

# Opportunities for Improving Efficiency

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- ❖ What is the freight system?
- ❖ What could we do to improve efficiency?
- ❖ Example: The Off-Hours Delivery Project in NYC
- ❖ Research needs

# What is the freight system?

# The freight system

❖ The conglomerate of all the economic entities involved in the generation, transportation, consumption, and transformation of cargo

❖ Key agents:

These are key to behavior change

- ❖ Producers, the ones that manufacture/produce the goods
- ❖ Shippers, the ones that send the goods
- ❖ Receivers, the ones that use the goods transported
- ❖ Carriers, the ones that transport the goods
- ❖ Ancillary functions: warehouses, distribution centers, etc.

# Relatively low efficiency

- ❖ Due to competitive market forces:
  - ❖ Carriers are very efficient from the private point of view, not necessarily efficient from the social point of view
  - ❖ In many instances, if carriers could freely decide how to do things (without constraints), private optimal solutions would coincide with social optimal
  - ❖ The solution: modify the markets thru policy interventions
- ❖ Surveys show that about:
  - ❖ 25% of the truck trips are empty
  - ❖ Average load factors in urban areas: 20-30%
- ❖ Increasing this efficiency will translate into more livable cities and a more productive economy

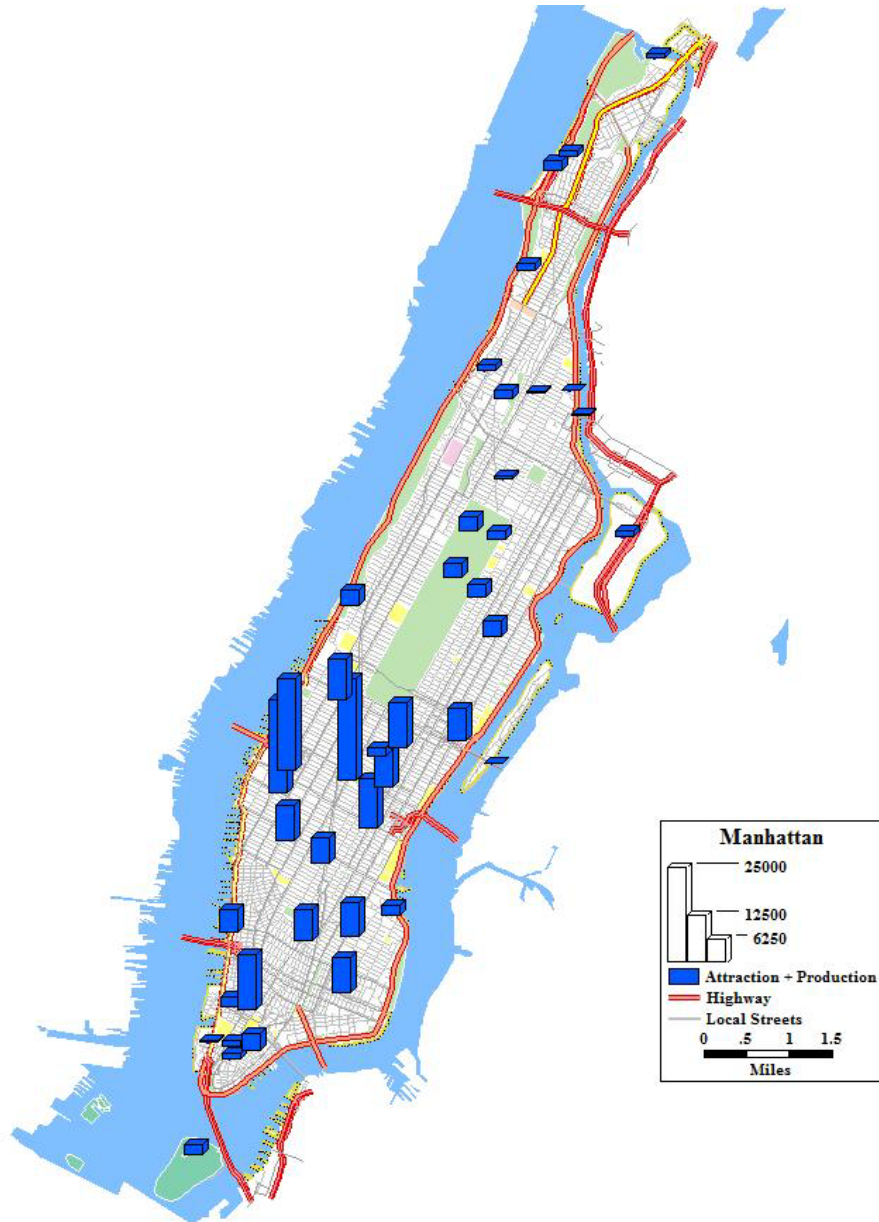
# NYC Metro area

County	Area (miles <sup>2</sup> )	Population	Establishments	Employment	Freight trip attraction (FTA)	% FTA	Freight trip production (FTP)	% FTP
BRONX	42.15	1,332,650	7,754	91,787	19,900	4%	14,048	4%
BROOKLYN	70.88	2,465,326	23,262	232,199	58,114	13%	40,883	12%
NASSAU	287.96	1,334,544	24,142	314,287	62,828	14%	46,956	14%
<b>MANHATTAN</b>	<b>23.09</b>	<b>1,537,195</b>	<b>40,415</b>	<b>692,260</b>	<b>113,069</b>	<b>26%</b>	<b>76,874</b>	<b>23%</b>
PUTNAM	245.91	95,745	1,731	14,937	4,040	1%	3,298	1%
QUEENS	109.71	2,229,379	23,276	290,156	55,737	13%	46,390	14%
RICHMOND	58.74	443,728	4,268	49,668	10,136	2%	8,182	2%
ROCKLAND	192.39	286,753	4,547	60,963	11,600	3%	8,895	3%
SUFFOLK	926.81	1,419,369	26,787	357,405	69,234	16%	52,788	16%
WESTCHESTER	465.79	923,459	15,127	204,525	38,498	9%	30,477	9%
