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Report on the Spring 2007 Mission

EMERGENCY PREPAREDNESS, RESPONSE, AND RECOVERY IN THE TRANSIT INDUSTRY

This TCRP digest summarizes the mission performed March 16–March 31, 2007, under TCRP Project J-03, "International Transit Studies Program." This digest includes transportation information on the organizations and facilities visited. This digest was prepared by staff of the Eno Transportation Foundation and is based on reports filed by the mission participants.

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INTERNATIONAL TRANSIT STUDIES PROGRAM

The International Transit Studies Program (ITSP) is part of the Transit Cooperative Research Program (TCRP), authorized by the Intermodal Surface Transportation Efficiency Act of 1991 and reauthorized, in 2005, by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. TCRP is managed by the Transportation Research Board of the National Academies, and is funded annually by a grant from the Federal Transit Administration (FTA). ITSP is managed by the Eno Transportation Foundation under contract to the National Academies.

ITSP assists in the professional development of transit managers, public officials, planners, and others charged with public transportation responsibilities. ITSP carries out its mandate by offering transportation professionals practical insight into global public transportation operations. The Program affords the opportunity for them to visit and study exemplary transit operations outside the United States.

Two ITSP study missions are conducted each year, usually in the spring and fall, and are composed of up to 14 participants, including a senior official designated as the group spokesperson. Transit organizations across the nation are contacted directly and asked to nominate candidates for Program participation. Nominees are screened by committee, and the TCRP Project (J-03) Oversight Panel endorses all selections. Members are appointed to the study team based on their depth of knowledge and experience in transit operations, as well as for their demonstrated advancement potential to executive levels of the public transportation industry. Travel expenses for ITSP participants are underwritten by TCRP Project (J-03) funding.

Each mission abroad focuses on a theme that encompasses a topic of concern in public transportation. Cities are selected according to their ability to demonstrate leading-edge strategies and approaches to public transportation issues and challenges, as reflected in the study mission's overarching theme.

TRANSPORTATION RESEARCH BOARD
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The members of each study team are fully briefed prior to departure. The 2-week mission has a triad of objectives: (1) to afford team members the opportunity to expand their network of domestic and international public transport peers, (2) to provide a forum for discussion of global initiatives and *lessons learned* in public transportation, and (3) to facilitate idea-sharing and the possible import of strategies for application to America's transportation communities.

For additional information about the International Transit Studies Program, please contact Gwen Chisholm Smith at TCRP (202-334-3246; gsmith@nas.edu), or Janet Abrams at the Eno Transportation Foundation (202-879-4718; janet.abrams@enotrans.com).

About This Digest

The following digest is an overview of the mission that investigated emergency preparedness programs in the public transportation systems in several Asian cities. It is based on individual reports provided by the team members, and it reflects the observations of the team members, who are responsible for the facts and accuracy of the data presented. The digest does not necessarily reflect the views of TCRP, the Transportation Research Board (TRB), the National Academies, the American Public Transportation Association (APTA), FTA, or the Eno Transportation Foundation.

EMERGENCY PREPAREDNESS, RESPONSE, AND RECOVERY IN THE TRANSIT INDUSTRY

Introduction

In March 2007, a team of transit professionals led by Michael H. Setzer, CEO of Southwest Ohio Regional Transit Authority in Cincinnati, Ohio, traveled to Asia to learn about emergency preparedness efforts underway at selected public transportation agencies; actual experiences in disaster response and recovery; and any national or regional structures that, during a crisis, would provide support to communities in need.

The mission team included managers from state, local, and regional transportation agencies, as well as senior executives of the FTA, the TCRP, and the APTA. For the team roster, please see Appendix A.

The mission itinerary included the following destinations:

- Hong Kong SAR, Beijing, and Tangshan in the Peoples Republic of China;
- Seoul, Republic of Korea; and
- Kobe/Hyogo Prefecture and Tokyo, Japan.

In planning the trip, Eno Foundation staff, working with the team leader and colleagues at TCRP, FTA, the Office of the U.S. Department of Transportation (USDOT) Secretary, APTA, and others, selected each city based on local experience in dealing with mass emergencies and/or planning for disaster contingencies:

- In Hong Kong, transit officials responded to the 2002–2003 outbreak of Severe Acute Respiratory Syndrome (SARS) and have been preparing for the possibility of an even greater occurrence of Avian Influenza. In addition, leaders there must be prepared for monsoons and other severe weather.
- Beijing will host the 2008 Olympic Summer Games. The city is expanding its transportation infrastructure massively and preparing to transport millions of visitors from around the world.
- In 1976, Tangshan, a city 93 mi east of Beijing, experienced a massive earthquake that took the lives of an estimated quarter-million people and destroyed all structures. In 2006, China celebrated the impressive rebuilding of the city. The mission team would explore how the experience of tragedy influences transportation planning and public attitudes today.
- Seoul hosted World Cup Soccer in 1992. Major investment was made in new transportation facilities and services. In addition, with the Demilitarized Zone just over 30 mi to the north, the city must maintain a high level of readiness to support civilian and military requirements.
- In 1995, an earthquake hit Kobe, the capital of Hyogo Prefecture. Team members would learn about the impact of the quake on the transit system, the role the system played in response to and recovery from the disaster, and how local officials have employed lessons learned.
- Also in 1995, members of the group Aum Shinrikyo attacked Tokyo subway riders with sarin gas, causing 12 deaths and some 6,000 other casualties. How did transit, law enforcement, and national security officials respond? How

did recovery proceed? What measures are in place now within the transit system to prevent, respond to, and recover from such events? Like most Japanese cities, Tokyo is also subject to typhoons and earthquakes.

Over the 2-week study mission, team members met with transit system executives, transit authority representatives, other municipal and regional officials, transportation industry researchers, and, in the case of Beijing, U.S. Embassy personnel. In addition to briefings, hosts provided tours of transit facilities (bus and rail) and sites commemorating past disasters. For a list of host organizations, please see Appendix B.

This report begins in Section I with general observations by the mission team about the state of transit emergency preparedness in the cities visited. In Section II, information gathered about the policies and programs in place in each of the transit environments is provided. Section III shows how the different transit systems manage key emergency functions, including the following: control centers, Information Technology (IT) and telecommunications, interagency coordination, public communications, and evacuation planning.

SECTION I MISSION TEAM OBSERVATIONS

Upon completion of the intensive tour of transit systems in China, South Korea, and Japan, team members developed consensus around a number of general observations.

First, two points should be made about the team's experience in China:

- In Beijing, where three of the ten working days of the trip were spent, the mission team received relatively little specific information about the city's emergency preparedness programs especially as related to the upcoming 2008 Olympic Games. This experience contrasted with the generous information-exchange that took place in Hong Kong, Seoul, Kobe, and Tokyo.
- Regarding Tangshan, the team made a day-trip there, 2.5 hours east of Beijing, to learn about the community's experience of rebuilding after a tremendous earthquake in 1976 destroyed the area and took an estimated 240,000 lives. Team members were hosted by the Deputy Mayor at a ceremonial luncheon, learned about the city's role in overall economic development in the region, and toured the Tangshan earthquake museum. The team did not hold detailed discussions with local officials about current emergency preparedness.

General Findings

- Setting aside Beijing and Tangshan, the transit systems visited in Hong Kong, Seoul, Kyoto, and Tokyo demonstrated that they have comprehensive plans for managing emergency situations. Based on information delivered during the team's brief visits, executives in Hong Kong seemed to embrace "business continuity planning" in the fullest sense.
- A city's past experience with disaster influences public attitudes about the need to be vigilant and transit leaders' approach to preparedness.
- The cultural and especially the political context has a great deal to do with all aspects of planning and management around emergencies.

Officials who hosted the mission team in Tangshan and Kobe/Hyogo Prefecture made clear that the devastation caused by earthquake and massive rebuilding remains at the top of their minds—even 30+ years after the tragedy in the case of Tangshan. Both cities have museums commemorating the terrible destruction and tremendous effort required to recover. Most all citizens were directly affected by the incidents. In Hong Kong, the SARS outbreak is fresh in the minds of public health experts and transportation planners, as they face the possibility of an Avian Flu pandemic. In Tokyo, memory of the Sarin gas attack of 1995 has not faded, especially as transit systems elsewhere in the world have been hit by terrorists.

Interestingly, in Hong Kong, where there has been no major terrorist incident to-date, transit executives who hosted the mission team seemed not to view terrorism as a major concern although they exhibited a high level of awareness and preparedness for other threats.

In all cities on the itinerary, local transit operators are focused fully on system performance, and other, separate public agencies (local/regional/national) take the lead in providing for passenger safety and security. Transit operators in Hong Kong, Seoul, Kobe, and Tokyo plan for disasters and partner with police, fire, emergency response, and defense agencies. The systems visited do not have their own transit police forces; nor do their executives have the authority or funding for disaster preparedness that U.S. authorities now do in the post-9/11 and post-Katrina era. In Beijing, preparing for disasters and responding to them appear to be roles exclusive to the central government.

This was to be expected of the cities in mainland China; however, it is also the case in other cities, where transportation companies, as noted, are for-profit entities, and without question, dynamic and capitalistic in operation.

In Beijing, local officials who spoke to the mission team noted that emergency planning for the Olympic Games and response to any incidents that might occur would be handled by the national government.

Team members noted the contrast with the United States, where the Federal Government has assigned responsibility for the development of Security Emergency Preparedness Plans, Readiness Alert Response Protocols, and Consequence Management Recovery programs to local agencies, while providing some financial and technical assistance.

In Asia, public expectations about the performance of public transportation are generally higher than in the United States, and ensuring passenger safety and security is assumed to be components of the overall performance of the system.

In Hong Kong, Seoul, Kobe, and Tokyo, the mission team was impressed with the efficiency and cleanliness of the bus and rail systems. For example, team members were awed by learning that Hong Kong's gleaming MTR rail system, which transports 2.5 million passengers each week day, had achieved 99.9% on-time performance in 2005. Petty crime is relatively uncommon in these systems, compared to the experience in major U.S. cities. This can be explained by differences in culture and by successful processes in place. Securing the systems against possible terrorist attack is not taken as wholly distinct from the overarching commitment to ensuring efficient service.

Team members noted fundamental differences in how the systems visited on the mission are managed, in comparison to American transit agencies. Most notable were the highly entrepreneurial providers in Hong Kong and Japan and their focus on business-based goals and objectives.

Several of the transportation agencies observed in Asia are regulated by profit-sharing agreements with their respective governing agencies. Earnings-based, they appear to enjoy greater freedom to develop strategic business plans to meet the operational and financial goals of their corporations.

The use of Total Quality Management (TQM) business practices was evident in briefings delivered in Hong Kong, South Korea, and Japan.

In Hong Kong, MTR embraced an enterprise risk management model—which treated risk of outage due to natural or man-made cause as one of numerous risk elements that could affect the bottom-line.

In Hong Kong and other locations, the ITSP team observed an emerging trend, wherein transit agencies are procuring tracts of land adjacent to their systems and are developing residential or commercial areas. These profit-driven developments are designed to financially support transportation companies as well as meet the growing needs of an over-populated society.

- Cultural attributes appeared to facilitate public acceptance of emergency preparedness programs.
- In none of the Asian cities did the mission team encounter concern by officials about the skepticism or indifference on the part of the public that is commonplace in discussion in the US among emergency planners.

Over the course of the study mission, hosts devoted relatively little time to discussion of how the views of particular passengers or employees are addressed in the development and deployment of disaster preparedness programs. In Beijing—given the traditional focus on the state versus the individual and the rush to launch service before the Olympics—ensuring open communications with riders is not identified as a priority. In the other more modern cities where many embrace TQM, information is gathered by customer service representatives to ensure the best possible system performance. However, managers in Hong Kong, Seoul, or Tokyo are unlikely to focus as much energy as U.S. transit executives are on managing relationships with the public, the media, governing boards, and various interest groups in regards to emergency preparedness or any other system objective.

SECTION II BACKGROUND ON CITIES AND TRANSIT AGENCIES VISITED

Hong Kong SAR, China

A long-time British Colony, Hong Kong was returned to the People's Republic of China in 1997 and named a “Special Administrative Region (SAR).” Located on the southern coast of China, it covers approximately 421 mi^2 and includes the New Territories (a portion of the mainland); Kowloon Peninsula; Hong Kong Island; Lantau Island; and more than 200 adjacent, smaller islands.

Since its days as a major trading post of the British Empire in the 19th century, Hong Kong has built its success on shipping, commerce, and manufacturing. Today, its deep, natural harbor ringed by steep, mountainous terrain continues to define the city as a world-class commercial port, financial center, and major tourist destination.

The population of Hong Kong is approximately 6.9 million. As a self-governing region of China, Hong Kong has its own chief executive, selected by an 800-member election committee and advised by a 19-member Executive Council. The Republic of China is officially responsible for only defense and foreign affairs.

Public transportation is provided by two rail companies: Mass Transit Rail (MTR) and Kowloon-Canton Railway (KCR), and a number of bus companies. The ITSP team visited three of these operators: MTR, KCR, and Kowloon Motor Bus Company (KMB).

Note: In April 2006, MTR Corporation Limited signed a non-binding Memorandum of Understanding with the Hong Kong government, the owner of Kowloon-Canton Railway Corporation (KCRC), to merge the operation of the two railway networks. The merger had not been finalized by the time of the ITSP team visit to Hong Kong, though a number of presenters did mention it. When the deal is made official, MTR Corporation Limited is expected to take over the operation of the KCR network and combine the fare system of the two networks.

Mass Transit Railway Corporation (MTR)

Company Background. The MTR Corporation operates a mass transit underground railroad that is one of the most intensively utilized systems in the world. Opened in 1979 with one line, it currently operates seven lines consisting of five key commuter lines and two destination-specific lines: the Disneyland Resort Line and Airport Express.

MTR’s total route length is 91 km. It has 53 stations and five depots and provides service to Kowloon, Hong Kong Island, the New Territories, and Lantau Island. The average train length is 8 cars, with a maximum loading capacity of 2,500 passengers. During the weekday, the system transports 2.5 million passengers with an on-time performance rating of 99.9%.

To ensure maximum safety and reliability, trains are operated with automatic control and protection systems, which regulate the distance between trains and determine the optimal rates of acceleration and braking, as well as coasting speeds on different sections of track. The routing and timing of train movements are controlled by computer systems according to scheduled timetables issued from a control center.

To meet escalating passenger demand, the Corporation expanded its train fleet from 140 cars in 1979 to 1,074 cars in 2006, 88.6% of which are in service during morning peak commuter hours.

Ease of passenger movement within the system is achieved by coordinated vertical and horizontal circulation of customers. Vertical circulation is by means of escalators and stairs. For stairs, holding capacity is 63 passengers per minute, and for escalators, the capacity is 135 passengers per minute. Horizontal circulation is managed through the use of Automated Fare Counters (AFCs). The clear directional flow avoids customer “cross-flow” and the need for excessive signage.

Members of the mission noted that all MTR facilities they visited appeared durable, clean, and quiet. The system ceases operation between the hours of 1:30 a.m. and 4:50 a.m. to allow for maintenance at every station and on each train car.

Fares on all lines are collected by an Automatic Fare Collection System. In 1997, MTR introduced the Octopus Card, a “smart fare card” that can also be used to access buildings and purchase goods and services. Approximately 7 million Octopus Cards are in circulation.

Beyond its operation of rail service, the MTR Corporation is internationally recognized for the “Rail and Property Development” business model it has pioneered. The company’s stated mission is “to build Hong Kong’s future.”

MTR enters into joint ventures with property developers to construct residential and commercial properties above stations and depots, and along railway sites. To date, there have been 18 property complexes completed that have collectively generated 31,366 housing units, 251,000 m^2 of office space, and 290,000 m^2 of retail space.

The Corporation also manages residential units and retains commercial property for investment. At the end of 2005, MTR managed 54,358 apartments and 562,296 m^2 of commercial space, among them, Hong Kong's tallest buildings, and Two International Finance Center.

