City Logistics and the Cities Network

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The purpose of this document is to provide a brief overview of the topic matter presented at the *Cities Network – Transport Working Group* meeting held on 23 July 2003, Buffalo City. The focus of the discussion is the emerging concept of *City Logistics* to improve the mobility of cities, and the research opportunity that we see, at the Department of Industrial and Systems Engineering at the University of Pretoria, to contribute to local governments.

1 City Logistics

The concept of *City logistics* has emerged to address a new area in transport planning. The objective of the concept is to support the sustainable development of cities and to address challenging problems such as high levels of traffic congestion, negative environmental impacts, high energy consumption and a shortage of trained labour.*City logistics* is the process of totally optimizing urban logistics activities by considering the social, environmental, economic, financial and energy impacts of urban freight movement.

Figure 1 illustrates the system boundaries that occur in improvement initiatives, which is an innovative view of the urban transport environment. The purpose of the framework is to *pitch* the initiatives that cities initiate with regards to urban freight (or public transport). The stakeholders are the *clients* of the improvement initiative. The community, or *residents*, are the people that live, work, shop, and entertain in the metropolitan areas. Their objectives include minimizing traffic congestion, noise, air pollution due to traffic, and traffic accidents. Residents do not welcome large freight carrying vehicles in residential areas. Nevertheless, these carriers are required; residents have an expectation to receive their commodities at convenience stores scattered all over residential areas.

Carriers represent both public and private stakeholders executing the logistic and distribution functions. The *cargo* is not limited to freight, but also encompasses passengers in the form of public transport.

Shippers are the customers of carriers, and often receive (or send) goods

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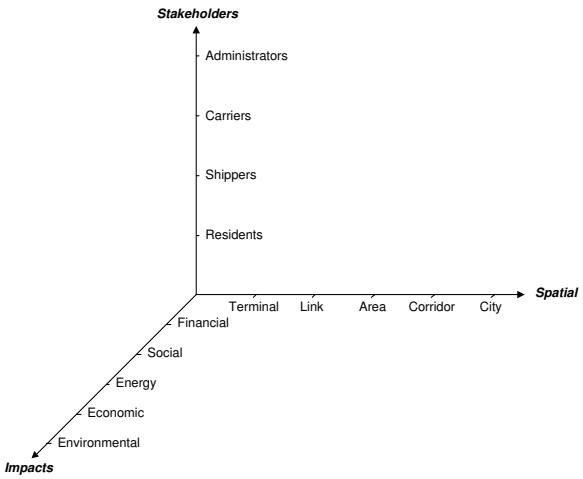

Figure 1: The *City Logistics* system boundaries

from (to) other shippers, or residents. Examples of shippers include manufacturing plants, wholesale and retail outlets, and mail centers. The objective of the shippers is to maximize their level of service, which can be a function of cost, reliability, and/or traceability. Shippers place requirements on carriers for specific collection and delivery times. These requirements are referred to as time windows.

Administrators represent local, provincial, and national government whose objective is to resolve conflict between stakeholders involved in urban freight transport, while facilitating sustainable development of urban areas. Transport authorities are responsible for planning, coordination, implementing, monitoring, funding and applying law-enforcement of land transport in provincial and local government spheres.

It is appropriate to distinguish between the various *impacts* that the transport network and infrastructure can have on the stakeholders.

- *Financial* impacts relate to, but is not limited to, commuting costs for residents; the payback period of investments that shippers consider making in establishing facilities in new locations; fuel and fleet costs for shippers; and *internal rate of return* (IRR) for administrators investing in public transport capacity such as train wagons and busses.
- *Social* impacts relate to equity for various user and non-user groups of transport, and could include the impact of accidents, accessibility to transport, or even business competition in the case of taxi operators servicing the same area.
- *Economic* impacts are more comprehensive than financial impacts.

Cost benefit analysis does not simply focus on the immediate financial implications, but rather the viability of a transport scheme over the period of the scheme's entire life. *Costs* could include the upfront acquisition of capital equipment and maintenance costs throughout the operational life, while *benefits* could represent the reduced travel times experienced by commuters or reduced fleet operating costs experienced by carriers on items such as consumables and maintenance.

- *Energy* conservation is becoming more important since there is a limited amount of natural resources. Petroleum and automotive diesel oil are the two main sources of energy for the transport industry. *City Logistics* initiatives, such as *route optimization*, could potentially reduce the total amount of fuel consumed by freight and public transport vehicles, if the objective of the exercise is to reduce route lengths.

- *Environmental* effects pose a direct risk on human health. Noise pollution is also an area of concern, especially in urban areas.

To be able to limit the scope of an investigation or optimization exercise, the system boundaries introduce a third *spatial* boundary to the transport system, as figure 1 indicates. A *terminal* refers to a single location, node, or venue, in the transport system, for example a distribution center or a bus stop. The infrastructure along which carriers move between two terminals are referred to as a *link*. Examples could include a bus route between two stops, or a segment of rail track between two stations. Multiple links make up an *area*, for example Centurion in Gauteng. A *corridor* refers to a number of directly-connected areas. The Mabopane-Centurion corridor would serve as an example. It is significant to distinguish between the various spatial elements, as each element holds unique improvement opportunities.

