Global challenges in smart logistics – Innovation driving supply chain control
13 November 2013, Utrecht

Urban Freight Transport Management for Sustainable and Liveable Cities

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Outline

1. Introduction
2. What is city logistics?
3. Visions for city logistics
4. Best practices
5. Conclusion
1. Introduction
Urbanisation

• About half of the World’s population (7 billion) live in urban areas

• The convergence of people and resources into urban areas for better lives---job, meeting, education, entrepreneurism, culture, transport, medical care....

• However, the growth of cities generates problems on traffic congestion, environment, public health, safety and security... --more serious in mega-cities
• Urban freight transport is an essential element for supporting efficient economic and social development in urban areas

• In addition, we face the aging society which requires more costs for medical, nursing and rehabilitation service as well as delivering daily commodities to elderly people
Challenging issues (1)

• Competition
• Efficient logistics systems --- *Just In Time* transport systems
• Freight carriers --- better services with lower costs
• Shippers --- designated time windows

Commercial logistics
Challenging issues (2)

- Increase in urban freight transport
  - Congestion
  - Negative environmental impacts
  - Crashes
  - Energy consumption

Intervention of public authority is needed
Smart solution by city logistics

- **City logistics** play an important roll for balancing the economic growth of cities and social and environmental issues.
- Because city logistics provides the basic **framework** for social, cultural activities of people and economic activities of companies.
- However, many urban planners and politicians have overlooked urban freight transport.
Framework for activities of people and companies in urban areas

Activities of people (Shopping, cultural, sport...)
Activities of companies (Location of depots, truck routing, e-commerce...)

City logistics

Efficiency  Environment  Safety & security

Urban transport planning  Urban land use planning
Efficiency and environment (function of city logistics)

(20th century)

Trade-off

Efficient freight transport systems

Environment friendly systems

(21st century)

Efficient and environment friendly freight transport systems

City Logistics
20\textsuperscript{th} century

• Any major reduction in environmental impact does not seem possible without putting the logistics innovations themselves into reverse (J. Cooper, 1991)
21st century

- **ICT** (Information and Communication Technology), e-commerce (B2B, B2C)
- Development and deployment of **ITS** (Intelligent Transport Systems)
- **SCM** (Supply Chain Management)
  - ERP (Enterprise Resource Planning)
  - CRP (Continuous Replenishment programme)
- Outsourcing of freight transport---**3PL, 4PL**
Cost structure

• Increasing efficiency as well as reducing negative social and environmental impacts can be represented by reducing social costs

(Social cost) = (Logistics cost) + (Congestion cost) + (Environmental cost) + (Traffic safety cost) + ….
2. What is City Logistics?

- City logistics is the process for totally optimising the logistics and transport activities by private companies with the support of advanced information systems in urban areas considering the traffic environment, its congestion, safety and energy savings within the framework of a market economy (Taniguchi, Thompson, Yamada and Van Duin, City logistics-Network modelling and Intelligent Transport Systems, *Pargamon*, 2001)
International Conferences on City Logistics

• Organised by Institute for City Logistics
• The 8th International Conference on City Logistics, Bali, Indonesia, 17-19 June 2013
History of logistics

Military logistics

Business logistics

City logistics

Humanitarian logistics

e-logistics

Green logistics
Stakeholders of City Logistics

- **Shippers** (manufacturers, wholesalers, retailers)
- **Freight carriers** (Transporters, warehouse companies)
- **Residents** (consumers)
- **Administrators** (national, state, and city level)

City logistics company or NPO
Characteristics of City Logistics

• **Total optimisation** taking into account environment, congestion, safety, energy etc.
• Relatively free activities of companies supported by public sector through deregulation
• Full utilisation of **advanced information techniques** including ICT and ITS
• Mindset of **Co-opetition**
3. Visions for city logistics

• We need visions for city logistics to establish efficient and environmentally friendly urban logistics systems through the process of city logistics
Visions for city logistics
Essential viewpoints

• ICT, ITS and city logistics
• **Urban planning** and city logistics
• **Land use planning** and city logistics
• **Units** of urban freight transport planning
• Subsidies and additional charges from the public
Change in rate of commercial use trucks and load factor of truck operation in Japan

Rate of commercial use trucks

Rate of commercial use trucks (ton kilometre)

Load factor of truck operation

Commercial use

Private use

Load factor = transp. t*km/capacity t*km

Source: MLIT
Costs of operating trucks

- **2 ton truck**
  - Vehicle: 51.4%
  - Insurance: 12.1%
  - Fuel: 7.7%
  - Repair: 5.2%
  - Personnel: 4.9%
  - Other transp.: 1.8%
  - General mgmt. (personnel): 7.4%
  - General mgmt. (others): 1.0%

