The Social Costs of Global Gateway Cities: The Case of the Port of New York

By

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Defining a gateway city

A global gateway city is defined as a coastal metropolis with port access to the rest of the globe, which captures a substantial share of total regional and international trade volumes.

Main advantage of a gateway city: economic development benefits that are conferred on its respective metropolitan area in the form of enhanced employment, expanded output, efficient logistic chains, increased tax revenues and higher real estate values. In NY/NJ it has been estimated that port related freight activity contributes annually $18 billion in economic activity and $2.2 billion in tax revenues.

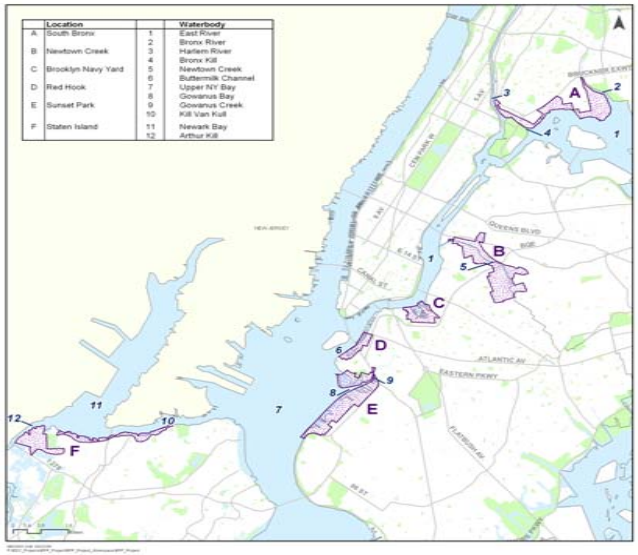
Key argument: maintaining the position of a gateway city, requires expansion of port activities, thus increase in traffic volumes, which in turn imply heavy social costs. And these costs must be recognized and incorporated into the analysis of port investment plans.

