Economías Urbanas, el Reto de la Logística Urbana, y el Rol de Ciudades Inteligentes

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Outline

- About the Rensselaer Polytechnic Institute
- The CoE-SUFS
- Informal discussion about myths and reality
- The challenge
- Why should we address freight issues
- Public sector initiatives
- Application of the NCFRP 38 planning guide

Instituto Politécnico de Rensselaer

Un poco de historia

- La institución de investigación tecnológica mas vieja en EUA
- Fundada en 1824 por Stephen Van Rensselaer
- Otorgó el primer titulo en Ingeniería Civil en los países de habla Inglesa en 1835
- Otorgó el primer titulo en Ingenieria Ambiental en el mundo en 1955
- Ranqueado en la posición 5 en USA Today List de "Top 10 Engineering Colleges in the U.S."

Contribuciones…

Washington Roebling, 1857

Cyril Martin, 1856

Brooklyn Bridge

Francis Collingwood, 1855

Contribuciones… de Latinos

6

Dr. Miguel Jaller
Profesor Asistente, University of California-Davis

Dr. Ivan Sánchez
Profesor Asociado, Chalmers University

Dr. Johanna Amaya
Profesor Asistente, Iowa State University

Dr. Carlos González
Profesor Asociado, Universidad Nacional Medellin

Areas de Investigación

7

- Sistemas de Transporte de Carga Sostenible: Diseñamos políticas de transporte para [illegible]mentar la sostenibilidad de las actividades lo[illegible]acemos investigación de comportamien[illegible]inir políticas.
- Modelos de Demanda de C[illegible]amos modelos que predicen la demar[illegible]ico de transporte de carga, para fines d[illegible]ión de sistemas de transporte.
- Logística d[illegible]a a Desastres: Hacemos investig[illegible]campo / post-mortems de desastres, definimos[illegible]ticas para mejorar las respuestas, desarrollamos modelos de procesos poco estudiados.

En estos temas, nuestro grupo es uno de los más citados a nivel mundial

The CoE for Sustainable Urban Freight Systems

-Funded by the Volvo Research and Educational Foundations (VREF)-

CoE-SUFS' Goal

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- To jumpstart an integrative process, involving cities, private sector, and researchers to develop new freight systems paradigms that:
  - Are sustainable
  - Increase quality of life
  - Foster economic competitiveness and efficiency
  - Enhance environmental justice
- To maximize the economic benefits of production and consumption of freight, and minimize the negative externalities produced by freight traffic

The CoE-SUFS Global Research Network

11

UNIVERSITY OF WESTMINSTER

TU Delft

TNO

PENNSTATE

Events

Events (see www.coe-sufs.org)

- Peer-to-Peer Exchange webinars
  - To disseminate best practices in urban freight
  - To foster research and implementation of novel ideas
- Regional workshops intended to:
  - Stimulate decision makers and researchers to adopt state of the art/practice of urban freight policy/programs
  - Grow the freight research community
  - Create an international network of researchers/practitioners
- Collaborative research projects ongoing with
  - Indian universities
  - Colombian universities
  - Brazilian universities
  - Swedish universities, etc etc etc

Myths and Reality in Urban Freight

Rules of the game

- I am going to flash a set of questions
- Five of you will be asked to answer each question (5 seconds each)
  - Do not try to be politically correct, diplomatic, etc
  - I want to hear the **first thing** that comes to your mind
  - It does not matter if somebody else said the same thing
- One of you will record the answers
- Urban Freight System = UFS

What comes to your mind when I say……? 20

- Truck?
- Freight?
- Urban Freight Transportation System?
- Logistics
- Internet purchases

What type of association (positive, negative…)? 21

- Truck?
- Freight?
- Urban Freight Transportation System?
- Logistics
- Internet purchases

What impacts do they produce…?

22

- Truck?
- Freight?
- Urban Freight Transportation System?
- Logistics
- Internet purchases

Which part of the UFS produces the most…

23

- Aesthetic degradation?
- Congestion?
- Pollution?
- Pavement damage?
- Accidents?

What is the best way to deal with…

24

- Aesthetic degradation?
- Congestion?
- Pollution?
- Pavement damage?
- Accidents?

Which stakeholder is key to solve…

25

- Aesthetic degradation?
- Congestion?
- Pollution?
- Pavement damage?
- Accidents?

In a typical city…

27

- How many kg/person-day are handled?
- What is the main use of the cargo?
- How many truck-trips/employee-day are generated?
- What percent of trucks are empty?
- What is the load factor of trucks?
- Who produces more trips? Small or large stores?

In a large city…

28

- Who produces more truck-trips? The port (or distribution centers) or restaurants?
- Who produces more truck-trips? The port (or distribution centers) or large buildings?
- Who handle more cargo? The food sector or the construction sector?

In most cities…

29

- The contribution of trucks is a net positive? negative?
- Could trucks be replaced with…?
  - Rail
  - Bicycles
  - Drones
  - Other
- Trucks produce more or less accidents (on a per capita basis) than cars?
- Trucks = Freight ?

In this beautiful city…

30

- List the large freight traffic generators
- How many people live?
- How many employees work in this metropolitan area?
- How many employees in freight-intensive-sectors (those that trade in freight)?
- How many restaurants? retail stores?

Answers…

In a typical city…

- How many kg/person-day are handled?
- What is the main use of the cargo?
- How many truck-trips/employee-day are generated?
- What percent of trucks are empty?
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In a large city…

33

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34

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In this beautiful city…

- List the large freight traffic generators
- How many people live?
- How many employees work in this metropolitan area?
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- How many restaurants? retail stores?

