Minutes Matter

A review of performance metrics at the MTA

Research Report
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PCAC
PERMANENT CITIZENS ADVISORY COMMITTEE TO THE MTA

Executive Summary

This research report by the Permanent Citizens Advisory Committee to the MTA (PCAC) investigates performance metrics presented by the operating agencies of the MTA and makes recommendations for improvement or adjustment with an eye to better capturing the impact on riders. The PCAC represents the interests of the riders of the nation's largest public transportation system and is comprised of three rider councils which were created by the New York State Legislature in 1981: the Long Island Rail Road Commuter Council (LIRRCC); the Metro-North Railroad Commuter Council (MNRCC); and, the New York City Transit Riders Council (NYCTRC).

The genesis of this study arose from commuters expressing skepticism at some of the on-time metrics presented by the Long Island Rail Road (LIRR). The PCAC began investigating data used in the computations and it became clear that “trains” had impressive on-time percentages while the time delay that “riders” experienced from canceled trains was not being captured. A three-month analysis of the LIRR delay data revealed that while a canceled train was counted as “late”, the added 20–30 minute delay to a rider, forced to wait for the next available train, was never captured. In order to inform Board members, riders and the general public on the frequency and passenger impacts of delayed and canceled trains, PCAC asked the LIRR and the Metro-North Railroad (MNR) to place these statistics in their MTA Board Committee Book and on the MTA website in a searchable databases. The railroads implemented this request in September 2010.

In light of these initial “canceled train” findings, the PCAC decided that a more in-depth study on metrics was warranted. It is hoped that this fuller report will lead to:

- Development of true passenger on-time performance (OTP) measures;
- Identification of the magnitude of passengers impacted by delays and canceled trains;
- Identification of passenger groups which experience the highest frequency of delays; and
- Linkage of capital investments to improvement in passenger service.

This inquiry includes a literature review; a review of the history of metrics at the MTA and current performance measures; a comparison of metrics at other leading transit agencies which are displayed on their websites; and a discussion on how the Capital Program relates to better service.

It should be pointed out that there are many measures that can be utilized to show performance in transportation services. Some, such as price value, quality of

customer service, station conditions, courtesy, comfort, etc., are more subjective than others. For most agencies information on these areas are garnered through passenger surveys. However, other metrics which represent reliability, such as OTP, travel speed, headway regularity, and equipment dependability, are quantifiable and can be delivered as numeric representations. *It is the latter indicators that are the focus of this study.*

Conclusions

The MTA and its Operating Agencies provide some of the most transparent and detailed operational metrics among U.S. transit agencies; and this information is readily available on the MTA website. With respect to MNR and LIRR, no major commuter railroad comes close to their level of operational performance disclosure, especially with the recent addition of metrics on delayed and canceled trains in Board materials and on the website. In addition, the NYCT is to be lauded for the improvement of its performance indicators over the last 15 years, particularly with the implementation and refinement of its Wait Assessment metric.

Yet, a true passenger based on-time metric still eludes the MTA and the other major U.S. transit agencies, except for BART (Bay Area Rapid Transit, California). The latter reaps the benefits from ticketing that requires an exit registration (swipe out) and a 20-year dedication to modeling passenger flows. Further, the effect of terminated and canceled trains on the commuter railroads — the magnitude of riders that are affected by delays and the resulting economic impact of lost work time — has yet to be captured.

Finally, despite the high level of disclosure, the MTA's operational metrics are often omitted in discussions of capital investments and the impact they will have on reducing slow, delayed and canceled trains. The average rider doesn't necessarily understand what new interlockings, switches and signals are, let alone appreciate how their improvement will enhance their commute. Historically, the use of performance metrics at the MTA began as an effort to secure needed capital funds. That linkage, as a tool to promote capital programs to the riding public and elected officials, has weakened over the years.

Priority Recommendations

1. *The MTA should continue to foster investment in operational and measurement technology, as new technology is providing the means to refine and improve both performance and performance measurement.* There should be a continued push for implementation of ATS (Automated Train Supervision) throughout the subway system; AVL (Automatic Vehicle Locator) on buses; contactless fare payment on subways, buses and railroads; and utilization of web media to provide searchable databases of performance metrics, particularly about delay information.

2. *The MTA should add an increased level of detail in their Strategic Operation Plan (SOP) which is required by NYS Public Authorities Law, Section 1269-D.* The legislation states that the report is to include the relationship of specific planned capital elements to the achievement of such service and performance standards for all operating services. The LIRR and MNR should identify those projects that will reduce delayed and canceled trains (excluding normal replacement projects) and use more localized performance indicators (by branch or line) to make their case that operations will improve due to the investment. Upon completion of the project, subsequent SOPs should reference the impact that capital investments have had on performance.

3. *The LIRR and MNR should place their ridership book, which contains average train ridership by specific train, on the MTA website in a searchable database.* Thus, the number of LIRR and MNR passengers onboard each delayed and canceled train could be estimated. Researchers should be encouraged to use this data to model the economic impacts of delayed and canceled trains on workers and employers.

4. *For improved transparency, the LIRR and MNR should change their "Categories of Delay" in the MTA Board Committee Book from categories that relate to departments responsible (as is currently done) to the actual reason for the delay.*

5. *In the same vein, NYCT should define what factors constitute a "major delay" in the subway system and identify them in the Transit Committee Book each month by line(s), cause, and number of trains and length of time they were delayed*. Currently, there is no major system delay information provided to the public.

6. *With respect to terminal delays, NYCT should further define their "Infrastructure" category in the Weekday Terminal Delays Systemwide Summary, in the Transit Committee Book, to identify track and signal delays.* This detail better supports and links to needed investment in the capital program.

7. *Performance databases for NYCT subways and buses on the web should be searchable and available to software application developers.* Currently, there are no searchable subway or bus performance databases on the MTA website that provide information on Wait Assessment.

8. *The NYCT should consider describing the Wait Assessment metric to the general public in more user friendly terms, such as the probability of a bus or train being on time and the average excess wait time associated with a bus route or subway line.* A good example is the performance reporting for Transport for London's buses and subways. As currently presented, the NYCT's Wait Assessment percentage means little to the average rider.

Additional Recommendations

9. *The LIRR and MNR should consider adding an additional metric that indicates the percentage of trains that arrive within 2 minutes of the scheduled arrival time.* Irrespective of the industry standard of 5 minutes 59 seconds, the railroads should be striving for true "on-time" performance. The industry standard is not mandatory and the review of other commuter railroads shows that some do use a more rigorous standard.

10. *The LIRR and MNR should strive to develop a canceled train "delay factor", i.e., time until the next train arrives or actual wait time for a "rescue" train or bus*. This factor should be included in the "average minutes late" metric. What happens to riders in the case of a canceled train should be a matter of record. If in-house resources are not available, outside sources, such as academic researchers, should be utilized to develop a methodology for capturing the true impact of a canceled or terminated train.

11. *The LIRR and MNR should strive to develop a true passenger-based OTP metric, for the AM Peak period to terminals, incorporating a canceled train delay factor.* Again, if in-house resources are not available, outside academic researchers would be an excellent potential to tackle this analysis.

12. *The LIRR and MNR need to develop a plan to keep Origin and Destination counts current, i.e., more frequent surveys, targeting smaller sections*. Accurate passenger flows are necessary for good operations planning and for assessing the impact of delayed or canceled trains. The most recent Origin and Destination reports are almost four years old and perhaps not reflective of the effects of the recent recession or service changes since then.

In sum, there is every reason to believe that the passenger experience can and will be better reflected with the data that new technology, such as a contactless fare payment system and ATS, can produce. Further, making this data available to the public will enable software developers to produce useful applications ("apps"), such as LIRR's CooCoo that provides schedules, service updates and ticket prices via cell phone. Also, having a riding public that is more aware and sensitive to published OTP metrics should give agencies additional motivation to improve performance.

Finally, tying capital program investments to specific improvements in operating performance must be a priority. The above recommendations should be taken as proposed goals, some that can be implemented with current resources and some that will need a stronger financial climate or help from outside researchers to implement. The MTA is moving in the right direction and the PCAC hopes that this trend will continue.

Acknowledgements

This report could not have been possible without the tireless efforts of a large number of people who shared their knowledge, insights and first-hand experiences. PCAC would like to thank all of those individuals who contributed their time and expertise to this endeavor.

First on the list are PCAC's Outreach Assistants, Ashley Emerole, a graduate student in the Urban Planning program at Hunter College, and Hye-Kyung Yang, a Masters student at the Edward J. Bloustein School of Planning and Public Policy at Rutgers University. Ashley undertook the daunting task of organizing and analyzing the raw data for LIRR's January – March delayed and canceled trains. Hye-Kyung investigated the metrics of other transit agencies through hours of web research, persistent phone calls and volumes of emails. She also applied her substantial graphic skills to the cover of the report.

Special thanks go to the various representatives that provided information about their agencies: Roy B. Henrichs, Manager, Reliability Engineering and Ken Watkins, Sr. Reliability Engineer, BART; Caroline Mael, NJT; Brigett Pawlak, Freedom of Information Officer and Jeanette Martin, Chief Operating Officer, CTA; Michael Gillis, Public Affairs, Metra (Chicago); Dan Epps, Rail Transportation Media Relations and Ron Harcum, Director, Office of Performance, WMATA; Rob Hanson and Jim Folk, Operations Planning, MBTA; Nancy McKenna, Assistant District Secretary, Caltrain (San Francisco); and Alexander Barron, Research Associate, Railway and Transport Strategy Centre, Imperial College London.

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The input from the staff at the MTA operating agencies provided a wealth of information for this report. We would like to acknowledge the time they spent helping us understand how performance metrics are produced at the MTA.

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Introduction

The Permanent Citizens Advisory Committee (PCAC) to the Metropolitan Transportation Authority (MTA) represents the interests of the riders of the nation's largest public transportation system. PCAC is comprised of three rider councils: the Long Island Rail Road Commuter Council (LIRRCC); the Metro-North Railroad Commuter Council (MNRCC); and, the New York City Transit Riders Council (NYCTRC). These councils, created by the New York State (NYS) legislature in 1981,[1] are comprised of volunteer members who are recommended by local officials and appointed by the Governor. One of the long-standing activities of the PCAC is providing timely research on issues relevant to riders. The selected topics are approved by the members. The most recent reports cover regional mobility, accessibility, the lack of transportation options in New York City's outer boroughs, and transit-oriented development.

The current investigation concerns passenger-based statistics that measure performance from the rider's perspective. The genesis of this study arose from commuters expressing skepticism at some on-time metrics presented by the Long Island Rail Road (LIRR). The PCAC began investigating data used in the computations and it became clear that while trains had respectable on-time percentages, the time delay that riders experienced from canceled trains was not being captured. A three-month analysis of the LIRR delay data revealed that canceled trains added a 20–30 minute delay to a journey because the rider was forced to wait for the next available train.

Armed with the data from this investigation, PCAC pressed the MTA and its commuter railroads, LIRR and Metro-North Railroad (MNR), to include a canceled train report in their Board Committee books and also place it on the MTA website. This request received a positive response from MTA management; and beginning with the September 2010 MTA Board materials, the numbers of delayed and canceled trains were included. In addition, new pages were created on the MTA website that now show the details of delayed and canceled trains, beginning July 1, 2010, in a searchable database.[2]

In light of these initial findings the PCAC decided that a more in-depth study on metrics was warranted. At a general level, metrics or performance measures serve to guide management in the most effective ways to improve the transportation system; they also inform the riding public, Board members and funding sources as to the level and quality of service; and they serve as a tool to measure the value of past and proposed capital expenditures. This current research, however, also aims at a

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[1] PCAC functions as the funding and staffing mechanism for the three councils and operates under a Memorandum of Understanding with the MTA. In the NYS legislation (S5451/A8180) passed May 7, 2009, the PCAC was given statutory standing and its members defined as those of the three rider councils.

[2] See Appendices A and B for examples of the new Committee Book presentations and website data pages on delayed and canceled trains.

sharper level, seeking to identify areas of MTA operational reporting which warrant improvement or adjustment with an eye to better capturing the impact on riders. It is hoped that this fuller report will lead to:

- Development of true passenger on-time performance (OTP) measures;
- Identification of the magnitude of passengers impacted by delayed and canceled trains;
- Identification of passenger groups who experience the highest frequency of delays; and
- Linkage of capital investments to improvement in passenger service.

The report begins with a general discussion of transportation performance measures through a review of key research publications in the area. Subsequent sections describe on-time metrics used at the MTA operating agencies as well as those used by other transit agencies in the United States and internationally. Finally, the need for linkage of operational performance to capital investment is examined, followed by conclusions and recommendations.

Research on Passenger-Based Statistics

TCRP Studies

Determining what metrics are appropriate for transit agencies to report has been the subject of significant research studies in recent years. Foremost are the Transit Cooperative Research Program's (TCRP) *Report 88: A Guidebook for Developing a Transit Performance-Measurement System* (2003) and *Report 100*: *Transit Capacity and Quality of Service Manual, 2nd Edition* (2003).[3]

According to the *Guidebook*, performance measures are used by transit agencies for three main reasons:

1. Because they are required to do so for reporting and regulatory requirements;
2. Because it is useful to the agency to do so for internal measurement of policy, procedures and planning; and

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[3] The TCQSM, 2nd Edition, is widely used by transit service providers, metropolitan planning organizations (MPOs), state DOTs, and universities. In addition, the Manual is often used as a source of transit definitions and transit capacity and quality-of-service concepts. During the past 7 years, important changes have occurred in public transit technologies, policies, practices, and procedures. Hence, a 3rd Edition is under development. See http://144.171.11.40/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2890

3. Because others outside the agency need to know what is going on.[4]

Specific to the third point are decision-making bodies, such as transit boards and funding bodies, as well as "the public who may need convincing that transit provides a valuable service for them, for someone they know, or for the community as a whole." A major point in the opening discussion is that, while management uses performance measurement data to inform assessments of current circumstances, past trends, existing concerns and unmet needs, the most valuable measures depend significantly upon perspective: customer, community, agency, and vehicle/driver — "where you stand depends upon where you sit" (see Exhibit 1 on the following page).[5]

The *Guidebook* also emphasizes the importance of stakeholder acceptance: "Experience shows that a program initiated without broad input and support of stakeholders is likely to fail or, at a minimum, operate substantially below expectations."[6] The *Guidebook* lists the following as stakeholders:

- Senior agency management
- Agency staff and operations employees
- Customers
- Agency governing body
- Service contractors

There are many measures that can be utilized to show performance in transportation (see Appendices C and D). Some — price value, quality of customer service, attractiveness of stations and equipment, courtesy of on-board personnel, comfort, amenities, user information, sense of security, etc. — are more subjective than others. For most agencies information on these areas are garnered through passenger surveys.[7] However, other metrics which represent reliability, such as OTP, travel speed, headway regularity, and equipment dependability, are quantifiable and can be delivered as numeric representations. *It is the latter indicators that are the focus of this study.*

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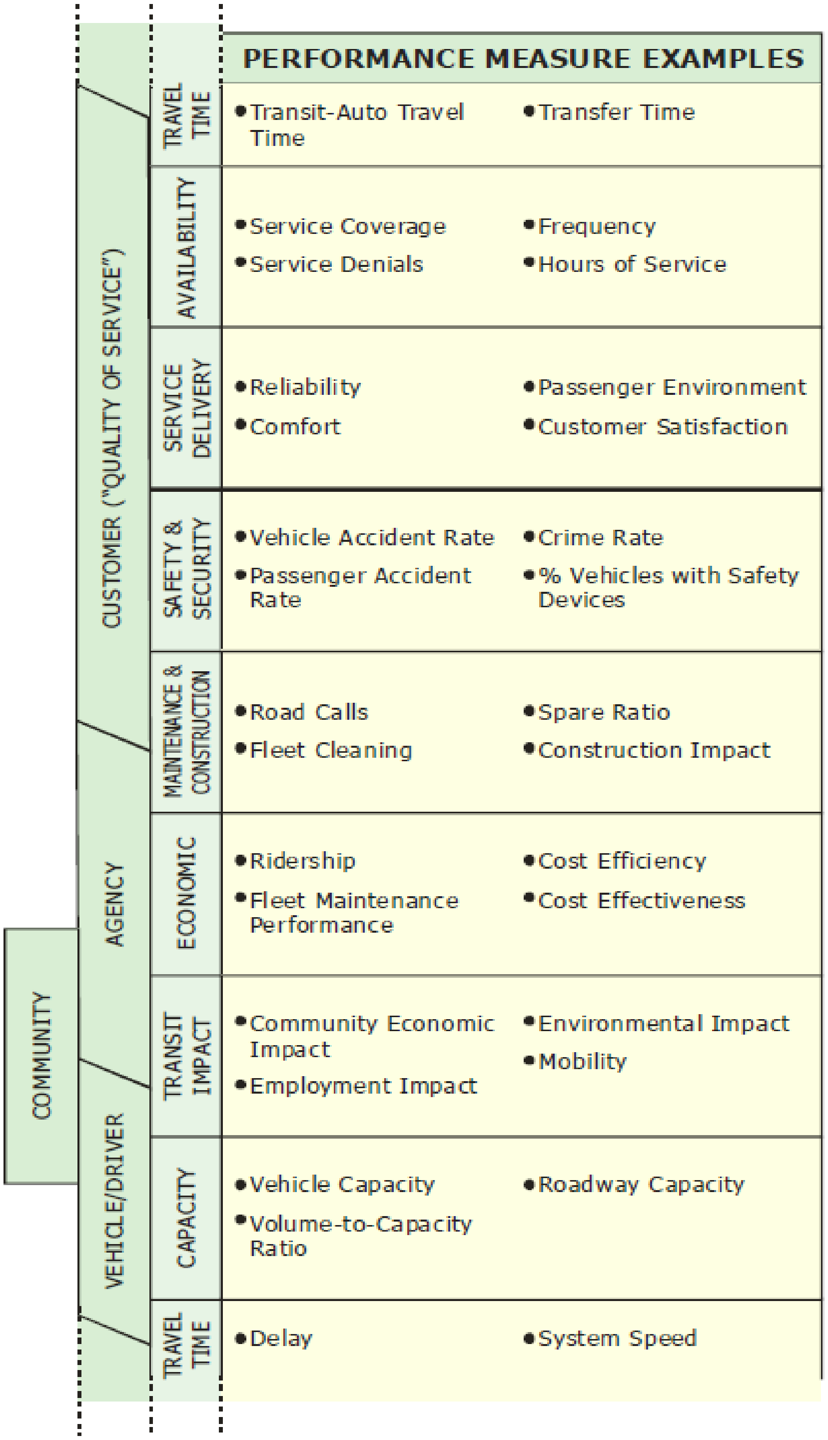
[4] p. 4

[5] p. 5

[6] p.10–11

[7] See *TCRP Report 47: A Handbook for Measuring Customer Satisfaction and Service Quality* (1999). At the MTA, the PES (Passenger Environment Survey) has been carried out for many years by New York City Transit (NYCT) and the Customer Satisfaction Survey has been a standard at both commuter railroads for some time.

