

**Bi-Monthly Progress Report:**

**Project Number and Title:** 4-2 Future-Proof Transportation Infrastructure Through Proactive, Intelligent, and Public-involved Planning and Management

**Research Area:** Thrust 4 Connectivity for enhanced asset and performance management

**PI:** Jin Zhu, Ph.D. Assistant Professor, University of Connecticut

**Reporting Period:** Mar 31, 2019- May 31, 2019

**Date:** May 31, 2019

**Overview:**

Between Mar 31 to May 31, 2019, the research team carried out the planned activities in the previous semi-annual progress report. First, we further developed the preliminary ontology by incorporating more documents into analysis. We collected about 20 additional transportation planning documents in the past two months and conducted topic modelling to extract emerging future-proofing keywords and concepts from these documents. Figure 1 shows the states that have documents in our data analysis. We used the data analysis results to refine the preliminary ontology.



Figure 1. Scope of our data collection analysis

Second, to test the effectiveness of the preliminary ontology, we started to conduct a case study. The case study is to use the ontology as a guideline to develop a future-proofing knowledge database for transportation infrastructure planning and management in Connecticut. To this end, we started to search relevant information regarding different aspects in the ontology (e.g., transportation infrastructure performance, funding, risk and disruptions) for the State of Connecticut. Through this process, we aim to answer the following questions: (1) Is there structured data (e.g., csv files, ARCGIS map, etc.) available that can be used to feed different concepts in the proposed taxonomy? (2) If structured data is not readily available, what other data sources (e.g., white paper, journal article, etc.) can be used to generate the data and information? (3) How the collected data can be used to predict future trend for future-proofed transportation infrastructure planning and management purposes? (4) Which concepts are inter-dependent and how? For example, the research team found no structured data readily available regarding the funding scenario in Connecticut. However, unstructured data sources such as white paper, published documents by CTDOT, Congress report, and newspaper articles provided a comprehensive picture on the condition of transportation funding sources. For example, historically, federal funding accounted for 70-80% of the CTDOT’s capital program. In recent years, this had changed with an influx of State bond funding for programs such as the Fix-it-First Road and Fix-it-First Bridge programs, and the Local Transportation Capital Improvement Program (LOTCIP). In total about 1.55 billion USD in state and federal resources are being pumped into the capital program every fiscal year. The current level of funding is barely enough and hence, the state is relying on a system of short-term “patches” that will become increasingly problematic over the next decade. As a result, the performance of different transportation infrastructures can significantly deteriorate and can jeopardize public safety. If Connecticut keeps on following this strategy for all structures it should be replacing 10 years from now, the overall condition of the transportation network would be significantly worse. It is estimated that, to make all repairs and the strategic enhancements needed to transform the aging transportation infrastructure, about 30% more funding is needed. Currently, this case study is ongoing and we plan to complete the case study by the end of June.

On May 24<sup>th</sup> 2019, a conference paper titled “Towards the ontology development for smart transportation infrastructure planning via topic modelling” was presented by the PI at the 36<sup>th</sup> International Symposium on Automated and Robotics in Construction in Banff, Canada.

**Participants and Collaborators:**

*Student Participants:*

Sudipta Chowdhury, PhD student, Civil and Environmental Engineering, University of Connecticut

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**Changes:**

No significant changes have been made in the past two months.

**Planned Activities:**

In the coming two months, based on the outcome of the case study, we plan to refine the previously proposed taxonomy, develop the ontology, and start developing the high-level structure of a smart decision support system.