The challenge…

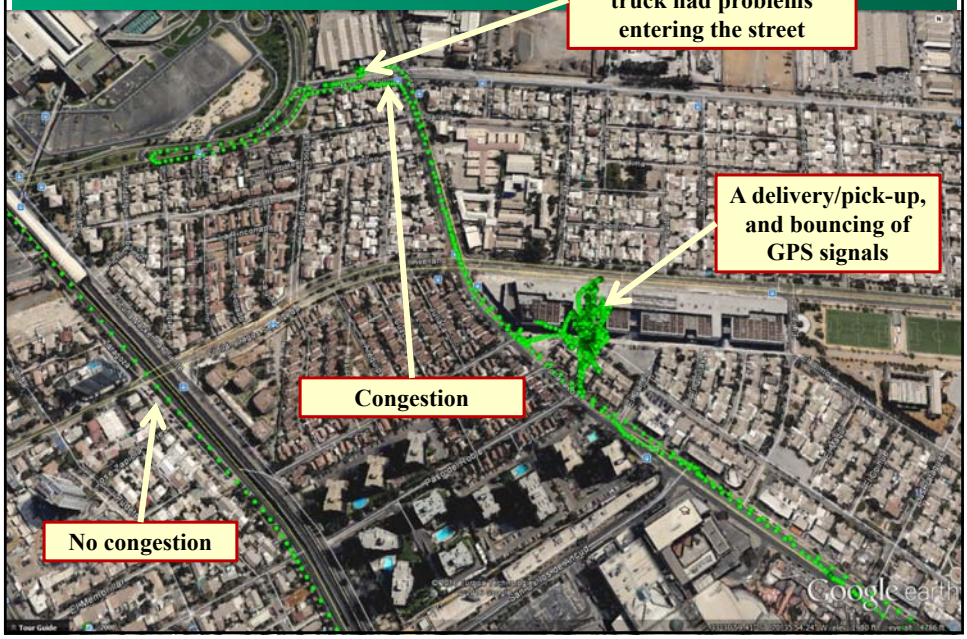

This is what we all want…
Square Park
ONLY


This is what we need to change…

Urban Economies and the Generation of Freight, Freight Trips, and Service Trips

Santiago

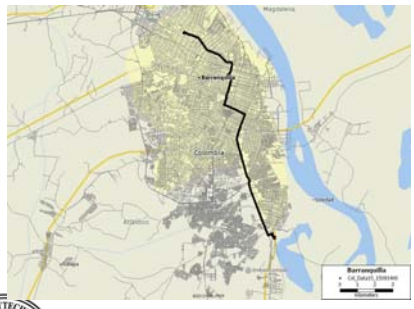
40

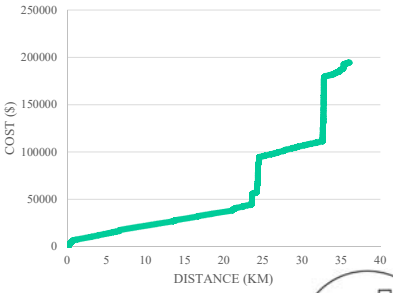


Barranquilla – Typical Congestion

41

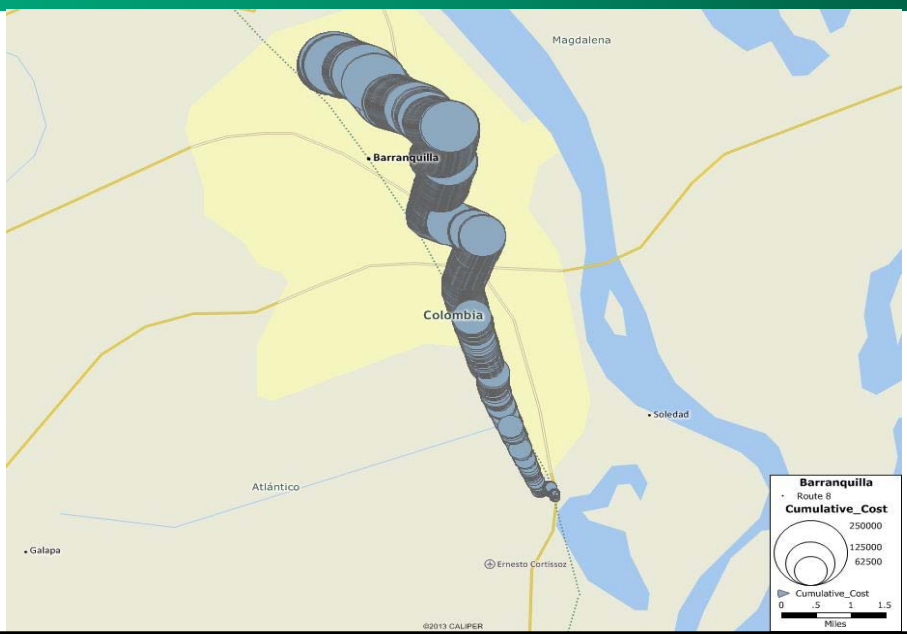
	Additional Time	Additional Cost
This Route	3.25 hours (71%)	164%
City Min	0.05 (7%)	9%
City Max	6.18 (87%)	368%
City Average	2.62 (65%)	151%





Barranquilla – Congestion Costs – One Way

42



Industry Sectors in Metro/Micropolitan Areas

NAICS	Freight-intensive Sectors (FIS)
11	Agriculture, Forestry, Fishing, Hunting
21	Mining, Quarrying, Oil / Gas…
22	Utilities
23	Construction
31-33	Manufacturing
42	Wholesale Trade
44-45	Retail Trade
48-49	Transportation and Warehousing
72	Accommodation and Food Services

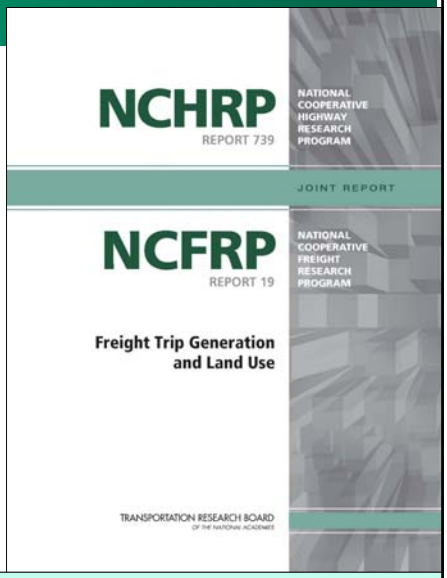
45% of commercial establishments and 50% of employment

