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## International Transit Studies Program

Report on the Fall 2002 Mission

### Transit Operations in Central and Eastern Europe

*This TCRP digest summarizes the mission performed October 17–31, 2002, under TCRP Project J-3, “International Transit Studies Program.” The report includes transportation information on the cities and facilities visited, lessons learned, and discussions of policies and practices that could be applied in the United States. This digest was prepared by Kathryn Harrington-Hughes of the Eno Transportation Foundation and is based on reports filed by the mission participants.*

## INTERNATIONAL TRANSIT STUDIES PROGRAM

### About the Program

The International Transit Studies Program (ITSP) is part of the Transit Cooperative Research Program (TCRP). ITSP is managed by the Eno Transportation Foundation under contract to the National Academies. TCRP was authorized by the Intermodal Surface Transportation Efficiency Act of 1991 and reauthorized in 1998 by the Transportation Equity Act for the 21st Century. It is governed by a memorandum of agreement signed by the National Academies, acting through its Transportation Research Board (TRB); by the Transit Development Corporation, which is the education and research arm of the American Public Transportation Association (APTA); and by the Federal Transit Administration (FTA). TCRP is managed by TRB and funded annually by a grant from FTA.

ISTP is designed to assist in the professional development of transit managers, public officials, planners, and others charged with public transportation responsibilities in the United States. The program accomplishes this objective by providing opportunities for participants to learn from foreign experience while expanding their network of domestic and international contacts for addressing public transport problems and issues.

The program arranges for teams of public transportation professionals to visit exemplary transit operations in other countries. Each study mission focuses on a theme that encompasses issues of concern in public transportation. Cities and transit systems to be visited are selected on the basis of their ability to demonstrate new ideas or unique approaches to handling public transportation challenges reflected in the study mission's theme. Each study team begins with a briefing before departing on an intensive, professionally stimulating 2-week mission, after which they return home with ideas for possible application in their own communities. Team members are encouraged to share their international experience and findings with peers in the public transportation community throughout the United States. Study mission experience also helps to better evaluate current and proposed transit improvements and can serve to identify potential public transportation research topics.

Study missions normally are conducted in the spring and fall of each year. Study teams consist of up to 15 individuals, including a senior official designated as the group's spokesperson. Transit properties are contacted directly and requested to nominate candidates for participation. Nominees are screened by a committee of transit officials, and the TCRP Project J-3 Oversight Panel endorses the selection.

Study mission participants are transit management personnel with substantial knowledge and

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experience in transit activities. Participants must demonstrate potential for advancement to higher levels of public transportation responsibilities. Other selection criteria include current responsibilities, career objectives, and the probable professional development value of the mission for the participant and sponsoring employer. Travel expenses for participants are paid through TCRP Project J-3 funding.

For further information about the study missions, contact Gwen Chisholm-Smith at TCRP (202-334-3246; gsmith@nas.edu) or Kathryn Harrington-Hughes at the Eno Transportation Foundation (202-879-4718; khh@enotrans.com).

### **About this Digest**

The following digest is an overview of the mission that investigated transit operations in central and eastern Europe. It is based on individual reports provided by the team members (for a roster of team members, see Appendix A), and it reflects the views 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, TRB, the National Academies, APTA, FTA, or the Eno Transportation Foundation.

## **TRANSIT OPERATIONS IN CENTRAL AND EASTERN EUROPE**

The theme of this study mission was “Transit Operations in Central and Eastern Europe.” The mission focused on how transit agencies in Poland, Hungary, Romania, and Russia are adapting to the major social and economic changes that have occurred as these countries have moved from centrally planned economies to market-based economies. The team met with staff from agencies that plan and operate public transport systems in Warsaw and Gdynia, Poland; Budapest, Hungary; Bucharest, Romania; and Moscow, Russia. The discussions covered financial and economic issues, market share, land use and right-of-way, specialized transit, and community support for transit. (For a list of host agencies, see Appendix B.)

In many ways, the current climate of change in eastern and central Europe parallels that which has been occurring in the United States for many years. As the number of automobiles has increased, so too has traffic congestion, parking problems, air pollution, and urban sprawl. All of these factors have made the urban environment more challenging for transit operators.

The team members met with staff of the World Bank in Washington, D.C., immediately prior to leaving on the study mission. The World Bank staff presented an overview of the economic and public transport conditions in Poland, Hungary, Romania, and Russia.

## **TRANSIT SYSTEMS STUDIED—OVERVIEW**

In the past 12 years, public transit in many cities of central and eastern Europe has changed from a state-(national government) owned enterprise with nearly 100% of the mode split, transporting passengers without regard to cost and/or funding, to a financially constrained, municipal enterprise with an emphasis on innovation, customer service, and competition. The tangible results vary considerably from system to system.

The transit agencies covered in this report have, with one exception (the Bucharest subway system), been transformed from state enterprises (political subdivisions of the national government) to municipal enterprises (city owned). This transformation has resulted in a radical shift in the operating and financial paradigm for these transit properties. Funding and planning for local public transit is no longer handled on a national basis, but is instead addressed through the city’s planning process—if one exists—and falls victim to the same municipal budget process as all other city services. Public transit must now compete with schools, fire and police services, and other municipal agencies for scarce city resources. In addition, these same ex-monopolies must now also compete for customers with private companies and the private automobile. The advent of competitive pressures from private companies and the surge in private car ownership have radically altered the transportation dynamic. Roads and other car-related infrastructure have taken on a newfound importance relative to public transit. Public transit agencies have developed various strategies and mechanisms to cope with these changes.

### **Warsaw and Gdynia, Poland**

The changes that affected public transit in Poland after its switch to a market-based economy were in many ways a microcosm of the changes happening on a macro level. Public transit was king in pre-1989 Poland; car ownership was very limited and restricted to the privileged few. The mode split was heavily dominated by the state-owned public transit enterprises. After 1989, the car became king, as car ownership became a statement of the country’s newly won independence and individual freedom. In addition, the collapse of socialism brought competition; privately owned public transit enterprises were created and competed with public transit for customers and subsidies.

The changes evident in the public transport system in Warsaw were more on the order of a slow-motion reform movement; in contrast, Gdynia has enthusiastically embraced competition and the private sector.

