Increasing the sustainability of urban freight systems

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Outline

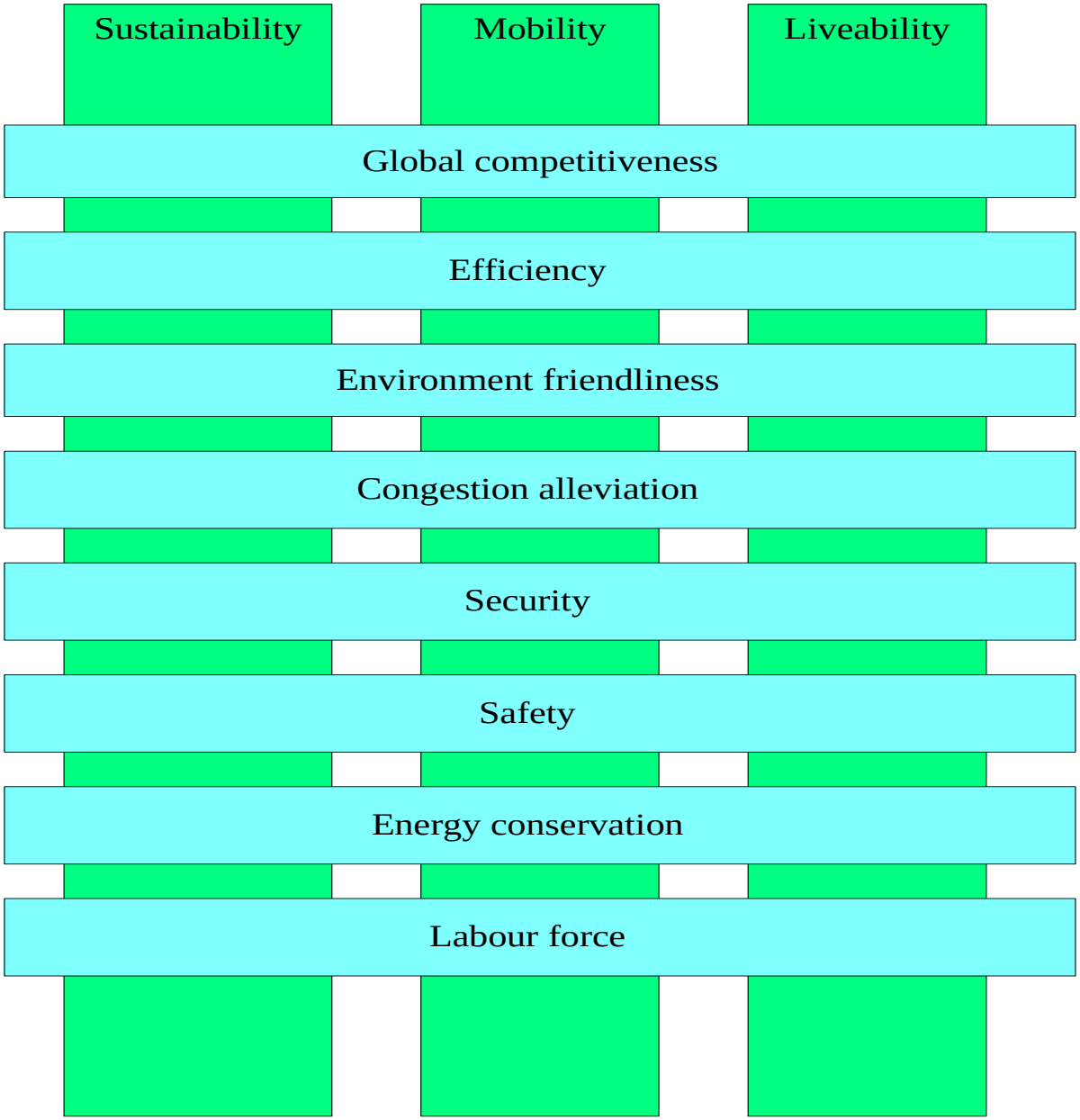
City Logistics concepts
Vehicle Routing & Scheduling
Logistics Network Design
Collaborative Freight Systems
Urban Consolidation Centres
Centre for Sustainable Urban Freight Systems
References