- **4 ton truck**
  - Vehicle: 46.4%
  - Insurance: 11.0%
  - Fuel: 11.6%
  - Repair: 1.2%
  - Personnel: 6.4%
  - Other transp.: 6.7%
  - General mgmt. (personnel): 4.9%
  - General mgmt. (others): 0.0%

- **11-12 ton truck**
  - Vehicle: 45.9%
  - Insurance: 12.6%
  - Fuel: 10.3%
  - Repair: 8.7%
  - Personnel: 6.9%
  - Other transp.: 6.5%
  - General mgmt. (personnel): 3.5%
  - General mgmt. (others): 2.2%

- **Total**
  - Vehicle: 45.9%
  - Insurance: 12.6%
  - Fuel: 10.3%
  - Repair: 8.7%
  - Personnel: 6.9%
  - Other transp.: 6.5%
  - General mgmt. (personnel): 3.5%
  - General mgmt. (others): 2.2%

Source: MLIT, Japan Truck Association
Change of CO$_2$ emissions in transport sector

- Freight transport: -16.4% of 1990
- Total transport: +6.7% of 1990

CO$_2$ emissions (100 million ton)

- Passenger car
- Bus, taxi
- Commercial truck
- Private truck
- Rail, ship


Eiichi Taniguchi, Kyoto University

[Graph showing changes in CO$_2$ emissions for different transport sectors, with specific values and percentage changes indicated.]
Two driving forces to promote city logistics schemes

• Development and deployment of Innovative technology (ICT and ITS) in logistics area
• Behaviour change of shippers and freight carriers associated with corporate social responsibility (CSR)
Example of application of ICT and ITS for logistics operation (Isuzu)

Data of vehicle operation are transmitted to the centre and stored

Source: Isuzu
Environmental management in logistics

• ISO 9001 & 14001 series
  – Plan, do, check and action procedure
• Green management schemes for small and medium size enterprises
• CSR (Corporate Social Responsibility)
Publications by World Road Associations (English, French, Spanish, Japanese)
Procedure of urban freight transport management

**Design stage**
- FQP/ Public Involvement (PI)
- Problem Identification
- Causes of Problems
- Goal Setting
- Desirable Freight Vehicle Movement
- Combination of approach and measures

**Implementation stage**
- Pilot program
- Identifying side effects

**Evaluation stage**
- Evaluation

**Assessment stage**
- Evaluation

**PLAN**
- Plan

**DO**
- Do

**ACT**
- Act

**CHECK**
- Check

**Procedure of urban freight transport management**

Source: PUBLIC SECTOR GOVERNANCE OF URBAN FREIGHT TRANSPORT, PIARC 2012

Eiichi Taniguchi, Kyoto University
## Approaches to urban freight transport management

<table>
<thead>
<tr>
<th>Approach</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(1) Infrastructure</strong></td>
<td>Development of bypasses/ring roads, urban distribution centers, loading facilities</td>
</tr>
</tbody>
</table>
| **(2) Regulatory** | Introduction of fuel taxes, road user charge, dedicated freight  
Impose vehicle restrictions  
Introduce congestion charging |
| **(3) Logistical** | Use of small delivery vehicles  
Improved terminal operations  
Improve driver competencies |
| **(4) Co-operative** | Form freight partnerships  
load sharing systems (increase load factors)  
Joint delivering |
| **(5) Technology** | Use of electric delivery vehicles  
Use of GPS and FTMS  
Implement a vehicle parking reservation system |
| **(6) Behavioral** | Implement anti idling messages  
Improve social acceptance of urban freight activities  
Use of recommended truck routes |

Source: PUBLIC SECTOR GOVERNANCE OF URBAN FREIGHT TRANSPORT, PIARC 2012
# Measures for urban freight transport management

<table>
<thead>
<tr>
<th>Traffic Management</th>
<th>Measure</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Flow</td>
<td>Through-traffic optimization</td>
<td>Infrastructure: Ring roads, bypasses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic management: Restriction of through-traffic in city</td>
</tr>
<tr>
<td></td>
<td>In/out-flow optimization</td>
<td>Infrastructure: Transshipment terminals outside city</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic management: Truck route designation</td>
</tr>
<tr>
<td>Parking management</td>
<td></td>
<td>Infrastructure: Loading/unloading facility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic management: Truck-only parking space</td>
</tr>
<tr>
<td>Time management</td>
<td></td>
<td>Limited time window for trucks</td>
</tr>
<tr>
<td>Vehicle management</td>
<td></td>
<td>Low-emission vehicles</td>
</tr>
</tbody>
</table>

Source: PUBLIC SECTOR GOVERNANCE OF URBAN FREIGHT TRANSPORT, PIARC 2012
# Measures for urban freight transport management

