SUGAR

Models and micro-simulation supporting city logistics

Dr Andrea Campagna Ph.D.
CTL – Sapienza University of Rome

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Current challenges for city logistics

Data collections, and the applications of ex ante and ex post evaluations.

Barriers and challenges to the implementation of innovative new approaches, and on the role of public policy.

Methods to analyze the interaction between goods, passenger transport and land use.

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Importance of ex-ante evaluation

Several types of city logistics measures can be used in order to mitigate negative effects of freight transport

The several reviews of ex-post evaluation highlight that many measures have generally been quite unsuccessful

It is fundamental to have methods and models to analyze measures before implementing for an ex-ante assessment of impacts

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Recent experiences of CTL in Rome

Year	Project	Activities
2008	Survey on urban freight distribution and comparison with 1999 survey on behalf of ATAC (mobility agency).	Traffic counts, survey on operators, city logistics measures, procedures
2009	VREF (Volvo, Sweden) smaller project "Innovative solutions to freight distribution in the complex large urban area of Rome"	Methodology for ex-ante evaluation, modelling systems, microsimulation
2010-current	Study on city logistics in Rome on behalf of the Employers and companies Association of Rome, Frosinone, Rieti, Viterbo (UNINDUSTRIA)	Survey on supply chains, business modelling, public-private coordination, test field of electromobility for freight distribution
2011	DG MOVE EC Urban Freight Study	Elaborate recommendations to the EC for the 2012 update of the urban mobility plan

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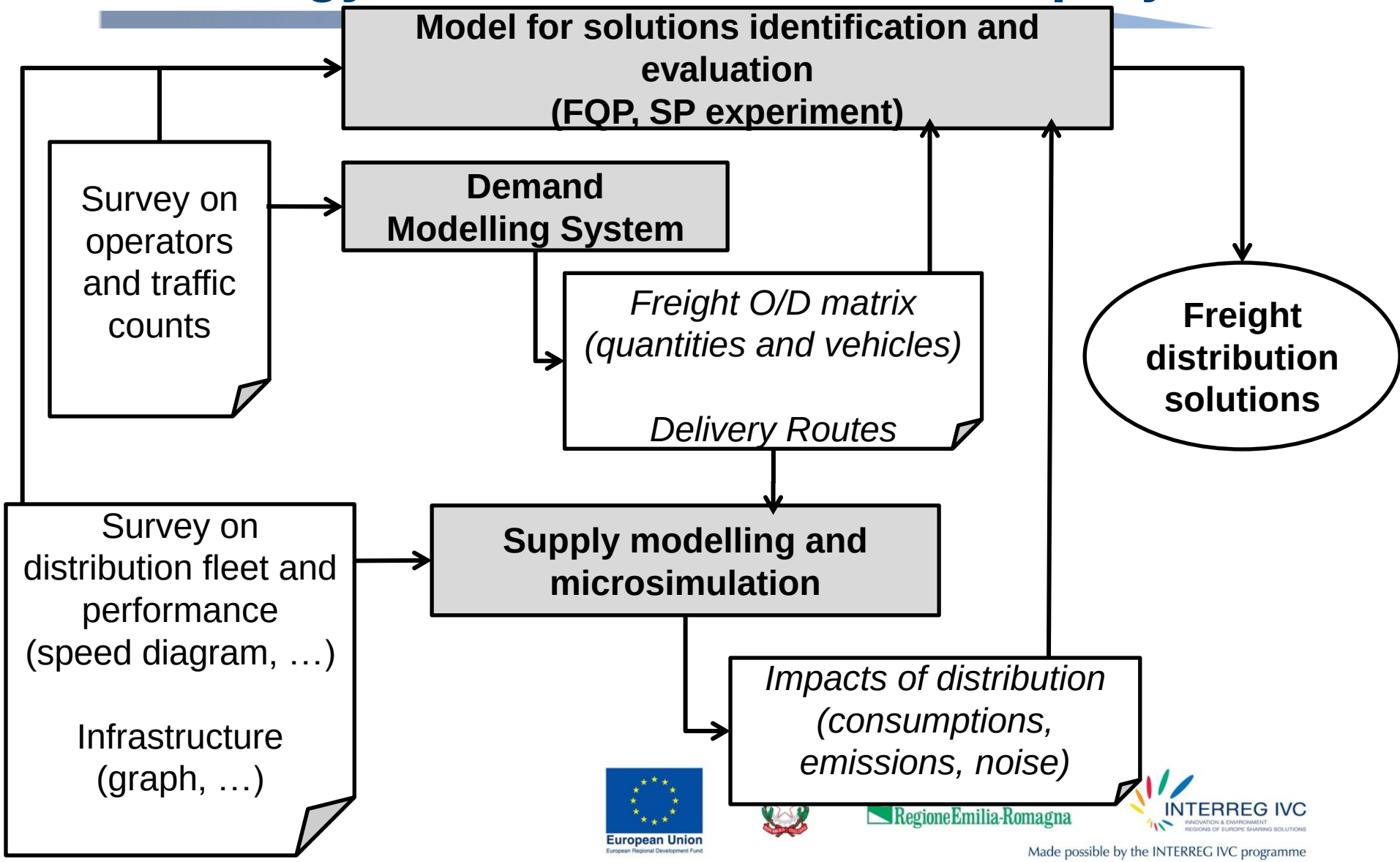
Methodology and models from VREF project



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Data gathering

Socio-economic data, area of study

- Operators and activities in the area
- Policies and regulation
- Infrastructures, network

Traffic counts

- Internal and external sections of the area
- Classification of vehicles

Surveys on

- Economic operators: type of goods, restocking practices, flows…
- Carriers: type of goods, type of services, transport practices…

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Demand modelling system - classification

Commodity-based

- (Ogden 1992; Oppenheim, 1994; Russo and Comi, 2002, 2009; Nuzzolo et al., 2006)
- Advantage: capture the mechanisms underlying the generation of freight demand
- Disadvantage: difficult to simulate trip-chains

Delivery-based

- (Routhier et al., 1999; Vigo and Gentile, 2006; Routhier and Toilier, 2007)
- Advantage: allow to follow the decision process of trip-chain definition
- Disadvantage: not able to account for changes in the mechanism underlying demand

Truck-based

- (Ogden 1992; Hunt and Stefan, 2007; Wang and Houlguin-Veras, 2009)
- Advantage: ease of data gathering, vehicle flows
- Disadvantage: not able to account for changes in the mechanism underlying freight demand, and to reproduce trip-chains