Using such a framework assist decision makers to limit the scope of an initiative, and thereby increase the awareness of *how* such an initiative could be evaluated. Once the scope has been determined, appropriate modelling techniques could be evaluated. It was again emphasized at the recent 3^{rd} *International Conference on City Logistics* that the modelling techniques *must* be appropriate, irrespective of whether they are qualitative of quantitative in nature. Figure 1 indicates the significance of ensuring that a model is appropriate before continuing to obtain solutions. The end leg, that of interpreting the solutions into feasible, implementable decisions, is as important. We use an interesting *Dynamic Actor Network Analysis* (DANA) tool to model the *perceptions* of stakeholders in a city logistics initiative, to comprehend, and appreciate, the underlying perceptions with regards to the initiative, and also other stakeholders, when considering appropriate models and actions, once the solutions are to be implemented.

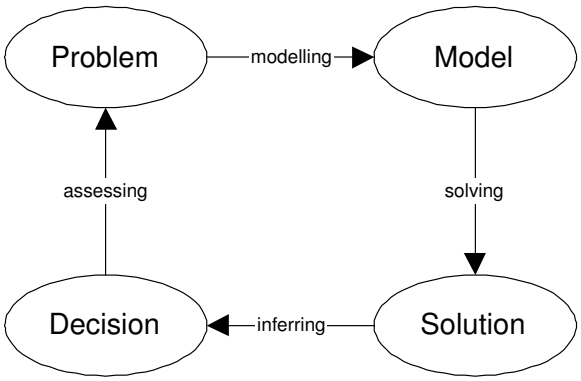

Figure 2: Problem solving life-cycle

2 Initiatives

The Department of Industrial and Systems Engineering at the University has a working relationship with *icomtek*, CSIR, to establish and promote a *Logistics Center of Excellence*. The collaborative initiative has been invited to become a consortium partner within the 6^{th} European Framework Programme. The consortium, known as *Best Urban Freight Systems* (BestUFS)[2] have since had their proposal accepted, providing an open door for us to international benchmarks and close working relationships. The research capacity that we have established in the field of logistics also have good working relationships with Georgia Tech, and TU\e (Eindhoven); both institutions of high regard with regards to logistics research.

We have, between the Department of Industrial Engineering and *icomtek*, a well-established modelling capability at various levels. At an undergraduate level we have outstanding final year projects. One of our undergraduate students have recently been awarded the first prize (at honours level) of the *SAS \ Operations Research Society of South Africa's* student competition. Any City Network member is more than welcome to attend the annual final year projects evening, I would gladly forward an invitation. The evening is a prestigious event and a showcase of what the undergraduates are capable of when leaving for industry. Every year we are overwhelmed by industry (and to a lesser extent the public sector) to have students doing their final year projects on specific problems. This is a very good opportunity to utilize research capacity, and I would urge you to please make contact if you have potential projects. I would be more than willing to give more detailed brief of project opportunities.

We are enthusiastic and excited about the amount of synergy that exist

[2]http://www.bestufs.net

between ourselves and the Cities Network's Transport Group. Modelling, simulation, and the more recent *Intelligent Transportation Systems* (ITS) and *Advanced Planning and Operations* (APO), are areas in which we can contribute to a great extent.

I would like to mention some of the activities and initiatives that were mentioned at the meeting where we could potentially add direct value through research projects. This include *KPI*'s for transport, economic development and the role of transport (with reference to *City Logistics*), modelling emissions, a quality service charter for public transport, to name but a few.

I believe it is also appropriate to clearly state our *modus operandi* and motives for contacting the Transport Working Group in the first place. We have no real intention to participate and compete with other consultants for projects, unless that is the only way through which we can contribute in terms of value-add. Our main interest is building a *track record* for the Logistics Center of Excellence through projects that have proved to add value (or reduce cost). From a funding point of view, we are in a totally different position than most consultants in that we have access to research funding that consultants don't have, which puts us at an unfair advantage anyway, in terms of costing.

THRIP is one such mechanism through which we as a Department have had great success with. *Department of Trade and Industry* (DTI) funds 50% of the project, while an industry partners provides the other 50%, which need not even be in actual cash, but rather rand value. The *National Research Foundation* (NRF) is another mechanism of research funding, especially if the public sector benefits, as a matter of fact. Being consortium partners within the European $FP6$ programme opens up numerous funding opportunities from the *Department of Science and Technology*. And lastly we also have the *Automotive Industry Development Center* (AIDC) sponsored academic chair in Automotive Manufacturing, Prof. Johan Strasheim, established in our Department.

Please be assured of our best intentions, and the highest quality of research outputs. We *are* going to execute and deliver on research projects, and I, specifically, would be disappointed if, in the processes of achieving our results, did not add value to our local governments. Quality research will happen, and I hope you utilize the benefit.

Being directly involved in both the Department of Industrial and Systems Engineering, and at *icomtek*, I would like to thank you again on behalf of both institutions for the opportunity given to introduce ourselves.