ENHANCING GREEN PRACTICE IN PUBLIC ROAD CONSTRUCTION PROCUREMENT

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ABSTRACT. Green practices and life cycle approach are increasingly adopted in the public construction of roads. One example is the Finnish pilot project 'Improvement of the Highway 9' carried out in 2005 by the Finnish Road Administration. In the 'Highway9' -project, the aim was to include life cycle aspects in the tender competition. This paper discusses these environmental aspects from the viewpoint of the basic principles and subsequent legislation of public procurement in the EU. Transport distance of materials is at the centre of the debate because it is an inherent part of the scientific method 'life cycle assessment' but due to the legal framework, it is not obvious that the offers can be valued in relation to the environmental burdens of transport without potentially causing a discrimination of some bidders. The 'Highway9' proposes, however, that environmental impacts of transport can be acceptable among the award criteria in road construction contracts.

INTRODUCTION

The Finnish Road Administration (Finnra) invests annually 280 M€[1] to ongoing road construction and improvement projects. During the years 2008 - 2011, this means 10 ongoing improvement projects. In addition, there are propositions for 20 other construction projects value of 1 200 M€ to the upcoming years (Tiefakta, 2008). Due to the large purchasing volume and the extensive responsibility for functional road network, the environmental impacts of construction works should be taken into

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account. One possibility is the green public procurement (GPP), i.e., formulating environmental requirements in the tendering process. Already in 1996, the Swedish Governmental Commission reported that the road sector and the construction sector were suitable for the introduction of green procurement (Faith-Ell, 2005). One of these efforts in Finland was the road maintenance procurement called 'Improvement of the Highway 9 between the towns Turku and Lieto', also called as 'Highway9' –pilot project, carried out by Finnra in the year 2005. The aim of the project was to include as many life cycle aspects as possible into the procurement criteria. An assessment tool (Meli) was developed in the Technical Research Centre of Finland (VTT) to determine environmental impacts of road construction and maintenance based on the life cycle approach (Korkiala-Tanttu et al, 2005). In public purchasing, there are four areas for the use of LCA: to learn about environmental aspects of the product, to fulfil requirements from customers, to set environmental requirements and to choose between alternatives (Hochschorner and Finnveden, 2004). Life cycle approach was seen important in the 'Highway9' –project in order to assess the environmental impacts of construction work and to enhance sustainable road construction practices. Life cycle considerations may also direct material use from virgin material towards recycled material (Korkiala-Tanttu et al., 2005). More generally, life cycle assessment provides possibilities to introduce innovations, new technical solutions, methods and systems where the performance requirements can also favor competition for environmental development (Sterner, 2002).

'Highway9' was the first time in Finland when the life cycle perspective was implemented to the real procurement of road construction work (Korkiala-Tanttu et al., 2005). The implementation of life cycle aspects into the procurement criteria was not, however, self evident. Public contracts at this magnitude are likely over the EU threshold value (5 150 000 €) and thus are covered by the EU purchasing directives. Although the directives allow requirements on materials, emissions, energy consumption, waste handling, and many other environmental considerations, they may also limit the environmental criteria applied in the call for tender. According to the directives, the possibilities to require environmental characteristics in technical specifications or award criteria exist only when these requirements concern the subject matter of the contract. The purchasing contract is thus covered by the Treaty principles of the free movement of goods and

services, notably the principle of non-discrimination. So the purchasing authorities are not free to impose requirements e.g., on transportation or production processes unless carefully thinking their relation to the subject matter of the contract (Directive 2004/18/EC). For example, the contracting authority can specify the way the goods are to be supplied and even the method of transport, however, making sure that the criteria are not discriminatory (EC 2004). For a major works contract it could be appropriate to require that goods be shipped by a rail or inland waterway facility. But a contract clause penalizing contractors solely on the basis of the distance they travel to deliver the goods would then be discriminatory (EC, 2004).

