Rail Research UK (RRUK)

Research Theme B (Whole System Performance)

Whole System Cost Modelling - 13th December 2006

Notes of Plenary Session

The session got underway with delegates being asked to address the question, “how feasible is it to create a whole system cost model capable of illuminating the investment decisions for complex and technically innovative projects; for example, electrification of the Paddington to Exeter route using carbon fibre bodied rolling stock”?

It was agreed that creation of a model requires an understanding of the “hard” engineering issues, as well as what might be termed the “softer” economic and social ones. The view was expressed that the engineering aspects are in fact, easier to model accurately, because they are governed by physical laws; it is the softer issues that pose more of a problem. This resulted in a general feeling that the big difficulty is successfully bringing together the engineering and socio-economic worlds.

The problems of forecasting demand for rail services were discussed, with the early forecasting work done in support of the Eurostar service taken as an example. Many years ago, when Eurostar was in the planning phase, the idea was that through services would operate from the north and south west of England, instead of just London as is now the case. No one foresaw the subsequent introduction of the budget airlines, which siphoned off much of the anticipated demand for the north-of-London services and made the operation uneconomic. We still do not have a robust method for forecasting costs and prices on competing modes in the face of major, unforeseen changes like this. It is a significant problem for an industry whose long-term planning horizon stretches out to at least thirty years.

With regard to the economic aspects of modelling, the restricted availability and variable quality of railway cost data received a lot of attention. It was generally accepted that good cost data is required to support cross-industry decision-making, and the importance of having access to the best data sources for the achievement of good results was stressed. The commercially sensitive nature of the data often means, however, that even if it is available to researchers, they are constrained in terms of the results they can publish. This problem can be overcome to some extent by masking the identity of the companies taking part, while still allowing the key findings to emerge.

Costs as compared to prices were discussed, along with the difficulty of telling the difference between them. Often one company's price is another's cost. Access to good cost data can be further complicated by the unforeseen effect of financial incentives incorporated into things like franchising agreements. This can make it very difficult to identify reliable cost data.

A question was raised about the ability of a model to predict future costs when currently we do not really know why Train Operating Company (TOC) costs have risen by over 40% in the last three years. In response it was suggested that the TOCs are in fact, aware of many of the reasons for the increases that have occurred, and that wider dissemination of this information requires improved intra-industry communication. Cost models were welcomed as a good way of providing a structured basis for this communication to take place.

A "real world" example of the high costs of carrying out even relatively simple tasks on the railway was quoted to illustrate the part that non-technical aspects seem to play. The project concerned the installation of a switch on a lightly used line, where the purchase cost for the switch itself was in the region of £100,000. The total cost for the work, however, including installation amounted to £1.25 million. While the reasons for the high cost were not entirely clear, they seemed to relate to issues like insurances and the infrastructure owner's procedures for executing the work. The question was raised as to whether railways in the rest of Europe suffer the same sort of problems and whether this might be an area worthy of a benchmarking study.

Responding to the inexplicably high cost of the switch installation, it was suggested that much can be learned about cost growth by looking at a railway's history, to establish how practices have changed over time and the effect that the changes have had. This point was illustrated with regard to railways in the Netherlands, where maintenance costs have risen by 100% in the last 10 years, due to a variety of operational and organisational changes. Systems engineering theory has demonstrated that changes in large and complex systems often lead to emergent properties that can result in higher costs and again, it was felt that this would be an interesting field in which to attempt a benchmarking study.

A question was raised about whether, by focusing so closely on costs, we might be missing a bigger picture. Costs are certainly important, but today's railway has never been busier and the assets are working flat-out. Should we be surprised about the level of costs we are facing given these circumstances, and would it not be better to concentrate more on optimisation of resource allocation? This moved the discussion on to a consideration of the models themselves, together with lessons that can be learned from other industries.

With regard to the models, a question was raised about whether they can be applied effectively without first constructing a physical model of the system? The view was expressed that a full physical model was not necessary, and that models could be effective as long as they shed enough light on the relative difference between options to allow decision-makers to act. An alternative view was that, while understanding the relative differences was useful, this should not be used as an argument against the need to understand the fundamentals of a problem. The energy-based, empirical model of rolling contact fatigue (r.c.f.) was used to illustrate the point: it provides a useful decision-making tool for track engineers, but it is empirical and is not based on a fundamental understanding of the mechanics of the r.c.f. process.

A number of areas were identified where the railway could benefit from the experiences of other industries. Greater use of risk analysis as employed by the oil and gas industry was suggested. Railways in the Netherlands have had good results in this area, with risk analysis helping to bring reality to their cost models. Another option was parametric estimating as used by the aerospace industry; it is already used in the UK to estimate rail project costs, but could it be employed more widely? Another suggestion was adoption of the sort of performance-based approach used in the United States, or the proactive maintenance approach used on Germany’s railways, where, for example, maintenance activities are based directly on the output from instrumented wheelsets.

The plenary session wrapped up with the final thought that, while a lot of work still remains to be done, we should take heart from the large amount of progress that has been achieved in the last 3 years.