Steel Fibre Reinforced Rubberised Concrete for Forgiving Road Infrastructure

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Outline

- SAFER Project Introduction
- Circular Economy
  - SAFER Contribution to Circular Economy

Rubberised Concrete for Forgiving Infrastructure

- Reduction of fatalities in road transport
  - 1 of top ten goals set by the European Union's "White paper on transport"
  - The goal of reducing to half by 2020 will **NOT** be reached

☆ Unless the decrease at much higher rates starting **now!**

(European Commission (EC) (2011). White Paper on Transport – Roadmap to a single European transport area – Towards a competitive and resource efficient transport system)

Most Vulnerable Road Users

- Motorcyclists
  - Comprise a significant 15% of all road fatalities in Europe
- An additional 3% of all road fatalities are
  - moped and
  - other light-powered 2-wheeler riders

Current Road Barriers..

- Hitting a barrier is a factor in 8-16% of deaths
- Injuries are up to 5 times more severe

Current Road Barriers..

- Hard metal, Plain concrete
- Limited deformability
- Limited energy absorption

$\Longrightarrow$ Upon collision, rider bodies absorb impact

The NEED for Forgiving Infrastructure

The NEED for Forgiving Infrastructure

- Plain concrete
  - Limited deformability, Limited energy absorption

+ Rubber ⟹ energy absorption, impact resistance

+ Steel fibres ⟹ flexural strength, energy absorption and toughness

+ Textile/polymer fibres ⟹ improved fresh concrete properties

The NEED for Forgiving Infrastructure

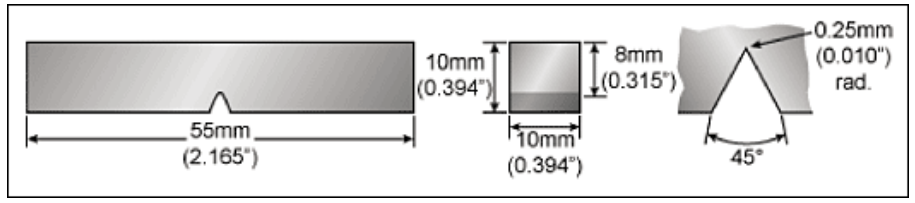
- There is critical need to adopt improved barrier designs to protect vulnerable road users

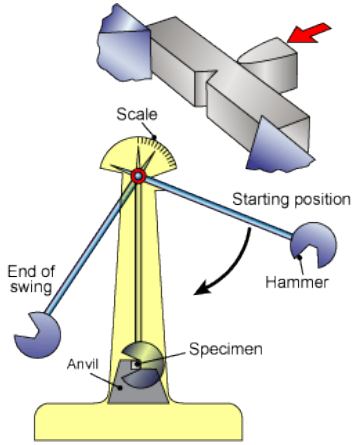
  (EuroRAP (2008). Barriers to change: Designing safe roads for motorcyclists)

- Our goal for road barriers
  - Absorb impact energy
  - Reduce injury and damage severity

Proposed Research

- Proposed Mix Designs
  - 10% , 40% and 60% aggregate volume replacement
- Impact testing using
  - Charpy testing machine



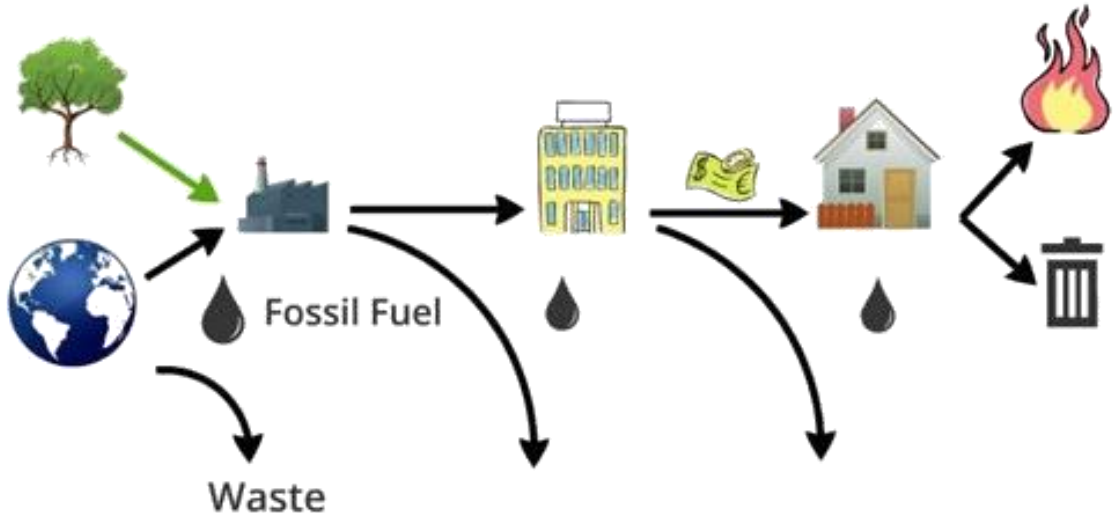


Circular Economy
SAFER Contribution

"closing the loop"