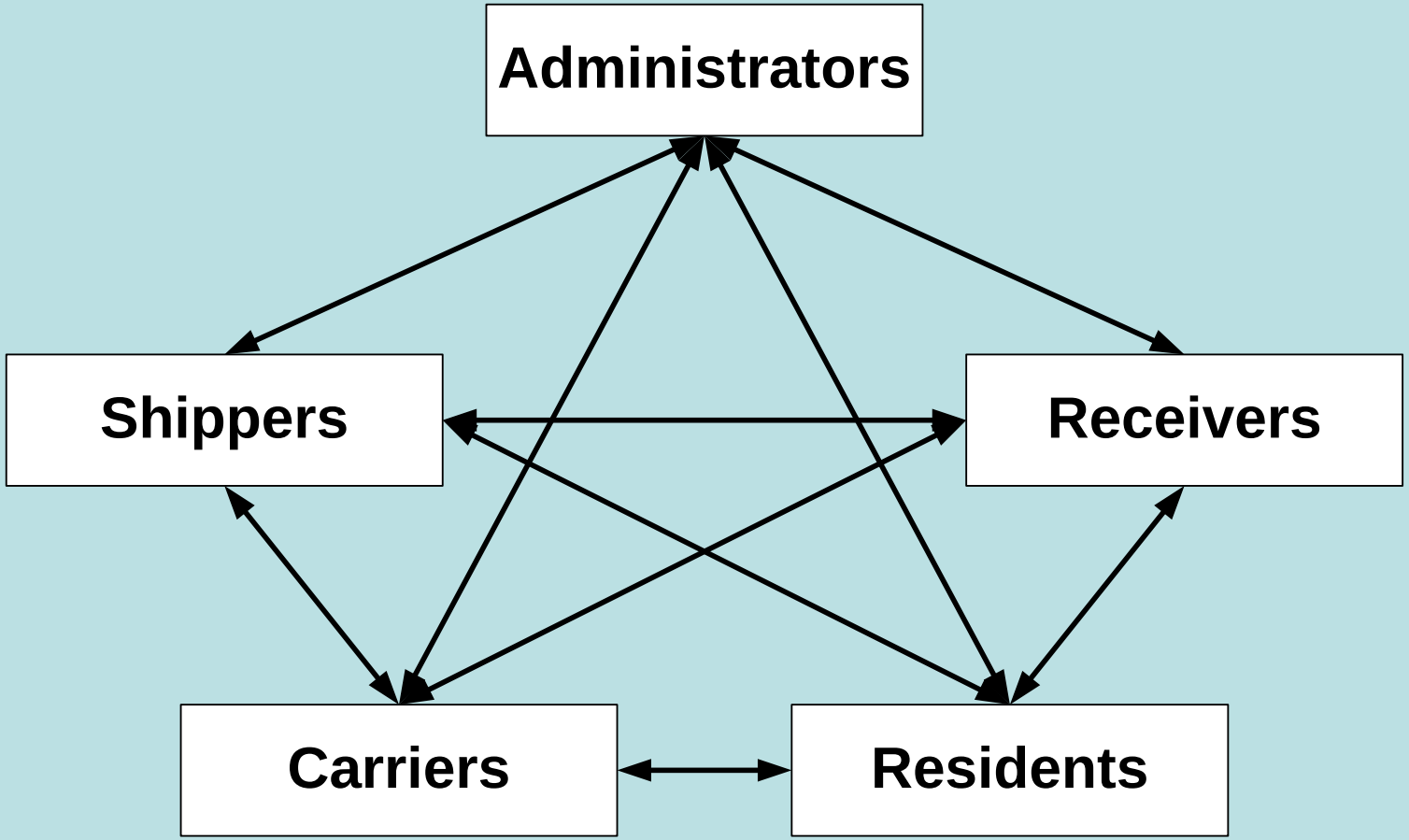
City Logistics

City Logistics is an integrated approach for urban goods distribution based on the systems approach. It promotes innovative schemes that reduce the **total** cost (including economic, social & environmental) of goods movement within cities

OECD, (2003) *Delivering the Goods, Challenges for the 21st Century,* Paris.

Structure of visions for city logistics





Key Stakeholders in City Logistics

Stakeholder Group	*Common Goals & Objectives*
Shipper	**Maximise levels of service, including cost, time for picking up or delivering & reliability of transport (delivery without any delay with respect to designated time at customers).**
Carriers	**Minimise costs associated with collecting & delivering goods to customers to maximise their profits.**
Residents	**Minimise traffic congestion, noise, air pollution & traffic accidents near their residential & retail areas.**
Receivers	**Minimise storage, disruption to business, impacts on local environment. Maximise reliability, punctuality & flexibility of deliveries.**
Administrators	**Enhance economic development of city & increase employment opportunities. Alleviate traffic congestion. Improve environment & increase road safety**

Some Common Schemes

Urban Consolidation Centres
Joint Delivery Systems
Off Hour Deliveries
Access Control (eg. LEZ)
Intelligent Transport Systems (ITS)
Alternative Fuel Vehicles

OECD Report (2002)

Recommendations

Active measures needed to increase awareness of importance of urban goods transport & to diffuse knowledge

Evaluation methods & *data* are prerequisites for effective policy measures

Consolidation key to achieving sustainable urban goods transport

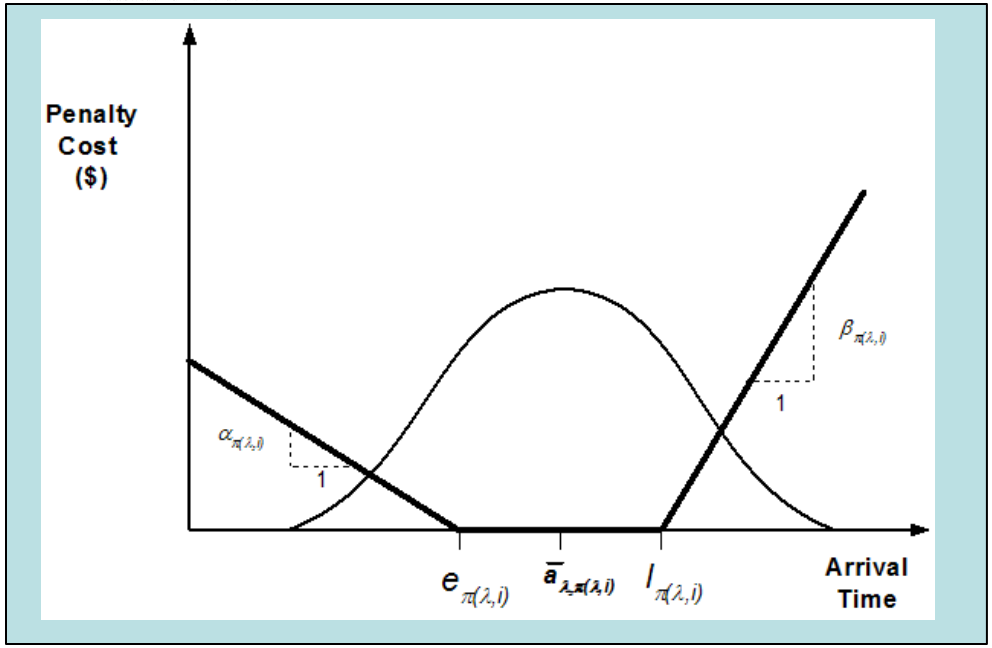
Regulations to be harmonised, standardised, stable, easy to enforce & cost-effective

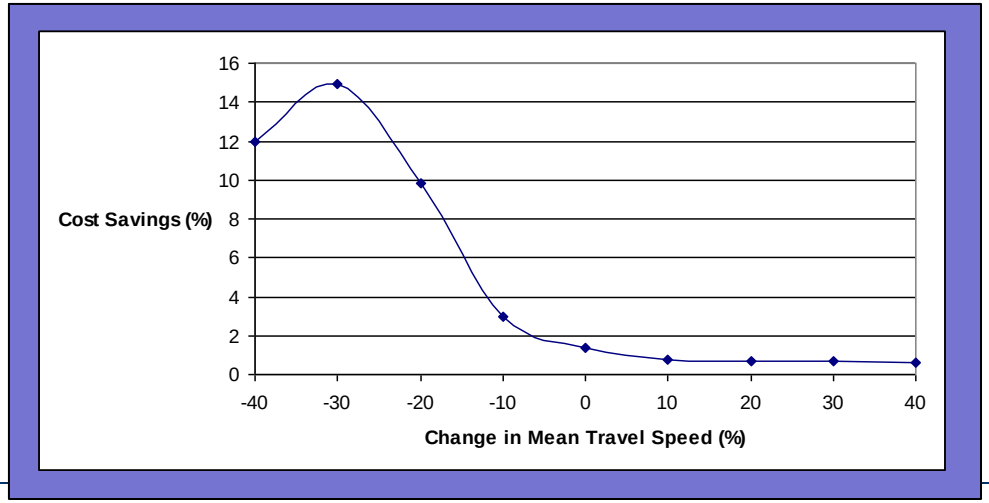
Infrastructure capacity be used more imaginatively on a *24-hour basis*

OECD Recommendations (Cont.)

