The Changing Face of Transit:

A Worldwide Survey of Transportation Agency Practices

February 2001

New York City Transit

Lawrence G. Reuter
President

PART ONE:

FARE SALES AND COLLECTION

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PREFACE

This report, issued by MTA New York City Transit's (NYC Transit) Office of Management and Budget, covers research conducted in the years 2000 and 2001.

In the Fall of 2000, NYC Transit surveyed metros from around the world under the auspices of CoMET, the Committee of Major Metros. CoMET provides a forum for the nine participating large international transit agencies (Berlin, Hong Kong, London, Mexico City, Moscow, New York, Paris, São Paulo, and Tokyo) to share information and compare practices. This networking project questionnaire was based on the CoMET goal of gathering and sharing information on peer practices and experiences.

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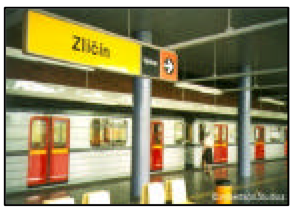
MTA New York City Transit

Technology has reinvented the way the world conducts its business, and the transit industry is no exception. Transit agencies around the world are striving to use technology to develop better ways of doing business and improve their customers' travel experience. This paper is intended to assess the state of the practice in three areas: fare sales and collection, automatic train supervision, and station personnel practices.

Introduction

In the Fall of 2000, MTA New York City (NYC Transit) surveyed metros from around the world about fare sales and collection, automatic train supervision, and station personnel practices. These issues reflect three areas of change in transit operations that are of interest to NYC Transit and other agencies.



In examining these three topics, NYC Transit intended to increase its knowledge base, and also had three broader objectives in mind:

- Focus on practices as a means to illustrate how transit agencies throughout the world address basic operational issues.
- Promote sharing of information on an international basis.
- Provide a model for future work on transit industry practices. The approach undertaken here is similar to the Transit Cooperative Research Program's (TCRP) "Synthesis of Practices" in the United States, which is an excellent prototype for presenting research on practical issues of interest to the transit industry.

Topics Addressed

The topics addressed were chosen because they address primary concerns of customers and are areas where advances in transit practices have led to improved service provision.

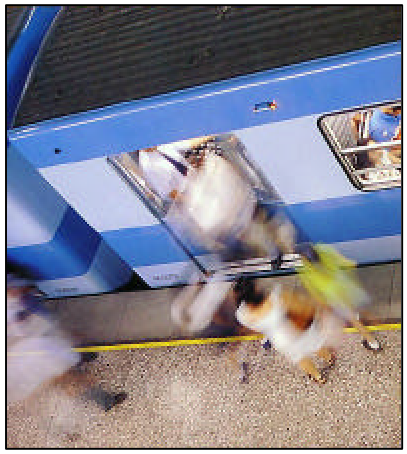
Fare sales addresses convenience, speed of access to service, and affects the range of products available. Innovations in fare sales collection technology have altered the transit functions in these key areas:

- Easier and more tailored purchases by customers due to advanced ticket sales and diverse payment options.
- Improved passenger flow due to introduction of smart, swipe and contactless cards.

- Integration of transit services offered by more than one transit agency resulting from unified fare systems.

- Improved transit service management, making use of data collected from fare sales and collection (possibly in conjunction with ATS technologies).

- Lower costs for fare collection.



Automatic Train Supervision (ATS) helps to provide reliable service by enabling transit agencies to pro-actively manage service, reducing the number and duration of delays and increasing speed and re-liability. ATS also gives agencies the ability to provide real-time passenger information allowing customers to plan and control their trip.

Two major advances in transit technology made up ATS systems:[1]

- Implementation of ATS technology varies widely from reporting the location of trains to a central control center where dispatchers make manual adjustments to service, to a complex computerized system that automatically controls train movement. This integration of various systems on and off vehicles can lead to more reliable service.

- Use of the same real-time data, along with new and established delivery mechanisms and train trip analysis software, to provide improved passenger information services.

Station personnel addresses the provision of high-quality customer service, as they are the public face of any transit agency. Key station personnel issues include:

- The role of agency and/or contracting personnel.
- Levels of station staffing.
- The discrete or combined role of station staff in performing ticket sales, customer assistance, cleaning, train crew assistance, and safety and security.

Research Efforts

In August 2000, NYC Transit surveyed 88 metros and high capacity commuter rails agen-cies around the world to evaluate areas of rapid change in transit industry practices. The survey covered the aforementioned topics of fare sales and collection, ATS, and station personnel (copies of the questionnaires are attached). NYC Transit also conducted a literature search on issues associated with these topics that can be found in each section of the report.

As shown in Table 1, 33 agencies, primarily metros and commuter rail agencies from the United States, Canada, Europe and Japan, have responded to the questionnaire. Of these, 25 reported on fare sales and collection, 29 reported on ATS systems, and 33 reported on station personnel issues. To provide context for the study findings, a brief profile of each agency is provided in Appendix A and more detailed subject summaries are provided in each chapter.

[1] Transit ITS Compendium, Institute of Transportation Engineers, Washington DC. April 1997

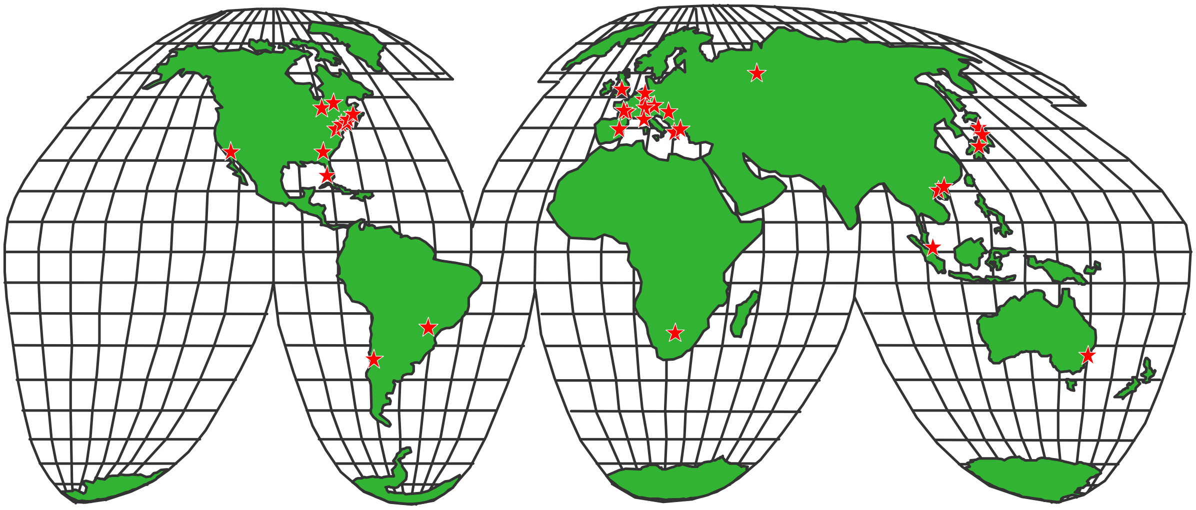


Table 1
Questionnaire Respondents

City	Service Provided
Berlin, Germany	Metro
Hong Kong, China (MTR)	Metro
London, England	Metro
Moscow, Russia	Metro
New York, New York, USA	Metro
Paris, France (RATP)	Metro
Paris, France (RER)	Metro/Commuter Rail
São Paulo, Brazil	Metro
Tokyo, Japan	Metro
Athens, Greece (Attiko Metro)	Metro
Athens, Greece (ISAP)	Metro
Atlanta, Georgia, USA	Metro
Baltimore, Maryland, USA	Metro
Barcelona, Spain	Metro
Boston, Massachusetts, USA	Metro
Budapest, Hungary	Metro
Hamburg, Germany	Metro
Jersey City, New Jersey, USA (PATH)	Metro
Los Angeles, California, USA	Metro
Miami, Florida, USA	Metro
Milan, Italy	Metro
Montreal, Canada	Metro
Munich, Germany	Metro
Nagoya, Japan	Metro
Prague, Czech Republic	Metro
Santiago, Chile	Metro
Singapore	Metro
Toronto, Canada	Metro
Washington, D.C., USA	Metro
Hong Kong, China (KCRC)	Commuter Rail
Johannesburg, South Africa	Commuter Rail
Osaka, Japan	Commuter Rail
Sydney, Australia	Commuter Rail

Summary of Findings

The following is an overview of survey findings. Detailed findings are presented in Part One "Fare Sales and Collection," Part Two "Automatic Train Supervision," and Part Three "Station Personnel." Individual agency responses to the surveys are provided in Appendices B, C, and D.

Fare Sales and Collection

Metros throughout the world are utilizing new technologies to improve their fare sales and collection systems and move from a cash-based, single ticket fare structure to a cashless environment with greater convenience and more options for customers. To increase

convenience for customers and reduce costs, some metros are now accepting credit cards and debit cards for ticket payment, and use of vending machines for ticket sales has become standard practice. Expanded use of smart cards and contactless cards enable transit agencies to offer many more ticket plans, including time-based passes and tickets with discounts. Many agencies are recognizing the convenience for customers of using fare cards for all transit agencies within a region, and to expand the use of fare cards for a variety of services (e.g., retail purchases, banking).

Ridership data from fare sales and collection systems is an important piece of transit agencies' data collection programs. Many agencies are using this data to speed fare sales, reduce transaction times, and adjust service levels.

Fare Sales Methods

- <u>Tickets/Plans</u>: The most common fare options are single fare tickets and monthly passes (each offered by 19 respondents).

  Passes for a specific number of days less than one week, multi-ride tickets with or without discounts, and annual or one-week passes are also popular among respondents. Additionally, most agencies offer discount fares for students and seniors.

- <u>Technology</u>: More agencies use paper tickets than any other type. Magnetic swipe cards, contactless cards, and insert and return ("dipping") cards are each used by less than half of respondents.

- <u>Operations</u>: All 23 respondents accept cash; a minority also accepts credit cards and/or debit cards. Credit and debit card usage ranges from less than 1% of sales (Hong Kong and Toronto) to 17% for each type of card in Paris. The most common fare sales locations are clerks in stations, merchants and vending machines. Other, less common fare sales locations include mail, on vehicle, invoice, bank machines (ATMs), ticket offices outside metro stations, corporate sales, and a mobile ticket office.

Vending Machines

- Scope: Most agencies use vending machines as part of their overall fare sales program. Most provide vending machines in all stations, and utilize two or more types of machines. Tokyo and Nagoya use vending machines as their only fare sales method in stations. Most agencies only provide vending machines outside the fare barrier (in the "unpaid" area of the station); five agencies provide vending machines both inside and outside the fare barrier.

- Ticket Plans and Payment Options: The most common fare option sold at vending machines is single fare tickets. Unlimited-ride passes of varying durations, and multi-ride tickets with or without discounts, are commonly sold. All respondents' vending machines accept cash, and a small number accept credit cards and/or debit cards. Most agency vending machines only dispense new cards; a small number also refill existing cards. New York, Paris, and Washington, D.C. reported various activities to control fraud associated with the use of credit cards in vending machines.

- Operations: Vending machines are heavily used by customers, with a median response of 350 daily transactions per machine. Few agencies report either target or average transaction times; responses for target transaction times range from two seconds to 60 seconds, and responses for average transaction times range from two seconds to 50 seconds. Similarly, few agencies report either target or average repair or downtime; for target downtime ranges from 0.5 hours to 24 hours, and responses for average downtime ranges from 0.3 hours to 24 hours.

Smart Cards

European and Asian transit agencies are generally ahead of North American transit agencies in their use of smart cards. Smart cards contain a microprocessor in addition to electronically erasable programmable memory and read-only memory, and are capable of being recoded with new or revised information when going through a fare gate. Use of smart cards enables transit agencies to work with private companies in offering multi-purpose cards, usable for both transit services and payments at merchants.

- Benefits of Smart Cards: Smart cards offer benefits for customers (easier purchase of tickets, a broader range of ticketing options) and management (improved information on customer travel patterns, greater revenue protection) while reducing expenses for operations and maintenance.

- "Open" or "Closed" Environment: An open environment refers to customers being able to use their smart card for more than one transit agency within a region, or for both transit fares and purchases at local merchants. Respondents recognize that an open environment is a key element in determining the success of a smart card program. Nine of ten respondents utilize their smart cards for all transit agencies within a region, and ten of eleven respondents report that customers can use their smart cards not only to pay transit fares but for a variety of services (e.g., retail purchases, banking).

Contactless Cards

- Fare Sales: Twelve of 22 agencies report that they use or will use contactless cards for fare sales. They were introduced as early as 1997, and all agencies who plan to use contactless cards will have them in place by 2003. Contactless cards are used to sell virtually every type of fare option.

- Conversion from Magnetic Stripe System: Six respondents are converting from magnetic swipe cards to contactless cards. The primary benefits of this conversion are reduced fraud, reduced processing costs, and an enhanced ability to add new features. Key issues associated with conversion include using appropriate levels of technology and the importance of public support for the new system. Paris reported operating and maintenance cost savings associated with the conversion to contactless cards.

- Technology: Contactless cards do not have to physically touch the reader to be read as "valid;" the range of distance at which cards can be read ranges from one to ten centimeters (0.4 to four inches). Cards can be read while contained in a wallet, purse or pocket. Three agencies include their contactless card circuitry within a watch.

- Customer Reaction: Five respondents report that contactless cards have improved passenger flow in stations. Six respondents report positive customer reaction to contactless cards.

Data Collection and Analysis

- Capabilities: Many respondents obtain ridership data from their fare sales and collection systems. The most common data from fare sales and collection are total ridership and ridership by line and time period.

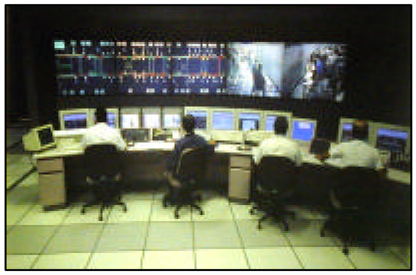
- Benefits: Twenty-two respondents utilize data from their fare sales and collection system to speed fare sales and reduce transaction times. Twenty respondents utilize this data to adjust levels of service.

Automatic Train Supervision (ATS)

ATS is a proven technology that is being used by transit agencies around the world to better operate and manage their transportation networks. Most agencies have ATS technology either on new construction such as Washington DC or on retrofitted lines including those in Paris, Berlin, and Moscow.

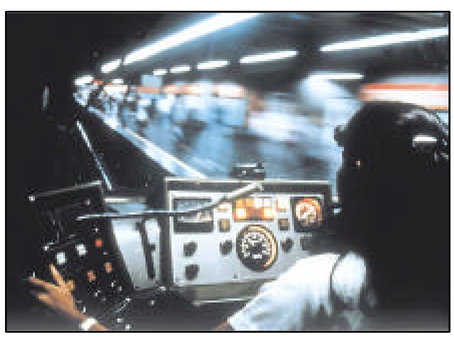
ATS can be used to increase a transit system's ability to adhere to schedule, improve customer service, and reduce operating costs. ATS also allows for the provision of real-time train service information to passengers.

Implementation



Implementation of ATS systems is a major time and capital investment for transit agencies. While some transit agencies have implemented ATS simultaneously on all lines, others have installed ATS incrementally, sometimes over decades. Gains associated with ATS depend on the age and capacity of previous communications and rail switching technology. Many metros have put in new ATS systems when rehabilitating old lines. Because old systems can be intermixed with new, transit agencies can upgrade gradually as funds become available.

- Implementation Scope: Experiences with ATS installation are diverse ranging in year of installation from the 1960's to today and from partial installations to full scale replacement of older systems. Survey findings indicate systems built since the 1960's have been built with various levels of ATS capabilities, and that ATS retrofits on older systems have generally been installed line by line as extensions or equipment replacement have occurred. Three-fourths of survey respondents have fully implemented ATS. Athens (Attiko, the new portion of the Athens metro system) installed an ATS system on newly constructed right-of-way in 1999. Berlin will complete a staged upgrading of its entire system to include ATS in 2001.



- Installation and Conversion: Most respondents had few or no problems with the installation or conversion to an ATS system. While it is often assumed that installation of ATS system will decrease the need for dispatching staff, most agencies converting to ATS from an older system retrained dispatchers and increased analyst and computer technician staff. Variations in technology, differences in definition of cost, and extent and period of installation lead to highly varied costs associated with installation, operation, and maintenance.

Technology

- Hardware: Agencies surveyed feature a variety of ATS systems, from the simple to complex and from very old to very new technology. ATS systems vary widely from reporting the location of trains to a central control center where dispatchers make manual adjustments to service, to a complex computerized system that automatically controls train movement.

  The use of fixed or moving block signal system affects the functionality of an ATS system. Most agencies use a fixed-block signal system. A smaller number use a hybrid of a fixed and moving block system. A greater variety of ATS operations are available to hybrid systems. Metros using hybrid systems are Hong Kong MTR, Paris RER, and Santiago. No agencies reported sole use of moving block technology. All agencies employed back-up systems in case of system failure.

- Software: Train movement analysis software is becoming widely used to provide real-time dispatching suggestions, take automatic control of various dispatching options, and provide post operation analysis. Software can also monitor trains and sound an alarm if trains operate outside of given parameters. Newer systems have software that indicates rule violations and transmits schedule or maintenance and diagnostic information. No standardization of ATS software vendors was evidenced.

Console display technology varies and includes workstation monitors and overhead screens, while capabilities ranged from audio and visual communications to scheduling and fire protection.

Data Collection and Analysis

- Capabilities: Post operations analysis of data is practiced at most agencies, though complex analysis of the system is often not performed by agencies with older or partial ATS systems. Issues examined include key operational components such as terminal on time departure, delays, and station dwell time.
- Benefits: ATS has enabled most agencies to improve service provision. Most responding agencies indicated with ATS they can more quickly identifying service delays and have reduced the impact and duration of delays. Over half of respondents also reported creating more efficient schedules and better utilization of resources as a result of ATS implementation.

Real-Time Passenger Information

Digital signage and maps are often the first choice for presenting information in metros. They allow passengers continuous access to information. In addition, using display media for advertising purposes can generate revenue.

Sound is also a common informational medium. Advances in station acoustical design have been employed by many agencies. Stations designed for audio announcements tend to provide the least acoustical distortion.[2] For example, on Tokyo's newest Namaboku line music is used to announce arrivals and departures, and verbal messages are kept to a minimum to create a peaceful atmosphere.

- Capabilities: Most agencies with ATS also provide real-time passenger information to customers. The most common display techniques are digital signs and audio announcements. Schematic display or maps, and closed circuit television (CCTV) displays are also used. Most agencies make efforts to accommodate disabled passengers needs in this area. The most common information provided to customers includes train destination, time to next train, and public service announcements (e.g., "please ride safely").

Station Personnel

Metro station personnel traditionally provide ticket sales, customer assistance, cleaning and maintenance, train crew assistance, and safety and security monitoring. Most metros do not assign station staff exclusively in one place, but utilize a mix of fixed personnel and personnel who move freely throughout the station. In addition, many metros use part-time staff persons or multi-tasking (utilizing

[2] "A New Generation of Information Systems," van Kemenade, Teis, *Passenger Rail Management*, January 1999. p. 26.

staff for varied functions), as a way to provide new and important functions. These uses of personnel enable metros to focus more on providing customer assistance and addressing safety and security concerns. Use of contractors for cleaning and other basic functions is standard industry practice.

Station Staffing

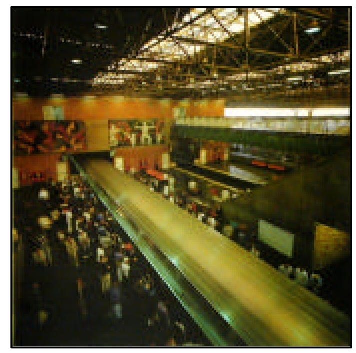
Respondents reported a wide range of the number of personnel in stations, from some reporting no personnel assigned solely to stations to others with extensive station personnel for numerous functions. Ten agencies report using part-time staff for station functions. The most common uses of part-time personnel are ticket sales (eight agencies) and cleaning or customer assistance (three agencies each).

Agency and/or Contracting Personnel

Contracting out for station functions is common among respondents to the survey. Cleaning is the most commonly contracted task. Station maintenance and additional security are completely or partially contracted out by half of survey respondents. Less commonly contracted tasks include ticket sales and fare inspection. Most agencies reassigned or retrained personnel whose functions were eliminated or contracted out. There does not appear to be a pattern among agencies in deciding whether to utilize agency staff or contractors for station functions.

- Multi-Tasking: Twelve agencies report that their station staff perform multiple tasks. There is little commonality of which assignments are multi-tasked among the respondents, except for customer assistance, which is multi-tasked by eight agencies.

- Station Staff Location Assignment: The most common assignments of station personnel are in the station lobby/ mezzanine, 80% of respondents, and to move freely throughout the station, 75% of respondents. Most agencies do not assign station staff exclusively in one place, but instead include a mix of fixed personnel and personnel who move freely throughout the station.



Ticket Sales

- Ticket Sale Capabilities: Most agencies, 26 of 30 respondents, utilize staff in stations to sell tickets. All agencies accept cash for ticket sales, and less than one-half accept credit or debit cards.

- Transaction Time: Few agencies report either target or average times for either sales staff transactions or waiting in queue for transactions.

Customer Assistance

- Assistance Capabilities: All 31 responding agencies provide extensive station personnel assistance to customers. Virtually all respondents provide written information and answer questions concerning routes and schedules. Many respondents also issue refunds to passengers, respond to incidents such as trains with mechanical problems, and provide medical assistance.

Cleaning and Maintenance

- Cleaning: All respondents sweep, mop, pick up litter and remove garbage on a regular basis (usually at least once daily). Most respondents also perform mechanized floor and wall cleaning, and graffiti removal. Most respondents do not clean trains in stations.

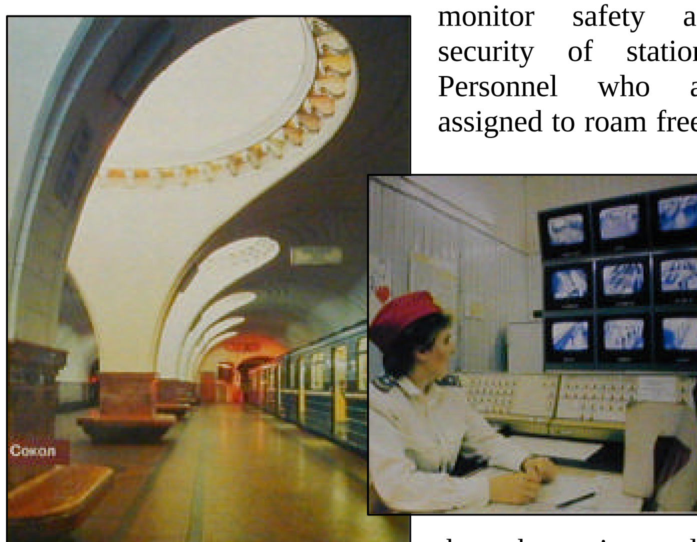
- Maintenance: More agencies perform maintenance of fare vending machines and gates than other types of equipment. Other common maintenance tasks include lights (half of respondents) and signs, maps, masonry and banisters (40% of respondents). These findings are consistent with the earlier finding that more than half of agencies surveyed contract out at least a portion of their station maintenance. Hong Kong MTR provides more maintainers than any other respondent for fare vending machines, both in total and on a machine-per-staff basis.

Train Crew Assistance

Sixteen of 29 respondents report that they utilize station personnel to assist train crews. All sixteen agencies utilize their personnel to control passenger flow, while thirteen also utilize their station personnel to dispatch trains. Other, less common, forms of assistance include closing off certain cars on a train during off-hours and minor car repairs.

Safety and Security

Most respondents utilize station personnel (agency police or other station staff) to monitor safety and security of stations. Personnel who are assigned to roam freely



through stations play an essential role in monitoring safety and security. Most respondents report that station staff monitor video cameras or other surveillance equipment as part of their normal duties. Station personnel also play an important role in eliminating safety hazards (e.g., tripping hazards and equipment in need of repair) and in assisting customers during emergency evacuations.

FARE SALES AND COLLECTION

Introduction

Transit agencies throughout the world are utilizing new technologies to improve their fare sales and collection systems. Implementation of these new systems will result in more convenient fare purchase options for customers. The new systems can provide important passenger flow data and can save on labor costs. Many transit agencies already utilize some type of fare card technology. Agencies that currently use fare cards, as well as those agencies that are still in the planning and development stage, are in a position to learn from each other's experiences.

European and Asian transit agencies are generally ahead of North American transit agencies in their use of smart cards. Smart cards are capable of being recoded with new or revised information when going through a fare gate. Smart cards can either be contact or contactless in nature. Use of smart cards enables transit agencies to work with private companies in offering multi-purpose cards, usable for both transit services and merchant purchases.

Vending machines and other points of sale, such as the internet and local merchants, allow transit agencies to increase customer convenience. In many cities, transit agencies offer a wide variety of fare options, including single and multi-ride tickets/passes, unlimited-ride passes for different time periods, and discount fares to various groups including students and seniors.

Modern, technology-based fare collection systems enable transit agencies to collect more data about their riders than ever before. Many modern fare collection systems allow transit agencies to categorize riders by line, time period, and station, and to determine the travel time and path of individual riders as well. This information can then be utilized to provide better service to riders, by taking steps to speed fare sales and adjusting levels of metro service in response to ridership patterns.

Overview of Topics Covered

Modern fare sales and collection systems offer transit agencies both an opportunity (to improve service to customers by offering more convenient options) and a challenge (to install systems that are simple to use and easy to maintain). Transit agencies worldwide are learning more about new fare sales technologies, particularly smart cards and contactless cards. Major fare sales and collection issues reviewed in this report include:

- Overview of fare sales methods, including the types of fare options sold (e.g., time-based passes, multi-ride or single-ride tickets) and points of sale such as the internet and merchants.
- Use of vending machines for fare sales, including the types of fare options sold, types of payment accepted, location of vending machines within metro stations, and key vending machine maintenance and operational issues.
- Use of smart cards and contactless cards, including their applicability across modes and for both transit and non-transit purposes (referred to as an "electronic purse" card or an "open" environment), and type of technology used (e.g., swipe card, contactless card or combination).
- Data collection from fare sales and collection, including the type and source of the data (examples of type include ridership by time period and passenger entries/exits by station), use of data to improve transit service, and privacy issues.

Types of Fare Cards and Their Capabilities

Fare sales and collection has been a feature of urban rail transit from the earliest days. Its function is to provide the means by which riders purchase fares and transit operators collect revenue from riders. Historically, this was done through the use of two groups of personnel, one group dedicated to selling tickets and one group dedicated to collecting the tickets. The introduction of mechanical coin or token-operated turnstiles in the 1920's eliminated the need for staff-based fare collection.

A number of transit agencies have moved beyond coins or tokens to Electronic Fare Payment (EFP) systems that involve use of fare cards. While some transit agencies have implemented magnetic stripe fare cards, two more modern types of fare cards are either in use or in development at a growing number of transit agencies:[1]

- **Smart Cards** contain a microprocessor in addition to electronically erasable programmable memory and read-only memory. The programmable memory can be used for storing information on the cash content of the card and use history, while the read-only memory stores the operating program and card identification data. While some pre-paid memory-only cards are sometimes called smart cards, the true smart card is essentially one that has its own microchip and can be used for multiple applications.[2] Swipe-based telephone cards also use smart card technology.
- **Contactless Cards**, also known as proximity cards, are the cutting edge of fare card technology. Proximity cards utilize an induction coil in the read-write unit to generate a radio frequency magnetic field that couples to another induction coil embedded in the card. The distance between card and read-write systems over which proximity card systems can work is primarily limited by the amount of energy in the magnetic field, but is generally limited to one foot.

Proximity cards have been more commonly used for identification purposes (e.g., to obtain access to a building). In this application, proximity cards simply identify their presence in the vicinity of a card reading unit. These cards need only contain circuitry capable of generating a single message when interrogated.

The use of proximity cards as transit passes is more recent and more limited. While a number of European and Asian transit operators are testing proximity cards, no transit operator has fully converted to their use.

- Hong Kong's Creative Star system is among the largest application of smart cards by transit operators. Creative Star became operational in 1997 on six suburban rail, metro, bus and ferry systems, and is handling four million transactions every day.[3] This kind of smart card is called a "closed" purse system because the stored value can be used to buy transit services only.
- The "Calypso" project, a demonstration effort in four European cities (Konstanz, Germany; Lisbon, Portugal; Paris, France; and Venice Italy), is testing the use of contactless smart cards for both transit payment and electronic purse capabilities.[4,5] The cards can be used for payment for public

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1 "Transit Intelligent Transportation Systems Electronic Fare Payment Systems," <http://www.fta.dot.gov/research/ fleet/its/efp.htm>(June 23, 2000).
2 "Riders Respond to a Fare Deal," *Railway Age*, May 1998, pages 55-58.
3 Ibid.
4 "The Calypso Project: Venice Demonstration," <http://194.7.159.227/GEDdata/2000/07/17/00000002/ venice.htm>(August 10, 2000).

transport, parking, payment for goods and services to local retailers, admission to certain museums, and access to university libraries and services. This kind of smart card is call an "open" purse system because the stored value can be used to buy both transit services and non-transit items and services.

Other demonstration efforts with contactless smart cards are underway in Singapore, Berlin and London. In the United States, Chicago, San Francisco, and Washington are testing or planning to test contactless smart cards over the next year.[6]

Research Efforts

In August of 2000, NYC Transit surveyed 88 metros and high capacity commuter rail agencies around the world to evaluate the role and value of fare sales and collection systems. The survey covered general information about fare sales methods, including fare sales over the internet and through merchants, use of vending machines for fare sales, use of smart cards and contactless cards, and data collection from fare sales and collection (See Appendix B for questions and tabulation of responses). As shown in Table III-1, 25 agencies, primarily metros and commuter rail agencies from the Americas, Europe and Japan, have responded to the questionnaire.

NYC Transit also conducted a literature search of issues associated with fare sales and collection. An extensive survey of materials published by the American Public Transportation Association (APTA), the Union Internationale des Transports Publics (UITP), and numerous transportation-related journals showed a wealth of information on smart card and contactless card technologies. However, there is little or no published information on fare sales methods, use of vending machines for fare sales, and data collection from fare sales and collection.

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5 "Proceedings of the Fifth International Conference on Automatic Fare Collection," Union Internationale des Transports Publics (UITP), February 2-4, 2000.

6 "Contactless Farecards 'Swipe' Across Continents," American Public Transportation Association (APTA) website, downloaded June 23, 2000.

Table III-1
Questionnaire Respondents

City	Service Provided
Berlin, Germany	Metro
Hong Kong, China (MTR)	Metro
Moscow, Russia	Metro
New York, New York, USA	Metro
Paris, France (RATP and RER)	Metro/Commuter Rail
São Paulo, Brazil	Metro
Tokyo, Japan	Metro
Athens, Greece (Attiko Metro)	Metro
Athens, Greece (ISAP)	Metro
Barcelona, Spain	Metro
Boston, Massachusetts, USA	Metro
Budapest, Hungary	Metro
Jersey City, New Jersey, USA (PATH)	Metro
Milan, Italy	Metro
Montreal, Canada	Metro
Nagoya, Japan	Metro
Prague, Czech Republic	Metro
Santiago, Chile	Metro
Singapore	Metro
Toronto, Canada	Metro
Washington, D.C., USA	Metro
Hong Kong, China (KCRC)	Commuter Rail
Johannesburg, South Africa	Commuter Rail
Osaka, Japan	Commuter Rail
Sydney, Australia	Commuter Rail

The objective of this research effort has been to highlight key aspects of fare sales and collection systems such as fare sales methods, including fare sales over the internet and through merchants, use of vending machines for fare sales, use of smart cards and contactless cards, and data collection and their applications from fare sales and collection. These issues are of particular importance to NYC Transit as it considers the next generation of its fare sales and collection systems.

Findings: Summary of Responses

Fare Sales Methods

Tickets/Plans

Transit agencies offer a wide variety of fare options. NYC Transit, for example, offers a monthly (30-day) pass, weekly (seven-day) pass, one-day pass, multi-ride cards with or without discount (the availability of the discount depends on the value purchased), single fare cards, single fare tokens, and cash admission (on bus only). Students and seniors/disabled persons are eligible for discounted fares. In addition, certain government employees are able to purchase an annual pass.

The survey showed that a small number of fare options are by far the most common:

- <u>Most Common Fare Options</u>: The most common fare options are single fare tickets and monthly passes (19 respondents each). Fourteen respondents offer passes for a specific number of days less than one week, 12 respondents each offer multi-ride tickets with or without discounts, and 11 respondents offer annual and one-week passes.

- <u>Least Common Fare Options</u>: The least common fare options are peak hour pricing (one respondent), and either single fare tokens or two-week passes (two respondents each).

- <u>Student/Senior Discounts</u>: Most agencies also offer discount fares for students (14 respondents) and seniors (12 respondents).

Different agency relies on a different mix of fare options. Some agencies in different countries rely on similar mixes of fare options for most of their total sales.

- Tokyo, Nagoya, Budapest, and Montreal rely heavily on monthly passes and single fare tickets. Montreal relies on these two types of fare options than the other cities, with larger sales of weekly passes and cash admissions.

- Paris and Toronto get more sales from monthly passes and multi-ride tickets than from other sources. Paris sells far more multi-ride tickets without discount, while all of Toronto's multi-ride tickets offer discounts.

- São Paulo, Barcelona, Singapore, and Hong Kong KCRC rely almost exclusively on single fare tickets and multi-ride tickets without discount.

- Moscow, Prague, and Washington, D.C. heavily use single fare tickets and multi-ride tickets (Moscow both with and without discount, Prague and Washington without discount). Prague also sells a lot of annual and monthly passes, while Washington uses cash admissions for a modest number of total sales.

Technology

In terms of fare collection technology, more agencies (14) report using paper tickets than any other type. Magnetic swipe cards are used by 11 agencies, insert and return ("dipping") cards are used by seven agencies, and five agencies each report using contactless cards or tokens.

Operations

Customers pay for fares via cash, credit card, debit card or other forms of payment. All 23 agencies responding to the question about types of payment accepted report that they accept cash; New York, Paris, Prague, Singapore, and Toronto are the only agencies where cash accounts for less than 90% of total sales. A small number of agencies accept credit cards (eight respondents) and debit cards (five respondents), with usage ranging from less than 1% for each type of card in Hong Kong and Toronto to 17% for each type of card in Paris. Other, less common forms of payment include checks, invoices and bank transfers.

The most common fare sales locations are clerks in stations (21 respondents), and either merchants or vending machines (15 respondents each). Other, less common fare sales locations used by no more than four respondents include mail, on vehicle, invoice, bank machines (ATMs), ticket offices outside metro stations, corporate sales, and a mobile ticket office.

Not all fare sales locations sell all types of fare options. For example, Paris does not sell annual passes through clerks in stations or in vending machines. Prague, Milan, and Budapest utilize their vending machines only for sales of single fare tickets.

Some agencies also sell fares through merchants or over the internet. Merchant sales are far more common with 16 agencies, versus four selling fares over the internet (New York, Paris, Boston, and Washington, D.C.). New York and Paris sell fares over the internet via an outside vendor, while Boston and Washington sell fares over their own homepages.

Most agencies selling fares through merchants or over the internet pay a transaction fee to the vendor. New York's transaction fee for internet sales is 3% of sales revenue, and Paris pays 4%. Transaction fees for merchant sales range from 0% in São Paulo and Washington, D.C. to as much as 6% in Santiago. Washington states that it pays no transaction fee because its fare tickets bring additional business to merchants.

Vending Machines

Fare sales via vending machine are of particular interest to NYC Transit because it is now introducing approximately 2,200 fare vending machines in subway stations to supplement (or replace) sales via station personnel; total vending machine sales in 2000 amounted to $400 million. Sales through merchants, over the internet, mobile sales channels and an employer-based sales program will continue to be a proportionately lesser component of NYC Transit's total fare sales program (less than 20% of total sales).

Scope

Twenty of 24 agencies responding report that vending machines are part of the overall fare sales program. Key findings about the number of vending machines and their placement is as follows:

- Placement of Vending Machines: Most agencies report that all stations have vending machines; four agencies (Barcelona, Boston, Toronto, and Sydney) report that not all stations have vending machines, with coverage ranging from 24% to 87% of stations. Five of 14 agencies report using vending machines as the only fare sales method in stations: Sydney (29% of stations), Berlin (89% of stations), Washington, D.C. (99% of stations), and Tokyo and Nagoya (all stations).

  Fifteen agencies only provide vending machines outside the fare barrier (in the "unpaid" area of the station). Five agencies – Berlin, New York, Paris, Toronto, and Washington, D.C. – provide vending machines both inside and outside the fare barrier (New York does so in only one of its 468 stations).

- Number of Vending Machines: The total number of vending machines ranges from a low of 62 in Boston (with less than two machines per station) to a high of 3,800 in Berlin (with four machines per station). Boston, and Sydney are the only agencies reporting less than two vending machines per station, while Hong Kong KCRC has 15 machines per station. No agency reports a particular formula used to determine the number of vending machines per station, but instead report that vending machines are added on an as-needed basis as ridership increases.

- Types of Vending Machines: Most agencies (15 of 19 respondents) report using two or more different types of fare sales vending machines. While there is no uniformity among the manufacturers, there is considerable uniformity in their operation. Fifteen of 20 respondents report that their machines operate via push buttons; two agencies (Hong Kong MTR and New York) use touch screen, while three agencies (Berlin, Tokyo, and Singapore) use both push buttons and touch screen.

Tickets/Plans and Payment Options

By far the most common fare option sold at vending machines is single fare tickets; 15 agencies report utilizing their vending machines for this purpose. Other fare options sold at vending machines include unlimited-ride passes for less than one week and multi-ride tickets without discount (seven agencies each), multi-ride tickets with discount (six agencies) and monthly and weekly passes (five agencies each). Berlin sells more fare options via vending machines than any other respondent (eight fare options), while Sydney and Washington, D.C. each sell seven fare options via vending machines, and New York and Tokyo each sell six.

All 20 agencies using vending machines accept cash. Four agencies also accept credit cards in their vending machines (New York, Paris, Barcelona, and Washington, D.C.), and three agencies also accept debit cards (New York, Paris, and Washington, D.C.).

To control fraud associated with the use of credit cards in vending machines, Paris and Washington, D.C. look for charges of more than a certain amount (Paris) or charges over the credit limit (Washington). Both agencies also consult a regularly updated list of cards to be rejected. New York places limits on the number and value of transactions allowed each day per card.

Most agency vending machines (13 of 18 respondents) only dispense new fare cards. Hong Kong MTR, New York, Washington, D.C., and Sydney vending machines dispense new fare cards and refill existing cards, while Hong Kong KCRC vending machines only refill existing cards.

Operations

- Transaction Time: Fewer than half of responding agencies report either a target/standard machine transaction time or an average machine transaction time. Of those responding, target transaction times range from two seconds in Tokyo to 60 seconds in Washington, D.C. Average transaction times range from two seconds in Tokyo to 50 seconds in Berlin. It is worth noting that although Washington sets a target transaction time of 60 seconds, its average transaction time of 20 seconds is considerably better.

- Usage: Most vending machines are heavily used by customers. Ten agencies report that the number of daily transactions per vending machine ranges from a low of 42 in Milan to a high of more than 1,900 in Athens (Attiko). The median response is approximately 350 daily transactions per vending machine.

- Repair Time: Similar to transaction time, fewer than half of responding agencies report either a target/standard machine repair or downtime or an average machine repair or downtime. Target downtime ranges from 0.5 hours in New York to 24 hours in Prague and Toronto, while average downtime ranges from 0.3 hours in Athens (Attiko) to 24 hours in Toronto.

- Customer Assistance: If customers have a problem with a vending machine, they can be directed to one of four places for assistance: personnel within the metro station, a general customer service telephone number, a telephone number exclusively for vending machine issues, and a general customer service intercom. Of these, directing customers to personnel within the metro station is by far the most common with 16 respondents. Seven agencies direct customers to a general customer service telephone number, while three agencies direct customers to a telephone number exclusively for vending machine issues or a general customer service intercom. Several agencies, including Berlin, São Paulo, Barcelona, Boston, Jersey City (PATH), Prague, and Washington, D.C. offer more than one customer assistance option.

Smart Cards

Smart cards contain a microprocessor in addition electronically erasable programmable memory (EEPROM) and read-only memory (ROM).[7] The EEPROM can be used for storing information on the cash content of the card, use history, and other data subject to change. The ROM is used to store the microprocessor's operating program, as well as card identification data. The microprocessor makes possible the performance of computational routines involved in verifying a user's identification for transactions. These features enable smart cards to be recoded with new or revised information. The

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[7] "Transit Intelligent Transportation Systems Electronic Fare Payment Systems," <http://www.fta.dot.gov/research/ fleet/its/efp.htm>(June 23, 2000).

business case for transit agencies to use smart cards as their fare tickets is compelling, with benefits for customers and management along with reduced costs:[8]

- Customer Benefits include easier purchase of tickets, a broader range of ticketing products, faster entry to stations/vehicles, and greater potential for protection against loss and theft (if cards are registered).

- Management Benefits include improved information on customer travel patterns for service planning, easier revenue apportionment between operators, and greater revenue protection (fraud control).

- Cost Benefits includes reduced expenses for operations and maintenance, surveys, cash handling, ticket selling, and fraud control.

Successful introduction of smart cards must be designed to maximize customer convenience, including proper staff training to assist customers and high quality information on the benefits of new ticket types. The future of smart card technology is so strong that the *Financial Times* stated in February 2000, “Soon smart cards will be everywhere.”[9]

Fourteen of 23 respondents report that they either currently use or plan to use smart cards for fare sales. The earliest reported use of smart cards is 1997, while those who plan to use smart cards intend to introduce them by no later than 2003.

Technology

Smart card technology can use contact or contactless interface with card readers. Contactless smart cards are considered to be “the hottest thing in transit fare collection”[10] because of their greater convenience to customers. Cards that combine swipe (contact) and contactless interfaces are considered to be a stopgap measure on the road to truly contactless cards.[11]

Ten agencies responded to the question concerning the type of smart card technology used. Nine agencies utilize contactless technology, while Sydney utilizes a combination swipe and contactless card.

“Open” or “Closed” Environment

The decision of whether smart cards operate in an “open” or “closed” environment is a critical factor in determining the success or failure of a smart card program. An open environment refers to customers being able to use their smart card not only to pay transit fares, but for purchases at local merchants as well. A similar issue concerns whether the card can be used for only one transit agency, or whether it can be used for all transit agencies within a region. Preliminary tests of the “Calypso” smart card

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[8] “Smartcards – Transport Ticketing for the 21st Century,” *Public Transport International*, June 1998, pages 32-33.
[9] Ibid, page 33.
[10] “Higher-Speed, Lower-Cost Transit Cards,” *Card Technology*, April 2000, pages 22-23.
[11] “Development of Contactless Smart Cards in Germany,” *Public Transport International*, May 1998, pages 20-25.

demonstration project in four European cities (Konstanz, Germany; Lisbon, Portugal; Paris, France; and Venice Italy) have already shown that customers will only accept an open environment.[12]

<u>One Transit Agency or Regional Transportation Network</u>: Ten agencies responded to this question. Nine agencies (Hong Kong MTR, Moscow, Paris RATP/RER, Athens Attiko, Singapore, Hong Kong KCRC; Johannesburg, and Sydney) report that their smart cards can be used for all transit agencies within a region. Washington, D.C. is the only respondent that has opted to use smart cards for only one transit agency.

<u>Open or Closed Environment</u>: Of the eleven agencies answering this question, ten report that their cards operate in an open environment (Moscow is the only respondent operating in a closed environment). Customers can use their smart cards not only to pay transit fares, but also for other services ranging from retail services and restaurants (Hong Kong) to banking (Washington, D.C.). Washington is particularly positive about its partnership with local banks; Peter Benjamin, chief financial officer of the Washington, D.C. Metro, recently stated, “Each organization should do what it does best. Banks should move money, and we should move people. We want to get to the point where we’re no longer issuing [fare] cards – that’s when we can say we’ve really been successful.”[13]

Operations

<u>Sales of New Cards and Refills</u>: Eight of 11 respondents sell new smart cards through clerks in stations. Four agencies sell new smart cards via the internet or via vending machines, three through the mail, and two through merchants. Smart card refills are most commonly offered through clerks in stations or vending machines (seven respondents), merchants (five respondents), or via the internet (four respondents). Sydney also refills smart cards via direct debit from customers’ bank accounts.

<u>Card Malfunctions</u>: Three agencies rely on contractors to handle card or equipment failures. Five agencies utilize their own staff to assist customers in the event of card or equipment failures.

<u>Lost or Stolen Cards</u>: Washington, D.C., Paris, and Hong Kong KCRC replace or refund lost or stolen smart cards in certain situations. Washington replaces registered cards for a $5 fee. Paris will replace cards for free if customers have a contract in place covering loss or theft, but otherwise charges customers to replace lost or stolen cards. Hong Kong will replace and refund personalized (registered) cards if the agency can verify the remaining value.

<u>Customer Privacy Rights</u>: Washington, D.C. utilizes data from smart cards for ridership analysis and planning purposes only. Hong Kong KCRC has developed internal guidelines in accordance with local law to ensure customer privacy, while Sydney seeks legal advice regarding data privacy issues on an as-needed basis.

<u>Integrating Smart Cards with Existing Fare Collection Systems</u>: Hong Kong KCRC was the only agency that responded to this question with any specificity. They reported considerable effort to train staff and customers on how to operate and use smart cards.

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[12] “Ibid, pages 20-25.
[13] “Taking Fare Cards to the ATM,” *Governing*,” October 2000, page 68.

Contactless Cards

The importance of contactless cards as the cutting edge technology in fare collection systems led to the inclusion of more detailed questions about their use in major transit systems around the world. Card issuers in various industries, including public transit, are taking major steps to convert magnetic-stripe cards to contactless cards. The reasons for this transition are threefold: reduced fraud because contactless cards are harder to duplicate, reduced processing costs due to fewer merchant calls to check credit, and an enhanced ability to add new features to attract customers and increase revenues.[14]

Use of Contactless Cards: Twelve of 22 respondents report that they either currently use or plan to use contactless cards for fare sales. Three agencies placed their contactless cards in operation in 1997, while those who plan to use contactless cards intend to introduce them by no later than 2003. Currently, the percentage of stations accepting contactless cards for fare collection ranges from 18% in Paris RATP (which is still in a testing phase) to 100% acceptance in Hong Kong MTR and KCRC, Moscow, and Washington, D.C.

Fare Sales

Available Fare Options: Contactless cards are used to sell virtually every type of fare option. Seven agencies use contactless cards for multi-ride tickets with discount, while six agencies offer single fare tickets or monthly or tickets on their contactless cards.

Washington, D.C. offers more fare options on its contactless cards than any other transit agency, with eight options available (unlimited-ride passes for one month, two weeks, one week and less than one week, along with multi-ride tickets with or without discount, peak-hour pricing and single fare tickets). Sydney offers seven fare options (unlimited-ride passes for one year, one month, one week and less than one week, along with multi-ride tickets with or without discount and single fare tickets). Paris RATP and RER offers five fare options (unlimited-ride passes for one year, one month, one week and less than one week, along with single fare tickets).

Sales of New Cards and Refills: The most common means of selling new contactless cards is via clerks in stations, with eight of 12 respondents. Four agencies sell new contactless cards by mail, through vending machines, merchants, or over the internet. Vending machines are much more commonly used for contactless card refills (eight respondents, the most popular response) than for new card sales). Other means of selling contactless card refills are through clerks in stations (seven respondents) or merchants (six respondents). Sydney has the greatest number of locations for contactless card sales, offering cards through clerks, merchants, by mail, and via the internet.

Conversion from Magnetic Stripe System

Conversion from Other Fare Collection Technology: Six agencies – Paris RATP and RER, Jersey City (PATH), Singapore, Washington, D.C., and Hong Kong KCRC – are converting from magnetic swipe cards to contactless cards. Athens (ISAP) and Johannesburg are replacing single paper tickets, Moscow is replacing tokens, and Milan is replacing all electronic tickets except for magnetic single fare tickets.

[14] "The Long Climb Ahead," *Card Technology*, March 2000, pages 30-43.

Issues: Agencies were asked to discuss issues associated with testing contactless card technology. Moscow discussed setting proper objectives and working with a well-trained team, while Paris emphasized the quality of technical work. Singapore emphasized security concerns, while Hong Kong KCRC focused on using the appropriate level of technology and obtaining public "buy-in" to the new system. Johannesburg concurred with Hong Kong on the importance of familiarization with appropriate levels of technology, and Washington, D.C. concurred with Hong Kong's other point about customer support and usage of the new system.

Operating and Maintenance Cost Impacts: Paris was the only respondent that reported reduced operating and maintenance costs from the conversion to contactless cards. They cited savings in maintenance, as well as reduced fare evasion and fraud; André Ampelas, director of Systems Information and Technology at RATP, was recently quoted as saying "With [swipeless] technology maintenance will be cut in half."[15] Singapore reported costs for front-end equipment, and Hong Kong KCRC reported higher operating costs. Other agencies said the impact was not yet known.

Capital Cost of Converting from Swipe Cards to Contactless Cards: Paris is the only respondent reporting its capital cost of converting from swipe cards to contactless cards, with a projected cost of 300 million French francs (equivalent to 42 million dollars at current exchange rates).

Other Comments: As might be expected based on their reduced operating and maintenance costs, Paris reported that their conversion from swipe cards to contactless cards has been generally positive.

Technology

Reading Contactless Cards: Contactless cards do not have to physically touch the reader to be read as "valid." Six of eight respondents reported that their contactless cards do not have to physically touch the reader. The range of distance at which cards can be read ranges from one centimeter to ten centimeters (0.4 to four inches). Cards can be read while contained in a wallet (six respondents), purse (five respondents) or pocket (three respondents).

Cards as a Component of Another Item: Contactless cards can be either a stand-alone object or a component of another item. Three agencies – Hong Kong MTR, Paris, France RATP/RER, and Hong Kong KCRC – include their contactless card circuitry within a watch.

"Open" or "Closed" Environment: Six agencies – Hong Kong MTR, Moscow, Paris RATP and RER, Milan, Singapore; and Hong Kong KCRC – report using their contactless cards across different modes of transportation or across different transportation agencies. Two agencies (Washington, D.C. and Johannesburg) use their contactless cards exclusively used for their own metro or commuter rail services.

Passenger Flow

Contactless cards offer the potential for both positive and negative impacts on passenger flow in metro stations. On the positive side, presenting a contactless card takes less time than a swipe card, resulting

[15] "Ile-de-France: The RATP Invents the Swipeless Ticket," *Public Transport*, September 2000.

in faster passenger flow. On the negative side, requiring the card at both entry and exit points can result in slower exiting from stations.

Entry, Exit or Both: Seven agencies require customers to use contactless cards at both entry and exit points. Moscow and Paris RATP are the only respondents that use contactless cards only at entry points.

Barrier or Barrier Free System: All eight respondents use barriers (fare gates) in their metro systems.

Experience with Passenger Flow: All five respondents to this question (Moscow, Paris RATP and RER, Singapore; Washington, D.C., and Hong Kong KCRC) report improved passenger flow in metro stations.

Customer Reaction

All six respondents report positive customer reaction to contactless cards. Washington, D.C. cited very high demand for the new contactless card technology, and Paris RATP and RER wrote "When a passenger has tested the contactless system, he doesn't want to come back any more to magnetic tickets."

Data Collection and Analysis

Transit agencies can obtain a wealth of ridership data from their fare sales and collection systems. Respondents reported that, in general, they obtain the majority of their ridership data from fare sales and collection systems:

Capabilities

- Hong Kong MTR obtains all its ridership data except transfers from its entry and exit gates. Systemwide transfers and the travel paths/times of individual riders are calculated using a mathematical model; transfers by station are not calculated.

- New York utilizes its ticket gates to obtain total ridership; ridership by station, time period, and fare option; passenger entries and exits at each station; and number of transfers systemwide and by station. Vending machines provide data on the average amount spent on transportation per transaction. In addition, New York is currently working to utilize entry records from its ticket gates to create station-to-station trip tables for various days (weekday vs. weekend) and time periods.

- Tokyo obtains total ridership from its ticket sales data, and obtains ridership by time period and entries/exits at each station from their ticket gates. Information from ticket utilization helps to generate data on ridership by line and by fare option. Transfers by station are counted by staff.

- Paris RATP and RER obtains total ridership, ridership by line, time period and fare option, and entries at each station from its ticket gates.

- Singapore obtains total ridership, ridership by line, time period, and fare option; passenger entries and exits at each station; and travel paths of individual riders from its ticket gates.

- Toronto obtains total ridership and entries at each station from its fare collection system. Ridership by line and by time period are manually counted by traffic checkers.

- Washington, D.C. relies on its faregates to provide total ridership, ridership by line, time period and fare option, entries/exits at each station, and the travel paths/times of individual riders.

- Hong Kong KCRC obtains all of its ridership data – total ridership, ridership by line, time period and fare option, entries/exits at each station, and transfers systemwide and by station – from its contactless entry and exit system. Travel paths/times of individual riders are available upon request from Creative Star, the interagency operator of the regional contactless card system.

- Nagoya utilizes its vending machines to obtain data on total ridership, ridership by time period, and entries/exits at each station.

- Johannesburg obtains total ridership and ridership by fare option from its ticket sales data.

- Sydney utilizes ticket sales data to determine total ridership and ridership by line, time period and fare option. Electronic barriers count passenger entries/exits at each station.

Privacy Issues: Five of 16 respondents – Hong Kong MTR, New York, Paris RATP and RER, Boston, and Hong Kong KCRC – mentioned privacy issues associated with data from fare sales and collection. Hong Kong KCRC stated that data is restricted to authorized personnel only, while Paris RATP and RER said it is necessary to dissociate client identity and fare collection data. New York can utilize a fare card's serial number to trace a person's travel, but has only provided this information for certain criminal investigations.

Benefits

Twenty-two agencies report that they have used data from their fare sales and collection systems to speed fare sales and reduce transaction times. Twenty respondents (all but Moscow and Hong Kong KCRC) have used their fare sales and collection data to adjust levels of service in response to customers' needs.

Findings: Individual Agency Responses

Berlin, Germany

FARE SALES METHODS

Tickets/Plans: Berlin offers single fare tickets, annual, monthly, weekly, multi-day passes, and multi-ride tickets with or without discounts. Discounts for students and seniors are also provided. Monthly passes are the most popular with 30 percent of sales, while single fare tickets represent three percent of ticket sales.

Technology: Magnetic swipe cards, tokens, and bills are used.

Operations: Tickets are sold by station clerks, at vending machines, by bus drivers, through local merchants, and by subscription. No sales are available over the internet.

VENDING MACHINES

Scope: Vending machines are available at all stations with an average of 4 per station.

Ticket Plans and Payment Options: All fare types except annual passes are sold at vending machines. Cash and credit cards are accepted. Vending machines cannot refill cards.

Operations: Vending machines are located inside and outside the fare barrier. Intercoms and customer service phone numbers are available for customers having problems with vending machines.

SMART CARDS

Berlin does not currently use smart cards, but expects to announce plans by May 2001.

CONTACTLESS CARDS

Berlin does not currently use contactless cards, but expects to announce plans by May 2001.

DATA COLLECTION & ANALYSIS

No information was provided.

Hong Kong, China (MTR)

FARE SALES METHODS

Tickets/Plans: Single fare tickets make up 13 percent of total ticket sales. Further information on fare options was not provided.

Technology: Contactless cards, magnetic stripe insert and return (“dip” cards), and paper tickets are used.

Operations: Location of ticket sales was not provided. Tickets are not sold over the internet or through merchants. 99 percent of ticket sales are cash (the remainder via credit or debit cards).

VENDING MACHINES

Scope: All stations are equipped with vending machines with an average of eleven machines per station.

Ticket Plans and Payment Options: Vending machines dispense single fare, student, and senior tickets and accept only cash. Tickets can be refilled at machines.

Operations: Vending machines are located outside the fare barrier. Station personnel assist customers with vending machine problems.

SMART CARDS

Technology: MTR began to use smart cards in 1997. Contactless card technology is used.

"Open" or "Closed" Environment: MTR smart cards use an open environment. Cards can be used throughout Hong Kong's transportation network and for non-transit retail services. Hong Kong has no joint ventures with the banking or financial industry.

Operations: Smart cards and smart card refills are sold by clerks in stations. No indication of problems integrating smart card technology into the existing fare collection system was given.

CONTACTLESS CARDS

Fare Sales: MTR uses contactless smart card technology. Fares available on contactless cards are multi-ride with discount, student, and senior. All stations currently accept contactless card fare collection and the contactless card system is fully operational.

Technology: Contactless cards must be presented within 100mm of a reader and can be used when enclosed in a briefcase or pocket. The "card" or contactless ticket is also available in a watch.

Passenger Flow: Contactless cards must be presented at station entrance and exit.

Customer Reaction: Customers have had a positive response to the contactless card system.

DATA COLLECTION & ANALYSIS

Capabilities: MTR uses information gathered at the entry and exit gates, mathematical models, and the station accounting system to produce a wide variety of reports.

Benefits: MTA has used data from fare sales and collection to speed fare sales and adjust service levels.

Moscow, Russia

FARE SALES METHODS

Tickets/Plans: Single fare tickets and discount and non-discount multi-ride tickets, make up the majority of ticket sales. Student discounts and annual and monthly passes are also offered. Additional fees are charged for carrying luggage.

Technology: Contactless smart cards and magnetic strip paper tickets are used.

Operations: 98.76% of all ticket sales are done through clerks in stations in cash only transactions. The remaining 1.24% of sales are done through money transfers.

VENDING MACHINES

Scope: Vending machines are not used.

SMART CARDS

Technology: Moscow has used a contactless smart card system since September 1998.

"Open" or "Closed" Environment: The smart card operates in a transit only environment. The cards can be used on both the metro and suburban rail systems.

Operations: Smart cards and smart card refills are only available from station clerks. There are plans to phase in vending machines in the near future.

CONTACTLESS CARDS

Fare Sales: Contactless smart cards are currently used. Annual passes, monthly passes, multi-ride discount tickets, and student passes are all available on the contactless smart cards. All stations currently accept contactless cards.

Technology: Contactless cards must be presented within 5 cm of the card reader. The card can be read through a wallet, in a purse, or in a briefcase.

Passenger Flow: Contactless cards are presented at entry points.

Customer Reaction: Customers have had a positive response to the contactless card system. A new flexible tariff plan is being developed to bring more customers using smart cards.

DATA COLLECTION & ANALYSIS

Capabilities: Information gathered at the entry gates is used to produce reports on total ridership, ridership by line, ridership by time period, and passenger entries/exits at each station.

Benefits: Data from fare sales and collection have allowed Moscow to adjust levels of service.

New York, New York, USA

FARE SALES METHODS

Tickets/Plans: New York offers annual, monthly, weekly and daily passes, along with multi-ride tickets with or without discount, single fare cards and tokens. New York offers discounts for students and seniors. Multi-ride discount packages and weekly passes are the most popular with 28% and 25% of total trips, respectively.

Technology: Magnetic swipe cards and tokens are used. The cards are used as insert and return (“dip”) cards on buses.

Operations: Most ticket are sold by station clerks (61%) or at vending machines (25%). Fares may also be purchased from local merchants, through employers, over the internet, through bank machines, or by mail.

VENDING MACHINES

Scope: By 2002, vending machines will be available in all stations with an average of 4.8 per station.

Ticket Plans and Payment Options: All fare types except annual passes and tokens are sold at vending machines. Cash, credit cards, and debit cards are accepted. Cards can also be refilled at vending machines.

Operations: Most vending machines are located outside of the fare barrier (one station also has machines inside the fare barrier). A general customer service phone number is available for customers having problems with the machines.

SMART CARDS

Technology: New York is in the early stages of planning for implementation of a smart card system.

“Open” or “Closed” Environment: To be determined. Pilot tests will be conducted within the next 2-3 years to determine the feasibility of an open system.

CONTACTLESS CARDS

Use of contactless cards has not yet been determined.

DATA COLLECTION & ANALYSIS

Capabilities: New York uses data collected from card swipes and electronic registers to produce reports on total ridership, ridership by station, ridership by time period, ridership by fare option, passenger entry and exit, and bus/subway transfers. Vending machine sales records calculate average amount spent on transportation. In addition, New York is working to use entry records from its ticket gates to create station-to-station trip tables for various days (weekday vs. weekend) and time periods.

Benefits: The data collected have allowed New York to increase the speed of fare sales and adjust service levels. Privacy issues have been raised because a passenger’s travel information can be traced from the serial number on a fare card.

Paris, France (RATP and RER)

FARE SALES METHODS

Tickets/Plans: Ticket sales for the RATP include annual passes, monthly passes, weekly passes, multi-ride tickets, single fare tickets, and student passes. Monthly passes are the most popular with 42.4% of sales. Multi-ride discount passes are second with 18.3% of sales.

Technology: Paper and plastic tickets with magnetic strips are used. Contactless cards are currently being phased in.

Operations: Tickets are sold by station clerks, at vending machines, through the mail, over the internet, and through local merchants. Tickets and passes may be purchased with cash, credit cards, debit cards, and through monthly deductions.

VENDING MACHINES

Scope: Ticket vending machines are available at all RATP and RER stations with an average of 2 per station.

Ticket Plans and Payment Options: Monthly passes, weekly passes, multi-ride discount tickets, and single fare tickets are sold at vending machines. Credit cards and debit cards are accepted. Cash is accepted in coins only. Vending machines cannot refill cards.

Operations: Most vending machines are located outside the fare-barrier. Some machines are also available inside the fare area in large transfer areas. Station personnel are available to help customers with vending machine problems.

SMART CARDS

Technology: RATP and RER use paper and plastic smart card tickets with magnetic strips. Contactless cards are currently being phased in with completion set for 2001.

"Open" or "Closed" Environment: An open environment system is planned for the new smart card system, allowing for its use as an electronic purse for financial purposes, as well as a card to be used on the entire regional transit system. The financial use aspect of the card will be handled by a private company partly owned by RATP.

Operations: Contactless cards will initially be sold by station clerks, over the internet, and through the mail, with refills available additionally at vending machines, and at local merchants. Problems have been encountered in passing from the concept of "multi-ride tickets" to a "money reserve" structure.

CONTACTLESS CARDS

Fare Sales: RATP and RER plan to phase in contactless cards by 2001. Annual, monthly, weekly, and multi-day passes, as well as single-fare, electronic purse, student, and senior tickets will be available. Currently, the RATP accepts contactless cards at 17% of their stations, while RER accepts it at 46% of stations. It should be fully operational by 2001.

Conversion from Magnetic Stripe System: The expected cost of conversion to a contactless system will be 30 million euros for RATP and 15 million euros for the RER.

Technology: The contactless card must be presented within 10 cm of a reader and may be enclosed in a purse or a wallet. The "card" can also be integrated into a watch.

Passenger Flow: Contactless cards must be presented at entry and exit on the RER. RATP requires the card only at entry points. The new technology is expected to speed passenger flow.

Customer Reaction: Customers have had a very positive reaction to the new system. Many indicate a strong preference for the new contactless cards over the older system.

DATA COLLECTION & ANALYSIS

Capabilities: RATP uses information gathered at entry readers to produce a wide variety of reports. Information on pass sales as well as vending machine information is also used for reports.

Benefits: The data collected have allowed RATP to increase the speed of fare sales and adjust service levels. The data has also allowed for revenue sharing between several transportation agencies. Privacy issues are a concern.

São Paulo, Brazil

FARE SALES METHODS

Tickets/Plans: Single fare tickets make up 53% of total ticket sales. Multi-ride discount tickets make up 45.1%, with the remaining 1.9% going to student fares.

Technology: Paper tickets are used. Smart cards and contactless cards are not currently used, but are planned for implementation.

Operations: Tickets are sold by clerks in stations as well as on buses and trains. Ticket are also sold directly to companies and through local merchants. Vending machines were installed in late 2000. All transactions are done in cash.

VENDING MACHINES

Scope: Ticket vending machines have recently been installed in all stations. Stations have between 2 and 8 machines.

Ticket Plans and Payment Options: Vending machines sell single fare tickets and multi-ride discount tickets. The machines only accept cash and only sell new tickets.

Operations: All vending machines are placed outside the fare-barrier.

SMART CARDS

São Paulo does not currently use a smart card system.

CONTACTLESS CARDS — São Paulo does not currently use contactless cards.

DATA COLLECTION & ANALYSIS — Capabilities: São Paulo uses data from fare sales, entries, and exits to compile reports on various aspects of ridership and station use.

Benefits: The data collected have allowed São Paulo to adjust ticket sales quantities. It is projected that service adjustments will also be facilitated by data collection.

Tokyo, Japan

FARE SALES METHODS — Tickets/Plans: Ticket sales include monthly and one day passes, single ride tickets, multi-ride tickets with discount, and student fares. Monthly passes make up 60.4% of sales. Single fares are 20.1% of sales.

Technology: Magnetic insert and return (“dipping”) cards are used along with paper tickets for group travel.

Operations: Tickets and passes are sold by station clerks and vending machines in stations. Tickets are not available from local merchants or over the internet. All transactions are done in cash.

VENDING MACHINES — Scope: Vending machines are available at all Tokyo stations, with an average of 8.1 machines per station.

Ticket Plans and Payment Options: All fare types are available from vending machines. Only cash is accepted; cards cannot be refilled.

Operations: Vending machines are located outside of the fare barrier. Station personnel are available to customers having problems with vending machines.

SMART CARDS — Tokyo does not classify its fare collection as a smart card system.

CONTACTLESS CARDS — Tokyo does not use or plan to use contactless cards.

DATA COLLECTION & ANALYSIS — Capabilities: Tokyo uses data collected from ticket sales, automatic ticket gates, and staff to generate reports on ridership and fares.

Benefits: The data have allowed Tokyo to adjust service levels.

Athens, Greece (Attiko Metro)

FARE SALES METHODS — Tickets/Plans: Ticket sales include annual, monthly, and daily passes, as well as single fares. Discounted tickets are available to students and those who cannot afford full price. Single fare tickets make up the largest share of sales with 69%. Monthly passes are second with 18%.

Technology: Paper tickets are used.

Operations: Tickets are sold through station clerks, vending machines and off-system kiosks. No tickets are sold through local merchants or the internet. All transactions are done with cash.

VENDING MACHINES

Scope: Ticket vending machines are present in all stations, with an average of 5.4 machines per station.

Ticket Plans and Payment Options: Vending machines sell single fare tickets and student tickets. The machines accept cash only.

Operations: Vending machines are located outside the fare barrier. Station personnel are available to assist customers with machines.

SMART CARDS

Technology: Attiko Metro plans to implement smart cards sometime after 2003 by using a contactless card.

"Open" or "Closed" Environment: An open environment system is planned for the new smart card system, allowing for multiple use for both transit and banking.

DATA COLLECTION & ANALYSIS

Capabilities: Attiko Metro uses exit passenger counts along with interview surveys to produce a wide range of reports.

Athens, Greece (ISAP)

FARE SALES METHODS

Tickets/Plans: Single fare tickets make up 75.5% of ticket sales. Monthly passes have a share of 13.9%, while student and military passes comprise 10.6%. Annual and daily passes make up a minute fraction of fare sales.

Technology: Paper tickets are used.

Operations: ISAP primarily sells tickets through station clerks (83.3%), and the remainder are sold through vending machines. All transactions are cash-only.

VENDING MACHINES

Scope: Ticket vending machines are available in all stations, with an average of 4.9 machines per station.

Ticket Plans and Payment Options: Single fare, student, and military tickets are available at vending machines. Cash must be paid in coin form only (exact change required).

