



The Data Behind Deployment: Simulating Crisis Response in Honolulu

Jenna Sparling¹ and Dr. Veronica M. White²

¹Departments of Geography and Economics, College of Social Sciences and Public Policy
²Department of Industrial and Manufacturing Engineering, FAMU-FSU College of Engineering

Introduction

Background

- Inconsistent police response to mental health related emergencies has led to arrests and the use of lethal force against Persons with Mental Illness (PWMI)
- Researchers have developed different police response models to improve the outcomes of mental-health related calls
- White and Albert (In Progress) developed a simulation tool in Python to compare four police response models
- Their study compares traditional police-only responses with responses from Crisis Intervention Teams, composed of trained mental-health professionals
- The model was ran using real data from the Seattle Police Department
- The model used Seattle's call frequency, travel times, service times, staffing levels, call priority distributions, and district neighbors as inputs

Research Objectives

- The aim of this research is to apply the Seattle framework to Honolulu, Hawaii in order to test variability between police departments
- My primary contribution to this project is the development and calibration of Honolulu-specific input parameters
- Parameters needed were call arrival rates (call frequency), driving time (time taken to reach an incident), and officer allocation (minimum staffing levels)
- Priority distribution and service times were assumed from Seattle data due to a lack of publicly available information

Data Collection

- Data was collected from Honolulu City and County Open Data Portal
- Honolulu Police Department (HPD) call data from 05/01/2025 to 10/31/2025 was collected, cleaned, and restructured in Python
- Addresses were geocoded (converted into geographic coordinates) using the US Census Bureau Geocoder

