Perspectives on City Logistics

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Plan

- A few thoughts on multimodal & intermodal transportation
- City Logistics: an intermodal urban transportation and logistics system
- Perspectives
Multi & Inter Modal Transportation
Moving Freight (and people)

Many journeys: Single mode from origin to destination

- Road (truck) based, mostly

Most use two or more modes

- Multimodal transportation

Require intermodal terminals for mode-to-mode transfer

- Operations on vehicles/convoys & possibly cargo
- No cargo warehousing (in general)

(For another day/show: need to carefully define “modes”)

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Multimodal Freight Transportation

Moving a load by a sequence of at least two transportation modes, the transfer from one mode to the next being performed at an intermodal terminal

E.G., door-to-door transportation of containers over long distances

- Origin → “short land” transport → port / rail yard
  → container ship / train → port / rail yard
  → “short land” transport → destination

Sometimes called “combined” or “intermodal”

Well-spread idea: container ⇔ intermodality
Containers: Backbone of International Trade
Modular & Standard $\pi$-Containers
Intermodal Transportation

Many things to many people

Freight and people

Maritime (and land) container transportation

Major policy instrument aiming to switch freight from trucks/highways to more environment-friendly modes (rail, water)

E.U.: condition to award development funds for “new” members

“New” transportation systems/services

National / regional planning
Intermodal Transportation (2)

✨ Dedicated rail services (subdivisions) moving large volumes of containers/trailers over long distances: the trans-continental “land bridges”

✨ Consolidation-based carriers and terminals

✨ Vision for the future (“the future is now”) of freight transportation (and logistics)

♀ City Logistics, Physical Internet & interconnected logistics systems, synchromodality, etc.
Transportation System & Stakeholders

Physical (Conceptual) Infrastructure and Services

SUPPLY

Economic and legal environment

Movements of people, goods, vehicles = Traffic

Costs/profits, delays, energy, emissions, …

Production, Consumption of Goods and Services

DEMAND
Points of View on Intermodality

System & Service design
Resource management
Operations

Carriers
Terminal operators

Shipment orders & quality criteria
Mode choice
Shipment organization

Shippers: producers, retailers …
Logistic service providers

Governmental institutions
The City
Economic and legal environment
Policy

Movements of people, goods, vehicles = Traffic
Costs/profits, delays, energy, emissions, …
Issues & Challenges

 Transportation systems & logistics chains are Efficient

 Freight flows around the globe supplying people, industry, institutions
 On time, low cost, making a profit …

 Inefficient

 System perspective & society costs
 Resource utilization & duplication
 Unsustainable in the long (medium?) term
Issues & Challenges (2)

❖ Continue to make as efficient as possible the systems of individual stakeholders
❖ Reconcile the efficiency requirements of the various stakeholders
❖ Freight transportation organization and business models that foster individual stakeholder and system efficiency
   ✤ Develop “new” sustainable & smart freight transportation and logistics (people too …) systems
   ✤ Evolve/change the way things are done
❖ The urban transportation case: City Logistics
Freight Transportation in Cities

- Essential to the life and prosperity of the city
- **Cities cannot survive without freight transportation**
- Significant part of traffic & traffic-related problems
  - Passenger traffic interference, congestion, parking
  - Negative environment impact (emissions, noise, …)
  - Quality of life and future generations
  - Energy consumption (and extraction/transport)
  - Safety & security
- Poorly used (low vehicle loads, many empty)
- General feeling: Cities are polluted and not safe …
- Problem will not go away: population growth, urbanization, globalization
Zoning Access Regulations

Access Forbidden to Heavy Trucks

Highly Restrictive Access & Parking

Regulated parking

Necessary but *NOT* Sufficient sometimes Detrimental
Sharing DC Resources – Last-Mile Services

Suburbs

Mid-Town

City Center

Red Inc.

Prune route

Prune Inc.

LogPlatForm Inc.

Violet Inc.

Violet route

Customer

Distribution center

Logistics Platform

Major flow

City route
Freight Transportation in Cities (2)

- Go beyond “urban freight transport” to “city logistics”
  - A logistics system = shippers, shipments, carriers, service providers, vehicles, and consignees
  - Optimize this logistics system
  - “Public system” view operated as best fits the local culture, laws and regulations
- To make the city a better place to experience: live, work, visit, move within and through …
- Without penalizing its economic activities
- To foster an efficient transportation system
- Become part of mainstream urban design and planning
Current/classic distribution: Many vehicles dedicated to small (single) numbers of shippers / shipments / consignees
⇒ Many empty vehicles or lightly loaded
Using Proven Strategy in Logistics, Long-haul Transportation, Passenger Transportation, …

City Distribution Centres (CDC)

Consolidation & coordination
Single-tier CL with Single CDC

- Customer
- Distribution center
- City Distribution Center
- Major flow
- City route

Violet Inc., Prune Inc., CL Operator Inc.
2T-CL: Multi-Echelon CDC & Specific Vehicles

Prune Inc.