Objectives

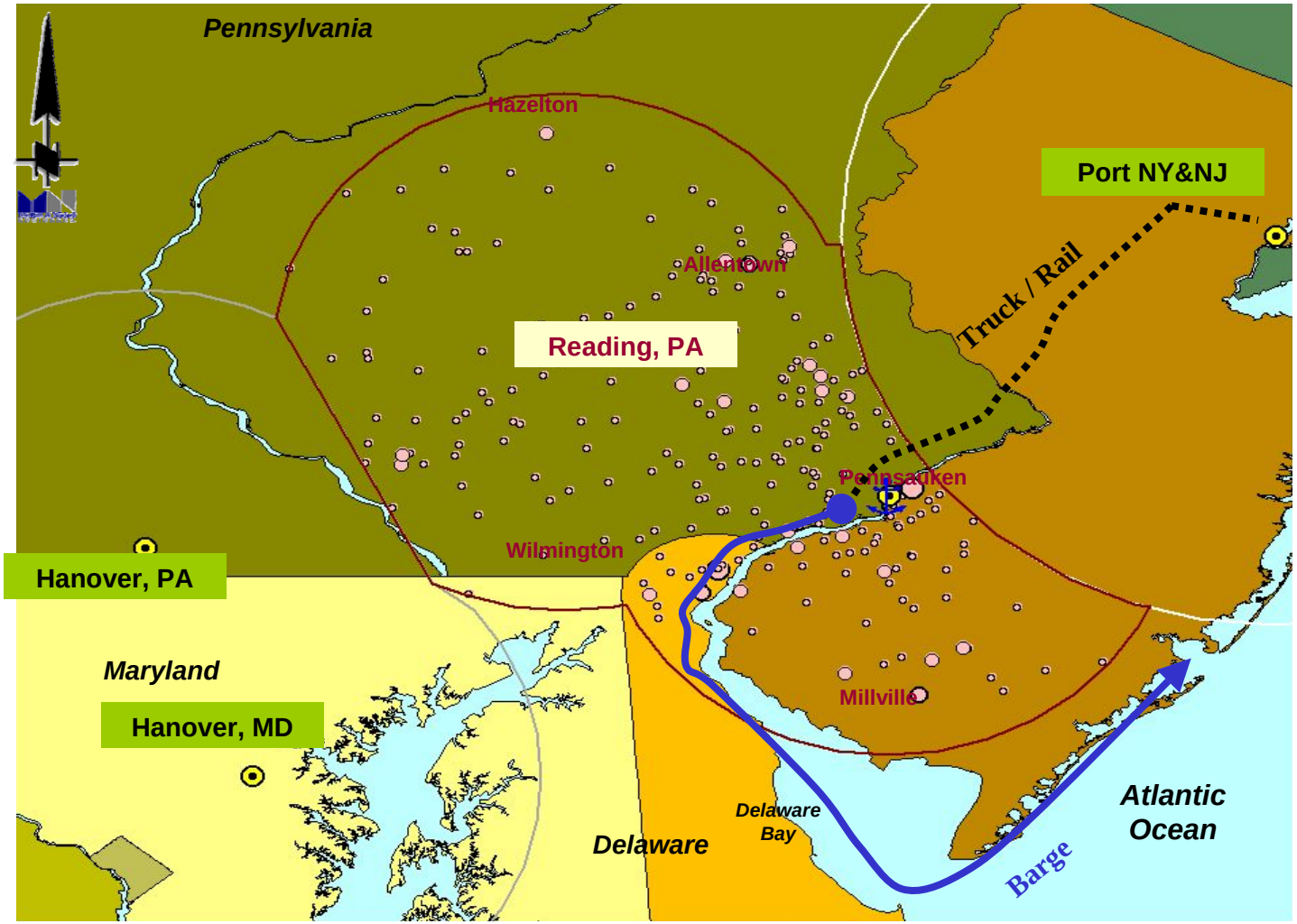
1. Define the social costs associated with the additional traffic from the expansion of the Port of New York/New Jersey
2. Propose a methodology to measure these costs
3. Using data on the NY/NJ Port freight activity and on the regional highway network, estimate the Full Marginal Costs of additional truck traffic, resulting from further development of the Port
4. Draw conclusions on the costs and benefits of planned port capacity investments

Location Map

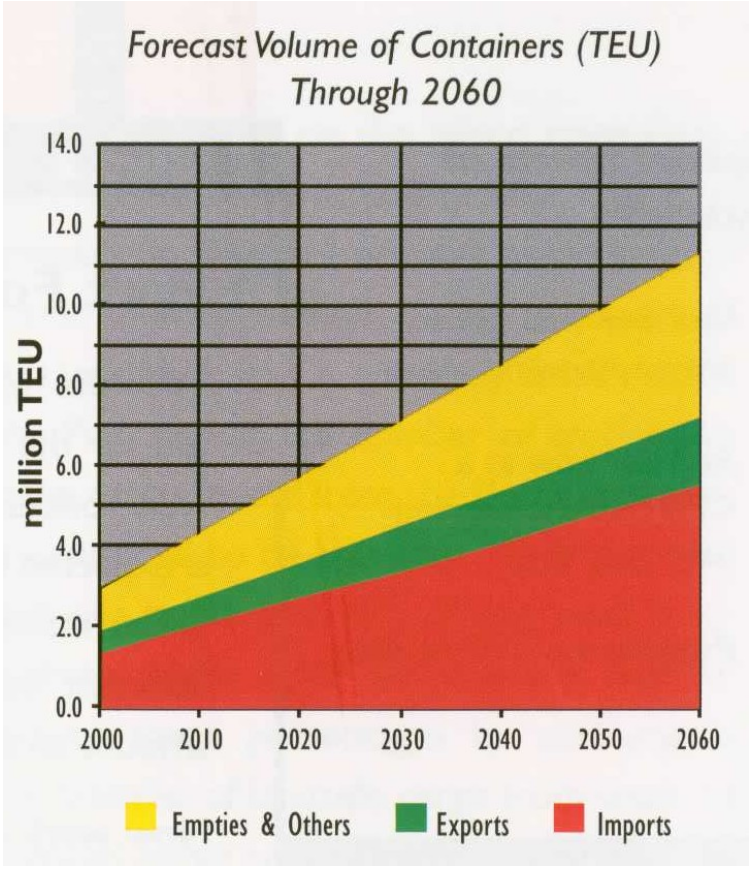
Location Map
Maritime Support Services Location Study