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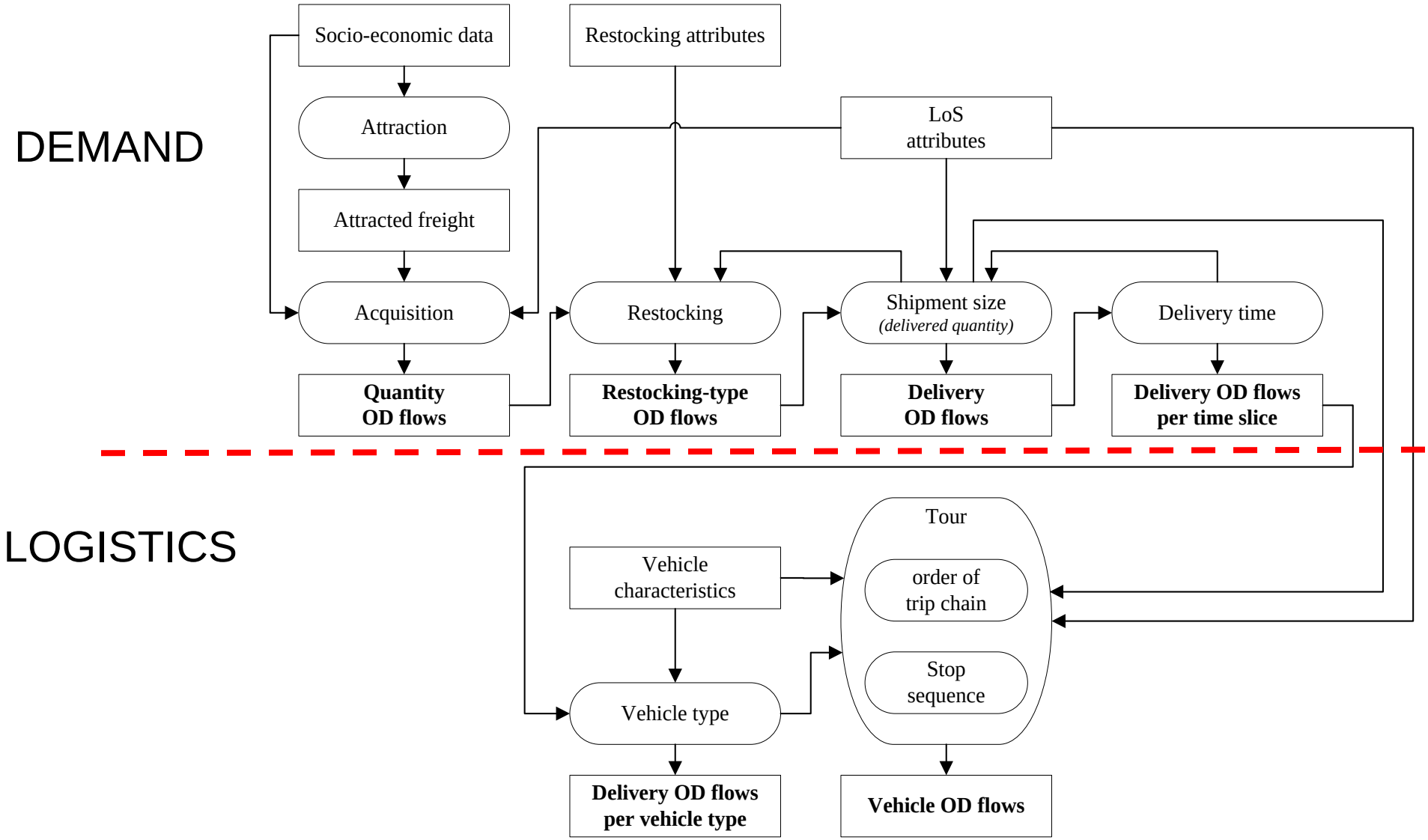
The developed modelling system



Model to evaluate stakeholders' attitudes

Dimensions

- evaluation of impacts that a policy-mix has on supply chain actors;
- distribution of the costs involved in the implementation of the policy among the supply chain members;
- identification of those supporting measures (e.g. fiscal measure, regulatory measures) that policy makers might introduce in order to induce specific policy-mixes.

Procedure

- Setup of a Freight Quality Partnership (public-private)
- Stated Preference Exercise (SPE): bundle of alternatives to describe and compare possible implementation of policy scenarios
- Evaluation of the condition to achieve willingness to accept and pay, and to collaborate with the others

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Example of results during the SPE in Rome

General problems:

- collecting and processing of data – flows and movement;
- correspondence between long term plans and short term projects;
- traffic flows and sharing of the city.

Specific problems:

- loading/unloading bays (too few, illegal occupation, no surveillance);
- time windows (too many exceptions to the current regulatory policy make it inefficient);
- entrance fee (thought to be too elevate or in need of a different articulation according to vehicle).

Innovative proposals

- UDC (placement and characteristics),
- Reserved lanes for goods distribution (hypothetical solution to the overlapping traffic flows problem).

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Example of evaluation of actors' reaction to policy mix

Behavioral reaction for retailer	% stating they will enact the behavior
Use pick-up-point for a part of deliveries	26.0
% of deliveries in pick-up-point	57.1
Use pick-up-point only if carrier covers the costs	24.7
Accept evening deliveries (before 22.00)	16.9
Accept night deliveries	13.0
Not change anything since I do not work in such hours	6.5
Other	16.9

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Microsimulation model for city logistics

Aim

- To verify whether or not the introduction of new loading zones within the Limited traffic area of Rome (ZTL) may improve the level of service by reducing road congestion and therefore reduce the emission of the vehicles whose trajectories are disturbed by the presence of a vehicle loading or delivering.

Data needed:

- delay to define the quality of the circulation;
- driving cycles to define punctual emissions.

Methods

- Traffic microsimulation models (e.g. TransModeler by Caliper)

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Why microsimulation?

Definition

- Dynamic and stochastic modelling of individual vehicle movements within a system of transportation facilities.
- Each vehicle is moved through the network of transportation facilities on a split second by split second basis according to the physical characteristics of the vehicle (length, maximum acceleration rate, etc.), the fundamental rules of motion (e.g. acceleration times time equals velocity, velocity times time equals distance) and rules of driver behaviour (car following rules, lane changing rules, etc.).

The use of simulation help model and analyze the operation of complex transportation systems under congested conditions.

Microsimulation is considered the best technical approach for performing a traffic analysis in several cases, including:

- incident management options
- choosing among alternatives, none of which eliminate congestion

