Journal of Computational Science 3 (2012) 216–227

Contents lists available at SciVerse ScienceDirect

Journal of Computational Science

journal homepage: www.elsevier.com/locate/jocs

Towards governance on noise between municipality and terminal operator by the use of simulation modelling

J.H.R. van Duin[a,*], R.E.C.M. van der Heijden[b,1]

[a] Delft University of Technology, Faculty Technology, Policy & Management, Section Transport & Logistics, Jaffalaan 5, 2628 BX Delft, The Netherlands
[b] Radboud University Nijmegen, Nijmegen School of Management, Thomas van Aquinostraat 5, 6500 HK Nijmegen, The Netherlands

ARTICLE INFO

Article history:
Received 27 April 2011
Received in revised form 27 February 2012
Accepted 1 March 2012
Available online 22 March 2012

Keywords:
Barge terminal
Simulation
Noise
Environmental planning
Urban planning

ABSTRACT

The development of multimodal transport terminals in urban areas generates various serious environmental problems. The available tools for the analyses of the use of such terminals offer insufficient support for decision-making on the location and design of these terminals from the sustainability perspective. New approaches are needed. This article contributes to satisfy this need, triggered by the planning of a new Barge Terminal in the Dutch city of Tilburg (BTT). Presently, the existing terminal in Tilburg is operating near full capacity and the construction of a new terminal is considered the best strategy to cope with steady growth. The main question concerns the optimal design of the new barge terminal to offer a high operational performance, however without exceeding the environmental quality standards, in particular noise. The article presents a simulation approach to assist in the process of finding a balance between the operational performance and the noise effects of alternative designs of the new terminal.
© 2012 Elsevier B.V. All rights reserved.

1. Container barge transport in urban sceneries

Today's tendency to develop an urban policy in favour of sustainable development also affects the urban freight transport system. Urban freight transport tends to follow its own economic rationality and often does not seem sensitive to policy interventions. Examples of this urban economic rationality are found in Holguin-Veras [1] and Quak [2] where the limited effect of a policy measure pricing scheme is demonstrated by imperfections in the freight transport market due to contractual limitations and poor interaction between different actors. A key problem to implementing a feasible strategy for sustainability is determining the parameters of impact measurement (e.g. geographical scale, environmental and social impacts, etc.), and inertia for impact assessment. Banister [3] notes that consistency between policy measures and integrated policy-making across different sectors is a key element in making sustainable mobility publicly acceptable. Diverging interests, multiple actors and different institutions create an inertia which makes it extremely difficult to achieve a workable, acceptable set of targets, actions and measures which will result in more sustainable cities.

More and more cities explicitly address the contribution of barge terminals to a sustainable urban development. The embedding of terminals into urban sceneries is not just a matter of technical and physical specifications of its elements, like the crane capacities, the location of the harbour and the connections to the main roads. Policy makers necessarily have to take into account the whole urban context. Before taking such policy decisions, public policy makers need to know the potential consequences of the accommodated operational logistical processes on the environmental quality. At the same time, the logistical operators need to know the consequences of policy measures on the costs and efficiency of their operations.

In exploring the consequences of logistical processes for the environment, problems do not present themselves to the 'problem solvers' in a clear and obvious setting. They must be constructed from incomplete information on problematic situations which are puzzling, troubling, and uncertain ([4], pp. 39–40). As Kohn et al. [5] argues, many unique factors play a role in this context. They stress that it is critical for logistics managers to in-depth understand the strategic issues facing their firms and their companies' strategic responses to those issues. Therefore, we need to 'think around' a problem; we redefine it a few times, we mentally simulate some of the possible outcomes from possible courses of action, we try to make sense of the situation [6].

In this context it has been frequently argued [7] that dedicated models quantifying logistical as well as environmental effects provide more insight for every specific actor involved. This might lead to adjustments of the actors' perceptions, since the outcomes of the

* Corresponding author. Tel.: +31 152781142.
E-mail addresses: j.h.r.vanduin@tudelft.nl (J.H.R. van Duin), r.vanderheijden@fm.ru.nl (R.E.C.M. van der Heijden).
[1] Tel.: +31 243612099.

1877-7503/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
doi:10.1016/j.jocs.2012.03.001

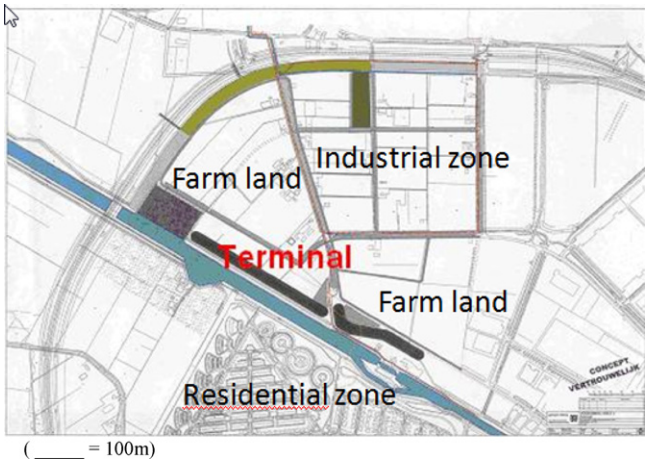

Fig. 1. Potential location of the new barge terminal (Municipality of Tilburg, 2005).

dedicated models can objectify or reduce uncertainty with respect to the outcomes as perceived by the actors. On the other hand, the outcomes of the dedicated models might also lead to adjustments of the logistics concept which then will correspond more closely to the desired outcomes of the actors. Methodologies used to develop such integrative assessment models include interviews and meetings of stakeholders, field research and empirical measurements, operational flow design and modelling and the analysis of outcomes.