http://www.housingeurope.eu

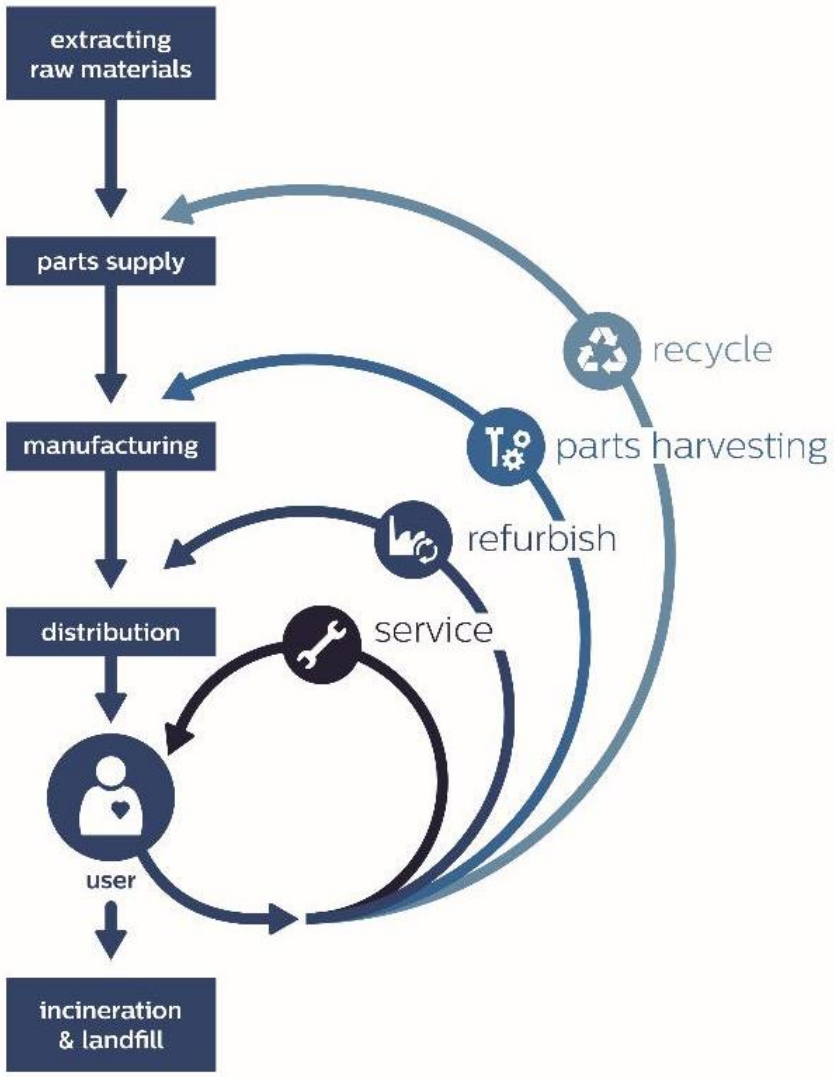
Take-make-consume and dispose model



This model is not sustainable!

“2020 Resource Efficiency” agenda:

- boost economic performance while reducing resource use;
- identify and create new opportunities for economic growth and greater innovation and boost the EU's competitiveness;
- ensure security of supply of essential resources;
- fight against climate change and limit the environmental impacts of resource use