In 2008, MTR will complete construction on the tallest building in the Hong Kong/Kowloon area. The Kowloon Station Development International Commerce Centre will stand 118 stories high and feature a 5-star hotel on its upper floors.

Emergency Preparedness Measures. In meeting with MTR executives, the ITSP mission team learned about the Corporation's ERMM, which establishes a common standard for identifying and measuring risks across all functions and business units of the organization—from transportation to real estate development to retail services. MTR representatives noted that this holistic approach to planning gives stakeholders an understanding of how risks impact the whole company and not just their individual divisions, and encourages a "common risk management culture."

ERMM is used to identify and mitigate enterprise risks that might affect safety of customers or employees, the company's finances, and/or public image. Risks identified for the ITSP team include:

- Public health crisis, such as Avian Flu.
- Operating railway crisis. Note: MTR Corporation has developed an Automatic Train Protection System (ATP) that prevents high-speed collisions. In an emergency, MTR can change rail speed and, if necessary, allow for manual operation of a train up to 25 mph.
- Property crisis, such as a fire in one of its commercial developments.
- Construction crisis, such as a building collapse or collapse of a tunnel on a new rail line.
- Political, socio-economic, or financial crises

Working from the Enterprise Risk Management Model, MTR planners have created and continuously update the Corporation's Business Continuity and Contingency Plan.

During an emergency, actions are directed by the MTR Crisis Management Committee, activated and chaired by the CEO. The Committee aims to keep all managers and other essential employees informed of their responsibilities.

All managers are issued a Crisis Management Manual, first published in 1995. The comprehensive guide details (1) activation of the Emergency Operation Center (EOC); (2) public information policy including media relations and rumor/misinformation control; (3) duties of essential employees; and (4) use of the Business Continuity and Contingency Plan to determine appropriate responses to specific events, e.g., earthquakes, train derailment, etc. Appendices include standard forms, worksheets, draft statements, and the like, so employees do not have to create these materials during a crisis.

MTR conducts annual Emergency Management Exercises, which call for employee training prior to the exercise and review of the Crisis Management Manual. Once employee preparation is completed, the exercise is conducted. All exercises are followed by debriefing and the development of an After Action Report, an Improvement Plan, and, if indicated, updates to the Manual.

MTR Corporation obtains monthly threat and risk information from the police. Based on law enforcement intelligence, the Corporation believes it is at relatively low risk for an attack by terrorists. However, management sees public health threats (SARS and Avian Flu) as more immediate.

It should be noted that MTR representatives who briefed the ITSP team did not describe active coordination on emergency preparedness with law enforcement authorities. This may occur, but it was not highlighted in the presentations.

MTR's Operations Control Center (OCC) coordinates all train service operations and ensures consistent safe, efficient and reliable service. It is staffed 24 hours per day and serves four major functions: (1) train service monitoring, control, and incident handling; (2) power supply monitoring and cost control; (3) environmental control, i.e., ventilation, air conditioning, humidity and fire protection systems in all MTR stations; and (4) dissemination of information both internally and externally.

MTR utilizes strict incident-management guidelines. Incidents are categorized by the length of service disruption. Minor incidents are those posing a delay of less than 5 min. Serious incidents disrupt service for 5 to 20 min. In the event service is disrupted for more than 20 min, the event is classified as a major incident. Major incidents are cause for a formal investigation and a full report, which may also be requested by the government.

The OCC is staffed by the following personnel:

- The Chief Controller is responsible for all OCC operations. Following an incident, the Chief Controller coordinates the recovery operation while maintaining the operation of unaffected trains.

- The Traffic Controller responsible for the operation of individual MTR lines, to include monitoring train service, handling incidents, and returning service to a regular schedule following an incident.
- The Communications Controller sends regular advisories to customers and staff, which may encompass weather reports, special train advisories, power supply status, as well as official notifications during a crisis. Crisis communications include the progress of recovery efforts, information about delays in service to passengers on trains and in stations. The Communications Controller uses teleprinter messaging, public announcement systems, and platform display boards to disseminate the information.
- The Power System Controller monitors and controls the whole MTR network to ensure a steady flow of electricity to support train operations. Electricity is provided by two power companies, which enables MTR to always have an alternate power source. While automatic power changeover circuits are built into the system, the Power System Controller must ensure an alternate source of power is always in place.
- The Environmental System Controller ensures that air temperature is adjusted depending on weather and passenger volumes in order to maintain a comfortable traveling environment. In addition, the Controller is charged with activating the smoke extraction system during a fire emergency.

Kowloon-Canton Railway Corporation (KCRC)

Company Background. Established in 1910, Kowloon-Canton Railway began its operation as part of the government. In 1982, KCR incorporated and became Kowloon-Canton Railway Corporation. Its mission is not unlike that of MTR—to be the world leader in providing quality transport services in accordance with prudent commercial principles.

KCRC provides domestic passenger rail service through a 113-km network of rail lines. In addition to core rail services, KCRC operates cross-boundary and inter-city passenger service and carries freight to-and-from the Mainland. It currently operates three rail services: East Rail, West Rail and Light Rail. Each of these networks is supported by feeder buses. KCRC has 31 stations on the East and West Rail lines and 68 stops on the Light Rail lines. KCRC's integrated fare system allows customers who use *Octopus* cards on the East Rail, West Rail and Light Rail and to use the feeder buses free of charge.

In addition to designing, constructing, and launching new rail lines to meet the demands of Hong Kong's growing population, KCRC is a property developer, with the goals of generating income that can be used for continuous improvement of its rail networks, contributing towards the capital cost of new rail projects, and securing an increasing flow of customers for its railway system.

KCRC has already developed thousands of apartments along its transportation routes. Thirteen additional projects, scheduled for completion by 2008, will yield 45,300 new apartments and over 3.1 million m^2 of land space.

Emergency Preparedness Measures. Kowloon-Canton Railway Corporation has an extensive Emergency Response Plan (ERP) categorized by three levels of response: alert, serious and emergency. The levels are determined by the length and degree of service disruption and the potentially negative impact on the reputation of the company.

In response to the 1995 Sarin gas attack in the Tokyo metro and the outbreak of Avian Flu in its own service area, KCRC developed a special ERP Annex entitled, *Response Plan for Special Medical Situations.* It addresses medical emergencies, specifying roles and responsibilities, policies, and activation and notification procedures. KCRC's Human Resources Department has responsibility for portions of the plan related to employees. The Annex includes medical leave applications, return to work policies, quarantine, contact policies, and medication stipulations, all of which are confidential personnel issues.

Noteworthy agency practices include mandating that all employees receive flu vaccines (therefore, if an employee falls ill with flu symptoms, the agency will know it is not the regular flu). In addition, at certain alert levels, the agency can require that employee temperatures be taken (to identify illness prior to the onset of symptoms). As an environmental protection, elevator buttons are covered in plastic and cleaned with bleach mixture daily to aid in stopping the spread of disease.

The ERP identifies critical employees and team assignments. Team deployment is predetermined depending on the time, day, and nature of the incident.

Replacements and back-up personnel are also identified. Employees are cross-trained for continuity of operations and to ensure essential functions, such as payroll, are uninterrupted.

KCRC conducts three emergency field exercises annually (one on each rail line) and the public and customers are invited to participate. Exercises are performed openly in the stations to remind customers of the potential for catastrophe and the importance of preparedness.

The ITSP team was briefed on provisions KCRC has made for disabled passengers, provisions which are important for this group of riders and really for all customers in the event of an emergency.

The Corporation makes rail cars and stations accessible to individuals with vision disabilities. Accommodations include:

- High contrast colors on rail car handrails and floors makes movement easier for individuals with low vision.
- Directional bar and decision tiles are installed in elevators and on tactile maps and platforms as well as other station areas.
- Detectable warning tile alerts vision-impaired customers that they are approaching the edge of a platform.
- Braille signage on handrails advises vision-impaired customers as to the number of steps they must ascend to exit a station.

In the event customers with mobility impairment have trouble boarding or exiting railcars, the car operator is able to view the interior and exterior of rail cars before moving the train.

Other accessibility features include (1) maps that light up and blink to indicate the next station stop; (2) light-emitting diode signs that announce the next stop; (3) clearly audible announcements of all station stops; (4) priority seating for seniors; and (4) designated areas for mobility devices.

Kowloon Motor Bus Company (KMB)

Company Background. Founded in 1993, the Kowloon Motor Bus Company is the largest bus operator serving Kowloon peninsula, the New Territories, and Hong Kong Island. Its fleet of 4,300 buses covers 400+ routes and 5,000+ bus stops. More than 3 million passenger trips are logged each day. KMB provides service 24 hours per day through its regular commuter service, airport transport, and overnight travel.

Its four main depots and 12 garages and yards, each equipped with maintenance facilities, handle daily operations and servicing. KMB's Overhaul Center is the largest bus maintenance facility in the world. With its own training facility, KMB has trained 2,000+ technicians. All busses are equipped with smart card technology, and at the time of the ITSP team visit, 80% of customers were using the Octopus card to pay fares.

The company attributes its success to the TQM principles instituted in the 1990s. All aspects of KMB's bus services, including vehicle assembly, maintenance, network planning and operations, and supporting services, meet the highest international standards.

KMB was one of three winners of the 2001 Hong Kong Management Association's award for Excellence in Quality Management. The Company was praised for its commitment to TQM and for its improvements in service, efficiency, reliability, effectiveness and value. KMB is the only bus company in Hong Kong to have received this prestigious award.

KMB has invested in its infrastructure by modernizing operations facilities, providing real time traffic information using CCTV systems, and employing state-of-the-art Traffic Operations Management (TOM) in all depots. To meet the needs of elderly and disabled passengers, KMB collaborated with their bus maker and designed the first super-low-floor, wheel chair accessible, double-deck bus.

The company has developed a comprehensive Customer Service Hotline that operates 24 hours per day with 72 phone lines. The fully automated system provides pre-recorded information on 400 bus lines in three languages. It is capable of providing interactive voice assistance. The Hotline handles approximately 15,000 calls each day, with 3,500 of the calls transferred to a Customer Service Operator.

KMB's high tech Digital Map Passenger Enquiry System integrates over 100,000 landmarks (bus stops, MTR stations, major businesses and retail outlets, police and fire stations, etc.). The technology provides the most accurate information about the status of KMB's transit system, and is capable of publicizing special traffic announcements and up-to-date information about other KMB services.

Emergency Preparedness Measures. Kowloon Motor Bus Company engages in careful planning to avoid disruption in operations due to outside events. Prior to the World Trade Organization (WTO) meeting in 2005, KMB performed a risk assessment to identify and mitigate potential weaknesses in their system that could be exploited by protesters or other parties. Threats that were identified and related responses included:

- Threat: Intentional blockage of key bus corridors
  Response: Developed an emergency diversion plan
- Threat: Disruption of diesel fuel supply
  Response: Arranged delivery of fuel from multiple suppliers; developed plan to refuel peak busses only
- Threat: Blockage of depots
  Response: Deploy buses from outside the depot
- Threat: Cyber attacks
  Response: IT department conducted drills on information recovery
- Threat: Suspicious packages
  Response: Continuing education of employees; development of a "quick-tip" card.

KMB has a Disaster Recovery Center that uses the same cutting edge technology that runs the Customer Service Hotline. The Center can be used as a back-up customer service center, or as a control center shared with KCRC and MTR.

Adjacent to the Disaster Recovery Center is the Radio Control Room staffed by four to five controllers on a 24-hour basis. Communication to or from Bus Inspectors (supervisors) occurs using VHF radio frequencies and cell phones. Communication from Bus Captains (drivers) to the Center is via personal cell phones. KMB employs 115 transit "foot soldiers" who randomly ride buses to provide spontaneous and unannounced security.

The Radio Control Section of the Radio Control Room staff is responsible for communication with outside agencies such as police and fire departments and power and water companies. This is done through telephone land-lines, while mandatory communication with the Hong Kong Transport Department is through multi-fax connections.

The ERP resides in the Radio Control Center. This document contains all standing orders and contingency plans, to include action check-lists and procedures for route diversions. The ERP is implemented and coordinated by Radio Control Center staff and executed by supervisors and investigators in the field.

KMB executives related that while there were no major incidents during the WTO meeting, they did activate the ERP. Staff documented the disruption of 27 bus routes and approximately 100 incidents in which law enforcement intervention was required.

Beijing, China

Beijing has a history that can be traced to the 1st millennium BC and has been China's capital for most of the past 800 years. The city now has a population of more than 15 million and will proudly host the 2008 Olympic Summer Games.

Beijing is a transportation hub, and traffic is heavily congested. Bus, subway, and taxi are the city's main methods of transport, but private automobile ownership is growing rapidly, with cars being added to the roadways at a rate of 40,000 per year.

City officials have implemented a number of measures to reduce traffic congestion. There are dedicated lanes to accommodate the city's more than 10 million bicycles. Roadway signage is detailed with pictures. Intersections include advanced technology. For example, Beijing's traffic signal system features "count down" clocks to alert motorists to the number of seconds before a light changes from red to green.

Currently, the city's leading mode of public transit is bus transportation, and more than 18,000 buses serve the population. In preparation for the Olympic Games, new subway lines are under construction. The Beijing subway now has five lines servicing 70 stations and transporting approximately 750,000 passengers daily in 624 train cars traveling over 114 km of track. Four additional subway lines are planned, and three of these are expected to be operational by summer 2008. When completed, the network of nine lines will translate to 200 km of rail.

Members of the ITSP team noted the large number of bicycles in use throughout Beijing and observed that during peak times on busy streets, biking appears to be the fastest means of transportation over short distances.

During the ITSP team's visit to Beijing, an issue of the government-run *China Daily* (March 23, 2007) was published that offered an overview of transit planning underway for the Games.

Along with the construction of new subway lines, the newspaper reported on the building of several transportation hubs, some including low-fee parking lots, to encourage drivers to switch to buses in making their way to the 27 Olympic venues.

Regarding the bus system, several upgrades were described:

To address air quality concerns, many older buses are being replaced by energy-saving “green” buses.

New buses are equipped with electronic bus-stop announcements, IC card readers, electronic monitors, and passenger-monitoring devices. Beijing bus operators are proceeding with efforts to improve bus signs to show bus numbers and routes, including departure and terminus locations. Signs will be luminous for better visibility at night. In addition, some city buses will be equipped with mobile television. Live broadcast television will also be available.

The article further described efforts to upgrade and enhance the city’s transportation systems:

- Traffic police have developed “microcirculation” road signs to ease traffic congestion in downtown areas.
- The city is introducing computer networks to time traffic lights according to traffic flow.
- Beijing is imposing Euro IV emission standards.
- A command center will oversee and manage traffic congestion during the Games.
- New traffic restrictions will reduce the volume of vehicles on the road by 20% to 25%.
- Special lanes will be dedicated to connect all Olympic venues for officials, athletes and referees.

The *China Daily* issue also contained a feature on one entrepreneur’s pioneering efforts to make bicycling more accessible for Beijing residents and visitors. Mr. Wang Yong acted on what he knew was an up-and-coming boom in two-wheeling in advance of the Games and opened a small bike rental operation. After 6 months, he owned 22 chains across the capital. “Beijing encourages the use of bicycles as part of its plan to improve the city’s public transport before and after the games,” he proclaimed. As of March 2007, Wang Yong had 1,000 bicycles for rent stored at business centers and subway stations; customers can return bikes to any of the sites. For those willing to pay a registration fee of about $48, he offered a VIP Card, promising the experience of “having a bicycle at your fingertips.”

Emergency Preparedness Measures. As mentioned above, the Chinese officials who met with the ITSP team offered relatively little specific information about the emergency measures being put in place for the Olympics. General reference was made to plans that were in effect to address all contingencies, but emphasis in briefings was placed on ensuring smooth flow of traffic and preventing/responding to vehicle accidents on the roads.

The ITSP team was told the following:

Under the auspices of the Beijing Municipal Committee on Communication, the Beijing Traffic Security System will support the Olympic Games. Security planning, led by the National Police, began in 2005.

