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STAKEHOLDER VIEWS OF MATERIALS SELECTION FOR ROAD PAVEMENTS

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Abstract

The growing prominence of Carbon calculators in the road construction sector has lead to a greater general awareness of the sustainability issues associated with road pavement materials and their selection. This paper presents results from a series of semi-structured interviews conducted with key stakeholders from the highways industry, which were used to gain an understanding of industry perceptions on the use of sustainability assessment in the selection of highway materials for road construction.

The stakeholders consulted ranged from government bodies and trade associations to contractors and academics. Analysis of the interviews has shown that there is a clear focus on Carbon/Climate change.

The frequency with which various topics were mentioned has been used in the analysis to produce a basic hierarchy of sustainability drivers for the highways industry. A comparison is also made against the existing civil engineering environmental quality assessment and award scheme (Ceequal) categories to identify gaps and areas of consensus to further enhance Ceequal. The paper concludes that several factors should be taken forward within any on-going development of LCA (Life Cycle Assessment) frameworks or Carbon assessment methodologies for road construction projects including, Carbon (footprinting)/Climate change, Maintenance phase considerations and broader Environmental Issues.

KEYWORDS

Sustainability, Road pavements, Materials

INTRODUCTION

It is estimated that there are now 6 million more vehicles on UK roads than in 1997 (Department for Transport, 2009a), indeed the Eddington Transport Study (2006) identified road congestion as a significant cost to the economy if left unchecked to the value of £22 billion. Recent trends in traffic management have seen an increase in the number of hard shoulder running schemes which advocate an overall reduction in environmental impacts.

Aside from policy drivers for a more sustainable highway (strategic road) network a transparent and accessible source of stakeholder opinion relating to specific drivers for materials selection in road construction is lacking. A series of semi-structured interviews were therefore conducted with 25 key stakeholders from the highways industry to gain an understanding of sustainability assessment in the selection of highway materials for road construction. Three key themes were investigated:

- The sustainability factors for road pavement maintenance and construction
- The issues relating to materials selection in road pavements, and
- Life cycle assessment based tools for materials selection.

The stakeholders consulted ranged from government bodies and trade associations to contractors and academics. In this paper, results are presented in a summary form, where the most frequently mentioned (top 5) issues are discussed and used in the analysis to produce a basic hierarchy of sustainability drivers for the road construction industry.

BACKGROUND

The last decade has seen a significant shift in consumer awareness relating to the environment in particular; climate change has moved from a controversial topic to being broadly accepted as being inevitable (IMechE, 2009). Carbon dioxide (hereafter referred to as Carbon) has been identified as one of the main contributors of Climate change as such more consumer facing sectors and products have had their Carbon footprint measured and displayed on the packaging with a view to reducing their Carbon footprint.

In line with this Carbon footprinting is becoming more common in the construction sector; figures for the embodied Carbon of materials (the amount of Carbon emitted by producing the item) can be downloaded readily from the internet (Hammond & Jones, 2008). The BRE Green Guide to Specification also cites the embodied Carbon of all building elements expressed in kg CO2 eq/m2 of construction material over a 60 year study period (Anderson et al, 2009). Numerous other organisations have their own Carbon calculators for projects, products or materials, such as the Environment Agency (EA, 2009), the Highways Agency (HA, 2009), and the International Road Federation (IRF, 2009).

METHODOLOGY

The research study consisted of 25 semi-structured interviews and focussed on three areas which were:

- What are the sustainability factors for road pavement maintenance and construction? What are the technical and functional aspects related to this and should these be taken into account in an LCA framework and if so to what extent?
- What are the issues relating to materials selection; what are the current and future drivers assessed during specification and procurement?
- What are the key issues relating to Life cycle assessment based tools for materials selection?
- The identified organisational types (Figure 1) represent a reasonable mix of the various groups of stakeholders within the highways construction sector.

