

2010 MULTIMODAL OPERATIONS PLANNING WORKSHOP

NEW YORK CITY

New York City Transit's Wait Assessment Performance Indicator Program

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System Data and Research, Operations Planning



New York City Transit



AMERICAN
PUBLIC
TRANSPORTATION
ASSOCIATION

PUBLIC TRANSPORTATION
TAKES US THERE

economy ▶ environment ▶ energy ▶ quality of life

Program Design (Subway)

- **Subway Route Selection**

- 21 major subway routes carry > 5 million weekday riders
- Every subway route in program carries > 100,000 daily riders
- **6** line is busiest (700,000 daily riders)



Program Design (Bus)

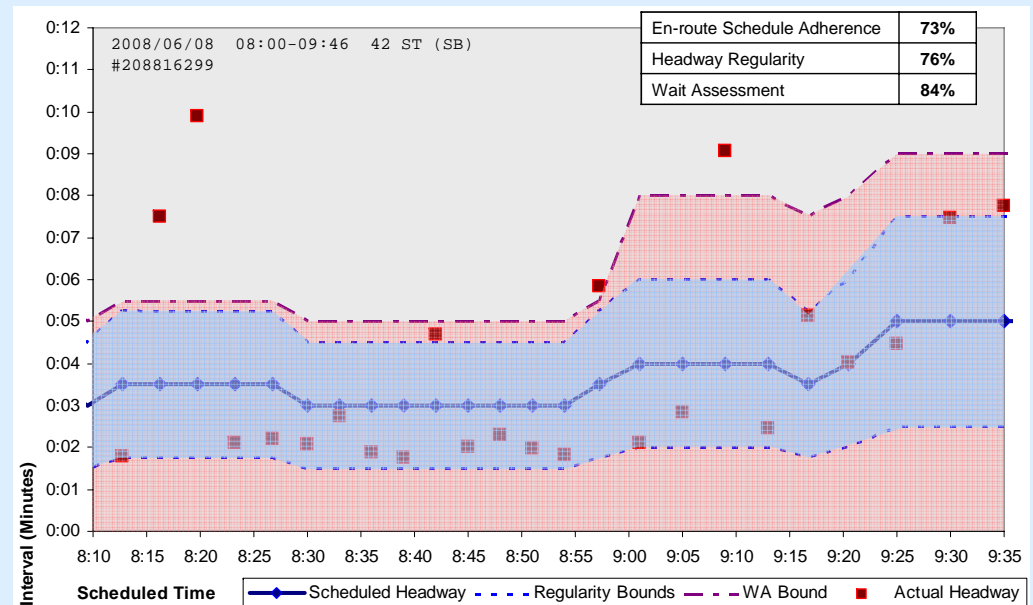
- **Bus Route Selection**

- Selected 42 of the ~200 route NYCT bus system
- Representing all Boroughs
- Top 45 routes in the bus system carry between 60,000 and 16,000 passengers a day



Measurement Standards

- **Headway Regularity**
 - How evenly distributed actual bus or subway service is in relation to scheduled service
- **En-route Schedule Adherence (ESA)**
 - Assesses timekeeping and schedule accuracy along en-route timepoints
- **Wait Assessment (WA)**
 - Sets a fixed threshold for acceptable service
 - Not penalized in bunched and unevenly spaced service