Port of NY/NJ to Camden/Philadelphia Market



Forecast of Containers Volume In NY/NJ Port (2060)



Data on the Port of New York and New Jersey

	2006	**2005**	**% Change**
Ship calls	5,577	5,321	4.8
Container Volume (loaded and empty) TEU	5,092,806	4,785,318	6.4
Total Imports and Export TEU	3,650,926	3,385,003	7.9
Loaded Imports TEU	2,599,554		
Loaded Exports TEU	1,051,372		
Empty TEU	1,441,880	1,400,315	2.9

Freight Modal Share by Trips in NY/NJ (2005)

Mode	Share (%)
Air Cargo	0.3
Waterway	36.0
Rail	0.9
Truck (2005) Truck (2006)	72.8 75.0

Categories of Social Costs

- Vehicle Operating Costs**:** Include fuel and oil consumption, expected and unexpected maintenance, car wear and tear, insurance, parking fees and tolls, and automobile depreciation.

- Congestion Costs: The time-loss due to traffic conditions and drivers' discomfort, both of which are a function of increasing volume to capacity ratios:
- a) Direct congestion costs; b) Congestion externality costs.

- Accident Costs: Categorized as fatality, injury and property damage accidents, and are closely related to intensity of traffic volume and roadway geometry.

- Environmental Costs: Defined as: a) air pollution; b) noise pollution costs.

- Infrastructure Costs: Defined as maintenance (mainly, resurfacing) and costs of capital.

Formulation of FMC

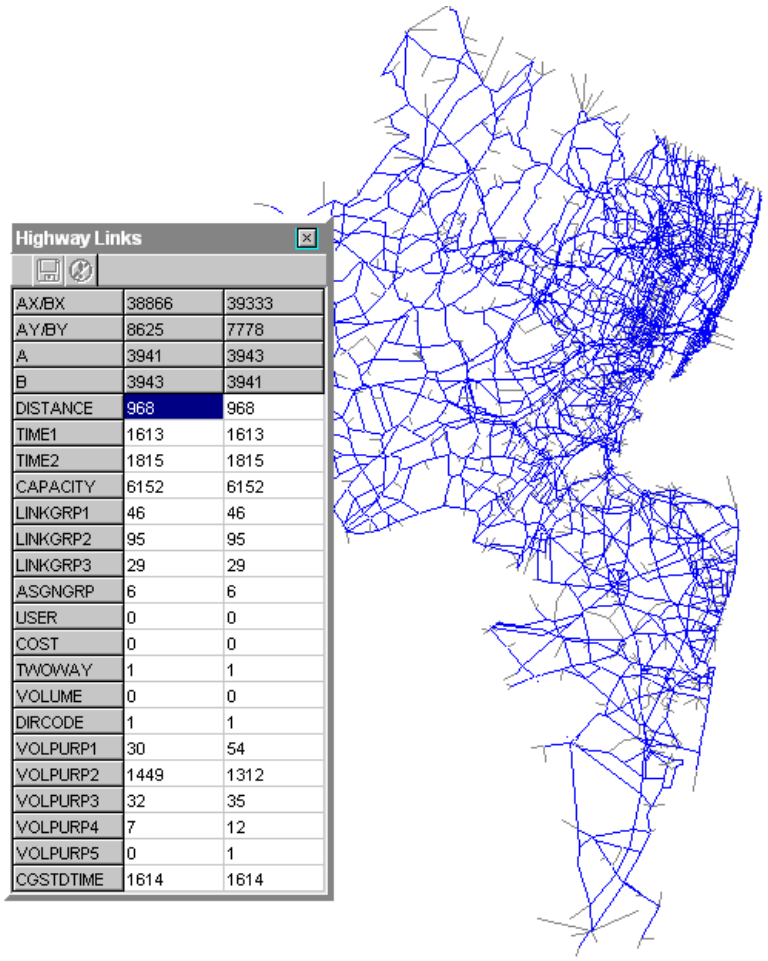
- For each OD pair in the network, the social Marginal Costs are defined as:

$$ORMC_{r,s} = \sum_{i=1}^{k} FMC^{i} = \sum_{i=1}^{k} d\,(MC^{i}_{opr} + MC^{i}_{cong} + MC^{i}_{acc} + MC^{i}_{\inf} + MC^{i}_{air} + MC^{i}_{noise})$$

Where,

ORMT = One Route Marginal Costs
FMC = Full Marginal Cost ($/mile)
MCopr = Marginal vehicle operating cost ($/trip),
MCcong = Marginal Congestion cost ($/trip),
MCacc = Marginal Accident cost ($/trip),
MCinf =Marginal Infrastructure cost ($/trip)
MCair = Marginal Air pollution cost ($/trip)
MCnoise = Marginal Noise Cost ($/trip)
(r, s) = Origin-Destination pair
k = Number of links between origin destination pairs, on the shortest route.
d = Trip distance (miles

New Jersey Highway Network



AX/BX	38866	39333
AY/BY	8625	7778
A	3941	3943
B	3943	3941
DISTANCE	968	968
TIME1	1613	1613
TIME2	1815	1815
CAPACITY	6152	6152
LINKGRP1	46	46
LINKGRP2	95	95
LINKGRP3	29	29
ASGNGRP	6	6
USER	0	0
COST	0	0
TWOWAY	1	1
VOLUME	0	0
DIRCODE	1	1
VOLPURP1	30	54
VOLPURP2	1449	1312
VOLPURP3	32	35
VOLPURP4	7	12
VOLPURP5	0	1
CGSTDTIME	1614	1614

Distribution of FMC by Distance and Time of day

- **FMC**
  - Direct Car Operating Costs
  - Direct Congestion Costs
  - Congestion Externality Costs
  - Accident Costs
  - Infrastructure Costs
  - Air Pollution Costs
  - Noise Costs

