



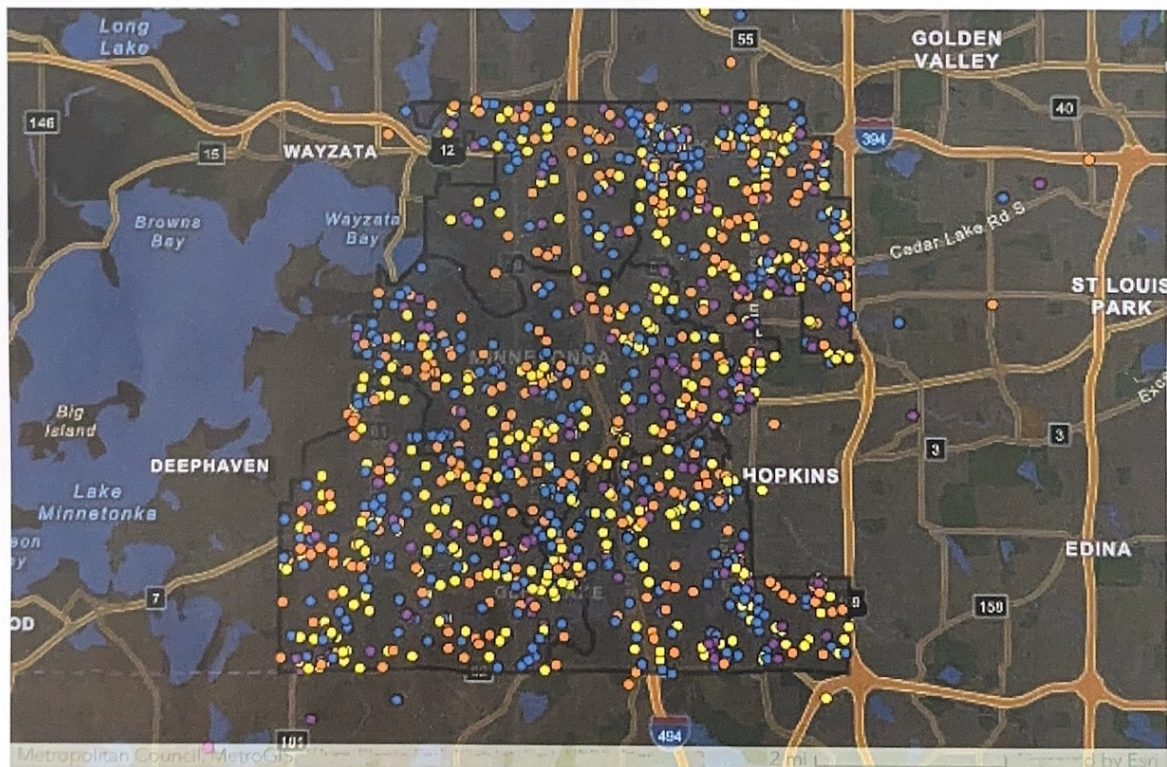
# CITY OF MINNETONKA

## 2023 Fire Department Calls in Minnetonka

Using maps to visualize how the Minnetonka Fire  
Department responded to calls so far this year

