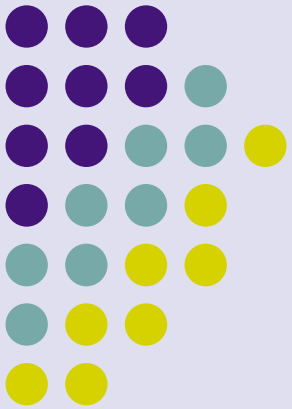
Simplified Methods for Travel Forecasting for Small Starts Projects

Session 13

- Travel forecasts for Small Starts
- Example 1: Fitchburg-Boston commuter rail
- Example 2: Brooklyn (NY) BRT
- Example 3: WMATA (DC-VA-MD) MetroRail



Travel Forecasts for Small Starts

- The huge simplification for Small Starts
  - Opening year forecasts only!
  - Shorter times from planning to opening year
  - So, current conditions ≈ opening-year conditions
    - Supply: highway congestion, transit services
    - Demand: demographics, travel patterns, ridership
  - Opportunity for simplification
    - Assemble data on current conditions
    - Represent supply-side deltas
    - Estimate demand-side deltas

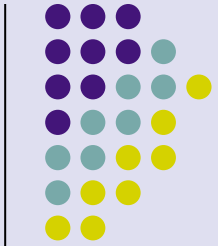
More data!

Fewer models!

Fewer moving parts!

Quicker, cheaper, better!

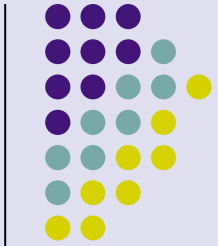
Travel Forecasts for Small Starts



- Conceptual approach
  - Data on current riders affected by the project
  - Estimates of project impacts on travel times
  - Project riders = riders with paths on the project
  - New riders = elasticity-based responses to Δtimes
  - Time savings = (current+new riders) x time saved
  - O.Y. riders = scaled-up current+new project riders
  - O.Y. time savings = scaled-up current time savings

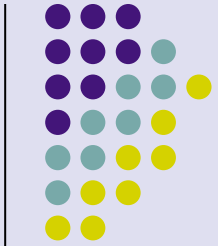
(O.Y. = opening year)

Travel Forecasts for Small Starts



- Requirements for New Starts forecasting tools
  - Be consistent with good practice √
  - Grasp the current transit situation √
  - Be mindful of new behaviors √ (with some work)
  - Adequately support the case for the project √
  - Quantify FTA evaluation measures √ (& respect conventions) √

Travel forecasts for Small Starts

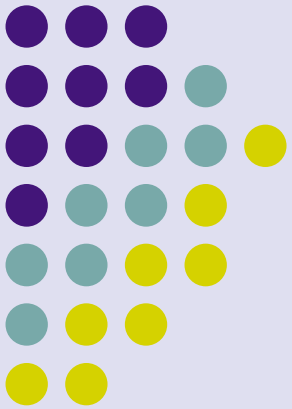


- Examples to illustrate (and to confirm!)
  - Two from the annals of the Small Starts program
    - Fitchburg-Boston commuter rail improvements
    - Brooklyn: Nostrand Avenue BRT

    } ***Approved into project development!***
  - One from the Washington Post
    - DC/MD/VA – WMATA Orange + Blue MetroRail lines

Travel Forecasting for the Fitchburg Commuter Rail Project

- Project
- Analysis
- Results
- Refinements



Fitchburg Commuter Rail

Location

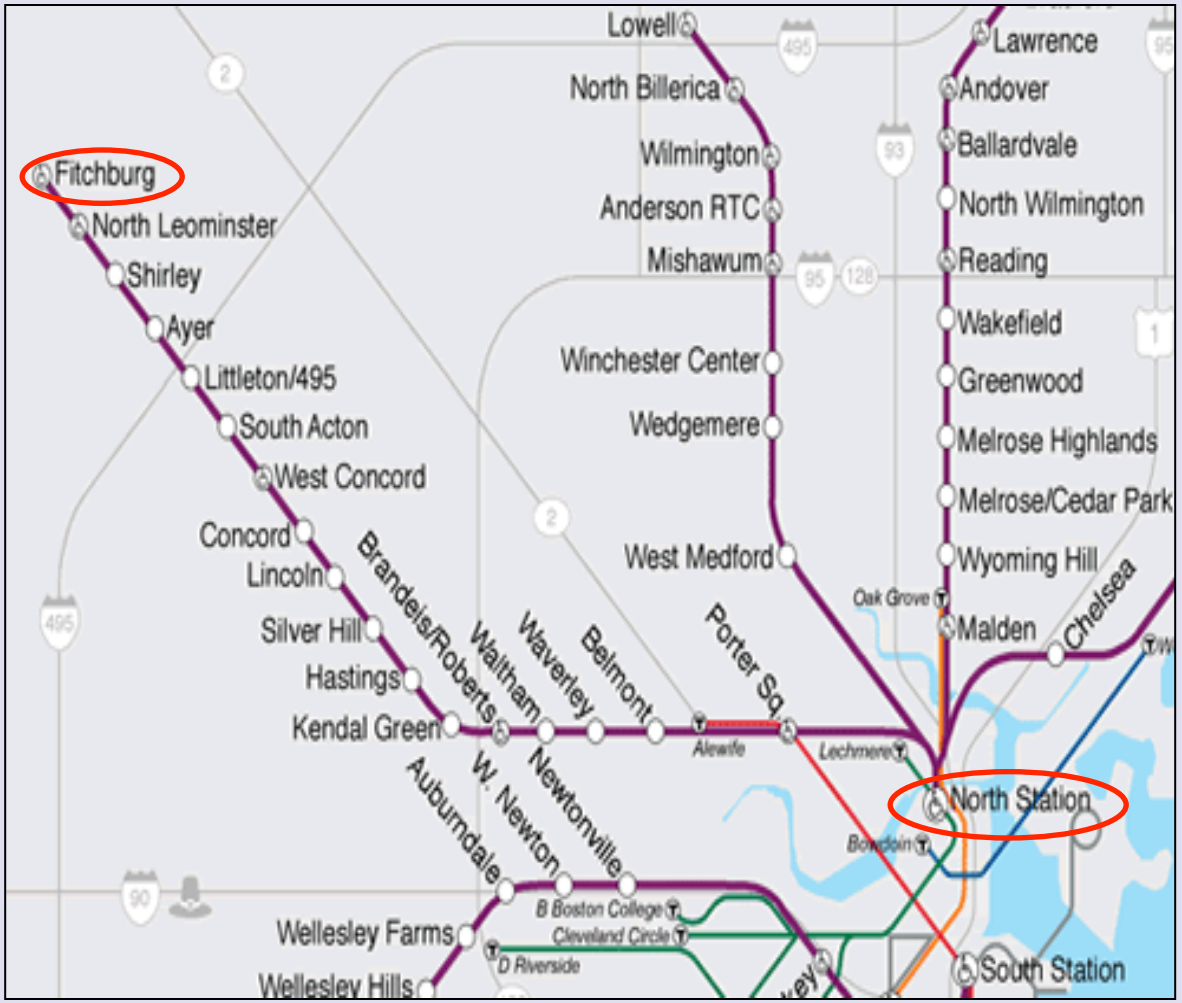
- Northwest suburban corridor of the Boston metro area

Existing line

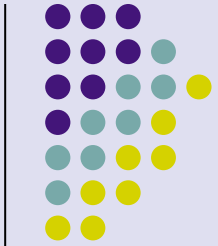
- 49.5 miles
- 18 stations
- 89 minutes travel time
- 60 mph maximum speed
- 10,600 trips/day, nearly all to/from downtown Boston

Problem

- ~20% of trains >5 min late
- Heavy freight corridor; single tracked over 15%; delays
- Poor drainage
- Antiquated signalization
- Delays at grade crossings

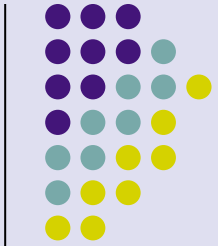


Fitchburg Commuter Rail



- Proposed project
  - Track improvements; top speed → 80mph
  - In-cab signal system
  - Installation of 10 miles double track
  - Improvements to four grade crossings
  - Construction of three high level platforms
  - Improvements to the drainage system
  - O&M cost savings → 2 added midday round trips
- Capital cost: $149.8M

