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Application of Life cycle cost analysis in rail transport

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Abstract The paper deals with the issue of life cycle cost analysis (LCC analysis) of rolling stock, which aims to optimize the cost of ownership, which can make up a large share of total costs. With the LCC application, you can identify all the important costs that you can use in the future in the rail economy. Further, you can get innovative resources and improve product quality by applying LCC analysis. The use of LCC analysis has begun to be used in both tendering and public procurement.

Key words LCC analysis, innovation, cost, rolling stock, data

1. LIFE CYCLE COST ANALYSIS

According to the technical standard (IEC 60300-3-3:2004), life cycle cost analysis is a process of economic analysis to assess the total cost of acquisition, ownership and settlement. Total cost of life cycle can be easily divided into 3 basic components.

LCC = Acquisition cost + Ownership cost + Disposal Cost

Based on a survey (questionnaire survey and interviews) among the leading manufacturers of rail vehicles, I found that LCC analysis in the Czech Republic is commonly used in this sector. If I look at customer requirements for LCC analysis across Europe, I can say that besides Baltic states (Estonia, Lithuania, Latvia) and Eastern Europe (Belarus, Moldova, Ukraine) this analysis is a common part of business offers.

Life Cycle Cost Analysis is intended to serve as an economic incentive for manufacturers to improve the quality of their products. In rail transport, where some rolling stock can be operated for up to 30 years, reliability and quality are crucial. However, the success of using product life cycle cost analysis requires close cooperation between the manufacturer and the customer. Therefore, it is very important that the customer carefully focus on the cost of ownership, which is not obvious at first sight. The cost of the rolling stock is not determinative. The costs of operation, maintenance and disposal are important. The total cost of ownership may be several times higher than its cost.

2. METHODOLOGY

In the frame of developing the LCC analysis model, it is important to first define (obtain) the basic input parameters (data), which are either directly based on the customer's requirements or are specified in the tender documentation. The customer decides on its scope. As the development of LCC analysis is complex and time-consuming, specially trained worker, called LCC specialist, who is responsible for it, must handle it. It is the correct and flawless preparation of the LCC analysis process that is very important as it can significantly influence its outcome in the selection of the customer. Subsequent processed output - LCC analysis is then part of the business offer.

A large amount of information and validated data is required to produce LCC analysis. The data is collected by an LCC specialist who receives it from each department. If we focused closely on individual inputs of LCC analysis, these would be the following basic areas:

- Technical specification of the vehicle (e.g. power, weight, capacity);
- Vehicle structure (elements of individual components);
- Vehicle operating conditions (e.g. durability, vehicle approach);
- Vehicle maintenance (e.g. preventive periodic maintenance, periodic technical inspections);
- Economic operating conditions (e.g. energy, track access prices, vehicle operator wages).

Rolling stock manufacturers have sufficient technical and cost data, but their use in LCC analysis can be problematic as the data may not be in the required volume or structure. They may also be outdated or unsuitable for the case.

The LCC analysis is important for the decision making process to choose the optimal variant from several possible solutions. With more information at the disposal the management can decide sooner and without stress. Experts call this process the probability of a proper decision in a systems control operation.

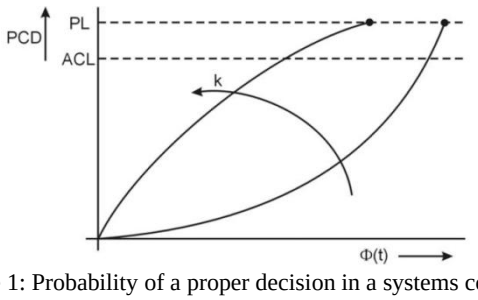

Figure 1: Probability of a proper decision in a systems control operation

PCD is the probability of a proper decision; PL is the possible (maximum) PCD probability level; ACL is the acceptable PCD level, Φ(t) is information flow k, and k is the level of knowledge, in the following function: PCD = F[Φ(t),k].

The research carried out in the companies producing the rolling stock shows that the most important cost items in the LCC analysis are the costs of preventive and corrective maintenance, and the cost of guarantees. It also includes vehicle acquisition costs, energy costs, fuel costs, wage costs, travel costs, cleaning costs, vehicle overheads, and vehicle disposal costs. It follows from the foregoing that these are all costs which are directly linked to the particular rolling stock in question and which are closely linked directly to the ownership and operation of the vehicle. The final cost structure is then agreed with the customer which costs are important for him.

2.1 Process of LCC analysis creation - flowchart

As already mentioned, the preparation of LCC analysis is financially and time consuming. Several departments within the whole company participate in its creation. These include, for example, the sales department, finance department, production, technical department, service department. The actual design of the LCC analysis is illustrated below, where the initial impulse is the customer's request for the LCC analysis. In the last stage, the final version analysis of the LCC is part of the offer and subsequently of the contract.

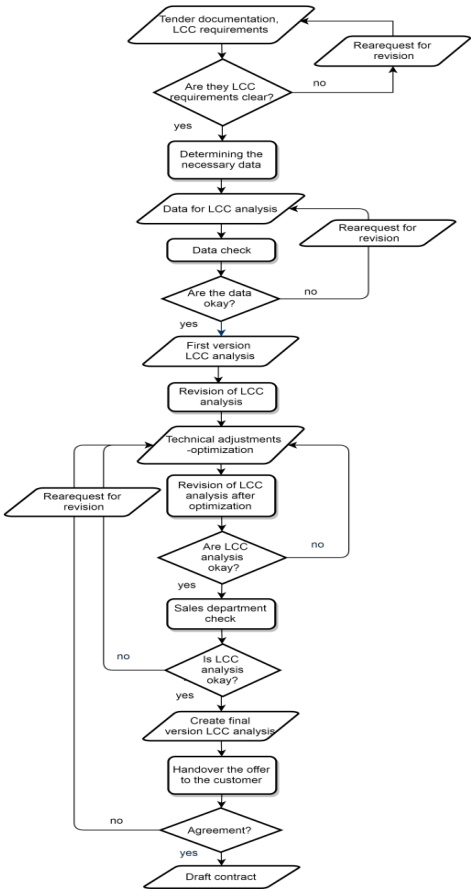

Figure 2: Process of LCC analysis creation

2.2 Rolling stock basic systems product breakdown structure

The Product breakdown structure is used to build the foundation of the LCC model. The figure below shows the basic decomposition of the rolling stock, and only its main parts. For each of these parts, the total costs from suppliers, including service demands, spare parts needs, etc. are collected.

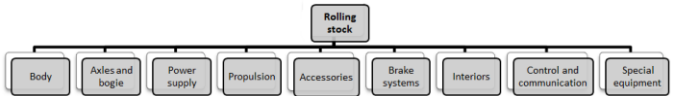

Figure 3: Rolling stock basic components

3. CONCLUSION

Life cycle cost analysis currently plays an important role in rail vehicle tenders. It is an integral part of the offer and the subsequent competition and contract. It is one of the important aspects for the final product selection. Customers have finally realized that the acquisition cost is often only a small proportion of the total cost of ownership. In the rail sector, where some rolling stock can be operated for up to 30 years, they can not only save considerable money, but also considerably worry about an unreliable product thanks to making of a detailed LCC analysis.

Life Cycle Cost Analysis is also intended to serve as an economic incentive for manufacturers to improve the reliability and quality of their products. The survey showed that its use does not only reduce the overall costs, but also activates the innovation effort, thus improving the technical and performance parameters.

Knowing the different stages of the product life cycle and the associated costs make it easier to make all strategic decisions before. LCC analysis contributes to a more efficient use of the company's internal resources and thus strengthens its competitiveness.

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