THE CROSS-BRONX EXPRESSWAY

BOSTON UNIVERSITY
METROPOLITAN COLLEGE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CENTER FOR TRANSPORTATION STUDIES

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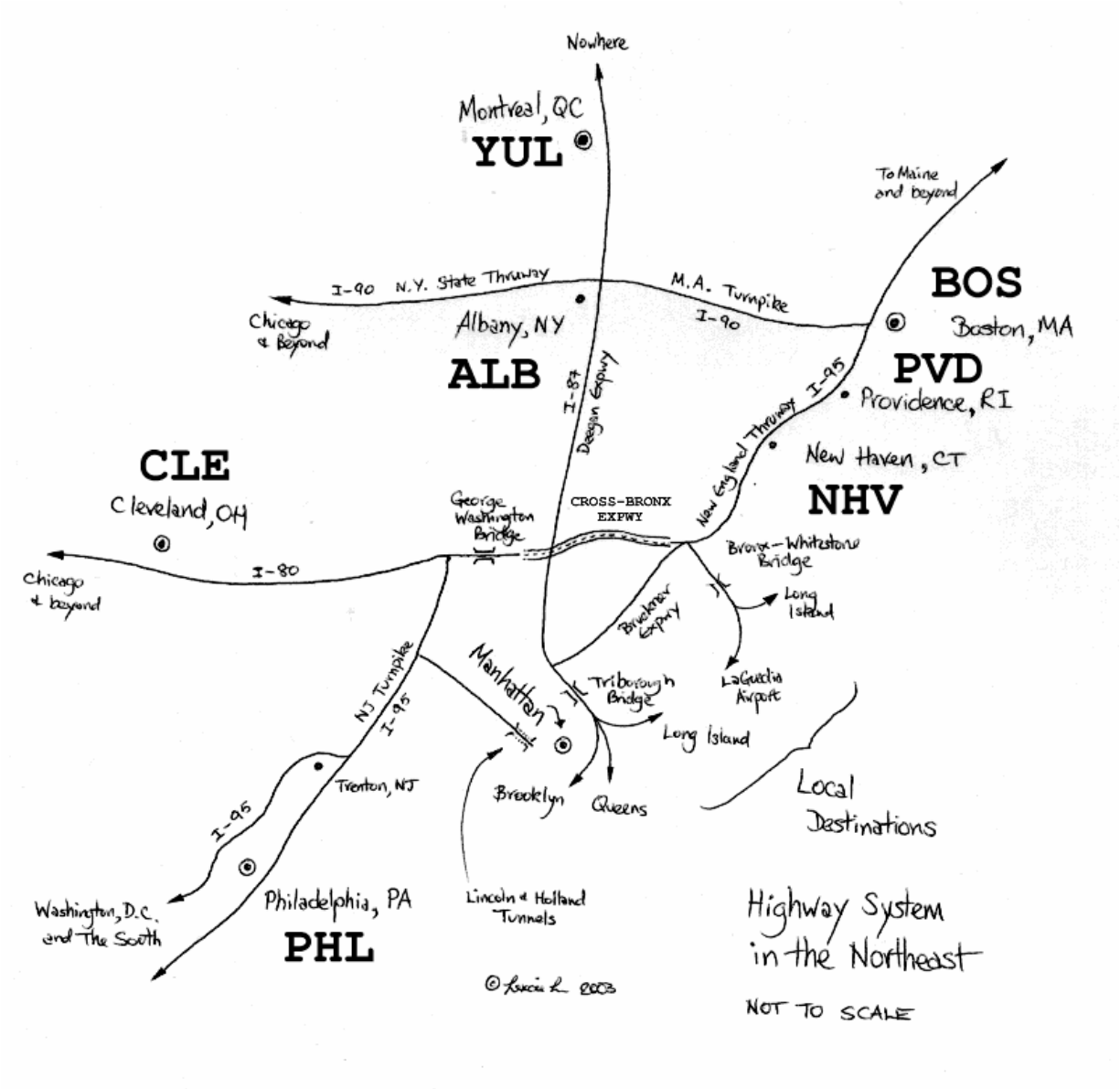
Outline

1. History of the Cross-Bronx
2. Robert Moses
3. Problems: Construction, Social
4. Interchange: Highbridge and Bruckner
5. Ramifications
6. Evaluation: Who was Right?
7. How to Build Urban Freeways