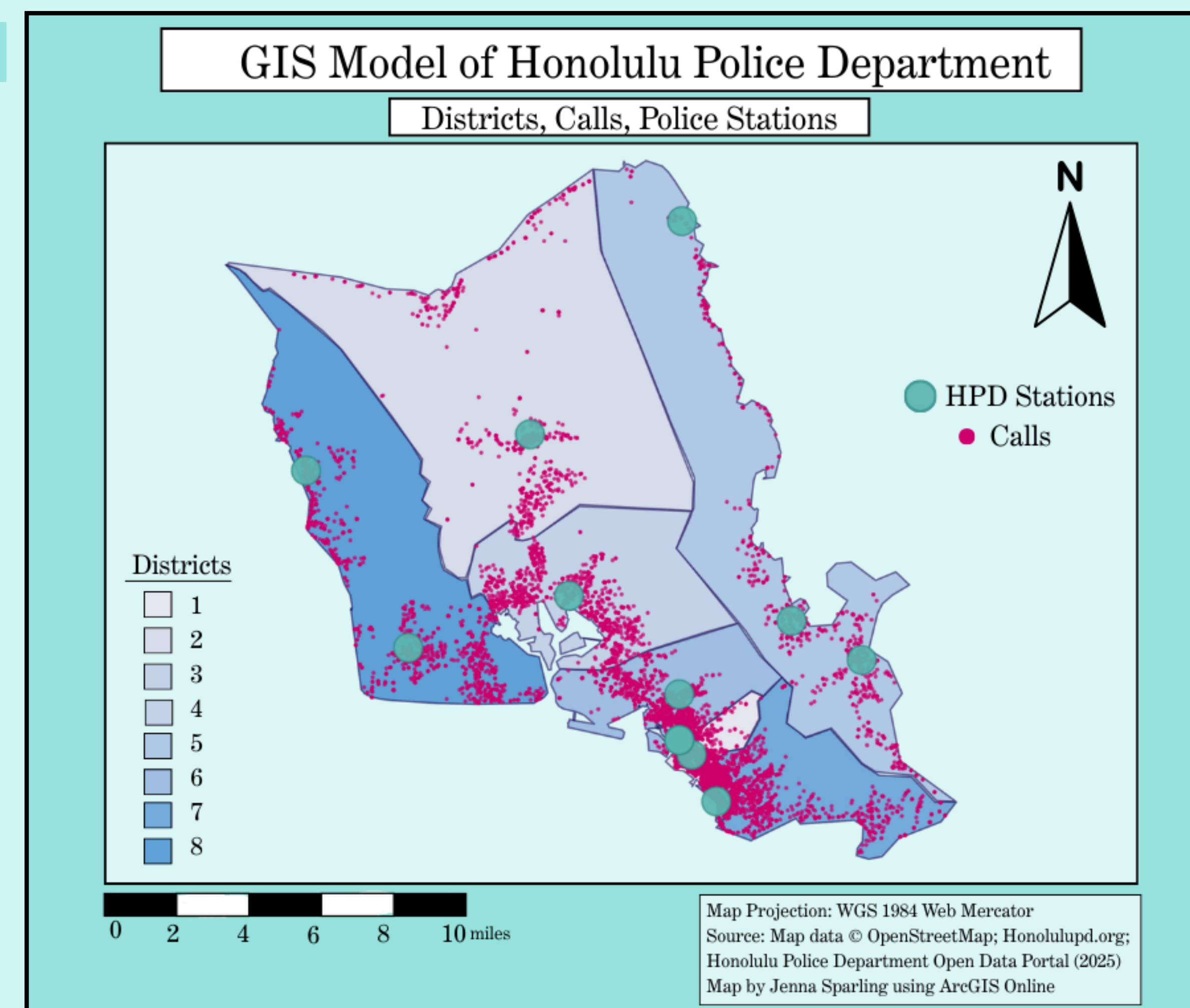
Incident #	Block Address	Date / Time	Incident Type
250501-0026	1200 BLOCK RIVER ST	2025-05-01 00:25	ASSAULT
250501-0031	1300 BLOCK PENSACOLA ST	2025-05-01 00:33	ASSAULT
250501-0051	1300 BLOCK PALI HWY	2025-05-01 00:52	ASSAULT
250501-0087	1200 BLOCK S KING ST	2025-05-01 01:24	THEFT / LARCENY
250501-0096	300 BLOCK W MOANALUA FWY	2025-05-01 01:37	DUI
250501-0175	859000 BLOCK FARRINGTON HWY	2025-05-01 03:48	THEFT / LARCENY
250501-0289	000 BLOCK MAHELE LOOP	2025-05-01 06:24	VEHICLE BREAKIN
250501-0312	900 BLOCK KAPIOLANI BLVD	2025-05-01 07:15	ASSAULT
250501-0346	2100 BLOCK ALA WAI BLVD	2025-05-01 08:02	BURGLARY
250501-0411	600 BLOCK N KING ST	2025-05-01 09:17	THEFT / LARCENY
250501-0479	1500 BLOCK KEEAUMOKU ST	2025-05-01 10:03	FRAUD
250501-0524	400 BLOCK KALAKAUA AVE	2025-05-01 11:21	VEHICLE BREAKIN

Sample HPD call data from 05/01/2025 to 10/31/2025

Methods

- Geographic Information Systems (GIS) is a tool used to map and analyze spatial data
- Using the official written boundaries on the HPD website, I constructed a map of the eight HPD districts using ArcGIS (GIS software)
- Using ArcGIS analysis tools, each geocoded call was spatially assigned to a district
- Additionally, all HPD stations were mapped and assigned a district

GIS Model



Results

- 15,391 calls were successfully geocoded and spatially assigned to HPD district boundaries
- Urban District 1 (Downtown Honolulu) had the highest call volumes
- Rural District 2 (Mililani, Wahiawa, and North Shore) had the lowest call volumes
- Call demand per district can now be calculated for arrival rates and officer allocation
- Call distance to station can now be calculated for driving times and officer allocation

Conclusion

Implications

- All needed inputs for the simulation were found
- These inputs are important for the development of the overall crisis response research project
- The Honolulu case study helps evaluate variability between different police departments
- The results of the simulation will be used to propose policy reform

Limitations

- Results are limited by the available data
- A longer date range for call data would improve accuracy
- Greater access to HPD data would reduce data gaps and the need for assumptions

Next Steps

- The calculated parameters will be entered into the simulation model
- Pilot simulations of Honolulu will then be conducted
- When more call data is publicly available, parameters will be recalculated using the same methodology