Definitions and Examples

Indicator	Definition	Examples	Applicable Time Period	Indicator Publicly Reported
Headway Regularity	<p>% of scheduled intervals passing the Regularity Criteria. A <u>scheduled interval</u> passes the Regularity Criteria if and <u>only if</u> it:</p> <ol style="list-style-type: none"> 1. contain an actual vehicle departure (i.e. train or bus leaving the timepoint); and 2. the actual service interval between that departure and <i>the following</i> actual departure fall within $\pm 50\%$ or five minutes of the scheduled interval, whichever is less. 	<p>For a scheduled headway of 4 minutes, an actual headway of between 2~6 minutes (-50% to $+50\%$ of four minutes) would be permissible.</p> <p>For a scheduled headway of 15 minutes, an actual headway of 10~20 minutes (-5 to $+5$ minutes) would be permissible.</p>	<p>Subway: 6am-midnight</p> <p>Not published for buses</p>	1994~2000
Wait Assessment (WA)	<p>% of scheduled intervals that passing the WA Criteria. A <u>scheduled interval</u> passes the WA Criteria if and <u>only if</u> it:</p> <ol style="list-style-type: none"> 1. contain an actual departure; and 2. the actual interval between that departure and <i>the following</i> actual departure is less than the time-period and mode dependent maximum acceptable wait times of scheduled headway <p>Subway: +25% of headway Bus: +3 mins (Peak), +5 mins (Off-Peak)</p>	<p>For a subway line with off-peak headway of 8 minutes, a maximum wait time of 10 minutes (8 mins + 25%) permissible.</p> <p>For a bus scheduled to operate every 10 minutes during the peak period, the maximum allowable headway is 13 minutes (10 +3).</p>	<p>Subway: 6am-midnight</p> <p>Buses: 7am-midnight</p> <p>Peak: 6am-9am 4pm-7pm</p>	2000~present
En-route Schedule Adherence (ESA)	<p>% of scheduled trips that passing the ESA Criteria. A <u>scheduled trip</u> passes the ESA Criteria if and <u>only if</u> the scheduled trip is observed in service between one minute before and five minutes after the scheduled time.</p>	<p>The regularly scheduled Manhattan-bound A train leaves the Far Rockaway Terminal in Queens at 22:11, and is scheduled to depart 125 Street (an intermediate en-route timepoint) northbound at 23:37. If this train is observed leaving 125 Street between 23:36:00 and 23:42:00, it is considered on-time.</p>	<p>Subway: 6am-midnight</p> <p>Buses: 7am-midnight</p>	1994~2007



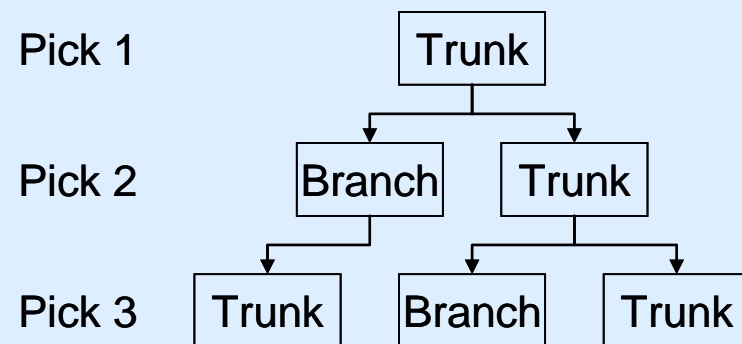
Sampling Plan

- **Sample size based on**
 - Required accuracy and precision
 - Available survey resources
- **Combined sample creation and scheduling algorithm maximizes resource utilization**
- **Sample Design**
 - Weekday is divided into five shifts
 - Each shift is a six-hour assignment for one surveyor
 - Sample is picked by route, location, and block to maximally represent trunk locations

$$n = \frac{Z^2 p(1 - p)}{d^2}$$

where

n = sample size,
 Z = confidence limit (1.960 for 95%, two-tailed),
 p = probability of successful (passing) trips, and
 d = expected margin of error (5%).