- Cleaner, low noise & more energy-efficient vehicles to be promoted
- Adequate logistic facilities to be provided
- Efforts to be made to reduce safety risks
- Reverse logistics to be developed
- Technological & conceptual innovation can support sustainable urban goods transport
- Next steps –further study & international co-operation

Risk and Urban Distribution





Benefits of considering travel time *variability* in vehicle routing with time windows

Risk of delays modelled using stochastic programming & robust optimisation

Formed the basis for City Logistics modelling and intelligent transport systems research programs…

2 International Patients registered.

Thompson et al (2011)

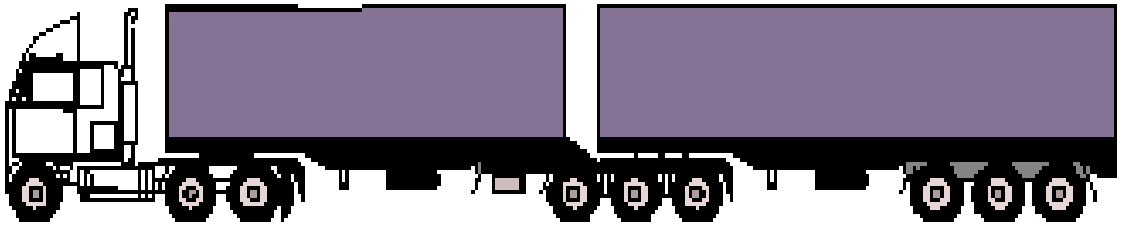
PBS Evaluation Methodology

- Vehicle operating cost savings
- Safety
- Environmental Benefits
- Costs
  - Compliance
  - Administrative
  - Infrastructure
- Flow on Benefits

PBS & Freight Networks

- Vehicle usage depends on commodity carried & type of freight network
- 16 case studies simulations to estimate distance & vehicle reductions
- Growth rates by vehicle class for ancillary and hire and reward sector produced

