

# **Wake County Fire Services— Stations Optimization for Long Range Planning**

January 6, 2021

Administrative Committee Meeting

# Phases and Deliverables

## Phase 1 Steps:

- Data Preparation, Cleaning, and Processing
- Develop Distribution Model
- Verify the Application of NFPA Standard 1720

## Phase 2 Steps:

- Develop Optimization Model
- Incorporate Data into the Optimization Model
- Validate Results

## Phase 3 Steps:

- Disseminate Findings
- Develop Final Report

# Outline

## **Project Updates**

### ➤ Phase 1

- Review Process and Results

### ➤ Phase 2

- New Stations: Update and Results
- Station Closure: Update and Results

## **Next Steps and Further Discussion**

## **Phase 1 Objectives**

- Verifying 1720 required developing a high-resolution population forecast for Wake County going out 10 years.
- Creating that population forecast required allocating population growth (OSBM) at the county level down to the subdivision level.
- Note: The higher the population resolution the better for optimization modeling purposes.

# Planning Unit Data Overview

## Planning Units:

- A high resolution GIS dataset capturing unique development densities at the subdivision level for all of Wake County.
- Encapsulate residential development growth with a high degree of detail.
- Updated each year with new development data.
- The geometry is very stable over time.



Planning Units  
N = 6,447

## Validation of 1720

The correct application of 1710 vs 1720 is defined in terms of station staffing (as career vs volunteer) and by the population density of the fire insurance districts covered, as seen below:

- **Rural-** Population density of less than 500 persons per square mile
- **Suburban-** Population density of between 500 to 1,000 persons per square mile
- **Urban-** Population density greater than 1,000 persons per square mile

# Population Densities with 2029 Projection

	2016 Population	2016 Density	2016 Classification		2029 Population	2029 Density	2029 Classification
Alert	17,813	405	Rural		25,224	668	Suburban
Bay Leaf / Six Forks	24,206	676	Suburban		*	*	*
Cary Suburban	361	315	Rural		744	697	Suburban
<b>Durham Hwy</b>	<b>8,186</b>	<b>898</b>	<b>Suburban</b>		<b>11,149</b>	<b>1,142</b>	<b>Urban</b>
Furina	24,413	448	Rural		45,069	876	Suburban
Garner	28,720	448	Rural		46,527	733	Suburban
Hipex	5,617	119	Rural		15,453	535	Suburban
Holly Springs	2,875	149	Rural		5,477	294	Rural
Hopkins	3,662	156	Rural		3,807	161	Rural
Morrisville	1,080	93	Rural		5,702	528	Suburban
Northern Wake	*	*	*		31,310	484*	Rural*
Rolesville	8,986	279	Rural		9,371	353	Rural
Stoney Hill	7,104	209	Rural		*	*	*
Swift Creek	7,745	515	Suburban		8,308	554	Suburban
<b>Ten-Ten</b>	<b>16,939</b>	<b>691</b>	<b>Suburban</b>		<b>25,843</b>	<b>1,081</b>	<b>Urban</b>
Wake New Hope	7,613	439	Rural		21,447	937	Suburban
Wakelon	4,997	200	Rural		6,174	307	Rural
Wakette	7,521	403	Rural		21,400	898	Suburban
Wendell Holmes	8,702	268	Rural		13,918	377	Rural
Western Wake	1,956	444	Rural		2,991	703	Suburban

\* Bay Leaf / Six Forks and Stoney Hill year 2029 data are reported for the new combined Northern Wake District.

## New Stations Update

### Recent Improvements:

- Modeling the probability component of meeting the 1720 standard. (Using chance constraints)
- What this does it is fully incorporates and models the percentage constraints that are part of the response standard.
- In other words, this is the advancement from deterministic to probabilistic travel time modeling.