References

Amendola, K.L., Weisburd, D., Hamilton, E.E. et al. An experimental study of compressed work schedules in policing: advantages and disadvantages of various shift lengths. *J Exp Criminol* 7, 407–442 (2011). <https://doi.org/10.1007/s11292-011-9135-7>

City and County of Honolulu. (n.d.). HPD crime incidents [Data set]. Honolulu Open Data. https://data.honolulu.gov/Public-Safety/HPD-Crime-Incidents/vg88-5rn5/about_data

Honolulu Police Department. (n.d.). Patrol command boundaries. <https://www.honolulu.gov/policy/policy-patrol-command-boundaries>

M. Yang, S. Park, Y. -F. Lu, and C. E. Gill. "Identifying signals of mental health crisis in calls for police service," *J. Crim. Justice*, vol. 97, p. 102356, Mar. 2025, doi: 10.1016/j.jerimjus.2025.102356.

M. W. Deane, H. J. Steadman, R. Borum, B. M. Veysey, and J. P. Morrissey, "Emerging Partnerships Between Mental Health and Law Enforcement," *Psychiatr. Serv.*, vol. 50, no. 1, pp. 99–101, Jan. 1999, doi: 10.1176/ps.50.1.99.

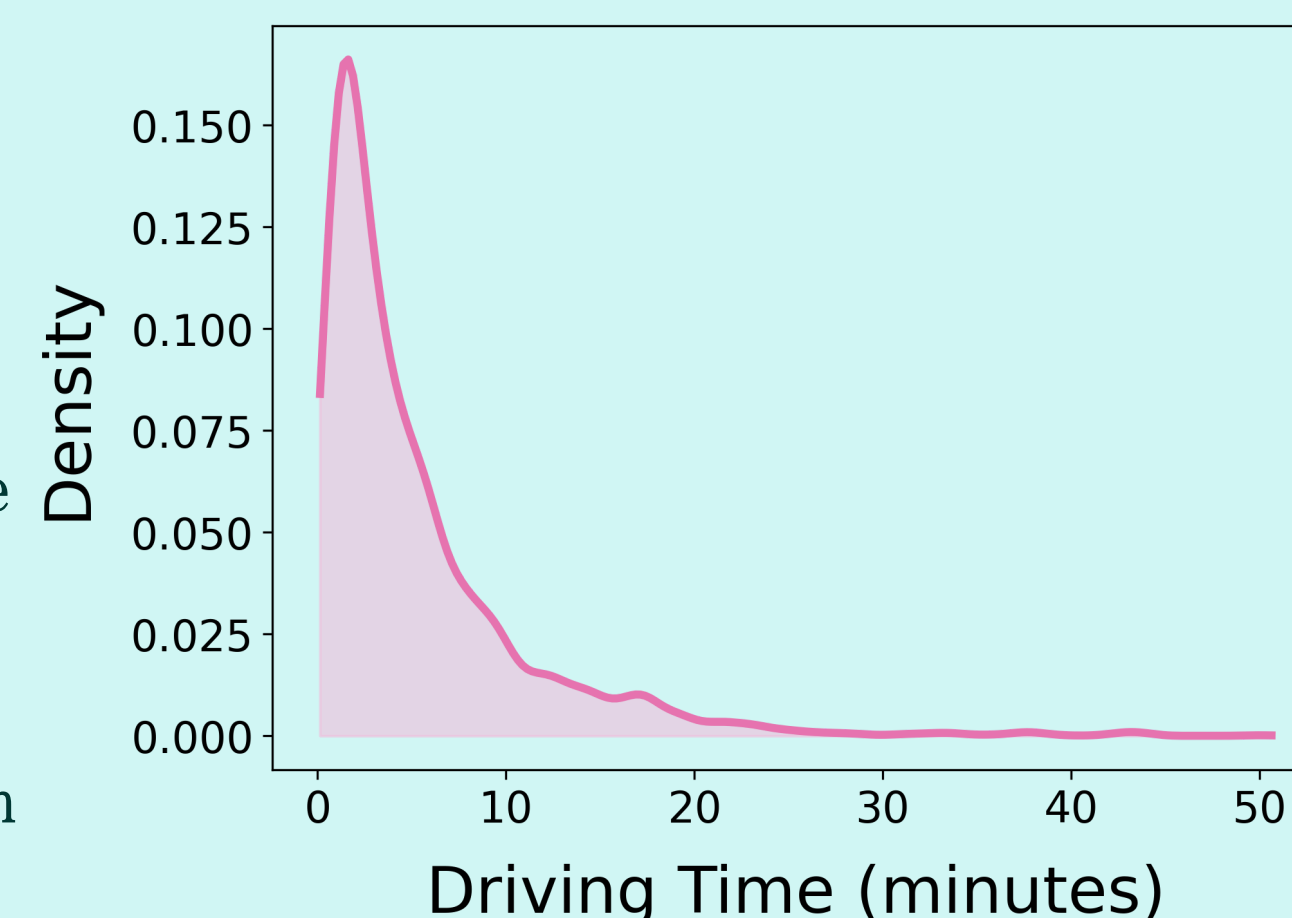
White, V. & Albert, L. (In Progress). Evaluating co-response models for crisis calls. Unpublished Manuscript