Fitchburg Commuter Rail



- Framework for the analysis
  - Spreadsheet calculations
  - On-off counts, by direction
- Computations
  - A – station on/off counts
  - B – train-time improvements from simulations
  - C – opening year estimates from aggregate factor
  - D – new riders from B and a run-time elasticity
  - E – person-hours saved; new and existing riders

Fitchburg Commuter Rail

AM PEAK

B A C E D E

Station	Inbound Run Time, Existing (min)	Inbound Run Time, Build (min)	Travel Time Savings (min)	Existing AM Riders	Opening Year AM Riders	Person Hours Saved	New AM Riders (.6 elasticity)	New Riders Hours Saved	User Benefits New & Existing Riders
Fitchburg	88.8	79.2	9.6	308	314	50.19	20	1.63	51.82
North Leominster	81.6	72	9.6	285	290	46.47	21	1.64	48.11
Shirley	73.8	64.2	9.6	124	127	20.26	10	0.79	21.05
Ayer	66.6	58.2	8.4	259	264	37.02	20	1.40	38.42
Littleton	57.6	51	6.6	135	138	15.15	9	0.52	15.67
South Acton	49.8	45.6	4.2	625	637	44.62	32	1.13	45.74
West Concord	46.2	42.6	3.6	331	338	20.27	16	0.47	20.75
Concord	42	39	3	310	316	15.79	14	0.34	16.13
Lincoln	36.6	33.6	3	241	246	12.29	12	0.30	12.59
Silver Hill	34.2	33	1.2	30	31	0.61	1	0.01	0.62
Hastings	32.4	30.6	1.8	54	55	1.64	2	0.03	1.67
Kendall Green	30.6	28.8	1.8	153	156	4.69	6	0.08	4.77
Brandeis/Roberts	25.8	24.6	1.2	299	305	6.11	9	0.09	6.19
Waltham	22.8	21	1.8	374	382	11.46	18	0.27	11.73
Waverly	17.4	16.8	0.6	76	77	0.77	2	0.01	0.78
Belmont	14.4	14.4	0	104	106	0.00	0	0.00	0.00
Porter Square	9	8.4	0.6	23	24	0.24	1	0.00	0.24
North Station	0	0	0	0	0	0.00	0	0.00	0.00
				3,730	**3,805**	287.56	**191**	8.71	**296.27**

Fitchburg Commuter Rail

- Forecast
  - Trips/day: 10,600 today → 11,300 opening year
  - Time savings: 987 hours/day in opening year
  - Benefits in scale with costs
- Uncertainty analysis on new-trip elasticity

ELASTICITY	NEW TRIPS	HOURS SAVED	CE
-0.4	453	975	24.03
-0.6	**679**	**987**	**$23.75/hr**
-0.8	905	999	23.47

  - Conclusion: little risk to the conclusion on CE
    - Medium CE = $16.00 – $24.49

2 WEEKS!

Fitchburg Commuter Rail

- Possible changes to the methodology
  - Incremental logit for mode choice? X
    - Probably the same results with (a little) more effort
    - Diversion of focus?
  - Iterative proportional fitting for demographic Δs? X
    - Probably the same results with (a little) more effort
    - Diversion of focus?
  - Time savings from improved reliability √ !!
    - Data on train delays/causes → estimate improvement
    - Opportunity here to add benefits (and OK with FTA)

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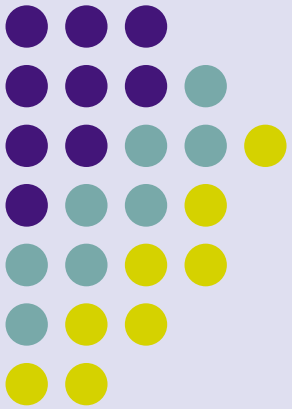

Methodology developed by Jim Barry
New York City Transit

Methodology updated by Jay Krantz
New York City Transit

Presented by Bill Woodford
AECOM Consult

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Overview

- Local funding
- Dedicated curb lane
- Transit signal priority
- Off-board fare collection
- Leading bus interval
- Branding
- New stations
- Customer ambassadors
- On-board cameras

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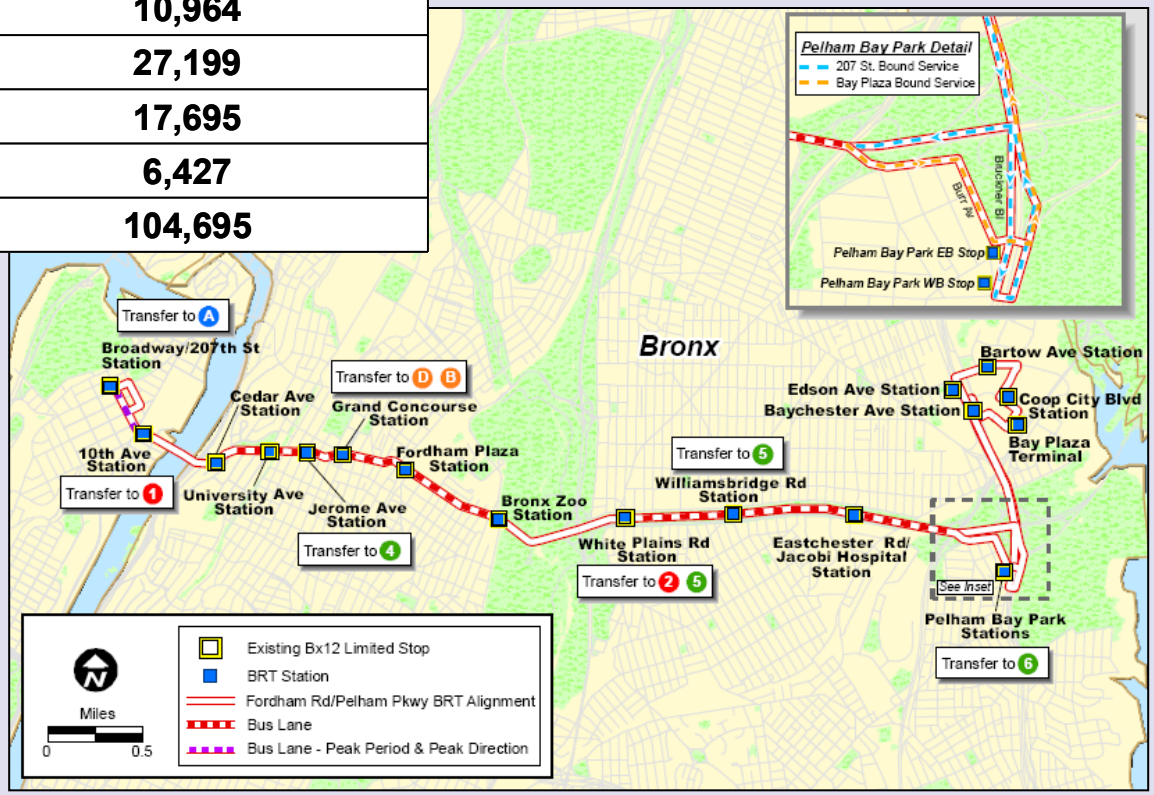
First Implementation – Bx12 - Fordham Road

Bus Route	Weekday Ridership (2006)
Bx12	42,410
Bx17	10,964
Bx9	27,199
Bx22	17,695
W60-61 (Westchester Co.)	6,427
TOTAL:	104,695



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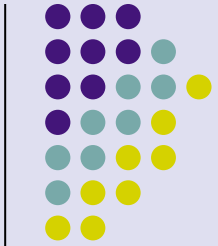
Bx12 – SBS 6-Month Outcomes



- 18-20% improvement in running time, depending on direction and time of day
- October corridor ridership increased 11% over October 2007
- Customer response:
  - 89% say SBS service is better than the limited.
  - 30% say that they are riding more frequently than before
  - 68% say that paying on the street is more convenient

