Freeman Anthony P.E.
APWA Transportation Committee
Chair – APWA Transportation Sustainability Subcommittee (TSSubCom)

Recycled Materials in Public Construction Projects – Regional Coordination for Success

Industrial Resources Council
Austin, Texas – 1 November, 2011

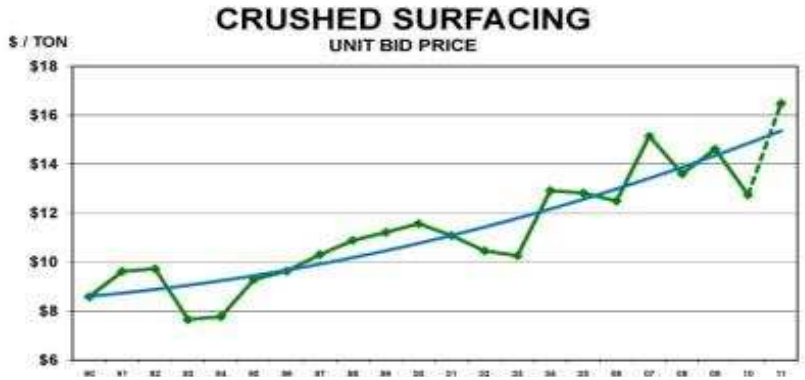
The Yin and Yang of Resources

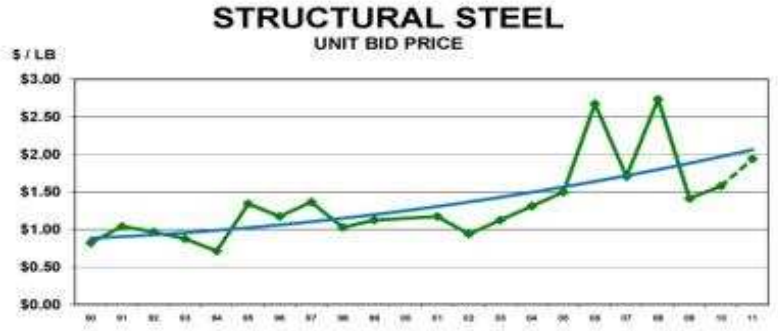
- Natural resources are:
  - Limited
  - Getting more expensive
  - Ecologically harmful to extract

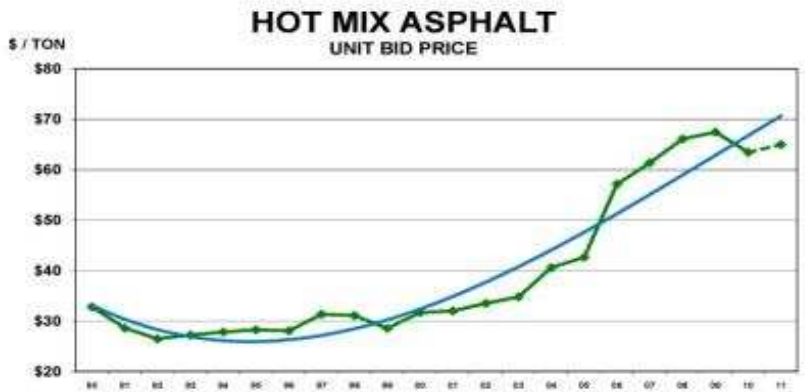
- Landfills are:
  - Expensive
  - Land/resource consuming
  - An environmental risk

So how do we put the two together?

Virgin Materials – Costs Increasing







Washington State Department of Transportation

For more information, please call the WSDOT Construction Office at (360) 705-7822 or visit http://www.wsdot.wa.gov/biz/construction

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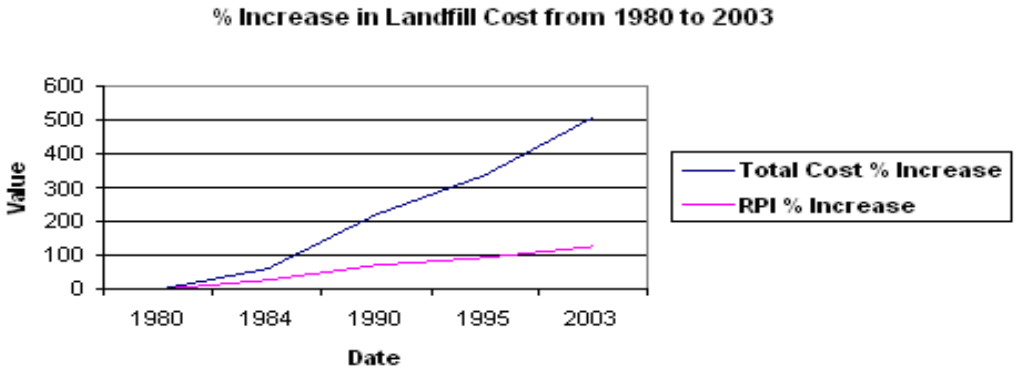
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION 2010

Waste Disposal – Increasing Costs



LANDFILL FINANCING AND CONTRACTS - R.J. COUTH, J.N. DAVIES AND A. HOWE 2003

"Most landfill applications will cost over $1M before the applications will even be considered."