<b>Grand Total</b>	<b>2,423.43</b>	<b>12,068,148.00</b>	<b>171,309.00</b>	<b>2,308,184.50</b>	<b>443,155.77</b>	<b>100%</b>	<b>328,790.82</b>	<b>100%</b>

Based on the models estimated by NCFRP 25  
 “Freight Trip Generation and Land Use” available at:  
<http://www.trb.org/Main/Blurbs/168396.aspx>



# Where do these deliveries go?



What Could We Do?  
The Short Answer is:  
A Lot...

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Based on the research conducted as part of NCFRP 38  
“Improving Freight System Performance in Metropolitan Areas”



# Range of interventions

❖ Infrastructure Related Interventions

❖ Traffic Management

❖ Logistical Management

❖ Vehicle Related Interventions

❖ Pricing, Taxation

❖ Demand Management

❖ Land Use Management

❖ Governance

Supply

Operations

Demand

Policy

# Traffic Management

- ❖ Access Time Restrictions
- ❖ Vehicle Size Restrictions
- ❖ Truck Traffic/Route Regulations:
  - ❖ Advisory, Statutory, Freight Routes
- ❖ Lane Management:
  - ❖ Multi-use lanes, exclusive truck lanes
- ❖ Traffic Signals and Signs
- ❖ General Infrastructure Investments

Considered using them very carefully, they could make things worse

# Pricing, Taxation

- ❖ Carefully use freight road pricing
  - ❖ Of limited effectiveness to reduce congestion
  - ❖ Could produce significant revenues to finance improvements
- ❖ Foster differentiated parking charges
- ❖ Make sure that vehicle license fees reflect externalities produced by vehicles, age, condition, etc.

# Muni Meters in NYC

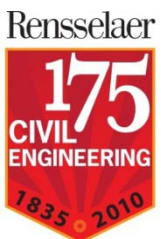


# Demand / Land Use Management

- ❖ Promote off-hour deliveries using incentives
- ❖ Foster: mode shift whenever possible, receiver-led consolidation of deliveries
- ❖ Promote staggered work hours
- ❖ Foster clustering of warehouses, terminals, and distribution centers
- ❖ Foster the location of terminals at the fringe of urban areas
- ❖ Relocate large generators to places where they can grow and generate less impacts

Considered using them very carefully, they could make things worse

# The Off-Hours Delivery Project



# The project has been, at times...

- ❖ A science mystery
- ❖ A political thriller
- ❖ A melodrama
- ❖ A comedy
- ❖ A Greek tragedy
- ❖ A good drama with a happy ending...

