Green Awards 2007

Project submission - British Highways
(Sustainable Business category)

"Green footways from black asphalt"
(in situ mobile asphalt recycling)

This page left intentionally blank

Green footways from black asphalt

Introduction

For some considerable time, Staffordshire Highways, the tri-partite partnership between Staffordshire County Council, Accord Highways and Wrekin Construction, has been extremely proactive in using a variety of recycling methods and materials to maintain the county road network. This Green Awards application is focussed on one specific technique that has been promoted and supported by the county's engineers and laboratory, together with Accord.

Four years ago, the first mobile asphalt recycler was trialled at Rocester to refurbish a footway using an in situ process. Since then, Staffordshire Highways has worked with the designers and builders of the machine, R.S.L., to improve safety and performance to the point where it is now an accepted and specified method of working.

The machine

The mobile asphalt recycler comprises a rotating steel drum fitted to a six-wheel lorry chassis similar to a cement mixer. At the rear is a charging hopper, an oil burner and a discharge chute. The drum has a 5-tonne capacity and is driven by a separate motor generator set fitted to the chassis (see Figure 1).

The process

Footways deteriorate due to construction failure, disturbance from utilities or oxidation from the weather. Provided that the construction is made from bitumen coated stone, they can be refurbished using in situ material. An excavator is first used to lift the existing footway base and wearing courses, which then loads them into the asphalt recycler via a charging hopper. The process takes place in 5-tonne batches, which means that only approximately 25 metres of footway are out of use at any time. This is a major benefit to nearby householders and business as it minimises disturbance to access routes.

During the loading period, the oil burner is fired to heat the asphalt as it tumbles in the drum and to help return it to its original aggregate size. If the material has lost a significant amount of the residual bitumen then additional new binder is added at this stage. Following 20 minutes of heating, the material is tipped from the drum via the discharge chute into wheelbarrows, and hence returned to the footway. At a temperature of 160 degrees Celsius, the hot black coated stone is then raked back into the footway and rolled—making the amazing transition from lumps of crumbling old footway to new shiny black tarmac. To finish the job off, a second visit to the site is normally made to add a thin layer of new wearing course, overlaid onto the recycled material.

Refining our working practices

Our recent efforts in the north of the county have significantly improved the quality and efficiency of the process. In May this year a project in Rudyard, where the footway required raising in height, we overlaid a recycled footway on top of the original, using road planings as a feedstock for the asphalt recycler. The planings originated from the adjacent carriageway, minimising the volume of transport required to get them on site. The quality of the planings was such that no additional bitumen was required, and the consistent aggregate size allowed the material to be brought up to finished level, removing the need for the addition of a separate wearing course. This practice is currently underway in similar works at Stanley, where the skills of the operatives have developed to meet the requirements of leaving the recycled material as the final surface finish.

Team-building and training

The new process has gained ownership from the team operating the machine, who are pleased to be involved in the new technology and working practice. There has been a real enthusiasm to embrace the change, as the operatives can clearly see the benefits of what they are achieving.

Changes in working methods have required operatives to sequence the operation of the machine with the working of the site, and to learn new skills to understand the complexities of the asphalt recycler, together with knowledge of burner controls and bitumen content. Another specific skill has involved the addition of sharp sand to the planings to produce an asphalt which has little or no voids when analysed.

Improved planning

The Staffordshire Highways staff at Riverway have been instrumental in changing the way schemes are planned to maximise the use of the asphalt recycler, and continuity has been achieved in sequencing start and finish dates linked with the generation of planings from carriageway works.

The Staffordshire Engineering Services Laboratory (SESL) carries out a program of work involving all the footway sites to be refurbished. Test cores are taken to ascertain the suitability of the process, and these results form the basis of the Forward Plan. The laboratory is used to provide ongoing analysis of the recycled footway material. Samples are taken to establish the density, strength and the presence of air voids, and after their years of experience in sampling, the laboratory staff are convinced that the present method of working is "as good as it gets".

The confidence level in the process is high, and the laboratory has recommended to the Highways Specification Group that this method of working is adopted as a standard throughout the industry.

Cost savings

Saving money in the highways business is largely about doing more work for the same budget. There is an ongoing demand to improve the condition of the county roads and footways, and it is important that any recycling process delivers on this requirement.

The actual cost savings vary from job to job, but the main areas for saving are:

1. There is no waste material generated from the site to go to landfill.
2. There is no requirement to purchase new aggregate from the quarry.
3. Minimum disruption to traffic and pedestrians means less requirement for traffic management.
4. The same manpower and plant are used as for conventional working methods.
5. The use of on-site planings reduces the volume of traffic movements associated with the works.
6. As a result of our recent refinement of the practice, it no longer needs a wearing course, saving material and a second site visit.

These savings typically amount to a 15% reduction in the capital cost of the works, and a projected saving of £60,000 per annum for a single machine in continuous use.

Carbon savings

Staffordshire Highways has been working closely with the County Climate Change Team and, following a proposal to consider the benefit of a number of recycling systems, were granted funds to establish the carbon footprint of the process. Enviros, a team of environmental consultants, were hence commissioned to perform a study to establish whether the new process led to an overall reduction in carbon emissions. The brief they were given requested them to establish a baseline for the normal practice of footway repair, where the waste would be landfilled and new stone purchased, and then compare it to the new process.

The study produced an interactive model that allows each separate project to be measured in terms of distance to landfill and to quarry. The embedded carbon in the materials and the energy consumption of the process is taken into account, based on five litres of fuel per tonne produced. The distance and fuel used in travelling to and from site is included in the formulae, and it is hence possible to calculate the nett carbon saving on a specific project.

An example is given in the attached supplementary information, showing the process maps and the text boxes where data can be entered into the worksheet to calculate the total carbon emission value.

