EcoLanes - “Economical and sustainable pavement infrastructure for surface transport”

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http://ecolanes.shef.ac.uk – http://www.etra-eu.org

Outline

- Concrete road pavements and fibres from tyre-steel cord
- EcoLanes overview
- Benefits from EcoLanes

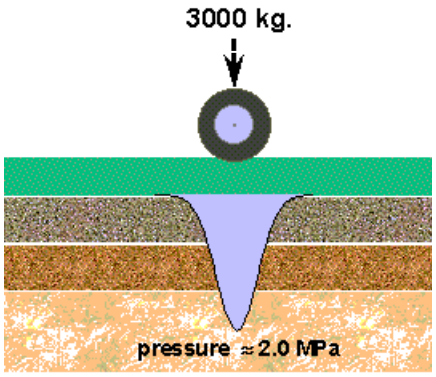
Surface transport infrastructure

- **EU infrastructure: €600bn up to 2010 for maintenance and extension of network**
  - respond needs of enlarged EU
  - benefit single market

- **Road pavements main element of infrastructure**
  - Flexible: Asphalt concrete
  - Rigid: Portland cement concrete

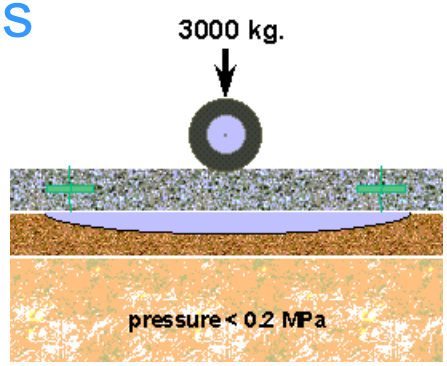
Road pavements

Flexible pavements:



- Deep foundations / multi layer construction
- Energy consumption due to transportation of materials
- Increasing cost of asphalt due to high oil prices

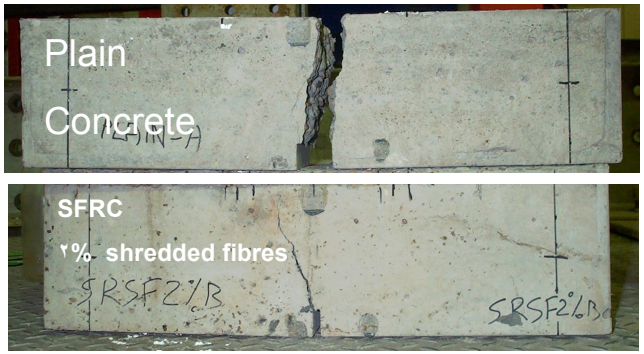
Rigid pavements



- Single layer
- Generally last longer
- May require asphalt topping due to noise / comfort issues

Conventional rigid pavements more expensive than flexible

Rigid pavements



- **Use steel reinforcement to**
  - improve mechanical properties
  - reduce pavement depth
- **Steel fibres reduce costs associated with rebar placement**
- **Concrete mixes**
  - wet / slip forming (laborious - require side formwork)
  - dry / roller compaction (fast – cost effective)
- **Difficult to add fibres in roller-compacted concrete**

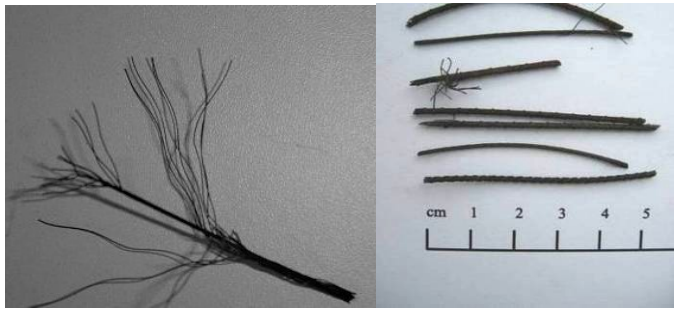
EcoLanes background:

- **University of Sheffield research on tyre recycling** (http://www.shef.ac.uk/tyre-recycling)