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# The experience with time of day pricing

- ❖ Theory and empirical evidence agree that cordon time of day pricing are of limited effectiveness in moving urban delivery traffic to the off hours
- ❖ 2001 Port Authority of New York and New Jersey Time of Day Pricing Initiative
  - ❖ 20.2% of carriers changed behavior, though mostly by increasing productivity (not by reducing facility usage)
    - ❖ Only 9.0% of the sample increased rates, increases were relatively small, about 15%
  - ❖ 69.8% of the carriers that did not change behavior indicated it was due to “customer requirements”
  - ❖ Almost no change in facility use
- ❖ Something similar happened in London

# There is a market failure

- ❖ Markets typically find the most efficient outcome
- ❖ When they do not, there is a market failure  
→ rationale for public sector intervention
- ❖ Off-hour deliveries are beneficial to Society
  - ( + ) Huge environmental impacts due to less pollution
  - ( + ) Carriers / Regular hour travelers (cars, buses, trucks) benefit
  - ( - ) Increased noise at night could be easily mitigated
  - ( - ) However, receivers accrue additional costs
- ❖ The market failure: carrier savings are not large enough to compensate for the receiver costs
- ❖ The solution is to either:
  - ❖ Compensate the receivers for additional costs, or
  - ❖ Develop technologies/systems to allow receivers to do OHD at lower costs (so that compensation could work)


# Project Concept



# Interlocking components

- ❖ Demand modeling/behavioral/economic components
  - ❖ Analyses of most promising industry segments
  - ❖ Freight trip generation analyses
- ❖ Technology component
  - ❖ GPS to assess performance (cell phones, own systems)
- ❖ Network modeling component
  - ❖ Mesoscale traffic model to assess local impacts
  - ❖ Regional model to assess networkwide impacts
- ❖ Industry/Agency outreach component
  - ❖ To get feedback from all involved
- ❖ Small scale pilot test component
  - ❖ To assess real life impacts...

**JHV aged  
twenty years**



# Pilot Test Results



# Pilot Test

- ❖ Initial efforts delayed by Wall Street collapse, skepticism on the part of the industry...initially a huge challenge because of lack of precedents
- ❖ Original plan: Sysco and Whole Foods
- ❖ Foot Locker/New Deal Logistics asked to join test
- ❖ Three separate stages to accommodate them:
  - ❖ Foot Locker (10 stores)/NDL (Oct. 2 -Nov.14, 2009)
  - ❖ Whole Foods (four stores) (Dec. 28, 2009-Jan. 31, 2010)
  - ❖ Sysco (twenty one stores) (Dec. 21, 2009-Jan. 23, 2010)
- ❖ About 35 receivers, 20 trucks/vendors
  - ❖ Half doing staffed OHD
  - ❖ Half doing unassisted OHD

# Regular vs. Off-Hour Deliveries



# Typical results from satisfaction surveys

## Scale:

**1= Very favorable,  
5= Very unfavorable**

❖ Whole Food Vendors: 1.55

❖ Participating drivers:

❖ Travel speeds = 1.33

❖ Congestion = 1.11

❖ Parking = 1.11

❖ Stress levels = 1.11

❖ Time to deliver goods = 1.38

❖ Time to complete the route = 1.44

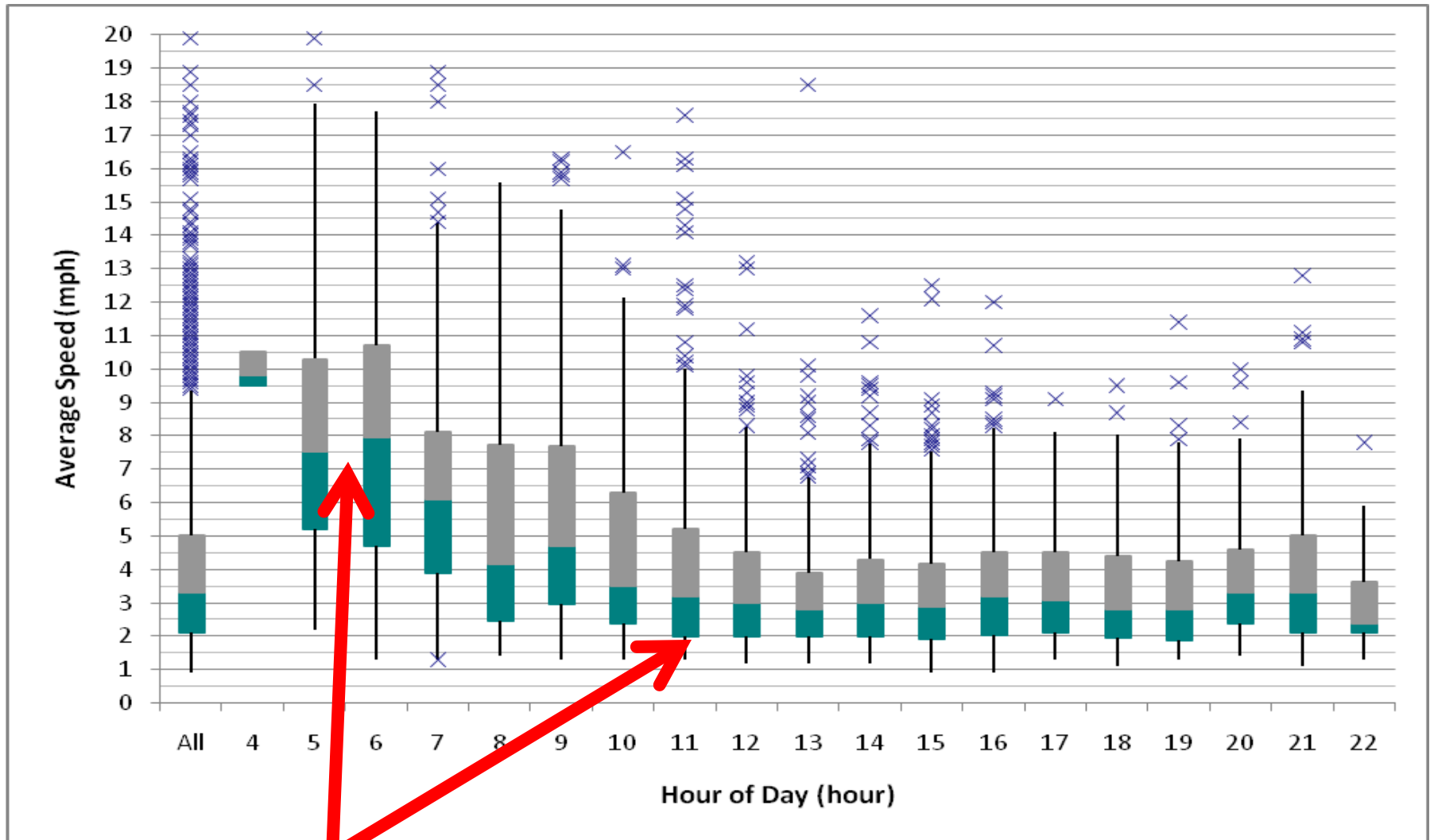
❖ Driver's feeling of safety = 1.86

❖ Sysco's customers:

❖ Impression of off-hour deliveries = 1.50

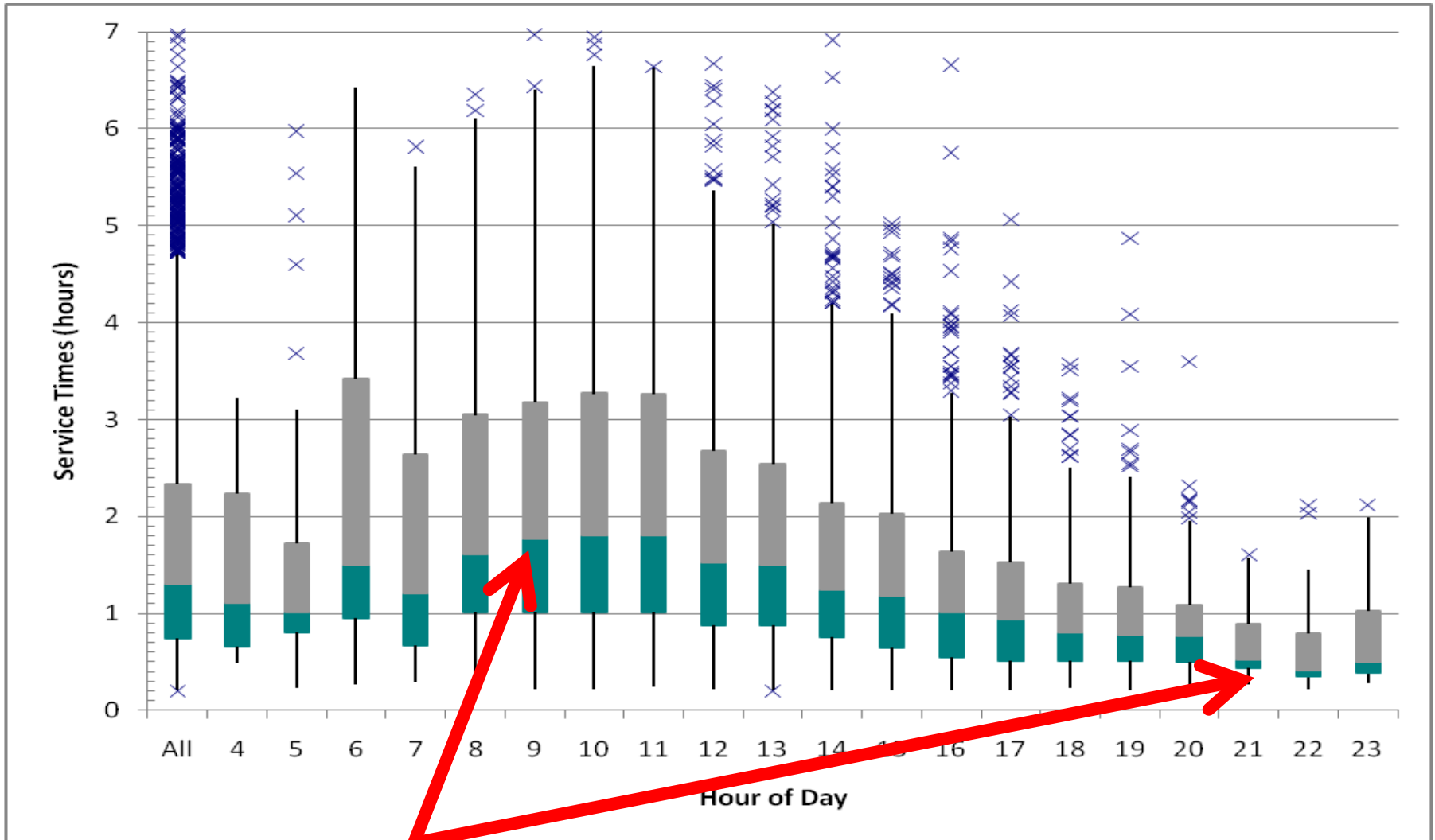
❖ How likely are you to accept OHD = 1.42