The city has a Traffic Management Center which coordinates with national, municipal, and local law enforcement agencies. Its mission is to plan for, and respond to, natural disasters, vehicle accidents, public sanitation problems, and public security incidents. During the Olympic Games, control of all traffic management (rail, subway and vehicle) will be coordinated at the Center. (Note: Later in the study mission, when team members visited Seoul, South Korea, they learned that representatives of the Beijing government had visited there to learn about the Seoul emergency coordination and response facility.)

For the Olympic Games, Beijing officials’ priorities are to ensure the city’s ability to transport the hundreds of thousands of athletes, volunteers, visitors, and customers to all 31 stadiums. The city’s emergency response system features 22 different security response procedures as well as strategically sited mobile command vehicles. There will be complete CCTV coverage of Olympic venues.

The Beijing Public Transportation Corporation (BPTC), the leading bus provider, is closely involved in planning activities and will support the Olympics with 18,800 buses that usually carry 11 million passengers daily. In an emergency, BPTC can assist rail lines with bus support. For the Paralympic Games, which will follow the Olympics, BPTC will supply 400 additional buses that will be disabled-accessible; special routes are under development. Working with the police, BPTC is advising drivers that, in the event of an onboard emergency, they are to park the bus, evacuate, and notify the police. Bus operator training also involves procedures for handling suspicious packages.

While the information they relayed was limited, the officials who met with the ITSP team made it clear that they were concerned about the possibility of traffic grid-lock, the potential for overloaded transit systems, the ever-present risk of natural disaster, and the threat of terrorism. They acknowledged the broad public relations and economic implications of the Games and the need for all Chinese to put their "best foot forward" at this significant moment in China's history.

Below are brief summaries of the presentations given to the ITSP team at selected Beijing government agencies as well as the United States Embassy.

Beijing Municipal Committee of Communications (BMCC)

The BMCC carries out national policies, laws, and regulations related to transportation development and reform. In addition to influencing macro-level city transportation programming, the Committee concerns itself with long term policies for traffic management.

Research Institute of Highway (RIOH)

The RIOH of the Beijing Ministry of Communications served as official host organization for the ITSP mission team. RIOH conducts scientific and technological research in the areas of road and bridge engineering, traffic engineering, Intelligent Transportation Systems, motor vehicle application, road- and transport-related environmental protection, physical distribution and logistics, and the impact of natural disasters on road transport. China does not presently have a separate research program focused on public transportation like the Transit Cooperative Research Program in the United States.

RIOH has a staff of 1,500, including 1,000 professionals. Their primary focus is the reduction of vehicle accidents.

In 2004, RIOH established an emergency response center. Under this umbrella, there are now 25 "special plans" and 80 "emergency response" departmental plans in place. Several specific systems have been developed to address requirements in forecasting, preparedness, and emergency response.

One area of research emphasized during the ITSP team visit related to the growing incidence of traffic accidents involving commercial vehicles. The number of commercial vehicles in China is growing rapidly, and with it, the number of fatalities on the roads. RIOH is assessing the value of traffic safety education for the general public, as well as limiting the number of times trucks can travel on the highways.

In addition, data exchanges have been instituted between the Transportation Management Bureau and the Traffic Management Bureau. A Control Center of Traffic Safety and Emergency has been established to coordinate emergency response efforts. And a vehicle-monitoring system based on GPS technology has been initiated in the commercial trucking industry.

Future efforts will target greater levels of communications; developing a transportation safety database; conducting company safety evaluations; and developing a driver fatigue warning system.

Beijing Xianglong Inter-Urban Transportation Company

The Beijing Xianglong Inter-Urban Transportation Company operates 160 vehicles along 88 routes reaching ten Chinese provinces. The provider has seven stations in Beijing and 78 terminals outside the capital.

The mission team visited one of the main bus terminals in Beijing, which could be compared to a large Greyhound station in the United States. Team members received a briefing on the Company's accident prevention program, specifically related to driver speeding, driver fatigue, and the overtaking of buses by other vehicles.

The government regulates the number of hours a bus driver may be at the wheel: 4 hours at any one interval and no more than 8 hours in a 24-hour period. Beijing Xianglong Inter-Urban Transportation Company representatives told the American visitors that approximately 5% of their drivers were in violation of the regulation according to internal data. Management stated they are researching the use of driver monitoring systems.

United States Embassy, Beijing

The ITSP mission team had the opportunity to visit the US Embassy for a briefing by staff charged with preparing for the US participation in the 2008 Olympic Games and related activities by American athletes, government officials, corporate sponsors, and general spectators.

Embassy personnel commented on the challenges they face in obtaining accurate information related to Olympics preparations. Building relationships to gather problem-specific facts was described as a "time intensive process." Staff members also noted the Chinese government practice not to share information about problems that arise in the transportation system or other municipal services with the public.

They expected to see the government take dramatic measures to limit traffic congestion and air pollution during the games. These might include preventing citizens from driving individual cars before and during the big events or possibly temporarily relocating a large number of residents out of the city on a "holiday."

Embassy staff recalled that during the outbreak of SARS in 2003, Beijing officials successfully "shut down" the city. They expected the government would be able to assert similarly effective control for the Games.

The Embassy stressed that international good will is dependent on relationship-building and trust-building in China, and that gathering information specific to real problems is a time-intensive process.

Tangshan, China

The port city of Tangshan, located in Hebei province in northeastern China, is known as the "Rising Phoenix." It was the site of the deadliest earthquake of the 20th century and has undergone complete rebuilding and revitalization since the devastation. The ITSP mission team made a special trip to Tangshan, approximately 200 km east of Beijing, to learn about the impact of such a disaster on the subsequent transportation planning and on public attitudes in general.

At 3:42 a.m. on July 28, 1976, a 7.8-magnitude earthquake shook Tangshan to its core. The quake's epicenter was near Tangshan, and fatalities were sustained as far away as Beijing. The Greater Tangshan Earthquake, as it came to be known, was 400 times more powerful than the atomic bomb that destroyed Hiroshima.

In less than 20 s, the seismic seizure leveled the entire city. An aftershock of 7.1-magnitude created further damage that afternoon. The official Chinese estimate of fatalities was 240,000. However, outside experts believe the death toll likely reached 500,000, with an additional 165,000 to 600,000 people severely injured.

On a tour of the Tangshan Anti-Earthquake Museum, the ITSP team was told that one survivor had the strength and fortitude to make his way to Beijing to report news of the quake. Survivors waited for days for rescue teams to arrive. With damaged roads and no water, food, or electricity, recovery efforts were difficult. Emergency personnel from neighboring Qinglong County were the first on the scene. Neighbors helped each other dig survivors out of the rubble. The People's Liberation Army arrived in Tangshan eight days after the quake.

Chinese leaders refused international assistance and launched a campaign titled, "*Resist the Earthquake, Rescue Ourselves.*" Doctors and soldiers were transported to Tangshan from all over China; the injured were evacuated to distant hospitals; and orphaned children were housed in government facilities.

Leading up to the quake, there was awareness of the threat of natural disaster and the need to take preparedness steps. A State Council Document, issued in 1974, alerted public administrators in the North China region of the possibility of a 6.0 or greater magnitude earthquake. Local officials were encouraged to step-up disaster preparedness, specifically in detecting earthquake precursors, increasing public education, and strengthening earthquake disaster management offices. As a result, 16 counties and hundreds of local observation stations were established and staffed by community volunteers prior to the Tangshan disaster. These stations watched for changes in water color, clarity, temperature, and levels as well as changes in animal behavior, geo-electricity, and geomagnetism.

Qinglong County, located 115 km from Tangshan, responded to the State Council Document by setting up an earthquake disaster management program. School classes were held outdoors in the days leading up to the quake. A high school team monitored instruments measuring geomagnetism, crustal stress, water-well levels, and animal behaviors. Students who noticed significant changes in animal behaviors encouraged school officials to a hold a workshop on earthquake preparedness the day before the disaster struck.

The county government used a planned agricultural meeting to get the word out to residents to prepare for a possible devastating earthquake. Telephone and public announcement systems were also utilized to alert the public. Temporary earthquake tents were set up. More than 60% of Qinglong County's 470,000 residents moved out of their homes; those who stayed kept their doors and windows open to avoid being trapped. Businesses also relocated during the lead-up to the earthquake.

Qinglong County saw 180,000 of its buildings destroyed by the earthquake, 7,000 totally collapsed. However, it appears that due to the advanced planning, only one person in Qinglong County lost his life (from a heart attack) compared to more than 240,000 deaths in the surrounding areas. Since this tragedy, public administrators of Qinglong County have moved forward to integrate scientific and technical knowledge with lay public involvement to develop a "best practices" guide.

In 2006, officials of China's national government celebrated the complete rebuilding of Tangshan that had occurred over the prior 30 years. The city's attributes include its coastal location, deepwater harbor, access to natural resources, and vibrant industrial base. A natural gas pipeline is under construction and, the city is developing a container shipping industry. Increasingly, Tangshan is seen as an important transportation link for the country. The government has constructed an eight-lane highway, a rail line, and two additional expressways. Three national rail lines pass through Tangshan, and there is a national plan to build high speed rail. At 200 km per hour, it would take just 40 min to travel from Tangshan to Beijing.

The experience of 1976 remains in the public psyche, and is vividly illustrated at the Anti-Earthquake Museum. While city and provincial officials who briefed the ITSP mission team preferred to focus on Tangshan's ascending position in the nation's economy, the shadow of the earthquake remains. The museum serves as a memorial and a focal point for public education about disaster preparedness, response, and recovery. In particular, the museum has an impressive display of construction techniques now used to fortify buildings and bridges, and shows images of annual public emergency drills—where citizens come to the adjacent open plaza to stand safe from debris that could fall from the many buildings downtown. The museum is also the coordinating site for regular disaster drills involving local emergency response personnel.

Even with the evident commitment to preparedness, ITSP team members noted that the scope of the 1976 devastation may be too much for current residents to fathom. Some in Tangshan believe that a tragedy of such magnitude cannot happen in their area again. Commenting in a 1995 newspaper article, the head of the Tangshan Earthquake Bureau at the time commented, "An earthquake is like a vaccination. Once you have one, there's no need to worry about another."

Seoul, Republic of Korea

Seoul is the capital of the Republic of Korea (ROK/South Korea) and is the nation's political, cultural, and economic center. Seoul's 14 million residents comprise one-third of the country's population, and an additional 6 million South Koreans commute into the city each workday. With a metropolitan area that encompasses almost 23 million people, Seoul is one of the most densely populated urban areas on earth. The city was almost entirely destroyed during the Korean War, and was rebuilt in the 1960s-1970s.

Memories of the conflict of the 1950s, Seoul's 30-mi proximity to the North Korean border, and a tradition of military-style governing up until the 1990s underpin the city's thorough dedication to emergency preparedness. In 2006, North and South Korean military leaders met to discuss cross-border transportation security, and agreed to allow trains to cross between the two regions in spring 2007. Residents of Seoul are generally optimistic about prospects for reconciliation; however, tension between the two governments persists.

Seoul is recognized for having efficient bus and subway systems.

Its public transit buses are operated by the Seoul Metropolitan Government Transportation Bureau, which contracts with 68 private firms to provide the 7,766 buses that service 400 routes in the city, transporting millions of passengers daily from 117 stations. The Bureau makes decisions concerning routes, scheduling, and fares.

Bus service is passenger-friendly with vehicles color-coded into four groups for ease of transit. Blue buses are long-distance express buses, connecting outlying suburbs with each other and with the city center. Red buses are long-distance express buses, connecting satellite cities with Seoul's downtown. Green buses provide local services throughout the metropolitan area, feeding metro stations and express bus stops. Lastly, Yellow buses provide local service within the city center.

The Seoul Metropolitan Government Transportation Bureau has established a Bus Management System (BMS) that employs GPS terminals in every bus. This allows the central bus control center to (1) monitor all bus locations and speeds; (2) adjust the number of buses assigned to any given route; (3) communicate with bus drivers; and (4) provide real-time information to passengers waiting at bus stops or checking bus schedules on the internet.

The Seoul Metropolitan Subway is one of the most heavily used subway systems in the world, serving the cities of Seoul and Inchon as well as nearby provinces. The system's total length is 179.4 mi, with more than 70% of the total track length underground.

Each day, well over 8 million trips are made in 3,505 rail carriages operated by the Seoul

Metropolitan Subway Corporation (SMSC), the Seoul Metropolitan Rapid Transit Corporation (SMRT), and the Korean National Railroad (KNR). The SMSC runs 199 trains that serve 115 stations, and carry an average daily load of 3.9 million passengers. The SMRT operates 201 subway trains that serve 148 stations, and carry 2 million passengers on an average day.

While in Seoul, the ITSP team visited the Seoul Metropolitan Government Transportation Bureau (SMGTB), the Transport Operation and Information System (TOPIS), the Seoul Emergency Operation Center, the ROK Ministry of Construction and Transportation, and the Seoul Metro control center. Team members traveled by subway and by KNR.

The Seoul Metropolitan Government Transportation Bureau directs transportation disaster management policy for the city.

Director-General Jung Woo Chang of the Seoul Transportation Improvement Bureau briefed the group on transportation and disaster response as well as traffic management. He emphasized the value of the media and the internet in informing the public about high-threat and emergency conditions.

Chang reported that bus and rail agencies conduct emergency response drills and training on a quarterly basis. Local subway station managers and employees drill together with police and fire emergency first responders. Existing emergency plans cover the following events: (1) storms and floods; (2) snowstorms; and (3) subway and bus strikes.

ITSP team member were told that in the coming years, disaster management plans would include new disaster mitigation methods and a greater number of preventive rather than recovery-oriented measures. These actions reflect the principle that the central government is responsible for establishing emergency countermeasures to guarantee national safety in the event of a terrorist attack.

Public education is an important component of the city's preparedness program. For example, Seoul Metro provides employees and customers terrorism awareness information in safety brochures. The pamphlets cite specific "What to do" instructions in the event employees or customers find an explosive device. Guidance is provided on how to contact staff or police personnel, how not to accidentally trigger the device with a radio or cell phone, and how to evacuate.

Transportation Operation and Information System

The ITSP team toured this impressive traffic management facility located downtown. TOPIS receives traffic data from related agencies like the Bus Management System, Transportation Card System, the Police, and the Korea Highway Corporation, as well as from road surface detectors and traffic monitoring cameras. TOPIS uses this data to solve traffic problems, improve traffic conditions, and develop appropriate transportation plans. Whether on a daily basis or in an emergency, TOPIS is able to provide real-time traffic reports to citizens, transportation agencies, and emergency responders. Both the police and TOPIS have access to the same store of information.

Seoul Emergency Operation Center

The Seoul Emergency Operation Center (SEOC) is operated by the Seoul Metropolitan Fire and Disaster Department. It functions as an emergency call center, 911 Control Center, Disaster Control Center, Civil Defense Control Center, and Control Center of Disaster Prevention and Countermeasures. It operates 24/7 and coordinates with other governmental and military agencies in disaster response. The SEOC plays a support role to the military in response to a terrorist incident.

ROK Ministry of Construction and Transportation

The national Ministry of Construction and Transportation's mission is bus road safety and rail safety. The Ministry collects accident statistics and recommends measures to reduce accidents. It conducts safety audits on public transportation companies and encourages drills and tabletop exercises with first responders, transportation providers, and related agencies to include utility companies and the military. The Ministry is primarily concerned with natural disasters such as earthquakes and weather-related incidents. For terror-related incidents, the South Korean military takes the lead in preparedness and response.

Seoul Metropolitan Subway Corporation Korean National Railroad

Both the SMSC and the KNR have central control centers to monitor service and to initiate service restoration in the event of a disruption. A system of surveillance cameras monitors stations and platforms. Police and security personnel also patrol facilities and monitor cameras. Emergency phones and fire alarms are present at all stations.

As with the Ministry above, planning and response related to terrorism is directed by national security officials.

Kobe City and Hyogo Prefecture, Japan

Kobe, the capital city of Hyogo Prefecture, is a prominent Japanese port located west of Osaka. It is home to approximately 1.5 million people and part of the sprawling Osaka-Kobe-Kyoto metropolitan corridor.

