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Project description:

Background

Polymers are currently recycled at rates of only a few percent in most countries, which means they are rapidly accumulating in landfills. They take an extremely long time to break down and, at the same time, have a significant impact on the environment by gradually contaminating soil and water. There are more and more polymer-based products on the market, often with increasingly short lifespans, as new products emerge and replace old ones at a rapid rate. However, the continued use of landfill for the disposal of these polymer-based products not only increases their life-cycle environmental impact, but also undermines the opportunity to reuse these materials. One potential reuse of polymers is in asphalt mixes. In Spain alone, about 45 million tonnes of asphalt mixes are produced annually. In Europe, the figure is about 300 million tonnes.

Objectives

The objective of the POLYMIX project was to demonstrate new environmentally-friendly asphalt mixes, made using polymer waste. By providing an avenue for its reuse, the project sought to reduce environmental problems associated with several types of polymeric waste: polyethylene, polypropylene and polystyrene, as well as end-of-life tyres. The project aimed to create several asphalt mixes containing recycled polymeric waste at laboratory scale and to characterise their performance, with different mixer and polymer additions. The most appropriate mixes were selected for industrial use; the project aimed to design the up-scaling of the process for a pilot-scale demonstration, along with life-cycle assessments and an economic analysis of the selected mixes.
Results

POLYMIX provided the first demonstration project of the use of polymer waste in asphalt mixtures in a real-road situation in Europe. The construction of the trial road sections involved the recycling of 20 tonnes of polymer waste, savings on the use of 60 tonnes of aggregate, with emissions reductions and less waste going to landfill; illustrating the environmental benefits to be gained with increasing uptake of the technology.

Four Polymix asphalt mixes incorporating polyethylene (PE), polypropylene (PP), polystyrene (PS) and end-of-life tyres (ELT) were designed, validated and used to construct four trial sections in a demonstration stretch of 1,600 m of road in Alcalá de Henares (Madrid), which supports heavy traffic loads. The project monitored the behaviour of the Polymix asphalt mixes over 18 months, to test their technical feasibility and economic viability. The project demonstrated that the Polymix asphalt mixes comply with Spanish (PG-3) and European regulations, and provide improved features that could reduce the environmental impact of road construction. The asphalt mixes were found to be cost-effective, because their improved performance ensures the road surface lasts longer than conventional asphalts; so they can be competitive in both the Spanish and European markets.

One of the project’s main results was to show improvements in the plastic deformation (rutting resistance) characteristic of Polymix asphalt mixes, compared to conventional asphalt mixes, which makes them especially resilient to extreme high temperatures combined with heavy traffic. The use of this technology by road managers will therefore result in less maintenance costs, due to the increased lifetime of these mixtures compared with conventional bituminous mixes. The economic feasibility study also showed that some high-performing Polymix mixes (PP and ELT) could be used to reduce the total asphalt pavement thickness, in lower-traffic situations. This could save on raw materials, such as natural aggregates and bitumen, and reduce the amount of asphalt produced, with reductions in CO2 emissions from the manufacturing process.

Polymix technology utilises, for example, recycled PE from plastic bottles, PP from plastic caps, PS from plastic clothes-hangers, as well as end-of-use vehicle tyres. Therefore, the market uptake of the technology would contribute to regulations concerning the treatment of polymer waste at regional, national and European levels, including EU directives on landfill (1999/31/EC), packaging waste (2004/12/EC), end-of-life vehicles (2000/53/CE), and waste electrical and electronic equipment (2002/96/EC). In addition, Polymix can contribute to Europe 2020 strategy objectives for sustainable economic growth, whilst reductions in CO2 emissions and decreased resource use intensity support the shift towards a resource-efficient, low-carbon economy.

The project team identified the main drivers and constraints to introducing Polymix technology into the Spanish market. Guidelines were produced for the production of asphalt mixes using recycled polymers, with criteria for including these solutions in green public procurement (GPP) procedures. The methodology was defined such that the guidelines could readily be adapted to other European countries. After-LIFE, the beneficiaries will continue to develop the technology and find new marketing opportunities.
Environmental issues addressed:

Themes

Waste - Packaging and plastic waste
Waste - Waste recycling

Keywords

road construction, waste recycling, plastic waste, tyre

Target EU Legislation

- Waste

Natura 2000 sites

Not applicable

Beneficiaries:

Coordinator: Universidad de Cantabria
Type of organisation: University
Description: The University of Cantabria (Universidad de Cantabria) is a young public educational establishment with a strong commitment to social progress through teaching and scientific excellence.
Partners

Acciona Infraestructuras, Spain
Asociación de Investigación de Materiales plásticos y conexas, Spain
Dirección General de Carreteras de la Comunidad de Madrid, Spain

Administrative data:

Project reference    LIFE10 ENV/ES/000516
Duration             01-SEP-2011 to 31-MAR -2015
Total budget         1,535,225.00 €
EU contribution      760,091.00 €
Project location     Madrid(España)

Read more:

Leaflet
Title: "Workshop POLYMIX : Desarrollo de asfalto con residus plásticos" (3.47 MB)
Author: Daniel Castro Year: 2014
Editor: Universidad de Cantabria No of pages: 2

Newsletter
Title: "Polymix news : Residuos poliméricos en mezclas asfálticas : en busca de carreteras más sostenibles : Boletin informativo del Proyecto Life+ Polymix, n°2" (810 KB) Year: 2014
Editor: Universidad de Cantabria No of pages: 2

Newsletter
Title: "Polymix news : Residuos poliméricos en mezclas asfálticas : en busca de carreteras más sostenibles : Boletin informativo del Proyecto Life+ Polymix, n°4" (1.24 MB) Year: 2014
Editor: Universidad de Cantabria No of pages: 2

Project web site
Project's website

Publication: After-LIFE Communication Plan
Title: After-LIFE Communication Plan No of pages: 5

Publication: After-LIFE Communication Plan
Title: After-LIFE Communication Plan No of pages: 5

Publication: Layman report
Title: Informe layman No of pages: 20

Publication: Layman report
Title: Layman report No of pages: 13

Publication: Technical report
Title: Project's Final technical report Year: 2014
Editor: Universidad de Cantabria No of pages: 78
Slides Presentation
Title: "Workshop polymix : desarrollo de asfalto con residuos plásticos : Diseño y caracterización" (1.82 MB) Author: Pedro Lastra Gonzalez Year: 2014 Editor: Universidad de Cantabria No of pages: 20

Slides Presentation
Title: "Conceptos básicos sobre betunes modificados y ligantes fabricados con PNFU : Proyecto #PolyMix" (618 KB) Author: Francisco Lucas Year: 2014 Editor: Repsol No of pages: 12

Slides Presentation
Title: "Implantación POLYMIX (M-300) Ventajas a inconvenientes de su ejecución : Polymeric waste in asphalt mixes: a way to increase sustainability of road infrastructures" (3.10 MB) Year: 2014 Editor: POLYMIX No of pages: 17

Video link
"POLYMIX: Mezclas asfálticas modificadas con residuos poliméricos" (4')