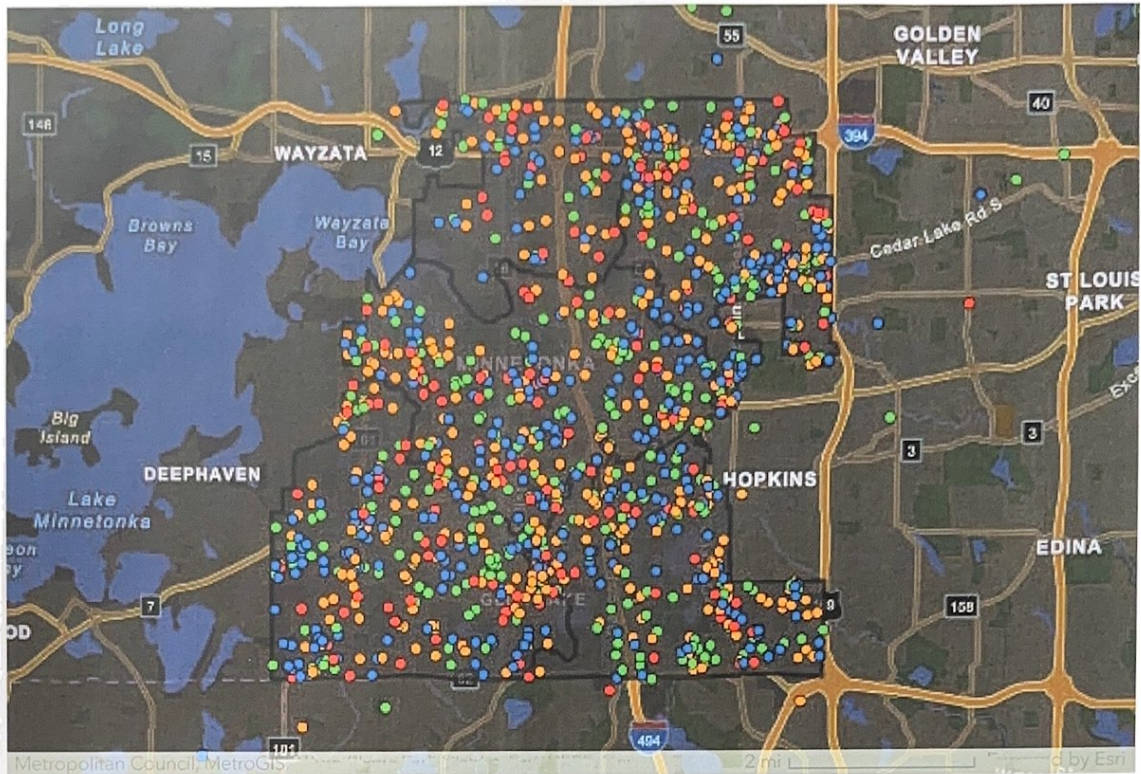
Justin Carter  
August 4, 2023

Let's explore the call data...

