

R&D Technical Summary W5-002/E/TS

**Sustainable Re-use of Tyres in Port, Coastal
and River Engineering
Guidance for planning, implementation and maintenance**

Background to R&D project

In 1996 around 37 million car and truck tyres (weighing approximately 380,000 tonnes) reached the end of their first lives in the UK. 26% of these were discarded to landfill, but a European Commission Directive banning the disposal of whole tyres and tyre crumb to landfill sites by 2003 and 2006 respectively means that alternative uses must be found for the 26% of tyres disposed of in this way.

The value of reusing tyres with their associated specific kind of longevity, resistance and shape has been considered in the past. For many years they have been used as boat and quayside fenders. However, during the 1970s and early 1980s use of tyres started to be promoted in the USA for floating breakwaters and for artificial reefs for fishery enhancement. The technology is now available to compress and bale whole scrap tyres into slightly rounded cuboids that can be used as cost effective void fillers and lend themselves to sea defences and bank protection. The tyre bales retain some porosity but would be compressed to a density of around 540kg/m³ to form a rounded cuboid of tyres of dimensions 1.5m x 1.2m x 0.75m containing about 110 passenger car and light truck tyres at a weight of 800 to 900 kg. Such tyre bales are relatively inexpensive and are beginning to be used extensively in some States in the USA for the construction of embankments, dams and river bank protection.

This project was therefore set up to examine all options for re-use of rubber vehicle tyres in port, coastal and river engineering, and all associated technical, environmental and economic issues and to provide some detailed technical guidance.

The study was led by HR Wallingford and it was jointly funded by Dti, EA, SCOPAC and others and included cross-industry collaboration. Key research partners were Southampton University and the BRE Fire Research Station. The Environment Agency provided considerable practical support, particularly in regard to the pilot projects.

Results of R&D project

The results of the project consisted of a combination of literature review, monitored pilot projects and laboratory testing summarised in a guidance document. The project faced the challenges of having to deal with an uncertain and changing waste management licensing situation, and the project team took part in the development of proposed exemptions to the regulations to cover the use of tyre materials

Pilot projects using tyre bales in coastal and river engineering structures were conducted at Pevensey in Sussex (shingle bank retaining wall) and on the River Witham (embankment flood defence) in Lincolnshire. Both these projects were monitored for physical movement, stability and chemical leaching and demonstrated no adverse effects. The Witham project, which employed 12,000 tyre bales (over 1.2 million tyres) was considered particularly successful. A further project at Selsey in West Sussex (seawalls) only reached detailed planning stage.

Full-scale laboratory testing at HR Wallingford enabled the density, porosity and permeability of tyre bales to be assessed, and model tests determined their stability under current and wave action. Tests in the BRE FRS burn hall confirmed the relative safety of tyre bales against ignition in relation to other tyre products.

R&D Outputs and their Use

The principal output of the project is the project report/guidance document (see below) in which all the work carried out is described. The guidance document includes chapters covering subjects such as:

- reasoning for re-using tyres,
- tyre and tyre bale properties, processing and re-use options;
- case studies and possible applications in port, coastal and river environments; and their
- durability, monitoring and maintenance.
- environmental impact and risk assessment for the use of tyres.

The appendices include detailed accounts and results of the various physical full-scale and model tests conducted during the project, summaries of the pilot projects, useful contacts and background information on legislation and waste management licensing exemptions.

The report is designed for use by practicing engineers interested in adopting whole tyres or tyre bales in their schemes.

This R&D Technical summary relates to R&D Project W5-002/E and the following R&D outputs:

- ***Sustainable Re-use of Tyres in Port, Coastal and River Engineering - guidance for planning, implementation and maintenance.*** Published June 2005 by HR Wallingford. Simm, J.D., Wallis, M.J. and Collins, K. (eds)

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Copies of the full range of documents relating to this project can be obtained from <http://www.tyresinwater.net>.

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