# Locating a New EMS Station

September 24, 2025

## 1 Background

The Vance County EMS system currently operates four ambulances and two stations, one located in the Southern district and one in the Central district. This setup has led to residents in the Northern district being under–served; average response times are noticeably higher there than in the other two districts, with delays being significant enough to change outcomes in potentially fatal scenarios. Coupling this with a rising demand for EMS services from the North, Vance County is considering a northern station in one of two proposed locations; the plan and task for this project is to use past call data to inform this decision. These originate from written and digitally recorded records. The dates of each trip have been manipulated into a mock dataset to protect patient privacy. Each row represents a single trip with details such as the dispatch station, the coordinates of the patient's address, various logged times (dispatch, en route, arrival to site, leaving site, arriving at hospital, and clear time), and other details about the trip. The objective is to use this information to analyze travel times, the associated system load, and assess different station location and vehicle allocation scenarios. Your task is to help answer the two following research questions: 1) which of the proposed North district station locations would better serve the community?, and 2) how should the four available ambulances be allocated to best serve the community? See Table 1 for a description of the scenarios under consideration.

| Scenarios | S0(Current) | S1 | S2 | S3 | S4 |
|---|---|---|---|---|---|
| Far North | 0 | 0 | 1 | 0 | 1 |
| Near North | 0 | 1 | 0 | 1 | 0 |
| Central | 3 | 3 | 3 | 2 | 2 |
| South | 1 | 0 | 0 | 1 | 1 |

Table 1: Summary of the five possible station location and vehicle allocation scenarios that are under consideration.

## 2 Analysis Objectives

- Construct a model and use it to answer the questions posed on slide 14 of the presentation. Consider travel times and some notion of system load when addresing these questions. When evaluating system load you might consider one or more of the following metrics: the number

of ambulances available at a given time; the amount of time each ambulance is in use; the frequency with which the ambulance at the closest station is available.

# 3 Data

The data can be found in the file `emsData.RData`. The file contains the following variables:

**REF.GRID** County Region (South, Central, North); see presentation slide 13.

**DISPATCH.PRIORITY** Emergency versus non–emergency call.

**REF.GPS.LAT; REF.GPS.LON** Coordinates of call location.

**BASE.NAME** EMS base ('Company 9' == Central; 'Company 1' == South).

**VEH.GRID** EMS vehicle/ambulance ID.

**VEH.GPS** Vehicle station location.

**DT.DISP** Date and time of dipatch call.

**DT.ENROUTE** Date and time EMS enroute.

**DT.ARRIVE** Date and time EMS arrive at call location.

**DT.LVREF** Date and time leave call location.

**DT.ARVREC** Date and time arrive at hospital.

**DT.AVAILABLE** Date and time EMS is available for a new call.

**REC.NAME** Destination hospital.

**Dist.*; eTT.*** Google API computed variables (see below).

**Parsing the API–Computed Column Names:**

- **So** indicates the existing south EMS station
- **Ce** indicates the existing central EMS station
- **NN** indicates the proposed near–north EMS station
- **FN** indicates the proposed far–north EMS station
- **Dist** indicates distance travelled in meters.
- **eTT** indicates an estimated travel time.
- **UA** is the unadjusted travel time. Note: this appears to be closer to an average travel time and likely a baseline value that Google applies travel model adjustments to in order to obtain the following types of estimates.

- **Pe** is the pessimistic travel time in traffic.
- **BG** is the best–guess travel time in traffic.
- **Op** is the optimistic travel time in traffic.

# 4 Assignment

- Conduct an exploratory data analysis for class on **Thursday October 2nd**. It may be useful to experiment with models at this stage in your analysis. Begin preparing your project slide deck by describing this analysis, highlighting any issues you encountered and unresolved questions you may have, and summarizing your preliminary inferences and discoveries. Be prepared to share these in class.
- *Add* to your project slides *about* five slides describing progress on your final analysis, highlighting assumptions, shortcomings and obstacles you have encountered (if any). Turn in your full set of slides (EDA + model–based analysis) and be prepared to present these in class on **Thursday October 9th**.
- Describe your analysis in a formal report of up to four pages (writing and display equations); all tables and figures should appear in a separate appendix and be referenced by name in the main text. Your report should highlight all relevant aspects of your analysis (exploratory and modeling) and include graphical and numerical summaries that aid in communicating your results. Submit your literate programing script to the associated assignment link. Due at the start of class **Thursday October 16**.