Driving Times

Methods

- Driving time was calculated as the distance between a reported incident and its nearest HPD station
- Distance was calculated using the Haversine Formula to get Distance (in miles) from coordinate inputs
- Driving time was calculated as $\text{Distance}/\text{Speed} \times 60$
- Speed was set at an average 27mph

Driving Time Distribution

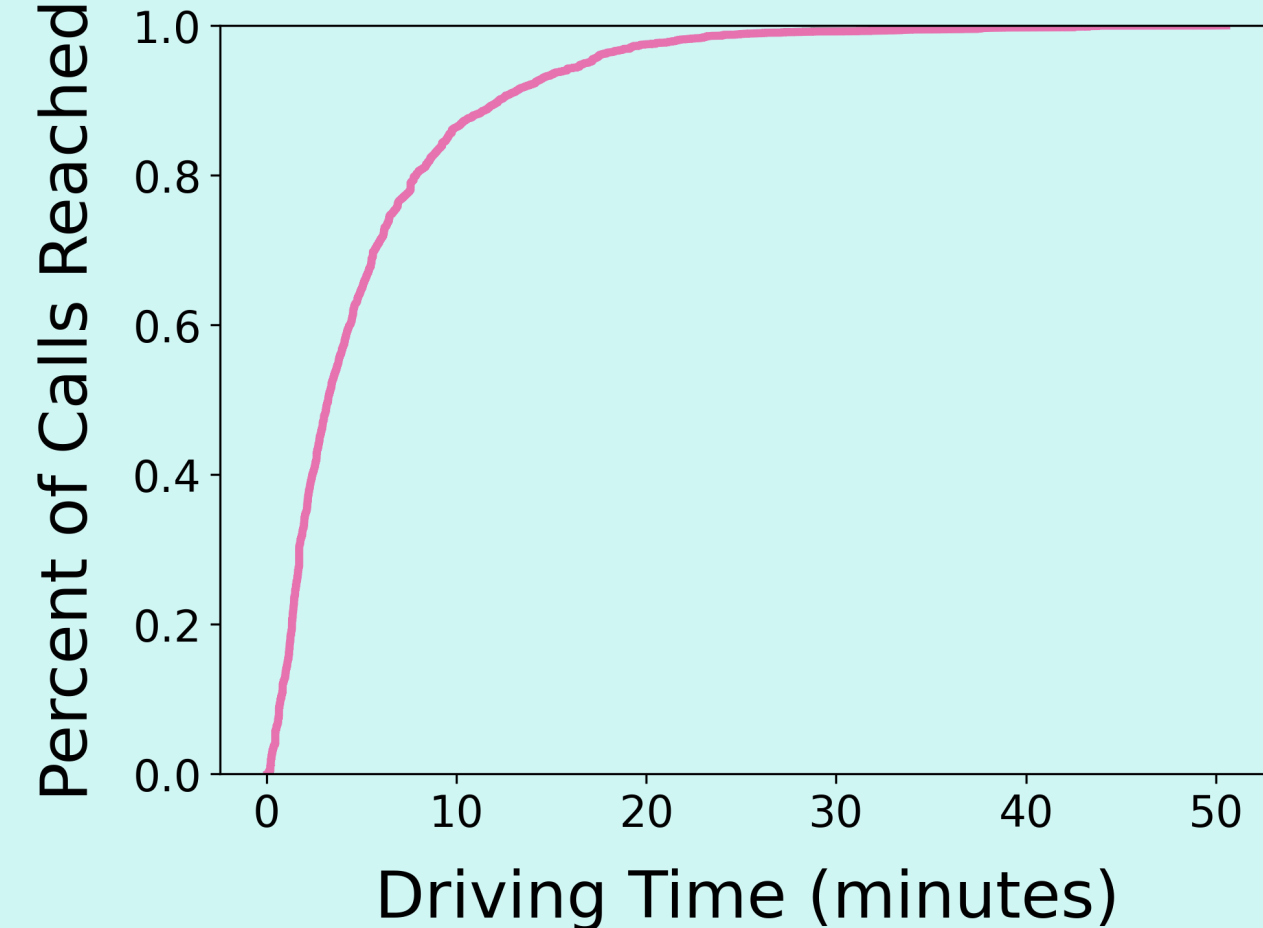


Graph of a Kernel Density Estimation of the relative frequency of Driving Times

Results

- The mean driving time was 4.75 minutes with a standard deviation of 5.71 minutes
