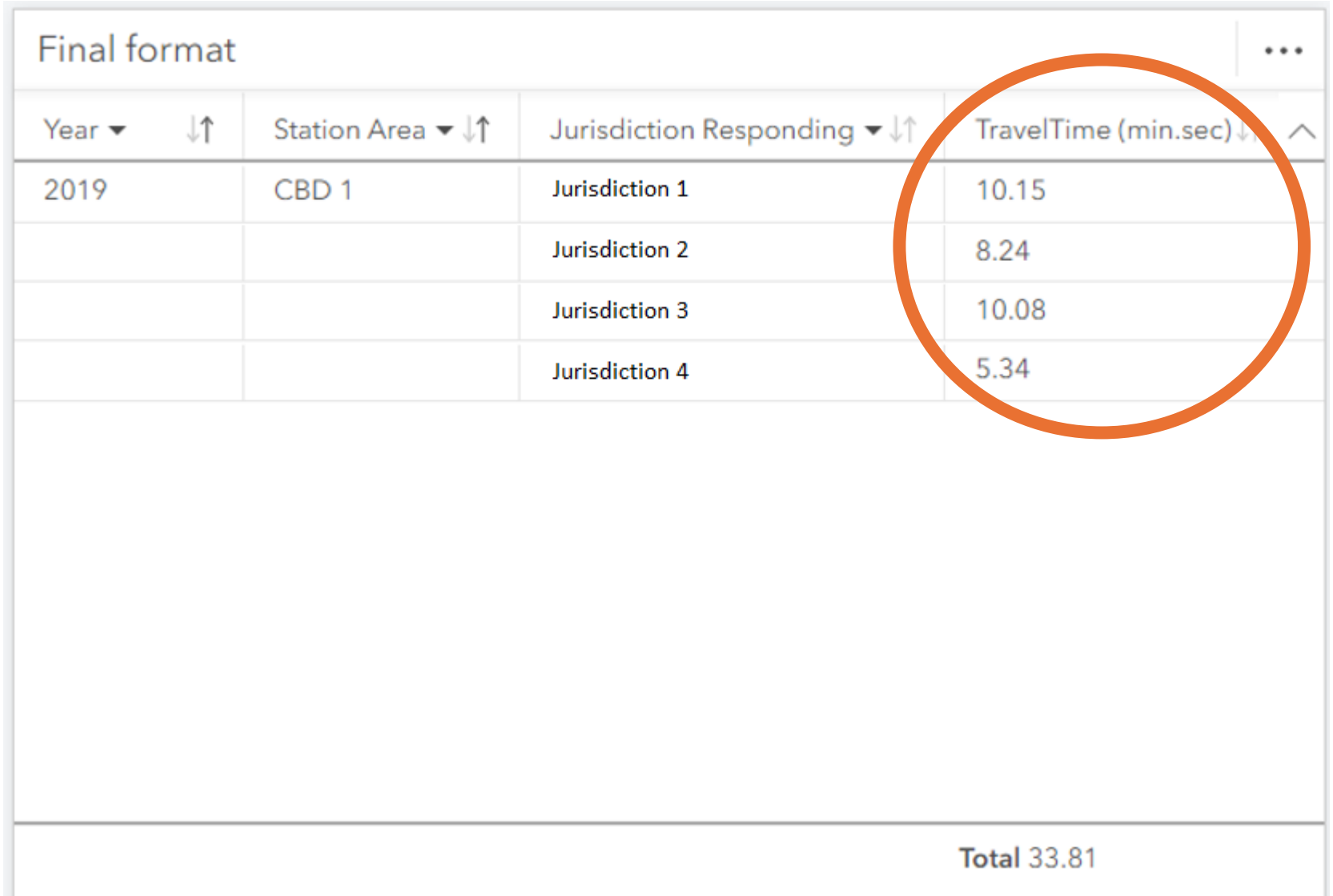
VALUE(CONCATENATE(FLOOR(IF(ROUND(traveltimesec_perc
entile) > 60, ROUND(traveltimesec_percentile) / 60)), ".",