In the Process Map 1 , the quantity reused was 300 tonnes: the amount used to reconstruct the Rudyard footway. The data tables show the number and length of journeys, the amount of fuel, the embedded manufacturing carbon, plus the conversion factor for landfill carbon emission. Based on these specific project parameters, the asphalt recycling process reduced carbon emissions by 192 tonnes.

Process Map 2 shows the projected annual tonnage based on the previous year's performance, where 2,500 tonnes of material were recycled using the asphalt recycling machine. Using the same parameters, the estimated saving was 1,596 tonnes of carbon emission for the year.

Best practice

Resulting from the development work between R.S.L. and Staffordshire Highways, a number of machines have been trialled in other parts of the Accord business, and it is now the intention of Staffordshire Highways to operate a second machine in the county.

The clear and positive advantages, as demonstrated by Accord, have led to the process being taken up by Cornwall and Leicestershire County Councils, who have each purchased two of the machines.

Conclusion

The combined efforts of the county, Accord and R.S.L. to change working practices to a more sustainable and cost-effective method of working have proved to be financially viable, and have led to a significant reduction in Staffordshire's carbon emissions.

Submitted by: Michael Johnson

This page left intentionally blank

Supplementary information - photographs

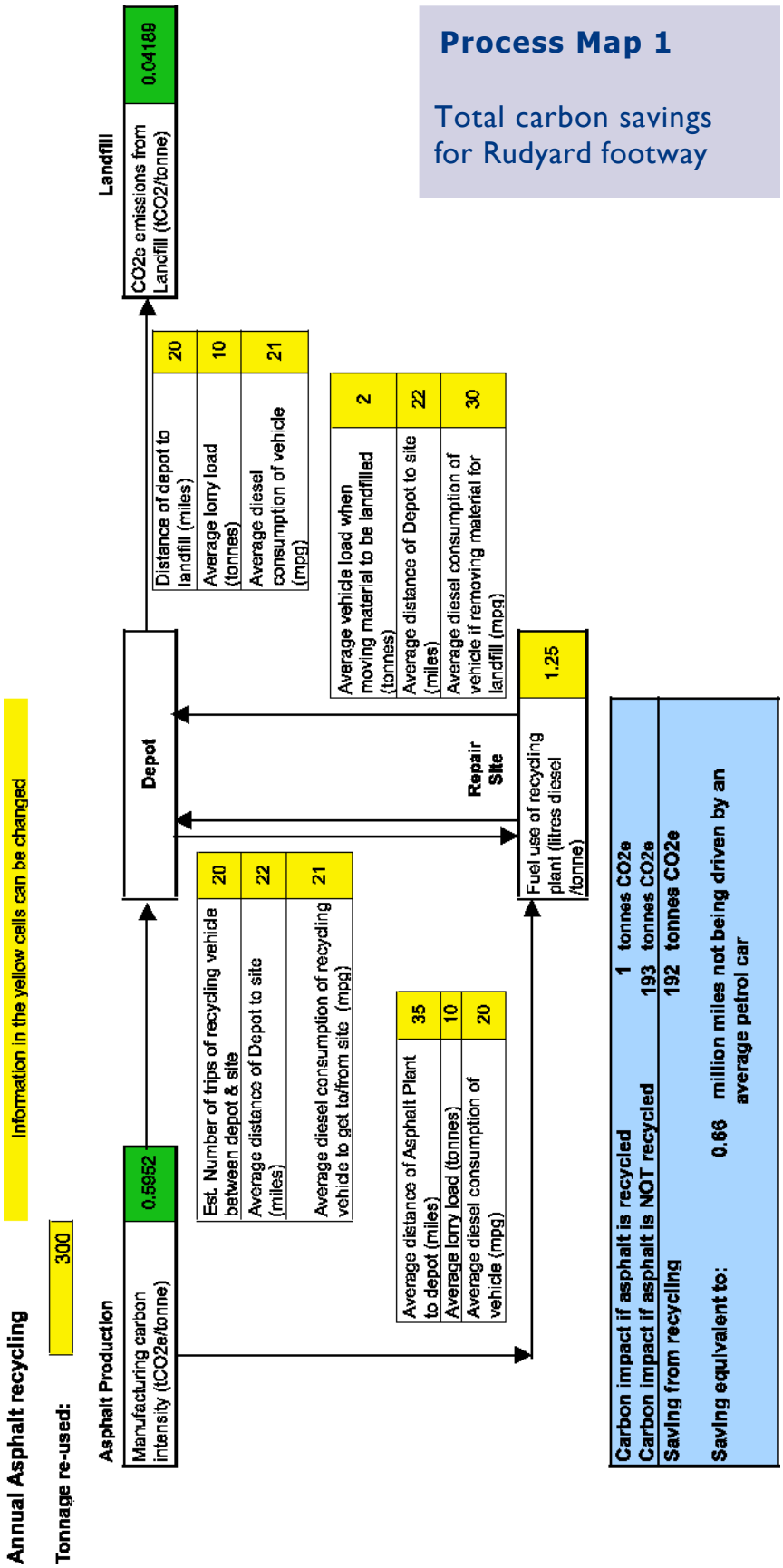
Figure 1 - A team of enthusiastic operatives take hot recycled material from the rear of the asphalt recycler to replace a worn out driveway

Figure 2 - A close up of the surface shows a textured finish —ideal on the steep inclines of Clewlows Bank

Figure 3 - The process creates minimum disruption to households, where both the footway and driveways are refurbished using the in-situ recycler

Figure 4 - The impact of replacing the footways on this steep bank with restricted working was significantly reduced by using the asphalt recycling machine

Supplementary information - process maps



Process Map 2

Projected annual savings due to mobile asphalt recycling