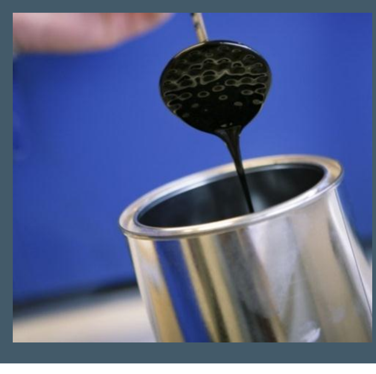
Importance of Some Aspects of Methodology in Pavement Life Cycle Assessment

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Introduction

➢ Background

Carbon Footprinting (CF) and Life Cycle Assessment are techniques still in development in the road pavement domain. The current standard for CF in the UK is PAS 2050:2011, which has been applied to asphalt pavements to generate an industry standard 'asPECT' tool. In 2011 Eurobitume published its revised life cycle inventory of bitumen. This generic European 'cradle to gate' study covers extraction of crude oil, transportation to Europe, manufacturing of bitumen and hot storage.

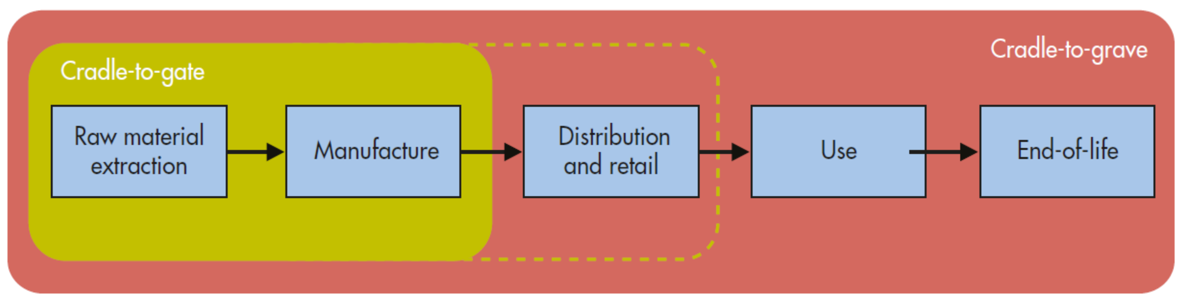

Figure 1: Types and stages of a life-cycle CF (PAS 2050).

➢ Methodological Issues

CFs are beset with uncertainty and error due to the necessity for assumptions to be made in the calculation methodology and the uncertainty inherent in data. This poster focuses on the allocation to co-products and at end-of-life.

Research Methodology

➢ Allocation

Several different types of emission allocation methods were considered for co-products and at end-of-life (EOL) recycling to test the sensitivity of these assumptions:

Co-products: economic; mass; zero; and mix (Eurobitume).

EOL recycling: 100:0; 0:100; 60:40; and 50:50 between producers and users of recycled asphalt.

➢ Case Study

A case study for a 'typical' UK interurban road was developed to test the sensitivity of CF methodological changes. It is a 1km single carriageway of asphalt construction modeled for a 60 year lifetime.

Results

➢ Material allocation

Figure 2 shows the CF results for two prominent materials in this case study. Blast Furnace Slag (BFS) is a 'waste' co-product of iron production and is used as an aggregate in pavements. Bitumen is a co-product from crude oil refining. Figure 2 shows that the embodied carbon of BFS and bitumen can vary significantly based on allocation type.