# Average space mean speeds



**More than twice as fast**

# Average service times



**More than three times as fast**

# After the end of the pilot

- ❖ All of the receivers doing staffed OHD reverted back to the regular hours
- ❖ Almost all the receivers doing unassisted OHD remained in the off-hours
  - ❖ The reason: reliability of OHD
  - ❖ “Our locations will continue to receive ‘night drops’ even though this program has ended as our managers now favor the dependability of night drops vs. late day time deliveries. Thanks again for the program.” Nick Kenner, Managing Partner, Just Salad LLC

# The Economic Bottom Line



# Economic Impacts

- ❖ Implementing various forms of off-hour delivery policies in Manhattan leads to:
  - ❖ Travel time savings to all highway users of about 3-5 minutes per trip
  - ❖ Travel time savings to carriers that switch to the off-hours of about 48 minutes per delivery tour
  - ❖ Savings in service times (per tour) could be in the range of 1-3 hours
- ❖ Depending on the extent of the policies, economic savings are between \$100 and \$200 million/year in travel time savings and pollution reduction

# Environmental Pollution Reductions

## TOTAL/YEAR

Scenario % OHD	CO (tonnes)	HC (tonnes)	NO <sub>x</sub> (tonnes)	PM <sub>10</sub> (kg)
6.49%	101.196	24.047	3.004	20.29
14.10%	169.582	28.535	8.223	48.81
20.90%	202.749	39.972	11.824	69.99
25.34%	253.141	56.559	15.044	90.09
29.07%	383.813	55.764	26.333	149.86

## PER RECEIVER/YEAR

% OHD	VMT (veh-mi)	VHT (veh-hrs)	CO (kg)	HC (kg)	NO <sub>x</sub> (kg)	PM10 (kg)
6.49%	348.93	438.20	19.563	3.186	0.581	0.0039
14.10%	549.40	207.09	14.896	1.812	0.722	0.0043
20.90%	551.69	195.51	12.052	1.885	0.703	0.0042
25.34%	542.89	233.92	12.411	2.125	0.738	0.0044
29.07%	1,052.06	244.31	16.399	1.414	1.125	0.0064

# How the Adventure Ended...



# A Huge Success...Widely Reported in the Press

**THE WALL STREET JOURNAL.**  
 Thursday, July 1, 2010  
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TOP STORIES IN New York  
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 ALLIANCE

## Congestion

Article

By ANDREW G. RO  
 New York City's speakers to make  
 Twenty-five busi  
 deliveries after 7  
 program that offe  
 Positioning Syst  
 The truckers saw  
 usage. All of the  
 program ended in  
 Sadik-Khan.

**Truckinginfo**  
 the web site of Heavy Duty Trucking magazine

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**News**

New York City is encouraging truck drivers to make deliveries 7/7/2010 New York to Ramp U

The New York City Department of Transportation has expanded deliveries, rather than peak-hour deliveries.