# New Stations Results

## New Station 1

Between F.V. #2, F.V. #3, and Garner #2  
Old Stage Rd and NC 42

## New Station 2

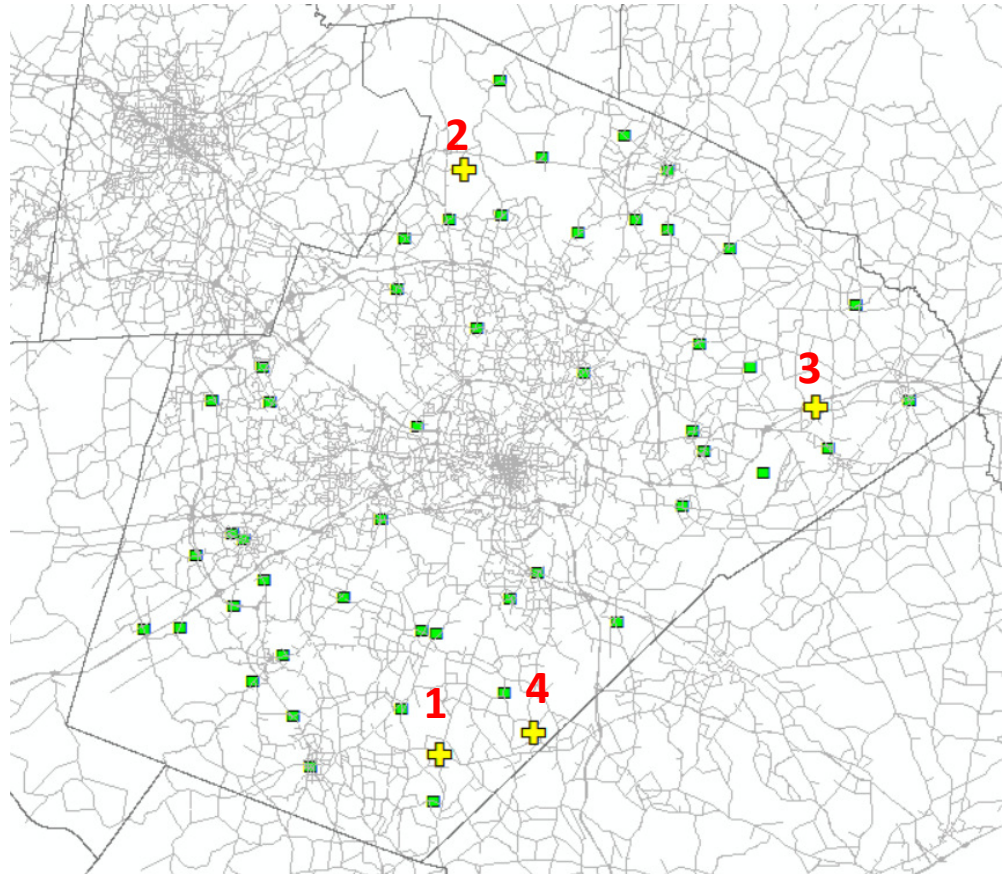
Creedmoor Rd. and Highway 98

## New Station 3

North of 64/264  
Splits distance between Wendell #1,#2  
Hopkins and Zebulon

## New Station 4

Southeast of Garner #2

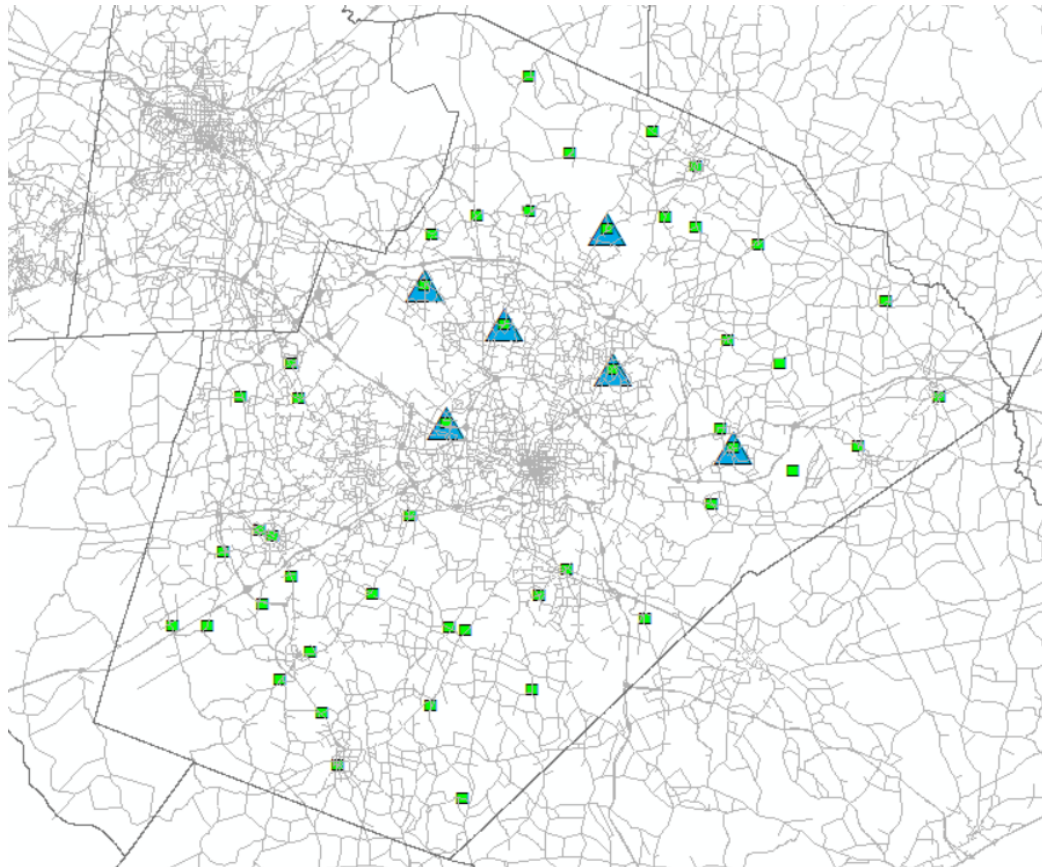


# Station Closure Update

## Recent Improvements:

- Varying the travel time constraints by neighborhood (Based on the projected rural, suburban, or urban population density classification.)
- General QA/QC improvements to the code and the TRM (Triangle Regional Model) travel time data
- The stations identified as closures were injected to validate and confirm the modeling, as well as past studies performed by Wake County.

# Station Closure Results



# Station Closure Results



## Next Steps and Further Discussion

- Writing up the process stressing:
  1. The “big picture”
  2. How this analysis is relevant for WCFS
  3. How this analysis fits into the broader long range facility plan
- Other topics for discussion