NAICS	Non-freight-intensive Sectors (non-FIS)
51	Information
52	Finance and Insurance
53	Real Estate and Rental and Leasing
54	Professional,Scientific,Tech. Services
55	Management of Companies /
56	Administrative,Support,Waste Manag.
61	Educational Services
62	Health Care and Social Assistance
71	Arts, Entertainment, and Recreation
81	Other Services
92	Public Administration

2.8% of commercial establishments and 3.6% of employment

Background

- Based on surveys:
  - Establishment-level surveys
  - CFS microdata
- Estimated FTG models
  - Establishment-level
  - Economic based
  - Using publicly available data as independent variables
- Validated them
- Outperformed the alternatives
- Free-software available…

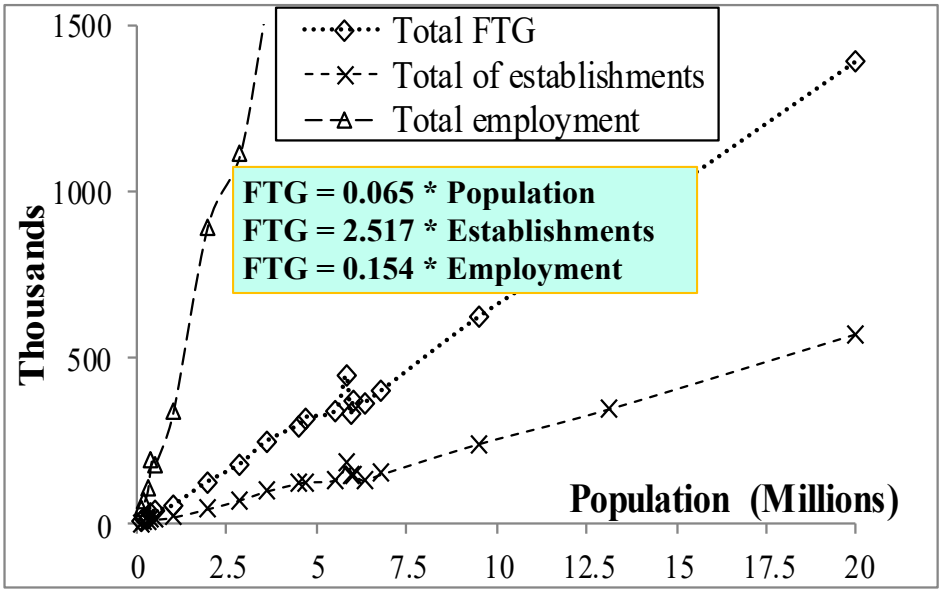


The second phase produced models to estimate freight generation, freight trip generation, and service trip generation (to be released later this year)

This presentation is based on the "old" models…

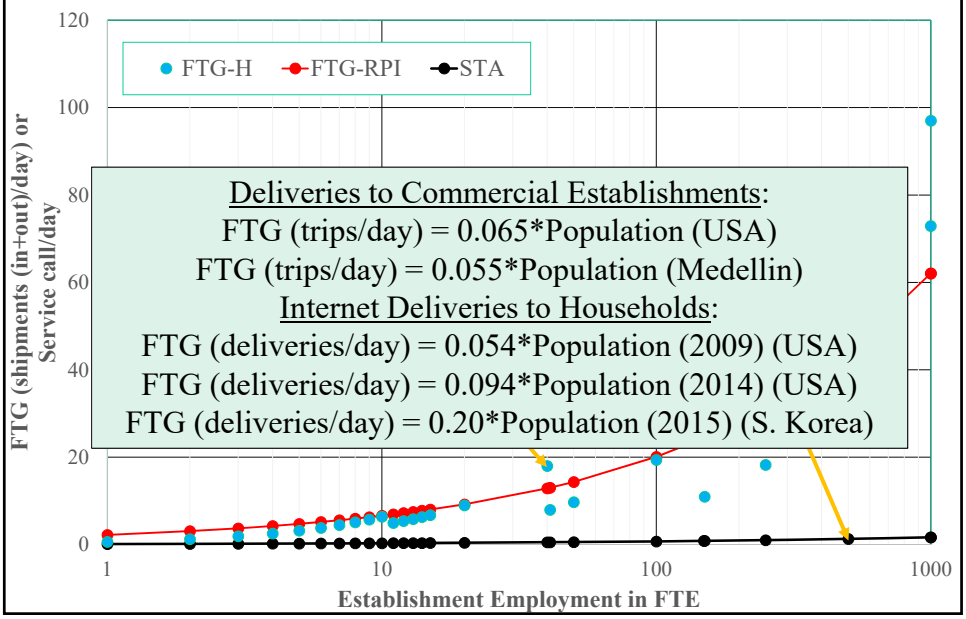
FTG at Metro/Micro-politan Areas

45

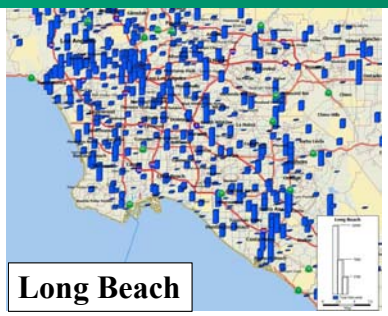


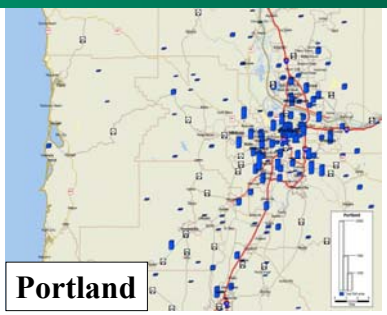
FTG for FIS, and STA for all sectors

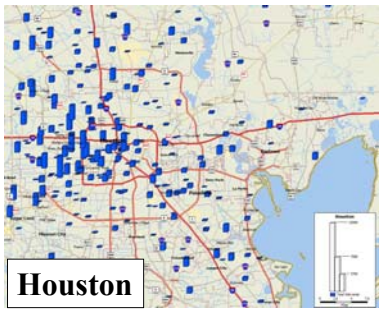
46

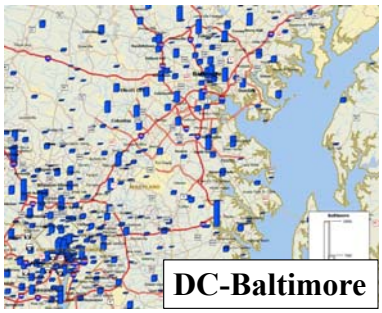


Freight Trip Generation by ZIP Code









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Establishment based freight trip generation …