NYC Expressways and Parkways: Timeline

1908	Long Island Motor Parkway opens: first highway using overpasses, one of first with concrete
1925	Bronx River Parkway opens: first surviving limited-access highway, first NYC-area parkway
1936	Regional Plan Association proposes NY/NJ/CT freeway network
Late 1945	Robert Moses proposes limited-access highways for all vehicles – Existing parkways only open to cars – Largest highway undertaking by far (100+ freeway miles)
1955	Triborough Bridge and Tunnel Authority introduces yet another freeway plan

Regional Importance of The Cross-Bronx



Next Hudson Crossing for I-95:
I-87 at Nyack, 12 miles to the North

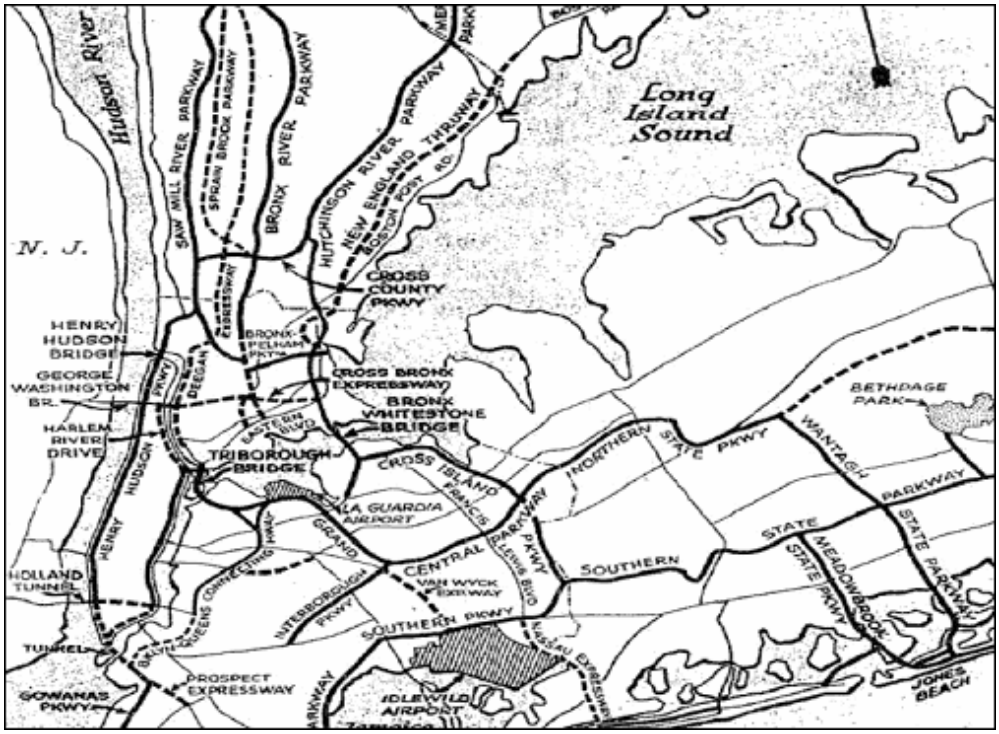
Robert Moses — Why the Highway System?

- NY State Head of Parks (1924)
- NYC Parks Commissioner,
  Head of Triborough Bridge & Tunnel Authority (1933)
- Notable (and hated) for pushing plans through without prior approval

- Philosophy
  - Beautiful parkways, state parks
  - Economic development:
    Shea Stadium, UN Building, 1960 World's Fair
- Hated 'ghetto' slums
  - Subways = waste of money
  - Downtown = dead without expressways

History of the Cross-Bronx

- Connect George Washington Bridge with proposed Bronx-Whitestone Bridge
  - Only East-West connection through Bronx
- Construction Issues
  - Topology: blasted trench to viaduct instantly
  - High real estate values
  - Population density = 34,548 /sq. mile (1950)
    (Somerville = 19,715 paxs/sq. mile, 1990)



Stages

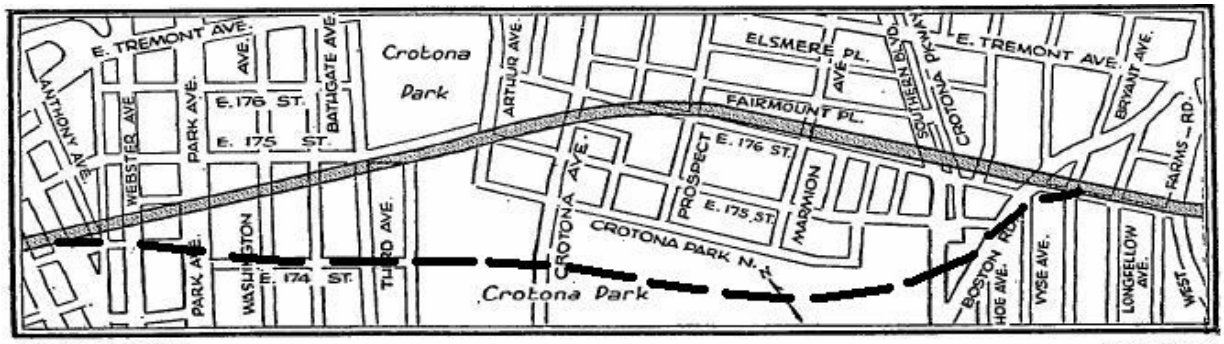
- Initial cost estimate: $17 million (1941)
- Became part of planned I-95 (1946)
- Interstate 95 approved (1957)
- 8.3 miles (Bruckner to Highbridge)