the **circular** economy

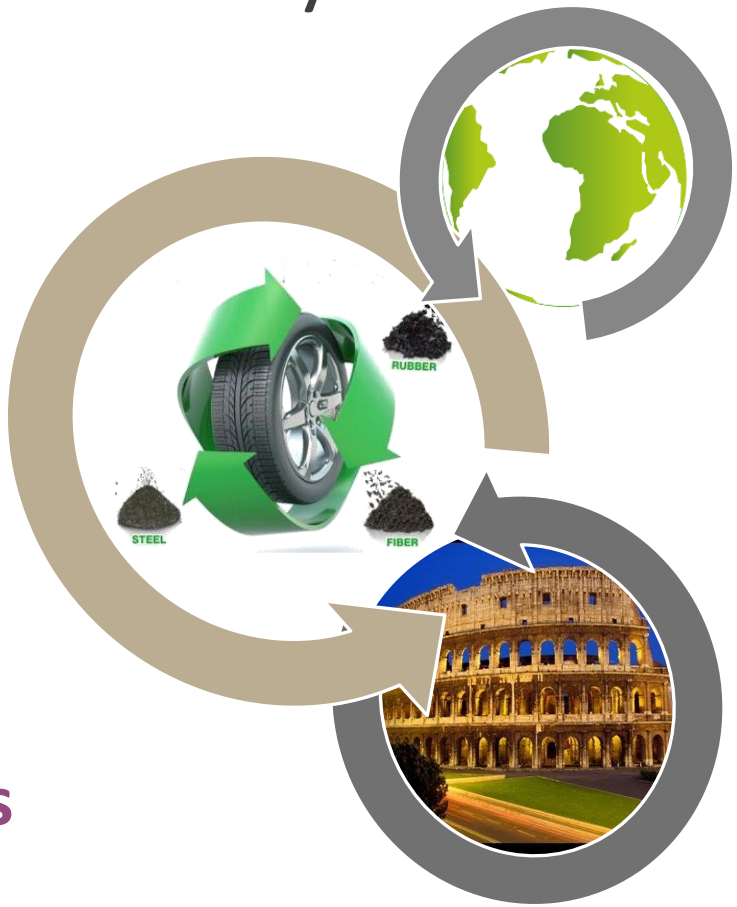
- Exchange by-products; refurbished or manufactured
- Turn waste into a resource service or change use

New EU Legislative Targets – Amongst others:

- Recycling 65% of municipal waste by 2030
- Recycling 75% of packaging waste by 2030
- Reduce landfill to maximum of 10% of all waste by 2030
- Ban on landfilling of separately collected waste
- Promotion of economic instruments to discourage landfilling
- Promote re-use and stimulate industrial symbiosis
- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes

Main Phases of Circular Economy

- Interlinked phases since materials can be used in a cascading way, e.g;
  - industries exchange by-products,
  - Products are refurbished or remanufactured



Main aim ⊳ minimise resources escaping the loop!

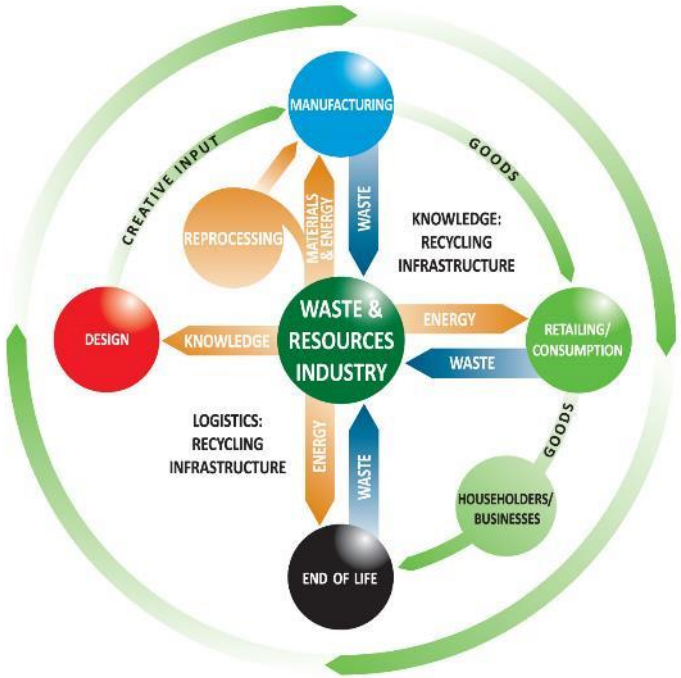
Transition to Circular Economy

Business and market model transformation requires:

- “Cradle to cradle” Life cycle assessment
- Definition of Key performance indicators
- Development of industrial symbiosis

  e.g. UK: NISP

Turning waste into resources and new uses through innovation and creativity



Circular Economy Benefits

- In Europe, the implementation of circular economy can achieve:
  - Overall cost savings worth up to €600 billion/year and a GDP boost by up to 4%

    (=> **Boosting job growth**)

    e.g if 95% of mobile phones were collected, this could generate savings on manufacturing material costs of more than €1 billion
  - Reduction of greenhouse gas emissions by 2-4%
- European companies can benefit from the fast growth in the market of eco-industries

SAFER Contribution to Circular Economy

- Positive contribution of SAFER by developing products and applications which:
- Are material and energy efficient during their production and use phases;
- Use ALL secondary raw materials from End-of-life tyre recycling in innovative concrete engineering applications

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Thank you

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