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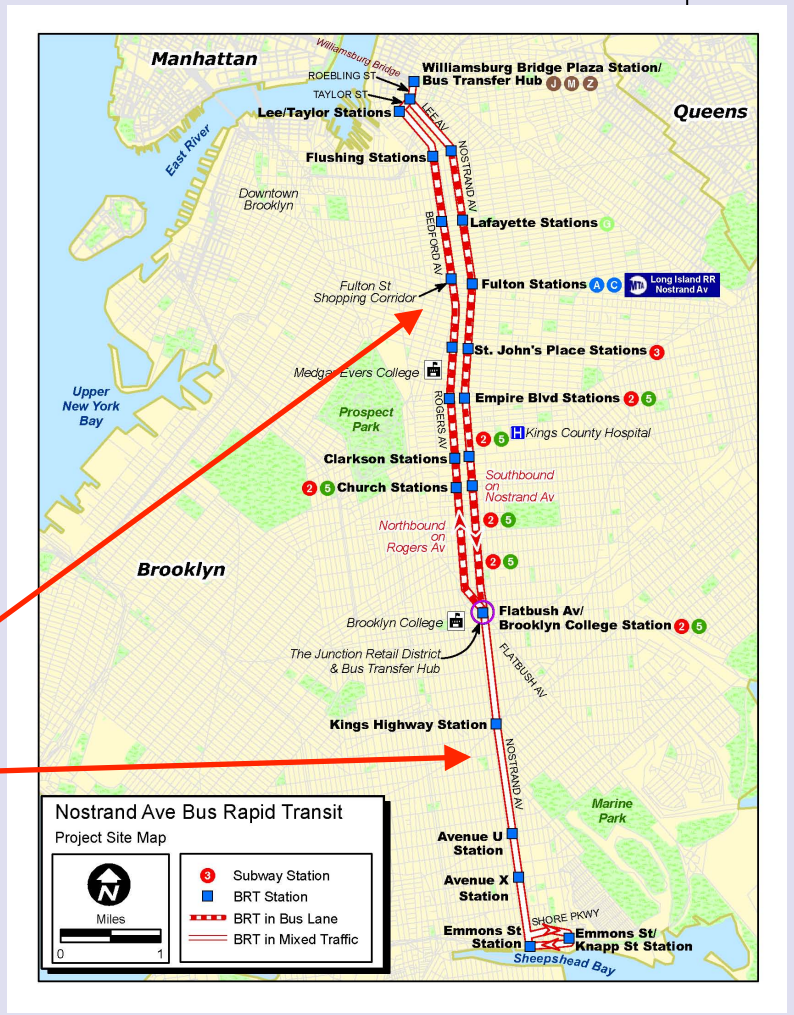
Next Implementation – B44 – Nostrand Ave

- FTA Small Starts funding
- Off-board fare collection
- Increased frequency
- Longer span of service
- New low-floor articulated buses
- Branding of stations and buses
- “Interior” bus lanes with bus bulb stations for 4.6 miles
- Transit signal priority for 3.8 miles



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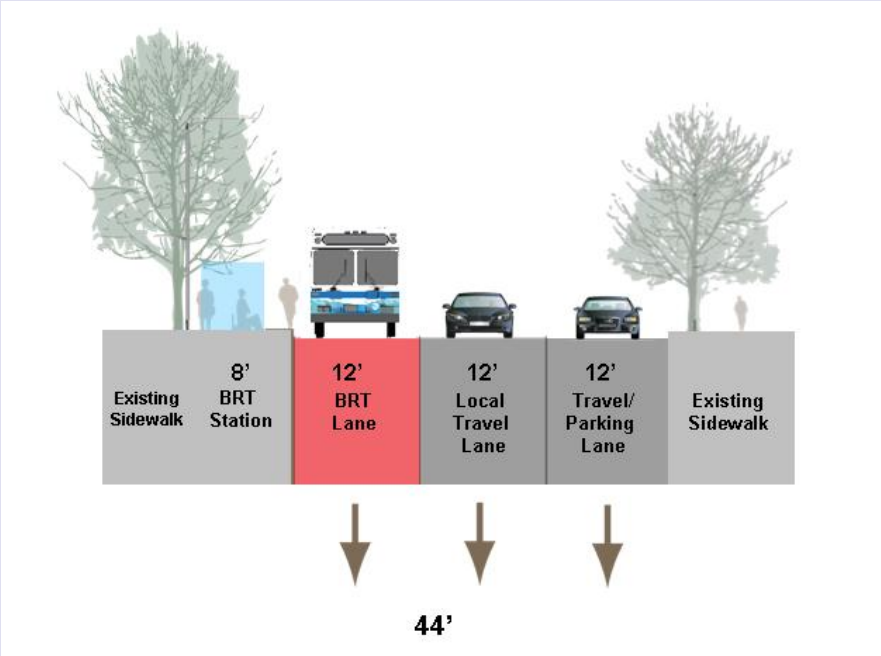
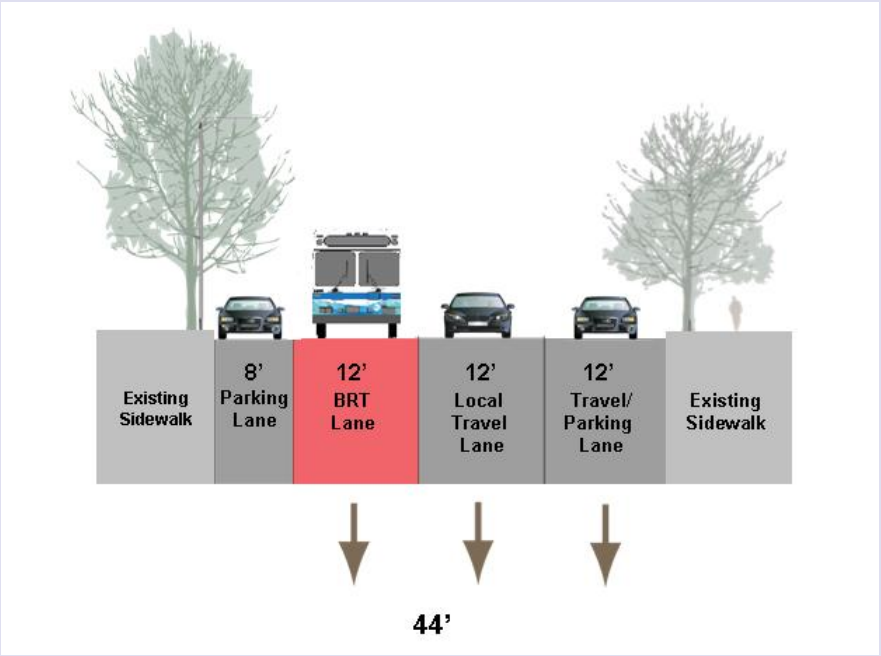
Lane Configuration



At stations



Between stations

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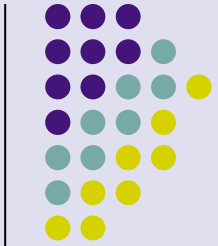
Forecasting Goals



- Support Small Starts application
- Accurate measurement of demand in a mature transit market
- Defensible estimate of Transportation System User Benefits
- Methods development commensurate with project scale and schedule

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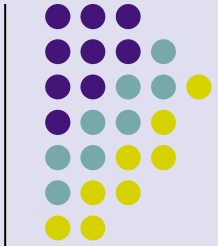
Forecasting Strategy



- **Transit demand**
  - Based on ride check/MetroCard data showing on and off locations
  - On and off locations "spread" to represent distribution of ultimate trip origin and destinations (along route)
  - On – off locations linked using friction factors and persons on-board from ride checks
  - Provision for demand adjustment based on SBS time savings and elasticities (never implemented since base demand sufficient to establish cost effectiveness)
- **Transit Supply**
  - Simplified network with SBS, competing buses and walk access
  - Clipped from City-wide network with centroids added to match "spread" on and off locations
  - Hard coded travel times representing observed or SBS planned times
- **Analysis**
  - Assignment via TransCAD SUE algorithm
  - User benefits—equivalent to time savings of SBS vs. TSM

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Transit Demand

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Starting Ridecheck Data

- Ridecheck data provides information on persons boarding and alighting vehicles by stop