The city of Warsaw is a rebuilt and restored cosmopolitan city in the heart of central Europe. Until 1989, Warsaw’s public transit was state owned, receiving generous subsidies from the central government. Due to low car ownership rates, competition was limited and public transit carried 80–85% of all passengers, versus 62% today. Before 1983, when

the national government started construction of the subway system, Warsaw had only surface mass transit: buses, trolleybuses, and trams (streetcars). In 1995, the Warsaw metro opened for business. Today, three transit entities exist as separate, municipally owned enterprises working in co-operation but under separate leadership and with very different corporate cultures and financial needs: namely, Miejskie Zakłady Autobusowe (MZA, the municipal bus company) for buses and trackless trolleys, Tramwaje Warszawskie (TW, Warsaw Tram Company) for trams, and Metro Warszawskie (the Warsaw metro) for the subway.

### **Budapest, Hungary**

Budapesti Közlekedési Részvénytársaság (BKV, Budapest Transport Limited), the public transit authority in Budapest, is an integrated transport provider with a subway, trams, buses, and a suburban rail serving 64% of the traveling public. Previously a traditional socialist monopoly, BKV is now organized as a joint-stock ownership entity, but is in fact still 100% owned by the city of Budapest. BKV does not currently actively engage in competition. In preparation for competition, it is, however, becoming more creative and innovative, particularly in the areas of management, corporate structure, and purchase of services.

### **Bucharest, Romania**

Bucharest has two public transit operators: Regia Autonomă de Transport București (RATB, Bucharest Transport Authority) and Metrorex (the subway). RATB provides all surface transport, including buses, trolleybuses, and trams, and is subordinate to the city of Bucharest. The Metrorex provides underground transport and is subordinate to the State Department of Housing and Transport. RATB carries about 85% of all public transit passengers, and Metrorex carries 15%.

RATB provides surface transport services to 800 million passengers per year (about 2.2 million daily passengers) on a \$100 million annual budget. The subway system spends an average of \$1.7 million per month, which translates to a \$20 million annual operating budget. Metrorex has a 40% farebox recovery rate, with the remaining 60% being supplied by state subsidy.

### **Moscow, Russia**

The Moscow transit system was by far the largest transit system visited in terms of passengers carried and the most impressive in terms of stations and sheer volume of people moved per day. As in Warsaw and Bucharest, Moscow has split its transit operators into specialized agencies: Mosgortrans, which provides surface transit (bus, trolleybus, and trams) and Metro, which provides subway service. Ten years ago, 99% of all travelers used public transit. Although this market share has dropped significantly, an estimated

24.5 million people now use public transit daily, and 5.5 million travel by car or other private mode of transportation.

## **PLANNING PROCESS**

### **Warsaw**

Newly democratic Poland inherited a transit system whose mission was to get citizens to work on time, regardless of costs, which were borne by the government. As the state began relinquishing control of municipal transportation operations, Poland's transit agencies embarked on a self-sustainability quest that has produced mixed results. Municipal agencies were forced to raise fares from the artificially low rates set by the communist government. At the same time, ridership levels began to decline because of (a) an unemployment rate that reached as high as 35%, (b) an explosion in the number of private cars on the road, and (c) rapid suburbanization outside historic transit service areas. In the past, strict land-use planning and restrictions imposed during the communist era helped ensure that development was oriented toward transit, rather than the American-style sprawl. Over the past 10 years, however, nearly 30 auto-oriented shopping centers have sprouted on the outskirts of the Warsaw metropolitan area. Although efforts are now being made to require municipalities to more carefully plan and manage land use, the immediate post-communist reaction to decades of development control produced sprawl problems that will challenge transportation service providers for years to come.

Warsaw boasts several primary forms of public transit—trams, buses (both motor and electric), and a recently added subway system, in addition to a suburban railway company. Looked down on for years as outdated and old-fashioned by citizens and officials, Warsaw's tram system has recently received renewed attention as an efficient and environmentally friendly way of moving passengers around the major transportation corridors of Warsaw. Approximately 45 new trams were purchased in 2001, and more are slated for acquisition in 2005. Additional investments are being made in rolling stock rehabilitation, as well as for improvements in track and overhead catenary system (OCS) infrastructure. Plans for expanding the tram lines are minimal, as local laws prohibit extension of tram lines beyond the city limits, where most of the development is now occurring. A 4-km expansion was completed in 1997, and construction is scheduled to commence in 2003 on another short extension.

Warsaw's bus routes are laid out according to traditional transportation patterns. To adapt the old network to modern needs, in-house planners use the ArcView 3.2 and Visum computer packages to map transit lines and monitor ridership patterns. Population data and traffic generators, as well as route, schedule, and stop information, are used in traffic modeling to test new services and determine the resulting impacts on overall traffic flow. Passenger counts are gener-

ated and monitored by downloading data from the ticket validation machines onboard the buses and at the Metro stations. Details such as the number of riders on a route between two stops and the time passengers wait to transfer from one route to another can be studied and tracked using this system. To further assist officials with route planning initiatives, Warsaw's municipal development office provides a matrix identifying residents' places of work and homes. Occasional surveys are also conducted to measure demand for new routes or changes to existing routes. Unfortunately, with limited resources on hand, an expansion in service in one area usually requires contraction of service in another. The data and transit-modeling functions provide valuable assistance for local authorities as they make these difficult decisions.

The Warsaw metro is a modest, one-line subway system running north and south along nearly 15 km of underground trackway (Figure 1). Opened in stages from 1995 to 2001, the metro generates strong opinions, both positive and negative. The next 3-km-long section of the main line and the

addition of a second east-west line were major campaign issues during the municipal elections that were to be held immediately after the team's visit to Warsaw, with the front-runners endorsing the expansion plans. Critics of the plans contended that, as the most expensive form of transit, the metro and its proposed second line will consume scarce transportation funds that would otherwise be put to better use for trams and buses. Transit officials are planning to set up a public-private partnership to construct the east-west line in three sections: a 6-km, 6-station piece crossing the main north-south line in the center of Warsaw, a subsequent 7-km, 7-station extension to the western edge of the capital, and a third 7-km, 5-station stretch that will cross the Wisla River and serve Warsaw neighborhoods that occupy the eastern portion of the city. With 70 million passengers transported during 2001 (an increase of 12.5 million from the year before), the Warsaw metro has a growing constituency that will undoubtedly press governmental officials for the necessary expenditures needed to continue expanding this system.



Figure 1. The Warsaw Metro, a one-line subway system, carries 70 million passengers/year. Planning is underway to expand the system.