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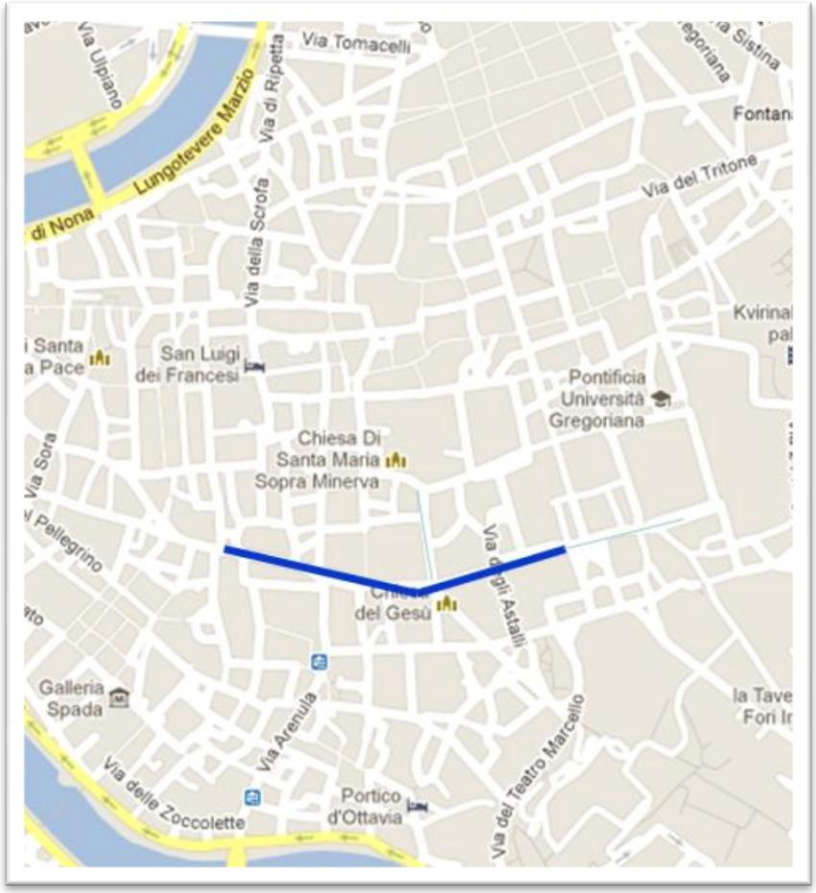
Example of application in Rome

The part of the Rome network with the highest number of loading/dropping stops has been selected

Peak hour (7.30-8.30)

Two heavy vehicles in each direction stop for 22 minutes (headway of 30 minutes)



Scenarios:

0 Second lane parking

1 Reserved loading zones

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Results

After some simulations (70 minutes each) the average delay is reduced by the new loading zone (scenario 1 against scenario 0)

The overall reduction of the time to run a km is close to 8% (52.1 sec/km to 48 sec/km)

The overall time saved by the simulated system is 2.2 hours

Anyway…

- In order to obtain validated models a large amount of experimental data is required

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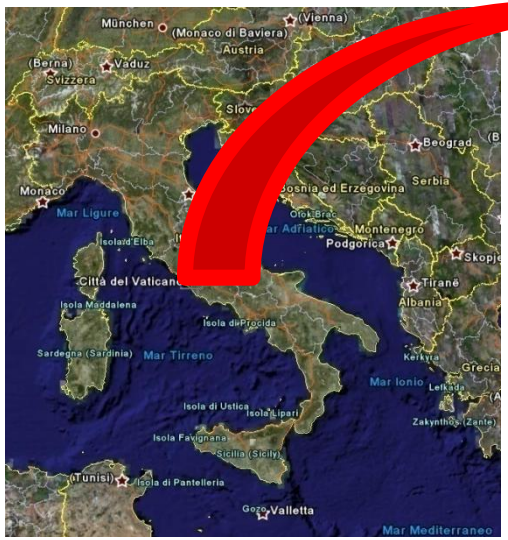
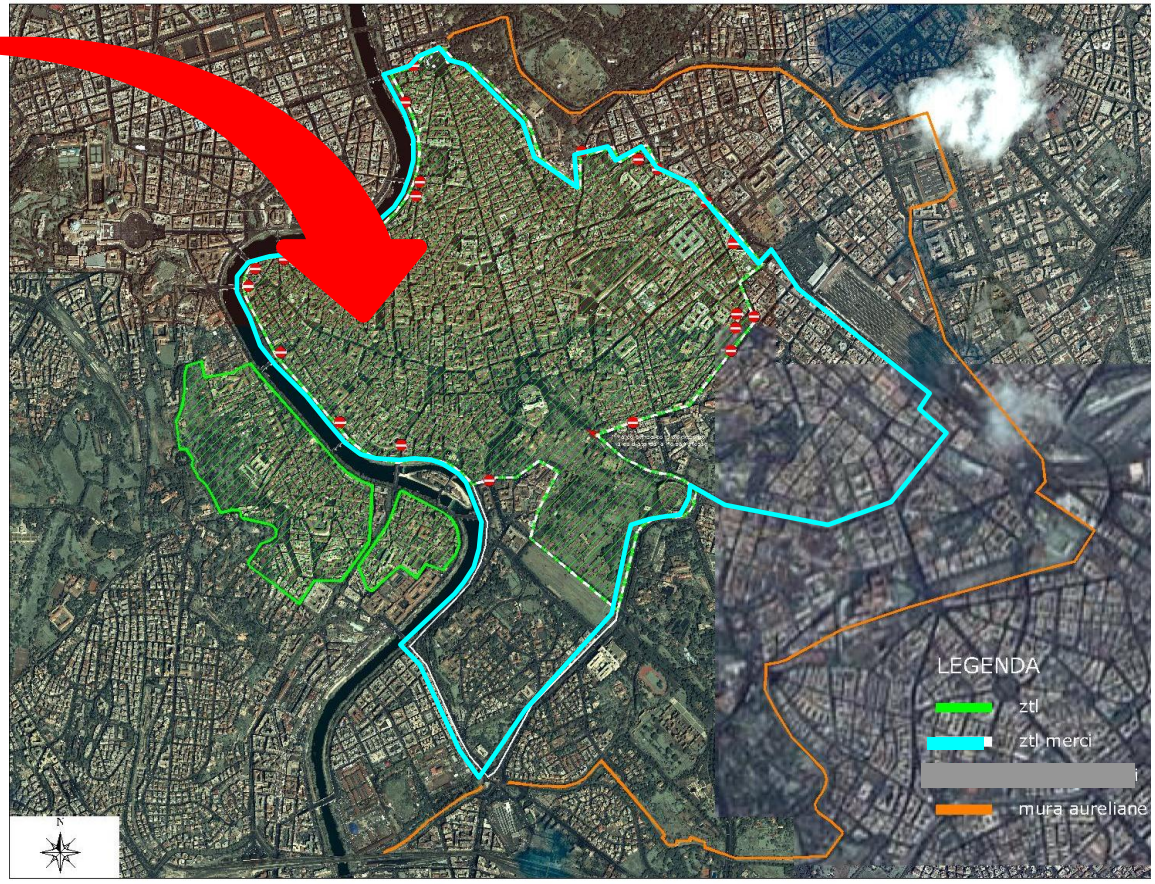
Example of application of the overall modelling in Rome





99 traffic zones

Inner area (*freight* LTZ)