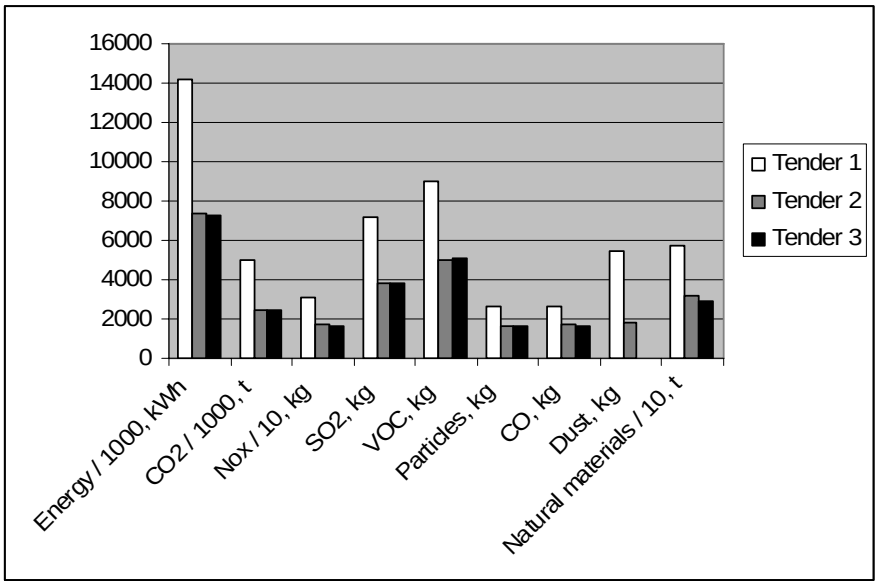
In the 'Highway9' –pilot project, the aim was to rehabilitate 14.2 kilometers of highway, including new asphalt concrete, reparations of three bridges and reparations of large settlements and unevenness. The project was carried out as a ‘design and build’ contract, where the design time for pavement structures was 20 years and for settlement actions 30 years. Exceptional to previous road construction purchases was that this project was a fixed price contract. This helped to simplify the comparison of the components e.g., costs, quality and environmental issues. The bidders competed on quality, minimum delay to the users due to the construction, and environmental impacts. The environmental impacts were given a share of 10 % in the award (Finnra, 2004).

In this paper, we discuss about the experiences in the pilot ‘Highway9’ where environmental aspects, including transport distance, were implemented as award criteria. First we discuss about environmental aspects in road construction and further the eco-efficiency in road construction procurement, which aims at providing cost savings and competitive advantage while also reducing the total environmental load of the construction work. The evaluation of eco-efficiency in the road construction procurement helped to find those environmental aspects that the procuring authority, i.e., Finnra, had the best possibilities to contribute through their purchasing. Finally, we focus on those environmental aspects that could, in principle, lead to a conflicting situation on the ground of the principles of the EU procurement directives.

ENVIRONMENTAL ASPECTS IN ROAD CONSTRUCTION

As stated in the call for tender of 'Highway9', the environmental impacts were evaluated based on the bidders' calculations by Meli - program, which was developed in the Technical Research Centre of Finland (VTT), and delivered to the bidders with user instructions. According to the Meli –program, major environmental impacts of road construction included the use of natural resources, energy consumption, waste, noise, dust, emissions to air (e.g., CO2, NOx, SO2) and emissions to soil and water (e.g., heavy metals, chlorides, sulphates) (Figure 1).

FIGURE 1
Total Environmental Loadings Of Different Tenders



Source: Korkiala-Tanttu et al. (2005).

