



## City of Raleigh and NC State Smart Cities Partnership Project Ideas Whitepaper

### **Project Title:**

### **Pavement Condition Assessment and Prioritization of Road Maintenance at the County- and State-Level**

### **Problem Description:**

The current practice of pavement condition mapping and assessment involves expensive specialized vehicles and manual work. Therefore there are challenges of increasing a frequency of performing data collection and condition assessment at larger scales – e.g., county- and state-level.

The increasing availability of portable technologies and connectivity makes the dream of having smart cities closer. There are various ways to automate pavement condition assessment. Mobile technologies also support successful applications, such as Waze, that provide traffic-aware city navigation by using data provided by the community. Many cars are now equipped with rear parking cameras and autonomous vehicles comes with many sensors that are suitable for detecting pavement defects. Data collection can be implemented by engaging citizens. Their daily drive can help the City of Raleigh and NCDOT collect data. The road data is captured across many discrete variables to understand the road's conditions, the location of particular defects, and the density of traffic in a particular area. Then data is analyzed and visualized so that decision makers can see exactly what problems exist, how severe they are, precisely where the problems are located, and what may be contributing to their causes. Access to live dashboards is also possible to provide an organization or municipality with the information they need to make quick, accurate, and justified decisions to rapidly improve local infrastructure. Easier collection of data on the way people live in a city and data analysis methods empower city administrators and policy makers to better manage the city and improve the lives of people.

### **Vision or Desired Outcome(s):**

Formalized plan for data collection; automated pavement condition mapping and assessment; formalized database (DB) for storing detected defects, their severity, types, estimated costs of repair, and GPS location; a tool that prioritize (e.g., by clustering DB by regions) and visualize outcome (e.g., dashboard showing a map and summaries).

### **Anticipated Timeline / Duration:**

Mid-Jan to Feb 1: Finish literature review; understand how NCDOT is performing pavement condition assessment; and determine whether to use an existing method or develop a new one. Prepare data collection.

Feb. 1 to Mar. 15: Key Activities 1 – 4.



Mar. 15 to May 1: Key Activities 5 – 9.

There is a long list of activities (see below) for a semester. The scope might be revised but this project has great potential to be extended beyond the semester, especially with graduate students and/or undergraduate students planning on continuing their graduate studies at NC State.

## Project Description

	NC State would provide:	Raleigh would provide:
Project Lead	Kevin Han	
Role of Participants	Perform research	Transportation: Data collection. Information provider – e.g., what are the current practices and what resources do we already have?
Key Activities	<ol style="list-style-type: none"><li>1. Literature review – ways to scale data collection, automation of pavement mapping and assessment.</li><li>2. Draft a data collection plan that the City and NCDOT can possibly implement.</li><li>3. Develop/implement condition mapping and assessment method</li><li>4. Plan a preliminary study - experiment at a small scale</li><li>5. Collect data and perform assessment to identify defects and their level of severity</li><li>6. Create a database (DB) that lists defects and their locations (GPS coordinates)</li><li>7. Visualize DB with a GIS tool (e.g., open source web-platform or something that the city have used if any).</li><li>8. Cluster of detects by different</li></ol>	Transportation: Collect data (see “Data Needed”); formalize levels of pavement condition severity.



	<p>levels of severity and regions for prioritizing pavement repair and road construction projects.</p> <p>9. Visualize results on a map (e.g., heat map with gradient colors or circles with different sizes for showing different levels of repair need.</p>	
Data Needed	Visual data (images and/or point clouds/range data) collection using GPS receiver, cameras, and/or LIDAR mounted on a vehicle.	
Time Required	Student(s) Time: ~20 hr/wk Faculty Time: ~5 hr/wk	

**Third Party Partners Required:**

*None*