Operations: Vending machines are located outside the fare barrier. Station personnel are available to help customers with vending machine problems.

SMART CARDS

Technology: ISAP does not have a smart card system. A contactless card system is planned for implementation by 2002.

"Open" or "Closed" Environment: Although the details are uncertain, it is likely that ISAP will use an open environment system in conjunction with banking.

Operations: Smart cards will be sold via station and non-station vending machines, over the internet, and through bank machines. Refills will be available from the internet, bank machines, and through local merchants.

CONTACTLESS CARDS

Fare Sales: ISAP plans to use contactless cards for annual and monthly passes, replacing paper tickets.

DATA COLLECTION & ANALYSIS

Capabilities: ISAP uses infrared sensors at entrances and exits to gather data for a variety of reports.

Benefits: The data collected have allowed ISAP to increase fare sale speed and to adjust service levels.

Barcelona, Spain

FARE SALES METHODS

Tickets/Plans: Barcelona offers single trip tickets, 10 trip discount tickets, monthly and daily passes, and a variety of other multi-trip discount packages. Discounts are also available for seniors.10 trip discount tickets are the most popular with 66.4% of total sales.

Technology: Magnetic swipe and insert and return ("dip") cards are used along with paper tickets and tokens.

Operations: Tickets are sold by station clerks, vending machines, bank machines, and by local merchants. Most transactions (98.6%) are in cash, the rest by credit card.

VENDING MACHINES

Scope: Half of all stations have fare vending machines, with an average of 2.7 per station.

Ticket Plans and Payment Options: Vending machines dispense single fare and tourist tickets. Machines accept cash or credit card.

Operations: Vending machines are located outside the fare barrier. Vending machines are never the only option for customers seeking to purchase fares. Station personnel and intercoms are available for customers having problems with the machines.

SMART CARDS

Barcelona does not use or plan to use smart cards.

CONTACTLESS CARDS

Barcelona does not use or plan to use contactless cards.

DATA COLLECTION & ANALYSIS

Capabilities: Data is collected to generate reports on total ridership, ridership by line, ridership by fare option, passenger entries per station, and amount spent per transaction.

Benefits: Data from fare sales and collection have been used to speed fare sales and adjust service levels.

Boston, Massachusetts, USA

FARE SALES METHODS

Tickets/Plans: Boston offers annual passes, monthly passes, multi-day passes, and single ride tokens.

Technology: Magnetic swipe cards, tokens, and paper tickets and transfers are used.

Operations: Fare sales are conducted by station clerks, station vending machines, local merchants, or by mail or internet. Transactions are made by cash, credit card, check, or money order.

VENDING MACHINES

Scope: Fare vending machines are placed at some stations.

Ticket Plans and Payment Options: Vending machines sell single ride tokens only. Others offer only change for bills.

Operations: Ticket vending machines are located outside the fare barrier. All stations are staffed by at least one collector. Station personnel and a general customer service phone number are available to customers having problems with the machines.

SMART CARDS

Technology: Boston uses read-only swipe cards for unlimited rides.

"Open" or "Closed" Environment: The smart cards exist in a closed environment and may be used only on transit. Swipe cards become flash passes on commuter rail and boats.

Operations: Smart cards are sold over the internet, by mail, through merchants, or through employers. Cards cannot be refilled.

CONTACTLESS CARDS

Boston does not use or plan to use contactless cards.

DATA COLLECTION & ANALYSIS

Capabilities: Data is collected to produce reports on total ridership, ridership by line, ridership by time period, passenger entries per station, and passenger exits per station. Other information is also analyzed concerning ridership for some stations.

Benefits: Data from fare sales and collection have been used to speed fare sales and adjust service levels in a limited way.

Budapest, Hungary

FARE SALES METHODS

Tickets/Plans: Budapest offers unlimited passes ranging from a few days to up to a year. Single fare and multi-ride discount tickets are also available. Discounts are offered to students and seniors. Military personnel ride free. Monthly passes are the most popular with 60.3% of all ticket sales. Single fare tickets make up 15.8%.

Technology: Paper tickets are used along with passes that must be shown to a ticket inspector upon request.

Operations: Tickets are primarily sold in ticket offices, by merchants and at vending machines. 94% of ticket sales are made in cash, with the remainder through bank transfers.

VENDING MACHINES

Scope: Vending machines are available in all stations with an average of 3 per station.

Ticket Plans and Payment Options: Only single fare tickets are offered at vending machines, which accept only coins.

Operations: Vending machines are located outside the fare barrier. Customers are given a toll-free phone number to call if they have a problem with the machines.

SMART CARDS

Budapest does not use or plan to use smart cards.

CONTACTLESS CARDS

Budapest does not use or plan to use contactless cards.

DATA COLLECTION & ANALYSIS

Capabilities: Budapest does not collect any data through the collection and sale of fares.

Jersey City, New Jersey, USA (PATH)

FARE SALES METHODS

Tickets/Plans: PATH offers multi-ride tickets without discount, cash admission, and limited monthly pass options.

Technology: Magnetic transport cards are used that are inserted into one slot, and returned after processing through a return slot.

Operations: PATH sells tickets through vending machines and merchants. A small percentage of sales are also done through the mail along with bulk corporate sales. All transactions at PATH stations are cash. PATH tickets may be purchased from New Jersey Transit by using credit/debit cards.

VENDING MACHINES

Scope: Vending machines are available in all stations with an average of 5 per station.

<u>Ticket Plans and Payment Options</u>: Non-discount multi-ride tickets are the only type of ticket available from vending machines. PATH vending machines accept cash only. PATH fare cards may be purchased from New Jersey Transit vending machines using cash or credit/debit cards. Machines only sell new cards.

<u>Operations</u>: Vending machines are located inside and outside of the fare-barrier. Personnel in stations are sometimes available to help customers with problems. If personnel are not available, passenger help phones and a toll-free phone number are available.

SMART CARDS

<u>Technology</u>: PATH does not utilize a smart card system. Although plans for smart card implementation exist, the time frame has not yet been determined.

CONTACTLESS CARDS

<u>Fare Sales</u>: PATH plans to implement contactless cards in the future.

DATA COLLECTION & ANALYSIS

<u>Capabilities</u>: PATH collects data from turnstile exit and entry count summaries to generate reports dealing with total ridership, ridership by time period, and ridership by fare option.

<u>Benefits:</u> The data collected have allowed PATH to adjust service levels.

Milan, Italy

FARE SALES METHODS

<u>Tickets/Plans</u>: Milan offers annual, monthly, weekly and a “2x6” pass which allows for 2 fares every day for 6 days in a week. Single fare and multi-ride discount tickets are also offered. Student and senior discounts are available.

<u>Technology</u>: Paper tickets are used.

<u>Operations</u>: Single fare tickets are available from station clerks and station vending machines. Merchant sales and ATM sales provide other forms of ticketing. Merchant sales make up 92.6% of all purchases. All transactions are done in cash.

VENDING MACHINES

<u>Scope</u>: Ticket vending machines are available at all stations with an average of 3 per station.

<u>Ticket Plans and Payment Options</u>: Vending machines only sell single fare tickets. Payment must be made in cash.

<u>Operations</u>: Vending machines are located outside the fare barrier. Personnel in stations are available if a problem occurs with the machines.

SMART CARDS

Technology: Milan plans to implement a smart card system in 2002 for the regional transportation network. It is proposed that both magnetic swipe cards and contactless cards will be used.

"Open" or "Closed" Environment: The smart card system will be a closed environment, only involving transit and parking.

Operations: Smart card sales and refills will be available from vending machines inside and outside stations and from merchants. Smart cards will also be available for purchase through the mail.

CONTACTLESS CARDS

Fare Sales: Milan plans to use contactless cards as part of its smart card system. Only discount multi-ride fares will be offered through these cards.

Technology: The contactless card must be presented within 10 cm of a reader and may be kept in a purse or a wallet in a pocket.

Passenger Flow: Contactless cards will be presented at both entry and exit points on the suburban network. The urban network will only require cards to be presented at entry points.

DATA COLLECTION & ANALYSIS

Capabilities: Milan uses data collected from fare validators to generate a wide variety of reports.

Benefits: The data collected have allowed for faster fare sales and to adjust service levels.

Montreal, Canada

FARE SALES METHODS

Tickets/Plans: Monthly passes make up 40% of total ticket sales. Weekly passes, multi-day passes, single fare tickets, and cash admissions are also offered.

Technology: Magnetic swipe cards and paper tickets are used.

Operations: 60% of tickets are sold by station clerks and the remainder sold by merchants. All transactions are done using cash.

VENDING MACHINES

Montreal does not use vending machines.

SMART CARDS

Montreal does not use or plan to use smart cards.

CONTACTLESS CARDS

Montreal does not use or plan to use contactless cards.

DATA COLLECTION & ANALYSIS

Capabilities: Montreal collects data on the number of passenger entries at each station.

Benefits: Data collection is used to adjust the number of available cashiers in each station.

Nagoya, Japan

FARE SALES METHODS

Tickets/Plans: Monthly passes make up 23.8% of total ticket sales. Single fare card sales are 31.1% and cash admission is 28.6%. Nagoya also offers student and senior discount tickets along with multi-day passes, all of which represent a lower share of total sales.

Technology: Magnetic swipe cards and insert and return ("dip") cards are used.

Operations: Ticket sales are conducted mostly through vending machines and local merchants. A small percentage of tickets are sold by station clerks. All transactions are done in cash.

VENDING MACHINES

Scope: Ticket vending machines are available at all stations with an average of 6.4 machines per station.

Ticket Plans and Payment Options: Monthly passes, multi-day passes, single fare cards, and student fares are available from vending machines. Only new cards can be purchased, and purchases must be made in cash.

Operations: All vending machines are located outside the fare-barrier in stations. Station personnel are available to help customers who are having problems with the machines.

SMART CARDS

Nagoya does not use or plan to use smart cards.

CONTACTLESS CARDS

Nagoya does not use or plan to use contactless cards.

DATA COLLECTION & ANALYSIS

Capabilities: Nagoya gathers data from vending machines to compile reports dealing with total ridership, ridership by time period, and passenger entries and exits.

Benefits: The data collected have been used to adjust service levels.

Prague, Czech Republic

FARE SALES METHODS

Tickets/Plans: Prague ticket sales include annual, monthly, biweekly, weekly, and multi-day passes; discounted and non-discounted multi-ride fares; single fare tickets; student and senior discounted tickets; and external zone tickets. Single fare tickets are the most common with 32.3% of total sales. Annual passes are next with 22.4% of total sales.

Technology: Paper tickets are used.

Operations: Tickets are sold through station agents, vending machines, local merchants, and through bank accounts. Unless the payment is through an account, all payments are made in cash.

VENDING MACHINES

Scope: Vending machines are available at all stations, with 2 to 6 machines per station.

Ticket Plans and Payment Options: Only single fare tickets are available at vending machines. Vending machines accept cash only.

Operations: All vending machines are located outside the fare barrier. Station personnel and customer service phone numbers are available for those who have problems with the machines.

SMART CARDS

Prague does not use or plan to use smart cards.

CONTACTLESS CARDS

Prague does not use or plan to use contactless cards.

DATA COLLECTION & ANALYSIS

No information was provided.

Santiago, Chile

FARE SALES METHODS

Tickets/Plans: Single fare tickets make up 63% of total ticket sales. “Value Tickets”, which are well used, are fare cards discounted according to time of day. Student and senior fares are also offered.

Technology: Tickets with magnetic strips are used.

Operations: Tickets are sold by station clerks and local merchants. All transactions are cash.

VENDING MACHINES

Scope: Vending machines are not used.

SMART CARDS

Smart cards are not currently used, however they are planned.

CONTACTLESS CARDS

Use of contactless cards is currently being studied.

DATA COLLECTION & ANALYSIS

Capabilities: Santiago uses data from fare collection to compile reports dealing with total ridership and passenger entries at stations.

Benefits: Data is used to speed fare sales and adjust service levels.

Singapore

FARE SALES METHODS

Tickets/Plans: 80% of ticket sales are multi-ride tickets without discount. Single fare tickets make up 11.3% of sales. Monthly passes and student and senior fares make up the difference.

Technology: Magnetic swipe cards are used.

Operations: Tickets are primarily sold through station clerks and bank machines. Vending machines inside and out of transit facilities are also used. Although local merchants do sell tickets, they represent a minimal percentage of the sales.

VENDING MACHINES

Scope: Vending machines are located at all stations with an average of 5 per station.

Ticket Plans and Payment Options: Vending machines only sell single fare tickets. Cash is accepted, in coin form only.

Operations: Vending machines are located outside the fare barrier. Station personnel are available to help customers who have problems with machines.

SMART CARDS

Technology: Singapore is conducting a trial run with smart cards, for planned implementation in 2002. Contactless cards are ultimately proposed for use.

"Open" or "Closed" Environment: An open environment system is currently being examined that would involve banking.

Operations: Contactless cards and refills will be available from station clerks as well as from station and non-station vending machines.

CONTACTLESS CARDS

Fare Sales: Contactless cards will be available for discounted and non-discounted multi-ride tickets, single fare tickets, as well as student, senior, and military tickets.

Technology: Contactless cards will need to be presented within 10 mm of the reader and may be enclosed in a purse, wallet, or briefcase.

Passenger Flow: Contactless cards will need to be presented at entry and exit.

Customer Reaction: Customers have had a very positive reaction to the idea of contactless cards.

DATA COLLECTION & ANALYSIS

Capabilities: Singapore uses data gathered from automatic fare collection gates for a variety of different reports.

Benefits: The data collected have allowed Singapore to increase the speed of fare sales and adjust service levels.

Toronto, Canada

FARE SALES METHODS

Tickets/Plans: Monthly passes make up 29.8% of total ticket sales. Discounted multi-ride tickets make up 49.9% while cash admissions make up 17.7%. Multi-day passes, as well as student, senior, and disabled passes, are also available.

Technology: Magnetic swipe cards, tokens, and paper tickets are used.

Operations: 65% of tickets are sold station clerks. Local merchants and vending machines also sell tickets. The majority of transactions are cash. 20.5% of sales are by check and a small percentage by credit cards.

VENDING MACHINES

Scope: Ticket vending machines are available in most stations, with an average of 2 per station.

Ticket Plans and Payment Options: Only single fare tokens are sold at vending machines. Payment must be in cash.

Operations: Vending machines are located inside and outside the fare barrier. A general customer service phone number is available for customers having problems with the machines.

SMART CARDS

Toronto does not use a smart card system, and is considering implementation.

CONTACTLESS CARDS

Toronto does not currently use contactless cards.

DATA COLLECTION & ANALYSIS

Capabilities: Toronto gathers data from farebox and turnstile counts as well as manually from traffic checkers. This data is used for reports dealing with various aspects of ridership.

Benefits: The data collected has allowed for the agency to adjust levels of service.

Washington, D.C., USA

FARE SALES METHODS

Tickets/Plans: Washington offers monthly and weekly passes along with multi-ride discount and single fare cards. Cash and senior fares are also accepted. Single fare cards account for 57.5% of the total sales and multi-ride discount cards account for 25%.

Technology: Contactless cards and magnetic swipe cards are used.

Operations: Tickets are sold primarily through vending machines in stations. Tickets are also available through local merchants and via the internet. Cash, credit and debit cards are all accepted.

VENDING MACHINES

Scope: Vending machines are available at all stations with an average of 7.4 machines per station.

Ticket Plans and Payment Options: Vending machines sell biweekly, weekly, and daily passes, along with discounted and non-discounted multi-ride cards, and single-fare cards. Machines accept cash as well as credit and debit cards.

Operations: Vending machines are located inside and outside of the fare barrier area. Those in the "paid" area add monetary value to a card when the passenger does not have the required amount to complete a trip. Station personnel are available to help customers with machine problems. There is also an exclusive phone number for vending machine assistance.

SMART CARDS

Technology: Washington uses a smart card system with magnetic strip and contactless cards.

"Open" or "Closed" Environment: Washington's smart card uses an open environment. The cards can be used for parking facilities in the transit system, and as a bank debit card.

Operations: Contactless cards may be initially purchased from station clerks, over the internet, and through the mail. Refills are available at vending machines, and will eventually be made available over the internet. When integrating the smart card technology into the existing system, problems were encountered with customer and employee familiarity.

CONTACTLESS CARDS

Fare Sales: Monthly, biweekly, weekly, and daily passes, multi-ride tickets with or without discount, and single ride tickets are available on contactless cards. Peak hour pricing is used along with discounts for students, seniors, and the disabled.

Conversion from Magnetic Stripe System: The contactless cards did not replace, but instead supplements, the swipe card system.

Technology: Contactless cards must be presented within 2 inches of the reader. It can be read through a wallet that is held in hand.

Passenger Flow: Contactless cards must be presented at entry and exit points. The contactless cards have speeded passenger flow.

Customer Reaction: There has been a very high demand for the contactless cards by customers since their implementation.

DATA COLLECTION & ANALYSIS

Capabilities: Washington uses data from fare vendor machines and faregates to generate a wide variety of analyses.

Benefits: The data collected have allowed Washington to adjust service levels.

Hong Kong, China (KCRC)

FARE SALES METHODS

Tickets/Plans: The "Octopus" multi-ride discount ticket represent 85% of the Hong Kong, urban and suburban rail, fare sales. The remaining 15% of sales are single fare tickets. Senior and children discounts are also offered.

Technology: Magnetic swipe cards, magnetic paper tickets, and contactless cards are currently used.

Operations: Tickets are sold through vending machines and station clerks. Local merchants can also be used to refill smart cards. Automatic payment of fares through bank accounts at exit gates can also be used, although this option is less popular than others. Fares may be paid with cash or debit card.

VENDING MACHINES

Scope: Ticket vending machines either sell magnetic tickets or smart cards, but not both. Smart card machines are available in all stations with an average of 4.5 per station; ticket machines are available in most stations with an average of 10.5 per station.

Ticket Plans and Payment Options: Vending machines add value to multi-ride discount tickets and sell single fare tickets. Senior and child discounts are also available. Cash or debit card are accepted.

Operations: Vending machines are located outside the fare barrier. Station personnel are available for customers having problems with the machines.

SMART CARDS

Technology: Hong Kong uses a smart card system with contactless cards.

"Open" or "Closed" Environment: Currently, the smart card system is undergoing tests in an open environment involving services such as parking and restaurants. The smart card can be used throughout the transit system and transit fares can be paid via smart card directly from bank accounts.

Operations: Contactless cards may only be purchased from station clerks, however value may be added to them from vending machines and local merchants, as well as station clerks.

CONTACTLESS CARDS

Fare Sales: Contactless cards can be used for multi-ride discount fares and single fares. Senior and child discounts are available.

Conversion from Magnetic Stripe System: Contactless cards supplement rather than replaces the swipe card system. Single paper tickets will eventually be eliminated.

Technology: Contactless cards must be presented within 80 mm of the reader. The card can be detected through a wallet placed in a purse or briefcase. The contactless card is also available in a watch.

Passenger Flow: Contactless cards must be presented at entry and exit points. They have speeded passenger flow.

Customer Reaction: Contactless cards have been well accepted by the public.

DATA COLLECTION & ANALYSIS

Capabilities: Contactless entry and exit allows for the collection of data for a wide range of analyses. Creative Star, the makers of the "Octopus Watch" used as a contactless card, can provide data about travel paths and travel times of individual riders, as well as passenger identification.

Benefits: The data collected have allowed KCRC to adjust service levels and plan station developments. Privacy issues have been raised concerning identification and telephone numbers that are collected with issuance of personalized cards. This data is governed by strict guidelines giving access to authorized persons only.

Johannesburg, South Africa

FARE SALES METHODS

Tickets/Plans: 74.5% of total fare sales are single fare tickets. The remainder is composed of monthly and weekly passes.

Technology: Paper tickets are used.

Operations: Tickets are sold through station clerks and mobile ticket offices. Tickets may be purchased using cash or credit card.

VENDING MACHINES

Johannesburg does not currently use vending machines.

SMART CARDS

Technology: No smart cards system is currently in place, however they are planned to be introduced in the next couple of years.

"Open" or "Closed" Environment: The anticipated smart card system will be an open system allowing for the purchase of goods or services along with banking. It will integrate all modes of public transport.

Operations: Contactless cards will be able to be purchased and refilled from station clerks, station and non-station vending machines, and local merchants.

CONTACTLESS CARDS

Fare Sales: Contactless cards will be used for monthly passes, weekly passes, and single fare tickets.

DATA COLLECTION & ANALYSIS

Capabilities: A variety of analyses are done from data collected from ticket sales, origin/destination studies, census information, and observational information.

Benefits: The data collected have been used to speed fare sales and adjust service levels.

Osaka, Japan

FARE SALES METHODS

Tickets/Plans: Osaka offers monthly passes along with single fare tickets and cards. Peak hour pricing is used and discounts are offered to students and seniors.

Technology: Insert and return ("dip") cards are used along with paper tickets.

Operations: Tickets are sold only through station clerks and vending machines. Cash and credit card are accepted.

VENDING MACHINES

Scope: Vending machines are located in 60% of stations with an average of 2.9 per station systemwide.

Ticket Plans and Payment Options: Vending machines issue monthly passes, single fare tickets and cards. They accept cash only.

Operations: Vending machines are located outside the fare barrier. Station personnel and help-point intercoms are available to help customers with vending machine problems.

SMART CARDS

Osaka does not use or plan to use smart cards.

CONTACTLESS CARDS

Osaka does not use or plan to use contactless cards.

DATA COLLECTION & ANALYSIS

Capabilities: Data is collected to produce a number of analyses concerning ridership.

Benefits: The data collected have allowed Osaka to adjust service levels.

Sydney, Australia

FARE SALES METHODS

Tickets/Plans: Sydney sells weekly passes (the most popular form of ticketing) and passes for any number of days between 28 and 366. Round trip tickets with peak hour pricing and single fare tickets are also common. Discounts are available for seniors.

Technology: Magnetic swipe cards and paper tickets are used.

Operations: Tickets are sold through station clerks and vending machines. Cash is accepted along with credit and debit cards. Cash represents 96% of sales.

VENDING MACHINES

Scope: Ticket vending machines are available in 87% of stations with an average of 1.4 per station systemwide.

Ticket Plans and Payment Options: Vending machines sell weekly passes, round-trip, and single fares. Machines accept only cash.

Operations: Vending machines are located outside the fare barrier. Station personnel are available for customers having problems with the machines.

SMART CARDS

Technology: Sydney plans to implement a smart card system by 2003 using a contactless card.

"Open" or "Closed" Environment: Sydney plans for their smart card to function in an open environment, although the details are still in development. The cards will be used across all modes of transit.

Operations: It is expected that contactless cards will be sold through station clerks, the internet, local merchants, and through the mail. Refills will also be available from vending machines.

CONTACTLESS CARDS

Fare Sales: Contactless cards will be used for unlimited passes, round trips, single fares and student and senior discounted fares.

DATA COLLECTION & ANALYSIS

Capabilities: Data is gathered from ticket offices, vending machines, and entry gates to produce a number of analyses concerning ridership.

Benefits: The data collected have allowed Sydney to increase the speed of fare sales and adjust service levels.

AUTOMATIC TRAIN SUPERVISION

Introduction

Automatic train supervision (ATS) technology is being used by transit agencies around the world to better operate and manage their transportation networks. Most agencies, 24 of the 29 respondents of this survey, have ATS including metros built since the 1960's and older metros that have retrofitted networks such as Paris, Berlin, and Moscow.

ATS can be used to increase a transit system's ability to adhere to schedule, improve customer service, and reduce operating costs. Additionally ATS allows for the provision of real-time train service information to passengers. Transit agency goals in pursuing these technologies include improved equipment utilization, more cost effective operations, and improved service to customers.

This chapter reviews the components and capabilities of ATS, outlines data analysis potential, and discusses real-time passenger information applications before presenting the research findings. ATS research findings includes two sections, "Findings: Summary of Responses" and "Findings: Individual Agency Responses," which summarize all responses to each question and each agency's response to the entire questionnaire, respectively.

Overview of Topics Covered

Major issues reviewed in this report include:

- ATS implementation; new installation and old system retrofits.
- ATS technology; ranging from reporting train locations to automatically adjusting train speeds and train routing to correct service delays.
- Use of data gathered by ATS systems; improving operations and increasing passenger satisfaction.
- Real-time passenger information systems; a survey of audio and visual communication used in regular and delay situations.

Today, metro agencies worldwide are providing ATS enhanced service. This timely examination of ATS practices contributes to the important discussion of how to provide better transit service to customers currently under consideration at NYC Transit. It will enable agencies like NYC Transit that plan to convert to ATS technology to review what has worked and help agencies focus their resources, increasing their probability of success.

Components and Capabilities of ATS

ATS is primarily a computerized communication system.[1] With ATS real-time information on train location is transmitted to a central control facility. The data can then be analyzed and used to direct train operations. Train operation modification identified through ATS can be acted on automatically or manually. Advanced ATS systems can use computer algorithms to automatically correct lateness and even provide predictive operations control to suggest operating strategies.

In newer systems information provided through ATS results in automatic changes in train operation. For example, when a train is delayed ATS software can automatically hold trains in stations or reroute trains through control of signaling. In older systems ATS informs dispatchers of delays and train locations enabling dispatchers to take corrective actions. Restoring service quickly and effectively after an incident results in more reliable service.

ATS has the proven capability to improve service reliability and help maximize capacity. Data collected in real time can also be stored for later analysis to facilitate schedule optimization and other service improvements. In addition, ATS data can be used to provide passengers with real-time service information that is considered a high value added feature by customers.

Modern Train Operation and Control

Signaling has been a feature of urban rail transit from the earliest days. Its function is to direct trains and safely separate trains from each other. This includes both a separation between following trains and the protection of specific paths through junctions and crossovers.[2]

Functions have been added to basic signaling, starting, from a very early date with automatic train stops. These apply the brakes should a train run through a stop signal. Automatic train stops were developed in the late 1800's and are in universal use. Speed control is a more recent and less common application, often introduced in conjunction with automatic train control or to meet specific safety concerns. Speed control is usually used to protect approaches to junctions (turnouts), sharp curves between stations and approaches to terminal stations where tracks end at a solid wall.

Three classifications of modern train signaling and control are: [3]

- **Automatic Train Protection (ATP)** provides basic separation of trains and protection at interlockings.

- **Automatic Train Operation (ATO)** builds on ATP through use of relays or microprocessors to control the train's rate of acceleration from the initial start to maximum speed. ATO, with or without attendants or drivers, allows a train to more closely follow the optimum speed envelope.

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[1] Transit ITS Compendium, Institute of Transportation Engineers, Washington, D.C.. April 1997.

[2] "Transit Cooperative Research Program (TCRP) Report 13 Rail Transit Capacity" Transportation Research Board, National Research Council, National Academy Press, Washington, D.C., 1996 p. 17.

[3] TCRP Report 13, p. 17.

This reduces station to station travel times and critical station close-in distances, and can increase total line capacity by 2 to 4%.[4]

- **Automatic Train Supervision (ATS)** capabilities vary widely from a system that reports the location of trains to a central control office, to an intelligent system that uses software to analyze this information and automatically adjust the performance (e.g., speed, switching, and dwell time) of trains to maintain either a timetable or an even headway spacing.

Moving and Fixed Block Signal Systems

How precisely an ATS system is able to function depends to a large degree on the signal system used. Signal systems used for rail transit include *fixed block* and *moving block*.

In a *fixed block* system, trains are detected by the heels and axles of a train shorting a low-voltage current inserted into the rails indicating occupancy of the "block." The signaling system knows the location of the train only by the relatively coarse measure of block occupancy. It does not know the position of the train within the block. Fixed block systems cannot identity a specific train within a block without an additional Automatic Vehicle Identification (AVI) system. Multiple aspect color-light systems and cab signaling are methods of train speed control used to maintain safe distance and maximize throughput.

Moving block signaling systems are also called transmission-based or communication-based signaling systems. These systems are based on a continuous or frequent calculation of the clear (safe) distance ahead of each train and relaying the appropriate speed, braking or acceleration rate to each train. This requires continuous or frequent two-way communication with each train and the control center, as well as precise knowledge of a train's location, speed, and length. Based on this information, a computer can calculate the next stopping point, or target point, of each train and command the train to brake, accelerate, or coast appropriately. The target point is based on the normal braking distance for that train plus a safety distance.

ATS Capacity

ATS has the potential to improve service reliability and so help maximize capacity. Strategies to correct irregular service on rail transit can be automated if there is close integration with ATO and its ability to automatically adjust train performance and station dwell times. Without ATO, ATS allows dispatchers to diagnose problems and address them manually through switches and communication with train operators.[5]

With ATO, ATS systems can use computer algorithms to choose corrective actions and use ATO to automatically adjust train performance. This arrangement is generally associated with moving block or hybrid systems. Corrective action can include eliminating coasting, increasing line speed, moving to higher rates of acceleration, adjusting dwell times, and route selection. For example, in Vancouver,

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[4] "Transit Capacity and Quality of Service Manual, TRCP Web Document 6" Prepared for Transportation Cooperative Research Board Submitted by Kittleson & Associates, Inc., National Research Council, Washington, D.C., 1999 p. 17.

[5] TCRP Report 13, p. 23.

Canada, trains have a normal maximum line speed of 80 km/h (50 m/h) which ATS can increase to 90 km/h as a catch up measure and acceleration and braking can be adjusted.[6]

A further potential of ATS operating strategies is predictive control. Predictive control allows a computer to examine variables for possible future conflicts within the system, such as a merge of two branches at a junction. The computer can then adjust terminal departures, dwell time and train speed to ensure that trains merge evenly without holds, or are appropriately spaced to optimize terminal turnarounds. Through these means ATS has a great potential to improve service reliability and increase capacity.

Data Analysis

Data from an ATS system can also be used to investigate and improve on past performance (e.g., punctuality or even spacing of trains). Train location data can be used to perform operations analysis. For example, because they contain a record every train at every time in specific locations, data from ATS can be used to generate time-space diagrams. These analyses provide critical feedback to schedulers and to operators.

Real-Time Passenger Information

In the effort to make transit a value-added experience, information must be available to customers via an easily accessible medium of their preference. Real-time passenger information provides customers with such information.

Customer service has been improved through use of new technologies. Data provided through ATS can be used to provide comprehensive real-time information to passengers. Travel information can be collected, processed, and communicated to the public in a matter of seconds, so that it reflects conditions at that very moment. This allows passengers to make on the spot travel decisions based on current information on all transportation modes for a given area. Real-time passenger information focuses on providing information to transit riders after their trips have begun. For example, this service can provide travelers with ongoing transit information such as time to next train, transfer points, service delays and alternate routes.

Real-time passenger information is a highly visible customer service improvement. In a society which is increasingly concerned with information, where everyone expects to be informed about what is going on around them, public transportation agencies need to supply their passengers with more accurate information on service and service delays.

An illustration of how a real time passenger information system can be structured is RENEFE-Cercanias of Spain that has installed:[7]

- (At the stations) a centralized public address system and digital signage indicate how long it will take for the next train to arrive at the platform, its destination, and the stops it will make. Any

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[6]

[7] "Applications of the Latest Public Transport Technologies," Pubic Transportation International, Sanchez Mendez, Wenceslao; February, 2000 p. 26- 27.

additional message may also be given to passengers. All passenger information is organized at a centralized information post, which is very near the train control center.

- (Inside the trains) real-time information is provided on moving trains. All of the tunnels are equipped with radiant wire to facilitate communication with each train. This provides an on-line channel of communication between the train and the central information post that allows passengers to be informed of real-time transit conditions. The Commuter Information Center interprets ATS information and relays real-time information to customers on the trains using both written (digital signage) and verbal (public address systems) communication.

Research Efforts

In August 2000, NYC Transit surveyed 88 metros and high capacity commuter rail agencies around the world to evaluate the role and value of ATS systems. The survey covered ATS implementation and technology, use of data to improve service, and real-time passenger information systems (See Appendix C for questions and tabulation of responses). As shown in Table II-1, 29 agencies, primarily metros and commuter rail agencies from the United States, Canada, Europe and Japan, have responded to the questionnaire. Of these, 24 reported having an ATS system.

Table II-1
Questionnaire Respondents

City	Service Provided
Berlin, Germany	Metro
Hong Kong, China (MTR)	Metro
Moscow, Russia	Metro
New York, New York, USA	Metro
Paris, France (RATP)	Metro
Paris, France (RER)	Metro/Commuter Rail
São Paulo, Brazil	Metro
Tokyo, Japan	Metro
Athens, Greece (Attiko Metro)	Metro
Athens, Greece (ISAP)	Metro
Baltimore, Maryland, USA	Metro
Barcelona, Spain	Metro
Boston, Massachusetts, USA	Metro
Budapest, Hungary	Metro
Hamburg, Germany	Metro
Jersey City, New Jersey (PATH) , USA	Metro
Los Angeles, California, USA	Metro
Miami, Florida, USA	Metro
Milan, Italy	Metro
Montreal, Canada	Metro
Nagoya, Japan	Metro
Prague, Czech Republic	Metro
Santiago, Chile	Metro
Singapore	Metro
Toronto, Canada	Metro
Washington, D.C., USA	Metro
Hong Kong, China (KCRC)	Commuter Rail
Osaka, Japan	Commuter Rail
Sydney, Australia	Commuter Rail

NYC Transit also conducted a literature search of issues associated with ATS and real-time customer information. An extensive survey of materials published by the American Public Transportation Association (APTA), the Union Internationale des Transports Publics (UITP), and numerous transportation-related journals showed a wealth of information on ATS technology and real-time passenger information. The array of technologies available in these areas, as well as the scarcity of published information on implementation efforts and data collection and use, highlights the importance of NYC Transit's ATS survey.

The objective of this research effort has been to highlight key aspects of ATS such as implementation, technology, data collection to improve service, and provision of real-time customer information. These issues are of particular importance to NYC Transit as it begins the process of implementing an ATS system. NYC Transit hopes to build on the experiences of its peers in the international transit community to best implement its own conversion to ATS technology in order to improve performance and provide a value added experience to its riders

Findings: Summary of Responses

ATS Implementation

Most metro systems have installed ATS on some or all of their lines. Of the 29 agencies responding to the survey 24 reported having ATS. Seven of these systems have implemented ATS only on new lines including Montreal and Washington, D.C., which installed ATS during metro construction. Seventeen systems have replaced older signal and communication systems with ATS including Berlin, Moscow, and Boston.

Implementation of ATS systems is a major time and capital investment for transit agencies. While some transit agencies have implemented ATS simultaneously on all lines, others have installed ATS incrementally, sometimes over decades, or only on new lines. The gains associated with implementation depend on the age and capacity of existing communications and switching technology. Metros with antiquated equipment are putting in new systems because it is time to rehabilitate the old lines. Upgrading track circuits to improve throughput is extremely costly. Because old systems can be intermixed with the new, transit agencies can upgrade gradually as funds become available. As Jim Egnot of Union Switch said in an interview with *Mass Transit*, "People assume that you put in a new system because the old systems are not safe. That's not true. It is also to increase throughput and to upgrade to a new generation of equipment."[8]

Implementation Scope

ATS Over the Decades: Experiences with ATS installation are diverse ranging in year of installation from 1967 to 2001 and include installation on entire new system construction, partial installations, and full scale replacement of older systems. The earliest installation of an ATS system by a respondent was in 1967 by the Paris (RAPT) and Montreal metros. In 1967, Paris implemented ATS on one new line of its 14-line system. Montreal's new metro was built with ATS capability in 1967 and has since been updated twice. Many older ATS systems have upgraded to increase efficiency and gain access to improved operating tools. The Athens, Attiko Metro (the new portion of the Athens metro system) opened two newly constructed lines of ATS controlled subway in 1999. Other recent ATS installations include Hong Kong (KCRC), Santiago, and Los Angeles, which all underwent systemwide upgrading to ATS in 1998. Berlin will complete a staged upgrading of its entire system to include ATS in 2001.

Extent of ATS Coverage: Respondents with ATS systems range in size from one line in Baltimore to 15 lines in Paris, and from four route miles in Miami to 238 route miles in London. The extent of ATS coverage on each system also varies. The majority of metros with ATS systems, sixteen of 24, have ATS on 100 percent of route miles.

New Construction Versus Replacement ATS Systems: Of the 24 respondents with ATS systems, seven installed ATS systems on new lines only and seventeen installed ATS on existing lines. Newer systems, built since the 1960's, were constructed with ATS capabilities installed. These include Washington, D.C. (1975), Miami (1986), and Athens (Attiko Metro) (1999). Other agencies have installed ATS on new extensions such as São Paulo in 1988 and Milan in 1993. Older metros

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[8] "Signal Technology Today" *Mass Transit*, Vol. 22, No. 5 1996, p. 49.

installing ATS, including Hamburg in 1983 to 1992 and Singapore in 1987, have upgraded older lines with ATS technology.

Installation and Conversion

ATS Systems Difficulties: While most respondents indicated no problems with installation or conversion to an ATS system, five of the respondents indicated difficulties with system startup. Paris (RER) reported maintenance problems (spare parts and computer capabilities) with first generation ATS systems and indicated that new generation ATS systems have improved operating tools and efficiency. São Paulo, whose system was installed on new lines and extensions in 1988, identified problems with processing multiple commands and delay of command indications. Boston reported interface problems in scheduling and incident management. Los Angeles experienced slowed field computer speeds when upgrading their existing system between 1989 and 1996. Finally, Prague experienced low reliability and a lack of information during ATS setup between 1996 and 1998.

Staffing: ATS systems often require fewer dispatching personnel than traditional systems. Prior to ATS installation, dispatcher correction of headway gaps was conducted manually by all respondents. Responses indicating the number of dispatchers required at peak periods ranged from zero to 24, with a median of five dispatchers. Of fifteen respondents, nine indicated that if ATS replaced an older system, the same dispatchers were retained. Additionally, thirteen respondents indicated that personnel were retrained or transferred as a result of ATS system installation. Twelve of 21 respondents reported that new job tasks were created through ATS. New or increased job tasks included data analyst, computer technician, ATS maintenance and training, line dispatcher, traffic regulator, and network controller.

Costs: Fourteen respondents reported the initial capital cost of their ATS system[9]. The median initial capital investment was $8.1 million dollars The range of costs was from approximately $0.8 million for the Toronto 1993 upgrade to $142.0 million for the Hong Kong (KCRC) full system upgrade in 1998. Annual operating costs were reported by six agencies with the minimum of $0.1 million and a maximum of $12 million per year. The median annual operating expenditure was $0.4 million. Annual maintenance costs for ATS systems were reported by eight agencies. The median annual maintenance cost reported was $0.6 million. The minimum maintenance cost was $7 thousand reported by Toronto and the maximum maintenance cost reported was $2.5 million, reported by Hong Kong (KCRC).

Technology

Implementation of ATS technology varies widely from reporting the location of trains to a central control center where dispatchers make manual adjustments to service, to a complex computerized system that automatically controls train movement. The level of ATS control of service is influenced by a wide variety of elements associated with train control and supervision. The diversity of system structures and utilization of systems is evidenced by the responses to this section of the questionnaire.

[9] Costs are not in constant year dollars and have been converted to US dollars only to provide a general idea of costs in different locations. Variables such as date(s) of installation, agency definitions of costs, and local labor markets vary so greatly that meaningful cost comparisons cannot be made.

Hardware

Fixed and Moving Block Systems: As mentioned in the introduction, the use of fixed or moving block or hybrid signal system effects the level of accuracy in determining train location. Of the 22 agency responses twenty reported using a fixed block signal system and three reported using a hybrid of a fixed and moving block system. A greater variety of ATS operations are available to hybrid systems that are able to pinpoint train location more accurately. Systems reporting use of hybrid systems include Hong Kong (MTR and KCRC), Paris (RER) and Santiago.

Work Station Location: All 24 respondents with ATS systems had central control room work stations. In addition, ten reported additional workstations at terminal stations and six were reported in other locations such as fault report centers and terminal stations.

Backup Systems: Backup systems employed by agencies include redundant ATS, retention of preexisting system, and manual control of trains. Of the twenty responding agencies, thirteen use a redundant ATS system, four retained a preexisting system and six used other backup including manual control of trains and local control boxes.

Route Selection Architecture: Route selection architecture is the mechanism that chooses and sets up train routes (for example at a line junction). Route selection architecture can be activated automatically (based on a schedule or other software input) or manually from a control center, or by tower or train operator from the field. For example, Paris (RER) uses a selection process where a train route is automatically provided on the basis of a theoretical timetable, identification of trains, and in accordance with the decision of the traffic controller.

Route selection architecture systems on lines equipped with ATS included:

- Eighteen incidences of automatic control center selection based on a schedule.
- Eleven incidences of control center selection made manually only.
- Two incidences of other types of control center selection.
- Four incidences of automatic field selection through Automatic Vehicle Identification (AVI) and
- Two incidences of another type of field selection.

Software

ATS software analyzes train movements in real-time and can suggest or make train operation modifications depending on the complexity of the system installed. Software can either be used to inform manual dispatchers or automatically control trains. Software was developed by a variety of vendors to suit the needs of transit agencies. No evidence of standardization of vendors used is reflected in the data collected.

Real-time Dispatching Suggestions: Software dispatching suggestions used by the fourteen responding agencies for non-automated actions are varied. The most common suggestion category is “holding trains or extension of dwell time in stations” with thirteen agencies reporting its use. Ten agencies reported “offset terminal departure times,” ten reported “alert dispatcher to service gap,” and two reported “short turn into service gap.” No agencies reported using software that recommended trains to skip stops. The most common set of suggestions, used by five of eighteen respondents, was to hold train, offset terminal departure time, and alert dispatcher to service gap.

Automatic Control of Dispatching Actions: Automatic control of dispatching actions is a seamless way for transit operations to use ATS technology. Fourteen of eighteen responding agencies have software that automatically controls one or more dispatching actions. The number of reported dispatching actions automatically controlled by ATS software are: terminal departure time control (14), dwell time/holding train control (12), speed control (8), dwell time holding time countdown for crews (5), dwell time/holding lights (4), and train separation (2).

Alarm Systems: It is also common to use software to monitor train operations and to signal an alarm if trains operate outside of given parameters. Fourteen agencies indicated the use of software to indicate operating rule violations. Of these nine systems indicated signal overrun, six indicated station overrun, one indicated speed overrun, and one indicated inter-station stops and train delay.

Scheduling: In addition to scheduling train route operations, ATS software can also be used to schedule many routine transit activities. The practice of scheduling other activities using ATS is not widely used. Of the twenty respondents that use ATS software to schedule trains, four use it to schedule train maintenance, and three use the software to schedule train crews.

Automatic Vehicle Identification (AVI): Thirteen respondents indicated having AVI systems in place. Five of these systems, (Moscow, Paris (RATP), Hong Kong (KCRC), Baltimore, Barcelona, and Prague) use AVI to transmit maintenance and diagnostic information to a control center. Systems using self-diagnostics significantly reduce maintenance costs because when a system failure occurs probable cause is indicated automatically.[10]

Console Display Capabilities: Console displays have changed dramatically over the past few decades from boards with lights to closed circuit television (CCTV) and interactive computer display screens with pan and zoom capabilities. Of the agencies surveyed, nineteen responded with descriptions of their console display abilities. These included fifteen with scheduling systems, twelve with public address systems, twelve agencies with voice communications, eight with CCTV, eight with fire protection systems, and four with video communications. Twenty-two respondents described their console display technologies eight have workstation monitors, nine have overhead screens, and six have other display technologies such as mimic boards and projection screens.

Data Collection and Analysis

Information that is displayed on computer screens as part of an ATS system can be stored for future analysis. ATS data can be used for several types of analysis. For example, they can be used to generate time-space diagrams that show train movements, because they contain a record of the time and location of all trains. These analyses can assist in making service improvements based on actual experience. ATS analysis used in combination with passenger load estimates, available through passenger counts or automatic fare collection data can further assist in system analysis and service improvements.

Capabilities

[10] "Signal Technology Today" *Mass Transit*, Vol. 22, No. 5 1996, p. 49.

Database Design and Operation: Of the 23 agencies responding, nineteen have a database where they recorded train movement and other data. Agencies save data for periods ranging from five days in São Paulo to "indefinitely, for future reference" in Hong Kong, (MTR). The median time data is stored by agencies is 60 days. The minimum of analysts reported was zero by Hong Kong (MTR) and Boston. The maximum number of analysts reported was eight by São Paulo. The median number of analysts used to interpret data is two.

Analysis: Most agencies reported performing several types of analysis with data collected via ATS. Of eighteen respondents all analyzed terminal departure-time compliance, seventeen analyzed headway regularity, sixteen analyzed delays and fifteen analyzed station dwell time. Analyses with less than fifteen respondents included running time, time space diagram analysis, mid-route on time, recovery time, and disruption recovery.

Incident Analysis: Of the twenty responses received, eleven record audio communications with crews. Fifteen also have an ATS playback feature for accident or delay investigations.

Simulation Capacity: Seven of 23 respondents have an ATS system that includes a model to simulate train operations. Of these five included block layout and signal system design as simulation factors, four used acceleration and deceleration, two used dwell times based on passenger flow estimates, and two used dwell times based on previous headway. Three of five respondents had simulations that could carry out alternatives analysis in real-time. Respondents employed a diverse group of software vendors including Hitachi and Alsthom.

Benefits

ATS has enabled most agencies to improve service provision. Fifteen of seventeen responding agencies report more quickly identifying service delays, thirteen reported shortened duration of delays, and twelve report reduced impact of delays. Eleven of eighteen respondents also reported creating more efficient schedules and better utilizing resources as a result of ATS implementation.

Passenger Information Systems

Real-time ATS data can be linked to passenger information systems to provide passengers with real-time train service information; improving the quality of the transit experience for customers.

Capabilities

Information Media: Display media such as digital signage and maps are often the first choice for presenting information in metros. They allow passengers access to information continuously. In addition to using display media for travel information purposes, revenue can be generated by using display media for advertising purposes. Sound is also a common informational medium. Design of stations can have a positive or negative effect on announcements depending on reverberation and sound quality. Stations designed for audio announcements tend to provide the least acoustical distortion.[11] For example, on Tokyo's newest line, Namaboku, music is used to announce arrivals and departures,

[11] "A New Generation of Information Systems," van Kemenade, Teis, *Passenger Rail Management*, January 1999. p. 26.

and verbal messages are kept to a minimum to create a peaceful atmosphere. In addition in-train information screens displaying the approaching station are located above each train door.[12]

Of 28 responding agencies, seventeen indicated having a real-time passenger information system. Digital signage is the most common method used to display real-time information used by fourteen agencies. Map or schematic display is used by four agencies and one agency (Jersey City (PATH)) uses CCTV display to provide real-time information to customers. Displays are located in a variety of areas with sixteen respondents displaying information on platforms. Other locations include station lobby (eleven agencies), and outside fare collection area (seven agencies). Other locations were sighted by two agencies, in-train displays by Hong Kong (MTR) and in bus terminals by Paris (RER).

<u>Accommodation of Passengers with Disabilities</u>: Eleven agencies indicated attempts to accommodate passengers with disabilities through: audio announcements, duration of display, size of display, and use of distinctive lettering.

<u>Type of Service Information Provided</u>: Of sixteen responding systems:

- Fifteen provide train destination.
- Twelve provide public service announcements.
- Eleven provide minutes to next train (real-time).
- Eight provide train routing.
- Eight provide train number.
- Six provide train length.
- Five provide marketing.
- Three provide train delay and alternate routing information and
- Two provide minutes to next train (schedule based).

The responses indicate that train arrival information is available between one and five trains in advance and information is updated from once every 60 seconds to continuously.

<u>Delay Announcements</u>: Information included in delay announcements of fifteen respondents includes: eleven report projected minutes of delay, ten report cause of delay, and six report suggested alternative routes. Delay announcements are either made at the discretion of dispatch or automatically. Examples of automated delay determination follow:

- Paris (RER) – When the headway gap is twice the scheduled headway.
- Hamburg – Normal countdown shows waiting time for approaching train with delays, when service stops, a general advice of disruption is displayed.
- Washington, D.C. – When train delays exceed one headway, usually after six minutes.

[12] "Aiming For the Future – On the High–Tech Namboku Line," Hara, Mikio, *Public Transport Report*, 1995/6 p. 120.

Findings: Individual Agency Responses

Berlin, Germany

IMPLEMENTATION

Scope: ATS is employed on the entire Berlin metro system of 9 lines, 191 stations, and 151.7 route-miles. The installation of the ATS system began in 1975.

Conversion Issues: ATS replaced an older, simple system on one of the lines when it was implemented. Because the older system was simple in nature, no conversion problems were encountered. Dispatchers were retained and other personnel had to be retrained or transferred. New line-dispatcher positions were added to handle additional responsibilities.

TECHNOLOGY

Hardware: ATS workstations are located in the control center. Fixed block technology is used along with wayside signalization. Route selection is schedule based and train yards are controlled from the ATS control center. A new redundant system is used in case of emergency.

Software: ATS software, which was designed externally by Siemens VT, takes automatic control of terminal departure times. Scheduling systems, such as train schedules and crew schedules are integrated into the workstations. Crew reassignment must be done manually. Workstation monitors display information graphically in a windows-like format.

DATA COLLECTION & ANALYSIS

Capabilities: No database is kept on train movement data. AVI devices are spaced at station distances to identify vehicles.

Benefits: ATS has enabled the agency to more quickly identify and shorten the duration and impact of service delays.

REAL-TIME INFORMATION

Capabilities: Real time information is displayed to passengers via digital signage on platforms and in some station mezzanines and lobbies. Displays are supplemented with audio announcements. Train name and number, minutes to next train, train destination, train length, delay information, and public service announcements are all made available to customers. Train information is usually given for the next two trains, and is updated on a minute-by-minute basis.

Hong Kong, China (MTR)

ATS - Hong Kong, China (MTR)

IMPLEMENTATION

Scope: Hong Kong began implementation of an ATS system on its metro in 1995 including an upgrade in 1996. This ATS system covers 3 of 5 lines, 38 of 43 stations, and 43.2 of 45 route miles.

Conversion Issues: ATS was an upgrade from hardwire panels and added regulation functions. No interface problems were experienced between the old and new systems. There was no change in the number of dispatchers used when the system was adopted and existing personnel were retained or transferred. Necessary manual headway gap reduction was performed before installation of ATS.

TECHNOLOGY

Hardware: ATS workstation locations include control center, a fault report center and depot. The Système d'Aide à la Conduite à l'Exploitation et à la Maintenance (SACEM) ATS system, which is literally translated as "assistance to (train) driving, operations and maintenance is used. Route selection is based on schedule and yards are not controlled from the ATS system control center. Wayside signal systems are relay interlocking and SSI. ATC and ATO are SACEM based. The backup system used is manual operation.

Software: ATS software makes dispatching suggestions for hold/dwell time, offsetting terminal departure times, and alerting dispatchers to service gaps. The software takes automatic control of speed, dwell time, and terminal departure time. Software was designed by ALCATEL. Only train schedules are included in the ATS system. Graphics capabilities of the console display include full screen layout, zooming to interchange stations. Voice communications, CCTV, and scheduling systems are integrated into ATS through workstations in stations called SICP (Signaling Interlocking Control Panel). Workstation monitors and overhead displays are provided.

DATA COLLECTION & ANALYSIS

Capabilities: A database stores all train movement data. The operations planning department is responsible for analyzing this data. Reports such as terminal departure time compliance, headway regularity, running time delays approaching stations, dwell time, and disruption recovery are automatically generated by software. Trains are identified through SACEM and transmittal of data is done via telemetry and radio channel. No on-line diagnostic information is integrated, communication with crews is not recorded, and a model to simulate train operations is not part of the ATS system.

Benefits: ATS data is not credited with allowing the agency to better utilize train resources (in fact, the system was not designed for such purpose). However, ATS is credited with allowing the agency to more quickly identify and shorten the duration of service delays.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is provided through display panel located in platform. Real time display includes minutes to next train, and train destination. Other displays are located on the platform, in the station lobby/mezzanine, and on the train mainly for advertising but also serving as passenger information display.

Moscow, Russia

IMPLEMENTATION

Scope: ATS was installed on 2 of the Moscow metro's 11 lines in 1999. The ATS system currently serves 46 stations and 78.1 route-miles.

Conversion Issues: Although ATS replaced an older system, no conversion problems were encountered and no new job tasks were added. Currently, 6 dispatchers are required for peak periods.

TECHNOLOGY

Hardware: ATS workstations are located in both the control center and terminal stations. Fixed block technology is used. Route selection architecture is schedule based. Train yards are not controlled from the system control center. A new redundant system and the preexisting system are available for back up in case of an emergency.

Software: ATS software, which was designed internally, makes dispatching suggestions that alert the dispatcher to service gaps. The software also takes automatic control of dwell/holding time. Train, crew, and maintenance schedules are all included in the ATS system. Voice communication, public address systems, and clearance control abilities are built into the ATS workstations. LED displays and workstation monitors are used for display. No graphics capabilities exist at this time.

DATA COLLECTION & ANALYSIS

Capabilities: A database records and stores train movement data for 2 weeks. The chief dispatcher has 2 analysts who produce reports including time-space diagrams, terminal departure-time compliance, mid-route on-time performance, headway regularity, running time, delays approaching terminal stations, dwell time, and recovery time. AVI devices transmit maintenance diagnostic information via landline. The ATS system has the ability to record audio communications and play them back.

Benefits: ATS has allowed for the creation of more efficient schedules as well as better utilization of train resources. ATS has enabled faster identification, reduced impact, and shorter delays.

REAL-TIME INFORMATION

Capabilities: No real-time passenger information is available to customers, except for radio announcements by train drivers to passengers during emergencies or shifts from normal operation.

New York, New York (NYCT)

The New York metro's ATS system is under construction on the "A" Division (the numbered lines, comprising 68.3 route miles out of a system wide total of 234.7 route miles). Completion is expected by 2005. Plans for ATS expansion to the "B" Division (the lettered lines, comprising the remainder of the metro system) are still under development. Siemens has been selected to lead a joint venture that will complete the remainder of the ATS "A" Division contract. $162.5 million has been allocated through the capital budget though 1999 for the "A" Division portion of ATS implementation.

Paris, France (RATP)

IMPLEMENTATION

Scope: The Paris Metro installed its ATS system between 1967 to 1975. ATS covers the entire metro system; 15 lines, 375 stations, and 211.3 route km.

Conversion Issues: The ATS system was implemented as a new system – it did not replace an older system. Since its implementation, it has required 12 dispatchers during peak periods, with the exclusion of Line 14 (Meteor). In addition, a "chef de regulation" or traffic controller position needed to be added to manage the ATS. Before ATS, in cases of disturbance, the driver used to report the delay to the stationmaster, who then forwarded it by phone to the departure master at the terminal.

TECHNOLOGY

Hardware: Workstations are located in centralized control center rooms. The Meteor Line has its own exclusive control center. Fixed block technology is used. In case of emergency, the Meteor Line has a redundant system, while the other lines use backup dispatching. Route selection is based on schedule for the Meteor Line. For other lines it is done manually. Train yards are not controlled by the ATS system control center.

Software: ATS software makes dispatching suggestions for hold/dwell time, offsetting terminal departure times, and alerting dispatchers to service gaps. The software, which was designed internally, takes automatic control for dwell time and holding time. Train schedules for priority regulation and traffic control are included in the ATS system. Graphics are done through an illuminated line diagram, without a console. Voice communications, public address systems in stations, scheduling systems, and fire protection systems are all integrated into the ATS workstations.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement and other data are recorded and stored in a database for one month. The Metro Operations Department analyzes the data. Examples of analysis include time-space diagrams, terminal departure-time compliance, headway regularity, running time, delays approaching terminal stations, dwell time, recovery time, and disruption recovery. The ATS system records the audio communications of dispatchers and crews, allowing for playback for accident or delay investigations.

Benefits: ATS has allowed for the creation of more efficient schedules as well as better utilization of train resources. Paris metro has experienced an enhanced regulation of trains and improved incident resolution. ATS has enabled faster identification of delays, a reduction of delay impact, and shortened delays.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is provided via video screens and public address systems. Information displayed includes train name/number, minutes to the next train, train destination and routing, and incident information. Information for the next 2 to 4 trains is updated constantly. Delay information provides the time of the projected delay, the cause of delay, and suggested alternative routes. Displays are located on platforms, mezzanines, and by fare collection areas.

Paris, France (RER)

IMPLEMENTATION

Scope: Line A of the Paris RER received ATS in 1969 and was rebuilt in 1992. Line B installed ATS during the 70's and was rebuilt in 1985.

Conversion Issues: Before both ATS systems were rebuilt, there were problems with the original systems, notably with spare parts and computer capacities. The new ATS systems allowed for improved operating tools and efficiency. When the systems were replaced, the same dispatchers were retained, but some personnel had to be retrained or transferred. Headway gaps were performed manually by the traffic controllers before ATS. Today, train delays are automatically provided and timetable regulation is performed manually.

TECHNOLOGY

Hardware: ATS workstations are located in the control center. Fixed block technology has been use on all of line "B" and the suburban parts of line "A." The rest of line "A" employs SACEM technology in order to reduce headway to 2 minutes. Route selection is automatically provided on the basis of theoretical timetables and the identification of trains, in accordance with the decision of the traffic controller. Train yards are controlled by the ATS system control center. Wayside signal systems are used along with continuous speed control and cab-signal controls on the SACEM portions of line A. An emergency backup system features shunting boxes that are locally operated.

Software: ATS system software only controls train schedules. Crew reassignment is performed manually. Console display features delays, information postings, rolling stock identification and electrical supply information. ATS workstations are integrated with voice communications, video communications, public address, and scheduling systems. Overhead display screens are provided in key points.

DATA COLLECTION & ANALYSIS

Capabilities: A database stores all train movement data for a period of one month. Two analysts in the operating department analyze data including time-space diagrams, terminal departure-time compliance, headway regularity, running time, delays approaching terminal stations and dwell time. Trains are identified through AVI devices placed at the exit of each operating siding, that transmit maintenance diagnostic information over the air. These devices are not integrated with the ATS system. All communications by rail telephone and radio are recorded, archived and may be played back. The ATS system does not have a model to simulate train operations.

Benefits: ATS is not credited with more efficient utilization of resources. ATS has enabled faster identification of delays, a reduction of delay impact, and shortened delays.

REAL-TIME INFORMATION

Capabilities: Real-time information is provided through digital signage displays on platforms, in station lobbies/mezzanines, near fare collection areas, and in bus terminals. Displays show train name/number, minutes to next train, train destination, train routing, public service announcements, and train length. Information on the next 5 trains is updated continually.

São Paulo, Brazil

IMPLEMENTATION

Scope: São Paulo installed their ATS system in 1988. It is integrated into all 3 lines of the metro, serves 13 out of 46 stations and 9.4 out of 33 route miles.

Conversion Issues: ATS was installed only on new lines and extensions. Problems have been experienced with the processing of multiple commands and the delay of command indications when non-ATS and ATS systems interface.

TECHNOLOGY

Hardware: ATS workstations are located in the control center and at terminal stations. Fixed block technology is used. Train yards are controlled from the ATS control center. There is no ATS backup system.

Software: ATS software takes automatic control of speed, dwell time, and terminal departure time. Reassignment of crews to trains during the service day is performed manually. Public address systems are integrated into ATS workstations. ATS is displayed on workstation monitors.

DATA COLLECTION & ANALYSIS

Capabilities: A database records train movement data and stores it for five days. Eight analysts in the Department of Centralized Operation Control produce reports including time-space diagrams, terminal departure-time compliance, mid-route on-time performance, headway regularity, delays approaching terminal stations, and dwell type reports are what come out of the analysis. AVI devices are located in the platforms. Diagnostic information is not transmitted.

Benefits: ATS data has resulted in more efficient schedules and use train resources.

REAL-TIME INFORMATION

Capabilities: Digital signs located on platforms, in station lobbies and in station mezzanines provide real-time passenger information. Information displayed includes train destination, public service announcements, and alternate routes.

Tokyo, Japan (TRTA)

IMPLEMENTATION

Scope: Tokyo's metro began using ATS in 1974. ATS is currently used on the entire metro system.

Conversion Issues: ATS replaced older systems on 5 of 8 lines no interface problems between the old and new systems were experienced. 3 dispatchers are used per line during peak periods. When ATS was installed existing personnel were retained or transferred. New job tasks such as having to input diagrams manually during service disruptions have been created. Before ATS, headway gaps were corrected by instructing drivers directly through radio communication.

TECHNOLOGY

Hardware: Workstations are located in the control center. Fixed block technology is used. Route selection is executed through schedule based office selection and AVI field selection. Train yards are not controlled from the ATS system control center. A backup system features a new redundant system.

Software: ATS software makes dispatching suggestions for hold/dwell time extensions and, at some stations, offset terminal departure times. It also makes dispatching warnings for delay and stopping in tunnels. Software takes automatic control of dwell time, dwell time countdown for crews, and terminal departure time control. Hitachi and Mitsubishi designed software both internally and externally. Only train schedules are included in the ATS system. Diagram display is available on consoles. CCTV capabilities, scheduling systems, and weather and news reports are integrated into the ATS workstations. Workstation monitors and video projectors are provided.

DATA COLLECTION & ANALYSIS

Capabilities: A database stores train movement data for up to a year. The data is analyzed by a varying number of analysts from the Transportation Bureau & Electricity Department. No analyses have been performed to date. On-line maintenance diagnostic devices are integrated with the ATS system. The ATS system does not record audio communications. The ATS system includes a model to simulate train operations. The simulation includes factors such as dwell times based on passenger flow estimates, dwell times based on previous headway, and acceleration and deceleration.

Benefits: ATS data has allowed for the creation of more efficient schedules and the better utilization of train resources through the prevention of affected delay. ATS has allowed service delays to be identified more quickly and the duration of those delays shortened.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is provided through LED displays and maps showing train locations. Displays are located on platforms and outside fare collection areas and display train destination and pubic service announcements.

Athens, Greece (Attiko Metro)

IMPLEMENTATION

Scope: The Athens Attiko Metro installed ATS in 1999 on their entire system consisting of 2 lines with 19 stations, covering 16 route miles.

Conversion Issues: ATS was installed for the new system as it was built, so no conversion issues were encountered. It requires 2 dispatchers during peak periods, one for each line.

TECHNOLOGY

Hardware: Workstations are located in the control center. Fixed block technology is used. Route selection is done through schedule based office selection and AVI field selection. The yards are not controlled from the ATS control center. An ATC signal system is used. The ATS system is backed up using local control panels.

Software: ATS software makes dispatching suggestions for hold/dwell time extensions, offsetting terminal departure times, and alerting dispatchers to service gaps. The software takes automatic control of dwell/holding time, dwell/holding lights, and terminal departure time. Alsthom Transport designed the software. Train and maintenance schedules are included in the ATS system crew assignment is not. ATS workstations feature integrated scheduling systems and are displayed on workstation monitors and visual control panels.

DATA COLLECTION & ANALYSIS

Capabilities: A database records train movement data and stores it for as long as 1 month. The operations department is charged with analyzing this data and producing reports featuring: time-space diagrams, terminal departure-time compliance, mid-route on-time performance, headway regularity, running time, delays approaching terminal stations, dwell time, and recovery time. AVI devices are spaced at 2 km and do not transmit or have on-line maintenance diagnostic information. The ATS system does not record audio communications. However, the ATS system does have a model to simulate train operations, including block layout and signal system design and acceleration and deceleration features.

Benefits: ATS data has allowed for the creation of more efficient schedules and the better utilization of train resources through the more effective adjusting of timetables. ATS has enabled the Athens Attiko Metro to identify service delays more quickly, reduce the impact of delays, and shorten the duration of delays.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is not provided.

Athens, Greece (ISAP)

IMPLEMENTATION

Scope: The Athens (ISAP) has had ATS since 1985, covering its system of 1 line with 23 stations.

Conversion Issues: Before ATS, local dispatchers corrected headway gaps manually. The addition of ATS added new tasks that are carried out by line regulators and radio operators.

TECHNOLOGY

Hardware: ATS workstations are located at the control center. Fixed block technology is used and route selection is schedule based. Train yards are not controlled from the ATS system control center. Wayside and CBTC signal systems are used. The pre-ATS system was retained for emergency backup purposes.

Software: ATS software, designed by AMBER, makes real-time dispatching suggestions for hold/dwell time extensions and to offset terminal departure times. Train schedules are included in the ATS system. Crew reassignment is manual.

DATA COLLECTION & ANALYSIS

Capabilities: Athens (ISAP) does not have an ATS database. AVI devices are located at every block, but they do not transmit maintenance diagnostic information. The ATS system records audio communications and has a playback feature. ATS system software does not model train operations.

Benefits: ATS has enabled Athens (ISAP) to provide better service through shortening of delays.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is not provided.

Baltimore, Maryland

IMPLEMENTATION

Scope: Baltimore's metro was constructed with ATS in 1983. The metro consists of 1 line and 14 stations.

Conversion Issues: Since the ATS system was installed originally, there were no conversion issues. The ATS system requires 2 dispatchers during peak periods.

TECHNOLOGY

Hardware: Workstations are located in the control center and terminal stations. Fixed block signal technology is used. Route selection is schedule based. The train yards are not controlled from the ATS control center.

Software: No response provided

DATA COLLECTION & ANALYSIS

Capabilities: No response provided

Benefits: No response provided

REAL-TIME INFORMATION

Capabilities: No response provided

Barcelona, Spain

IMPLEMENTATION

Scope: The Barcelona metro installed ATS on the entire metro system in 1986.

Conversion Issues: ATS replaced an older system. No problems were experienced with the conversion. The same dispatchers were not retained and new job tasks were created with ATS. Currently, 5 dispatchers are required during peak periods.

TECHNOLOGY

Hardware: Workstations are located in the control center and in terminal stations. Route selection is manual and train yards are controlled from the ATS system control center. A new redundant system is used as a backup.

Software: ATS system software makes dispatching suggestions for skip stops, hold/dwell time extensions, offset terminal departure times, and alerts the dispatcher to service gaps. Software takes automatic control of speed and terminal departure time. SAINCO designed the software. Only train schedules are included in the ATS system. Radio telephone and telephone systems, CCTV capabilities, video communications systems, public address systems, scheduling systems, and fire protection systems are all built into ATS workstations.

DATA COLLECTION & ANALYSIS

Capabilities: A database stores train movement data for a period of 15 days. One analyst in the supervision department analyzes this data. Time-space diagrams, terminal departure time compliance, headway regularity, running time, delays approaching terminal stations, dwell time, recovery time, and disruption recovery are all analyzed. AVI devices transmit diagnostic information. ATS can also record and playback audio communications and model train operations.

Benefits: ATS data enabled the creation of more efficient schedules and better utilization of train resources. ATS is credited with identifying service delays more quickly and reducing the impact and shortening delays.

REAL-TIME INFORMATION

Capabilities Real-time passenger information is provided through digital signage and audio announcements on platforms. Train name, train number, and minutes to the next train are all provided routinely and constantly updated. In the instance of delay, cause and suggested alternative routes are provided.

Boston, Massachusetts

IMPLEMENTATION

Scope: Boston's metro installed their ATS system in 1998. It currently operates on 3 of the 4 lines.

Conversion Issues: ATS replaced a hardwired lever and light bulb system. The conversion created few problems. Dispatchers were retained. Staff providing maintenance support were transferred.

TECHNOLOGY

Hardware: ATS workstations are located in the control center and in field management centers. Route selection is both schedule based and manual. Train yards are not controlled from the ATS control center.