The pilot program, which ran from last September through 24 deliveries between 7 p.m. and 6 a.m. The DOT found that the parking, reduced congestion and significant savings. Business percent and a reduction in parking tickets and fines, which is "New York is a city that never stops, and neither should its trucks. There is money and this program is a signal to the entire deliveries that also helps reduce congestion and pollution."

Freight deliveries into the borough exceed 100,000 daily, with The project was funded with a \$1.2 million grant from the Res Rensselaer Polytechnic Institute's Center for Transportation Research.

With less competition for parking spaces accessible to the sit outside making deliveries. Instead of 100 minutes before the minutes faster during the pilot.

The project also focused on encouraging businesses to accept deliveries to make the process easier. Such as allowing "one door deliveries" for deliveries to a building with loading dock

Avenue from New take an hour and "It's physics. The have the space."

But residents exp and retailers freq said she thinks r

"Right now you understand that it

## Fleets Say They Discovered Time, Cost Bonanza Through New York's Night-Delivery Experiment

By Michele Foutsch Staff Reporter

When Joe Killen heard that New York City needed participants for its trial off-hours delivery program, he did more than volunteer his Kearny, N.J., trucking firm, New Deal Logistics. Killen persuaded eight Foot Locker stores he supplies in Manhattan to volunteer, which meant the retail outlets agreed to substitute night deliveries for the daytime shoe shuttles New Deal normally

runs under the Hudson River. "Instead of leaving here at 7 o'clock in the morning and spending an hour and a half trying to get through the Holland Tunnel, [trucks were] on the other side... in 25 minutes," Killen said of the night trips.

For carriers in the pilot program, which lasted from October 2009 through January 2010, the results were dramatic. Off-hour deliveries improved average travel speeds by as much as 75%, according to the analysis submitted to one of the program's

funders, the Research and Innovative Technology Administration, or RITA, of the U.S. Department of Transportation.

Adding to the off-hours benefit, data generated by Global Positioning System devices on the trucks showed that trucks delivering between 7 p.m. and 6 a.m. averaged 30 minutes at a receiver's site, compared with an average of 100 minutes during the day on streets clogged with traffic and lacking space to park.



More than 100,000 truck deliveries, like this on New York City every day. A pilot program tested

crain's  
 Article can be found at

## Nighttime

City's Departmen p.m. and 6 a.m.s

By Jeremy Smerd  
 Published: July 1, 20

It seemed like a no-brain pilot program:  
 Now that the program are continuing their n

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## TRUCKING

### New York Delivers at Night

William B. Cassidy | Sep 7, 2009 4:00AM GMT  
 The Journal of Commerce Magazine - News Story  
 States | Regulation | Trucking | United States

The latest Manhattan project uses incentives to get freight off streets during peak hours

East side, west side, congestion is choking traffic all around New York City. A pilot project that encourages off-peak deliveries may help the city clear traffic jams believed to cost New York \$13.4 billion a year.

This week, Rensselaer Polytechnic Institute researchers start to work with shippers, consignees and trucking firms in a month-long test of a program they say could cut daytime truck deliveries in Manhattan by as much as 20 percent for some companies.

The program uses a key incentive — money — to convince businesses to take off-hour deliveries, in hopes they will reschedule at least a portion of the estimated 2.8 million truck trips a day in and around New York City.

"We're talking about a policy that is being designed to be business-friendly," said Jose Holguin-Veras, an expert in freight transportation networks and professor in Rensselaer's Department of Civil and Environmental Engineering in Troy, N.Y. "Only those companies for which it makes sense financially would do it."

And if off-peak distribution can make it in New York, it can make it anywhere, Holguin-Veras said. "Barcelona is considering this type of program, and London is, too. They're very interested in what we find in New York," he said.

Shifting even a portion of the city's truck deliveries to off-peak hours would have a significant impact on congestion, he said. "You don't have to move every single truck to nighttime delivery. If you move only 10 percent or 20 percent, the congestion savings will be significant."

(See CONGESTION, p. 8)

and New Jersey raised its tolls in 2001. "Hitting truckers with tolls in hopes that they will induce change in receivers doesn't make sense in a competitive market like the one we have."

10 BIG IDEAS TRANSPORTATION

# DELIVER A FIX FOR TRAFFIC JAMS

BY JOSH SANBURN

THE NEXT TIME YOU'RE STUCK IN traffic, blame all that stuff you buy online.