## Gdynia

As the heir apparent to the centuries-old former economic powerhouse of Gdansk, Gdynia is a relatively modern industrial community nestled on a harbor of the Baltic Sea. Just north of Gdansk (known also in the past as the free-trade city of Danzig), Gdynia is committed to capitalism and competition. Owners of “Hipermarkets” (the European version of big box retailers such as Wal-Mart) pay the entire operating costs for certain bus lines that travel to their stores. Three separate independent bus companies competitively bid on transit lines in the Gdynia service area, on a route-by-route basis. The company with the lowest bid on each particular route wins the right to operate that route for the term of the contract. These operating companies are monitored by yet another company—Zarząd Komunikacji Miejskiej (ZKM, the urban transport authority)—that provides administrative functions such as service planning, marketing, customer information, and performance monitoring.

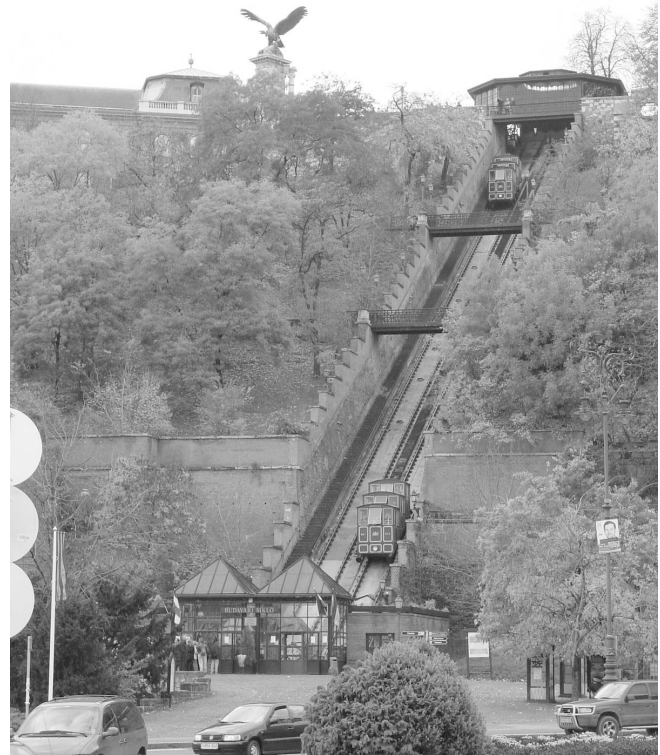
A post-communist boom sent ridership up from 98.5 million in 1993 to 140 million in 2000. However, as wealth and car ownership have increased, ridership has begun to decline—by approximately 20% in the past 2 years. In 1994, fully 75% of citizens used public transit in Gdynia. By 2000, that number had fallen to 65%, and it is predicted to decline further as suburbanization and the resulting car-oriented development continue to increase.

Ridership on each route is analyzed on a monthly basis and determines future expansion needs and other planning matters. In an effort to enhance transit service to passengers in the central part of Gdynia, ZKM has submitted plans to close a major shopping street to automobile traffic and to implement a bus-only arrangement. However, city officials have not yet approved this plan.

Every 2 years, ZKM conducts a door-to-door survey in which citizens are questioned about their transportation needs and habits. Composed of 45 questions, the survey instrument allows ZKM to gauge customers’ expectations, determine where new lines should be built, and track other attitudes toward transit. Instead of polling only enough respondents to achieve a sufficiently low margin of error, ZKM chooses to survey fully 1% of the citizens of the service area each time the survey is conducted.

## Budapest

The mighty Danube River bisects the vibrant capital city of Hungary. Hilly, historic Buda on one side of the river overlooks flat, cosmopolitan Pest, presenting several interesting transportation challenges, met by a plethora of public transportation choices. Bus, trolleybus, tram, subway, and suburban rail lines that crisscross the metropolitan area are joined by a funicular (Figure 2), cog railway, and chairlift. Home to the oldest continuously operating subway line on the European continent, Budapest celebrates its historical heritage as well as its westward-leaning attitudes that have



*Figure 2. Budapest’s public transit system includes a funicular, which provides pedestrians with easy access between Chain Bridge and the Castle District at the top of the hill.*

kept the nation at the forefront of the former communist-bloc countries.

At a museum on the outskirts of the city, the city’s first forays into public transit are remembered. The first omnibus service began in 1832, and horse-pulled streetcars were inaugurated in 1866. Constructed to celebrate the millennial celebration of the first Hungarian settlement in Europe in A.D. 896, the original Budapest subway line—dubbed the Millennium Metro—connects the Parliament Building and the downtown area with a major municipal park, home to one of the city’s famed public baths. This historical underground transportation innovation still carries passengers quickly and efficiently today (99.5% on-time performance) and was joined by two additional metro lines that were constructed after World War II. Since 1990, no additional metro lines have been opened; however, a fourth line has been planned, and the initial work has already commenced. Extensions to the two existing lines are also being considered.

Some 50 tram routes operate on portions of over 150 mi of double trackway organized in a complex “trunk and multiple branch” arrangement. In 2001, a third main tramway

line was opened. Measuring 14 km, it connected the two existing lines, provided service to new neighborhoods, and enhanced connectivity to those passengers who already used these services. Trolleybuses travel along approximately 65 km of Budapest streets underneath fixed overhead catenary wires. In 2002, BKV transit planners extended the route of a trolleybus line to the new Uzosoki Hospital in order to accommodate the associated job growth and development.

The need for public transit in Budapest grew rapidly throughout the 1960s and 1970s. Ample financing sources allowed BKV to expand rapidly as it served a large workforce that staffed Hungary's state-owned industrial developments. By the 1980s, BKV was operating at peak performance, with low fares heavily subsidized by the government and high ridership. However, the start of economic liberalization, which moved the country rapidly toward capitalism following the end of communist rule, began to erode BKV's position as the leading transit provider for citizens of Budapest. Well-defined traffic patterns were quickly replaced by more chaotic home-to-work trips as a result of the breakup of major industrial plants. This new multidirectional commuting pattern was best served by automobiles, which were becoming increasingly accessible to the average middle-class Hungarian.