- **16 Districts**
- **51,413 inhabitants**
- **24,401 trade employees**

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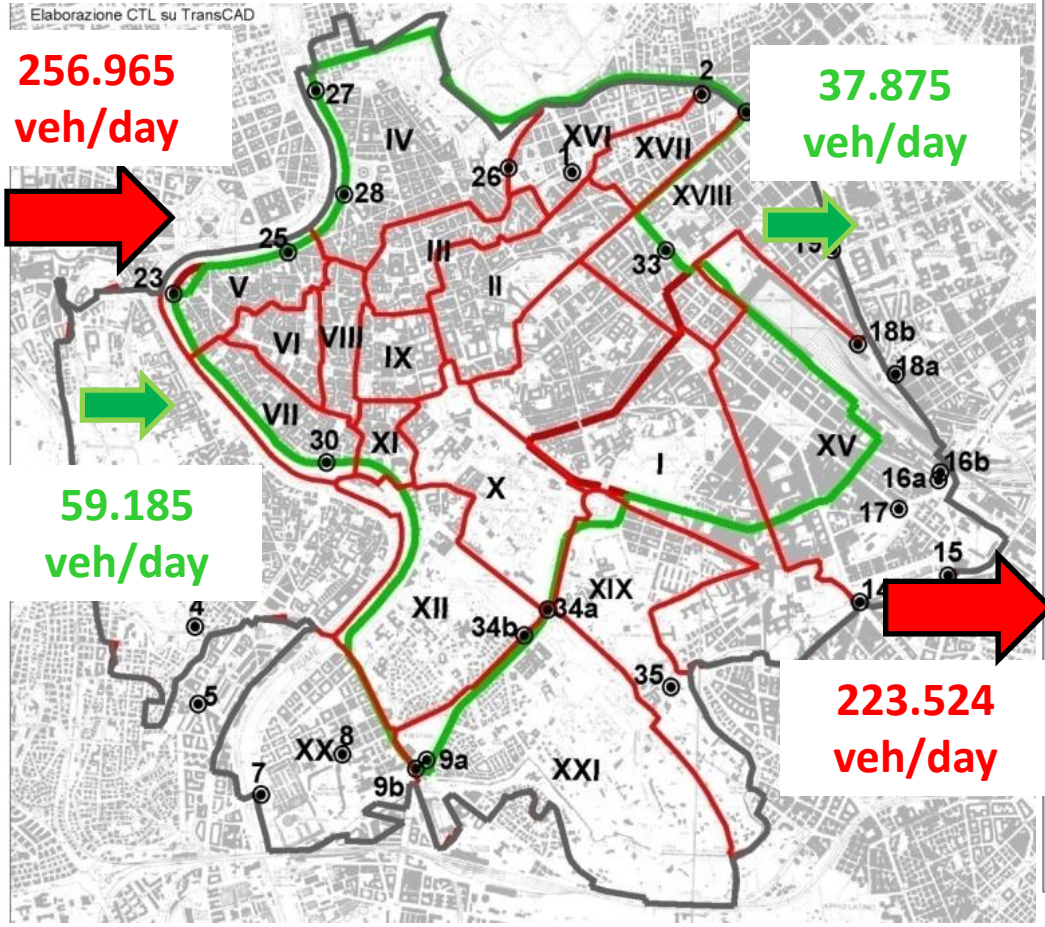
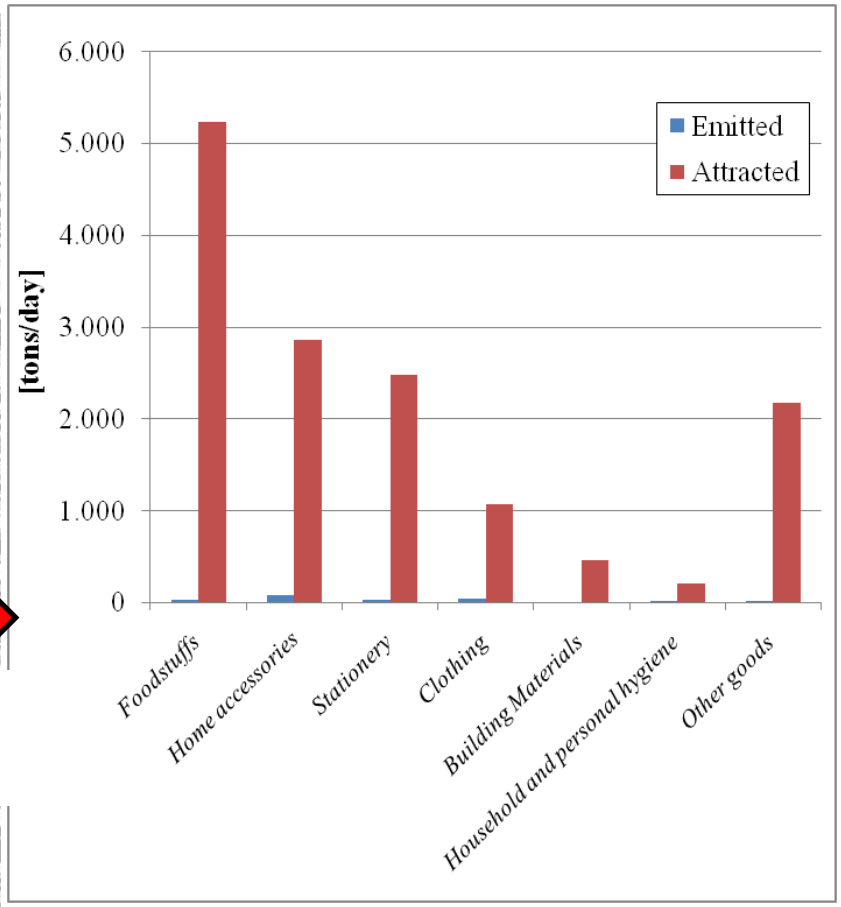
Revealed freight flows





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Assessment of solutions

The described methodology was applied to test four different scenarios in Rome:

- SC0 non-intervention and vehicle demand growth following the previous trend (+1.6%) without enforcing the control access;
- SC1 intervention and enforcing control for access to pre-Euro vehicles and for parking;
- SC2 access prohibition to vehicles that do not comply with the Euro 2 standards and market entry of Euro 5 standards;
- SC3 previous scenario (SC2) with a Urban Distribution Center.

The evaluation of environmental impacts was conducted using CORINAIR guidelines (European Environment Agency)