- State of Kentucky – Division of Waste Management, Landfill Permitting Overview

"Cap installations can cost between $80,000 and $500,000 per acre."

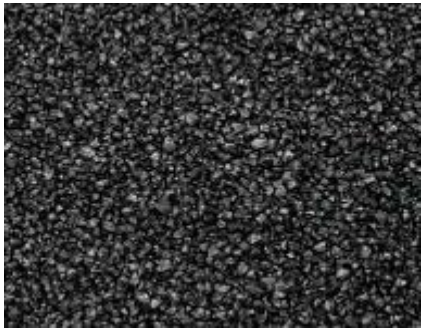
- Maryland Department of the Environment – Estimate Costs of Landfill Closure

Recycled Materials Everywhere

- Concrete
- Asphalt
- Plastic
- Glass
- C&D Materials
- Processed tires
- Wood
- Shingles

Recycled Materials Here and There

- Municipal ash
- Smelter slag
- Foundry sand
- Fly ash
- Carbon byproducts
- Treated water process products



Key Roles

- **Public Sector** – Guardian of public funds – Final call – Risk Adverse
- **Industrial Sector** – Regional economic base – Materials source
- **Academic Sector** – Determines materials qualities – Sets standards
- **Private Sector** – Brings designs together – Manages risk for Public Sector

Know Your Regional Materials

- Public Agencies/Private Sector
  - Materials supply/costs
  - Regional industrial byproducts
- Producers/Academia
  - Technical material information
  - Forecasted supply
- Together
  - Regulations
  - Designs/anticipated performance

Potential Benefits

- Waste stream diversion
- Decreased materials costs/hauling/emissions
- Decreased disposal costs/emissions/impacts
- Decreased environmental impact
- Higher grade material quality
- Regional economic partnering
- Project sustainability 'certification' points

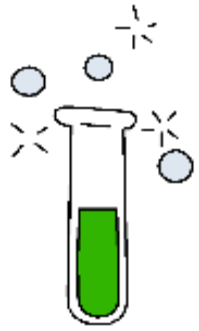
So what does all this mean?

It's Time to be Aggressive

- Public agencies need to lead
  - Become aware of what's available
  - Work to incorporate in to spec/pilot projects
  - Take 'strategic risks' to increase recycled materials use
- Suppliers/Private Sector/Academia need to support efforts
  - Develop design/specs
  - Collaborate in testing

Technical Use Concerns

- Material type/chemistry – varies by application
- Long-term durability – chose low-risk applications
- Educate contractors to reduce perceived risk
- Quality and constant supply of recycled materials – requires adjustable spec



Environmental Concerns

- EPA storage regulation (Kingston fly-ash spill)
- Processing noise
- Industrial runoff/stockpiling
- Leaching
- Byproducts
- NIMBYs

Address These Concerns

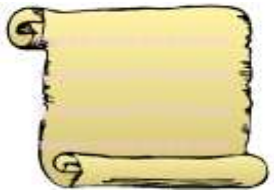
- Collaboration between agencies, suppliers, and the private sector
  - Technical solutions
  - Pilot projects
  - Site specific design
  - Processing/stockpiling approach
- Work together to address concerns to allow projects to go forward

Future Considerations

- HMA Binder availability
- Cement costs
- Landfill permitting
- Landfill maintenance costs
- Source permitting
- Emissions regulations
- Fuel prices

How do we move forward with recycled materials in construction and really MEAN it?