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NAICS	Description	NY-North NJ-Long Island	Palm Bay-Melb...FL	Fargo, ND-MN	Lebanon, PA
44	Retail trade	39.06%	44.19%	34.85%	37.50%
42	Wholesale Trade	19.41%	11.04%	17.89%	13.57%
72	Accommodation / Food Services	15.72%	16.87%	13.97%	14.35%
23	Construction	1.47%	14.35%	16.14%	12.18%
31	Manufacturing	8.17%	8.80%	8.11%	15.35%
48	Transpor			3%	7.05%
Total freight trip generation (FTG) for FIS		1,024,477	25,082	15,515	10,285

Retail/Accommodation/Food > 50% of FTG

1964: 2.8 million truck-trips (all sectors), 18.5 million people, 8 million employees

Number of establishments (FIS)	235,325	5,893	3,317	2,185
Employment (Total)	7,568,043	172,925	119,626	79,543
Employment (FIS)	3,061,899	84,821	63,186	47,164
Establishments (FIS)/1000 persons	11.796	10.699	14.842	16.127
Employment (FIS)/1000 persons	153.482	153.990	282.724	348.110
FTG/1000 employees (all sectors)	135.369	148.517	129.698	129.302
FTG/1000 employees (FIS)	334.589	302.783	245.549	218.071
FTG/1000 persons	51.354	46.625	69.423	75.913
Average FTG per establishment	4.353	4.358	4.677	4.707
Average employment per establishment	13.011	14.394	19.049	21.585

FTG vs. Establishment Size

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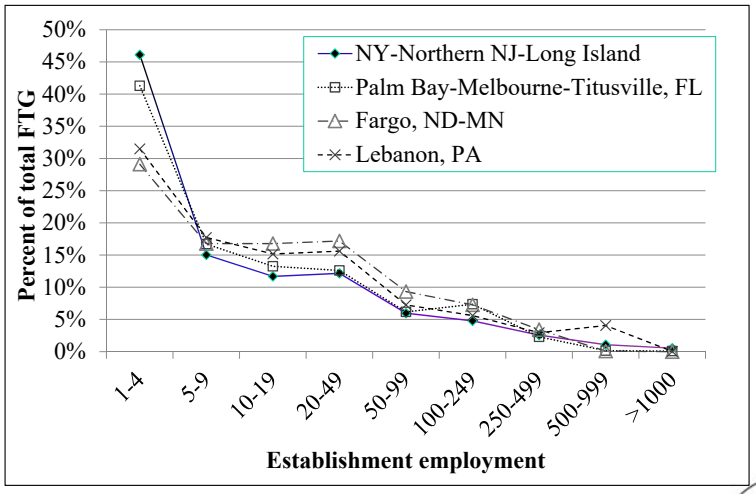
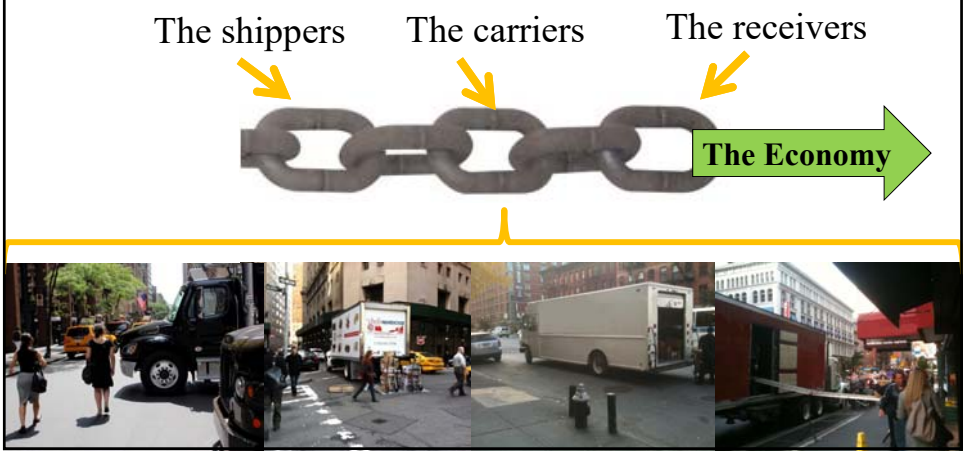


Who needs to change behavior??

50

- Not only the freight carriers → Entire supply chains need to change behavior…



The JHV principle: In complex systems, obvious solutions are (almost) always wrong…

Congestion problems are not new…

Julius Caesar's Rome: Lex Iulia Municipalis BC 45

QUAE VIAE IN URBAN ROMAN SUNT ERUNT INTRA EA LOCA, UNI CONTINETI HABITABITUR, NE QUIS IN IEIS VIEIS POST K. INANUR. PIRMAS PLOSTRUM INTERDIU POST SOLEM ORTUM, NEVE ANTE HORAM X DIEI DUCITO AGITO, NISI QUOD AUDIUM SACRARUM DEORUM INMORTALIUM CAUSSA AEDIFICANDARUM, OPERISVE PUBLICE FACIUMDEI CAUSA, ADVEHEI PORTARI OPORTEBIT, AUT QUOD EX URBE EX VE IEIS LOCIS EARUM RERUM, QUAE PUBLICE DEMOLIENDAE LOCATAE ERUNT, PUBLICE EX PORTAREI OPORTEBIT, ET QUARUM RERUM CAUSSA PLOSTRA H.L. CERTEIS HOMINIBUS CERTEIS DE CAUSEIS AGERE DUCERE LICIBIT.

"On the roads which are in the city of Rome or will be within the area where will be lived joined tightly, no one is allowed after next January 1st to drive or lead a carriage during the day after sunrise and before the tenth hour of the day, except if something will have to be supplied or transported for building temples of the immortal gods or for the implementation of a work for the authorities, or as from the city or from those areas something of those things of which the demolition will be put out to tender by the authorities, will have to be removed on behalf of the authorities, and except for those cases in which it will be according to this law permitted to certain persons for certain reasons to drive or lead a carriage".

