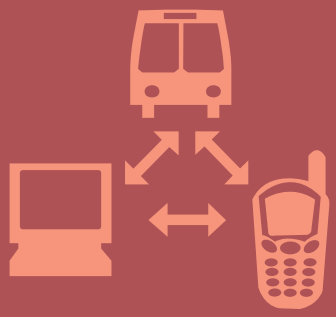


INFORMATION TECHNOLOGIES

New York's Metropolitan Transportation Authority (MTA) has several pilot programs—including the "Time to Next Train" arrival displays currcently in use on the L line, new trip planner services for web-enabled cell phones and PDA's, email alerts offered by the MTA, LIRR information screens available at Penn Station, and the recently announced plan to test "Time to Next Bus" displays in Manhattan—that will dramatically improve the quality, clarity and quantity of travel information that transit users receive. These programs are part of a larger body of new information technologies, often called Intelligent Transportation Systems (ITS), which gather traffic and transportation data (e.g. vehicle, bus or subway GPS) and communicate it to customers in real-time and personalized form (e.g. on-line trip planners or digital platform signage).

This report examines ITS-based traveler information systems which complement the programs already in progress by the MTA. They are intended to increase the quality and quantity of transit information that users have available, provide information about alternative routes and modes and reduce the overall impact of delays throughout the transit system. Most require minimal capital investments on the part of transit authorities outside of making information available online and in simplified mobile-forms which can be easily loaded by handheld technologies.

- Real-Time Information Screens
  - » Case Study 11: Information TV Monitors
- Portable Real-Time Systems
  - » Case Study 12: Cell Phone/PDA Arrival Information Systems
  - » Case Study 13: Interactive Text Message (SMS) Arrival Information Systems
  - » Case Study 14: Codes2D Matrix Barcodes

Paper signs announcing service changes on the 2 and 3 lines.

NYC Dept . City Planning

REAL TIME INFORMATION SCREENS

Since the early 1990's, the RATP, Paris, France's regional transportation authority has centralized important, time-sensitive transit information on simple television screens in place throughout their stations. The monitors are easy to locate and understand and their digital format makes it easy to update information as situations change.

Background:

The primary methods of conveying short-term service alerts or emergency information to NYCT riders are station and train announcements, staff guidance, hand-written whiteboard messages in station booth windows, and Service Updates posted on the MTA website.[1] An emergency email alert system was recently introduced. Routine or planned service changes are publicized through posted paper signs, in daily newspapers or on the MTA website.

However, because service information on the website is only updated weekly, many riders are not accustomed to checking the website before using the subway or bus. Paper signs tend only to be relevant for the station in which they are placed or the lines that serve that station. As a result, riders hoping to transfer to other lines may find themselves already in the transit system by the time they learn about changes. The MTA has announced plans to provide wireless reception in subway stations, which would allow transit users to access other widely used information resources. Completion of this project is not expected until 2018.[2]

As city and state transportation authorities and elected officials are aware, the current communication systems employed by the MTA are insufficient, particularly in emergency situations. Often, the ability of transit authorities to communicate information to riders is limited. Under emergency or severe weather conditions, the lack of real-time information options can pose serious safety issues as riders may not know how, where, and when to evacuate or avoid certain stations or make other transportation plans. As in the case of the August 2007 storm and flooding, poor real-time communication between the MTA and its own employees can further hamper operations.

A newly installed LIRR real-time information screen at Penn Station. NYC Dept. City Planning

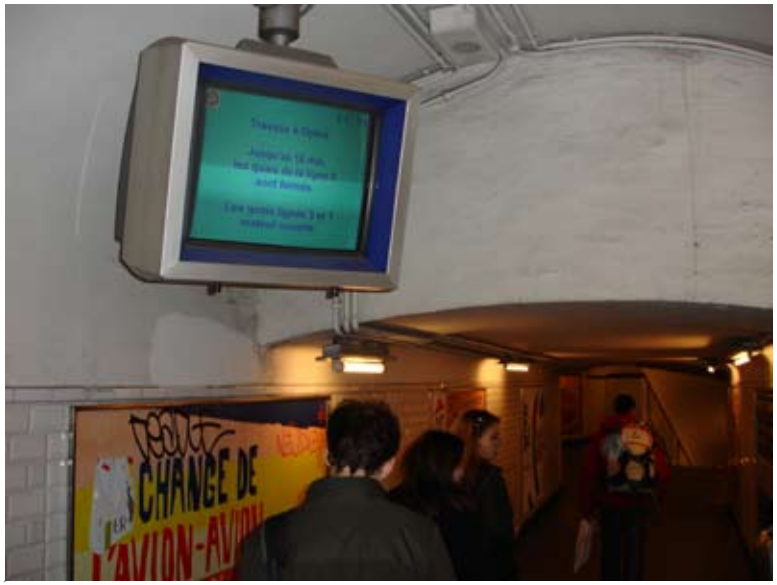
While the overall quality and clarity of the MTA/NYCT's public address systems has improved over the past 20 years, many passengers often find it difficult to hear or understand announcements made in subway stations, especially those