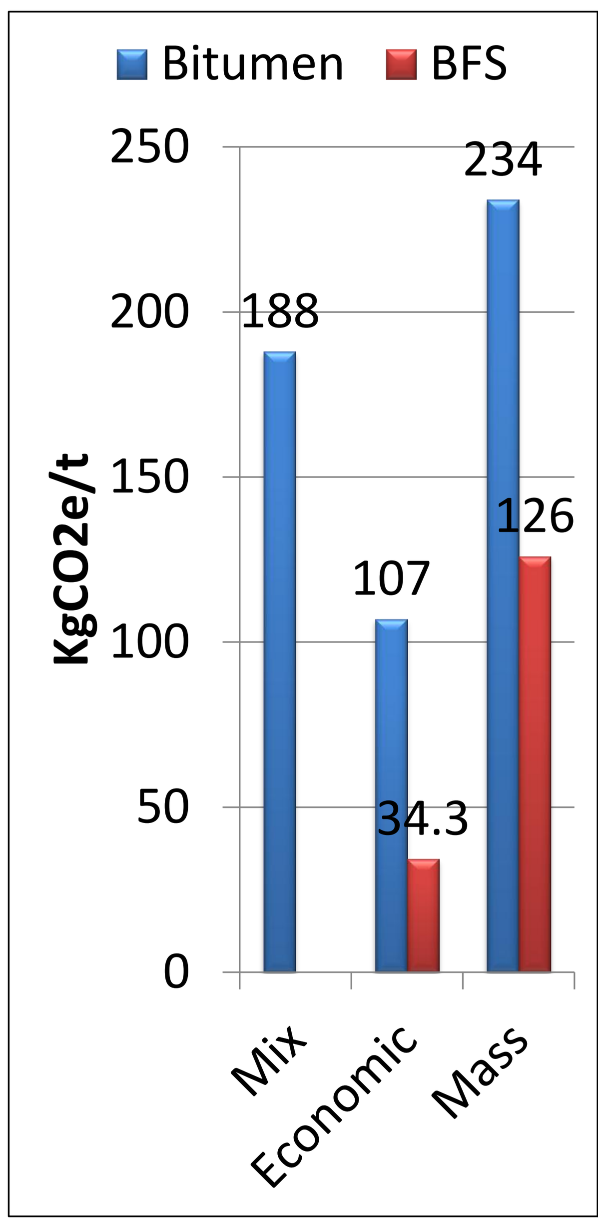

Figure 2: Embodied carbon of bitumen and BFS for different allocation types.

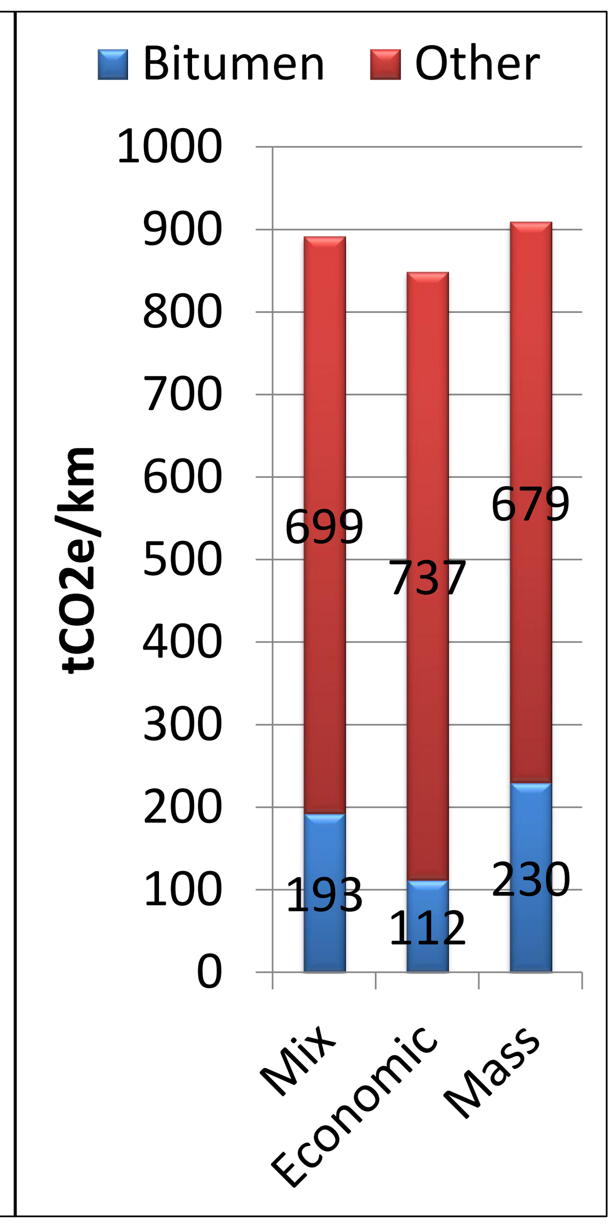

Figure 3: Effect of bitumen allocation assumption on case study CF.

Figure 3 shows insignificant variation in total case study carbon footprint based on bitumen allocation type. However, BFS allocation type leads to significant variation (over 200%).

➢ Allocation at end-of-life

Figure 4 shows the sensitivity of the road case study carbon footprint to changing the recycling credit ratio. This variation leads to a change of 22% in the total carbon footprint. The change from the asPECT chosen 60:40 ratio to the often used 50:50 ratio results in a 2% decrease for this case.

