QUARTERLY PROGRESS REPORT

June 1, 2016 to August 31, 2016

PROJECT TITLE: Use of Solid Waste in Asphalt and Concrete in Florida.

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COMPLETION DATE: August 31, 2016 **PHONE NUMBER: 352-392-0846**

PROJECT WEB SITE: http://pages.ees.ufl.edu/townsend/research/hc15/

Work accomplished during this reporting period:

Municipal Solid Waste Incineration Ash

A mobile screening machinery vendor was contracted to process stockpiled bottom ashes from two facilities. Graduate and undergraduate students assisted in the field screening of two MSW incineration bottom ashes to obtain ideal particle size distribution for use as aggregate. The ashes were processed into two desired particle sizes corresponding to potential reuse scenarios: (1) as a coarse aggregate in Portland cement concrete and asphalt concrete and (2) as a base coarse material. The target particles size ranges were 1/4" to 3/4" for use as concrete and asphalt coarse aggregates, and less than 1.5" for use as a graded aggregate base material. Samples from both screened fractions of each ash were collected in accordance with ASTM D75 and transported to UF to assess the potential of using them as a road base and aggregate material.

Five laboratory mixes of Portland Cement Concrete (PCC) cylinders containing MSWI bottom ash as a coarse aggregate replacement were cast. The mixes consisted of four different replacement percentages screened bottom ash and a control mix containing no bottom ash. The cylinders, measuring 4 inches in diameter and 9 inches in height, were cured in a lime water solution and evaluated for unconfined compressive strength at different ages, in accordance with ASTM C39 (7, 28, and 56 days). Results were compared to FDOT Road and Bridge Specifications Section 346 for Class 1 Concrete Pavements to determine the optimal percentage of bottom ash that could be used as an effective coarse aggregate replacement. Surface and bulk resistivity measurements of the cylinders were taken at the same three ages to assess the potential of chloride ion penetration resulting in corrosion during the service life of field concrete. Results of the ash containing cylinders were compared to the control, and each mix was classified based on its susceptibility to chloride ion penetration.

A suite of SPLP leaching tests was conducted on blends of MSWI bottom ash and natural/recycled aggregates in varying percentages. The intent of the experiment was to quantify the leaching of metals from blended ash products to be used in a road base coarse application. Four aggregates (limerock, coquina, recycled concrete, and reclaimed asphalt) were blended with aged bottom ash at 4 different ratios. The test was performed in triplicate for each blend. Leaching results were compared to Florida Groundwater

Cleanup Target Levels listed in F.A.C 62-777 to establish constituents of concern and quantify risk associated with the use of bottom ash in a road base product. Additionally, monolithic leaching tests (EPA Method 1315) were carried out on bottom ash-amended concrete cylinders of various ash percentages to quantify the cumulative mass release of trace metal pollutants from an encapsulated matrix.

Virgin aggregate sources have been targeted for blending the <1.5" screened ash. The blend percentages have been determined to be 15%, 30%, 50% ash. These blends will be tested using ASTM D1557 Proctor Compaction. The Florida Method 5-515 Limerock Bearing Ratio will also be performed on the blends, producing a proctor curve and an LBR value for the optimum moisture content. This information can be used to approve the blends as a base material.

A Review of the literature was performed to find articles that discuss ash reuse in asphalt pavement applications. The MSWI ash specimens were wash-graded following the ASTM method D1140. The specific gravity and absorption of both ash specimens were tested and calculated following the test methods ASTM C127-15 and ASTM C128-15. This as well as the wash gradation will be used to input the ash into an already accepted mix design.

Work planned for the next reporting period:

Cast 5 additional mixes of 4" x 8" PCC cylinders containing varying amounts of ¼" to ¾" screened bottom ash from a Florida refuse-derived fuel (RDF) incineration facility. The targeted application for the bottom ash in this set of mixes is also as a coarse aggregate replacement. A similar suite of testing protocols is to be conducted on these cylinders, with the addition of tensile strength (ASTM C496) and modulus of elasticity (ASTM C469).

Obtain FDOT approved mix designs for asphalt pavement structures and input the MSWI ash specimens into a design for each. Use certain analytical data sheets to determine the best mix for each ash specimen.

Metrics:

Graduate Students

Name	Rank	Department	Professor	Institution
Justin Roessler	PhD student	Environmental Engineering	Timothy Townsend	University of Florida
Linda Monroy Sarmiento	PhD student	Environmental Engineering	Timothy Townsend	University of Florida
Chad Spreadbury	PhD student	Environmental Engineering	Timothy Townsend	University of Florida
Matthew Schafer	Master's student	Environmental Engineering	Timothy Townsend	University of Florida

Stephen Townsend	Master's student	Environmental Engineering	Timothy Townsend	University of Florida

Undergraduate Students

Name	Rank	Department	Professor	Institution
Kyle Clavier	Undergraduate Research Assistant	Environmental Engineering	Timothy Townsend	University of Florida
Jarrod Petrohvich	Undergraduate Research Assistant	Environmental Engineering	Timothy Townsend	University of Florida
Sara Fox	Undergraduate Research Assistant	Environmental Engineering	Timothy Townsend	University of Florida
Rachel Cohen	Undergraduate Research Assistant	Environmental Engineering	Timothy Townsend	University of Florida

TAG Meeting: No TAG meetings were held during this period