Exhibit 1 — Transit Performance Measure Points of View



	PERFORMANCE MEASURE EXAMPLES	
TRAVEL TIME	Transit-Auto Travel Time	Transfer Time
AVAILABILITY	Service Coverage Service Denials	Frequency Hours of Service
SERVICE DELIVERY	Reliability Comfort	Passenger Environment Customer Satisfaction
SAFETY & SECURITY	Vehicle Accident Rate Passenger Accident Rate	Crime Rate % Vehicles with Safety Devices
MAINTENANCE & CONSTRUCTION	Road Calls Fleet Cleaning	Spare Ratio Construction Impact
ECONOMIC	Ridership Fleet Maintenance Performance	Cost Efficiency Cost Effectiveness
TRANSIT IMPACT	Community Economic Impact Employment Impact	Environmental Impact Mobility
CAPACITY	Vehicle Capacity Volume-to-Capacity Ratio	Roadway Capacity
TRAVEL TIME	Delay	System Speed

Source: TCRP Report 88

MTA Office of the Inspector General (OIG) Studies

In 1979 the MTA began developing a performance and service reporting system as a means to monitor its constituent agencies and to provide data upon which to base capital and operating decisions. The PCAC and other transit advisory groups called on the MTA to adopt standards in order to secure the cooperation of the State Legislature in the development of the needed capital program.[8] The MTA's first *Monthly Performance Progress Report* was issued in 1981.

During late 1985 and early 1986 the OIG, under Inspector Sanford E. Russell, reviewed the reporting system for selected non-financial performance indicators used by the Transit Authority (TA), the LIRR and the MNR.[9] A reading of these reports reveals that even 25 years ago both commuter railroads were criticized for omitting canceled trains in calculating "average delay per late train":

> In calculating this indicator [the railroad] incorporates only late trains and omits the delays that passengers experience when scheduled trains are canceled enroute or canceled at terminals. From the passengers' perspective this may be inadequate because train cancelations may result in commuters arriving at their destinations extremely late. The degree to which passengers from a canceled train are late, depends upon the railroad's success in making up service.[10]

For subways, the OIG was equally disapproving:

> Our examination identified serious problems in the way basic data is recorded and reported by train dispatchers. As a result, we found that on-time performance and key station throughput performance statistics were so grossly inaccurate that they have limited or questionable value to TA management and others in monitoring and evaluating subway performance. From the passengers' viewpoint, the on-time performance indicator does not come even close to portraying what riders typically experience.[11]

For buses, the OIG identified the key failing of measuring OTP at terminals:

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[8] The MTA was able to obtain funding from the Urban Mass Transportation Administration (UMTA) for a Service Standards Study and the PCAC participated on the Technical Advisory Committee. See: *An Analysis of the Development of MTA Service Standards Study*, PCAC, September 1984.

[9] *An Examination of Selected Long Island Rail Road Performance Indicators*, MTA/IG 85-17, February 1986.

An Examination of Selected Metro-North Commuter Railroad Performance Indicators, MTA/IG 86-1, May 1986.

An Examination of Selected New York City Transit Authority Performance Indicators for the Division of Rapid Transit, MTA/IG 86-6, October 1986.

An Examination of Selected New York City Transit Authority Performance Indicators for Surface Transportation, MTA/IG 86-13, December 1986.

[10] See p. 3 in the above referenced reports concerning the LIRR and MNR.

[11] See Overview and Summary, S1, in the above referenced report on Rapid Transit.

> The most critical aspect of bus performance to passengers is the actual time between bus arrivals at a bus stop or "headway". This is not monitored by the TA. Nor does the TA monitor the average time a passenger waits for a bus. Both of these aspects of bus service can be measured. We consider these omissions to be a serious shortcoming in the TA's system of performance measurement from the passenger's viewpoint.[12]

After issuing these reports, the OIG, under Inspector General John S. Pritchard III, continued to press the TA on its performance indicators for the rest of the decade. In 1990, the Office once again released a series of reports analyzing subway[13] and bus[14] timeliness, concluding that serious shortcomings in service quality still existed.

However, this time the OIG researchers Henderson, Kwong and Adkins followed the investigative reports with a technical application that proposed two possible alternative measures: a Headway Regularity Index and a Passenger Wait Index. This research garnered national attention when the authors presented these findings at the 70th Annual Meeting of the Transportation Research Board (TRB) in January, 1991.[15] The OIG annual report for 1990 notes that partly as a result of these service review studies, NYCT created a task force to reform existing performance indicators and produce new ones that better measure the passengers' experience. Since that time NYCT has continued to refine its performance metrics and a detailed description of the evolution of NYCT performance metrics is contained in Appendix E.

Comparable Research on Airline Passenger Delays

In 2006 researchers at George Mason University released a report that questioned the traditional air transportation metrics, such as flight delays and flight cancelations.[16] Wang, Sherry and Donohue argued that the flight-based on-time performance metrics do not accurately reflect delays on passengers. By comparing complaint levels with flight-based statistics they found a clear discrepancy between flight-based metrics and passenger feedback:

> Delays, missed connections and cancelations are the reasons that caused a difference between flight experience and passenger experience. Firstly, flight-

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[12] Press Release, MTA OIG, October 29, 1986.

[13] *A Review of New York City Transit Authority Subway Service and Performance 1984–1989*, MTA/IG 90-6, June 27, 1990; and *The Inspector General's Evaluation of Morning Rush Hour Subway On-Time Performance, 1987–1988;* MTA/IG Technical Report 90-11, August 14, 1990.

[14] *A Review of Midday Performance for the B35 and B45 Brooklyn Bus Routes*, MTA/IG Technical Report 90-4, June 19, 1990; *A Review of Midday Performance for the Bx28, Bx30, Bx41, and Bx55 Bronx Bus Routes*, MTA/IG 90-15, September 27, 1990; and *A Review of Midday Performance for Selected Manhattan Bus Routes*, MTA/IG Technical Report 90-14.

[15] *Toward a Passenger Oriented Model of Subway Performance*, Transportation Research Record No. 1266.

[16] Wang, Danyi, Lance Sherry and George Donohue. *Passenger Trip Time Metric for Air Transportation.* 2006.

> based metrics are constrained by the unit they use (per flight). They do not consider passenger related factors, like load factor, aircraft size, etc.… Secondly, flight-based metrics underestimated the serious impacts of cancelations on passenger trip time.[17]

Much like riders on commuter rail, air passengers are impacted by delays, missed connections and cancelations. And, like railroad on-time metrics, air statistics (compiled by the Bureau of Transportation Statistics) do not capture passenger load (number of passengers inconvenienced) in OTP. As a result of their analysis of passenger delays at the 35 largest capacity airports in 2006, Wang, Sherry and Donohue found that:

- Cancelations disproportionally generate high passenger delays. A simple metric such as the number of cancelations does not tell the complexity of the passenger relocation process. If a flight is canceled, passengers will be relocated to the nearest available flights that belong to the same carrier and have the same origin-destination pair, if there are empty seats available. If seats are not available, then the passenger has to wait for a later flight with available seats, etc. On average, 40% of total passenger delays were caused by flight cancelations, while cancelations only accounted for 1.7% of total flights.

- There is validation between the passengers’ complaints and estimated passenger delays. On average there was one complaint on flight cancelations for every 94 cancelations and one complaint on flight delays reported for every 1896 delayed flights.

- Finally, different routes have different service levels. Since routes have different levels of enplanements and flights due to limited airport and airspace capacities, the passenger delays were normalized in order to compare delays. Flights on some of the short haul routes in the East produced the largest normalized passenger delays and also have the highest risk of a passenger being delayed more than an hour.

The researchers proposed a new passenger based metric, “estimated passenger delay”, to measure OTP from a passenger’s perspective based on the summation of passenger delays each passenger in the canceled flight experiences separately.

This research strongly supports the PCAC’s call for more passenger-based reporting. Air travel delays parallel the problems that commuters face when a train is canceled. Riders must wait for another train or a “rescue” bus, or in some way find alternate transportation to their destination.

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[17] Wang, *et.al.*, p.1.

Current Operational Metrics at the MTA

NYCT

As noted in Appendix E, a Wait Assessment measure was implemented in 2000 for both subways and buses. Wait Assessment is expressed as the percentage of service intervals that are no more than a set time limit over the scheduled interval. Obviously, the higher the percentage, the more service that has arrived within an acceptable interval.

Subways

The NYCT maintains the following service measures:

- A subway Weekday Wait Assessment, which is measured weekdays 6:00 AM –midnight and defined as the percent of actual intervals between trains that are no more than the scheduled interval plus 25%. This standard was adopted in May 2010 to reduce the bias against lines with infrequent service. This new standard is shown in comparison to the old standard in Exhibit 2 from the MTA Board Transit Committee Book on the following page. It can be seen that the new standard is much more stringent than the old standard.[18]

- A Weekday and Weekend Terminal OTP, calculated as the percentage of scheduled trains, based on the schedule in effect, arriving at terminal locations within five minutes of their scheduled arrival time during a 24-hour weekday period. An on-time train is defined as a train arriving at its destination terminal on-time, early, or no more than five minutes late, and that has not skipped any planned station stops. This measure is primarily a tool for internal operations. Since October 2008 Terminal OTP began to be designated as “Absolute” and “Controllable”, the latter measure excluding trains that are late due to incidents beyond NYCT’s control.[19]

- A Mean Distance Between Failures (MDBF) which measures the average number of miles a subway car travels in service before a mechanical failure, reported as a percentage of the systemwide goal, based on a 12-month rolling average. This metric is also primarily a tool for management.

- A Service–Key Performance Indicator (S-KPI), which is the weighted combination of the three existing service indicators: Wait Assessment (60%), Terminal OTP (30%) and MDBF (10%).[20]

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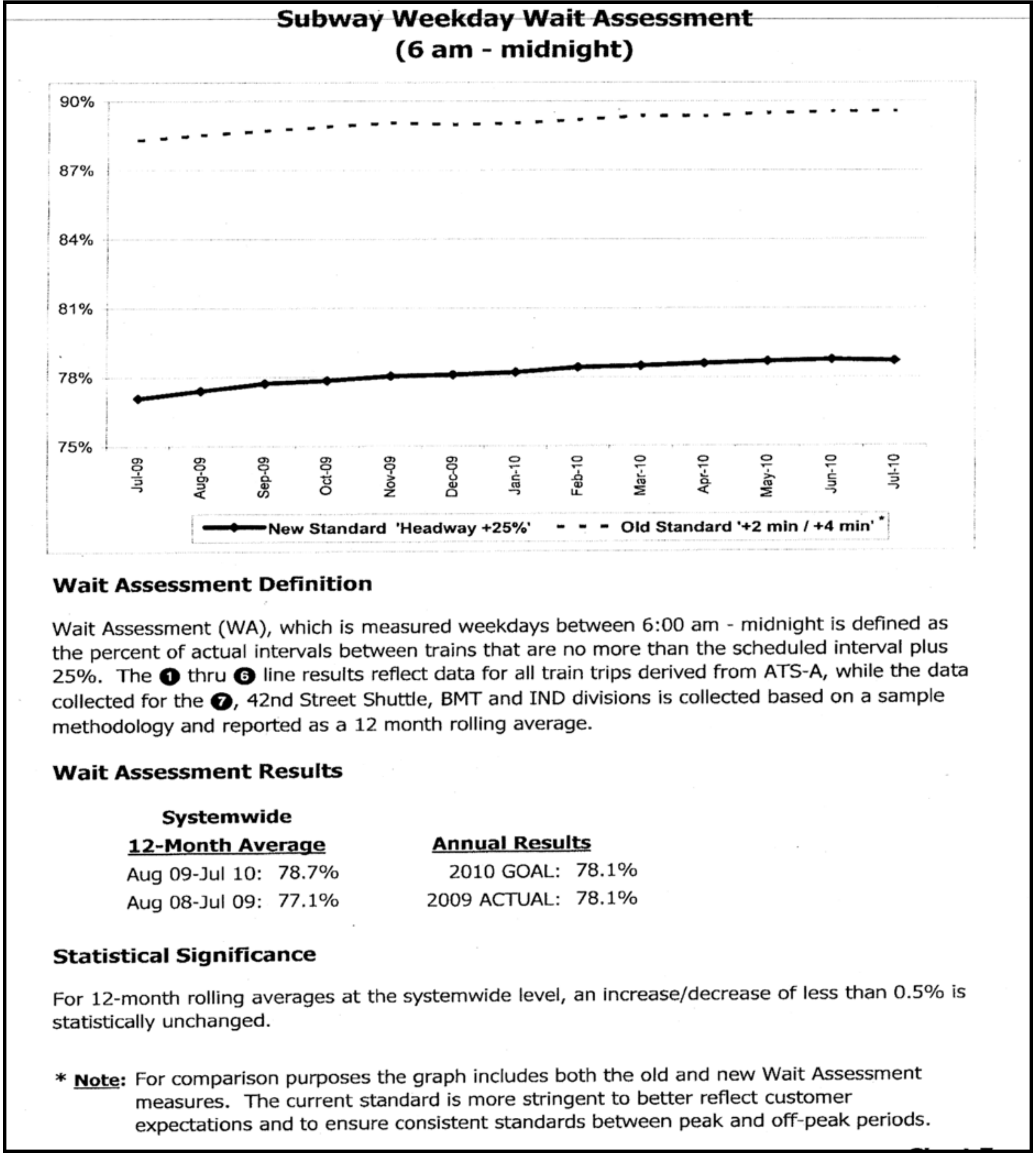
[18] See MTA Board Transit Committee Book, May 2010, special presentation: Recommended Modifications to Train Performance Indicators, http://www.mta.info/mta/news/books/docs/train%20performance%20presentation%205-24-10%20(CAB1173).pdf and Appendix E.

[19] MTA Board Transit Committee Book, October 2008, pp. 12–18. See definitions in Appendix E.

[20] NYCT also monitors KPIs for Passenger Environment in subway cars and stations. All of the KPI measures can be found in the monthly MTA Board Transit Committee Books.

Exhibit 2 — Comparison of Subway Old and New Wait Assessment Metrics



Wait Assessment Definition

Wait Assessment (WA), which is measured weekdays between 6:00 am - midnight is defined as the percent of actual intervals between trains that are no more than the scheduled interval plus 25%. The ❶ thru ❻ line results reflect data for all train trips derived from ATS-A, while the data collected for the ❼, 42nd Street Shuttle, BMT and IND divisions is collected based on a sample methodology and reported as a 12 month rolling average.

Wait Assessment Results

Systemwide 12-Month Average		Annual Results	
Aug 09-Jul 10:	78.7%	2010 GOAL:	78.1%
Aug 08-Jul 09:	77.1%	2009 ACTUAL:	78.1%

Statistical Significance

For 12-month rolling averages at the systemwide level, an increase/decrease of less than 0.5% is statistically unchanged.

* **Note:** For comparison purposes the graph includes both the old and new Wait Assessment measures. The current standard is more stringent to better reflect customer expectations and to ensure consistent standards between peak and off-peak periods.

Source: MTA Board Transit Committee Book, September 2010

Buses

NYCT monitors the following performance measures (fixed routes):

- Wait Assessment for buses[21] — currently monitored weekdays between 7AM and midnight and reported every six months. It is defined as the percentage of observed service intervals that are no more than the scheduled interval plus three minutes during peak (7AM–9AM, 4PM–7PM) and plus five minutes during off-peak (9AM–4PM, 7PM–12AM). Chart 1 on the following page shows the Wait Assessment breakdown for the first half of 2009 and 2010, by Borough. Wait Assessments are also shown by route in the Service Quality Indicators Report, part of the MTA Board Bus Operations Committee Book.