	Direction of Travel	→					
	Offs						
Ons	Stop 1	Stop 2	Stop 3	Stop 4	Stop 5	Stop 6	Stop 7	Totals
Stop 1	0	?	?	?	?	?	?	50
Stop 2	0	0	?	?	?	?	?	30
Stop 3	0	0	0	?	?	?	?	25
Stop 4	0	0	0	0	?	?	?	15
Stop 5	0	0	0	0	0	?	?	10
Stop 6	0	0	0	0	0	0	?	0
Stop 7	0	0	0	0	0	0	0	0
Totals	0	0	10	20	25	30	45	130

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Identifying "Known" Cell Values

- Many cells are zero or fixed due to distance or stop sequence

	Direction of Travel →							
	Offs							
Ons	Stop 1	Stop 2	Stop 3	Stop 4	Stop 5	Stop 6	Stop 7	Totals
Stop 1	0	0	10	?	?	?	?	50
Stop 2	0	0	0	?	?	?	?	30
Stop 3	0	0	0	0	?	?	?	25
Stop 4	0	0	0	0	0	?	?	15
Stop 5	0	0	0	0	0	0	10	10
Stop 6	0	0	0	0	0	0	0	0
Stop 7	0	0	0	0	0	0	0	0
Totals	0	0	10	20	25	30	45	130

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Completing Remaining Cell Values

- The remaining cells are partially known by the row and column totals and the stop sequence

	Direction of Travel →							
	Offs							
Ons	Stop 1	Stop 2	Stop 3	Stop 4	Stop 5	Stop 6	Stop 7	Totals
Stop 1	0	0	10	?	?	?	?	50
Stop 2	0	0	0	?	?	?	?	30
Stop 3	0	0	0	0	?	?	?	25
Stop 4	0	0	0	0	0	?	?	15
Stop 5	0	0	0	0	0	0	10	10
Stop 6	0	0	0	0	0	0	0	0
Stop 7	0	0	0	0	0	0	0	0
Totals	0	0	10	20	25	30	45	130

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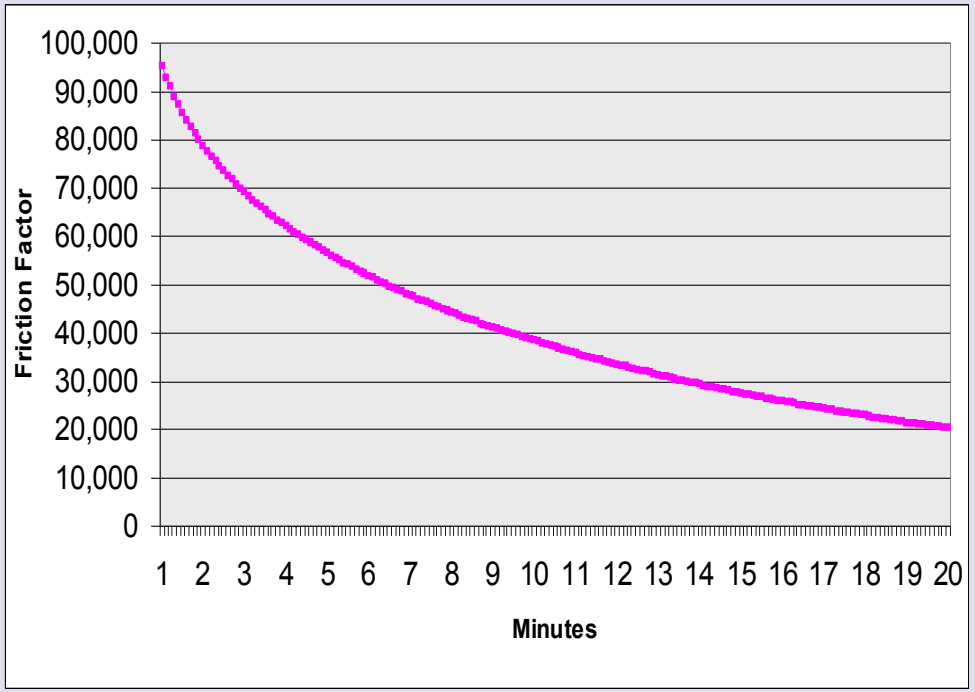
Completing Remaining Cell Values

- For a given boarding stop, the probability of getting off at a stop is based on:
  - the travel time to the stop (friction factor)
  - the total offs at the stop
- Probablity times total ons = initial trip estimate
- Total offs and ons are balanced to actual counts



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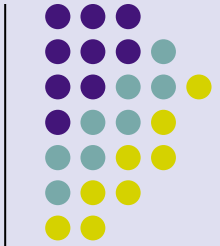
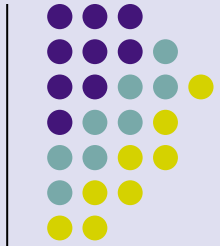
Example Matrix for Nostrand Avenue



Stop Name	WASHINGTON WASHINGTON	ROEBLING ST S 9TH ST	LEE AV ROSS ST	LEE AV WILLIAMSBUR	LEE AV HEWES ST	LEE AV RUTLEDGE ST	LEE AV LYNCH ST	LEE AV WALLABOUT S	LEE AV FLUSHING AV	NOSTRAND AV MYRTLE AV	NOSTRAND AV DE KALB AV	NOSTRAND AV GATES AV	NOSTRAND AV FULTON ST	NOSTRAND AV BERGEN ST	NOSTRAND AV SAINT JOHNS	NOSTRAND AV EMPIRE BL	NOSTRAND AV CLARKSON A	NOSTRAND AV CHURCH AV	NOSTRAND AV NEWKIRK AV	NOSTRAND AV GLENWOOD	NOSTRAND AV AV H	NOSTRAND AV AV L	NOSTRAND AV KINGS HY	NOSTRAND AV AV R	NOSTRAND AV AV S	NOSTRAND AV AV U	NOSTRAND AV GRAVESEND	NOSTRAND AV AV V	NOSTRAND AV AV W	NOSTRAND AV AV X	NOSTRAND AV AV Y	NOSTRAND AV AV Z	NOSTRAND AV VOORHIES A	SHORE PY SV NOSTRAND AV	SHORE PY SV BROWN ST	SHORE PY SV COYLE ST
WASHINGTON WASHINGTON	0	4	2	1	4	1	2	1	9	4	12	5	21	3	5	8	13	7	4	6	3	1	1	1	0	1	1	0	1	7	0	0	0	0	0	0
ROEBLING ST S 9TH ST		0	0	0	1	0	1	0	3	1	4	2	7	1	2	3	5	2	1	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
LEE AV ROSS ST			0	0	0	0	1	0	3	1	4	1	6	1	1	2	4	2	1	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
LEE AV WILLIAMSBUR				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEE AV HEWES ST					0	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEE AV RUTLEDGE ST						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEE AV LYNCH ST							0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEE AV WALLABOUT S								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEE AV FLUSHING AV									0	4	11	4	17	3	4	6	10	5	3	4	2	1	1	1	0	0	1	0	0	5	0	0	0	0	0	0
NOSTRAND AV MYRTLE AV										0	15	5	21	3	4	7	12	6	4	5	2	1	1	1	0	1	1	0	0	6	0	0	0	0	0	0
NOSTRAND AV DE KALB AV											0	9	34	5	7	11	18	10	6	8	4	2	2	1	0	1	1	1	1	9	1	0	0	0	0	0
NOSTRAND AV GATES AV												0	85	13	16	25	41	22	13	18	8	4	3	2	0	2	3	1	2	21	1	1	1	0	0	0
NOSTRAND AV FULTON ST													0	29	33	49	82	42	25	34	15	7	6	4	1	4	5	3	3	40	2	2	1	1	0	0
NOSTRAND AV BERGEN ST														0	11	16	26	13	8	11	5	2	2	1	0	1	2	1	1	12	1	1	0	0	0	0
NOSTRAND AV SAINT JOHNS															0	18	29	15	8	12	5	2	2	1	0	1	2	1	1	13	1	1	0	0	0	0
NOSTRAND AV EMPIRE BL																0	38	19	10	14	6	3	3	2	0	1	2	1	1	15	1	1	0	0	0	0
NOSTRAND AV CLARKSON A																	0	46	22	30	13	6	5	3	1	3	4	2	2	32	2	1	1	0	0	0
NOSTRAND AV CHURCH AV																		0	43	56	24	11	10	6	1	5	7	4	4	58	3	3	1	1	0	1
NOSTRAND AV NEWKIRK AV																			0	66	28	12	10	7	1	5	8	4	4	60	4	3	2	1	0	1
NOSTRAND AV GLENWOOD																				0	0	14	12	8	1	6	9	5	5	67	4	3	2	1	0	1
NOSTRAND AV AV H																					0	31	26	16	3	13	18	10	10	143	8	6	4	2	0	1
NOSTRAND AV AV L																						0	3	2	0	1	2	1	1	17	1	1	0	0	0	0
NOSTRAND AV KINGS HY																							0	17	3	12	18	9	10	134	8	6	3	2	0	1
NOSTRAND AV AV R																								0	0	1	1	1	1	10	1	0	0	0	0	0
NOSTRAND AV AV S																									0	1	1	0	0	6	0	0	0	0	0	0
NOSTRAND AV AV U																										0	0	0	0	17	1	1	0	0	0	0
NOSTRAND AV GRAVESEND																											0	0	0	6	0	0	0	0	0	0
NOSTRAND AV AV V																												0	0	0	0	0	0	0	0	0
NOSTRAND AV AV W																													0	0	0	2	1	1	0	0
NOSTRAND AV AV X																														0	0	0	9	5	1	3
NOSTRAND AV AV Y																															0	0	0	1	0	1
NOSTRAND AV AV Z																																0	0	0	0	1
NOSTRAND AV VOORHIES A																																	0	0	0	0
SHORE PY SV NOSTRAND AV																																		0	0	0
SHORE PY SV BROWN ST																																			0	0
SHORE PY SV COYLE ST																																				0
SHORE PY SV BRIGHAM ST																																				
KNAPP ST SHORE PY																																				
Total Offs	0	4	2	1	5	2	3	1	16	11	48	26	196	59	83	145	280	190	149	267	116	98	88	73	13	59	85	46	48	685	40	33	28	18	2	11