- The median driving time was 3.25 minutes
- Because the mean is greater than the median the distribution is right skewed
- The fastest recorded driving time was 5.4 seconds
- The slowest calculated driving time was 50.5 minutes
- 50% of calls are reached within 4-5 minutes
- 80-90% of calls are reached within 10-12 minutes

Cumulative Response Time



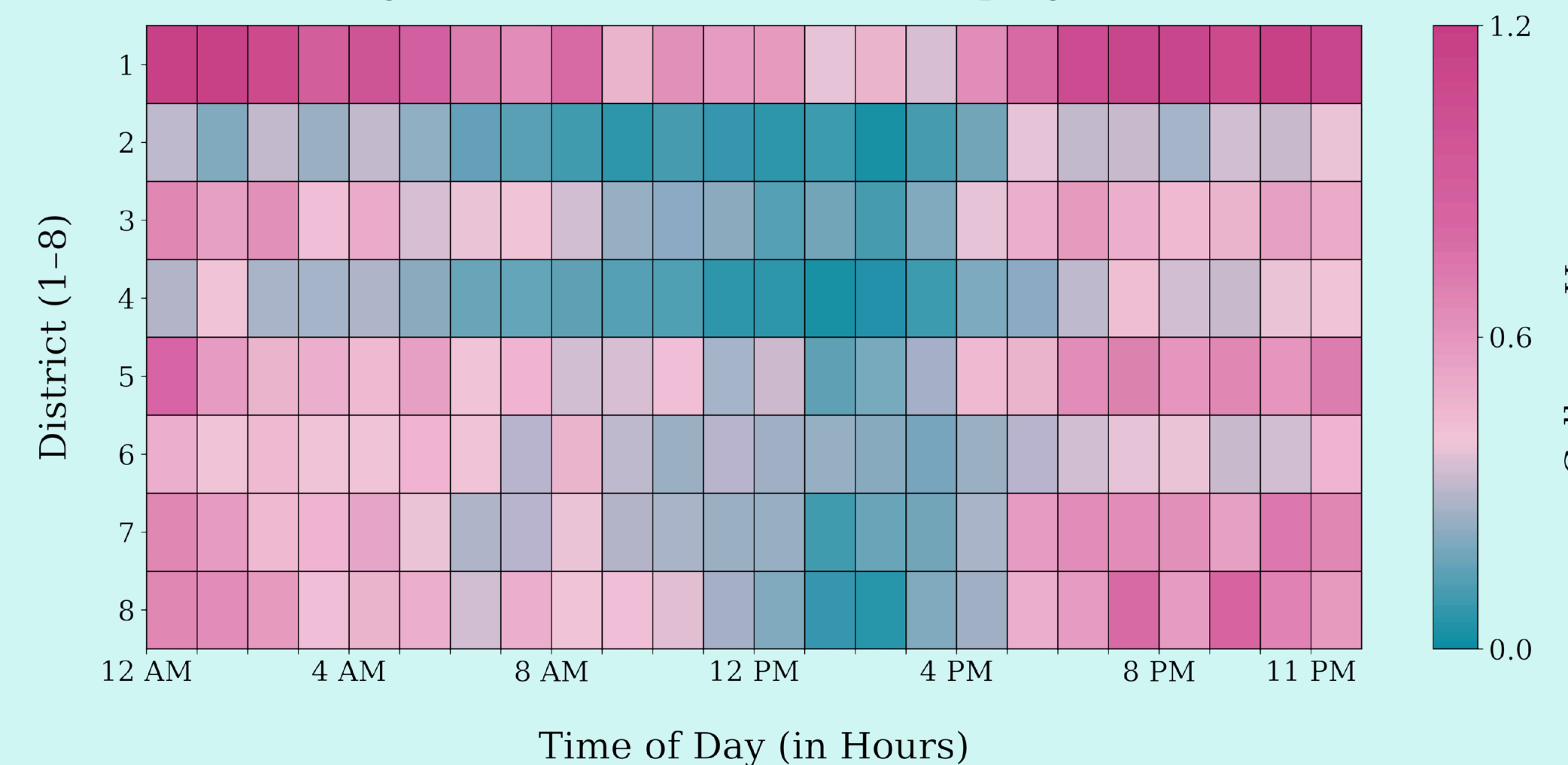
A Cumulative Distribution Graph of Driving Times in terms of probability of a call reached by a certain minute