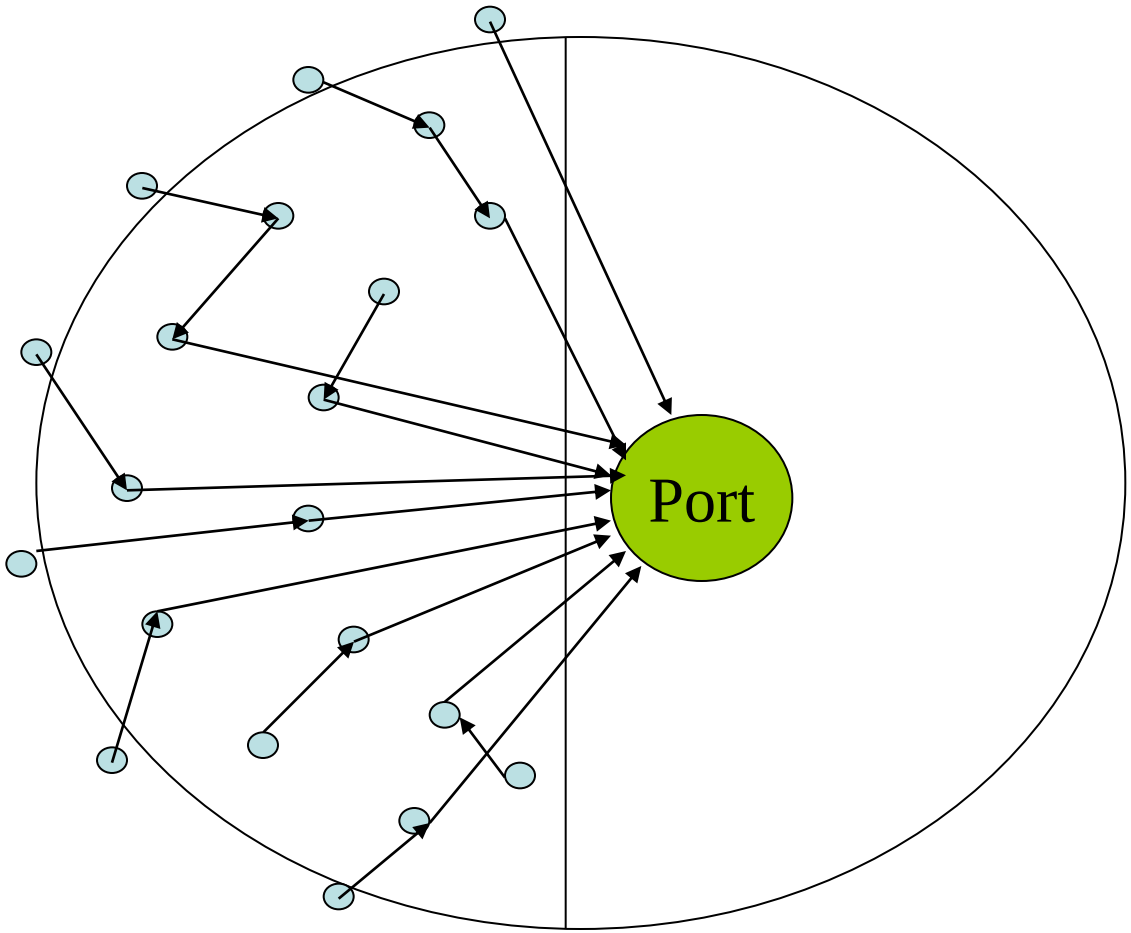
Super B Double 30m



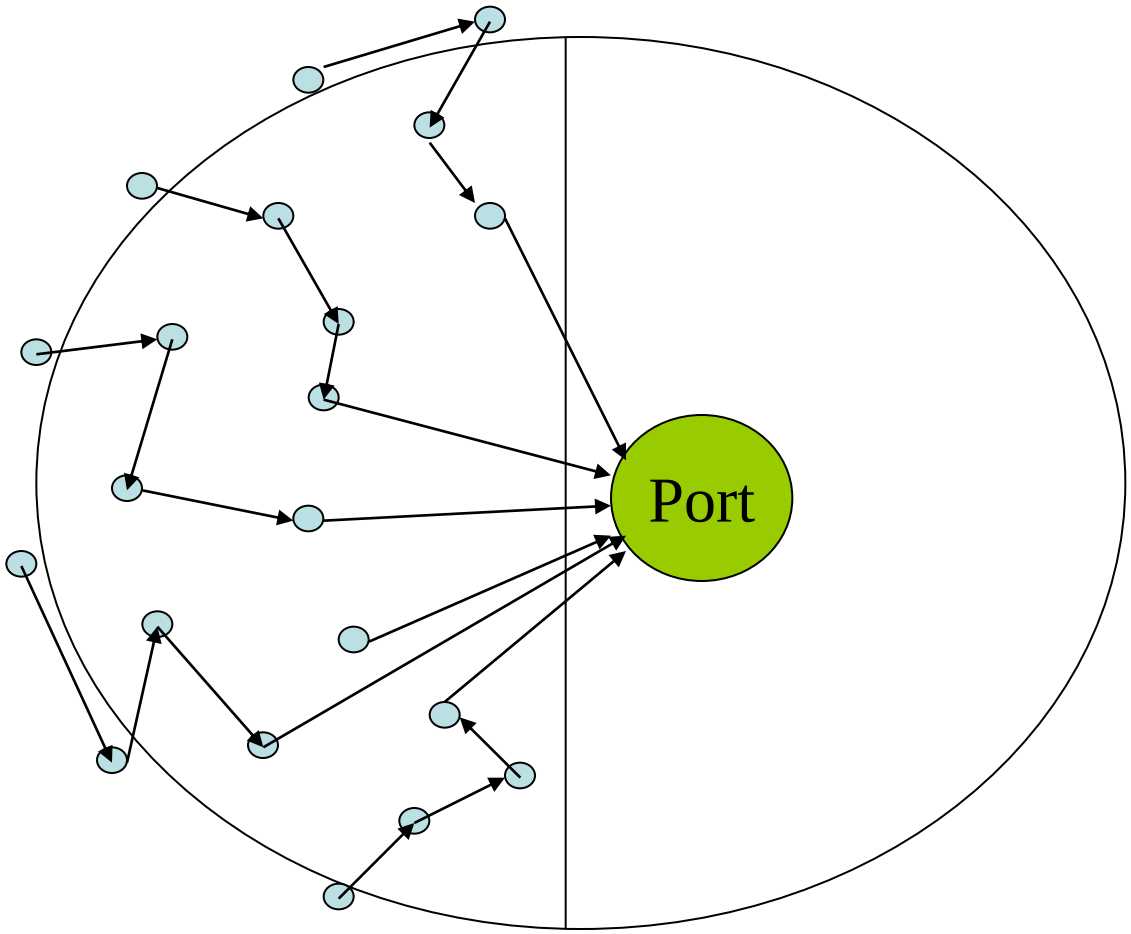
2 x 40’ or 4 x 20’ containers

Hassall and Thompson, 2011

Urban Port Scenario Simulation
Single Articulated Vehicles



Urban Port Scenario Simulation
Super B-Double Vehicles



Simulation Results

To Port Super B-double vs Single Articulated Truck				
	Single	Super B-double	Change	
Directional Trips	24	12	-50.0%	
Kilometers	708	530.4	-25.1%	
Vehicles	4	3	-25.0%	