- AM and PM Pull Out — defined as the percent of required buses and operators available in the AM and PM peak period, respectively.

- Percent of Completed Trips — percent of scheduled trips completed.

- MDBF — measures the average miles between mechanical road calls, considered an indicator of the mechanical reliability of the fleet.

- Bus Mean Distance Between Service Interruptions (MDBSI) — measures the average distance traveled by a bus between all delays and/or inconveniences to customers. All road calls caused by both mechanical and non-mechanical are included.

While all of the above measures address service and reliability, Wait Assessment is the most meaningful to riders; the others are primarily for internal operations management.

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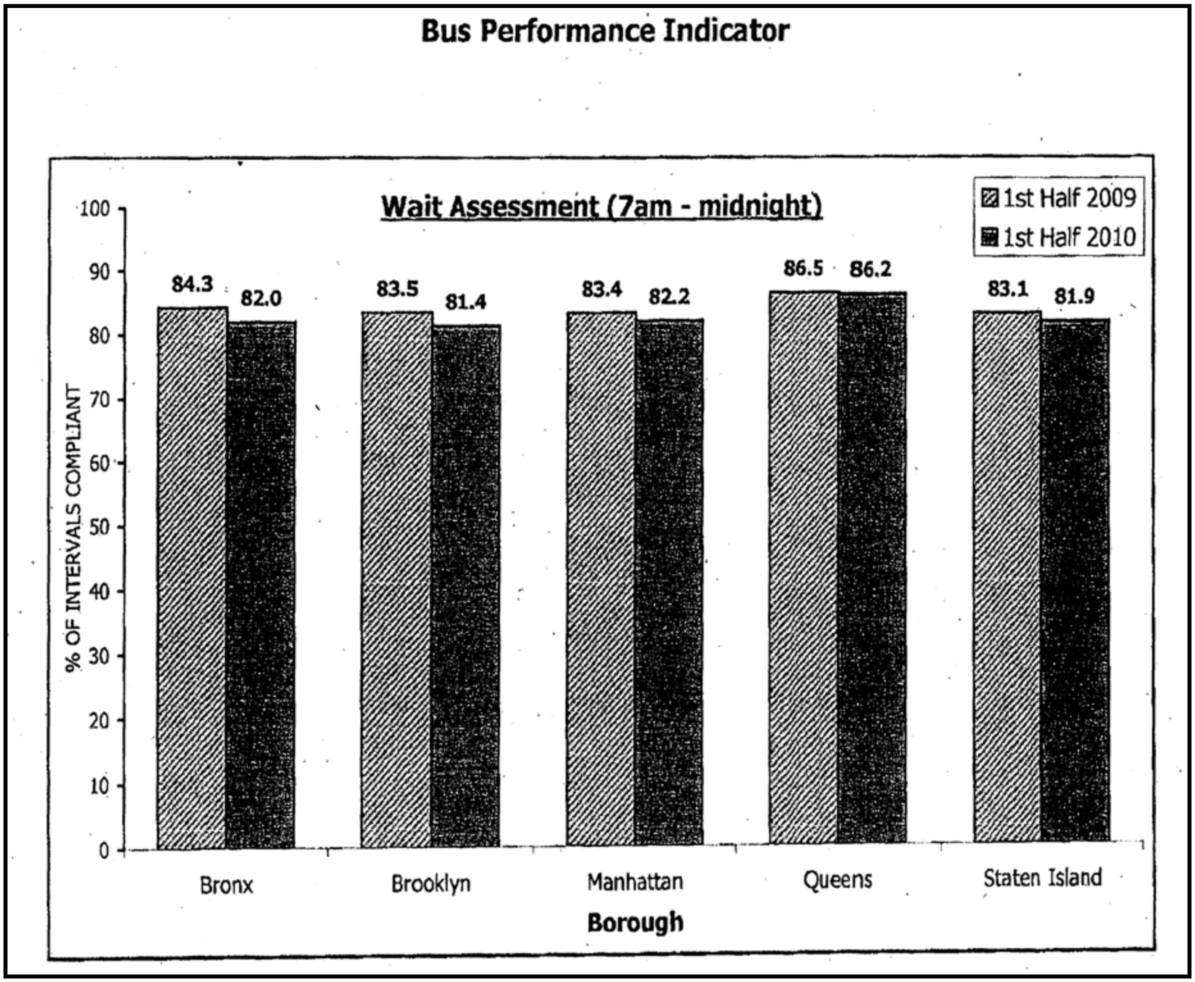
[21] It should be clarified that the Wait Assessment metric applies only to NYCT buses, not MTA buses (private lines that were taken over by MTA), nor Long Island Bus operations, which NYCT currently operates under a contract with Nassau County. According to NYCT, providing such indicators for these other bus lines is a desirable goal, but implementing them would be a new undertaking with a significant incremental cost, and for that reason is not currently planned.

Chart 1



Source: MTA Board Bus Committee Book, September 2010

Gathering Data
NYCT is using technology to improve the gathering of data for Wait Assessment. The installation of Automated Train Supervision (ATS) in the A Division subway lines ①②③④⑤⑥ is now underway, gathering arrival and departure times at many stations; however, as of this writing neither the ② nor the ⑤ lines have ATS in the Bronx. For 42 NYCT bus lines spread across the five boroughs and the remaining subway lines (B Division lettered lines, the ⑦ and the Ⓢ), NYCT staff has developed a sophisticated sampling system with trained personnel (checkers) who survey arrival and departure times.[22]

Traditionally, performance indicator data were manually collected by field surveyors by using preprinted data collection forms. However, in August 2008, paper forms for

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[22] See Anthony Cramer, John Cucarese, Minh Tran, Alex Lu and Alla Reddy, *Performance Measurements on Mass Transit*, TRB. 2009,

bus data collecting were replaced with a personal digital assistant (PDA) application, running an in-house developed program. In 2009 a similar application was rolled out for subways. Checkers clock in and receive their randomly generated location in the morning when they arrive at 340 Flatbush Avenue in Brooklyn. Upon the checker's return at the end of a shift, the PDA is "cradled" and the data is sent to the Automated Traffic Clerking (ATC), the backend engine for collecting and analyzing data.[23]

Exhibit 3 — PDA used for Wait Assessment

Other Technology Applications for Subways

New technology implementation is also helping to provide riders with current service information. Public Address/Customer Information Screen (PA/CIS) equipment with real-time arrival countdown clocks are being rolled out incrementally with 152 stations on the Division A numbered lines, ①②③④⑤⑥, to be operational by the first quarter of 2011. PA/CIS was first introduced along the Canarsie L line in January 2007 using a communication-based train control (CBTC) system.

An innovative pilot is being implemented on the A and C Lines whereby countdown screens are being tied to existing signal infrastructure so they can receive real-time arrival information. Unlike the more advanced (and expensive) system currently being implemented along the numbered lines (which receive information from the

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[23] PCAC staff joined NYCT staff in the field on September 16, 2010 to observe how checkers input data.

schedule data provided by ATS), this simpler system identifies train location using the signal system's track circuits and sending this information to the screens. Due to the limitations of the information transmitted by the signal track circuits, the demonstration pilot will provide information on train movement on a specific track only and cannot identify specific trains as the ATS system is able to do. While countdown clocks do not create performance measurements, they serve to moderate the rider’s expectation of performance with real time knowledge.

Commuter Railroads

Unlike NYCT buses and subways, OTP at the LIRR and MNR is much more focused on arrival and departure times related to their main terminals, NY Penn Station and Grand Central Terminal, respectively. Both railroads use an industry on-time arrival standard of 5 minutes, 59 seconds or less. Until September 2010 their performance metrics were similar, but they did differ in some elements of reporting. However, as of April 2010 the two commuter railroad MTA Board Committees were combined into one and they were charged with presenting the same metrics in their monthly operating reports. It was during this “readjustment” period that PCAC made its request for a proactive dissemination of delayed and canceled trains information to the public. Specifically, PCAC requested that MTA create a webpage where more extensive data could be placed, and asked that the number of canceled and terminated trains be included in the monthly Board materials.

For the new presentation the railroads agreed that a “canceled” train would be defined as a train that never started its journey and a “terminated” train would be one that was ended enroute. Appendix F contains tables for LIRR, MNR East of Hudson and MNR West of Hudson which compare the old and new metrics. Major new items include: LIRR showing OTP “goals” and weekend performance; the number of trains over 15 minutes late; the number of canceled trains; the number of terminated trains; and the percent of scheduled trips completed. Both railroads, at the request of PCAC, have added an explanatory note that canceled and terminated trains are not included in average minutes late.

To be compatible, MNR has added the following metrics to its performance indicators: number of trains scheduled; average delay per late train; number of trains canceled; number of trains terminated, categories of delay; and events resulting in 10 or more late, canceled or terminated trains (up from five trains).

The problem for riders of both railroads is that the standard OTP measurement is still unable to capture the true passenger experience. It does not reflect the number of passengers that were delayed each day, or how long they were delayed. It does not reveal how frequently passengers were asked to disembark from a terminated train midway during a trip, nor does it describe the crowding and discomfort they experience as a result. This is of particular concern for the LIRR riders since the LIRR, percentage-wise, has more terminated and canceled trains and more trains over 15 minutes late compared to MNR.[24] This condition relates in part to the nature of their operations — the LIRR is a complex branch system of mostly single and double track capacity that contributes to major bottlenecks along the main line, while MNR is a three line system with little overlap or interdependency between them.

As described in the introduction, to better understand the passenger experience, the PCAC and the LIRRCC launched an investigation of delayed and canceled trains in the spring of 2010 using LIRR data from its Train Information Monitoring and Control System (TIMACS).[25] For the months of January, February and March the analysis revealed that more than 28,000 passengers were impacted by canceled trains in the first quarter of 2010. The concern is that, while OTP recognizes a canceled train as not on-time, the metric does not indicate:

- How many passengers are impacted by canceled or terminated trains each month;

- Which passengers experience the highest frequency of canceled or terminated trains; and

- How many minutes late are passengers when they arrive at their end destination when their train is canceled or terminated.

The metric "average minutes late" which is included as a part of the OTP report, does not include the impact of canceled or terminated trains. PCAC found that during the first quarter of 2010 passengers who planned to take trains that were canceled, arrived at their destination on average 25 minutes late.[26] It is important to note that only 50% of the canceled trains listed in the TIMACS report showed which train or trains picked up the stranded passengers. Most often these LIRR passengers are picked up by the following train; however, there are times when, due to crowding conditions, they are further delayed until a second train can arrive at the station. MNR, however, can be more agile when there is a canceled or terminated train because of its track capacity. Express trains can more easily be slotted into affected stations to quickly pick up marooned passengers. In fact, when rescue trains arrive on a timely basis, riders can often arrive at their destination on or close to schedule.

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[24] The new metrics published in the September MTA Board Commuter Rail Committee Book shows that YTD through August 2010 LIRR had 1,725 canceled and terminated trains or 1.1% of trains scheduled; MNR had .2% canceled and terminated trains for the same period. LIRR had 1.5% of its scheduled trains over 15 minutes late while MNR had only .5% of its trains over 15 minutes late.

[25] TIMACS records arrival times of individual trains, minutes late, canceled or terminated trains, with an explanation of delays and assigns a "trouble code". TIMACS is accessed on the MTA Intranet.

[26] This number was arrived at by comparing the passenger's original expected arrival time at Penn Station with that of the next following train.

Clearly, canceled and terminated trains can significantly impact the rider's commuting experience, and the PCAC rider Councils believe that it is important to fully inform Committee members, riders and the general public on their frequency and passenger impacts.

Website Performance Dashboard

The MTA has greatly improved its website over the last year and one of the new features is the "MTA Stat" page. This is a performance dashboard that lists the key performance indicators for each operating agency. The content of this site has grown substantially since it was created and it features a wide range of indicators with detailed year-to-date activity. However, it is not searchable, does not contain historic data, and Bus Wait Assessment is not included. Still, this is an easy way to access performance metrics without going to the individual Board Committee books. See Appendix G for examples of these stat pages.

Benchmarking

Before moving on into the comparison of metrics with other transit agencies, it would be valuable to discuss "benchmarking projects", an international effort to pool data for the purpose of in-depth analysis and research on performance. The Railway and Transport Strategy Centre, part of the Imperial College London, provides a forum for organizations to share experiences and exchange information. There are three public transit groups*:* one for bus — comprised of 13 large and medium sized bus systems; one for subways (metro) — comprised of CoMET, a consortium of twelve of the world's largest metros, and Nova, made up of a consortium of fourteen small and medium sized metro systems from around the world; and one for rail (just recently formed[27]). The most prominent transit agencies around the world are members, including the MTA. Each group undertakes, through the researchers at the Centre, studies that are directed towards the highest priority needs of the members and the areas which will produce the greatest benefits. Importantly, each group operates under a strict confidentiality agreement so that data and information can be shared only within the group. Each benchmarking process uses approximately 35 KPIs, which measure the performance of the organization. As an example of studies undertaken, the most recent paper out of the urban bus operators is focused on "Excess Wait Time".[28]

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[27] The rail group held its first meeting in New York during the first week in November, 2010. Helena Williams, President of the LIRR, and Howard Permut, President of the MNR, hosted the event.

[28] Trompet, M., X. Liu and D. Graham. *Development of a Key Performance Indicator to Compare Regularity of Service Between Urban Bus operators.* See http://www.rtsc.org.uk/ for more information about these benchmarking groups.

Performance Metrics at Other Major Transit Agencies

For comparison purposes, PCAC looked at the performance metrics produced and published on the websites[29] at several U.S. major transit agencies: Bay Area Rapid Transit (BART) and Caltrain in California; Chicago Transit Authority (CTA) and Metra in Chicago; Massachusetts Bay Transportation Authority (MBTA) in Boston; NJ TRANSIT, and the Washington Metropolitan Area Transit Authority (WMATA) in DC. Internationally, web published indicators were reviewed at Transport for London (TfL) and two other commuter railroads in the London area — Southeastern and South West Trains. In Canada, only Société de Transport de Montréal (STM) showed any performance metrics on their website. As the larger foreign transportation systems are now part of the benchmarking effort described above, PCAC decided to limit international comparisons to the London area and Canadian agencies (English language based). A detailed description of all of the reviewed agencies can be found in Appendix H.

While not a surprise, few examples of true passenger based metrics were found. This could be due to several factors: lack of technology or manpower to accumulate needed data; no pressure to create these metrics from rider advocacy groups or public officials; or, the failure to post such information in a web-based format. Tables 1, 2 and 3 (pp. 18–20) summarize the types of performance measures available on the internet websites of the various agencies for commuter rail lines, subway/rapid transit systems, and bus services. While not part of the primary focus of the review, the detail of reporting, such as providing explanatory notes and definitions, was found to vary widely. Further, locating performance metrics within the site often was a challenge due to differences in terminology, categorization and organization in the web presentations.

Commuter Rail

As shown in Table 1, the LIRR and MNR have the most robust performance metrics available to the public among the commuter rail agencies reviewed. As previously discussed, this level of transparency comes with the changes incorporated in the September 2010 MTA Board Commuter Rail Committee Book and new website pages which include the delayed and canceled train data.

At the other end of the spectrum is Caltrain which shows no performance indicators on its website.[30] Only slightly better are Chicago's Metra and NJ TRANSIT, both publishing an OTP percentage once a year in their annual reports.

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[29] Although performance data might be secured in hard copy upon request to an agency, it seems more appropriate, in light of MTA's admirable use of the website to post MTA Board materials and the delayed and canceled train data, to examine other agencies by the same measure. Clearly, the public is better served being able to access this information electronically. And, the trend is definitely in that direction with the larger transit agencies already placing a fair amount of performance metrics on their websites.

[30] The definition of on-time arrival was garnered from the agency in an email response. Caltrain is operated by Amtrak.

Somewhat more informative is Boston's MBTA with monthly reports on equipment and late trains. Even more impressive is Southeastern, which launched England's first high speed rail service. The company posts a daily performance report that details services that were diverted, canceled or delayed for over 10 minutes. Although Southeastern operates only two lines, it carries more than 400,000 passengers a day (see Appendix H).

Another London commuter service, South West Trains, provides only minimal OTP information along with the number of incidents beyond its control and those days that seasonal ticket holders are entitled to refunds ("void days").[31]

London Overground currently posts minimal OTP information (Public Performance Measure or PPM) on its website. Timing may be at issue here as its four lines were transferred relatively recently to TfL's London Rail in 2007. Future plans include the East London Line extension and equipment upgrades. A recent research report, *Oyster-Based Performance Metrics for the London Overground*, by Michael Frumin at the MIT School of Civil and Environmental Engineering,[32] concluded that with the use of Oyster smart card[33] data better passenger metrics could be developed for rail service.

Subway/Rapid Transit

There has been more progress in capturing the passenger perspective with respect to travel on subways and rapid transit systems (see Table 2). London Underground, through the information gathered from the use of the Oyster card, has been able to formulate a journey time metric (JTM), which when compared to scheduled times, also yields an excess journey time (EJT).