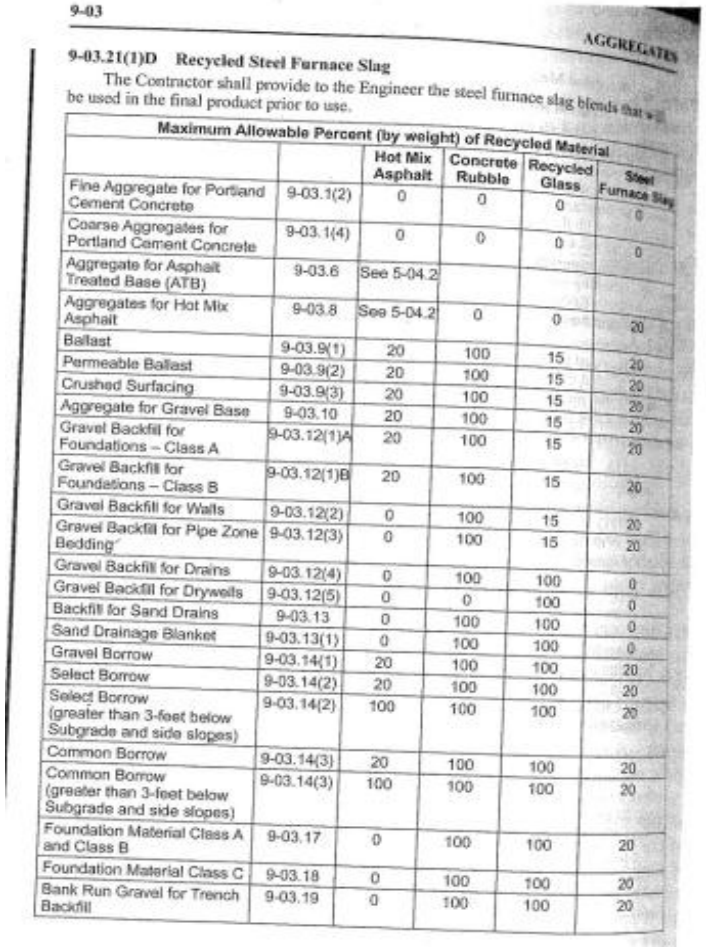
Get it in your spec!



- Let experimentation and 'strategic' risk be a departmental value
- Focus on local and regional markets
- Use state DOT specs as a base
- Work with contractors and suppliers to develop regional and project specific specs
- Use AASHTO/ASTM for proven materials and methods
- Look to industry to provide progressive designs
- Spec recycled products to support industry

WSDOT Recycled Materials

- Starting point for City projects
- No mention of crushed concrete for PCC
- Opportunity for City to develop it's own
- Do the numbers = keep your City Engineer on board



9-03 AGGREGATES

9-03.21(1)D Recycled Steel Furnace Slag

The Contractor shall provide to the Engineer the steel furnace slag blends that will be used in the final product prior to use.

		Maximum Allowable Percent (by weight) of Recycled Material			
		Hot Mix Asphalt	Concrete Rubble	Recycled Glass	Steel Furnace Slag
Fine Aggregate for Portland Cement Concrete	9-03.1(2)	0	0	0	0
Coarse Aggregates for Portland Cement Concrete	9-03.1(4)	0	0	0	0
Aggregate for Asphalt Treated Base (ATB)	9-03.6	See 5-04.2			
Aggregates for Hot Mix Asphalt	9-03.8	See 5-04.2	0	0	20
Ballast	9-03.9(1)	20	100	15	20
Permeable Ballast	9-03.9(2)	20	100	15	20
Crushed Surfacing	9-03.9(3)	20	100	15	20
Aggregate for Gravel Base	9-03.10	20	100	15	20
Gravel Backfill for Foundations – Class A	9-03.12(1)A	20	100	15	20
Gravel Backfill for Foundations – Class B	9-03.12(1)B	20	100	15	20
Gravel Backfill for Walls	9-03.12(2)	0	100	15	20
Gravel Backfill for Pipe Zone Bedding	9-03.12(3)	0	100	15	20
Gravel Backfill for Drains	9-03.12(4)	0	100	100	0
Gravel Backfill for Drywells	9-03.12(5)	0	0	100	0
Backfill for Sand Drains	9-03.13	0	100	100	0
Sand Drainage Blanket	9-03.13(1)	0	100	100	0
Gravel Borrow	9-03.14(1)	20	100	100	20
Select Borrow	9-03.14(2)	20	100	100	20
Select Borrow (greater than 3-feet below Subgrade and side slopes)	9-03.14(2)	100	100	100	20
Common Borrow	9-03.14(3)	20	100	100	20
Common Borrow (greater than 3-feet below Subgrade and side slopes)	9-03.14(3)	100	100	100	20
Foundation Material Class A and Class B	9-03.17	0	100	100	20
Foundation Material Class C	9-03.18	0	100	100	20
Bank Run Gravel for Trench Backfill	9-03.19	0	100	100	20

Critical Path for Public Specification

Materials Evaluation – 5000’

Quantity? → Useful? → Meet Spec? → Quality Control? → Safe? → Costs? → USE IT!

Specification Development – 5’

Source → Evaluate → Mix or Place → Test → Report → Confirm → SPEC IT!

Example – Bellingham Specs

- RAP (From ½" HMA spec)

5-04.02 Materials
Section 5-04.2, Paragraph 2 is revised as follows:

The Contractor shall utilize recycled asphalt pavement (RAP) in the production of the HMA. The amount of RAP utilized shall be between 30 and 40% of the total weight of the HMA. The RAP may be from pavements removed under the Contract, if any, or pavement material from an existing stockpile.