As one of the first Japanese cities opened to trade with the West (1868), Kobe is highly cosmopolitan. Approximately 45,000 foreign residents from more than 100 countries call Kobe home. The city hosts the Asian headquarters of corporations including Procter & Gamble and Nestlé, and exports famous Kobe beef to customers around the globe.

Kobe was Japan's busiest port until 1995 when the city was severely damaged by the Great Hanshin-Awaji Earthquake, which ranks as one of the most costly natural disasters in Japan's modern history. In less than 20 seconds in the early morning hours of January 17, 1995, a powerful jolt inflicted unprecedented damage to the Hanshin-Awaji region and the cities Kobe, Awaji, Ashiya, and Nishinomiya. Measuring 7.3 on the Richter Scale, the quake killed 6,433 people; 4,571 lives were lost in the city of Kobe alone. Total destruction occurred among concentrations of old wooden homes, where buildings simply collapsed and large-scale fires broke out. Almost 41,000 people were injured and 300,000 left homeless. The final property toll was 460,357 houses and 249,180 other buildings completely or partially destroyed.

The earthquake notably leveled the elevated Hanshin Expressway. In addition to road transportation, rail and bus transit systems were also severely disrupted. The interruption of expressway services affected not only Kobe's own economy, but that of the Japanese economy as a whole.

The ITSP team was eager to learn about the response and recovery efforts undertaken by the City of Kobe and Hyogo Prefecture.

Public transportation is an integral part of the daily lives of Kobe's citizens, and the transportation network across the city and surrounding area is extensive. Sannomiya Station is Kobe's main rail hub, serving as the transfer point for the three major inter-city rail lines connecting Kobe to Osaka and Himeji. Other rail lines include the Kobe Electric Railway, Hokushin Kyuko Railway, and Kobe New Transit.

Kobe is a nexus for a number of Japan's expressways, including the Meishin Expressway (Nagoya—Kobe) and the Hanshin Expressway (Osaka—Kobe). Others include the Sanyō Expressway (Kobe—Yamaguchi) and the Chūgoku Expressway (Osaka—Yamaguchi). The Kobe-Awaji-Naruto Expressway runs from Kobe to Naruto via Awaji Island and includes the Akashi-Kaikyo Bridge, the longest suspension bridge in the world.

The Municipal Subway, a major artery in this network, was begun in 1977, and initially covered a distance of 5.7 km. A 1987 extension added 22.7 km. And in 2001, Kobe opened an 8-km subway route, the Kaigan Line, as part of a rejuvenation of the inner city. Overall, the subway system carries an average of 310,000 passengers per day.

City buses, operated by Hanku Bus Company, carry an average of 240,000 passengers each day along 80 routes.

Kobe's *Portliner* is a medium-capacity commuter transit system capable of carrying up to 74,000 passengers a day the distance (6.4 km) between the centrally located Sannomiya Station and Port Island. A round trip takes a mere 27 min. A similar system was employed for Rokko Island as well. The *Rokkoliner* can carry up to 50,000 passengers per day between Rokko Island and the line's terminus, a distance of 4.5 km.

The impact of the Great Hanshin-Awaji Earthquake on both the infrastructure of the city of Kobe and its complex transportation system was massive. In rebuilding, local officials were committed to using the painful lessons learned from the disaster as a foundation on which to create a safer, more secure Kobe.

Only one month after the quake, the city had designated restoration promotion areas of over 5,887 hectares (approximately 23 mi^2). In the months that followed, additional priority restoration areas were identified to re-establish urban functions in severely damaged areas. Project plans for land readjustment and urban redevelopment areas were authorized as well. Community development councils were constituted to administer local areas.

Following restoration of basic public services and utilities, housing was the priority concern. The construction of temporary housing began on January 20th, only 3 days after the quake. In all, 32,346 units were built. While emergency evacuation shelters closed within 6 months of the disaster, temporary housing remained in place for many years.

Kobe's Three Year Emergency Plan for Housing Reconstruction was implemented in July 1995 to provide 82,000 housing units. Between February 1995 and November 2003, more than 200,000 units were constructed, far exceeding the initial goal.

The economic well being of Kobe and its citizens was a vital issue. Although restoration of public facilities such as the port, roads and railways was completed within two years of the quake, the city's full economic revival remains a major goal. To that end, Port Island 2nd Stage and similar projects are the focal points for enhanced reconstruction and urban renewal.

On their brief visit, the ITSP team was graciously hosted by the Japanese MLIT and officials of both Kobe City and Hyogo Prefecture. Team members received briefings on how the earthquake affected transportation systems across the area, how service was restored, and how networks have been rebuilt and fortified against such disasters. In addition to a traditional Japanese luncheon, the team enjoyed a tour of the information-rich and highly moving museum at the Disaster Reduction and Human Renovation Institution.

The quake's impact on transportation systems was immediate and devastating. All modes of Kobe's commuter transit system were severely compromised. Government officials worked tirelessly to restore service by collaborating with managers of local transit providers. In planning repairs and reconstruction, the leadership group established detour routes for rail transit and buses, expedited the construction permitting process, and channeled public funds to the appropriate contractors.

Both the national and local governments approved subsidies for minor and major national rail companies. Subsidies were also approved for local bus companies.

For a period of 7 months following the quake, bus companies provided shuttle services for city residents and commuters. Bus service was also offered that linked functioning stations in the damaged rail system.

Damage to the Kobe Line of the Number 3 Hanshin Expressway was severe. An incredible 630-m-long collapse was coupled with destruction of four bridges and ten spans. Originally, reconstruction was expected to take 24 months; however, the work was completed, and the Expressway reopened, in 18 months.

Railways were seriously damaged along the JR Tokaida and Sanyo Lines, the Kobe Line of Hankyu Railway, and the Main Line of Hanshin Railway. Here, too, recovery was swift: full function was restored within seven months of the quake. The JR Sanyo Shinkansen was running again within 81 days, and the Hanshin Electric and Hankyu Railways each required about 5 months for service to resume.

Overall, the Kobe Subway System, with 16 stations and 22.7 km of track, suffered only slight damage from the earthquake, but the Shin-Nagata Station was severely impacted, with 457 columns damaged. Temporary supports were installed while the Station's structure was repaired and reinforced. Partial operation of 13.9 km of Kobe's subway system began the day after the earthquake, and full service was restored within one month.

The Great Hanshin-Awaji Earthquake generated a spate of new disaster prevention measures in Kobe and across Hyogo Prefecture. A fully functional Disaster Prevention Center is now capable of responding quickly to large-scale emergencies. Built in 2000 adjacent to the Prefecture's Government Office, it features an advanced information control room. Local agencies responsible for the city's response and recovery efforts are to convene at this location in the event of a major incident. Disaster drills are held regularly, and disaster response regulations have been published and provided to all Prefecture employees.

One year after the 1995 earthquake, a 6-billion Yen disaster prevention information network was established. Titled the Phoenix-Disaster Management System, it integrates disaster information, and utilizes maps, images, and other advanced information technologies to aid in disaster management. In addition, Miki Earthquake Disaster Memorial Park was created and is used, in part, for storage of relief goods and rescue equipment. In the event of another major disaster, the Park will be the site for disaster support groups to locate and begin serving the community.

Since the earthquake, JR-West (West Japan Railway Company) has reinforced nearly 100% of the piers and bridges for the Shinkansen high speed rail lines. It has established a new command center to support and enhance communications throughout its system. JR-West has also installed an early warning earthquake detection system that will enable the company to shut off power prior to shock waves. It has also established countermeasures in the event of a tsunami by utilizing an advanced warning meteorological system. Periodic disaster training takes place for all JR-West employees. Each staff member is given a disaster manual and an emergency card specifying vital contact information and individual response actions.

Tokyo, Japan

Tokyo is Japan's capital, and one of the world's preeminent cities. More than 12 million people, 10% of Japan's population, live within its boundaries.

Since Tokyo's modest beginning as a fishing village, residents have experienced numerous natural disasters, including fire, earthquake, and volcanic eruption. Powerful earthquakes wreaked havoc in 1703, 1782, 1812, and 1855. In 1923, the Great Kanto Earthquake (magnitude 8.3) killed approximately 140,000 inhabitants.

The city has also suffered the effects of war. In 1945, Allied bombings left more than 75,000 people dead and half the city destroyed.

Massive rebuilding took place after World War II, and in 1964, Japan welcomed the world to its modern capital.

Today, public transportation is dominated by an extensive network of clean and efficient—albeit very crowded—trains and subways run by a variety of operators. Buses, monorails, and trams play a feeder role. The Metro system consists of eight subway lines, making Tokyo the largest subway operator in Asia. Private railway lines are linked to six of Tokyo's Metro lines. Overall, the system transports 5.76 million passengers each day.

Mass transportation is highly developed, and operators make full use of the latest technologies for safety and security. Commitment to innovation is also evident in Tokyo's sophisticated fare card system and "green" transit construction standards.

The ITSP mission team came to Tokyo with particular interest in the tragic terrorist attack on subway commuters that took place on Monday morning, March 20, 1995. In a series of coordinated attacks carried out by a religious cult, sarin gas was released on five trains. The gas began affecting people instantly. During the ensuing evacuation, trains were parked with doors and windows open to the crowded platforms, causing secondary contamination. The attack resulted in 12 deaths and serious injury to 50 other individuals. Nearly 1,000 people suffered temporary vision problems.

It should be noted that transit service was restored within 1 day of the 1995 Sarin gas attacks.

ITSP team members learned that over the dozen years since the tragedy, Tokyo's leadership has marshaled an extensive emergency preparedness effort.

A multitude of steps have been taken to enhance security for passengers and employees:

- A 2,400-camera remote incident detection closed circuit TV (CCTV) system has been installed. A proven crime deterrent, the system's video recordings are kept for a 30-day period.
- Transit system operating manuals were updated and improved to expand emergency procedures.
- Train emergency communication systems have been installed.
- The rolling stock was redesigned to provide more ventilation—Train car windows can now be manually opened to air out coaches.
- Partially transparent trash bins are used throughout the system.
- Increased public announcements, coupled with pocket-sized security cards, help inform and reassure Metro's ridership.
- Emergency intercoms have been installed at stations.
- Security personnel are highly visible.
- Emergency breathing apparatuses are readily available for subway workers. Because gas masks are chemical-specific and unsuitable from a practical standpoint, only respiratory devices are used by Metro staff.
- Staff members are trained regularly in emergency preparedness and in managing emergency situations.

Cross-agency communication protocols have been strengthened. Prior to the Sarin attack in 1995, numerous bomb threats had caused police, fire, and emergency management personnel to build good working relations. These networks have been further developed.

Telephone is the primary communication between police and fire departments. There is telephone linkage between Metro stations and the police, as well as a special dedicated line that wirelessly connects the underground and police. In high-threat, high-risk situations, an emergency radio system belonging to the Tokyo city government is made available.

Special attention has been given to evacuation procedures. The first priority is to bring transit passengers to a safe location, ideally to the nearest above-ground site. Tokyo Metro seeks to avoid situations where trains are stranded between stations for fear of evacuations that put passengers at further risk for injury. Crews are trained to keep passengers calm and to deliver clear directions for evacuation if necessary.

Ministry of Land, Infrastructure & Transportation (MLIT)

Japan's Ministry of Land Infrastructure & Transportation has responsibility for crisis management across Tokyo's bus and railway systems. Emergency response communications are structured within two distinct risk frameworks: "caution" and "emergency."

The Ministry encompasses the Japan Meteorological Association, which provides essential information and assistance related to natural disasters. On the terrorism front, MLIT has launched initiatives to enlist passengers in identifying suspicious behavior by other riders or suspicious packages. Train operators distribute "Railway Security Cards."

Facial recognition software has been piloted as a potential transportation security measure. The software trial was encouraging, and performance was characterized as "robust"; however, unresolved issues remain. The software trial recognized approximately 80% of human faces, although in a very crowded station, faces may be hidden from view or overlap. The effects of allergies on facial features or the use of sunglasses or other tinted eyeglasses can make recognition problematic. The Ministry is working to rectify these problems and reported that additional study is underway.

One related challenge for Tokyo authorities is developing a reliable database of images of known terror suspects and utilizing that data. Confidentiality and individual privacy are significant concerns in Japan.

The Ministry reports that there are over 200 bus and train companies or transit "operators" in Japan. Each operator trains its employees independently and conducts security classes according to its own curriculum. To provide commonality of instruction, the Ministry requests that companies send their teaching/training staff to selected professionals to receive "train the trainer" instruction. The Ministry also requests that operators conduct security drills in conjunction with police, fire, or emergency management services.

In 2007, MLIT plans to implement two pilot programs testing real-time automatic chemical, biological, and nuclear detection systems.

ITSP team members were told that in the event of a man-made or natural disaster, the Ministry's foremost priorities are rescue and service recovery. For locations not directly affected by the incident, MLIT supports operators in continuing normal transit operations. The Ministry's goal is to minimize the geographic areas where services are suspended; this is usually achieved by employing proven methods such as "bridging" bus services.

With respect to CCTV, the national government does not subsidize its operation within the Tokyo transit system. Individual companies bear the cost of installation and equipment. MLIT is now assessing a new automatic recognition system designed to identify potential problems and automatically notify operators.

Road Transport Bureau

The Road Transit Bureau is part of MLIT and operates an emergency headquarters that oversees disaster prevention and disaster response.

Bus service in Japan is a mix of private and public operators. There are 3,740 charter bus operators; 515 city bus operators; and 477 private operators. The majority of Japan's city bus operators are privately owned.

All Japanese buses must have blue crime prevention lamps or "SOS" signals on their back ends. This requirement stems from a well-publicized bus hijacking in 2000, which ended with one death and numerous injuries after a 190-mi chase and hours of negotiations with the 17-year old hijacker.

There are 25 bus companies large enough to undertake emergency evacuations in Japan, and the Japanese government has the authority to order bus operators to evacuate citizens during times of crisis. In the event bus operators are ordered to conduct an evacuation, they recover their costs from the governing prefecture on a contractual basis. The prefecture also loans buses to assist in evacuation operations. There are no formal, pre-existing agreements among bus operators to support each other in conducting emergency operations.

The Bureau's Safety & Compliance Office regulates and sets criteria for bus operation safety and associated inspections. At the time of an incident, this office also collects information on damages and service disruptions.

East Japan Railway Company

The East Japan Railway Company (JR-East) is a multi-group entity with three corporate pillars: railway, retail services, and the *Suica* transportation credit card. The rail operation consists of 70 lines serving more than 16 million passengers per day across 1,699 stations. The company has invested heavily in technology—evidenced by the Super Urban Intelligent Card, *Suica*, a combined fare and charge card. Beyond this "smart card" system, JR-East plans to put a hybrid train car into operation by the summer of 2007.

JR-East's counter terrorism measures are significant.

Closed circuit TV cameras—a total of 7,600—are installed at stations across the country, with the highest camera density in Tokyo. JR-East has changed its security approach from "hidden" cameras to a more effective, high-visibility camera presence. Station monitoring on a 24/7 basis is difficult as well as expensive, and JR-East's research and development department is preparing an automated video monitoring system. One software problem that must be addressed is the ability to differentiate among human actions, e.g. between a hug and a fight.

JR-East's station trash cans feature see-though acrylic sheeting on the outside to prevent a perpetrator from using the cans to hide explosive devices.

Public announcements advise passengers of anti-terror measures, while posters reinforce security awareness at stations and other facilities. Security awareness is reinforced among the riding public by *Anti-terrorism Co-operator* badges worn by both staff and station shop keepers.

JR-East actively seeks cooperation and information exchange with other transportation providers and local authorities. Joint MLIT and JR-East Counter Terrorism Conferences figure prominently in these alliances.

SECTION III MANAGEMENT OF KEY ELEMENTS OF EMERGENCY PREPAREDNESS

In processing the great volume of information received over the course of the mission, the ITSP team focused in on key elements of transit emergency preparedness:

- coordination of efforts within the transit organization and the agency's degree of collaboration with other public and private entities;
- information technology and telecommunications systems employed to monitor the system, detect problems, and ensure effective response;
- communications with the public; and
- planning for (and capacity for) evacuation of passengers and employees.