BKV found itself at a crossroads, where it had to rethink its role as the capital's public transit provider. Citizens of Budapest now expected public transit to be as dependable, high-quality, and convenient as automobile commuting. Even the human factor was reevaluated, from ticket cashiers, to drivers, to informational staffers. In its drive to increase company revenues, boost its approximately 58% market share (private automobiles have 36% of the market, and other public transit rivals have 6%), and to create a better overall public image, BKV targeted three major population segments: adult commuters, occasional riders (including school-age children, who may become regular users, and visitors to Budapest), and families, who would together choose public transit over the costs of owning a private automobile. BKV's primary messages were as follows:

- The BKV company and its services are continually improving.
- BKV is making efforts to customize services to the customers' needs.
- Quality is BKV's highest priority.
- BKV is committed to building and maintaining better relationships and partnerships with its passengers.

The above messages were transmitted to the public in numerous ways, including brochures, media advertisements, posters, billboards, direct mail, public relations articles in newspapers and travel magazines, a website, presentations at exhibitions and fairs, multilingual leaflets, transit stop informational signs, and incentives to passengers. Sophisticated marketing techniques were a significant change for BKV, but were necessary to the company's survival in the

new capitalist Hungary. Instead of considering itself as a utility, such as water, gas or power, BKV assumed the identity of a western-style corporate enterprise, with the attendant marketing and public relations strategies that are part and parcel of American private enterprise. BKV now responds to customer demands as it plans its transit routes and schedules.

After a 20% loss in ridership between 1986 and 1996, BKV saw figures level off during the past 5 years at approximately 1.4 billion passengers per year, with utility figures (i.e., passengers per mile and seat-mileage) decreasing about 1% per year. Transit officials began looking for ways to increase ridership in a city whose residents were increasingly choosing automobiles as their mode of choice.

In 1998 and 1999, several new transit lines were introduced, and the revolutionary BKV-Plus bus system was implemented. This service puts the needs of customers first, focusing on schedule dependability, comfort, and convenience. New or newly refurbished vehicles operate on BKV-Plus lines, which not only provide a higher comfort level for passengers but also reduce the chance of delays due to mechanical problems. Maps and timetables are provided free of charge to passengers aboard these lines, and upgraded passenger information is posted at the stops along these routes. In addition, buses operating on BKV-Plus lines are guaranteed to leave the route origin at the published time. Dispatchers and drivers closely monitor traffic congestion along the BKV-Plus routes. If a bus becomes delayed or is running so late that it cannot arrive at the terminus to turn around and depart in the opposite direction on time, a replacement bus is sent from the depot to make the scheduled run. BKV-Plus vehicles are cleaned every day, and the bus stop areas are cleaned several times a week. In 2002, the first BKV-Plus line to run beyond the Budapest administrative limits was inaugurated. Approximately 14% of all buses operate as BKV-Plus service. Offered at no extra charge to passengers, the BKV-Plus service offers valuable learning tools for transit agencies in Europe and here in the United States.

Other route-planning initiatives are being carried out in association with other communities that border BKV's service area. The "Western Gateway" area beyond Buda is experiencing rapid development and population growth. Service contracts between municipal governments and BKV arrange for express bus service to the capital's downtown. In addition, a suburban rail line brings commuters into Budapest from many of the outlying communities.

In order to reach out to its customers and to assess passenger needs, BKV implemented a frequent rider system in 2002, in which approximately 8,600 people currently participate. Frequent riders may purchase four special types of discount tickets for themselves, as well as for friends and relatives. Frequent riders receive a newsletter and periodic surveys. Focus groups that include frequent riders are held on a quarterly basis, and telephone opinion polls are conducted every 6 months among the general population. The

company has initiated efforts targeted at children to instill in them the importance of transit to the community, as well as its overall convenience. This “long-range” form of transit planning includes the publication of a children’s magazine that is distributed approximately every 2 months to over 400 schools in the Budapest metropolitan area. Despite all these public outreach efforts, only 45% of the public sees BKV as trying to improve its services.

## Bucharest

Since winning their freedom in December 1989, the citizens of Bucharest have joined together to remake their capital into a westward-looking, business-friendly city. Although it has both a surface public transit system and an underground metro, the capital suffers from troubling traffic congestion brought on by increasing numbers of private automobiles, which grew from 100,000 cars in 1990 to about a

million today. Nonetheless, approximately 80% of the citizens of Bucharest still ride public transit.

RATB can trace its roots back over a century to when the first horse-drawn trolley was established in 1871, with electric railways arriving in 1894. Over the past 30 years, trends in public transit in Bucharest have followed the national economy. During the late 1980s, many services and projects were cut due to a lack of money. Many operation units were closed, including six bus garages and four tram depots. During the worst of these economic troubles, only 40% of the demand for transportation was being met, forcing thousands of Bucharest’s citizens to walk to work and school each day. Beginning in the 1990s, new vehicles were purchased and existing vehicles were overhauled and refurbished. Public transit now meets approximately 80% of demand, with private vehicles for hire (dubbed “maxi-taxis,” Figure 3) and a handful of private bus lines meeting the remaining 20% of demand.



Figure 3. RATB service in Bucharest is augmented by private “maxi-taxi” service.



Today, trams, light rail, trolleybuses, and motor buses, as well as the underground metro (operated by Metrorex), serve the 710-sq-mi Bucharest service area. Efforts are currently being made to improve links between the various modes of public transit; to implement a unified, integrated, automated ticket system for RATB and Metrorex; and to upgrade, modernize, and rehabilitate both rolling stock and infrastructure. With a farebox recovery ratio of only 25%, RATB is faced with the challenges that come with scarce revenues provided from the municipal budget.

While RATB does little in the way of western-style marketing and informational campaigns, officials do point to transit improvements such as the #41-Metrou Usor light rail line. Beginning at an intermodal transit terminal just steps away from the city's new convention center and mammoth media building, the #41-Metrou Usor connects this commercial area with fast-growing residential areas on the western and southwestern edges of the capital. This route was created by upgrading a traditional tramway, eliminating many at-grade crossings, and using modern vehicles. Headways have been reduced from 2.58 min to 2.18 min, while trip time has been shortened from 40 min to just 26 min. While the old trams had a maximum carrying capacity of 4,638 passengers per hour, the new vehicles can transport over 6,300 customers per hour. Inaugurated in September 2002, the #41-Metrou Usor line is considered a great success, and RATB planners are looking for other lines to upgrade in a similar manner.