E-commerce sales jumped 15% last year, to \$186 billion in the U.S., and the daily volume of shipments for FedEx and UPS has grown every year since 2009. Moreover, to keep pace with demand for faster deliveries, many of the rigs dispatched by Amazon, eBay and Fresh Direct leave before they're fully stocked.

In other words, there are now more trucks, and more traffic, than ever. That increase helps explain why urban commuters waste at least 52 hours each year in stop-and-go jams, according to the Texas Transportation Institute.

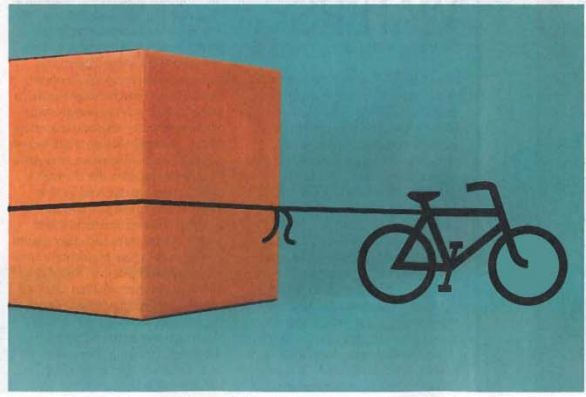
There are a number of ways to address this problem, including a push for off-peak

delivery (see sidebar). But one of the most promising new solutions is actually an old idea: bikes. In recent years, a growing number of cities have welcomed such services, partly to help the environment and partly to skirt—and alleviate—congestion. For example, B-Line, based in Portland, Ore., works with companies like Office Depot to transport parcels via electric tricycles, which can carry up to 600 lb. (270 kg) of freight at a time. CEO Franklin Jones says his six-bike, 15-person company has replaced 20,000 truck and van deliveries since it started in 2009, and B-Line plans to expand to Seattle later this year. Similar companies have launched in Boston, Vancouver and London, where bike deliveries from UPS were essential during the

crush of the 2012 Olympics.

The most inventive option, however, comes from Brussels. Last September, courier TNT Express loaded packages into a mobile trailer during the middle of the night, then towed it to a place near a populated area (but out of traffic zones). Come daybreak, messengers on electric tricycles took the packages to their destinations. If implemented on a wider scale, the strategy could lead to fewer trucks, reduced costs per stop and lower CO<sub>2</sub> emissions.

Although bikes can't fix delivery backups by themselves—they struggle with larger shipments—Hani Mahmassani, of Northwestern University's Transportation Center, sees their potential. "They're the best way to beat the traffic," he says.



THE NIGHT-DROP-OFF SOLUTION

Bikes are great for delivering smaller packages, but what about the bulk items forcing trucks into rush-hour traffic? The answer, say most transportation experts, is simple: give businesses incentives to deliver during off-peak hours—perhaps to storage lockers like the ones Amazon offers. Here's how Manhattan could benefit if at least 20% of all package drop-offs occurred after 10 p.m., according to Jose Holguin-Veras of the Rensselaer Polytechnic Institute:

1. **LESS CURBSIDE CLOGGING**  
 Drivers could save three to five minutes of travel time each day, thanks to fewer trucks that would drive and park along busy streets.

2. **LOWER PRICES**  
 Holguin-Veras estimates that trucking companies pay at least \$500 per truck each month in parking fines, which aren't levied at night. There's also less traffic after hours, meaning that trucks can get better gas mileage. Reducing that overhead would trim delivery costs across the board.

3. **MORE ECO-FRIENDLY VEHICLES**  
 Because they make less noise—crucial during night deliveries on residential streets—electric vehicles could become more attractive.

**TIME magazine listed the OHD project as a "Top 10 Ideas" March 25<sup>th</sup>, 2013**

PHOTO COURTESY OF RENSSELAER POLYTECHNIC INSTITUTE

# The Impacts of the Project...



- ❖ NYC adopted off-hour deliveries as part of its sustainability strategy!



# The Impacts of the Project...

- ❖ In June 2012 the Federal Highway Administration (FHWA) and Environmental Protection Agency (EPA) issued \$450,000 in grants for small to medium size cities to implement off-hours goods movement /delivery programs based on the NYC pilot



U.S. Department of Transportation  
Federal Highway Administration

- ❖ Numerous cities are considering off-hour delivery programs: Boston, Washington, Atlanta, etc.

