

Freight distribution in cities: Design challenges

A lunch lecture in course AR3CS100 *City of the Future*

Dr. Jaap Vleugel
CiTG Transport & Planning
MSc TIL 5050-20 Design course

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Content

- 1. Purpose of the lecture
- 2. Freight distribution and (city) logistics
- 3. Demand for goods in cities
- 4. Changes in buying *behaviour*
- 5. Changes in retail business
- 6. Demands on urban logistics are rising
- 7. Externalities of city logistics
- 8. Policy: Emissions, noise, disturbance, congestion
- 9. New *vehicle technologies* and logistic *concepts*
- 10. *Designing* for urban freight transport?
- 11. Urban (re)design
- Conclusions
- Discussion

1. Purpose of the lecture

- To (as far as needed) introduce you into the topic of city logistics
- To help you understand that its challenges are (partially) also your challenges
- To stimulate you develop a (more) balanced opinion about city logistics
- To stimulate you to think about or even develop (new) solutions to improve its functioning
- Such solutions should (in my opinion) be part of integrated city (re-)design and *not* an 'afterthought'
- Such solutions may improve (y)our world a bit

2. Freight distribution and (city) logistics

Logistics [1]: Organisation, planning, management and execution of the supply chain. Fulfill market demand in an efficient way, keep customers satisfied and returning
Deliver: On time, flexible
Manage and execute: Low stock level, low on resources, low operational (OPEX) and capital cost (CAPEX)

Supply chain management: “Oversight of materials, information and finances as they are distributed within the supply chain” [2]



Fig. 1: Supply chain [2]