- Recycled Concrete (from sidewalk spec)

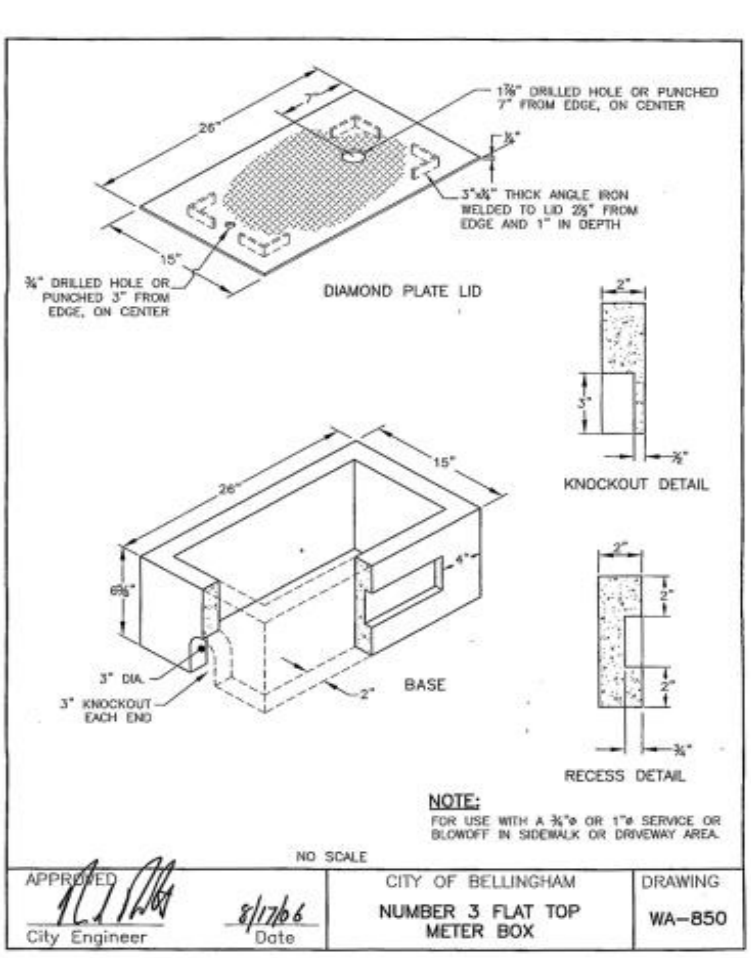
Coarse aggregate shall be from solely recycled concrete and shall meet the requirements of 9-03.21 of the Standard Specifications. The coarse aggregate shall meet the gradation requirements of AASHTO Grading No. 67 (see WSDOT Standard Specification 9.03-1(4)C).

Bellingham – Moving Forward

- Toured regional aluminum smelter with local ready-mix operator
- In discussions with local recycler for crushed glass use
- Municipal ash in concrete – not currently feasible
- Regional recycler to take porcelain and tile products
- Working with former Kayak designer to make water meter boxes from recycled plastic

Plastic Water Meter Boxes

- Potential local economic base
- Currently working on prototype with plastics engineer
- City sourcing of product for state mandate



The Information is Out There!

- APWA - TSSubCom working on WA State pilot info website
- Local spec modification can be most effective
- Current specs (AASHTO, StateDOT, ASTM, APWA) available
- Utilize private and academic research support – Recycled Materials Resource Center http://www.rmrc.unh.edu/ and Industrial Resources Council http://www.industrialresourcescouncil.org/
- Joint development of specs by agencies, producers and contractors/vendors – a local process!
- Materials, testing and support are out there waiting for public agencies to take the lead

2011 WA State Industry Survey

- APWA/AGC/ASCE approached
- Results
  - Agencies need:
    - Case studies and approved specs
    - Regulatory requirements/guidelines
  - Contractors need:
    - Regional materials costs (processing)
    - Design, handling and installation information
  - Private sector needs::
    - Test results and anticipated performance

Get Crazy!

Bellingham Poticrete

- Housing Authority efficiency grant produced 400 waste toilets – C&D materials
- Contractor separated waste toilets
- Worked with local concrete supplier to crush

Bellingham Poticrete - Testing

- Developed/adjusted Mix
- Tested resulting concrete
- Compressive strength over 4000 psi at 28 days, flexural 610 psi at 28 days

Bellingham Poticrete - Installed!

- Placed with urban roadway improvement
- Part of recycled aggregate spec for concrete
- Working to match demand in projects with projected material supply

Thanks for your time. Questions?

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