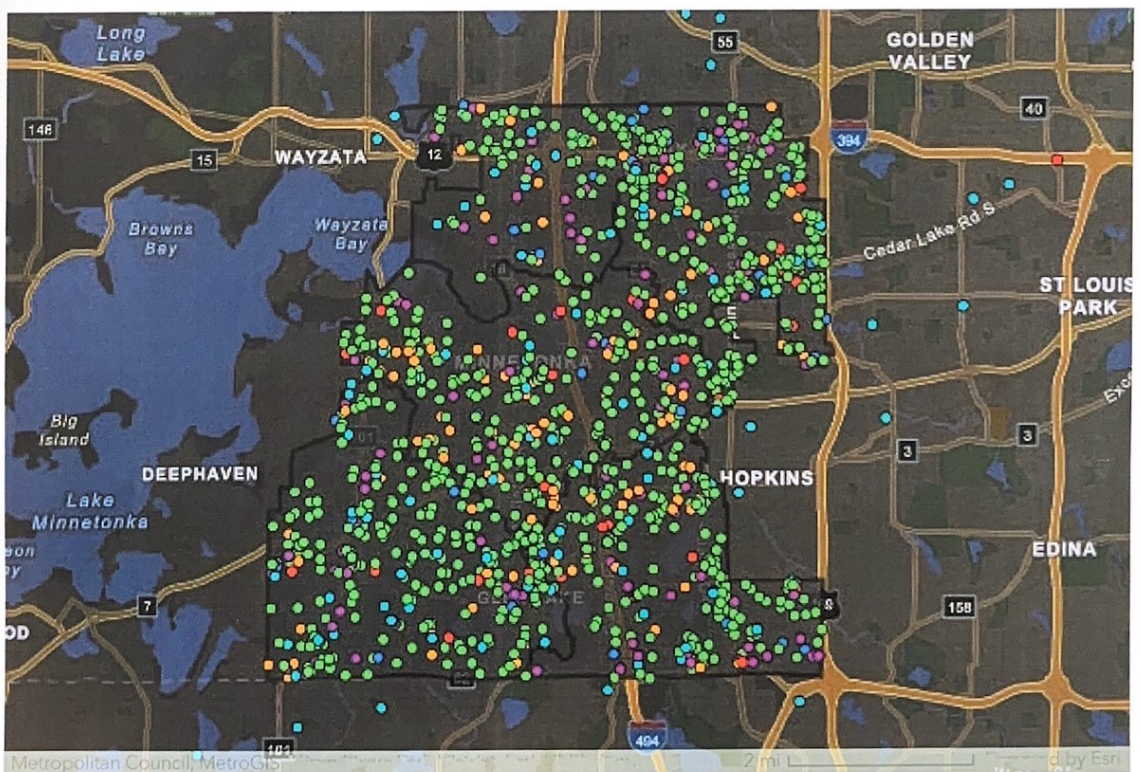




This map shows Fire Department calls by the time of the call



This map shows Fire Department calls by the date of the call



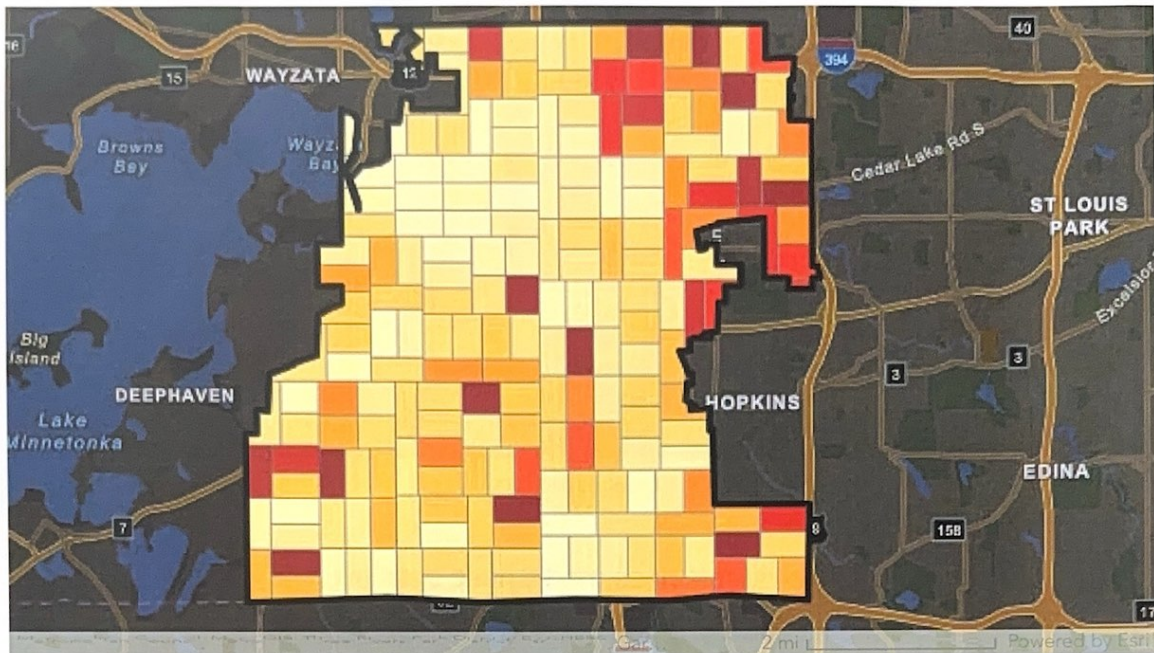
This map shows Fire Department calls by the type of the call

Let's continue to explore the data by looking at the number of calls in different parts of the city. Below is a



map of call densities (darker areas have more calls).

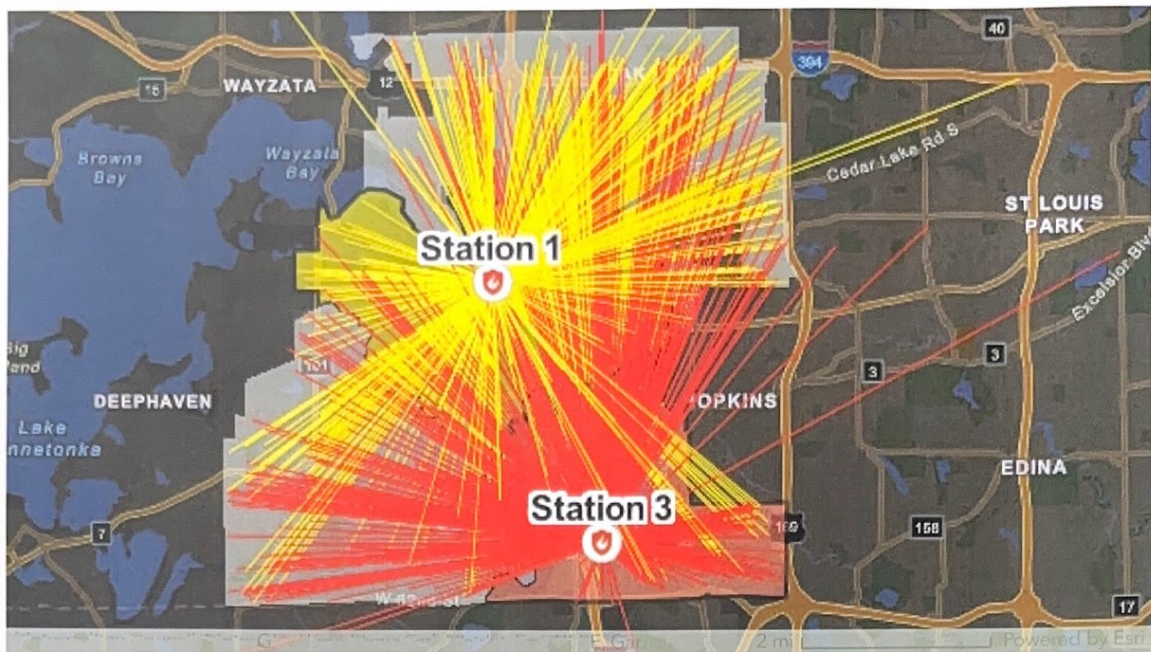
Click on an area to see the number of Fire Department calls made in that area.