Data Collection

- **Traditionally Manually Collected by Field Surveyors**
 - Pre-printed data collection forms
- **Paper Forms for Bus Data Replaced in 2008**
 - Electronic data collection
 - Personal Digital Assistant (PDA) application
- **Subway Lines 1 ~ 6 uses signal system data**
 - Automated Train Supervision (ATS-A) system

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Data Collection - Bus
Operations Planning

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FORM SS

SPH0633868 Checker #: [] Date: 07/11/2008 Day: FRIDAY Start: 0630 Finish: 0930

Route: S B S 12 FORDHAM RD - PELHAM

To: BAY PLAZA BL IFO JC FENNEY (43960), ORCHARD BEACH ORCHARD BEACH (53495)

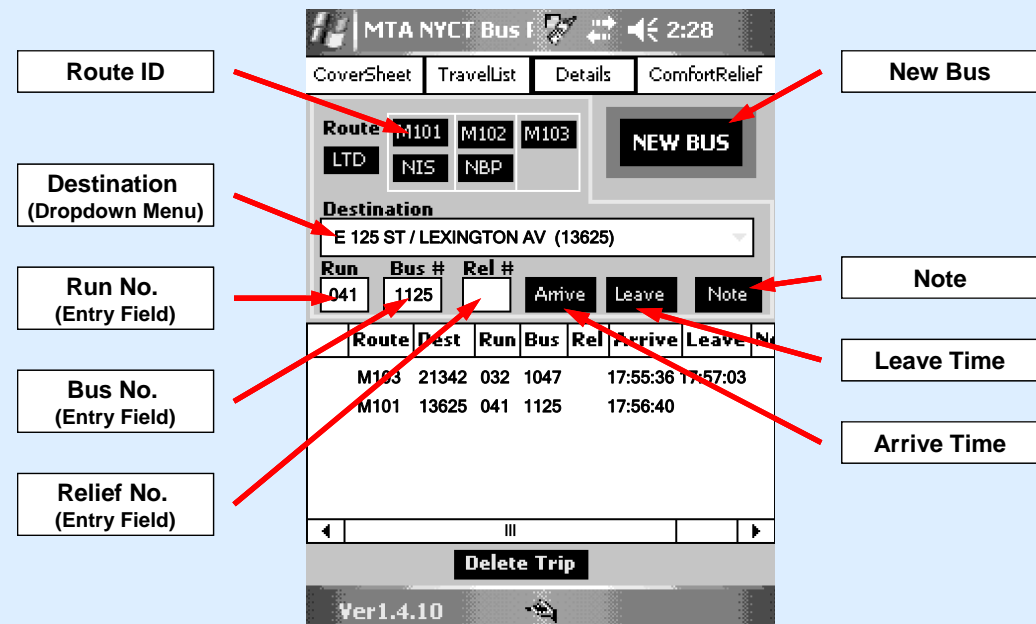
Location: E FORDHAM RD VALENTINE AV 21059 Weather: H O

AAA AAA

SPT	Route	Run #	Rel #	Bus	Destination	Arr Time	Lv Time	Notes
S	B S 12	205		5759	53495	0830	0831	
S	B S 12	206		5749	43960	0836	0837	
S	B S 12	207		5765	53495	0839	0841	
S	B S 12	208		5750	43960	0841	0842	
S	B S 12	209		5753	53495	0845	0847	
S	B S 12	210		5732	43960	0850	0851	
S	B S 12	211		5768	53495	0858	0859	
S	B S 12	212		5744	43960	0905	0906	
S	B S 12	213		5735	53495	0906	0908	
S	B S 12	214		5741	43960	0913	0914	
S	B S 12	215		5747	53495	0916	0917	
S	B S 12	216		5743	43960	0923	0924	
S	B S 12	217		5755	53495	0925	0927	

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Data Processing

- **Automated Traffic Clerking (ATC)**
 - client-server system
 - backend analysis engine
- **Bus Analysis Module**
 - Automatically match schedule and actual times
 - Computes Regularity, WA and ESA
- **Subway Analysis Module**
 - Uses Train Registers
 - Manual spreadsheet process
 - Import results into ATC