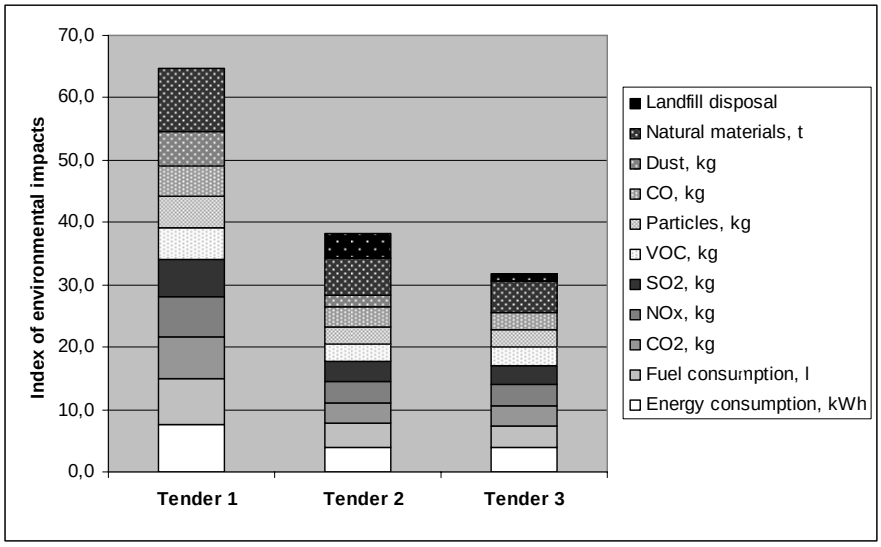
In the award phase, environmental quality points were given based on environmental loadings. The bidder that showed the lowest environmental impacts (Figure 2) was ranked with the highest points (Finnra, 2004). Major differences between the tenders occurred in the environmental loads of energy, CO_2, NO_x, SO_2, VOC, particles, CO, dust

and natural materials (Figure 2). Transport distance and noise did not have an important contribution to the order of superiority of the tenders.

In addition to the environmental impacts defined by the Meli – software (i.e., the award criteria), the procuring authority, Finnra, listed some additional environmental issues into the contractual terms, e.g.:

- The environmental principles that are followed should be stated in the quality system and must be sent to the purchaser for checking. The contractor must provide environmental reports relating to the construction work.
- Waste that is generated in the construction work should be separated into timber, concrete and other construction waste. Waste from the rest rooms must be gathered and delivered appropriately off the site.

FIGURE 2
Environmental Criteria In The Road Maintenance Construction Work And The Proportional Environmental Quality Points Of The Tenders



Source: Korkiala-Tanttu et al. (2005).

- Paints used in the road markings must be solvent-free. It is recommended that the fuel used in the machines is free from sulfur (< 0.005 p-%), hydraulic oil is biodegradable and that the suppliers join to the energy saving contracts in the transport sector.
- Several precautions concerning water and soil conservation must be followed in the construction work, e.g., special caution in the treatment of oils, fuels, bitumen, solvents and detrimental additives.

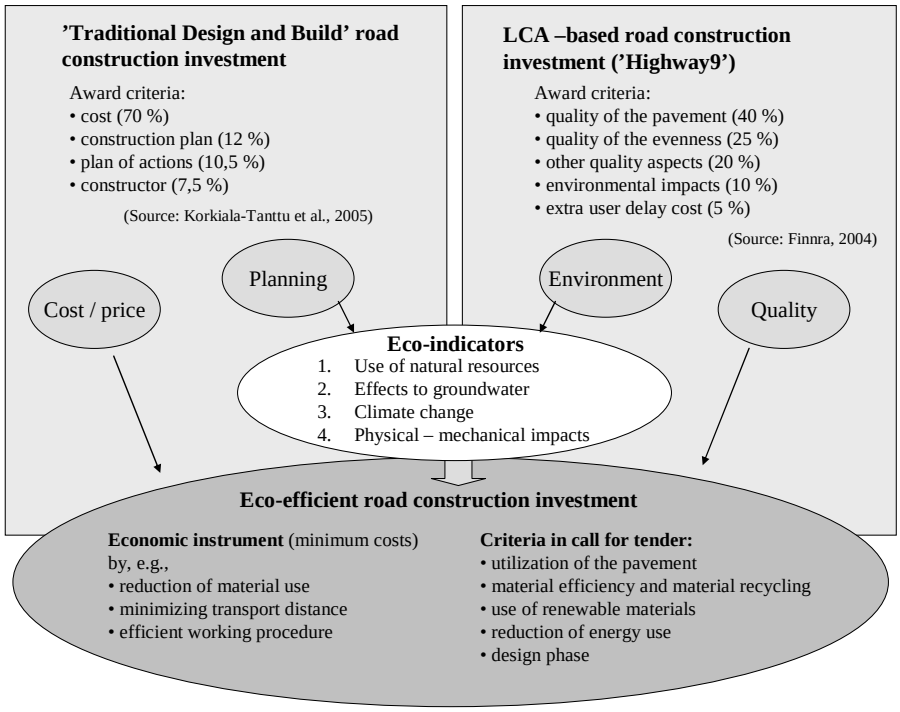
ECO-EFFICIENCY IN ROAD CONSTRUCTION PROJECTS