1 NYPRIG Straphangers Campaign Website, "News Release," (http://www.straphangers.org/announcements/2002/); Accessed 11/27/2007

2 Neuman, William, "MTA Makes Deal for Cellphones in Stations;" The New York Times, 20 September 2007

that are not pre-recorded. Subway stations are loud, especially those served by multiple lines or with local and express service arriving on the same platform. Public announcements made when a train is entering or leaving the station are almost inevitably inaudible, despite the quality of the public address system itself. Recognizing this, the LIRR has recently introduced information screens showing information about track work and unexpected train delays at Penn Station. But, as the MTA/NYCT balance out funding and spending priorities, improvements to communications systems often fall by the wayside in the face of major upgrades like signals and track work. For example, an MTA plan to upgrade the subways' public address systems by 2009 stalled in 2005 during budget revisions.[3]

Case Study 11: Information TV Monitors (Paris, France)



An Information TV Monitor installed in the Paris Metro. The blue/green screen indicates routine or scheduled information. Image used with permission of Anthony Rizos.

In 1993, the Régie Autonome des Transports Parisiens (RATP), the transportation authority for the Paris region, began installing information television screens in Metro stations throughout Paris.[4] These screens display real-time service information for the Paris Metro, including unplanned service changes, major delays and station closures as well as planned service changes and track work. They are updated constantly throughout the day.

The average stations has 2-3 monitors, both inside and outside of the fare-zone, at key locations where riders congregate.[5] This placement of the monitors allows passengers who have already

3 Smerd, Jeremy, "Inaudible Announcments in Subways Are Endangering Riders, Critics Say;" The New York Sun, 21 September, 2005 (http://www.nysun.com/article/20304); Accessed 11/09/07

4 Email Correspondence with Thierry Anselot, Domaine Information Voyageurs, Régie Autonome des Transports Parisiens (RATP), 4 October 2007

5 ibid., 9 October 2007

paid their fare and are transferring within the system to make changes to their planned routes as necessary while also providing potential passengers with information about their planned route before they pay their fare.

To a large degree, the effectiveness of the RATP monitors comes from their simplicity. The display on the monitors is text only, without advertisements, graphics or scrolling text which distract the viewer. The displays are color coded—blue/green screens for planned service changes or routine announcements, yellow screens for unplanned service changes and red screens for emergencies—making it easy for users to glance at the monitors in passing and still gain information.[6]

The current television monitors used by the RATP are standard televisions, available in any electronics store, which are protected by a plexiglass cover. As the RATP renovates its stations however, these screens are being replaced by flat screen moniors (TFT 4/3 or 16/9). Independent of the installation, wiring and renovation costs, these screens will cost about 130 Euros per year and last for three years.[7]

Examples and Opportunities:

Enhancing New York City's current information offerings for mass transit can help the city meet a number of important Transportation goals laid out in PlaNYC 2030. These goals include increasing capacity on overcrowded lines and improving access to underserved areas by providing users with information about schedules, delays and alternate routes.

Real-time information screens provide transit users with essential transit information at a glance. In loud places like subway stations, they provide quick information that cannot be garbled or drowned out by other noise. While wireless communications technologies are becoming increasingly popular as a transportation information resource, including "low-tech" solutions as well will allow transit authorities to communicate important and time-sensitive transit information in the immediate future, without waiting for subway stations to be wired for cellular and internet service. In addition, "low-tech" devices can reach all New Yorkers, including those who do not have access to the internet or mobile wireless technologies. A consistent format and placement throughout the NYCT network could help draw attention to the screens and ensure their use. Overall, introducing immediate communication solutions could also improve customer service and satisfaction ratings.