New York City in the 1900s

54

Potential Solutions…

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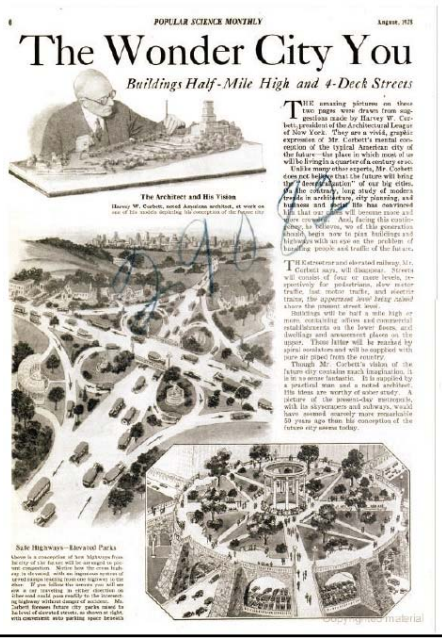


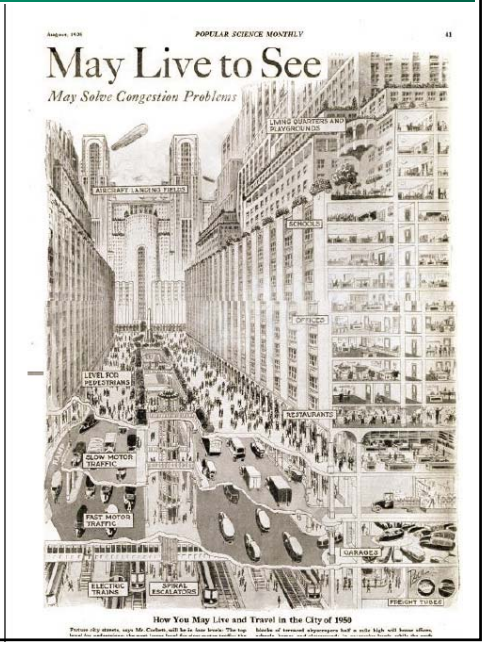
POPULAR SCIENCE MONTHLY

The Wonder City You

Buildings Half-Mile High and 4-Deck Streets

The Architect and His Vision

Safe Highways—Elevated Parks



POPULAR SCIENCE MONTHLY

May Live to See

May Solve Congestion Problems

How You May Live and Travel in the City of 1950

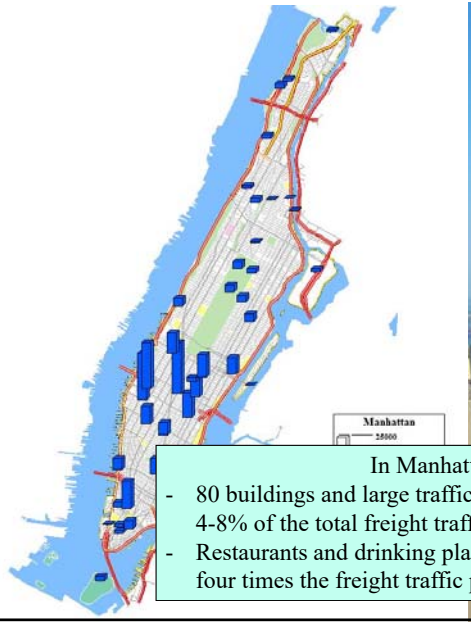
The reality in the 1940s…

56

37th Street and 7th Ave, New York City, 1945

Where do these deliveries go?

58



In Manhattan:

- 80 buildings and large traffic generators produce 4-8% of the total freight traffic…
- Restaurants and drinking places (10,000) produce four times the freight traffic produced by the port…

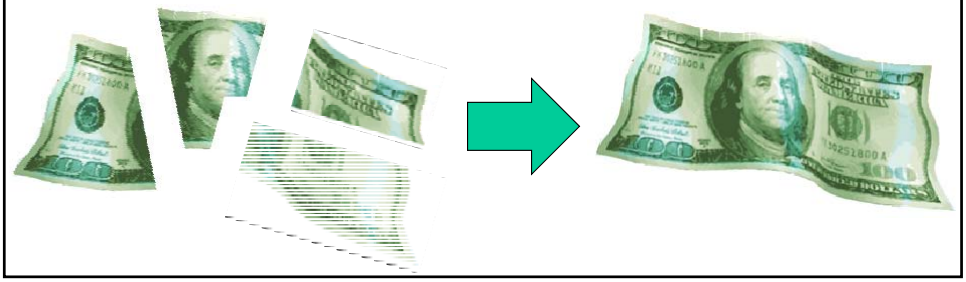
The history of the world clearly shows that…

59

- The public sector has not been able to completely solve the congestion problem…
- The private sector has not been able to completely solve the congestion problem…
- Communities have not been able to completely solve the congestion problem…
- Then, why do keep using the same approaches that failed in the past?
  - Complex problems cannot be solved with simple solutions (if they were, somebody would have solved them…)
  - We need comprehensive approaches to the urban freight issues…

Collaboration is key to our approach…

- No single player could solve all freight issues by itself
  - Public sector → Regulates, manages infrastructure
  - Private sector → Operates the system
  - Academia → Conducts research to find solutions
  - Communities → Enjoy freight benefits, suffer the impacts
- All players control a different piece, no one benefits from the status quo:



Why Must We Work on Urban Freight?

