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Resource efficiency case study: tar bound road planings

A66 Little Burdon to Newton Grange resurfacing

This case study demonstrates how assessing the volume, type and condition of existing pavement materials at an early stage in the project lifecycle can maximise materials resource efficiency.

Background

Site investigation undertaken as part of the £2.5m 'A66 Little Burdon to Newton Grange Carriageway Resurfacing Scheme' identified the potential to generate in the region of 9,000 tonnes of tar bound road planings during the excavation of the existing pavement material.

Organisations involved

- Highways Agency (Client);
- A-one+ (Designer / Highways Managing Agent Contractor);
- Pavement Testing Services Ltd (Pavement Testing Sub-contractor)
- Hanson (Managed Works Contractor); and
- Roadstone Aggregates Ltd / BaseCon UK (Planing and Foamix Sub-contractor).

Waste classification

Coal tar is classified as carcinogenic due to its high concentration of Polynuclear Aromatic Hydrocarbons (PAHs) - more that 15,000 times that found in bitumen. Consequently, waste tar bound road planings are considered to be hazardous waste (European Waste Code 17 03 01* bituminous mixtures containing coal tar) where the level of coal tar is >0.1% w/w (1,000 mg/kg). Even when treated, normally by using a binding agent such as cold bitumen foam mix, they are still considered to be hazardous waste and their subsequent use in construction requires an environmental permit to be registered with the Environment Agency.

Coal tar identification process

The presence of coal tar can have major implications to a construction project, due to the health and safety issues posed by handling the material as well as the additional cost that comes with the removal and disposal of a hazardous waste. The early identification of tar bound material can therefore act as an early warning to Project Managers and Designers involved in highways maintenance projects and can be be vital in reducing project costs and delays.

A66 pavement core (tar bound binder course can be observed between 100mm - 200mm). Photo courtesy of PTS Ltd

The scheme used a innovative core logging methodology, developed by the pavement testing sub-contractor in order to identify tar bound construction layers at the project feasbility stage. This uses a simple chemical indication process applied to each layer of the core allowing the operator to detect the presence of tar. This method has been validated on cores from a number of different sites and has been verified by UKAS accredited laboratory testing.

Resource efficient approach

The original scheme design, based on a conventional pavement reconstruction, required removal of the tar bound planings and their disposal to landfill or treatment at a suitably licensed site. However, through employing a flexible and reactive tendering process, the project team were able to respond to a tender query which highlighted the potential cost saving of recycling the planings. The project team subsequently amended the scheme tender documents to ensure this option was considered.

The early identification of tar bound material enabled the project team to:

- undertake pre-contract discussions with the Environment Agency and Local Authority to clarify the regulatory position relevant to the re-use of

hazardous waste tar bound road planings in construction projects;
- ensure that all the necessary permits or exemptions for the operations were obtained prior to starting work on site;and
- delineate between tar and non-tar materials during the removal process.

Ex-situ recycling (Foamix)

The tender assessment took into account the proposals developed by the contractors for managing these materials. Ex-situ recycling, in the form of 'Foamix', was selected by the project team in preference to conventional pavement reconstruction as it provided significant financial and resource efficiency benefits.

Treatment of waste tar bound planings. Photo courtesy of A-one+.

Foamix is a term commonly used to describe a cold lay asphalt base course which has been mixed with a binder consisting predominantly of foamed bitumen. Merrill, D *et al* (2004)[1] states that "*Foamed bitumen is produced by the injection of 1 to 2% cold water with air into hot penetration grade bitumen. This process produces a high-volume, low viscosity fluid with low surface tension; these properties enable the foamed bitumen to coat a wide range of moist, cold recycled aggregates*".

The Foamix used on the scheme included:
- asphalt waste containing coal tar - 87.5%;
- pulverised Fuel Ash - 8%;
- bitumen - 3%;
- Ordinary Portland Cement - 1.5%; and
- water.