6 Email Correspondence with Thierry Anselot, Domaine Information Voyageurs, Régie Autonome des Transports Parisiens (RATP), 9 October 2007

7 ibid.

PORTABLE REAL-TIME SYSTEMS:

Transit riders are becoming more comfortable with technology-on-the-go and the number of people with wireless web enabled handheld devices is likely to dramatically increase in coming years. With this trend comes the growing public expectation that nearly all web-based transportation information should also be accessible wirelessly. In addition, information systems that utilize cell phone or PDA technologies provide an unique information distribution option for transit authorities, as many New Yorkers already carry cell phones and/or PDA's, making costly capital improvements unnecessary. Three portable real-time systems of note are:

- Cell Phone/PDA Arrival Information Systems
- Interactive Text Message (SMS) Arrival Information Systems
- Matrix Barcodes

Background:

With most riders on the move throughout the day, the challenge for transit authorities is how to get current or emergency service change information to riders before they enter the transit system, while they are at stations, and when they are in the system between stations. Cities like San Francisco, Paris, London, and Shanghai address these issues by offering estimated train/bus arrival times, transit schedules, system maps, emergency alerts and trip planners in mobile-friendly format, allowing riders and potential riders to access information while out and about.

In recent years, MTA/NYCT has dramatically increased the amount of information that transit users can access, both in stationary (in front of a computer) and portable (on the go) formats. For example, if a transit rider, seated at a computer at home or at work, wanted to access basic transit information online, they would have a variety of options, including GoogleTransit, Hopstop.com, Trips123.com and the MTA's tripplanner.mta.info. At any of these sites, that transit rider would find system maps, trip planners and information on planned service changes.

Color-coded real-time traffic congestion message board in Beijing, China. NYC Dept. City Planning

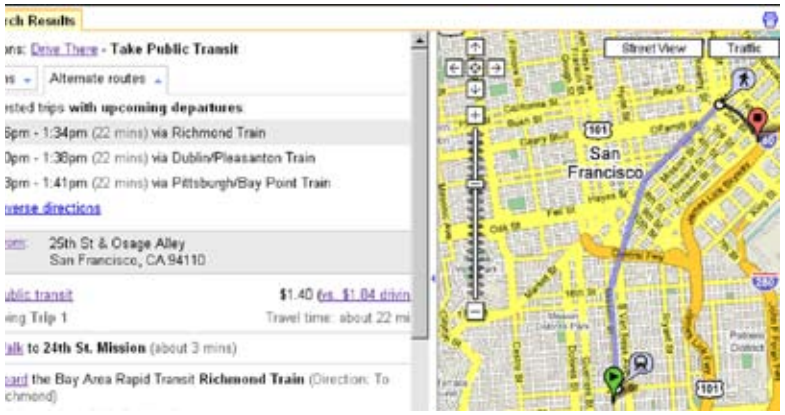
Recent announcements by the MTA indicates that these transit offerings may soon be joined by a more robust GoogleTransit trip planner which would provide maps and schedules and take advantage of existing popularity of Google's mapping services.[8] At this time, GoogleTransit is available for 18 transit systems, including San Francisco and Portland, OR, however none of these systems are as complex as the New York City subway, bus and rail systems.[9]

The MTA's recent introduction of its web-based TripPlanner for mobile-enabled phones and PDA's, provides access to its website and transportation information services (trip planner, planned service changes etc.) to New Yorkers who are moving about the city, and greatly increases the number of portable information systems New Yorkers have at their disposal. This system, like the ones already in place in London or San Francisco, uses a simplified

8 LaForge, Patrick, "Can Google Untangle the New York Transit Web?" The New York Times, 24 August, 2007 & Daily Wireless.org Website, (http://www.dailywireless.org/2007/08/24/google-metro-transit-authority/); Accessed 11/27/2007

9 Like Trips123 previously did, Google will receive access to the MTA's digital schedule data. According to Tom Sly, Google New Business Development, and Jori Pearsall, Transit at Google, Google does not charge transit operators to upload their transit information into the GoogleTransit service. The only costs incurred would be those of formatting and uploading the MTA's digital transit data into the Google Transit Feed Format (GTFS).

website that can be easily loaded by handheld wireless devices (cellphones, PDA's, Blackberries etc.), to provide commuters with route information and planned service changes.[10]



The search results from a GoogleTransit search offer a traditional "Drive There" and a new "Take Public Transit" option. The "Take Public Transit" option provides detailed walking and train directions and offers a price comparison to driving. Images used with permission of Google.