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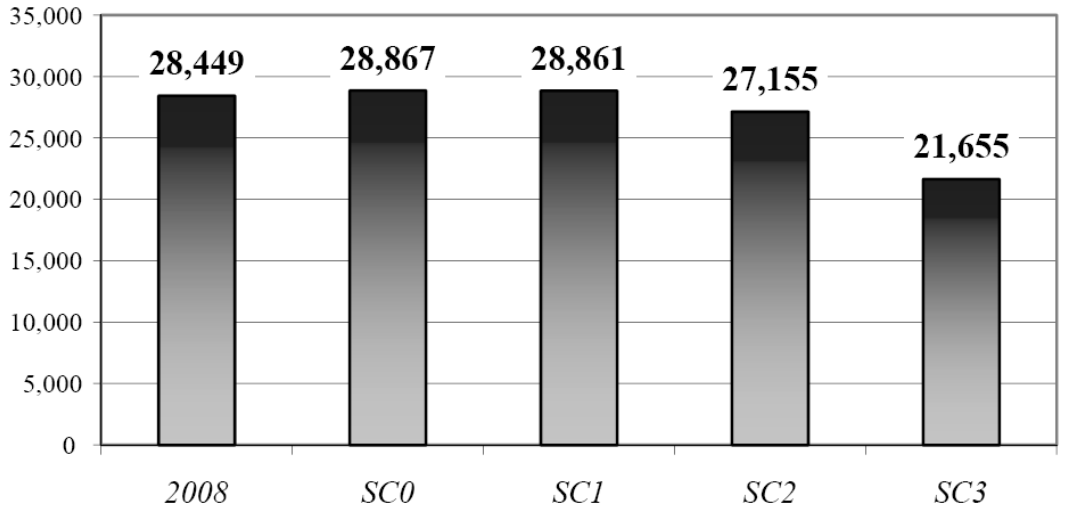
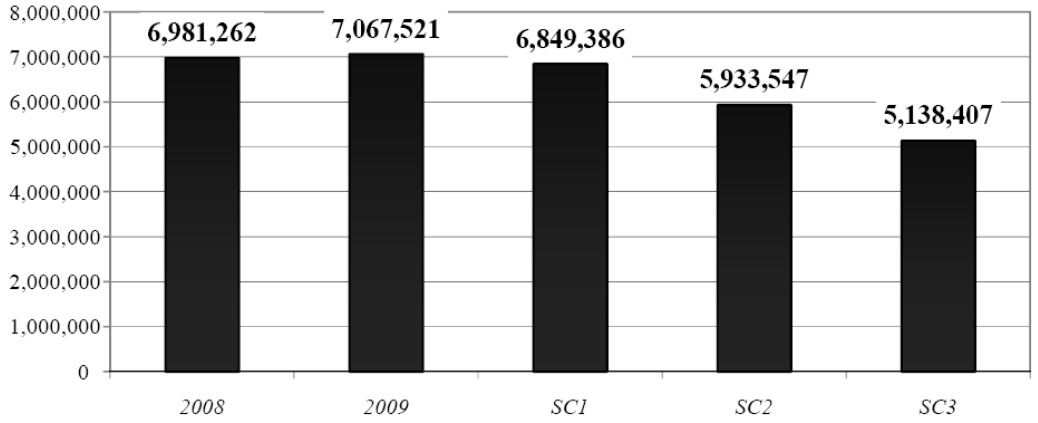
Impacts assessment

CO2 tonn/year



External costs €/year



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Effects of scenario implementation

Scenario	Unit	SC0	SC1	SC2	SC3
Variation on 2008	€/year	+86,259	-131,875	-1,047,715	-1,842,855
Vehicle replacement	Vehicles		523	2,541	523
Saving for vehicle	€		252	412	

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Cost Benefits Analysis of scenario SC3

Building costs	€	4,200,000
Handling equipment	€	200,000
Management costs	€/year	1,000,000
Operating and building time	Year	10+3
Reduction of pollution	€/year	1,842,855
Net Present Value	€	1,364,477
Internal Return Rate		18,1%

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Open issues

The methodology briefly presented has demonstrated to be a promising decision support tool for public decision makers.

But:

- Once a solution is ex-ante demonstrated to be valid and potentially sustainable, which is the most effective procedure to the full implementation?

- Which is the role of the public actors and the private?

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Evidence from EU cases (DGMove study)

It is fundamental to have a reference authority (skills within administrations' staff) for the organisation of urban freight transport. Many cities developed plans and guidelines.

Freight generally is not in the agenda of local politicians, but when this happens it is a success factor (e.g. Parma, Gothenburg)

Many initiatives have been originated by private entrepreneurs, while public administration provided an indirect support (e.g. the Netherlands).

Cooperation and agreement between the different stakeholders is a success factors for all the implemented measures (UDC, UCC, electromobility, access control,…)

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Specific requirements from main industries (DGMove study)

« Retail industry »

- Cooperation and coordination between actors and administrations
- More efficient urban planning
- Coordination between freight and passengers traffic
- Exploitation of new technologies in the sector

« Express Couriers »

- Harmonisation of regulations
- Use of electric vehicles
- Training of operators and adoption of recognition schemes

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The initiative of roman enterprises and CTL

Main objectives

- Design and validate a new procedure/model with sustainable practical solutions in the short/medium term, in conjunction with the specific requirements to achieve an effective and efficient implementation
- The model should include the specific needs of the operators
- The model should improve current freight distribution and make it more environmentally, socially and business sustainable

The ambitious intent is to go beyond usual common understandings regarding city logistics, which even if correct and proper cannot take into account procedures and financial issues connected with implementation processes.

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A new approach

From top-down political discussion to bottom-up approach with the involvemnt of all the stakeholders

Urban freight initiatives should not be considered limited to the last-mile segment, which can penalize the weakest leg, but a supply chain approache should be used, which includes supply chain alignment

Solutions business-oriented. City logistics problems should be transformed in economic opportunities for enterprises.

Decisions to be adopted on the basis of real measures of distribution (use of models).

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The Business Opportunity Plan concept

A tool to create conditions to promote business projects within the supply chain characterizing urban distribution flows

Makes use of direct institutional actions supported by the municipality with the involvement of stakeholders (mobility agency, industrial associations, retailers, etc.)

A committee has to be put in place in order to:

- Define, promote and support the implementation of the measures for sustainable urban distribution
- Define strategies and procedures for freight distribution using win-win approach, balancing environmental, economical and social requirements

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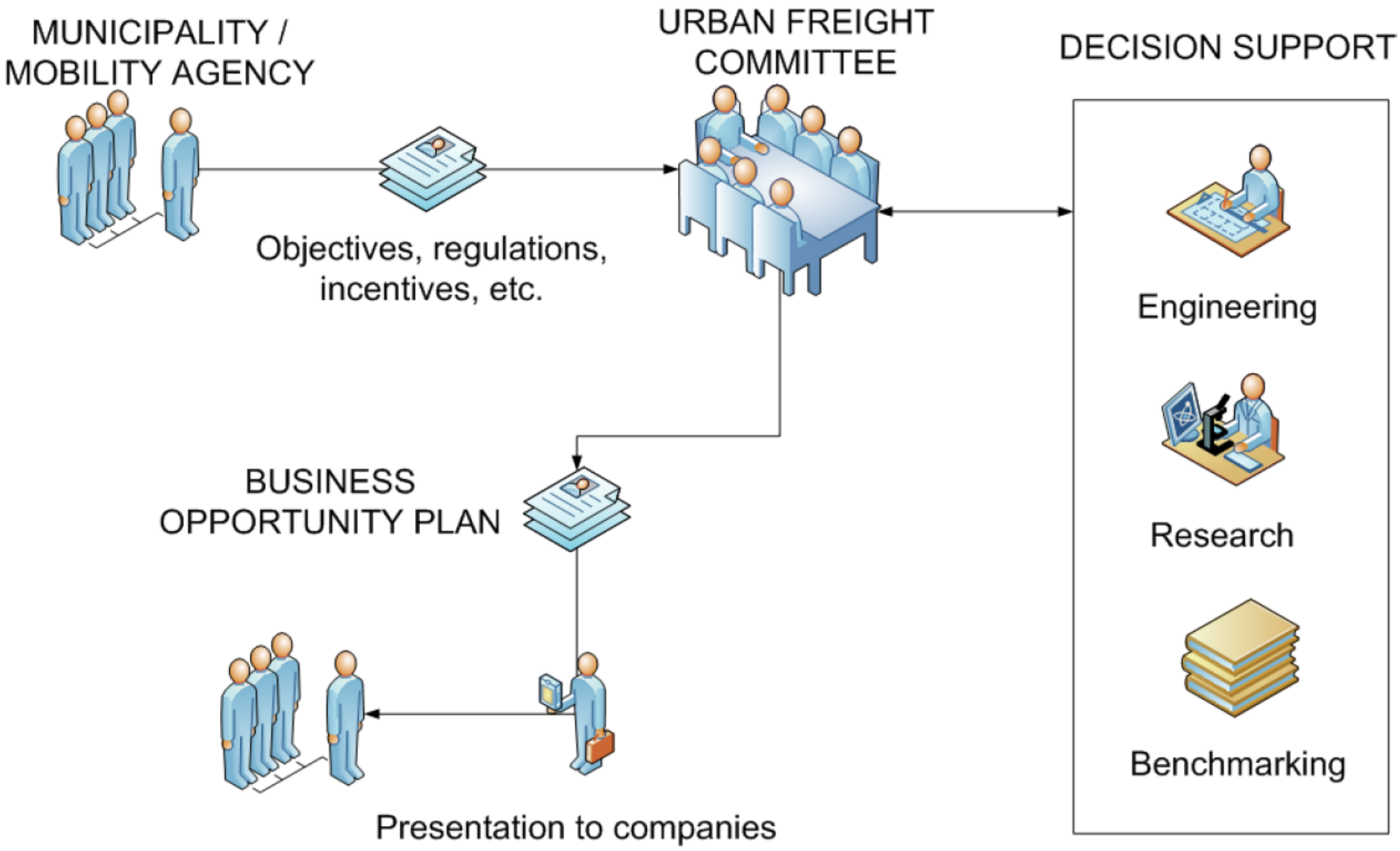
The model to be validated



