NAWTEC2015

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Extracting Maximum Value from Waste in a Circular Economy

Waste to Energy Bottom Ash Recycling at the Pasco County Resource Recovery Facility

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Ash Recycling in Pasco County

- WTE ash recycling has been targeted in Florida multiple times in the past decades.
- In 2013, after a statewide working group on opportunities and limitations of combustion residuals recycling, Pasco County moved forward with a demonstration project.

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Research, Development and Demonstration (RD&D) Project

[pursuant to Section 403.70715 of the Florida Statutes]

- The County applied for a RD&D permit to construct a test roadway using WTE bottom ash.
- Multiple different use options were targeted.

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Preliminary Bottom Ash Characterization

- The objective was to utilize a processed ash product as part of road construction. Two ash fractions were targeted.

Used as aggregate — >3/8-inch fraction (<3/4 inch)

< 3/8-inch fraction

Combined fraction used as road base

- Both fractions were characterized over 7-days for TCLP, SPLP and total element concentrations.

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Ash was cured (aged) prior to use

- Curing the ash reduces the ash pH and results in less leaching of elements such as lead.
- Additional testing was conducted on the cured ash (as well as ash products).
  - EPA methods 1313-1316

Performance Characterization

Materials were characterized for structural properties to support the roadway designs and on materials created during roadway construction.

The FDOT State Materials Office was of critical assistance

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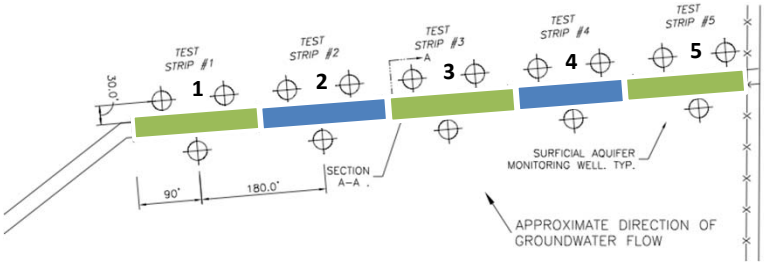
Test Roadway



Test Strip	Base Course	Pavement
1	WTE Bottom Ash	Asphalt
2	Lime Rock	Asphalt
3	Lime Rock	Asphalt with WTE Bottom Ash
4	Lime Rock	Concrete
5	Lime Rock	Concrete with WTE Bottom Ash

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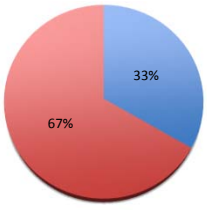
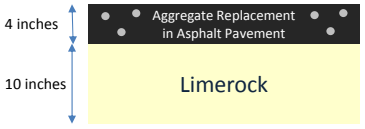
Road Base

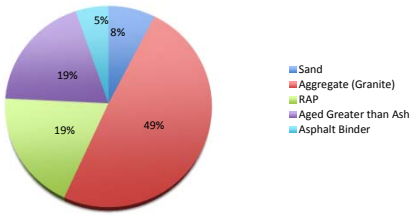


Aged Less than Ash
Aged Greater than Ash

- WTE bottom ash consisting of combination of:
  - <3/8-inch fraction
  - >3/8-inch fraction (<3/4 inch)

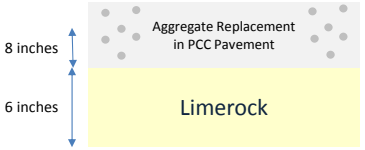
Partial Aggregate Replacement in Asphalt Pavement

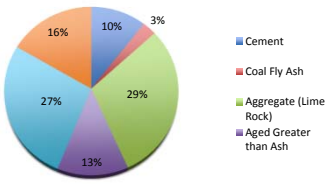




- WTE bottom ash consisting of:
  - o >3/8-inch fraction (<3/4 inch)

Partial Aggregate Replacement in Portland Cement Concrete Pavement





- WTE bottom ash consisting of:
  - o >3/8-inch fraction (<3/4 inch)