1954	• "East" (between Bronx River Pkwy and Bruckner Circle) • "West" (between Harlem River and Jerome Avenue)
1961	• "Extension" (Bruckner Circle to Throgs Neck Bridge) • Now I-295 spur (also I-895)
1962	• "Middle" (between east and west)
1964	• Highbridge interchange with I-87, Alexander Hamilton Bridge
1972	• Bruckner Interchange (I-95 complete)

Problems: Construction

- Highway to Nowhere
  - First section is less than a mile long
  - Western and Eastern sections done first
    - Possibility the middle never gets built
    - Traffic problems through the center of the Bronx
- Accidents
  - 1959: retaining wall collapses (rain weakened hillside), one died
  - 1962: crane buckles, two died
- Materials
  - Unionport Bridge delayed – competition for materials with other highway projects
  - Inferior drying method used on Highbridge pavement = 70% cost overrun
- Existing Infrastructure
  - Tunnels under a subway line (!)
  - IRT subway station raised to fit highway underneath – service not disrupted

Problems: Social



Moses' (solid) and proposed alternative (dashed) routings.

- Many people displaced along corridor
  - First contract was for relocating tenants
  - 1,530 families moved in above stretch
    - 5,000 total for highway
  - $7 million to move people
  - Neighbourhood(s) destroyed permanently

- Moses v.s. Bronx Borough President James Lyons
  - Lyons wanted alignment through Crotona Park
    - 1-2% of the damage (19 families moved)
  - Moses threatened to stop construction
    - Interstate engineering standards; Corruption

Highbridge Interchange

- Washington Bridge is not Interstate-standard
  - Ends in traffic light
  - Narrow lanes, no shoulders
- New interchange with Washington Bridge and Harlem River Drive
- Washington Bridge built in 1888 for $2.65 million
  - Improve to six lanes, remove trolley tracks (1949)
  - Replaced by Alexander Hamilton Bridge (1959-64)
- Connect Cross-Bronx and Deegan Expwy
  - 18 months overrun
- Ultimate Cost = $60 million (1969)

Bruckner Interchange

- Traffic Circle is inadequate for traffic
  - Not freeway standard
- Built with Bruckner Expressway (new traffic source)
- $67.8 million (largest single contract ever)
  - Entire Bruckner Expressway was $137 million
- Brings four freeways together
- Delayed almost 20 years
  - Community opposition to elevated freeway
  - Money and land acquisition were problems
  - Redesign for building around existing drawbridges

Ramifications

- Robert Moses forced out of New York
  - Resigned from city to head World's Fair (1959)
  - Lost NY State jobs under Rockefeller, then retired (1968)
- No more construction through cities
  - Planned NYC expressways (Bushwick, Lower- and Mid- Manhattan, Nassau) stopped
    - Nassau half-built
  - Embarcadero, Central Artery, other elevated highways now being torn down
- Boston
  - Inner Belt (I-695) cancelled
  - Route 2 (Northwest Expressway) replaced with Alewife Red Line Extension (interstate funds transfer)
  - Southwest Expressway (I-95)
- Community opposition = effective force
  - Park Freeway West (Milwaukee), Somerset Freeway (NJ), West Side Highway (Manhattan)
- Highways seen as bad in urban areas

Cancelled Highway Projects

Southwest Expressway (I-95), Boston, Mass.

I-295 and U.S. Route 6, Providence, R.I.

Route 1 and MA 60, Lynn, Mass. (planned I-95)

I-189 (at U.S. Route 7), Burlington, Verm.

Who was Right?