<table>
<thead>
<tr>
<th>Measure</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Better transport method</strong></td>
<td></td>
</tr>
<tr>
<td>Joint delivery</td>
<td>Infrastructure Joint delivery center</td>
</tr>
<tr>
<td>Traffic management</td>
<td>Joint delivery agreement</td>
</tr>
<tr>
<td><strong>Intermodal transport</strong></td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Intermodal terminals Transshipment equipments</td>
</tr>
<tr>
<td><strong>Harmony with urban structure</strong></td>
<td></td>
</tr>
<tr>
<td>Land-use plan</td>
<td>Infrastructure Environmental buffer along arterial roads</td>
</tr>
<tr>
<td>Land-use management</td>
<td>Restriction of residential building along arterial roads</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
</tr>
<tr>
<td>Improve vehicle movement</td>
<td>ITS, ICT</td>
</tr>
<tr>
<td>Organizational activities</td>
<td>Freight Quality Partnership</td>
</tr>
</tbody>
</table>

Source: PUBLIC SECTOR GOVERNANCE OF URBAN FREIGHT TRANSPORT, PIARC 2012
Public private partnerships (PPP)

- **Coordination** and cooperation among stakeholders
- **Meeting and discussing together** urban freight transport issues from the initial stage of planning
- **Sharing** data and thoughts
- Identifying problems, finding approaches and measures, implementing policy measures, evaluating them and feedback
- **Benchmarking**
  - Key performance indicators
### Examples of measures in traffic simulation

<table>
<thead>
<tr>
<th>Description</th>
<th>a) Truck route designation</th>
<th>b) In-flow traffic restriction</th>
<th>c) Joint delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trucks are allowed only on designated routes</td>
<td>No through-traffic</td>
<td>Joint delivery</td>
<td></td>
</tr>
</tbody>
</table>

#### Expected effects

<table>
<thead>
<tr>
<th>a) Truck route designation</th>
<th>b) In-flow traffic restriction</th>
<th>c) Joint delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Reduction in freight transport on local streets</td>
<td>-Reduction in freight transport in the restricted area</td>
<td>-Reduction in number of freight vehicles in delivery</td>
</tr>
<tr>
<td>-Reduction in environmental burdens and accidents</td>
<td>-Reduction in environmental burdens and accidents</td>
<td>-Reduction in environmental burdens and accidents</td>
</tr>
</tbody>
</table>

Source: PUBLIC SECTOR GOVERNANCE OF URBAN FREIGHT TRANSPORT, PIARC 2012
Results of Traffic Simulation in Tokyo

ESTIMATED CHANGE IN TRAFFIC VOLUME

<table>
<thead>
<tr>
<th>Measure Package</th>
<th>Inside District</th>
<th>Outside District</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current (no measures conducted)</td>
<td>5,000</td>
<td>19,572</td>
<td>24,572</td>
</tr>
<tr>
<td>Truck route designation</td>
<td>4,400</td>
<td>11,294</td>
<td>15,694</td>
</tr>
<tr>
<td>Inflow traffic restriction</td>
<td>3,080</td>
<td>3,248</td>
<td>6,328</td>
</tr>
<tr>
<td>Joint delivery + Truck route</td>
<td>1,719</td>
<td>588</td>
<td>2,307</td>
</tr>
<tr>
<td>Joint delivery + Inflow restriction</td>
<td>1,203</td>
<td>588</td>
<td>1,791</td>
</tr>
</tbody>
</table>

Most effective measure package: joint delivery + truck route

Source: PUBLIC SECTOR GOVERNANCE OF URBAN FREIGHT TRANSPORT, PIARC 2012
## Key Performance Indicators for evaluation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Objective</th>
<th>Indicator</th>
<th>Source</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life quality</td>
<td>Emissions reduction</td>
<td>-noise</td>
<td>-field study</td>
<td>-modeling, measurements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-air quality</td>
<td>-local authority</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-CO2</td>
<td>-police</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-traffic volume</td>
<td>-literature research</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-accidents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic development</td>
<td>Economic development</td>
<td>-Commercial floor space</td>
<td>-local authorities</td>
<td>-statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-number of visitors</td>
<td>-real state statistics</td>
<td>-questionnaire study</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Improving accessibility</td>
<td>-vehicle-km</td>
<td>-carriers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-travel time</td>
<td>-drivers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-number of obstacles</td>
<td>-field study</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-police</td>
<td></td>
</tr>
<tr>
<td>Transport efficiency</td>
<td>Improving vehicle load factors</td>
<td>-average load factor of vehicles</td>
<td>-operators</td>
<td>-study</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-fuel consumption per unit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: PUBLIC SECTOR GOVERNANCE OF URBAN FREIGHT TRANSPORT, PIARC 2012

Eiichi Taniguchi, Kyoto University
4. Best practices

(1) Urban consolidation centre
(Motomachi, Yokohama Japan, 2004-)