BART, which is the only agency in the U.S. to offer a "passenger" OTP metric, uses a combination of data from the train control system and the fare collection system to model system performance at the individual passenger level. "The result is a passenger on-time statistic, best interpreted as the percentage of patrons who depart from the station of origin and arrive at their destination station with in a five minute window."[34] This is possible because the BART system requires an entrance and exit registration.

These methodologies are in contrast to the Wait Assessment used by NYCT which does not represent an individual passenger level; but does capture service

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[31] Also reviewed were First Capital Connect and Southern Railway, commuter lines into London, but neither had performance reports on their website.

[32] Part of the Strategy Team for London Rail at TfL.

[33] The Oyster card is the contactless fare payment system used by TfL. This type of card is often called a "smart" card and functions like a credit card for fare payment. It needs only to be flashed in front of a reader and the fare is recorded against the rider's account.

[34] Per Dr. Roy Henricks, PE, of BART. He indicated that the Passenger Flow Modeling (PFM) program was originally written over 20 years ago.

performance in a more meaningful way to the rider than Terminal OTP. MBTA essentially does a Wait Assessment as well.

WMATA produces a monthly scorecard, but a train OTP is the only operating performance measure given. However, if one looks through the website, a daily list of unexpected disruptions can be found under the "Rail" dropdown menu. Each entry includes the line affected and the nature of the problem. STM provides only minimal indicators in its annual activity report: reliability, delivery of planned service and number of incidents lasting five minutes or more.

Found only at CTA and MBTA is the "slow speed" metric. It would appear that the frequency of reduced track speed restrictions is significant enough to warrant this explanation for delays.

Bus

When it comes to the rider's experience on the bus (see Table 3), TfL is significantly ahead of other transit agencies through its iBus, one of the largest computer integrated Automatic Vehicle Locator (AVL) systems in the world.[35] In high frequency services Wait Assessment is fined tuned: average scheduled wait; average excess wait and average actual wait. In addition, performance is also shown as the probability of waiting: less than 10 minutes, 10–20 minutes, 20–30 minutes and greater than 30 minutes. Low frequency services get a less intense treatment: % departing on time, departing early, departing 5–15 minutes late and non-arrival.

As described earlier, NYCT also produces a bus Wait Assessment measure through a sampling program. CTA reports a "gap" metric which is based on actual headways that are double the expected time or are greater than 15 minutes, divided by the total weekday headways traveled in the month. Their reported "bunching" metric represents those intervals less than 60 seconds divided by the total weekday headways traveled in the month.

NJ TRANSIT and WMATA look at scheduled arrival times at a terminal or fixed time points. This OTP may be useful to internal operations personnel but has little import to the rider. In the annual activity report, STM shows only "bus punctuality" and delivery of planned service. MBTA does not report any bus OTP metric.

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[35] See http://www.tfl.gov.uk/corporate/projectsandschemes/technologyandequiPMent/7204.aspx

Table 1
Comparison of Metrics Used by Major Transit Agencies with Commuter Rail

Metric	Caltrain (Cal)	LIRR	MBTA (Boston)	Metra (Chicago)	MNR	NJT (NJ)	London Area		
							London Overground	Southeast	Southwest Trains
On-Time Performance									
Definition of On Time (min.)[1]	≤5:00	≤5:59	≤4:00	≤5:59	≤5:59	≤5:59	≤5:00	≤5:00	≤5:00
Train		X	X	X	X	X	X[7]	X[5]	X[7]
Passenger									
By line or branch		X	X		X		X[7]	X[5]	X[7]
Trips									
Average delay per late train		X			X				
# or % late trains		X[6]	X		X[6]				
% or # of service operated		X			X			X[4]	X[7]
# trains scheduled		X			X			X[4]	
# canceled trains[2]		X			X			X[4]	
# terminated trains[3]		X			X			X[4]	
Cause or category of delay/cancelation		X			X			X[4]	
Equipment									
Reliability (MDBF/MMBF)		X	X		X			X	
Availability			X					X[4]	
Consist compliance		X			X				
Standees		X			X				
Presentation									
Public Website, frequency		monthly	monthly	yearly	monthly	yearly	monthly	monthly	monthly

[1] Train arriving after scheduled arrival time

[2] Train does not leave the yard

[3] Train is terminated enroute

[4] On the website daily

[5] On the website daily and monthly

[6] Trains over 15 minutes late

[7] Previous 4 weeks and previous 52 week average

Table 2
Comparison of Metrics Used by Major Transit Agencies for Subways/Rapid Transit

Metric	BART (SF Bay Area, CA)	CTA (Chicago)	MBTA (Boston)	NYCT (NY)	WAMATA (DC)	London Underground (TfL)	STM (Montreal)
On-Time Performance							
Train	X		X[5]	X	X		
Passenger	X					X[1]	X[6]
Wait assessment			X[5]	X			
Total				X			
By line			X	X			
Trips							
% scheduled service operated			X			X	X
% or number of delays	X	X		X		X	X
Cause of delay/cancelation	X	X[3]	X[4]	X	X[2]		
Equipment							
Reliability (MDBF/MMBF)	X	X	X	X			
Availability	X	X	X			X	
Presentation							
Public website, frequency	quarterly	monthly	monthly	monthly	monthly	monthly	yearly

[1] Expressed as average passenger journey time and excess journey time

[2] Daily, under Rail, Disruption Reports

[3] CTA reports the % of "Slow Zone" mileage, 6 to 35 mph speed restriction

[4] MBTA reports "Speed Restrictions" in minutes of impacted travel time

[5] MBTA OTP compares the scheduled frequency of service to the actual frequency, in essence this a wait assessment

[6] Labeled as % of clients that arrive on time

Table 3
Comparison of Metrics Used by Major Transit Agencies for Bus

Metric	CTA (Chicago)	MBTA (Boston)	NJT (NJ)	NYCT (NY)	WMATA (DC)	London Bus (TfL)	STM (Montreal)
On-Time Performance							
By terminal or time point			X		X		
Wait assessment							
Total	X[1]			X[2]		X[3]	X[5]
By line or route				X[2]		X[3]	
Trips							
% scheduled service operated		X		X		X[4]	X
Equipment							
Reliability (MDBF/MMBF)	X	X		X	X		
Availability	X	X		X[2]			
Presentation							
Public website, frequency	monthly	monthly	yearly	monthly	monthly	quarterly/yearly	yearly

[1] Expressed as % of gaps and bunching intervals

[2] Only available semi-annually, expressed as a %

[3] Expressed in minutes for high frequency service; for timetabled (low frequency) service this indicator is expressed as % on time

[4] Expressed as vehicle kms scheduled, % kms operated and kms lost by cause

[5] Denoted as "Bus punctuality"

On a final note, for those bus riders with a computer or mobile phone, CTA offers Bus Tracker. The rider, on the computer or by text message, can receive the estimated arrival time at a particular bus stop and even locate the bus along its route on a map. While this does not reflect the rider experience, per se, it does enable the rider to avoid an extended wait time. This feature is enabled by GPS (global positioning system) which is sending location information to a computer. This same system[36] is currently installed on the NYCT M16 and M34 buses as a pilot. Through the CIS display screens at selected bus stops estimated arrival times are posted, and upcoming stops are announced on the bus automatically. In addition, NYCT just introduced “Bus Time” for the M16 and M34 routes, which allows riders to receive real-time bus arrival information through on-demand (on-line) or subscription-based email and text message alerts.

Linking Operational Performance to Capital Investment

In the past year, the MTA has done a tremendous amount in the area of public transparency and accountability with respect to the projects in its five-year Capital Program. The unveiling of the MTA’s “Capital Projects Dashboard” put the MTA in the forefront of capital program transparency among transit agencies. This online database enables the public to track individual projects, identifying their scope, budget and schedule. The information contained in the MTA Board Capital Program Oversight Committee Book has also seen substantive accountability improvements. With the direction the MTA has already begun to take, a natural progression would be to relate specific operational metrics to certain individual capital projects that will tangibly improve the commuting experience. Specific information on how an item in the Capital Program will reduce the number of delayed and canceled trains, increase track speeds, and improve the ability to recover from a major service disruption is relevant to the riders.

This topic is addressed in the New York State Public Authorities Law (PAL) Section 1269-D, which requires the MTA to submit a Strategic Operation Plan (SOP) to the Governor for the five-year MTA Capital Program and is to be updated yearly. In reviewing the MTA plan submitted for the 2010-2014 Capital Program, PCAC found few references that speak directly to the investment in infrastructure issues. The legislation states that the plan shall include, but need not be limited to, the following:

> j. An analysis of the relationship between specific planned capital elements contained in the approved capital program plans and the achievement of planned service and performances standards. Such analysis shall include the relationship of specific planned capital elements to the achievement of such

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[36] This is a proprietary system developed by Clever Devices.

> service and performance standards for each subway line, bus route or group of bus routes, or commuter rail lines, divisions or branches as appropriate.[37]

In this most recent SOP report, the NYCT and MNR reference the positive impact new car equipment will have on the MDBF metric, and the LIRR references car equipment along with the Queens Interlocking project, track and signal improvements. Yet, there are no specific numbers on how many delayed or canceled trains occurred due to the old Queens interlocking equipment in order to demonstrate the need for the investment. While PCAC is aware that there were many delays, specific numbers would be extremely useful. It is this type of correlation that the document lacks. More detailed operational metrics (and expected change in those metrics) should be used to show the need to improve infrastructure through the 2010-2014 Capital Program investments. Below are the types of metrics that would be useful in further supporting the justification of the Capital program.

A. Track and Signal Capacity Projects
  - Identify the number of trains delayed in the past five years due to capacity issues and the length of time those trains were delayed.
  - Use examples of delays in the previous year and how those delays would have been different had the new capital investments been in place.
  - Identify the lines/branches that will benefit the most from the capacity investment and how they will benefit.
  - Determine how much faster a major congestion issue will be cleared upon completion of the capacity improvement.
  - Identify slow track speed areas that will be improved with identified investments.
  - Identify the number of track miles that slow track speeds are in place for and what this means for the branch/line train schedule/frequency.
  - Identify how often, where and for how long slow speed mandates were imposed during the previous year because of unexpected track or signal conditions that required fixing.

B. Interlocking Projects
  - Identify how many train delays occurred at the interlocking in the preceding five years and passengers impacted.
  - Identify the number of delayed and canceled trains that occurred in the preceding five years because of interlocking issues.
  - Describe how the new interlocking will reduce slow, delayed and canceled trains.
  - Identify how track speeds will improve.

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[37] New York State Public Authorities Law 1269-D, Section j. See https://www.weblaws.org/states/new_york/statutes/n.y._public_authorities_law_sec._1269-d

- Identify how often, where and for how long slow speed mandates were imposed during the previous five years because of an unexpected or known track or signal condition.

PCAC recognizes that the above list is ambitious and it should be viewed as objectives to strive for. Further, it is acknowledged that the current economic environment certainly puts constraints on the manpower to develop these statistics. Nevertheless, justification for capital investment needs to be more closely tied to operation improvements in the minds of the riders, the public and elected officials. The following is a summary of PCAC's conclusions and recommendations.

Conclusions

The MTA and its Operating Agencies provide some of the most transparent and detailed operational metrics among U.S. transit agencies; and this information is readily available on the MTA website. With respect to MNR and LIRR, no major commuter railroad comes close to their level of operational performance disclosure, especially with the recent addition of metrics on delayed and canceled trains in Board materials and on the website. In addition, the NYCT is to be lauded for the improvement of its performance indicators over the last 15 years, particularly with the implementation and refinement of its Wait Assessment metric.

Yet, a true passenger based on-time metric still eludes the MTA and the other major U.S. transit agencies, except for BART (Bay Area Rapid Transit, California). The latter reaps the benefits from ticketing that requires an exit registration (swipe out) and a 20-year dedication to modeling passenger flows. Further, the effect of canceled and terminated trains on the commuter railroads — the magnitude of riders that are affected by delays and the resulting economic impact of lost work time — has yet to be captured.

Finally, despite the high level of disclosure, the MTA’s operational metrics are often omitted in discussions of capital investments and the impact they will have on reducing slow, delayed and canceled trains. The average rider doesn’t necessarily understand what new interlockings, switches and signals are, let alone appreciate how their improvement will enhance their commute. Historically, the use of performance metrics at the MTA began as an effort to secure needed capital funds. That linkage, as a tool to promote capital programs to the riding public and elected officials, has weakened over the years.

Priority Recommendations

1. *The MTA should continue to foster investment in operational and measurement technology, as new technology is providing the means to refine and improve both performance and performance measurement.* There should be a continued push for implementation of ATS (Automated Train Supervision) throughout the subway system; AVL (Automatic Vehicle Locator) on buses; contactless fare payment on subways, buses and railroads; and utilization of web media to provide searchable databases of performance metrics, particularly about delay information.

2. *The MTA should add an increased level of detail in their Strategic Operation Plan (SOP) which is required by NYS Public Authorities Law, Section 1269-D.* The legislation states that the report is to include the relationship of specific planned capital elements to the achievement of such service and performance standards for all operating services. The LIRR and MNR should identify those projects that will reduce delayed and canceled trains (excluding normal replacement projects) and use more localized performance indicators (by branch or line) to make their case that operations will improve due to the investment. Upon completion of the project, subsequent SOPs should reference the impact that capital investments have had on performance.

3. *The LIRR and MNR should place their ridership book, which contains average train ridership by specific train, on the MTA website in a searchable database.* Thus, the number of LIRR and MNR passengers onboard each delayed and canceled train could be estimated. Researchers should be encouraged to use this data to model the economic impacts on workers and employers of delayed and canceled trains.

4. *For improved transparency, the LIRR and MNR should change their "Categories of Delay" in their MTA Board Committee Book from categories that relate to departments responsible (as is currently done) to the actual reason for the delay.*

5. *In the same vein, NYCT should define what factors constitute a "major delay" in the subway system and identify them in the Transit Committee Book each month by line(s), cause, and number of trains and length of time they were delayed.* Currently, there is no major system delay information provided to the public.

6. *With respect to terminal delays, NYCT should further define their "Infrastructure" category in the Weekday Terminal Delays Systemwide Summary, in the Transit Committee Book, to identify track and signal delays*. This detail better supports and links to needed investment in the capital program.

7. *Performance databases for NYCT subways and buses on the web should be searchable and available to software application developers.* Currently, there are no searchable subway or bus performance databases on the MTA website that provide information on Wait Assessment.

8. *The NYCT should consider describing the Wait Assessment metric to the general public in more user friendly terms, such as the probability of a bus or train being on time and the average excess wait time associated with a bus route or subway line.* A good example is the performance reporting for Transport for London's buses and subways. As currently presented, the NYCT's Wait Assessment percentage means little to the average rider.

Additional Recommendations

9. *The LIRR and MNR should consider adding an additional metric that indicates the percentage of trains that arrive within 2 minutes of the scheduled arrival time.* Irrespective of the industry standard of 5 minutes 59 seconds, the railroads should be striving for true "on-time" performance. The industry standard is not mandatory and the review of other commuter railroads shows that some do use a more rigorous standard.

10. *The LIRR and MNR should strive to develop a canceled train "delay factor", i.e., time until the next train arrives or actual wait time for a "rescue" train or bus.* This factor should be included in the "average minutes late" metric. What happens to riders in the case of a canceled or terminated train should be a matter of record. If in-house resources are not available, outside sources, such as academic researchers, should be utilized to develop a methodology for capturing the true impact of a canceled or terminated train.

11. *The LIRR and MNR should strive to develop a true passenger-based OTP metric, for the AM Peak period to terminals, incorporating a canceled/terminated train delay factor.* Again, if in-house resources are not available, outside academic researchers would be an excellent potential to tackle this analysis.

12. *The Railroads need to develop a plan to keep Origin and Destination counts current, i.e., more frequent surveys, targeting smaller sections.* Accurate passenger flows are necessary for good operations planning and for assessing the impact of delayed or canceled trains. The most recent Origin and Destination reports are almost four years old and perhaps not reflective of the effects of the recent recession or service changes since then.

In sum, there is every reason to believe that the passenger experience can and will be better reflected with the data that new technology, such as a contactless fare payment system and ATS, can produce. Further, making this data available to the public will enable software developers to produce useful applications ("apps"), such as LIRR's CooCoo that provides schedules, service updates and ticket prices via cell phone. Also, having a riding public that is more aware and sensitive to published OTP metrics should give agencies additional motivation to improve performance.

Finally, tying capital program investments to specific improvements in operating performance must be a priority. The above recommendations should be taken as proposed goals, some that can be implemented with current resources and some that will need a stronger financial climate or help from outside researchers to implement. The MTA is moving in the right direction and the PCAC hopes that this trend will continue.