On duty hours	26.5	22	-17.0%	
Ave kms per trip duty	29.5	44.2	49.8%	
Other Data				
Container Mix	60% TEU	40% FEU		
Customers	**17**			
Time window	8 hour total shift operation			

Freight Networks

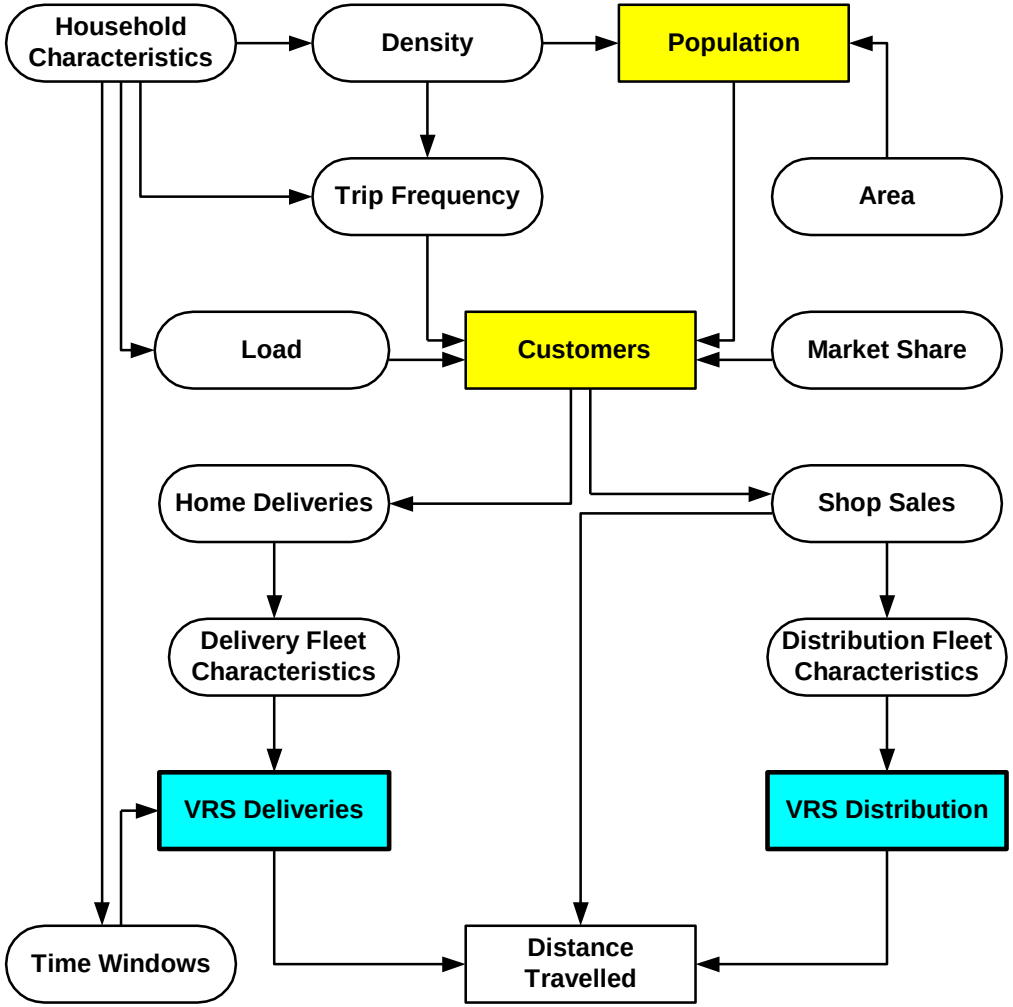
- Vehicle usage depends on commodity carried & type of freight network
- 16 case studies simulations to estimate distance & vehicle reductions
- Growth rates by vehicle class for ancillary and hire & reward sector produced