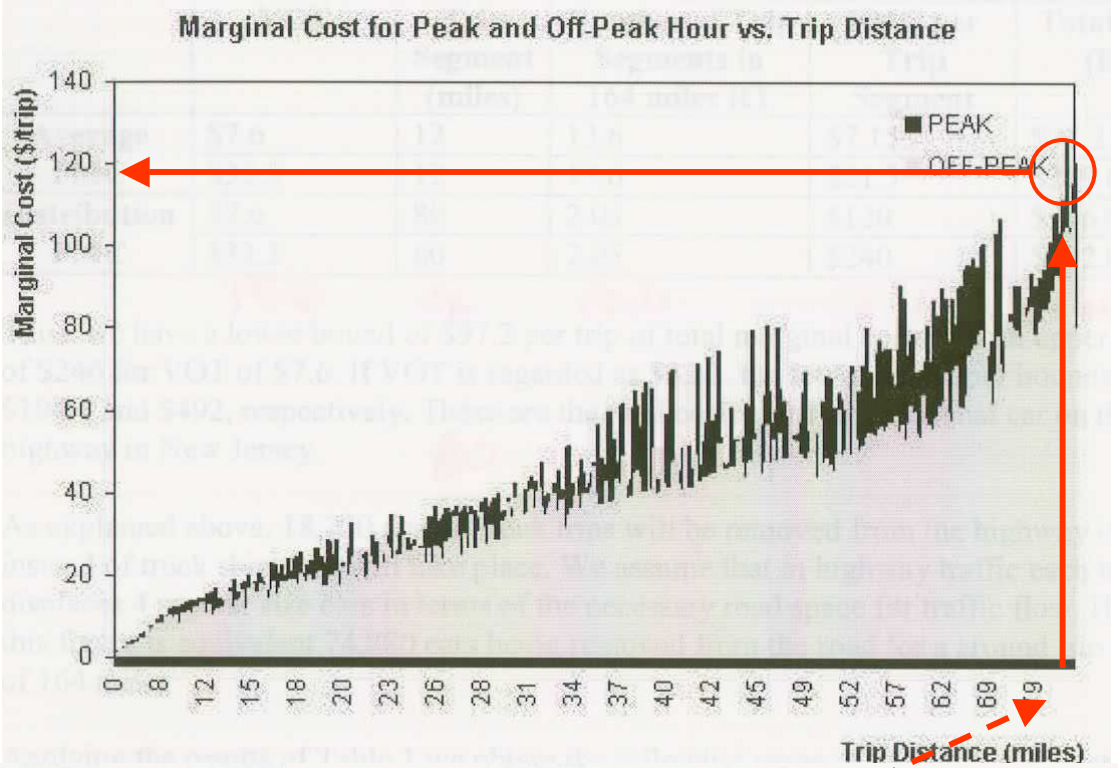
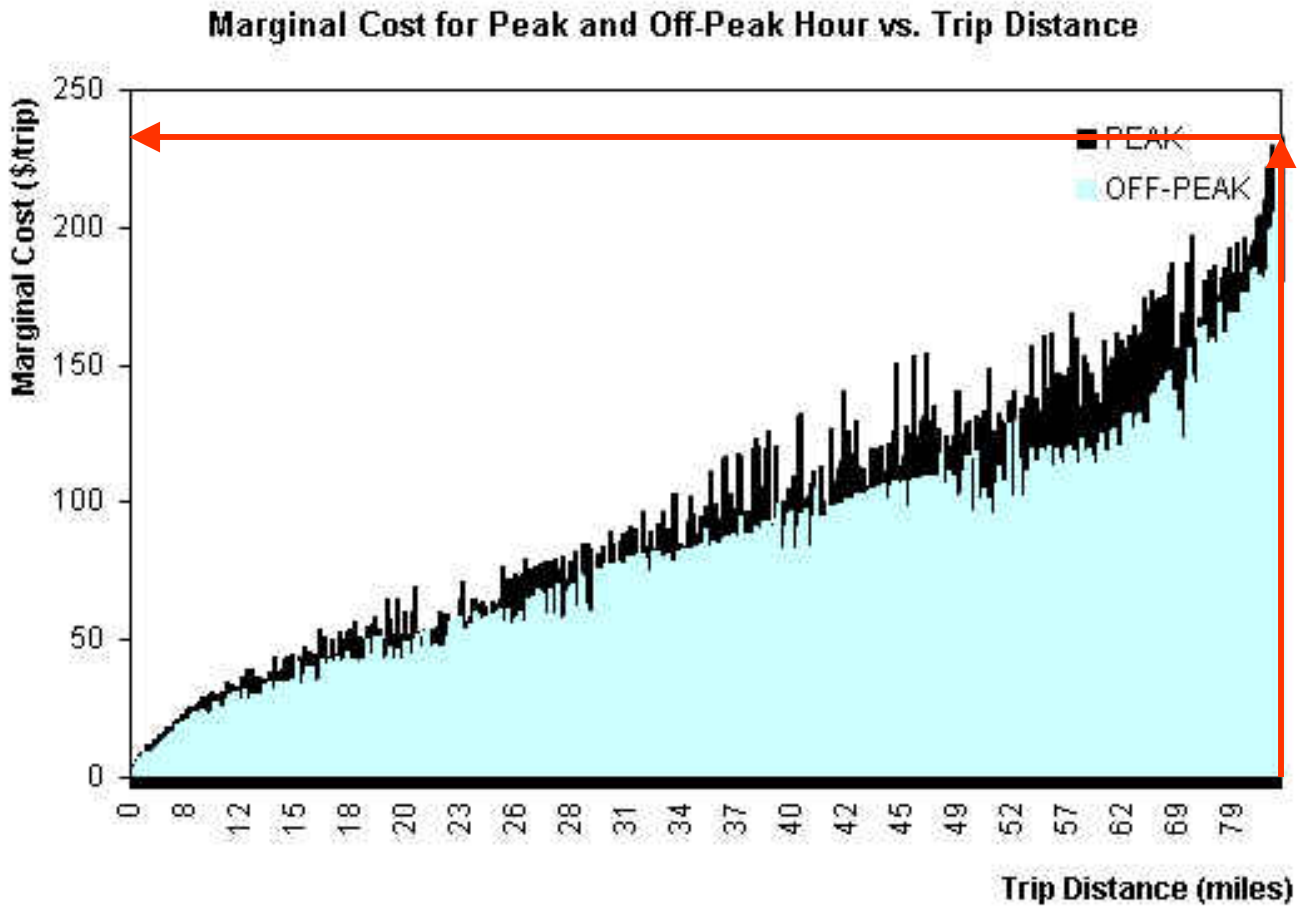