Preliminary Construction

Initial Condition of Roadway

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Preliminary Construction

Installation of Groundwater Monitoring Wells

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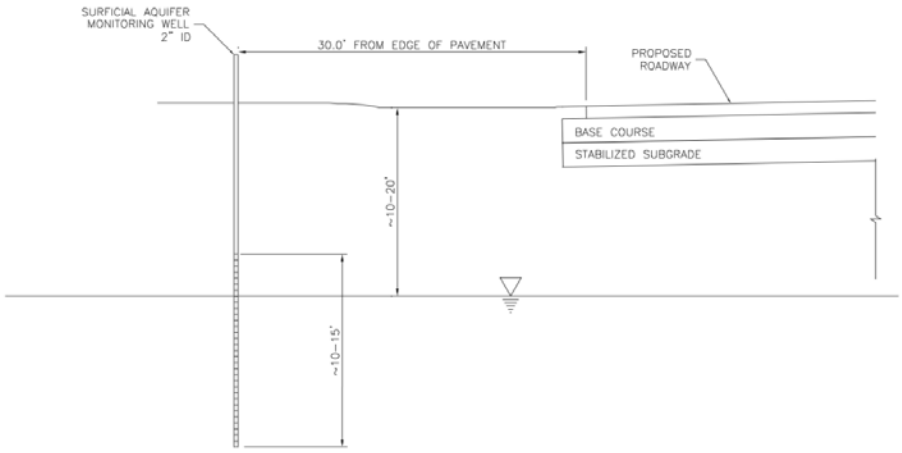

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Material Screening

Storage, processing and aging conducted on top of existing Class I landfill

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Wetting Before Placement

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Size Fraction 3/4” to 3/8”

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WTE Bottom Ash as Base

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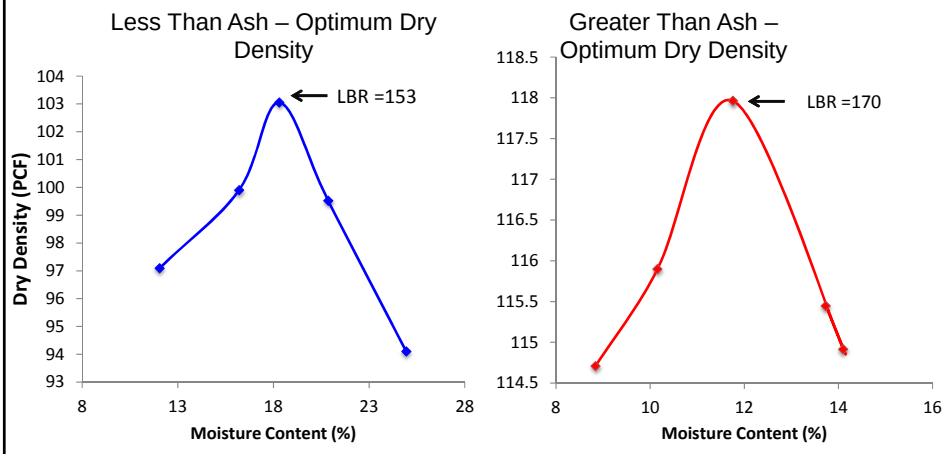
Ash as a Road Base Course



UF Solid and Hazardous Waste **http://pages.ees.ufl.edu/townsend/**

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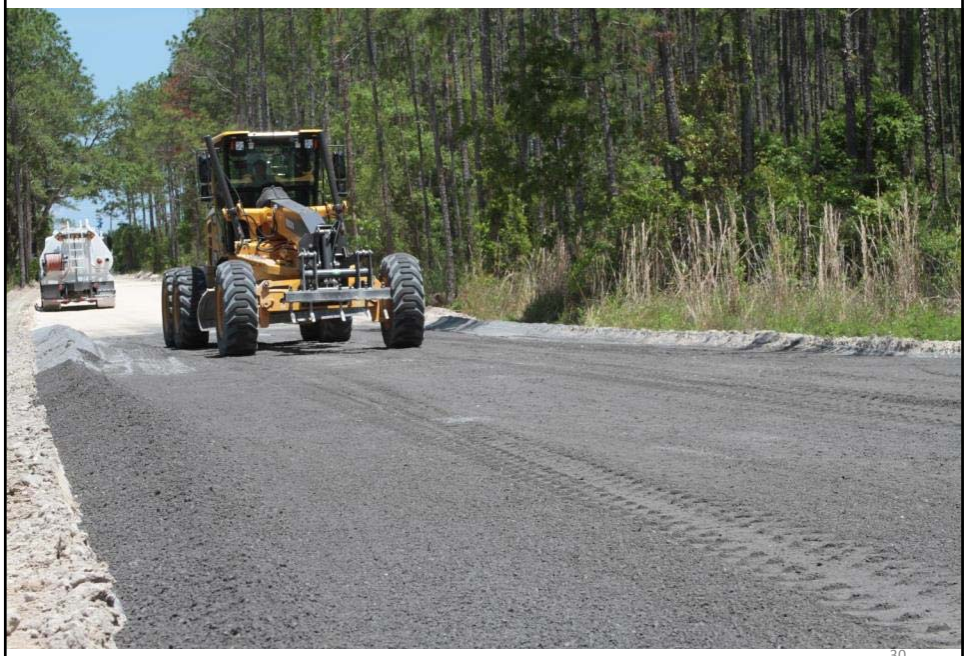