The QuickPlanner interface for PDA's offers users increased site mobility. Image used with permission of Bay Area Rapid Transit (BART).

Case Study 12: Cell Phone/PDA Information Systems (San Francisco, CA)

San Francisco's transit authority, BART, offers real-time arrival and service alert information to users from their mobile phones or internet-enabled PDAs. Information is made easily and quickly available to cell-phone browsers or other hand-held devices by way of simplified interfaces on BART's webpage. A basic root menu serves as a gateway to multiple transit information tools offered.[11] Such wireless technology provides increasingly personalized service information while requiring minimal infrastructure investments.

For example, customers looking for real-time information navigate to the BART website (http://www.bart.gov/index.asp) from their phones as they would if they were looking to access the BART QuickPlanner or other static information. From the main menu, they are given the option of selecting Service Advisories or Arrival Information. For Service Advisories, users are directed to the service advisories page. For Arrival Information, users select their location from a pull-down menu and are directed to a page with estimated arrival times to that location from all directions.

BART users can navigate to the BART website from their handheld device and receive estimated arrival times from any station. Image used with permission of Bay Area Rapid Transit (BART).

10 MTA Website, "Trip Planner on the Go," (http://tripplanner.mta.info/tripPlannerPDA.aspx); Accessed 2/15/08

11 BART Website, "Wireless Trip Planner," (http://www.bart.gov/stations/quickPlanner/wireless.asp); Accessed 11/27/2007

Case Study 13: Interactive Text-Message Information (Paris, France)

Text messages (also known as Short Message Service or SMS) are widely used by transit authorities to provide transit information to customers. Transit authorities in San Francisco, London, Portland, OR., Baltimore, New York and New Jersery all allow riders to sign up for automated text message alerts which are sent out whenever a problem occurs. In Paris, France, however, the Parisian transportation authority, the RATP, has taken text messaging a step further, creating an interactive SMS service that provides real-time arrival estimates to transit users on demand.

The RATP's interactive SMS service offers arrival and departure information for all of Paris's buses, regional rail (RER), and streetcars (trams). To use the system, riders send a text message to a designated phone number (61064*) stating the mode of transportation (bus, RER or tram) and the route number and full station name. For RER service, Paris's regional commuter rail, users enter the RER line (A or B) and the boarding and destination station names.[12] Within minutes, users receive a text message from the RATP with arrival times in both directions.

The RATP's interactive text messaging system allows cellphone users who do not have web-enabled cellphones to receive real-time information about arrivals and departures for Paris's buses, trams and regional RER service.

12 RATP Website, "Ma RATP dans la poche;" (http://www.ratp.fr/); Accessed 12/17/07

On-demand SMS service substantially reduces information distribution infrastructure costs for transit authorities. Transit users themselves provide the distributuion interface (their cell phones); the only infrastructure requirement for the transit authorities is to gather relevant information in a format that can be sent. In addition, because SMS messages can be up to 160 characters in length and all messages are automatically stored on the users' phone for easy retrival, SMS systems are extremely user friendly.[13] Users can access the information provided at a later time even if they are no longer in an area with wireless access.

Case Study 14: Codes2D Matrix Barcodes (Paris, France)

The RATP has also begun experimenting with matrix barcodes as a way to simplify communications between transit authorities and users. Also known as 2-Dimensional Barcodes or QR codes, matrix barcodes are essentially the next-generation of barcodes. Like any other barcode, matrix barcodes store information in a compact format. As a transportation (or marketing or security) device, they can be coded to act as an active hyperlink which, when "scanned" by a cell phone camera, directs users to specific pages on specific websites. Matrix barcodes are more powerful than standard "cereal box" barcodes because they can hold significantly more data and because their format is more dificult to forge.[14] Traditional bar codes carry up to 21 characters per inch; a matrix barcode can represent up to 4,296 alphanumeric characters.[15]

The RATP's six month pilot matrix barcode program, called Codes2D, began in April 2007 at the Noisy-Le-Grand Mont d'Est RER and bus station.[16] Riders use their cell phone cameras to