Other transportation planning functions are guided by the Master Plan on the Comprehensive Urban Transport Study of Bucharest City and its Metropolitan Area, conducted by the Japan International Cooperation Agency (JICA). JICA staffers visited Romania five times between July 1998 and December 1999 to conduct field surveys in Bucharest and confer with local governmental representatives and officials. Released in 2000, this plan provides public transit officials, as well as local transportation planners, with recommendations for improving traffic flow and services within the metropolitan area, creating an attractive city center, cultivating suburban cores, and improving the environment. The study report highlights the tram as the most important transportation mode for Bucharest's future, and it encourages the establishment of a trackway separate from automobiles, the purchase of new tram vehicles, and the introduction of priority signalization for public transit vehicles. The study report also recommends the creation of a new public transit corridor across Bucharest, from southwest to northwest through the city center.

Metrorex operates four main subway lines along 69 km of track connecting 45 stations. Metrorex has suffered its share of financial difficulties, forcing it to flood subway tunnels under construction in order to preserve them until money again became available. These tunnels are now being reclaimed and will soon be completed and put into operation. Metrorex is also using several European Investment Bank (EIB) loans totaling over half a billion dollars to pur-

chase new rolling stock and to begin planning new metro lines, including one connecting Bucharest's airport, located north of the city, to the main train station downtown.

Ridership has fallen from a peak of 1 million passengers per day to approximately 350,000, largely because of a weak economy and the downsizing or outright closing of large-scale industrial plants. Few attempts have been made from a marketing standpoint to try to regain riders, as fares are very low and the service is generally thought of as dependable. A plan has been proposed—but not yet approved by the government—to unite Metrorex and RATB.

## Moscow

Deep underground Moscow lies the world's busiest subway system, serving over 3.2 billion passenger trips annually—a number equivalent to about half the world's population. To enter the subway system, one travels through portals of marble into stations decorated with chandeliers, stained glass, mosaic tiles, and gold leaf (Figure 4). Artisans who once worked on palaces for the tsars were engaged to build subway stations that celebrated the common person, but were luxurious enough for those with royal blood. Trains arrive and depart as quickly as every 90 sec.

Above ground, 17,000 operators and 15,000 mechanics keep trams, trolleybuses, and motor buses moving along 623 transit routes that crisscross the city. Mosgortrans is a union of 52 separate enterprises that provide surface public transit throughout the capital. These enterprises include operations facilities, as well as infrastructure functions such as power supply, fare collection, research, and training. Officials are currently attempting to merge all the enterprises into one large company.

One of Mosgortrans's 52 enterprises conducts service and route-planning functions, including routes, stops, fleet sizes, and depot operations. General transportation planning is accomplished through the Institute of General Planning, a governmental body composed of 600 specialists who are charged with solving Moscow's problems and guiding the city's development, including transit-oriented issues. The Institute of General Planning can modify Mosgortrans's plans if it wishes. The transportation section of the General Plan for the Development of the City of Moscow contains directives regarding streets, thoroughfares, length of transit routes, types of rolling stock, frequency of service, and the like. Metroplan 2015 is a long-range comprehensive blueprint for Moscow's future and also addresses transportation issues. It has been adopted by Moscow's municipal government and now awaits final approval—and funding—from the Duma, Russia's national legislature.

Mosgortrans's ridership has been falling because of the increase in private automobiles, now estimated at approximately 2 million in the Moscow area. In an effort to stem that loss, new service was introduced in 2002, which caters to middle-class Muscovites who live in new suburban-style developments on the outskirts of the city. For this premium



*Figure 4. The Moscow Metro is graced with marble portals, crystal chandeliers, and stunning artwork.*

service, buses have been equipped with televisions and magazines, and nonalcoholic drinks are available. The fare is approximately 30% higher than for standard buses and trams, but most customers consider the added amenities and better service to be well worth the price. These buses run on an express basis, stopping at approximately one-third of the locations as standard service.

Moscow Metro is the lifeblood of the capital city, allowing this city of nearly 10 million to function on a daily basis. The metro carries 9 million passengers on an average weekday along 11 different lines, including a circle line that rings the central part of the city. A model of intermodality, the metro's 163 stations include 6 that offer connections to suburban railroads and 9 that are underneath national railway terminals. Ridership has not decreased on the metro, in part because of the influx of new residents into the city. One official commented that the metro was not actively courting new riders, as the system was performing near capacity.

With regard to route-planning functions, the mayor of

Moscow has considerable power in ordering feasibility studies for future routes and route extensions. In the past, residential areas were developed first and then Metro was extended to meet the demand. The new municipal government is making attempts to reverse that inefficient, disruptive, and expensive procedure by planning Metro extensions before permission is given to develop. A new mixed-use office, retail, and residential project is currently under development in an area several miles north of the Kremlin. Metro extensions and a new elevated light rail are simultaneously under construction; they will connect the area with the city's traditional downtown and then run southward to new suburbs on the periphery of Moscow. In addition, an 11-km monorail line is being constructed in northwest Moscow to connect to existing Metro lines, eliminating the need to travel downtown to transfer lines. Previous metro additions were undertaken in advance of the 1984 Summer Olympics and connect many of the stadiums and venues where the various events were held.

## FINANCIAL MANAGEMENT AND CAPITAL PLANNING

### Warsaw and Gdynia

Prior to 1989, public transit in Poland was incorporated into one nationwide entity. Funds were distributed based on the state's determination of the needs of transportation versus other governmental needs. With the advent of municipal ownership came a new mechanism for subsidy. Today, cities and towns are faced with responsibility for ensuring the delivery of vital public services, prompting difficult choices. As the grim reality of reduced levels of government support became apparent, Warsaw raised fares substantially—as much as 400%, with fares accounting for up to 75% of operating needs. The municipality failed to provide adequately for capital needs, with a detrimental impact on the system's state of good repair (i.e., when the infrastructure components are replaced on a schedule consistent with life expectancy). The annual 1-year municipal budget cycle makes it difficult for public transit in Warsaw to undertake meaningful long-term planning, to commit to critical infrastructure investments, or even to purchase necessary rolling stock. Despite these limits, public transit continues to provide impressive service levels on the surface and a high level of investment to complete the initial subway line and design others.

Transit operators in Warsaw have three basic sources of income: farebox, state subsidy for capital expenses, and municipal subsidies for operating and capital expenses. The city's subsidy and the farebox revenue each represents about 50% of operating costs. Current operating budgets total \$200 million. Capital costs are funded on an annual basis and vary considerably, with investment activity for the current year reported to be about \$200 million, with one-half going to the continued construction of the Warsaw metro and the balance split between TW and MZA. All capital spending is "pay as you go" money because many of the traditional financing mechanisms used in the United States or western Europe, such as bonds or loans, were unavailable to the transit enterprises because of a lack of municipal guarantees and a nonexistent municipal bond market.

