

Extended Gates

- System for sustainable heavy goods vehicles through the city core - feasibility study
Port of Gothenburg



Project within: Transport Efficiency

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Content

1. Executive summary	3
2. Background	3
3. Objective	5
4. Project realization	5
5. Results and deliverables	5
5.1 Delivery to FFI goals	6
6. Dissemination and publications	7
6.1 Knowledge and results dissemination	7
6.2 Publications	7
7. Conclusions and future research	7
8. Participating parties and contact person	8

FFI in short

FFI is a partnership between the Swedish government and automotive industry for joint funding of research, innovation and development concentrating on Climate & Environment and Safety. FFI has R&D activities worth approx. €100 million per year, of which half is governmental funding. The background to the investment is that development within road transportation and Swedish automotive industry has big impact for growth. FFI will contribute to the following main goals: Reducing the environmental impact of transport, reducing the number killed and injured in traffic and Strengthening international competitiveness. Currently there are five collaboration programs: **Vehicle Development, Transport Efficiency, Vehicle and Traffic Safety, Energy & Environment and Sustainable Production Technology.**

For more information: www.vinnova.se/ffi



1. Executive summary

The feasibility study is an analysis of one of the many variations on the design and operation of a system with an extended gate.

The reported analysis is not based on the needs of new technologies or systems. Supporting assumptions for the outcome of the analysis is that the operating system manages to avoid the queues at the Extended Gate terminal, and that the actual volumes allow fully loaded shuttles in both directions.

The solution with the best performance with regard to financial and environmental parameters require permission to express HCT6 vehicles on Hisingsleden between the port and Skändlakrysset, which is 19 km north of the port.

Based on the reported assumptions and calculations, we find no reason to reject the proposal of an Extended gate as a way to achieve the following:

- Reduced number of vehicle movements and mileage with heavy trucks on the roads through the urban area.
- Reduced emissions of CO₂ and NO_x linked to road transport to and from the port of Gothenburg
- Reduced costs and the 'turn-around' times for lorries delivering or collecting containers in Port of Gothenburg
- Increased capacity of the port to receive and dispatch containers, reduced waiting times for trucks

Ability to establish a permanent flow of shuttles that can be used as a Living Lab for automotive and infrastructure development.

2. Background

Truck transport to and from cargo terminals in urban locations pose a significant environmental disturbance to the growing cities around the world.



Figure 1 Summary of challenges and conflicts

This applies especially to cities with ports that have trans-ocean vessels calling and short sea RoRo traffic. These types of ships generate large land-based freight flows to and from the port's hinterland, the transport largely done by trucks. Despite some successful development of rail shuttles to and from ports there is a steady increase in truck traffic. This traffic causes problems for the development of the cities that are growing because of the urbanization and therefore encounter problems with traffic noise, air emissions, congestion, and barrier effects. A need to simultaneously meet the need for increased flows of import and export cargo through the port and the city's responsibility for the environment and traffic creates a demand for innovative solutions for sustainable transport through the urban area. As examples of the problems that need to be addressed, the following have been identified as most prominent:

- traffic noise and congestion effects from trucks along the highways through the city core
- time-pressed drivers, that drives heavy vehicles at high speeds in city traffic
- emissions of NOx and particles that contributes to air quality problems
- increasing demand for land dedicated to the ports operations and related logistics and service activities
- unregulated parking in the vicinity of ports of trucks waiting for transport assignments

- Complex relation of responsibilities between the stakeholders, ie, the City, port companies, logistics companies, national transport administrations, which requires interaction to create as good a solution as possible.
- need for innovative transport systems to create efficient and sustainable solutions
- Currently the largest inflow (ref Gothenburg harbor) from the north goes via primarily E6, from the south through E6 and the centre of Gothenburg or Söderleden and E20 and from the east the R40.
- The Swedish national transport administration plans a refurbishment of Hisingsleden during the period 2017-2020 which opens an interesting possibility to realize changes in design and use of road infrastructure along the approach road to the port. The proposed project thus represents an interesting contribution to particularly step 2 of the Four Stage Principle applied to all infrastructure projects.
- The four stage principle: Step 1 is to influence transport demand, step 2, measures to effectively utilize the existing system, step 3 minor rebuilding measures and step 4 new construction and major renovations.

3. Objective

The project was conducted as an exploratory study aimed to answer the overall question:

Is an Extended Gate an appropriate method to address the problems and challenges that are related to the heavy goods traffic to and from the Port of Gothenburg?