Collaboration and Coordination

Of great interest to the mission team was the extent to which transit operators worked in partnership with other municipal, regional, and national agencies in the planning for and response to critical events. In each major city visited, the team was advised that such collaboration does occur and is well coordinated.

Perhaps the most vivid example of collaboration seen during the mission was in Kobe, Japan, where the team visited the Great Hanshin-Awaji Earthquake Memorial. There participants saw dramatic images of the mass destruction caused in 1995 and the rebuilding of the city by a multitude of local, regional, and national agencies, transportation companies, and citizens.

Transportation executives in Kobe and Tokyo spoke the most comprehensively of the need for agencies to coordinate carefully, and their stated range of concerns was the broadest offered, including weapons of mass destruction, fires, earthquakes, severe weather, and other natural and man-made disasters.

Hong Kong

Internally, station, maintenance, and rail personnel appear to be highly coordinated in their operations efforts. The impressive visual order—spotless stations and organized tasks—seems to support station managers' stance that if an explosive device were placed, it would be identified in short order.

Host agencies spoke about the preparation they undertake internally and with other public service providers and authorities for the typhoon season. Unfortunately, mission team members did not spend time with front-line operational personnel. Thus, assessment cannot be offered about the degree of coordination that actually plays out in preparing for major events, like a typhoon, or in the regular response protocols for incidents like equipment problems, accidents, and suicides.

External coordination with related agencies seems to be given less emphasis than in the United States. Transit providers MTR and KCR operate independently from Hong Kong police and fire departments. Briefly mentioned was an annual table-top exercise that encompasses all agencies. Exercises include two-to-three simultaneous scenarios. This may be attributable, in part, to the fact that police and fire departments are government agencies with the ability to exercise complete control over the rail component. Once a transit situation occurs that requires a response from either of these agencies, the government controls the incident to its conclusion. Most likely, the rail companies do not have a choice in how an emergency situation is managed.

While not all Hong Kong rail transit and bus operators have established protocol and procedures regarding interagency coordination, each of these agencies appears to have internal processes under which departments join forces during an emergency or disaster.

MTR has a "Corporate Crisis Management Manual" that instructs staff in responsibilities, meeting locations, backup systems, continuity planning, and managing the media. The agency had a consultant review policy plans in the event of a pandemic outbreak; however, it now feels that their guidelines are extreme and that it needs to streamline its procedures. This effort is being accomplished in six phases.

KCR has established a response plan in the event of an Avian Influenza outbreak. The plan spans the corporate, divisional, and staff levels. Human Resources Policies include leave application, medical clearances, quarantine, staff travel, insurance, and the stockpiling of antiviral medication.

In addition, Hong Kong rail transit command centers each have a room reserved and dedicated for the police. The rooms provide police commanders with redundant communication and CCTV-access capability during an emergency. Hong Kong, Kowloon, and Macao are served by one police force and one fire service, thus minimizing the need to include multiple first-responder agencies at training exercises and for actual incidents.

Beijing and Tangshan

The mission team received briefings at the RIOH, which supports the Beijing Municipal Committee of Communication. RIOH researchers spoke about a road safety improvement project initiated in 2004. They noted that there is a "Master State Plan for Rapid Response to Public Emergencies" that includes 25 *special emergency* response plans. These plans call for shared responsibility between central and local governments at the national, provincial, municipal and county levels. In addition, an agreement is in place with the meteorological society for forecasting weather conditions that could affect traffic.

During briefings at the Beijing Municipal Committee of Communication, officials described their general approach to emergency planning as a good basis for planning required for the Olympic Games. They did not comment specifically on how various agencies would coordinate with one another. However, they did mention that in the event of an emergency in the transportation system, 100 buses could be fed into the system within 30 min. The hosts also said the city had 13 branch offices where emergency response personnel would be located and that 4,000 volunteers would be ready to assist as needed.

While the ITSP team was not briefed by any emergency response personnel in Beijing or Tangshan, a clear inference was drawn that localities rely upon the national government in times of crisis. The people of Tangshan experienced a devastating earthquake in 1976 that flattened the city, and the museum that now commemorates the event focuses on the overarching role of the People's Liberation army in responding to the disaster and rebuilding the city. Likewise with the Olympics, the expectation is that the central government will respond to any critical incidents.

Seoul

In Seoul, coordination between transit providers and emergency response agencies is very apparent, not only in the subway system but in the community as a whole.

Seoul's has two metro operators and a third operator for its commuter rail line. Nearly 63% of Seoul's population relies on public transportation. Having two separate subway systems protects the city from a total transportation shut down in the event of an emergency or a labor strike at either one. Citizens are trained to shelter in place in the event of a disaster or terrorist attack. Strategically placed cameras help the police department to make decisions on traffic flow and evacuation routes.

According to Mr. Young Hwang, Director General of Transportation, Seoul Emergency Operation Center, cooperation between the federal government and the local authorities for event mitigation is crucial and well orchestrated. A briefing at the TOPIS Center illustrated how the situation room monitors and analyzes traffic.

Seoul Metropolitan Government Transportation's main concern is fire. The staging of fire extinguishers, escape hoods, flashlights, and well-placed, easy-to-understand evacuation plans were prevalent throughout the subway system and other facilities. Officials also spoke about disaster management plans they have for weather-related events (e.g., snow, floods).

Personnel at the rail companies and various emergency response agencies train together to respond to critical incidents. The different entities have issues with interoperability of communications systems. ITSP team members were told that during emergencies, the most reliable means of communication are often Seoul's cable-television network, public radio, print media, and the internet.

Kobe/Hyogo Prefecture

In the Kobe City-Hyogo Prefecture region, disaster preparedness and response is a joint effort by transit providers, many public agencies engaged in safety and emergency response, and the general public. The foundation for this collaborative approach appears to have been in place before the earthquake struck in 1995, and the experience of dealing with massive tragedy strengthened existing relationships and created many new ones. Today, Kobe City and Hyogo Prefecture have implemented an extensive emergency response plan based on extensive interagency communication and coordination and communication with the public. In addition, the jurisdictions have developed technology to provide advance warning of earthquakes so that threatened areas can be evacuated and traffic rerouted as necessary.

Problem solving conducted at the local level and involving many players drove the recovery in the late 1990s. Soon after the quake, city officials established the Kobe Rapid Transit Disaster Outmeasure Technology Committee to study the damage and direct restoration work. Transportation providers and all relevant agencies of government participated. The city now has established guidelines for assessing and resuming operations after major incidents occur.

One ITSP team member observed that whereas the earthquake memorial museum in Tangshan emphasizes the primacy of the national government in responding to the disaster there in 1976 and then rebuilding the city, the memorial museum in Kobe highlights the roles of many government agencies, businesses, and citizens in dealing with the aftermath of the 1995 quake.

Tokyo

Tokyo has implemented comprehensive plans and standard operating procedures for transit emergency response. Transit providers, the city's police and fire departments, and key Japanese ministries plan and drill together.

The Ministry of Land, Infrastructure and Transportation has developed a detailed response framework for implementation in a crisis or emergency situation. The backbone of this plan is coordination and communication among all of the entities involved. National conferences are held to enhance working relationships between the public and private sectors and to exchange information about best practices in transportation security and incident response.

Ministry officials and executives of MTR and JR-East Railway emphasized the need to enlist transit users and the media in preparedness efforts. They conduct extensive outreach to the public and the media, which will be discussed below.

Information Technology and Telecommunications Systems

The ITSP team was eager to learn about how technology was used in the various Asian systems to assure integrated and coordinated approaches for business continuity in the event of a disaster or emergency. Of particular interest were information technology and communication systems that facilitated rapid dissemination of information and effective communications among transit operators, police and fire departments, and sister transit agencies.

The following systems were explored:

- Business Continuity Planning
  - Interoperability and centralization of agencies' emergency disaster recovery plans
  - Evacuation planning readiness—(pre- and post-communications)
  - Drills
  - Disaster recovery restoration process
- Intelligent Transportation Systems/Safety and Security Systems
  - Communications Systems
  - GPS and Automatic Vehicle Locator Systems (AVL)
  - Automatic Passenger Counters (APC)
  - Geographic Information Systems (GIS)
  - CCTV
  - Automated train control systems
  - Real time passenger information systems
  - Traffic management systems

- Integrated Emergency Response Centers
- Control Centers

The following outlines the benefits of each of the above technologies and describes the efficiencies realized by the agencies on the mission itinerary that deploys the systems.

Business Continuity Planning

In current times, the list of potentially business-disrupting events is long: computer viruses, power outages and blackouts, fires, natural disasters, and terrorist events. These operating disruptions can occur with or without warning and may have a known or unknown impact. Effective business continuity planning (BCP) is the process whereby agencies ensure the maintenance or recovery of operations, including services to customers, when confronted with adverse events such as natural disasters, technological failures, human error, or terrorism. The objective for BCP is to minimize the financial loss to the agency and to continue to serve customers and mitigate the negative effects the disruptions can have on the agencies operations as a whole. An effective business continuity plan should describe how transit agencies respond to an event that disrupts one or several departments within an organization's normal business operations and how the effected department will continue to provide service to customers and/or other parts of the enterprise. The two primary components of BCP are continuity of business operations and continuity of technology services.

ITSP team members found transit executives in China, South Korea, and Japan aware of the importance of corporate- and agency-wide planning for threats against the operations of the systems, but there were varying levels of formal plans in place to ensure emergency preparedness and clear communications channels. The mission team asked their hosts about interoperability and centralization of communications, emergency disaster recovery plans, evacuation plans (communications, pre and post), disaster drills, and IT systems disaster recovery drills with the strategy for restoring systems.

Hong Kong

The team visited Mass Transit Railway Corporation (MTRC), KCRC, and KMB. These agencies provide an extensive transit network and all utilize the Octopus Smart Card fare collection system affording seamless travel from one provider to another, for taxi services, and retail.

MTRC is committed to comprehensive business continuity planning and training.

The company has established a Crisis Management Committee, chaired by the CEO and including key executives. The committee meets regularly and is responsible for updating the Crisis Management Manual that guides the organization's response to a major incident. MTRC defines a major incident as an undesired event resulting in an initial delay in or disruption of passenger service of 20 min or more with no immediate opportunity for resumption of service and requiring the closure of a station, part of a station, or a running line. Examples include derailments, collisions, train fires or overhead wire displacement. The Crisis Management Manual describes the structure of the Crisis Management Committee and their responsibilities, a comprehensive business continuity plan, procedures for communicating with the media during a major incident, etc.

At KCRC, the business continuity planning committee is chaired by the Human Resource Department which is charged with working across the organization to ensure compliance and participation. BCP in this environment includes mobilization plans, response systems, policies and procedures outlining contingency requirements for essential personnel, alternate work locations, continuity of essential functions (workforce and inventory), and HR policies.

KCRC management spoke to the ITSP group about their continuity planning related to a possible outbreak of Avian Flu. They spoke about various scenarios, e.g. H5 virus which has an incubation rate of 2 to 4 days (up to 10 days) creating a pandemic that may last 9 to 18 months, with each episode/wave generally lasting 6 to 12 weeks.

Specific policies and plans are being developed for chain of command succession, communication with employees and the public, maintaining continuity of functions, promoting employee health, cross-training employees so they can fill in when colleagues fall sick, developing alternate work teams to address risks of entire categories of employees falling ill, and commitment of financial resources to address the above. Human resource issues being addressed include quarantining of employees and conducting medical screening, contact-tracing, stockpiling of antiviral medications, etc.

Their internal business continuity planning related to Avian Flu seemed comprehensive. ITSP team members did not hear whether an inter-agency plan for the whole city exists.

KMB appeared to have less developed programs for disaster preparedness and response. The organization has somewhat limited communications infrastructure—relying on old technology to disseminate information to its bus operators.

KMB does have a clear plan for response to typhoons. With three hours' notice, the agency decreases bus services incrementally, with bus operators remaining at their base/depot. Radio and television are used to communicate service disruptions to the public. The Customer Service Call Center continues to function, but there are no general communications pushed out to passengers. Once the typhoon passes, KMB begins a sequenced restoration of services.

Beijing

Throughout the mission team's visit to the Chinese capital, preparedness for roadway traffic incidents was emphasized. Business continuity planning, as evidenced in the Hong Kong rail systems, was not stated as a priority for transit providers in Beijing.

Hosts did report that China has a Master State Plan composed of 25 Special Emergency Response Plans and 80 Emergency Response Department Plans. These plans assume unified leadership between central government and local government. Each local government is responsible for the local area and has an emergency response steering group. While some motor carriers are for-profit entities, the public sector funds all Emergency Response Transport, and there are agreements in place between transport providers and the government to cover the costs of Emergency Response Transportation.

Seoul

Seoul has a large transit system consisting of multiple rail and bus providers not unlike the systems in Hong Kong and Beijing. The agencies explored during this segment of the mission included the Seoul Municipal Government, Seoul TOPIS, the Republic of Korea Ministry of Construction and Transportation, Seoul Metro, and the Seoul Emergency Operations Center.

The ITSP team received briefings on the roles each of these entities play in emergency preparedness and response. Comprehensive business continuity planning by the various transit providers and the IT and telecommunications systems underpinning this planning were not the focus of briefings given to the mission team.

Kobe

Kobe is the capital city of Hyōgo Prefecture and a prominent port city in Japan with a population of about 1.5 million. The city is located in the Kansai region of Japan to the west of Osaka. A review of the transit operations was conducted at Kobe's Disaster Reduction and Human Renovation Institution with concentration on BCP.

The Hyogo Prefecture utilizes the Phoenix Disaster Management system. The Phoenix Disaster Management system collects information and data from earthquake monitor stations, the Japan Meteorological agency, weather information from local meteorological sources, rainfall and water level information from local rivers, and other information from local police and neighboring localities. The information is collected, processed, and distributed to District Administrative Offices. The District Administration Offices filter information to Public works offices, local cities and towns, fire defense headquarters, National Government, and other related organizations. Satellite is used to back up functions of the Emergency Relief Headquarters at the District Offices. The internet is used to distribute select information to Prefecture citizens. The institution provides data to transit and government agencies as well as the public in advance warnings of natural disasters such as earthquakes. The organization does not conduct BCP as it is an information provider and not a transit or transportation service provider.

Tokyo

Tokyo is the center of the most populous metropolitan area in the world. According to the 1995 census, approximately 8 million people live within the city limits, and over 32 million call the greater Tokyo community "home." Since 1960, the number of people residing within a 50-km radius of the city center has more than doubled. Each day within the metro area, approximately 9.3 million people commute to work and school by public transportation. Thirty percent of the traffic volume occurs between 7 and 10 am.

The ITSP mission team visited Japan's Ministry of Infrastructure and Transport, the Tokyo Metro Company, JR-East Railways, and West Japan Railway Company. The following section will discuss the level of business continuity planning implemented at these organizations.

Tokyo Metro Co. LTD. was formed on April 1, 2004 upon the privatization of Teito Rapid Transit Authority (TRTA). The TRTA was founded in 1941 to speed up the development of the Tokyo transportation network. Tokyo Metro has a network of eight lines covering a distance of 183.2 km. It is the largest subway operator in Asia with 168 stations and an average passenger ridership of 5.7 million per day. Tokyo Metro has significant components of BCP in place including a safety and disaster prevention program. This program includes disaster prevention planning that address the agencies level of preparedness and response to power failures, earthquakes, floods and fires. All Tokyo Metro employees participate in annual emergency response training. Tokyo Metro conducts regular drills, both table top and in the field. Debriefs are held after each drill to assist in analyzing the efficiency and effectiveness of personnel, policies, and equipment. In addition, all employees are issued pocket-sized incident manuals that may be useful with regard to emergency management. An example of the disaster preparedness for earthquakes includes the installation of seismometers in the Tokyo Metro lines and network. The seismometers are monitored in the Integrated Control Center (ICC) for instantaneous response to an earthquake emergency. From the ICC, instructions can be sent to all trains in service and to operation/maintenance points.