- Direct Costs
  - Opportunity cost of land (acquisition costs)
  - Construction cost
- Externalities (also Costs)
  - Displacement of existing residents
  - Devaluation of properties immediately adjacent
  - Splitting neighbourhoods in half
- Direct Benefits (Convertible to Revenue)
  - Time saving for passengers
  - Logistics cost savings for freight
- Positive Externalities
  - Increase in value of nearby properties
  - Reduction in accident rate
- Monetize costs and benefits for *Project Evaluation* (Economic Analysis)

Using Numbers

- Lots of people are kicked out of their homes. How many is lots? Is it too many?
  - Highway Footprint = (Lane Width * Lanes + Shoulders) * Length
  - Dwelling Replacement Cost = Pop. Density * Footprint * Cost per Dwelling
- Translate this 'problem' into a 'cost'

Highway Footprint Control Panel			
Number of Lanes (both direction combined)	6	lanes	
Lane Widths (standard = 12')	12	feet	
Padding for shoulder, median, reservations, etc.	30%		
Right of Way Width	93.6	feet	
Highway Footprint per Mile	0.018	sq. mile	
Dwellings & Opportunity Cost Control Panel			
Local Urban Density	34,548	pax per sq. mile	
% of Land within Town zoned Residential	40%		
Effective Urban Density	86,370	pax per sq. mile	
Implied Displacement by Highway (per mile)	612	dwelling units displaced	
Replacement Dwelling Unit Cost (incl. moving expenses, land cost)	$400,000	per dwelling unit	
Dwelling Displace Costs per Mile	$245	million	

- Not an alignment analysis, but gives general results
- Reasonably accurate and verifiable:
  612 dwellings/mile * 8.3 miles = 5,079 (actual ~5,000)

Estimating Social Costs

Urban Freeway Social Cost Control Panels			
Lexcie Lu, MIT Center for Transportation Studies, 04/06/03			
Based on prior work by Steve Alpert, MIT Department of Civil Engineering			
Value of Time for the Average Citizen	$20	per hour	

Rent per Household per Annum	$18,000	per household per annu	
Number of Households per Building	4.0	households/building	
Opportunity Cost per Building per Year	$72,000	per building per annum	
Opportunity Cost per Mile	$11.0	million per annum	
(This should increase with inflation -- ongoing cost)			
Adjacent Property Devaluation Control Panel			
Mileage Either Side of Alignment Impacted	0.2	miles	
Number of paxs per household	2.5	paxs/household	
Household Impacted per Mile	5,528	households	
Assume Rent Value Reduced by n% in These Households	10%		
Loss of Equity per Annum per Household	$1,800	per annum per househo	
Total Loss of Equity per Annum	$9.9	million per annum	
Neighbourhoods Cut-off Control Panel			
Population per Neighbourhood	34,548	paxs	
Percentage of Neighbourhood Transactions Affected	33%		
Time-Value Penalty per Transaction Affected	8	minutes	
Daily Penalty per Neighbourhood	$30,402		
Number of Neighbourhood Transactions per Person per Week	5	transactions	
Annual Penalty due to Neighbourhood being Cut-off	$7.9	million per annum	

- Repeat the process for each item considered a social 'cost'
- Invent ways to model intangibles
  - Neighbourhood cut-off? Use gravity model!

Estimating Social Benefits

Urban Freeway Social Benefits Control Panels			
Lexcie Lu, MIT Center for Transportation Studies, 04/06/03			
Based on prior work by Steve Alpert, MIT Department of Civil Engineering			
Value of Time for the Average Citizen	$20	per hour	
Traffic Flow Control Panel			
Initial Number of Vehicles per Day	70,000	vehs/day	
Max Number of Vehicles per Day	160,000	vehs/day	
Number of Years to Reach Maximum Thoroughput	20	years	
Effective Increase in Highway Traffic per day per year	4,500	vehs/day added per yea	
Vehicle Speed on City Streets	25	mph	
Vehicle Speed on Urban Freeway	50	mph	
Time Saved per Mile of Freeway per Vehicle	0.02	hours	
Average Vehicle Occupancy	1.3	paxs/vehicle	
Person-Time Saved per Mile of Freeway per Vehicle	0.026	hours	
Total Daily Time Value Saved per Mile Freeway per Day, First Year	$28,000	per day	
Total Time Value Saved per Mile Freeway, First Year	$10.22	million per mile per yea	
Incremental Daily Time Value Saved per Day, Subsequent Years	$2,340	per day	
Incremental Time Value Saved per Mile Freeway, Subsequent Years	$0.85	million per mile per yea	
Nearby Property Value Apperciation Control Panel			
Minimum Mileage Either Side of Alignment	0.2	miles	
Maximum Mileage Either Side of Alignment	1	miles	
Ramp Spacing Every x Miles	2	miles	
Household Impacted per Mile	11,055	households	
Assume Rent Value Increased by n% in These Households	3%		
Gain in Equity per Annum per Household	$840	per annum per househo	
Total Gain in Equity per Annum	$9.3	million per annum	