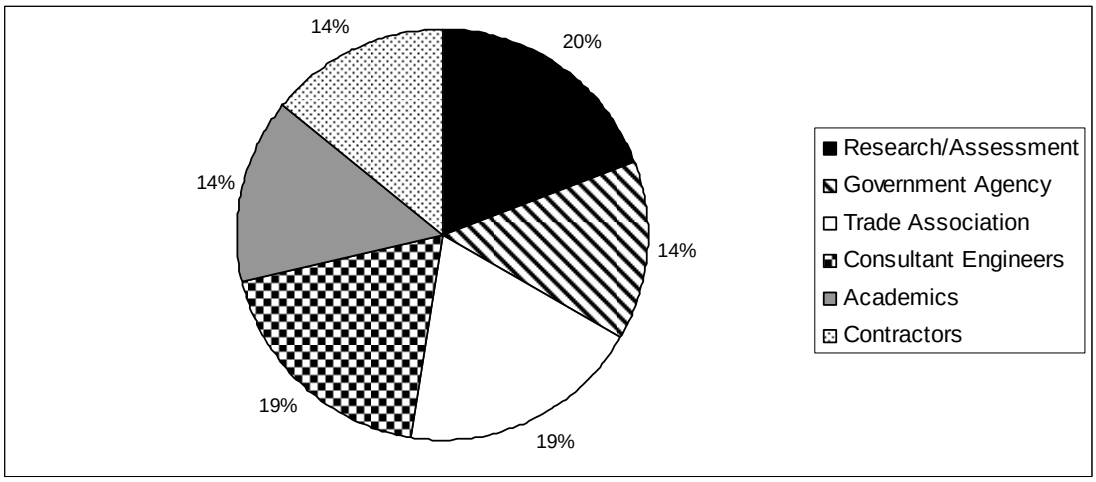


Figure 1: Breakdown of Interviewees' Backgrounds

RESULTS

This section presents the results of the interviews where the most mentioned issues (top 5) are presented for each of the three key themes investigated.

SUSTAINABILITY OF ROAD PAVEMENT CONSTRUCTION

The term sustainability evokes different meanings for different groups of people. The results clearly support this view with the top 5 sustainability issues relating to a range of both environmental issues and material attributes.

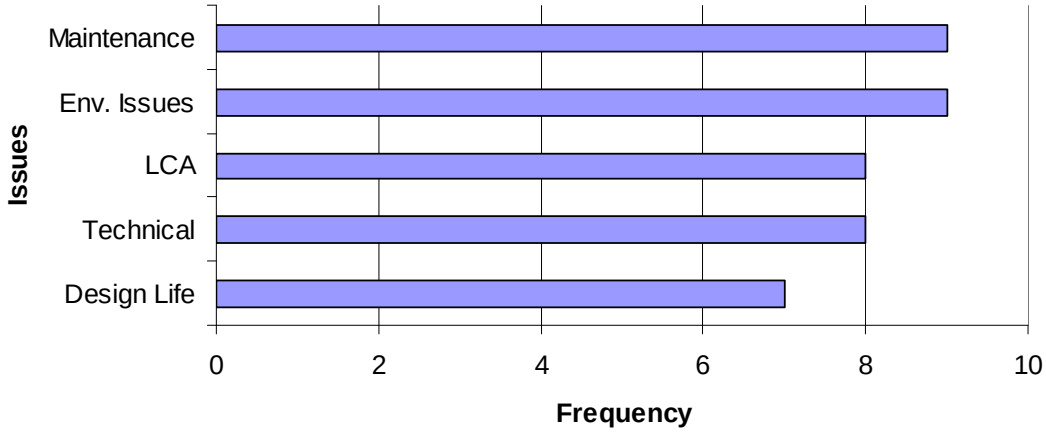


Figure 2: Frequency of Sustainability Issues for Road Pavement Construction

Figure 2 shows that both maintenance and environmental issues scored well whilst only three individuals mentioned both topics. Maintenance was mentioned by a range of stakeholders including academics, trade associations, contractors and consultant engineers. As would be expected a number of these respondents (5) also considered technical aspects important. The two are inexorably linked but have been kept separate because the cost of maintenance may be influenced by durability of the material, but without taking into account usage of the road pavement it would only present part of the picture.

MATERIALS SELECTION

Cost and Carbon/Climate change featured strongly in the results of this theme and material characteristics were also mentioned. As shown in Figure 3, Carbon/Climate change was deemed to be the most significant factor for materials selection with 10 out of the 25 participants mentioning this factor. Of those, three were from trade associations whilst the remainder (excluding 1 academic), had developed Carbon calculators or sustainability assessment tools.