Oracle Forms Runtime

SP_VALIDATION

Surface Point Check Data Validation

Sched ID: 00633868 Status: 0 Fatal: 0 Warn: 0 Override: 0

Checker #: 2 Date: 07/11/2008 Daytype: W Start: 0630 End: 0930

Route1: 5B512 FORDHAM RD - PELHAM Route2:
 Route3:
 Route4:
 Location: 21059 E FORDHAM RD VALENTINE A' Direction Arr: EB Lv: EB Weather Id: 00L

Trip Num	Status	Analyst	Error	Text

Trip	Route	Run1	Run2	Bus	Dest	Sched. ArTime	Time	Arrive Load	Offs	Ons	Leave Load	Time	Sched. LvTime	Note
1	5B512	204		5758	11111		062900	0	0	0	0	063100	063200	
2	5B512	205		5759	11111		063600	0	0	0	0	063800	063700	
3	5B512	206		5749	11111		064100	0	0	0	0	064200	064200	
4	5B512	207		5765	11111		064300	0	0	0	0	064400	064700	
5	5B512	208		5750	11111		065000	0	0	0	0	065100	065200	
6	5B512	209		5753	11111		065500	0	0	0	0	065600	065700	
7	5B512	210		5738	11111		065900	0	0	0	0	070000	070200	
8	5B512	211		5768	11111		070600	0	0	0	0	070700	070700	
9	5B512	212		5744	11111		071200	0	0	0	0	071200	071200	
10	5B512	213		5735	11111		071600	0	0	0	0	071700	071700	

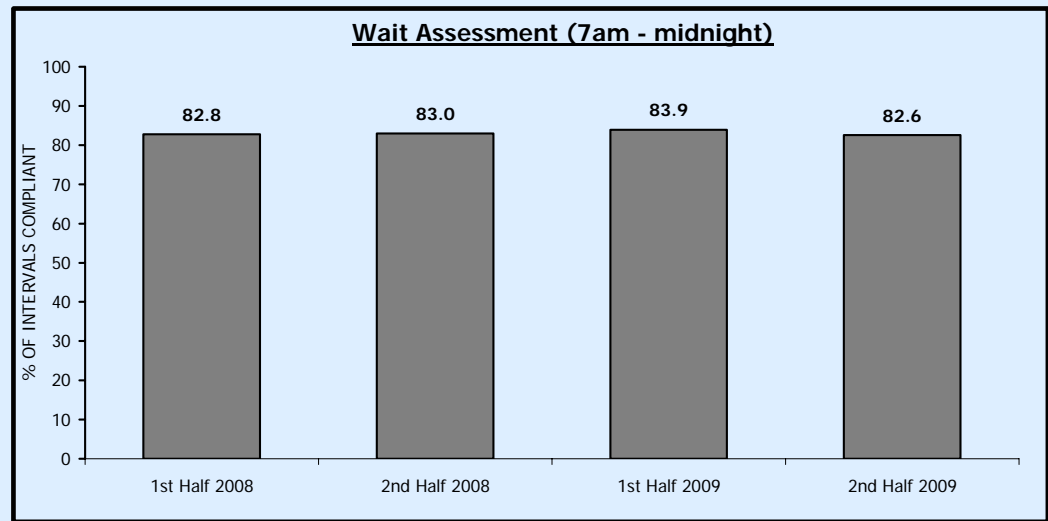
Record: 4/21 <OSC> <DBG>



Public Reporting

- **Disaggregated Data**
 - Systemwide
 - by Borough
 - by Route
- **Main Purpose is to Monitor Service**
 - “Public Watchdog”
 - Transparency
 - Accountability
 - Public Trust
 - Used by Rider Advocacy Groups

Bus Performance Indicator



Definition

Wait Assessment is measured weekdays between 7:00 a.m. and midnight, when service is relatively frequent. It is defined as the percentage of observed service intervals that are no more than the scheduled interval plus 3 minutes during peak (7 a.m. – 9 a.m., 4 p.m. – 7 p.m.) and plus 5 during off-peak (9 a.m. – 4 p.m., 7 p.m. – 12 a.m.)

