

Adding Fibres to Bituminous Mixes

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An on-going focus of research at the University of Ulster is the re-use and recycling of material into bituminous materials for road construction. The research has considered many different waste streams such as rubber, glass, construction and demolition waste, roofing felt shingles, paper and fibre reinforced polymer. These waste streams cover a range of material types with different properties that may have a significant affect on the overall performance of the bituminous road construction material.

Each waste stream has typically been considered by a bespoke research project, investigating its suitability as an additive or replacement in a specific type of bituminous road construction material. Typically, these projects have considered the optimum proportion of waste material added and its effect on mix properties.

The aim of these research projects have been to produce sustainable highway construction materials that have to be able to perform to a similar or better standard than the original material that contains no waste. The philosophy for the research has been to improve performance of the road construction material and not to consider the road as an alternative landfill for waste disposal and a means to avoid landfill taxes. With this in mind some waste additives have been found to be beneficial while others have not.

Global environmental initiatives such as the Kyoto protocol which came into effect in February 2005 aim to curb rises in global temperatures, mainly caused by the burning of fossil fuels, by cutting greenhouse gas emissions by at least 5 percent below 1990 levels by 2008-2012. In the UK, the Carbon Trust, an independent company, funded by government has been established to facilitate the transition to a low carbon economy.

European and UK Government policies with respect to construction materials and the environment are forcing changes in the way construction materials are used. The introduction of the UK Aggregates Levy in April 2002 was aimed at reducing demand for virgin aggregates, and encouraging the use of recycled materials. In many cases the introduction of the levy has prompted the use of alternatives to virgin aggregate.

In the Fibre Reinforced Polymer (FRP) market the European Directive on the *end-of-life Vehicles* required government to legislate to ensure re-use and recovery of 85% vehicle weight by 2006 and 95% by 2015. This has prompted the FRP market to consider further end of use recycling of their product, as modern vehicles are now comprised of large proportions of FRP.

This paper first provides an overview of research at the University of Ulster into the production of sustainable highway construction materials. The paper will then consider specific research into the use of fibres to modify / enhance bituminous materials. For example, it traces the use of loose and pelletised cellulose fibre in the design of surfacing mixes such as stone mastic asphalt, porous asphalt and proprietary thin surfacings. In contrast, it summarises a collaborative research project with the Building Research Establishment and Aggregate Industries Ltd into the addition of glass reinforced plastic fibres to a dense bitumen macadam material.

The research presented shows how former waste streams may become valuable sustainable highway construction materials.