

Abstract

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Modelling Intermodal Freight Transport The Potential of Combined Transport in Sweden

Intermodal transport between road and rail, also known as combined transport, has received a large interest in recent years as part of a possible solution for a sustainable and efficient transport system. However, there has been a lack of tools to evaluate the potential in intermodal transport and of help in designing a competitive intermodal transport system.

The aim of this thesis was to develop a general, large-scale model for strategic modelling of intermodal transport between road and rail. The model is called The Heuristics Intermodal Transport Model, or the HIT-model. The model is a heuristic model and it takes its starting point in a competitive situation between traditional all-road transport and intermodal transport, where the theoretical potential of intermodal transport is determined by how well it performs in comparison with all-road transport. The model can also be used as a tool to calculate the costs and environmental effects of a given transport system.

A transport buyer is supposed to select the mode of transport offering the best combination of transport quality, cost, and environmental effects. Intermodal transport is also required to match, or outperform, the delivery times offered by all-road transport. Given a demand for transport, the model determines the most appropriate modal split, sets train time tables, type and number of trains, number of rail cars, type of load carriers, etc. and calculates business economic costs, social economic costs and the environmental effects of the transport system. The heuristics can further be controlled by a number of control parameters to adjust the behaviour and modal choice of the model. The model is flexible and can be used to test different suggested system layouts, conduct sensitivity analyses, and to test the effect of the intermodal transport system on specific factors, e.g. changed taxes, regulations or infrastructure investments. The model is useful for both large scale national transport systems and small individual transport systems. The model is programmed in C++ and the model size is only limited by available computer memory. Output from the model is the modal choice for each demand occurrence with departure time, arrival time, train departure used, position on train, type of lorry used, number of lorries used, business economic cost, social economic cost, environmental impact (CO₂, CO, SO₂, NO_x, PM, HC, energy consumption and a monetary estimation). If all-road transport is selected, the model also shows the reason why intermodal transport could not be selected (e.g. violated time constraint, economic constraint, etc.). The suggested train system is output with time tables, train lengths, business economic costs, social economic costs and environmental impact.

As a sub-aim, the potential of intermodal road-rail transport in Sweden was determined using the HIT-model. An input data set was developed, which included building a national demand database and calculating operational costs and cost structures for the transport system. Intermodal transport was found to have a large potential in Sweden. Business economic costs and social economic costs can be lowered and environmental effects can be mitigated by using more intermodal road-rail transport. It can also be seen that intermodal transport, almost always, is economically competitive, if the transport distance is long enough. Thus, the main challenge for intermodal transport is not cost, but achieving competitive pick-up and delivery times compared with all-road transport.

Keywords: Intermodal transport, Combined transport, Modelling, Freight transport, Sweden, Potential, Heuristics, Environment

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