Average PBS Savings (%)

	Reduction in Kilometres	Reduction in Vehicles
Linehaul/Regional	25.2	28.3
Urban	19.1	21.0

Hassall and Thompson, 2011

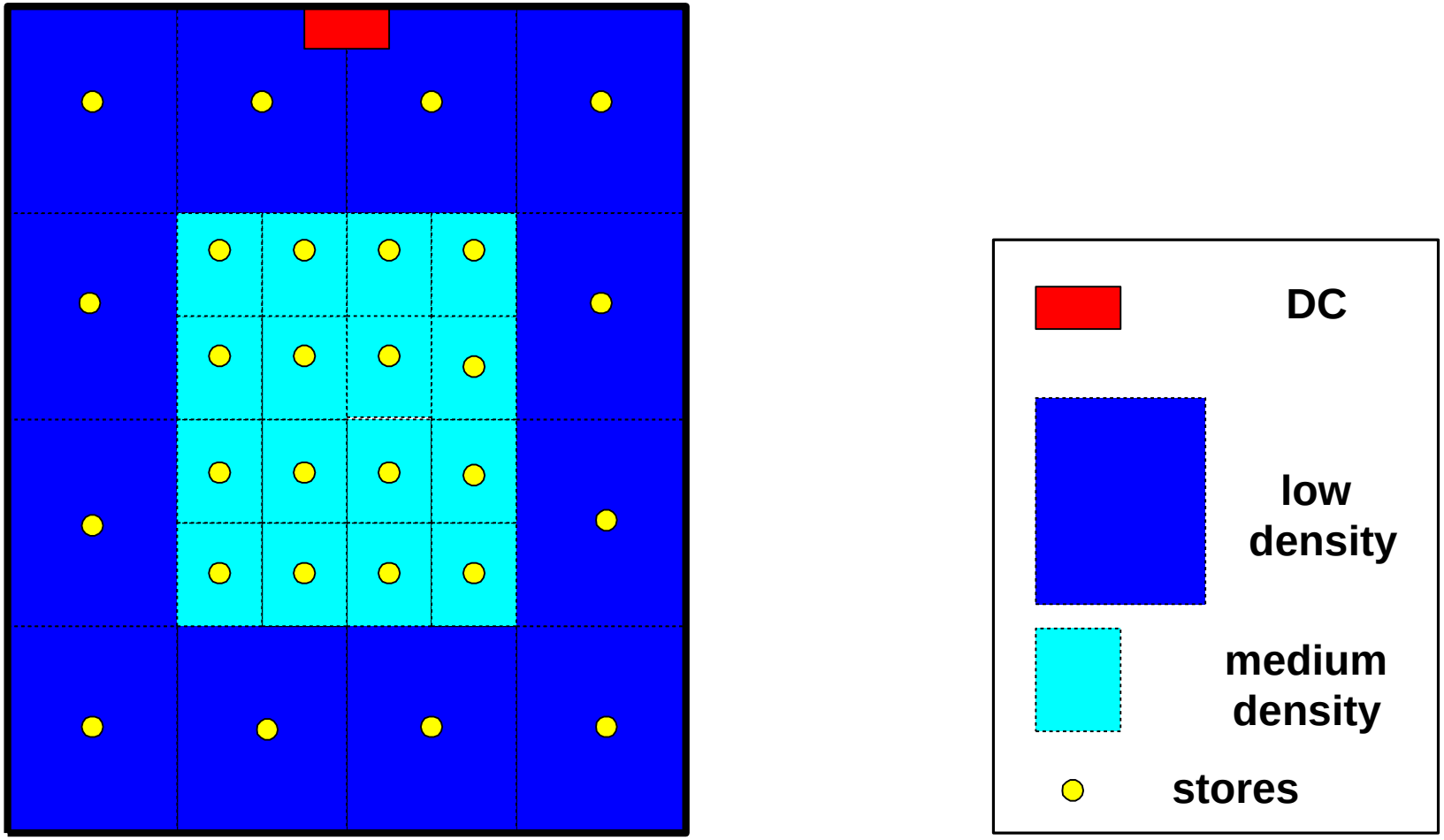
B2C Food Items



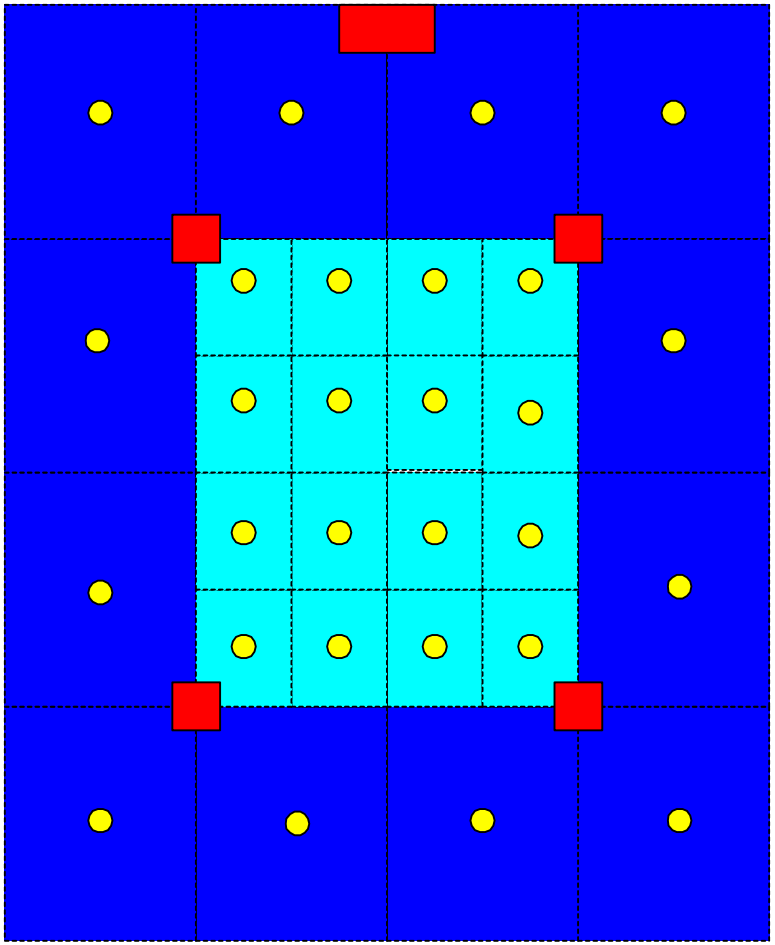
Thompson et al, 2001


colesonLINE
www.colesonline.com.au
POST
Food Transport Vehicle

Single Urban DC



Regional DC's



VKT with 1 DC

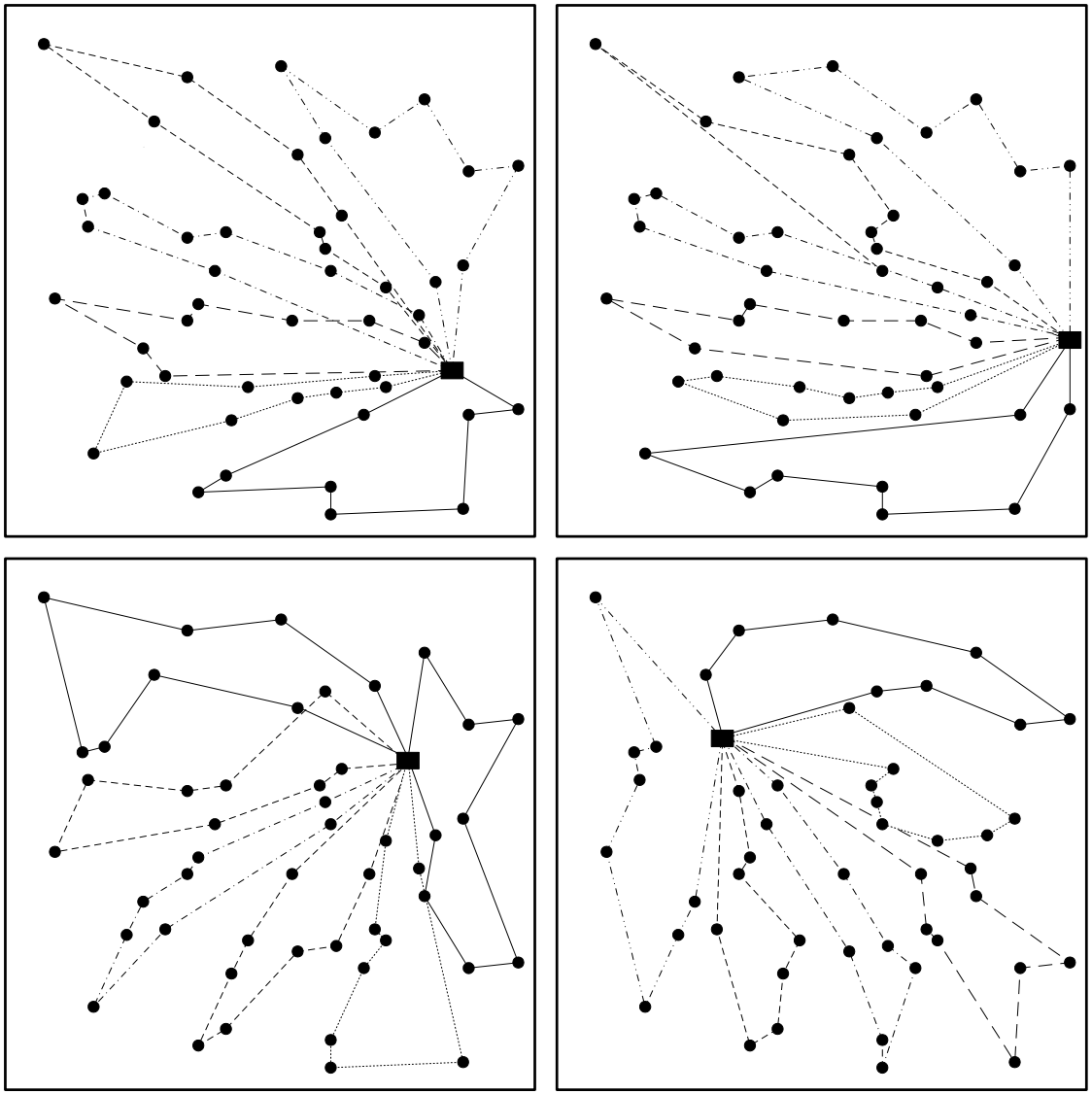
	Internet Sales		
	0%	5%	10%
Suppliers to distribution centre	481.1	481.1	481.1
Distribution to stores	458.5	458.5	426.9
Stores and homes (customers)	24037	22835.3	21633
Deliveries to homes	0	2805.9	6346.2
Total	24977	26580.9	28888
Increase (%)		6.4	15.7