Tokyo Metro experienced a Sarin gas attack about 10 years ago that has since been the catalyst for the development of business continuity planning. On Monday, March 20, 1995, the Tokyo Metro subway system experienced a Sarin Gas attack at 8:14 am. The attack occurred within the span of a half hour on five trains on three lines during a peak commuter period. The gas was dispersed by pricking a bag containing sarin liquid with the tip of an umbrella. As a result of the attack, 12 individuals were fatally wounded, 999 individuals were hospitalized, and over 4,600 others were treated. In this catastrophic incident, Tokyo Metro learned a great deal from the attack. The agency was not prepared or trained to handle multiple simultaneous incidents such as the Sarin Gas attack. As a result of the attack, adjustments were made to standard operating procedures. Additionally, response to such attacks is now divided among divisions (both operational and technical) by region to help ensure timely rescue operations. Finally, it was determined that all staff should have certified life-saving skills enabling them to perform life-saving procedures anytime, anywhere, as necessary.

To assist in preventing a repeat of such an attack, Tokyo Metro now employs countermeasures against terrorist attacks. These measures include improved preventive measures to deter terrorist attacks, response plan of actions to be taken when an incident occurs, and improved response capabilities/facilities. Other proactive measures in place include the installation of security cameras and routine patrols conducted in high risk areas by security guards, and adjustments have been made to standard operating procedures that dictate how to respond to a poisonous gas attack. The plan also includes a notification system that includes communication with police, fire and EMS and standard evacuation procedures.

Deployment of Intelligent Transportation Systems/Safety and Security Systems

In 1991, the United States Department of Transportation (USDOT) and the Intelligent Society of America (now called Intelligent Transportation Society of America) were directed by Congress to develop an Intelligent Transportation System (ITS) Architecture that was compatible with the transportation technology in use nationally. Principal benefits of the National as well as International ITS Architecture are:

- Integration of highway and transit systems
- Data sharing
- Increasing levels of system integration and performance
- Open standards to increase interoperability
- Leveraging existing transportation infrastructure
- Encouraging public/private partnerships
- Enhancing safety

Completed in 1996, the resulting National ITS Architecture provides a common structure for the design of intelligent transportation systems. The USDOT wanted to ensure that a nationally compatible system was developed, linking all modes of transportation. This architecture was designed to promote national standards to accommodate inter-city travel and cross country-goods movements while discouraging local or regional areas from developing incompatible ITS implementations. In January 1996, the then United States Secretary of Transportation, Frederico Peña, announced a national goal, to "implement the Intelligent Transportation Infrastructure across the United States within a decade to save time and lives and to improve [the] quality of life." The currently stated objective of the USDOT is to deploy 75 integrated ITS systems by 2006.

The ITSP mission team explored the use of ITS in Asia and whether government mandates had been established to encourage interoperability between systems and transit agencies. Deployment within the agencies and inter-agency integration of the following types of systems were explored:

- Communications Systems (public information displays)
- GPS and AVL
- APC
- GIS
- CCTV
- Automated train control systems
- Real time passenger information systems
- Traffic management systems

In Asia, most transit organizations visited appear to have the basic technologies for communicating with the public or employees during an emergency. These include:

- Hotlines
- Fax lines
- Remote monitoring capabilities (closed circuit television)
- Customer service lines
- Remote messaging signs (such as terminal signage generally used to transmit information about service arrivals and departures)
- Internet
- Use of local news media (television and radio)

Interestingly, most transit systems do have real-time information on services and revenue vehicle equipment through the use of AVL. AVL is a computer-based vehicle tracking system. For transit, the actual real-time position of each vehicle is measured and its location is relayed to a control center. Some of the benefits of AVL technology include:

- ***Safety and security of passengers and drivers:*** "Real-time" location assures that buses are continuously monitored and with "real-time" schedule information, passengers spend less time at bus stops.
- ***Communication of major mechanical and diagnostic information on buses:*** "On board" data collection includes on-time performance, bus speed, mileage, passenger activity; lift usage and arrival/departure times. In addition to significant reduction in the manual labor of collecting information, emergency vehicles can be dispatched quickly and accurately in the case of problems.
- ***Interfaces with other "on board" electronic systems:*** Automatic Vehicle Locator (AVL) functions as an integrator of other information systems on board the vehicles including APC, fare boxes, annunciation systems, signage, signal preemption, etc. AVL serves as the information management "backbone" of the other data collection systems by transmitting and storing appropriate information.
- ***Traffic management systems:*** AVL facilitates the use of transit vehicles as "probes" for various traffic management systems including emergency deployment, routine location services and as integrators of intelligent highways along with other "smart" technologies.

Transit agencies often incorporate other advanced public transportation system features in conjunction with AVL system implementations. These include the Computer-aided Dispatch (CAD) software and Mobile data terminals (MDT) for sending real-time data communication from vehicles to an emergency alarm.

Another widely used technology used by most transit agencies throughout Asia is CCTV for improved safety and security. The agencies:

- Used CCTV-recorded events to solve fare evasion and security problems
- Reduced the number of on-bus incidents by use of surveillance cameras
- Provided more accurate location information for faster response
- Foiled several criminal acts on buses with quick response
- Enhanced drivers' sense of safety

The following section addresses the specific types of technology implemented by county.

Hong Kong

KMB has a limited communications and ITS infrastructure. Four bus garages have dated VHF radio systems that are installed on select vehicles used to communicate with other supervisors. The buses are not equipped with communication devices requiring bus operators to use their personal cell phones if there is an emergency or need to contact bus dispatch. There is currently no interoperability of radio communication with other agencies. The agency also uses facsimiles and in some cases dedicated phone lines to communicate with other agencies. KMB is considering making changes to their radio system to allow for interoperability through the use of 800 MHz radio systems. This advancement would not only improve internal radio communication but allow communication across agencies such as fire and police departments.

KMB has installed CCTV with wide-angle cameras in its bus terminals to monitor and respond to traffic conditions in and around the bus terminals; advanced communications facilities with electronic bus announcements in multiple languages and digital displays to keep passengers informed of the next stop, safety information as well as emergency communications as necessary; GPS to advise passengers at bus stops of estimated arrival time of the next bus, as well as enabling operations staff to track the location of buses for better fleet management and in the case of an emergency, the positioning of the fleet and; a two-way messaging system to provide real time communication between bus supervisors and the headquarters.

Beijing

In visiting the RIOH of Ministry of Communications (MOC), an agency responsible for construction of highways and communications along highway areas, we found that use of ITS is extensive. The agency invokes a mandatory requirement for onboard tracking devices for any buses and any trucks traveling on its highway. Transport agreements are in place to govern this requirement in efforts to ensure safety and the ability to respond to an emergency.

The Beijing Public Transport group is composed of buses, taxis, and long-distance buses. This group holds 18,880 buses with over 11 million boardings per day on about 601 bus lines. This group has extensive video capabilities including on the road, subway, bus, and in bus yards.

In 2004, there were 5.6 million accidents/incidents in Beijing. There were approximately 210,000 fatalities and 1.75 million injuries reported as a result of these accidents. The total cost of these accidents was approximately 455 billion Yen. To assist in reducing accidents, GPS-based Road Monitoring devices have been mandated in long haul buses as well as hazardous and heavy trucks. These devices are optional for members of the general public to install on private vehicles. These on-board vehicle monitoring devices have automatic collision detection systems that notify a command center when an accident has occurred. The driver must push a button if they are not injured seriously. These devices assist in prioritizing responses to incidents. The devices also monitor vehicle speed and tire pressure.

Challenges cited by the agencies in implementing ITS are the lack of command and control of IT platforms (currently under development), need for more capacity to build for road transport, need for further development of laws, regulation and polices and lack of technical support for technology systems.

Passenger Transport Safety Control Center of Xianglong Company is an intercity bus Operator. Xianglong has about 434 drivers and 160 vehicles. Most operations travel through mountainous areas at night. The system operates about 60,000 km per day. Each vehicle has a GPS/AVL that tracks Vehicle locations and a video data recorder that collects speed, travel time, travel miles, braking and lighting.

Data is available in real-time. The system is capable of sending short messages to drivers such as weather warning or other issues. If a driver is excessively speeding, a message is sent through the system to the operator to slow down. Since implementing the system, safety accidents/incidents are down. They are currently working on standards for using data recorder information.

Seoul

The Seoul Metropolitan city developed a Bus Management System (BMS) to assist in reducing serious traffic congestion in Seoul. The BMS system focused on transit customer satisfaction by improving schedule adherence and assisting with an advanced fare payment system.

The Seoul TOPIS is an offspring from BMS. TOPIS is an integrated traffic management system that collects and manages traffic stream, images, and public traffic information from other agencies such as the old BMS system, police agencies, and the Korea Highway Corporation. TOPIS collects bus running data, traffic volumes, running speed, accident, highway conditions, civilian traffic reports and other forms of useful data that impact traffic throughout the region. Citizens are provided real-time traffic information via TOPIS.

The TOPIS system is composed of a large number of CCTVs. TOPIS also has an automated camera system that can be used for monitoring and controlling illegally parked vehicles. Traffic cameras automatically identify illegally parked vehicles and disseminate information and images on these vehicles to a central dispatch center. This is useful not only for controlling traffic congestion problems, but also for monitoring suspicious vehicle activity.

Tokyo

Tokyo Metro has a sophisticated CCTV system which has approximately 2,400 cameras installed throughout it's network. In the past, most cameras were hidden from the customer view. However, recently the agency has learned that CCTV is more effective when the cameras are in clear view of passengers. CCTV cameras are also strategically located to assist in obtaining more useful information with regard to emergency response efforts. Cameras are now pointed directly at each entrance to the subway system and key infrastructure in addition to general platform cameras.

Portions of the Tokyo Metro fleet are equipped with Automatic Train Operations (ATO) software and equipment. The ATO system selects appropriate braking, acceleration, and coasting along the line while in operation.

The ATC system has been installed on all rail lines. The ATC monitors train speed and compares the speed to signal data. If a train is found to be running at a speed in excess of the speed limit set for a particular section of track, the ATC automatically applies the train brakes and reduces the train's speed to recommended speeds. The ATO and ATC system assists with smoothness of operation and in the reduction of operator error that could result in rail accidents.

East Japan Railway uses platform detection equipment that prevents doors from opening in places other than at platforms. Additionally, fall detection mats are placed near platforms to detect when a passenger has fallen from the platform onto the tracks. When a fall detection mat sensor is triggered, platform cameras automatically pan and zoom to the area where the sensor was triggered. A real-time image is sent to the Station supervisor's desk and incoming trains are notified of the incident automatically.

Emergency stop buttons are placed on each platform. If someone falls from the platform onto the track, anyone can push the emergency stop button and shut down the rail line impacted.

JR-East also remotely controls all electrical currents for rail lines through their central dispatch area. Electrical controllers can re-route or shut down rail line electricity remotely and monitor electrical currents for abnormalities or service problems.

Emergency Response Centers/Systems

The benefits of implementing an emergency management system that supports regional transit operations, transportation, police departments, emergency management services, fire departments, paramedics and any other emergency management are immeasurable. These benefits include improved notification, dispatch, and guidance of emergency responders to the scene of an incident and the ability to communicate an incident or event to multiple agencies simultaneously. ITS applications in emergency management cover hazardous materials management, the deployment of emergency medical systems, and large- and small-scale emergency response and evacuation operations. Each of these systems can improve public safety by decreasing response times and increasing the operational efficiency of safety professionals during emergency situations, such as hurricane evacuations. The ITSP mission team inquired about the organization and operation of emergency response centers and related systems in each of the Asian cities visited and were able to tour several facilities.

Hong Kong

MTRC's operations control center handles incident management for all stations and makes decisions about operational impacting events which result in an initial delay or disruption of passenger service of 20 min or more with no immediate opportunity for resumption of service.

Beijing

Beijing's RIOH of the Ministry of China built its first Emergency Response Center in 2001 with the assistance of Motorola. The development of the agency's emergency response plans also began at this time.

Seoul

The integrated information system in the Seoul Emergency Operations Center is shared by:

- Metropolitan Defense Headquarters
- Korea Telecom
- Korea Electric/Power
- Provincial Police
- Korea Gas Safety Corporation.

These entities use the 119 system to determine dispatch order as well as mobilize equipment and manpower. While the appropriate teams are on the move to the scene of the incident and/or at the scene of the incident, on-site support situation information is disseminated promptly through a satellite navigation system and wireless radio.

The Seoul Operations Center also has the capabilities to make civil defense announcements and trigger civil defense alarms from the EOC Control Center.

The Seoul Operations Center also has a mobile operations command center (MOC). In the event of an emergency, Operations can continue remotely from the MOC with little or no disruption in Operational Support.

The Seoul Metropolitan Emergency Operations Center has an integrated dispatch center that utilizes 119 reporting systems and databases as well as other forms of technology to provide emergency response support to the field. The 119 center has five primary functions:

- 119 electronic information—the reception of accident and disaster reports, remote dispatching of resources and prioritization of calls, analysis of situational information, and operational support.
- Integrated Operation System—Situational analysis and processing in case of large scale accidents.
- Meteorological Management System—collects meteorological information from various sources including satellite systems, monitors dams and river levels, and is prepared for floods as well as heavy storms.
- National Security System—manages and controls emergency situations, collects information from other regions or agencies, and reports situational information to appropriate administrative bodies.
- Civil Defense Control System—receives warnings from civil defense control centers and the city of Seoul with regard to large scale disasters and distributes information to the public.

The databases within the 119 center contain information with regard to information on buildings and traffic conditions above ground as well as underground utilities and subway passages. The databases also contain other information such as meteorological forecasts and remote flood monitoring in areas prone to heavy and/or easy flooding.

The databases are linked to a GIS that is equipped with advanced mapping capabilities and aerial photography.

In addition to databases and the GIS system previously described, the SEOC used CCTV to conduct situational analysis as well as monitor and support field operations. Additionally, remote fire cameras are used to monitor high-rise buildings for potential fires. These remote cameras are programmed to search for abnormalities that may be fire related. When a fire camera is triggered based upon a potential abnormality, EOC dispatch is notified automatically and the camera spotting the abnormality is panned and displayed on the EOC monitoring wall for further inspection by an EOC dispatcher.

The integrated information system in the SEOC is shared by:

- Metropolitan Defense Headquarters
- Korea Telecom
- Korea Electric/Power
- Provincial Police
- Korea Gas Safety Corporation.

These entities use the 119 system to determine dispatch order as well as mobilize equipment and manpower. While the appropriate teams are on the move to the scene of the incident and/or at the scene of the incident, on-site situation and support situation information is disseminated promptly through a satellite navigation system and wireless radio.

The Seoul Operations Center also has the capabilities to make civil defense announcements and trigger civil defense alarms from the EOC Control Center.

The Seoul Operations Center also has a MOC. In the event of an emergency, Operations can continue remotely from the MOC with little or no disruption in Operational Support.

Finally, TOPIS is used to collect information with regard to commute trip reductions. Radio Frequency Identification stickers (RFID) have been distributed to cars in Seoul to check whether the car-drivers comply with the “Leave your car home once-a-week campaign.” This program gives tax-cuts and premium-benefit to cars with the sticker.

Tokyo

Tokyo has a fully advanced ICC that is the master dispatch and control center for Tokyo Metro Services. The ICC is divided into functional groups as follows:

- Train Traffic Control—Trains are controlled automatically. However, if service disruptions occur, schedules are adjusted through cooperation between the ICC and the site operation region.
- Passenger Traffic Control—When an emergency occurs, this functional group re-directs passengers to substitute lines and transmits information to the mass media. In addition, information regarding trouble is transmitted by the group to the Fire Defense Agency, the Meteorology Agency, and the Tokyo Metro Disaster Countermeasure Headquarters via Hot Line.
- Electric Power Control—System electric power is monitored by this functional group. Should electrical-related problems occur, this group makes adjustments to the system to minimize impacts on train operation services.
- Rolling Stock Control—This group monitors all operational trains and intervenes when trouble occurs in the vehicle as well as supporting traffic control work. This group also monitors heat, vibration, and noise of all operational vehicles to prevent accidents and trouble from occurring while in service.
- Facilities and Equipment Control—This group monitors data related to trouble/abnormalities in engineering and electric facilities. It also provides support to traffic control, electric power control, and maintenance work. In addition, this group is responsible for monitoring stations for fire, flooding, and rail temperatures as a disaster prevention measure.