Call Density

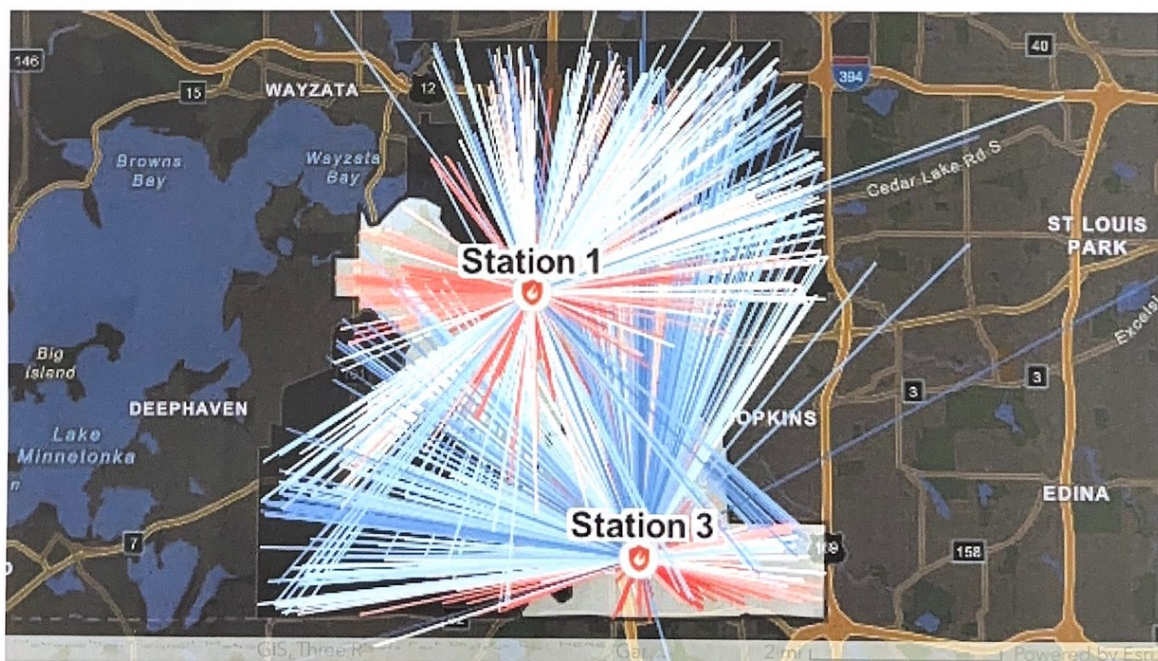
An important aspect of responding to calls is choosing what station to dispatch units from. Station 1 and Station 3 are manned 24 hours everyday. Together, they have responded to the majority of calls this year, including many that are not in their respective districts. Click on a line below to see the driving distance from the responding fire station to a particular call.