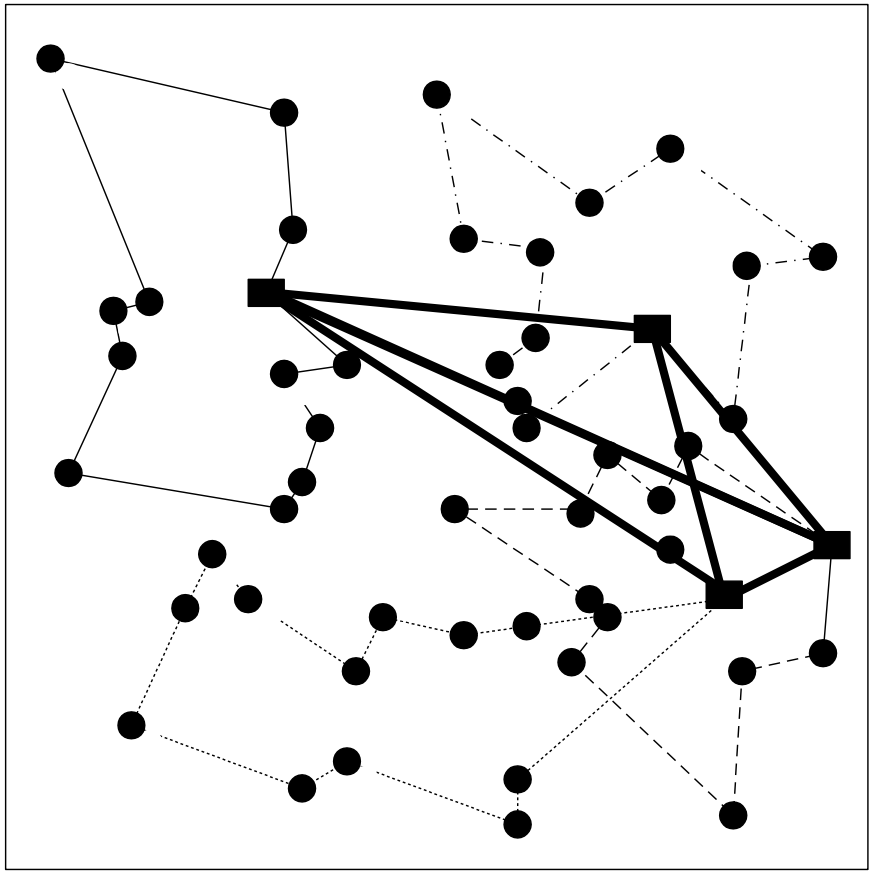
VKT with regional DCs

	Internet Sales		
	0%	5%	10%
Suppliers to distribution centre	481.1	481.1	481.1
Distribution to stores	458.5	458.5	426.9
Stores and homes (customers)	24037	22835.3	21633
Deliveries to homes from RDC's	0	1077.1	1841.5
Distribution to RDC's from MDC	0	214.8	214.8
Total	24977	25066.8	24598
Change (%)		0.4	-1.5

Collaborative Distribution

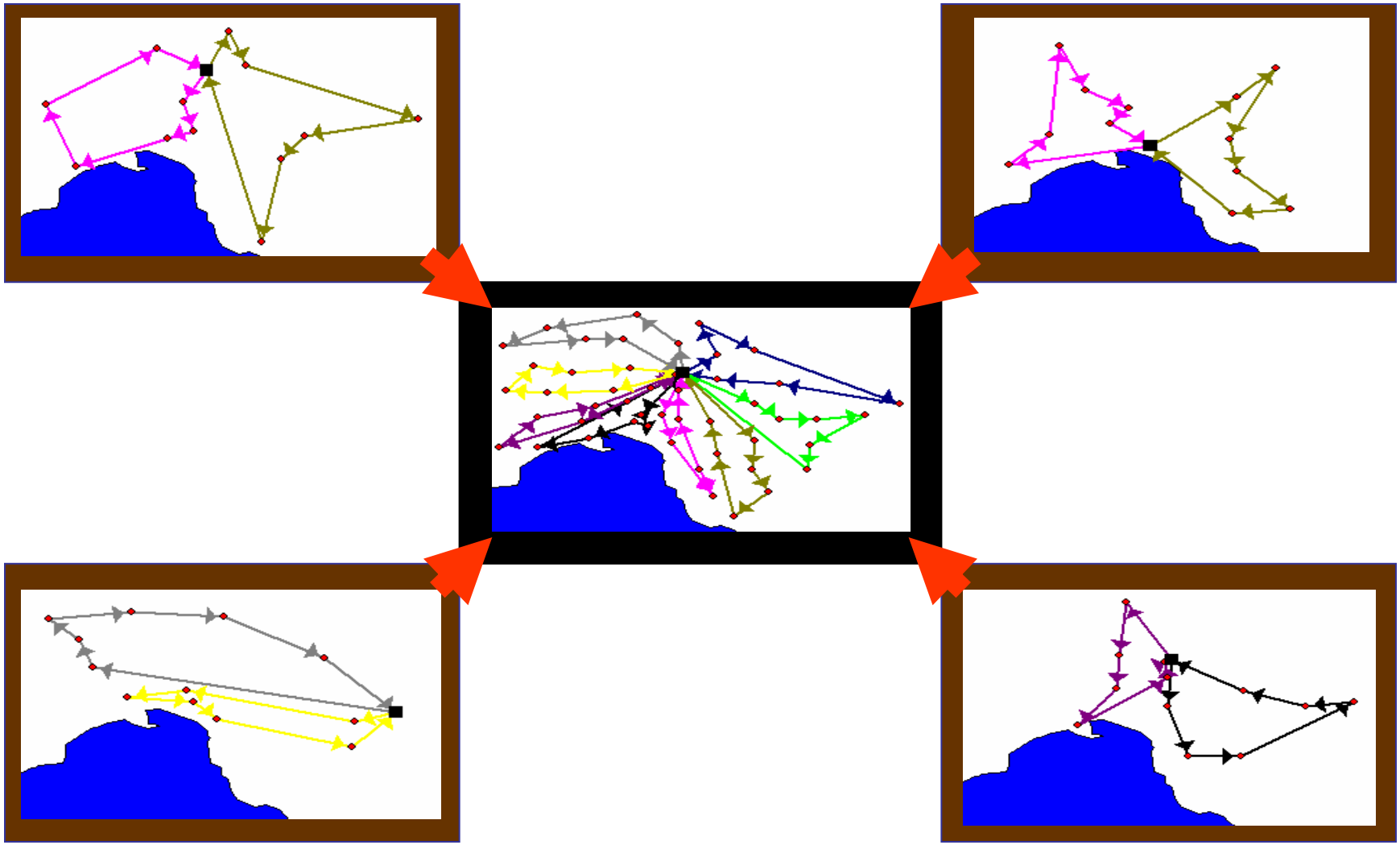
- Shared storage location(s)
- Networks restructured using advanced vehicle routing & scheduling systems
- Distribution to outlets by areas & priority
- Substantial savings in transport costs (20-30%)
- Significant reduction in environmental & social costs