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HMA with WTE Bottom Ash as Partial Aggregate Replacement

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Suitability of Bottom Ash for Hot Mix Asphalt Pavement

Durability of aggregates assessed by LA Abrasion Test

- Previous LA Abrasion values have been in the 45-50% range

Pasco County GT Ash = LA Abrasion 42%

- Attributed to removal of fines
- FDOT Spec <45%

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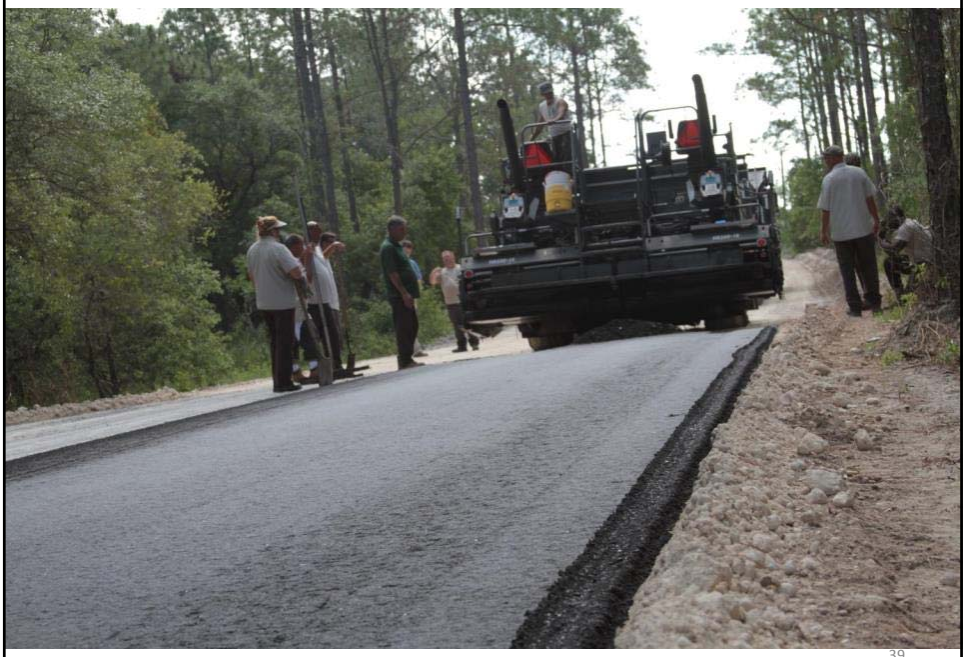

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PCC with WTE Bottom Ash as Partial Aggregate Replacement

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Use in Concrete Pavement

- During Pasco project we developed a series of mixes for use of WTE bottom ash as a partial course aggregate replacement in concrete pavement
- Using a size separated fraction of the bottom ash we were able to produce mixes using a 25% replacement of ash and meet strength goals
- Non ferrous metal in portions of the ash caused problems related to gas formation
  - Use of admixtures helped to reduce some of these concerns
- Slab instrumented during placement

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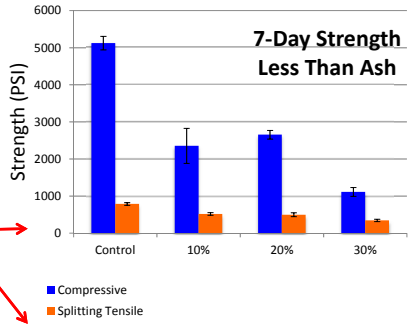
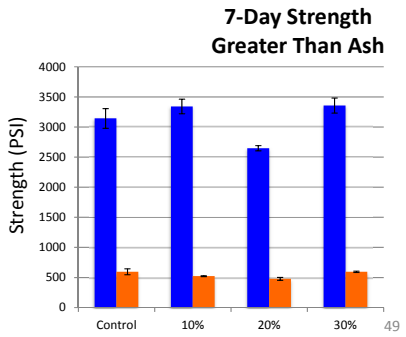
Bottom Ash in Portland Cement Concrete

Example of preliminary testing in the laboratory
(not final mix for roadway)





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Request for Authorization

- Following positive preliminary results, Pasco County submitted a request for authorization for county-wide use of processed WTE bottom ash in three applications:
  - Ash used as a road base course
  - Ash used as an aggregate Portland Cement Concrete
  - Ash used as an aggregate in Asphalt
- Supported by a technical evaluation document prepared by UF.