Software: ATS system software, developed in conjunction with the Massachusetts Institute of Technology, takes automatic control of terminal departure times. Both train schedules and crew schedules are included in the ATS system. Console graphics, displayed on workstation CRT's and rear projection screens, feature zoom, pan, clutter level control, multiple windows, and multiple screen capabilities. Workstations are integrated with voice communications, CCTV, public address systems, scheduling, fire protection systems, and vent fans.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement data is stored for one year. The Operations Department, with the assistance of the Signal Division and the Information Technology Department, analyzes data and produces reports on terminal departure time compliance, mid route on-time performance, headway regularity, running time, delays approaching terminal stations, dwell time, recovery time, disruption recovery, and mileage. AVI equipment is used. Audio communications can be recorded and played back manually. A model to simulate train operations is currently in the development stage.

Benefits: As a supplement to manually collected data, ATS data has enabled the development of more efficient schedules and the better utilization of train resources. ATS has facilitated identification of service delays, reduction in delay impact, and shortened delays.

REAL-TIME INFORMATION

Capabilities: Dot matrix "zipper" signs provide real-time information to passengers in some stations. This information is supplemented with announcements. Information on train destination is provided and interior electronic information displays are occasionally provided.

Budapest, Hungary

The Budapest metro does not have ATS.

Hamburg, Germany

IMPLEMENTATION

Scope: Hamburg began ATS installation in 1983. The agency plans to complete its ATS installation by 2002.

Conversion Issues: Before ATS was installed, train operation was manual. No problems were encountered in the installation of ATS. Currently, 2 dispatchers are required for peak periods.

TECHNOLOGY

Hardware: Workstations are located in the control center. Fixed block technology is used. Route selection is schedule based for one line and manual for others. Only reverse tracks in train yards are controlled by the ATS control center. Wayside and ATC signal systems are used. ATS backup is an old system of announcements and orders via phone.

Software: ATS software makes dispatching suggestions for hold/dwell time extensions. Train schedules are incorporated in the

ATS system. Reassignment of train crews is done manually. ATS data is displayed via workstation monitors.

DATA COLLECTION & ANALYSIS

Capabilities: A database stores train movement data for 6 months. Analysts in the Department of Metro Operations analyze the data. Analysis includes: terminal departure-time compliance, mid-route on-time performance, delays approaching terminal and transfer stations, percentage of losses of departures per month, and percentage of delays per day. Hamburg plans to install AVI devices.

Benefits: ATS has not lead to more efficient schedules or better utilization of resources. However, it has assisted in providing a better survey of the extent and location of delays. Thus allowing for better distribution of time reserves in the internal schedule. It has also aided in improving planning of track work, enabled faster identification of service delays, a reduction in the impact of delays, and shortening of their duration. ATS has helped in keeping trains in stations to ensure proper interchange of passengers.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is provided to customers on digital signage displays on platforms and near fare collection areas. In the future, displays will be placed in mezzanine and station lobby areas. Displays show train line number, train destination, minutes to next train, train length, public service announcements, marketing, advertising, waiting time for delayed train, and service advice during disruptions.

Jersey City, New Jersey (PATH)

The New Jersey (PATH) metro does not have ATS.

Los Angeles, California

IMPLEMENTATION

Scope: The Los Angeles metro installed ATS in stages in 1989, 1992, and 1996. ATS is now fully implemented.

Conversion Issues: The problem encountered during conversion was that field computer speeds were not as efficient as they used to be before the newer technology was implemented. With installation of ATS, dispatchers were retained. More analysts were also required. Five dispatchers are currently required during peak periods. Before ATS, headway gaps were corrected manually.

TECHNOLOGY

Hardware: Workstations are located in the control center. Route selection is done manually, through terminal modes, and through field selection. Wayside and ATC signal systems are used. The backup system is manual block.

Software: ATS software used by the Los Angeles metro was designed externally by Sesica. ATS workstations are integrated with voice communications systems, public address systems and fire protection systems. Scheduling systems will be added shortly. Displays include workstation monitors and back projection screens.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement data is stored for up to 90 or more days. The Rail Operations Department uses two analysts to analyze data. Data is analyzed for terminal departure-time compliance, mid-route on-time performance, and headway regularity. AVI devices are available on one line. The devices will be able to transmit maintenance diagnostic information in the future. The ATS system is able to record audio communications.

Benefits: Undetermined.

REAL-TIME INFORMATION

Capabilities: The Los Angeles Metro provides real-time passenger information displayed on digital signage on platforms, in station lobbies and mezzanines, and outside of fare collection areas. Displays show train destination, public service announcements, and emergency information.

Miami, Florida

IMPLEMENTATION

Scope: Miami's metro mover was installed with an ATS system in 1986 and extended in 1994. Covering 7.1 miles and 21 stations the people mover uses unmanned cars.

Conversion Issues: Since ATS is the original system, no conversion issues were experienced. Three dispatchers are required during the peak period.

TECHNOLOGY

Hardware: Workstations are located in the central control center and in terminal stations. Vehicles are either automatically or manually operated. Schedules and train frequency are automatic. Manual operation is available when needed.

Software: Miami's ATS software, designed externally by ADTRANZ, makes dispatching suggestions to prevent bunching of vehicles. The software takes automatic control of speed. Control panels with pushbuttons and display boards are used for console displays. These displays show track layout, signals, switches, and power distribution. ATS workstations are integrated with voice communications systems, CCTV capabilities, video communications systems, public address systems, and fire protection systems.

DATA COLLECTION & ANALYSIS

Capabilities: Miami does not store train movement data.

REAL-TIME INFORMATION

Capabilities: Next train arrival/destination is displayed.

Milan, Italy

IMPLEMENTATION

Scope: The Milan metro constructed Line 3 with ATS in 1993. Lines 1 and 2 do not have ATS.

Conversion Issues: No conversion problems were encountered as ATS was installed on new construction. Line 3 requires 2 dispatchers during peak periods.

TECHNOLOGY

Hardware: Workstations are located in the control center and in the terminal stations. Fixed block technology is used. Route selection is based on schedule and yards are not controlled from the control center. ATC and ATO signal systems are used. An older system is used as a backup in case of emergency.

Software: Milan's ATS software makes dispatching suggestions for hold/dwell time extension and alerts dispatchers to service gaps. The software also takes automatic control of dwell/holding time and terminal departure time. Train schedules are included in the ATS system. Consoles feature workstation monitors with zooming and panning and are integrated with scheduling.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement data is stored for 6 months. The Operation Maintenance Department performs analysis including time-space diagrams, terminal departure-time compliance, headway regularity, running time, delays approaching terminal stations, dwell time, and recovery time. ATS is integrated with maintenance diagnostic devices. The ATS system does not model train operations.

Benefits: ATS data has not enabled of efficient schedule development or better utilization of train. ATS has enabled service delays to be identified more quickly.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is provided using digital signs on platforms showing minutes to the next train, train destination, and train length. Train information is shown two trains in advance. Information is updated every 30 seconds. Delay information is displayed when delays are more than 10 minutes.

Montreal, Canada

IMPLEMENTATION

Scope: Montreal's metro was built with ATS capacity in 1967 and encompasses the entire metro system.

Conversion Issues: Montreal's ATS system has been updated twice. No problems have been encountered as a result of conversion. Currently, 2 peak period dispatchers are needed for Lines 1 and 2, and one dispatcher is needed for Lines 4 and 5.

TECHNOLOGY

Hardware: Workstations are located in the control center. Fixed block technology is used. Route selection is manual and based on schedule. Train yards are controlled from the ATS control center. An ATC signal system is used. A new redundant system is used for backup.

Software: Dispatching suggestions are made in real-time for hold/dwell time extensions, offsetting terminal departure times, and alerting dispatchers to service gaps. Automatic control of dwell/holding time, holding lights, and terminal departure time, and alarms for signal overruns are provided. Software was designed externally by SODETEG. Train schedules, public address systems, scheduling systems, and fire protection systems are integrated into workstations. Displays include monitors and overhead screens.

DATA COLLECTION & ANALYSIS

Capabilities: Train movements are stored for one year, then analyzed by the engineering department to produce reports covering terminal departure-time compliance, mid-route on-time performance, headway regularity, running time, delays approaching terminal stations, dwell time, and recovery time. ATS does not record audio communications, though communications are recorded by other means. The ATS system does not model train operations.

Benefits: ATS has been effective in reducing the impact of delays on the metro system. Because ATS has always been a part of Montreal's metro, no comparison can be made to a pre-ATS system.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is not provided.

Nagoya, Japan

The Nagoya metro does not have ATS.

Prague, Czech Republic

IMPLEMENTATION

Scope: Prague's metro system installed ATS between 1996 to 1998. ATS now encompasses the entire system of 3 lines and 51 stations.

Conversion Issues: Problems encountered during the conversion include low reliability and lack of information. Dispatchers were retained and other personnel were transferred due to the conversion. Computer technician and system analyst positions were added. Currently, 4 dispatchers operate during peak periods.

TECHNOLOGY

Hardware: Workstations are located in the control center. Fixed block technology is used. Route selection is schedule based. Yards are not controlled from the ATS control center. Wayside signals and ATO are used. A new redundant system serves as backup.

Software: Software, designed externally by UniControls, makes dispatching suggestions to alert dispatchers to service gaps, and takes automatic control of terminal departure times. Train schedules voice communications systems, CCTV capabilities, public address systems, scheduling systems, and fire protection systems are all integrated to the system. Workstation monitors and overhead screens provide tabular and zoom capabilities.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement data is store between 1 and 12 months. 3 analysts in the Operational Inspection department perform analysis to determine terminal departure-time compliance, headway regularity, delays approaching terminal stations, dwell time, disruption recovery, and time-space diagrams. AVI devices are not in use. ATS can record and play back audio communications.

Benefits: ATS data has not been used to create efficient schedules or better utilize train resources. ATS data has enabled faster identification of service delays, reduced delay impact, and shortened delays.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is not provided.

Santiago, Chile

IMPLEMENTATION

Scope: Santiago's metro installed ATS in 1997 and 1998. ATS currently covers the entire metro system.

Conversion Issues: ATS was installed on old and new lines. No problems from conversion were indicated. Dispatchers were retained and retrained without transfer. During peak periods, two dispatchers per line are located in the control center and one dispatcher is located in each terminal station.

TECHNOLOGY

Hardware: Workstations are located in the control center as and in each station. The signal technology uses hybrid, SACEM technology. Route selection is both schedule based and manual, without train yard control by ATS. ATC is used for signalization. In emergencies, a new redundant system functions as a backup along with manual driving.

Software: Software, designed by SYSECA–FRANCE, makes real-time dispatching suggestions for hold/dwell time extensions, short-turns into service gaps, offset terminal departure times, and alerts the dispatcher to service gaps. Automatic control of speed, dwell/holding time, and terminal departure times are provided. Train schedules and maintenance schedules are included in the ATS system. Workstations include monitors and overhead screens. Consoles feature zooming and panning capabilities.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement data is stored for over one year. Two analysts in the Planning Department create reports featuring time-space diagrams, terminal departure-time compliance, mid-route on-time performance, headway regularity, running time, delays approaching terminal stations, dwell time, recovery time, and disruption recovery. AVI devices transmit maintenance diagnostic information via landline. ATS does not record audio communications.

Benefits: ATS data been used to develop efficient schedules and better utilize train resources by creating many schedules to be applied towards different times of the day and different days of the week. ATS has enabled delays to be identified more quickly, as well as reducing their impact and shortening their duration.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is not provided.

Singapore

IMPLEMENTATION

Scope: Singapore's metro completed ATS installation on the entire system in 1987 and is currently in the process of an upgrade due for completion in 2002.

Conversion Issues: There have been no problems with the older systems interfacing with new. Dispatchers have been retained and other personnel have been retrained or transferred. 4 dispatchers are required for the peak period.

TECHNOLOGY

Hardware: Workstations are located in the control center, depots, and maintenance offices. Fixed block technology is used. Route selection is schedule based and ATC signalization is used. The old ATS system did not have the capability to control train yards from the control center. Under the new ATS system, that ability will exist. A new redundant system functions as backup.

Software: Software makes dispatching suggestions for hold/dwell time extensions, offset terminal departure times, and alerts the dispatcher to service gaps. Automatic control of speed, dwell/holding time, dwell/holding time countdown for crews, dwell/holding lights, and terminal departure time control are provided. Train and maintenance schedules are included in the ATS system. Crew reassignment is performed manually. Workstation monitors, overhead screens, and LED Mimic displays are used.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement data is stored for 20 days. The data is analyzed by the Signals and Traffic department to create reports featuring terminal departure-time compliance, mid-route on-time performance, headway regularity, running time, delays approaching terminal stations, dwell time, recovery time, and disruption recovery. AVI devices are not in use and ATS cannot record audio communications. ATS does simulate train operations.

Benefits: ATS data has facilitated efficient scheduling and the utilization of train resources. ATS has enabled service delays to be quickly identified, and reduce delay impacts.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is provided on a very basic level.

Toronto, Canada

IMPLEMENTATION

Scope: Toronto's metro installed ATS in 1993 on the entire subway system.

Conversion Issues: No substantial conversion problems were reported. Dispatchers were retained and other personnel were retrained to use the new system. Currently, 3 peak period dispatchers are required. No new jobs were created. Before ATS, headway gaps were manually corrected by canceling signals.

TECHNOLOGY

Hardware: Workstations are located in the control center. Fixed block technology is used. Route selection is performed manually in the control office and at terminals. The train yards are not controlled via the ATS control center. Wayside signalization is used on two lines, while ATO is used on the remaining line. A new redundant system is used as backup.

Software: Software, designed by LKSK Signals, makes dispatching suggestions for both hold/dwell time extensions and offset terminal departure times. Automatic control of terminal departure times is provided. Train schedules are included in the ATS system. Crew reassignment is manual. Workstation monitors are used for display.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement data is stored for one year. One staff in the Transportation department is responsible for analyzing this data. The data is used to generate reports concerning terminal departure-time compliance and headway regularity. ATS records audio communications and does not simulate train operations.

<u>Benefits</u>: ATS has not been used to create efficient schedules and better utilize train resources, ATS is responsible for a 5% increase in reliability over the prior system.

REAL-TIME INFORMATION

<u>Capabilities</u>: Real-time passenger information is not provided

Washington, D.C.

IMPLEMENTATION

<u>Scope</u>: Washington DC's metro was built with ATS in 1975.

<u>Conversion Issues</u>: No conversion issues exist. The current system requires 6 controllers, 3 for line responsibility and 3 for communications.

TECHNOLOGY

<u>Hardware</u>: Washington's ATS workstations are located in the control center and at terminal stations. Fixed block technology is used. Route selection is based on schedule and field selection. Train yards are not controlled from the ATS system control center. Wayside, ATC, ATO, and ATP signalization systems are all used. A new redundant system is in place as backup.

<u>Software</u>: The ATS software for Washington was designed externally by BDM and takes automatic control of speed. Automatic dwell/holding time control is also available, although unused. Instead, speed commands are given after dwell time expires. Train schedules are included in the ATS system. Reassignment of crews is done manually. Voice communications, CCTV capabilities, video communications, public address, scheduling, and fire protection are all integrated into ATS workstations. Workstation monitors and overhead screens are used for display. Workstation capabilities include zoom by station platform, interlocking, substation, and fans.

DATA COLLECTION & ANALYSIS

<u>Capabilities</u>: Train movement data is stored for 30 days. Four analysts in the ATC Engineering and Rail Transportation Department create reports featuring time-space diagrams, terminal departure-time compliance, mid-route on-time performance, headway regularity, running time, delays approaching terminal stations, dwell time, recovery time, and disruption recovery. The system has the ability to record and play back audio communications and simulate train operations.

<u>Benefits</u>: ATS data has been used to create efficient schedules and better use train resources by evaluating average incident times and inserting gap trains. ATS data has enabled quicker identification of delays, reduction in delay impact, and shortening delays.

REAL-TIME INFORMATION

<u>Capabilities</u>: Washington is installing a real-time passenger information system consisting of digital signs on platforms and

station lobbies (viewable from free areas). Displays will show minutes to the next train, train destination, train routing, train delays, elevator/escalator outages, special service updates, information items, and public service announcements. Information will be provided two trains in advance and updated every minute.

Hong Kong, China (KCRC)

IMPLEMENTATION

Scope: Hong Kong's commuter rail (KCRC) has had ATS since its installation in 1998.

Conversion Issues: Although ATS replaced an older system, no significant conversion problems were experienced. Previous dispatchers were not retained; other personnel were retrained or transferred. Data analysis was increased with the implementation of ATS. Currently, one peak period dispatcher is required.

TECHNOLOGY

Hardware: Workstations are located in the control center, at terminal stations, and in the EMU Maintenance Depot. Fixed block technology is used. Route selection is both schedule based and manual. Train yards are not controlled by the ATS control center. Wayside and CBTC signalization are used. A new redundant system is in place as backup.

Software: Software, externally designed for Hong Kong (KCRC) by Vision, takes automatic control of speed, dwell/holding time, dwell/holding time countdown, dwell/holding lights, and terminal departure time control. Train schedules are included in the ATS system and crew reassignment is done manually. ATS workstations are integrated with voice communications, CCTV capabilities, public address systems, and scheduling. Workstation monitors feature zooming and layering.

DATA COLLECTION & ANALYSIS

Capabilities: Train movement data is stored for 1 month. Five analysts create reports featuring time-space diagrams, terminal departure-time compliance, headway regularity, running time, delays approaching terminal stations, dwell time, recovery time, and disruption recovery. The system records audio communications and simulates train operations.

Benefits: ATS data enabled development of efficient schedules and better utilization of train resources through greater headway control. It has enabled faster identification of delays through increased train operations information.

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is provided through digital signage located on platforms and in station lobby/mezzanine areas. Passengers are routinely provided with information on the number of minutes to the next train (both scheduled and real-time), train destination, train routing, public service announcements, length of delays, and the cause of the delays. Information is displayed for the next two trains and is updated constantly.

Osaka, Japan

IMPLEMENTATION

Scope: Osaka installed ATS in 1997 on their commuter rail system.

Conversion Issues: Osaka uses more than one ATS system. There have not been any problems integrating these systems because new systems have the ability to control older systems. Implementing newer ATS systems resulted in the transfer of some personnel and a decrease in the number of dispatchers. No new jobs were created.

TECHNOLOGY

Hardware: Workstations are located in the control center and at terminal stations. Fixed block technology is used. Route selection is schedule based and train yards are not controlled from the central control center. Wayside and ATC signalization is used.

Software: Software makes dispatching suggestions for short-turns into service gaps. Monitoring and alarms for signal and station overruns are provided. Train schedules are included in the ATS system. Voice communications systems and scheduling systems are integrated into the ATS workstations.

DATA COLLECTION & ANALYSIS

Capabilities: No answer provided

Benefits: No answer provided

REAL-TIME INFORMATION

Capabilities: Real-time passenger information is provided through digital signs located on platforms and in station lobby/mezzanines. Displays show train destination and train routing information.

Sydney, Australia

Sydney's City Rail, commuter railroad does not have ATS.

STATION PERSONNEL

Introduction

Functions of Station Personnel

Personnel assigned in metro stations typically serve one of five predominant roles: fare sales, customer assistance, safety and security, cleaning and maintenance, and assisting train service. In each area, the role of personnel assigned in metro stations has evolved over time.

Fare Sales: When the New York City metro opened in the early 20th century, station personnel were required to both sell and collect fares. This was done primarily through the use of paper tickets. The introduction of coin (later token) operated turnstiles in the early 1920's eliminated the fare collection function, as ticket collectors were no longer required. However, the fare sales function has remained a major role for station personnel in many transit agencies (24 of 29 surveyed). Today, NYC Transit maintains a staff of more than 3,300 persons dedicated to selling fares, second only to Johannesburg's 4,200 ticket sales persons among survey respondents.

Customer Assistance: All transit agencies provide some form of customer service, but not all agencies have personnel specifically devoted to this function. As automated fare sales and collection systems have been introduced, some of the older metros throughout the world have redeployed their station personnel in concert with changing fare collection technology and an increased focus on customer service. Many metros have exploited the efficiencies afforded by automated fare sales technologies by greatly expanding the provision of assistance to customers by their station personnel. Customer assistance, in printed or verbal form, has not only become increasingly important in all metros, but in many metros it is the primary function of their station personnel. London uses a staff of 4,000 for customer assistance, and Washington, D.C. has deployed its station personnel as customer service representatives since its metro opened to make customers' travel more convenient and comfortable.

Cleaning and Maintenance: Cleaning and maintenance of metro stations have always been important functions. Properly functioning equipment, from fare gates to lights to elevators and escalators, is more than simply good customer service. All metros need to ensure that equipment and facilities are available for customers' use. Every transit agency surveyed performs sweeping, picking up litter, and graffiti removal as components of their cleaning program, and virtually every agency performs mopping and mechanized floor and wall cleaning as well. More than half of the metros surveyed have contracted out at least a portion of their station maintenance functions, due to increasing emphasis on competitive contracting and privatization.

Assisting Train Service: Assisting train crews is a less common function of station personnel among the world's metros. Certain metros, including São Paulo, Tokyo, and Toronto, consider station personnel to be an indispensable component of their efforts to provide reliable train service to customers. The two most common train service functions of station personnel are train dispatching and controlling passenger flow.

Safety and Security: Ensuring the safety (from accidents) and security (from crime) of customers and employees is an essential function for any private company or government agency. The roles played by station personnel, agency police, or other police varies from metro to metro. Station staff or agency police are most commonly used for monitoring safety and security.

Research Efforts

To ascertain the changing role of personnel assigned in metro stations in light of emerging technologies, NYC Transit surveyed 88 metros and high capacity commuter rail agencies around the world. The survey covered the use of agency or contractor staff to provide station-based functions, the decision-making process for staffing metro stations when they are open, and staff functions in the areas of ticket sales, customer assistance, station cleaning, station maintenance, assisting train crews, and ensuring safety and security (See Appendix D for questions and tabulation of responses). As shown in Table III-I, 33 agencies, primarily metros and commuter rail agencies from the Americas, Europe and Japan, have responded to the questionnaire.

Table III-1
Questionnaire Respondents

City	Service Provided
Berlin, Germany	Metro
Hong Kong, China (MTR)	Metro
London, England	Metro
Moscow, Russia	Metro
New York, New York, USA	Metro
Paris, France (RATP)	Metro
Paris, France (RER)	Metro/Commuter Rail
São Paulo, Brazil	Metro
Tokyo, Japan	Metro
Athens, Greece (Attiko Metro)	Metro
Athens, Greece (ISAP)	Metro
Atlanta, Georgia, USA	Metro
Baltimore, Maryland, USA	Metro
Barcelona, Spain	Metro
Boston, Massachusetts, USA	Metro
Budapest, Hungary	Metro
Hamburg, Germany	Metro
Jersey City, New Jersey, USA (PATH)	Metro
Los Angeles, California, USA	Metro
Miami, Florida, USA	Metro
Milan, Italy	Metro
Montreal, Canada	Metro
Munich, Germany	Metro
Nagoya, Japan	Metro
Prague, Czech Republic	Metro
Santiago, Chile	Metro
Singapore	Metro
Toronto, Canada	Metro
Washington, D.C., USA	Metro
Hong Kong, China (KCRC)	Commuter Rail
Johannesburg, South Africa	Commuter Rail
Osaka, Japan	Commuter Rail
Sydney, Australia	Commuter Rail

NYC Transit also conducted a literature search of issues associated with station personnel. An extensive survey of materials published by the American Public Transportation Association (APTA), the Union Internationale des Transports Publics (UITP), and numerous transportation-related journals showed very little information on this subject.

The objective of this research effort has been to highlight key aspects of how metros operate their stations and utilize their personnel. This issue is of particular importance to NYC Transit as it augments its personnel-based fare sales with a machine-based electronic fare sales and collection system. NYC Transit hopes to build on the experiences of its peers in the international transit community to best utilize its station personnel in order to meet the needs of today's customers.

Findings: Summary of Responses

Station Staffing

The size of the transit systems responding to the station staffing survey ranged from some of the smallest in the world to some of the largest. The smallest agencies responding were Osaka with seven stations, Jersey City (PATH) with 13 stations, and Athens (Attiko) and Baltimore with 14 stations each. The largest agencies responding were Johannesburg with 470 stations, New York with 468 stations, and Paris RATP with 375 stations. The median response for the 32 agencies answering this question was 68 stations, typical of a mid-sized to large metro system.

Number of Personnel

The number of staff working in metro stations not only depends on the number of stations, but on general agency policies of whether stations should be staffed at all or if so only for certain specific functions. Findings with regard to the number of personnel in metro stations are as follows:

- <u>Total Number of Station Personnel, Personnel per Station</u>: On the low end, Jersey City (PATH) reports that no station personnel are assigned to its 13 stations. On the high end, Moscow provides 30,090 personnel in its 162 stations. Respondents have, on average, approximately 3,000 personnel in their metro stations. Moscow also provides more personnel per station (186) than any other respondent.

- <u>Most Personnel for Specific Functions</u>: Johannesburg has the highest number of station personnel, 4,200, dedicated to ticket sales. Other station functions with large number of personnel include maintenance (New York has 1,135 maintainers), police (Moscow has 4,200 police officers), customer assistance (London utilizes 4,000 persons to provide customer assistance among other functions), cleaning (São Paulo has 1,273 cleaners), and fare inspection (Paris has 1,250 inspectors).

- <u>Full and/or Part-Time Personnel</u>: Part-time personnel can provide greater flexibility to transit agencies by enabling them to increase staffing during peak service levels without incurring costs for full-time staff who may not be needed during other times of the day. Eight agencies report using part-time staff for at least some station functions. The most common uses of part-time personnel are ticket sales (eight agencies), and customer assistance or cleaning (three agencies each). Some agencies report greater use of part-time staff than full-time staff in particular areas:

  – Hamburg has four times as many part-time staff for ticket sales as they have full-time staff, and uses only part-time staff for maintenance.

  – Hamburg and Prague use only part-time staff for fare inspection and cleaning.

  – Atlanta uses only part-time staff to provide customer assistance.

Agency and/or Contracting Personnel

Survey findings with regard to the use of agency staff or contractors for station functions are as follows:

- <u>Most Commonly Contracted Tasks</u>: Cleaning stations is by far the most commonly contracted task. Twenty-one of 31 agencies responded that they contract out for station cleaning services. Four additional agencies use a combination of agency and contractor staff. Only six agencies surveyed – New York, Montreal, Munich, Toronto, Washington, D.C., and Sydney – use agency staff exclusively.

- <u>Least Commonly Contracted Tasks</u>: Supervision of station personnel/functions, and providing assistance to train crews (e.g., dispatching, helping customers on/off trains) are not contracted by any agency.

- <u>Tasks Performed by Agency or Contractor Staff</u>: Slightly more than half of respondents perform station maintenance either exclusively by contractors or by a combination of agency and contractor staff. The remainder use agency staff for station maintenance.

Station functions such as ticket sales and customer assistance are contracted out by a minority of respondents. Los Angeles and Miami are the only agencies that report using contractors for fare inspection, and five agencies (Berlin, Tokyo, Budapest, Hamburg, and Miami) utilize a combination of agency and contract staff for customer assistance.

There does not appear to be a pattern among agencies in deciding whether to utilize agency staff or contractors for more or fewer station functions. Different cities in the same country can report widely diverging use of agency or contractor staff. Specific findings with regard to agency decisions of whether to contract for station functions are as follows:

- <u>Most Common Use of Contractors</u>: The greatest use of contractor staff for station functions can be found in Athens Attiko (cleaning, maintenance, and elevator/escalator operations), Budapest (cleaning, security, and train crew assistance), and Nagoya (cleaning, maintenance, and elevator/escalator operations).

- <u>Least Common Use of Contractors</u>: Munich, Toronto, and Sydney do not contract out any of their station functions. New York contracts for nurses who assist sick customers at six stations during peak hours, but otherwise does not contract out any station functions.

- <u>Combination of Agency and Contractor Staff</u>: Four agencies utilize a combination of agency and contractor staff for at least three station functions. They are Berlin (fare inspection, maintenance, elevator and escalator operations, and assisting train crews), Tokyo (customer assistance, maintenance, and elevator and escalator operations), Hamburg (ticket sales, customer assistance, maintenance, and police), and Jersey City PATH (cleaning, maintenance, and elevator/escalator operations).

Agencies that have contracted out station functions have, in most instances (19 of 24 respondents), reassigned or retrained the personnel whose functions were eliminated or contracted out.

Multi-Tasking

Many agencies require that their station staff perform a variety of tasks. Examples of combined duties include:

- Hong Kong and Tokyo: station staff are responsible for a broad range of tasks including "general well being of the station"
- Berlin, London, New York, São Paulo, Athens (ISAP), Montreal, and Toronto: a common combination of ticket sales and customer information
- Budapest: traffic staff provide customer assistance and medical assistance
- Hamburg and Singapore: customer assistance is provided by all station personnel
- Prague: station staff assist during emergency situations, provide assistance to customers and perform station surveillance
- Sydney: customer service attendants also perform cleaning, maintenance and train dispatch

Full-Time and/or Part-Time Station Staffing

Some agencies maintain at least one staff person in stations during their hours of operation (none of the respondents except New York and PATH operate 24-hour service). Other agencies, including Berlin, Atlanta, Jersey City (PATH), and Sydney, operate unstaffed stations during part of the day or at all times. Agencies generally increase station staffing (number of personnel and hours of staffing) as ridership increases, but there are no specific formulas in place to make that determination.

Station Staff Location Assignment

Station staff can either be assigned to work in a fixed location, such as in a lobby/mezzanine or platform, or they can assigned/able to roam freely throughout a station as needed. The most common assignments of station personnel are:

- In the station lobby/mezzanine (23 agencies), and
- Able to move freely or assigned to move freely (22 agencies each).

Approximately half of agencies report stationing staff on platforms.

Most agencies do not assign station staff exclusively in one place. Instead, they include a mix of fixed personnel (again, most commonly in the station lobby/mezzanine) and personnel who move freely throughout the station.

Ticket Sales

26 of 30 respondents reported that staff in stations sells tickets. Of the four agencies that reported an absence of ticket sales by station staff, three are located in the United States: Atlanta, Jersey City (PATH), and Los Angeles. The only non-American system with no ticket sales by station staff is Prague.

Ticket Sales Capabilities

All agencies accept cash for ticket sales, while a minority accept credit cards (11 respondents) or debit cards (seven respondents).

- Agencies that accept both credit and debit cards include Berlin, London, Paris (RATP and RER), Washington, D.C., and Sydney.
- Agencies that accept credit cards but not debit cards include Hong Kong MTR, Atlanta, Boston, Johannesburg, and Osaka.
- Hamburg is the only transit agency that accepts debit cards but not credit cards.

Seven respondents accept other forms of payment. For example, New York accepts TransitChek (a voucher offered by employers, enabling employees to pay for transit with pre-tax dollars), and Paris RATP and RER accept a special check made available to unemployed persons.

Transaction Time

Few respondents report a target or standard time for either sales staff transactions or waiting in queue for transactions. Similarly, few agencies report the average time for either sales staff transactions or waiting in queue for transactions.

- <u>Sales Staff Transaction Time</u>: Five agencies report a standard time for sales staff transactions – Hong Kong MTR, São Paulo, Santiago, Singapore, and Johannesburg – ranging from a low of eight seconds in Santiago to a high of 300 seconds in Johannesburg. Eleven agencies report an average time – Hong Kong MTR, New York, Paris RATP, Munich, Santiago, Athens (ISAP), Budapest, Washington, D.C., Singapore, Hong Kong KCRC, and Johannesburg – ranging from a low of ten seconds in New York and Munich to a high of 300 seconds in Budapest. The median average transaction time is 14 seconds.
- <u>Queue Time for Transactions</u>: Seven agencies report a standard queue time for transactions – Hong Kong MTR, London, Moscow, São Paulo, Santiago, Athens (Attiko), and Hong Kong KCRC – ranging from a low of ten seconds in Santiago to a high of 180 seconds in São Paulo. Eight agencies report an average queue time – Hong Kong MTR, Moscow, New York, Paris (RATP and RER), Barcelona, Santiago, and Hong Kong KCRC – ranging from a low of 25 seconds in Moscow to a high of 66 seconds in New York.

Customer Assistance

Assistance Capabilities

As noted previously, many metros have greatly expanded the provision of assistance to customers by their station personnel. Virtually every agency's station staff provides printed information (maps and schedules), answers questions concerning routes and schedules, provides audio or visual service announcements, and provides assistance to persons with disabilities. Other types of customer assistance provided by many transit agencies include:

- Responding to incidents such as trains with mechanical problems (25 of 31 respondents).

- Providing CPR/medical assistance (21 of 31 respondents).
- Issuing refunds to passengers who lose money in vending machines (16 of 31 respondents).
- Operating elevators and/or escalators (15 of 31 respondents).

São Paulo provides a type of customer assistance unreported by any other agency known as an occurrence bulletin. This is an official document of police incidents.

Training

Training is an important component of providing customer assistance, and virtually all agencies report using some type of training regimen. Most agencies utilize training classes to ensure that their staff is properly trained in providing assistance to customers. Only three or four agencies report exclusive reliance on on-the-job training for any type of customer assistance. Three or four agencies rely on a combination of both classes and on-the-job training.

Visibility of Customer Assistance Personnel

All transit agencies recognize that staff must be visible to customers if they are going to provide assistance to customers. Thirty-one agencies reported that staff members who primarily assist customers wear uniforms to make them more visible. While it is unknown whether the color selected for station uniforms has any impact on staff visibility, it is interesting to note that nine of the 15 agencies describing the uniforms of their customer assistance staff use blue as the basic uniform color.

Cleaning and Maintenance

Cleaning

Cleaning of stations and their components is a universally performed task, whether by agency or contractor staff. Agencies report the following about their station cleaning programs:

- <u>Sweeping</u>: Every agency reports that sweeping is a basic component of their station cleaning program. Twenty-five agencies report that stations are swept at least once per day.
- <u>Mopping</u>: Every agency except New York reports that mopping is a basic component of their station cleaning program. Twenty-one agencies reported that mopping is done at least once per day. Prague, Czech Republic mops stations every other day rather than every day.
- <u>Picking Up Litter</u>: Every agency reports that picking up litter is a basic component of their station cleaning program. Twenty-five agencies report litter pickup at least once per day.
- <u>Garbage Removal</u>: Every agency reports that garbage removal is a basic component of their station cleaning program. Twenty-three agencies remove garbage at least once per day.
- <u>Mechanized Floor Cleaning</u>: 26 agencies report that mechanized floor cleaning is a basic component of their station cleaning program. Frequency ranges from daily at eight agencies to

every two to three weeks in Toronto. Athens (ISAP) and Singapore do not perform mechanized floor cleaning.

- Mechanized Wall Cleaning: 22 agencies report that mechanized wall cleaning is a basic component of their station cleaning program. Frequency ranges from weekly in Miami and Moscow, to yearly in Montreal. Six agencies – Tokyo, Athens (ISAP), Baltimore, Milan, Barcelona, and Singapore – do not perform mechanized wall cleaning.

- Graffiti Removal: 28 agencies report that graffiti removal is a basic component of their station cleaning program. All agencies remove graffiti on an as-needed basis. New York removes graffiti from tile surfaces as part of regular cleaning at least once per day (more than once per day in busy stations), and paints over graffiti on painted surfaces no more than 72 hours after detection.

- Other Cleaning Tasks: Four agencies report other cleaning tasks. Boston cleans light fixtures and token booths. Montreal cleans light tubes every 2 years. Hamburg removes litter from the tracks on a monthly basis. Nagoya also performs additional unspecified cleaning tasks.

Most agencies – 18 of 24 responding – report they do not clean trains in stations. The only agencies that clean trains in stations are Hong Kong MTR, London, New York, São Paulo, Baltimore, and Boston.

Maintenance

Station staff performs maintenance on a wide variety of station equipment, from fare equipment (vending machines and gates) to safety components (lights and banisters) to information components (maps, signs, and public address systems). The survey found that:

- More agencies perform maintenance of fare vending machines and gates than other types of equipment.

- Approximately half of agencies report performing maintenance of lights.

- Approximately 40% of agencies report performing maintenance of information components, masonry and railings/banisters.

- Two agencies performing maintenance not discussed by other respondents. New York repairs metalwork in stations, and Miami reported maintenance of heating/ventilation/air conditioning systems.

These findings are generally consistent with the earlier finding that more than half of the agencies surveyed contract out at least a portion of their station maintenance. Agencies did not report which components are maintained by contractors.

Agencies were specifically asked about the number of staff persons providing maintenance for fare vending machines. Eighteen respondents reported a range of zero staff persons (at several agencies) to 879 staff persons (Hong Kong MTR, whose vending machine maintainers are also responsible for other equipment in stations), with a median of 14. On a machine-per-staff basis, Hong Kong MTR is the lowest with 0.6 vending machines per maintainer, while Hong Kong KCRC reports 31 vending machines per maintainer and New York reports 25 vending machines per maintainer when its systemwide rollout of vending machines is complete.

Train Crew Assistance

As noted previously, assisting train crews is a less common function of station personnel among the world's metros. Sixteen of 29 respondents report that staff in stations are responsible for assisting train crews.

The two most common types of train crew assistance are controlling passenger flow (16 respondents) and dispatching trains (13 respondents). Other, less common, forms of assistance include closing off certain cars on a train during off-hours (eight agencies) and performing minor car repairs (six agencies). Station staff in Berlin, London, Moscow, São Paulo, Barcelona, Boston, Jersey City (PATH), Toronto, and Hong Kong KCRC provide the most train crew assistance (at least three types).

Safety and Security

Monitoring Stations

Most agencies report that monitoring safety and security of metro stations is a function performed by more than one group of employees. The groups most commonly involved in safety and security monitoring are station staff (22 of 29 respondents), agency police (19 of 29 respondents), other (usually municipal government) police (16 of 29 respondents), and fare inspectors (10 of 29 respondents). Three agencies – Athens Attiko, Boston, and Hamburg – monitor safety and security of metro stations from a remote control center. Use of these categories of personnel varies among agencies:

- Twenty-one agencies utilize more than one group of station personnel to monitor safety and security. Seven respondents (Berlin, London, Paris RATP and RER, Athens Attiko, Montreal, and Johannesburg) utilize all four of the most common groups.

- Seven agencies rely solely on one group of station staff. Moscow, Barcelona and Jersey City (PATH) rely on their own police, Sydney relies on governmental police, while Tokyo, Osaka and Nagoya rely on station staff.

Personnel who are assigned or able to roam freely throughout metro stations play an essential role in monitoring safety and security. This is done through routine patrols in Athens (Attiko), Budapest, Prague, and Toronto. Hamburg reported the most extensive use of personnel who roam throughout stations; their tasks with regard to safety and security include monitoring incidents and informing the control center, agency police, police or emergency doctor; evacuating passengers as needed; and stopping trains before or keep them in stations.

Twenty-four of 27 agencies report that staff in stations monitor video cameras or other surveillance equipment as part of their normal duties. The only agencies that do not include this monitoring function are Berlin, Jersey City (PATH), and Miami. Additionally, 23 agencies report that stations are monitored from remote locations as well, usually either a station manager's office or a police station.

Staff who monitor video cameras or other surveillance equipment have other responsibilities as well. The most common are ticket sales (New York, Baltimore, Toronto, and Sydney) and customer assistance (Berlin, Paris [RATP and RER], Athens Attiko, Budapest, Prague, and Sydney).

Safety Hazards

Station personnel also play an important role in eliminating safety hazards, such as tripping hazards and equipment in need of repair. Eleven agencies report this is done through notification to maintenance personnel. Less common means of eliminating safety hazards includes posting warning signs (Athens Attiko and Hamburg) and requiring station personnel to perform repairs (Santiago).

Emergency Evacuations

Emergency evacuation of passengers is a basic function of station personnel. All 28 agencies responding to this question reported that station staff assists during emergency evacuations.

Findings: Individual Agency Responses

Berlin, Germany

STATION STAFFING

Number of Personnel: Berlin has 2,981 station staff, including 130 staff members for ticket sales, 670 fare inspectors, 172 maintenance workers, 453 elevator and escalator operators, 491 supervisors, 65 agency police officers, 220 security workers, 366 employees involved with train crew assistance, and 100 persons to lock up the metro stations for the night. The largest category of station staff, 1,369 employees, provide customer service.

Agency and/or Contracting Personnel: Agency staff are used for customer assistance, train crew assistance, and supervision and management in Berlin's 191 stations. A combination of agency staff and outside contractor staff are used for ticket sales, fare inspection, maintenance, elevator and escalator operation, policing, and security. Cleaning is contracted out entirely.

Multi-Tasking: Berlin ticket sales and security staff also provide customer service and elevator/escalator operation.

Station Operations: Eleven stations are staffed at all times they are opened, and 159 stations are staffed part time. Station staff are able to move freely throughout the station.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash, credit cards, debit cards, and checks for ticket sales.

CUSTOMER ASSISTANCE

Assistance Capabilities: Various Berlin station staff provide printed information to customers, answer routing questions, make public announcements, assist disabled passengers, respond to incidents, provide first aid, and restart elevators and escalators after emergency stops.

Training: Functional training is provided to various station employees for all aspects of customer service.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter removal, garbage removal, mechanized floor and wall cleaning, and graffiti removal, are all part of the basic cleaning routine in the metro stations. Trains are cleaned in terminal stations.

Maintenance: Station staff perform maintenance on maps and map holders within the station.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist train crews with dispatching, control of passenger flow, and closing off certain cars on trains if necessary.

SAFETY AND SECURITY

Monitoring Stations: Agency police, security workers, fare inspectors, and other station staff all contribute to the overall safety and security of the stations. Non-police staff has the ability to call for police or security staff as well as issue provide aid, if needed. Additionally, stations are monitored from a remote central location.

Safety Hazards: Station staff are responsible for identifying any potential hazards and alerting the appropriate department. Station staff also assist in emergency passenger evacuations.

Hong Kong (MTR)

STATION STAFFING

Number of Personnel: MTR has 2,750 station staff. 1,258 of these are general station staff (tasks described below). Additionally there are 592 cleaning and 879 maintenance staff.

Agency and/or Contracting Personnel: Agency and contractor staff provide station staffing for MTR's 43 stations. Agency staff inspect fares, provide customer assistance, operate elevators and escalators, supervise or manage stations, and assist train crews. Agency and contractor staff sell tickets, provide maintenance to stations and other security, non-government provided policing such as in station or remote staffing. Areas that have been or are under consideration to be contracted out include cleaning, some maintenance, limited security, and assisting train crews. Agency staff whose functions have been contracted out have been either reassigned or retrained.

Multi-Tasking: MTR station staff are responsible for multiple station functions including ticket sales; customer assistance; elevator and escalator operation; station supervision/management; assisting train crews; and security.

Station Operations: All stations are staffed at all times they are open. Staff are assigned to platforms, station lobby or mezzanine, and are able to and assigned to move freely though out the station.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash for ticket sales. Credit cards are accepted only at a specified airport express line.

Transaction Time: The agency's target or standard and average sales transaction time are between 0.5 and one minute. The agency's target or standard and average queue time is within one minute.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station staff provide printed information, answer route and schedule questions, make announcements, provide assistance to persons with disabilities, respond to incidents, and operate elevators and/or escalators. Station operators issue refunds to customers who lose money in station ticket vending machines. Station Supervisors can provide first aid assistance to customers.

Training: MTR provides functional training in customer service skills by using a variety of techniques including: videos; role playing; discussing and sharing experiences; and on-the-job training to ensure that staff develop their potential.

CLEANING & MAINTENANCE

Cleaning: Stations are cleaned by contractors. The contract is performance based and cleaning frequencies are adjusted to maintain a litter/dust and graffiti free environment. Some trains are cleaned in stations.

Maintenance: Station equipment, including fare vending machines, masonry, elevator and plumbing are maintained by the station maintenance or systemwide maintenance team of technicians. Station maintenance staff responsible for vending machines are also responsible for other equipment in stations. 879 station maintenance staff provide a full complement of maintenance.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff do not assist in train dispatching but provide assistance to train crews on an exceptional basis. Passenger flow control is provided.

SAFETY AND SECURITY

Monitoring Stations: The Hong Kong Police Force, station staff, and fare inspectors monitor safety and security in metro stations. Station operators are responsible for the patrol of concourses and platforms. They have the legal rights to enforce MTR by-laws whenever there is any misbehavior of passengers. Station staff who monitor video or other surveillance equipment are additionally responsible for customer service or supervision duties. In addition stations are monitored from remote locations.

Safety Hazards: Station staff are responsible for identifying any potential hazards and eliminating or mitigating same real time.

London, England

STATION STAFFING

Number of Personnel: 4,000 station employees serve in a multi-functional capacity providing customer assistance, ticket sales, security monitoring, and assistance to train crews. There are 400 fare inspectors, 350 agency police, and 200 supervisors.

Agency and/or Contracting Personnel: Agency staff serve as fare inspectors, provide customer assistance, assist train crews, monitor security and safety, and provide supervision and management. Cleaning and maintenance activities are contracted out.

Multi-Tasking: London's station assistants are responsible for customer assistance, security and safety, and train crew assistance.

Station Operations: One of London's 277 stations is unstaffed. Location of station staff within the station varies from station to station depending on the complexity and size of stations. Ticket halls are always staffed. Larger stations also have platform staff and/or customer assistance personnel who roam freely throughout stations.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash, credit cards, debit cards, and warrants for ticket sales.

Transaction Time: London's goal is to keep waiting times in ticket lines to under two minutes.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station assistants or customer care assistants provide printed information, answer routing questions, provide announcements, and help disabled passengers. Station supervisors issue refunds. Incidents are responded to by both station supervisors and duty managers. First aid assistance is also available.

Training: No information on training is available.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter removal, and garbage removal are all done as needed throughout the day. Mechanized floor and wall cleanings are done overnight. Graffiti is removed as required.

Maintenance: All maintenance work is contracted out. No further information was provided.

TRAIN CREW ASSISTANCE

Assistance Capabilities: In some stations, station assistants assist the train crews through dispatching, controlling passenger flow, and closing off certain cars on trains.

SAFETY AND SECURITY

Monitoring Stations: British transport police provide routine patrols, supplemented by other forces as required. Station staff monitor stations and call for assistance on radios. Stations are monitored by video surveillance as well through remote operations rooms, from the network control center, and from the police headquarters.

Safety Hazards: Station staff are responsible for identifying any potential hazards. Staff would then either remedy the problem or close off the area, alerting the appropriate authorities. Station staff also assist in emergency passenger evacuations.

Moscow, Russia

STATION STAFFING

Number of Personnel: 30,090 persons make up the station staff. Of these 2,860 handle ticket sales, 1,642 are fare inspectors, 1,994 clean the stations, 8,331 provide maintenance, 1,906 work with elevators and escalators, 2,336 are supervisors, 4,200 are agency police, and 300 provide other security. Customer assistance and train crew assistance are provided by station staff, in addition to their regular duties.

Agency and/or Contracting Personnel: Agency staff are used for ticket sales, fare inspection, customer assistance, elevator and escalator operation, train crew assistance, and supervision in Moscow's 162 stations. A combination of agency staff and subcontractor staff are used for cleaning, maintenance and security.

Multi-Tasking: Moscow ticket agents provide customer information. In general, station staff perform discrete duties with discrete responsibilities.

Station Operations: All metro stations are staffed at all times they are open. Station staff are assigned to platforms, station mezzanines, lobbies, elevators, and escalators. Some station staff are also assigned to move throughout the stations.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash only for ticket sales.

Transaction Time: The targeted wait time for transactions to occur is 13 seconds. The average wait time for customers conducting transactions is between 13 and 25 seconds.

CUSTOMER ASSISTANCE

Assistance Capabilities: Various station staff provide printed information, answer routing questions, provide announcements, respond to incidents, provide medical assistance, and operate elevators and escalators.

Training: Training for all aspects of customer assistance is provided to station staff at a central training center.

CLEANING & MAINTENANCE

Cleaning: In each station sweeping and mopping are performed at least one time per shift. Litter removal is done at least twice per shift. Garbage removal and mechanized floor cleaning is done daily. Mechanized wall cleaning is done weekly. Graffiti is removed when necessary. Trains are not cleaned in stations.

Maintenance: Electricians from the Signaling Department are responsible for fare gates, lights, and signs. Electricians from the Communications Department are responsible for public address systems. The Fixed Installations Department handles railings and banisters, masonry, and maps and map holders. The Escalator Department fixes elevators and escalators. Plumbing work is done by the Electromechanical Department.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist train crews through dispatching, control of passenger flow, and minor car repairs.

SAFETY AND SECURITY

Monitoring Stations: Agency police (a special police force within the City Police, specifically serving Moscow Metro) maintain order within the stations as well as help to control the passenger flow along with other station staff. Station staff monitor stations as well, both by walking around stations and through video surveillance.

Safety Hazards: Managerial station staff are responsible for eliminating safety hazards and monitoring the station. Station staff also assist in evacuating passengers during emergency conditions.

New York, New York, USA

STATION STAFFING

Number of Station Personnel: 8,335 persons comprise New York's station staff. Of these 3,312 handle ticket sales, 1,289 clean the stations, 1,238 provide maintenance, 42 work with elevators and escalators, 561 are supervisors, 1,314 provide assistance to train crews, and 560 persons clean trains in stations. Customer assistance is provided by station staff, in addition to their regular duties. Additionally, New York employs 631 persons (277 as station cleaners, 354 as metro car cleaners) through the municipal Work Experience Program that provides employment to former recipients of government assistance.

Agency and/or Contracting Personnel: Agency staff are used for ticket sales, customer assistance, cleaning, maintenance, elevator and escalator operation, train crew assistance, and supervision in New York's 468 stations. Municipal police provide security, and contract personnel provide medical assistance in six stations during peak hours.

Multi-Tasking: New York ticket agents provide customer information. In general, station staff perform discrete duties with discrete responsibilities.

Station Operations: All metro stations are staffed at all times they are open. Station staff are assigned to platforms, station mezzanines, lobbies, elevators, and escalators. Supervisors are able to move freely throughout stations, and cleaners must clean all station areas but are not otherwise free to move throughout stations.

TICKET SALES	Ticket Sales Capabilities: Staff in stations accept cash or TransitChek (a voucher offered by employers, enabling employees to pay for transit with pre-tax dollars) for ticket sales.
	Transaction Time: The average wait time for transactions to occur is 70 seconds. The average transaction time for ticket sales is 10 seconds.
CUSTOMER ASSISTANCE	Assistance Capabilities: Station staff provide printed information, answer routing questions, provide announcements, provide assistance to persons with disabilities, respond to incidents, provide medical assistance (at six stations during peak hours), and operate elevators and escalators (only at a limited number of stations).
	Training: Training for all aspects of customer assistance is provided to station staff as part of general station agent training or (in the case of providing announcements) through special training emphasizing speaking skills and familiarization with the subway system.
CLEANING & MAINTENANCE	Cleaning: In each station sweeping and picking up litter are performed at least once per day (more than once per day in busy stations). Garbage removal from stations occurs daily in busy stations on a daily basis, and in less busy stations two to three times per week. Mechanized floor cleaning varies from twice weekly in the busiest stations to once every three months in the quietest stations. Mechanized wall cleaning varies depending on station volume. Graffiti is removed from tile surfaces as part of regular cleaning at least once per day (more than once per day in busy stations). Graffiti on painted surfaces is painted over no more than 72 hours after detection. Trains are swept and mopped in stations.
	Maintenance: Revenue equipment maintainers from MetroCard Operations are responsible for fare gates and vending machines. Structure maintainers from the Stations division of Subways fix railings/banisters, masonry, maps/map holders, signs, plumbing, and metalwork. Light maintainers from Stations repair/replace lights. Communication maintainers from the Telecommunications and Information Services are responsible for public address systems. Mechanical maintainers from Maintenance of Way repair elevators and escalators. When systemwide installation of vending machines is completed, New York will provide 90 maintainers for its 2,245 vending machines.
TRAIN CREW ASSISTANCE	Assistance Capabilities: Station staff assist train crews through control of passenger flow (only at some stations).
SAFETY AND SECURITY	Monitoring Stations: The municipal police has a “Transit Division” that maintains order within metro stations. Station staff function as

"eyes and ears," and will report incidents to the police. In a few locations, ticket sales staff monitor closed-circuit television cameras in remote parts of the station.

Safety Hazards: Station staff report conditions, and maintenance staff repair conditions. Station staff also assist in evacuating passengers during emergency conditions.

Paris, France (RATP)

STATION STAFFING

Number of Station Personnel: Paris RATP has 5,900 station staff. Of these, 2,500 are ticket sales staff, 1,250 are fare inspectors, 800 are customer assistance staff, 140 are station supervision and management staff, and 60 are agency police. It is estimated that the cleaning contract employs approximately 1,000 station cleaners.

Agency and/or Contracting Personnel: Agency staff in RATP's 375 stations sell tickets, inspect fares, provide customer assistance, supervise and manage the stations, and police stations. A combination of agency and contractor staff perform station maintenance and an outside contractor is responsible for station cleaning. Areas that have been or are under consideration to be contracted out include cleaning, which was contracted out a long time ago, and some maintenance. Ticket collectors were phased out after the introduction of turnstiles in the 1970's. Elevator operators were also phased out many years ago. Agency staff whose functions have been contracted out have been either reassigned or retrained.

Multi-Tasking: In addition to a primary function, most station staff are responsible for customer assistance, first response maintenance (fixing small problems or identifying problems needing more technical expertise), and safety/security.

Station Operations: All metro stations are staffed at all times they are open. However, customer assistance staff are not located at each station. Staff are assigned to station lobby or mezzanine, and "walking around staff" are able to and assigned to move freely though out the station.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash, credit and debit cards for ticket sales. Additionally, bank checks, specific checks for unemployed, and customer service coupons are accepted.

Transaction Time: The agency's average sales transaction time is 29 seconds. 95 percent of waiting passengers begin their transaction with sales staff within one minute.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station master and service agents staff provide printed information, answer route and schedule questions, make announcements, provide assistance to persons with disabilities, respond to incidents, relay information in case of need for medical assistance, and operate elevators and/or escalators in case of malfunction. Station receivers issue refunds to customers who lose money in station ticket vending machines.

Training: RATP provides training in answering travel information questions, phrasing of announcements, and releasing people in jammed elevators.

CLEANING & MAINTENANCE

Cleaning: In each station sweeping, mopping, picking up litter, and garbage removal are performed once or twice a day in large stations. Mechanized floor cleaning is performed once a day. Mechanized wall cleaning and graffiti removal are performed on request. Litter in trains is picked up at terminal stations. Otherwise trains are cleaned in operating sidings.

Maintenance: Station staff perform the first level of intervention for fare vending machines, turnstiles, lights and elevators or escalators. The receiver is responsible for vending machine repairs and the station master is responsible for turnstiles, lights and elevators or escalators repairs. All other repairs are conducted by non-station staff. 44 staff provide maintenance for 792 vending machines. Approximately 5.55 staff are required per 100 vending machines.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff do not assist in train dispatching or assisting train crews.

SAFETY AND SECURITY

Monitoring Stations: Agency police and city police provide public security. Station staff including fare inspectors, all "walking around staff," and security staff apply railway security regulations. "Walking around staff" are mainly assigned to check equipment and to call agency police in event of an incident. Staff in stations who monitor video cameras or other surveillance equipment are also responsible for requesting maintenance in case of disorder, public address, and organizing "walking around staff." In addition, security video surveillance is provided from two or three section headquarters on each line and the security central control room.

Safety Hazards: Station staff are responsible for identifying any potential hazards and alerting the maintenance department. Station staff also assist in emergency passenger evacuations.

Paris, France (RER)

STATION STAFFING

Number of Station Personnel: RER has 1,700 station staff. Of these, 560 are ticket sales staff, 280 are fare inspectors, 170 are customer assistance staff, 80 are station supervision and management staff, and 45 are agency police. The number of cleaning and maintenance staff is unavailable.

Agency and/or Contracting Personnel: Agency staff, the majority in Paris RER's 66 stations, sell tickets, inspect fares, provide customer assistance, supervise and manage the stations, police stations, and assist train crews. A combination of agency and contractor staff perform station maintenance and an outside contractor is responsible for station cleaning. No other tasks have been contracted out or are planned to be contracted out.

Multi-Tasking: In addition to a primary function, most station staff are responsible for customer assistance, first response maintenance, and safety/security.

Station Operations: All stations are staffed at all times they are open. Staff are assigned to station lobby or mezzanine and to move freely throughout the station. Station staff are not assigned to platforms except when helping people on or off trains.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash, credit and debit cards for ticket sales. Additionally, bank checks, specific checks for unemployed, and customer service coupons are accepted.

Transaction Time: No staff ticket sales transaction time goal or average is available. 95 percent of waiting passengers begin their transaction with sales staff within one minute.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station masters and service agents provide written information, answer route and schedule questions, make announcements, provide assistance to persons with disabilities, respond to incidents, relay information in case of need for medical assistance, and operate elevators and/or escalators in case of malfunction. Station receivers issue refunds to customers who lose money in station ticket vending machines.

Training: RER provides training in answering travel information questions, phrasing of announcements, and releasing people in jammed elevators.

CLEANING & MAINTENANCE

Cleaning: In each station sweeping, mopping, picking up litter, and garbage removal are performed once daily (twice a day in large stations). Mechanized floor cleaning is performed once a day. Mechanized wall cleaning and graffiti removal are performed on request. Litter in trains is picked up at terminal stations. Otherwise trains are cleaned in operating sidings.

Maintenance: Station staff perform the first level of intervention in the maintenance of fare vending machines, turnstiles, lights and elevators or escalators. The receiver is responsible for vending machine repairs and the station master is responsible for turnstiles, lights and elevators or escalators repairs. All other repairs are conducted by non-station staff. 44 staff provide maintenance for 792 vending machines. Approximately 5.55 staff are required per 100 vending machines.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist in train dispatching or assisting train crews by controlling passenger flow on and off trains.

SAFETY AND SECURITY

Monitoring Stations: Agency police and city police provide public security. Station staff including fare inspectors, all "walking around staff," and security staff apply railway security regulations. "Walking around staff" are mainly assigned to check equipment and to call agency police in event of an incident. Staff in stations who monitor video cameras or other surveillance equipment are also responsible for requesting maintenance in case of disorder, public address, and organizing "walking around staff." In addition, security video surveillance is provided from the security central control room or the control room in large stations.

Safety Hazards: Station staff are responsible for identifying any potential hazards and alerting the maintenance department. Station staff also assist in emergency passenger evacuations.

São Paulo, Brazil

STATION STAFFING

Number of Station Personnel: Aside from cleaning and maintenance, São Paulo has 3,246 station staff. 1,132 station agents perform ticket sales fare inspection and customer assistance tasks. 310 staff provide station facilities maintenance. 348 station operators are responsible for elevators and escalators as well as other equipment and power sub stations. Of 332 station supervision and management staff, 241 provide station support, 55 provide security support and 36 provide traffic support. 589 are agency police. Additionally, 118 controller operators assist train crews. It is estimated that the cleaning contract employs 1, 273 station cleaners.

Agency and/or Contracting Personnel: Agency staff are the majority of station staff in São Paulo's 49 stations. Agency staff inspect fares, provide customer assistance, maintenance, operate elevators and escalators, supervise and manage the stations, police stations, and assist train crews. A combination of agency and contractor staff sell tickets and an outside contractor is responsible for station cleaning, maintenance of station gardens, and ambulance service for customers. No tasks previously attended by staff have been or are under consideration to be contracted out.

Multi-Tasking: Station agents are responsible for ticket sales, fare inspection, customer assistance, and security monitoring via video.

Station Operations: All stations are staffed at all times they are open.

TICKET SALES

Ticket Sales Capabilities: Staff in stations only accept cash for ticket sales.

Transaction Time: The agency's standard sales transaction rate is 6 transactions per minute. The standard queue time for transactions is a maximum of 3 minutes. Average sales transaction time and queue times are unavailable.

CUSTOMER ASSISTANCE

Assistance Capabilities: São Paulo station staff provide printed information, make announcements, and issue refunds to customers who loose money in station ticket vending machines. Station agents and security agents answer route and schedule questions, provide assistance to persons with disabilities, respond to incidents, and provide CPR or medical assistance. Station agents and station operators operate elevators and/or escalators. Security agents provide incident bulletins.

Training: São Paulo provides training to all station staff that includes operation of station equipment, characteristics of the system, standard procedures for customer assistance and public service.

CLEANING & MAINTENANCE

Cleaning: In each station sweeping, mopping, picking up litter, garbage removal, and mechanized floor cleaning are performed daily. Mechanized wall cleaning and graffiti removal are performed when necessary. Trains are cleaned in stations.

Maintenance: Station staff perform the first level of intervention in the maintenance on turnstiles, public address systems and elevators or escalators. The supervisor and station agent are responsible for fare gates, advertising and escalator and elevator maintenance. Maintenance of lights, railings, masonry, maps, signs and plumbing are performed by non-station staff.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist train crews by controlling passenger flow in and out of trains.

SAFETY AND SECURITY

Monitoring Stations: Station security is provided by station and security agents. All station staff play a role in passenger safety and security but only security agents act directly in risk situations. Station agent responsibilities include monitoring video cameras. Video cameras are monitored from the station supervision room and the operational control center.

Safety Hazards: Station staff are directed to eliminate safety hazards of isolate the area and call for the maintenance personnel to solve the problem. Station staff also assist in emergency passenger evacuations.

Tokyo, Japan

STATION STAFFING

Number of Station Personnel: Tokyo has 3,281 station personnel.

Agency and/or Contracting Personnel: Both agency and contractor staff provide staff for Tokyo's 159 stations. Agency staff inspect fares, provide customer assistance at smaller stations, operate elevators and escalators, supervise or manage stations, provide security, and assist train crews. Combined agency and contractor staff provide customer assistance at larger stations and maintenance. Agency staff whose functions have been contracted out have been reassigned or retrained.

Multi-Tasking: Tokyo station personnel are responsible for a wide variety of tasks.

Station Operations: All metro stations are staffed at all times they are open. Staff are assigned to move freely throughout the station including platforms.

TICKET SALES

Ticket Sales Capabilities: Staff in stations only accept cash for ticket sales.

Transaction Time: Tokyo has no target or average sales transaction time or queue time.

CUSTOMER ASSISTANCE

Assistance Capabilities: All station staff provide printed information, answer route and schedule questions, make announcements, provide assistance to persons with disabilities, respond to incidents, operate elevators and/or escalators, and provide first aid assistance to customers. Station chiefs issue refunds to customers who lose money in station ticket vending machines.

Training: Tokyo provides on the job training for all types of customer service.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, picking up litter, and mechanized floor washing are performed when necessary. Garbage removal is performed daily.

Maintenance: Station staff perform light maintenance on fare vending machines and fare gates.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist in train dispatching and provide assistance to train crews by giving clear sign to train guard and controlling passenger flow at peak periods.

SAFETY AND SECURITY

Monitoring Stations: Tokyo station staff are responsible for safety and security. No staff are assigned to specific safety or security tasks but are advised to play a role in passenger safety. Staff in stations monitor video cameras though not full time. Staff who monitor video cameras have a variety of other responsibilities. Video cameras are monitored from the station office.

Safety Hazards: Station staff are responsible for eliminating potential hazards such as tripping hazards, equipment needing repair, and unidentified objects.

Athens, Greece (Attiko Metro)

STATION STAFFING

Number of Station Personnel: Athens Attiko has 336 station staff. Station staff include 34 full time and 332 part time ticket sales staff, 13 fare inspectors, 73 station masters, 10 supervisors, 140 police guards, and 34 security staff.

Agency and/or Contracting Personnel: Both agency and contractor staff provide station staffing for Athens Attiko's 19 stations. Agency staff sell tickets, inspect fares, provide customer assistance, and assist train crews. Agency and contractor staff provide security. Areas that have been or are under consideration to be contracted out include cleaning, some maintenance, elevator/escalator operations, limited supervision and management, and security.

Multi-Tasking: Ticket sales staff are responsible for some customer assistance functions and for security monitoring via video.

Station Operations: All metro stations are staffed at all times they are open. Staff are generally assigned to the station lobby and move freely though out the station if necessary.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash for ticket sales.

Transaction Time: 99 percent of passengers wait less than 2 minutes in queue for tickets.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station masters and ticket sellers provide printed information to passengers. Station masters also answer route and schedule questions, make public address announcements, provide assistance to disabled passengers, and provide first aid.

Training: Station masters are given eight weeks of training at a training center and in stations, focusing on all areas of customer assistance.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping and garbage removal are performed daily. Litter is picked up several times a day. Mechanized floor cleaning is done at night and graffiti removal is done as required. Trains are not cleaned in stations.

Maintenance: All aspects of station maintenance are contracted out.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff do not assist in train dispatching or assisting train crews.

SAFETY AND SECURITY

Monitoring Stations: Safety and security is a combined effort by agency and other police, station staff, and fare inspectors. Stations and trains are routinely patrolled and monitored via CCTV from a remote central location.

Safety Hazards: Station staff are responsible for identifying any potential hazards and posting the appropriate warnings. Station staff also assist in emergency passenger evacuations.

Athens, Greece (ISAP)

STATION STAFFING

Number of Station Personnel: ISAP has 468 station staff. Of these, approximately 233 are in ticket sales, 30 are fare inspectors, 30 are supervisors or management, 35 are agency police, and 140 assist train crews.

Agency and/or Contracting Personnel: Staffing for ISAP's 23 stations is provided by the agency and by contractors. Agency staff sell tickets, inspect fares, assist customers, supervise stations, and assist train crews. Maintenance and police work are handled both by agency staff and outside contractors. Cleaning and remote station monitoring are handled solely by contractors. Ticket sales will be partially contracted out in the future.

Multi-Tasking: Ticket sales staff are also responsible for customer assistance.

Station Operations: All metro stations are staffed at all times they are open. Ticket sellers are located in the lobby/mezzanine area, while security officers and fare collectors move about the station.

TICKET SALES

<u>Ticket Sales Capabilities</u>: Ticket sellers accept cash only.

<u>Transaction Time</u>: Average sales staff transaction time is 12 seconds.

CUSTOMER ASSISTANCE

<u>Assistance Capabilities</u>: Ticket sellers provide printed information to passengers. Station supervisors and central control room employees provide announcements. Security personnel provide assistance to disabled persons. All station staff answer passenger questions concerning routing and schedules.

<u>Training</u>: Course training is given to staff for providing assistance with responding to incidents, answering routing questions, helping disabled passengers, and making public announcements.

CLEANING & MAINTENANCE

<u>Cleaning</u>: Sweeping and mopping are done daily. Garbage is removed twice a day. Litter is picked up and graffiti is removed as required. No mechanized floor or wall cleaning is done.

<u>Maintenance</u>: All aspects of station maintenance are contracted out except for fare vending machines, which require 13 staff persons.

TRAIN CREW ASSISTANCE

<u>Assistance Capabilities</u>: Station staff do not assist in train dispatching or assisting train crews.

SAFETY AND SECURITY

<u>Monitoring Stations</u>: Agency and other police provide safety and security monitoring for metro stations. Station supervisors and security officers also monitor the stations using video surveillance.

<u>Safety Hazards</u>: Station staff assist in evacuating passengers in case of an emergency.

Atlanta, Georgia, USA

STATION STAFFING

<u>Number of Station Personnel</u>: There are 55 full and part time station staff members. Of these, 20 are full time sales agents and five are part time sales agents. 30 part time Customer Service Agents are used in specific stations during times when normal revenue service is affected by such things as trackwork.

<u>Agency and/or Contracting Personnel</u>: Atlanta has agency staff in ticket sales and customer assistance positions for its 38 stations.

<u>Multi-Tasking</u>: No information was provided.

<u>Station Operations</u>: Not all metro stations are staffed at all times they are open. Customer Service Agents are placed according to need due to service disruption. Staff are assigned to platforms and station lobbies/mezzanines.

TICKET SALES

Ticket Sales Capabilities: Tickets are only sold at four Atlanta operated RideStores. Cash, credit card, and checks are accepted.