As an illustration of this way of working in this article we report on a case study on the design and location of a new terminal. The Barge Terminal Tilburg (BTT), located in the city of Tilburg since 1998, is one of the most successful inland intermodal transport container terminals in the Netherlands. Currently, this container terminal is operating near full capacity with an annual throughput volume of 85,000 TEU. With an annual growth rate of 5% on average in waterway transport the existing terminal will be short of handling capacity in the near future. Since terminal expansion is not possible at the current location, plans for constructing a new terminal are being prepared.

Fig. 1 shows the potential location of the new terminal located at the banks of the canal Wilhelminakanaal. The municipality has offered a new location which is the only candidate site, a situation that often occurs in densely built urban environments where space of a certain quality and size is scarce. The site borders to an ecological zone (Farm land); the protective status of this zone has been strengthened in recent years. Southwards, at the other side of the canal, a residential zone is located. Since the distance from the residential zone to the terminal is relatively small, most of the residents will be affected by the noise from the terminal if no noise protection measures are taken. Studies based on cross-sectional data analysis on (road traffic) noise have for example shown that exposure to noise increases the risk of myocardial infarction and total ischemic heart disease [8]. Dedicated analyses show that operations at this location will not violate external safety standards.

The municipality believes that the design of a new, large terminal can solve the capacity problems in the future. However, the municipality is also concerned about the living environment around the terminal. In particular an increased noise level in the neighbourhood is not acceptable. In policy practice of terminals the consequence of noise are seldom foreseen, although at the start of a terminal project an environmental impact assessment is executed to visualize the environmental consequences (including noise). Operating terminals nevertheless appear to be confronted with noise constraints after a while, notably when they start growing in their volumes. Recent examples of these practices are found in the Netherlands at the inland terminal Alpherium [9] and the inland terminal of Wanssum [10]. In case of the terminal Alpherium, terminal manager asked the municipality for permission to operate night shifts since many ships arrive after 11.00 pm. People living in adjacent neighbourhoods forced the municipality not to give this permit. Also the authorities at the Provincial level concluded, after having received the outcomes of the real noise measurements, that the noise-constraints are permanently and significantly exceeded. The Province threatened to raise high penalties in case the terminal continues with the current noise production at night.

These examples illustrate an issue in practice that needs a well elaborated governance approach. The aim of this article is to illustrate an analytical approach to support local decision making by systematically increasing awareness of the consequences of optional policy measures (in this case the noise constraints) on the logistical operations of the new terminal. The analytical approach significantly contributes to the required governance approach. The main research question underlying this study was "*How to find a balance between the operational issues and the noise effects of alternative designs of the new terminal and how to evaluate the performance of these alternatives*?"

This article follows the modelling paradigm of Sargent ([11], p. 170) which shows the processes of developing system theories and simulation models, and relates verification and validation to both of these processes. First Section 2 explores the literature on intermodal transportation followed by the description of the first process step of the paradigm concerning the definition of the conceptual model. Section 3 presents the second step of the paradigm, the specification and validation of the simulation model. Section 4 elaborates on the issues of noise, resulting in the specification of potential noise reduction measures. Section 5 describes the last step of the paradigm showing the results of the experiments with noise reductions and growth scenarios. Section 6 ends with some conclusions and reflects on the role of the simulation model in the policy making process.

2. Towards a conceptual model of a barge terminal

This section gives a short literature review on intermodal transport and develops a conceptual model of the terminal operations.

2.1. Literature review on intermodal (barge) transport

The dominant focus in intermodal research is on the socio-economic impacts of the shift from truck transport to intermodal transport (e.g. [12–16]). From these studies we learn that intermodal transport research requires a multi-disciplinary approach. The review also shows that the structure and complexity of intermodal problems demand further development of operations research techniques. Especially, models which can better deal with the complexity of intermodal problems are required. The complexity for research is shaped by the application of logistic, economic, management and policy theory and methods in relation to the operational parts of the intermodal chain [17,18].

From a policy making perspective, policy makers search for effective measures for improving the structure and/or the use of infrastructure networks. They like to know the effects of certain measures before taking the decisions. For instance road pricing measures can have positive effects on the usage of intermodal transport services. For this type of problems, spatial price equilibrium models and network models have been developed in the past. These types of models, however, have been developed for one mode only and cannot deal with intermodal flows [19–25] have developed network models that are capable of dealing with intermodal

Download English Version:

https://daneshyari.com/en/article/429447

Download Persian Version:

https://daneshyari.com/article/429447

Daneshyari.com