



The University of
Nottingham

Re-use of Materials in Asphalt Pavements. Interest of Society. Environmental and Sustainability Issues: Benefits and Drawbacks

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Asphalt Recycling and Materials Re-use in Asphalt Pavements
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Waste
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Social and Environment

- Environmental impact
 - Construction only a small contribution compared to entire infrastructure operation (usage)
 - Part of overall operation under our control
- Emissions & energy consumption
 - Warm and cold (construction & maintenance) processes
 - Pollution absorbing roads (Titanium oxide slurry surfacing)
- Use of finite resources
 - Local recycling (Reduce need for transport)
 - Insitu (Mobile plant)

Key Players

- WRAP (UK)
- AggRegain (UK)
- SAMARIS
- EAPA
- RILEM TC 206 ATB, TG5 Recycling
- FP7 consortia

Future Strategy

- Integrating material flows
- Life cycle assessment (LCA)
- Design for maintenance
- Marketing

Integrating Material Flows

- (Waste management)
- Network level
- Generating asphalt planings
- Linked to recycling needs

Design for Maintenance

- (Automotive industry)
- Aim of recycling built into initial construction
- Currently use recycled material in 'lower spec' application
- Keeping good records

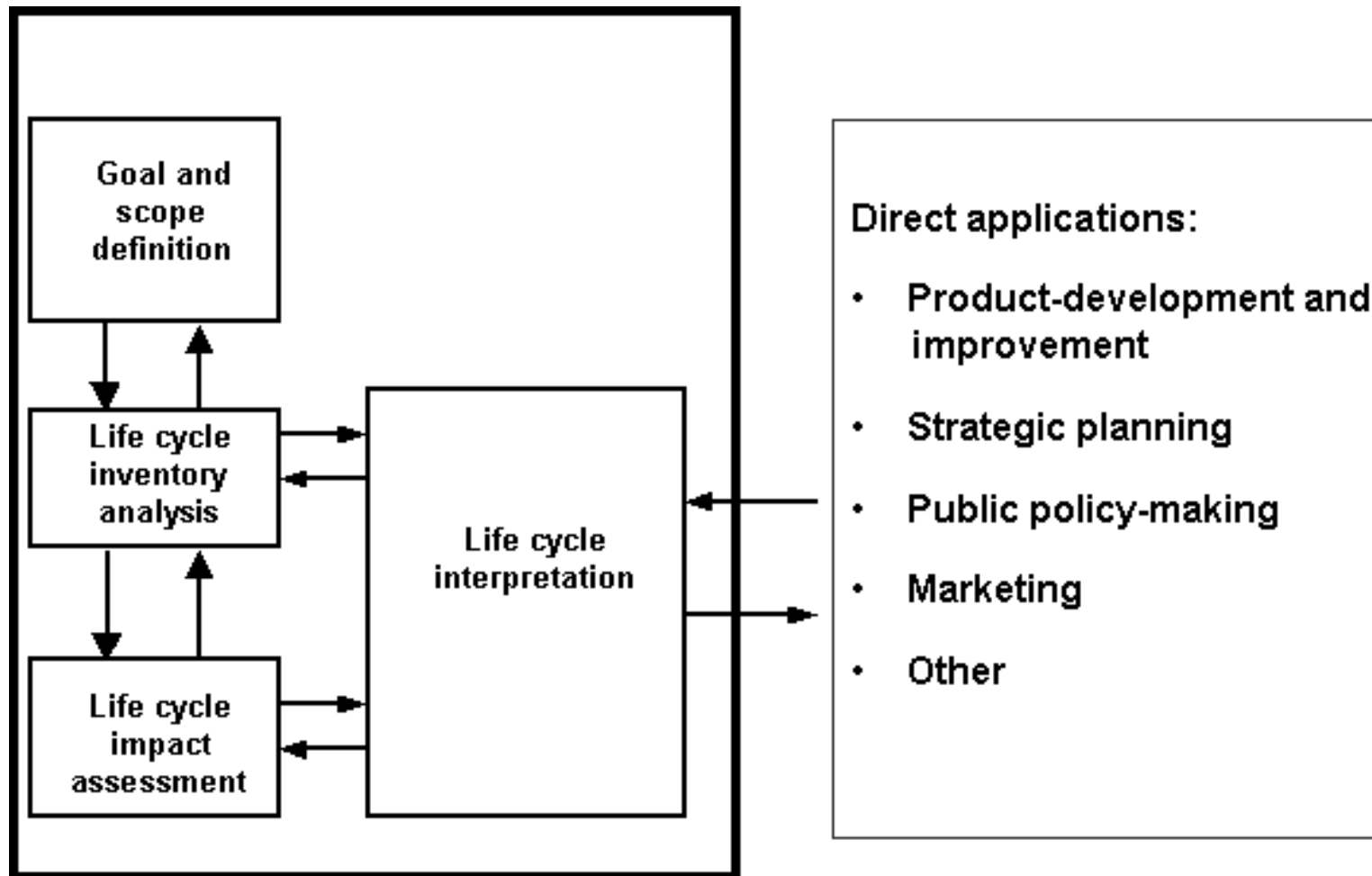
Marketing

- (Appliances)
- Energy rating
- 'Road materials' with targets (green house gas emissions)

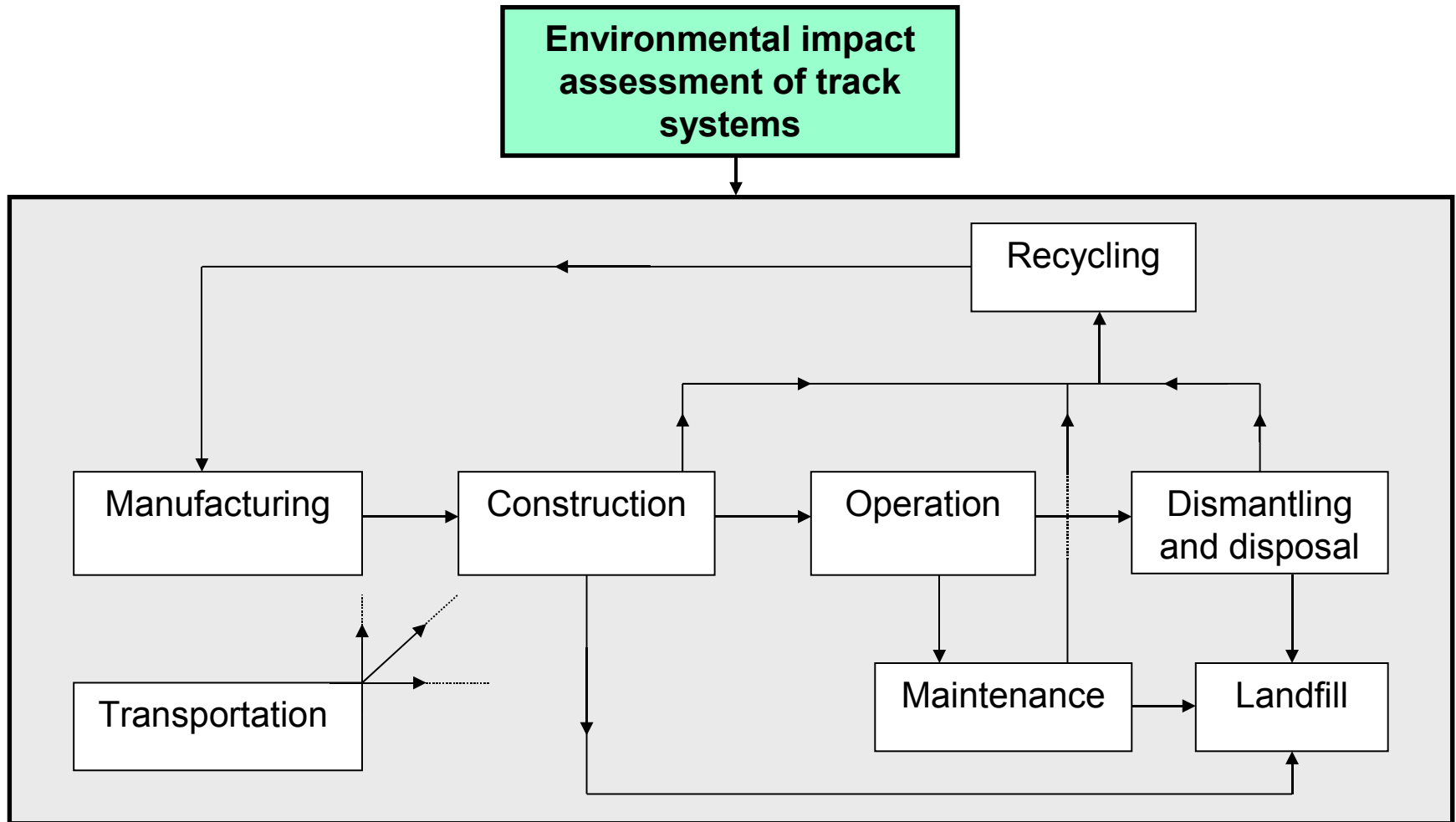
Life Cycle Assessment (LCA)