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Technical Evaluation Document

- An independent engineering analysis was conducted which incorporated:
  - Laboratory test results
  - Climactic and hydrogeologic data specific to Pasco County
  - Typical pavement design and construction practices in Pasco county
  - Modeling of rainwater infiltration through pavement surfaces
  - Fate and transport modeling of the potential for elements leached from the ash to impact the groundwater at a prescribed distance (100 ft) from the roadway

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Technical Evaluation Document

- Environmental testing for permit application done with aged ash, and ash amended products produced from aged ash
- Batch tests done on ash-amended products
- Column testing on ash used as input parameters for model
  - Enabled the demonstration of a wash-off mechanism for certain elements over time

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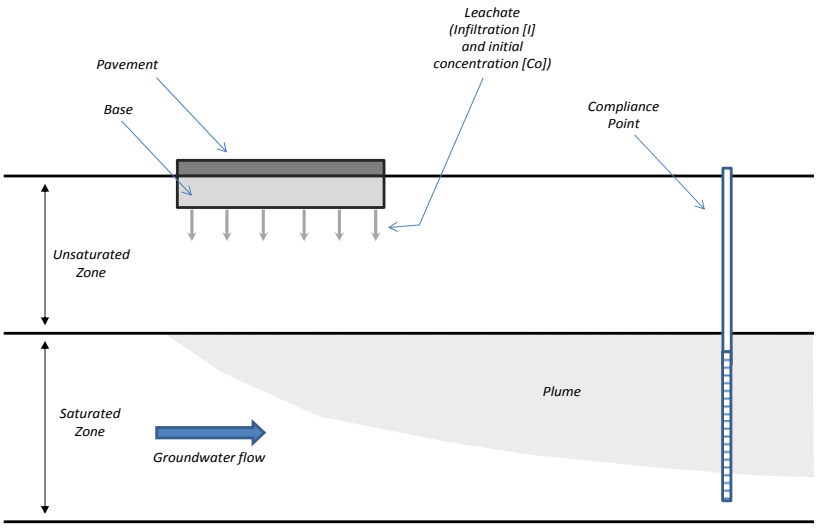
Modeling Approach



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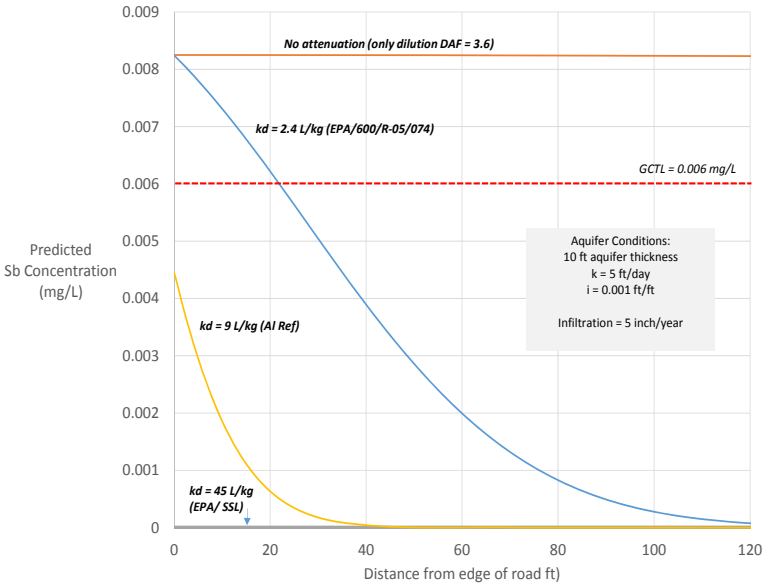
Example of Fate and Transport Modeling Output



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Request for Authorization

- Authorization letter from FDEP: Dec 5, 2015
- Examples of specific conditions:
  - Aging of ash for a period of three months
  - Covering completely with pavement layer
  - Removal of ash from the sides of the road
  - Removal of ash used as a base if the roadway is removed
  - 120 hour storage limit at batch plants

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Next Steps

- Continue monitoring progress of the roadway test strips.
- The County plans to move forward with ash recycling in County roadways and exploring use of mined ash from the on-site ash landfills.

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