Violet Inc.
City Logistics

- Several (not necessarily integrated) sub-systems
- Access to some public infrastructure (light rail lines, buses, parking lots, ...) even for private initiatives
- Dedicated transportation modes (underground) proposed
- Use dynamically available transportation & storage capacity
- Redefine particular systems, e.g., dry ports
Dry Ports

- An intermodal system of ports and inland terminals
- “An Inland Freight Terminal is any facility, other than a port or an airport, operated on a common-user basis, at which cargo in international trade is received or dispatched.” [Economic Commission for Europe, 1998]
- “A Dry Port is an inland terminal which is directly linked to a maritime port.” [Economic Commission for Europe, 2001]
- “A Dry Port is an inland terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardised units as if directly to a Seaport” [Leveque and Roso, 2002]
Dry Port-based Distribution Processes

Dry Ports (2)

- To perform consolidation of goods, customs, management services, information processing activities, short term storage, value-added manufacturing services
- Extended gates for sea ports, through which transport flows may be better controlled and adjusted to match conditions in the port and the city surrounding it
- Need to design, plan, manage this system/network
Close Dry Ports

Distant Dry Ports

Midrange Dry Ports

Multi Port, Multi-Terminal Structures Emerging
High-capacity Transport – Rail Shuttles

Rail benefits

- Increased business
- Enhanced pre-blocking

System benefits

- High-capacity transport, dedicated lines, reduce and avoid congestion in the city (truck benefits too !!)
- Enhanced blocking/loading of containers to synchronize with departing ships and trains

Need to plan and operate efficiently
City Logistics

In all cases, *one disconnects the actual mean of transportation/delivery from the carrier/shipper/3PL originally contracted*

Multimodal systems that aim for intermodality
Challenges & Opportunities

❖ Culturally and socially-aware organization and business models, e.g., accounting for and modelling
❖ Cultural (government ↔ people & business, business models, taxation, etc.) impact ⇒ need for somewhat tailored solutions
❖ Stakeholder behaviour
❖ Demand
❖ Partnerships & collaborations → Supply
❖ Public policy
❖ What CL systems for North America? For Montreal?
❖ A dry port for Montreal?
Challenges & Opportunities (2)

Evaluation models and tools

- A few proposals, pace increasing
- Still limited in scope & size
- Limited account (if any) of planning issues and advanced ITS technology

Comprehensive urban transportation planning

- Integration with people (private, public, alternative) transportation
- ITS
- Land use, …
Challenges & Opportunities (3)

❖ System & service & operation planning
❖ New problems ⇒ New models, algorithms, instruments
❖ Strategic planning – System design
  ↨ Multi-level location-routing, freight corridors
  ↨ Fleet (resource) dimensioning, …
❖ Tactical planning – Service network design
  ↨ Schedules, time issues, multi-level routing, blocking
❖ Operational planning, control & management
  ↨ Adjustment of plans
  ↨ Dynamic demand response & routing
❖ Uncertainty, robustness, resilience
Perspectives

❖ City Logistics is already delivering in several cities around the world
❖ Perspectives for better, more efficient & profitable transportation & logistics systems and better cities
❖ Lots of technology already here (ITS, smart boxes, …)
❖ Obvious links to the evolution of interurban systems
❖ Many challenges (mentality, policy, politics, …)
❖ Extremely rich R&D field with great potential for scientific creation/innovation and real-life impact
Interconnected City Logistics
Merci beaucoup

\[ \text{Min}\left\{ f^T y + c^T x : Ay + Bx \geq d, \ y \in \mathbb{Z}^n_+, \ x \in \mathbb{R}^p_+ \right\} \]
Building Container Blocks – A New Problem

Set of modular containers to be shipped

Destination Dimensions

- 1,2*1,2*1,2
- 1,2*1,2*1,2
- 2,4*2,4*1,2
- 2,4*2,4*1,2
- 4,8*2,4*1,2
- 2,4*1,2*1,2
- 2,4*1,2*1,2
- 2,4*1,2*1,2
- 2,4*1,2*2,4
- 4,8*1,2*1,2
- 1,2*1,2*1,2
- 1,2*1,2*1,2
- 2,4*1,2*1,2
- 2,4*1,2*1,2
- 2,4*1,2*1,2
- 4,8*1,2*1,2
- 2,4*1,2*1,2
- 1,2*1,2*1,2
- 1,2*1,2*1,2
- 2,4*1,2*1,2