The Zarząd Transportu Miejskiego (ZTM, Warsaw Transport Authority) has developed and implemented an advanced fare collection system. Buses, trackless trolleys, and trams use proof-of-payment fare systems and smartcards. On the metro, cards with magnetic stripes and smartcards are used as forms of payment. ZTM expects to be able to introduce paper smartcards for single-ride use, as well as multiple-ride use, at some point in the future. Although regular fare inspections are the norm, the system estimates a fare evasion rate of up to 20%, with 15,000 evaders caught monthly. These evaders face a penalty of 50 times the base fare, which, if paid immediately, is discounted.

TW owns 860 trams with about 710 in service daily. However, as the director of TW reported, quantity does not

guarantee quality. Although TW suggested that the quality of service is poor from the rider's perspective, many of the trams, although old, appear to be providing frequent, safe, and efficient service.

MZA has provided bus service for 82 years and is now facing an uncertain future as it transitions to a private joint stock ownership company. It currently carries 90% of all bus passengers, but expects this to shift to 70% as a result of competition from the private sector. Consequently, MZA must learn to be more competitive if it is to survive. Since personnel constitute 61% of costs and fuel 17% of costs, MZA has a real incentive to reduce personnel and purchase more fuel-efficient, environmentally friendly vehicles. Today MZA employs 3,164 drivers, 1,448 technical personnel, and 641 administrative employees, with an average salary of \$800 per month. Management estimates that a cost reduction of 12–15% is necessary simply to survive and that a reduction of up to 20% in costs will allow MZA to compete in the new environment. The proposed reorganization is facing substantial opposition from trade unions and might take up to 6 years to achieve some modicum of success.

The Warsaw metro has a farebox recovery ratio of only 10%, with the balance coming from the city. Metro continues to expand: an additional 108 cars have been ordered, with the first 60 scheduled to arrive in 2005 in time for the next expansion, which includes five more stations and 4.5 km of track. A second metro line is being considered, including 20 km of track and 18 stations. Metro, like MZA and TW, is scheduled for privatization, although no specific plans have been made.

Capital needs for both trams and buses were reported to significantly exceed funding provided. The surface transit entities report that they jointly have an annual capital investment need of \$250 million, but they receive a \$100 million municipal grant, or about 40% of their infrastructure needs. The staff of the metro, which opened in 1995, did not report any compelling repair needs, but pointed out that funding for the completion of the existing line and for the addition of other lines was critical to the metro's future. Among the three enterprises, only funding for the expansion activity of metro is considered stable. Although funding for transportation is provided on a year-to-year basis, which is impractical as a planning horizon, all three transit agencies made reference to a citywide transportation plan that is updated annually to reflect the reality of the municipal budget process and available funding.

TW reported a declining state of good repair for its tram system. Trams were reported to have a useful life of 35 years. The tram fleet has an average age in excess of this, and 35% of all tram rolling stock was reported to be older than the useful life. The director of TW reported that half of all trams should be replaced because of age and that a subset of 150 trams needed immediate replacement. The city has promised to support the purchase of 50 new trams in 2005. Replacing elderly trams is a priority for TW, but an expensive proposition; cars were reported to cost \$2 million each.

The total immediate vehicle needs exceed \$300 million, but do not appear likely to be funded by the city any time soon. TW expects to be able to provide \$10 million for new rolling stock (3.3% of need), but believes it is facing decapitalization as investment shortcomings manifest themselves in deteriorating conditions in regards to rolling stock and the track, signal, and power infrastructure.

MZA reported being in a better state of good repair than TW but still without sufficient capital and operating resources. As an example, buses have an average life of 12 years (in a state-of-good-repair context, the average age should be 6 years). Today, however, 62% of MZA's buses are more than 6 years old. Although the purchase of 133 buses per year is the minimum to maintain an average age of 6, this level of purchasing has been reached or exceeded only twice in the past 13 years; actual bus buys for the past 12 years have averaged 83 per year. This low average is further evidence of a declining state of good repair. Despite the reported lack of capital investment in rolling stock, most of the buses that the team members rode on or inspected appeared to be in excellent condition and had many of the amenities that have begun to be commonly accepted as standard in the United States and other countries, such as light-emitting diode (LED) signs listing the next bus stop.

Transit operators have learned to "make do" with insufficient capital resources. For example, as an alternative to new rolling stock procurement, TW is modernizing its existing rolling stock to extend the vehicles' useful life; about 300 trams appear to be likely candidates for this treatment. Stations, track, power, and signals all also need modernization, and capital and maintenance funds for these assets are lacking as well. TW is about halfway through modernizing 40 stations and is spending about \$10 million per annum to maintain track.

Additional innovations and expansions in both the bus and tram operations are contemplated or underway, including exclusive bus lanes and plans for expanding the existing tram network.

Gdynia's ZKM is not only responsible for long-range and strategic planning and the service-planning aspects of transportation, but is also the fare medium issuer, collector, and enforcer and serves as the contract administrator for all public transit service. Within ZKM's service area, the city controls three transit companies, two of which provide bus service and one of which provides trolleybus service. Combined, these three firms have a 78% public transit market share: PKM Gdynia (bus), with a 34% public transit market share; PKA Gdynia (bus), with a 23% public transit market share; and PKT Gdynia (trolleybus service, Figure 5), with a 21% public transit market share. Another state-owned transit entity holds a 7% market share. Several private-sector firms provide the remaining transport services. All of these firms compete with each other under the ZKM umbrella.

Both private and public companies compete for concessions to provide service on lines. Service is based on routes and/or certain runs within a larger route structure. Firms do

not necessarily compete for passengers or even exclusive rights to a single route. On any given route within any given hour, if the standard is a 10-min headway with six buses, a different firm could provide each bus. All of this would be transparent from the customer's point of view since all buses have the same color scheme, fare structure, driver uniforms, and so forth.

In 2000, the modal split between public transit and cars in Gdynia was 65%/35%. Today ZKM estimates that the mode split is 53%/47%. This falling modal split is occurring despite customer satisfaction surveys that have risen from an average of 3.39 in 1994 to 4.01 in 2000 (on a 5-point scale, with 5 being excellent) and increasing vehicle-kilometers. During the same period, ridership has fluctuated considerably, from 98.5 million in 1997 to 140 million in 2001 to 112 million (estimated) in 2002.