Tokyo Metro Services also has a number of countermeasures in place for the subway trains and platforms. These measures include the following:

- *Platform Doors.* Some lines within Tokyo Metro have platform doors installed at stations to assist in improving passenger safety. These doors assist in preventing suicide attempts within a station and also assist with minimizing other passenger accidents that can occur on a platform or train while boarding. Sensors and CCTV are used to monitor platform and train doors. If a sensor detects a person or object obstructing the doors, the doors will temporarily open and close again. If the sensors are triggered again, the doors remain open and information is transmitted to the driver's cab as well as the station office and ICC.
- *Half-height Platform Doors.* Some lines within Tokyo have half-height platform doors installed. These doors function similarly to full-sized platform doors.
- *Gap Fillers.* At some stations, there are fairly significant gaps between the train and the platform. At stations such as this, gap fillers have been installed to assist in reducing passenger falls and accidents. When a train arrives at a station equipped with gap fillers, the gap filler slides from beneath the platform to fill in the distance between the train and the platform. After boarding/alighting is completed, the gap filler is retracted back under the platform. The train cannot depart until it receives verification that all gap fillers have been safely retracted.

Overall, the emergency response centers/systems operated in Japan are robust and are equipped with advanced technologies. CCTV, traffic control systems and platform door sensors are among the technologies used to communicate between the control centers and the transit agencies. An area of improvement continues to be the communications infrastructure and the need for interoperability of radio systems between agencies.

The mission team's exploration of business continuity planning, intelligent transportation systems, communications infrastructure, and emergency response centers/systems in Asia yielded interesting and valuable findings. The transit networks in Hong Kong, mainland China, South Korea and Japan are among the most sophisticated and extensive in the world. Hong Kong's transport network appeared to be the most advanced in terms of formal business continuity planning. Most agencies did have an emergency response plan to handle events or incidents, but these were primarily evacuation and response plans for internal purposes only. The need for an enterprise approach that consolidates the various business and technology related emergency response and disaster recovery plans is needed.

The goal of the segment of the research was to determine the state of maturity in these areas of transit operations. The findings in general were that Hong Kong and its transit systems were the most advanced in formal business continuity planning with the majority of the other cities/countries in the early developmental stage of planning. Most agencies did have an emergency response plan to handle events or incidents but these were primarily evacuation and response plans for internal purposes only.

The need for an enterprise approach that consolidates the various business and technology related emergency response and disaster recovery plans is needed.

Inter-agency communication was a challenge for most of the countries where the BCP, if existent, only addresses the agencies' internal communications and response needs and did not address the required regional coordination efforts. In terms of communication systems, most agencies had various forms of ITS implemented on their bus or rail fleet, particularly CCTV, video data recorders and GPS or AVL systems. However, the interoperability of radio systems and other communications was not available requiring manual efforts such as facsimiles or dedicated lines for agencies to communicate with police, fire, paramedics and emergency response centers. Ironically, buses were often equipped with cameras and GPS technology but lacked radio systems for communication between the bus operators and the bus command centers.

All countries had centralized emergency control centers/systems in some form with varying levels of complexity and technologies. The coordination and communication with local and regional agencies continues to be a challenge but plans are underway to fully integrate the communication across agencies that impact traffic, transit and transportation.

Control Centers

In general, a Control Center may act as the 24/7 operations center for a transit agency. It coordinates the movement of bus and rapid transit systems by gathering information, solving problems, maintaining and restoring service, and facilitating communication within the transit agency as well as with police, fire, emergency medical services and other organizations in the public and private sectors.

Challenges to successful Control Center operations can include: (1) cross-training of controllers in multiple specialties; (2) an active recertification program as well as a successful controller recruitment program; (3) adequate staffing with quality individuals; and (4) creating a climate of Six Sigma in which Control Center personnel focus on the customer, the process, and the employees' effective and consistent decision making.

The goal is to offer customers consistent, predictable service to meet their travel needs safely and on-time.

Hong Kong

The MTR-OCC coordinates all train service operations on various lines and train movements in and out of depots. Its mission is to ensure consistently safe, efficient, and reliable train service for customers. The MTR-OCC is the largest control center in Hong Kong, and it will serve as the main control center when MTR completes its planned merger with the KCRC.

The MTR-OCC operates 24 hours per day and serves four major functions:

1. Train service monitoring, control, and incident handling
2. Power supply monitoring and cost control
3. Environmental control such as monitoring of ventilation, air-conditioning, humidity and fire detection in all stations
4. Dissemination of information to internal and external parties

The Chief Controller oversees the entire OCC to ensure safe and efficient train operations. The MTR system uses Automatic Train Regulation, which allows adjustment and maintenance to a pre-determined level, and also provides an instant record of train service and performance.

When an incident occurs, the Chief Controller coordinates the recovery operation. Serving the Chief Controller are the Traffic Controllers, each responsible for operation on individual MTR Lines. The Communications Controller is responsible for communications with stations and outside entities. The Power System Controller is responsible for all electrical services, and the Environmental System Controller is responsible for environmental control of all stations and tunnels.

The ITSP team visited the Nam Cheong Station, which houses a rail stop for both MTR's Tung Chung Line and KCRC's West Rail. The Control Room located at the Nam Cheong Station serves both MTR and KCRC's West Rail. Supervision of the control room, which jointly serves both sets of tracks, changes on a weekly basis between MTR and KCRC. Representatives from both rail operations are always available. The Control Room's purpose is to coordinate all train service operations on each company's line, as well as train movement in and out of the station while ensuring safety and punctual performance at the Nam Cheong Station.

The KCRC West Rail OCC coordinates all train service operations on the different lines and train movements in and out of the depots. The KCRC system uses Automatic Train Regulation, as does the MTR-OCC. And similarly, it operates 24-hours per day and serves the same four major functions specified above.

Staffing of the KCRC-OCC mirrors that of the MTR-OCC. When an incident occurs, the Chief Controller coordinates the recovery operation and is supported by the Traffic Controller, Communications Controller, Power System Controller, and Environmental System Controller.

The KMBC is one of the world's largest transportation companies. Its Customer Service Hotline receives up to 385,000 inquiries each month. Customers may also obtain information through the KMB Customer Service Hotfax service. The Hotline deploys modern technology in the form of a Digital Map Passenger Enquiry System that integrates over 100,000 landmarks to enhance service efficiency and accuracy. Calls to the Hotline are usually answered within 5 sec in any of three languages: Cantonese, Putonghua, or English.

The KMB Radio Control Room is used to contact field supervisors about pending route, traffic, or emergency issues. KMB Supervisors are situated throughout the city and use VHF radios to communicate with the KMB Radio Control Room. Repeaters are sited city-wide to provide complete geographical radio coverage. Vital information is conveyed to KMB Bus Operators, known as Bus Captains, when KMB Supervisors flag them down at various check points along bus routes. KMB Buses are not equipped with radios.

KMB uses advanced technologies to enhance efficiency. Many buses have electronic tachographs installed, which store the vital records of bus operation, such as speed and distance traveled. These are standard equipment for all new buses. KMB also created an internal system in which Bus Captains use a hand-held radio frequency identifier to access their buses, thereby eliminating the use of sign-in logs. Bus Captains also use their personal Octopus Cards to access information regarding route, vehicle number, duty schedule, and any ad hoc operational arrangements.

Beijing

The ITSP mission team was provided limited information during its visits with Beijing transit managers. At the Xianglong Inter-Urban Transportation Company, team members did learn that the agency's buses were equipped with two specific advanced technology devices to improve safety and efficiency.

All Xianglong buses feature a vehicle data recorder (VDR). The VDR, which utilizes an onboard computer, captures vehicle's speed, operating time, distance, brake usage, lighting, and door usage. When bus drivers complete their routes, they must hand in the VDR disk. When reviewed, the disk's information analyzes drivers' abilities and adherence to policy.

Buses are also equipped with an active GPS unit. The Control Center can contact the bus drivers via text message, and provide vital real time information. The GPS also can provide information regarding bus speed, route adherence, emergency rerouting, and bus operating time. All GPS equipped busses can be viewed on an active map showing location, speed, and other information.

For the Xianglong Company, use of these technologies has proven effective in reducing accidents and injuries, improving route efficiency, deploying more rapid emergency road service, reducing driver overtime, and establishing "Good Driver" standards.

Seoul

The TOPIS is a traffic management agency. It receives traffic data from related agencies like the Bus Management System, Transportation Card System, the Police, and the Korea Highway Corporation, as well as from road surface detectors and traffic monitoring cameras. TOPIS uses this data to solve traffic problems, to improve traffic conditions and for transportation planning. In an emergency and on a daily basis, TOPIS is able to provide real-time traffic reports to citizens, transportation agencies, and emergency responders. Both the police and TOPIS have access to the same roadside information.

Besides reporting on traffic conditions in Seoul, TOPIS is geared to implement response plans for rain and snow storms, and flooding, and provide assistance to affected bus companies. A situation room is manned around the clock and uses 1,011 CCTV cameras to monitor roads and bridges. TOPIS also maintains an emergency response plan for bus and subway strikes. In the event of a crisis, principals in the situation room could include the vice mayor and six teams with approximately 120 members, working two, 12-hour shifts for the duration of the crisis. Public notifications, cooperation with relevant agencies, and the TOPIS operational headquarters are all priorities during a crisis. TOPIS would follow the lead of the Central Government in the event of a major disaster, man-made terrorist-related disasters, or in the case of a major natural disaster such as earthquakes or SARS incident.

The SMSC and the KNR each have central control centers to monitor service and to initiate service restoration. Surveillance cameras monitor stations and platforms. There is a high-visibility security presence that patrols facilities and monitors cameras. Emergency phones and fire alarms are available at stations. In the event of a terrorist attack, these transportation agencies would follow the lead of the military. In general, the transportation agencies focus on service issues and rely on the military to take the lead in responding to a terrorist incident.

The SEOC is operated by the Seoul Metropolitan Fire and Disaster Department. It is an emergency call center, 911 (emergency phone number) Control Center, Disaster Control Center, Civil Defense Control Center, and Control Center of Disaster Prevention and Countermeasures. It operates 24/7 and coordinates with other governmental and military agencies to provide disaster response.

The SEOC use the following IT systems: (1) a 911 Electronic Information System which receives accident and disaster reports and dispatches emergency response; (2) a National Security System that manages and controls emergency situations by collecting information from outside organizations and reports that information to appropriate parties; (3) an Integrated Operation System that processes information on large-scale accidents from input provided by six related organizations within Seoul; (4) an Accident Management System that collects meteorological data in preparation for floods and snow storms; and (5) the Civil Defense Control System, which receives warnings from the Central Defense System Control Center as well as from the city of Seoul in times of large scale disasters such as air raids or earthquakes. The SEOC would support the military in response to any terrorist incident.

Seoul does have an emergency operations center that is shared by a number of agencies including:

- Metropolitan Defense Headquarters
- Korea Telecom
- Korea Electric/Power
- Provincial Police
- Korea Gas Safety Corporation.

These entities use the 119 system to determine dispatch order as well as mobilize equipment and manpower. While the appropriate teams are on the move to the scene of the incident and/or at the scene of the incident, on-site situation and support situation information is disseminated promptly through a satellite navigation system and wireless radio.

The Seoul Operations Center also has the capabilities to make civil defense announcements and trigger civil defense alarms from the EOC Control Center.

The Seoul Operations Center also has a MOC. In the event of an emergency, Operations can continue remotely from the MOC with little or no disruption in Operational Support. The integration of the communication systems is an important component of business continuity planning as the inter-agency communication is critical in expediting service restoration.

Tokyo

The ITSP team visited the East Japan Railway Company (JR-East) Tokyo Center of Operational Control (TCOC), which works to control facilities and transportation by providing quality information to both employees and the public. The TCOC utilizes the Autonomous Decentralized Transport Operation Control System (ATOS) to modernize train control on heavily congested railway lines in the Tokyo suburbs. ATOS assists traffic control, provides passenger information, and helps with maintenance operations control. The ATOS network operates under a central system which monitors functions such as maintenance work, facilities, passenger service, and branch planning. There is also an operation control network that manages station systems to include passenger information terminals, displays and public address systems, portable terminals, and signals.

The TCOC employs a variety of dispatchers who cover electric power supply, power control, signal and telecommunications, facilities, freight, train operations, scheduling, transport and passenger service. Within the Control Center, alignment of TCOC personnel is divided by functions and rail lines.

Regarding disaster preparedness, fire response plans as well as earthquake recovery plans are in place, and terrorism response plans are being formalized. The TCOC and JR-East station personnel make regular announcements urging passengers to remain aware of their surroundings. Stations are equipped with CCTV. In the event of a crisis, TCOC's role would be to facilitate implementation of the response plans and provide assistance and direction to employees and customers as well as interface with responding agencies.

Public Communications

The openness and means of public communications varied among the transit systems visited on the mission. Cell phones are an omni-present means of communication for system employees and customers.

Mission participants were sensitive to any suggestions of government control over the release of information related to emergency preparedness or response. Restrictions were most evident in China and less so in Hong Kong, South Korea, and Japan.

Most of the systems visited provided English-speaking visitors adequate information on how to utilize services. Directions were generally available in English at ticket vending machines, on system maps, as well as on some brochures, etc. Signage along roadways is often in English or in universal symbols.

Signage for how to exit safely was adequate throughout the transit systems. However, only in Japan were actual announcements about the need for vigilance against possible terrorist threats posted.

Hong Kong

The Hong Kong train system is particularly user-friendly. Two train operators, MTRC and KCR, offer similar services, and there is seamless movement between systems. A merger of these two rail companies is planned.

Cell phone is the primary means of communication used by employees and customers of MTR and KCR. Pay phones are available in all stations, and enhanced mobile telecommunication services provide seamless coverage to passengers using the railways. Additionally, MTR keeps its customers informed via a sophisticated telecommunications network, vibrant multi-media advertising in stations and on trains, and through retail outlets in the stations. The sophisticated telecommunications networks have been upgraded, and MTR is now one of the first rail networks in the world to be 3G-enabled. With 3G-capability, passengers can make telephone calls and access the Internet and other high speed data services via their mobile handsets.

MTR Corporation tries to maintain open communication channels with its customers in order to be aware of their needs and preferences. A customer service hotline, monthly Coffee Evenings, a bi-annual "Liaison Train," and bi-weekly live radio programming all ensure that MTR stays abreast of passenger concerns.

KCR developed the on-train Passenger Information Display System, "Newsline Express," which features general and financial news while generating non-transport revenue for the Corporation. While MTR and KCR have a high level of communication and interaction with the passenger community, ITSP team members sensed that business objectives were the primary reason for fostering this communication; security and emergency preparedness seemed secondary.

Communications within the MTR and KCR systems regarding public health matters are impressive. In response to the Avian flu outbreak of 2003, transit organizations implemented thorough employee education programs that include regular dissemination of information, drills, and access to medical services as needed. Passengers are educated about the importance of washing their hands, and waterless soap is provided in stations. They are also warned about the risks of transporting illegal birds.

At Kowloon Motor Bus Company, staff members run a large and comprehensive Customer Service Hotline, capable of interactive voice assistance. Recognized throughout Hong Kong for service excellence, the Customer Hotline operates 24 hours per day with 72 telephone lines. It is a fully automated system that provides pre-recorded information on 400 bus lines in three different languages. The Customer Service Center also offers information brochures to the public.

KMB executives told the ITSP team that typhoons are typically the cause of the few major incidents, apart from traffic problems, that occur each year. Staff work diligently to keep riders informed about possible weather problems. In typhoon season, Hong Kong's Metrological Observatory broadcasts real time information on the severity of storms. With a warning of about 3 hours, KMB coordinates with radio and television stations to disseminate information regarding service interruptions and delays. Even though citizens can call the Hotline for information, KMB has been criticized for not having more direct communications with the riding public during storms.

