

## Bi-Monthly Progress Report:

Project Number and Title: URI Project 3.6 Recycling Infrastructure Assets and Reduction of Transportation System Greenhouse Gas Emissions Research Area: Thrust 3 New Systems for Longevity and Constructability

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Reporting Period: June – July 2019

Date: 9/6/2019

### *Overview:*

*Provide overview and summary of activities performed during previous two months....*

The study team pursued its software comparisons and took the opportunity to frame the overall study. Two additional undergraduate students were recruited to conduct independent studies on the project. Their study scopes, as derived directly from the larger study frame, are in the process of being stated.

With regards to the larger study frame, study goal was stated to be the design of better performing asphalt pavements (with performance to include environmental impacts). To this end, the following tasks as stated in the proposal would be completed:

- Comparison of Life-Cycle Cost Analysis (LCCA) of varied baseline of asphalt pavements obtained from the DOTs
- Performance ranking of baseline asphalt pavements
- Interpretations of trends
- Design of mixes with enhanced performances given trends observed

Pre-stated comparisons entail use of a Life Cycle Analysis (LCA) software product. Products fall within varied categories cost-wise and with regards to their efficiencies at duplicating the average environmental impacts of asphalt pavements designed within the northeastern region of the nation. A framework was derived to select preferable software to conduct the study.

For software within the private domain, software assessment cannot entail pre-purchase. Hence, only demos would be utilized to gauge software performance per the criteria stated in prior bi-monthly reports. For university owned software, assessment entails the use of the full software product. And similarly, full software assessment applies to the software LCA tools within the public domain. This assessment approach will favor university-owned and private domain software. No weights are thus anticipated in the use of software preference criteria.

However, overall preference scores that favor one particular criterion over another may be introduced. To derive such scores, criterion weights may have to be introduced. The team further identified a variety of demos and YouTube videos that facilitate software familiarization. Once favorable software is identified, screening tests will be run with selected software and database, possibly supplementary tools, to ensure satisfactory results. In particular, it will be established whether selected products show sensitivity to the parameters that may differentiate one DOT mix from another.

The study scope anticipates cradle to grave analyses, with study boundaries to include raw material extraction and transportation, mix production and transportation, pavement construction, use, maintenance and disposal or re-use. Encompassing all life-cycle stages will enable an evaluation of not only the mix designs, but also their combined performances with given maintenance schedules and reclaiming techniques, the both of major study interest.

With regards to Life-Cycle Inventory (LCI), the importance of regional (New England) data will be stressed. The environmental impacts considered will include those impacting on ecosystem health, human health, resource depletion and social health. A weighing of the structural performance predictions of baseline mixes versus their assessed environmental impacts will aid in the ranking of the baseline mixes assessed. The best ranked mixes will guide the search of new designs through an interpretation of the rankings achieved as well as their potential use as start-up mixes.

*Provide context as to how these activities are helping achieve the overarching goal of the project ...*

The study aims to achieve durable, cost effective and environmental system with reclaimed asphalt pavement (RAP) in hot mix asphalt (HMA), warm mix asphalt (WMA) and/or cold mix asphalt (CMA). Conducted tasks are genuine to the review of best practice as well as to the conduct of baseline and proposed pavement structures LCA.

*Describe any accomplishments achieved under the project goals ...*

Using its derived framework and criteria stated in Dovetail Partners Inc., 2017, plus avoiding the pitfalls outlined by AzariJafari, H et al., 2015, and taking advantage of demos and implementation videos available, the study will shortly narrow down on the actual data and tools to utilize for LCCA' conduct. The availability of study data and the reliability or validity of actual LCA tools utilized in carrying the study will determine the study's ability to meet its own goals.

*Describe any opportunities for training/professional development that have been provided...*

The undergraduate student working on the project will be a senior in the Civil Engineering BS program. Per his participation in this project, the student will positively enhance the labor pool of the northeastern region of the US.

*Describe any activities involving the dissemination of research results (be sure to include workshops, seminars, and conferences attended/held for dissemination of information regarding this project) ...*

None applicable

### **Participants and Collaborators:**

*What organizations have been involved as partners on this project?*

None

***Have other collaborators or contacts been involved? If so, who and how?***

**Name of Technical Champion:** Dr. Wilfred Hernandez, P.E.

**Title:** Safety Specialist/EDC Coordinator

**Organization:** FHWA – RI Division

**Phone number:** 401-528-4033

**Email:** Wilfred.hernandez@dot.gov

***What students have participated in the project? (Include class standing, major, role in the research)***

Stephan Zaets, CVE Junior, initiated framing of life cycle cost analysis and model comparisons.

**Changes:**

None

***Discuss any actual or anticipated problems or delays and actions or plans to resolve them...***

None

***Discuss and changes in approach and the reasons for the change...***

None

**Planned Activities:**

An increase in the number of undergraduate students staffing the project in the fall semester should afford the fast completion of the software selection and data collection tasks anticipated. The study team, enlarged this semester by 2 persons, will shortly collect baseline asphalt mixes to compare from regional DOTs. Students anticipated to join the study team at the beginning of the fall semester include:

1. Anthony Scrivanitch, Junior Undergraduate Researcher, University of Rhode Island, Department of Civil and environmental Engineering.
2. Gerardo Santizo, Junior, Independent Study Credit Pursuer, University of Rhode Island, Department of Civil and environmental Engineering.
3. Tam Tran, Junior, Independent Study Credit Pursuer, University of Rhode Island, Department of Civil and environmental Engineering.

Design instruments to collect the study's data from regional DOTs. Utilize designed software selection framework to select preferable software for use to conduct study's LCA analyses for collected pavement mixes.