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Transit Supply

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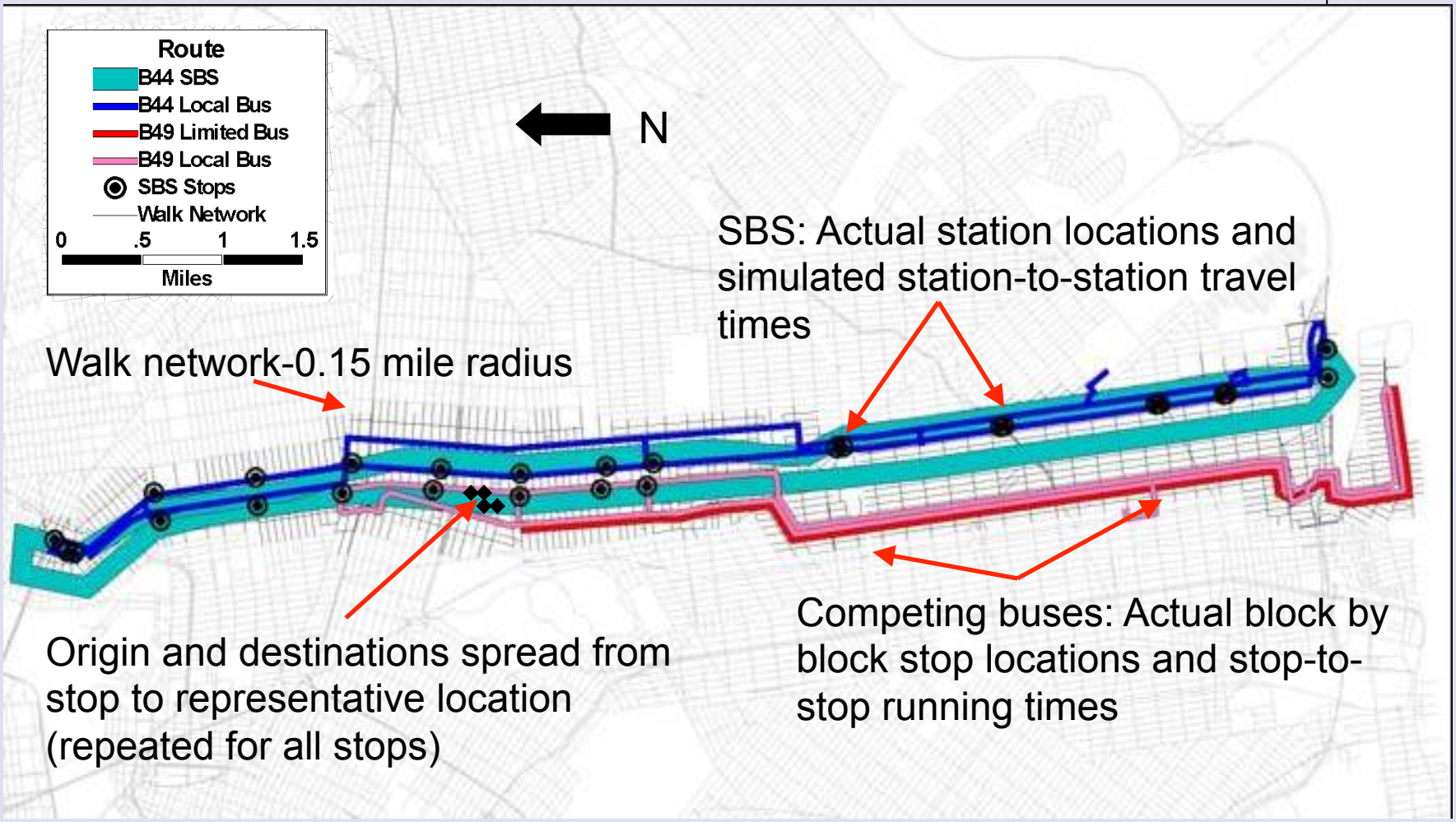
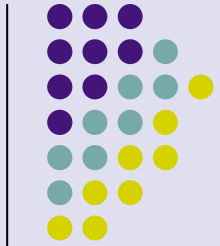
Supply represented with detailed network

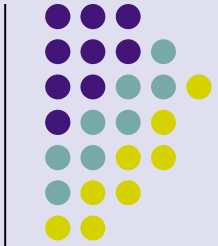




New York +selectbusservice

Analysis

New York +selectbusservice
Analysis

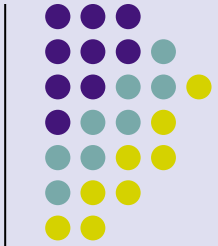


- SBS ridership determined by TransCAD Stochastic User Equilibrium Assignment
  - Wait time for each bus route based on one-half of headway but includes term to simulate random arrival time
  - Capacity effects accounted for using BPR-type volume/ capacity – time relationships
- User benefits computed by comparing weighted travel times for each trip of SBS alternative as compared to TSM (existing limited bus converted to SBS stopping pattern).