The Good…

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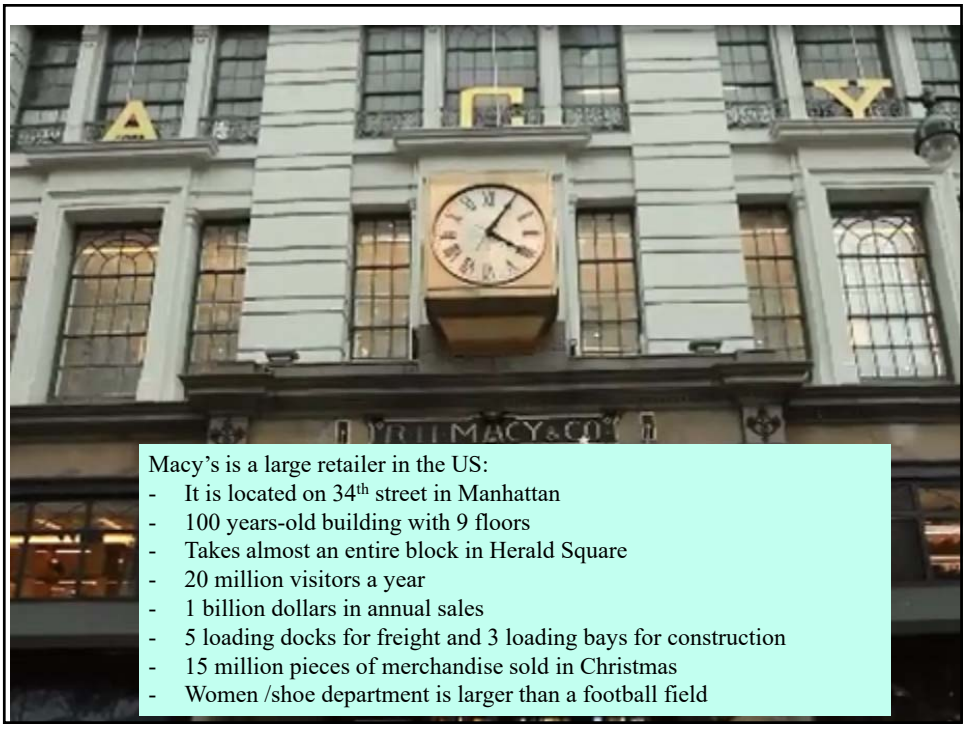
- Freight is the physical expression of the economy, **<u>impeding freight flows = impeding the economy</u>**
- All the goods we consume, and the trash we produce, is moved in and out by the freight system. Every day:
  - New York City: 45Kg/person of cargo are transported
  - Beijing: 30 kg/person of cargo are transported
  - Medellin, Colombia: 25kg/person of cargo are transported
- Without that cargo, urban economies will collapse
- Between 5-10% of GDP is related to freight / logistics
- 1/10 of employees are in freight / logistics



Macy's is a large retailer in the US:
- It is located on 34th street in Manhattan
- 100 years-old building with 9 floors
- Takes almost an entire block in Herald Square
- 20 million visitors a year
- 1 billion dollars in annual sales
- 5 loading docks for freight and 3 loading bays for construction
- 15 million pieces of merchandise sold in Christmas
- Women /shoe department is larger than a football field

The Bad…

- Freight traffic is a major consumer of resources and a major producer of environmental externalities
- Transportation consumed:
  - 28.5% of the total energy and 67.9% of the petroleum
- Transportation produced:
  - 54% of carbon monoxide and 36% of nitrogen oxide
  - 22% of volatile organic compounds
  - 1.4% of the Sulfur dioxide
- Freight transport contributes a large portion of these numbers

Macy's in 34th Street

The Ugly…

- **Freight is good, freight traffic creates problems**
- There are no easy solutions, no Magic Bullets
- The system is complex and not well understood
  - Multiple agents: shippers, carriers, receivers
  - Multiple ways to measure freight
- Solutions are complex and involve multiple partners: public and private sectors, communities, etc.
- Proper governance is required
- This is why multi-stakeholder cooperation between academia and public/private sectors is required

How should we tackle freight issues?

We need to recognize that in complex cities… 68

- Simple approaches will not work…
- We need to use all policy weapons to reduce congestion and improve environmental conditions
- It is not enough to:
  - Build infrastructure (in some cases, it is not even possible)
  - Manage traffic (it has limits, cannot solve the root problem)
  - Use ITS (it has limits, cannot solve the root problem)
  - etc.
- It is better to:
  - Use comprehensive approaches
  - Manage demand (to reduce the number of deliveries made), in combination with other initiatives

Suggested decision making approach 69

- The best approach
  - Assess the problem/need to identify its roots
  - Identify key agents involved
  - Engage the main stakeholders in the solution
- Once a small set of strategies is identified:
  - Establish goals
  - Identify resources available
  - Define performance measures
  - Analyze existing conditions
  - Evaluate initiatives and select preferred (based on tradeoffs)
  - Develop an action plan
  - Implement, Follow up, and Reassess

To keep in mind: For an initiative to work …

- Fact #1: Policy makers must have a good idea of how the target will respond to the policy, lack of such insight leads to:
  - (Negative) unintended consequences
  - Ineffective policies
  - Lack of credibility and public trust
- Fact #2: Policy makers have to:
  - Select the best policy lever (regulation, pricing, incentives)
  - Apply the policy stimuli on the best target (not obvious)
  - Select the strength of the stimuli correctly: if the stimuli is too weak, nothing will be accomplished; if too strong, it may lead to misallocation of resources
- **Behavior research provides the answers**

Our Approach to Freight Issues

From "Improving Freight System Performance in Metropolitan Areas"
http://coe-sufs.org/wordpress/initiativeselector/

NCFRP 33

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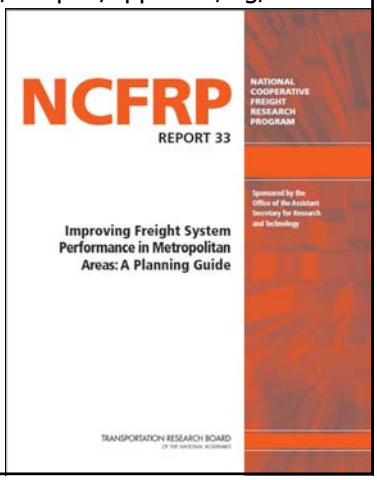
- Planning Guide: http://onlinepubs.trb.org/onlinepubs/ncfrp/ncfrp_rpt_033.pdf
- Interactive version: http://coe-sufs.org/wordpress/ncfrp33/
- Initiative Selector: http://transp.rpi.edu/~InitiativeSelector/assessment.htm
- FTG Estimator: https://coe-sufs.org/wordpress/ncfrp33/appendix/ftg/



NCFRP Report 33 "Improving Freight System…"