The results presented are for a sample of 42 high-volume bus routes (and 10 associated limited-stop services).

2009 Annual Goals: Wait Assessment: 82.9%

Semi-Annual Results

<u>Wait Assessment</u>	
2nd Half 2009	82.6%
1st Half 2009	83.9%
2nd Half 2008	83.0%
1st Half 2008	82.8%

Discussion of Results: an increase/decrease of less than 1% is statistically unchanged.

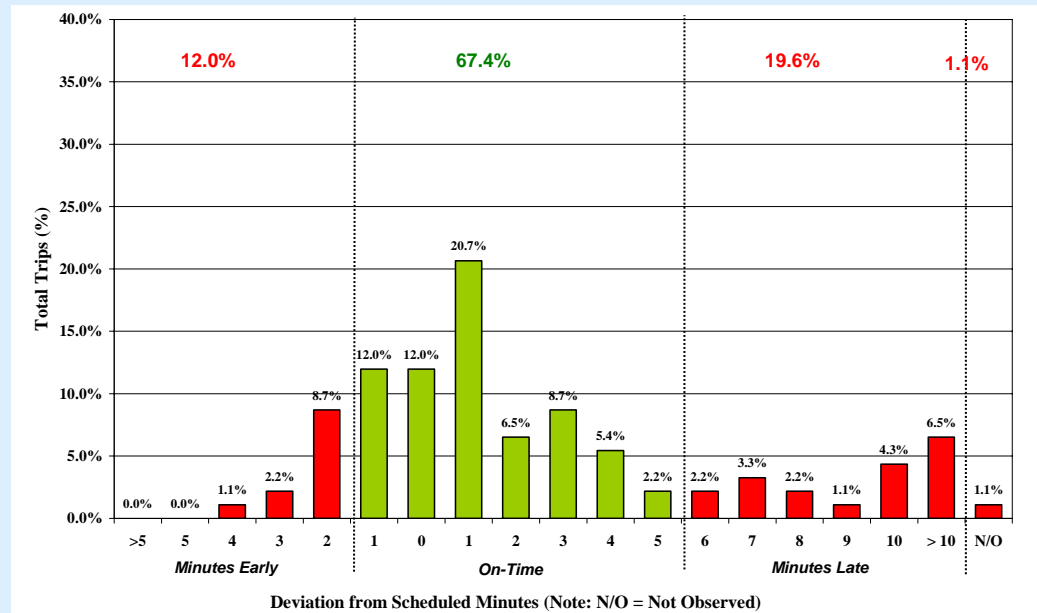
2nd Half 2009 vs. 2nd Half 2008: Bus Wait Assessment results remained statistically unchanged (-0.4%).



Internal Reporting

- **Facilitates Corrective Actions**
 - Developed internal reports in partnership with operating departments
 - Troubleshoots consistently early or late problems
 - Detailed reporting on a bi-weekly basis

M15 - Local Northbound 1 AVE / E 42 ST
Weekday 01/01/07 - 12/31/07
Enroute On-Time Performance (1900-0000)