- LCA is a tool to evaluate the environmental impacts associated with stages of a product's lifecycle from cradle to grave
- ISO 14040
- Sensitivity analysis
- Quantify environmental impacts
- Target green house gas emissions
- Manufacturing & maintenance versus transport

Phases of LCA



Inventory Analysis



Inventory Analysis

Inputs:

- Materials.....steel, cement, aggregate, grout, etc.
- Travelling distance.....materials, plant, workers?
- Fuel consumption.....non-combined and combined
- Type of machinery.....energy consumption during construction
- Life expectancy of components.....replacement and renewal
- Maintenance period.....replacement and renewal
- Recycling percentage.....during maintenance and demolition

Outputs:

- Energy consumption.....throughout the life cycle
- Emission to air.....from materials, fuel and manufacturing stage
- Emission to water.....materials, manufacturing and construction
- Waste and land fill.....materials, construction, maintenance and demolition
- Noise pollution.....construction and demolition

FP7 – Re-road

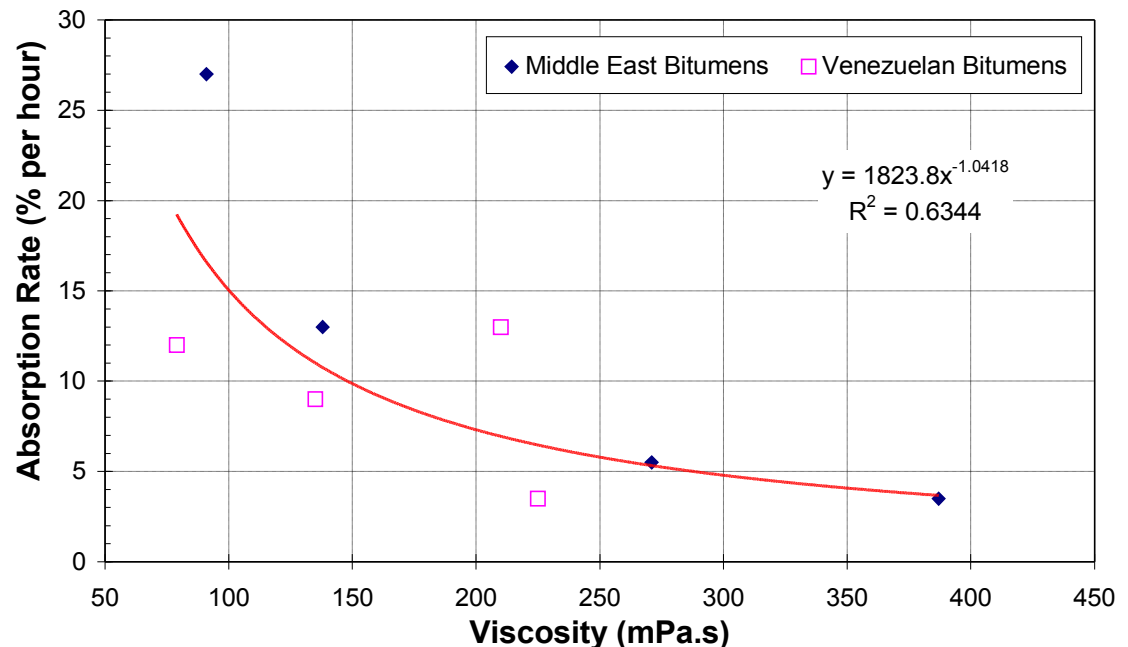
- Re-road – End of life strategies of asphalt pavements
- FEHRL proposal
- A level of re-use of 99% for recovered asphalt concrete, to be reintroduced into new mixes with a minimum of downgrading of the material and a minimal introduction of virgin material