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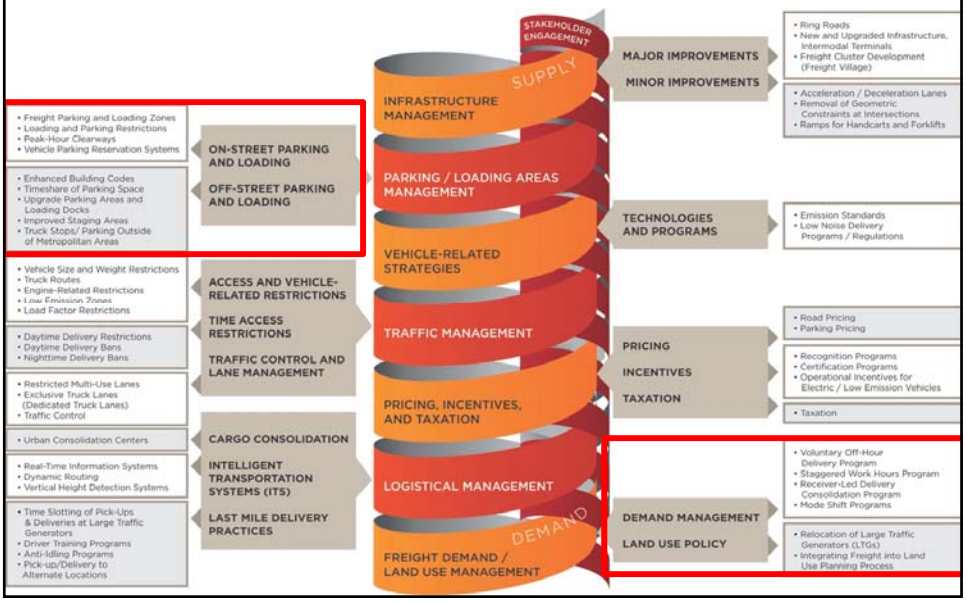
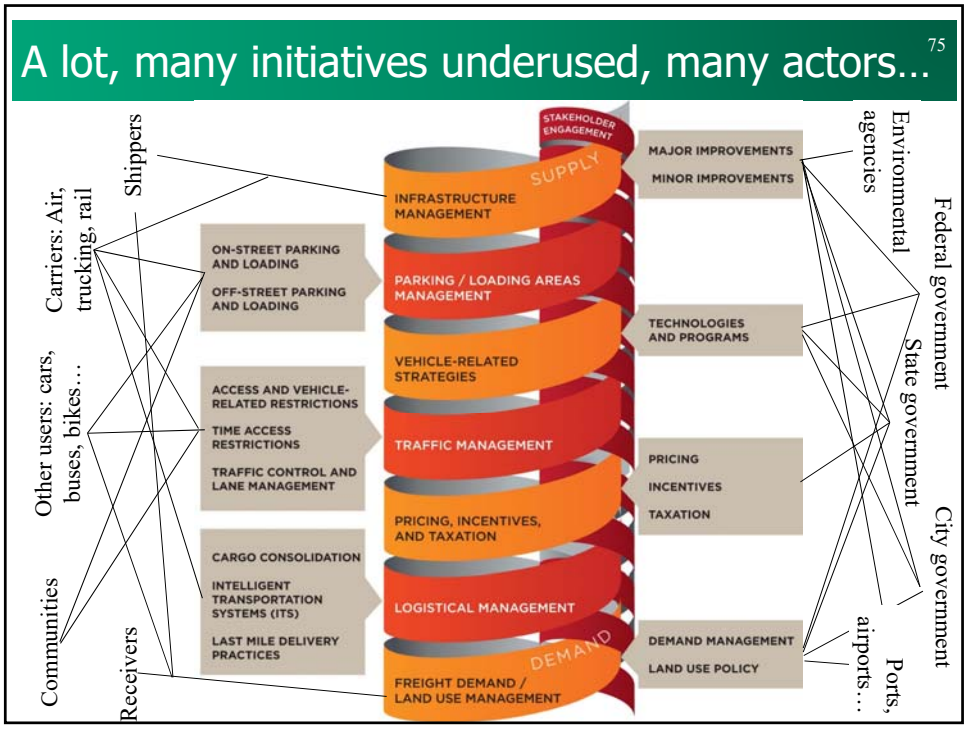
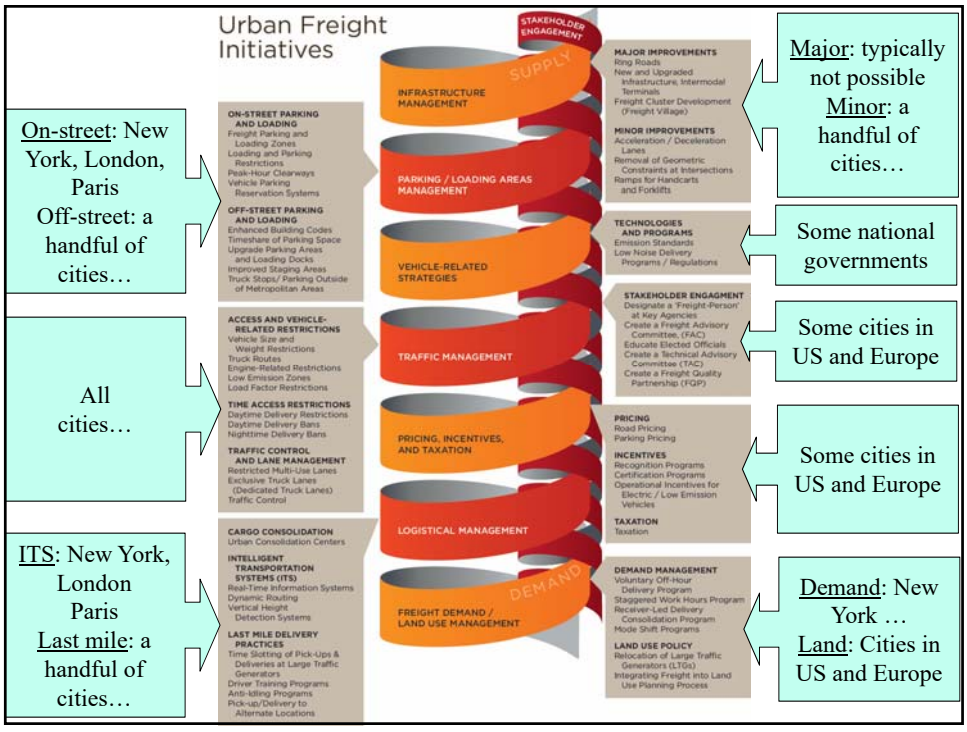
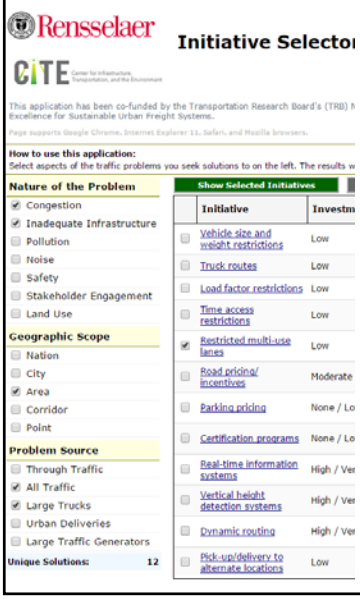