4. Project realization

A study containing the following elements were carried out; problem definition, limitations, workshops with the project team, formulation of the study, collection of empirical data, calculation and analysis, conclusions, reporting, final seminar.

This study is a preliminary analysis based on the collected data, ASEK values and assumptions in order to make an assessment of the costs and benefits an Extended Gate would entail.

The work has been carried out by IVL together with Logistics Landscapers and representatives of the project stakeholders and funders.

5. Results and deliverables

The results of the study show that a solution with an Extended Gate along Hisingsleden with HCT shuttles to and from the port reduces both the number of vehicle movements (50-75%) and the number of kilometers driven (30-50%). This solution using

conventional technology is cost-neutral, depending on the design at a volume of 90 000 units per year. At a volume of 200 000 units per year demonstrated a cost reduction of approximately 50 SEK / unit depending on the design of an Extended Gate. CO₂ is reduced by up to 30%, NO_x is reduced by 80% and the energy consumption per unit is constant.



Figure 2 Location analysed

5.1 Delivery to FFI-goals

The project in itself, being a feasibility study has not contributed to the FFI-goals per se, but an implementation of one or more Extended gates in Gothenburg or elsewhere would provide contributions both to meet the environmental and climate challenges, and to increase the accessibility and mobility of both people and cargo. The decrease in the number of vehicle movements (heavy transport) is between 65-75% depending on the selected solution.

Environmental effects of increased transport volumes would also be reduced by the reported decrease in the number of kilometers traveled by between 40-50%. A reduction of CO₂ by between 20-30% was shown while NO_x emissions are reduced by 80%, again depending on the selected solution. Energy consumption is shown to be constant per unit. These figures are calculated on an Extended gates terminal located about 20 km from the port. A location at a distance of 30 km (Kungälv) increases the benefits considerably and the following reduction potentials per container are shown: kilometers driven by truck 60-70%, NO_x by 90%, CO₂ 40-50% and reducing energy consumption by between 20-30%.



Through the effects of the consolidation and a shift of the transport over the day, to less congested times, the traffic capacity of the existing infrastructure increases and results in reduced travel and transport times through fewer disruptions and increased accessibility.

6. Dissemination and publications

6.1 Knowledge and results dissemination

The result has been presented in a final seminar at CLOSER and in a final report and will be presented at the Transport Forum and the ITS 2015 in Bordeaux. Knowledge and dissemination of results, except presentations and meetings during the project, has been done through the participating stakeholder organizations and networks.

6.2 Publications

An article will be submitted to WCTR 2016 (World Conference on Transport Research) in Shanghai, deadline September 30, 2015.

7. Conclusions and future research

The completed study should be seen as an analysis of one of the many variations on the design and operation of a system with an Extended gate. The reported analysis is not based on the needs of new technologies or systems. Supporting assumptions for the outcome of the analysis is that the operating system manages to avoid the queues at the Extended Gate terminal, and that the actual volumes allow fully loaded shuttles in both directions.

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- Increased capacity of the port to receive and dispatch containers, reduced waiting times for trucks
- The possibility to establish a permanent flow of shuttles that can be used as a Living Lab for automotive and infrastructure development.

Based on the results of this project, a project to analyse the freight and transport flows to and from the port of Gothenburg started under the leadership of the Port of Gothenburg, with the support of the City of Gothenburg Traffic Department and Swedish Transport Administration. The aim of the project is to gain better knowledge of the actual routes travelled to and from the port through the centre of Gothenburg to thus obtain a better basis for the most appropriate placement of an extended gate.

An application to the Swedish Energy Agency regarding heavy goods transports use of energy in urban areas have also been submitted.

8. Participating parties and contact person

The work has been carried out by IVL, Sebastian Bäckström, along with Logistics Landscapers, Jonas Waidringer, and representatives of the project stakeholders and funders in a steering committee of representatives from the following organizations, which also contributed to the project's financing.

The following organizations have participated in the project as stakeholders and funders:

- APM Terminals – Britta Kilander and Patrik Foureaux
- Business Region Göteborg – John Wedel
- The Port of Gothenburg – Arvid Guthed and Magnus Nordfeldt
- Traffic Department – City of Gothenburg – Magnus Jäderberg
- The Swedish Transport Administration – Ulf Knape and Patrik Benrick
- Volvo Advanced Technology Research – Anders Berger and Fredrik Cederstav
- Region Västra Götaland – Christian Bergman