Tyre shredding: SRSF

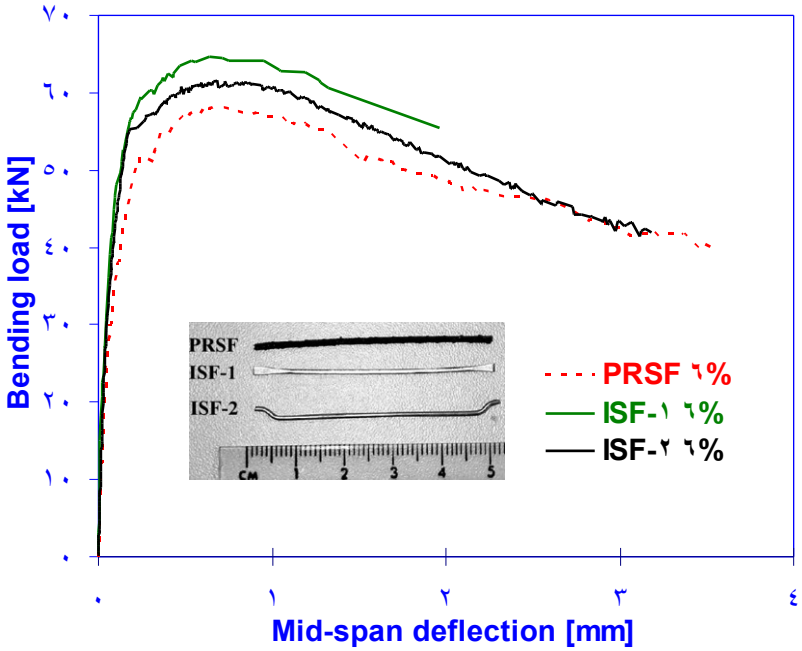


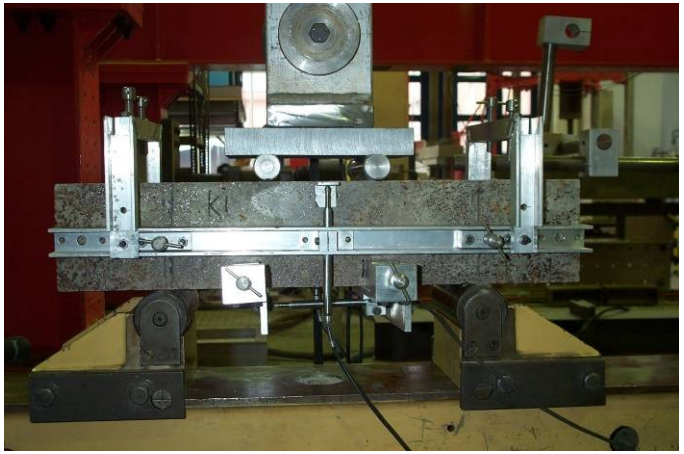

Microwave induced pyrolysis of whole tyres: PRSF



EcoLanes background

UoS research proved that tyre-fibres (e.g PRSF) can be as effective as industrially-produced fibres (ISF).





AGGREGATE INDUSTRIES

Holcim

EcoLanes

EcoLanes background

- **Aggregate Industries Ltd UK (AI) / Holcim**
  - Precast concrete products
  - Contractors for all types of pavement surfacing and construction
  - Major supplier of aggregate / asphalt / cement
  - But interested in concrete road pavements
    - future competitiveness (uncertain future of asphalt)
    - environmental issues (CO_2 trading scheme)