Life cycle approach was used as a basis for awarding the 'Highway9' tender competition. However, it was seen a bit problematic to commensurate the price, functioning, quality and environmental impacts, and thus the price was fixed. After the pilot 'Highway9', the Finnish Road Administration launched a new project where they focused on describing these factors more in-depth (Korkiala-Tanttu et al, 2006). The project was carried out in a co-operation of the Finnish Environment Institute (SYKE) and the Technical Research Centre of Finland (VTT) in 2006. Results of the study of eco-indicators in road construction indicated that the most important environmental impact classes in the road construction included (Korkiala-Tanttu et al., 2006):

1) Use of natural resources, e.g., natural gravel, bitumen and fossil fuels (28%).
2) Effects to ground water (as lower water quality) (15%).
3) Climate change, e.g., emissions from material production, machinery and transportation (14%).
4) Physical – mechanical impacts, e.g., local noise and turbulence (10%).

The study about eco-indicators in road construction, and the 'Highway9' –pilot were used as ground information when Finnra started yet another project in order to define the eco-efficient road construction procurement (Figure 3). In eco-efficient procurement, both the economical and environmental perspectives are considered. The major component in the awarding criteria in the 'traditional' road construction investment is the cost / price component. In addition, Finnra's

FIGURE 3
Eco-Efficient Road Construction Investment



procurement strategy underlines the consideration of environmental aspects in all phases of the project, i.e., from planning to construction (Tienpidon hankintastrategia, 2006). Criteria in LCA-based road construction investment, on the other hand, include quality and environmental aspects as most important award criteria. In Figure 3, the award criteria of a 'traditional design and build' investment and an 'LCA-based design and build' investment (i.e., 'Highway9') are illustrated, and completed to an eco-efficient road construction investment through the eco-indicators defined by Korkiala-Tanttu et al. (2006).

The eco-efficiency of road construction can be fostered by reducing the use of non-renewable raw materials, for example by increasing the material recycling as well as the use of reusable materials. Energy

consumption and emissions can be cut by optimization of logistic solutions, e.g., transport kilometers. Eco-efficiency can be enhanced also by using less energy consuming device and working methods. In addition, longer bidding and delivery time may allow the planning and implementation of procedures that increase the eco-efficiency of the project (Korkiala-Tanttu et al., 2007).

The idea behind the 'eco-efficient road construction investment' is that the environmental impacts of the tenders are not calculated (as it was done in the 'Highway9' project) but the requirements presented in the calls for tender, i.e., in the selection criteria, technical specifications, award criteria or contract clauses, will be selected so that they lead to the eco-efficient solutions. In other words, it is assumed that the supplier aims at making the best profit through minimization of costs (Figure 3). This would be acquired by decent use of materials, minimizing transportation, and by using efficient working procedure. It is considered that the cost-efficiency of these aspects increases also the eco-efficiency. Thus in the call for tender, it is important to focus on those award criteria, which the economic instrument will not steer. These include e.g., recycling of materials, utilization of the pavement, material efficiency, use of renewable materials, eco-efficiency considerations in the design phase, and the total use of energy (Korkiala-Tanttu et al., 2007).

DISCUSSION

The outcomes of Meli -software, i.e., the environmental criteria in the call for tender of 'Highway9', were straightforward except to the criteria 'transport distance'. Albeit transport distance is an important part of the environmental load effecting the global warming, it has been considered that it cannot be taken into account in the evaluation of tenders. This is due to the fact that it is not in accordance with the principle of free movement of goods and services in the EU (Directive2004/18/EC) and may lead to a discrimination of some bidders in the EU area. Indeed, this is justified in the procurement of products, but in the 'Highway9', it was considered that the transport distance was an essential measurement in the life cycle assessment and thus cannot be excluded from the life cycle consideration. The rationale for this was that the focus was actually not on the transport distance but on the environmental loads of transportation. It is also affected by the unit environmental loads of transport modes.