New York +selectbusservice

Results and Conclusions

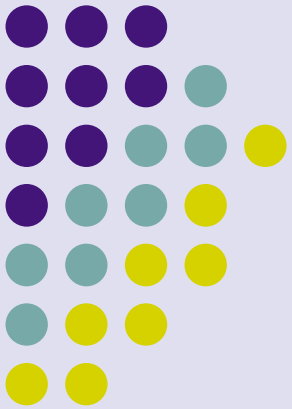
New York +selectbusservice
Results and Conclusions



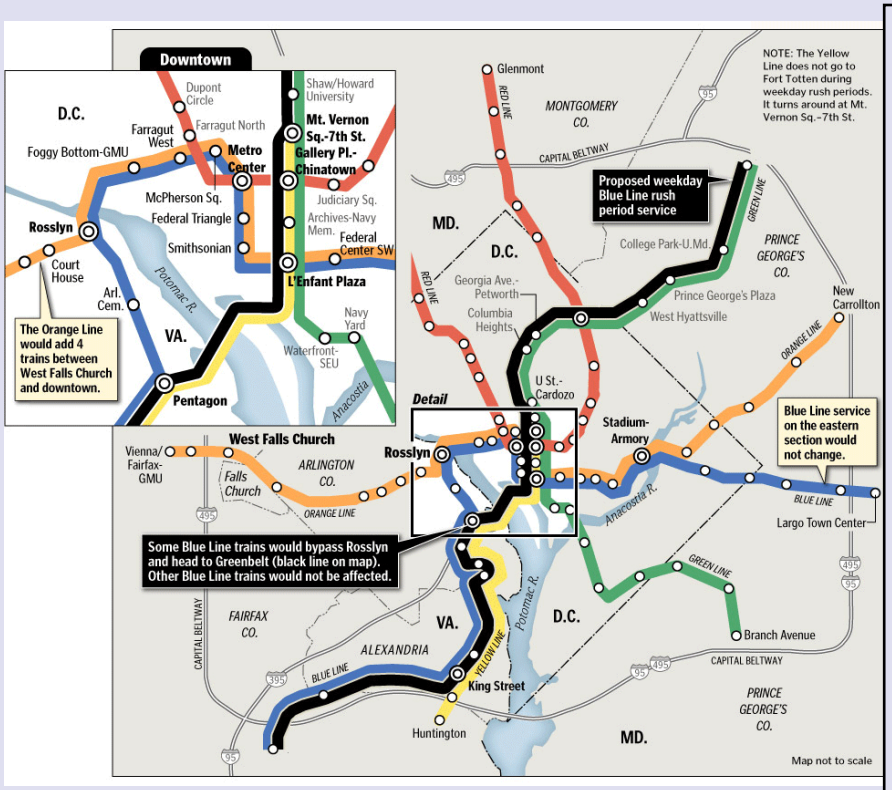
- Forecast results:
  - 5,900 am-peak-period SBS riders
  - 285 am-peak-period hours of user benefits; 970 hours daily
  - CEI = $13.88/hour
- NYCT time and effort required to develop approach
  - Based on existing NYCT networks and MetroCard trip tables that have been assembled over the years
  - Ride-check collection can be a significant effort
  - Nostrand Avenue model update, itself, 4-6 weeks
- FTA response:
  - Highly supportive of data-driven approach
  - Review centered on reliability of stop-to-stop matrix and estimates of travel time savings
  - Concluded that results accurately depict project features and benefits

Travel Forecasting for Possible Adjustments to the Orange + Blue Lines

- Project
- Analysis
- Results
- Refinements



WMATA Orange + Blue Lines



Breaking the Blue Line Jams
Washington Post
Sunday, October 26, 2008; Page C02

Metro is considering rerouting some Blue Line trains between Virginia and the District during weekday rush periods by having them cross the Potomac River on the Yellow Line bridge near the Pentagon rather than follow the current longer path through a tunnel near Rosslyn, the system's biggest choke point.

The plan, which would send the trains to Greenbelt, the last stop on the Green Line, is intended to ease congestion at the Rosslyn portal and provide more service to parts of downtown Washington where economic development has spurred high ridership growth, according to Metro officials. But it also would mean less-frequent service for riders going from southern parts of the Metro system, such as Franconia and Van Dorn, to Rosslyn and points west on the Orange Line and to western downtown stations, including Foggy Bottom.

A recent Metro survey of 446 riders found that most did not know about the Blue Line proposal. But of those who did, 61 percent felt positively about it, although these tended to be riders who would most benefit. Those commuting from Franconia to L'Enfant Plaza, for example, would have more direct train service. Riders at Greenbelt would also have direct service to Reagan National Airport.

Not surprisingly, the people whose travel times would increase because they would have to wait longer for Blue Line trains to get to Rosslyn, Foggy Bottom and out to Vienna were most negative about the proposal.

Metro officials say there would be no additional operating costs for rerouting some Blue Line trains. But riders whose travel times would increase because of fewer Blue Line trains have asked the transit agency to look into adding bus service along the Rosslyn corridor to make up for fewer trains. Metro officials are looking into that possibility, which would add to costs.

There would also be costs for additional signage associated with any rerouting of trains. More signs would have to be added to platform pylons on affected lines, to electronic information display boards on platforms, and to the front and sides of trains, officials said. The signs would have to show that the rerouting would only occur during rush hour.

Riders also suggested that Metro consider giving any rerouting a different color to avoid confusion. Officials hope to research the costs and conduct an analysis before presenting a recommendation to the Metro board in December or January. Even if the board signs off on the plan, it would probably be an additional six months before any rerouting could take place so there is time for customer outreach and sign changes, officials say.

Metro's planning maps depict the new route as a brown line, but no color has been chosen.

What do you think about the proposal? What color do you think the new route should be? Send your thoughts about the new color and proposed route changes to commuter@washpost.com.

-- Lena H. Sun

WMATA Orange + Blue Lines

The problem

(just the AM peak, for presentation purposes)

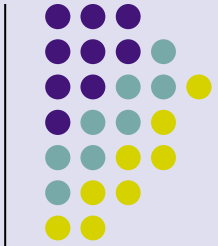
- Capacity through tunnel
  - Rosslyn-Stadium/Armory
  - Dulles line in <10 years
- Orange crush (VA-DC AM)
  - 16 trains/hr inbound
  - 62% of trains at merge
  - 67% of riders at merge
- Blue line
  - 10 trains/hour inbound
  - 38% of trains at merge
  - 33% of riders at merge

WMATA Orange + Blue Lines

An alternative

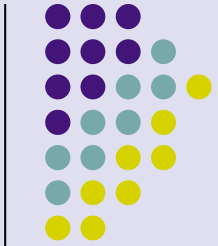
- Orange line
  - Add 4 trains/hr inbound
  - West Falls Church to Stadium/Armory
- Blue line
  - Reroute 5 trains/hr
  - Yellow Line bridge to Greenbelt
- Merge
  - Orange: 20 trn/hr (80%)
  - Blue: 5 trn/hr (20%)
- Question: time savings and increases for riders?

WMATA Orange + Blue Lines
Data and Methods



- WMATA faregate data
  - Station-to-station records of farecard swipes
  - Entry, exit, timestamp for every rail trip
  - Aggregated to AM peak period
- Analysis
  - MinUTP-coded rail network
  - Baseline and “Build” alternatives
  - MinUTP pathbuilder: paths and impedances
  - Summit: changes in weighted-time expenditures

WMATA Orange + Blue Lines
Important Starting Assumptions



- Single path for each station-to-station pair
- No representation of transfer walk times
- Generic 2-minute transfer penalty (4 minutes, weighted)
- No gains or losses in linked rail trips
- No representation of merge delays
- No representation of crowding or its relief

WMATA Orange + Blue Lines

Findings: Paths from the Pentagon and South

Baseline AM peak trips

- Northbound from Pentagon
  - Blue Line: 11,011
  - Yellow Line: 7,724
  - Destination stations
    - Via Blue Line
    - Via Yellow Line

WMATA Orange + Blue Lines

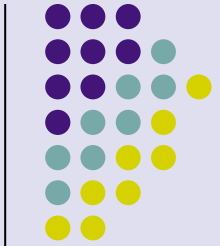
Findings: Paths from the Pentagon and South

Build AM peak trips

- Northbound from Pentagon
  - Blue Line: 5,261
  - Yellow Line: 13,149
  - Diverted to bridge: 5,750
  - Destination stations
    - Via Blue Line
    - Via Yellow Line
    - Diverted Blue→Yellow:
      - Farragut West
      - McPherson Square
      - Metro Center
      - Federal Triangle

WMATA Orange + Blue Lines

Findings: Changes in Travel Times, Expenditures

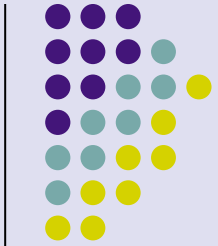


Change in Time Expenditure (hours)