CUSTOMER ASSISTANCE

Assistance Capabilities: Customer Service Agents provide printed information, answer routing questions, provide announcements, and provide assistance to disabled passengers. This occurs when situations require their presence.

Training: Prior to the start of construction projects that change normal service, Customer Service Agents are briefed on the work to be done and the potential impact and options available to customers.

CLEANING & MAINTENANCE

Cleaning: No information was provided.

Maintenance: No information was provided.

TRAIN CREW ASSISTANCE

Assistance Capabilities: No information was provided.

SAFETY AND SECURITY

No information was provided.

Baltimore, Maryland, USA

STATION STAFFING

Number of Station Personnel: Baltimore has 59 full-time station staff. Of these, 17 provide customer assistance, 15 clean the stations, 25 are responsible for maintenance, and 2 are supervisors.

Agency and/or Contracting Personnel: Staffing for Baltimore's 14 stations is done both internally and by contractors. Agency staff provide customer assistance, maintenance, supervision and management, security and policing, and assist train crews. A combination of contractor and agency staff are used for ticket sales and cleaning. Elevator and escalator work is contracted out.

Multi-Tasking: Station attendants are responsible for customer assistance and safety/security.

Station Operations: There is generally one attendant per station. An aide is added for busy periods. The two supervisors are assigned to move throughout the stations.

TICKET SALES

Ticket Sales Capabilities: Ticket sales staff accept cash and checks.

Transaction Time: No information was given on the survey.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station attendants answer routing questions, provide announcements, and provide assistance to persons with disabilities.

Training: No information was provided.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, and garbage and litter removal are done daily. Mechanized floor cleaning is done weekly. Graffiti removal is done as required.

Maintenance: All aspects of station maintenance are done by agency staff. Technicians handled vending machine, turnstile and public address system maintenance. Repairmen are responsible for all tasks.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff do not assist in train dispatching or assisting train crews.

SAFETY AND SECURITY

Monitoring Stations: Agency police and station staff are responsible for monitoring the safety and security of stations. Station attendants monitor stations using video surveillance cameras. Two individual stations are monitored remotely by the Operations Control Center.

Safety Hazards: Station staff is responsible for notifying the appropriate maintenance department concerning safety hazards. Station staff also assist in evacuating passengers in case of an emergency.

Barcelona, Spain

STATION STAFFING

Number of Station Personnel: Barcelona has 1,080 station staff. Of these employees, 860 are in ticket sales, 34 are fare inspectors, 6 handle customer assistance, 2 handle cleaning, 32 work maintenance, 9 are supervisors, 32 handle security, and 108 assist the train crews.

Agency and/or Contracting Personnel: Agency staff provide customer assistance, supervision and management, and train crew assistance in Barcelona's 112 stations. Contractor and agency personnel provide ticket sales, fare inspection, and maintenance. Cleaning and security matters are done under contract.

Multi-Tasking: Data on multi-tasking was inconclusive.

Station Operations: All metro stations are staffed at all times they are open. Staff are stationed in lobbies and mezzanines, and some are able to move freely throughout the station.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept only cash for ticket sales.

Transaction Time: The average wait time for a passenger on line to buy a ticket is approximately one minute.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station staff provide printed information, answer routing questions, make announcements, help disabled passengers, issue refunds, respond to incidents, and provide medical assistance.

Training: Station staff are given 4 weeks of specific training to handle customer assistance tasks.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter, garbage, and graffiti removal are all a part of station cleaning routines. Mechanized floor scrubbing is done in some stations.

Maintenance: Station staff maintain fare vending machines, fare gates, maps and map holders, public address systems, signs and plumbing. The rest is done by an outside contractor.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist in train crews through dispatching, closing off certain cars on trains, and through minor car repairs.

SAFETY AND SECURITY

Monitoring Stations: Agency police are responsible for safety and security of the metro stations. Stations are also under video surveillance monitored from within and outside of the station.

Safety Hazards: Station staff are responsible for identifying any potential hazards and alerting the proper authorities. Station staff also assist in emergency passenger evacuations.

Boston, Massachusetts, USA

STATION STAFFING

Number of Station Personnel: There are 363 fare booth clerks and 155 maintenance employees. Boston also maintains an agency cleaning staff of 25, supplemented by an outside contractor. A police force of 239 officers and 10 civilians help keep the metro secure.

Agency and/or Contracting Personnel: In Boston's 132 stations, agency staff provide ticket sales, customer assistance, maintenance, supervision and management, and train crew assistance. Agency police are also used for security. Most station cleaning is contracted out as well as elevator and escalator operation.

Multi-Tasking: Data on multi-tasking was inconclusive.

Station Operations: All stations are staffed at all times. Surface routes leading into the metro have unstaffed stations. Staff are located in collector booths in station lobbies and mezzanines. They are also located on platforms, in and near elevators and escalators, and move throughout the station during events and incidents. Supervisors and police move freely throughout the station.

TICKET SALES

Ticket Sales Capabilities: Tickets are sold by staff at stations. Only cash is accepted at most stations. Stations with commuter rail ticket windows also accept credit cards.

CUSTOMER ASSISTANCE

Assistance Capabilities: Although no customer assistance duties are specifically laid out, station staff are instructed to be "attentive and helpful" towards customers. Announcements are made from a control center. Staff is also available to respond to incidents.

Training: Training is given to station employees regarding aspects of customer assistance.

CLEANING & MAINTENANCE

Cleaning: In each station sweeping, mopping, and picking up litter is done throughout the day as needed. Garbage removal is done daily after the morning peak period. Mechanized floor cleaning is scheduled for stations on a rotating basis. Mechanized wall cleaning is done once per month. Trains are cleaned in stations during overnight periods.

Maintenance: Fare vending machines and fare gates are repaired by the Revenue Department. Lights, railings, banisters, masonry, public address systems, signs, and plumbing are repaired by Subway Operations. Elevators, escalators, and advertising maintenance are all contracted out.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist train crews through dispatching, control of passenger flow, minor car repairs, and closing off sections of trains. These functions are performed by starters, inspectors, and chief inspectors.

SAFETY AND SECURITY

Monitoring Stations: Agency police, station staff, and Operations Control Center (OCC) dispatchers monitor the stations for safety and security. Police patrol the stations, while the OCC dispatchers monitor the stations via video surveillance.

Safety Hazards: Station staff notify maintenance staff of potential hazards. They also assist in evacuating passengers in case of emergency.

Budapest, Hungary

STATION STAFFING

Number of Station Personnel: Budapest has 294 full-time employees. Of these, 82 work in the ticket offices, 120 are fare inspectors, 63 work in customer service, 32 perform station maintenance, and 42 are in charge of the escalators and elevators. Not all of these employees are full-time employees and are not counted in the 294 mentioned earlier. Additionally, there are 20 members of the Metro Police on duty each day as well as 40 employees of the Metro Security Service.

Agency and/or Contracting Personnel: Agency staff provides most station functions, including ticket sales, fare inspection, maintenance, elevator/escalator operation, and supervision and management. Customer assistance is shared by staff and an outside contractor. Cleaning and non-police security positions have been subcontracted out. The state police provides policing.

Multi-Tasking: Traffic staff are responsible for customer assistance, providing first aid, monitoring vending machines, and safety/security monitoring via video.

Station Operations: All 42 metro stations are staffed 24 hours a day. In addition to ticket sales staff, station employees are also assigned to move about the station.

TICKET SALES

Ticket Sales Capabilities: Staff in station accept only cash for ticket sales.

CUSTOMER ASSISTANCE

Assistance Capabilities: Dispatchers and personal guides provide printed information, make announcements, respond to incidents, and provide medical assistance. Security staff along with dispatchers and personal guides answer routing questions and help passengers with disabilities. Dispatchers alone work with elevators and escalators.

Training: An 8-hour annual training course is given to employees for handling all aspects of customer service and assistance.

CLEANING & MAINTENANCE

Cleaning: Cleaning is contracted out privately. Stations are cleaned while the system is shut down overnight. All the activities, with the exception of garbage removal, are carried out daily. Garbage is removed twice a week. Trains are not cleaned in stations.

Maintenance: Most maintenance is done by staff. A subcontractor provides maintenance for fare vending machines. The staff of the metro stations regularly check machines, and immediately report any kind of disorder to the maintenance staff.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Staff does not provide assistance to train crews.

SAFETY AND SECURITY

Monitoring Stations: Agency police along with station staff and the Metro Security Service provide a safe and secure environment. Police and the security service patrol the stations. Stations are monitored remotely by the central passenger traffic dispatcher.

Safety Hazards: Station staff are involved in providing first aid, accident prevention, and accident reporting. Station staff also assist in evacuating passengers in case of emergency.

Hamburg, Germany

STATION STAFFING

Number of Station Personnel: Hamburg has 239 full-time station employees. There are 15 full-time and 59 part-time ticket sales agents. 95 security officers are placed in stations or monitor the stations remotely. 129 full-time employees assist train crews. Outside of this, 80 fare inspectors, 30 maintenance workers, 64 supervisors, and 187 agency police officers patrol from station to station.

Agency and/or Contracting Personnel: Agency staff are the majority of station staff in Hamburg's 97 stations. Agency staff function as fare inspectors, supervision and management, security, and assist train crews. Agency and contractor staff conduct ticket sales, provide customer assistance, maintain stations, and provide policing. Contractor staff is responsible for cleaning stations.

Multi-Tasking: Fare inspectors, service staff, and agency police are all responsible for customer assistance in addition to their regular duties.

Station Operations: Two metro stations are staffed at all times they are open. 44 stations are staffed part-time and 51 stations are unstaffed (these stations are monitored remotely).

TICKET SALES

Ticket Sales Capabilities: Special sales staff sell tickets in stations. Cash and debit cards are accepted as payment.

CUSTOMER ASSISTANCE

Assistance Capabilities: Dispatching staff provide written information (along with sales staff), answer routing questions, make public announcements, help passengers with disabilities, issue refunds, respond to incidents, and call a doctor in medical emergencies. Dispatchers are often assisted in these duties by agency police and remote monitoring staff.

Training: Customer assistance training is part of basic training. Certain functions, such as public announcements, help for disabled passengers, incident response, and answering routing questions are also addressed during annual additional training sessions.

CLEANING & MAINTENANCE

Cleaning: Sweeping and litter and garbage removal are done 2 to 3 times per day, with mopping done additionally as necessary. Mechanized floor scrubbing is done daily. Mechanized wall cleaning is done twice per year. Litter is picked up off of tracks monthly. Graffiti removal is done as necessary.

Maintenance: 8 staff persons provide maintenance for fare vending machines. No other information on maintenance was supplied in the survey response.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist train crews though train dispatching and controlling passenger flow.

SAFETY AND SECURITY

Monitoring Stations: Agency police along with station staff help provide safety and security. Stations are also remotely monitored from local control centers.

Safety Hazards: Station staff are responsible for monitoring the station, warning customers of hazards, and calling maintenance staff. Station staff also play a role in evacuating passengers during emergency conditions.

Jersey City, New Jersey, USA (PATH)

STATION STAFFING

Agency and/or Contracting Personnel: PATH has no specific personnel assigned to its 13 stations. Agency staff provides customer assistance, police, assisting train crews, security monitoring, and supervision. A combination of agency and contractor personnel is used for cleaning and maintenance. These employees, however, are system employees, not station employees.

Multi-Tasking: PATH employees are responsible for a combination of customer assistance and safety and security monitoring when they are in stations.

Station Operations: None of the metro stations are staffed full-time. Eight stations are staffed part-time and five are unstaffed.

TICKET SALES

Ticket Sales Capabilities: All ticket sales are through vending machines.

CUSTOMER ASSISTANCE

Assistance Capabilities: Passenger information agents provide customers with printed information, answers to routing questions, assistance to disabled passengers, and refunds. Operations examiners answer routing questions and respond to incidents. Police help disabled passengers and provide medical assistance in addition to their regular duties. Announcements are made by dispatchers and supervisors.

Training: Customer service training is given to help staff answer routing questions and help disabled passengers. A formalized apprenticeship program is used to train staff for incident response.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter removal, garbage removal, and graffiti removal are all part of the daily cleaning routine. Mechanized floor and wall scrubbing are done on a scheduled basis.

Maintenance: All aspects of station maintenance is done by the Way and Structures department (except for advertising, elevators, and escalators, which are maintained by outside contractors).

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist train crews through dispatching, control of passenger flow, closing off cars on trains, and through minor cleaning and repairs of cars.

SAFETY AND SECURITY

Monitoring Stations: Safety and security are monitored by agency police and safety division employees. Stations are also monitored remotely by police as well.

Safety Hazards: Station staff assist in emergency passenger evacuations.

Los Angeles, California, USA

STATION STAFFING

Number of Station Personnel: No discernable information on the number of station personnel was supplied in the survey response.

Agency and/or Contracting Personnel: Los Angeles uses no staff for ticket sales. Fare inspection is done under contract with local police, who also provide security. Maintenance of ticket vending machines is done under contract.

Multi-Tasking: No information was provided.

Station Operations: No information was provided.

TICKET SALES

Ticket Sales Capabilities: Staff in stations are not responsible for selling tickets.

CUSTOMER ASSISTANCE

No information was provided.

CLEANING & MAINTENANCE

Cleaning: No information was provided.

Maintenance: 17 contracted staff persons provide maintenance for fare vending machines in stations.

TRAIN CREW ASSISTANCE

No information was provided.

SAFETY AND SECURITY

No information was provided.

Miami, Florida, USA

STATION STAFFING

Number of Station Personnel: Exact figures were not made available from the survey.

Agency and/or Contracting Personnel: Agency staff provide ticket sales, customer assistance, maintenance, train crew assistance, and management and supervision in Miami's 42 metro and people mover stations. Elements of customer assistance, as well as fare inspection, cleaning and elevator/escalator repair are all contracted out. Policing is done by the Miami-Dade Police Department.

Multi-Tasking: No information was provided.

Station Operations: Not all of Miami's are staffed when they are open (information on how many stations are staffed full-time and how many are not was not provided). Station staff are placed in station lobbies and mezzanines. Some staff are also able to move throughout the station.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash for ticket sales.

CUSTOMER ASSISTANCE

Assistance Capabilities: Miami provides assistance to persons with disabilities and responds to incidents.

Training: No information was provided.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter removal, and garbage removal are all part of the daily cleaning routine in stations. Mechanized floor and wall cleaning are done on a weekly basis. Graffiti removal is done as needed.

Maintenance: Station staff maintain lights, railings and banisters, masonry, and plumbing, and are responsible for heating/ventilation/ air conditioning systems.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff do not provide assistance to train crews.

SAFETY AND SECURITY

Monitoring Stations: Police and private security guards ensure the safety of customers. In addition, video surveillance is used, monitored from a remote location.

Safety Hazards: Station staff are not responsible for identifying any potential hazards. Station staff do assist in emergency passenger evacuations.

Milan, Italy

STATION STAFFING

Number of Station Personnel: No information was provided.

Agency and/or Contracting Personnel: Fare inspection, customer assistance, supervision and management, security, and train crew assistance are provided by agency staff. Ticket sales, maintenance, and elevator/escalator operation are performed jointly by agency staff and by contracted staff. Station cleaning is performed entirely by contractor personnel.

Multi-Tasking: Data on multi-tasking was inconclusive.

Station Operations: All stations are staffed at all times they are open. Staff are able to more freely throughout the station.

TICKET SALES

Ticket Sales Capabilities: Ticket sales are done by station staff in the metro. Only cash is accepted.

CUSTOMER ASSISTANCE

Assistance Capabilities: Staff provides information, answer routing questions, make announcements, help passengers with disabilities, respond to incidents, provide medical assistance and operate elevators/escalators.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter removal, garbage removal, mechanized floor cleaning, and graffiti removal are all done to help keep stations clean.

Maintenance: No information was provided.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff are not responsible for assisting train crews or dispatching.

SAFETY AND SECURITY

Monitoring Stations: Agency police and station staff are responsible for safety and security in stations. Video surveillance is used and monitored remotely from a police control room.

Safety Hazards: Station staff are responsible for identifying any potential hazards and calling police when necessary. Staff also assist in evacuating passengers during emergency conditions.

Montreal, Canada

STATION STAFFING

Number of Station Personnel: Montreal has 744 agency station staff. Of these, 374 are ticket sales staff, 154 are cleaning staff, 66 are supervisors or management, and 150 are agency police officers.

Agency and/or Contracting Personnel: Agency staff are the majority of staff in Montreal's 70 stations, providing ticket sales, fare inspection, customer assistance, cleaning, maintenance, elevator/escalator operation, supervision and management, policing, and assisting train crews. Security monitoring is contracted out.

Multi-Tasking: Ticket sales staff are also responsible for customer assistance.

Station Operations: All stations are staffed at all times they are open. Staff are stationed in station lobbies and mezzanines.

TICKET SALES

Ticket Sales Capabilities: Ticket sales are performed by station staff. Transactions are cash only.

CUSTOMER ASSISTANCE

Assistance Capabilities: Printed information is provided by fare booth staff and by supervisors and clerks in brochure trays. Fare booth staff also answer questions concerning routing. Public announcements are done by control center staff. Supervisors respond to incidents as well as issue refunds.

Training: Station staff receive formal training in printed information materials, passenger refunds, incident response, and elevator/ escalator operation.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, letter removal, and graffiti removal are performed every day. Garbage is removed weekly. Mechanized floor scrubbing is performed 2 to 3 times per week. Mechanized wall cleaning is done every year. Light tubes in the stations are changed every 2 years.

Maintenance: No information was provided.

TRAIN CREW ASSISTANCE

Assistance Capabilities: No information was provided.

SAFETY AND SECURITY

Monitoring Stations: Agency police as well as local police patrol the metro for crime prevention. Video monitoring is used as well for surveillance purposes.

Safety Hazards: Station staff regularly report safety hazards and other problems to the appropriate authorities. Station staff assist in evacuating passengers in cases of emergency.

Munich, Germany

STATION STAFFING

Number of Station Personnel: It is unclear from the survey how many people work in Munich stations.

Agency and/or Contracting Personnel: All aspects of operation in Munich's 49 stations are the responsibility of agency staff.

Multi-Tasking: Plans are in the works to change the function of ticket sales staff to customer service agents.

Station Operations: All stations are staffed at all times. Staff are assigned to station lobbies, to mezzanines, and to move freely throughout the stations.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash for ticket sales.

Transaction Time: Average transaction time is 10 seconds.

CUSTOMER ASSISTANCE

Assistance Capabilities: Cashiers and supervisors provide printed information to customers, answer routing questions, and provide assistance to persons with disabilities.

Training: There is a 10 day initial cashier training that prepares cashiers in all aspects of customer assistance.

CLEANING & MAINTENANCE

Cleaning: No information was provided.

Maintenance: No information was provided.

TRAIN CREW ASSISTANCE

No information was provided.

SAFETY AND SECURITY

No information was provided.

Nagoya, Japan

STATION STAFFING

Number of Station Personnel: Nagoya has 1,248 full time employees in their stations. Of these, 1,231 have a customer service role. Supervision and management has a staff of 17.

Agency and/or Contracting Personnel: Agency staff are used for ticket sales, customer assistance, supervision/management, and train crew assistance in Nagoya's 76 stations. Cleaning, maintenance, and elevator/escalator service have been contracted out.

Multi-Tasking: Data on multi-tasking was inconclusive.

Station Operations: All stations are staffed at all times they are open. Staff are assigned to platforms, station lobbies, and station mezzanines. Staff are also assigned to move freely about stations.

TICKET SALES

Ticket Sales Capabilities: Ticket sales staff accepts only cash.

CUSTOMER ASSISTANCE

Assistance Capabilities: Nagoya station staff provide written information to passengers, answer routing questions, provide assistance to disabled passengers, issue refunds, respond to incidents, and provide medical assistance to passengers.

Training: Training is provided for all aspects of customer assistance.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter removal, garbage removal, mechanized floor and wall cleaning, and graffiti removal are all part of the Nagoya's cleaning staff's efforts to keep stations clean.

Maintenance: Station staff maintain fare vending machines, turnstiles and lights, as well as other aspects of the station.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist in train dispatching or assisting train crews by controlling passenger flow on and off trains.

SAFETY AND SECURITY

Monitoring Stations: Station staff play the primary role in station security and safety. Video surveillance is used as a tool in station safety and security.

Safety Hazards: Station staff assist in evacuating passengers during emergency conditions.

Prague, Czech Republic

STATION STAFFING

Number of Station Personnel: The Prague metro has 135 full-time station staff and 115 part-time station staff.

Agency and/or Contracting Personnel: Agency staff are used in Prague's 50 stations for fare inspection, customer assistance, elevator/escalator work, supervision and management, train crew assistance and maintenance. Some maintenance is contracted out.

Multi-Tasking: Station staff are responsible for customer assistance, cleaning, maintenance, and safety/security.

Station Operations: All metro stations are staffed at all times they are open. Staff are assigned to station lobbies/mezzanines as well as to platforms in some stations. Some staff are able to move freely throughout the station.

TICKET SALES

Ticket Sales Capabilities: Agency staff do not sell tickets. Tickets are sold at vending machines and merchants.

CUSTOMER ASSISTANCE

Assistance Capabilities: Prague station staff answer routing questions, provide announcements, help passengers with disabilities, respond to incidents, provide medical assistance, and operate elevators and escalators.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter removal, garbage removal, and mechanized floor cleaning are done daily. Mechanized wall cleaning is done twice a year and graffiti removal is done as necessary.

Maintenance: Maintenance work performed by agency staff include lights, railings and banisters, masonry, public address systems, signs, plumbing, elevators, and escalators. Maps, map holders, and advertising displays are contracted out.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff do not assist train crews or dispatch trains.

SAFETY AND SECURITY

Monitoring Stations: Municipal police and station staff are responsible for the safety and security of the metro stations. A special squad of the Czech national police also works in the metro. Station staff are trained to be very versatile and to assist during emergency situations. Work sites are equipped with computers and monitors for surveillance of stations. Station staff are connected to dispatching via phone to be able to ask for additional help.

Safety Hazards: Station staff are responsible for identifying any potential hazards and working to fix them with the appropriate authorities. Station staff also assist in emergency passenger evacuations.

Santiago, Chile

STATION STAFFING

Number of Station Personnel: Santiago has 1,225 full-time station personnel. Of these, 280 work in ticket sales, 117 work assisting customers, 331 clean stations, 30 work maintenance, 10 are supervisors, 30 are agency police, 16 work remote security, and 337 are on the private security staff.

Agency and/or Contracting Personnel: Agency personnel are used for customer assistance and supervision/management in Santiago's 52 stations. Outside contractors and agency staff provide ticket sales and security. All cleaning and maintenance work is performed by outside contractors.

Multi-Tasking: "Station chiefs" are responsible for customer assistance and maintenance.

Station Operations: All stations are staffed at all times they are open. Staff are assigned to station lobbies and mezzanines. Some are also able to move freely throughout the station.

TICKET SALES

Ticket Sales Capabilities: Tickets are sold by station staff. Only cash is accepted.

Transaction Time: Ticket agents sell 250 tickets per hour. The average wait time for passengers waiting in line to buy tickets is about 40 seconds.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station chiefs provide printed information to passengers, answer routing questions, provide announcements, give assistance to disabled passengers, respond to incidents and provide medical assistance. They are assisted in some cases by private security guards or cashiers.

Training: Station chiefs receive crisis management and first aid training to help them deal with incidents and emergencies.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, and littler removal are done throughout the day. Garbage removal is done at night. Mechanized floor and wall cleaning are done weekly. Graffiti removal is done immediately when needed. Trains are not cleaned in the stations.

Maintenance: All aspects of maintenance are performed by maintenance staff under the oversight of the station chief. The exact division of maintenance work is not discernable from the survey.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff are not involved in dispatching and do not assist the train crews.

SAFETY AND SECURITY

Monitoring Stations: Agency police and private security guards provide safety and security in the metro stations. 12 stations will soon be wired with video surveillance cameras linked to a centralized monitoring system.

Safety Hazards: Station staff are trained to detect hazardous conditions and make corrective actions. If equipment needs to be repaired, they are trained to inform the repair unit immediately. There are also different emergency plans in place for dealing with the evacuation of passengers in emergencies.

Singapore

STATION STAFFING

Number of Station Personnel: No information was provided.

Agency and/or Contracting Personnel: Agency staff perform most duties in Singapore's 51 stations, including fare inspection, customer assistance, maintenance, elevator and escalator work, supervision and management, security, and train crew assistance. Contractors are used in combination with agency employees for ticket sales. Primary police work and cleaning are handled by contractors.

Multi-Tasking: All station staff assist customers in addition to their other responsibilities.

Station Operations: All stations are staffed at all times they are open. Staff are positioned according to passenger volume and criticality and are able to move freely throughout the station.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept only cash for ticket sales.

Transaction Time: The average sale transaction time for ticket sales is 10 seconds. No information on average wait time for customers is available.

CUSTOMER ASSISTANCE

Assistance Capabilities: All station staff answer questions concerning routing, make announcements, provide assistance to disabled passengers, issue refunds, respond to incidents, provide medical assistance, and operate elevators and escalators.

Training: All station staff are trained upon recruitment and given regular refresher courses for all aspects of customer assistance.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter removal, and garbage removal are all performed daily. Graffiti is removed if/when it occurs.

Maintenance: Station based maintenance is under consideration. 14 staff persons provide maintenance to ticket vending machines.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff help people on and off trains and close off certain cars on a train.

SAFETY AND SECURITY

Monitoring Stations: Police, station staff, and fare inspectors are all responsible for safety and security. Video surveillance is also used, where it is monitored from a station control room in a public area.

Safety Hazards: Station staff are responsible for identifying any potential hazards keeping them out of the way of passengers. Station staff also assist in emergency passenger evacuations.

Toronto, Canada

STATION STAFFING

Number of Station Personnel: Toronto uses 807 full-time station employees. Of these, 352 sell tickets, 13 are fare inspectors, 212 clean the stations, 141 work maintenance, 44 are supervisors or managers, and 45 are agency police officers. In addition, 25 additional ticket sales employees work over the summer. There are also an additional 14 part-time cleaning employees.

Agency and/or Contracting Personnel: Agency staff are the only personnel used in Toronto's 69 stations.

Multi-Tasking: Ticket sales staff are also responsible for customer assistance.

Station Operations: All stations are staffed at all times they are open. Station staff are located on platforms and in station lobbies and mezzanines. Some are assigned to move throughout the station.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash only for ticket sales.

CUSTOMER ASSISTANCE

Assistance Capabilities: Ticket sales agents and supervisors provide written information, answer questions concerning routes and schedules, issue refunds, and respond to incidents.

Training: Toronto provides initial and rulebook training to station employees to cover all aspects of customer assistance.

CLEANING & MAINTENANCE

Cleaning: Each station is swept and mopped every day. Little and garbage removal are done every shift. Mechanized floor cleaning is done every 2 to 3 weeks. Mechanized wall cleaning is done every 4 to 6 weeks. Graffiti is removed within 24 hours of notification.

Maintenance: Station staff maintain all equipment within the station, with the exception of advertising equipment.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist train crews through dispatching and controlling passenger flows as required. Station staff also perform minor car repairs and close off certain cars on trains as needed.

SAFETY AND SECURITY

Monitoring Stations: Agency police and station staff are responsible for station security and safety. Uniformed patrols roam freely around the stations and station fare agents monitor waiting areas with video surveillance.

Safety Hazards: Station staff are responsible for identifying any potential hazards and alerting Transit Control to activate a response. Station staff also assist in emergency passenger evacuations.

Washington, D.C., USA

STATION STAFFING

Number of Station Personnel: Washington has 1,168 full-time station employees, plus 34 part-time employees who provide customer assistance. Of the full-time employees, 15 are in ticket sales, 386 provide customer assistance, 158 clean the stations, 171 work maintenance, 95 repair elevators and escalators, 39 are maintenance and custodial supervisors, 77 are rail transportation supervisors, 220 are agency police, and 7 are traffic checkers.

Agency and/or Contracting Personnel: Agency staff are the primary personnel in Washington's 87 stations, providing ticket sales, giving customer assistance, cleaning stations, providing supervision and management, policing stations, and assisting train crews. Maintenance is done by agency and contractor staff. Contractors are responsible for 170 of the metro's 557 escalators.

Multi-Tasking: No information was provided.

Station Operations: All stations are staffed at all times they are open. Cleaning crews, supervisors, and transit police move freely throughout stations. A pilot program is underway to place additional staff on platforms at select stations.

TICKET SALES

Ticket Sales Capabilities: Station staff sell tickets in one sales office in a centrally located station. Cash, credit cards, debit cards, and transit vouchers are all accepted.

Transaction Time: There is an average of 300 ticket sales per 8 hour shift.

CUSTOMER ASSISTANCE

Assistance Capabilities: No information was provided.

Training: No information was provided.

CLEANING & MAINTENANCE

Cleaning: No information was provided.

Maintenance: No information was provided.

TRAIN CREW ASSISTANCE

Assistance Capabilities: No information was provided.

SAFETY AND SECURITY

Monitoring Stations: No information was provided.

Safety Hazards: No information was provided.

Hong Kong, China (KCRC)

STATION STAFFING

Number of Station Personnel: KCRC has 200 full-time ticket sales employees, 25 fare inspectors, 15 customer assistance agents, 80 supervisors, 70 employees handling train crew assistance, 70 employees working control room monitoring, and 40 employees involved with crowd control. There are 50 part-time ticket sales employees, 100 part-time employees in train crew assistance, and 100 part-time employees involved with crowd control.

Agency and/or Contracting Personnel: Agency staff provide ticket sales, fare inspection, customer assistance, elevator and escalator operation, supervision and management, security, and train crew assistance in KCRC's 13 stations. Cleaning, luggage handling, and cash delivery services have been contracted out. Maintenance is performed by both agency staff and outside contractors.

Multi-Tasking: Station staff are responsible for ticket sales, customer assistance, cleaning, train crew assistance, and safety/security.

Station Operations: All stations are staffed at all times. Station staff are located at all times on platforms, in ticket offices, control rooms, and in station lobbies and mezzanines. Elevators and escalators are staffed on a part-time basis. Supervisors move freely throughout stations.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept only cash for ticket sales.

Transaction Time: The average sales staff transaction time for magnetic tickets is 14 seconds while the average transaction time for smart card add value transactions is 17 seconds. The average wait time for a customer in line at a ticket agent is 54 seconds.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station officers provide printed information, answer routing questions, make announcements, help disabled passengers, issue refunds, respond to incidents, provide first aid, and operate elevators and escalators.

Training: KCRC gives general customer service training and first aid training to its station officers.

CLEANING & MAINTENANCE

Cleaning: All stations are swept several times a day, and are mopped as required. Litter is removed twice a day, and garbage is picked up once a day. Mechanized floor and wall cleaning is performed monthly. Graffiti is removed as required.

Maintenance: Building maintenance staff are responsible for maintaining lights, railings and banisters, masonry, maps and map holders, signs, and plumbing. Automatic Revenue Collection staff maintains fare vending machines and fare gates. Signal and communications staff is responsible for the public address system. Advertisers maintain advertisements. Elevator and escalator maintenance is contracted out.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff control passenger flow on and off trains and close off certain cars on trains.

SAFETY AND SECURITY

Monitoring Stations: Hong Kong Police patrol stations, and are assisted by station staff who also monitor the safety and security of the stations. Stations are also monitored from central CCTV rooms.

Safety Hazards: A station supervisor and two station officers will form a team to take care of the station equipment, environment, and engineering works at each station to ensure safety. Station staff also assist in evacuating passengers during emergencies.

Johannesburg, South Africa

STATION STAFFING

Number of Station Personnel: Johannesburg employs 9,800 employees, of which 4,200 conduct ticket sales, 200 are fare inspectors, and 200 are involved with customer assistance.

Agency and/or Contracting Personnel: Johannesburg's 470 stations employ agency staff for ticket sales, fare inspection, customer assistance, maintenance, and supervision and management. Agency police are also used. Station cleaning is performed by an outside contractor.

Multi-Tasking: Station staff are responsible for ticket sales, customer assistance, cleaning, and safety/security.

Station Operations: Not all train stations are staffed at all times. Staff are assigned to locations on platforms, in ticket offices, or are free to move about the stations.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash and credit cards for ticket purchases.

Transaction Time: The average wait time is 45 seconds.

CUSTOMER ASSISTANCE

Assistance Capabilities: Staff provide printed information and answer routing questions. Public announcements are made by announcers. Senior Administrative Officials operate turnstiles.

Training: Training is provided to employees to help them carry out the various aspects of customer assistance. Voice training is also given to announcers.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter and garbage removal, mechanized floor and wall cleanings, and graffiti removal are all performed according to station size and passenger volumes.

Maintenance: Station staff are not involved with maintenance.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff do not assist train crews.

SAFETY AND SECURITY

Monitoring Stations: Agency police and other police patrol stations along with help from station staff, fare inspectors, and station management. Agency station employees make reports to police if they observe problems. Stations are also monitored remotely from a central control room.

Safety Hazards: Station staff are responsible for identifying any potential hazards and alerting the appropriate authorities. Station staff also assist in emergency passenger evacuations.

Osaka, Japan

STATION STAFFING

Number of Station Personnel: No information was provided.

Agency and/or Contracting Personnel: Agency staff provide ticket sales, fare inspection, train crew assistance, and management and supervision in Osaka's seven stations. Outside contractors are used for cleaning, elevator and escalator operation, and security. A combination of agency staff and contractor staff are used for customer assistance and maintenance. Police services are provided by the local police departments.

Multi-Tasking: Station staff are responsible for ticket sales, customer assistance, cleaning, maintenance, and safety/security.

Station Operations: All metro stations are staffed at all times they are open. Staff are moved from location to location, depending on the time of day.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash and credit cards for ticket purchases.

CUSTOMER ASSISTANCE

Assistance Capabilities: Station staff assist customers by providing written information, answering routing questions, providing announcements, helping passengers with disabilities, issuing refunds, and responding to incidents.

Training: Station staff are trained in customer assistance activities.

CLEANING & MAINTENANCE

Cleaning: Sweeping and litter removal are done on a daily basis. Mopping, garbage removal, mechanized floor and wall cleanings, and graffiti removal are done on a regular basis as well.

Maintenance: Station staff maintain fare vending machines and fare gates.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff do not assist train crews and are not involved with dispatching.

SAFETY AND SECURITY

Monitoring Stations: Station staff monitor the safety and security of the stations. Stations are also monitored from a remote location.

Safety Hazards: Station staff assist in emergency passenger evacuations.

Sydney, Australia

STATION STAFFING

Number of Station Personnel: There are 2,421 full-time staff. Of these, 324 sell tickets, 156 are fare inspectors, 530 are supervisors, and 193 are team leaders. There are also 1,218 Customer Service Attendants who have a number of different duties including cleaning, maintenance, and train crew assistance.

Agency and/or Contracting Personnel: Agency staff are used for most aspects in Sydney's 301 stations. Agency staff provide ticket sales, fare inspection, customer assistance, cleaning, maintenance, supervision and management, and train crew assistance. Security is handled by an outside contractor as well as some aspects of maintenance.

Multi-Tasking: Customer service attendants are also responsible for cleaning, maintenance, train crew assistance, and elements of safety and security.

Station Operations: 248 stations are staffed at all times, 5 are staffed part time, and 48 are completely unstaffed. Station staff are assigned to platforms, station lobbies and mezzanines, and ticket offices. Some are also able to move freely throughout the station.

TICKET SALES

Ticket Sales Capabilities: Staff in stations accept cash, credit and debit cards for ticket sales.

CUSTOMER ASSISTANCE

Assistance Capabilities: Customer Service Attendants provide printed information, answer routing questions, make announcements, give assistance to disabled passengers, and administer first aid. Ticket sales persons issue refunds for loss of money in ticket vending machines.

Training: Training is provided to all Customer Service Attendants to handle each task of customer service and general first aid.

CLEANING & MAINTENANCE

Cleaning: Sweeping, mopping, litter and garbage removal, and graffiti removal are done in all stations. The frequency of the cleaning depends on individual station needs. Mechanized floor and wall cleaning are done in some stations.

Maintenance: Customer Service Attendants maintain and clean railings and banisters and masonry. They also maintain maps and map holders, as well as signs. Outside contractors are responsible for maintaining fare vending machines, fare gates, lights, public address systems, advertising, and plumbing.

TRAIN CREW ASSISTANCE

Assistance Capabilities: Station staff assist in train dispatching or assisting train crews by controlling passenger flow on and off trains.

SAFETY AND SECURITY

Monitoring Stations: Train security guards provide safety and security on Sydney's trains. Stations are monitored from the Station Manager's office as well as from other locations within the station.

Safety Hazards: Station staff are responsible for identifying any potential hazards and alerting the Station Manager. Station staff also assist in emergency passenger evacuations.

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Appendix A: Agency Profiles

"Jane's Urban Transport Systems," Nineteenth Edition, 2000-2001.

The Changing Face of Transit:

A Worldwide Survey of Transportation Agency Practices

February 2001

MTA New York City Transit

Lawrence G. Reuter
President

PART ONE:

FARE SALES AND COLLECTION

PART TWO:

AUTOMATIC TRAIN SUPERVISION

PART THREE:

STATION PERSONNEL

BIBLIOGRAPHY AND APPENDICES

APPENDIX A: AGENCY PROFILES

All information in Appendix A from "Jane's Urban Transport Systems," 19th edition, 2000-2001 unless noted.

Berlin, Germany

BRIEF	Berliner Verkehrsbetriebe (BVG) is the municipal agency that operates the Berlin metro along with buses, tramways, and ferries. The first line of the metro system opened in 1902. Metro stations previously closed when the city was divided, have been reopened and restored.
POPULATION	3.4 million
PASSENGER JOURNEYS	771 million (1999 – all modes)
CAR-KM	129.3 million (1998)
ROUTE LENGTH KM	143
NUMBER OF LINES	9
NUMBER OF STATIONS	169
SERVICE FREQUENCY	Peak 3 min, off peak 5 to 10 min
HOURS OF OPERATION	04.00 to 01.00
FAREBOX OPERATING RATIO	40 percent (includes other commercial sources)
NEW PROJECTS	A 7-year modernization program is underway that will see the introduction of automated train operation, new trains, new signaling, wide-ranging station improvements, and rolling stock replacement. A number of line extensions are currently underway or have been recently completed.

Hong Kong (MTR)

BRIEF	The Hong Kong Mass Transit Railway Corporation (MTR) operates a metro line first opened in 1979. As part of the "Octopus" group of public transportation systems the Hong Kong MTR has a multimodal integrated fare system.
POPULATION	6.8 million(1999)[1]
PASSENGER JOURNEYS	779 million (1999) [2]

[1] E-mail from Hong Kong MTR, Felix Ng, January 29, 2001.
[2] Ibid.

CAR-KM	88.2 million (1997)
ROUTE LENGTH KM	74.9 (excluding airport line)[3]
NUMBER OF LINES	4 (excluding airport line)[4]
NUMBER OF STATIONS	43 (excluding airport line)[5]
SERVICE FREQUENCY	Peak 2 min, off peak 4 min[6]
HOURS OF OPERATION	06.00 to 01.00
FAREBOX OPERATING RATIO	100 percent (191 percent)
NEW PROJECTS	1998 completion of 34 km line to new airport on Lantau Island. Complete refurbishment of rolling stock fleet by 2001 and installation of SACEM system to increase capacity and improve customer and staff environment. Continued expansion planned or under construction for Kwun Tung line.

London, England

BRIEF	The London metro is run by London Transport, a government controlled authority. London's first metro line was opened in 1863.
POPULATION	6.3 million in region.
PASSENGER JOURNEYS	832 million (1997/98)
CAR-KM	62.1 million (1997/98 train-km)
ROUTE LENGTH KM	392
NUMBER OF LINES	12
NUMBER OF STATIONS	267
SERVICE FREQUENCY	2 minutes at peak in central area
HOURS OF OPERATION	Not Available
FAREBOX OPERATING RATIO	Not Available
NEW PROJECTS	Extension of the Jubilee line from Green Park to Stratford in 1999. Modernization of the Central line with new trains, new signaling, and

[3] Ibid.
[4] Ibid.
[5] Ibid.
[6] Ibid.

ATO. Refurbishment of Bakerloo and Metropolitan line trains. Massive funding has been acquired for additional improvements over the next couple of years.

Moscow, Russia

BRIEF	Moscow's first metro line was opened in 1935. Currently, the metro is the city's principal mode of transportation with ridership gains requiring frequent capacity increases.
POPULATION	8.8 million
PASSENGER JOURNEYS	3,208 million (1997)
CAR-KM	615 million (1996)
ROUTE LENGTH KM	262
NUMBER OF LINES	11
NUMBER OF STATIONS	160
SERVICE FREQUENCY	1 min 30 s peak, 2 to 4.5 min off-peak
HOURS OF OPERATION	06.00 to 01.00
FAREBOX OPERATING RATIO	Not Available
NEW PROJECTS	Installation of ATC on two lines has reduced headways to 90 seconds and further resignaling is planned. A modern fare collection system (magnetic strip tickets and contactless smart cards) has replaced token-operated turnstiles.[7]

New York, New York, USA

BRIEF	New York's metro is operated by MTA New York City Transit (NYC Transit), a division of the Metropolitan Transportation Authority. The first metro line opened in 1904. The metro operates throughout four of the five boroughs of New York City. NYC Transit also operates most local and express bus service in New York City, and contracts out for paratransit service.
POPULATION	City 7.3 million, region 13.2 million
PASSENGER JOURNEYS	1,381 million (2000)[8]
CAR-KM	514.0 million (2000)[9]

[7] E-mail from Moscow, Vasily Tikhonov, February 15, 2001.
[8] NYC Transit operating statistics, Office of Management and Budget, February 2001.

ROUTE LENGTH KM	371
NUMBER OF LINES	25
NUMBER OF STATIONS	468
SERVICE FREQUENCY	peak 2-10 min., off-peak 5-15 min.., late night 20 min.
HOURS OF OPERATION	24 h
FAREBOX OPERATING RATIO	64.2 percent (systemwide, not metro only)[10]
NEW PROJECTS	Since fare discounts and unlimited-ride passes were introduced in 1997/8, ridership has risen sharply (between 1996 and 2000, metro ridership up 24% and bus ridership up 43%). Service levels in 2001 will be at their highest level since at least the early 1960's. New metro cars are being delivered to replace older cars and increase the fleet size for peak period service increases. The 63rd Street Connection will open in August 2001, providing a 20% increase in capacity between Queens and Manhattan.

Paris, France (RATP)

BRIEF	RATP, established in 1900, provides service to downtown Paris. High level of interconnectivity with the Paris regional metro (RER), national railways, and suburban bus services.
POPULATION	City 2 million, region 11 million
PASSENGER JOURNEYS	1,157 million (1998)
CAR-KM	199.4 million (1997)
ROUTE LENGTH KM	201.5
NUMBER OF LINES	15
NUMBER OF STATIONS	297
SERVICE FREQUENCY	1 min 35 s to 3 min minimum
HOURS OF OPERATION	05.30 to 01.15
FAREBOX OPERATING RATIO	Not Available
NEW PROJECTS	The 7.5 km Météor Line opened in 1998 has seven stations serviced by rubber-tired driverless trains. Météor Line extension to the north and to the south is expected in 2003 and 2005 respectively.

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[9] Ibid.
[10] Ibid.

	Suburban extensions of most existing lines is also planned. Long term goal is to convert entire network to driverless operation in order to achieve reduced costs and increased service.

Paris, France (RER)

BRIEF	RER is a regional express metro with a high level of interconnectivity with the Paris metro, national railways, and suburban bus services.
POPULATION	City 2 million, region 11 million
PASSENGER JOURNEYS	268 million (1998)
CAR-KM	Not Available
ROUTE LENGTH KM	336
NUMBER OF LINES	4
NUMBER OF STATIONS	158
SERVICE FREQUENCY	Not Available
HOURS OF OPERATION	Not Available
FAREBOX OPERATING RATIO	Not Available
NEW PROJECTS	1995 installation of SACEM moving block system on line A. Line D extension to southwestern suburbs in 1995. Extensions planned for most lines.

São Paulo, Brazil

BRIEF	The Companhia do Metropolitano de São Paulo (CMAP) began providing service in 1974. The São Paulo Metro connects with feeder suburban rail, bus and trolleybus services as well as regional rail.
POPULATION	City 11 million, metropolitan region 17 million
PASSENGER JOURNEYS	486 million (2000)[11]
CAR-KM	Not Available
ROUTE LENGTH KM	49.2[12]
NUMBER OF LINES	3

[11] E-mail from São Paulo Metro, Peter Alouche, February 9, 2001.
[12] Ibid.

NUMBER OF STATIONS	46
SERVICE FREQUENCY	Line 1 (Blue): Peak 1 min 49 s, off-peak 2 min 32 s Line 2 (Green): Peak 2 min 40 s, off-peak 3 min 35 s Line 3 (Red): Peak 1 min 41 s, off-peak 2 min 45 s[13]
HOURS OF OPERATION	05.00 to 00.00 (lines 1 and 2), 04.40 to 00.00 (line 3)[14]
FAREBOX OPERATING RATIO	97.04 percent[15]
NEW PROJECTS	Two extensions opened in 1998. A section of line 5 is under construction (completion expected in 2002).[16]

Tokyo, Japan

BRIEF	The Teito Rapid Transit Authority (TRTA) operates a metro line first opened in 1927. TRTA accounts for 80 percent of metro journeys in Tokyo. High level of interconnectivity with other railways.
POPULATION	City 8 million, metro area 11.3 million, extended service area 30 million
PASSENGER JOURNEYS	2,082 million (1997)
CAR-KM	236 million (1997)
ROUTE LENGTH KM	171.5
NUMBER OF LINES	8
NUMBER OF STATIONS	158
SERVICE FREQUENCY	Peak 1 min 50 s, off peak 3 to 8 min
HOURS OF OPERATION	05.00 to 00.30
FAREBOX OPERATING RATIO	85.5 percent
NEW PROJECTS	Namboku line (7) opened in 1991 with one person train operation and platform screen doors. Extended in 1996, 1997, and 2000. Continued expansion planned or under construction for Yurakucho and Hanzomon lines.

[13] Ibid.
[14] Ibid.
[15] Ibid.
[16] Ibid.

Athens, Greece (Attiko Metro)

BRIEF	Attiko Metro is a private company set up in 1992 to own and manage the Athens metro. Attiko Metro currently operates two new subway lines opened in February 2000 a third line is still under construction. Attiko Metro will merge with the Athens-Piraeus Electric Railways Company (ISAP) in approximately three years.
POPULATION	3.6 million
PASSENGER JOURNEYS	
CAR-KM	
ROUTE LENGTH KM	
NUMBER OF LINES	3
NUMBER OF STATIONS	
SERVICE FREQUENCY	
HOURS OF OPERATION	
FAREBOX OPERATING RATIO	
NEW PROJECTS	Construction of Line 3 of the three-line network began in 1992. Extensions of the existing Line 1 have been approved. Two new tramway lines are also under consideration.

Athens, Greece (ISAP)

BRIEF	The Athens-Piraeus Electric Railways Company (ISAP) runs a north south rail line (to become Line 1 of the Athens Metro), as well as a small complementary bus network.
POPULATION	3.6 million
PASSENGER JOURNEYS	92 million (1997)
CAR-KM	
ROUTE LENGTH KM	51
NUMBER OF LINES	1
NUMBER OF STATIONS	23
SERVICE FREQUENCY	Peak 3.5 min
HOURS OF OPERATION	05.00 to 01.00

FAREBOX OPERATING RATIO	
NEW PROJECTS	

Atlanta, Georgia, USA

BRIEF	The Metropolitan Atlanta Rapid Transit Authority (MARTA), created in 1965, became an operating agency in 1972 when it purchased the privately owned Atlanta Transit System. Their first metro line opened in 1979. Since then, they have been operating integrated bus and metro service.
POPULATION	1.2 million
PASSENGER JOURNEYS	78.4 million (1997)
CAR-KM	59.4 million (1997)
ROUTE LENGTH KM	62.9
NUMBER OF LINES	3
NUMBER OF STATIONS	36
SERVICE FREQUENCY	8 min
HOURS OF OPERATION	04.30 to 01.00
FAREBOX OPERATING RATIO	35 percent
NEW PROJECTS	3.2 km extension to North Springs under construction. Plans include further metro routes to serve the northern suburbs, new service to South DeKalb, 70 km of automated light metro, an exclusive busway, and commuter rail service.

Baltimore, Maryland, USA

BRIEF	The Mass Transit Administration, an agency of the Maryland Department of Transportation, provides bus, metro, and light rail services to the Baltimore area. Metro service has been operating since 1983.
POPULATION	750,000
PASSENGER JOURNEYS	12.8 million (1998)
CAR-KM	
ROUTE LENGTH KM	23.7

NUMBER OF LINES	1
NUMBER OF STATIONS	12
SERVICE FREQUENCY	Peak 8 min, off-peak 10 to 15 min. No Sunday service
HOURS OF OPERATION	05.00 to 24.00
FAREBOX OPERATING RATIO	35.4 percent
NEW PROJECTS	Recent fare structure change from zonal to flat fare. All day passes were implemented, and transfers were eliminated.

Barcelona, Spain

BRIEF	Metro and bus service have been under municipal control since 1959 and 1960, respectively. In 1980, both operations were brought under common management through Transports de Barcelona SA., although both continue to operate under separate entities. The metro is currently operated by Ferrocarril Metropolita de Barcelona SA.
POPULATION	City 1.7 million, region 2.6 million
PASSENGER JOURNEYS	277.9 million (1998 - estimated)
CAR-KM	53.2 million (1997)
ROUTE LENGTH KM	81
NUMBER OF LINES	5
NUMBER OF STATIONS	111
SERVICE FREQUENCY	Peak 3.5 min, off-peak 4.5 min
HOURS OF OPERATION	05.00 to 23.00 Friday
	05.00 to 02.00 Saturday
	05.00 to 24.00 Sunday
FAREBOX OPERATING RATIO	79.6 percent
NEW PROJECTS	Extension of Line 3 from Montbau to Canyelles, as well as extension of Line 4 from Roquetes to Trinitat Nova. A modernization program is also in progress for many stations.

Boston, Massachusetts, USA

BRIEF	The Boston metro opened in 1897 and is the oldest metro in the United States. The Massachusetts Bay Transportation Authority

	(MBTA) directly operates bus, trolleybus, metro, and light-rail service; commuter rail and ferry services are operated under contract.
POPULATION	City 562,000, region 2.6 million
PASSENGER JOURNEYS	107.6 million (metro), 69 million (light rail) (1996)
CAR-KM	36.6 million (metro), 8.9 million (light rail) (1996)
ROUTE LENGTH KM	125
NUMBER OF LINES	4
NUMBER OF STATIONS	84
SERVICE FREQUENCY	Peak 4.5 min, off-peak 8 min
HOURS OF OPERATION	05.00 to 00.30
FAREBOX OPERATING RATIO	30.2 percent
NEW PROJECTS	Station modernization to improve accessibility and attractiveness. Relocation of the Haymarket-Science Park section of the Green Line underground.

Budapest, Hungary

BRIEF	Full metro service, along with one small-profile line, began running in 1896. Budapest Transport Limited, a municipal agency, operates the metro system along with the city's bus, trolleybus, tram, rack and suburban railways.
POPULATION	2.1 million
PASSENGER JOURNEYS	314.7 million (1997)
CAR-KM	30.7 million (1997)
ROUTE LENGTH KM	30.8
NUMBER OF LINES	3
NUMBER OF STATIONS	41
SERVICE FREQUENCY	Peak 2 to 3 min, off-peak 4 to 9 min
HOURS OF OPERATION	04.30 to 23.10
FAREBOX OPERATING RATIO	40.4 percent

NEW PROJECTS	A new metro line 4 has been proposed to be constructed. However, it has been postponed due to financial problems.

Hamburg, Germany

BRIEF	The first full service metro line was opened in 1912. The metro system, along with the bus system, is operated by the Hamburger Hochbahn Aktiengesellschaft (HHA). A zonal system of ticketing allows for intermodal transfer between vehicles from other operating agencies in the region.
POPULATION	1.9 million
PASSENGER JOURNEYS	
CAR-KM	61.9 million (1998)
ROUTE LENGTH KM	100.7
NUMBER OF LINES	3
NUMBER OF STATIONS	89
SERVICE FREQUENCY	Peak 2 to 5 min, off-peak 5 to 10 min
HOURS OF OPERATION	04.05 to 01.16
FAREBOX OPERATING RATIO	51 percent
NEW PROJECTS	LCD displays called "Trainscreen" have been installed in metro cars providing service information, news, entertainment, and commercials. Station staff are expected to be eliminated by 2000, when new technology will permit "self-dispatch" of trains by drivers.

Jersey City, New Jersey (PATH), USA

BRIEF	Full service metro linking New York and New Jersey since 1908. PATH has been operated by the Port Authority of New York and New Jersey since 1962.
POPULATION	7.3 million (New York City), 13.2 million in region
PASSENGER JOURNEYS	60.7 million (1996)
CAR-KM	
ROUTE LENGTH KM	22.2
NUMBER OF LINES	4

NUMBER OF STATIONS 13 (7 in New Jersey, 6 in New York)

SERVICE FREQUENCY frequent

HOURS OF OPERATION 24 h

FAREBOX OPERATING RATIO

NEW PROJECTS

Los Angeles, California, USA

BRIEF Metro service (red line) opened in 1993, operated by the Los Angeles County Metropolitan Transportation Authority (MTA). MTA also operates 2 light rail lines (blue and green lines) and bus service. Commuter rail service and additional bus service are provided by other agencies.

POPULATION 3.6 million

PASSENGER JOURNEYS 11.6 million (1996)

CAR-KM

ROUTE LENGTH KM 16.1

NUMBER OF LINES 1

NUMBER OF STATIONS 6

SERVICE FREQUENCY Peak 5 min, off-peak 10 min

HOURS OF OPERATION 04.43 to 23.32

FAREBOX OPERATING RATIO 4.6 percent

NEW PROJECTS The recently completed red line extension provides service to North Hollywood. Construction has begun for a 13.1 mile Pasadena extension slated for completion in the mid 00’s.

Miami, Florida, USA

BRIEF The Miami-Dade Transit Agency runs bus, metro, people mover and paratransit services. Metro service began in 1984.

POPULATION 1.9 million

PASSENGER JOURNEYS 14 million (1996/97)

CAR-KM

ROUTE LENGTH KM	33
NUMBER OF LINES	1
NUMBER OF STATIONS	21
SERVICE FREQUENCY	Peak 6 min, off-peak 15 min
HOURS OF OPERATION	05.30 to 24.00
FAREBOX OPERATING RATIO	27 percent
NEW PROJECTS	Two extensions of the metro have been discussed. A third extension is in design and is scheduled to open in 2002.

Milan, Italy

BRIEF	Azienda Trasporti Municipali (ATM) is responsible for bus, trolleybus, tram, and metro services in the Milan area. The metro first opened in 1964.
POPULATION	City 1.5 million, region 4 million
PASSENGER JOURNEYS	307.1 million urban, 31.9 million suburban (1997)
CAR-KM	52.7 million
ROUTE LENGTH KM	69.3
NUMBER OF LINES	3
NUMBER OF STATIONS	84
SERVICE FREQUENCY	Peak (red line) 2 to 2.5 min, off-peak 5 min
HOURS OF OPERATION	05.56 to 00.20
FAREBOX OPERATING RATIO	37.3 percent
NEW PROJECTS	Line extensions are currently underway on lines 2 and 3. Additional extensions for line 3 are also proposed.

Montreal, Canada

BRIEF	The rubber-tired Montreal metro first opened in 1966. It is operated by the Societe de transport de la Communaute urbaine de Montreal (SITCUM).
POPULATION	City 1.8 million
PASSENGER JOURNEYS	197 million (1997)

CAR-KM	57.5 million
ROUTE LENGTH KM	65
NUMBER OF LINES	4
NUMBER OF STATIONS	65
SERVICE FREQUENCY	Peak 3 to 5 min, off-peak 7 to 10 min
HOURS OF OPERATION	05.30 to 01.00
FAREBOX OPERATING RATIO	38 percent
NEW PROJECTS	Two extensions are planned for completion in 2004. Line 2 will extend from Henri-Bourassa across the river into Laval and Line 5 will extend from St. Michael to Pie IX.

Munich, Germany

BRIEF	Stadtwerke Munchen (SWM) runs bus, tramway, and metro operations in Munich under the authority of the municipal agency Munchner Verkehrs- und Tarifverbund (MVV). Metro service has been operating since 1971.
POPULATION	City 1.3 million, region 2.4 million
PASSENGER JOURNEYS	427.7 million (1998 – bus, tramway, and metro)
CAR-KM	50.6 million (1998)
ROUTE LENGTH KM	77.7
NUMBER OF LINES	6
NUMBER OF STATIONS	86
SERVICE FREQUENCY	Peak 2 to 3 min, off-peak 10 min
HOURS OF OPERATION	
FAREBOX OPERATING RATIO	51 percent
NEW PROJECTS	A good number of extensions on various lines have been either completed recently, are currently under construction, or are planned for the future. The system will eventually extend to 108 km in length after all projects are completed.

Nagoya, Japan

BRIEF	Nagoya's municipally owned metro is operated by Nagoya-shi Kotsu Kyoku – Municipal Transit Bureau, which also operates the city's buses. The metro currently holds a share of about 11 percent of daily travel in the city.
POPULATION	2.2 million
PASSENGER JOURNEYS	412.4 million (1996/97)
CAR-KM	67.5 million (1996/97)
ROUTE LENGTH KM	76.5
NUMBER OF LINES	5
NUMBER OF STATIONS	74
SERVICE FREQUENCY	Peak 2 to 5 min, off-peak 4 to 8 min
HOURS OF OPERATION	05.30 to 00.18
FAREBOX OPERATING RATIO	61 percent
NEW PROJECTS	Various extensions of existing lines are underway or proposed. Many of these improvements are aimed towards linking existing lines with commuter railways and trunk bus services. Eventually, a network of 8 metro lines is envisaged, totaling 130 km.

Prague, Czech Republic

BRIEF	Bus, tramway and metro services are provided by the municipal agency Dopravni podnik hlavniho mesta Prahy. Transit trips account for 65 percent of weekday journeys.
POPULATION	1.2 million
PASSENGER JOURNEYS	407 million (1997)
CAR-KM	
ROUTE LENGTH KM	43.6
NUMBER OF LINES	3
NUMBER OF STATIONS	43
SERVICE FREQUENCY	Peak 1 min 50 s
HOURS OF OPERATION	05.00 to 24.00

FAREBOX OPERATING RATIO	25 percent
NEW PROJECTS	A 6.4 km extension of Line B opened in November 1998. Extension and modernization of Line C is slated to begin soon. A new Line D is also proposed to be built.

Santiago, Chile

BRIEF	Santiago's rubber-tired metro is operated by Metro de Santiago, a government agency. It was first opened in 1975.
POPULATION	4.3 million
PASSENGER JOURNEYS	200 million (1997)
CAR-KM	
ROUTE LENGTH KM	37.6
NUMBER OF LINES	3
NUMBER OF STATIONS	47
SERVICE FREQUENCY	Peak 2 min 55 s, off-peak 3 min 40 s to 8 min
HOURS OF OPERATION	06.30 to 22.30
FAREBOX OPERATING RATIO	90.3 percent
NEW PROJECTS	Line 5, the third route, opened in 1997 with more extensions already approved. Signaling is being upgraded on Lines 1 and 2 to reduce headway times.

Singapore

BRIEF	The Land Transport Authority is the owner and builder of transport infrastructure in Singapore, including the metro and light rapid transit systems. Operation of the metro is licensed to Singapore MRT (SMRT). The metro opened in 1987 and is currently being expanded.
POPULATION	2.9 million
PASSENGER JOURNEYS	337 million (1997/98)
CAR-KM	
ROUTE LENGTH KM	83
NUMBER OF LINES	2

NUMBER OF STATIONS	48
SERVICE FREQUENCY	Peak 2 to 6 min, off-peak 6 min
HOURS OF OPERATION	05.16 to 00.47
FAREBOX OPERATING RATIO	
NEW PROJECTS	Construction of the new North East line is currently in progress, scheduled for completion in 2003. In addition, various other extensions to the system are also planned.

Toronto, Canada

BRIEF	The Toronto Transit Commission operates bus, metro, tramway and light rail for Toronto in coordination with neighboring systems. Metro service began in 1954.
POPULATION	2.3 million
PASSENGER JOURNEYS	142.1 million (1996)
CAR-KM	63.9 million (1996)
ROUTE LENGTH KM	56.4
NUMBER OF LINES	2
NUMBER OF STATIONS	61
SERVICE FREQUENCY	Peak 2.5 min, off-peak 4 to 7 min
HOURS OF OPERATION	05.47 to 01.34
FAREBOX OPERATING RATIO	75 percent
NEW PROJECTS	Construction of the Sheppard Avenue East extension (6.4 km) is in progress. A number of other extensions are proposed. 23 stations are being made accessible through installation of elevators.

Washington, D.C., USA

BRIEF	Bus and metro service for Washington and parts of suburban Maryland and Virginia is operated by the Washington Metropolitan Area Transit Authority (WMATA). WMATA was created in 1967 and adopted a plan to build a 166 km metro network, the first line of which opened in 1976. The network was completed in 2001.
POPULATION	City 607,000, region 2.3 million

PASSENGER JOURNEYS	194 million (1996)
CAR-KM	69.7 million (1996)
ROUTE LENGTH KM	150
NUMBER OF LINES	5
NUMBER OF STATIONS	75
SERVICE FREQUENCY	Peak 3 to 6 min, off-peak 6 to 16 min
HOURS OF OPERATION	05.30 to 24.00
FAREBOX OPERATING RATIO	47.2 percent
NEW PROJECTS	Station rehabilitation and upgrading the fare collection system are currently in the works.

Hong Kong, China (KCRC)

BRIEF	The Kowloon-Canton Railway Corporation operates a high-intensity urban and suburban rail network, which was originally opened in 1910 and is known as East Rail. KCRC also operates one of the worlds busiest light rail networks.
POPULATION	5.5 million
PASSENGER JOURNEYS	261 million (1997)
CAR-KM	
ROUTE LENGTH KM	34
NUMBER OF LINES	1
NUMBER OF STATIONS	13
SERVICE FREQUENCY	Peak 3 min, off-peak 5 to 6 min
HOURS OF OPERATION	05.35 to 00.25
FAREBOX OPERATING RATIO	100 percent
NEW PROJECTS	A short extension of East Rail is being built in addition to a new West Rail line that will be 30.3 km in length.

Johannesburg, South Africa

Brief	Suburban commuter rail surrounding Johannesburg is run by the South African Rail Commuter Corporation. Their network serves the entire southern Transvaal area.
Population	City 1.7 million, region 5.5 million
Passenger Journeys	178 million (1997/98)
Car-km	
Route Length km	456
Number of Lines	14
Number of stations	162
Service Frequency	Peak up to 2 min, off-peak hourly
Hours of Operation	
Farebox Operating Ratio	20.3 percent
New Projects	Proposals for two new lines totaling 16 km in northern Johannesburg, as well as another 20 km line to serve the Baralink commercial and residential development southwest of the city. Fleet renewal has also been started.

Osaka, Japan

Brief	JR West is one of a number of suburban and interurban rail providers for Osaka. JR West offers a network of service to Kobe and Kyoto, with Osaka as the hub of service. Both local and rapid service is available.
Population	2.6 million
Passenger Journeys	1,012 million (1995/96)
Car-km	
Route Length km	600
Number of Lines	12
Number of stations	
Service Frequency	
Hours of Operation	

FAREBOX OPERATING RATIO	
NEW PROJECTS	The 12.3 km Katafuku line opened in 1997 providing an east-west link through central Osaka. In addition to this, a new airport line has been built and is proposed to be extended to reach Kobe and Nara via existing freight right of way. Plans are also in the works for additional links throughout the area for increased passenger service.

Sydney, Australia

BRIEF	Suburban and interurban rail in Sydney is operated by CityRail on infrastructure owned by the state-run Rail Access Corporation. This network extends well beyond the Sydney suburban area.
POPULATION	3.8 million
PASSENGER JOURNEYS	266.5 million (1997/98)
CAR-KM	
ROUTE LENGTH KM	1700
NUMBER OF LINES	
NUMBER OF STATIONS	301
SERVICE FREQUENCY	
HOURS OF OPERATION	
FAREBOX OPERATING RATIO	36 percent
NEW PROJECTS	A new 6 km loop was constructed in 1998 to serve the Olympic 2000 stadium. Construction is also in progress of a direct underground link to the airport. Environmental impact assessments are in the works for additional line extensions. New double-deck cars are scheduled to be purchased in the near future.