Global logistics

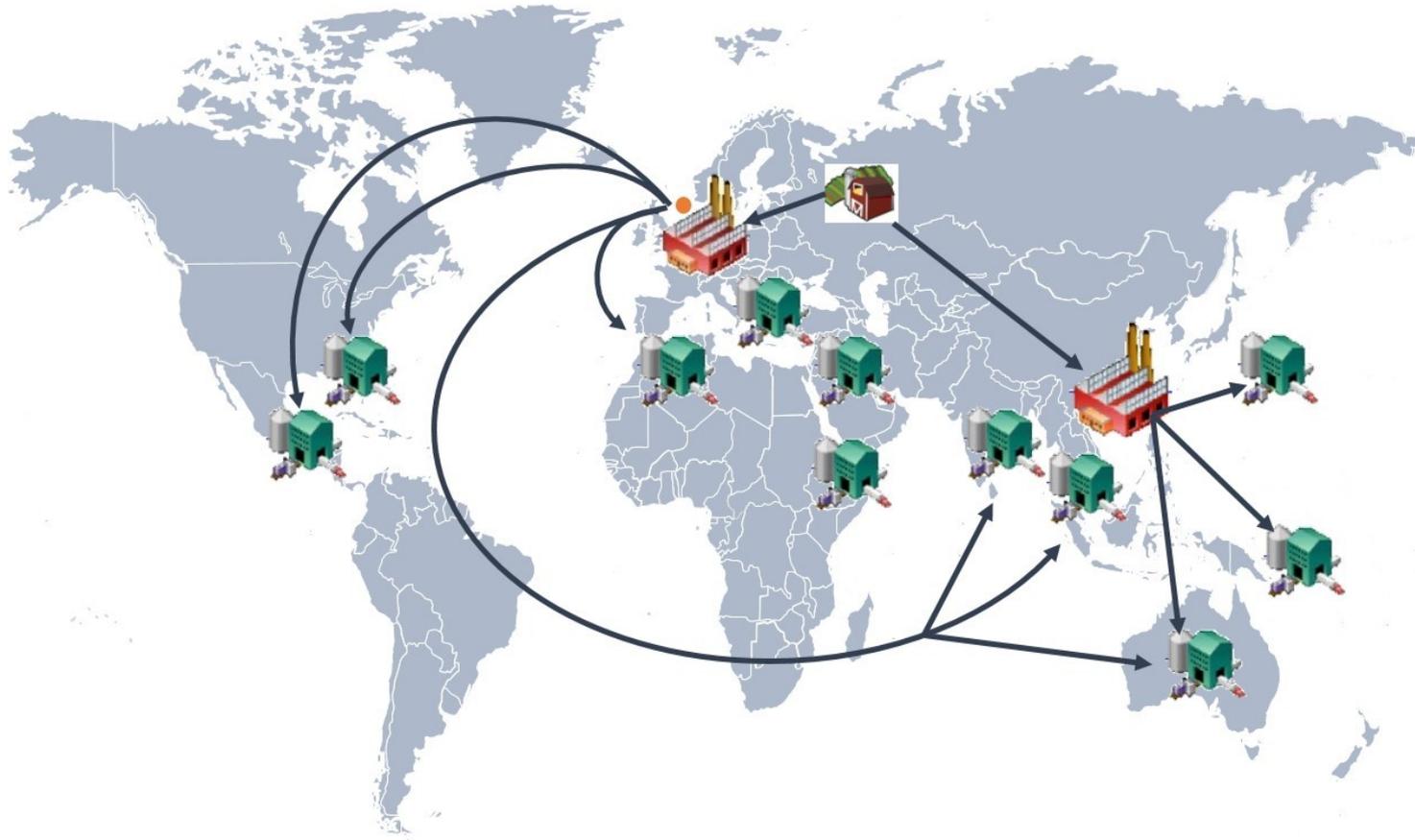


Fig. 2: Global supply chain [3]

Global supply chain: Complex organisation and execution

Global logistics

Fig. 3 Global supply chain: Container vessel in Hamburg port [4]



Fig. 4 Global supply chain: Container train on New Silk Route connecting China and Europe [5]

City logistics

City logistics - the final ('last') kms / miles of a logistic chain + the first kms in case of reverse logistics (waste / packaging / “returns”)

You are part of that chain if

- * You receive or send packages as a consumer
- * Buy goods in a (n online) shop or other busines
- * Have or work in a business receiving or sending packages



3. Demand for goods in cities

Demand for goods is quite complex:

- Volume - **number of customers** (business, consumers, government)
- Demand per customer - volume split into goods categories e.g. food / non-food, Daily / non-daily, cheap / valuable
- **Buying behaviour**
 - > Type of store: physical ('brick & mortar'), webshop (ecommerce)
 - > Buying quantities
 - > Buying moment + frequency
 - > Returns (not satisfied, defects, etc.)
- Buyer's **experience** - order fulfillment (do you get what you ordered, in-full, on-time?)
Or have you experienced this:
 - Wrong product?
 - In part?
 - Delayed / not delivered / wrong address / disappeared?
 - Broken?

Interaction of demand and supply for goods

Demand characteristics + the available supply options determine:

- The way logistics is carried out
- The volume, frequency and regularity of transport flows in and out of the city
- Demand is flexible and partially stochastic, which makes freight transport planning complex and uncertain
- Supply options are not perfect

Who are the final consumers in a city?

Cities are popular, in particular among age 30-

Outflow: age 30+, but also age 30-

On balance: Net outflow - **number of consumers is not rising**

"Natural" process - suburbanization-reurbanization etc.

City population is dynamic - age distribution changes

"Hip" versus age-dependent motives for migration: Family formation, affordable living, urban stress, ..

PBL, Trek van en naar de stad, Veranderingen in verhuispatronen, 1996-2018, 2019.

· There are, as always, local variations

4. Changes in buying *behaviour*

Internet - rise of e-commerce

Adapted and new types of goods and services

Ownership replaced by rent & service:

- Downloading, streaming, cloud software & services
- Mobility as a service
- Autonomous vehicles [special applications]



U.S. e-commerce penetration

U.S. e-commerce sales as a % of total retail sales

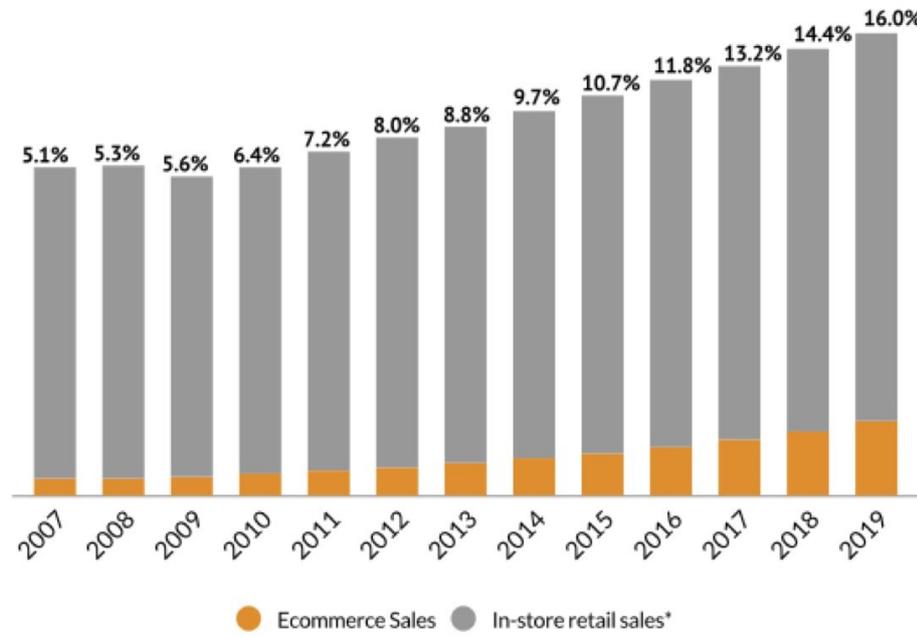


Figure 5. E-commerce USA [6]