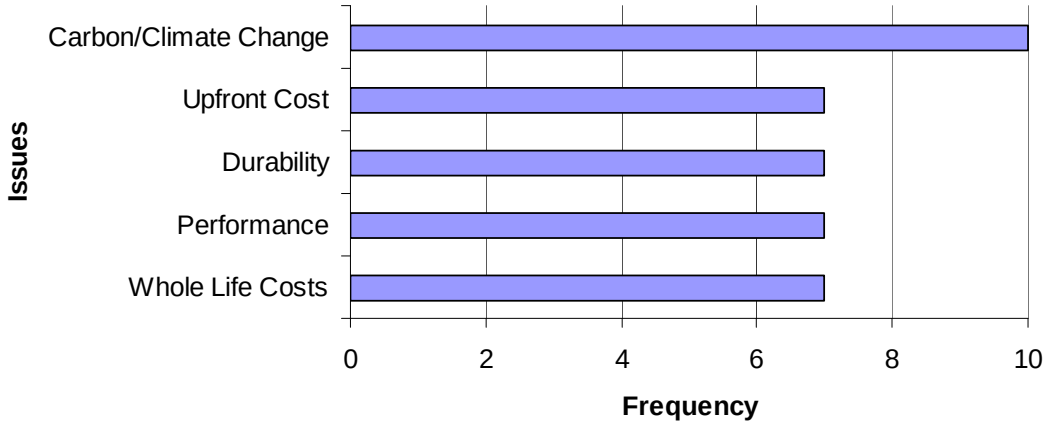


Figure 3: Frequency of relating to Materials Selection

LIFE CYCLE ASSESSMENT

The LCA (Life Cycle Assessment) theme provided a greater breadth of opinion. Figure 4 shows that over a third of the respondents (9) commented that confidence and transparency were important factors in the development of any LCA methodology. All nine had some degree of experience or knowledge about LCA and they represented all the stakeholder groups.

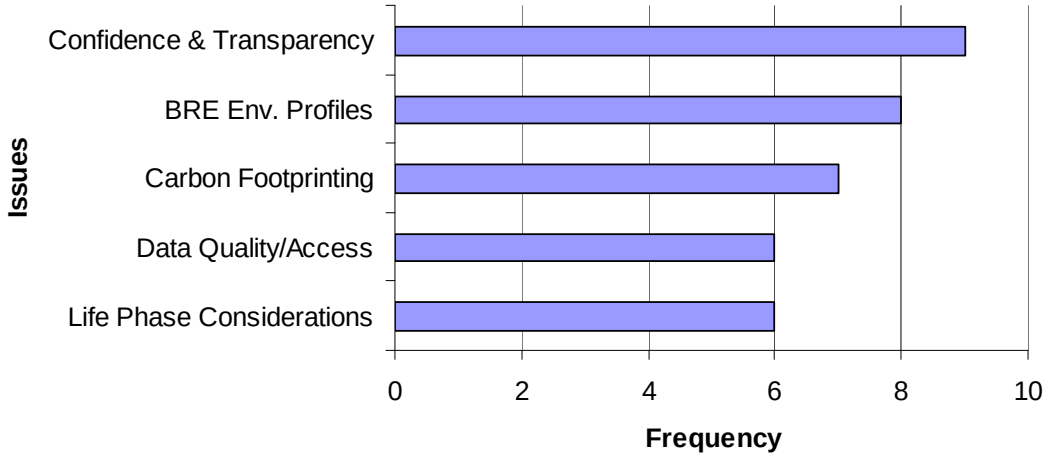


Figure 4: Frequency of LCA Issues for Road Pavement Construction

ANALYSIS AND DISCUSSION

The responses stimulated by the first theme were based on the broader sustainability issues connected to road pavements. Maintenance and LCA were mentioned most frequently; as the in-use phase of a road pavement is maintenance, it is reassuring that the participants understood the link between these variables. The issues associated with maintenance such as traffic management and disruption were not mentioned immediately; rather the environmental impacts of having slower vehicle movements and increased fuel consumption were discussed. The lack of any more specific impacts being mentioned is a possible reflection of government policy on Carbon, although the general level of environmental awareness has increased significantly from 10 years ago.