Q58		Local Trips					6 37 181 29 7 260					2.3% 14.2% 69.6% 11.2% 2.7%					REPORTED	
SPH	Date	Dir	StopID	Location	StartTime	EndTime	NIS	Early	On-Time	Late	Late >10	Obsv.	NIS	Early	On-Time	Late	Late >10	Wait Assessment
647130	10/2/08	EB	16465	CORONA AV / JUNCTION BL	1345	1645	0	4	15	4	0	23	0.0%	17.4%	65.2%	17.4%	0.0%	77.8%
647160	10/3/08	EB	16465	CORONA AV / JUNCTION BL	2100	0	1	0	11	5	2	19	5.3%	0.0%	57.9%	26.3%	10.5%	76.5%
647134	10/3/08	WB	48829	FRESH POND RD / METROP	1730	2030	0	2	23	7	1	33	0.0%	6.1%	69.7%	21.2%	3.0%	76.7%
647200	10/6/08	EB	16465	CORONA AV / JUNCTION BL	630	930	2	1	29	3	3	38	5.3%	2.6%	76.3%	7.9%	7.9%	72.4%
647320	10/9/08	EB	16465	CORONA AV / JUNCTION BL	2100	0	0	8	9	2	0	19	0.0%	42.1%	47.4%	10.5%	0.0%	82.4%
647252	10/10/08	EB	11290	FRESH POND RD / METROP	1345	1645	1	5	18	3	1	28	3.6%	17.9%	64.3%	10.7%	3.6%	77.8%
647747	10/13/08	WB	15630	GRAND AV / QUEENS BL	2100	0	0	9	15	0	0	24	0.0%	37.5%	62.5%	0.0%	0.0%	95.5%
647714	10/13/08	WB	48829	FRESH POND RD / METROP	1015	1415	0	3	32	0	0	35	0.0%	8.6%	91.4%	0.0%	0.0%	97.0%
647882	10/15/08	EB	48805	108 ST / HORACE HARDING I	1015	1415	0	3	16	5	0	24	0.0%	12.5%	66.7%	20.8%	0.0%	90.9%
647914	10/16/08	EB	11290	FRESH POND RD / METROP	2100	0	2	2	13	0	0	17	11.8%	11.8%	76.5%	0.0%	0.0%	86.7%

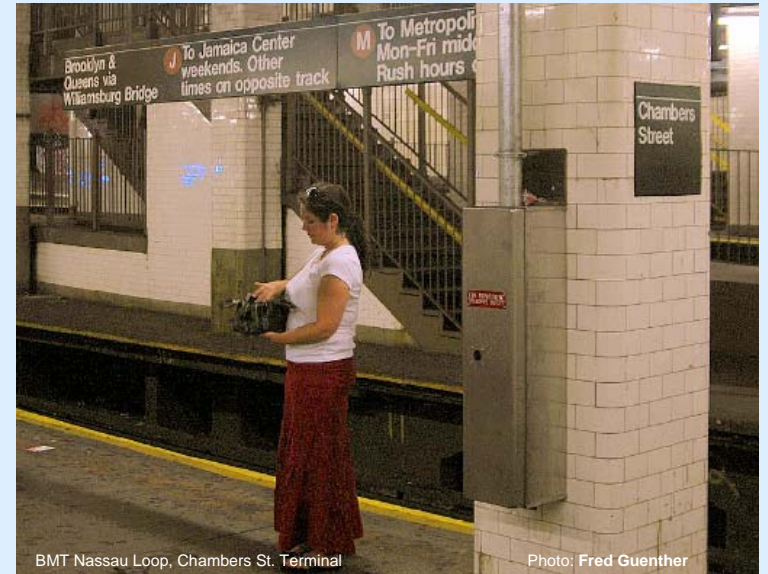
Special Programs

- **Scheduled Running Time Recalibration**
 - Periodic Adjustment for Traffic Conditions
- **Dispatcher Programs**
 - Respond to performance declines
 - Respond to community reliability concerns
- **Pilot Program Monitoring**
 - Monitor new or revised operating plans
- **Dispatching Strategy Evaluation**
 - Monitor pilot subway dispatching methods



Summary

- Rider advocacy groups adopt NYCT's performance measures
- Senior management set goals for operating areas
- Cooperation between Operations Planning and Field Management
- Extensive technology infrastructure to collect, process, and analyze large volumes of data
- Monitoring performance of pilot service plans, dispatcher programs, and dispatching strategy



BMT Nassau Loop, Chambers St. Terminal

Photo: Fred Guenther



Future Work

- **Expanding Use of Automatically Collected Data**
 - Automated Passenger Counter
 - Passenger Load Sensors
 - Automated Fare Collection
 - Automated Vehicle Locator

BMT Culver El, Bay Parkway

Photo: Fred Guenther



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Any Questions?



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