Table 2: Summary of FMC Results for Alternative VOT (Annual)

	VOT	Trip Segment (miles)	Number of Trip Segments in 164 miles RT	FMC per Trip Segment	Total FMC (RT)
Average FMC	$7.6	12	13.6	$7.153	$97.2
	$32.3	12	13.6	$21.3	$289.6
Distribution FMC	$7.6	80	2.05	$120	$246.0
	$32.3	80	2.05	$240	$492.0

Distribution by Distance of FMC for Peak and Off-Peak
(VOT= $32.3/H)



FMC ($) by Categories for a Trip Distance Range of 10 miles (based on Analysis of NY/NJ data with VOT $7.60/Hour)

Operating	Congestion Direct	Congestion Externality	Accident	Infrastructure	Air Pollution	Noise
1.389	3.786	0.635	1.009	0.062	0.114	0.158

Total FMC = $7.153

Value of Time (2003):

VOT = $7.60 (50% of median wage rate for all NJ occupations);

VOT = $32.30 (75% of median wage rate in management occupations)

Source: "Estimation and evaluation of full marginal costs of highway transportation in New Jersey", 2001, *Journal of Transportation and Statistics*, 4(1), 81-104. (with Ozbay and Bartin)

Key Results

Δ

	Change in container volume (2006-2005)	3,819,000
1	Modal Split	75% truck (2006)
2	Change in truck trips (2006-2005)	230,250
3	PCE	3-4 cars/truck
4	Change in car trips (2006-2005) PCE = 3,4	690,750-921,000
5	Avg. FMC per 10 miles trip	$7.1
6	Truck trip length	80 miles
7	No. of car trips within 80 miles (80/10)	8 trips
8	Avg. FMC 80 miles (5)x (7)	$56.8
9	Total avg. annual FMC (4)x(8)	$39,234,600 - $52,312,800
10	Peak FMC (VOT=$7.2/hour)	$120/trip
11	Peak FMC (VOT=$32.3/hour)	$220/trip
12	**Total Peak FMC (VOT=$7.2/hour) (4)x(7)x(10)**	**$663 M - $884 M**
13	**Total Peak FMC (VOT=$32.3/hour) (4)x(7)x(11)**	**$1.215 B-$1.620 B**

Conclusions

1. Truck freight movements from additional port activity have significant impact on traffic conditions in the NY/NJ region.

2. Being a highly congested and densely populated region, this additional traffic translates into substantial annual social costs, ranging from $663 million to $884 million (for VOT=$7.2/H), to $1.215 billion to $1.620 billion for (VOT=$32.3/H).

3. These results are quite conservative:

   a) Using a micro-simulation traffic model, FMC is much higher

   b) Due to the non-linear nature of FMC, loading the network incrementally (not by 6.4%) would have yielded higher estimates

4. These results should be incorporated into COBA of port expansion investments