Appendix B: Fare Sales and Collection Survey Results

4. What percent of total sales do the following types of tickets or plans represent?	Total	# Selling This Type of Pass	Minimum Percent of Sales	Maximum Percent of Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Annual pass	23	11	0%	22%	14.00%	-	0.00%	1.00%
Monthly pass	24	19	0%	60%	30.00%	-	2.43%	11.00%
Two week pass	23	2	0%	1%	0.00%	-	0.00%	0.00%
One week pass	23	11	0%	43%	1.00%	-	0.00%	25.00%
Specific number of days less than a week	23	14	0%	50%	11.00%	-	0.00%	3.00%
Multi-ride without discount	23	12	0%	85%	17.00%	-	25.19%	13.00%
Multi-ride with discount	23	12	0%	50%	1.00%	-	35.61%	28.00%
Peak hour pricing	23	1	0%	17%	0.00%	-	0.00%	0.00%
Single fare ticket	24	19	0%	76%	3.00%	13.00%	33.40%	0.00%
Single fare card	23	4	0%	58%	0.00%	-	0.00%	1.00%
Single fare token	23	2	0%	15%	0.00%	-	0.00%	15.00%
Cash admission	23	5	0%	57%	0.00%	-	0.00%	0.00%
Student	23	14	0%	14%	13.00%	-	3.26%	5.00%
Senior/pensioner	23	12	0%	10%	1.00%	-	0.00%	0.00%
Military	23	0	0%	0%	0.00%	-	0.00%	0.00%
Other	23	13	0%	59%	9.00%	-	0.11%	0.00%

5. What percent of total sales do the following fare sales mechanisms and locations represent?	Total	# Using This for Fare Sales	Minimum Percent of Sales	Maximum Percent of Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Clerks in stations	22	21	0%	99%	16.10%	-	98.76%	61.00%
Vending machines in stations	22	15	0%	69%	22.20%	-	0.00%	25.00%
Vending machines at bus stops	22	2	0%	10%	0.00%	-	0.00%	0.00%
Vending machines in non-transit locations	22	2	0%	11%	0.00%	-	0.00%	0.00%
Internet	22	1	0%	1%	0.00%	-	0.00%	1.00%
Bank machines	22	3	0%	36%	0.00%	-	0.00%	1.00%
Mail in	22	4	0%	18%	17.80%	-	0.00%	1.00%
Merchant sales	22	15	0%	93%	25.20%	-	0.00%	12.00%
Other (Example: Ticket sale by bus drivers)	22	12	0%	94%	18.20%	-	1.24%	2.00%

6. What percent of sales are made by the following?	Total	# Accepting This Type of Payment	Minimum Percent of Sales	Maximum Percent of Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Cash	23	23	40%	100%	97.00%	99.00%	98.76%	88.00%
Credit Card	23	8	0%	17%	3.00%	0.50%	0.00%	8.00%
Debit Card	23	5	0%	17%	0.00%	0.50%	0.00%	4.00%
Other	23	7	0%	40%	0.00%	0.00%	1.24%	0.00%

	Total	Sell Fares via Internet	Do Not Sell Fares via Internet	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
8. Do you sell fares over the Internet? (yes/no) If no, go to question 11	24	4	20	No	No	No	Yes

Appendix B: Fare Sales and Collection Survey Results

9. How do you sell fares over the Internet?

Summary: Total	Sell By Vendor	Sell Through Homepage	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
4	2	2	-	-	-	Vendor

10. If fare sales are made through a vendor what is the transaction fee? (as a percent of sales revenue)

Summary: Total	Minimum Fee	Maximum Fee	Median Fee	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
2	3%	4%	4%	-	-	-	3.00%

11. Do you sell fares through merchants? (yes/no) If no, go to question 13

Summary: Total	Sell through Merchants	Do Not Sell through Merchants	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
26	16	10	Yes	No	No	Yes

12. If fare sales are made through merchants what is the transaction fee? (as a percent of sales revenue)

Summary: Total	Minimum Fee	Maximum Fee	Median Fee	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
14	0%	5%	2%	1.5-4.5%	-	-	3.00%

13. Do you use fare vending machines? (yes/no) If no, go to question 44

Summary: Total	Use Vending Machines	Do Not Use Vending Machines	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
24	20	4	Yes	Yes	No	Yes

14. What fare options are sold at fare vending machines?

	Summary: Total	Option Sold at Machine	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
14. What fare options are sold at fare vending machines?	18	-				
Annual	22	0	No	No	-	No
Monthly	22	5	Yes	No	-	Yes
Two week	22	1	No	No	-	No
One week	22	5	Yes	No	-	Yes
Less than a week	22	7	Yes	No	-	Yes
MR with discount	22	6	Yes	No	-	Yes
MR no discount	22	7	Yes	No	-	Yes
Single fare tickets	22	15	Yes	Yes	-	No
Single fare card	22	4	No	No	-	Yes
Single fare token	22	3	No	No	-	No
Student	22	7	Yes	Yes	-	No
Senior/ Pensioner	22	5	Yes	Yes	-	No
Military	22	1	No	No	-	No
Other	22	4	No	No	-	No

15. What type of payment do fare vending machines accept?

Summary: Total	Cash	Credit	Debit	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
20	20	6	5	Cash, Credit	Cash	-	Cash, Credit, Debit

16. If machines accept cash, what is the largest bill accepted (converted from local currency to U.S.$)?

Summary: Total	Minimum Largest Bill Accepted	Maximum Largest Bill Accepted	Median Largest Bill Accepted	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
19	$0.00	$88.01	$13.24	$45.42	$12.82	-	$50.00

17. If machines accept cash, what is the largest amount of change given (converted from local currency to U.S.$)?

Total	Minimum Largest Amount of Change	Maximum Largest Amount of Change	Median Largest Amount of Change	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
20	$0.00	$87.93	$5.50	$9.08	$5.13	-	$6.00

18. Do machines refill cards or only provide new cards?

Total	Provide New Cards Only	Refill Cards Only	Provide New and Refill Cards	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
18	13	1	4	New Cards Only	Both	-	Both

Question	Total	Minimum Transaction Time	Maximum Transaction Time	Median Transaction Time	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
19. What is your agencies target or standard machine transaction time? (if available) (in seconds)	8	2	60	18	-	-	-	-
20. What is the average machine transaction time? (if available) (in seconds)	12	2	50	14	50	-	-	-

21. What is the average daily number of sales per machine?

Total	Minimum Average Daily Number of Sales	Maximum Average Daily Number of Sales	Median Average Daily Number of Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
15	42	41,000	353	-	615	-	109

22. What is the average transaction value? (in US currency)

Total	Minimum Average Transaction Value	Maximum Average Transaction Value	Median Average Transaction Value	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
16	0	17	3	-	$0.94	-	$11.06

23. How many fare vending machines do you have?

Total	Minimum Number of Fare Vending Machines	Maximum Number of Fare Vending Machines	Median Number of Fare Vending Machines	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
20	62	3,800	258	3,800	488	-	2,245

24. What percent of stations have fare vending machines?

Total	Minimum Percent of Stations with Vending Machines	Maximum Percent of Stations with Vending Machines	Median Percent of Stations with Vending Machines	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
20	24%	100%	100%	100.00%	100.00%	-	100.00%

25. How many vending machines are located in each station? (total system average)

Total	Minimum Average Vending Machines per Station	Maximum Average Vending Machines per Station	Median Average Vending Machines per Station	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
20	0	15	5	4	11	-	5

27. In which of the following locations do you have vending machines?

Summary: Total	Outside the Fare Barrier	Outside and Inside the Fare Barrier	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
20	15	5	Both	Outside	-	Both

29. How many stations use vending machines as the only fare sales method?

Summary: Total	Minimum Stations Using Vending Machines Only	Maximum Stations Using Vending Machines Only	Median Stations Using Vending Machines Only	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
19	0	170	0	170	0	-	0

30. What percent of stations use vending machines as the only fare sales method?

Summary: Total	Minimum Percent of Stations Using Vending Machines Only	Maximum Percent of Stations Using Vending Machines Only	Median Percent of Stations Using Vending Machines Only	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
14	0%	100%	0%	88.80%	0.00%	-	0.00%

31. How many types of ticket vending machines do you use?

Summary: Total	Minimum Number of Types of Vending Machines	Maximum Number of Types of Vending Machines	Median Number of Types of Vending Machines	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
19	1	7	3	7	2	-	2

32. Please describe the following details for each type of vending machine used.

	Summary: Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Maker	17	Almex, Autelca, Scheidt & Bachmann, Deutsche Verkehrsbank, Siemens	-	-	Cubic Transportation Systems
Specific function	12	Register of the sell tickets, on-line operations	-	-	Sells and adds value to MetroCards
Capital Cost	11	-	-	-	$51,000 for MVM's and $17,500 for MEM
Annual operating and maintenance cost	9	-	-	-	-

Types of payment accepted	Summary: Total	Payment Accepted	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Cash	20	20	Yes	Yes	-	Yes
Credit	20	4	No	No	-	Yes
Debit	20	3	No	No	-	Yes
Other (Example: Staff Service)	20	2	Yes	No	-	No

Appendix B: Fare Sales and Collection Survey Results

	Summary: Number of Agency Responses: Total	Push Button	Touch Screen	Touch Screen and Push Button	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Touch screen or push button	20	15	2	3	Both	Touch Screen	-	Touch Screen

	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Other important distinctions between machines	3	-	-	-	-

	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
33. What department is responsible for filling fare vending machines?	20	Outside	Operations	-	MetroCard Operations-Revenue Control
34. What department is responsible for removing cash from machines?	20	Outside	Operations	-	MetroCard Operations-Revenue Control
35. How do you address security concerns associated with cash removal and machine vandalism?	18	Outside	Special Train	-	Armed agents remove cash. Equipment vandal-resistant and monitored constantly
36. What department is responsible for repairing fare vending machines?	20	Infrastructure	Operations	-	MetroCard Operations- AFC Maintenance

	Total	Minimum Average Downtime	Maximum Average Downtown	Median Average Downtown	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
37. What is your agencies target or standard repair or downtime for fare vending machines? (if available) (in hours)	9	1	24	2	2	-	-	0.5
38. What is the average repair or downtime for machines? (if available) (in hours)	10	0	24	1	9	-	-	0.5

	Total	Minimum Staff per Machine	Maximum Staff per Machine	Median Staff per Machine	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
39. For how many machines is each vending machine repair staff responsible?	15	1	95	20	95	-	-	20

40. Where are customers directed when they have a problem with a vending machine?	Total	Customers Directed	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
To personnel within the station	22	16	No	Yes	-	No
A help-point intercom	22	2	Yes	No	-	No
A general customer service intercom	22	3	Yes	No	-	No
A general customer service phone number	22	7	Yes	No	-	Yes
A phone number exclusively for vending machine assistance	22	3	No	No	-	No
Other (Example: Call Center)	22	1	Yes	No	-	No

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Question	Summary: Number of Agency Responses — Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
41. Were any of the following required prior to the installation of fare vending machines? Please describe in the second column.	16	All	Other	-	All
42. If your vending machines accept credit cards, what methods of fraud control do you use?	6	-	-	-	Limits on number and value of transactions per day & Frequency of Use

Question	Total	Using or Plan to Use Smart Cards	Not Using Smart Cards	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
44. Are you using or do you plan to use smart cards? Smart card is a term use to describe integrated circuit, stored value, fare media If no, go to question 59	23	14	9	-	Yes	Yes	Yes

Question	Total	Earliest Year	Latest Year	Median Year	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
45. If you currently use smart cards, when were they introduced?	11	1997	1999	1997	-	1997	1998	-
46. If you plan to use smart cards, when do you plan to introduce them?	7	2001	2003	2002	-	-	-	-

Question	Total	Single Transit Mode	Regional Transportation Network	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
47. Can or will your smart card be used in one transit mode (e.g., the metro only) or can it be used throughout a regional transportation network (e.g., subway, suburban rail, and national rail networks)? Please describe in second column.	13	1	10	-	Transportation Network	Transportation Network	-

Question	Total	Transit Only	"Open" Environment	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
48. Can or will your smart card be used in a transit-only environment or an "open" environment where cards can be used for non-transit purposes? Please specify what the card can be used for in the second column.	11	1	9	-	Open	Transit Only	-

Question	Total	Involved with Joint Arrangements	Not Involved with Joint Arrangements	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
49. Are you or are you planning to be involved with joint smart card arrangements with the banking or financial industry? (yes/no) If yes, please explain in the second column.	9	8	0	-	-	Yes	-

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
50. Is or do you plan to have your smart card system administered by your transit agency or by a financial or other private entity? Please specify in second column.	10	-	-	Transit Agency	-
51. If you are involved with financial or other private entities please describe the entities involved, their roles and their legal and organizational relationship.	5	-	-	No	-

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	Summary: Number of Agency Responses				Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
	Total	Contactless Card	Combination Swipe and Contactless Card with "Purse"					
52. Which type of smart card technology do you use or plan to use? Please indicate the manufacturer, data storage capacity and per card cost to the agency in the second column.	10	9	1		-	Contactless	Contactless	-
Manufacturer	4				-	Sony	PHILIIPS technology	-
Data storage capacity	2				-	-	-	-
Per card cost to agency	3				-	-	-	-
53. How do you or how do you plan to sell smart card initial sales?	Total	Use for Initial Sales						
Clerks in station	11	8			-	Yes	Yes	-
Vending Machines located in stations	11	4			-	No	Yes	-
Vending Machines in non station locations	11	3			-	No	No	-
Internet	11	4			-	No	No	-
Bank Machine	11	1			-	No	No	-
Mail in	11	3			-	No	No	-
Merchant sales	11	2			-	No	No	-
Other	11	0			-	No	No	-
54. How do you or how do you plan to sell smart card refills?	Total	Use for Refills						
Clerks in station	11	7			-	Yes	Yes	-
Vending Machines located in stations	11	7			-	No	Yes	-
Vending Machines in non station locations	11	4			-	No	No	-
Internet	11	4			-	No	No	-
Bank Machine	11	1			-	No	No	-
Mail in	11	0			-	No	No	-
Merchant sales	11	5			-	No	No	-
Other	11	1			-	No	No	-
	Total	With Staff Assistance	With a Contractor	With Another Method				
55. How do you or how do you plan to handle card or equipment malfunction?	9	5	3	1	-	Staff assistance	Staff assistance-free magnetic ticket given and card inspected	-

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Question	Summary: Number of Agency Responses — Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
56. How do you or how do you plan to handle replacing or refunding lost or stolen cards?	8	-	Staff assistance and network	Lost cards not refunded	-
57. How do you or how do you plan to handle customer privacy rights?	6	-	-	-	-
58. What problems did you encounter integrating smart card technology into the existing fare collection system?	4	-	-	-	-

59. What type of fare collection does your metro use? (check all that apply)	Total	Uses Fare Collection Method	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Contactless cards	25	5	No	Yes	Yes	No
Magnetic swipe cards	25	11	Yes	No	Yes	Yes
Insert and return ("dipping") cards	25	7	No	Yes	Yes	Yes
Tokens	25	5	Yes	No	No	Yes
Paper tickets	25	14	No	Yes	No	No
Other (Example: Bills)	25	5	Yes	No	No	No

Question	Total	Use Contactless Cards	Do Not Use Contactless Cards	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
60. Are you using or do you plan to use contactless cards?(yes/no) If no, go to question 87	22	12	9	-	Yes	Yes	TBD

61. What fare options do you or do you plan to make available with contactless cards?	Total	Fare Options Available	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Annual pass	12	4	-	No	Yes	-
Monthly pass	12	6	-	No	Yes	-
Two week pass	12	1	-	No	No	-
One week pass	12	4	-	No	No	-
Specific number of days less than a week	12	2	-	No	No	-
Multi ride with discount	12	7	-	Yes	Yes	-
Multi ride without discount	12	3	-	No	No	-
Peak hour pricing	12	2	-	No	No	-
Single fare ticket	12	6	-	No	No	-
Student	12	6	-	Yes	Yes	-
Senior/ pensioner	12	6	-	Yes	No	-
Military	12	1	-	No	No	-
Other	12	3	-	No	No	-

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62. How do you or how do you plan to sell contactless card initial sales?

	Total	Sell Initially	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Clerks in station	12	8	-	Yes	Yes	-
Vending Machines located in stations	12	4	-	No	Yes	-
Vending Machines in non station locations	12	3	-	No	No	-
Internet	12	4	-	No	No	-
Bank Machine	12	1	-	No	No	-
Mail in	12	4	-	No	No	-
Merchant sales	12	4	-	No	No	-
Other	12	0	-	No	No	-

63. How do you or how do you plan to sell contactless card refills?

	Total	Sell Refills	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Clerks in station	12	7	-	Yes	Yes	-
Vending Machines located in stations	12	8	-	No	Yes	-
Vending Machines in non station locations	12	5	-	No	No	-
Internet	12	4	-	No	No	-
Bank Machine	12	1	-	No	No	-
Mail in	12	1	-	No	No	-
Merchant sales	12	6	-	No	No	-
Other	12	1	-	No	No	-

	Total	Minimum Number of Stations	Maximum Number of Stations	Median Number of Stations	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
64. How many stations currently accept contactless card fare collection?	13	0	162	37	-	44	162	-

	Total	Minimum Percent of Stations	Maximum Percent of Stations	Median Percent of Stations	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
65. What percent of stations currently accept contactless card fare collection?	10	0%	100%	32%	-	100%	100%	-

	Total	Fully Operational	Not Fully Operational	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
66. Is your contactless card system fully operational? (yes/no) If yes, go to question 69	11	4	7	-	Yes	Yes	-

	Total	Earliest Year	Latest Year	Median Year	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
67. If you have begun testing contactless card fare collection, when did you start?	3	1997	1998	1997	-	-	1998	-
68. When do you expect your contactless card system to be fully operational?	5	2001	2003	2002	-	-	-	-

Question	Summary: Number of Agency Responses – Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
69. What are some of the issues you believe an agency should be aware of when considering testing of contactless card technology?	8	-	-	Set correct objectives, have a well-trained team, select the right system integrator, with the ability to look into the future	-
70. What are expected to be the reductions/increases in annual operation and maintenance expenses related to use of contactless card technology?	6	-	-	-	-

Question	Total	Magnetic Swipe Cards Replaced	Single Paper Tickets Replaced	Other Method Replaced	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
71. Which of the following was or will be replaced or supplemented with a contactless system (please check all that apply)?	9	7	2	2	-	-	Tokens	-

Question	Total	Planning To Change	Not Planning To Change	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
72. Is your agency planning to change from a swipe to a contactless card system? (yes/no) If no, go to question 75	9	2	7	-	No	No	-

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
73. Including the cost of fare control equipment and vending machines, what do you expect to be the cost of conversion to a contactless system?	3	-	-	-	-
74. Please include any further comment on implementation of a change from a swipe to a contactless system you consider relevant.	1	-	-	-	-

Question	Total	Must be Physically Presented	Does Not Need to be Physically Presented	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
75. Must the contactless card be physically presented to the reader?	8	1	6	-	No	No	-

Question	Total	Minimum Distance Cards Can be Read	Maximum Distance Cards Can be Read	Median Distance Cards Can be Read	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
76. At what distance can non-enclosed cards be read? (centimeters)	7	1	10	8	-	10	5	-

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Summary: Number of Agency Responses

Question	Total	Pocket	Wallet	Purse	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
77. In which of the following locations can the contactless card or object be detected? (Please indicate by what distance in the second column)	7	3	6	5	-	All	All	-

Question	Total	Circuitry in Watch	Do Not Use Non-Card Locations	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
78. Do you use or intend to use non-card locations for contactless card circuitry (e.g. in a watch phone or other item)? (yes/no) Please indicate what item(s) in the second column.	8	3	5	-	Watch	No	-

Question	Total	Use	Do Not Use	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
79. Do you use contactless cards across different modes of transportation? (yes/no) Please describe other uses in the second column.	8	6	2	-	Yes	Yes	-
80. Do you use contactless cards across different transportation agencies? (yes/no) Please discuss any issues related to interagency fare collection you consider relevant (e.g., allocation of fare revenues between agencies) in the second column.	8	6	2	-	Yes	Yes	-

Question	Total	Use at Entry Points	Use at Both Entry and Exit Points	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
81. Do you use contactless cards at entry and exit points or only at entry points?	10	2	7	-	Both	Entry	-

Question	Total	Improved Passenger Flow	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
82. Please describe your projected and actual experience with passenger flow.	5	5	-	-	Improving	-

Question	Total	Barrier	Barrier-Free	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
83. Do you use a barrier (e.g., turnstile or gate) or barrier free system?	8	8	0	-	Barrier	Barrier	-

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
84. If your system is barrier free, how is proof of payment detected?	0	-	-	-	-

Question	Total	Positive Reaction	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
85. What has been the customer reaction to contactless technology?	6	6	-	Positive	Positive	-

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
86. Please address any other issues related to contactless card technology.	0	-	-	-	-

87. Do you collect or do you expect to collect any of the following data? (yes/no) Please describe the origin of the data (e.g., fare sale at vending machine, card swipe, contactless entry, exits) in the 2nd column.

	Summary: Number of Agency Responses: Total	Collect Data	Do Not Collect Data	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Total ridership	22	20	2	-	Entry Gate	Contactless Entry and Manual control	Card Swipe/Electronic Register
Ridership by line	22	17	5	-	Entry Gate	Yes	Card Swipe/Electronic Register
Ridership by time period	22	19	3	-	Entry Gate	Yes	Card Swipe
Ridership by fare option	22	16	6	-	Gate	No	Card Swipe
Number of passenger entries at each station	22	20	2	-	Entry Gate	Yes	Card Swipe/Electronic Register
Number of passenger exits at each station	22	14	8	-	Exit Gate	Yes	Electronic Register
Number of transfers system-wide	22	10	12	-	Mathematical Model	No	Card Swipe
Number of transfers by station	22	8	14	-	No	No	Card Swipe
Number of transfers by station and by arrival route number	21	2	19	-	No	No	No
Travel paths of individual riders	22	7	15	-	Mathematical Model	No	No
Travel time of individual riders	22	5	17	-	Mathematical Model	No	No
Passenger identification	22	4	18	-	No	No	No
Average amount spent on transportation per transaction	22	9	13	-	Station Accounting System	No	Fare Sale at Vending Machine
Average amount spent on transportation per passenger	22	5	17	-	No	No	No
Other	6	1	5	-	No	No	

	Total	Speed Fare Sales	Adjust Service Levels	Other	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
88. How has, or how would, data collection from fare sales and collection help the agency provide better transit service?	22	11	20	2	-	Speed, Adjust	Adjust	Speed, Adjust

	Total	Privacy Issues	No Privacy Issues	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
89. Are there or would there be privacy issues associated with data from fare sales and collection? (yes/no) Please explain in the second column.	16	5	11	-	Yes	-	Yes

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
4.What percent of total sales do the following types of tickets or plans represent?								
Annual pass	6.70%	0.00%	0.00%	0.40%	0.01%	0.00%	-	11.50%
Monthly pass	42.40%	0.00%	60.40%	18.00%	13.90%	10.17%	44.50%	60.30%
Two week pass	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.80%
One week pass	4.50%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.30%
Specific number of days less than a week	2.50%	0.00%	0.20%	0.10%	0.01%	1.89%	-	1.80%
Multi-ride without discount	18.30%	45.10%	0.00%	0.00%	0.00%	72.21%	-	0.00%
Multi-ride with discount	1.80%	0.00%	5.90%	0.00%	0.00%	0.00%	-	5.20%
Peak hour pricing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Single fare ticket	14.30%	53.00%	20.10%	69.00%	75.50%	14.37%	-	15.80%
Single fare card	0.00%	0.00%	6.00%	0.00%	0.00%	0.00%	-	0.00%
Single fare token	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Cash admission	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Student	9.50%	1.90%	7.40%	11.00%	10.60%	0.00%	-	0.00%
Senior/pensioner	0.00%	Free	0.00%	0.00%	0.00%	1.23%	-	0.00%
Military	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Other	0.00%	0.00%	0.00%	1.50%	0.00%	0.12%	-	4.30%
5. What percent of total sales do the following fare sales mechanisms and locations represent?								
Clerks in stations	69.00%	55.20%	49.40%	76.00%	83.30%	88.20%	-	1.00%
Vending machines in stations	4.00%	0.00%	50.60%	21.00%	16.70%	8.48%	-	1.00%
Vending machines at bus stops	3.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Vending machines in non-transit locations	3.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Internet	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Bank machines	0.00%	0.00%	0.00%	0.00%	0.00%	2.12%	-	0.00%
Mail in	15.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Merchant sales	6.00%	0.10%	0.00%	0.00%	0.00%	1.20%	-	4.00%
Other (Example: Ticket sale by bus drivers)	0.00%	44.70%	0.00%	3.00%	0.00%	0.00%	-	94.00%
6. What percent of sales are made by the following?								
Cash	40.00%	100.00%	100.00%	100.00%	100.00%	98.60%	-	91.00%
Credit Card	17.00%	0.00%	0.00%	0.00%	0.00%	1.40%	-	0.00%
Debit Card	17.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Other	26.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	9.00%
8. Do you sell fares over the Internet? (yes/no) If no, go to question 11	Yes	No	No	No	No	No	Yes	No

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
9. How do you sell fares over the Internet?	Vendor	-	-	-	-	-	Homepage	-
10. If fare sales are made through a vendor what is the transaction fee? (as a percent of sales revenue)	4.00%	-	-	-	-	-	-	-
11. Do you sell fares through merchants? (yes/no) If no, go to question 13	Yes	Yes	No	No	No	Yes	Yes	No
12. If fare sales are made through merchants what is the transaction fee? (as a percent of sales revenue)	4.00%	0.00%	-	-	-	2.00%	-	-
13. Do you use fare vending machines? (yes/no) If no, go to question 44	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14. What fare options are sold at fare vending machines?								
Annual	No	No	No	No	No	No	No	No
Monthly	Yes	No	Yes	No	No	No	No	No
Two week	No	No	No	No	No	No	No	No
One week	Yes	No	No	No	No	No	No	No
Less than a week	No	No	Yes	No	No	Yes	No	No
MR with discount	No	Yes	Yes	No	No	No	No	No
MR no discount	Yes	No	No	No	No	Yes	No	No
Single fare tickets	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Single fare card	No	No	Yes	No	No	No	No	No
Single fare token	No	No	No	No	No	No	Yes	No
Student	No	No	Yes	Yes	Yes	No	No	No
Senior/ Pensioner	No	No	No	No	No	Yes	No	No
Military	No	No	No	No	Yes	No	No	No
Other	No	No	No	No	No	No	No	No
15. What type of payment do fare vending machines accept?	Cash, Credit, Debit	Cash	Cash	Cash	Cash	Cash, Credit	Cash	Cash
16. If machines accept cash, what is the largest bill accepted (converted from local currency to U.S.$)?	$28.34	$5.20	$88.01	$0.26	$0.00	$27.93	$10.00	$0.35

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	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
17. If machines accept cash, what is the largest amount of change given (converted from local currency to U.S.$)?	$1.70	$5.87	$87.31	$0.18	$0.00	$27.12	$10.00	$0.32
18. Do machines refill cards or only provide new cards?	New Cards Only	New Cards Only	New Cards Only	New Cards Only	New Cards Only	New Cards Only	-	-
19. What is your agencies target or standard machine transaction time? (if available) (in seconds)	20	20	2	-	-	-	2	-
20. What is the average machine transaction time? (if available) (in seconds)	20	-	2	2	8	-	15	-
21. What is the average daily number of sales per machine?	150	-	1,050	1,933	-	41,000	305	cca. 10 pieces
22. What is the average transaction value? (in US currency)	-	-	$2.73	$0.59	-	$3.35	$1.01	$3.33
23. How many fare vending machines do you have?	792	228	1,292	108	112	154	62	440
24. What percent of stations have fare vending machines?	100.00%	100.00%	100.00%	100.00%	100.00%	50.00%	24.24%	100.00%
25. How many vending machines are located in each station? (total system average)	2	2 to 8	8	5	5	3	0.47	3

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
27. In which of the following locations do you have vending machines?	Both	Outside	Outside	Outside	Outside	Outside	Outside	Outside
29. How many stations use vending machines as the only fare sales method?	0	0	159	0	0	0	0	0
30. What percent of stations use vending machines as the only fare sales method?	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	-
31. How many types of ticket vending machines do you use?	2	3	4	1	2	6	1	4
32. Please describe the following details for each type of vending machine used.								
Maker	MONETEL, DASSAULT	Phonecard (Made in Brazil)	Omron, Takamizawa, Nihon Signal	-	Xamax	MONTEL, INDRA	GFI Genfare	Protokon Ltd
Specific function	-	Only ticket vending machines	single, multiple	-	-	Venta de billetes	Token/ Change Vending	-
Capital Cost	245,000 FRF	-	-	3,000,000,000 DRS	3,500,000 DRS	7 million p	$ 32K-38K	Changing
Annual operating and maintenance cost	2,050 FRF	-	206 million yen	140,000,000 DRS	-	TMB and INDRA	-	Changing
Types of payment accepted								
Cash	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Credit	Yes	No	No	No	No	Yes	No	No
Debit	Yes	No	No	No	No	No	No	No
Other (Example: Staff Service)	No	No	No	No	No	No	No	No

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
Touch screen or push button	Push Button	Push Button	Both	Push Button	Push Button	Push Button	Push Button	Push Button
Other important distinctions between machines	-	-	-	-	-	-	-	-
33. What department is responsible for filling fare vending machines?	Metro+RER Operating Units	Contractor	Finance Department	Operations	Maintenance	TMB	Revenue Collection	Contractor
34. What department is responsible for removing cash from machines?	Metro+RER Operating Units	Contractor	Finance Department	Operations	Finance	PROSEGUR (Security Company)	Revenue Collection	Contractor
35. How do you address security concerns associated with cash removal and machine vandalism?	Staff	Contractor	Staff	Closed Coin Boxes, CCTV, supervision, security company collects cash	-	Repair Machines	Armed Revenue Agent and MBTA Police	-
36. What department is responsible for repairing fare vending machines?	Operating unit and maintenance unit for fare sale and collection	Contractor	Passenger Transport System	Operations	Maintenance	TMB Toll Systems	Revenue Maintenance	Contractor
37. What is your agencies target or standard repair or downtime for fare vending machines? (if available) (in hours)	-	2	-	1	-	-	12	-
38. What is the average repair or downtime for machines? (if available) (in hours)	-	2	1	0.3	-	-	12	-
39. For how many machines is each vending machine repair staff responsible?	18	-	-	29	10	39	15	-
40. Where are customers directed when they have a problem with a vending machine?								
To personnel within the station	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
A help-point intercom	No	No	No	No	No	Yes	No	No
A general customer service intercom	No	No	No	No	No	Yes	No	No
A general customer service phone number	No	No	No	No	No	No	Yes	Yes
A phone number exclusively for vending machine assistance	No	Yes	No	No	No	No	No	No
Other (Example: Call Center)	No	No	No	No	No	No	No	No

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
41. Were any of the following required prior to the installation of fare vending machines? Please describe in the second column.	Some equipment relocation and station modernization	All	All	-	Infrastructure	All	Infrastructure, Other	-
42. If your vending machines accept credit cards, what methods of fraud control do you use?	Amount, frequency of use, rejected card check list	-	-	No	-	Black Lists	-	-
44. Are you using or do you plan to use smart cards? Smart card is a term use to describe integrated circuit, stored value, fare media If no, go to question 59	Yes	No	No	Yes	Yes	No	No	No
45. If you currently use smart cards, when were they introduced?	1998	Plan	-	-	-	-	-	-
46. If you plan to use smart cards, when do you plan to introduce them?	2001	-	-	2003	2002	-	-	-
47. Can or will your smart card be used in one transit mode (e.g., the metro only) or can it be used throughout a regional transportation network (e.g., subway, suburban rail, and national rail networks)? Please describe in second column.	Transportation Network	-	-	Transportation Network	Unknown Yet	-	-	-
48. Can or will your smart card be used in a transit-only environment or an "open" environment where cards can be used for non-transit purposes? Please specify what the card can be used for in the second column.	Open	-	-	Open	Open	-	-	-
49. Are you or are you planning to be involved with joint smart card arrangements with the banking or financial industry? (yes/no) If yes, please explain in the second column.	Yes	-	-	Yes	Yes	-	-	-
50. Is or do you plan to have your smart card system administered by your transit agency or by a financial or other private entity? Please specify in second column.	Financial entity	-	-	Private Entity	Private Entity	-	-	-
51. If you are involved with financial or other private entities please describe the entities involved, their roles and their legal and organizational relationship.	MODEUS & MONEO	-	-	-	No	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
52. Which type of smart card technology do you use or plan to use? Please indicate the manufacturer, data storage capacity and per card cost to the agency in the second column.	Contactless	-	-	Contactless	Contactless	-	-	-
Manufacturer	Ask et Schlumberger	-	-	-	-	-	-	-
Data storage capacity	2 K0	-	-	-	-	-	-	-
Per card cost to agency	20 - 30 FRF	-	-	1500 drs	-	-	-	-
53. How do you or how do you plan to sell smart card initial sales?								
Clerks in station	Yes	-	-	-	No	-	-	-
Vending Machines located in stations	No	-	-	-	Yes	-	-	-
Vending Machines in non station locations	No	-	-	-	Yes	-	-	-
Internet	Yes	-	-	-	Yes	-	-	-
Bank Machine	No	-	-	-	Yes	-	-	-
Mail in	Yes	-	-	-	No	-	-	-
Merchant sales	No	-	-	-	No	-	-	-
Other	No	-	-	-	No	-	-	-
54. How do you or how do you plan to sell smart card refills?								
Clerks in station	Yes	-	-	-	No	-	-	-
Vending Machines located in stations	Yes	-	-	-	No	-	-	-
Vending Machines in non station locations	Yes	-	-	-	No	-	-	-
Internet	Yes	-	-	-	Yes	-	-	-
Bank Machine	No	-	-	-	Yes	-	-	-
Mail in	No	-	-	-	No	-	-	-
Merchant sales	Yes	-	-	-	Yes	-	-	-
Other	No	-	-	-	No	-	-	-
55. How do you or how do you plan to handle card or equipment malfunction?	Replacement of defective cards	-	-	-	to be defined	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
56. How do you or how do you plan to handle replacing or refunding lost or stolen cards?	Free, Charge	-	-	-	to be defined	-	-	-
57. How do you or how do you plan to handle customer privacy rights?	Sharing of files with client data and files with Fare collection data.	-	-	-	to be defined	-	-	-
58. What problems did you encounter integrating smart card technology into the existing fare collection system?	Passing from the concept multi-ride tickets/cards to the concept Money reserve	-	-	-	-	-	-	-
59. What type of fare collection does your metro use? (check all that apply)								
Contactless cards	Yes	No	No	No	No	No	No	No
Magnetic swipe cards	No	No	No	No	No	Yes	Yes	No
Insert and return ("dipping") cards	No	No	Yes	No	No	Yes	No	No
Tokens	No	No	No	No	No	Yes	Yes	No
Paper tickets	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other (Example: Bills)	Yes	No	No	No	No	No	Yes	No
60. Are you using or do you plan to use contactless cards?(yes/no) If no, go to question 87	Yes	Yes	No	Yes	Yes	No	No	No
61. What fare options do you or do you plan to make available with contactless cards?								
Annual pass	Yes	-	-	-	Yes	-	-	-
Monthly pass	Yes	-	-	-	Yes	-	-	-
Two week pass	No	-	-	-	No	-	-	-
One week pass	Yes	-	-	-	No	-	-	-
Specific number of days less than a week	Yes	-	-	-	No	-	-	-
Multi ride with discount	No	-	-	-	No	-	-	-
Multi ride without discount	No	-	-	-	No	-	-	-
Peak hour pricing	No	-	-	-	No	-	-	-
Single fare ticket	Yes	-	-	-	No	-	-	-
Student	Yes	-	-	-	No	-	-	-
Senior/ pensioner	Yes	-	-	-	No	-	-	-
Military	No	-	-	-	No	-	-	-
Other	Yes	-	-	-	No	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
62. How do you or how do you plan to sell contactless card initial sales?								
Clerks in station	Yes	-	-	-	No	-	-	-
Vending Machines located in stations	No	-	-	-	No	-	-	-
Vending Machines in non station locations	No	-	-	-	No	-	-	-
Internet	Yes	-	-	-	Yes	-	-	-
Bank Machine	No	-	-	-	Yes	-	-	-
Mail in	Yes	-	-	-	No	-	-	-
Merchant sales	No	-	-	-	Yes	-	-	-
Other	No	-	-	-	No	-	-	-
63. How do you or how do you plan to sell contactless card refills?								
Clerks in station	Yes	-	-	-	No	-	-	-
Vending Machines located in stations	Yes	-	-	-	No	-	-	-
Vending Machines in non station locations	Yes	-	-	-	No	-	-	-
Internet	Yes	-	-	-	Yes	-	-	-
Bank Machine	No	-	-	-	Yes	-	-	-
Mail in	No	-	-	-	No	-	-	-
Merchant sales	Yes	-	-	-	Yes	-	-	-
Other	No	-	-	-	No	-	-	-
64. How many stations currently accept contactless card fare collection?	80	-	-	-	No	-	-	-
65. What percent of stations currently accept contactless card fare collection?	18%	-	-	-	0%	-	-	-
66. Is your contactless card system fully operational? (yes/no) If yes, go to question 69	No	-	-	-	No	-	-	-
67. If you have begun testing contactless card fare collection, when did you start?	1997	-	-	-	-	-	-	-
68. When do you expect your contactless card system to be fully operational?	2001	-	-	-	-	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
69. What are some of the issues you believe an agency should be aware of when considering testing of contactless card technology?	Good technical work	-	-	-	-	-	-	-
70. What are expected to be the reductions/increases in annual operation and maintenance expenses related to use of contactless card technology?	Saving in maintenance, fare-evasion.	-	-	-	Unknown	-	-	-
71. Which of the following was or will be replaced or supplemented with a contactless system (please check all that apply)?	Magnetic	-	-	-	Single, Other	-	-	-
72. Is your agency planning to change from a swipe to a contactless card system? (yes/no) If no, go to question 75	Yes	-	-	-	-	-	-	-
73. Including the cost of fare control equipment and vending machines, what do you expect to be the cost of conversion to a contactless system?	$42,505,500	-	-	-	-	-	-	-
74. Please include any further comment on implementation of a change from a swipe to a contactless system you consider relevant.	Positive	-	-	-	-	-	-	-
75. Must the contactless card be physically presented to the reader?	No	-	-	-	-	-	-	-
76. At what distance can non-enclosed cards be read? (centimeters)	10	-	-	-	-	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
77. In which of the following locations can the contactless card or object be detected? (Please indicate by what distance in the second column)	Purse, Wallet	-	-	-	-	-	-	-
78. Do you use or intend to use non-card locations for contactless card circuitry (e.g. in a watch phone or other item)? (yes/no) Please indicate what item(s) in the second column.	Watch	-	-	-	-	-	-	-
79. Do you use contactless cards across different modes of transportation? (yes/no) Please describe other uses in the second column.	Yes	-	-	-	-	-	-	-
80. Do you use contactless cards across different transportation agencies? (yes/no) Please discuss any issues related to interagency fare collection you consider relevant (e.g., allocation of fare revenues between agencies) in the second column.	Yes	-	-	-	-	-	-	-
81. Do you use contactless cards at entry and exit points or only at entry points?	Both	-	-	-	-	-	-	-
82. Please describe your projected and actual experience with passenger flow.	Improving	-	-	-	-	-	-	-
83. Do you use a barrier (e.g., turnstile or gate) or barrier free system?	Barrier	-	-	-	-	-	-	-
84. If your system is barrier free, how is proof of payment detected?	-	-	-	-	-	-	-	-
85. What has been the customer reaction to contactless technology?	Positive	-	-	-	-	-	-	-
86. Please address any other issues related to contactless card technology.	-	-	-	-	-	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
87. Do you collect or do you expect to collect any of the following data? (yes/no) Please describe the origin of the data (e.g., fare sale at vending machine, card swipe, contactless entry, exits) in the 2nd column.								
Total ridership	Entry Gate	Yes	Ticket Sales Data	Yes	Infrared Sensors at Entrances and Exits	Yes	Yes	No
Ridership by line	Entry Gate	Yes	All kind of tickets sold	Yes	Yes	Yes	Yes	No
Ridership by time period	Entry Gate	Yes	Automatic ticket gate	Passenger Counts	Yes	Yes	Yes	No
Ridership by fare option	Entry Gate	Yes	All kind of tickets sold	Passenger Counts	Yes	Yes	No	No
Number of passenger entries at each station	Entry Gate	Yes	Automatic ticket gate	No	Yes	Yes	Yes	No
Number of passenger exits at each station	No	No	Automatic ticket gate	Passenger Counts	Yes	No	Yes	No
Number of transfers system-wide	Entry Gate	No	All kind of tickets sold	Passenger Counts	Yes	No	Yes	No
Number of transfers by station	No	No	Counted by staff	Passenger Counts	Yes	No	Yes	No
Number of transfers by station and by arrival route number	No	No	No	Passenger Counts	-	No	No	No
Travel paths of individual riders	No	No	No	No	No	No	Yes	No
Travel time of individual riders	No	No	No	No	No	No	Yes	No
Passenger identification	Pass sales.	No	No	No	No	No	No	No
Average amount spent on transportation per transaction	No	No	446 yen	No	No	Yes	Yes	No
Average amount spent on transportation per passenger	Fillers at VM, ticket office equipment	No	127 yen	No	No	No	Yes	No
Other	No	No	-	Passenger Counts	-	-	-	-
88. How has, or how would, data collection from fare sales and collection help the agency provide better transit service?	Speed, Adjust, Other	Other	Adjust	Other	Speed, Adjust	Speed, Adjust	Speed, Adjust	-
89. Are there or would there be privacy issues associated with data from fare sales and collection? (yes/no) Please explain in the second column.	Yes	No	-	No	No	No	Yes	-

Appendix B: Fare Sales and Collection Survey Results

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
4.What percent of total sales do the following types of tickets or plans represent?								
Annual pass	0.00%	1.69%	0.00%	0.00%	22.40%	0.00%	0.00%	0.00%
Monthly pass	3.50%	1.90%	40.00%	23.80%	11.46%	0.00%	1.70%	29.80%
Two week pass	0.00%	0.00%	0.00%	0.00%	0.56%	0.00%	0.00%	0.00%
One week pass	0.00%	4.97%	12.70%	0.00%	1.34%	0.00%	0.00%	0.70%
Specific number of days less than a week	0.00%	1.50%	0.00%	1.70%	1.81%	0.00%	0.00%	1.20%
Multi-ride without discount	0.00%	0.01%	0.00%	0.00%	12.54%	0.00%	80.00%	0.00%
Multi-ride with discount	0.00%	17.85%	0.00%	0.00%	1.15%	0.00%	0.00%	49.90%
Peak hour pricing	0.00%	0.00%	0.00%	0.00%	0.00%	17.00%	0.00%	0.00%
Single fare ticket	0.00%	36.88%	17.90%	0.00%	32.31%	55.70%	11.30%	0.00%
Single fare card	0.00%	0.00%	0.00%	31.10%	0.00%	0.00%	0.00%	0.00%
Single fare token	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cash admission	56.80%	0.00%	17.10%	28.60%	0.00%	0.00%	0.00%	17.70%
Student	0.00%	7.03%	0.00%	7.10%	9.88%	13.80%	4.50%	6.00%
Senior/pensioner	0.00%	3.00%	0.00%	7.70%	5.08%	0.80%	2.50%	9.50%
Military	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other	59.30%	25.17%	12.90%	0.00%	1.37%	0.00%	0.00%	0.70%
5. What percent of total sales do the following fare sales mechanisms and locations represent?								
Clerks in stations	0.00%	0.01%	60.00%	0.60%	1.36%	63.00%	42.00%	65.00%
Vending machines in stations	60.00%	1.40%	0.00%	69.40%	0.00%	0.00%	11.00%	5.50%
Vending machines at bus stops	0.00%	0.00%	0.00%	0.00%	9.50%	0.00%	0.00%	0.00%
Vending machines in non-transit locations	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	11.00%	0.00%
Internet	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bank machines	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	36.00%	0.00%
Mail in	3.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Merchant sales	36.00%	92.59%	40.00%	30.00%	90.00%	8.00%	0.00%	29.50%
Other (Example: Ticket sale by bus drivers)	1.00%	6.00%	0.00%	0.00%	10.00%	29.00%	0.00%	0.00%
6. What percent of sales are made by the following?								
Cash	100.00%	100.00%	100.00%	100.00%	60.40%	100.00%	60.00%	78.70%
Credit Card	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.80%
Debit Card	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other	0.00%	0.00%	0.00%	0.00%	39.60%	0.00%	40.00%	20.50%
8. Do you sell fares over the Internet? (yes/no) If no, go to question 11	No	No	No	No	No	No	No	No

Appendix B: Fare Sales and Collection Survey Results

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
9. How do you sell fares over the Internet?	-	-	-	-	-	-	-	-
10. If fare sales are made through a vendor what is the transaction fee? (as a percent of sales revenue)	-	-	-	-	-	-	-	-
11. Do you sell fares through merchants? (yes/no) If no, go to question 13	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12. If fare sales are made through merchants what is the transaction fee? (as a percent of sales revenue)	2.00%	3.00%	1.00%	4.50%	4.00%	3.5-6.0%	2.50%	1.00%
13. Do you use fare vending machines? (yes/no) If no, go to question 44	Yes	Yes	No	Yes	Yes	No	Yes	Yes
14. What fare options are sold at fare vending machines?								
Annual	No	No	-	No	No	-	No	No
Monthly	No	No	-	Yes	No	-	No	No
Two week	No	No	-	No	No	-	No	No
One week	No	No	-	No	No	-	No	No
Less than a week	No	No	-	Yes	Yes	-	No	No
MR with discount	No	No	-	No	No	-	No	No
MR no discount	No	No	-	No	No	-	No	No
Single fare tickets	No	Yes	-	No	Yes	-	Yes	No
Single fare card	No	No	-	Yes	No	-	No	No
Single fare token	No	No	-	No	Yes	-	No	Yes
Student	No	No	-	Yes	No	-	No	No
Senior/ Pensioner	No	No	-	No	No	-	No	No
Military	No	No	-	No	No	-	No	No
Other	Yes	No	-	No	Yes	-	No	No
15. What type of payment do fare vending machines accept?	Cash	Cash	-	Cash	Cash	-	Cash	Cash
16. If machines accept cash, what is the largest bill accepted (converted from local currency to U.S.$)?	$20.00	$4.80	-	$88.01	$26.63	-	-	$13.24

Appendix B: Fare Sales and Collection Survey Results

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
17. If machines accept cash, what is the largest amount of change given (converted from local currency to U.S.$)?	$18.00	$2.35	-	$87.93	$0.53	-	$0.58	$0.86
18. Do machines refill cards or only provide new cards?	New Cards Only	New Cards Only	-	New Cards Only	New Cards Only	-	New Cards Only	New Cards Only
19. What is your agencies target or standard machine transaction time? (if available) (in seconds)	-	30	-	15	-	-	12	-
20. What is the average machine transaction time? (if available) (in seconds)	-	30	-	15	7	-	12	3
21. What is the average daily number of sales per machine?	-	42	-	500	251	-	400	49
22. What is the average transaction value? (in US currency)	$10.00	$0.80	-	$2.01	$0.28	-	$0.75	$6.62
23. How many fare vending machines do you have?	66	250	-	487	190	-	266	135
24. What percent of stations have fare vending machines?	100.00%	100.00%	-	100.00%	100.00%	-	100.00%	84.60%
25. How many vending machines are located in each station? (total system average)	5	3	-	6	4	-	5	2

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
27. In which of the following locations do you have vending machines?	Outside	Outside	-	Outside	Outside	-	Outside	Both
29. How many stations use vending machines as the only fare sales method?	0	4	-	76	0	-	0	-
30. What percent of stations use vending machines as the only fare sales method?	-	-	-	100.00%	-	-	0.00%	-
31. How many types of ticket vending machines do you use?	2	single fare ticket of	-	5	2	-	1	-
32. Please describe the following details for each type of vending machine used.								
Maker	General Fare Inc	Autelca-Telesistemi, Ribali, Eltec, Tecnotour	-	Japanese maker	Mikroelektronika spol. Sr.o.	-	Cubic	Laniel Canada
Specific function	-	-	-	-	Printing and issue of 15 types of PT passes	-	Vend single ride ticket	Token sales
Capital Cost	-	2.500000 each	-	-	AVJ24E 108 044, -CZK, AVJ24G 151 000, -CZK	-	-	1,350,000
Annual operating and maintenance cost	-	-	-	156,931,000 yen	5,600,000 CZK	-	-	250,000
Types of payment accepted								
Cash	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Credit	No	No	-	No	No	-	No	No
Debit	No	No	-	No	No	-	No	No
Other (Example: Staff Service)	No	No	-	No	No	-	No	No

Appendix B: Fare Sales and Collection Survey Results

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
Touch screen or push button	Push Button	Push Button	-	Push Button	Push Button	-	Both	Push Button
Other important distinctions between machines	-	-	-	-	Use of Box and Operating Elements	-	-	-
33. What department is responsible for filling fare vending machines?	Transportation Division- Revenue	Marketing Department	-	Transportion Devision	Fare Voucher and Advanced Sale Department	-	Traffic	Finance Department
34. What department is responsible for removing cash from machines?	Transportation Division- Revenue	Marketing Department	-	Station	Fare Voucher and Advanced Sale Department	-	Traffic	Finance Department
35. How do you address security concerns associated with cash removal and machine vandalism?	Police, Sealed Bags	Marketing Department	-	Contractor	Police	-	Self-locking boxes upon removal	Corporate Security involvement and Armed Guard Service
36. What department is responsible for repairing fare vending machines?	Way & Structures Division	Electrical Equipment Maintenance Department	-	Transport Devision	Fare Voucher and Advanced Sale Department	-	Maintenance	Subway- Rail Car and Shops
37. What is your agencies target or standard repair or downtime for fare vending machines? (if available) (in hours)	-	-	-	-	24	-	1	24
38. What is the average repair or downtime for machines? (if available) (in hours)	-	-	-	-	-	-	1	24
39. For how many machines is each vending machine repair staff responsible?	-	12	-	1	40	-	15	34
40. Where are customers directed when they have a problem with a vending machine?								
To personnel within the station	Yes	Yes	-	Yes	Yes	-	Yes	No
A help-point intercom	No	No	-	No	No	-	No	No
A general customer service intercom	Yes	No	-	No	No	-	No	No
A general customer service phone number	Yes	No	-	No	Yes	-	No	Yes
A phone number exclusively for vending machine assistance	No	No	-	No	Yes	-	No	No
Other (Example: Call Center)	No	No	-	No	No	-	No	No

Question	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
41. Were any of the following required prior to the installation of fare vending machines? Please describe in the second column.	None	Equipment	-	-	Infrastructure	-	None	-
42. If your vending machines accept credit cards, what methods of fraud control do you use?	-	-	-	No	-	-	-	-
44. Are you using or do you plan to use smart cards? Smart card is a term use to describe integrated circuit, stored value, fare media If no, go to question 59	Yes	No	No	Yes	Yes	No	Yes	No
45. If you currently use smart cards, when were they introduced?	Future date tbd	-	-	-	-	-	Plan	-
46. If you plan to use smart cards, when do you plan to introduce them?	Unknown	-	-	-	-	-	2002	-
47. Can or will your smart card be used in one transit mode (e.g., the metro only) or can it be used throughout a regional transportation network (e.g., subway, suburban rail, and national rail networks)? Please describe in second column.	Unknown	-	-	-	-	-	Transportation Network	-
48. Can or will your smart card be used in a transit-only environment or an "open" environment where cards can be used for non-transit purposes? Please specify what the card can be used for in the second column.	Unknown	-	-	-	-	-	Open	-
49. Are you or are you planning to be involved with joint smart card arrangements with the banking or financial industry? (yes/no) If yes, please explain in the second column.	Unknown	-	-	-	-	-	Yes	-
50. Is or do you plan to have your smart card system administered by your transit agency or by a financial or other private entity? Please specify in second column.	Unknown	-	-	-	-	-	Transit agency	-
51. If you are involved with financial or other private entities please describe the entities involved, their roles and their legal and organizational relationship.	-	-	-	-	-	-	Not decided yet	-

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
52. Which type of smart card technology do you use or plan to use? Please indicate the manufacturer, data storage capacity and per card cost to the agency in the second column.	-	-	-	-	-	-	Contactless	-
Manufacturer	-	-	-	-	-	-	-	-
Data storage capacity	-	-	-	-	-	-	-	-
Per card cost to agency	-	-	-	-	-	-	-	-
53. How do you or how do you plan to sell smart card initial sales?								
Clerks in station	-	-	-	-	-	-	Yes	-
Vending Machines located in stations	-	-	-	-	-	-	Yes	-
Vending Machines in non station locations	-	-	-	-	-	-	Yes	-
Internet	-	-	-	-	-	-	No	-
Bank Machine	-	-	-	-	-	-	No	-
Mail in	-	-	-	-	-	-	No	-
Merchant sales	-	-	-	-	-	-	No	-
Other	-	-	-	-	-	-	No	-
54. How do you or how do you plan to sell smart card refills?								
Clerks in station	-	-	-	-	-	-	Yes	-
Vending Machines located in stations	-	-	-	-	-	-	Yes	-
Vending Machines in non station locations	-	-	-	-	-	-	Yes	-
Internet	-	-	-	-	-	-	No	-
Bank Machine	-	-	-	-	-	-	No	-
Mail in	-	-	-	-	-	-	No	-
Merchant sales	-	-	-	-	-	-	No	-
Other	-	-	-	-	-	-	No	-
55. How do you or how do you plan to handle card or equipment malfunction?	-	-	-	-	-	-	Other	-

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
56. How do you or how do you plan to handle replacing or refunding lost or stolen cards?	-	-	-	-	-	-	Other	-
57. How do you or how do you plan to handle customer privacy rights?	-	-	-	-	-	-	-	-
58. What problems did you encounter integrating smart card technology into the existing fare collection system?	-	-	-	-	-	-	-	-
59. What type of fare collection does your metro use? (check all that apply)								
Contactless cards	No	No	-	No	No	No	No	No
Magnetic swipe cards	No	No	-	Yes	No	No	Yes	Yes
Insert and return ("dipping") cards	Yes	No	-	Yes	No	No	No	No
Tokens	No	No	-	No	No	No	No	Yes
Paper tickets	No	Yes	-	No	Yes	No	No	Yes
Other (Example: Bills)	No	No	-	No	Yes	Yes	No	No
60. Are you using or do you plan to use contactless cards?(yes/no) If no, go to question 87	Yes	Yes	-	No	No	No	Yes	No
61. What fare options do you or do you plan to make available with contactless cards?								
Annual pass	-	No	-	-	-	-	No	-
Monthly pass	-	No	-	-	-	-	No	-
Two week pass	-	No	-	-	-	-	No	-
One week pass	-	No	-	-	-	-	No	-
Specific number of days less than a week	-	No	-	-	-	-	No	-
Multi ride with discount	-	Yes	-	-	-	-	Yes	-
Multi ride without discount	-	No	-	-	-	-	Yes	-
Peak hour pricing	-	No	-	-	-	-	No	-
Single fare ticket	-	No	-	-	-	-	Yes	-
Student	-	No	-	-	-	-	Yes	-
Senior/ pensioner	-	No	-	-	-	-	Yes	-
Military	-	No	-	-	-	-	Yes	-
Other	-	No	-	-	-	-	No	-

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
62. How do you or how do you plan to sell contactless card initial sales?								
Clerks in station	-	No	-	-	-	-	Yes	-
Vending Machines located in stations	-	Yes	-	-	-	-	Yes	-
Vending Machines in non station locations	-	Yes	-	-	-	-	Yes	-
Internet	-	No	-	-	-	-	No	-
Bank Machine	-	No	-	-	-	-	No	-
Mail in	-	Yes	-	-	-	-	No	-
Merchant sales	-	Yes	-	-	-	-	No	-
Other	-	No	-	-	-	-	No	-
63. How do you or how do you plan to sell contactless card refills?								
Clerks in station	-	No	-	-	-	-	Yes	-
Vending Machines located in stations	-	Yes	-	-	-	-	Yes	-
Vending Machines in non station locations	-	Yes	-	-	-	-	Yes	-
Internet	-	No	-	-	-	-	No	-
Bank Machine	-	No	-	-	-	-	No	-
Mail in	-	Yes	-	-	-	-	No	-
Merchant sales	-	Yes	-	-	-	-	No	-
Other	-	No	-	-	-	-	No	-
64. How many stations currently accept contactless card fare collection?	0	0	-	-	-	-	48	-
65. What percent of stations currently accept contactless card fare collection?	-	0	-	-	-	-	-	-
66. Is your contactless card system fully operational? (yes/no) If yes, go to question 69	No	No	-	-	-	-	No	-
67. If you have begun testing contactless card fare collection, when did you start?	-	-	-	-	-	-	1997	-
68. When do you expect your contactless card system to be fully operational?	TBD	-	-	-	-	-	2002	-

Appendix B: Fare Sales and Collection Survey Results

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
69. What are some of the issues you believe an agency should be aware of when considering testing of contactless card technology?	TBD	Electric Equipment Maintenance Dept., Warehouse & Test Dept.	-	-	-	-	Security	-
70. What are expected to be the reductions/increases in annual operation and maintenance expenses related to use of contactless card technology?	TBD	-	-	-	-	-	1,400,000	-
71. Which of the following was or will be replaced or supplemented with a contactless system (please check all that apply)?	Magnetic	Magnetic	-	-	-	-	Magnetic	-
72. Is your agency planning to change from a swipe to a contactless card system? (yes/no) If no, go to question 75	No	No	-	-	-	-	Yes	-
73. Including the cost of fare control equipment and vending machines, what do you expect to be the cost of conversion to a contactless system?	-	-	-	-	-	-	-	-
74. Please include any further comment on implementation of a change from a swipe to a contactless system you consider relevant.	-	-	-	-	-	-	-	-
75. Must the contactless card be physically presented to the reader?	-	No	-	-	-	-	No	-
76. At what distance can non-enclosed cards be read? (centimeters)	-	10	-	-	-	-	1	-

Appendix B: Fare Sales and Collection Survey Results

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
77. In which of the following locations can the contactless card or object be detected? (Please indicate by what distance in the second column)	-	Pocket, Wallet, Purse	-	-	-	-	Other	-
78. Do you use or intend to use non-card locations for contactless card circuitry (e.g. in a watch phone or other item)? (yes/no) Please indicate what item(s) in the second column.	-	No	-	-	-	-	No	-
79. Do you use contactless cards across different modes of transportation? (yes/no) Please describe other uses in the second column.	-	Yes	-	-	-	-	Yes	
80. Do you use contactless cards across different transportation agencies? (yes/no) Please discuss any issues related to interagency fare collection you consider relevant (e.g., allocation of fare revenues between agencies) in the second column.	-	Yes	-	-	-	-	Yes	-
81. Do you use contactless cards at entry and exit points or only at entry points?	-	Both	-	-	-	-	Both	-
82. Please describe your projected and actual experience with passenger flow.	-	-	-	-	-	-	Improving	-
83. Do you use a barrier (e.g., turnstile or gate) or barrier free system?	-	Barrier	-	-	-	-	Barrier	-
84. If your system is barrier free, how is proof of payment detected?	-	-	-	-	-	-	-	-
85. What has been the customer reaction to contactless technology?	-	-	-	-	-	-	Positive	-
86. Please address any other issues related to contactless card technology.	-	-	-	-	-	-	-	-

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
87. Do you collect or do you expect to collect any of the following data? (yes/no) Please describe the origin of the data (e.g., fare sale at vending machine, card swipe, contactless entry, exits) in the 2nd column.								
Total ridership	Yes	Yes	No	Vending machine	-	Entry gate	AFC gate	Yes
Ridership by line	No	Yes	No	No	-	No	AFC gate	Manually collected
Ridership by time period	Yes	Yes	No	Vending machine	-	No	AFC gate	Manually collected
Ridership by fare option	Yes	Yes	No	No	-	No	AFC gate	Farebox counts
Number of passenger entries at each station	Yes	Yes	Yes	Vending machine	-	Yes	AFC gate	Turnstile counts
Number of passenger exits at each station	No	Yes	No	Vending machine	-	No	AFC gate	No
Number of transfers system-wide	No	Yes	No	No	-	No	No	Yes
Number of transfers by station	No	Yes	No	No	-	No	No	No
Number of transfers by station and by arrival route number	No	No	No	No	-	No	No	No
Travel paths of individual riders	No	Yes	No	No	-	No	AFC gate	No
Travel time of individual riders	No	Yes	No	No	-	No	No	No
Passenger identification	No	Yes	No	No	-	No	No	Yes
Average amount spent on transportation per transaction	No	Yes	No	No	-	No	No	No
Average amount spent on transportation per passenger	No	Yes	No	No	-	No	No	No
Other	-	No	-	-	-	-	-	-
88. How has, or how would, data collection from fare sales and collection help the agency provide better transit service?	Adjust	Speed, Adjust	Adjust	Adjust	Adjust	Speed, Adjust	Speed, Adjust	Adjust
89. Are there or would there be privacy issues associated with data from fare sales and collection? (yes/no) Please explain in the second column.	No	-	-	No	-	No	No	No

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
4.What percent of total sales do the following types of tickets or plans represent?					
Annual pass	0.00%	0.00%	0.00%	6.00%	6.00%
Monthly pass	1.00%	0.00%	25.50%	0.00%	0.00%
Two week pass	0.00%	0.00%	0.00%	0.00%	0.00%
One week pass	2.70%	0.00%	0.00%	43.40%	43.40%
Specific number of days less than a week	0.00%	0.00%	0.00%	50.00%	0.50%
Multi-ride without discount	0.00%	85.00%	0.00%	10.70%	10.70%
Multi-ride with discount	25.00%	0.00%	0.00%	12.80%	12.80%
Peak hour pricing	0.00%	0.00%	0.00%	0.00%	0.00%
Single fare ticket	0.00%	15.00%	74.50%	18.90%	18.90%
Single fare card	57.70%	0.00%	0.00%	0.00%	0.00%
Single fare token	1.30%	0.00%	0.00%	0.00%	0.00%
Cash admission	11.30%	0.00%	0.00%	0.00%	0.00%
Student	0.00%	0.00%	0.00%	0.00%	0.00%
Senior/pensioner	1.00%	2.20%	0.00%	5.70%	5.70%
Military	0.00%	0.00%	0.00%	0.00%	0.00%
Other	0.00%	4.00%	0.00%	2.00%	2.00%

5. What percent of total sales do the following fare sales mechanisms and locations represent?					
Clerks in stations	69.00%	37.80%	95.00%	-	79.00%
Vending machines in stations	0.00%	59.00%	0.00%	-	21.00%
Vending machines at bus stops	0.00%	0.00%	0.00%	-	0.00%
Vending machines in non-transit locations	0.00%	0.00%	0.00%	-	0.00%
Internet	0.00%	0.00%	0.00%	-	0.00%
Bank machines	0.00%	0.00%	0.00%	-	0.00%
Mail in	0.00%	0.00%	0.00%	-	0.00%
Merchant sales	31.00%	3.00%	0.00%	-	0.00%
Other (Example: Ticket sale by bus drivers)	0.00%	0.20%	5.00%	-	0.00%

6. What percent of sales are made by the following?					
Cash	90.00%	99.00%	90.00%	-	96.00%
Credit Card	8.00%	0.00%	10.00%	-	0.00%
Debit Card	2.00%	1.00%	0.00%	-	0.00%
Other	0.00%	0.00%	0.00%	-	4.00%

8. Do you sell fares over the Internet? (yes/no) If no, go to question 11	Yes	No	No	-	No

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
9. How do you sell fares over the Internet?	Homepage	-	-	-	-
10. If fare sales are made through a vendor what is the transaction fee? (as a percent of sales revenue)	-	-	-	-	-
11. Do you sell fares through merchants? (yes/no) If no, go to question 13	Yes	Yes	No	-	No
12. If fare sales are made through merchants what is the transaction fee? (as a percent of sales revenue)	-	0.16%	-	-	-
13. Do you use fare vending machines? (yes/no) If no, go to question 44	Yes	Yes	No	-	Yes
14. What fare options are sold at fare vending machines?					
Annual	No	No	-	-	No
Monthly	No	No	-	-	No
Two week	Yes	No	-	-	No
One week	Yes	No	-	-	Yes
Less than a week	Yes	No	-	-	No
MR with discount	Yes	No	-	-	Yes
MR no discount	Yes	Yes	-	-	Yes
Single fare tickets	Yes	Yes	-	-	Yes
Single fare card	Yes	No	-	-	No
Single fare token	No	No	-	-	No
Student	No	No	-	-	Yes
Senior/ Pensioner	No	Yes	-	-	Yes
Military	No	No	-	-	No
Other	No	Yes	-	-	Yes
15. What type of payment do fare vending machines accept?	Cash, Credit, Debit	Cash, Debit	-	-	Cash, Credit, Debit
16. If machines accept cash, what is the largest bill accepted (converted from local currency to U.S.$)?	$20.00	$12.82	-	-	$11.18

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
17. If machines accept cash, what is the largest amount of change given (converted from local currency to U.S.$)?	$ 5.00	$6.41	-	-	$11.18
18. Do machines refill cards or only provide new cards?	Both	Refill only	-	-	Both
19. What is your agencies target or standard machine transaction time? (if available) (in seconds)	60	-	-	-	-
20. What is the average machine transaction time? (if available) (in seconds)	20	-	-	-	-
21. What is the average daily number of sales per machine?	-	594	-	-	250
22. What is the average transaction value? (in US currency)	$17.00	$13.72	-	-	$3.30
23. How many fare vending machines do you have?	585	184	-	-	430
24. What percent of stations have fare vending machines?	100.00%	100.00%	-	-	87.00%
25. How many vending machines are located in each station? (total system average)	7	15	-	-	1.4

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
27. In which of the following locations do you have vending machines?	Both	Outside	-	-	Outside
29. How many stations use vending machines as the only fare sales method?	81	0	-	-	87
30. What percent of stations use vending machines as the only fare sales method?	98.70%	-	-	-	29.00%
31. How many types of ticket vending machines do you use?	3	3	-	-	3
32. Please describe the following details for each type of vending machine used.					
Maker	Cubic Transportation System	-	-	-	Cubic Transportation Pvt. Ltd.
Specific function	Paper fare media, passes and smart cards, add fare to card	Ticket Vending, Add value	-	-	Dispenses tickets
Capital Cost	-	220,000: 460,000: 400,000:	-	-	-
Annual operating and maintenance cost	-	14,700: 61,400: 34,200	-	-	-
Types of payment accepted					
Cash	Yes	Yes	-	-	Yes
Credit	Yes	No	-	-	No
Debit	Yes	No	-	-	No
Other (Example: Staff Service)	No	Yes	-	-	No

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
Touch screen or push button	Push Button	Push Button	-	-	Push Button
Other important distinctions between machines	-	No	-	-	Full range of ticket available
33. What department is responsible for filling fare vending machines?	Office of Treasurer	Operations	-	-	Ticket Rolls-Station Staff
34. What department is responsible for removing cash from machines?	Office of Treasurer	Operations	-	-	Contractor
35. How do you address security concerns associated with cash removal and machine vandalism?	Police, Sealed Bags	Staff, Secure Coin & Cash Boxes, Alarms	-	-	Contractor
36. What department is responsible for repairing fare vending machines?	Systems Maintenance/Automated Fare Collection Systems	Infrastructure and Building	-	-	Contractor
37. What is your agencies target or standard repair or downtime for fare vending machines? (if available) (in hours)	1	-	-	-	-
38. What is the average repair or downtime for machines? (if available) (in hours)	3	1	-	-	-
39. For how many machines is each vending machine repair staff responsible?	20	22	-	-	15
40. Where are customers directed when they have a problem with a vending machine?					
To personnel within the station	Yes	Yes	-	-	Yes
A help-point intercom	No	No	-	-	No
A general customer service intercom	No	No	-	-	No
A general customer service phone number	No	No	-	-	No
A phone number exclusively for vending machine assistance	Yes	No	-	-	No
Other (Example: Call Center)	No	No	-	-	No

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
41. Were any of the following required prior to the installation of fare vending machines? Please describe in the second column.	All	All	-	-	Infrastructure upgrade
42. If your vending machines accept credit cards, what methods of fraud control do you use?	Floor limits, velocity check, hot list	-	-	-	-
44. Are you using or do you plan to use smart cards? Smart card is a term use to describe integrated circuit, stored value, fare media If no, go to question 59	Yes	Yes	Yes	-	Yes
45. If you currently use smart cards, when were they introduced?	1999	1997	-	-	Plan
46. If you plan to use smart cards, when do you plan to introduce them?	-	-	2001	-	2003
47. Can or will your smart card be used in one transit mode (e.g., the metro only) or can it be used throughout a regional transportation network (e.g., subway, suburban rail, and national rail networks)? Please describe in second column.	Transit Mode	Transportation Network	Transportation Network	-	Transportation Network
48. Can or will your smart card be used in a transit-only environment or an "open" environment where cards can be used for non-transit purposes? Please specify what the card can be used for in the second column.	Open	Open	Open	-	Open
49. Are you or are you planning to be involved with joint smart card arrangements with the banking or financial industry? (yes/no) If yes, please explain in the second column.	Yes	Yes	Yes	-	-
50. Is or do you plan to have your smart card system administered by your transit agency or by a financial or other private entity? Please specify in second column.	Currently in House, planning to contract out	Private Entity	Transit Agency	-	Private Entity
51. If you are involved with financial or other private entities please describe the entities involved, their roles and their legal and organizational relationship.	-	Private Entity	-	-	-

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
52. Which type of smart card technology do you use or plan to use? Please indicate the manufacturer, data storage capacity and per card cost to the agency in the second column.	Contactless	Contactless	Contactless	-	Combination
Manufacturer	Cubic	-	-	-	-
Data storage capacity	2K FRAM	-	-	-	-
Per card cost to agency	4.53	-	-	-	-
53. How do you or how do you plan to sell smart card initial sales?					
Clerks in station	Yes	Yes	Yes	-	Yes
Vending Machines located in stations	No	No	Yes	-	No
Vending Machines in non station locations	No	No	Yes	-	No
Internet	Yes	No	No	-	Yes
Bank Machine	No	No	No	-	No
Mail in	Yes	No	No	-	Yes
Merchant sales	No	No	Yes	-	Yes
Other	No	No	No	-	No
54. How do you or how do you plan to sell smart card refills?					
Clerks in station	No	Yes	Yes	-	Yes
Vending Machines located in stations	Yes	Yes	Yes	-	Yes
Vending Machines in non station locations	No	No	Yes	-	Yes
Internet	Yes	No	No	-	Yes
Bank Machine	No	No	No	-	No
Mail in	No	No	No	-	No
Merchant sales	No	Yes	Yes	-	Yes
Other	No	No	No	-	Yes
55. How do you or how do you plan to handle card or equipment malfunction?	Staff Assistance	Staff and Contractor Assistance	Contractor	-	Contract maintenance