In the LCA-based purchasing, 'Highway9', the award criteria were based simply on environmental impacts and quality issues, whereas eco-efficiency in the road construction purchase aims at providing cost savings, and gaining competitive advantage while also reducing the total environmental impacts of construction work. The evaluation of eco-efficiency in the road construction procurement (Korkiala-Tanttu et al., 2007) was not focused solely on forming environmental impacts as purchasing criteria but to define those factors that the procuring authority, i.e., Finnra, had the best possibilities to contribute through their purchasing. According to their study, the recommended award criteria for eco-efficient road construction purchase include functionality and suitability of the construction, costs, and those environmental aspects that cannot directly be affected by economic efficiency or cost minimization, e.g., use of renewable materials and energy use. Thus, reduced material use, transport distance and efficient working manners were excluded from the advisable award criteria as they could, in principle, be affected by market activities. For example, transport function has a significant cost component: up to 50 % of the price of aggregates (e.g., gravel, sand and crushed stone) consists of transportation costs (SML, 2004). The study of eco-efficient road construction investment (Korkiala-Tanttu et al., 2007) proposes that the economic instrument – cost of transportation – will overcome the problems of transport distance and thus, it need not to be among the technical or award criteria. On the other hand, transport distance is an inherent part of the life-cycle analysis and the eco-efficiency evaluation of road construction work, and thus cannot automatically be dismissed from the award criteria that aim at an eco-efficient road construction.

In order to lower the cost of transport and to reduce the emissions of greenhouse gases, the extraction of soil and other materials should be provided locally. It seems obvious that the bidders, regardless of their location, use the shortest possible distance to provide the aggregates and other materials, and if possible, prefer to use materials that are from the region nearby. It is therefore unlike that the bidder closest to the construction site would get any additional benefit in the tender competition although the transport distance was presented as an award criterion. On the other hand, if the emissions from transport are included into the other criteria, e.g., in the CO_2 emissions, the environmental impacts of transport distance are then taken into account without explicitly stating the transport distance as a criterion.

However, there are cases in which long transport distances would be worthy for the supplier. First, aggregates are a scarce resource and material could be carried from a long distance in case the quarries locate far from the construction site. Another example is the policy instruments, e.g., taxes that could direct the transportation of aggregates towards more economically – but not environmentally – preferable solution. For example, there is a threat in certain parts of Sweden that aggregates will be exported to Sweden from Finland due to the Swedish tax on gravel and sand, which raise the price of aggregates (Finansdepartementet, 2003). In this case, the assumption that economic efficiency would lead to eco-efficiency and reduced environmental impacts, would not realize. Thus, it may be beneficial to explicitly state the criterion concerning environmental loads of transportation in the call for tender, albeit in the 'Highway9' –pilot project, transport distance was not in a crucial role when calculating the winning bid as the environmental impacts accounted only for 10 % of the total award points.

Based on the previous studies, it seems that there are at least three instruments which could steer the aspect of transport distance in public procurement. First, as assumed by Korkiala-Tanttu et al. (2007) markets could affect the aspect of transport distance so that it needs not to be stated as a criterion in the calls for tenders. Second, policy instruments like environmental taxes, could direct construction manners towards more environmentally sound direction. Third, criteria in public purchasing could work as a policy instrument. As discussed earlier, the use of transport distance as a technical or award criterion would pose the bidders at least to consider the options for different transport modes and location of quarries. On the other hand, the use of life-cycle assessment in the design phase preceding the tender competition phase could be an even more efficient way to direct the environmental performance of the supplier and the material selection in the construction work, i.e., planning the construction work based on the availability and environmental impacts of different materials.

CONCLUSIONS

Environmental performance is an important part of managing road construction investments. At the same time it ties up a large proportion of road construction costs. The life-cycle approach in the road construction investments would be important in gaining environmentally

sound procurement. In addition, environmental loads of transport are an inherent part of the life-cycle approach and thus should be possible to take into consideration also in the public procurement process.

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NOTES

1. During the years 2008 – 2011 the investments of ongoing road construction projects are estimated to 1 110 M€ (Tiefakta, 2008).

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