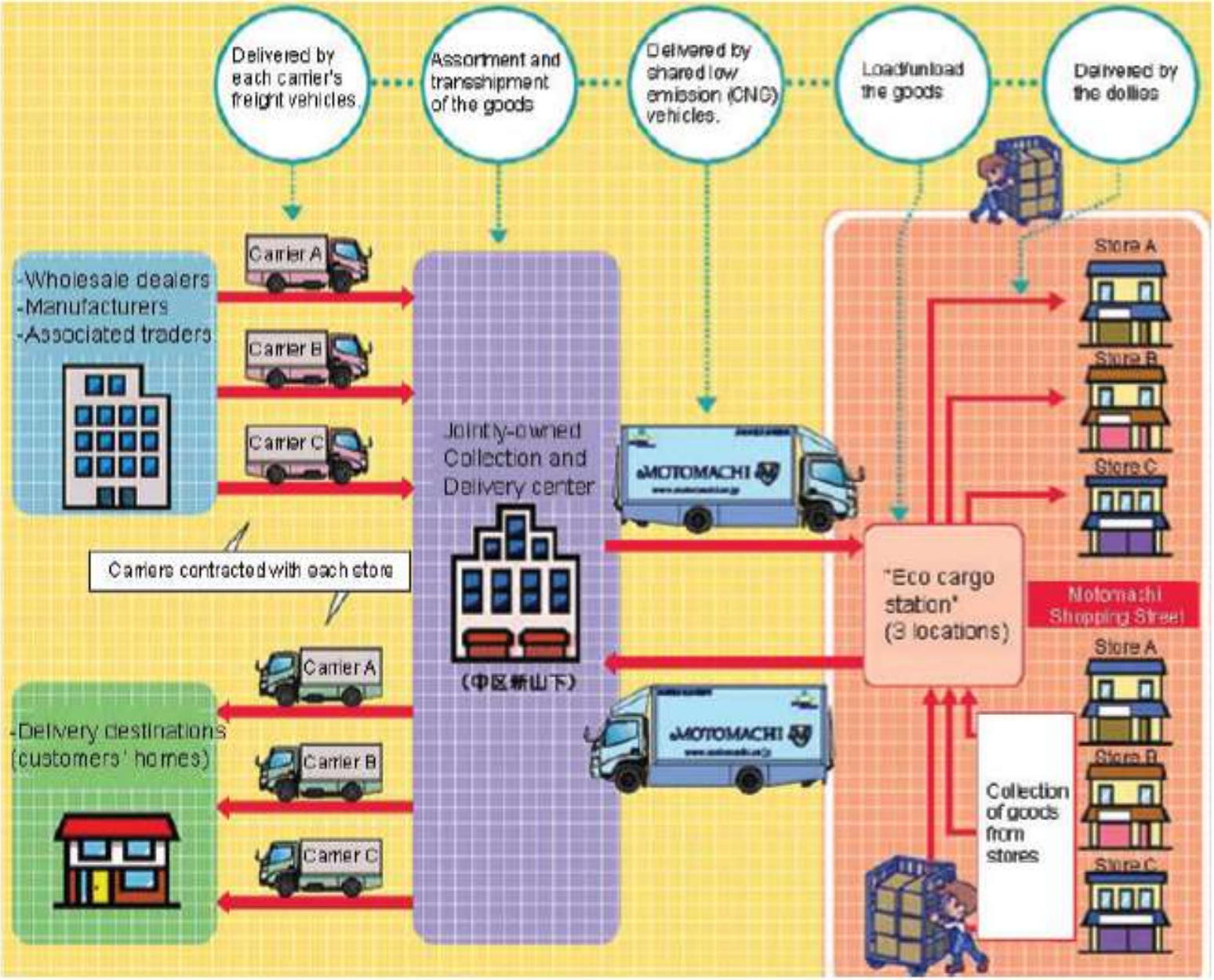




Around 20% saving in distance travelled

Collaborative Distribution in Melbourne





Motomachi Joint Delivery Centre in Yokohama, Japan PIARC, 2012

Binnenstadservice (inner city service)

www.binnenstadservice.nl

Quak and Hendriks, 2012


Parcel lockers
Parcel Lockers
24/7
auspost.com.au
Post office
boxes from

Volvo Centre of Excellence in Sustainable Urban Freight Systems

Aims to increase the quality of life, economic efficiency and ecological sustainability of urban freight systems

Research Themes

City Logistics (Collaborative & Intelligent Freight Systems)

Innovative Freight Vehicles (Alternative Fuels & High Productivity)

Freight Planning Methods (Surveys & Modelling)

Intermodal Freight Systems (Road & Rail)

Currently working with industry partners (Vicroads, CoM, DoTPLI) to define their research & training needs…

Core Research Partners: Group Leaders

CoE SUFS Goal

To jumpstart an integrative and participatory process—involving cities, private sector, and researchers—that will lead to the implementation of new UFS paradigms that:

- Are sustainable
- Increase quality of life
- Foster economic competitiveness and efficiency
- Enhance environmental justice

Urban Freight Symposium

Centre for Sustainable Urban Freight Systems (SUFS)

The University of Melbourne, 13th November, 2014

Featuring

Dynamic Vehicle Routing & Scheduling

Pick-up & Deliveries with Transfers

HPFVs: Network Design & Safety Benefits

VRS: phone traffic data (HERE)

Off Hours deliveries (NYC)

Urban consolidation centres with cargobikes

Parcel Lockers (AP & InPost)

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