Criticalities in Rome

After about 10 years the distribution in Rome has the same dimension (number of vehicles) and the only effect of the regulation is that fleet have been resized to be compliant

No use of loading/unloading bays, difficult to control

Stakeholders have different thoughts on what the problems are and which solutions can be put in place

High percentage of own-account transport

The municipality is focussed on a short-term vision (administrative period) while long-term scope is required

Confusion about the priorities:

- UDC? Incentives on eco-compatible vehicles?
- More restrictive rules?

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Current actions and policies of the Municipality of Rome

A new regulation scheme will be effective from 1 november 2011 and will modify time windows and access costs on the basis of the enviromental classification of the vehicle

Control of freight LTZ borders

Incentives to renew the fleet towards low emission vehicles

Van sharing services

New loading areas and control

UDC to be realised in central areas

Pedestrianisation of the historical centre

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Pilots

Activities:

- Operative re-organisation of services (consolidation, route re-planning, increase of load factor, ecc.)
- Change of restoking practices
- Use of technologies (vehicles, ICT)

Scenarios:

- Transit point,
- UDC or UCC,
- Platform

Synergy with GreenEMotion

La Petite Reine (FR)

CargoHopper (Utrecht,NL)

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Role of the actors

Municipality

- Provide the area for pilots
- Individuate potential areas for full implementation
- Establish an agreement with enterprises association in order to prepare tenders

Enterprises

- Evaluate the viability of current technologies for city logistics
- Suggest requirements to the administration
- Cooperate to design and realize the pilot project on electromobility

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Expected results

After the pilot

- Evidence of benefits from innovation on the actual business related to urban freight
- Actual data to evaluate impacts of measures will be made available
- Business opportunities to stimulate entrepreneurs
- Orientation of urban plans and regulation

Dissemination and exploitation

- New mobility concepts
- Support of shared policies

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Conclusions

Discussion around city logistics seems to be focussing on public-private mechanisms to make efficient the process to improve urban freight distribution practices

Policy makers should be concerned with the involvement also of business stakeholders to invest in opportunities from city logistics related activities

Regulation should be based on proper support from continuous monitoring of current practices

Technologies can be actual enablers only in business oriented scenarios

The concept of Business Opportunity Plan could be a valid method and is being investigated in Rome

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Thanks for your attention!

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campagna@ctl.uniroma1.it

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Backup slides

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Policy actions in Rome

1999 Urban Transport Plan required a Freight Plan to:

- Improve the quality level of urban liveability, and the efficiency of urban freight distribution
- Reduce traffic congestion, pollution and noise

2007 Review of the regulation on freight vehicle traffic zone

2008 Comparative survey on urban distribution practices (CTL)

2010 PSMS – strategic plan on sustainable mobility

2010 Institution of a working table to prepare the freight plan

- New apprach to simultaneously reduce the impact of freight distribution (new eco-vehicles) and guarantee business activities
- CTL cooperates with UIR (roman association of industries)

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Access charging in Rome LTZ

Categories qualifying for permit include goods delivery

Yearly permit at 570 €

- discounts for green vehicles
  (-20% CNG, LPG hybrid, -50% electric)

Daily permits at 35 € + 20 € una tantum

Opposition of operators to charge and to obligation of documentation delivery to get a permit