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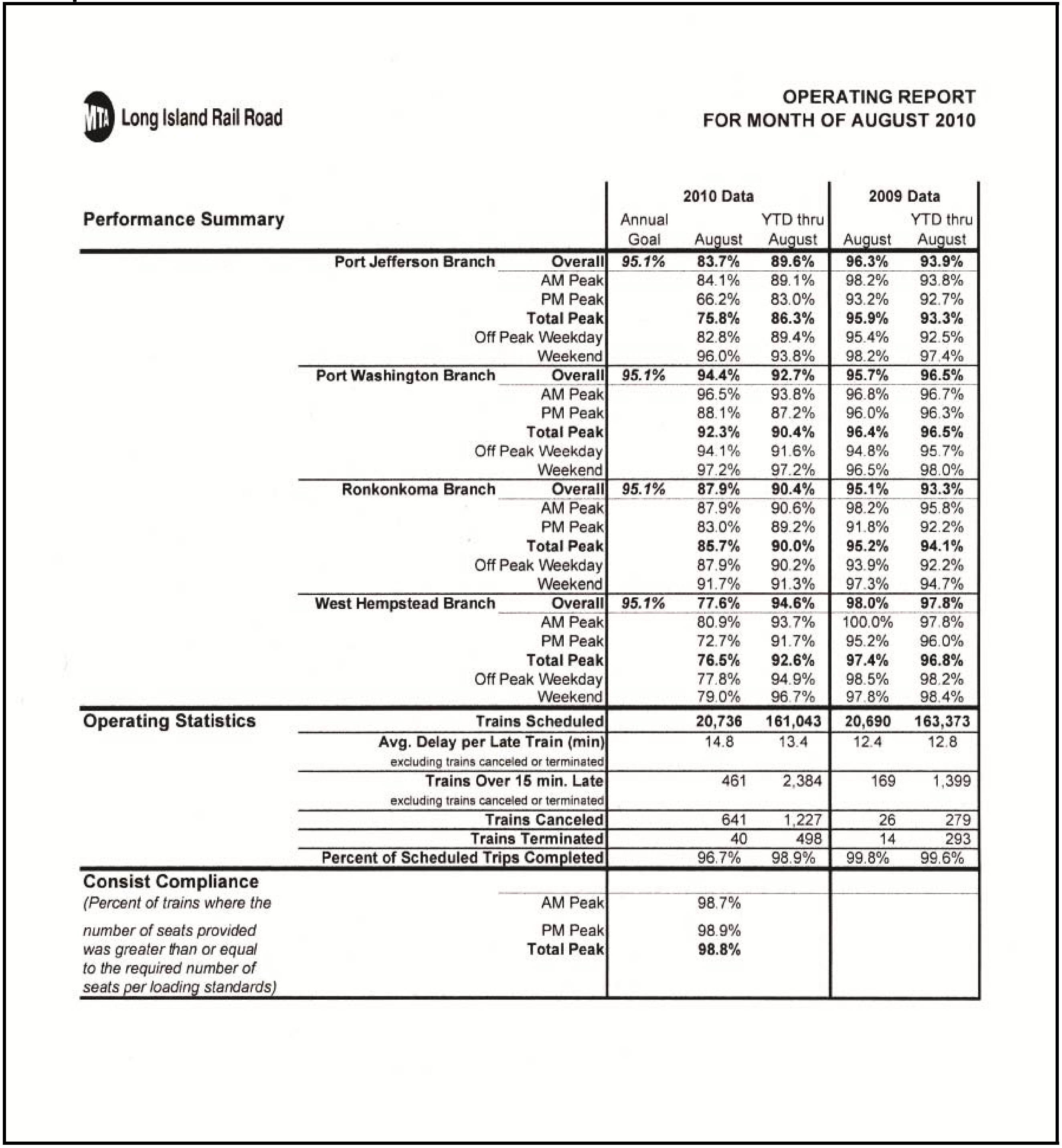
Appendix A

LIRR and MNR
Example of New Performance Indicators

Appendix A
Example of New Performance Indicators — LIRR

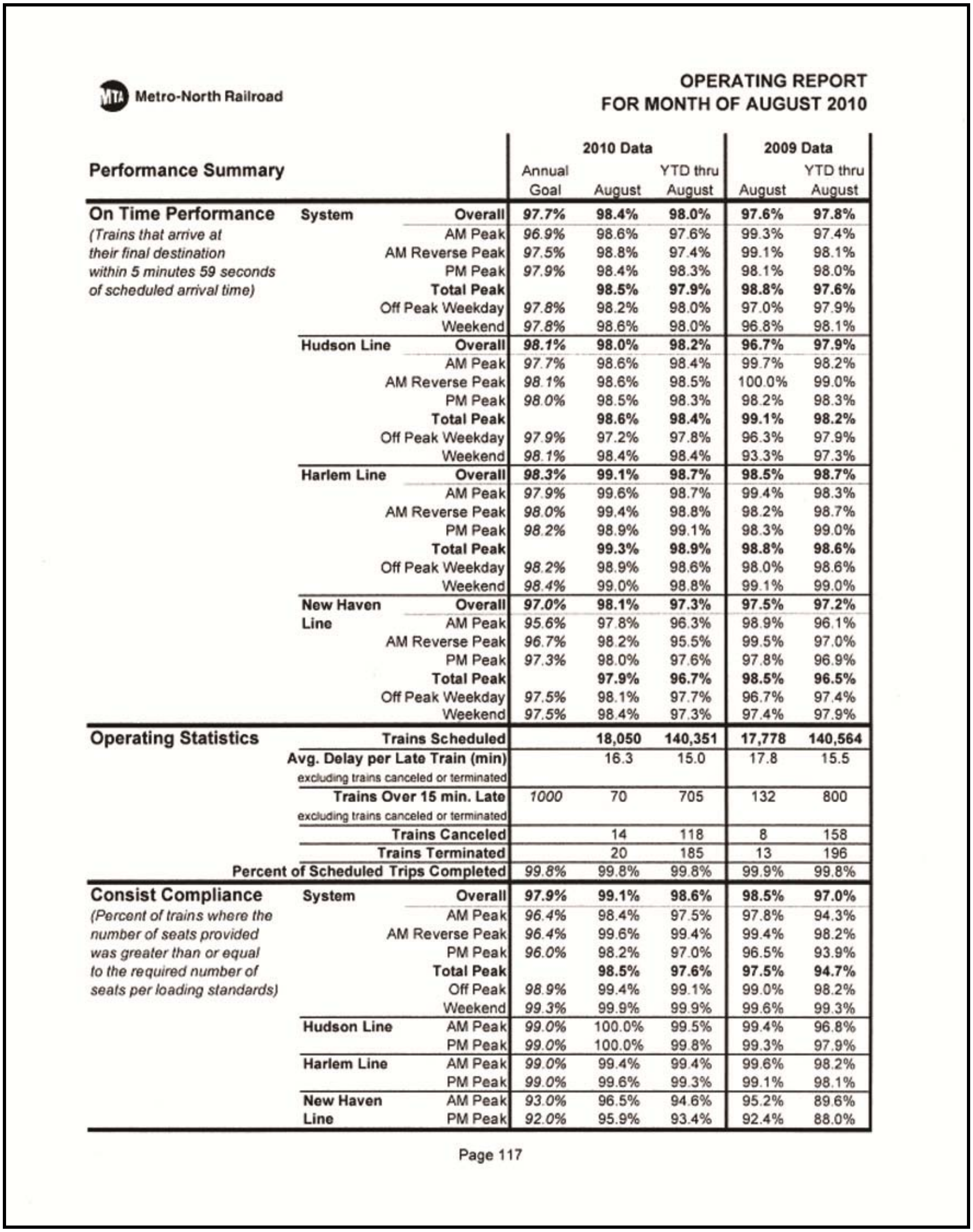


Long Island Rail Road

OPERATING REPORT
FOR MONTH OF AUGUST 2010

			2010 Data			2009 Data	
Performance Summary			Annual Goal	August	YTD thru August	August	YTD thru August
	Port Jefferson Branch	**Overall**	***95.1%***	**83.7%**	**89.6%**	**96.3%**	**93.9%**
		AM Peak		84.1%	89.1%	98.2%	93.8%
		PM Peak		66.2%	83.0%	93.2%	92.7%
		Total Peak		**75.8%**	**86.3%**	**95.9%**	**93.3%**
		Off Peak Weekday		82.8%	89.4%	95.4%	92.5%
		Weekend		96.0%	93.8%	98.2%	97.4%
	Port Washington Branch	**Overall**	***95.1%***	**94.4%**	**92.7%**	**95.7%**	**96.5%**
		AM Peak		96.5%	93.8%	96.8%	96.7%
		PM Peak		88.1%	87.2%	96.0%	96.3%
		Total Peak		**92.3%**	**90.4%**	**96.4%**	**96.5%**
		Off Peak Weekday		94.1%	91.6%	94.8%	95.7%
		Weekend		97.2%	97.2%	96.5%	98.0%
	Ronkonkoma Branch	**Overall**	***95.1%***	**87.9%**	**90.4%**	**95.1%**	**93.3%**
		AM Peak		87.9%	90.6%	98.2%	95.8%
		PM Peak		83.0%	89.2%	91.8%	92.2%
		Total Peak		**85.7%**	**90.0%**	**95.2%**	**94.1%**
		Off Peak Weekday		87.9%	90.2%	93.9%	92.2%
		Weekend		91.7%	91.3%	97.3%	94.7%
	West Hempstead Branch	**Overall**	***95.1%***	**77.6%**	**94.6%**	**98.0%**	**97.8%**
		AM Peak		80.9%	93.7%	100.0%	97.8%
		PM Peak		72.7%	91.7%	95.2%	96.0%
		Total Peak		**76.5%**	**92.6%**	**97.4%**	**96.8%**
		Off Peak Weekday		77.8%	94.9%	98.5%	98.2%
		Weekend		79.0%	96.7%	97.8%	98.4%
Operating Statistics		**Trains Scheduled**		**20,736**	**161,043**	**20,690**	**163,373**
		Avg. Delay per Late Train (min) excluding trains canceled or terminated		14.8	13.4	12.4	12.8
		Trains Over 15 min. Late excluding trains canceled or terminated		461	2,384	169	1,399
		Trains Canceled		641	1,227	26	279
		Trains Terminated		40	498	14	293
		Percent of Scheduled Trips Completed		96.7%	98.9%	99.8%	99.6%
Consist Compliance *(Percent of trains where the number of seats provided was greater than or equal to the required number of seats per loading standards)*		AM Peak		98.7%			
		PM Peak		98.9%			
		Total Peak		**98.8%**			

Appendix A
Example of New Performance Indicators — MNR East of Hudson



Metro-North Railroad

OPERATING REPORT
FOR MONTH OF AUGUST 2010

Performance Summary			2010 Data			2009 Data	
			Annual Goal	August	YTD thru August	August	YTD thru August
On Time Performance	**System**	**Overall**	**97.7%**	**98.4%**	**98.0%**	**97.6%**	**97.8%**
(Trains that arrive at their final destination within 5 minutes 59 seconds of scheduled arrival time)		AM Peak	96.9%	98.6%	97.6%	99.3%	97.4%
		AM Reverse Peak	97.5%	98.8%	97.4%	99.1%	98.1%
		PM Peak	97.9%	98.4%	98.3%	98.1%	98.0%
		Total Peak		**98.5%**	**97.9%**	**98.8%**	**97.6%**
		Off Peak Weekday	97.8%	98.2%	98.0%	97.0%	97.9%
		Weekend	97.8%	98.6%	98.0%	96.8%	98.1%
	Hudson Line	**Overall**	**98.1%**	**98.0%**	**98.2%**	**96.7%**	**97.9%**
		AM Peak	97.7%	98.6%	98.4%	99.7%	98.2%
		AM Reverse Peak	98.1%	98.6%	98.5%	100.0%	99.0%
		PM Peak	98.0%	98.5%	98.3%	98.2%	98.3%
		Total Peak		**98.6%**	**98.4%**	**99.1%**	**98.2%**
		Off Peak Weekday	97.9%	97.2%	97.8%	96.3%	97.9%
		Weekend	98.1%	98.4%	98.4%	93.3%	97.3%
	Harlem Line	**Overall**	**98.3%**	**99.1%**	**98.7%**	**98.5%**	**98.7%**
		AM Peak	97.9%	99.6%	98.7%	99.4%	98.3%
		AM Reverse Peak	98.0%	99.4%	98.8%	98.2%	98.7%
		PM Peak	98.2%	98.9%	99.1%	98.3%	99.0%
		Total Peak		**99.3%**	**98.9%**	**98.8%**	**98.6%**
		Off Peak Weekday	98.2%	98.9%	98.6%	98.0%	98.6%
		Weekend	98.4%	99.0%	98.8%	99.1%	99.0%
	New Haven Line	**Overall**	**97.0%**	**98.1%**	**97.3%**	**97.5%**	**97.2%**
		AM Peak	95.6%	97.8%	96.3%	98.9%	96.1%
		AM Reverse Peak	96.7%	98.2%	95.5%	99.5%	97.0%
		PM Peak	97.3%	98.0%	97.6%	97.8%	96.9%
		Total Peak		**97.9%**	**96.7%**	**98.5%**	**96.5%**
		Off Peak Weekday	97.5%	98.1%	97.7%	96.7%	97.4%
		Weekend	97.5%	98.4%	97.3%	97.4%	97.9%
Operating Statistics		**Trains Scheduled**		**18,050**	**140,351**	**17,778**	**140,564**
		Avg. Delay per Late Train (min) excluding trains canceled or terminated		16.3	15.0	17.8	15.5
		Trains Over 15 min. Late excluding trains canceled or terminated	1000	70	705	132	800
		Trains Canceled		14	118	8	158
		Trains Terminated		20	185	13	196
		Percent of Scheduled Trips Completed	99.8%	99.8%	99.8%	99.9%	99.8%
Consist Compliance	**System**	**Overall**	**97.9%**	**99.1%**	**98.6%**	**98.5%**	**97.0%**
(Percent of trains where the number of seats provided was greater than or equal to the required number of seats per loading standards)		AM Peak	96.4%	98.4%	97.5%	97.8%	94.3%
		AM Reverse Peak	96.4%	99.6%	99.4%	99.4%	98.2%
		PM Peak	96.0%	98.2%	97.0%	96.5%	93.9%
		Total Peak		**98.5%**	**97.6%**	**97.5%**	**94.7%**
		Off Peak	98.9%	99.4%	99.1%	99.0%	98.2%
		Weekend	99.3%	99.9%	99.9%	99.6%	99.3%
	Hudson Line	AM Peak	99.0%	100.0%	99.5%	99.4%	96.8%
		PM Peak	99.0%	100.0%	99.8%	99.3%	97.9%
	Harlem Line	AM Peak	99.0%	99.4%	99.4%	99.6%	98.2%
		PM Peak	99.0%	99.6%	99.3%	99.1%	98.1%
	New Haven Line	AM Peak	93.0%	96.5%	94.6%	95.2%	89.6%
		PM Peak	92.0%	95.9%	93.4%	92.4%	88.0%

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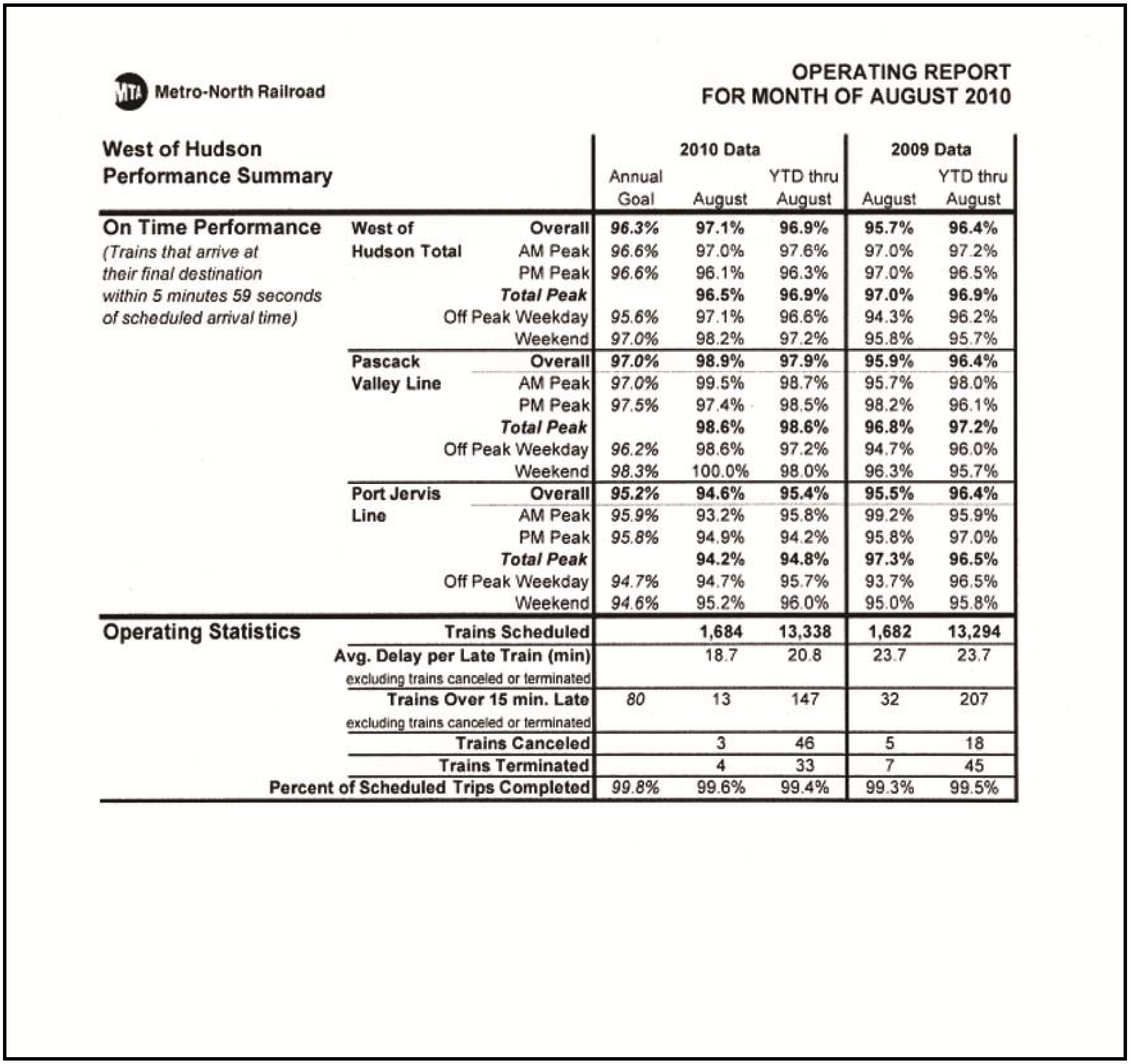
Appendix A
Example of New Performance Indicators — MNR West of Hudson