2023 Calls Station 1 & 3

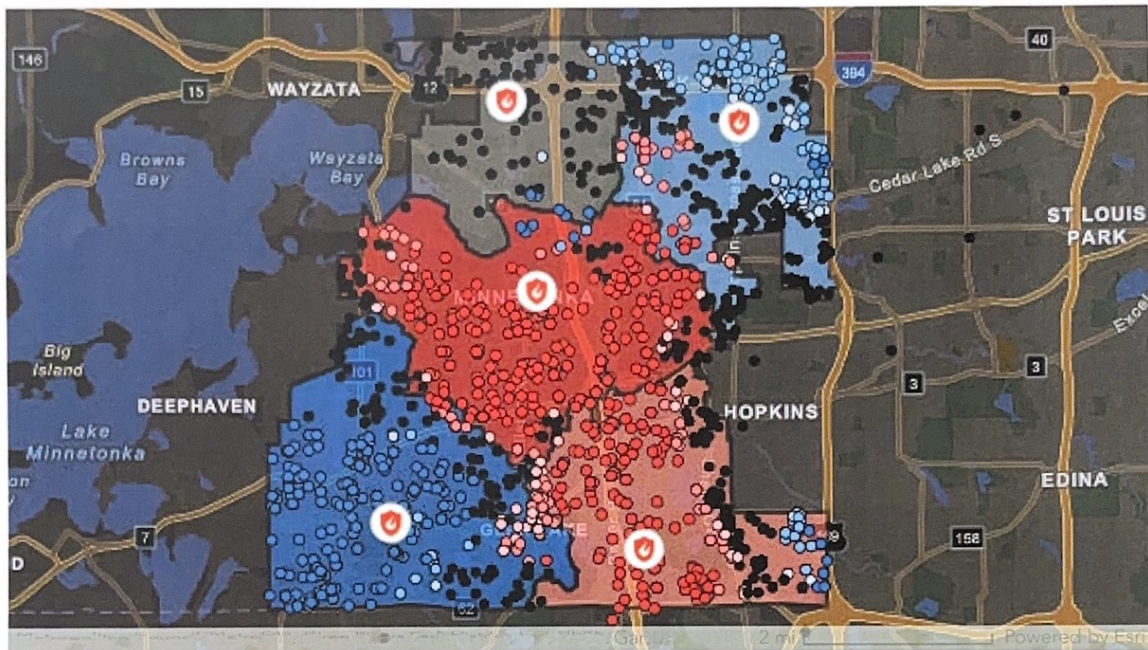
Now that we have seen where each station is responding, let's take a look on how much drive time is estimated for each call. Red lines represent faster drive times and blue lines represent slower drive times. Click on a line below to view estimated drive time from the responding fire station to the particular call.



2023 Calls Station 1 & 3 (Drive Times)



Finally, we perform a statistical analysis to determine whether or not a particular call is a part of a cluster that has slow travel times or fast travel times. The color of the call represents a call that is in a hot, cold, or neutral zone with a corresponding level of confidence. Click on a particular point to see the drive time for that call.



Hot Spot Analysis

The analysis above demonstrates that drive times are faster for calls in fire districts with stations that are staffed 24/7 (stations 1 & 3).

### Methods:

- Preliminary data cleaning was performed in R to take the raw data which included every responding unit and condense this to only the first response unit (excluding Chief and Battalion Chief cars). This was done to prevent data skewedness due to support units taking longer to respond.
- For the processing of time, data, and category data fields, functions in R were created to convert string fields into numeric fields. Additionally, a function was created to sort the different call codes into the six categories used in the call types map.

- Data processing for the location maps (line maps) was done first in R by creating a field representing the station that responded to a call and then batching the data by station. The responding station was found by using the responding unit type and matching it to either Station 1 or 3 with the information of the units that are always housed in these stations. Next, the ArcGIS tool OD Cost Matrix was used to map lines from origin to destination and estimate the driving time between each fire station and call. This was done in batches of 1000 observations or lower (the maximum the tool allows) and then merged back into one dataset using the Append tool
- For the call density map, the ArcGIS tool Subdivide Polygon was used to split the boundary of Minnetonka into 200 parts. Using these new boundaries, the tool Optimized Hot Spot Analysis was used to identify hot spots by call counts within the newly subdivided areas.
- For the travel time hot spot map and analysis, the tool Optimized Hot Spot Analysis was used again. The Optimized Hot Spot Analysis tool was run on the travel time field. Because hot spots correspond to higher values (in this case greater travel times), the legend was adjusted so hot zones correspond to faster times (lower values) and cold zones correspond to slower times (higher values). Additionally, the wording was changed so hot and cold spots became fast and slow zones.
- Throughout the process of creating this project, extensive use of the ArcGIS tool XY Table To Point was used to create point objects on each map from raw coordinate data. Additionally, symbology tools and the ArcGIS library of symbols were used to create visualizations of the data.