<table>
<thead>
<tr>
<th>Type</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of carriers</td>
<td>17 (participating carriers)</td>
<td>1 (jointly-owned carrier)</td>
</tr>
<tr>
<td>Total number of vehicle-days</td>
<td>40 vehicles 30 days</td>
<td>20 vehicles 30 days</td>
</tr>
<tr>
<td>Type of vehicle</td>
<td>Diesel truck</td>
<td>CNG truck</td>
</tr>
<tr>
<td>Number of participating stores</td>
<td>-</td>
<td>Almost all stores</td>
</tr>
<tr>
<td>Goods of exclusion</td>
<td>-</td>
<td>Directly delivered goods from manufactures, High-value items</td>
</tr>
</tbody>
</table>

Eco-cargo station

Delivery with jointly-owned vehicles

Delivery center

Motomachi Shopping Street

Delivering

Sorting
Structure of cooperative freight transport in Motomachi, Yokohama

- Wholesale dealers
- Manufacturers
- Associated traders

Carriers contracted with each store

Jointly-owned Collection and Delivery center

“Eco cargo station” (3 locations)

Collection of goods from stores

Carriers contracted with each store

Delivered by each carrier’s freight vehicles

Assortment and transshipment of the goods

Delivered by shared low emission (CNG) vehicles

Load/unload the goods

Delivered by the dollies
CNG truck for cooperative freight transport
Parking area for cooperative freight transport
Urban consolidation centre
(2) Urban consolidation centre for high-rise buildings (Shinjuku, Tokyo, 1992-)
Impacts on air pollutant by urban consolidation centre

<table>
<thead>
<tr>
<th>Air pollutant (g/month)</th>
<th>Emission (kg/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>2.63</td>
</tr>
<tr>
<td>CO</td>
<td>1.90</td>
</tr>
<tr>
<td>HC</td>
<td>1.37</td>
</tr>
<tr>
<td>PM</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>0.225</td>
</tr>
<tr>
<td></td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
</tr>
</tbody>
</table>

- Diesel truck (before JD)
- Diesel truck (after JD)
- CNG truck (after JD)
(3) Street parking regulation of freight vehicles (Paris, France, 2007-)

Regulation of use of on street loading/unloading space within 30 minutes was introduced to City of Paris in the light of “Charter of Good Practices of Transport and Delivery of Goods” that had been concluded between City of Paris and 47 interested groups in 2006.
The sign of starting time of delivery
(4) Freight operator recognition scheme (London, UK, 2007-)

Freight Operator Recognition Scheme (FORS) is a key project within the London Freight Plan and provides a quality and performance benchmark for the industry. It will benefit London as a whole by encouraging freight companies to priorities safety and reduce their impact on the environment.
- Recognizing and rewarding excellence: 3 levels; Bronze, Silver and Gold
- Raising standards: Educating operators beyond compliance
- Promoting sustainability
- Supports operators to increase safety, environmental awareness and efficiency
(5) Public-private cooperative organisation activity (East Osaka, Japan, 2006-)

1. Eliminating trucks’ on-street parking
   - Development of logistics parking
   - Informing the location of parking space

2. Eliminating private cars’ on-street parking
   - Instructing and raising awareness about illegal street-parking
   - Tightening of regulations

3. Managing traffic flow
   - Traffic restriction into the residential roads
   - Access route map of the subject area

4. Improving the local environment
   - Planting trees and trash picking activities
   - Idling stop practice
Local problems

Improvement strategy

Action plan

Prepared in Mar. 2007

Activities

Improved living environment

Vitalized business activities

Improved settings for logistics

Local business

Local community

Freight operators

Improved settings for freight operation

Police

Improved traffic safety

Offices

Improved settings for office work

Improved City Logistics
Parking space dedicated for trucks

On street parking

Off street parking
(6) Parking lot booking systems using ITS for loading/unloading

(1) Objectives
- To support early promotion of ETC
- To create new market by the introduction to parking places

(2) Used functions
- Use Vehicle ID of ETC (ORSE-ID)
- Users are registrants
- Insertion of ETC card is necessary

(3) Accounting
- Month-end accounting for the time being

Possible to transfer information on registration number/entry time/payment time/parking fee to the parking information management center.
(7) Truck/load matching system KIT

- Click map below directly to select region or click the select all button.
- Further detail search or sort is available. Easy to find information you are seeking.
- Detail search available.
- Easy to find the newest information.

Eiichi Taniguchi, Kyoto University
(8) Delivery plan/optimum route

The vehicle allocation and delivery plan support system
5. Conclusion

• **City Logistics** provide powerful tool for solving complicated urban freight transport problems
• Efficient and environmentally friendly logistics systems for mobile, **sustainable and liveable cities**
• **Modelling** is needed for evaluating policy measures
• **Public-Private partnerships** play vital role for implementing city logistics schemes
Thank you