5. Changes in retail business

Rise of e-commerce → Threat to traditional “brick & mortar” stores

At first many b & m stores died
Then adaptation → Online also

Also diversification by e-commerce -> goes 'brick & mortar e.g. Bol.com, Amazon open (or take-over of) physical shops

Result: Rise in multi-channel logistics

6. Demands on urban logistics are rising

Last-mile order fulfillment for consumers – challenges:

- Rise in home delivery and pickup ('last mile')
- Consumers demand fast delivery (next day -> same day?)
- Less planned transports (compared to business deliveries)
- More kms/miles driven, more distribution vehicles on the road, more parking lots needed
- Limited trip coordination among logistic companies
- Many return trips (e.g. 1/3 with clothes): Not at home, other behaviour

Covid-19

Already huge pre-covid

Expected to keep growing post-covid:

- Experience and adaptation
- Convenient, affordable (to many) etc.

There has never been a time of greater demand for last-mile transport



Urbanization

60%

people living in cities in 2030

20–35%

congestion increase since 2010



Customers

2.1bn

people expected to buy goods online by 2021

20%

online retail share by 2023



Products

10%

per annum e-grocery growth worldwide

32%

of furniture sold online by 2023 in the US



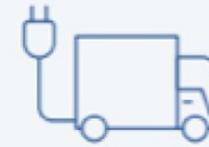
Delivery

20%–40%

growth in same-day

10%

per annum growth in instant delivery



Technology

14–35%

xEV share of new car sales across regions by 2030

2024

year in which most OEMs will release L4/5 autonomous vehicles

78%

growth through 2030 in urban last-mile deliveries

Figure 6. Demand for last-mile transport, global perspective [7]

7. Externalities of city logistics

Global developments:

Environmental impact rises. Example world's 100 top cities [7]:

78% growth in demand for last mile delivery

36% more delivery vehicles in innercities

21% more traffic congestion (11 additional car minutes per daily commute)

More parking options needed

30% more CO₂-emissions in 2030 (25 million ton) **without** effective intervention

Local impact

Depends on many factors

- Urban fabric (street network layout, building density)
- Type of area - innercity, suburban
- Type of road
- Overall traffic volume (congestion), freight traffic share
- Vehicle technology used
- Other factors (policy)

8. Policy: Emissions, noise, disturbance, congestion

Traditional (legal) approach:

- Restrictions on traffic (vehicle routing, vehicle size and weight, time windows (e.g. before opening times of shops))
- Car free areas (pedestrian zones)
- Obligated use of urban distribution centers (UDC's)

Did not solve the problem: Congestion and pollution remained, organisational problems, higher logistics costs etc.



Recent policy approaches

Combination of policy instruments: Manage and stimulate

- Pollution and noise regulation
- Flexible time windows, night delivery
- Shared distribution, urban distribution centers
- Road vehicle technology
- Non-motorized vehicles
- Transport by water (barges)

9. New vehicle technologies and logistic concepts

New vehicle technologies

- Lower emission vehicles (euro 6+, hybrid diesel-electric)
- Zero emission vehicles (electric, hydrogen)
- Autonomous vehicles

New logistic concepts

- Cooperation between transport companies
- Scale reduction: Smaller, but still motorized
- Smaller, non-motorized e.g. bike couriers
- Parcel lockers
- Off-road: Water (barges), air (drones)
- Challenges: Odd-size or weighty parcels, weather