AGGREGATE INDUSTRIES

Holcim

EcoLanes

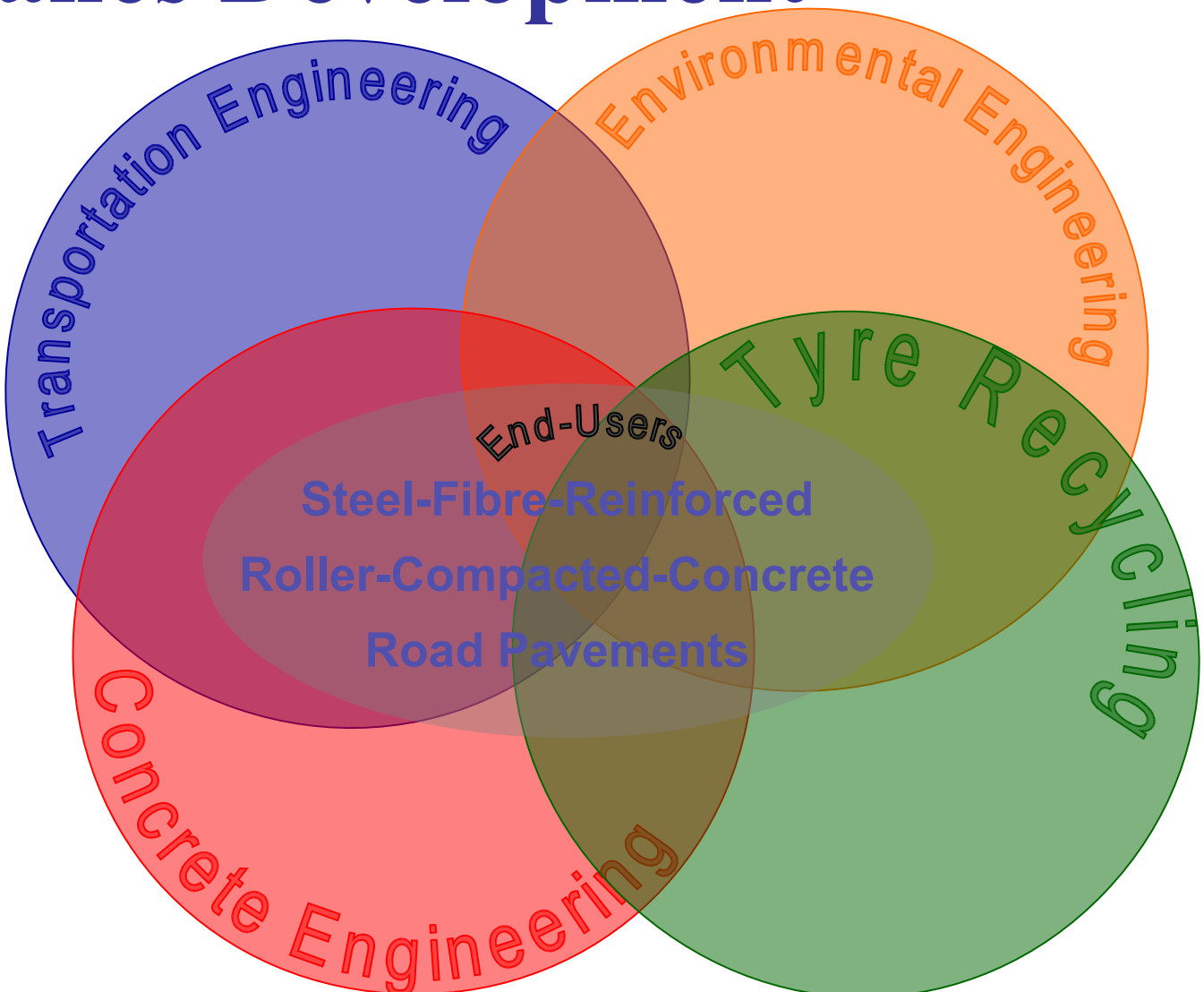
EcoLanes background

- **Al's interest in road pavements**

  - research collaboration between AI and UoS

  - funded a year's Fellowship for further research & preparation of proposals on concrete roads

EcoLanes Development



No.	Participant organisation name	Country
1	The University of Sheffield (concrete)	United Kingdom
2	Akdeniz University (environmental)	Turkey
3	Technical University “Gheorghe Asachi” Iasi (transportation)	Romania
4	European Tyre Recycling Association (environmental policy)	France
5	Aggregates Industries UK Ltd (concrete materials & pilot demonstration)	United Kingdom
6	Antalya Municipality (demonstration)	Turkey
7	Romanian National Road Authority (demonstration)	Romania
8	Adriatica Riciclaggio e Ambiente s.r.l.* (tyre recycler)	Italy
9	Public Works Department (demonstration)	Cyprus

EcoLanes Outline

Call: FP6-2005-Transport-4

Type of instrument: Specific Targeted Research Project (STREP)

9 partners, 9 work packages, 633 man-months total cost ~€2.5m

Reference Number: 031530

Submitted: 1 September 2005

Evaluated: October 2005

Contract Negotiations: March – August 2006

Start of contract: 1 October 2006

End of contract: 30 September 2009

EcoLanes Objectives

Develop infrastructure for surface transport using:

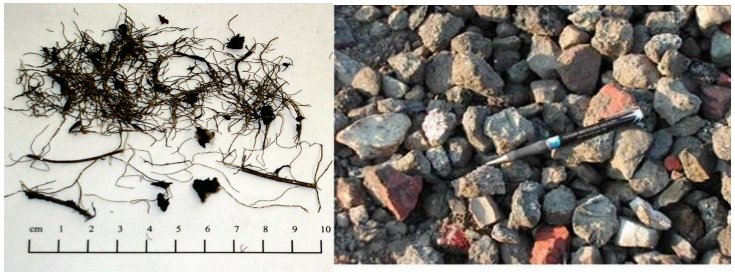
- Roller-compacted techniques based on existing asphalt laying equipment
- Steel fibre reinforced concrete
- Concept of long-lasting-rigid-road-pavements

The project aims to reduce:

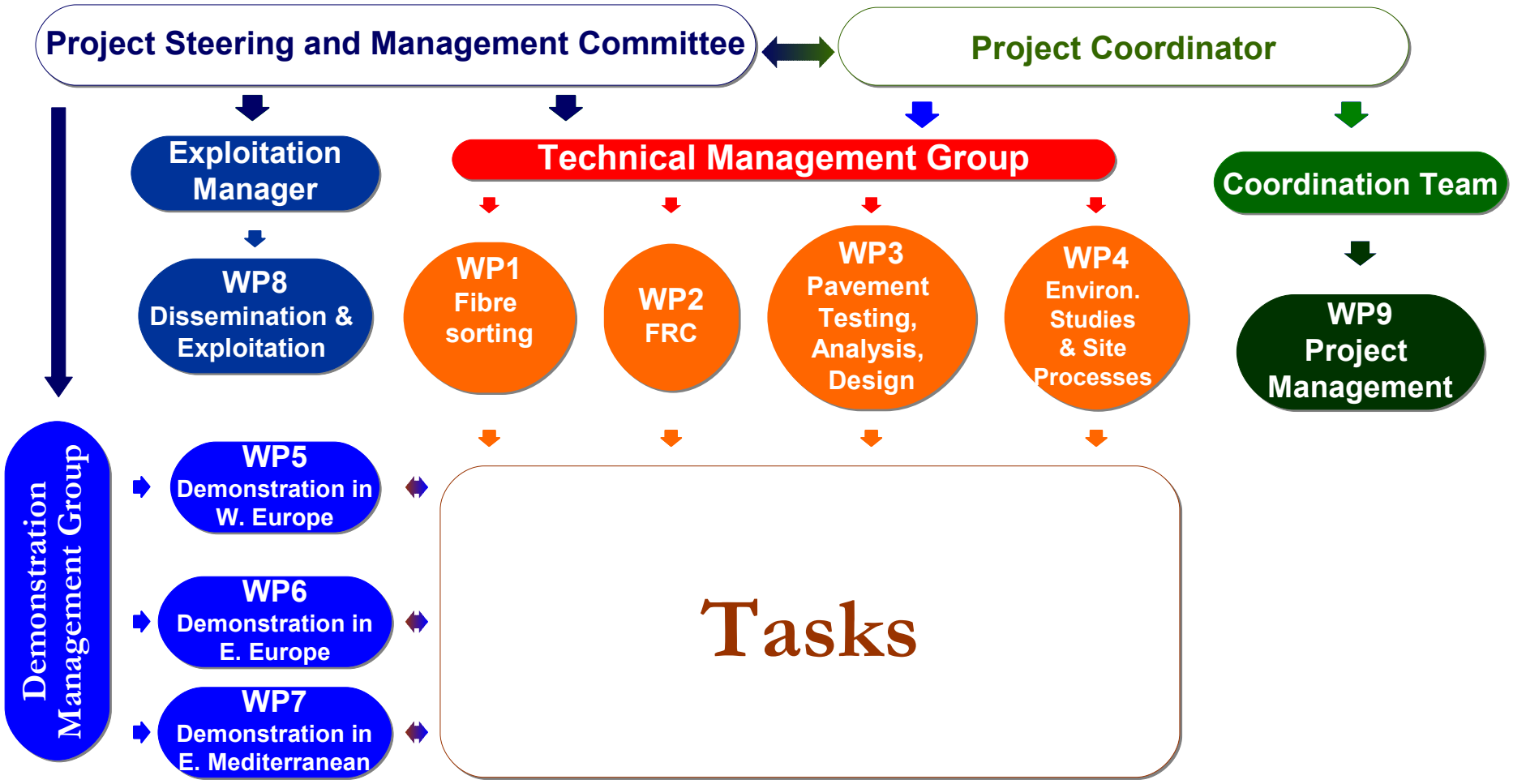
- Construction costs by 10-20%
- Construction time by 15%
- Energy consumption in road construction by 40%,
- Maintenance