# Ongoing Work



# Ongoing work

- ❖ USDOT/RITA provided funds for a larger implementation project focusing on:
  - ❖ Unassisted deliveries:
    - ❖ Technologies/systems that enable OHD without the need for staff of the receiving business would produce the same benefits as regular OHD, at minimal cost
    - ❖ To address the liability concerns of receivers
  - ❖ Large Traffic Generators:
    - ❖ Large buildings/establishments generate hundreds of truck trips per day
      - ❖ About 80 such buildings → 4% of the truck traffic
      - ❖ Adding large establishments → 8% of truck traffic
    - ❖ They could implement OHD very cost effectively and without inconveniencing the receivers

# Unassisted OHD: Virtual cages

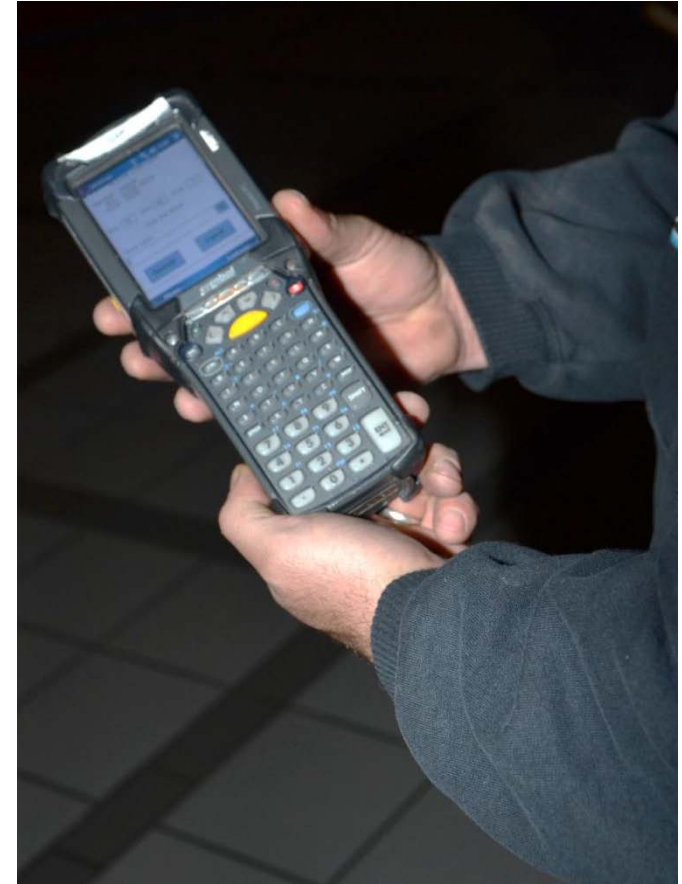


Left: The security gate outside the store is brought up and down electronically by the turn of a key. This is the first level of access control.

Center: On the opposite side of the gate key wall is an electronic keypad that logs the start and end times of the delivery, in addition to the driver number.

Right: Once inside, the driver is restricted by a virtual cage that is marked off by four sensors. The area is almost the full width and roughly half the depth of the store.

# Unloading the Goods



Top: The goods are brought inside the store past the security tag detectors, which will sound if the boxes are brought back outside. The driver dismantles the pallets and sorts the boxes according to department.

Right: The carrier company provides the driver with a handheld scanner, and there is a program to connect to the specific retailer. Goods are automatically entered into the inventory system.

# The Bottom Line



# Chief conclusions

- ❖ Removing the constraints imposed by receivers (either by providing financial incentives, or using unassisted OHDs) works as it is
  - ❖ More effective than freight road pricing
  - ❖ A truly win-win-win-win-win policy:
    - ❖ Benefits regular hours travelers
    - ❖ Benefits the environment, improves quality of life
    - ❖ Benefits the business community, enhances economy
    - ❖ Noise impacts could be easily mitigated → electric trucks, low-noise truck technologies/practices
    - ❖ Benefits participants in OHD
  - Political appeal, implementable as a voluntary program

There is power to tap...



# Research Needs

# Research Needs

- ❖ Infrastructure Related
- ❖ Traffic Management
- ❖ Logistical Management
- ❖ Vehicle Related
- ❖ Pricing, Taxation
- ❖ Demand Management
- ❖ Land Use Management
- ❖ Governance

Freight demand modeling, behavior, economics, game theory...

Traffic models, consideration of tour behavior, behavior, economics, policy...

Freight demand modeling, behavior, consideration of tour behavior, economics, policy...

Governance structures, multi-stakeholder decision making...

# The allure (and trap) of the low hanging fruit

43

- ❖ We love the low hanging fruit...though we may not realize that we are benefiting from the trees planted by others...
- ❖ If that's all we plan to do...we are in trouble... we need to plant trees...



Gerard van Honthorst, circa 1632

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Thanks!

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