Material Re-use

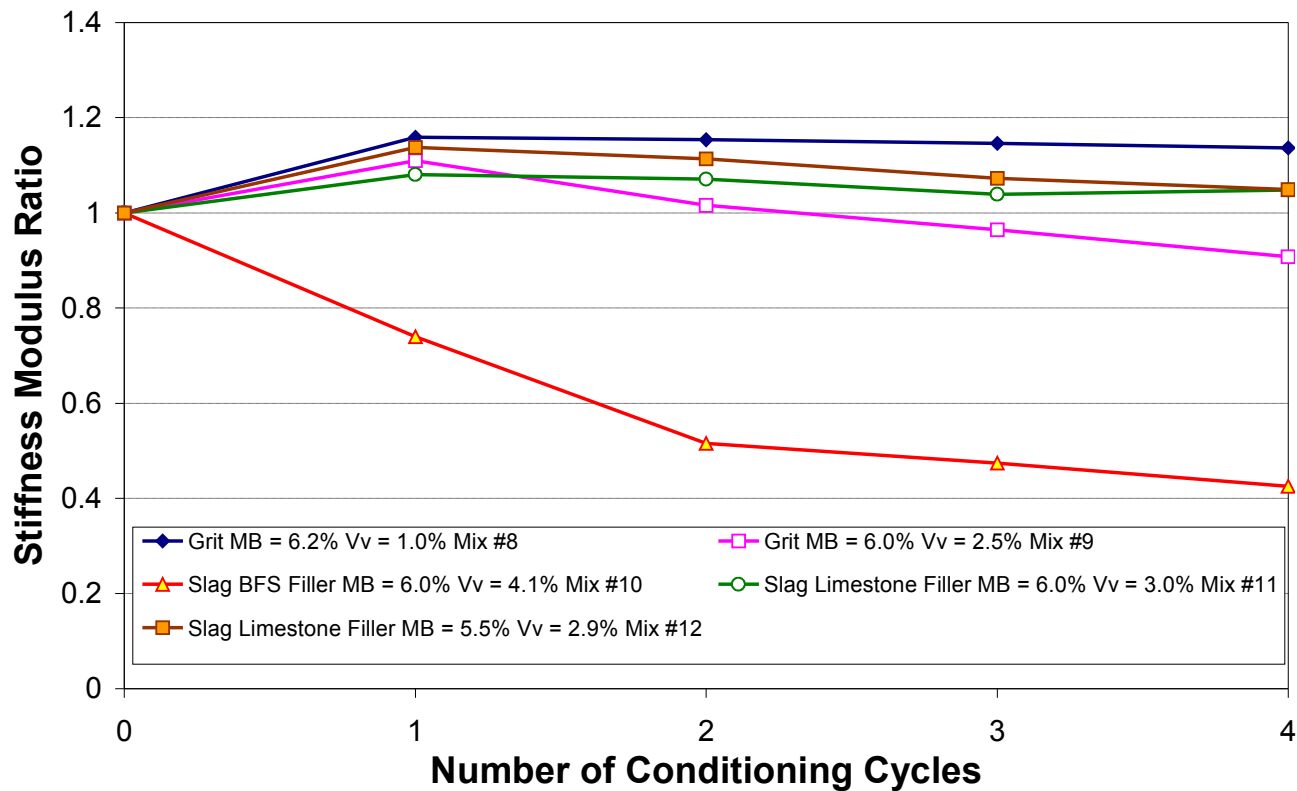
- Crumb rubber tyres
- Industrial slags
- Waste products – glass cullet & plastics
- Bio-materials