Metro-North Railroad

OPERATING REPORT
FOR MONTH OF AUGUST 2010

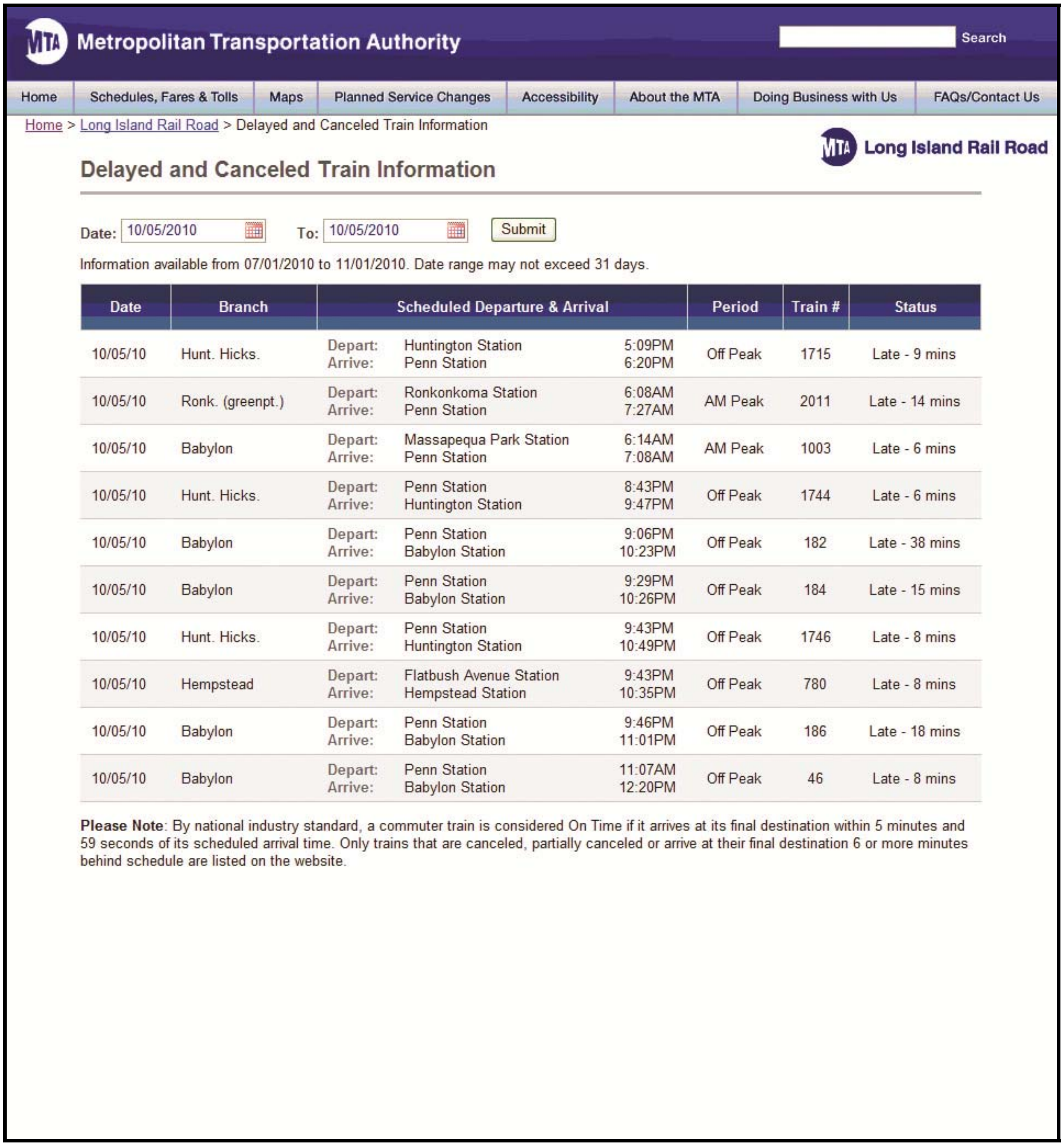
West of Hudson Performance Summary			2010 Data			2009 Data	
			Annual Goal	August	YTD thru August	August	YTD thru August
On Time Performance	**West of Hudson Total**	**Overall**	***96.3%***	**97.1%**	**96.9%**	**95.7%**	**96.4%**
(Trains that arrive at		AM Peak	*96.6%*	97.0%	97.6%	97.0%	97.2%
their final destination		PM Peak	*96.6%*	96.1%	96.3%	97.0%	96.5%
within 5 minutes 59 seconds		***Total Peak***		**96.5%**	**96.9%**	**97.0%**	**96.9%**
of scheduled arrival time)		Off Peak Weekday	*95.6%*	97.1%	96.6%	94.3%	96.2%
		Weekend	*97.0%*	98.2%	97.2%	95.8%	95.7%
	Pascack Valley Line	**Overall**	***97.0%***	**98.9%**	**97.9%**	**95.9%**	**96.4%**
		AM Peak	*97.0%*	99.5%	98.7%	95.7%	98.0%
		PM Peak	*97.5%*	97.4%	98.5%	98.2%	96.1%
		Total Peak		**98.6%**	**98.6%**	**96.8%**	**97.2%**
		Off Peak Weekday	*96.2%*	98.6%	97.2%	94.7%	96.0%
		Weekend	*98.3%*	100.0%	98.0%	96.3%	95.7%
	Port Jervis Line	**Overall**	***95.2%***	**94.6%**	**95.4%**	**95.5%**	**96.4%**
		AM Peak	*95.9%*	93.2%	95.8%	99.2%	95.9%
		PM Peak	*95.8%*	94.9%	94.2%	95.8%	97.0%
		Total Peak		**94.2%**	**94.8%**	**97.3%**	**96.5%**
		Off Peak Weekday	*94.7%*	94.7%	95.7%	93.7%	96.5%
		Weekend	*94.6%*	95.2%	96.0%	95.0%	95.8%
Operating Statistics		**Trains Scheduled**		**1,684**	**13,338**	**1,682**	**13,294**
		Avg. Delay per Late Train (min) excluding trains canceled or terminated		18.7	20.8	23.7	23.7
		Trains Over 15 min. Late excluding trains canceled or terminated	*80*	13	147	32	207
		Trains Canceled		3	46	5	18
		Trains Terminated		4	33	7	45
		Percent of Scheduled Trips Completed	*99.8%*	99.6%	99.4%	99.3%	99.5%

Source: September 2010 Commuter Rail Committee Book

Appendix B-1 and B-2

LIRR and MNR
Example of New Website Delay and Canceled Train Information

Appendix B-1
Example of new MTA Delay and Canceled Train Information website page — LIRR



Home > Long Island Rail Road > Delayed and Canceled Train Information

Delayed and Canceled Train Information

Date: 10/05/2010 To: 10/05/2010

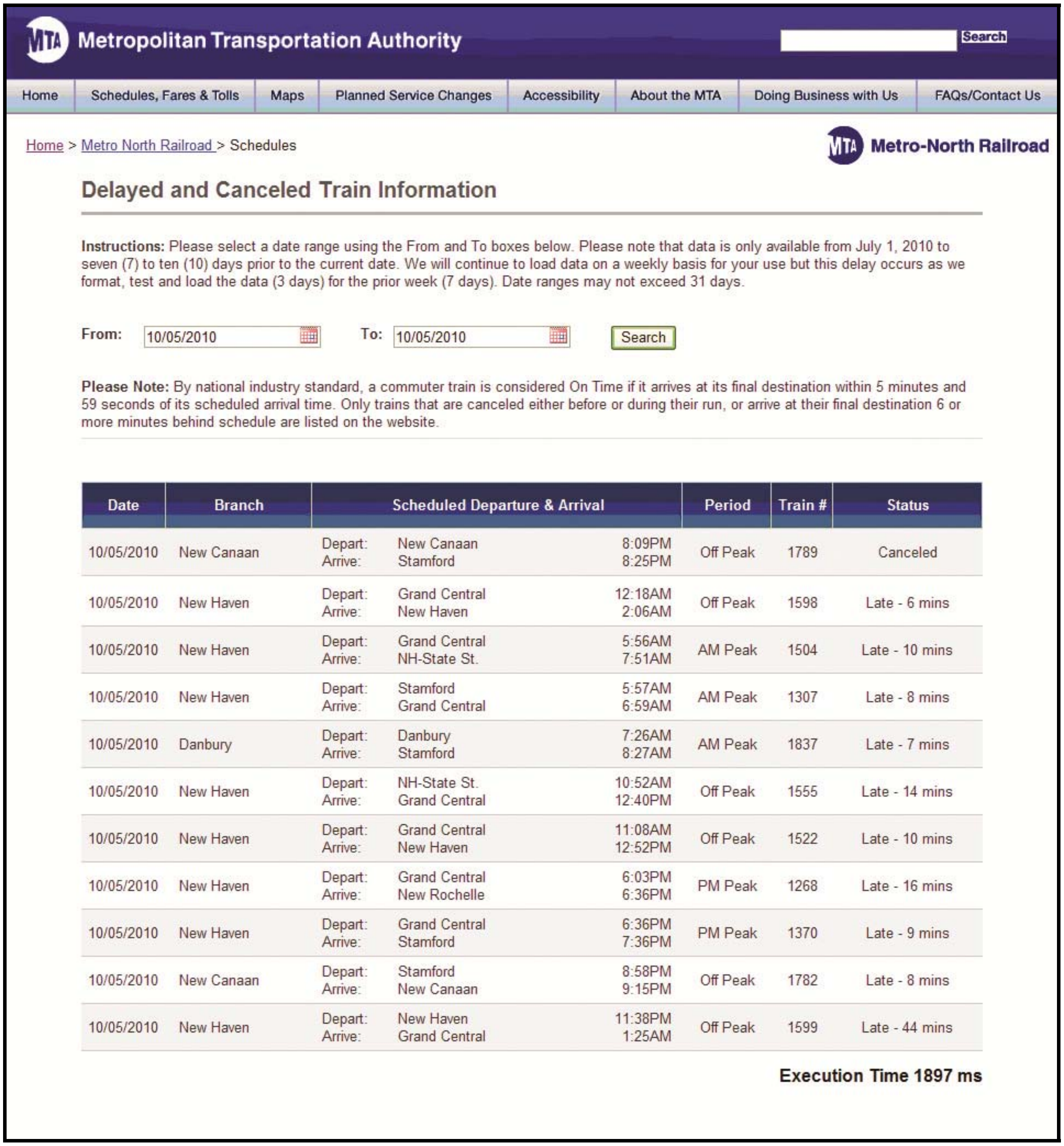
Information available from 07/01/2010 to 11/01/2010. Date range may not exceed 31 days.

Date	Branch	Scheduled Departure & Arrival			Period	Train #	Status
10/05/10	Hunt. Hicks.	Depart: Arrive:	Huntington Station Penn Station	5:09PM 6:20PM	Off Peak	1715	Late - 9 mins
10/05/10	Ronk. (greenpt.)	Depart: Arrive:	Ronkonkoma Station Penn Station	6:08AM 7:27AM	AM Peak	2011	Late - 14 mins
10/05/10	Babylon	Depart: Arrive:	Massapequa Park Station Penn Station	6:14AM 7:08AM	AM Peak	1003	Late - 6 mins
10/05/10	Hunt. Hicks.	Depart: Arrive:	Penn Station Huntington Station	8:43PM 9:47PM	Off Peak	1744	Late - 6 mins
10/05/10	Babylon	Depart: Arrive:	Penn Station Babylon Station	9:06PM 10:23PM	Off Peak	182	Late - 38 mins
10/05/10	Babylon	Depart: Arrive:	Penn Station Babylon Station	9:29PM 10:26PM	Off Peak	184	Late - 15 mins
10/05/10	Hunt. Hicks.	Depart: Arrive:	Penn Station Huntington Station	9:43PM 10:49PM	Off Peak	1746	Late - 8 mins
10/05/10	Hempstead	Depart: Arrive:	Flatbush Avenue Station Hempstead Station	9:43PM 10:35PM	Off Peak	780	Late - 8 mins
10/05/10	Babylon	Depart: Arrive:	Penn Station Babylon Station	9:46PM 11:01PM	Off Peak	186	Late - 18 mins
10/05/10	Babylon	Depart: Arrive:	Penn Station Babylon Station	11:07AM 12:20PM	Off Peak	46	Late - 8 mins

Please Note: By national industry standard, a commuter train is considered On Time if it arrives at its final destination within 5 minutes and 59 seconds of its scheduled arrival time. Only trains that are canceled, partially canceled or arrive at their final destination 6 or more minutes behind schedule are listed on the website.

See http://wx3.lirr.org/lirr/LateTrains

Appendix B-2
Example of new MTA Delay and Canceled Train Information website page — MNR



Delayed and Canceled Train Information

Instructions: Please select a date range using the From and To boxes below. Please note that data is only available from July 1, 2010 to seven (7) to ten (10) days prior to the current date. We will continue to load data on a weekly basis for your use but this delay occurs as we format, test and load the data (3 days) for the prior week (7 days). Date ranges may not exceed 31 days.

From: 10/05/2010 **To:** 10/05/2010 Search

Please Note: By national industry standard, a commuter train is considered On Time if it arrives at its final destination within 5 minutes and 59 seconds of its scheduled arrival time. Only trains that are canceled either before or during their run, or arrive at their final destination 6 or more minutes behind schedule are listed on the website.

Date	Branch	Scheduled Departure & Arrival	Period	Train #	Status
10/05/2010	New Canaan	Depart: New Canaan 8:09PM Arrive: Stamford 8:25PM	Off Peak	1789	Canceled
10/05/2010	New Haven	Depart: Grand Central 12:18AM Arrive: New Haven 2:06AM	Off Peak	1598	Late - 6 mins
10/05/2010	New Haven	Depart: Grand Central 5:56AM Arrive: NH-State St. 7:51AM	AM Peak	1504	Late - 10 mins
10/05/2010	New Haven	Depart: Stamford 5:57AM Arrive: Grand Central 6:59AM	AM Peak	1307	Late - 8 mins
10/05/2010	Danbury	Depart: Danbury 7:26AM Arrive: Stamford 8:27AM	AM Peak	1837	Late - 7 mins
10/05/2010	New Haven	Depart: NH-State St. 10:52AM Arrive: Grand Central 12:40PM	Off Peak	1555	Late - 14 mins
10/05/2010	New Haven	Depart: Grand Central 11:08AM Arrive: New Haven 12:52PM	Off Peak	1522	Late - 10 mins
10/05/2010	New Haven	Depart: Grand Central 6:03PM Arrive: New Rochelle 6:36PM	PM Peak	1268	Late - 16 mins
10/05/2010	New Haven	Depart: Grand Central 6:36PM Arrive: Stamford 7:36PM	PM Peak	1370	Late - 9 mins
10/05/2010	New Canaan	Depart: Stamford 8:58PM Arrive: New Canaan 9:15PM	Off Peak	1782	Late - 8 mins
10/05/2010	New Haven	Depart: New Haven 11:38PM Arrive: Grand Central 1:25AM	Off Peak	1599	Late - 44 mins

Execution Time 1897 ms

See http://as0.mta.info/mnr/schedules/latez/late_trains.cfm

Appendix C

Performance Measurement

Appendix C — Performance Measurement

Performance measurement is not a new concept and is widely applied to many disciplines, e.g., school grades, blood pressure levels or batting averages; and operations of businesses, agencies and governments. Performance indicators (also called measures of effectiveness or metrics) are "specific measureable outcomes used to evaluate progress toward established goals and objectives".

