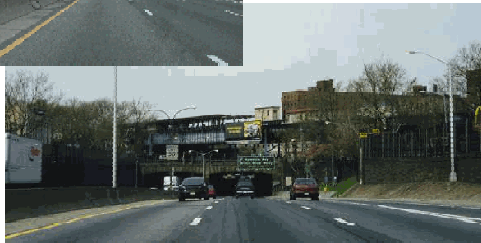


THE CROSS-BRONX EXPRESSWAY



MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CENTER FOR TRANSPORTATION STUDIES

Steve Alpert & Lexcie Lu

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

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NYC Expressways and Parkways: Timeline

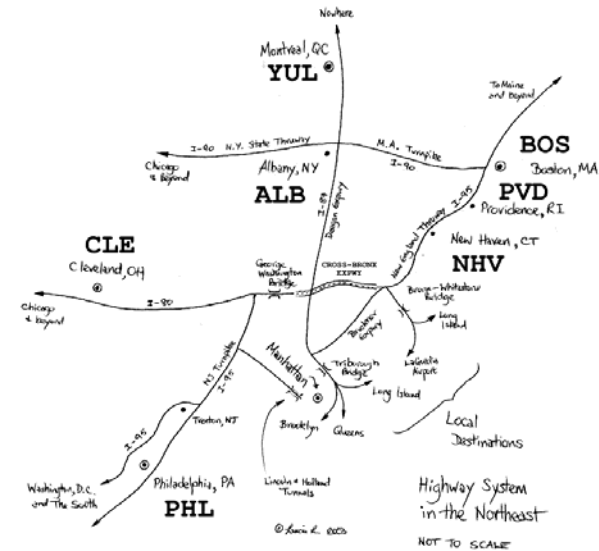
1908	Long Island Motor Parkway opens: first highway using overpasses, one of first with concrete
1925	Bronx River Parkway opens: first surviving limited-access highway, first NYC-area parkway
1936	Regional Plan Association proposes NY/NJ/CT freeway network
Late 1945	Robert Moses proposes limited-access highways for all vehicles <ul style="list-style-type: none"> - 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

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Regional Importance of The Cross-Bronx



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

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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

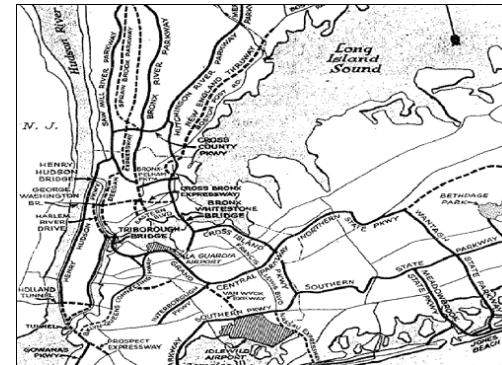
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History of the Cross-Bronx

- 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)



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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	<ul style="list-style-type: none"> • “East” (between Bronx River Pkwy and Bruckner Circle) • “West” (between Harlem River and Jerome Avenue)
1961	<ul style="list-style-type: none"> • “Extension” (Bruckner Circle to Throgs Neck Bridge) • Now I-295 spur (also I-895)
1962	<ul style="list-style-type: none"> • “Middle” (between east and west)
1964	<ul style="list-style-type: none"> • Highbridge interchange with I-87, Alexander Hamilton Bridge
1972	<ul style="list-style-type: none"> • Bruckner Interchange (I-95 complete)

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Problems: Construction

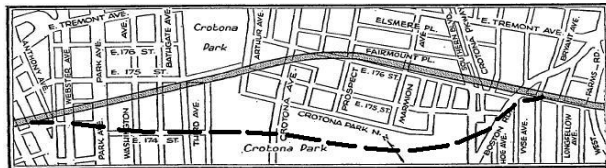
- Highway to Nowhere
 - First section is less than a mile long
 - Western and Eastern sections done first
 - Possibility the middle never gets built
 - Traffic problems through the center of the Bronx
- Accidents
 - 1959: retaining wall collapses (rain weakened hillside), one died
 - 1962: crane buckles, 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

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Problems: Social



The New York Times
Moses' (solid) and proposed alternative (dashed) routings.
May 15, 1953

- 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

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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)

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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

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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

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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.

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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)

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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)

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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 annum
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 household
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!

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Estimating Social Benefits

Urban Freeway Social Benefits Control Panels	
<i>Lexcie Lu, MIT Center for Transportation Studies, 04/06/03</i>	
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 Throughput	20 years
Effective Increase in Highway Traffic per day per year	4,500 vehs/day added per year
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 year
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 year
Nearby Property Value Appreciation 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 household
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

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Urban Freeway Evaluation

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

Evaluation of Urban Freeways			
<i>Lexcie Lu, MIT Center for Transportation Studies, 14/06/03</i>			
Based on prior work by Steve Alpert, MIT Department of Civil Engineering			
Interest Rate (i%) =	7%		
Inflation Rate = (i%)	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

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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

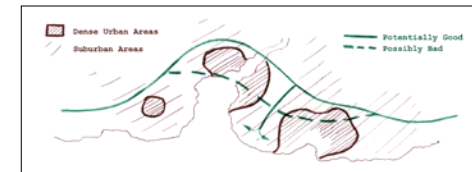
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How to Build Urban Freeways

- 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)

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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)

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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*)

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