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
56. How do you or how do you plan to handle replacing or refunding lost or stolen cards?	Charge	Replacement for personal cards by contractor	Contractor	-	-
57. How do you or how do you plan to handle customer privacy rights?	Data for analysis only	Internal guidelines in accordance with law	Contractor	-	Leagal advice
58. What problems did you encounter integrating smart card technology into the existing fare collection system?	Lack of familiarity	Lack of familiarity	None	-	-
59. What type of fare collection does your metro use? (check all that apply)					
Contactless cards	Yes	Yes	No	-	No
Magnetic swipe cards	Yes	Yes	No	-	Yes
Insert and return ("dipping") cards	No	No	No	-	No
Tokens	No	No	No	-	No
Paper tickets	No	Yes	Yes	-	Yes
Other (Example: Bills)	No	No	No	-	No
60. Are you using or do you plan to use contactless cards?(yes/no) If no, go to question 87	Yes	Yes	Yes	-	No
61. What fare options do you or do you plan to make available with contactless cards?					
Annual pass	No	No	No	-	Yes
Monthly pass	Yes	No	Yes	-	Yes
Two week pass	Yes	No	No	-	No
One week pass	Yes	No	Yes	-	Yes
Specific number of days less than a week	Yes	No	No	-	No
Multi ride with discount	Yes	Yes	No	-	Yes
Multi ride without discount	Yes	No	No	-	Yes
Peak hour pricing	Yes	No	No	-	Yes
Single fare ticket	Yes	Yes	Yes	-	Yes
Student	Yes	No	No	-	Yes
Senior/ pensioner	Yes	Yes	No	-	Yes
Military	No	No	No	-	No
Other	Yes	Yes	No	-	No

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
62. How do you or how do you plan to sell contactless card initial sales?					
Clerks in station	Yes	Yes	Yes	-	Yes
Vending Machines located in stations	No	No	Yes	-	No
Vending Machines in non station locations	No	No	Yes	-	No
Internet	Yes	No	No	-	Yes
Bank Machine	No	No	No	-	No
Mail in	Yes	No	No	-	Yes
Merchant sales	No	No	Yes	-	Yes
Other	No	No	No	-	No
63. How do you or how do you plan to sell contactless card refills?					
Clerks in station	No	Yes	Yes	-	Yes
Vending Machines located in stations	Yes	Yes	Yes	-	Yes
Vending Machines in non station locations	No	No	Yes	-	Yes
Internet	Yes	No	No	-	Yes
Bank Machine	No	No	No	-	No
Mail in	No	No	No	-	No
Merchant sales	No	Yes	Yes	-	Yes
Other	No	No	No	-	Yes
64. How many stations currently accept contactless card fare collection?	82	13	0	-	0
65. What percent of stations currently accept contactless card fare collection?	100%	100%	0%	-	-
66. Is your contactless card system fully operational? (yes/no) If yes, go to question 69	Yes	Yes	No	-	No
67. If you have begun testing contactless card fare collection, when did you start?	-	-	-	-	-
68. When do you expect your contactless card system to be fully operational?	-	-	2001	-	2003

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
69. What are some of the issues you believe an agency should be aware of when considering testing of contactless card technology?	Customer usage rate, card orders	Level of technology, acceptance of public	System compatibility, technological advances	-	-
70. What are expected to be the reductions/increases in annual operation and maintenance expenses related to use of contactless card technology?	Unknown	15,000,000	-	-	-
71. Which of the following was or will be replaced or supplemented with a contactless system (please check all that apply)?	Magnetic	Magnetic	Single	-	-
72. Is your agency planning to change from a swipe to a contactless card system? (yes/no) If no, go to question 75	No	No	No	-	-
73. Including the cost of fare control equipment and vending machines, what do you expect to be the cost of conversion to a contactless system?	-	-	-	-	-
74. Please include any further comment on implementation of a change from a swipe to a contactless system you consider relevant.	-	-	-	-	-
75. Must the contactless card be physically presented to the reader?	No	No	Yes	-	-
76. At what distance can non-enclosed cards be read? (centimeters)	5	8	-	-	-

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
77. In which of the following locations can the contactless card or object be detected? (Please indicate by what distance in the second column)	Wallet	All	-	-	-
78. Do you use or intend to use non-card locations for contactless card circuitry (e.g. in a watch phone or other item)? (yes/no) Please indicate what item(s) in the second column.	No	Watch	No	-	-
79. Do you use contactless cards across different modes of transportation? (yes/no) Please describe other uses in the second column.	No	Yes	No	-	-
80. Do you use contactless cards across different transportation agencies? (yes/no) Please discuss any issues related to interagency fare collection you consider relevant (e.g., allocation of fare revenues between agencies) in the second column.	No	Yes	No	-	-
81. Do you use contactless cards at entry and exit points or only at entry points?	Both	Both	Neither	-	-
82. Please describe your projected and actual experience with passenger flow.	Improving	Improving	-	-	-
83. Do you use a barrier (e.g., turnstile or gate) or barrier free system?	Barrier	Barrier	Barrier	-	-
84. If your system is barrier free, how is proof of payment detected?	-	-	-	-	-
85. What has been the customer reaction to contactless technology?	Positive	Positive	-	-	-
86. Please address any other issues related to contactless card technology.	-	-	-	-	-

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
87. Do you collect or do you expect to collect any of the following data? (yes/no) Please describe the origin of the data (e.g., fare sale at vending machine, card swipe, contactless entry, exits) in the 2nd column.					
Total ridership	Faregate Data	Contactless entry & exit	Ticket Sales Data	-	Ticket Sales Data
Ridership by line	Faregate Data	Contactless entry & exit	Origin Destination	-	Ticket Sales Data
Ridership by time period	Faregate Data	Contactless entry & exit by 15 minute	Origin Destination	-	Ticket Sales Data
Ridership by fare option	Faregate Data	Contactless entry & exit	Ticket Sales Data	-	Ticket Sales Data
Number of passenger entries at each station	Faregate Data	Contactless entry & exit	Census	-	Electronic Barrier
Number of passenger exits at each station	Faregate Data	Contactless entry & exit	Census	-	Electronic Barrier
Number of transfers system-wide	No	Contactless entry & exit	No	-	No
Number of transfers by station	No	Contactless entry & exit	Census	-	No
Number of transfers by station and by arrival route number	No	Contactless entry & exit	No	-	No
Travel paths of individual riders	Faregate Data	Special Request to Creative Star	Origin Destination	-	No
Travel time of individual riders	Faregate Data	Special Request to Creative Star	No	-	No
Passenger identification	No	Special Request to Creative Star	No	-	No
Average amount spent on transportation per transaction	Faregate Data	Contactless entry & exit	Observation	-	No
Average amount spent on transportation per passenger	No	Contactless entry & exit	No	-	No
Other	-	-	-	-	-
88. How has, or how would, data collection from fare sales and collection help the agency provide better transit service?	Adjust	Adjust, Other	Speed, Adjust	-	Speed, Adjust
89. Are there or would there be privacy issues associated with data from fare sales and collection? (yes/no) Please explain in the second column.	No	Yes	No	-	-

Appendix B: Fare Sales and Collection Survey Results

4. What percent of total sales do the following types of tickets or plans represent?	Summary: Number of Agency Responses – Total	# Selling This Type of Pass	Minimum Percent of Sales	Maximum Percent of Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Annual pass	23	11	0%	22%	14.00%	-	0.00%	1.00%
Monthly pass	24	19	0%	60%	30.00%	-	2.43%	11.00%
Two week pass	23	2	0%	1%	0.00%	-	0.00%	0.00%
One week pass	23	11	0%	43%	1.00%	-	0.00%	25.00%
Specific number of days less than a week	23	14	0%	50%	11.00%	-	0.00%	3.00%
Multi-ride without discount	23	12	0%	85%	17.00%	-	25.19%	13.00%
Multi-ride with discount	23	12	0%	50%	1.00%	-	35.61%	28.00%
Peak hour pricing	23	1	0%	17%	0.00%	-	0.00%	0.00%
Single fare ticket	24	19	0%	76%	3.00%	13.00%	33.40%	0.00%
Single fare card	23	4	0%	58%	0.00%	-	0.00%	1.00%
Single fare token	23	2	0%	15%	0.00%	-	0.00%	15.00%
Cash admission	23	5	0%	57%	0.00%	-	0.00%	0.00%
Student	23	14	0%	14%	13.00%	-	3.26%	5.00%
Senior/pensioner	23	12	0%	10%	1.00%	-	0.00%	0.00%
Military	23	0	0%	0%	0.00%	-	0.00%	0.00%
Other	23	13	0%	59%	9.00%	-	0.11%	0.00%

5. What percent of total sales do the following fare sales mechanisms and locations represent?	Total	# Using This for Fare Sales	Minimum Percent of Sales	Maximum Percent of Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Clerks in stations	22	21	0%	99%	16.10%	-	98.76%	61.00%
Vending machines in stations	22	15	0%	69%	22.20%	-	0.00%	25.00%
Vending machines at bus stops	22	2	0%	10%	0.00%	-	0.00%	0.00%
Vending machines in non-transit locations	22	2	0%	11%	0.00%	-	0.00%	0.00%
Internet	22	1	0%	1%	0.00%	-	0.00%	1.00%
Bank machines	22	3	0%	36%	0.00%	-	0.00%	1.00%
Mail in	22	4	0%	18%	17.80%	-	0.00%	1.00%
Merchant sales	22	15	0%	93%	25.20%	-	0.00%	12.00%
Other (Example: Ticket sale by bus drivers)	22	12	0%	94%	18.20%	-	1.24%	2.00%

6. What percent of sales are made by the following?	Total	# Accepting This Type of Payment	Minimum Percent of Sales	Maximum Percent of Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Cash	23	23	40%	100%	97.00%	99.00%	98.76%	88.00%
Credit Card	23	8	0%	17%	3.00%	0.50%	0.00%	8.00%
Debit Card	23	5	0%	17%	0.00%	0.50%	0.00%	4.00%
Other	23	7	0%	40%	0.00%	0.00%	1.24%	0.00%

	Total	Sell Fares via Internet	Do Not Sell Fares via Internet	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
8. Do you sell fares over the Internet? (yes/no) If no, go to question 11	24	4	20	No	No	No	Yes

Appendix B: Fare Sales and Collection Survey Results

Summary: Number of Agency Responses | Berlin, Germany | Hong Kong, China (MTR) | Moscow, Russia | New York, New York (NYCT)

Question	Total	Sell By Vendor	Sell Through Homepage	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
9. How do you sell fares over the Internet?	4	2	2	-	-	-	Vendor

Question	Total	Minimum Fee	Maximum Fee	Median Fee	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
10. If fare sales are made through a vendor what is the transaction fee? (as a percent of sales revenue)	2	3%	4%	4%	-	-	-	3.00%

Question	Total	Sell through Merchants	Do Not Sell through Merchants	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
11. Do you sell fares through merchants? (yes/no) If no, go to question 13	26	16	10	Yes	No	No	Yes

Question	Total	Minimum Fee	Maximum Fee	Median Fee	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
12. If fare sales are made through merchants what is the transaction fee? (as a percent of sales revenue)	14	0%	5%	2%	1.5-4.5%	-	-	3.00%

Question	Total	Use Vending Machines	Do Not Use Vending Machines	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
13. Do you use fare vending machines? (yes/no) If no, go to question 44	24	20	4	Yes	Yes	No	Yes

Question	Total	Option Sold at Machine	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
14. What fare options are sold at fare vending machines?	18	-				
Annual	22	0	No	No	-	No
Monthly	22	5	Yes	No	-	Yes
Two week	22	1	No	No	-	No
One week	22	5	Yes	No	-	Yes
Less than a week	22	7	Yes	No	-	Yes
MR with discount	22	6	Yes	No	-	Yes
MR no discount	22	7	Yes	No	-	Yes
Single fare tickets	22	15	Yes	Yes	-	No
Single fare card	22	4	No	No	-	Yes
Single fare token	22	3	No	No	-	No
Student	22	7	Yes	Yes	-	No
Senior/ Pensioner	22	5	Yes	Yes	-	No
Military	22	1	No	No	-	No
Other	22	4	No	No	-	No

Question	Total	Cash	Credit	Debit	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
15. What type of payment do fare vending machines accept?	20	20	6	5	Cash, Credit	Cash	-	Cash, Credit, Debit

Question	Total	Minimum Largest Bill Accepted	Maximum Largest Bill Accepted	Median Largest Bill Accepted	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
16. If machines accept cash, what is the largest bill accepted (converted from local currency to U.S.$)?	19	$0.00	$88.01	$13.24	$45.42	$12.82	-	$50.00

Summary: Number of Agency Responses

Question	Total	Minimum Largest Amount of Change	Maximum Largest Amount of Change	Median Largest Amount of Change	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
17. If machines accept cash, what is the largest amount of change given (converted from local currency to U.S.$)?	20	$0.00	$87.93	$5.50	$9.08	$5.13	-	$6.00

Question	Total	Provide New Cards Only	Refill Cards Only	Provide New and Refill Cards	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
18. Do machines refill cards or only provide new cards?	18	13	1	4	New Cards Only	Both	-	Both

Question	Total	Minimum Transaction Time	Maximum Transaction Time	Median Transaction Time	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
19. What is your agencies target or standard machine transaction time? (if available) (in seconds)	8	2	60	18	-	-	-	-
20. What is the average machine transaction time? (if available) (in seconds)	12	2	50	14	50	-	-	-

Question	Total	Minimum Average Daily Number of Sales	Maximum Average Daily Number of Sales	Median Average Daily Number of Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
21. What is the average daily number of sales per machine?	15	42	41,000	353	-	615	-	109

Question	Total	Minimum Average Transaction Value	Maximum Average Transaction Value	Median Average Transaction Value	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
22. What is the average transaction value? (in US currency)	16	0	17	3	-	$0.94	-	$11.06

Question	Total	Minimum Number of Fare Vending Machines	Maximum Number of Fare Vending Machines	Median Number of Fare Vending Machines	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
23. How many fare vending machines do you have?	20	62	3,800	258	3,800	488	-	2,245

Question	Total	Minimum Percent of Stations with Vending Machines	Maximum Percent of Stations with Vending Machines	Median Percent of Stations with Vending Machines	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
24. What percent of stations have fare vending machines?	20	24%	100%	100%	100.00%	100.00%	-	100.00%

Question	Total	Minimum Average Vending Machines per Station	Maximum Average Vending Machines per Station	Median Average Vending Machines per Station	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
25. How many vending machines are located in each station? (total system average)	20	0	15	5	4	11	-	5

Appendix B: Fare Sales and Collection Survey Results

27. In which of the following locations do you have vending machines?

Summary: Number of Agency Responses: Total	Outside the Fare Barrier	Outside and Inside the Fare Barrier	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
20	15	5	Both	Outside	-	Both

29. How many stations use vending machines as the only fare sales method?

Total	Minimum Stations Using Vending Machines Only	Maximum Stations Using Vending Machines Only	Median Stations Using Vending Machines Only	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
19	0	170	0	170	0	-	0

30. What percent of stations use vending machines as the only fare sales method?

Total	Minimum Percent of Stations Using Vending Machines Only	Maximum Percent of Stations Using Vending Machines Only	Median Percent of Stations Using Vending Machines Only	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
14	0%	100%	0%	88.80%	0.00%	-	0.00%

31. How many types of ticket vending machines do you use?

Total	Minimum Number of Types of Vending Machines	Maximum Number of Types of Vending Machines	Median Number of Types of Vending Machines	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
19	1	7	3	7	2	-	2

32. Please describe the following details for each type of vending machine used.

	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Maker	17	Almex, Autelca, Scheidt & Bachmann, Deutsche Verkehrsbank, Siemens	-	-	Cubic Transportation Systems
Specific function	12	Register of the sell tickets, on-line operations	-	-	Sells and adds value to MetroCards
Capital Cost	11	-	-	-	$51,000 for MVM's and $17,500 for MEM
Annual operating and maintenance cost	9	-	-	-	-

Types of payment accepted	Total	Payment Accepted	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Cash	20	20	Yes	Yes	-	Yes
Credit	20	4	No	No	-	Yes
Debit	20	3	No	No	-	Yes
Other (Example: Staff Service)	20	2	Yes	No	-	No

Appendix B: Fare Sales and Collection Survey Results

	Summary: Number of Agency Responses: Total	Push Button	Touch Screen	Touch Screen and Push Button	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Touch screen or push button	20	15	2	3	Both	Touch Screen	-	Touch Screen

	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Other important distinctions between machines	3	-	-	-	-

	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
33. What department is responsible for filling fare vending machines?	20	Outside	Operations	-	MetroCard Operations-Revenue Control
34. What department is responsible for removing cash from machines?	20	Outside	Operations	-	MetroCard Operations-Revenue Control
35. How do you address security concerns associated with cash removal and machine vandalism?	18	Outside	Special Train	-	Armed agents remove cash. Equipment vandal-resistant and monitored constantly
36. What department is responsible for repairing fare vending machines?	20	Infrastructure	Operations	-	MetroCard Operations- AFC Maintenance

	Total	Minimum Average Downtime	Maximum Average Downtown	Median Average Downtown	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
37. What is your agencies target or standard repair or downtime for fare vending machines? (if available) (in hours)	9	1	24	2	2	-	-	0.5
38. What is the average repair or downtime for machines? (if available) (in hours)	10	0	24	1	9	-	-	0.5

	Total	Minimum Staff per Machine	Maximum Staff per Machine	Median Staff per Machine	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
39. For how many machines is each vending machine repair staff responsible?	15	1	95	20	95	-	-	20

40. Where are customers directed when they have a problem with a vending machine?	Total	Customers Directed	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
To personnel within the station	22	16	No	Yes	-	No
A help-point intercom	22	2	Yes	No	-	No
A general customer service intercom	22	3	Yes	No	-	No
A general customer service phone number	22	7	Yes	No	-	Yes
A phone number exclusively for vending machine assistance	22	3	No	No	-	No
Other (Example: Call Center)	22	1	Yes	No	-	No

Appendix B: Fare Sales and Collection Survey Results

Summary: Number of Agency Responses

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
41. Were any of the following required prior to the installation of fare vending machines? Please describe in the second column.	16	All	Other	-	All
42. If your vending machines accept credit cards, what methods of fraud control do you use?	6	-	-	-	Limits on number and value of transactions per day & Frequency of Use

Question	Total	Using or Plan to Use Smart Cards	Not Using Smart Cards	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
44. Are you using or do you plan to use smart cards? Smart card is a term use to describe integrated circuit, stored value, fare media If no, go to question 59	23	14	9	-	Yes	Yes	Yes

Question	Total	Earliest Year	Latest Year	Median Year	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
45. If you currently use smart cards, when were they introduced?	11	1997	1999	1997	-	1997	1998	-
46. If you plan to use smart cards, when do you plan to introduce them?	7	2001	2003	2002	-	-	-	-

Question	Total	Single Transit Mode	Regional Transportation Network	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
47. Can or will your smart card be used in one transit mode (e.g., the metro only) or can it be used throughout a regional transportation network (e.g., subway, suburban rail, and national rail networks)? Please describe in second column.	13	1	10	-	Transportation Network	Transportation Network	-

Question	Total	Transit Only	"Open" Environment	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
48. Can or will your smart card be used in a transit-only environment or an "open" environment where cards can be used for non-transit purposes? Please specify what the card can be used for in the second column.	11	1	9	-	Open	Transit Only	-

Question	Total	Involved with Joint Arrangements	Not Involved with Joint Arrangements	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
49. Are you or are you planning to be involved with joint smart card arrangements with the banking or financial industry? (yes/no) If yes, please explain in the second column.	9	8	0	-	-	Yes	-

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
50. Is or do you plan to have your smart card system administered by your transit agency or by a financial or other private entity? Please specify in second column.	10	-	-	Transit Agency	-
51. If you are involved with financial or other private entities please describe the entities involved, their roles and their legal and organizational relationship.	5	-	-	No	-

Appendix B: Fare Sales and Collection Survey Results

	Summary: Number of Agency Responses: Total	Contactless Card	Combination Swipe and Contactless Card with "Purse"	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
52. Which type of smart card technology do you use or plan to use? Please indicate the manufacturer, data storage capacity and per card cost to the agency in the second column.	10	9	1	-	Contactless	Contactless	-
Manufacturer	4			-	Sony	PHILIIPS technology	-
Data storage capacity	2			-	-	-	-
Per card cost to agency	3			-	-	-	-

53. How do you or how do you plan to sell smart card initial sales?	Total	Use for Initial Sales	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Clerks in station	11	8	-	Yes	Yes	-
Vending Machines located in stations	11	4	-	No	Yes	-
Vending Machines in non station locations	11	3	-	No	No	-
Internet	11	4	-	No	No	-
Bank Machine	11	1	-	No	No	-
Mail in	11	3	-	No	No	-
Merchant sales	11	2	-	No	No	-
Other	11	0	-	No	No	-

54. How do you or how do you plan to sell smart card refills?	Total	Use for Refills	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Clerks in station	11	7	-	Yes	Yes	-
Vending Machines located in stations	11	7	-	No	Yes	-
Vending Machines in non station locations	11	4	-	No	No	-
Internet	11	4	-	No	No	-
Bank Machine	11	1	-	No	No	-
Mail in	11	0	-	No	No	-
Merchant sales	11	5	-	No	No	-
Other	11	1	-	No	No	-

	Total	With Staff Assistance	With a Contractor	With Another Method	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
55. How do you or how do you plan to handle card or equipment malfunction?	9	5	3	1	-	Staff assistance	Staff assistance-free magnetic ticket given and card inspected	-

Question	Summary: Number of Agency Responses — Total			Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
56. How do you or how do you plan to handle replacing or refunding lost or stolen cards?	8			-	Staff assistance and network	Lost cards not refunded	-
57. How do you or how do you plan to handle customer privacy rights?	6			-	-	-	-
58. What problems did you encounter integrating smart card technology into the existing fare collection system?	4			-	-	-	-
59. What type of fare collection does your metro use? (check all that apply)	Total	Uses Fare Collection Method					
Contactless cards	25	5		No	Yes	Yes	No
Magnetic swipe cards	25	11		Yes	No	Yes	Yes
Insert and return ("dipping") cards	25	7		No	Yes	Yes	Yes
Tokens	25	5		Yes	No	No	Yes
Paper tickets	25	14		No	Yes	No	No
Other (Example: Bills)	25	5		Yes	No	No	No
	Total	Use Contactless Cards	Do Not Use Contactless Cards				
60. Are you using or do you plan to use contactless cards?(yes/no) If no, go to question 87	22	12	9	-	Yes	Yes	TBD
61. What fare options do you or do you plan to make available with contactless cards?	Total	Fare Options Available					
Annual pass	12	4		-	No	Yes	-
Monthly pass	12	6		-	No	Yes	-
Two week pass	12	1		-	No	No	-
One week pass	12	4		-	No	No	-
Specific number of days less than a week	12	2		-	No	No	-
Multi ride with discount	12	7		-	Yes	Yes	-
Multi ride without discount	12	3		-	No	No	-
Peak hour pricing	12	2		-	No	No	-
Single fare ticket	12	6		-	No	No	-
Student	12	6		-	Yes	Yes	-
Senior/ pensioner	12	6		-	Yes	No	-
Military	12	1		-	No	No	-
Other	12	3		-	No	No	-

62. How do you or how do you plan to sell contactless card initial sales?

	Total	Sell Initially	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Clerks in station	12	8	-	Yes	Yes	-
Vending Machines located in stations	12	4	-	No	Yes	-
Vending Machines in non station locations	12	3	-	No	No	-
Internet	12	4	-	No	No	-
Bank Machine	12	1	-	No	No	-
Mail in	12	4	-	No	No	-
Merchant sales	12	4	-	No	No	-
Other	12	0	-	No	No	-

63. How do you or how do you plan to sell contactless card refills?

	Total	Sell Refills	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Clerks in station	12	7	-	Yes	Yes	-
Vending Machines located in stations	12	8	-	No	Yes	-
Vending Machines in non station locations	12	5	-	No	No	-
Internet	12	4	-	No	No	-
Bank Machine	12	1	-	No	No	-
Mail in	12	1	-	No	No	-
Merchant sales	12	6	-	No	No	-
Other	12	1	-	No	No	-

	Total	Minimum Number of Stations	Maximum Number of Stations	Median Number of Stations	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
64. How many stations currently accept contactless card fare collection?	13	0	162	37	-	44	162	-

	Total	Minimum Percent of Stations	Maximum Percent of Stations	Median Percent of Stations	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
65. What percent of stations currently accept contactless card fare collection?	10	0%	100%	32%	-	100%	100%	-

	Total	Fully Operational	Not Fully Operational	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
66. Is your contactless card system fully operational? (yes/no) If yes, go to question 69	11	4	7	-	Yes	Yes	-

	Total	Earliest Year	Latest Year	Median Year	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
67. If you have begun testing contactless card fare collection, when did you start?	3	1997	1998	1997	-	-	1998	-
68. When do you expect your contactless card system to be fully operational?	5	2001	2003	2002	-	-	-	-

Appendix B: Fare Sales and Collection Survey Results

Question	Summary: Number of Agency Responses — Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
69. What are some of the issues you believe an agency should be aware of when considering testing of contactless card technology?	8	-	-	Set correct objectives, have a well-trained team, select the right system integrator, with the ability to look into the future	-
70. What are expected to be the reductions/increases in annual operation and maintenance expenses related to use of contactless card technology?	6	-	-	-	-

Question	Total	Magnetic Swipe Cards Replaced	Single Paper Tickets Replaced	Other Method Replaced	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
71. Which of the following was or will be replaced or supplemented with a contactless system (please check all that apply)?	9	7	2	2	-	-	Tokens	-

Question	Total	Planning To Change	Not Planning To Change	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
72. Is your agency planning to change from a swipe to a contactless card system? (yes/no) If no, go to question 75	9	2	7	-	No	No	-

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
73. Including the cost of fare control equipment and vending machines, what do you expect to be the cost of conversion to a contactless system?	3	-	-	-	-
74. Please include any further comment on implementation of a change from a swipe to a contactless system you consider relevant.	1	-	-	-	-

Question	Total	Must be Physically Presented	Does Not Need to be Physically Presented	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
75. Must the contactless card be physically presented to the reader?	8	1	6	-	No	No	-

Question	Total	Minimum Distance Cards Can be Read	Maximum Distance Cards Can be Read	Median Distance Cards Can be Read	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
76. At what distance can non-enclosed cards be read? (centimeters)	7	1	10	8	-	10	5	-

Appendix B: Fare Sales and Collection Survey Results

Summary: Number of Agency Responses

77. In which of the following locations can the contactless card or object be detected? (Please indicate by what distance in the second column)

Total	Pocket	Wallet	Purse
7	3	6	5

Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
-	All	All	-

78. Do you use or intend to use non-card locations for contactless card circuitry (e.g. in a watch phone or other item)? (yes/no) Please indicate what item(s) in the second column.

Total	Circuitry in Watch	Do Not Use Non-Card Locations
8	3	5

Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
-	Watch	No	-

79. Do you use contactless cards across different modes of transportation? (yes/no) Please describe other uses in the second column.

80. Do you use contactless cards across different transportation agencies? (yes/no) Please discuss any issues related to interagency fare collection you consider relevant (e.g., allocation of fare revenues between agencies) in the second column.

Question	Total	Use	Do Not Use
79	8	6	2
80	8	6	2

Question	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
79	-	Yes	Yes	-
80	-	Yes	Yes	-

81. Do you use contactless cards at entry and exit points or only at entry points?

Total	Use at Entry Points	Use at Both Entry and Exit Points
10	2	7

Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
-	Both	Entry	-

82. Please describe your projected and actual experience with passenger flow.

Total	Improved Passenger Flow
5	5

Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
-	-	Improving	-

83. Do you use a barrier (e.g., turnstile or gate) or barrier free system?

Total	Barrier	Barrier-Free
8	8	0

Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
-	Barrier	Barrier	-

84. If your system is barrier free, how is proof of payment detected?

Total
0

Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
-	-	-	-

85. What has been the customer reaction to contactless technology?

Total	Positive Reaction
6	6

Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
-	Positive	Positive	-

86. Please address any other issues related to contactless card technology.

Total
0

Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
-	-	-	-

87. Do you collect or do you expect to collect any of the following data? (yes/no) Please describe the origin of the data (e.g., fare sale at vending machine, card swipe, contactless entry, exits) in the 2nd column.

	Summary: Number of Agency Responses: Total	Collect Data	Do Not Collect Data	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
Total ridership	22	20	2	-	Entry Gate	Contactless Entry and Manual control	Card Swipe/Electronic Register
Ridership by line	22	17	5	-	Entry Gate	Yes	Card Swipe/Electronic Register
Ridership by time period	22	19	3	-	Entry Gate	Yes	Card Swipe
Ridership by fare option	22	16	6	-	Gate	No	Card Swipe
Number of passenger entries at each station	22	20	2	-	Entry Gate	Yes	Card Swipe/Electronic Register
Number of passenger exits at each station	22	14	8	-	Exit Gate	Yes	Electronic Register
Number of transfers system-wide	22	10	12	-	Mathematical Model	No	Card Swipe
Number of transfers by station	22	8	14	-	No	No	Card Swipe
Number of transfers by station and by arrival route number	21	2	19	-	No	No	No
Travel paths of individual riders	22	7	15	-	Mathematical Model	No	No
Travel time of individual riders	22	5	17	-	Mathematical Model	No	No
Passenger identification	22	4	18	-	No	No	No
Average amount spent on transportation per transaction	22	9	13	-	Station Accounting System	No	Fare Sale at Vending Machine
Average amount spent on transportation per passenger	22	5	17	-	No	No	No
Other	6	1	5	-	No	No	

	Total	Speed Fare Sales	Adjust Service Levels	Other	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
88. How has, or how would, data collection from fare sales and collection help the agency provide better transit service?	22	11	20	2	-	Speed, Adjust	Adjust	Speed, Adjust

	Total	Privacy Issues	No Privacy Issues	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York (NYCT)
89. Are there or would there be privacy issues associated with data from fare sales and collection? (yes/no) Please explain in the second column.	16	5	11	-	Yes	-	Yes

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
4.What percent of total sales do the following types of tickets or plans represent?								
Annual pass	6.70%	0.00%	0.00%	0.40%	0.01%	0.00%	-	11.50%
Monthly pass	42.40%	0.00%	60.40%	18.00%	13.90%	10.17%	44.50%	60.30%
Two week pass	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.80%
One week pass	4.50%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.30%
Specific number of days less than a week	2.50%	0.00%	0.20%	0.10%	0.01%	1.89%	-	1.80%
Multi-ride without discount	18.30%	45.10%	0.00%	0.00%	0.00%	72.21%	-	0.00%
Multi-ride with discount	1.80%	0.00%	5.90%	0.00%	0.00%	0.00%	-	5.20%
Peak hour pricing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Single fare ticket	14.30%	53.00%	20.10%	69.00%	75.50%	14.37%	-	15.80%
Single fare card	0.00%	0.00%	6.00%	0.00%	0.00%	0.00%	-	0.00%
Single fare token	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Cash admission	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Student	9.50%	1.90%	7.40%	11.00%	10.60%	0.00%	-	0.00%
Senior/pensioner	0.00%	Free	0.00%	0.00%	0.00%	1.23%	-	0.00%
Military	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Other	0.00%	0.00%	0.00%	1.50%	0.00%	0.12%	-	4.30%
5. What percent of total sales do the following fare sales mechanisms and locations represent?								
Clerks in stations	69.00%	55.20%	49.40%	76.00%	83.30%	88.20%	-	1.00%
Vending machines in stations	4.00%	0.00%	50.60%	21.00%	16.70%	8.48%	-	1.00%
Vending machines at bus stops	3.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Vending machines in non-transit locations	3.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Internet	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Bank machines	0.00%	0.00%	0.00%	0.00%	0.00%	2.12%	-	0.00%
Mail in	15.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Merchant sales	6.00%	0.10%	0.00%	0.00%	0.00%	1.20%	-	4.00%
Other (Example: Ticket sale by bus drivers)	0.00%	44.70%	0.00%	3.00%	0.00%	0.00%	-	94.00%
6. What percent of sales are made by the following?								
Cash	40.00%	100.00%	100.00%	100.00%	100.00%	98.60%	-	91.00%
Credit Card	17.00%	0.00%	0.00%	0.00%	0.00%	1.40%	-	0.00%
Debit Card	17.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	0.00%
Other	26.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-	9.00%
8. Do you sell fares over the Internet? (yes/no) If no, go to question 11	Yes	No	No	No	No	No	Yes	No

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
9. How do you sell fares over the Internet?	Vendor	-	-	-	-	-	Homepage	-
10. If fare sales are made through a vendor what is the transaction fee? (as a percent of sales revenue)	4.00%	-	-	-	-	-	-	-
11. Do you sell fares through merchants? (yes/no) If no, go to question 13	Yes	Yes	No	No	No	Yes	Yes	No
12. If fare sales are made through merchants what is the transaction fee? (as a percent of sales revenue)	4.00%	0.00%	-	-	-	2.00%	-	-
13. Do you use fare vending machines? (yes/no) If no, go to question 44	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14. What fare options are sold at fare vending machines?								
Annual	No	No	No	No	No	No	No	No
Monthly	Yes	No	Yes	No	No	No	No	No
Two week	No	No	No	No	No	No	No	No
One week	Yes	No	No	No	No	No	No	No
Less than a week	No	No	Yes	No	No	Yes	No	No
MR with discount	No	Yes	Yes	No	No	No	No	No
MR no discount	Yes	No	No	No	No	Yes	No	No
Single fare tickets	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Single fare card	No	No	Yes	No	No	No	No	No
Single fare token	No	No	No	No	No	No	Yes	No
Student	No	No	Yes	Yes	Yes	No	No	No
Senior/ Pensioner	No	No	No	No	No	Yes	No	No
Military	No	No	No	No	Yes	No	No	No
Other	No	No	No	No	No	No	No	No
15. What type of payment do fare vending machines accept?	Cash, Credit, Debit	Cash	Cash	Cash	Cash	Cash, Credit	Cash	Cash
16. If machines accept cash, what is the largest bill accepted (converted from local currency to U.S.$)?	$28.34	$5.20	$88.01	$0.26	$0.00	$27.93	$10.00	$0.35

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
17. If machines accept cash, what is the largest amount of change given (converted from local currency to U.S.$)?	$1.70	$5.87	$87.31	$0.18	$0.00	$27.12	$10.00	$0.32
18. Do machines refill cards or only provide new cards?	New Cards Only	New Cards Only	New Cards Only	New Cards Only	New Cards Only	New Cards Only	-	-
19. What is your agencies target or standard machine transaction time? (if available) (in seconds)	20	20	2	-	-	-	2	-
20. What is the average machine transaction time? (if available) (in seconds)	20	-	2	2	8	-	15	-
21. What is the average daily number of sales per machine?	150	-	1,050	1,933	-	41,000	305	cca. 10 pieces
22. What is the average transaction value? (in US currency)	-	-	$2.73	$0.59	-	$3.35	$1.01	$3.33
23. How many fare vending machines do you have?	792	228	1,292	108	112	154	62	440
24. What percent of stations have fare vending machines?	100.00%	100.00%	100.00%	100.00%	100.00%	50.00%	24.24%	100.00%
25. How many vending machines are located in each station? (total system average)	2	2 to 8	8	5	5	3	0.47	3

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	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
27. In which of the following locations do you have vending machines?	Both	Outside	Outside	Outside	Outside	Outside	Outside	Outside
29. How many stations use vending machines as the only fare sales method?	0	0	159	0	0	0	0	0
30. What percent of stations use vending machines as the only fare sales method?	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	-
31. How many types of ticket vending machines do you use?	2	3	4	1	2	6	1	4
32. Please describe the following details for each type of vending machine used.								
Maker	MONETEL, DASSAULT	Phonecard (Made in Brazil)	Omron, Takamizawa, Nihon Signal	-	Xamax	MONTEL, INDRA	GFI Genfare	Protokon Ltd
Specific function	-	Only ticket vending machines	single, multiple	-	-	Venta de billetes	Token/ Change Vending	-
Capital Cost	245,000 FRF	-	-	3,000,000,000 DRS	3,500,000 DRS	7 million p	$ 32K-38K	Changing
Annual operating and maintenance cost	2,050 FRF	-	206 million yen	140,000,000 DRS	-	TMB and INDRA	-	Changing
Types of payment accepted								
Cash	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Credit	Yes	No	No	No	No	Yes	No	No
Debit	Yes	No	No	No	No	No	No	No
Other (Example: Staff Service)	No	No	No	No	No	No	No	No

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
Touch screen or push button	Push Button	Push Button	Both	Push Button	Push Button	Push Button	Push Button	Push Button
Other important distinctions between machines	-	-	-	-	-	-	-	-
33. What department is responsible for filling fare vending machines?	Metro+RER Operating Units	Contractor	Finance Department	Operations	Maintenance	TMB	Revenue Collection	Contractor
34. What department is responsible for removing cash from machines?	Metro+RER Operating Units	Contractor	Finance Department	Operations	Finance	PROSEGUR (Security Company)	Revenue Collection	Contractor
35. How do you address security concerns associated with cash removal and machine vandalism?	Staff	Contractor	Staff	Closed Coin Boxes, CCTV, supervision, security company collects cash	-	Repair Machines	Armed Revenue Agent and MBTA Police	-
36. What department is responsible for repairing fare vending machines?	Operating unit and maintenance unit for fare sale and collection	Contractor	Passenger Transport System	Operations	Maintenance	TMB Toll Systems	Revenue Maintenance	Contractor
37. What is your agencies target or standard repair or downtime for fare vending machines? (if available) (in hours)	-	2	-	1	-	-	12	-
38. What is the average repair or downtime for machines? (if available) (in hours)	-	2	1	0.3	-	-	12	-
39. For how many machines is each vending machine repair staff responsible?	18	-	-	29	10	39	15	-
40. Where are customers directed when they have a problem with a vending machine?								
To personnel within the station	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
A help-point intercom	No	No	No	No	No	Yes	No	No
A general customer service intercom	No	No	No	No	No	Yes	No	No
A general customer service phone number	No	No	No	No	No	No	Yes	Yes
A phone number exclusively for vending machine assistance	No	Yes	No	No	No	No	No	No
Other (Example: Call Center)	No	No	No	No	No	No	No	No

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	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
41. Were any of the following required prior to the installation of fare vending machines? Please describe in the second column.	Some equipment relocation and station modernization	All	All	-	Infrastructure	All	Infrastructure, Other	-
42. If your vending machines accept credit cards, what methods of fraud control do you use?	Amount, frequency of use, rejected card check list	-	-	No	-	Black Lists	-	-
44. Are you using or do you plan to use smart cards? Smart card is a term use to describe integrated circuit, stored value, fare media If no, go to question 59	Yes	No	No	Yes	Yes	No	No	No
45. If you currently use smart cards, when were they introduced?	1998	Plan	-	-	-	-	-	-
46. If you plan to use smart cards, when do you plan to introduce them?	2001	-	-	2003	2002	-	-	-
47. Can or will your smart card be used in one transit mode (e.g., the metro only) or can it be used throughout a regional transportation network (e.g., subway, suburban rail, and national rail networks)? Please describe in second column.	Transportation Network	-	-	Transportation Network	Unknown Yet	-	-	-
48. Can or will your smart card be used in a transit-only environment or an "open" environment where cards can be used for non-transit purposes? Please specify what the card can be used for in the second column.	Open	-	-	Open	Open	-	-	-
49. Are you or are you planning to be involved with joint smart card arrangements with the banking or financial industry? (yes/no) If yes, please explain in the second column.	Yes	-	-	Yes	Yes	-	-	-
50. Is or do you plan to have your smart card system administered by your transit agency or by a financial or other private entity? Please specify in second column.	Financial entity	-	-	Private Entity	Private Entity	-	-	-
51. If you are involved with financial or other private entities please describe the entities involved, their roles and their legal and organizational relationship.	MODEUS & MONEO	-	-	-	No	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
52. Which type of smart card technology do you use or plan to use? Please indicate the manufacturer, data storage capacity and per card cost to the agency in the second column.	Contactless	-	-	Contactless	Contactless	-	-	-
Manufacturer	Ask et Schlumberger	-	-	-	-	-	-	-
Data storage capacity	2 K0	-	-	-	-	-	-	-
Per card cost to agency	20 - 30 FRF	-	-	1500 drs	-	-	-	-
53. How do you or how do you plan to sell smart card initial sales?								
Clerks in station	Yes	-	-	-	No	-	-	-
Vending Machines located in stations	No	-	-	-	Yes	-	-	-
Vending Machines in non station locations	No	-	-	-	Yes	-	-	-
Internet	Yes	-	-	-	Yes	-	-	-
Bank Machine	No	-	-	-	Yes	-	-	-
Mail in	Yes	-	-	-	No	-	-	-
Merchant sales	No	-	-	-	No	-	-	-
Other	No	-	-	-	No	-	-	-
54. How do you or how do you plan to sell smart card refills?								
Clerks in station	Yes	-	-	-	No	-	-	-
Vending Machines located in stations	Yes	-	-	-	No	-	-	-
Vending Machines in non station locations	Yes	-	-	-	No	-	-	-
Internet	Yes	-	-	-	Yes	-	-	-
Bank Machine	No	-	-	-	Yes	-	-	-
Mail in	No	-	-	-	No	-	-	-
Merchant sales	Yes	-	-	-	Yes	-	-	-
Other	No	-	-	-	No	-	-	-
55. How do you or how do you plan to handle card or equipment malfunction?	Replacement of defective cards	-	-	-	to be defined	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
56. How do you or how do you plan to handle replacing or refunding lost or stolen cards?	Free, Charge	-	-	-	to be defined	-	-	-
57. How do you or how do you plan to handle customer privacy rights?	Sharing of files with client data and files with Fare collection data.	-	-	-	to be defined	-	-	-
58. What problems did you encounter integrating smart card technology into the existing fare collection system?	Passing from the concept multi-ride tickets/cards to the concept Money reserve	-	-	-	-	-	-	-
59. What type of fare collection does your metro use? (check all that apply)								
Contactless cards	Yes	No	No	No	No	No	No	No
Magnetic swipe cards	No	No	No	No	No	Yes	Yes	No
Insert and return ("dipping") cards	No	No	Yes	No	No	Yes	No	No
Tokens	No	No	No	No	No	Yes	Yes	No
Paper tickets	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other (Example: Bills)	Yes	No	No	No	No	No	Yes	No
60. Are you using or do you plan to use contactless cards?(yes/no) If no, go to question 87	Yes	Yes	No	Yes	Yes	No	No	No
61. What fare options do you or do you plan to make available with contactless cards?								
Annual pass	Yes	-	-	-	Yes	-	-	-
Monthly pass	Yes	-	-	-	Yes	-	-	-
Two week pass	No	-	-	-	No	-	-	-
One week pass	Yes	-	-	-	No	-	-	-
Specific number of days less than a week	Yes	-	-	-	No	-	-	-
Multi ride with discount	No	-	-	-	No	-	-	-
Multi ride without discount	No	-	-	-	No	-	-	-
Peak hour pricing	No	-	-	-	No	-	-	-
Single fare ticket	Yes	-	-	-	No	-	-	-
Student	Yes	-	-	-	No	-	-	-
Senior/ pensioner	Yes	-	-	-	No	-	-	-
Military	No	-	-	-	No	-	-	-
Other	Yes	-	-	-	No	-	-	-

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	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
62. How do you or how do you plan to sell contactless card initial sales?								
Clerks in station	Yes	-	-	-	No	-	-	-
Vending Machines located in stations	No	-	-	-	No	-	-	-
Vending Machines in non station locations	No	-	-	-	No	-	-	-
Internet	Yes	-	-	-	Yes	-	-	-
Bank Machine	No	-	-	-	Yes	-	-	-
Mail in	Yes	-	-	-	No	-	-	-
Merchant sales	No	-	-	-	Yes	-	-	-
Other	No	-	-	-	No	-	-	-
63. How do you or how do you plan to sell contactless card refills?								
Clerks in station	Yes	-	-	-	No	-	-	-
Vending Machines located in stations	Yes	-	-	-	No	-	-	-
Vending Machines in non station locations	Yes	-	-	-	No	-	-	-
Internet	Yes	-	-	-	Yes	-	-	-
Bank Machine	No	-	-	-	Yes	-	-	-
Mail in	No	-	-	-	No	-	-	-
Merchant sales	Yes	-	-	-	Yes	-	-	-
Other	No	-	-	-	No	-	-	-
64. How many stations currently accept contactless card fare collection?	80	-	-	-	No	-	-	-
65. What percent of stations currently accept contactless card fare collection?	18%	-	-	-	0%	-	-	-
66. Is your contactless card system fully operational? (yes/no) If yes, go to question 69	No	-	-	-	No	-	-	-
67. If you have begun testing contactless card fare collection, when did you start?	1997	-	-	-	-	-	-	-
68. When do you expect your contactless card system to be fully operational?	2001	-	-	-	-	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
69. What are some of the issues you believe an agency should be aware of when considering testing of contactless card technology?	Good technical work	-	-	-	-	-	-	-
70. What are expected to be the reductions/increases in annual operation and maintenance expenses related to use of contactless card technology?	Saving in maintenance, fare-evasion.	-	-	-	Unknown	-	-	-
71. Which of the following was or will be replaced or supplemented with a contactless system (please check all that apply)?	Magnetic	-	-	-	Single, Other	-	-	-
72. Is your agency planning to change from a swipe to a contactless card system? (yes/no) If no, go to question 75	Yes	-	-	-	-	-	-	-
73. Including the cost of fare control equipment and vending machines, what do you expect to be the cost of conversion to a contactless system?	$42,505,500	-	-	-	-	-	-	-
74. Please include any further comment on implementation of a change from a swipe to a contactless system you consider relevant.	Positive	-	-	-	-	-	-	-
75. Must the contactless card be physically presented to the reader?	No	-	-	-	-	-	-	-
76. At what distance can non-enclosed cards be read? (centimeters)	10	-	-	-	-	-	-	-

Appendix B: Fare Sales and Collection Survey Results

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
77. In which of the following locations can the contactless card or object be detected? (Please indicate by what distance in the second column)	Purse, Wallet	-	-	-	-	-	-	-
78. Do you use or intend to use non-card locations for contactless card circuitry (e.g. in a watch phone or other item)? (yes/no) Please indicate what item(s) in the second column.	Watch	-	-	-	-	-	-	-
79. Do you use contactless cards across different modes of transportation? (yes/no) Please describe other uses in the second column.	Yes	-	-	-	-	-	-	-
80. Do you use contactless cards across different transportation agencies? (yes/no) Please discuss any issues related to interagency fare collection you consider relevant (e.g., allocation of fare revenues between agencies) in the second column.	Yes	-	-	-	-	-	-	-
81. Do you use contactless cards at entry and exit points or only at entry points?	Both	-	-	-	-	-	-	-
82. Please describe your projected and actual experience with passenger flow.	Improving	-	-	-	-	-	-	-
83. Do you use a barrier (e.g., turnstile or gate) or barrier free system?	Barrier	-	-	-	-	-	-	-
84. If your system is barrier free, how is proof of payment detected?	-	-	-	-	-	-	-	-
85. What has been the customer reaction to contactless technology?	Positive	-	-	-	-	-	-	-
86. Please address any other issues related to contactless card technology.	-	-	-	-	-	-	-	-

	Paris, France (RATP and RER)	São Paulo, Brazil	Tokyo, Japan	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary
87. Do you collect or do you expect to collect any of the following data? (yes/no) Please describe the origin of the data (e.g., fare sale at vending machine, card swipe, contactless entry, exits) in the 2nd column.								
Total ridership	Entry Gate	Yes	Ticket Sales Data	Yes	Infrared Sensors at Entrances and Exits	Yes	Yes	No
Ridership by line	Entry Gate	Yes	All kind of tickets sold	Yes	Yes	Yes	Yes	No
Ridership by time period	Entry Gate	Yes	Automatic ticket gate	Passenger Counts	Yes	Yes	Yes	No
Ridership by fare option	Entry Gate	Yes	All kind of tickets sold	Passenger Counts	Yes	Yes	No	No
Number of passenger entries at each station	Entry Gate	Yes	Automatic ticket gate	No	Yes	Yes	Yes	No
Number of passenger exits at each station	No	No	Automatic ticket gate	Passenger Counts	Yes	No	Yes	No
Number of transfers system-wide	Entry Gate	No	All kind of tickets sold	Passenger Counts	Yes	No	Yes	No
Number of transfers by station	No	No	Counted by staff	Passenger Counts	Yes	No	Yes	No
Number of transfers by station and by arrival route number	No	No	No	Passenger Counts	-	No	No	No
Travel paths of individual riders	No	No	No	No	No	No	Yes	No
Travel time of individual riders	No	No	No	No	No	No	Yes	No
Passenger identification	Pass sales.	No	No	No	No	No	No	No
Average amount spent on transportation per transaction	No	No	446 yen	No	No	Yes	Yes	No
Average amount spent on transportation per passenger	Fillers at VM, ticket office equipment	No	127 yen	No	No	No	Yes	No
Other	No	No	-	Passenger Counts	-	-	-	-
88. How has, or how would, data collection from fare sales and collection help the agency provide better transit service?	Speed, Adjust, Other	Other	Adjust	Other	Speed, Adjust	Speed, Adjust	Speed, Adjust	-
89. Are there or would there be privacy issues associated with data from fare sales and collection? (yes/no) Please explain in the second column.	Yes	No	-	No	No	No	Yes	-

Appendix B: Fare Sales and Collection Survey Results

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
4.What percent of total sales do the following types of tickets or plans represent?								
Annual pass	0.00%	1.69%	0.00%	0.00%	22.40%	0.00%	0.00%	0.00%
Monthly pass	3.50%	1.90%	40.00%	23.80%	11.46%	0.00%	1.70%	29.80%
Two week pass	0.00%	0.00%	0.00%	0.00%	0.56%	0.00%	0.00%	0.00%
One week pass	0.00%	4.97%	12.70%	0.00%	1.34%	0.00%	0.00%	0.70%
Specific number of days less than a week	0.00%	1.50%	0.00%	1.70%	1.81%	0.00%	0.00%	1.20%
Multi-ride without discount	0.00%	0.01%	0.00%	0.00%	12.54%	0.00%	80.00%	0.00%
Multi-ride with discount	0.00%	17.85%	0.00%	0.00%	1.15%	0.00%	0.00%	49.90%
Peak hour pricing	0.00%	0.00%	0.00%	0.00%	0.00%	17.00%	0.00%	0.00%
Single fare ticket	0.00%	36.88%	17.90%	0.00%	32.31%	55.70%	11.30%	0.00%
Single fare card	0.00%	0.00%	0.00%	31.10%	0.00%	0.00%	0.00%	0.00%
Single fare token	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cash admission	56.80%	0.00%	17.10%	28.60%	0.00%	0.00%	0.00%	17.70%
Student	0.00%	7.03%	0.00%	7.10%	9.88%	13.80%	4.50%	6.00%
Senior/pensioner	0.00%	3.00%	0.00%	7.70%	5.08%	0.80%	2.50%	9.50%
Military	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other	59.30%	25.17%	12.90%	0.00%	1.37%	0.00%	0.00%	0.70%
5. What percent of total sales do the following fare sales mechanisms and locations represent?								
Clerks in stations	0.00%	0.01%	60.00%	0.60%	1.36%	63.00%	42.00%	65.00%
Vending machines in stations	60.00%	1.40%	0.00%	69.40%	0.00%	0.00%	11.00%	5.50%
Vending machines at bus stops	0.00%	0.00%	0.00%	0.00%	9.50%	0.00%	0.00%	0.00%
Vending machines in non-transit locations	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	11.00%	0.00%
Internet	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bank machines	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	36.00%	0.00%
Mail in	3.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Merchant sales	36.00%	92.59%	40.00%	30.00%	90.00%	8.00%	0.00%	29.50%
Other (Example: Ticket sale by bus drivers)	1.00%	6.00%	0.00%	0.00%	10.00%	29.00%	0.00%	0.00%
6. What percent of sales are made by the following?								
Cash	100.00%	100.00%	100.00%	100.00%	60.40%	100.00%	60.00%	78.70%
Credit Card	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.80%
Debit Card	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other	0.00%	0.00%	0.00%	0.00%	39.60%	0.00%	40.00%	20.50%
8. Do you sell fares over the Internet? (yes/no) If no, go to question 11	No	No	No	No	No	No	No	No

Appendix B: Fare Sales and Collection Survey Results

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
9. How do you sell fares over the Internet?	-	-	-	-	-	-	-	-
10. If fare sales are made through a vendor what is the transaction fee? (as a percent of sales revenue)	-	-	-	-	-	-	-	-
11. Do you sell fares through merchants? (yes/no) If no, go to question 13	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12. If fare sales are made through merchants what is the transaction fee? (as a percent of sales revenue)	2.00%	3.00%	1.00%	4.50%	4.00%	3.5-6.0%	2.50%	1.00%
13. Do you use fare vending machines? (yes/no) If no, go to question 44	Yes	Yes	No	Yes	Yes	No	Yes	Yes
14. What fare options are sold at fare vending machines?								
Annual	No	No	-	No	No	-	No	No
Monthly	No	No	-	Yes	No	-	No	No
Two week	No	No	-	No	No	-	No	No
One week	No	No	-	No	No	-	No	No
Less than a week	No	No	-	Yes	Yes	-	No	No
MR with discount	No	No	-	No	No	-	No	No
MR no discount	No	No	-	No	No	-	No	No
Single fare tickets	No	Yes	-	No	Yes	-	Yes	No
Single fare card	No	No	-	Yes	No	-	No	No
Single fare token	No	No	-	No	Yes	-	No	Yes
Student	No	No	-	Yes	No	-	No	No
Senior/ Pensioner	No	No	-	No	No	-	No	No
Military	No	No	-	No	No	-	No	No
Other	Yes	No	-	No	Yes	-	No	No
15. What type of payment do fare vending machines accept?	Cash	Cash	-	Cash	Cash	-	Cash	Cash
16. If machines accept cash, what is the largest bill accepted (converted from local currency to U.S.$)?	$20.00	$4.80	-	$88.01	$26.63	-	-	$13.24

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	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
17. If machines accept cash, what is the largest amount of change given (converted from local currency to U.S.$)?	$18.00	$2.35	-	$87.93	$0.53	-	$0.58	$0.86
18. Do machines refill cards or only provide new cards?	New Cards Only	New Cards Only	-	New Cards Only	New Cards Only	-	New Cards Only	New Cards Only
19. What is your agencies target or standard machine transaction time? (if available) (in seconds)	-	30	-	15	-	-	12	-
20. What is the average machine transaction time? (if available) (in seconds)	-	30	-	15	7	-	12	3
21. What is the average daily number of sales per machine?	-	42	-	500	251	-	400	49
22. What is the average transaction value? (in US currency)	$10.00	$0.80	-	$2.01	$0.28	-	$0.75	$6.62
23. How many fare vending machines do you have?	66	250	-	487	190	-	266	135
24. What percent of stations have fare vending machines?	100.00%	100.00%	-	100.00%	100.00%	-	100.00%	84.60%
25. How many vending machines are located in each station? (total system average)	5	3	-	6	4	-	5	2

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
27. In which of the following locations do you have vending machines?	Outside	Outside	-	Outside	Outside	-	Outside	Both
29. How many stations use vending machines as the only fare sales method?	0	4	-	76	0	-	0	-
30. What percent of stations use vending machines as the only fare sales method?	-	-	-	100.00%	-	-	0.00%	-
31. How many types of ticket vending machines do you use?	2	single fare ticket of	-	5	2	-	1	-
32. Please describe the following details for each type of vending machine used.								
Maker	General Fare Inc	Autelca-Telesistemi, Ribali, Eltec, Tecnotour	-	Japanese maker	Mikroelektronika spol. Sr.o.	-	Cubic	Laniel Canada
Specific function	-	-	-	-	Printing and issue of 15 types of PT passes	-	Vend single ride ticket	Token sales
Capital Cost	-	2.500000 each	-	-	AVJ24E 108 044, -CZK, AVJ24G 151 000, -CZK	-	-	1,350,000
Annual operating and maintenance cost	-	-	-	156,931,000 yen	5,600,000 CZK	-	-	250,000
Types of payment accepted								
Cash	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Credit	No	No	-	No	No	-	No	No
Debit	No	No	-	No	No	-	No	No
Other (Example: Staff Service)	No	No	-	No	No	-	No	No

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	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
Touch screen or push button	Push Button	Push Button	-	Push Button	Push Button	-	Both	Push Button
Other important distinctions between machines	-	-	-	-	Use of Box and Operating Elements	-	-	-
33. What department is responsible for filling fare vending machines?	Transportation Division- Revenue	Marketing Department	-	Transportion Devision	Fare Voucher and Advanced Sale Department	-	Traffic	Finance Department
34. What department is responsible for removing cash from machines?	Transportation Division- Revenue	Marketing Department	-	Station	Fare Voucher and Advanced Sale Department	-	Traffic	Finance Department
35. How do you address security concerns associated with cash removal and machine vandalism?	Police, Sealed Bags	Marketing Department	-	Contractor	Police	-	Self-locking boxes upon removal	Corporate Security involvement and Armed Guard Service
36. What department is responsible for repairing fare vending machines?	Way & Structures Division	Electrical Equipment Maintenance Department	-	Transport Devision	Fare Voucher and Advanced Sale Department	-	Maintenance	Subway- Rail Car and Shops
37. What is your agencies target or standard repair or downtime for fare vending machines? (if available) (in hours)	-	-	-	-	24	-	1	24
38. What is the average repair or downtime for machines? (if available) (in hours)	-	-	-	-	-	-	1	24
39. For how many machines is each vending machine repair staff responsible?	-	12	-	1	40	-	15	34
40. Where are customers directed when they have a problem with a vending machine?								
To personnel within the station	Yes	Yes	-	Yes	Yes	-	Yes	No
A help-point intercom	No	No	-	No	No	-	No	No
A general customer service intercom	Yes	No	-	No	No	-	No	No
A general customer service phone number	Yes	No	-	No	Yes	-	No	Yes
A phone number exclusively for vending machine assistance	No	No	-	No	Yes	-	No	No
Other (Example: Call Center)	No	No	-	No	No	-	No	No

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	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
41. Were any of the following required prior to the installation of fare vending machines? Please describe in the second column.	None	Equipment	-	-	Infrastructure	-	None	-
42. If your vending machines accept credit cards, what methods of fraud control do you use?	-	-	-	No	-	-	-	-
44. Are you using or do you plan to use smart cards? Smart card is a term use to describe integrated circuit, stored value, fare media If no, go to question 59	Yes	No	No	Yes	Yes	No	Yes	No
45. If you currently use smart cards, when were they introduced?	Future date tbd	-	-	-	-	-	Plan	-
46. If you plan to use smart cards, when do you plan to introduce them?	Unknown	-	-	-	-	-	2002	-
47. Can or will your smart card be used in one transit mode (e.g., the metro only) or can it be used throughout a regional transportation network (e.g., subway, suburban rail, and national rail networks)? Please describe in second column.	Unknown	-	-	-	-	-	Transportation Network	-
48. Can or will your smart card be used in a transit-only environment or an "open" environment where cards can be used for non-transit purposes? Please specify what the card can be used for in the second column.	Unknown	-	-	-	-	-	Open	-
49. Are you or are you planning to be involved with joint smart card arrangements with the banking or financial industry? (yes/no) If yes, please explain in the second column.	Unknown	-	-	-	-	-	Yes	-
50. Is or do you plan to have your smart card system administered by your transit agency or by a financial or other private entity? Please specify in second column.	Unknown	-	-	-	-	-	Transit agency	-
51. If you are involved with financial or other private entities please describe the entities involved, their roles and their legal and organizational relationship.	-	-	-	-	-	-	Not decided yet	-

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	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
52. Which type of smart card technology do you use or plan to use? Please indicate the manufacturer, data storage capacity and per card cost to the agency in the second column.	-	-	-	-	-	-	Contactless	-
Manufacturer	-	-	-	-	-	-	-	-
Data storage capacity	-	-	-	-	-	-	-	-
Per card cost to agency	-	-	-	-	-	-	-	-
53. How do you or how do you plan to sell smart card initial sales?								
Clerks in station	-	-	-	-	-	-	Yes	-
Vending Machines located in stations	-	-	-	-	-	-	Yes	-
Vending Machines in non station locations	-	-	-	-	-	-	Yes	-
Internet	-	-	-	-	-	-	No	-
Bank Machine	-	-	-	-	-	-	No	-
Mail in	-	-	-	-	-	-	No	-
Merchant sales	-	-	-	-	-	-	No	-
Other	-	-	-	-	-	-	No	-
54. How do you or how do you plan to sell smart card refills?								
Clerks in station	-	-	-	-	-	-	Yes	-
Vending Machines located in stations	-	-	-	-	-	-	Yes	-
Vending Machines in non station locations	-	-	-	-	-	-	Yes	-
Internet	-	-	-	-	-	-	No	-
Bank Machine	-	-	-	-	-	-	No	-
Mail in	-	-	-	-	-	-	No	-
Merchant sales	-	-	-	-	-	-	No	-
Other	-	-	-	-	-	-	No	-
55. How do you or how do you plan to handle card or equipment malfunction?	-	-	-	-	-	-	Other	-

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	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
56. How do you or how do you plan to handle replacing or refunding lost or stolen cards?	-	-	-	-	-	-	Other	-
57. How do you or how do you plan to handle customer privacy rights?	-	-	-	-	-	-	-	-
58. What problems did you encounter integrating smart card technology into the existing fare collection system?	-	-	-	-	-	-	-	-
59. What type of fare collection does your metro use? (check all that apply)								
Contactless cards	No	No	-	No	No	No	No	No
Magnetic swipe cards	No	No	-	Yes	No	No	Yes	Yes
Insert and return ("dipping") cards	Yes	No	-	Yes	No	No	No	No
Tokens	No	No	-	No	No	No	No	Yes
Paper tickets	No	Yes	-	No	Yes	No	No	Yes
Other (Example: Bills)	No	No	-	No	Yes	Yes	No	No
60. Are you using or do you plan to use contactless cards?(yes/no) If no, go to question 87	Yes	Yes	-	No	No	No	Yes	No
61. What fare options do you or do you plan to make available with contactless cards?								
Annual pass	-	No	-	-	-	-	No	-
Monthly pass	-	No	-	-	-	-	No	-
Two week pass	-	No	-	-	-	-	No	-
One week pass	-	No	-	-	-	-	No	-
Specific number of days less than a week	-	No	-	-	-	-	No	-
Multi ride with discount	-	Yes	-	-	-	-	Yes	-
Multi ride without discount	-	No	-	-	-	-	Yes	-
Peak hour pricing	-	No	-	-	-	-	No	-
Single fare ticket	-	No	-	-	-	-	Yes	-
Student	-	No	-	-	-	-	Yes	-
Senior/ pensioner	-	No	-	-	-	-	Yes	-
Military	-	No	-	-	-	-	Yes	-
Other	-	No	-	-	-	-	No	-

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	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
62. How do you or how do you plan to sell contactless card initial sales?								
Clerks in station	-	No	-	-	-	-	Yes	-
Vending Machines located in stations	-	Yes	-	-	-	-	Yes	-
Vending Machines in non station locations	-	Yes	-	-	-	-	Yes	-
Internet	-	No	-	-	-	-	No	-
Bank Machine	-	No	-	-	-	-	No	-
Mail in	-	Yes	-	-	-	-	No	-
Merchant sales	-	Yes	-	-	-	-	No	-
Other	-	No	-	-	-	-	No	-
63. How do you or how do you plan to sell contactless card refills?								
Clerks in station	-	No	-	-	-	-	Yes	-
Vending Machines located in stations	-	Yes	-	-	-	-	Yes	-
Vending Machines in non station locations	-	Yes	-	-	-	-	Yes	-
Internet	-	No	-	-	-	-	No	-
Bank Machine	-	No	-	-	-	-	No	-
Mail in	-	Yes	-	-	-	-	No	-
Merchant sales	-	Yes	-	-	-	-	No	-
Other	-	No	-	-	-	-	No	-
64. How many stations currently accept contactless card fare collection?	0	0	-	-	-	-	48	-
65. What percent of stations currently accept contactless card fare collection?	-	0	-	-	-	-	-	-
66. Is your contactless card system fully operational? (yes/no) If yes, go to question 69	No	No	-	-	-	-	No	-
67. If you have begun testing contactless card fare collection, when did you start?	-	-	-	-	-	-	1997	-
68. When do you expect your contactless card system to be fully operational?	TBD	-	-	-	-	-	2002	-

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
69. What are some of the issues you believe an agency should be aware of when considering testing of contactless card technology?	TBD	Electric Equipment Maintenance Dept., Warehouse & Test Dept.	-	-	-	-	Security	-
70. What are expected to be the reductions/increases in annual operation and maintenance expenses related to use of contactless card technology?	TBD	-	-	-	-	-	1,400,000	-
71. Which of the following was or will be replaced or supplemented with a contactless system (please check all that apply)?	Magnetic	Magnetic	-	-	-	-	Magnetic	-
72. Is your agency planning to change from a swipe to a contactless card system? (yes/no) If no, go to question 75	No	No	-	-	-	-	Yes	-
73. Including the cost of fare control equipment and vending machines, what do you expect to be the cost of conversion to a contactless system?	-	-	-	-	-	-	-	-
74. Please include any further comment on implementation of a change from a swipe to a contactless system you consider relevant.	-	-	-	-	-	-	-	-
75. Must the contactless card be physically presented to the reader?	-	No	-	-	-	-	No	-
76. At what distance can non-enclosed cards be read? (centimeters)	-	10	-	-	-	-	1	-

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	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
77. In which of the following locations can the contactless card or object be detected? (Please indicate by what distance in the second column)	-	Pocket, Wallet, Purse	-	-	-	-	Other	-
78. Do you use or intend to use non-card locations for contactless card circuitry (e.g. in a watch phone or other item)? (yes/no) Please indicate what item(s) in the second column.	-	No	-	-	-	-	No	-
79. Do you use contactless cards across different modes of transportation? (yes/no) Please describe other uses in the second column.	-	Yes	-	-	-	-	Yes	
80. Do you use contactless cards across different transportation agencies? (yes/no) Please discuss any issues related to interagency fare collection you consider relevant (e.g., allocation of fare revenues between agencies) in the second column.	-	Yes	-	-	-	-	Yes	-
81. Do you use contactless cards at entry and exit points or only at entry points?	-	Both	-	-	-	-	Both	-
82. Please describe your projected and actual experience with passenger flow.	-	-	-	-	-	-	Improving	-
83. Do you use a barrier (e.g., turnstile or gate) or barrier free system?	-	Barrier	-	-	-	-	Barrier	-
84. If your system is barrier free, how is proof of payment detected?	-	-	-	-	-	-	-	-
85. What has been the customer reaction to contactless technology?	-	-	-	-	-	-	Positive	-
86. Please address any other issues related to contactless card technology.	-	-	-	-	-	-	-	-