Ex-situ recycling was undertaken by Roadstone Aggregates Ltd, at an old compound adjacent to the scheme, in accordance with the Environment Agency Regulatory Position Statement covering 'The use of treated waste tar bound road planings in construction operations'. This confirms that the Environment Agency will not pursue an application for an environmental permit for the activity where:

- the waste tar bound road planings are treated at a suitably permitted facility;
- the treated planings meet the Specification for Highways Works Series 900; bituminous bound materials, before re-use;
- the subsequent movement of the treated planings is covered by a hazardous waste consignment note; and
- the relevant objectives of the Waste Framework Directive are met '…ensuring that waste management is carried out without endangering human health, without harming the environment and in particular:
  (i) without risk to water, air, soil, plants or animals;
  (ii) without causing a nuisance through noise or odours; and
  (iii) without adversely affecting the countryside or places of special interest.'

Resource efficiency benefits

Ex-situ recycling delivered a number of significant resource efficiency benefits, compared to a traditional design option of a primary aggregate hot mix asphalt base course:

- wastage rates and material demand

Ex-situ recycling avoided approximately 9,000 tonnes of hazardous waste requiring off-site disposal, and the subsequent import of the same volume of new construction materials.

- embodied carbon in materials / products

The use of the cold recycled bound material resulted in a calculated 28%[2] (169 tonnes) embodied carbon[3] saving due to reduced bitumen content and lower mixing temperatures.

- increased lifespan

The treated material was placed at a depth of between 150mm and 300mm. This depth ensured that future patching schemes would not require the removal of the tar containing Foamix material.

[1] *Merrill, D et al (2004). A guide to the use and specification of cold recycled materials for the maintenance of road pavements TRL Report TRL611.*

[2] *Emissions Factor Ref: University of Bath's Inventory of Carbon and Energy (ICE) V1.6a (Hammond and Jones, 2008).*

[3] *Carbon is used as shorthand for carbon dioxide equivalents*

- significant cost savings

Avoiding sending the tar bound planings to landfill which would have cost in the region of £1.3m.

- reduced vehicle movements

Ex-situ recycling avoided an estimated 2,325 tonne-kilometres (tkm) – eliminating over 490 tonnes of carbon from the schemes carbon footprint[4].

Lessons learnt and key learning for future projects

- placing emphasis on assessing the volume, type and condition of existing pavement materials, at an early stage, provides the greatest opportunity of developing solutions that avoid disposal of materials to landfill;
- neither the project team nor the local Environment Agency Office had previously dealt with tar bound road planings on such a scale and detailed discussions were required regarding the interpretation of the relevant legislation. In addition, because the environmental permit for the Foamix plant was new it needed to be issued by the Local Authority (rather than the Environment Agency) which required additional discussion between the contractor and the Local Authority and Environment Agency over the wording of the permit;
- ex-situ recycling was undertaken at an old compound adjacent to the highway and it was agreed with the Environment Agency that this compound could be classed as part of the site. The significance of this was that as the material was being treated 'at the place of production' this precluded the need for hazardous waste consignment notes for moving the tar bound materials to and from the batching plant;
- the scheme generated useful primary data (e.g. cores, Foamix samples, leachate data) to assist the European Pathway to Zero Waste Project with developing the ongoing Quality Protocol (QP) for 'Asphalt Waste Containing Coal Tar'. The QP will define the standards which asphalt waste containing coal tar must achieve (to be considered a non-waste) to encourage its use as recycled aggregate. The Environment Agency's position statement is an interim position, pending the outcome of the waste QP process, which will be withdrawn once a decision is made whether to give a Quality Protocol or not; and
- greater awareness and understanding of hazardous waste regulations in relation to tar bound materials within client, regulators, designers, and contractors would help to ensure a resource efficient approach.

[4] *Emissions Factor Ref: Department of Energy and Climate Change (DECC) et al (2011) GHG Conversion Factors for Company Reporting.*

Waste & Resources Action Programme

The Old Academy
21 Horse Fair
Banbury, Oxon
OX16 0AH

Tel: 01295 819 900
Fax: 01295 819 911
E-mail: info@wrap.org.uk

Helpline freephone
0808 100 2040

www.wrap.org.uk/construction

recycle