The second theme relating to key issues for material selection notably identified Carbon and cost. The segregation of embodied Carbon and whole life impacts was replicated with upfront cost and whole life cost. This is perhaps driven through the traditional type of contract where the contractor is concerned with immediate and certain aspects of the materials; more modern operational contracts will cause a shift in this type of thinking to longer term impacts for both Carbon and cost (contract type was also mentioned by a few individuals). When probing for issues related to materials selection a number of responses were more project focussed such as ‘social issues’ and ‘asset management’.

The third theme relating to LCA methodology prompted more politically charged responses and some controversial viewpoints. The credibility of data and transparency of the process was deemed to be very important as was the BRE Environmental Profiles methodology. Carbon footprinting was acknowledged as a key issue; the knowledge of LCA has been taken up by most sectors within industry and in part could be credited to the prominence of Carbon footprinting and its very public profile. Data quality and life phase considerations were also inherently linked to LCA.

In producing the hierarchy of drivers shown in Figure 5 the top five issues from the three themes were collated and similar issues amalgamated for clarity, (such as durability, specification and design life). Whilst still a significant factor monetary considerations are positioned below general environmental issues and material characteristics.

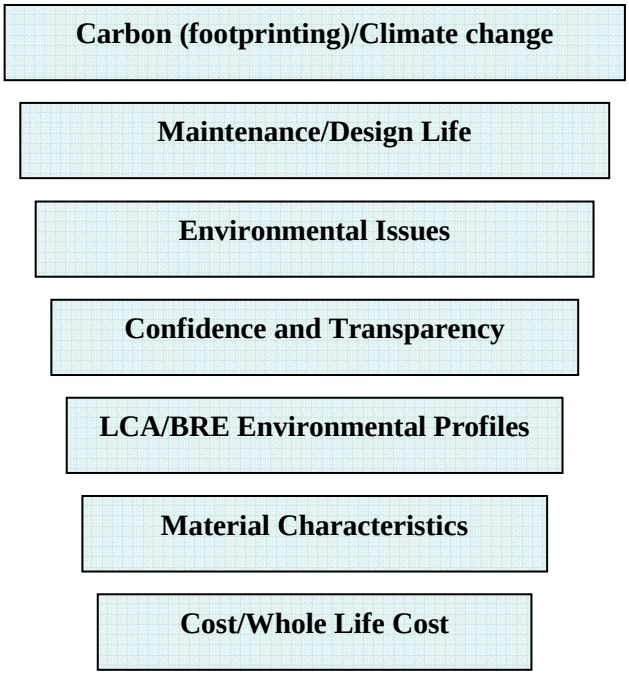


Figure 5: Hierarchy of Drivers

To what extent this hierarchy would manifest itself in practice as a hierarchy for decision making or procurement is debatable, practical experience might suggest that the hierarchy could be reversed at the point when money changes hands. There is an awareness and acceptance that LCA is a tool that can aid decision making, but it should play a role in informing a wider range of decisions and not end up being the process through which decisions are solely made.

CONCLUSIONS

The aim of this research was to examine the key issues relating to materials selection and road construction through a series of semi-structured interviews with key highways industry stakeholders. The objectives have been met through the investigation of three key themes:

Pavement Construction Sustainability
Materials Selection
Life Cycle Assessment

Environmental concerns have been identified as being the most important for materials selection in road construction projects but the range was limited and focused primarily on Carbon. Analysis and subsequent discussion of the findings has lead to a number of conclusions:

1. Maintenance issues and factors such as design life and durability are very important, associated to this was the issue of upfront cost and whole life costing. Stakeholders from a contracting background were more likely to raise concerns about cost.

2. The credibility and transparency of LCA and associated boundaries was seen as a problem. Any further work in this area needs to address these issues before actually seeking to simulate a LCA for road construction.

The results have highlighted that there is a need to develop a LCA framework for the understanding of broader environmental impacts that take into account the hierarchy of drivers identified through this research. Any further development of LCA for road construction should consider the impacts of climate change in relation to whole life Carbon; the design life of the material and how this influences the maintenance and in-use phase of the life cycle.

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