- Ignore costs/benefits that have small values
  - e.g. two people on three occasions a year not being able to launch their yacht isn't a big deal
- Compare proposed with counterfactual

Urban Freeway Evaluation

- Use Net Present Value method
- Negative social externalities are huge
- But so are social benefits – compensate losers

Evaluation of Urban Freeways					
Lexcie Lu, MIT Center for Transportation Studies, 14/06/03					
Based on prior work by Steve Alpert, MIT Department of Civil Engineering					
Interest Rate (i%) =	7%				
Inflation Rate = (j%)	3%				
Value of Time =	$20	per hour			
Time Horizon =	100	years			
Population Density Parameter			*Bronx*	*Somerville*	*Hicksville*
			34,548	19,715	1,000
			(1950)	(2000)	(hypoth.)
Cost Items			*Present Value*		
Displacement of Existing Residents			-$240	-$140	-$7 million
Opportunity Cost of Land			-$290	-$165	-$8 million
Devaluation of Immediately Adjacent Properties			-$260	-$150	-$8 million
Cutting of Neighborhoods in Half			-$210	-$120	-$6 million
Construction Cost			-$25	-$25	-$25 million
Benefit Items			*Present Value*		
Time Savings for Passenger Vehicles			$630	$440	$160 million
Increase in Value of Properties			$250	$120	$10 million
Reduction of Accidents			$20	$20	$20 million
Logistics Cost Savings for Freight			$20	$15	$5 million
Benefits – Costs			*Present Value*		
Total			-$105	-$5	$141 million

Sensitivity Analysis

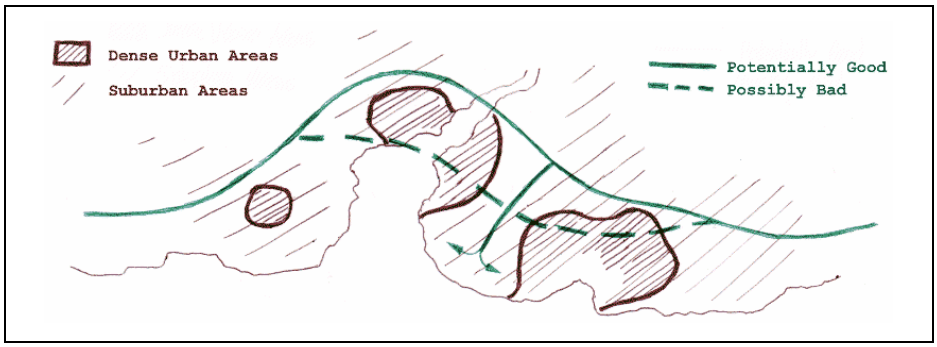
- Economic case for urban highways very sensitive to **existing** population density
- Net benefit low or negative in dense areas
  - Little economic development benefits
  - High opportunity cost of land
- Net benefit high in not-so-dense areas
  - Time saving remain the same, if highly utilized
  - Lower displacement and opportunity costs

- Most externalities are people-related (explains high sensitivity to pop. density)
- Toll the highways to pay the abutters

- Did Moses know this stuff?
  - Not really, he was mostly a philosopher
  - His vision was great everywhere except downtown New York City

How to Build Urban Freeways

- Avoid dense neighbourhoods – detour
  - Retain time savings (Crotona Park alignment)
- Skirt existing conurbations – design
  - Land use pattern will adapt (I-95 Providence)



- Analyze costs and benefits explicitly
- Relax Interstate standards if necessary
  - Highway design could be economically driven
  - Urban or Mountain terrain:
    - provide some access
    - lower design speed to lower externalities
  - Elevated over existing alignments, or Praries:
    - low externalities permit higher engineering standards
- Sometimes a question of who got there first! (Value of existing infrastructure)

The Cross-Bronx Today

- 160,000+ vehicles per day on average (259,200 capacity)
- Routinely backed up at all hours
- Still 6 lanes (no room to widen)
- Only one good alternate route (Bruckner Expressway to I-87) – still ends up at I-95
- Many signs from when it was built still up

- **Verdict:** Although built at great social and financial cost, the Expressway was sorely needed locally, regionally, and nationally. Still a traffic bottleneck, but much better alternative than surface arteries.
- Suggestions in retrospect:
  - Use the Crotona Park routing (fewer people displaced)

Acknowledgements

Carl D. Martland – **1.011 Project Evaluation**
(MIT Civil & Environmental Engineering)
http://www.mit.edu/~1.011/

Sources: http://www.nycroads.com/, *The New York Times*, The Godfather of Sprawl (*Atlantic Monthly*)