Crumb rubber

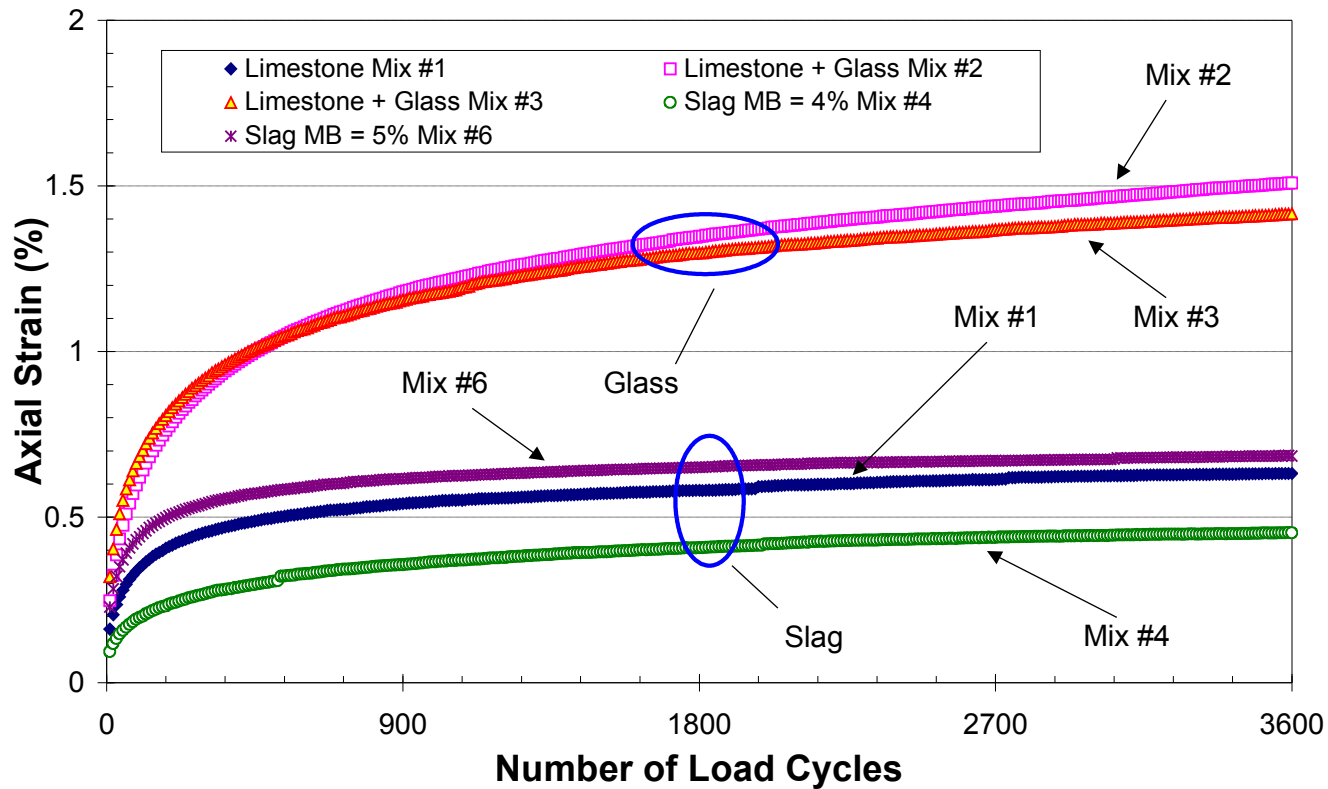
- Wet process – small quantities & compete with synthetic PMBs
- Dry process – absorption & reduced material performance



Slags & Glass Cullet



Slags & Glass Cullet



Asphalt Recycling - RAP

- Growing use to overcome bitumen cost increase and aggregate shortage
- RAP not generally mandatory
- Main techniques involve hot recycling
- RAP contents limited, <50%, usually <30%, <10% surfacings
- Cold cycling – 100%
- Usually in base and binder layers

Final Thoughts

- More holistic approach needs to be taken to material re-use and asphalt recycling
- Experience needs to be shared amongst researchers, practitioners and clients



Thank You

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