Entry Station	Exit Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
1 SthBlue	-1			31	17	120	44	30	23	-11	-13	-5		-3	1		1	8	2	16	-2	256
2 SthYlw	-2			16	3	5	-1		-1			-1		-1								19
3 PentKingSt	-5		-6	91	50	314	63	9	-12	-26	-30	-18		-3	-14	-2	2	-21	-3	-21	-6	361
4 ArlRosln					-3	2	1		1													2
5 ViennaCH			-9	-8	-12	-65	-22	-16	-16	-8	-7	-3		-2	-10	-1	1	-15	-1	-9	-1	-206
6 FogFW				-1	-4									-1	1		3					-1
7 McPhSq				-1	-2	-1											2					-1
8 MtroCntr					-1												1					-1
9 SmithFedTr																	1					-1
10 Lfant			-4		-1	-2	-1	-1	-1		-2	-1		-1			2	-1		-1		-14
11 GalPlNvyMm			-3							-1		-1		-1			1					-8
12 MtVerPet	-4		-50	-2	-5	-5	-1	-4	-2	-8	-13	-7	-2	-9	-7	-3	7	-12	-4	-15		-146
13 FtTott			-2		-1	-1				-2	-1	-4		-2			2					-11
14 NEGreen	-2	-1	-15	-5	-7	-16	-8	-15	-10	-22	-28	-17	-2	-6	-6	-1	2	-22	-11	-51		-246
15 FdCnStadm			-6	-1	-2	-6	-2	-2	-2	-1	-2	-3		-1	-1	-2	11	-1		-3		-26
16 EastOrng	-1		-13	-2	-4	-18	-7	-7	-10	-7	-7	-5		-1	-9	-4	5	-4	-1	-9	-2	-107
17 EastBlu			-7		-2						-2	-3		-1		-1	11					-5
18 SERed			-11	-1	-3	-3	-2		1	-4	-1	-5		-3		-1	4					-30
19 NERed			-10	-1	-4	-3	-2		1	-4	-1	-5		-6	1		3					-32
20 NWRed			-18	-2	-6	-3	-2		2	-5	-1	-3		-5	2	-1	3					-39
21 SEGreen	-2		-19	-1	-4	-7	-4		-4						1	-3	9					-34
Totals	**-17**	**-1**	**-173**	**113**	**9**	**311**	**56**	**-6**	**-30**	**-99**	**-108**	**-81**	**-4**	**-46**	**-41**	**-19**	**71**	**-68**	**-18**	**-93**	**-11**	**-270**

WMATA Orange + Blue Lines

Findings: Changes in Travel Times, Expenditures



Average Change in Travel Time per Trip (minutes)

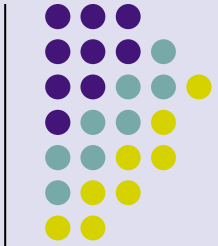
Entry Station	Exit Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
1 SthBlue	-0.9			6.0	5.3	6.0	6.0	6.0	5.2	-2.3	-2.3	-7.4	-2.5	-12.3	0.4	-3.0	6.0	2.0	2.0	4.1	-2.3	**2.7**
2 SthYlw	-2.0			6.0	1.5	0.6	-0.3		-0.3			-1.3		-2.0	0.1	-0.8	6.0					**0.3**
3 PentKingSt	-2.0		-0.2	6.0	5.3	5.5	3.3	0.8	-0.9	-1.1	-1.1	-4.7	-2.1	-2.3	-1.0	-1.9	4.9	-1.1	-1.1	-1.1	-1.1	**1.3**
4 ArlRosln				0.2	-0.7	0.1	0.1	0.1	0.1	0.1		-0.7	0.1	-1.9	0.1	-0.8	6.0	0.1	0.1	0.1	0.1	
5 ViennaCH	-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5	-0.5	-0.6	-1.3	-0.5	-2.5	-0.5	-0.5	5.4	-0.5	-0.5	-0.5	-0.5	**-0.5**
6 FogFW				-0.3	-0.6		0.1	0.1	0.1	0.1		-0.7	0.1	-1.9	0.1	-0.8	6.0	0.1	0.1	0.1	0.1	
7 McPhSq		0.1		-0.3	-0.6	-0.3		0.1	0.1	0.1	-0.1	-0.8	0.1	-1.9	0.1	-0.8	6.0	0.1	0.1	0.1	0.1	**-0.1**
8 MtroCntr				-0.2	-0.6	-0.3	-0.3		0.1	0.1	-0.1	-1.0		-2.0	0.1	-0.8	6.0					**-0.1**
9 SmithFedTr		0.1	-0.5	-0.3	-0.6	-0.3	-0.3	-0.3	-0.2	0.1	-0.3	-0.4		-1.9	0.1	-0.8	6.0	-0.3	-0.3	-0.3	0.1	**-0.1**
10 Lfant	-2.3		-1.1	-0.3	-0.6	-0.3	-0.3	-0.3	-0.3		-0.4	-1.0	-1.1	-2.0	0.1	-0.8	6.0	-0.4	-0.4	-0.3		**-0.4**
11 GalPlNvyMm	-2.3		-1.1	-0.3	-0.7	-0.4	-0.4		0.1	-0.4	-0.4	-1.1	-0.4	-2.0	-0.3	-1.2	5.6	-0.1				**-0.4**
12 MtVerPet	-10.6	-0.9	-6.5	-1.3	-1.6	-1.3	-1.3	-1.0	-1.2	-1.0	-1.1	-1.1	-1.1	-2.0	-1.0	-1.8	4.9	-1.0	-1.1	-1.0		**-1.4**
13 FtTott	-2.5		-2.1	-0.3	-0.6	-0.3	-0.3		0.1	-1.1	-0.3	-1.1		-2.0	0.1	-0.8	6.0					**-0.3**
14 NEGreen	-12.3	-2.0	-2.3	-2.3	-2.7	-2.3	-2.3	-2.0	-2.1	-2.0	-2.0	-2.0	-2.0	-2.0	-1.9	-2.8	4.0	-2.0	-2.0	-2.0		**-2.0**
15 FdCnStadm		-0.3	-1.4	-0.3	-0.6	-0.3	-0.3	-0.3	-0.3	-0.3	-0.7	-1.3	-0.3	-2.3	-0.2	-0.8	6.0	-0.3	-0.3	-0.3	-0.3	**-0.3**
16 EastOrng	-3.0	-0.8	-1.9	-0.8	-0.6	-0.8	-0.8	-0.8	-0.8	-0.8	-1.2	-1.8	-0.8	-2.8	-0.8	-0.8	5.2	-0.8	-0.8	-0.8	-0.8	**-0.8**
17 EastBlu			-1.1		-0.6						-0.4	-1.0		-2.0		-0.8	4.0					
18 SERed			-1.1	-0.3	-0.7	-0.3	-0.3		0.1	-0.4	-0.1	-1.0		-2.0	0.1	-0.8	6.0					**-0.1**
19 NERed			-1.1	-0.3	-0.7	-0.3	-0.3		0.1	-0.4	-0.1	-1.1		-2.0	0.1	-0.8	6.0					**-0.1**
20 NWRed			-1.1	-0.3	-0.7	-0.3	-0.3		0.1	-0.3		-0.9		-2.0	0.1	-0.8	6.0					**-0.1**
21 SEGreen	-2.3		-1.1	-0.3	-0.6	-0.3	-0.3		-0.3						0.1	-0.8	6.0					**-0.1**
Totals	**-1.9**	**-0.1**	**-0.9**	**1.3**	**0.1**	**0.8**	**0.4**		**-0.2**	**-0.6**	**-0.6**	**-1.3**	**-0.5**	**-1.9**	**-0.3**	**-0.9**	**5.3**	**-0.2**	**-0.3**	**-0.2**	**-0.2**	**-0.1**

WMATA Orange + Blue Lines
Uncertainty Analysis

- Transfer penalty
  - No data on station-to-station paths
  - Value of transfer penalty therefore a guesstimate
  - Starting assumption: 2-min. penalty (4 minutes, weighted)
  - Central to the analysis (obviously, right?) → TEST!