And to

- Use waste materials
- Make tyre recycling more economically attractive

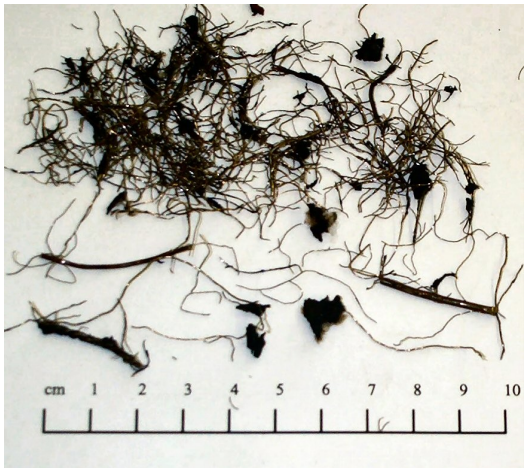


EcoLanes work plan



WP 1: Fibre Sorting

Leader: AD.RI.A (Italian Tyre Recycler)



Develop techniques and equipment:

- Post-processing steel fibres extracted from tyres
- Arrive at fibres suitable for incorporation in concrete

WP 2: Fibre-reinforced Concrete

Leader: The University of Sheffield (United kingdom)

Develop steel fibre-reinforced concrete mixes:

- Suitable for slip forming and roller compaction
- Use recycled materials, low energy cements

WP 3: Pavement testing, analysis and design

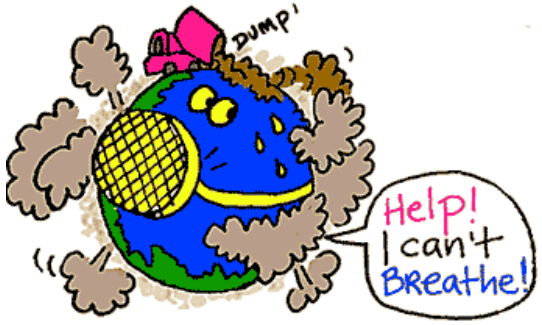
Leader: Technical University of Iasi (Romania)

Develop *long-lasting-rigid-road-pavement concept*:

- Accelerated load tests
  (facility ALT-LIRA)
  1.5 million cycles: 30 years
  (600 trucks /day)
- Durability (climate) tests
- Develop design guidelines for LLRRPs

WP 4: Environmental studies & site processes

Leader: Akdeniz University (Turkey)



Develop life-cycle cost tool to assess environmental impact:

- Site construction processes
- Long-last-rigid pavements (LLRRP)

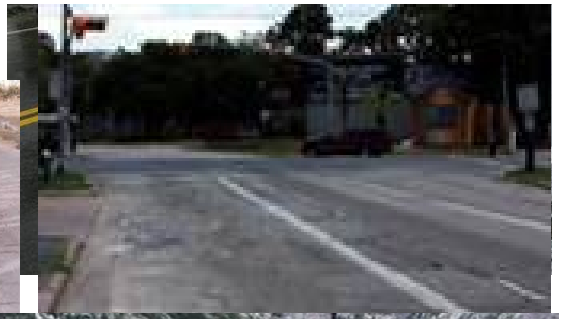
Develop optimised processes for constructing LLRRPs:

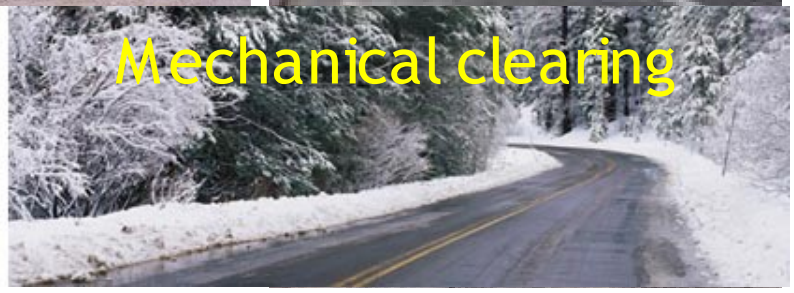
- Use of existing asphalt equipment

WP 5 - 7: Demonstrations

Leaders: Aggregate Industries (UK), DRDPIASI (RO), Antalya Municipality (TR)

