Vance County EMS Station Analysis Report

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Background

Without an effective distribution of emergency medical resources, counties risk delayed response times that can mean the difference between life and death. To improve coverage across Vance County, researchers analyzed data from the county's EMS system, which currently operates four ambulances from two stations located in the Central and South districts. Historical records show that residents in the North district face much longer response times, often averaging over 12 minutes, compared to 6 and 9 minutes in the Central and South regions.

Using a dataset of recorded EMS trips containing call locations, dispatch and arrival times, and Google API travel estimates, this analysis evaluates how different station configurations and vehicle allocations affect system performance. The county is considering establishing a new station in the North district, with two potential site options (Near North and Far North), and several ambulance distribution scenarios.

Our goal is to determine which North station location would most effectively reduce response times and how the four available ambulances should be allocated among the stations to balance coverage and minimize system strain. We aim to illustrate this through visual and numerical summaries that highlight tradeoffs in travel time and resource availability across the scenarios.

Data and Exploratory Analysis

Data

We were given 489 observations of calls occurring in Vance County between January 1st to January 25th in 2024.

One of the calls went to Duke Hospital, which we excluded. Additionally, in certain incidents where multiple patients were involved, they would be transported in the same ambulance. As we only care about the availability of ambulances and not how many patients were in a single ambulance, we cleaned the dataset so that every identical row represented a single, unique incident involving one ambulance. The identical condition ensured datapoints where multiple ambulances were sent out for one incident with multiple patients would still be in the dataset, as it would impact ambulance load.

Exploratory Data Analysis

To understand where and when ambulance demand occurs, our EDA began with plotting a call-density map (Figure 1) that showed a clear cluster around the Central station with spread in the South and scatter in the North, motivating scenarios that add northern coverage. We then compared Near North vs. Far North (Figure 2) calls, and found that using Google's UA travel times, Near North was closer for 90% of northern calls, cut response time by about 4 minutes on average relative to Far North, and had shorter total call duration with quicker transportation to hospitals.