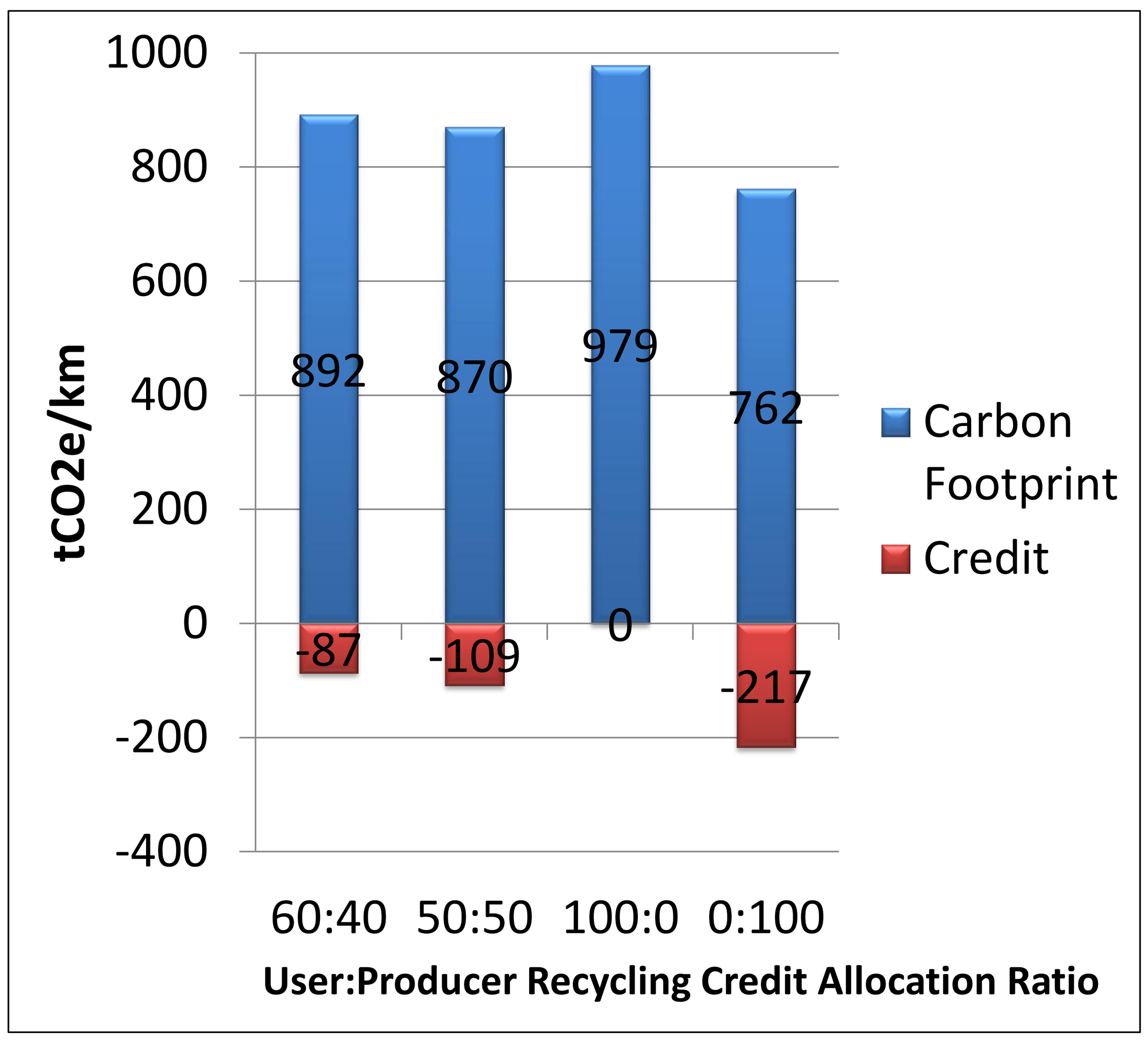

Figure 4: Embodied CO2e of the case study using different recycling credit ratios.

Relevance

The results have shown the sensitivity of CF results in the road pavements sector to methodological choices. This has demonstrated the importance of transparency to CF practitioners and decision makers, and the need to develop sector specifications for methodology.

For further work and detail see:

HUANG, Y., SPRAY, A. & PARRY, T. Sensitivity analysis of methodological choices in road pavement LCA. International Journal of Life Cycle Assessment, 2012.
DOI: 10.1007/s11367-012-0450-7
and other publications.

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