- Construct four concrete roads in rural and urban European environments
- Eliminate the problem of r deterioration due to cold a wet environments
- Eliminate the problem of asphalt displacement due to hot weather





WP 8: Dissemination and Exploitation

Leaders: European Tyre Recycling Association (France), Sheffield University Entrerprices Ltd (UK)

- Focus the project on developing solutions needed for transport infrastructure
- Develop technology implementation plan (IPR)
- Disseminate research findings:

  - website (http://ecolanes.shef.ac.uk)

  - 2 industrial seminars

WP 9: Project Management

Leader: The University of Sheffield (United Kingdom)

- Optimise application of technical resources
- Ensure compliance with the project objectives
- Ensure efficient communication within the project
- Ensure that all aspects of the EC requirements for communication and reporting are met

EcoLanes expected output

Tyre-recycled steel fibres:

- Processes & machinery to sort and clean shredded fibres

Steel-fibre-reinforced RCC rigid pavements

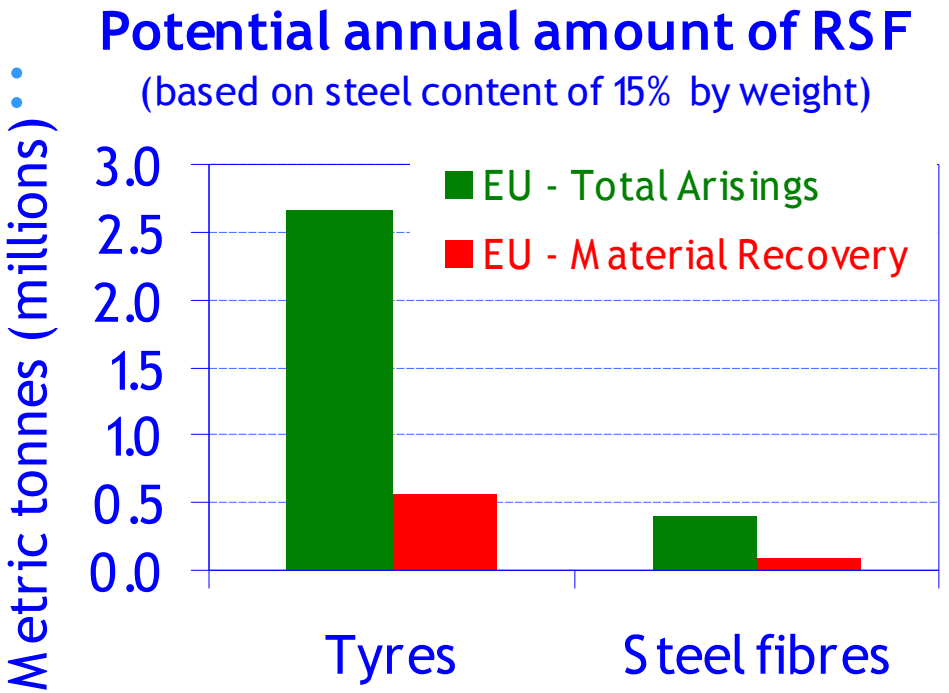
- Processes and machinery to disperse steel fibres in RCC
- Use of waste materials
- Analysis and design software for concept of LLRRPs

Surface transport infrastructure

- Reduction of construction time and cost
- Reduction of energy consumption during construction

Benefits for tyre recyclers

- Price of industrial fibres: €650 ~ €14000 per tonne
- Initial market value of RSF:
  €150 ~ €300 per tonne
- Economic benefits for tyre recycling industry



Benefits for tyre recyclers

Use of recycled tyre-cord in concrete construction

- Provide sustainable market for recycled tyre-cord
- Encourage material recovery of large amounts of tyres
- Facilitate implementation of EC directives

Benefits for construction industry

- Low-cost steel-fibre reinforcement
- Economic method for road construction
- Reduction of industry's CO_2 emissions
- Access to construction innovation

The presentation is available online :

http://ecolanes.shef.ac.uk/diss.htm

Thank You

Background Notes

From mixing to rolling ~ ½ hour