A lot, many initiatives underused, many actors…
75
Shippers
Carriers: Air, trucking, rail
Other users: cars, buses, bikes…
Communities
Receivers
ON-STREET PARKING AND LOADING
OFF-STREET PARKING AND LOADING
ACCESS AND VEHICLE-RELATED RESTRICTIONS
TIME ACCESS RESTRICTIONS
TRAFFIC CONTROL AND LANE MANAGEMENT
CARGO CONSOLIDATION
INTELLIGENT TRANSPORTATION SYSTEMS (ITS)
LAST MILE DELIVERY PRACTICES
STAKEHOLDER ENGAGEMENT
SUPPLY
INFRASTRUCTURE MANAGEMENT
PARKING / LOADING AREAS MANAGEMENT
VEHICLE-RELATED STRATEGIES
TRAFFIC MANAGEMENT
PRICING, INCENTIVES, AND TAXATION
LOGISTICAL MANAGEMENT
DEMAND
FREIGHT DEMAND / LAND USE MANAGEMENT
MAJOR IMPROVEMENTS
MINOR IMPROVEMENTS
TECHNOLOGIES AND PROGRAMS
PRICING
INCENTIVES
TAXATION
DEMAND MANAGEMENT
LAND USE POLICY
Environmental agencies
Federal government
State government
City government
Ports, airports…


Urban Freight Initiatives
On-street: New York, London, Paris
Off-street: a handful of cities…
All cities…
ITS: New York, London Paris
Last mile: a handful of cities…
Major: typically not possible
Minor: a handful of cities…
Some national governments
Some cities in US and Europe
Some cities in US and Europe
Demand: New York …
Land: Cities in US and Europe
STAKEHOLDER ENGAGEMENT
SUPPLY
INFRASTRUCTURE MANAGEMENT
PARKING / LOADING AREAS MANAGEMENT
VEHICLE-RELATED STRATEGIES
TRAFFIC MANAGEMENT
PRICING, INCENTIVES, AND TAXATION
LOGISTICAL MANAGEMENT
DEMAND
FREIGHT DEMAND / LAND USE MANAGEMENT

Initiative Selector



Initiative 26: Restricted Multi-Use Lanes

Restricted Multi-Use Lanes

Description: Promotes the use of available road capacity by allocating restricted lane right-of-way to trucks, buses, and occasionally high-occupancy vehicles. The lane usage can be: allocated to different users using time windows; shared among designated users all day; or restricted to special use for certain users. Restrictions can be by vehicle type, or can allow mixed traffic during the restriction interval.

Targeted mode: All traffic / large trucks	**Geographic scope:** Area
Type of initiative: Traffic Management: Lane Management	**Primary objective:** Optimize road capacity

Expected costs and level of effort to implement: Lane management strategies and restrictions to multi-use lanes require thorough planning to consider the characteristics of the network, and the needs of different users. Planning should involve extensive stakeholder engagement, and weigh both the positive and negative impacts to all agents that are part of the system. The costs are mainly associated with the installation of variable message signs (VMS) or changeable message signs (CMS), and enforcement resources.

Advantages:	**Disadvantages:**
- Reduce congestion	- May confuse drivers
- Enhance safety	- May conflict with other traffic users
- Increase efficiency	- May not be adequate for sensitive locations
- Enhance livability	- Hard to enforce
- Can be used as incentive to foster other strategies	- Lane geometry may not be adequate for large trucks

Examples:
- Multifunctional lanes in its commercial center: Barcelona, Spain (City Ports, 2005)
- Clean vehicles are allowed to use public transport lanes: Göteborg, Sweden (START, 2009)
- Consolidation vehicles are allowed to use bus lanes: Bristo, England(START, 2009)
- Truck lane restricted to right lane: New York City, New York, US (The City of New York, 2012), North Carolina, US (Federal Highway Administration, 2011; North Carolina Department of Transportation, 2013)
- Ban on through trucks on interstate inside the perimeter freeway, Georgia

Source: (Federal Highway Administration, 2011)

Related alternatives: 1. Acceleration/Deceleration Lanes; 2. Traffic Control; 3. Dynamic Routing

References: (Ogden, 1992; City Ports, 2005; BESTUFS, 2007; START, 2009; Georgia Department of Public Safety, 2010; Federal Highway Administration, 2011; SUGAR, 2011; The City of New York, 2012; North Carolina Department of Transportation, 2013).

Reference Materials:

Planning Guide: PDF Version
http://onlinepubs.trb.org/onlinepubs/ncfrp/ncfrp_rpt_033.pdf

Electronic Planning Guide
http://coe-sufs.org/wordpress/ncfrp33/

Initiative Selector:
http://coe-sufs.org/wordpress/InitiativeSelector/
http://transp.rpi.edu/~InitiativeSelector/assessment.htm

Software de Generación de Viajes de Carga:
https://coe-sufs.org/wordpress/ncfrp33/appendix/ftg/

The Importance of Urban Goods:
http://www.vref.se/ See: "Why Goods Matter"

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