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

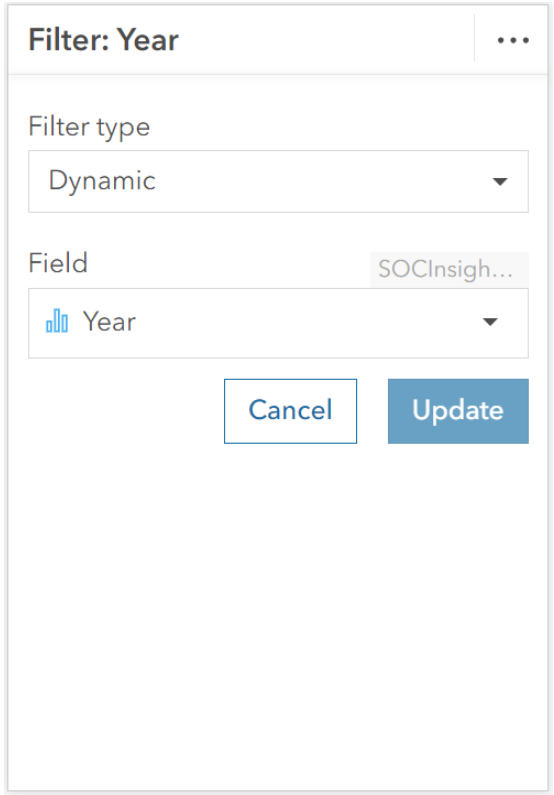


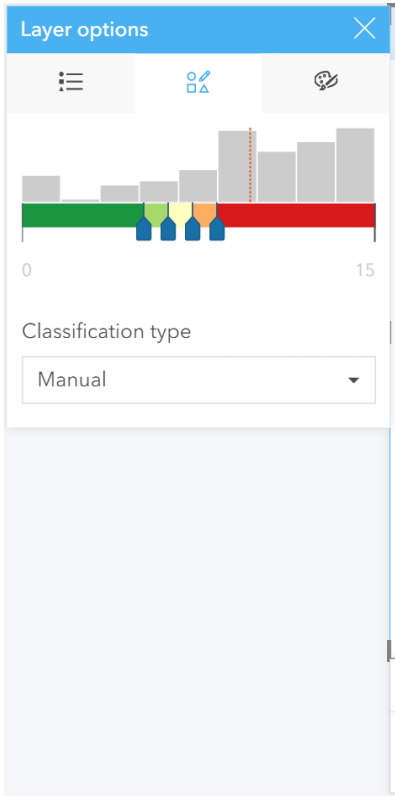
Final format

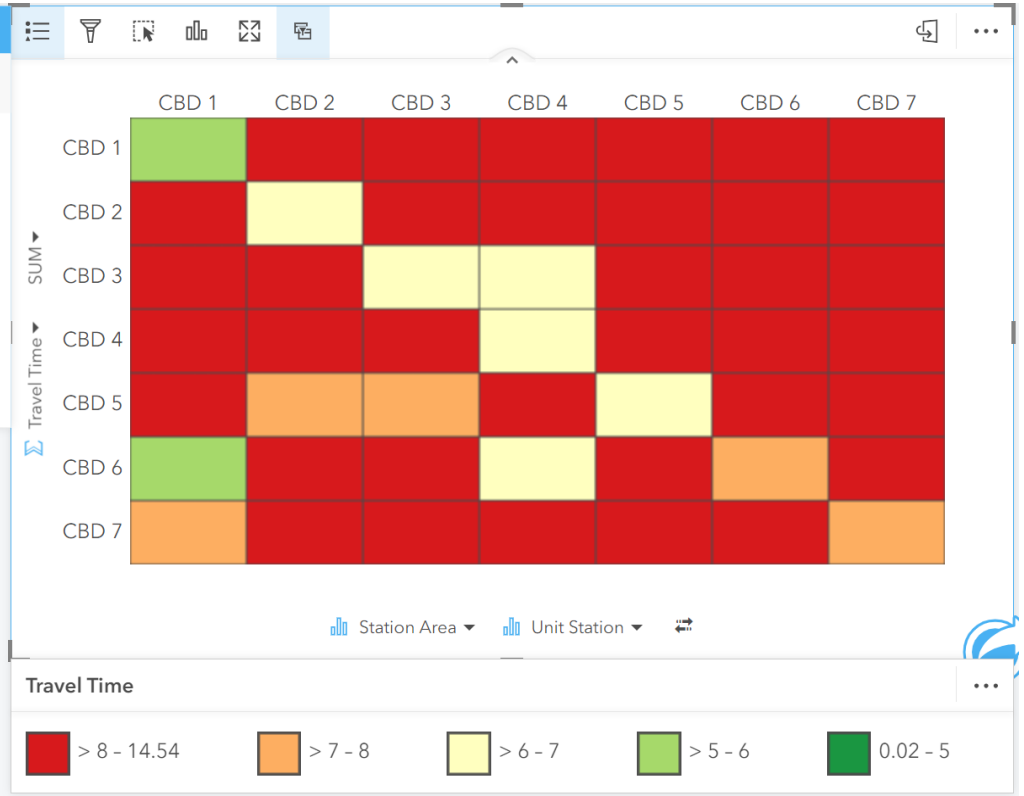
Year	Station Area	Jurisdiction Responding	TravelTime (min.sec)
2019	CBD 1	Jurisdiction 1	10.15
		Jurisdiction 2	8.24
		Jurisdiction 3	10.08
		Jurisdiction 4	5.34
			Total 33.81

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







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!

Aurora.Moreno-Resendiz@carlsbadca.gov
David.vanGilluwe@carlsbadca.gov

July 16, 2024

City of Carlsbad