	Jersey City, New Jersey (PATH)	Milan, Italy	Montreal, Canada	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada
87. Do you collect or do you expect to collect any of the following data? (yes/no) Please describe the origin of the data (e.g., fare sale at vending machine, card swipe, contactless entry, exits) in the 2nd column.								
Total ridership	Yes	Yes	No	Vending machine	-	Entry gate	AFC gate	Yes
Ridership by line	No	Yes	No	No	-	No	AFC gate	Manually collected
Ridership by time period	Yes	Yes	No	Vending machine	-	No	AFC gate	Manually collected
Ridership by fare option	Yes	Yes	No	No	-	No	AFC gate	Farebox counts
Number of passenger entries at each station	Yes	Yes	Yes	Vending machine	-	Yes	AFC gate	Turnstile counts
Number of passenger exits at each station	No	Yes	No	Vending machine	-	No	AFC gate	No
Number of transfers system-wide	No	Yes	No	No	-	No	No	Yes
Number of transfers by station	No	Yes	No	No	-	No	No	No
Number of transfers by station and by arrival route number	No	No	No	No	-	No	No	No
Travel paths of individual riders	No	Yes	No	No	-	No	AFC gate	No
Travel time of individual riders	No	Yes	No	No	-	No	No	No
Passenger identification	No	Yes	No	No	-	No	No	Yes
Average amount spent on transportation per transaction	No	Yes	No	No	-	No	No	No
Average amount spent on transportation per passenger	No	Yes	No	No	-	No	No	No
Other	-	No	-	-	-	-	-	-
88. How has, or how would, data collection from fare sales and collection help the agency provide better transit service?	Adjust	Speed, Adjust	Adjust	Adjust	Adjust	Speed, Adjust	Speed, Adjust	Adjust
89. Are there or would there be privacy issues associated with data from fare sales and collection? (yes/no) Please explain in the second column.	No	-	-	No	-	No	No	No

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
4.What percent of total sales do the following types of tickets or plans represent?					
Annual pass	0.00%	0.00%	0.00%	6.00%	6.00%
Monthly pass	1.00%	0.00%	25.50%	0.00%	0.00%
Two week pass	0.00%	0.00%	0.00%	0.00%	0.00%
One week pass	2.70%	0.00%	0.00%	43.40%	43.40%
Specific number of days less than a week	0.00%	0.00%	0.00%	50.00%	0.50%
Multi-ride without discount	0.00%	85.00%	0.00%	10.70%	10.70%
Multi-ride with discount	25.00%	0.00%	0.00%	12.80%	12.80%
Peak hour pricing	0.00%	0.00%	0.00%	0.00%	0.00%
Single fare ticket	0.00%	15.00%	74.50%	18.90%	18.90%
Single fare card	57.70%	0.00%	0.00%	0.00%	0.00%
Single fare token	1.30%	0.00%	0.00%	0.00%	0.00%
Cash admission	11.30%	0.00%	0.00%	0.00%	0.00%
Student	0.00%	0.00%	0.00%	0.00%	0.00%
Senior/pensioner	1.00%	2.20%	0.00%	5.70%	5.70%
Military	0.00%	0.00%	0.00%	0.00%	0.00%
Other	0.00%	4.00%	0.00%	2.00%	2.00%
5. What percent of total sales do the following fare sales mechanisms and locations represent?					
Clerks in stations	69.00%	37.80%	95.00%	-	79.00%
Vending machines in stations	0.00%	59.00%	0.00%	-	21.00%
Vending machines at bus stops	0.00%	0.00%	0.00%	-	0.00%
Vending machines in non-transit locations	0.00%	0.00%	0.00%	-	0.00%
Internet	0.00%	0.00%	0.00%	-	0.00%
Bank machines	0.00%	0.00%	0.00%	-	0.00%
Mail in	0.00%	0.00%	0.00%	-	0.00%
Merchant sales	31.00%	3.00%	0.00%	-	0.00%
Other (Example: Ticket sale by bus drivers)	0.00%	0.20%	5.00%	-	0.00%
6. What percent of sales are made by the following?					
Cash	90.00%	99.00%	90.00%	-	96.00%
Credit Card	8.00%	0.00%	10.00%	-	0.00%
Debit Card	2.00%	1.00%	0.00%	-	0.00%
Other	0.00%	0.00%	0.00%	-	4.00%
8. Do you sell fares over the Internet? (yes/no) If no, go to question 11	Yes	No	No	-	No

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
9. How do you sell fares over the Internet?	Homepage	-	-	-	-
10. If fare sales are made through a vendor what is the transaction fee? (as a percent of sales revenue)	-	-	-	-	-
11. Do you sell fares through merchants? (yes/no) If no, go to question 13	Yes	Yes	No	-	No
12. If fare sales are made through merchants what is the transaction fee? (as a percent of sales revenue)	-	0.16%	-	-	-
13. Do you use fare vending machines? (yes/no) If no, go to question 44	Yes	Yes	No	-	Yes
14. What fare options are sold at fare vending machines?					
Annual	No	No	-	-	No
Monthly	No	No	-	-	No
Two week	Yes	No	-	-	No
One week	Yes	No	-	-	Yes
Less than a week	Yes	No	-	-	No
MR with discount	Yes	No	-	-	Yes
MR no discount	Yes	Yes	-	-	Yes
Single fare tickets	Yes	Yes	-	-	Yes
Single fare card	Yes	No	-	-	No
Single fare token	No	No	-	-	No
Student	No	No	-	-	Yes
Senior/ Pensioner	No	Yes	-	-	Yes
Military	No	No	-	-	No
Other	No	Yes	-	-	Yes
15. What type of payment do fare vending machines accept?	Cash, Credit, Debit	Cash, Debit	-	-	Cash, Credit, Debit
16. If machines accept cash, what is the largest bill accepted (converted from local currency to U.S.$)?	$20.00	$12.82	-	-	$11.18

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
17. If machines accept cash, what is the largest amount of change given (converted from local currency to U.S.$)?	$ 5.00	$6.41	-	-	$11.18
18. Do machines refill cards or only provide new cards?	Both	Refill only	-	-	Both
19. What is your agencies target or standard machine transaction time? (if available) (in seconds)	60	-	-	-	-
20. What is the average machine transaction time? (if available) (in seconds)	20	-	-	-	-
21. What is the average daily number of sales per machine?	-	594	-	-	250
22. What is the average transaction value? (in US currency)	$17.00	$13.72	-	-	$3.30
23. How many fare vending machines do you have?	585	184	-	-	430
24. What percent of stations have fare vending machines?	100.00%	100.00%	-	-	87.00%
25. How many vending machines are located in each station? (total system average)	7	15	-	-	1.4

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
27. In which of the following locations do you have vending machines?	Both	Outside	-	-	Outside
29. How many stations use vending machines as the only fare sales method?	81	0	-	-	87
30. What percent of stations use vending machines as the only fare sales method?	98.70%	-	-	-	29.00%
31. How many types of ticket vending machines do you use?	3	3	-	-	3
32. Please describe the following details for each type of vending machine used.					
Maker	Cubic Transportation System	-	-	-	Cubic Transportation Pvt. Ltd.
Specific function	Paper fare media, passes and smart cards, add fare to card	Ticket Vending, Add value	-	-	Dispenses tickets
Capital Cost	-	220,000: 460,000: 400,000:	-	-	-
Annual operating and maintenance cost	-	14,700: 61,400: 34,200	-	-	-
Types of payment accepted					
Cash	Yes	Yes	-	-	Yes
Credit	Yes	No	-	-	No
Debit	Yes	No	-	-	No
Other (Example: Staff Service)	No	Yes	-	-	No

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
Touch screen or push button	Push Button	Push Button	-	-	Push Button
Other important distinctions between machines	-	No	-	-	Full range of ticket available
33. What department is responsible for filling fare vending machines?	Office of Treasurer	Operations	-	-	Ticket Rolls- Station Staff
34. What department is responsible for removing cash from machines?	Office of Treasurer	Operations	-	-	Contractor
35. How do you address security concerns associated with cash removal and machine vandalism?	Police, Sealed Bags	Staff, Secure Coin & Cash Boxes, Alarms	-	-	Contractor
36. What department is responsible for repairing fare vending machines?	Systems Maintenance/Automated Fare Collection Systems	Infrastructure and Building	-	-	Contractor
37. What is your agencies target or standard repair or downtime for fare vending machines? (if available) (in hours)	1	-	-	-	-
38. What is the average repair or downtime for machines? (if available) (in hours)	3	1	-	-	-
39. For how many machines is each vending machine repair staff responsible?	20	22	-	-	15
40. Where are customers directed when they have a problem with a vending machine?					
To personnel within the station	Yes	Yes	-	-	Yes
A help-point intercom	No	No	-	-	No
A general customer service intercom	No	No	-	-	No
A general customer service phone number	No	No	-	-	No
A phone number exclusively for vending machine assistance	Yes	No	-	-	No
Other (Example: Call Center)	No	No	-	-	No

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
41. Were any of the following required prior to the installation of fare vending machines? Please describe in the second column.	All	All	-	-	Infrastructure upgrade
42. If your vending machines accept credit cards, what methods of fraud control do you use?	Floor limits, velocity check, hot list	-	-	-	-
44. Are you using or do you plan to use smart cards? Smart card is a term use to describe integrated circuit, stored value, fare media If no, go to question 59	Yes	Yes	Yes	-	Yes
45. If you currently use smart cards, when were they introduced?	1999	1997	-	-	Plan
46. If you plan to use smart cards, when do you plan to introduce them?	-	-	2001	-	2003
47. Can or will your smart card be used in one transit mode (e.g., the metro only) or can it be used throughout a regional transportation network (e.g., subway, suburban rail, and national rail networks)? Please describe in second column.	Transit Mode	Transportation Network	Transportation Network	-	Transportation Network
48. Can or will your smart card be used in a transit-only environment or an "open" environment where cards can be used for non-transit purposes? Please specify what the card can be used for in the second column.	Open	Open	Open	-	Open
49. Are you or are you planning to be involved with joint smart card arrangements with the banking or financial industry? (yes/no) If yes, please explain in the second column.	Yes	Yes	Yes	-	-
50. Is or do you plan to have your smart card system administered by your transit agency or by a financial or other private entity? Please specify in second column.	Currently in House, planning to contract out	Private Entity	Transit Agency	-	Private Entity
51. If you are involved with financial or other private entities please describe the entities involved, their roles and their legal and organizational relationship.	-	Private Entity	-	-	-

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
52. Which type of smart card technology do you use or plan to use? Please indicate the manufacturer, data storage capacity and per card cost to the agency in the second column.	Contactless	Contactless	Contactless	-	Combination
Manufacturer	Cubic	-	-	-	-
Data storage capacity	2K FRAM	-	-	-	-
Per card cost to agency	4.53	-	-	-	-
53. How do you or how do you plan to sell smart card initial sales?					
Clerks in station	Yes	Yes	Yes	-	Yes
Vending Machines located in stations	No	No	Yes	-	No
Vending Machines in non station locations	No	No	Yes	-	No
Internet	Yes	No	No	-	Yes
Bank Machine	No	No	No	-	No
Mail in	Yes	No	No	-	Yes
Merchant sales	No	No	Yes	-	Yes
Other	No	No	No	-	No
54. How do you or how do you plan to sell smart card refills?					
Clerks in station	No	Yes	Yes	-	Yes
Vending Machines located in stations	Yes	Yes	Yes	-	Yes
Vending Machines in non station locations	No	No	Yes	-	Yes
Internet	Yes	No	No	-	Yes
Bank Machine	No	No	No	-	No
Mail in	No	No	No	-	No
Merchant sales	No	Yes	Yes	-	Yes
Other	No	No	No	-	Yes
55. How do you or how do you plan to handle card or equipment malfunction?	Staff Assistance	Staff and Contractor Assistance	Contractor	-	Contract maintenance

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
56. How do you or how do you plan to handle replacing or refunding lost or stolen cards?	Charge	Replacement for personal cards by contractor	Contractor	-	-
57. How do you or how do you plan to handle customer privacy rights?	Data for analysis only	Internal guidelines in accordance with law	Contractor	-	Leagal advice
58. What problems did you encounter integrating smart card technology into the existing fare collection system?	Lack of familiarity	Lack of familiarity	None	-	-
59. What type of fare collection does your metro use? (check all that apply)					
Contactless cards	Yes	Yes	No	-	No
Magnetic swipe cards	Yes	Yes	No	-	Yes
Insert and return ("dipping") cards	No	No	No	-	No
Tokens	No	No	No	-	No
Paper tickets	No	Yes	Yes	-	Yes
Other (Example: Bills)	No	No	No	-	No
60. Are you using or do you plan to use contactless cards?(yes/no) If no, go to question 87	Yes	Yes	Yes	-	No
61. What fare options do you or do you plan to make available with contactless cards?					
Annual pass	No	No	No	-	Yes
Monthly pass	Yes	No	Yes	-	Yes
Two week pass	Yes	No	No	-	No
One week pass	Yes	No	Yes	-	Yes
Specific number of days less than a week	Yes	No	No	-	No
Multi ride with discount	Yes	Yes	No	-	Yes
Multi ride without discount	Yes	No	No	-	Yes
Peak hour pricing	Yes	No	No	-	Yes
Single fare ticket	Yes	Yes	Yes	-	Yes
Student	Yes	No	No	-	Yes
Senior/ pensioner	Yes	Yes	No	-	Yes
Military	No	No	No	-	No
Other	Yes	Yes	No	-	No

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
62. How do you or how do you plan to sell contactless card initial sales?					
Clerks in station	Yes	Yes	Yes	-	Yes
Vending Machines located in stations	No	No	Yes	-	No
Vending Machines in non station locations	No	No	Yes	-	No
Internet	Yes	No	No	-	Yes
Bank Machine	No	No	No	-	No
Mail in	Yes	No	No	-	Yes
Merchant sales	No	No	Yes	-	Yes
Other	No	No	No	-	No
63. How do you or how do you plan to sell contactless card refills?					
Clerks in station	No	Yes	Yes	-	Yes
Vending Machines located in stations	Yes	Yes	Yes	-	Yes
Vending Machines in non station locations	No	No	Yes	-	Yes
Internet	Yes	No	No	-	Yes
Bank Machine	No	No	No	-	No
Mail in	No	No	No	-	No
Merchant sales	No	Yes	Yes	-	Yes
Other	No	No	No	-	Yes
64. How many stations currently accept contactless card fare collection?	82	13	0	-	0
65. What percent of stations currently accept contactless card fare collection?	100%	100%	0%	-	-
66. Is your contactless card system fully operational? (yes/no) If yes, go to question 69	Yes	Yes	No	-	No
67. If you have begun testing contactless card fare collection, when did you start?	-	-	-	-	-
68. When do you expect your contactless card system to be fully operational?	-	-	2001	-	2003

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
69. What are some of the issues you believe an agency should be aware of when considering testing of contactless card technology?	Customer usage rate, card orders	Level of technology, acceptance of public	System compatibility, technological advances	-	-
70. What are expected to be the reductions/increases in annual operation and maintenance expenses related to use of contactless card technology?	Unknown	15,000,000	-	-	-
71. Which of the following was or will be replaced or supplemented with a contactless system (please check all that apply)?	Magnetic	Magnetic	Single	-	-
72. Is your agency planning to change from a swipe to a contactless card system? (yes/no) If no, go to question 75	No	No	No	-	-
73. Including the cost of fare control equipment and vending machines, what do you expect to be the cost of conversion to a contactless system?	-	-	-	-	-
74. Please include any further comment on implementation of a change from a swipe to a contactless system you consider relevant.	-	-	-	-	-
75. Must the contactless card be physically presented to the reader?	No	No	Yes	-	-
76. At what distance can non-enclosed cards be read? (centimeters)	5	8	-	-	-

Appendix B: Fare Sales and Collection Survey Results

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
77. In which of the following locations can the contactless card or object be detected? (Please indicate by what distance in the second column)	Wallet	All	-	-	-
78. Do you use or intend to use non-card locations for contactless card circuitry (e.g. in a watch phone or other item)? (yes/no) Please indicate what item(s) in the second column.	No	Watch	No	-	-
79. Do you use contactless cards across different modes of transportation? (yes/no) Please describe other uses in the second column.	No	Yes	No	-	-
80. Do you use contactless cards across different transportation agencies? (yes/no) Please discuss any issues related to interagency fare collection you consider relevant (e.g., allocation of fare revenues between agencies) in the second column.	No	Yes	No	-	-
81. Do you use contactless cards at entry and exit points or only at entry points?	Both	Both	Neither	-	-
82. Please describe your projected and actual experience with passenger flow.	Improving	Improving	-	-	-
83. Do you use a barrier (e.g., turnstile or gate) or barrier free system?	Barrier	Barrier	Barrier	-	-
84. If your system is barrier free, how is proof of payment detected?	-	-	-	-	-
85. What has been the customer reaction to contactless technology?	Positive	Positive	-	-	-
86. Please address any other issues related to contactless card technology.	-	-	-	-	-

	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
87. Do you collect or do you expect to collect any of the following data? (yes/no) Please describe the origin of the data (e.g., fare sale at vending machine, card swipe, contactless entry, exits) in the 2nd column.					
Total ridership	Faregate Data	Contactless entry & exit	Ticket Sales Data	-	Ticket Sales Data
Ridership by line	Faregate Data	Contactless entry & exit	Origin Destination	-	Ticket Sales Data
Ridership by time period	Faregate Data	Contactless entry & exit by 15 minute	Origin Destination	-	Ticket Sales Data
Ridership by fare option	Faregate Data	Contactless entry & exit	Ticket Sales Data	-	Ticket Sales Data
Number of passenger entries at each station	Faregate Data	Contactless entry & exit	Census	-	Electronic Barrier
Number of passenger exits at each station	Faregate Data	Contactless entry & exit	Census	-	Electronic Barrier
Number of transfers system-wide	No	Contactless entry & exit	No	-	No
Number of transfers by station	No	Contactless entry & exit	Census	-	No
Number of transfers by station and by arrival route number	No	Contactless entry & exit	No	-	No
Travel paths of individual riders	Faregate Data	Special Request to Creative Star	Origin Destination	-	No
Travel time of individual riders	Faregate Data	Special Request to Creative Star	No	-	No
Passenger identification	No	Special Request to Creative Star	No	-	No
Average amount spent on transportation per transaction	Faregate Data	Contactless entry & exit	Observation	-	No
Average amount spent on transportation per passenger	No	Contactless entry & exit	No	-	No
Other	-	-	-	-	-
88. How has, or how would, data collection from fare sales and collection help the agency provide better transit service?	Adjust	Adjust, Other	Speed, Adjust	-	Speed, Adjust
89. Are there or would there be privacy issues associated with data from fare sales and collection? (yes/no) Please explain in the second column.	No	Yes	No	-	-

Appendix C: Automatic Train Supervision Survey Results

Summary: Number of Agency Responses | Berlin, Germany | Hong Kong, China (MTR) | Moscow, Russia | New York, New York

4. Do you have an Automatic Train Supervision (ATS) system? ATS describes computerized systems that report train location to a central control office. Some ATS systems also adjust individual train performance to maintain schedules.

Total	Have ATS	Do Not Have ATS	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
29	24	5	Yes	Yes	Yes	No

5. What year(s) was your ATS system installed?

Total	Earliest Year	Latest Year	Median Year	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
					1996		
				2001	1992		
24	1967	1999	1989	1975	1985	1999	-

6. Describe the extent of your Metro system.

	Total	Minimum Number	Maximum Number	Median Number	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Number of lines	24	1	15	3	9	5	11	-
Number of stations	24	7	375	60	191	54	262	-
Total route-miles	24	4	485	51	151.7	110.5	484.5	-
7. Describe the extent of your ATS system.								
Number of lines	24	1	15	3	9	3	2	-
Number of stations	24	7	375	51	191	44	46	-
Total route-miles	24	4	152	42	151.7	44.5	48.5	-

	Total	Number with 100% ATS Implementation	Average % ATS Implementation	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
% of Lines with ATS	24	19	89.1%	100%	60%	18%	-
% of Stops with ATS	24	18	86.6%	100%	81%	18%	-
% of Route Miles with ATS	24	17	84.1%	100%	40%	10%	-

8. Did ATS replace an older system or was it installed for new lines only?

Total	For New Lines Only	Replaced Older System	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
24	7	17	Replaced	Replaced	Replaced	-

9. Have there been any problems with older systems working with ATS interfaces in terms of data updates and system maintenance? (yes/no) Please describe in second column.

Total	Interface Problems	No Interface Problems	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
19	5	14	No	No	No	-

10. How many dispatchers are required during peak periods?

Total	Minimum Dispatchers	Maximum Dispatchers	Median Dispatchers	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
23	0	24	5	11	2	6	-

11. If ATS replaced an older system, were the same dispatchers retained?

Total	Dispatchers Retained	Dispatchers Not Retained	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
15	9	6	Yes	Yes	No	-

Appendix C: Automatic Train Supervision Survey Results

Summary: Number of Agency Responses; city responses: Berlin, Germany; Hong Kong, China (MTR); Moscow, Russia; New York, New York

Question	Total	Personnel Retained	Personnel Not Retained	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
12. If ATS replaced an older system, were personnel retrained or transferred? (yes/no) If so, please discuss any problems with the loss of institutional memory (knowledge of the track network and passenger flows) in the second column.	14	13	1	Yes	Yes	-	-

Question	Total	New Job Tasks Created	New Job Tasks Not Created	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
13. Were new job tasks created as a result of installation of your ATS system?(yes/no)	21	12	9	Yes	No	No	-

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
14. What new job tasks were added to handle additional responsibilities for the ATS or other system(s) the ATS interfaces with?	13	Line-Dispatcher	-	No	-

Question	Total	Done Manually	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
15. Describe how correction of headway gaps was done before ATS. (keyword)	16	16	Manually	Manually	Manually	-

16. What are the following costs associated with your ATS system?

	Total	Minimum Cost	Maximum Cost	Median Cost	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Initial Capital Cost	14	$777,000	$142,010,000	$8,125,590	$ 49,962,000	$6,470,000	-	-
Annual Operating Cost	6	$112,548	$12,820,000	$431,263	$ 481,452	-	-	-
Annual Maintenance Cost	8	$6,798	$2,564,000	$574,146	$ 90,840	-	-	-

Question	Total	Scheduling	Incident Management	Fire Protection	Other	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
17. Please describe any problems you have experienced with interface of ATS and preexisting systems.	7	0	2	0	2	None	-	None	-

18. Where are work stations located? (Check all that apply)

	Total	Work Stations Located	Work Stations Not Located	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Control Center	24	24	0	Yes	Yes	Yes	-
Terminal Stations	24	10	14	No	No	Yes	-
Other	24	6	18	No	Yes	Yes	-

19. What type of backup system or features does your agency employ in case of an emergency?

	Total	Features	Does Not Feature	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
New redundant system	20	13	7	Yes	No	Yes	-
Retained older system	20	4	16	No	No	Yes	-
Other	20	6	14	No	Yes	No	-

20. Describe the signal technology of lines equipped with ATS.	Summary: Number of Agency Responses			Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
	Total	Describes Signal Technology	Does Not Describe Signal Technology				
Fixed Block	22	20	2	Yes	No	Yes	-
Moving Block	22	0	22	No	No	No	-
Hybrid	22	3	19	No	Yes	No	-
Other	21	0	21	No	No	No	-

21. Which of the following describe the route selection architecture of lines equipped with ATS? (check all that apply)	Total	Used	Not Used	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Office Selection (schedule)	23	19	4	Yes	Yes	Yes	-
Office Selection (manual)	23	10	13	No	No	No	-
Office Selection (other)	23	2	21	No	No	No	-
Field Selection (AVI)	23	5	18	No	No	No	-
Field Selection (other)	23	2	21	No	No	No	-
Other	23	1	22	No	No	Yes	-

22. Are train yards controlled from the ATS system Control Center?	Total	Controlled	Not Controlled	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
	23	8	15	Yes	No	No	-

23. What type of signal system(s) is used on your ATS-equipped lines? (check all that apply)	Total	Used	Not Used	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Wayside	24	18	6	Yes	Yes	No	-
ATC	24	17	7	No	Yes	Yes	-
ATO	24	12	12	No	Yes	No	-
CBTC	24	3	21	No	No	No	-
Other	24	4	20	No	No	Yes	-

24. Does your software make any of the following dispatching suggestions (not including automatic control) in real-time? (check all that apply)	Total	Software Makes Suggestions	Software Does Not Make Suggestions	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Skip stops	18	1	17	No	No	No	-
Hold/dwell time extension	18	13	5	No	Yes	No	-
Short-turn into a service gap	18	2	16	No	No	No	-
Offset terminal departure times	18	10	8	No	Yes	No	-
Alert dispatcher to service gap	18	10	8	No	Yes	Yes	-
Other	18	2	16	No	No	Yes	-

Summary: Number of Agency Responses

25. Does your software take automatic control of any of the following dispatching actions? (check all that apply)	Total	Software Takes Automatic Control	Software Does Not Take Automatic Control	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Speed Control	18	8	10	No	Yes	No	-
Dwell Time/holding time control	18	12	6	No	Yes	Yes	-
Dwell Time/holding time countdown for crews	18	5	13	No	Yes	No	-
Dwell Time/holding lights	18	4	14	No	No	No	-
Terminal Departure Time Control	18	14	4	Yes	Yes	No	-
Other	18	2	16	No	No	No	-

26. Does your software provide any monitoring and/or alarms for operating rule violations?	Total	Provides Monitoring	Does Not Provide Monitoring	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Signal	14	9	5	Yes	No	No	-
Station	14	6	8	No	No	No	-
Other	14	3	11	No	Yes	Yes	-

	Total	Internally	Externally	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
27. If you use software algorithms for dispatching control or suggestion software was it designed internally or externally? If externally, name vendor.	18	1	17	Siemens VT	ALCATEL	Internally	-

28. What schedules are included in your ATS system?	Total	Included	Excluded	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Train Schedules	20	20	0	Yes	Yes	Yes	-
Crew Schedules	20	3	17	Yes	No	Yes	-
Maintenance Schedules	20	4	16	No	No	Yes	-
Other	20	0	20	No	No	No	-

	Total	Software	Manually	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
29. Do you have software which reassigns crews to trains automatically during the service day, or is crew reassignment done manually?	20	0	20	Manually	Manually	Manually	-

	Total	Midroute Also	Terminals Only	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
30. Do crews begin and end their duties at terminals only or also at mid-route locations?	21	14	7	Mid-route	Mid-route	Mid-route	-

31. Please list the number of each type of terminal you have in your Metro system.

	Summary: Total	Contains Terminal	Does Not Contain Terminal	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Relay	19	18	1	Yes	Yes	0	-
1 track stub-end	10	7	3	No	No	2	-
2 track stub-end	14	14	0	Yes	Yes	6	-
3+ track stub-end	10	7	3	Yes	No	4	-
Simple loop	8	4	4	No	No	0	-
Loop with bypass tracks	8	4	4	No	No	0	-
Other	5	1	4	No	No	0	-

38. Are any of the following built or integrated into the ATS workstations? (check all that apply) Please describe in second column.

	Total	Built Into ATS Workstations	Not Built Into ATS Workstations	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Voice communications systems	19	12	7	No	Yes	Yes	-
CCTV capabilities	19	8	11	No	Yes	No	-
Video communications systems	19	4	15	No	No	No	-
Public address systems	19	12	7	No	No	Yes	-
Scheduling systems	19	15	4	Yes	Yes	No	-
Fire protection systems	19	8	11	No	No	No	-
Other	19	2	17	No	No	Yes	-

39. What types of display are available? (check all that apply)

	Total	Available	Not Available	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Workstation monitors	22	18	4	Yes	Yes	Yes	-
Overhead screens	22	9	13	No	Yes	No	-
Other	22	6	16	No	No	Yes	-

	Total	Have Database	Do Not Have Database	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
40. Do you have a database where train movement data and other data are recorded? (yes/no) If no, please skip to question 46	23	19	4	No	Yes	Yes	-

	Total	Minimum Storage of Data	Maximum Storage of Data	Median Storage of Data	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
41. How long do you store data? (Days)	19	5	Indefinitely	60	-	Indefinitely	14	-

	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
42. What department is responsible for analyzing this data?	19	-	Operations Planning	Dispatching	-

Columns marked "Summary" give the number of agency responses.

Question	Total	Minimum Positions	Maximum Positions	Median Positions	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
43. How many analysts are needed for analyzing this data?	15	0	8	2	-	0	2	-

44. What kind of analyses are done with this data? (check all that apply)	Total	Analysis of Data	No Analysis of Data	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Time-Space Diagrams	19	11	8	-	No	Yes	-
Terminal Departure-time	19	18	1	-	Yes	Yes	-
Mid-route On-time	19	11	8	-	No	Yes	-
Headway Regularity	19	17	2	-	Yes	Yes	-
Running Time	19	13	6	-	Yes	Yes	-
Delays	19	16	3	-	Yes	Yes	-
Dwell Time	19	15	4	-	Yes	Yes	-
Recovery Time	19	11	8	-	No	Yes	-
Disruption Recovery	19	9	10	-	Yes	No	-
Other	19	1	18	-	No	No	-

Question	Total	Allowed	Not Allowed	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
45. Has ATS data allowed you to create more efficient schedules and better utilize train resources than before? (yes/no) If yes, please describe how in 2nd column	18	11	7	-	No	Yes	-

46. Has ATS enabled you to do the following better? (check all that apply) please describe in 2nd column.	Total	Enabled	Not Enabled	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
More Quickly Identify Service Delays	18	16	2	Yes	Yes	Yes	-
Reduce the Impact of Delays	18	13	5	Yes	No	Yes	-
Shorten the Duration of Delays	18	14	4	Yes	Yes	Yes	-
Other	18	0	18	No	No	No	-

Question	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
47. If you have Automatic Vehicle Identification (AVI) devices what is the spacing?	12	Station Distance	Positive Train ID by SACEM	One for 3 or 4 stations with stub ends	-

Question	Total	Transmit	Do Not Transmit	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
48. Do AVI devices transmit maintenance diagnostic information? If yes, please indicate if transmission of information is over-the-air, landline or another method in 2nd column.	13	6	7	No	Yes	Yes	-

Question	Total	Integrated with ATS	Not Integrated with ATS	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
49. If you have on-line maintenance diagnostic devices are they integrated with your ATS system? If yes, please describe how in 2nd column.	16	3	13	No	No	No	-

Appendix C: Automatic Train Supervision Survey Results

Question	Total	Minimum Increase in Relaibility	Maximum Increase in Reliablity	Median Increase in Reliability	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
50. If ATS replaced an older system, how has your reliability changed (e.g. 5% increase in regularity)?	8	0	1	0	0%	-	Difficult to say	-

Question	Total	ATS Features	ATS Does Not Feature	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
51. Does your ATS system record audio communications of dispatchers and crews	20	11	9	No	No	Yes	-
52. Is there a playback feature (audio and/or graphical) for accident or delay investigations (yes/no)? Please describe in 2nd column	20	15	5	Yes	-	Yes	-
53. Does your ATS system include a model to simulate train operations? (yes/no) If no, go to question 57	23	7	16	No	No	No	-

54. What factors are included in your simulation software? (check all that apply)	Total	Factors Included	Factors Not Included	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Block Layout and signal System Design	6	5	1	-	-	-	-
Dwell Times based on passenger flow estimates	6	2	4	-	-	-	-
Dwell Times based on previous headway	6	2	4	-	-	-	-
Acceleration and deceleration	6	4	2	-	-	-	-
Other	6	0	6	-	-	-	-

Question	Total	Can Do Alternatives Analysis	Cannot Do Alternatives Analysis	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
55. Can the simulation do alternatives analysis in real-time?	5	3	2	-	-	-	-
56. Who is the simulation software vendor?	5			-	-	-	-

Question	Total	Have Real-Time Information	Do Not Have Real-Time Information	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
57. Do you have a real-time passenger information system on your metro lines? (yes/no) If no, you have completed the survey	28	17	11	Yes	Yes	No	No

58. What type of display is provided to passengers?	Total	Display Provided	Display Not Provided	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Digital signage	17	14	3	Yes	No	-	-
Map/schematic	17	3	14	No	Yes	-	-
Other	17	2	15	No	No	-	-

59. Please describe how your real-time passenger information system accommodates people with disabilities (e.g., illiterate, deaf, blind, physically impaired).	Total	Accommodates	Does Not Accommodate	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
							-
Size of lettering	11	5	6	No	-	-	-
Duration information is displayed	11	8	3	No	-	-	-
Audio announcements	11	11	0	Yes	-	-	-
Other	11	1	10	No	-	-	-

60. What type of service information is routinely provided to passengers? (check all that apply)

	Summary: Total	Information Provided	Information Not Provided	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
							-
Train Name/Number	16	8	8	Yes	Yes	-	-
Minutes to Next Train (real time)	16	11	5	Yes	Yes	-	-
Minutes to Next Train (schedule based)	16	2	14	No	No	-	-
Train Destination	16	15	1	Yes	Yes	-	-
Train Routing	16	8	8	No	No	-	-
Public Service Announcements	16	12	4	Yes	No	-	-
Marketing	16	5	11	No	No	-	-
Train Length	16	6	10	Yes	No	-	-
Other	16	3	13	No	No	-	-

	Total	Minimum Number of Trains	Maximum Number of Trains	Median Number of Trains	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
61. For how many trains in advance is information displayed?	14	1	5	2	2	1	-	-

	Total	Minimum Time	Maximum Time	Median Time	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
62. How often is information updated? (seconds)	14	0	60	0	60	-	-	-

63. Where are displays located? (check all that apply)

	Total	Displays Located	Displays Not Located	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Platforms	16	16	0	Yes	Yes	-	-
Station Lobby/Mezzanine	16	11	5	Yes	Yes	-	-
Outside fare collection area	16	7	9	No	No	-	-
Other	14	1	13	No		-	-

	Total	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
64. How do you determine when to display information about service delays?	14	Train is standing for over 3 minutes	-	-	-

65. What delay information is displayed to passengers?

	Total	Information Displayed	Information Not Displayed	Berlin, Germany	Hong Kong, China (MTR)	Moscow, Russia	New York, New York
Minutes of Projected Delay	15	11	4	No	-	-	-
Cause of Delay	15	10	5	Yes	-	-	-
Suggested Alternative Routes	15	6	9	Yes	-	-	-
Other	15	2	13	No	-	-	-

Appendix C: Automatic Train Supervision Survey Results

	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Baltimore, Maryland	Barcelona, Spain
4. Do you have an Automatic Train Supervision (ATS) system? ATS describes computerized systems that report train location to a central control office. Some ATS systems also adjust individual train performance to maintain schedules.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. What year(s) was your ATS system installed?	1967 1975	1969 1985 1992	1988	1974 1991 1978 1993 1995	1999	1985	1983	1986
6. Describe the extent of your Metro system.								
Number of lines	15	2	3	8	2	1	1	5
Number of stations	375	66	46	159	19	23	14	112
Total route-miles	132.1	71.9	33.0	107.2	10.0	16.9	16.0	50.5
7. Describe the extent of your ATS system.								
Number of lines	15	2	3	8	2	1	1	5
Number of stations	375	66	13	159	19	23	14	112
Total route-miles	132.1	71.9	9.4	107.2	10.0	16.9	16.0	50.5
% of Lines with ATS	100%	100%	100%	100%	100%	100%	100%	100%
% of Stops with ATS	100%	100%	28%	100%	100%	100%	100%	100%
% of Route Miles with ATS	100%	100%	28%	100%	100%	100%	100%	100%
8. Did ATS replace an older system or was it installed for new lines only?	Replaced	Replaced	New	Replaced	New	Replaced	New	Replaced
9. Have there been any problems with older systems working with ATS interfaces in terms of data updates and system maintenance? (yes/no) Please describe in second column.	-	Yes	Yes	No	-	-	No	No
10. How many dispatchers are required during peak periods?	12	21	0	24	2	-	2	5
11. If ATS replaced an older system, were the same dispatchers retained?	-	Yes	-	No	-	-	-	No

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	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Baltimore, Maryland	Barcelona, Spain
12. If ATS replaced an older system, were personnel retrained or transferred? (yes/no) If so, please discuss any problems with the loss of institutional memory (knowledge of the track network and passenger flows) in the second column.	-	Yes	-	Yes	-	-	-	Yes
13. Were new job tasks created as a result of installation of your ATS system?(yes/no)	Yes	No	Yes	Yes	Yes	Yes	No	Yes
14. What new job tasks were added to handle additional responsibilities for the ATS or other system(s) the ATS interfaces with?	Traffic Controller	-	ATS Maintenance, operation and maintenance personnel training	Manual Data Entry	Traffic Regulators and Network Controllers	Line Regulator, Radio Operators	-	Transferring Phone Blocking
15. Describe how correction of headway gaps was done before ATS. (keyword)	Manually	Manually	-	Manually	-	Manually	-	Manually
16. What are the following costs associated with your ATS system?								
Initial Capital Cost	$90,620,000	$110,950,400	-	$7,253,000	$8,211,840	$1,838,235	-	-
Annual Operating Cost	-	$5,516,000	-	$112,548	-	-	-	-
Annual Maintenance Cost	$2,300,960	$803,760	-	$637,772	-	-	-	-
17. Please describe any problems you have experienced with interface of ATS and preexisting systems.	-	-	Incident	-	-	-	-	None
18. Where are work stations located? (Check all that apply)								
Control Center	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Terminal Stations	No	No	Yes	No	No	No	Yes	Yes
Other	No	No	No	No	No	No	No	No
19. What type of backup system or features does your agency employ in case of an emergency?								
New redundant system	Yes	No	-	Yes	No	No	-	Yes
Retained older system	No	Yes	-	No	No	Yes	-	No
Other	Yes	No	-	No	Yes	No	-	No

	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Baltimore, Maryland	Barcelona, Spain
20. Describe the signal technology of lines equipped with ATS.								
Fixed Block	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Moving Block	No	No	No	No	No	No	No	-
Hybrid	No	Yes	No	No	No	No	No	-
Other	No	No	No	No	No	No	No	-
21. Which of the following describe the route selection architecture of lines equipped with ATS? (check all that apply)								
Office Selection (schedule)	Yes	No	-	Yes	Yes	Yes	Yes	No
Office Selection (manual)	Yes	No	-	No	No	No	No	Yes
Office Selection (other)	No	Yes	-	No	No	No	No	No
Field Selection (AVI)	No	Yes	-	Yes	Yes	No	No	No
Field Selection (other)	No	No	-	No	No	No	No	No
Other	No	No	-	No	No	No	No	No
22. Are train yards controlled from the ATS system Control Center?	No	Yes	Yes	No	No	No	No	Yes
23. What type of signal system(s) is used on your ATS-equipped lines? (check all that apply)								
Wayside	Yes	Yes	Yes	No	No	Yes	Yes	Yes
ATC	Yes	No	Yes	Yes	Yes	No	Yes	No
ATO	Yes	No	Yes	Yes	No	No	Yes	Yes
CBTC	No	No	No	No	No	Yes	No	Yes
Other	No	Yes	No	No	No	No	No	No
24. Does your software make any of the following dispatching suggestions (not including automatic control) in real-time? (check all that apply)								
Skip stops	No	-	-	No	No	No	-	Yes
Hold/dwell time extension	Yes	-	-	Yes	Yes	Yes	-	Yes
Short-turn into a service gap	No	-	-	No	No	No	-	No
Offset terminal departure times	Yes	-	-	Yes	Yes	Yes	-	Yes
Alert dispatcher to service gap	Yes	-	-	No	Yes	No	-	Yes
Other	No	-	-	Yes	No	No	-	No

	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Baltimore, Maryland	Barcelona, Spain
25. Does your software take automatic control of any of the following dispatching actions? (check all that apply)								
Speed Control	No	-	Yes	No	No	-	-	Yes
Dwell Time/holding time control	Yes	-	Yes	Yes	Yes	-	-	No
Dwell Time/holding time countdown for crews	No	-	No	Yes	No	-	-	No
Dwell Time/holding lights	No	-	No	No	Yes	-	-	No
Terminal Departure Time Control	No	-	Yes	Yes	Yes	-	-	Yes
Other	No	-	No	No	No	-	-	No
26. Does your software provide any monitoring and/or alarms for operating rule violations?								
Signal	-	-	-	-	No	-	-	Yes
Station	-	-	-	-	Yes	-	-	Yes
Other	-	-	-	-	No	-	-	No
27. If you use software algorithms for dispatching control or suggestion software was it designed internally or externally? If externally, name vendor.	-	-	-	Hitachi, Mitsubishi	Alsthom Transport	AMBER-Greece	-	SAINCO
28. What schedules are included in your ATS system?								
Train Schedules	Yes	Yes	-	Yes	Yes	Yes	-	Yes
Crew Schedules	No	No	-	No	No	No	-	No
Maintenance Schedules	No	No	-	No	Yes	No	-	No
Other	No	No	-	No	No	No	-	No
29. Do you have software which reassigns crews to trains automatically during the service day, or is crew reassignment done manually?	-	Manually	Manually	Manually	Manually	Manually	-	Manually
30. Do crews begin and end their duties at terminals only or also at mid-route locations?	Terminal	Terminal	Terminal	Mid-route	Terminal	Mid-Route	-	Terminal

Appendix C: Automatic Train Supervision Survey Results

	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Baltimore, Maryland	Barcelona, Spain
31. Please list the number of each type of terminal you have in your Metro system.								
Relay	Yes	2	2	-	-	5	-	Yes
1 track stub-end	Yes	4	-	-	-	-	-	-
2 track stub-end	-	2	3	Yes	Yes	3	-	-
3+ track stub-end	-	3	-	Yes	-	1	-	-
Simple loop	Yes	-	-	-	-	-	-	-
Loop with bypass tracks	-	-	-	-	-	-	-	-
Other	Yes	-	-	-	-	-	-	-
38. Are any of the following built or integrated into the ATS workstations? (check all that apply) Please describe in second column.								
Voice communications systems	Yes	Yes	No	No	No	-	-	Yes
CCTV capabilities	No	No	No	Yes	No	-	-	Yes
Video communications systems	No	Yes	No	No	No	-	-	Yes
Public address systems	Yes	Yes	Yes	No	No	-	-	Yes
Scheduling systems	Yes	Yes	No	Yes	Yes	-	-	Yes
Fire protection systems	Yes	No	No	No	No	-	-	Yes
Other	No	No	No	No	No	-	-	No
39. What types of display are available? (check all that apply)								
Workstation monitors	No	No	Yes	Yes	Yes	Yes	-	No
Overhead screens	Yes	Yes	No	No	No	No	-	No
Other	No	No	No	Yes	Yes	Yes	-	No
40. Do you have a database where train movement data and other data are recorded? (yes/no) If no, please skip to question 46	Yes	Yes	Yes	Yes	Yes	No	-	Yes
41. How long do you store data? (Days)	30	30	5	365	30	-		15
42. What department is responsible for analyzing this data?	Metro Operations	Operating	Centralized Control of the Operation	Transportation Bureau & Electricity Department	Operations	-	-	Supervision

	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Baltimore, Maryland	Barcelona, Spain
43. How many analysts are needed for analyzing this data?	2	2	8	Varies	-	-	-	1
44. What kind of analyses are done with this data? (check all that apply)								
Time-Space Diagrams	Yes	Yes	Yes	No	Yes	-	-	Yes
Terminal Departure-time	Yes	Yes	Yes	No	Yes	-	-	Yes
Mid-route On-time	No	Yes	Yes	No	Yes	-	-	No
Headway Regularity	Yes	Yes	Yes	No	Yes	-	-	Yes
Running Time	Yes	Yes	No	No	Yes	-	-	Yes
Delays	Yes	Yes	Yes	No	Yes	-	-	Yes
Dwell Time	Yes	Yes	Yes	No	Yes	-	-	Yes
Recovery Time	Yes	No	No	No	Yes	-	-	Yes
Disruption Recovery	Yes	No	No	No	No	-	-	Yes
Other	No	No	No	No	No	-	-	No
45. Has ATS data allowed you to create more efficient schedules and better utilize train resources than before? (yes/no) If yes, please describe how in 2nd column	Yes	No	Yes	Yes	Yes	-	-	Yes
46. Has ATS enabled you to do the following better? (check all that apply) please describe in 2nd column.								
More Quickly Identify Service Delays	Yes	Yes	-	Yes	Yes	No	-	Yes
Reduce the Impact of Delays	Yes	Yes	-	No	Yes	No	-	Yes
Shorten the Duration of Delays	Yes	Yes	-	Yes	Yes	Yes	-	Yes
Other	No	No	-	No	No	No	-	No
47. If you have Automatic Vehicle Identification (AVI) devices what is the spacing?	-	Located at the exit of each operating siding	In the Platform	No	2 kms	1 block	-	Yes
48. Do AVI devices transmit maintenance diagnostic information? If yes, please indicate if transmission of information is over-the-air, landline or another method in 2nd column.	-	Yes	No	-	No	No	Yes	Yes
49. If you have on-line maintenance diagnostic devices are they integrated with your ATS system? If yes, please describe how in 2nd column.	-	No	No	Yes	No	-	No	No

Appendix C: Automatic Train Supervision Survey Results

	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Baltimore, Maryland	Barcelona, Spain
50. If ATS replaced an older system, how has your reliability changed (e.g. 5% increase in regularity)?	-	-	-	90%	-	-	-	90%
51. Does your ATS system record audio communications of dispatchers and crews	Yes	Yes	No	Yes	No	Yes	-	Yes
52. Is there a playback feature (audio and/or graphical) for accident or delay investigations (yes/no)? Please describe in 2nd column	Yes	Yes	Yes	-	No	Yes	-	Yes
53. Does your ATS system include a model to simulate train operations? (yes/no) If no, go to question 57	No	No	No	Yes	Yes	No	-	Yes
54. What factors are included in your simulation software? (check all that apply)								
Block Layout and signal System Design	-	-	-	No	Yes	-	-	Yes
Dwell Times based on passenger flow estimates	-	-	-	Yes	No	-	-	No
Dwell Times based on previous headway	-	-	-	Yes	No	-	-	No
Acceleration and deceleration	-	-	-	Yes	Yes	-	-	Yes
Other	-	-	-	No	No	-	-	No
55. Can the simulation do alternatives analysis in real-time?	-	-	-	Yes	No	-	-	Yes
56. Who is the simulation software vendor?	-	-	-	Hitachi	Alsthom	-	-	SAINCO
57. Do you have a real-time passenger information system on your metro lines? (yes/no) If no, you have completed the survey	Yes	Yes	Yes	Yes	No	No	-	Yes
58. What type of display is provided to passengers?								
Digital signage	Yes	Yes	Yes	Yes	-	-	-	Yes
Map/schematic	No	No	No	Yes	-	-	-	No
Other	Yes	No	No	No	-	-	-	No
59. Please describe how your real-time passenger information system accommodates people with disabilities (e.g., illiterate, deaf, blind, physically impaired).								
Size of lettering	Yes	Yes	Yes	No	-	-	-	No
Duration information is displayed	Yes	Yes	Yes	No	-	-	-	Yes
Audio announcements	Yes	Yes	Yes	Yes	-	-	-	Yes
Other	No	No	No	Yes	-	-	-	No

Appendix C: Automatic Train Supervision Survey Results

	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)	Baltimore, Maryland	Barcelona, Spain
60. What type of service information is routinely provided to passengers? (check all that apply)								
Train Name/Number	Yes	Yes	No	No	-	-	-	Yes
Minutes to Next Train (real time)	Yes	Yes	No	No	-	-	-	Yes
Minutes to Next Train (schedule based)	No	No	No	No	-	-	-	No
Train Destination	Yes	Yes	Yes	Yes	-	-	-	No
Train Routing	Yes	Yes	No	No	-	-	-	No
Public Service Announcements	Yes	Yes	Yes	Yes	-	-	-	No
Marketing	No	No	Yes	No	-	-	-	No
Train Length	No	Yes	No	No	-	-	-	No
Other	No	No	Yes	No	-	-	-	No
61. For how many trains in advance is information displayed?	2	5	1	2	-	-	-	1
62. How often is information updated? (seconds)	0	0	0	0	-	-	-	0
63. Where are displays located? (check all that apply)								
Platforms	Yes	Yes	Yes	Yes	-	-	-	Yes
Station Lobby/Mezzanine	Yes	Yes	Yes	No	-	-	-	No
Outside fare collection area	Yes	Yes	No	Yes	-	-	-	No
Other	No	Yes	No	No	-	-	-	No
64. How do you determine when to display information about service delays?	If long probable delay	Twice the normal headway gap	Consider delay length & gravity of situation	-	-	-	-	Notify when next train is delayed
65. What delay information is displayed to passengers?								
Minutes of Projected Delay	Yes	Yes	No	-	-	-	-	No
Cause of Delay	Yes	Yes	Yes	-	-	-	-	Yes
Suggested Alternative Routes	Yes	Yes	No	-	-	-	-	Yes
Other	No	No	No	-	-	-	-	No

Appendix C: Automatic Train Supervision Survey Results

	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California	Miami, Florida	Milan, Italy	Montreal, Canada	Nagoya, Japan
4. Do you have an Automatic Train Supervision (ATS) system? ATS describes computerized systems that report train location to a central control office. Some ATS systems also adjust individual train performance to maintain schedules.	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No
5. What year(s) was your ATS system installed?	1998	-	1992 1983	-	1989	1986	1993	1967	-
6. Describe the extent of your Metro system.									
Number of lines	5	-	3	-	3	3	3	4	-
Number of stations	132	-	97	-	50	21	84	65	-
Total route-miles	63.6	-	63.1	-	118	4.4	41.6	39.0	-
7. Describe the extent of your ATS system.									
Number of lines	3	-	2	-	3	3	1	4	-
Number of stations	112	-	51	-	50	21	11	65	-
Total route-miles	55.1	-	28.0	-	110	4.4	6.8	39.0	-
% of Lines with ATS	60%	-	67%	-	100%	100%	33%	100%	-
% of Stops with ATS	85%	-	53%	-	100%	100%	13%	100%	-
% of Route Miles with ATS	87%	-	44%	-	93%	100%	16%	100%	-
8. Did ATS replace an older system or was it installed for new lines only?	Replaced	-	Replaced	-	Replaced	New	New	New	-
9. Have there been any problems with older systems working with ATS interfaces in terms of data updates and system maintenance? (yes/no) Please describe in second column.	Yes	-	-	-	Yes	-	No	No	-
10. How many dispatchers are required during peak periods?	6	-	2	-	5	3	2	6	-
11. If ATS replaced an older system, were the same dispatchers retained?	Yes	-	-	-	Yes	-	-	No	-

	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California	Miami, Florida	Milan, Italy	Montreal, Canada	Nagoya, Japan
12. If ATS replaced an older system, were personnel retrained or transferred? (yes/no) If so, please discuss any problems with the loss of institutional memory (knowledge of the track network and passenger flows) in the second column.	Yes	-	-	-	Yes	-	-	No	-
13. Were new job tasks created as a result of installation of your ATS system?(yes/no)	Yes	-	No	-	Yes	-	-	No	-
14. What new job tasks were added to handle additional responsibilities for the ATS or other system(s) the ATS interfaces with?	Maintenance engineers	-	-	-	Analysts	-	-	-	-
15. Describe how correction of headway gaps was done before ATS. (keyword)	Manually	-	Manually	-	Manually	-	-	Manually	-
16. What are the following costs associated with your ATS system?									
Initial Capital Cost	-	-	$8,039,340	-	$4,000,000	-	-	-	-
Annual Operating Cost	-	-	$381,074	-	-	-	-	-	-
Annual Maintenance Cost	-	-	$510,521	-	-	-	-	-	-
17. Please describe any problems you have experienced with interface of ATS and preexisting systems.	Scheduling, Incident	-	-	-	Other	-	-	-	-
18. Where are work stations located? (Check all that apply)									
Control Center	Yes	-	Yes	-	Yes	Yes	Yes	Yes	-
Terminal Stations	No	-	No	-	No	Yes	Yes	No	-
Other	Yes	-	No	-	No	No	No	No	-
19. What type of backup system or features does your agency employ in case of an emergency?									
New redundant system	Yes	-	No	-	No	-	No	Yes	-
Retained older system	No	-	No	-	No	-	Yes	No	-
Other	No	-	Yes	-	Yes	-	No	No	-

Appendix C: Automatic Train Supervision Survey Results

	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California	Miami, Florida	Milan, Italy	Montreal, Canada	Nagoya, Japan
20. Describe the signal technology of lines equipped with ATS.									
Fixed Block	Yes	-	Yes	-	-	Yes	Yes	Yes	-
Moving Block	No	-	No	-	-	No	No	No	-
Hybrid	No	-	No	-	-	No	No	No	-
Other	No	-	No	-	-	No	No	No	-
21. Which of the following describe the route selection architecture of lines equipped with ATS? (check all that apply)									
Office Selection (schedule)	Yes	-	Yes	-	No	Yes	Yes	Yes	-
Office Selection (manual)	Yes	-	Yes	-	Yes	Yes	No	Yes	-
Office Selection (other)	No	-	No	-	No	No	No	No	-
Field Selection (AVI)	Yes	-	No	-	Yes	No	No	No	-
Field Selection (other)	Yes	-	No	-	No	No	No	No	-
Other	No	-	No	-	No	No	No	No	-
22. Are train yards controlled from the ATS system Control Center?	No	-	Yes	-	-	Yes	No	Yes	-
23. What type of signal system(s) is used on your ATS-equipped lines? (check all that apply)									
Wayside	Yes	-	Yes	-	Yes	Yes	Yes	No	-
ATC	Yes	-	Yes	-	Yes	Yes	Yes	Yes	-
ATO	Yes	-	No	-	No	Yes	Yes	No	-
CBTC	No	-	No	-	No	No	No	No	-
Other	No	-	No	-	No	Yes	No	No	-
24. Does your software make any of the following dispatching suggestions (not including automatic control) in real-time? (check all that apply)									
Skip stops	No	-	No	-	-	No	No	No	-
Hold/dwell time extension	No	-	Yes	-	-	Yes	Yes	Yes	-
Short-turn into a service gap	No	-	No	-	-	No	No	No	-
Offset terminal departure times	No	-	No	-	-	No	No	Yes	-
Alert dispatcher to service gap	No	-	No	-	-	No	Yes	Yes	-
Other	No	-	No	-	-	No	No	No	-

	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California	Miami, Florida	Milan, Italy	Montreal, Canada	Nagoya, Japan
25. Does your software take automatic control of any of the following dispatching actions? (check all that apply)									
Speed Control	No	-	-	-	-	Yes	No	No	-
Dwell Time/holding time control	No	-	-	-	-	No	Yes	Yes	-
Dwell Time/holding time countdown for crews	No	-	-	-	-	No	No	No	-
Dwell Time/holding lights	No	-	-	-	-	No	No	Yes	-
Terminal Departure Time Control	Yes	-	-	-	-	No	Yes	Yes	-
Other	No	-	-	-	-	Yes	No	No	-
26. Does your software provide any monitoring and/or alarms for operating rule violations?									
Signal	No	-	-	-	Yes	-	-	Yes	-
Station	No	-	-	-	No	-	-	No	-
Other	No	-	-	-	No	-	-	No	-
27. If you use software algorithms for dispatching control or suggestion software was it designed internally or externally? If externally, name vendor.	Massachusets Institute of Technology	-	-	-	Sesica	ADTRANZ	SIEMENS, ALCATEL-SEL, ABB	SODETEG	-
28. What schedules are included in your ATS system?									
Train Schedules	Yes	-	Yes	-	-	-	Yes	Yes	-
Crew Schedules	Yes	-	No	-	-	-	No	No	-
Maintenance Schedules	No	-	No	-	-	-	No	No	-
Other	No	-	No	-	-	-	No	No	-
29. Do you have software which reassigns crews to trains automatically during the service day, or is crew reassignment done manually?	Manually	-	Manually	-	Manually	-	Manually	Manually	-
30. Do crews begin and end their duties at terminals only or also at mid-route locations?	Mid-Route	-	Mid-Route	-	Mid-Route	-	Mid-route	Mid-Route	-

Appendix C: Automatic Train Supervision Survey Results

	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California	Miami, Florida	Milan, Italy	Montreal, Canada	Nagoya, Japan
31. Please list the number of each type of terminal you have in your Metro system.									
Relay	2	-	1	-	2	-	Yes	Yes	-
1 track stub-end	1	-	0	-	-	-	-	-	-
2 track stub-end	4	-	21	-	2	-	Yes	-	-
3+ track stub-end	0	-	0	-	1	-	-	-	-
Simple loop	2	-	0	-	-	Yes	-	-	-
Loop with bypass tracks	5	-	0	-	1	-	-	-	-
Other	-	-	0	-	-	-	-	-	-
38. Are any of the following built or integrated into the ATS workstations? (check all that apply) Please describe in second column.									
Voice communications systems	Yes	-	-	-	Yes	Yes	No	No	-
CCTV capabilities	Yes	-	-	-	No	Yes	No	No	-
Video communications systems	No	-	-	-	No	Yes	No	No	-
Public address systems	Yes	-	-	-	Yes	Yes	No	Yes	-
Scheduling systems	Yes	-	-	-	No	No	Yes	Yes	-
Fire protection systems	Yes	-	-	-	Yes	Yes	No	Yes	-
Other	Yes	-	-	-	No	No	No	No	-
39. What types of display are available? (check all that apply)									
Workstation monitors	Yes	-	Yes	-	Yes	No	Yes	Yes	-
Overhead screens	Yes	-	No	-	No	No	No	Yes	-
Other	No	-	No	-	Yes	Yes	No	No	-
40. Do you have a database where train movement data and other data are recorded? (yes/no) If no, please skip to question 46	Yes	-	Yes	-	Yes	No	Yes	Yes	-
41. How long do you store data? (Days)	365	-	183	-	90	-	183	365	-
42. What department is responsible for analyzing this data?	Operations, Signal Division and Information Technology	-	Metro Operations	-	Rail Operations	-	Operation Maintenance	Engineering	-

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	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California	Miami, Florida	Milan, Italy	Montreal, Canada	Nagoya, Japan
43. How many analysts are needed for analyzing this data?	0	-	1	-	2	-	-	-	-
44. What kind of analyses are done with this data? (check all that apply)									
Time-Space Diagrams	No	-	No	-	No	-	Yes	No	-
Terminal Departure-time	Yes	-	Yes	-	Yes	-	Yes	Yes	-
Mid-route On-time	Yes	-	Yes	-	Yes	-	No	Yes	-
Headway Regularity	Yes	-	No	-	Yes	-	Yes	Yes	-
Running Time	Yes	-	No	-	No	-	Yes	Yes	-
Delays	Yes	-	Yes	-	No	-	Yes	Yes	-
Dwell Time	Yes	-	No	-	No	-	Yes	Yes	-
Recovery Time	Yes	-	No	-	No	-	Yes	Yes	-
Disruption Recovery	Yes	-	No	-	No	-	No	No	-
Other	Yes	-	No	-	No	-	No	No	-
45. Has ATS data allowed you to create more efficient schedules and better utilize train resources than before? (yes/no) If yes, please describe how in 2nd column	Yes	-	No	-	No		No	-	-
46. Has ATS enabled you to do the following better? (check all that apply) please describe in 2nd column.									
More Quickly Identify Service Delays	Yes	-	Yes	-	-	-	Yes	No	-
Reduce the Impact of Delays	Yes	-	Yes	-	-	-	No	Yes	-
Shorten the Duration of Delays	Yes	-	Yes	-	-	-	No	No	-
Other	No	-	No	-	-	-	No	No	-
47. If you have Automatic Vehicle Identification (AVI) devices what is the spacing?	Irregular	-	-	-	1 line	-	-	-	-
48. Do AVI devices transmit maintenance diagnostic information? If yes, please indicate if transmission of information is over-the-air, landline or another method in 2nd column.	-	No	-	No	-	-	-	-	-
49. If you have on-line maintenance diagnostic devices are they integrated with your ATS system? If yes, please describe how in 2nd column.	-	No	-	No	-	Yes	-	-	No

	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California	Miami, Florida	Milan, Italy	Montreal, Canada	Nagoya, Japan
50. If ATS replaced an older system, how has your reliability changed (e.g. 5% increase in regularity)?	-	-	-	-	No	-	-	-	-
51. Does your ATS system record audio communications of dispatchers and crews	Yes	-	No	-	Yes	-	-	No	-
52. Is there a playback feature (audio and/or graphical) for accident or delay investigations (yes/no)? Please describe in 2nd column	Yes	-	No	-	Yes	Yes	No	Yes	-
53. Does your ATS system include a model to simulate train operations? (yes/no) If no, go to question 57	No	-	No	-	Yes	No	No	No	-
54. What factors are included in your simulation software? (check all that apply)									
Block Layout and signal System Design	-	-	-	-	Yes	-	-	-	-
Dwell Times based on passenger flow estimates	-	-	-	-	No	-	-	-	-
Dwell Times based on previous headway	-	-	-	-	No	-	-	-	-
Acceleration and deceleration	-	-	-	-	No	-	-	-	-
Other	-	-	-	-	No	-	-	-	-
55. Can the simulation do alternatives analysis in real-time?	-	-	-	-	-	-	-	-	-
56. Who is the simulation software vendor?	-	-	-	-	-	-	-	-	-
57. Do you have a real-time passenger information system on your metro lines? (yes/no) If no, you have completed the survey	Yes	No	Yes	Yes	Yes	No	Yes	No	No
58. What type of display is provided to passengers?									
Digital signage	Yes	-	Yes	No	Yes	-	Yes	-	-
Map/schematic	No	-	No	No	No	-	No	-	-
Other	No	-	No	Yes	No	-	No	-	-
59. Please describe how your real-time passenger information system accommodates people with disabilities (e.g., illiterate, deaf, blind, physically impaired).									
Size of lettering	No	-	-	No	Yes	-	-	-	-
Duration information is displayed	No	-	-	Yes	Yes	-	-	-	-
Audio announcements	Yes	-	-	Yes	Yes	-	-	-	-
Other	No	-	-	No	No	-	-	-	-

	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California	Miami, Florida	Milan, Italy	Montreal, Canada	Nagoya, Japan
60. What type of service information is routinely provided to passengers? (check all that apply)									
Train Name/Number	Yes	-	Yes	No	No	-	No	-	-
Minutes to Next Train (real time)	Yes	-	Yes	No	No	-	Yes	-	-
Minutes to Next Train (schedule based)	No	-	No	No	No	-	No	-	-
Train Destination	Yes	-	Yes	Yes	Yes	-	Yes	-	-
Train Routing	Yes	-	No	Yes	No	-	No	-	-
Public Service Announcements	Yes	-	Yes	Yes	Yes	-	No	-	-
Marketing	Yes	-	Yes	Yes	No	-	No	-	-
Train Length	Yes	-	Yes	No	No	-	Yes	-	-
Other	No	-	No	No	No	-	No	-	-
61. For how many trains in advance is information displayed?	2	-	1	-	-	-	2	-	-
62. How often is information updated? (seconds)	-	-	60	0	As required	-	30	-	-
63. Where are displays located? (check all that apply)									
Platforms	Yes	-	Yes	Yes	Yes	-	Yes	-	-
Station Lobby/Mezzanine	No	-	Yes	No	Yes	-	No	-	-
Outside fare collection area	Yes	-	Yes	No	Yes	-	No	-	-
Other	No	-	No	No	-	-	No	-	-
64. How do you determine when to display information about service delays?	As delays occur	-	Service stopage	Trainmaster judgement	From control center	-	Delay over 10 minutes	-	-
65. What delay information is displayed to passengers?									
Minutes of Projected Delay	Yes	-	Yes	Yes	Yes	-	Yes	-	-
Cause of Delay	Yes	-	No	Yes	Yes	-	No	-	-
Suggested Alternative Routes	No	-	Yes	No	No	-	No	-	-
Other	No	-	No	No	No	-	No	-	-

Appendix C: Automatic Train Supervision Survey Results

	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Osaka, Japan	Sydney, Australia
4. Do you have an Automatic Train Supervision (ATS) system? ATS describes computerized systems that report train location to a central control office. Some ATS systems also adjust individual train performance to maintain schedules.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
5. What year(s) was your ATS system installed?	1996	1997	1987	1993	1975	1998	1997	-
6. Describe the extent of your Metro system.								
Number of lines	3	3	4	3	5	1	1	-
Number of stations	51	52	48	69	82	13	7	-
Total route-miles	31.3	25.0	51.9	105.3	96.6	20.9	7.8	-
7. Describe the extent of your ATS system.								
Number of lines	3	3	4	3	5	1	1	-
Number of stations	51	52	48	69	82	13	7	-
Total route-miles	31.3	25.0	51.9	105.3	96.6	20.9	7.8	-
% of Lines with ATS	100%	100%	100%	100%	100%	100%	100%	-
% of Stops with ATS	100%	100%	100%	100%	100%	100%	100%	-
% of Route Miles with ATS	100%	100%	100%	100%	100%	100%	100%	-
8. Did ATS replace an older system or was it installed for new lines only?	Replaced	Replaced	Replaced	Replaced	New	Replaced	Replaced	-
9. Have there been any problems with older systems working with ATS interfaces in terms of data updates and system maintenance? (yes/no) Please describe in second column.	Yes	No	No	No	No	No	No	-
10. How many dispatchers are required during peak periods?	4	12	4	3	6	1	Varies	-
11. If ATS replaced an older system, were the same dispatchers retained?	Yes	Yes	Yes	Yes	-	No	No	-

Appendix C: Automatic Train Supervision Survey Results

Question	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Osaka, Japan	Sydney, Australia
12. If ATS replaced an older system, were personnel retrained or transferred? (yes/no) If so, please discuss any problems with the loss of institutional memory (knowledge of the track network and passenger flows) in the second column.	Yes	Yes	Yes	Yes	-	Yes	Yes	-
13. Were new job tasks created as a result of installation of your ATS system?(yes/no)	Yes	No	Yes	No	-	Yes	No	-
14. What new job tasks were added to handle additional responsibilities for the ATS or other system(s) the ATS interfaces with?	Computer Technicians, Systems Analyst	-	Enhanced Functionalities	-	-	More Data Analysis Needed	-	-
15. Describe how correction of headway gaps was done before ATS. (keyword)	Manually	-	Manually	Manually	-	Manually	-	-
16. What are the following costs associated with your ATS system?								
Initial Capital Cost	$1,820,500	$50,000,000	$33,000,000	$777,000	-	$142,010,000	-	-
Annual Operating Cost	$125,550	-	-	-	-	$12,820,000	-	-
Annual Maintenance Cost	$25,110	-	-	$6,798	-	$2,564,000	-	-
17. Please describe any problems you have experienced with interface of ATS and preexisting systems.	-	Other	-	-	-	Incident	-	-
18. Where are work stations located? (Check all that apply)								
Control Center	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Terminal Stations	No	Yes	No	No	Yes	Yes	Yes	-
Other	No	Yes	Yes	No	No	Yes	No	-
19. What type of backup system or features does your agency employ in case of an emergency?								
New redundant system	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Retained older system	No	No	No	No	No	No	-	-
Other	No	Yes	No	No	No	No	-	-

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	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Osaka, Japan	Sydney, Australia
20. Describe the signal technology of lines equipped with ATS.								
Fixed Block	Yes	No	Yes	Yes	Yes	Yes	Yes	-
Moving Block	No	No	No	No	No	No	No	-
Hybrid	No	Yes	No	No	No	No	No	-
Other	No		No	No	No	No	No	-
21. Which of the following describe the route selection architecture of lines equipped with ATS? (check all that apply)								
Office Selection (schedule)	Yes	Yes	Yes	No	Yes	Yes	Yes	-
Office Selection (manual)	No	Yes	No	Yes	No	Yes	No	-
Office Selection (other)	No	No	No	Yes	No	No	No	-
Field Selection (AVI)	No	No	No	No	No	No	No	-
Field Selection (other)	No	No	No	No	Yes	No	No	-
Other	No	No	No	No	No	No	No	-
22. Are train yards controlled from the ATS system Control Center?	No	No	Yes	No	No	No	No	-
23. What type of signal system(s) is used on your ATS-equipped lines? (check all that apply)								
Wayside	Yes	No	No	Yes	Yes	Yes	Yes	-
ATC	No	Yes	Yes	No	Yes	No	Yes	-
ATO	Yes	No	No	Yes	Yes	No	No	-
CBTC	No	No	No	No	No	Yes	No	-
Other	No	No	No	No	Yes	No	No	-
24. Does your software make any of the following dispatching suggestions (not including automatic control) in real-time? (check all that apply)								
Skip stops	No	No	No	No	-	-	No	-
Hold/dwell time extension	No	Yes	Yes	Yes	-	-	No	-
Short-turn into a service gap	No	Yes	No	No	-	-	Yes	-
Offset terminal departure times	No	Yes	Yes	Yes	-	-	No	-
Alert dispatcher to service gap	Yes	Yes	Yes	No	-	-	No	-
Other	No	No	No	No	-	-	No	-