ZKM generates sufficient revenue to cover 75% of its operating costs from the farebox. The remaining 25% is provided through a budget donation from the city. ZKM is reimbursed for its performance based on a payment per vehicle-kilometer. The firms are not compensated based on passengers, but rather on vehicle-kilometers traveled. The capital portion of the program is included in this payment. Interestingly, city-owned firms are not tax exempt and are required to pay a variety of taxes that add up to a tax rate of approximately 28%. This was done to "level the playing field" for competition between private firms and public firms.

ZKM uses a proof-of-payment system with onboard validation. About two-thirds of all riders use monthly passes. In addition, ZKM sells 6-month passes. Fares are enforced by a team of 28 inspectors. Despite this enforcement effort, the authority has a 13% fare evasion rate. The average fare is 2 zlotys (\$0.54), and the average penalty is 90 zlotys (\$24.30), with discounts for those who make immediate payment or who pay at ZKM headquarters. Bus and trolley operators sell tickets onboard, and their compensation package includes 9% of onboard ticket sales on their routes.

ZKM is concerned about the age of its trolley and bus fleet. Many of the buses are purchased used, about halfway through their useful life (i.e., 5 or 6 years of age); the current ratio of new to used buses is 3 to 5, except trolleybuses, which are all purchased new. At one 98-bus garage, the rate of replacement was 8 buses per year, which is about the standard. But given the ratio of new and used buses purchased, the average age is rising, not falling. The purchase price of a bus ranges from \$150,000 to \$250,000, depending on size. All new buses have interior and exterior cameras, LED stop-announcement signs, air conditioning, and global positioning system (GPS) technologies.

## Budapest

Hungary's Municipal Act mandates that cities provide local public transit. In Budapest, the contract between the city and BKV stipulates the quality and quantity of transit



Figure 5. PKT's trolleybuses carry 21% of public transit customers in Gdynia.

services to be provided and provides a subsidy to account for the difference between discounted fares for certain classes set by the state and the cost of a full fare. Fares are determined by the State Ministry of Finance, not by the municipality, which provides the operating and social subsidies, or the operator that provides the service.

The entire system carries 3.9 million passengers daily to and from 4,625 stops and stations. Service is provided by 12,400 staff (down from 22,000 employees 10 years ago) and 3,072 vehicles, all within an annual budget of \$300 million.

Each mode of service (tram, bus, metro, and suburban rail) provides varying degrees of coverage of BKV's service area. Although bus offers service to 67% of the service area, it carries 40% of passengers. Rail (metro and trams) provides service only to 17% of the district, but carries 52% of all passengers. Suburban rail and trolleybuses have usage ratios that are proportional to their coverage.

For many years the number of passengers per seat and per kilometer more or less matched each other. Starting in

1990, the ratio changed considerably, as ridership dropped and capacity did not. This capacity gap peaked in the early 1990s and has changed over time as BKV reorganized itself and reduced capacity. Today, given the dynamics of the market, BKV believes that it might actually need to expand to provide sufficient capacity for the passenger demand.

In 1996, BKV developed a reorganization plan based on an in-depth study that focused on transforming an over-staffed public monopoly into a slimmer, more competitive, and self-reliant transport enterprise. The study outlined a plan whose sole purpose was to ensure the organization's survival. The plan distinguished between core and noncore activities, it rationalized the operating structure, and it emphasized the creation of a viable financial structure. It recommended, among other actions, reducing the size of staff, outsourcing noncore functions, and creating wholly owned subsidiaries to provide service to the parent organization, as well as to compete for business on the open market. This reform plan was implemented over several years and was completed in 1998. Through these reforms, attrition, and

retirement, the number of staff members was cut almost in half (from 22,000 to 12,000), but with only 250 employees having to be laid off.

All of the restructuring was designed to be transparent to the customer. Some critical, noncore tasks, even if they supported core functions, were “outsourced” to BKV-created limited partnership companies; these functions included fare collection, engineering, telecommunication, vehicle repair, health services, chairlift maintenance, and escalator repair. Other noncore activities, such as security, cleaning, printing, and clothing, were either suspended or simply bought on the open market.

The structure of remaining BKV units was fundamentally altered. For example, corporate functions such as finance, personnel, and technology retained the traditional top-down corporate structure. Operational units, such as bus operations, were broken down by geographic area, and the fixed lines were broken down by mode (tram, suburban rail, metro, and trolleybus). Functionally, power and decision making devolved into decentralized units. Each branch was designed and intended to act as its own cost center, with a certain degree of operational independence.

In the new environment, the organization recognized that its financial viability was paramount if it was to survive; BKV has not generated a surplus since 1993. Management said that it had not yet succeeded in developing an alternative financial structure for BKV. The organization has accomplished measured success with its management reforms, which have generated substantial one-time savings, as well as some ongoing savings. For example, one of the goals of the reform was to dispose of unnecessary assets. Through this process, a substantial amount of one-time savings was generated, primarily by the sale of unneeded real estate. Other reforms have led to more modest ongoing operational savings, generated primarily by streamlining functions, reducing fleet size, privatizing functions, and reducing staff. Fares were also increased significantly. The ongoing savings remain insufficient to cover BKV’s operating expenses or to provide adequate funds for capital investment needs. The financial goals that remain for the organization are to break even for operations and to replenish the existing infrastructure using state and municipal grants.

In addition to the management goals, the timing and process for the setting of the municipal subsidy cries out for reform. For example, the state’s budget is set in November/December for a January 1 start date. The municipal budget often does not obtain final approval until February or as late as April. The fare levels, which are approved by the state, are also set at a different time. So, the budget, subsidy, and fares are all approved by different institutions and with different timetables. This is a major source of difficulties for BKV as it struggles to meet the needs of its approved budget without the subsidy and/or fare level it needs until several months into the fiscal year. The campaign platforms for each candidate in the most recent mayoral elections included normative financing of public transit. BKV’s basis for norma-

tive financing is to develop grant-based performance indicators, such as passenger place per kilometer.

