QUARTERLY PROGRESS REPORT

March 1, 2018 - May 31, 2018

PROJECT TITLE: Research Advances on the Use of Solid Wastes in Concrete and Asphalt

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COMPLETION DATE: May 31, 2018 **PHONE NUMBER: 352-392-0846**

PROJECT WEBSITE: https://www.essie.ufl.edu/home/townsend/research/bu/research-advances-on-waste-in-concrete--asphalt/

Work accomplished during this reporting period:

During this time period, monitoring continues for portland cement concrete made using unwashed and washed WTE ash as a partial coarse aggregate replacement along with recycled glass powder as a supplementary cementitious material (SCM). A suite of mixes has been created that will be used to evaluate the potential of ground glass powder and WTE bottom ash for use in concrete. Specimens have been created in accordance with the standard laboratory procedure ASTM C192 for the determination of alkali-silica reactivity (ASR) as per test method ASTM C1293. A total of 16 concrete mixes have been cast and are currently being measured (in triplicate) which include control bars containing traditional aggregates and three experimental groups containing a 30% replacement of traditional coarse aggregate with WTE bottom ash from three different Florida facilities. Other experimental groups include cementitious materials replacements of 20% with ground glass and fly ash, which are pozzolans are known to control ASR. The concrete was amended with the pozzolan to evaluate benefits with respect to mitigation of expansion. Expansion is known to occur when concrete is amended with WTE bottom ash. To date, these bars have shown no indication of deleterious alkali-silica reaction.

UF researchers are also beginning work on developing mix designs for asphalt concrete incorporating WTE ash (unwashed and washed) from various facilities as a partial coarse aggregate replacement. This process involves determining a total aggregate blend that meets Superpave gradation control points while attempting to meet Superpave volumetrics (e.g., air voids, voids in mineral aggregate – VMA, voids filled with asphalt – VFA) at the optimum asphalt content, or the amount of asphalt necessary to achieve approximately 4.0% air voids or otherwise meet most, if not all, volumetrics. Once this optimum asphalt content is determined, physical performance testing will begin to determine if washed WTE ash creates a better

performing material. Additionally, it will be observed whether washed WTE ash correlates to a lower asphalt binder demand relative to unwashed ash due to excessive fines. This finding could have significant economic impacts considering that asphalt binder is by far the most expensive component of an asphalt mix.

Work planned for the next reporting period:

UF researchers will continue the literature review of WTE ash pretreatment/processing and use of WTE ash in asphalt concrete. UF researchers will continue acquiring WTE bottom ash from several Florida WTE facilities and traditionally used aggregates that fulfill the FDOT specifications. This ash will undergo the washing process under different liquid to solid ratios and contact times to identify the optimum washing parameters. Unwashed WTE bottom ash aggregate properties (e.g., specific gravity, absorption, gradation) will be compared to that achieved using washed WTE bottom ash aggregate to examine how washing changes these properties. Data derived from these experiments will be utilized when considering the effects of ash washing on the physical and environmental performance of ash-amended asphalt and portland cement concretes and factored into the economic analysis associated with this project. UF researchers will also continue monitoring cast portland cement concrete specimens for indication of deleterious alkali-silica reactions and proceed with additional mixes with changing variables (e.g., additions of glass powder and WTE bottom ash subjected to various treatments/processing). In addition, asphalt concrete using unwashed and washed WTE ash-derived aggregate as a partial coarse aggregate replacement will be created and tested for physical performance.

TAG Meetings:

No Technical Awareness Group (TAG) meetings were planned for this period.

Metrics:

- *Graduate Students:*

Name	Rank	Department	Professor	Institution
Kyle Clavier	PhD Student	Environmental Engineering	Timothy Townsend	University of Florida
Yalan Liu	PhD Student	Environmental Engineering	Timothy Townsend	University of Florida
Chad Spreadbury	PhD Student	Environmental Engineering	Timothy Townsend	University of Florida

- *Undergraduate Students:*

Name	Rank	Department	Professor	Institution
Brian Cochran	Undergraduate Research Assistant	Civil Engineering	Timothy Townsend	University of Florida
Mohamad Shawar	Undergraduate Research Assistant	Civil Engineering	Timothy Townsend	University of Florida
Sharez Sohail	Undergraduate Research Assistant	Environmental Engineering	Timothy Townsend	University of Florida
Thomas LeBlanc	Undergraduate Research Assistant	Environmental Engineering	Timothy Townsend	University of Florida

- *Research publications resulting from THIS Hinkley Center project:* **None.**
- *Research presentations resulting from (or about) THIS Hinkley Center project:* **None.**
- *Who has referenced or cited your publications from this project:* **None.**
- *How have the research results from THIS Hinkley Center project been leveraged to secure additional research funding? What additional sources of funding are you seeking or have you sought?* **None.**
- *What new collaborations were initiated based on THIS Hinkley Center project?* **None.**
- *How have the results from THIS Hinkley Center funded project been used (not will be used) by the FDEP or other stakeholders?* **None.**