Call Arrival Rates

Methods

- Arrival rates represent the average number of calls per HPD district given the day and hour
- Arrival rates are the average calls per hour in each district
- Arrival rates were calculated as $\text{Calls}(\text{District, Hour, Day}) / \text{Number of Days}$

Hourly Call Arrival Rate Heatmap by District



Results

- Crisis and non-Crisis call rates were calculated separately, with 10% of calls assumed to crisis based on policing literature (Yang et al, 2025)
- The Crisis/Non-Crisis Split was applied to all calculated arrival calls
- 384 Crisis and 384 Non-Crisis arrival rates were calculated
- The highest average call demand occurred in the evening, with rates peaking at 5.44 calls per hour at 11pm
- The lowest average call demand occurred in the afternoon, with rates dropping to 1.14 calls per hour at 2 pm
- Weekdays have a higher average demand than weekends
- Weekday demand was highest at 11pm and lowest at 2pm
- Weekend demand was highest at 12am and lowest at 3pm

Officer Allocation

Methods

- Officer allocation refers to the distribution of officers across districts, shifts, and day types
- An optimization model was constructed to allocate HPD officers to districts based on the call demand
- There are two shifts for the HPD: First Watch (6 am-7:30pm) and Second Watch (6 pm -7:30am)
- Weekend and weekday shifts were calculated separately
- The optimization calculation requires several inputs: call demand per district, district spatial overlap, and a minimum officer requirement
- District spatial overlap allows for districts to assist each other when feasible
- District overlap rule: if any call was less than or equal to 1.5 miles away from another district, that district could provide assistance
- Calculations were completed using Microsoft Excel Solver

$$\min_x \sum_{d \in D} \sum_{s \in S} \sum_{w \in W} X_{dsw}$$

The calculation to minimize total officers assigned across all districts (D), shifts (S), and watches (W)

$$X_{dsw} \geq \beta_{sw}$$

A constraint that states that officers per district per shift-day must be greater than or equal to the minimum required officers (alpha)

Results

- Second watch weekdays required the most amount of officers at 67
- First watch weekends required the least amount of officers at 35
- District 1 consistently required the most officers
- District 2 consistently required the fewest officers

$$\text{s.t. } \sum_{b \in B_d} X_{bsw} \geq \alpha_{dsw}$$

A constraint that states that district overlap (Bd) must be greater than or equal to demand (alpha)

$$X_{dsw} \in \mathbb{Z}^+$$

A constraint that states that officer numbers must be whole numbers