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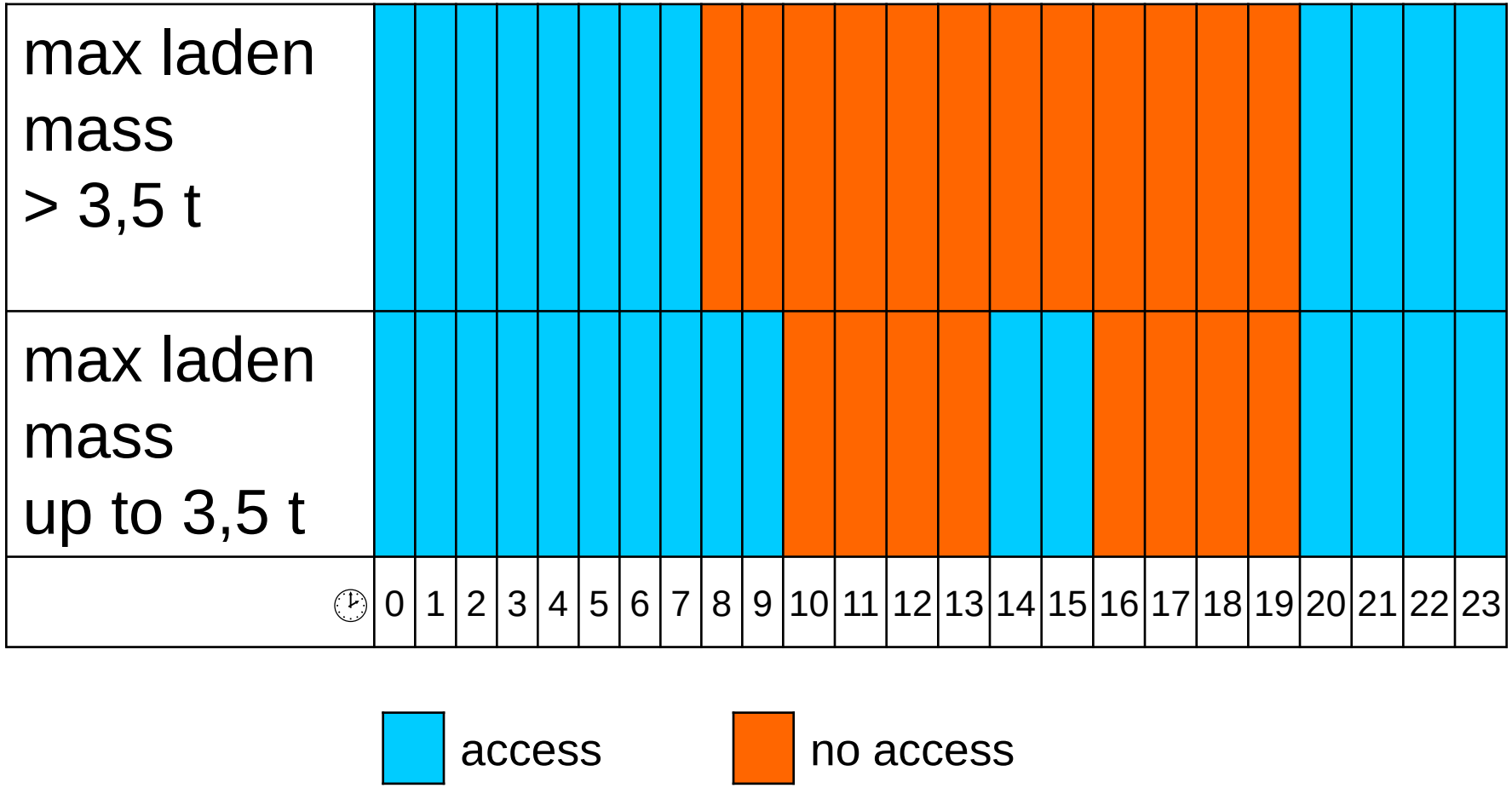
Time windows in Rome inner area



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Impacts of time windows in Rome

Third account vehicles exempted

Increase of third account based on survey on retailers

	own account	third account
1999 survey	54%	46%
2007 survey	21%	79%

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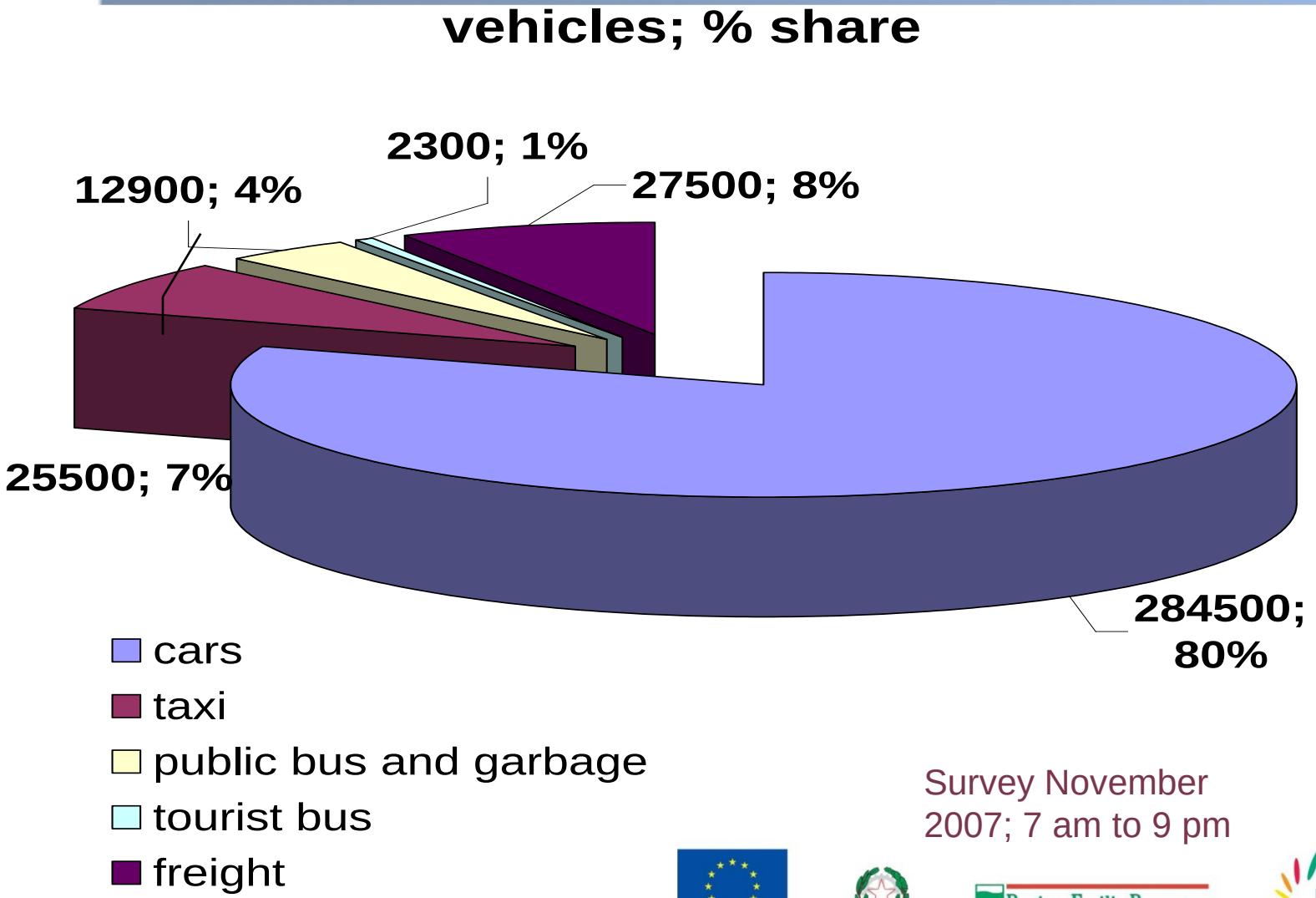
Traffic flows measured