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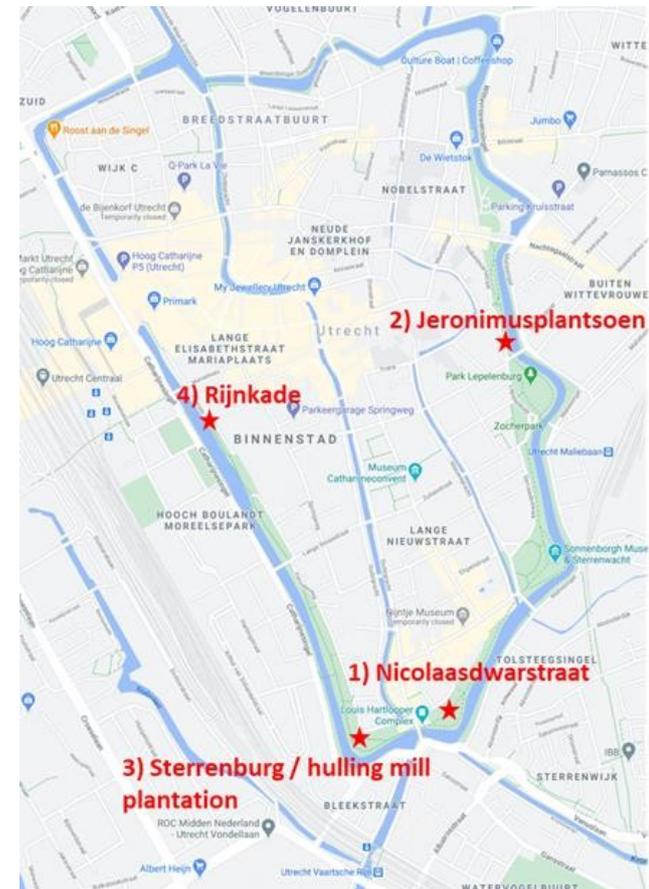
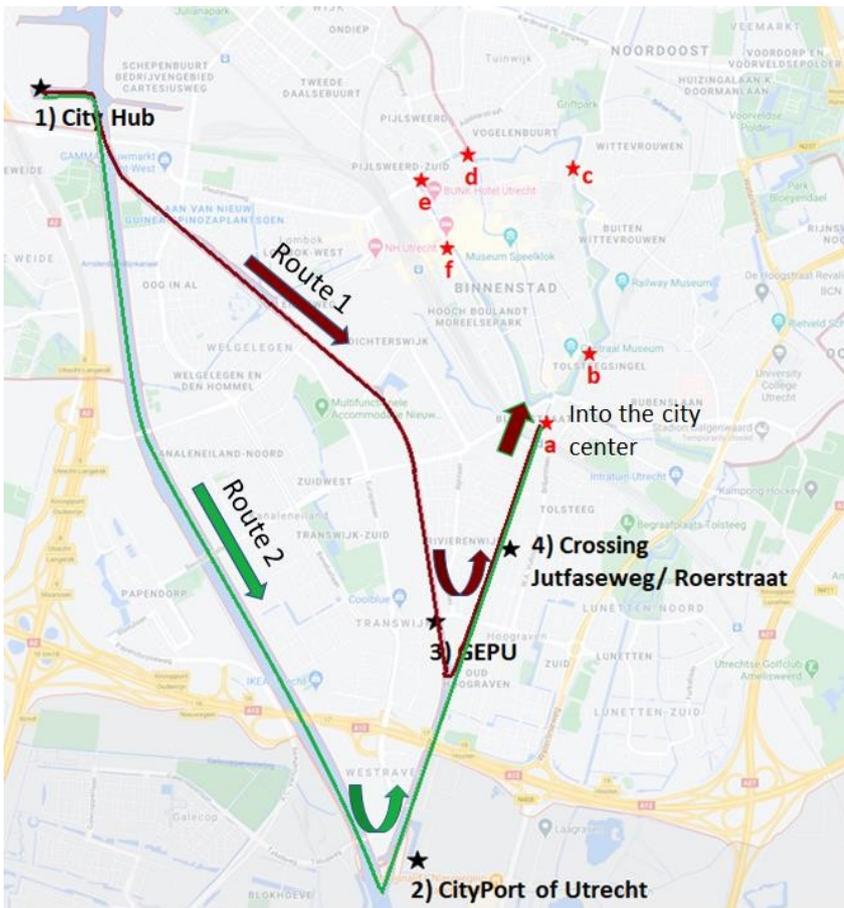


Figure 7. Potential routes for waste (container) removal by barge in the city of Utrecht [8]

10. *Designing* for urban freight transport?

Design requirements:

- Complex buyers' behaviour
- Oversized and overweight products
- Organisation: Cooperation between competitors?
- IT improvements: Flexible ordering, receiving (time windows for home delivery)
- Transport is a very low profit business (if at all)
- Privacy - is your data safe?
- Security of delivery

11. Urban (re)design

Traditional:

- Logistics as a nuisance
- Re-active public policies - afterthought

Innovative:

- Forward thinking public policies - Integrate logistics into urban planning
- Small-scale pilots - area (re)development

Conclusions

Freight transport & logistics is a vital economic activity

Treating it as a nuisance does not make sense

It seems more effective to find ways to better integrate it into our daily lives

The challenge is yours!

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· All hyperlinks effective on 05-09-2021.

Thank you. Questions?



Contact



Dr. Jaap M. Vleugel
Research & Education

j.m.vleugel@tudelft.nl
T +31 (0) 15 27 86487
<http://transport.citg.tudelft.nl>

Building 23
Stevinweg 1
2628 CN Delft
P.O. Box 5048 CN
2600 GA Delft
The Netherlands

Faculty of Civil Engineering
and Geosciences