Examples of Performance Indicators for Various Modes

Mode	Service Quality	Outcomes	Cost Efficiency
Walking	• Sidewalk/path supply • Pedestrian LOS • Crosswalk conditions	• Pedestrian mode split • Avg. annual walk distance • Pedestrian crash rates	• Cost/sidewalk-km • Cost/walk-km • Cost/capita
Cycling	• Bike path and lane supply • Cycling LOS • Path conditions	• Bicycle mode split • Avg. annual cycle distance • Cyclist crash rates	• Cost/path-km • Cost/cycle-km • Cost/capita
Automobile	• Roadway supply • Roadway pavement condition • Roadway LOS • Parking availability	• Avg. auto trip travel time • Vehicle energy consumption and pollution emissions • Motor vehicle crash rates	• Cost/lane-km • Cost/vehicle-km • User cost/capita • External cost/capita
Public Transit	• Transit supply • Transit LOS • Transit stop and station quality • Fare affordability	• Transit mode split • Per capita transit travel • Avg. transit trip travel time • Transit crash and assault rates	• User cost/rider-km • User cost/capita • Subsidy/capita
Taxi	• Taxi supply • Avg. response time	• Taxi use • Taxi crash and assault rates	• Cost/taxi trip • External costs
Multi-modal	• Transport system integration • Accessibility from homes to common destinations • User survey results	• Total transportation costs • Total avg. commute time • Total crash casualty rates	• Total cost passenger-km • Total cost/capita • External cost/capita
Aviation	• Airport supply • Air travel service frequency • Air travel reliability	• Air travel use • Air travel crash rates	• Cost/trip • External costs • Airport subsidies
Rail	• Rail line supply • Rail service speed and reliability	• Rail mode split • Rail traffic volumes • Rail crash rates	• Cost/rail-km • Cost per ton-km • External costs
Marine	• Marine service supply • Marine service speed and reliability	• Marine mode split • Marine traffic volumes • Marine accident rates	• Cost/ton-km • Subsidies • External costs

Source: Litman, 2008. The Victoria Transport Policy Institute (VTPI), Victoria, Canada, is an independent research organization dedicated to developing innovative and practical solutions to transportation problems and headed by Todd Litman, founder and executive director. He has authored numerous publications including the Online *TDM Encyclopedia*; *Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications*; and *Parking Management Best Practices*.

Appendix D

Transit Level-of-Service (LOS) Rating Factors

Appendix D — Transit Level-of-Service (LOS) Rating Factors

Feature	Description	Indicators
Availability	Where and when transit service is available	• Annual service-km/capita • Daily hours of service • Portion of destinations located within 500m of transit service • Hours of service
Frequency	Frequency of service and average wait time	• Trips/hour or day • Headways (time between trips) • Average waiting times
Travel Speed	Transit travel speed	• Average vehicle speeds • Transit travel speed relative to driving the same trip • Door-to-door travel time
Reliability	How well service actually follows published schedules	• On-time operation • Portion of transfer connections made • Mechanical failure frequency
Boarding Speed	Vehicle loading and unloading speed	• Dwell time • Boarding and alighting speeds
Safety and Security	Users perceived safety and security	• Perceived transit passenger security • Accidents and injuries • Reported security incidents • Visibility and lighting • Official response to perceived risks • Absence of vandalism
Price and Affordability	Fare prices, structure, payment options, ease of purchase	• Fares relative to average incomes • Fares relative to other travel mode costs • Targeted discounts or exemptions as appropriate • Payment options (cash, credit cards, etc.) • Ticket availability (stations, stores, Internet, etc.)
Integration	Ease of transferring between transit and other travel modes (bus, train, ferry, airport, etc.)	• Integration between transit routes service providers • Integration between transit and other modes
Comfort	Passenger comfort	• Seating availability and quality • Space (lack of crowding) • Quiet (lack of excessive noise) • Fresh air (lack of unpleasant smells) • Temperature • Cleanliness • Washrooms and refreshments

Appendix D (Cont.)

Feature	Description	Indicators
Accessibility	Ease of reaching transit stations and stops	• Transit-oriented development • Distance from transit stations and stops to destination • Walkability (quality of walking conditions) in areas serviced by transit
Baggage Capacity	Accommodation of baggage	• Ability, ease and cost of carrying baggage, including special items such as pets
Universal Design	Accommodation of diverse users including people with special needs	• Accessible design for transit vehicles, stations and nearby areas • Ability to carry baggage • Ability to accommodate people who cannot read or understand the local language
User Information	Ease of obtaining user information	• Availability, accuracy and understandability of route, schedule and fare information, at stops, stations, destinations; by Internet and mobile telephone; and by transit agency staff and other information providers • Real-time transit vehicle arrival information • Information available to service people with special needs (audio or visual disabilities, inability to read or understand the local language, etc.)
Courtesy and Responsiveness	Courtesy with which passengers are treated	• How passengers are treated by transit staff • Ease of filing a complaint • Speed and responsiveness with which complaints are treated
Attractiveness	The attractiveness of public transit facilities	• Attractiveness of vehicles and facilities • Attractiveness of documents and websites • Livability (environmental and social quality of an area of a transit stop and station areas • Provision of public art
Amenity	Features and services that enhance user comfort and enjoyment	• Internet service (on vehicles and in waiting areas) • Entertainment • Supports sociability and community cohesion
Marketing	Effectiveness of efforts to encourage public transportation	• Popularity of promotion programs • Effectiveness at raising the social status of transit travel • Increases in public transit ridership in response to marketing efforts

Source: VTPI, http://www.vtpi.org/tdm/tdm129.htm

Appendix E

History of NYCT Performance Metrics

Appendix E
History of NYCT Performance Metrics

Beginning in the late 1970s, as a result of New York State initiating a program of state/local operating assistance for public transportation systems, NYCT[38] was required to report performance measures to demonstrate economy, efficiency and effectiveness levels in its operations. These metrics were devoid of any recognition of the riders' perspective. In response, PCAC consistently called for the establishment of meaningful rider-oriented service standards.[39]

As mentioned previously in this report, in 1990 the OIG presented evidence that existing metrics did not reflect the rider experience and recommended the need for measures of service reliability other than the traditional terminal OTP. In 1993, NYCT released a study, *Bus Service Strategy and Facilities Development Plan,* which established a broad-based action plan to reverse the long-term decline in bus ridership. As a result, in late 1994 NYCT instituted a performance indicator (PI) program for buses consisting of two new indicators: Service Regularity and Enroute OTP.[40] In 1995, similar new subway performance measures were adopted.

By 2000 NYCT decided its performance indicators needed revision to better reflect customer perceptions. For both subways and buses "Service Regularity" was replaced with "Wait Assessment". This new measure was adopted because:

- The Service Regularity measure was too complex with varying standards depending on the frequency of service, making it unclear to the public and to management.
- The Service Regularity tolerance range of one to two minutes turned out to be unreasonable because traffic congestion or sick passengers can cause delays of several minutes; further, during periods of less frequent service, the tolerance range of five minutes was too long. [41]

The NYCT also slightly redefined the OTP indicator for buses and Schedule Adherence indicator for subways with respect to early departures from enroute

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[38] Referred to at the time as the New York City Transit Authority (TA).

[39] In 1981 and 1984 PCAC offered its own analysis of MTA performance by compiling tables with data provided by the MTA. See *MTA Performance: A Statistical Study 1975–1980* and *MTA Performance: A Statistical Study, 1975–1983.* In June 1984 the PCAC issued another report, *An Analysis of: The Development of MTA Service Standards Study* (Phase I). Again there was a call for the NYCT to set goals for performance.

[40] MTA Board NYCT Committee Book Summary, December 1994, p. I.7.

[41] MTA Board NYCT Committee Book, September 2000, p. 134.

timepoints. Finally, beginning with the 3rd quarter 2000 NYCT began presenting a consolidated report that included subway and bus performance indicators.[42]

1994

Bus

- Service Regularity — the percentage of intervals between two bus trips departing from all scheduled timepoints, not including terminals, which are within +/- 50% of the scheduled interval (for intervals less than 10 minutes), or within +/- 5 minutes of the scheduled interval (for scheduled intervals of 10 minutes or more).

- Enroute OTP — the percentage of bus trips departing from all scheduled timepoints, not including terminals, between 0 to 5 minutes of schedule, with early buses not considered on-time.[43]

1995

Subway

- Service Regularity — defined as the percentage of intervals between train trips departing from all scheduled timepoints, not including terminals, which is: within plus or minus 50% of the scheduled interval (for all intervals less than 10 minutes), or, within plus or minus five minutes of the scheduled interval (for scheduled intervals of 10 minutes or more), weekdays 6AM–9PM.

- Enroute Schedule Adherence (ESA) — defined similarly to that for bus Enroute OTP. This weekday indicator was to be reported during the late evening/overnight period (9PM – 6AM).[44]

2000

Bus and Subway

- Wait Assessment — defined as the percentage of service intervals that are no more than three minutes over the scheduled interval. For subways the frequent service period was defined as 6AM – 9PM; for buses it was 7AM – 7 PM.

- OTP for buses and Schedule Adherence indicator for subways changed as now accepting one minute early departures from enroute timepoints as being compliant during their respective infrequent service periods.

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[42] MTA Board NYCT Committee Book, September 2000, p. 146.

[43] See *New Bus Service Quarterly Performance Indicators* report, pp. I.8–I.10, NYCT Committee Book, 1994.

[44] NYCT Committee Meeting Agenda, September 2000, p. 134.

2008

Subway

- On-Time Performance began to be designated as “Absolute” and “Controllable”. The following definition was given for Controllable OTP:

> The percentage of regularly scheduled trains arriving at the terminal no more than 5 minutes late, compared to the published schedule, as reported to the Rail Control Center, excluding trains that are late due to incidents beyond NYCT’s control, including sick customers, police or fire department activity, vandalism, trespassing, opening of moveable bridges for maritime traffic and loss of outside electrical power. Trains running on supplemental schedules are considered on time if they arrive at the terminal within 5 minutes of the scheduled arrival as indicated on the supplement.[45]

2010

Subway

- Adjusted Terminal OTP to reflect the schedule and service plan in effect, all delays, including those charged to Police and customers, with no penalty for planned platform closure.

- Tightened the Wait Assessment standard to +25% of scheduled headway which will reduce the bias against lines with infrequent service.

Bus

- Wait Assessment for buses is currently monitored weekdays between 7AM and midnight and only reported every six months. It is defined as the percentage of observed service intervals that are no more than the scheduled interval plus three minutes during peak (7AM–9AM, 4PM–7PM) and plus five minutes during off-peak (9AM–4PM, 7PM–12AM).

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[45] MTA Board NYCT Committee Meeting Book, October 2008, pp. 12–18.

Appendix F

LIRR and MNR
Comparison of “Old” and “New” Performance Metrics In the MTA Board Committee Book

Appendix F

LIRR Comparison of "Old" and "New" Performance Metrics

Before	**September 2010**
OTP (terminals, 5:59 min): YTD, Previous Year, by Branch, AM, PM, Off Peak	**OTP** (terminals, 5:59 min): Goal, Current Month, YTD, Previous Year, by Branch, Peak AM/ PM, Off-Peak, Wkend
# **Trains Scheduled**: Current Month and Previous Year	# **Trains Scheduled**: Current Month, YTD, Previous Year
Average Minutes Late: Current Month and Previous Year	**Average Delay Per Late Train** (min): Current Month, YTD, Previous Year, *excluding trains canceled or terminated*
	# **Trains over 15 Minutes Late**: Current Month, YTD, Previous Year, *excluding trains canceled or terminated*
	# **Trains Canceled**: Current Month, YTD, Previous Year
	# **Trains Terminated**: Current Month, YTD, Previous Year
	% of Scheduled Trips Completed: Current Month, YTD, Previous Year
Peak Trains Below Full Complement of Cars: Daily, AM/PM Peak, by Mode	**Consist Compliance** (*% of trains where the number of seats provided was greater than or equal to the required number of seats per loading standards*): Current Month, AM/PM/Total Peak
Categories of Delay*: Total Trains Late -- Month, YTD, Previous Year, Comparison	**Categories of Delay***: Late Train Incidents -- Month, YTD, Previous Year, Comparison
Events Causing 10 or More Train Delays: By Date, # Trains Delayed AM/PM Peak,Off Peak, Total	**Events resulting in 10 or more Late, Canceled or Terminated trains**: # Trains (L,C,T), Date, AM/PM Peak, Off Peak, Total
Standees: Date, AM/PM Peak, Branch, Programmed and Actual	**Standees**: Current Month, by Branch, System Wide, AM Peak, Programmed and Additional
MDBF: Goal**,** Equipment, Current Month, YTD, 12 Month Rolling Average, Primary Failures, Previous Year, Total Fleet	**MDBF:** Goal, Equipment, Current Month, YTD, 12 Month Rolling Average, Primary Failures, Previous Year, Total Fleet

*These are departments of the RR to which the delay is assigned

Source: 2010 MTA Committee Books

Metro-North Railroad East of Hudson

Comparison of "Old" and "New" Performance Metrics

Before	**September 2010**
OTP (terminals, 5:59 min): Goal, Current Month, YTD, by Line, AM/ PM Peak, Off-Peak, Wkend	**OTP** (terminals, 5:59 min): Goal, Current Month, YTD, by Line, AM/ PM Peak, Off-Peak, Wkend
	# Trains Scheduled: Month,YTD and Previous Year
	Avg. Delay Per Late Train (min): Month, YTD, Previous Year, *excluding trains canceled or terminated*
Trains over 15 Minutes Late: Goal, Current Month, YTD, Previous Year	**# Trains over 15 Minutes Late**: Goal, Current Month, YTD, Previous Year, *excluding trains canceled or terminated*
	# Trains Canceled: Current Month, YTD, Previous Year
	# Trains Terminated: Current Month, YTD, Previous Year
% Scheduled Trips Completed: Goal, Current Month, YTD, Previous Year	**% Scheduled Trips Completed**: Goal, Current Month, YTD, Previous Year
% Full Consist: Goal, Current Month, YTD, Previous Year, by Line, AM/AM REV/PM Peak, Off Peak, Wkend, System	**Consist Compliance** (*% of trains where the number of seats provided was greater than or equal to the required number of seats per loading standards*): Current Month, AM/PM/Total Peak
	Categories of Delay* -- Train Delay Incidents: Current Month, YTD, Previous Year
Events Resulting in 5 or More Late, Canceled or Terminated Trains: Date, Primary, Secondary, # Trains (L,A,T), Total, Period, Line	**Events Resulting in 10 or More Late, Canceled or Terminated Trains**: # Trains (L,C,T), Date, AM/AM REV/PM Peak, Off Peak, Wkend, Total
Standees: Monthly Daily Average, AM/PM Peak, Programmed, Additional, By Line, System Total	**Standees**: Current Month, YTD, by Line, System Wide, AM/PM Peak, Programmed and Additional
MDBF: Goal, Equipment Type, Fleet Size, Current Month, YTD, 12 Month Rolling Average, System Total	**MDBF**: Goal, Equipment Type, Fleet Size, Total Fleet, Current Month, YTD, 12 month Rolling Average, Previous Year, Fleet Total