13 3GPP Website (http://www.3gpp.org/ftp/Specs/html-info/0340.htm); Accessed 11/27/07
14 Stellin, Susan, "Paper is Out, Cellphones are In," The New York Times, 18 March 2008
15 Wikipedia Website, "QR Codes," (http://en.wikipedia.org/wiki/QR_Code); Accessed 11/27/2007
16 Cousin, Capucine; "La RATP expérimente les codes-barres 2D pour l'info voyageur," businessMOBILE.fr, 4 June 2007

"scan" the barcode which directs their mobile browser to specific pages on the RATP webpage. Instead of scrolling through menus or typing in URLs, the matrix barcodes directly link transit users to system maps, schedules, real-time arrival times and service alerts.[17] All information—maps, schedules, arrival times and service alerts that appears on the standard transit agency website—is accessible wirelessly on a one-click basis.[18] In addition, information accessed through the Codes2D program can be stored on the user's phone, allowing them to access it again later, even if wireless service is no longer available.

The RATP's Code2D system takes users directly to the information they request on the RATP's website. Image used with permission of the RATP.

Placards displaying the Codes2D are easy to find; the RATP has placed them at all the bus stops at Noisy-Le-Grand Mont d'Est, on the RER platforms, and throughout the central waiting room.[19] Transit users access the service by first downloading and installing the Codes2D application to their mobile phone from the Scanbuy website which produced the Codes2D technology for the RATP.

In the United States, matrix barcodes are most frequently used on shipping labels. However, in addition to the transit uses being tested by the French, manufacturers and advertisers in Japan and South Korea have begun coding matrix barcodes to directly link potential customers to commercial websites.[20] Users can see a barcode on an advertisement, "scan" it with their phone and are directed to the product website where they can purchase the products from their cell phones. All Nippon Airways allows passengers to check in for domestic flights via a matrix-barcode sent to their cellphone.[21] Continental Airlines has recently followed suite, working with the Transportation Security Administration since December 2007 to test the system at Continental's Houston hub.[22]

Examples and Opportunities in New York City:

Enhancing New York City's current information offerings for mass transit can help the city meet a number of important transportation goals laid out in PlaNYC 2030, including increasing capacity on overcrowded lines and improving access to underserved areas by providing users with information about schedules, delays and alternate routes.

Because users themselves supply the majority of the infrastructure (cellular phones, PDA's, iPods etc.) web-based and wireless information services can be implemented relatively quickly and at minimal costs to transit providers. In partnership with companies like Google and others, existing information websites such as the MTA website and Transcom's Trips123 can be enhanced to include a wide variety of transit information options. These can be done without impeding efforts to develop the city's long-term transportation communications systems, like real-time digital platform signage. In addition, as not all New Yorkers have access to wireless technologies, introducing non-wireless low-tech immediate solutions could also improve the information offerings and increase customer service and satisfaction ratings.

A key step in enabling wireless information services throughout

17 RATP Website, (http://ratp.fr); Accessed 11/27/2007
18 Cousin, Capucine; "La RATP expérimente les codes-barres 2D pour l'info voyageur," businessMOBILE.fr, 4 June 2007
19 ibid.
20 CNET Asia Website, "QR Code Smudges Japanese Daily Life," (http://asia.cnet.com/reviews/blog/mobileojisan/0,39050793,62020373,00.htm); Accessed 11/27/2007
21 Story, Louise; "In a New Web World, Bar Codes May Talk With Your Cellphone;" The New York Times, April 1, 2007
22 Stellin, Susan, "Paper is Out, Cellphones are In," The New York Times, 18 March 2008

the transit system is outfitting subway stations with the cellphone reception. The city is planning to install cellphone equipment in all of the transit system's stations – a task that will take several years to complete. In the meantime, wireless services would still be valuable at bus stops, above-ground at station entrances and throughout the rest of the city.

Information systems that could be introduced in New York City are as follows:

- Increased publicity for the MTA's new cell-phone-friendly http://tripplanner.mta.info/tripPlannerPDA.aspx website.
- Increase publicity for the MTA's Service Alert text messages.
- Use SMS technology to disseminate train arrival times (for the lines where signal upgrades are completed) on demand.
- Code2D matrix barcode technology could be incorporated into bus signage and all above-ground subway signage to direct customers to important information.