Appendix C: Automatic Train Supervision Survey Results

	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Osaka, Japan	Sydney, Australia
25. Does your software take automatic control of any of the following dispatching actions? (check all that apply)								
Speed Control	No	Yes	Yes	No	Yes	Yes	-	-
Dwell Time/holding time control	No	Yes	Yes	No	Yes	Yes	-	-
Dwell Time/holding time countdown for crews	No	No	Yes	No	Yes	Yes	-	-
Dwell Time/holding lights	No	No	Yes	No	No	Yes	-	-
Terminal Departure Time Control	Yes	Yes	Yes	Yes	No	Yes	-	-
Other	No	Yes	No	No	No	No	-	-
26. Does your software provide any monitoring and/or alarms for operating rule violations?								
Signal	Yes	Yes	No	-	Yes	Yes	Yes	-
Station	Yes	Yes	Yes	-	No	No	Yes	-
Other	No	Yes	No	-	No	No	No	-
27. If you use software algorithms for dispatching control or suggestion software was it designed internally or externally? If externally, name vendor.	UniControls	SYSECA-France	Turnkey ATS Upgrade Project	LKSK Signals	BDM	Vision	-	-
28. What schedules are included in your ATS system?								
Train Schedules	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Crew Schedules	No	No	No	No	No	No	No	-
Maintenance Schedules	No	Yes	Yes	No	No	No	No	-
Other	No	No	No	No	No	No	No	-
29. Do you have software which reassigns crews to trains automatically during the service day, or is crew reassignment done manually?	Manually	Manually	Manually	Manually	Manually	Manually	-	-
30. Do crews begin and end their duties at terminals only or also at mid-route locations?	Mid-Route	Terminal	Mid-route	Mid-Route	Terminal	-	Mid-Route	-

Appendix C: Automatic Train Supervision Survey Results

	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Osaka, Japan	Sydney, Australia
31. Please list the number of each type of terminal you have in your Metro system.								
Relay	15	6	1	-	Yes	1	Yes	-
1 track stub-end	1	-	3	-	-	1	-	-
2 track stub-end	-	-	-	Yes	-	1	-	-
3+ track stub-end	-	-	-	-	-	1	-	-
Simple loop	-	9	-	-	-	-	-	-
Loop with bypass tracks	-	3	-	-	-	1	-	-
Other	-	-	-	-	-	-	-	-
38. Are any of the following built or integrated into the ATS workstations? (check all that apply) Please describe in second column.								
Voice communications systems	Yes	-	No	-	Yes	Yes	Yes	-
CCTV capabilities	Yes	-	No	-	Yes	Yes	No	-
Video communications systems	No	-	No	-	Yes	No	No	-
Public address systems	Yes	-	No	-	Yes	Yes	No	-
Scheduling systems	Yes	-	Yes	-	Yes	Yes	Yes	-
Fire protection systems	Yes	-	No	-	Yes	No	No	-
Other	No	-	No	-	No	No	No	-
39. What types of display are available? (check all that apply)								
Workstation monitors	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Overhead screens	Yes	Yes	Yes	No	Yes	No	-	-
Other	No	No	No	No	No	No	-	-
40. Do you have a database where train movement data and other data are recorded? (yes/no) If no, please skip to question 46	Yes	Yes	Yes	Yes	Yes	Yes	No	-
41. How long do you store data? (Days)	365	365	30	365	30	30	-	-
42. What department is responsible for analyzing this data?	Operational Inspection	Planning Operations	Signals/Traffic	Transportation	ATC Engineering and Rail Transportation	Signal Unit	-	-

Appendix C: Automatic Train Supervision Survey Results

	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Osaka, Japan	Sydney, Australia
43. How many analysts are needed for analyzing this data?	3	2	-	1	4	5	-	-
44. What kind of analyses are done with this data? (check all that apply)								
Time-Space Diagrams	Yes	Yes	No	No	Yes	Yes	-	-
Terminal Departure-time	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Mid-route On-time	No	Yes	Yes	No	Yes	No	-	-
Headway Regularity	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Running Time	No	Yes	Yes	No	Yes	Yes	-	-
Delays	Yes	Yes	Yes	No	Yes	Yes	-	-
Dwell Time	Yes	Yes	Yes	No	Yes	Yes	-	-
Recovery Time	No	Yes	Yes	No	Yes	Yes	-	-
Disruption Recovery	Yes	Yes	Yes	No	Yes	Yes	-	-
Other	No	No	No	No	No	No	-	-
45. Has ATS data allowed you to create more efficient schedules and better utilize train resources than before? (yes/no) If yes, please describe how in 2nd column	No	Yes	Yes	No	Yes	Yes	-	-
46. Has ATS enabled you to do the following better? (check all that apply) please describe in 2nd column.								
More Quickly Identify Service Delays	Yes	Yes	Yes	-	Yes	Yes	-	-
Reduce the Impact of Delays	Yes	Yes	Yes	-	Yes	No	-	-
Shorten the Duration of Delays	Yes	Yes	No	-	Yes	No	-	-
Other	No	No	No	-	No	No	-	-
47. If you have Automatic Vehicle Identification (AVI) devices what is the spacing?	-	Identified Manually when it enters line	-	-	-	-	-	-
48. Do AVI devices transmit maintenance diagnostic information? If yes, please indicate if transmission of information is over-the-air, landline or another method in 2nd column.	Landline	No	-	-	-	-	-	-
49. If you have on-line maintenance diagnostic devices are they integrated with your ATS system? If yes, please describe how in 2nd column.	No	Yes	No	-	-	-	-	-

Appendix C: Automatic Train Supervision Survey Results

	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Osaka, Japan	Sydney, Australia
50. If ATS replaced an older system, how has your reliability changed (e.g. 5% increase in regularity)?	30%	-	-	5%	-	50%	-	-
51. Does your ATS system record audio communications of dispatchers and crews	Yes	No	No	No	Yes	Yes	-	-
52. Is there a playback feature (audio and/or graphical) for accident or delay investigations (yes/no)? Please describe in 2nd column	Yes	Yes	No	No	Yes	Yes	-	-
53. Does your ATS system include a model to simulate train operations? (yes/no) If no, go to question 57	No	No	Yes	No	Yes	Yes	No	-
54. What factors are included in your simulation software? (check all that apply)								
Block Layout and signal System Design	-	-	Yes	-	-	Yes	-	-
Dwell Times based on passenger flow estimates	-	-	No	-	-	Yes	-	-
Dwell Times based on previous headway	-	-	No	-	-	Yes	-	-
Acceleration and deceleration	-	-	No	-	-	Yes	-	-
Other	-	-	No	-	-	No	-	-
55. Can the simulation do alternatives analysis in real-time?	-	-	No	-	-	Yes	-	-
56. Who is the simulation software vendor?	-	-	-	-	BDM	Alstom (Siu)	-	-
57. Do you have a real-time passenger information system on your metro lines? (yes/no) If no, you have completed the survey	No	No	Yes	No	Yes	Yes	Yes	Yes
58. What type of display is provided to passengers?								
Digital signage	-	-	No	-	Yes	Yes	Yes	Yes
Map/schematic	-	-	Yes	-	No	No	No	No
Other	-	-	No	-	No	No	No	No
59. Please describe how your real-time passenger information system accommodates people with disabilities (e.g., illiterate, deaf, blind, physically impaired).								
Size of lettering	-	-	-	-	Yes	-	-	No
Duration information is displayed	-	-	-	-	Yes	-	-	Yes
Audio announcements	-	-	-	-	Yes	-	-	Yes
Other	-	-	-	-	No	-	-	No

	Prague, Czech Republic	Santiago, Chile	Singapore	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Osaka, Japan	Sydney, Australia
60. What type of service information is routinely provided to passengers? (check all that apply)								
Train Name/Number	-	-	-	-	No	No	No	Yes
Minutes to Next Train (real time)	-	-	-	-	Yes	Yes	No	Yes
Minutes to Next Train (schedule based)	-	-	-	-	No	Yes	No	Yes
Train Destination	-	-	-	-	Yes	Yes	Yes	Yes
Train Routing	-	-	-	-	Yes	Yes	Yes	Yes
Public Service Announcements	-	-	-	-	Yes	Yes	No	Yes
Marketing	-	-	-	-	No	No	No	Yes
Train Length	-	-	-	-	No	No	No	Yes
Other	-	-	-	-	Yes	No	No	Yes
61. For how many trains in advance is information displayed?	-	-	-	-	1	2	2	3
62. How often is information updated? (seconds)	-	-	-	-	60	0	1	0
63. Where are displays located? (check all that apply)								
Platforms	-	-	-	-	Yes	Yes	Yes	Yes
Station Lobby/Mezzanine	-	-	-	-	Yes	Yes	Yes	Yes
Outside fare collection area	-	-	-	-	No	No	No	Yes
Other	-	-	-	-	No	No	No	-
64. How do you determine when to display information about service delays?	-	-	-	-	Delay over one headway, usually after 6 min.	System determines (manually assigns)	Varies	Updated constantly/real-time information
65. What delay information is displayed to passengers?								
Minutes of Projected Delay	-	-	No	-	Yes	Yes	Yes	Yes
Cause of Delay	-	-	No	-	No	Yes	No	Yes
Suggested Alternative Routes	-	-	No	-	No	No	No	Yes
Other	-	-	Yes	-	No	No	No	Yes

Appendix D: Station Personnel Survey Results

	Summary: Number of Agency Responses				Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
4. How many stations does your metro have? (Count transfer stations as two or more stations, based on the number of lines)	**Total**	**Minimum Number of Stations**	**Maximum Number of Stations**	**Median Number of Stations**				
	32	7	470	68	191	43	277	162

5. How does your agency provide the following functions? (Agency staff, outside contractor, a combination of agency and contractor staff, or not provided)	Total	Agency Staffed	Contractor Staffed	Agency and Contractor Staffed	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Ticket Sales	31	18	2	11	Agency	Combination	-	Agency
Fare Inspectors	25	22	2	1	Combination	Agency	Agency	Agency
Customer Assistance	32	27	0	5	Agency	Agency	Agency	Agency
Cleaning	31	6	21	4	Contractor	Contractor	Contractor	Combination
Maintenance	32	14	5	13	Combination	Combination	Contractor	Combination
Elevator/ Escalator Operators	20	11	6	3	Combination	Agency	-	Agency
Supervision	30	30	0	0	Agency	Agency	Agency	Agency
Agency Police	25	12	4	4	Combination	Government	Agency	Contractor
Other Security	25	12	8	4	Combination	Combination	Agency	Combination
Assisting Train Crews	27	27	0	0	Agency	Agency	Agency	Agency
Other (Example: Garden management)	6	1	4	1	-	-	-	

6. Systemwide, how many staff work in metro stations in the following functions? (Please indicate full-time staff in the 1st column and part-time staff in the 2nd column)	Total	# With this Type of Staff	Minimum Number of Staff	Maximum Number of Staff	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Full Time Total Staff	29	28	0	30,090	4,036	2,729	6,750	30,090
Part Time Total Staff	18	10	0	474	-	0	-	-
Ticket Sales	28	24	0	4,200	130	1,258	-	2,860
Fare Inspectors	29	15	0	1,642	670	0	400	1,642
Customer Assistance	29	19	0	4,000	1,369	0	4,000	0
Cleaning	28	16	0	1,994	0	592	-	1,994
Maintenance	28	15	0	8,331	172	879	-	8,331
Elevator Escalator Operations	28	7	0	1,906	453	0	-	1,906
Supervision	29	21	0	2,336	491	0	2,000	2,336
Agency Police	29	13	0	4,200	65	0	350	4,200
Other Security	28	0	0	300	220	0	-	300
Assisting Train Crews	27	0	0	1,314	366	0	-	-
Other (Example: Control Room and Crowd Control Staff)	27	0	0	727	100	0	-	-

Appendix D: Station Personnel Survey Results

7. Systemwide, what are the annual work hours for staffing stations in the following functions? (Please do not include vacations, holidays, etc.)	Summary: Number of Agency Responses: Total	Minimum Hours	Maximum Hours	Median Hours	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Total Staff	21	0	50,336,000	1,855,439	4,240,059	5,261,512	-	50,336,000
Ticket Sales	17	0	6,019,163	660,000	250,000	2,425,424	-	5,721,700
Fare Inspectors	14	0	3,275,800	38,000	616,616	-	780,000	3,275,800
Customer Assistance	15	0	7,800,000	49,240	1,087,449	-	7,800,000	0
Cleaning	14	0	3,978,000	500,000	0	1,141,376	-	3,978,000
Maintenance	14	0	12,805,400	255,815	264,880	1,694,712	-	12,805,400
Elevator/ Escalator Operators	10	0	3,802,500	0	370	-	-	3,802,500
Supervision	14	0	4,660,300	96,000	760,265	-	3,900,000	4,660,300
Agency Police	13	0	958,892	65,000	102,245	-	682,500	0
Other security	10	0	247,500	0	437,294	-	-	0
Assisting Train Crews	11	0	2,524,095	54,000	563,640	-	-	-
Other (Example: Control Room and Crowd Control Staff)	5	0	1,183,556	711,744	157,300	-	-	-

	Total	Staffed at All Times	Not Staffed at All Times	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
9. Are all of your metro stations staffed at all times stations are open? If yes, go to question 12	31	23	8	No	Yes	No	Yes

10. How many metro stations are staffed as follows?	Total	Minimum Number of Stations	Maximum Number of Stations	Median Number of Stations	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Staffed at all times station are open	5	0	276	11	11	-	276	-
Staffed part-time	6	0	159	8	159	-	0	-
Unstaffed	5	0	51	5	0	-	1	-

13. Where in metro stations are staff assigned? (check all that apply)	Total	Staff Assigned	Staff Not Assigned	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Platforms	31	16	15	No	Yes	Yes	Yes
Station Lobby	30	23	7	No	Yes	Yes	Yes
Elevators/ Escalators	30	4	26	No	No	No	Yes
Able to move freely throughout station	30	22	8	Yes	Yes	Yes	Yes
Assigned to move throughout station	31	22	9	No	Yes	Yes	Yes
Other (Example: Fare Barriers, Ticket Offices)	32	9	23	No	No	Yes	No

Appendix D: Station Personnel Survey Results

14. Which station functions have been eliminated or contracted out, or are planned for elimination/contracting out? (check all that apply; if none go to question 16)	Summary: Number of Agency Responses — Total	Functions Contracted Out	Functions Not Contracted Out	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Ticket Sales	27	7	20	Yes	No	No	-
Fare Inspectors	27	3	24	Yes	No	No	-
Customer Assistance	27	7	20	No	No	No	-
Cleaning	28	19	9	Yes	Yes	No	-
Maintenance	28	16	12	Yes	Yes	Yes	-
Elevator/ Escalator Operators	27	9	18	No	No	Yes	-
Supervision	27	3	24	No	No	Yes	-
Agency Police	27	7	20	Yes	No	No	-
Other security	27	7	20	No	Yes	No	-
Assisting Train Crews	27	3	24	No	Yes	No	-
Other (Example: Luggage Handling)	27	4	23	No	No	No	-

	Total	Staff Reassigned	Staff Not Reassigned	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
15. Were staff whose functions eliminated or contracted out reassigned and retrained (yes/no)? Please describe in 2nd column.	24	19	5	Yes	Yes	Yes	-

	Total	Station Staff Selling Tickets	Station Staff Not Selling Tickets	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
16. Do staff in stations sell tickets? If no, go to question 22	30	26	4	Yes	Yes	Yes	Yes

17. What type of payment do ticket sales staff accept? (check all that apply)	Total	Accept	Do Not Accept	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Cash	30	30	0	Yes	Yes	Yes	Yes
Credit Card	30	11	19	Yes	Yes	Yes	No
Debit Card	30	7	23	Yes	No	Yes	No
Other (Example: Checks)	30	7	23	Yes	No	Yes	No

	Total	Minimum Time (in seconds)	Maximum Time (in seconds)	Median Time (in seconds)	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
18. What is your agency's target or standard sales staff transaction time (if available)? (in seconds)	5	8	300	10	-	45	-	-
19. What is the average sales staff transaction time (if available)? (in seconds)	11	10	300	14	-	45	-	-
20. What is your agency's target or standard queue time for transactions with sales staff (if available)? (in seconds)	7	10	180	120	-	60	120	13
21. What is the average queue time for transactions with sales staff (if available)? (in seconds)	8	25	66	60	-	60	-	25

22. What types of assistance do station staff provide to customers? (check all that apply in the 1st column; please indicate job title for each type of assistance in the 2nd column)	Summary: Number of Agency Responses – Total	Provided	Not Provided	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Provide Written Information	31	27	4	Yes	Yes	Yes	Yes
Answer questions concerning routes, schedules, transfer point	31	30	1	Yes	Yes	Yes	Yes
Provide announcements	31	28	3	Yes	Yes	Yes	Yes
Provide assistance to persons with disabilities	30	27	3	Yes	Yes	Yes	-
Issue refunds to passengers who lose money in vending machines	31	16	15	No	Yes	Yes	No
Respond to incidents	31	25	6	Yes	Yes	Yes	Yes
Provide CPR/ medical Assistance	31	21	10	Yes	Yes	Yes	Yes
Operate elevators and/ or escalators	31	15	16	Yes	Yes	No	Yes
Other	31	1	30	No	No	No	No

23. Please describe the training provided to staff in stations for each type of customer assistance.	Total	Using Training Classes	Using On The Job Training	Using Both	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Provide Written Information	22	14	5	3	Training Class	OJT and Class	-	Training Class
Answer questions concerning routes, schedules, transfer point	25	15	5	4	Training Class	OJT and Class	-	OJT
Provide announcements	22	14	3	4	Training Class	OJT and Class	-	OJT
Provide assistance to persons with disabilities	20	13	2	4	Training Class	OJT and Class	-	-
Issue refunds to passengers who lose money in vending machines	14	9	3	2	Training Class	OJT and Class	-	-
Respond to incidents	20	12	3	3	Training Class	OJT and Class	-	Training Class
Provide CPR/ medical Assistance	15	9	3	3	Training Class	OJT and Class	-	-
Operate elevators and/ or escalators	16	11	3	2	Training Class	OJT and Class	-	Training Class
Other	2	1	0	1	Training Class	OJT and Class	-	-

* OJT represents On The Job training

24. Do staff in stations who primarily assist customers wear uniforms to make them more visible to passengers (yes/no)? If yes, please describe in 2nd column.	Total	Uniformed	Not Uniformed	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
	31	31	0	Yes	Yes	Yes	Yes

25. Which specific cleaning tasks are performed in metro stations? (check all that apply in 1st column; please identify how frequently these tasks are performed in the 2nd column)	Total	Cleaned	Not Cleaned	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Sweeping	29	29	0	Yes	Yes	Yes	Yes
Mopping	29	28	1	Yes	Yes	Yes	Yes
Picking up litter	29	29	0	Yes	Yes	Yes	Yes
Garbage removal	29	29	0	Yes	Yes	Yes	Yes
Mechanized floor cleaning	29	27	2	Yes	Yes	Yes	Yes
Mechanized wall cleaning	29	23	6	Yes	Yes	Yes	Yes
Graffiti removal	29	28	1	Yes	Yes	Yes	Yes
Other (Example: Maintaining Light Tubes)	29	4	25	No	No	No	No

Appendix D: Station Personnel Survey Results

	Summary: Number of Agency Responses				Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
	Total	**Cleaned in Stations**	**Not Cleaned in Stations**					
26. Are trains cleaned in stations (yes/no)?	24	6	18		Yes	Yes	Yes	No
27. What types of equipment do station staff maintain? (check all that apply in the 1st column; please indicate job title for each type of equipment in the 2nd column)	**Total**	**Maintaining Equipment**	**Not Maintaining Equipment**					
Fare Vending Machine	29	14	15		No	Yes	No	Yes
Fare Gate	28	15	13		No	Yes	No	Yes
Lights	28	13	15		No	Yes	No	Yes
Railinigs/ Banisters	28	11	17		No	Yes	No	Yes
Masonry	28	11	17		No	Yes	No	Yes
Maps/ Mapholders	28	11	17		Yes	Yes	No	Yes
Public Address Systems	28	11	17		No	Yes	No	Yes
Signs	28	11	17		No	Yes	No	Yes
Advertising	28	5	23		No	Yes	No	Yes
Elevator/ Escalator	28	9	19		No	Yes	No	Yes
Plumbing	28	10	18		No	Yes	No	Yes
Other (Example: HVAC)	28	2	26		No	No	No	No
	Total	**Minimum Staff Providing Maintenance**	**Maximum Staff Providing Maintenance**	**Median Staff Providing Maintenance**				
28. How many staff persons provide maintenance for fare vending machines (full-time equivalents)?	18	0	879	14	0	879	-	-
	Total	**Responsible for Train Dispatching**	**Not Responsible for Train Dispatching**					
29. Are staff in stations responsible for train dispatching or assisting train crews? If no go to question 31	29	16	13		Yes	Yes	Yes	Yes
30. Please describe the functions of station staff assisting train crews (complete all that apply).	**Total**	**Assisting Train Crews**	**Not Assisting Train Crews**					
Train Dispatching	17	13	4		Yes	No	Yes	Yes
Control Passenger flow	18	16	2		Yes	Yes	Yes	Yes
Minor Car Repairs	17	6	11		No	No	No	Yes
Closing off certain Cars on a train	17	8	9		Yes	No	Yes	No
Other (Example: Cleaning Off Cars As Needed)	17	1	16		No	No	No	No

Appendix D: Station Personnel Survey Results

31. Who monitors safety and security of metro stations? (check all that apply) Please derscribe the role in metro station safety and security in second column.	Total	Monitoring Safety/Security	Not Monitoring Safety/Security	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
Agency Police	29	19	10	Yes	No	Yes	Yes
Other Police	29	16	13	Yes	Yes	Yes	No
Station Staff	29	22	7	Yes	Yes	Yes	No
Fare inspectors	29	10	19	Yes	Yes	Yes	No
Other (Example: Staff in Local Control Centers)	29	9	20	Yes	No	No	No

Summary: Number of Agency Responses

	Total	Monitoring Cameras	Not Monitoring Cameras	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
33. Do staff in stations monitor video cameras or other surveillance equipment?	27	24	3	No	Yes	Yes	Yes
35. Are stations monitored from a remote location? Please identify location (e.g., police station, station manager's office) in 2nd column (yes/no)	28	23	5	Yes	Yes	Yes	Yes
Where?	21	-	-	Service and information centers and leading control center	-	Network Control Center and Police Headquarters	Station Manager's Office

	Total	Providing Emergency Assistance	Not Providing Emergency Asistance	Berlin, Germany	Hong Kong, China (MTR)	London, England	Moscow, Russia
37. Do station staff assist in evacuating passengers during emergency conditions?	28	28	0	Yes	Yes	Yes	Yes

Appendix D: Station Personnel Survey Results

	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
4. How many stations does your metro have? (Count transfer stations as two or more stations, based on the number of lines)	468	375	66	49	159	14	23

5. How does your agency provide the following functions? (Agency staff, outside contractor, a combination of agency and contractor staff, or not provided)

	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
Ticket Sales	Agency	Agency	Agency	Combination	Agency	Agency	Agency
Fare Inspectors	-	Agency	Agency	Agency	Agency	Agency	Agency
Customer Assistance	Agency	Agency	Agency	Agency	Combination	Agency	Agency
Cleaning	Agency	Contractor	Contractor	Contractor	Contractor	Contractor	Contractor
Maintenance	Agency	Combination	Combination	Agency	Combination	Contractor	Combination
Elevator/ Escalator Operators	Agency	-	-	Agency	Combination	Contractor	-
Supervision	Agency	Agency	Agency	Agency	Agency	Agency	Agency
Agency Police	Government	Agency	Agency	Agency	-	Combination	Combination
Other Security	-	-	-	Agency	Agency	Combination	Contractor
Assisting Train Crews	Agency	-	Agency	Agency	Agency	Agency	Agency
Other (Example: Garden management)	Contractor	-	-	Contractor	-	-	-

6. Systemwide, how many staff work in metro stations in the following functions? (Please indicate full-time staff in the 1st column and part-time staff in the 2nd column)

	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
Full Time Total Staff	8,335	5,900	1,700	3,246	3,281	336	468
Part Time Total Staff	0	0	0	0	-	32	-
Ticket Sales	3,312	2,500	560	1,132	-	66	233
Fare Inspectors	0	1,250	280	0	-	13	30
Customer Assistance	0	800	170	0	-	73	0
Cleaning	1,289	1,000	0	1,273	-	0	0
Maintenance	1,238	0	0	310	-	0	0
Elevator Escalator Operations	42	0	0	348	-	0	0
Supervision	580	140	80	332	-	10	0
Agency Police	0	760	745	589	-	140	30
Other Security	0	0	0	0	-	34	35
Assisting Train Crews	1,314	0	200	118	-	0	140
Other (Example: Control Room and Crowd Control Staff)	560	0	0	727	-	0	0

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7. Systemwide, what are the annual work hours for staffing stations in the following functions? (Please do not include vacations, holidays, etc.)	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
Total Staff	15,147,378	8,800,000	2,540,000	5,284,488	7,134,876	640,000	640,000
Ticket Sales	6,019,163	3,750,000	840,000	1,842,896	-	100,000	-
Fare Inspectors	0	1,875,000	420,000	0	-	26,000	-
Customer Assistance	0	1,200,000	255,000	0	-	146,000	-
Cleaning	2,238,611	1,000,000	400,000	3,720,224	-	0	-
Maintenance	2,284,714	700,000	380,000	504,680	-	0	-
Elevator/ Escalator Operators	72,942	0	0	566,544	-	0	-
Supervision	1,064,402	210,000	115,000	540,496	-	20,000	-
Agency Police	0	65,000	76,000	958,892	-	280,000	-
Other security	0	0	0	-	-	68,000	-
Assisting Train Crews	2,524,095	0	54,000	192,104	-	0	-
Other (Example: Control Room and Crowd Control Staff)	943,452	-	0	1,183,556	-	-	-

	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
9. Are all of your metro stations staffed at all times stations are open? If yes, go to question 12	Yes	Yes	Yes	Yes	Yes	Yes	Yes

10. How many metro stations are staffed as follows?	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
Staffed at all times station are open	-	-	-	-	-	-	-
Staffed part-time	-	-	-	-	-	-	-
Unstaffed	-	-	-	-	-	-	-

13. Where in metro stations are staff assigned? (check all that apply)	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
Platforms	Yes	No	No	Yes	No	No	No
Station Lobby	Yes	Yes	Yes	Yes	No	Yes	Yes
Elevators/ Escalators	Yes	No	No	Yes	No	No	No
Able to move freely throughout station	Yes	Yes	Yes	Yes	No	Yes	No
Assigned to move throughout station	Yes	Yes	Yes	Yes	Yes	No	Yes
Other (Example: Fare Barriers, Ticket Offices)	Yes	No	No	Yes	No	No	No

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	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
14. Which station functions have been eliminated or contracted out, or are planned for elimination/contracting out? (check all that apply; if none go to question 16)							
Ticket Sales	No	No	No	No	No	No	Yes
Fare Inspectors	No	No	No	No	No	No	No
Customer Assistance	No	No	No	No	Yes	No	No
Cleaning	No	Yes	No	No	Yes	Yes	Yes
Maintenance	No	No	No	No	Yes	Yes	No
Elevator/ Escalator Operators	No	Yes	No	No	No	Yes	Yes
Supervision	No	No	No	No	No	Yes	No
Agency Police	No	No	No	No	No	Yes	No
Other security	No	No	No	No	No	Yes	Yes
Assisting Train Crews	No	No	No	No	No	No	No
Other (Example: Luggage Handling)	No	Yes	No	No	No	Yes	No
15. Were staff whose functions eliminated or contracted out reassigned and retrained (yes/no)? Please describe in 2nd column.	No	Yes	-	No	Yes	Yes	No
16. Do staff in stations sell tickets? If no, go to question 22	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17. What type of payment do ticket sales staff accept? (check all that apply)							
Cash	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Credit Card	No	Yes	Yes	No	No	No	No
Debit Card	No	Yes	Yes	No	No	No	No
Other (Example: Checks)	Yes	Yes	Yes	No	No	No	No
18. What is your agency's target or standard sales staff transaction time (if available)? (in seconds)	-	-	-	10	-	-	-
19. What is the average sales staff transaction time (if available)? (in seconds)	10	29	-	-	-	-	12
20. What is your agency's target or standard queue time for transactions with sales staff (if available)? (in seconds)	-	-	-	180	-	120	-
21. What is the average queue time for transactions with sales staff (if available)? (in seconds)	66	60	60	-	-	-	-

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	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
22. What types of assistance do station staff provide to customers? (check all that apply in the 1st column; please indicate job title for each type of assistance in the 2nd column)							
Provide Written Information	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Answer questions concerning routes, schedules, transfer point	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provide announcements	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provide assistance to persons with disabilities	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issue refunds to passengers who lose money in vending machines	No	Yes	Yes	Yes	Yes	No	No
Respond to incidents	Yes	Yes	Yes	Yes	Yes	No	No
Provide CPR/ medical Assistance	Yes	Yes	Yes	Yes	Yes	Yes	No
Operate elevators and/ or escalators	Yes	Yes	Yes	Yes	Yes	No	No
Other	No	No	No	Yes	No	No	No
23. Please describe the training provided to staff in stations for each type of customer assistance.							
Provide Written Information	Training Class	-	-	Training Class	OJT	OJT and Class	-
Answer questions concerning routes, schedules, transfer point	Training Class	Training Class	Training Class	Training Class	OJT	OJT and Class	Yes
Provide announcements	Training Class	Training Class	Training Class	Training Class	OJT	OJT and Class	Yes
Provide assistance to persons with disabilities	Training Class	-	-	Training Class	OJT	OJT and Class	Yes
Issue refunds to passengers who lose money in vending machines	-	-	-	Training Class	OJT	-	-
Respond to incidents	Training Class	-	-	Training Class	OJT	-	Yes
Provide CPR/ medical Assistance	-	-	-	Training Class	OJT	OJT and Class	-
Operate elevators and/ or escalators	Training Class	Training Class	Training Class	Training Class	OJT	OJT and Class	-
Other		-	-	-	-	-	-

* OJT represents On The Job training

	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
24. Do staff in stations who primarily assist customers wear uniforms to make them more visible to passengers (yes/no)? If yes, please describe in 2nd column.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
25. Which specific cleaning tasks are performed in metro stations? (check all that apply in 1st column; please identify how frequently these tasks are performed in the 2nd column)							
Sweeping	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mopping	No	Yes	Yes	Yes	Yes	Yes	Yes
Picking up litter	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Garbage removal	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mechanized floor cleaning	Yes	Yes	Yes	Yes	Yes	Yes	No
Mechanized wall cleaning	Yes	Yes	Yes	Yes	No	Yes	No
Graffiti removal	Yes	Yes	Yes	Yes	No	Yes	Yes
Other (Example: Maintaining Light Tubes)	No	No	No	No	No	No	No

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	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
26. Are trains cleaned in stations (yes/no)?	Yes	No	No	Yes	-	No	-
27. What types of equipment do station staff maintain? (check all that apply in the 1st column; please indicate job title for each type of equipment in the 2nd column)							
Fare Vending Machine	Yes	Yes	Yes	No	Yes	No	No
Fare Gate	Yes	Yes	Yes	Yes	Yes	No	No
Lights	Yes	Yes	Yes	No	No	No	No
Railinigs/ Banisters	Yes	No	No	No	No	No	No
Masonry	Yes	No	No	No	No	No	No
Maps/ Mapholders	Yes	No	No	No	No	No	No
Public Address Systems	Yes	No	No	Yes	No	No	No
Signs	Yes	No	No	No	No	No	No
Advertising	No	No	No	Yes	No	No	No
Elevator/ Escalator	Yes	Yes	Yes	Yes	No	No	No
Plumbing	Yes	No	No	No	No	No	No
Other (Example: HVAC)	Yes	No	No	No	No	No	No
28. How many staff persons provide maintenance for fare vending machines (full-time equivalents)?	90	44	44	0	-	0	13
29. Are staff in stations responsible for train dispatching or assisting train crews? If no go to question 31	Yes	No	Yes	Yes	Yes	No	No
30. Please describe the functions of station staff assisting train crews (complete all that apply).							
Train Dispatching	No	-	No	Yes	Yes	-	-
Control Passenger flow	Yes	-	Yes	Yes	Yes	-	-
Minor Car Repairs	No	-	No	Yes	No	-	-
Closing off certain Cars on a train	No	-	No	Yes	No	-	-
Other (Example: Cleaning Off Cars As Needed)	No	-	No	No	No	-	-

	New York, New York	Paris, France (RATP)	Paris, France (RER)	São Paulo, Brazil	Tokyo, Japan (TRTA)	Athens, Greece (Attiko Metro)	Athens, Greece (ISAP)
31. Who monitors safety and security of metro stations? (check all that apply) Please derscribe the role in metro station safety and security in second column.							
Agency Police	No	Yes	Yes	No	No	Yes	Yes
Other Police	Yes	Yes	Yes	No	No	Yes	Yes
Station Staff	Yes	Yes	Yes	Yes	Yes	Yes	No
Fare inspectors	No	Yes	Yes	Yes	No	Yes	No
Other (Example: Staff in Local Control Centers)	No	Yes	Yes	No	No	Yes	No
33. Do staff in stations monitor video cameras or other surveillance equipment?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
35. Are stations monitored from a remote location? Please identify location (e.g., police station, station manager's office) in 2nd column (yes/no)	No	Yes	Yes	Yes	Yes	Yes	No
Where?	-	Control Center and manager office	Control Center and manager office	Control Center and manager office	Station Office	Local Control Centers	-
37. Do station staff assist in evacuating passengers during emergency conditions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
4. How many stations does your metro have? (Count transfer stations as two or more stations, based on the number of lines)	38	14	112	132	42	97	13	-

5. How does your agency provide the following functions? (Agency staff, outside contractor, a combination of agency and contractor staff, or not provided)

	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
Ticket Sales	Combination	Combination	Combination	Agency	Agency	Combination	Contractor	Combination
Fare Inspectors	-	-	Agency	-	Agency	Agency	-	Contractor
Customer Assistance	Agency	Agency	Agency	Agency	Combination	Combination	Agency	-
Cleaning	-	Combination	Contractor	Combination	Contractor	Contractor	Combination	-
Maintenance	-	Agency	Combination	Agency	Agency	Combination	Combination	Contractor
Elevator/ Escalator Operators	-	Contractor	-	Contractor	Agency	-	Combination	-
Supervision	-	Agency	Agency	Agency	Agency	Agency	Agency	-
Agency Police	-	Agency	Contractor	Agency	Contractor	Combination	Agency	-
Other Security	-	Agency	Contractor	Agency	Contractor	Agency	Agency	-
Assisting Train Crews	-	Agency	Agency	Agency	-	Agency	Agency	-
Other (Example: Garden management)	-	-	-	Contractor	Agency	-	-	-

6. Systemwide, how many staff work in metro stations in the following functions? (Please indicate full-time staff in the 1st column and part-time staff in the 2nd column)

	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
Full Time Total Staff	55	59	1,082	563	294	239	0	15
Part Time Total Staff	35	-	32	48	-	474	0	-
Ticket Sales	25	0	860	363	82	74	0	0
Fare Inspectors	0	0	34	0	120	80	0	0
Customer Assistance	30	17	6	3	103	0	0	0
Cleaning	0	15	2	19	0	54	0	0
Maintenance	0	25	32	0	134	30	0	15
Elevator Escalator Operations	0	0	0	0	42	0	0	0
Supervision	0	2	41	178	0	64	0	0
Agency Police	0	0	0	0	30	187	0	0
Other Security	0	0	0	0	40	95	0	0
Assisting Train Crews	0	0	108	0	0	129	0	0
Other (Example: Control Room and Crowd Control Staff)	0	0	0	0	0	0	0	0

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	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
7. Systemwide, what are the annual work hours for staffing stations in the following functions? (Please do not include vacations, holidays, etc.)								
Total Staff	83,000	-	1,855,439	-	-	389,570	0	-
Ticket Sales	44,000	-	1,474,742	-	-	24,450	0	-
Fare Inspectors	-	-	59,030	-	-	-	0	-
Customer Assistance	39,000	-	10,284	-	-	-	0	-
Cleaning	-	-	3,428	-	-	-	0	-
Maintenance	-	-	53,991	-	-	-	0	-
Elevator/ Escalator Operators	-	-	-	-	-	-	0	-
Supervision	-	-	15,426	-	-	-	0	-
Agency Police	-	-	54,042	-	-	-	0	-
Other security	-	-	-	-	-	154,850	0	-
Assisting Train Crews	-	-	184,495	-	-	210,270	0	-
Other (Example: Control Room and Crowd Control Staff)	-	-	-	-	-	-	-	-
9. Are all of your metro stations staffed at all times stations are open? If yes, go to question 12	No	-	Yes	Yes	Yes	No	No	-
10. How many metro stations are staffed as follows?								
Staffed at all times station are open	-	-	-	-	-	2	0	-
Staffed part-time	Varies	-	-	-	-	44	8	-
Unstaffed	-	-	-	-	-	51	5	-
13. Where in metro stations are staff assigned? (check all that apply)								
Platforms	Yes	No	No	Yes	Yes	Yes	Yes	-
Station Lobby	Yes	No	Yes	Yes	-	Yes	Yes	-
Elevators/ Escalators	No	No	No	Yes	-	No	No	-
Able to move freely throughout station	No	No	Yes	Yes	-	No	Yes	-
Assigned to move throughout station	No	Yes	Yes	Yes	Yes	No	Yes	-
Other (Example: Fare Barriers, Ticket Offices)	Yes	No	No	No	Yes	No	No	-

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	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
14. Which station functions have been eliminated or contracted out, or are planned for elimination/contracting out? (check all that apply; if none go to question 16)								
Ticket Sales	-	-	No	No	No	Yes	Yes	-
Fare Inspectors	-	-	No	No	No	No	No	-
Customer Assistance	-	-	Yes	Yes	No	Yes	No	-
Cleaning	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Maintenance	-	-	Yes	Yes	No	Yes	Yes	Yes
Elevator/ Escalator Operators	-	-	No	Yes	No	No	Yes	-
Supervision	-	-	No	No	No	No	No	-
Agency Police	-	-	Yes	No	Yes	Yes	No	-
Other security	-	-	Yes	No	Yes	No	No	-
Assisting Train Crews	-	-	Yes	No	No	No	No	-
Other (Example: Luggage Handling)	-	-	No	No	No	No	No	-
15. Were staff whose functions eliminated or contracted out reassigned and retrained (yes/no)? Please describe in 2nd column.	-	-	Yes	Yes	No	Yes	Yes	-
16. Do staff in stations sell tickets? If no, go to question 22	No	-	Yes	Yes	Yes	Yes	No	No
17. What type of payment do ticket sales staff accept? (check all that apply)								
Cash	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Credit Card	Yes	No	No	Yes	No	No	-	-
Debit Card	No	No	No	No	No	Yes	-	-
Other (Example: Checks)	Yes	No	No	No	No	No	-	-
18. What is your agency's target or standard sales staff transaction time (if available)? (in seconds)	-	-	-	-	-	-	-	-
19. What is the average sales staff transaction time (if available)? (in seconds)	-	-	-	-	300	-	-	-
20. What is your agency's target or standard queue time for transactions with sales staff (if available)? (in seconds)	-	-	-	-	-	-	-	-
21. What is the average queue time for transactions with sales staff (if available)? (in seconds)	-	-	60	-	-	-	-	-

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	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
22. What types of assistance do station staff provide to customers? (check all that apply in the 1st column; please indicate job title for each type of assistance in the 2nd column)								
Provide Written Information	Yes	No	Yes	Yes	Yes	Yes	Yes	-
Answer questions concerning routes, schedules, transfer point	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Provide announcements	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Provide assistance to persons with disabilities	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Issue refunds to passengers who lose money in vending machines	No	No	Yes	No	No	Yes	Yes	-
Respond to incidents	No	No	Yes	Yes	Yes	Yes	Yes	-
Provide CPR/ medical Assistance	No	No	Yes	No	Yes	Yes	Yes	-
Operate elevators and/ or escalators	No	No	No	No	Yes	No	Yes	-
Other	No	No	No	No	No	No	No	-
23. Please describe the training provided to staff in stations for each type of customer assistance.								
Provide Written Information	Training Class	-	Training Class	OJT	Training Class	OJT	-	-
Answer questions concerning routes, schedules, transfer point	Training Class	-	Training Class	OJT	Training Class	OJT and Class	Training Class	-
Provide announcements	Training Class	-	Training Class	Training Class	Training Class	OJT and Class	-	-
Provide assistance to persons with disabilities	-	-	Training Class	Training Class	Training Class	OJT and Class	Training Class	-
Issue refunds to passengers who lose money in vending machines	-	-	Training Class	Training Class	-	OJT	-	-
Respond to incidents	-	-	Training Class	OJT	Training Class	OJT and Class	Apprenticeship	-
Provide CPR/ medical Assistance	-	-	Training Class	-	Training Class	OJT	-	-
Operate elevators and/ or escalators	-	-	-	OJT	Training Class	-	-	-
Other	-	-	-	-	-	-	-	-

* OJT represents On The Job training

	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
24. Do staff in stations who primarily assist customers wear uniforms to make them more visible to passengers (yes/no)? If yes, please describe in 2nd column.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
25. Which specific cleaning tasks are performed in metro stations? (check all that apply in 1st column; please identify how frequently these tasks are performed in the 2nd column)								
Sweeping	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Mopping	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Picking up litter	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Garbage removal	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Mechanized floor cleaning	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Mechanized wall cleaning	-	No	No	Yes	Yes	Yes	Yes	-
Graffiti removal	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Other (Example: Maintaining Light Tubes)	-	No	No	Yes	No	Yes	No	-

	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
26. Are trains cleaned in stations (yes/no)?	-	No	No	No	No	Yes	No	-
27. What types of equipment do station staff maintain? (check all that apply in the 1st column; please indicate job title for each type of equipment in the 2nd column)								
Fare Vending Machine	-	Yes	Yes	Yes	No	No	Yes	Yes
Fare Gate	-	Yes	Yes	Yes	No	No	Yes	-
Lights	-	Yes	No	Yes	No	No	Yes	-
Railinigs/ Banisters	-	Yes	No	Yes	No	No	Yes	-
Masonry	-	Yes	No	Yes	No	No	Yes	-
Maps/ Mapholders	-	Yes	Yes	Yes	No	No	Yes	-
Public Address Systems	-	Yes	Yes	Yes	No	No	Yes	-
Signs	-	Yes	Yes	Yes	No	No	Yes	-
Advertising	-	Yes	No	No	No	No	No	-
Elevator/ Escalator	-	No	No	No	No	No	No	-
Plumbing	-	Yes	Yes	Yes	No	No	Yes	-
Other (Example: HVAC)	-	No	No	No	No	No	No	-
28. How many staff persons provide maintenance for fare vending machines (full-time equivalents)?	-	14	33	-	0	8	17	17
29. Are staff in stations responsible for train dispatching or assisting train crews? If no go to question 31	-	No	Yes	Yes	No	Yes	Yes	-
30. Please describe the functions of station staff assisting train crews (complete all that apply).								
Train Dispatching	-	-	Yes	Yes	-	Yes	Yes	-
Control Passenger flow	-	-	No	Yes	-	Yes	Yes	-
Minor Car Repairs	-	-	Yes	Yes	-	No	Yes	-
Closing off certain Cars on a train	-	-	Yes	Yes	-	No	Yes	-
Other (Example: Cleaning Off Cars As Needed)	-	-	No	No	-	No	Yes	-

	Atlanta, Georgia	Baltimore, Maryland	Barcelona, Spain	Boston, Massachusetts	Budapest, Hungary	Hamburg, Germany	Jersey City, New Jersey (PATH)	Los Angeles, California
31. Who monitors safety and security of metro stations? (check all that apply) Please derscribe the role in metro station safety and security in second column.								
Agency Police	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Other Police	-	No	No	No	Yes	No	No	-
Station Staff	-	Yes	No	Yes	Yes	Yes	No	-
Fare inspectors	-	No	No	No	No	No	No	-
Other (Example: Staff in Local Control Centers)	-	No	No	Yes	No	Yes	Yes	-
33. Do staff in stations monitor video cameras or other surveillance equipment?	-	Yes	Yes	Yes	Yes	Yes	No	-
35. Are stations monitored from a remote location? Please identify location (e.g., police station, station manager's office) in 2nd column (yes/no)	-	Yes	Yes	Yes	Yes	Yes	Yes	-
Where?	-	Control Center	Control Center	Control Center	Control Center	Local Control Centers	Control Center, Police Desk	-
37. Do station staff assist in evacuating passengers during emergency conditions?	-	Yes	Yes	Yes	Yes	Yes	Yes	-

Appendix D: Station Personnel Survey Results

	Miami, Florida	Milan, Italy	Montreal, Canada	Munich, Germany	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore
4. How many stations does your metro have? (Count transfer stations as two or more stations, based on the number of lines)	42	84	70	49	76	50	52	48

5. How does your agency provide the following functions? (Agency staff, outside contractor, a combination of agency and contractor staff, or not provided)

	Miami, Florida	Milan, Italy	Montreal, Canada	Munich, Germany	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore
Ticket Sales	Agency	Combination	Agency	Agency	-	Contractor	Combination	Combination
Fare Inspectors	Contractor	Agency	Agency	Agency	-	Agency	-	Agency
Customer Assistance	Combination	Agency	Agency	Agency	Agency	Agency	Agency	Agency
Cleaning	Contractor	Contractor	Agency	Agency	Contractor	Contractor	Contractor	Contractor
Maintenance	Agency	Agency	Agency	Agency	Contractor	Agency	Contractor	Agency
Elevator/ Escalator Operators	Contractor	Agency	Agency	-	Contractor	Agency	-	Agency
Supervision	Agency	Agency	Agency	-	Agency	Agency	Agency	Agency
Agency Police	Government	-	Agency	Agency	-	-	Government	Contractor
Other Security	Contractor	Agency	Contractor	-	-	Government	Agency	Agency
Assisting Train Crews	Agency	Agency	Agency	Agency	Agency	Agency	-	Agency
Other (Example: Garden management)	-	-	-	-	-	-	Combination	-

6. Systemwide, how many staff work in metro stations in the following functions? (Please indicate full-time staff in the 1st column and part-time staff in the 2nd column)

	Miami, Florida	Milan, Italy	Montreal, Canada	Munich, Germany	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore
Full Time Total Staff	55	-	744	-	1,248	135	1,225	-
Part Time Total Staff	-	-	-	-	0	115	74	-
Ticket Sales	2	-	374	350	0	25	321	-
Fare Inspectors	0	-	0	0	0	50	0	-
Customer Assistance	2	-	0	359	1,231	105	150	-
Cleaning	4	-	154	0	0	40	331	-
Maintenance	21	-	0	0	0	20	30	-
Elevator Escalator Operations	0	-	0	9	0	0	0	-
Supervision	3	-	66	0	17	6	10	-
Agency Police	0	-	0	0	0	0	30	-
Other Security	0	-	150	0	0	0	16	-
Assisting Train Crews	0	-	0	0	0	4	0	-
Other (Example: Control Room and Crowd Control Staff)	0	-	0	0	0	0	337	-

Appendix D: Station Personnel Survey Results

	Miami, Florida	Milan, Italy	Montreal, Canada	Munich, Germany	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore
7. Systemwide, what are the annual work hours for staffing stations in the following functions? (Please do not include vacations, holidays, etc.)								
Total Staff	-	-	1,043,600	-	49,920	251,640	2,587,200	-
Ticket Sales	-	-	461,890	635,169	-	-	677,952	-
Fare Inspectors	-	-	-	25,896	-	-	0	-
Customer Assistance	-	-	-	-	49,240	195,720	316,800	-
Cleaning	-	-	228,690	-	-	-	699,072	-
Maintenance	-	-	-	-	-	37,280	63,360	-
Elevator/ Escalator Operators	-	-	-	-	-	-	0	-
Supervision	-	-	-	-	680	11,184	21,120	-
Agency Police	-	-	105,600	-	-	-	63,360	-
Other security	-	-	247,500	-	-	-	33,792	-
Assisting Train Crews	-	-	-	-	-	7,456	0	-
Other (Example: Control Room and Crowd Control Staff)	-	-	-	-	-	-	711,744	-
9. Are all of your metro stations staffed at all times stations are open? If yes, go to question 12	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10. How many metro stations are staffed as follows?								
Staffed at all times station are open	-	-	-	-	-	-	-	-
Staffed part-time	-	-	-	-	-	-	-	-
Unstaffed	-	-	-	-	-	-	-	-
13. Where in metro stations are staff assigned? (check all that apply)								
Platforms	No	No	No	No	Yes	Yes	No	No
Station Lobby	Yes	No	Yes	Yes	Yes	Yes	Yes	No
Elevators/ Escalators	No	No	No	No	No	No	No	No
Able to move freely throughout station	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Assigned to move throughout station	Yes	Yes	No	Yes	Yes	No	No	No
Other (Example: Fare Barriers, Ticket Offices)	No	No	No	No	Yes	No	No	No

Appendix D: Station Personnel Survey Results

	Miami, Florida	Milan, Italy	Montreal, Canada	Munich, Germany	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore
14. Which station functions have been eliminated or contracted out, or are planned for elimination/contracting out? (check all that apply; if none go to question 16)								
Ticket Sales	No	No	-	Yes	No	No	Yes	No
Fare Inspectors	Yes	No	-	No	No	No	No	Yes
Customer Assistance	Yes	No	-	No	Yes	No	No	No
Cleaning	Yes	Yes	-	No	No	Yes	Yes	No
Maintenance	No	Yes	-	No	No	Yes	Yes	No
Elevator/ Escalator Operators	Yes	Yes	-	No	No	No	No	No
Supervision	No	No	-	No	Yes	No	No	No
Agency Police	Yes	No	-	No	No	No	No	No
Other security	No	No	-	No	No	No	No	No
Assisting Train Crews	No	No	-	No	Yes	No	No	No
Other (Example: Luggage Handling)	No	No	-	No	No	No	Yes	No
15. Were staff whose functions eliminated or contracted out reassigned and retrained (yes/no)? Please describe in 2nd column.	-	Yes	-	Yes	Yes	Yes	Yes	Yes
16. Do staff in stations sell tickets? If no, go to question 22	-	Yes	Yes	-	Yes	No	Yes	Yes
17. What type of payment do ticket sales staff accept? (check all that apply)								
Cash	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes
Credit Card	No	No	No	No	No	-	No	No
Debit Card	No	No	No	No	No	-	No	No
Other (Example: Checks)	No	No	No	No	No	-	No	No
18. What is your agency's target or standard sales staff transaction time (if available)? (in seconds)	-	-	-	-	-	-	8	10
19. What is the average sales staff transaction time (if available)? (in seconds)	-	-	-	10	-	-	14	10
20. What is your agency's target or standard queue time for transactions with sales staff (if available)? (in seconds)	-	-	-	-	-	-	10	-
21. What is the average queue time for transactions with sales staff (if available)? (in seconds)	-	-	-	-	-	-	40	-

Appendix D: Station Personnel Survey Results

	Miami, Florida	Milan, Italy	Montreal, Canada	Munich, Germany	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore
22. What types of assistance do station staff provide to customers? (check all that apply in the 1st column; please indicate job title for each type of assistance in the 2nd column)								
Provide Written Information	No	Yes	Yes	Yes	Yes	No	Yes	No
Answer questions concerning routes, schedules, transfer point	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Provide announcements	No	Yes	Yes	No	No	Yes	Yes	Yes
Provide assistance to persons with disabilities	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Issue refunds to passengers who lose money in vending machines	No	No	Yes	No	Yes	No	No	Yes
Respond to incidents	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Provide CPR/ medical Assistance	No	Yes	No	No	Yes	Yes	Yes	Yes
Operate elevators and/ or escalators	No	Yes	No	No	No	Yes	No	Yes
Other	No	No	No	No	No	No	No	No
23. Please describe the training provided to staff in stations for each type of customer assistance.								
Provide Written Information	-	-	Training Class	-	OJT and Class	Training Class	Training Class	OJT
Answer questions concerning routes, schedules, transfer point	-	-	-	-	OJT and Class	Training Class	Training Class	OJT
Provide announcements	-	-	-	-	-	Training Class	Training Class	OJT
Provide assistance to persons with disabilities	-	-	-	-	OJT and Class	Training Class	Training Class	OJT
Issue refunds to passengers who lose money in vending machines	-	-	Training Class	-	OJT and Class	Training Class	-	OJT
Respond to incidents	-	-	Training Class	-	OJT and Class	Training Class	Training Class	OJT
Provide CPR/ medical Assistance	-	-	-	-	OJT and Class	Training Class	Training Class	OJT
Operate elevators and/ or escalators	-	-	Training Class	-	-	Training Class	-	OJT
Other	-	-	-	-	-	-	-	-
* OJT represents On The Job training								
24. Do staff in stations who primarily assist customers wear uniforms to make them more visible to passengers (yes/no)? If yes, please describe in 2nd column.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
25. Which specific cleaning tasks are performed in metro stations? (check all that apply in 1st column; please identify how frequently these tasks are performed in the 2nd column)								
Sweeping	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
Mopping	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
Picking up litter	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
Garbage removal	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
Mechanized floor cleaning	Yes	Yes	Yes	-	Yes	Yes	Yes	No
Mechanized wall cleaning	Yes	No	Yes	-	Yes	Yes	Yes	No
Graffiti removal	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
Other (Example: Maintaining Light Tubes)	No	No	Yes	-	Yes	No	No	No

Appendix D: Station Personnel Survey Results

	Miami, Florida	Milan, Italy	Montreal, Canada	Munich, Germany	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore
26. Are trains cleaned in stations (yes/no)?	-	No	-	-	No	No	No	No
27. What types of equipment do station staff maintain? (check all that apply in the 1st column; please indicate job title for each type of equipment in the 2nd column)								
Fare Vending Machine	No	No	-	No	Yes	No	No	No
Fare Gate	No	No	-	No	Yes	No	Yes	No
Lights	Yes	No	-	No	Yes	Yes	Yes	No
Railinigs/ Banisters	Yes	No	-	No	No	Yes	Yes	No
Masonry	Yes	No	-	No	No	Yes	Yes	No
Maps/ Mapholders	No	No	-	No	No	No	Yes	No
Public Address Systems	No	No	-	No	No	Yes	Yes	No
Signs	No	No	-	No	No	Yes	Yes	No
Advertising	No	No	-	No	No	No	Yes	No
Elevator/ Escalator	No	No	-	No	No	Yes	Yes	No
Plumbing	Yes	No	-	No	No	Yes	No	No
Other (Example: HVAC)	Yes	No	-	No	No	No	No	No
28. How many staff persons provide maintenance for fare vending machines (full-time equivalents)?	-	-	-	-	0	-	-	14
29. Are staff in stations responsible for train dispatching or assisting train crews? If no go to question 31	No	No	-	No	Yes	No	No	No
30. Please describe the functions of station staff assisting train crews (complete all that apply).								
Train Dispatching	-	-	-	-	Yes	-	No	-
Control Passenger flow	-	-	-	-	Yes	-	No	Yes
Minor Car Repairs	-	-	-	-	No	-	No	-
Closing off certain Cars on a train	-	-	-	-	No	-	No	-
Other (Example: Cleaning Off Cars As Needed)	-	-	-	-	No	-	No	-

Appendix D: Station Personnel Survey Results

	Miami, Florida	Milan, Italy	Montreal, Canada	Munich, Germany	Nagoya, Japan	Prague, Czech Republic	Santiago, Chile	Singapore
31. Who monitors safety and security of metro stations? (check all that apply) Please derscribe the role in metro station safety and security in second column.								
Agency Police	Yes	Yes	Yes	-	No	No	Yes	No
Other Police	Yes	No	Yes	-	No	Yes	No	Yes
Station Staff	No	Yes	Yes	-	Yes	Yes	No	Yes
Fare inspectors	No	No	Yes	-	No	No	No	Yes
Other (Example: Staff in Local Control Centers)	No	No	No	-	No	No	Yes	No
33. Do staff in stations monitor video cameras or other surveillance equipment?	No	Yes	Yes	-	Yes	Yes	-	Yes
35. Are stations monitored from a remote location? Please identify location (e.g., police station, station manager's office) in 2nd column (yes/no)	Yes	Yes	No	-	No	Yes	Yes	Yes
Where?	Control Center	Control Center	-	-	-	-	Centralized monitoring system	Control Center
37. Do station staff assist in evacuating passengers during emergency conditions?	Yes	Yes	Yes	-	Yes	Yes	Yes	-

Appendix D: Station Personnel Survey Results

	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
4. How many stations does your metro have? (Count transfer stations as two or more stations, based on the number of lines)	69	87	13	470	7	301
5. How does your agency provide the following functions? (Agency staff, outside contractor, a combination of agency and contractor staff, or not provided)						
Ticket Sales	Agency	Combination	Agency	Agency	Agency	Agency
Fare Inspectors	Agency	-	Agency	Agency	Agency	Agency
Customer Assistance	Agency	Agency	Agency	Agency	Combination	Agency
Cleaning	Agency	Agency	Contractor	Contractor	Contractor	Agency
Maintenance	Agency	Combination	Combination	Agency	Combination	Agency
Elevator/ Escalator Operators	-	-	Agency	Agency	Contractor	-
Supervision	Agency	Agency	Agency	Agency	Agency	Agency
Agency Police	Agency	Agency	-	Agency	Government	-
Other Security	Agency	-	Agency	Contractor	Contractor	Contractor
Assisting Train Crews	Agency	Agency	Agency	-	Agency	Agency
Other (Example: Garden management)	-	-	Contractor	-	-	-
6. Systemwide, how many staff work in metro stations in the following functions? (Please indicate full-time staff in the 1st column and part-time staff in the 2nd column)						
Full Time Total Staff	807	1,168	500	9,800	-	2,421
Part Time Total Staff	39	34	50	-	-	0
Ticket Sales	377	15	250	4,200	-	324
Fare Inspectors	13	0	25	200	-	156
Customer Assistance	0	420	15	200	-	1,218
Cleaning	226	158	300	0	-	0
Maintenance	141	171	0	0	-	0
Elevator Escalator Operations	0	95	0	0	-	0
Supervision	44	116	80	0	-	530
Agency Police	45	220	0	0	-	0
Other Security	0	7	0	0	-	0
Assisting Train Crews	0	0	170	0	-	0
Other (Example: Control Room and Crowd Control Staff)	0	0	210	0	-	193

Appendix D: Station Personnel Survey Results

	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
7. Systemwide, what are the annual work hours for staffing stations in the following functions? (Please do not include vacations, holidays, etc.)						
Total Staff	1,486,050	-	1,000,000	-	-	4,783,896
Ticket Sales	660,000	-	400,000	-	-	-
Fare Inspectors	24,000	-	50,000	-	-	-
Customer Assistance	-	782,708	30,000	-	-	-
Cleaning	395,500	-	600,000	-	-	-
Maintenance	246,750	-	0	-	-	-
Elevator/ Escalator Operators	-	174,925	0	-	-	-
Supervision	77,000	-	160,000	-	-	-
Agency Police	82,800	-	0	-	-	-
Other security	-	-	0	-	-	-
Assisting Train Crews	-	-	140,000	-	-	-
Other (Example: Control Room and Crowd Control Staff)	-	-	220,000	-	-	-
9. Are all of your metro stations staffed at all times stations are open? If yes, go to question 12	Yes	Yes	Yes	No	Yes	No
10. How many metro stations are staffed as follows?						
Staffed at all times station are open	-	-	-	-	-	248
Staffed part-time	-	-	-	-	-	5
Unstaffed	-	-	-	-	-	48
13. Where in metro stations are staff assigned? (check all that apply)						
Platforms	Yes	Yes	No	Yes	-	Yes
Station Lobby	Yes	Yes	No	No	-	Yes
Elevators/ Escalators	No	No	No	No	-	No
Able to move freely throughout station	No	Yes	No	Yes	-	Yes
Assigned to move throughout station	Yes	Yes	No	Yes	-	Yes
Other (Example: Fare Barriers, Ticket Offices)	No	No	No	Yes	Yes	Yes

Appendix D: Station Personnel Survey Results

	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
14. Which station functions have been eliminated or contracted out, or are planned for elimination/contracting out? (check all that apply; if none go to question 16)						
Ticket Sales	-	No	No	No	Yes	No
Fare Inspectors	-	No	No	No	No	No
Customer Assistance	-	No	No	No	Yes	No
Cleaning	-	No	Yes	Yes	Yes	No
Maintenance	-	Yes	Yes	No	Yes	No
Elevator/ Escalator Operators	-	No	No	No	Yes	No
Supervision	-	No	No	No	No	No
Agency Police	-	No	No	No	Yes	No
Other security	-	No	No	Yes	No	Yes
Assisting Train Crews	-	No	No	No	No	No
Other (Example: Luggage Handling)	-	No	Yes	No	No	No
15. Were staff whose functions eliminated or contracted out reassigned and retrained (yes/no)? Please describe in 2nd column.	-	-	Yes	Yes	No	Yes
16. Do staff in stations sell tickets? If no, go to question 22	Yes	Yes	Yes	Yes	Yes	Yes
17. What type of payment do ticket sales staff accept? (check all that apply)						
Cash	Yes	Yes	Yes	Yes	Yes	Yes
Credit Card	No	Yes	No	Yes	Yes	Yes
Debit Card	No	Yes	No	No	No	Yes
Other (Example: Checks)	No	Yes	No	No	No	No
18. What is your agency's target or standard sales staff transaction time (if available)? (in seconds)	-	-	-	300	-	-
19. What is the average sales staff transaction time (if available)? (in seconds)	-	96	14	45	-	-
20. What is your agency's target or standard queue time for transactions with sales staff (if available)? (in seconds)	-	-	120	-	-	-
21. What is the average queue time for transactions with sales staff (if available)? (in seconds)	-	-	54	-	-	-

Appendix D: Station Personnel Survey Results

	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
22. What types of assistance do station staff provide to customers? (check all that apply in the 1st column; please indicate job title for each type of assistance in the 2nd column)						
Provide Written Information	Yes	-	Yes	Yes	Yes	Yes
Answer questions concerning routes, schedules, transfer point	Yes	-	Yes	Yes	Yes	Yes
Provide announcements	Yes	-	Yes	Yes	Yes	Yes
Provide assistance to persons with disabilities	No	-	Yes	No	Yes	Yes
Issue refunds to passengers who lose money in vending machines	Yes	-	Yes	No	Yes	Yes
Respond to incidents	Yes	-	Yes	No	Yes	Yes
Provide CPR/ medical Assistance	No	-	Yes	No	No	Yes
Operate elevators and/ or escalators	Yes	-	Yes	No	No	No
Other	No	-	No	No	No	No
23. Please describe the training provided to staff in stations for each type of customer assistance.						
Provide Written Information	Training Class	-	Training Class	OJT	Training Class	Training Class
Answer questions concerning routes, schedules, transfer point	Training Class	-	Training Class	OJT	Training Class	Training Class
Provide announcements	Training Class	-	Training Class	OJT and Class	-	Training Class
Provide assistance to persons with disabilities	Training Class	-	Training Class	-	Training Class	Training Class
Issue refunds to passengers who lose money in vending machines	Training Class	-	Training Class	-	-	Training Class
Respond to incidents	Training Class	-	Training Class	-	-	Training Class
Provide CPR/ medical Assistance	Training Class	-	Training Class	-	-	Training Class
Operate elevators and/ or escalators	Training Class	-	Training Class	-	-	-
Other	-	-	-	-	-	-

* OJT represents On The Job training

	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
24. Do staff in stations who primarily assist customers wear uniforms to make them more visible to passengers (yes/no)? If yes, please describe in 2nd column.	Yes	-	Yes	Yes	Yes	Yes
25. Which specific cleaning tasks are performed in metro stations? (check all that apply in 1st column; please identify how frequently these tasks are performed in the 2nd column)						
Sweeping	Yes	-	Yes	Yes	Yes	Yes
Mopping	Yes	-	Yes	Yes	Yes	Yes
Picking up litter	Yes	-	Yes	Yes	Yes	Yes
Garbage removal	Yes	-	Yes	Yes	Yes	Yes
Mechanized floor cleaning	Yes	-	Yes	Yes	Yes	Yes
Mechanized wall cleaning	Yes	-	Yes	Yes	Yes	Yes
Graffiti removal	Yes	-	Yes	Yes	Yes	Yes
Other (Example: Maintaining Light Tubes)	No	-	No	No	No	No

Appendix D: Station Personnel Survey Results

	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
26. Are trains cleaned in stations (yes/no)?	No	-	No	No	No	-
27. What types of equipment do station staff maintain? (check all that apply in the 1st column; please indicate job title for each type of equipment in the 2nd column)						
Fare Vending Machine	Yes	-	No	-	Yes	No
Fare Gate	Yes	-	No	-	Yes	No
Lights	Yes	-	No	-	No	No
Railinigs/ Banisters	Yes	-	No	-	No	Yes
Masonry	Yes	-	No	-	No	Yes
Maps/ Mapholders	Yes	-	No	-	No	Yes
Public Address Systems	Yes	-	No	-	No	No
Signs	Yes	-	No	-	No	Yes
Advertising	No	-	No	-	No	No
Elevator/ Escalator	Yes	-	No	-	No	No
Plumbing	Yes	-	No	-	No	No
Other (Example: HVAC)	No	-	No	-	No	No
28. How many staff persons provide maintenance for fare vending machines (full-time equivalents)?	-	-	6	-	-	28
29. Are staff in stations responsible for train dispatching or assisting train crews? If no go to question 31	Yes	-	Yes	No	No	Yes
30. Please describe the functions of station staff assisting train crews (complete all that apply).						
Train Dispatching	Yes	-	Yes	-	-	Yes
Control Passenger flow	Yes	-	Yes	-	-	Yes
Minor Car Repairs	Yes	-	No	-	-	No
Closing off certain Cars on a train	Yes	-	Yes	-	-	No
Other (Example: Cleaning Off Cars As Needed)	No	-	No	-	-	No

Appendix D: Station Personnel Survey Results

	Toronto, Canada	Washington, D.C.	Hong Kong, China (KCRC)	Johannesburg, South Africa	Osaka, Japan	Sydney, Australia
31. Who monitors safety and security of metro stations? (check all that apply) Please derscribe the role in metro station safety and security in second column.						
Agency Police	Yes	-	No	Yes	No	No
Other Police	No	-	Yes	Yes	No	Yes
Station Staff	Yes	-	Yes	Yes	Yes	No
Fare inspectors	No	-	No	Yes	No	No
Other (Example: Staff in Local Control Centers)	No	-	No	Yes	No	No
33. Do staff in stations monitor video cameras or other surveillance equipment?	Yes	-	Yes	Yes	-	Yes
35. Are stations monitored from a remote location? Please identify location (e.g., police station, station manager's office) in 2nd column (yes/no)	No	-	-	Yes	Yes	Yes
Where?	-	-	Station Office	Control Center	Major Station	Station Office
37. Do station staff assist in evacuating passengers during emergency conditions?	Yes	-	Yes	Yes	Yes	Yes