Source: 2010 MTA Committee Books

Metro-North Railroad West of Hudson

Comparison of "Old" and "New" Performance Metrics

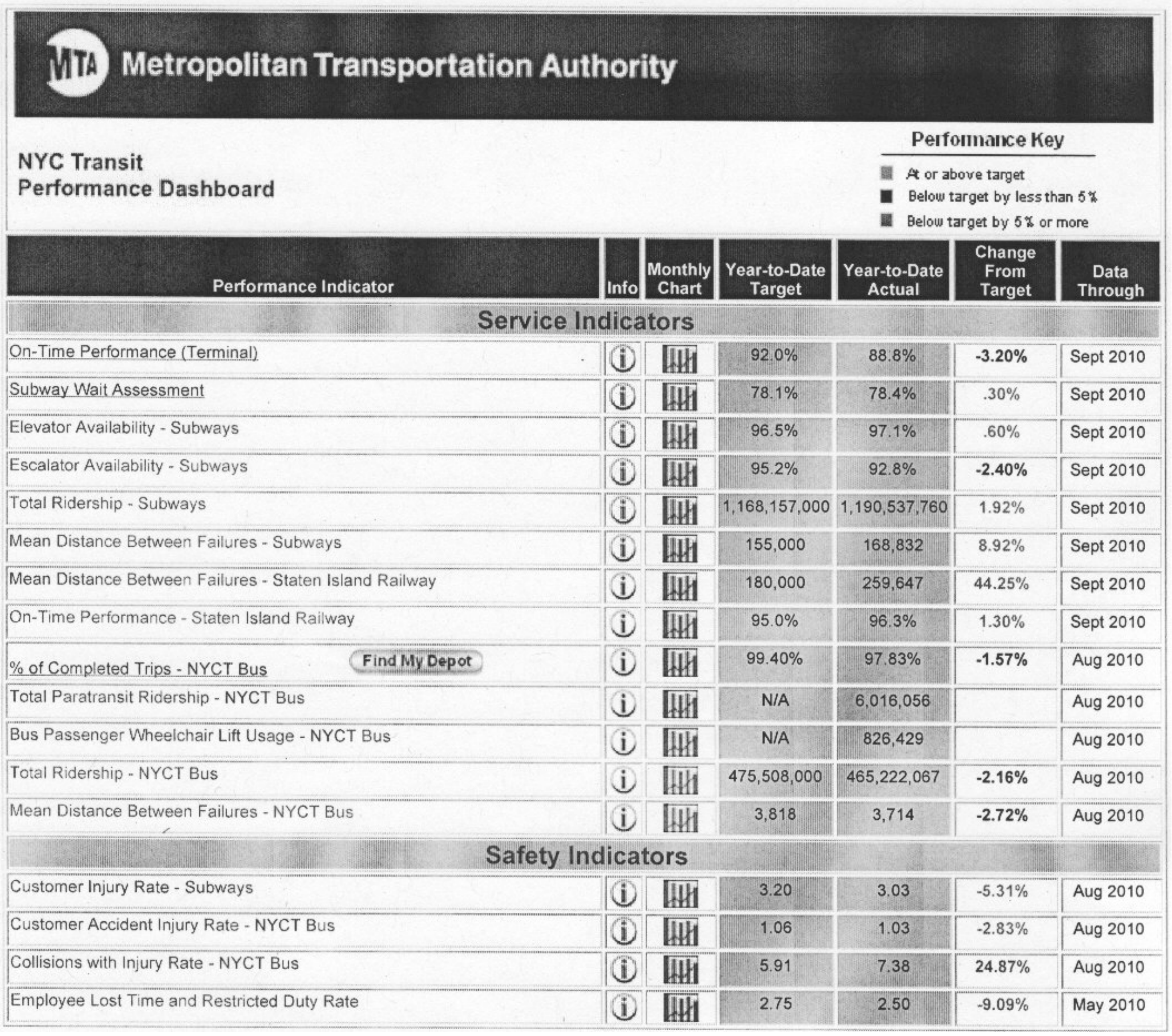
Before	September 2010
OTP (terminals, 5:59 min): Goal, Current Month, YTD, by Line, AM/ PM Peak, Off-Peak, Wkend	**OTP** (terminals, 5:59 min): Goal, Current Month, YTD, by Line, AM/ PM Peak, Off-Peak, Wkend
	# Trains Scheduled: Month,YTD and previous year
	Average Delay Per Late Train (min): Month, YTD, Previous Year, *excluding trains canceled or terminated*
Trains over 15 Minutes Late: Goal, Current Month, YTD, Previous Year	**# Trains over 15 Minutes Late**: Goal, Current Month, YTD, Previous Year, *excluding trains canceled or terminated*
	# Trains Canceled: Current Month, YTD, Previous Year
	# Trains Terminated: Current Month, YTD, Previous Year
% Scheduled Trips Completed: Goal, Current Month, YTD, Previous Year	**% of Scheduled Trips Completed**: Goal, Current Month, YTD, Previous Year
Events Resulting in 3 or More Late, Annulled, Canceled or Terminated Trains: Date, Line, # (L, A, T) and Total	**Events Resulting in 3 or More Late, Canceled or Terminated Trains**: Date, Line, AM/PM Peak, Off Peak, # (L, C, T) and Total
Standees: Monthly Daily Average, AM/PM Peak, Programmed, Additional, By Line, System Total	**Standees**: Current Month, YTD, by Line, System Wide, AM/PM Peak, Programmed and Additional

Source: 2010 MTA Committee Books

Appendix G

Examples of the MTA Website Stat Page

Appendix G



Metropolitan Transportation Authority

NYC Transit
Performance Dashboard

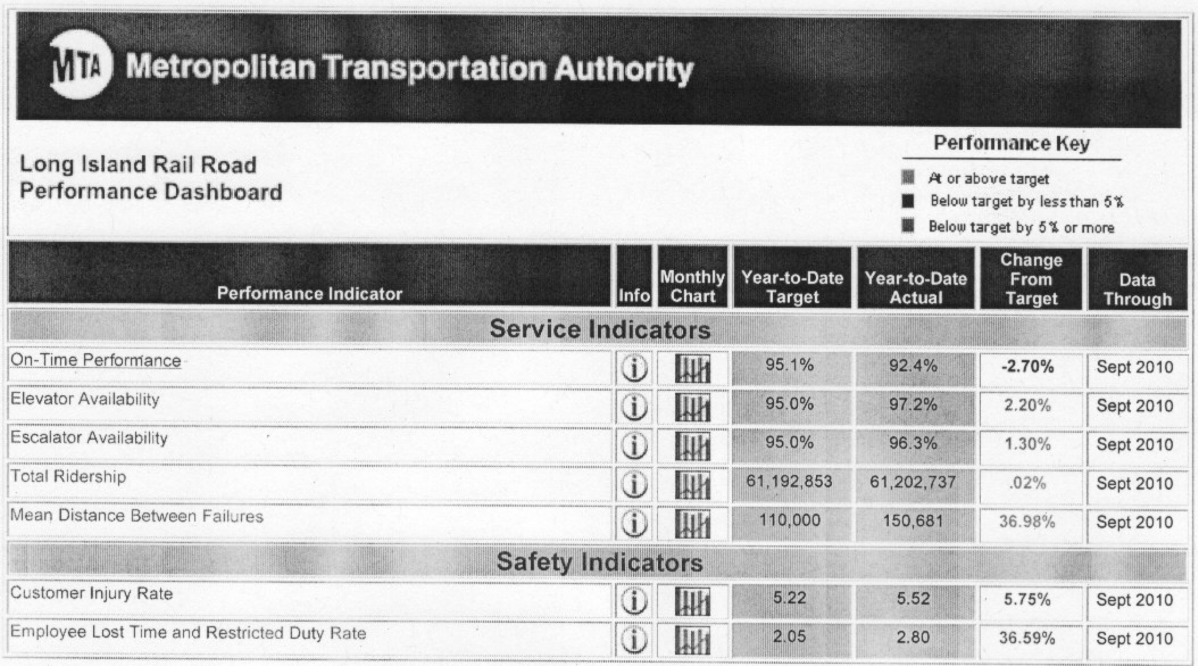
Performance Key

- ▨ At or above target
- ■ Below target by less than 5%
- ▨ Below target by 5% or more

Performance Indicator	Info	Monthly Chart	Year-to-Date Target	Year-to-Date Actual	Change From Target	Data Through
Service Indicators						
On-Time Performance (Terminal)	ⓘ	▥	92.0%	88.8%	**-3.20%**	Sept 2010
Subway Wait Assessment	ⓘ	▥	78.1%	78.4%	.30%	Sept 2010
Elevator Availability - Subways	ⓘ	▥	96.5%	97.1%	.60%	Sept 2010
Escalator Availability - Subways	ⓘ	▥	95.2%	92.8%	**-2.40%**	Sept 2010
Total Ridership - Subways	ⓘ	▥	1,168,157,000	1,190,537,760	1.92%	Sept 2010
Mean Distance Between Failures - Subways	ⓘ	▥	155,000	168,832	8.92%	Sept 2010
Mean Distance Between Failures - Staten Island Railway	ⓘ	▥	180,000	259,647	44.25%	Sept 2010
On-Time Performance - Staten Island Railway	ⓘ	▥	95.0%	96.3%	1.30%	Sept 2010
% of Completed Trips - NYCT Bus Find My Depot	ⓘ	▥	99.40%	97.83%	**-1.57%**	Aug 2010
Total Paratransit Ridership - NYCT Bus	ⓘ	▥	N/A	6,016,056		Aug 2010
Bus Passenger Wheelchair Lift Usage - NYCT Bus	ⓘ	▥	N/A	826,429		Aug 2010
Total Ridership - NYCT Bus	ⓘ	▥	475,508,000	465,222,067	**-2.16%**	Aug 2010
Mean Distance Between Failures - NYCT Bus	ⓘ	▥	3,818	3,714	**-2.72%**	Aug 2010
Safety Indicators						
Customer Injury Rate - Subways	ⓘ	▥	3.20	3.03	-5.31%	Aug 2010
Customer Accident Injury Rate - NYCT Bus	ⓘ	▥	1.06	1.03	-2.83%	Aug 2010
Collisions with Injury Rate - NYCT Bus	ⓘ	▥	5.91	7.38	24.87%	Aug 2010
Employee Lost Time and Restricted Duty Rate	ⓘ	▥	2.75	2.50	-9.09%	May 2010

Source: http://www.mta.info/persdashboard/performance14.html#

Appendix G (cont.)

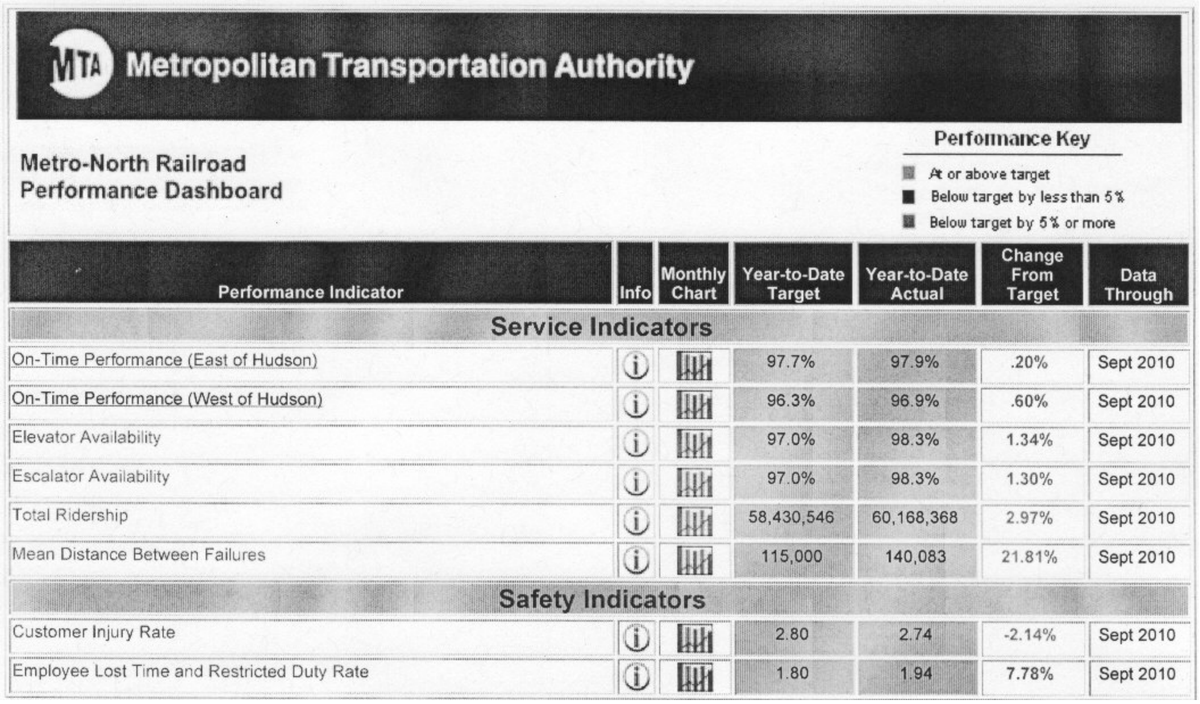


Metropolitan Transportation Authority

Long Island Rail Road
Performance Dashboard

Performance Key
- ▨ At or above target
- ■ Below target by less than 5%
- ▨ Below target by 5% or more

Performance Indicator	Info	Monthly Chart	Year-to-Date Target	Year-to-Date Actual	Change From Target	Data Through
Service Indicators						
On-Time Performance	ⓘ	📊	95.1%	92.4%	**-2.70%**	Sept 2010
Elevator Availability	ⓘ	📊	95.0%	97.2%	2.20%	Sept 2010
Escalator Availability	ⓘ	📊	95.0%	96.3%	1.30%	Sept 2010
Total Ridership	ⓘ	📊	61,192,853	61,202,737	.02%	Sept 2010
Mean Distance Between Failures	ⓘ	📊	110,000	150,681	36.98%	Sept 2010
Safety Indicators						
Customer Injury Rate	ⓘ	📊	5.22	5.52	5.75%	Sept 2010
Employee Lost Time and Restricted Duty Rate	ⓘ	📊	2.05	2.80	36.59%	Sept 2010



Metropolitan Transportation Authority

Metro-North Railroad
Performance Dashboard

Performance Key
- ▨ At or above target
- ■ Below target by less than 5%
- ▨ Below target by 5% or more

Performance Indicator	Info	Monthly Chart	Year-to-Date Target	Year-to-Date Actual	Change From Target	Data Through
Service Indicators						
On-Time Performance (East of Hudson)	ⓘ	📊	97.7%	97.9%	.20%	Sept 2010
On-Time Performance (West of Hudson)	ⓘ	📊	96.3%	96.9%	.60%	Sept 2010
Elevator Availability	ⓘ	📊	97.0%	98.3%	1.34%	Sept 2010
Escalator Availability	ⓘ	📊	97.0%	98.3%	1.30%	Sept 2010
Total Ridership	ⓘ	📊	58,430,546	60,168,368	2.97%	Sept 2010
Mean Distance Between Failures	ⓘ	📊	115,000	140,083	21.81%	Sept 2010
Safety Indicators						
Customer Injury Rate	ⓘ	📊	2.80	2.74	-2.14%	Sept 2010
Employee Lost Time and Restricted Duty Rate	ⓘ	📊	1.80	1.94	7.78%	Sept 2010

Source: http://www.mta.info/persdashboard/performance14.html#

Appendix H

Description of Major Transit Agencies Reviewed

Appendix H
Description of Major Transit Agencies Reviewed

PCAC looked at the following transit agencies and their performance metrics on their websites for a comparison to those presented by MTA's operating agencies:

BART
In San Francisco, California, Bay Area Rapid Transit (BART) operates five lines on 104 miles of track with 43 stations in four counties. It is the fifth- busiest heavy-rail transit system in the United States and carries an average ridership of 350,000 passengers.

Caltrain
California's commuter rail line, Caltrain, runs on the San Francisco Peninsula and in the Santa Clara Valley in the United States. It is currently operated under contract by Amtrak and funded jointly by the City and County of San Francisco, San Mateo County Transit District and Santa Clara Valley Transportation Authority. Average weekday ridership in February 2008 was 36,993. Caltrain operates 98 weekday trains between San Francisco and San Jose, with commute-hour service to Gilroy.

Chicago Transit Authority
CTA, the Chicago Transit Authority, operates the mass transit within the city of Chicago and Illinois. In 2009, CTA provided a total of 521.2 million rides. CTA operates 24 hours each day and on an average weekday provides 1.7 million rides on buses and trains. Buses operate over 154 routes traveling along 2,273 route miles providing one million passengers service. CTA's trains operate over 8 routes and 222 miles of track and provide an average of 650,000 customer trips each day.

Metra
The Northeast Illinois Regional Commuter Railroad Corporation, Metra, is a suburban rail system that serves the city of Chicago and surrounding suburbs. The railroad serves 240 stations on 11 different rail lines across the Regional Transportation Authority's six-county service area, providing over 80 million rides annually.

MBTA
The Massachusetts Bay Transportation Authority (MBTA) operates most bus, subway, commuter rail and ferry systems in the greater Boston area. In 2008, the system averaged 1.3 million passenger trips each weekday, of which the subway averaged 598,200, making it the fourth busiest subway system in the U.S. In 2009, MBTA was placed within the administrative authority of the Massachusetts Department of Transportation (Mass DOT).

NJ TRANSIT
In New Jersey, NJ TRANSIT runs the nation's largest statewide public transportation system providing more than 761,000 daily trips on 238 bus routes, two light rails and 12 commuter rail lines. It is the third largest transit system in the country linking major points in New Jersey, New York and Philadelphia.

Société de Transport de Montréal (STM)
The public transportation system of Montreal, STM, provides 364 million trips per year or 1.3 million trips on average each day of the week, which accounts for 85% of all public transit trips in Québec. The bus fleet consists of almost 1,600 buses plus 93 adapted transport minibuses. The Métro network consists of four lines, 68 stations and 759 cars. The Montréal Métro was the first in the world to run entirely on tires.

Washington Metropolitan Area Transit Authority WMATA
WMATA operates transit service in the Washington, D.C. metropolitan area, including the Washington Metrorail and Metrobus. The rapid transit services and is jointly funded by the District of Columbia, Virginia and Maryland. In 2009, the Metrobus had an average ridership count of 450,000 and the Metrorail had an average weekday passenger boarding count of 747,500 passengers in its 86 stations.

Transport for London (TfL)
TfL was created in 2000 and is the integrated body responsible for the London's transport system. Its main role is to implement the Mayor's Transport Strategy for London and manage transport services across the Capital for which the Mayor has responsibility, specific to this study:

- London Buses
  London Buses is responsible for managing one of the largest bus networks in the world, with more than 8,000 buses in the fleet serving 700 routes. It is also responsible for 50 bus stations (35 of them staffed), eight bus garages, 19,000 bus stops and other support services. The network has a weekday ridership of 6 million.
- London Underground
  The Underground is one of the world's most famous metro systems and is responsible for more than 3.5 million passenger journeys a day. It has 11 lines covering 402km and serving 270 stations. During peak hours, more than 500 trains are in operation. More than one billion passenger journeys were made on the Tube in 2009/10.
- London Overground
  On 11 November 2007, TfL took over the management of the four rail services in Inner London under the moniker London Overground. It has since added another service bringing the number of lines to five. It consists of 78 stations

with an approximate daily ridership of 30,000. The services TfL inherited were somewhat run down and neglected. Since that time TfL introduced a brand new fleet of 54 trains specifically designed for London Overground. The trains have a number of passenger benefits, including more capacity, air conditioning, audio and visual announcements and CCTV, which is monitored by the driver.