Survey November 2007; 7 am to 9 pm

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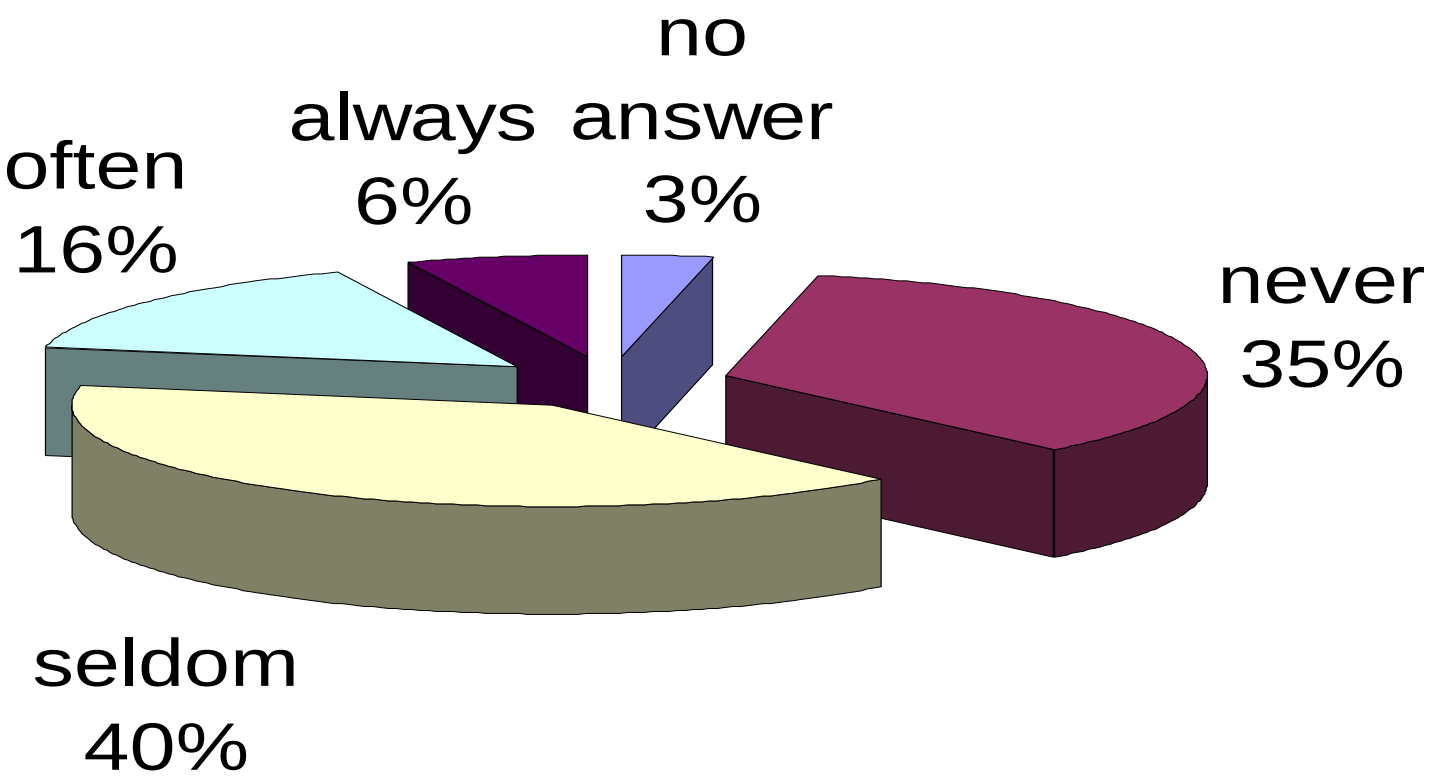
Use of loading/unloading space



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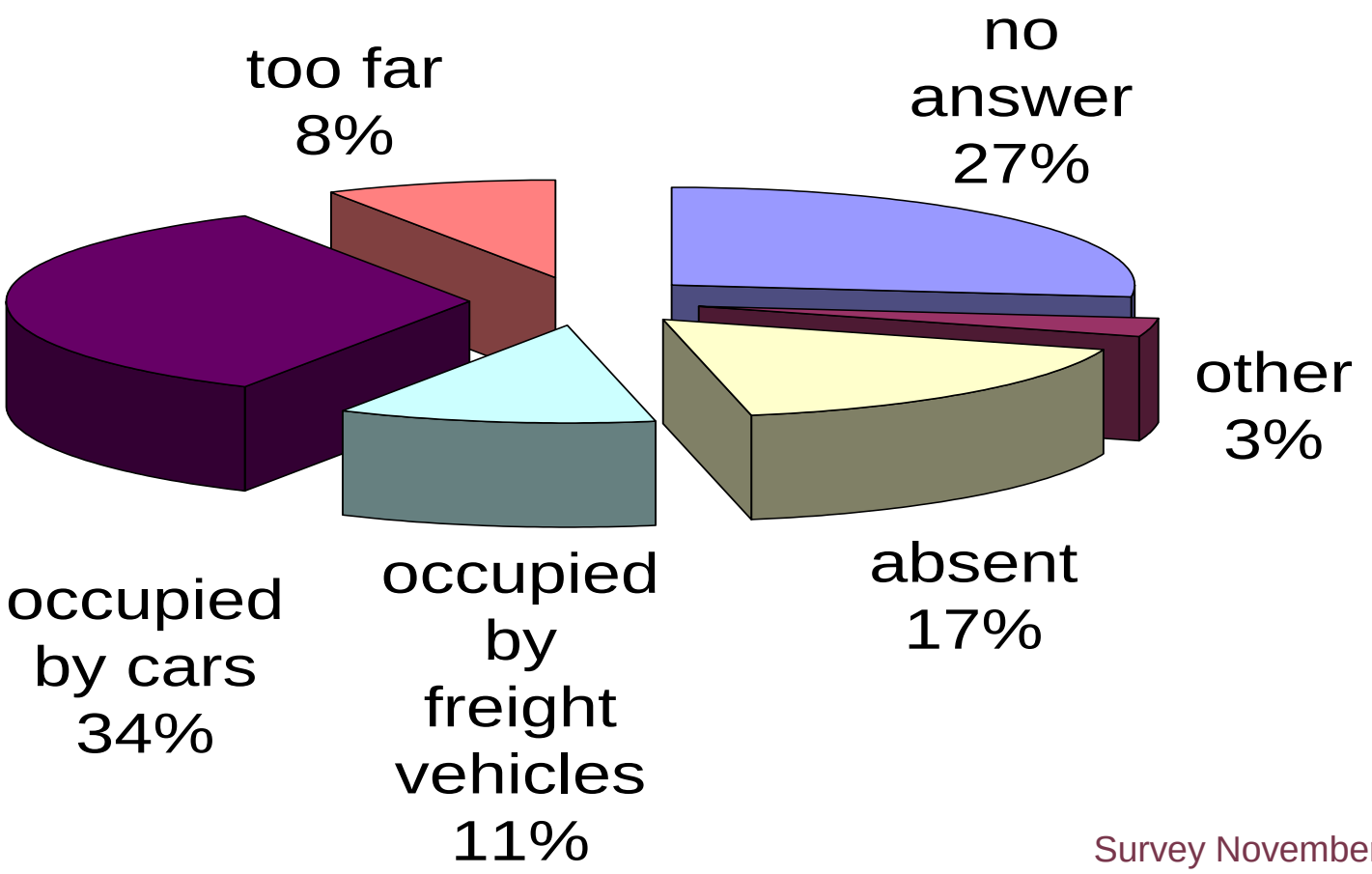
Reasons for non-use of L/U spaces



Survey November 2007

Volumes in the reference area

	Quantity	
	Emitted	*Attracted*
	[t/g]	*[t/g]*
Foodstuffs	34	5.234
Home accessories	88	2.864
Stationery	31	2.476
Clothing	38	1.075
Building Materials	0	468
Household and personal hygiene	0,1	207
Other goods	3	2.175
Total	**194,1**	**14.499**

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