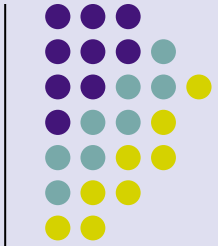
Uncertainty Test on the Transfer-Penalty Assumption		
Xfer pen (minutes)	Trips Diverted Blue → Yellow	Savings in Time Expenditures (hours)
1	4,376(?)	364
2	5,750	270
5	1,846(?)	180

WMATA Orange + Blue Lines
Additional Tasks



- Refinements
  - Data on path choice →question on next survey
  - Explicit coding of transfer stations (walking, escalators)
  - Choice model
    - Path-choice probabilities instead of single path
    - Incremental mode-choice consequences
  - Representation of merge delays and their relief
  - Representation of Orange crush and its relief
- Other topics for uncertainty analysis?

Simplified Methods
for Small Starts (and Maybe New Starts)

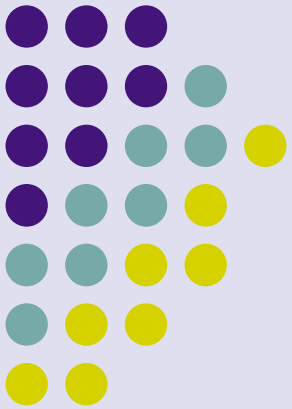


- The gift of an opening-year focus
  - Data can replace many of the demand-side models.
  - No-change can replace the highway-supply models.
  - Δriders and Δtimes can be computed directly.
  - Scaling up to opening year is modest.
  - Substantial simplifications possible for Small Starts.
- Extension to New Starts?
  - Incremental methods for well-developed markets
  - Honolulu (‘87), Newark (’95), Tucson(‘05)….

Current Research

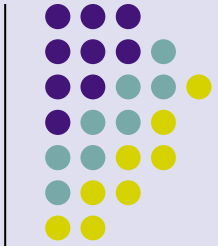
Session 14

- Travel Forecasting
- Economic Development



Current Research

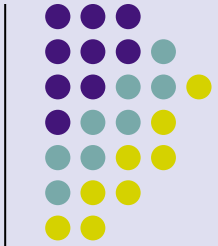
Travel Forecasting and New Starts



- Characteristics of Premium Transit Services that Affect Choice of Mode
  - Details: TCRP H-37, $375k, 03/2010, RSG/AECOM
  - Objective: advance forecasting practice regarding the currently unmeasured attributes of fixed guideways
  - Tasks: - synthesis of previous work
    - preliminary survey/interviews with transit agencies
    - final survey design; field survey in #? urban areas
    - data analysis using conjoint analysis method
    - recommendations on bringing results into practice
  - Contact: Diane Schwaeger, TRB

Current Research

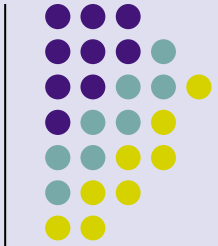
Travel Forecasting and New Starts



- Improved Travel Forecasts for New Starts
  - Details: FTA, $667k, 1/2012, AECOM/PB
  - Objectives: advance the state of the practice in forecasting ridership & benefits of major transit projects
  - Tasks: - methods for data collection
    - urban travel models
    - forecasting for New Starts projects
    - Refinements of methods for FTA oversight of travel forecasts
  - Contact: Nazrul Islam, FTA

Current Research

Travel Forecasting and New Starts

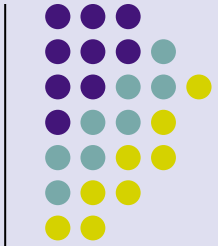


- Congestion-relief Benefits of Transit
  - Details: FTA, 2-3.5k hours, 10/2010, competed soon
  - Objectives: identify a reliable, nationally applicable approach to estimating highway speed changes
  - Tasks: - review best current practices
    - develop an approach for performance testing
    - test and validate proposed approach(es)
    - develop options for national implementation
  - Contact: Nazrul Islam, FTA

Current Research
Economic Development and New Starts

- Integrated Land-use / Transportation Models
  - Details: FTA, $300k, 4/2009, wrapping up
  - Objectives: develop a method for evaluating economic development benefits of New Starts/Small Starts projects
  - Tasks: - *review models currently in use*
    - select case studies & run FTA scenarios
    - apply it on other New Starts projects
    - implement recommended method in technical tools
  - Status: terminated after evaluation of existing models determined that none is suitable to the task
  - Contact: Steve Lewis-Workman, FTA

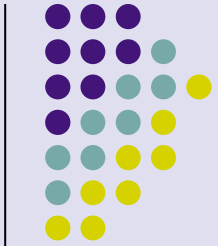
Current Research
Economic Development and New Starts



- Integrated LU / TF Models (continued)
  - Findings from the review of current models
    - Only one model calibrated/validated at less than regional level
    - That model uses highway travel time only – no transit influence
    - Absent variables on walk-accessibility, tax and TOD policies
    - Generally coarse, spatially, so insensitive to transit access
    - No past applications to evaluation of transit projects
  - Conclusion: further development of these models needed before they are suitable platforms for exploration of the economic-development benefits of transit projects

Current Research

Economic Development and New Starts

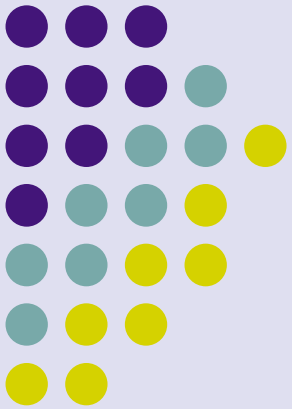


- Methodology for Determining the Economic Development Impacts of Transit Investments
  - Details: TCRP H-39, $400k, 4/2010, Rutgers Univ./Steer Davies
  - Objectives: develop a methodology for determining the economic development impacts of transit investments
  - Tasks: - focus on estimating urban agglomeration economies
    - document project evaluation methods for "wider economic benefits" used in the U.K.
    - adopt and apply a method in the US
    - develop guidance, technical tools, and case studies of the approach
  - Status: Just started
  - Contact: Lawrence Goldstein, TRB

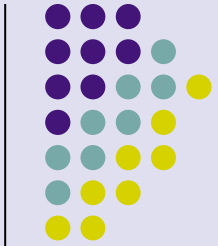
Wrap-up

Session 15

- Key Points
- Next Steps
- Future Workshops?

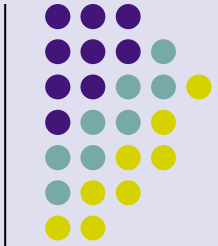


Key Points



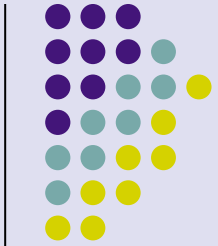
- Big-picture insights, not just numbers
  - Data collection
  - Model development and testing
  - Forecasts for alternatives and projects
  - Assessments of completed projects
- Data
  - Understanding transit markets; informing travel models
  - Careful design of sampling plans and survey instruments
  - ARRF – synthesis of data from completed projects

Key Points



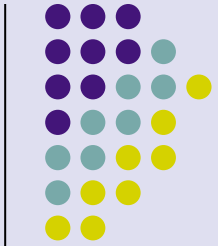
- Rigorous model testing
  - Data matching
  - Model assessment
  - Forecasting testing
  - Documentation
- Information for decision-making
  - The case for the project
  - Analysis and documentation of uncertainties

Key Points



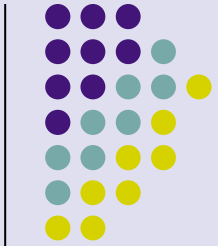
- Learning from completed projects
  - Before-and-after: what actually happened?
  - Predicted-vs-actual: how good were our forecasts?
- Simplified methods for Small Starts
  - More data, fewer models
  - Faster, more reliable

Next Steps



- FTA
  - Draft guidance on the FTA website
  - Summit 1.0
  - Uncertainty analysis and cases for projects
- Travel forecasters
  - Reviews of draft guidance
  - Beta testers for Summit?
  - Information from New Starts travel forecasts

Future Workshops



- Approaching closure on post-2002 issues?
  - Guidance, examples, case studies
  - Ongoing FTA technical assistance
- Nature of future outreach efforts
  - Continuing workshops – annual or less frequently
  - Roundtable sessions
  - An FTA course – principles and practice
  - New Starts session at the Applications Conference
  - Other options?

Thanks!

- To our guest presenters
- To our travel forecasting colleagues