Beijing

Communication with the public about emergency preparedness was not as evident in Beijing. Although the mission team found it fairly easy to move about China's capital city, they were not afforded exposure to the process used for informing the public about threats or actual events. During a visit to the US Embassy, staff told the ITSP team that during the outbreak of SARS a few years prior, the Chinese government was able to respond quickly and "shut down the city." Yet, there was no information available on exactly how this task was accomplished. Embassy staff also related an incident where a subway under construction collapsed, creating a massive hole in the street, but no report was ever made to the public.

The information that mission participants did hear about from official hosts in Beijing related to traffic incidents.

Seoul

As explained in the description of the Seoul Transportation Operation and Information Systems above, traffic information in the Seoul metropolitan area is readily shared with the public. Seoul has an extensive CCTV system deployed throughout the city. The purchase, installation, and maintenance of the system are managed by a joint venture between the government and the private sector. The database is shared among first responders, transportation agencies, and the media. The two primary users of the system are TOPIS and the SEOC. Publication communication occurs throughout the city and through TV, radio, newspaper, broadcasts, and a traffic internet service.

With regard to communications aimed at the public, ITSP team members noticed an upbeat, colorful logo used throughout the city on publications issued by transportation providers and other organizations. The logo reads: "Hi Seoul," and defines the city as the *Soul of Asia*. It has the effect of drawing readers' attention to whatever message is being delivered as one of importance to the community. Devices like this, consistently used, can facilitate important communications with citizens and tourists.

Tokyo

Thanks to clear directions and timely notifications given in stations and on trains, the ITSP team found Tokyo's rail system more user-friendly than expected. In addition, team members were struck by the attention transit operators gave to communicating with the public about the threat of terrorism. Hosts in Tokyo (government agencies and private-sector operators alike) spoke about their commitment to promoting continual vigilance.

Throughout Tokyo—even apart from the transit system—one sees signs reminding them to be aware of suspicious packages. Employees of the Tokyo Metro are provided with educational pocket-size information cards about how to handle threats, and customers are educated through posters in stations and on vehicles and via light emitting diode (LED) information displays. Trash receptacles in stations are all partially transparent. Messages can be broadcast throughout the stations when needed. Security personnel wear arm bands to identify themselves, signaling to concerned commuters that their safety is a priority and posing a deterrent to those who might do ill.

The mission team's hosts in Tokyo reported that the 1995 Sarin gas attacks brought the Metro and police organizations closer together and improved communications between the two groups. Both agencies agree that one of the worst transportation scenarios is a train stranded between stations. They understand the importance of communication with customers in terms of evacuation safety. In these situations, communication between first responders and transit employees is primarily by telephones located in the stations.

JR-East makes public announcements in stations to remind customers that combating terrorism is an ongoing effort. Literature (posters, stickers, etc.) is found on station platforms, bulletin boards, and on train cars. These are all geared to raise the awareness level of both employees and the riding public. ITSP team members were given brightly colored anti-terrorism badges during their visit.

With regard to the bus system, the public is exhorted to be vigilant via signage at bus stops and terminals. Hosts described a tragic bus hijacking that had occurred a few years prior. They explained that buses must now have special lamps on their exteriors that can be switched on by the bus operator in the event of an incident on board.

Evacuation Planning

Team members asked each host how evacuation of passengers might be achieved in the event a disaster affects the system and how their facilities/services might be used. While each responded a bit differently the overall theme was consistent. They all relied on a wide array of technology and community assets to assist with the safe evacuation of residents. Many had detailed plans in place for evacuating passengers but did not have the capability to evacuate major cities should disaster strike. Due to the mammoth size of the population, the Asian cities lacked the infrastructure to fully mobilize, evacuate, and relocate millions of residents. At many systems the evacuation plan is to get everyone home safely and have residents shelter in place.

Hong Kong

During emergencies, the Chief Controller of MTR coordinates the recovery operation while maintaining the operations of other trains. All relevant parties are informed to ensure appropriate measures are taken to guarantee safety and minimize inconvenience to passengers. MTR's preparations include a detailed crisis management manual, a secondary storage of backup systems, backup work locations for employees, draft press statements, monthly meetings with police regarding terrorism, and computer simulated incidents.

Officials we spoke with are concerned about the possibility of an Avian Flu outbreak. MTR has prepared a comprehensive response plan for this pandemic flu, to include a process for screening people entering the subway to limit the spread of disease, and measures for cleaning all surfaces where people were likely to spread germs.

In terms of evacuation, Hong Kong's train stations are designed to expedite passenger flow, and evacuation needs focus on functional requirements, changes and challenges, and outreach to the community.

MTR built their rail stations with the knowledge that the nearest place of safety might not be at street surface level. Stations are all constructed to withstand and contain fire. In the event of a fire, customers can be moved to a smoke-free zone until first responders arrive.

Stations have the means to determine a fire's location and to enable safe exit with special doors along the rail line. Smoke simulation and passenger flow analyses are conducted during drills and exercises. In an evacuation, the objectives are to: (1) discharge passengers to the nearest place of safety; (2) maintain a safe location clear of smoke for a minimum of 30 min; and (3) have the fire service on the scene within 5 minutes.

Additionally, station design supports passenger mobility. Their configuration eliminates cross flow where people bump into one another, while minimal signage and clutter facilitates movement. Vertical circulation is achieved with high speed escalators in addition to stairs (as shown in Figure 1). Escalator

Figure 1 High Speed Escalators at MTR Station.

speed is calibrated to the number of minutes it would take to evacuate a fully occupied train, or approximately 2,000 passengers. The holding capacity of stairs is 63 passengers per minute and 135 people per minute for escalators.

Horizontal circulation is supported by automatic fare collection gates that can process 48,000 people per hour.

Directional tile provides pathway guidance to the vision-disabled. Surrounding retail outlets feature their own sprinkler and smoke extraction systems. Safety design addresses the presence of restaurants in the stations; none can use flammable heat sources. All food is pre-cooked and then re-heated for service.

The public address system and electronic display boards publicize information and keep passengers updated. The KCR Emergency Response Plan assigns various response levels to emergencies. The most serious crisis requires increased alert status for onsite personnel. A rail line delay of more than 8 min must be reported to the media and broadcast to the internet. Buses are summoned once an emergency is declared, and an amber or red alert is issued. Information is disseminated to the public via electronic media and paging companies after the alerts are issued.

Kowloon Motor Bus Company (KMB) operations employ an interactive voice recognition system capable of issuing special traffic announcements, traffic congestion announcements, rail information, etc., in three languages. Comprehensive digital maps assist passengers who need information about bus routes.

A radio control room is used for emergency communications. Communications equipment includes a VHF radio system, telephones, plasma screen TV, and walkie-talkies for bus inspectors, but no radio systems for bus operators. Real-time traffic cameras relay information from the transportation department to television stations.

Beijing

The topography of Beijing is relatively flat, and officials report that the city is not prone to natural disasters. There are, however, many accidents in Beijing's surrounding mountainous areas primarily due to mudslides.

A greater concern is terrorism, and the Chinese government has entered into transport agreements to provide financial assistance to any private motor coach operator that provides evacuation assistance in the event of an emergency.

The government is currently focusing on safety and security for the 2008 Olympic Games.

There is a master state plan for rapid response to public emergencies. There are 25 *special emergency* response plans, and 80 *emergency response* department plans. Unified leadership is integrated with central and local governments. Each local government is responsible for its own area. There is an emergency response steering group at each plan level with routine administration on site at command and control locations.

Chinese government officials conceded that China, as a whole, is in the infancy stages of developing an emergency response and recovery program. They are looking to develop capacity building strategies for road transportation as well as greater development of relevant laws, regulations, guidelines and policies. A national emergency response law will be enacted this year and its major provisions include:

(1) Procedures and mechanisms for emergency response;
(2) Communications guidelines;
(3) Rehearsal and first-aid training;
(4) Financing and support;
(5) Road transportation command and control for rapid response to emergencies;
(6) National road forecast system;
(7) Expressway network monitoring.

Seoul

The Seoul Metropolitan EOC features a state-of-the-art facility to prepare for, and respond to emergencies. It includes a Mayor's center; a conference room fully equipped with audio visual equipment; a 911 Emergency Dispatch Center that responds to 2,000 ambulance calls per day (see Figure 2); an emergency operations rooms for VIPs; a weather forecast center; a situation room; and a command vehicle.

The EOC utilizes traffic and fire monitoring cameras. There is video storage of all records since 2002. A backup center is also a critical part of the operation.

The EOC operates 24 hours a day, 365 days a year. In the event of an emergency, text messages can be sent to cell phones to alert the public. People with special medical needs can register at the EOC, and information is kept in the 911 database so that treatment can be administered on the way to the hospital. The EOC can track a person's cell phone location immediately when calling 911.

The power, gas, telecommunications companies; Ministry of Construction and Transportation; Korean Meteorological; police; fire; subway; and Red Cross are all an active part of the emergency preparedness, response, and recovery plan. Regional aid units are placed on standby. Special response teams are available in the event of a chemical dispersal in the subway system. Within a year, EOC will have the capability to view all subway closed circuit TV cameras.

Disaster response information is shared with related organizations such as the Red Cross, police, military, and Korea Telecom for systematic support operations. Staff using command center vehicles are equipped with the latest high tech communications and broadcasting equipment to manage and control all vehicles and manpower at the scene of an emergency.

Figure 2 Seoul Emergency Operations Center—911 Emergency Dispatch Center Employee.

Kobe

The Great Hanshin-Awaji Earthquake of 1995 provided the template for emergency preparedness and evacuations brought about by natural disaster. City residents were evacuated for two reasons: (1) safety; and (2) others in the neighborhood had evacuated. Kobe's evacuated population suffered significantly as a result of prolonged residency in shelters. More than a quarter-of-a-million evacuees were housed in 599 shelters throughout the Kobe region. These shelters remained open for 8 months following the quake.

Today, the Disaster Reduction and Human Renovation Institution (DRI) dispatches disaster management specialists to large-scale disasters to provide advice, mitigate damage, and lead recovery efforts. DRI acts as an international research and study hub, disseminating information on effective and practical disaster reduction measures. The DRI provides opportunities for disaster reduction professionals to acquire the latest knowledge and information in emergency management in hope they will one day take a leadership role in disaster management. DRI also conducts training for local government leaders who play an integral role in disaster management.

Kobe regularly updates the Regional Disaster Preparedness Plan, Community Tsunami Preparedness Plan, and Community Safety Map. The city provides presentations and briefings about disaster management to community groups; promotes studies and research relating to disaster preparedness; conducts disaster preparedness drills, and is instrumental in preserving earthquake documents and disaster history as research records and learning tools for future generations.

The city of Kobe has a plan to strengthen emergency response and disaster preparedness. It includes improving rescue and emergency medical systems; organizing a large-scale disaster response rescue team; establishing a distribution system for food and emergency supplies; upgrading fire stations, emergency vehicles and equipment; maintaining emergency toilet facilities; developing emergency hotlines; establishing emergency supplies of drinking water; and creating disaster-resistant utilities.

The transportation network is a key component of emergency preparedness, and evacuation measures encompass a multi-modal land, sea, air network and expansion of the railway as well as an interlinking road network.

Tokyo

More than 5,000 Japanese were affected by the 1995 Sarin gas attack in the Tokyo subway system. The enormity of that terrorist attack caused Tokyo Metro to re-evaluate its emergency disaster plan and create counter-measures sufficient to respond to a large-scale catastrophe. The agency came to the realization that it must be able to address multiple simultaneous incidents. The resulting improvements in overall disaster preparedness and response strategies include:

(1) Standard manuals for simultaneous events;
(2) Rail divisions organized by region;
(3) Regular security patrols to identify suspicious passengers or packages;
(4) CCTV images recorded and stored for one month;
(5) Routes divided into 15 districts with cross-functional organization;
(6) Regular drills and emergency training for transit personnel;
(7) Improved communications among emergency response personnel. A dedicated phone line links to police and fire support and to a disaster prevention radio system;
(8) Stations and retail shops that can be used as safe havens in the event of an evacuation.

Like the Chinese, the Japanese government has also entered into agreements with private bus operators to assist during emergencies requiring evacuation.

CONCLUSION

The ITSP mission team returned from their trip overseas with great respect for the leaders they had met and transit systems they had toured.

Across Asia, team members observed first-hand the remarkable commitment to operational excellence in public transport and the public embrace of transit as integral to a city's vitality and growth. Passenger safety and security, they observed, were treated by managers as conditions to be met in the pursuit of flawless system performance.

Mission participants noted that each city's past experience with disaster—whether it be earthquake, epidemic, or terrorist attack—influenced public and official expectations for readiness and the priority transit leaders placed on preparedness.

They also noted that cultural attributes and political context play important roles in shaping how emergency planning and management are undertaken and how the public engages in the process. One manifestation of these factors is the very active involvement of the national governments in each of the countries visited.

Important differences from U.S. practice were identified in how responsibility for ensuring safety and security on public transit is allocated among system managers, local law enforcement, national law enforcement and military authorities, and other entities.

In Asia, the study team glimpsed the exciting possibilities offered by services like high-speed rail and management models that encourage entrepreneurship. While energized by these images, team members also returned home with a sense of pride in their industry's leadership in building partnerships at the local level in thousands of diverse communities across America to prepare for and respond to emergencies that might arise.

APPENDIX A—STUDY MISSION TEAM MEMBERS*

Mike Setzer, Team Leader, CEO, Southwest Ohio Regional Transit Authority
Frederick Worthen, Community Transit, Everett, WA, Director of Transportation
Patrick Daly, Chicago Transit Authority, VP, Safety & Security
Elissa Darnell, Central Florida Regional Transportation Authority, Chief Operating Officer
Rochelle Ferguson, Low Country Regional Transit Authority, South Carolina, Executive Director (employee of First Transit)
Gary Gee, San Francisco Bay Area Rapid Transit District, Chief of Police
Lisa Locati, Golden Gate Bridge Highway & Transportation District, Security & Emergency Management Specialist
Grantley Martelly, Utah Transit Authority, Manager, Safety & Environmental Protection
Ronald Masciana, NY MTA, Deputy Chief of Police
Michael Metz, New York City Transit, Manager, Environmental Monitoring & Emergency Response
Erhart Olson, Washington Metropolitan Area Transit Authority, Captain, Metro Transit Police
Jannet Thoms, Metropolitan Atlanta Rapid Transit Authority, Deputy GM
Camille Williams, Santa Clara Valley Transportation Authority, Accessible Services Program Manager
Gwen Chisholm Smith, Senior Program Officer, TCRP
Michael Taborn, Director, Office of Safety & Security, FTA
Rachelle Jezbera, Senior Project Manager, APTA
Janet Abrams, Mission Coordinator, Eno Transportation Foundation

*Titles and affiliations are at the time of the mission.

APPENDIX B—STUDY MISSION HOST ORGANIZATIONS

Hong Kong SAR, Beijing & Tangshan, China

MTR Corporation
Kowloon-Canton Railway Corporation
Kowloon Motor Bus Company (1933) Ltd.
Beijing Municipal Committee on Communication
- Research Institute of Highway

Beijing Public Transport Holdings, Ltd.
U.S. Embassy in Beijing
Tangshan Municipal People's Government
- Foreign Affairs Office

Hebei Province
- Tangshan Communications Bureau

Seoul & Gwacheon City, Republic of Korea

Seoul Metropolitan Government
- Transportation Bureau
- Transport Operation and Information System (TOPIS)
- Seoul Emergency Operation Center

Ministry of Construction and Transportation
Seoul Metro
Korea Railroad

Kobe & Tokyo, Japan

Ministry of Land, Infrastructure, and Transport
Hyogo Prefecture
Kobe City
West Japan Railway Company
Hankyu Bus Company
Disaster Reduction and Human Renovation Institution
Tokyo Metro Co., Ltd.
East Japan Railway Company

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