Fares, farebox recovery ratios, and fare evasion rates are critical components of BKV’s financial stability. Individual operating units have varying farebox recovery ratios, but the organization has an overall cost recovery ratio of about 48%. The balance of operating costs is primarily provided by municipal operating subsidies (27%) and social (25%) subsidies. BKV’s municipal subsidy, after taking into account inflation, has declined. Fares have grown slightly more rapidly than the other sources of income, but in general the split between income sources today is virtually the same as it was 10 years ago, with the exception of “other revenue,” which is generated primarily from the disposal of assets. Fare levels, as mentioned above, are determined not by the transit authority or the municipality but by the state. For the most part, the state has not allowed fares to increase faster than the official projected rate of inflation. Since the official rate of inflation is almost always lower than the actual rate of inflation, fares tend to lag the actual rate of inflation. The consequence of this is a real decline in BKV’s financial resources from all sources of income—none of which it has any real control over.

There is an expectation that joining the European Union (EU) will provide some rationality to the financial structure for public transit through the regulatory process, as well as through access to financial aid and loans. EU regulations require that fares be set to break even or that an agent be willing to fully cover the deficit. The opening of the market under EU regulations will require that municipalities put public transit services out to bid in the international market. The city government must decide if it will leave BKV burdened by its large debt, insufficient subsidies, and limited control over its fares to compete in this new environment. Management estimates that a subsidy of 20 billion forints (\$88,000,000) would be required to prepare BKV for competition in the EU environment. Another concern is whether BKV will be forced to put the services provided to it by wholly owned subsidiaries out to bid (current regulations state that if the partnership is owned by BKV and 80% of its business is with its parent corporation then bidding is not required).

The precarious state of BKV’s finances has implications for both operations and capital investment levels. The total operating cost for BKV is approximately \$300 million, and the annual capital budget is \$25 million. The capital budget primarily depends on the whims of the annual municipal budget process, which makes anything other than day-to-day planning difficult. BKV stated that \$50 million per annum would be necessary to keep the system in a state of good repair and allow for a balanced turnover of assets as they age. Alternative forms of financing for the capital budget, such as tax benefit financing, are not popular in Europe. Some loans have been offered by and accepted from the World Bank. In the 1999–2002 period, a total of \$100 million in capital funding from all sources was expended.

In Budapest, as elsewhere in eastern Europe, reforming the mechanism of fare collection is viewed as an opportunity to introduce new technology and management reforms. The proof-of-payment fare collection system is used on the bus, trolleybus, tram, and metro. On the suburban railway, conductors collect fares. For the urban modes, fares are set not by distance but by line used. For example, a journey from Station A to Station B on one metro line will cost the consumer one fare, while a journey from Station A to Station C that includes a transfer from one line to another at Station B is a two-fare trip. There are no entrance gates or barriers in the metro, trolleybus, tram, or bus networks. The proof-of-payment aspect of the fare collection system is enforced by inspectors, but BKV estimates that 11–12% of fares are not paid.

To address the fare collection rate and to better manage its revenue, BKV is proposing to introduce barrier entry fare collection systems, along with a rationalization of fares to incorporate such innovations as zone-based fares and smartcards. This system would be introduced gradually. First, barrier entry would be introduced. Next, zoned fares would be introduced (six zones are proposed, one in central Budapest and five in surrounding parts of the city). Multiple types of tickets would be proposed, including single tickets, bi- and tri-zonal tickets, and zone-based monthly tickets. This system is surprisingly not designed to increase fares or ridership and actually would result in a decrease in fares for most riders. This drop in actual cost to the rider is intended as a benefit to offset the introduction of barriers. What BKV gains is a management tool for understanding ridership that will enable a rationalization of its service with concurrent lowering of its costs and perhaps a decrease in the fare evasion rate.

## Bucharest

The JICA study recommended \$2.2 billion worth of projects in Bucharest, including \$615 million for various road improvements, \$696 million for expansion of Metrorex and investment in new and rehabilitated rolling stock, \$660 million for expansion of the existing tram network and the purchase/overhaul of rolling stock, \$56 million for public transit transfer facilities, and \$30 million for an integrated automated fare collection (AFC) system. Today, both RATB and Metrorex have some major investment projects underway, planned (with funding anticipated), or awaiting a better-funded future.

Some of the major projects planned include the rehabilitation of 110 km of surface right-of-way, the purchase of new buses and trolleybuses, the in-house modernization of the tram fleet, the purchase of new low-floor trams, the introduction of a new AFC system that would be integrated with the metro, the construction of a state-of-the-art dispatch center, and the revitalization and expansion of the metro.

A new AFC system seems to be a critical component of plans by both RATB and Metrorex. Currently, RATB uses

350 controllers to enforce the proof-of-payment system. Despite this, RATB estimates that its average fare evasion rate is 14–15%, with the actual evasion rate fluctuating from 7% to 20%. The fraud rate in Bucharest appears to be equal in both RATB, which is an open system, and Metrorex, which is a closed system (i.e., it has entry gates). The proposed AFC system, to be shared by both systems, will include smartcards and magnetic strip cards.

The capital budget appears to be funded by municipal and state grants, as well as loans from such institutions as the European Bank for Reconstruction and Development.

Resources for operations are scarce, but RATB reported that the city's subsidy for public transit has managed to keep up with inflation; however, the funds available for capital investment are insufficient. To keep the infrastructure in a state of good repair and to carry the current passenger load at the current capacity of 8.5 passengers per square mile (0.78 passengers per square foot), RATB staff said a 20% increase in funding would be necessary. To increase the passenger load or decrease the load factors, a 50% increase in capital funding would be required.

The useful life and actual average age information provided by RATB management reflected the need for substantial increase in capital funding: buses are kept in service 15 years, nearly twice as long as the expected 8-year life. Trams are kept up to 15 years beyond the expected useful life of 25 years. It is interesting to note that the expected life for buses in Bucharest is about half that of buses in the United States, but the actual life of an RATB bus approximates the 15-year useful life of a bus at most American transit properties. The shorter expected useful life for an RATB bus might reflect the quality of the bus purchased, the level of maintenance provided, or a lack of a mid-life overhaul. The useful life of a tram approximates that estimated by the FTA for light rail vehicles, and the actual life approximates the experience of most American light rail properties. From an operational and capital point of view, the priority for RATB management is the tram system. This echoes the recommendation of the JICA transport report. RATB's rationale is that trams are the most efficient mode, are the easiest to maintain and operate, and are the most ecological option because of limited noise, vibration, and air pollution.

The Metrorex system is about 25 years old. According to management, the infrastructure is obsolete and consumes a substantial amount of power compared with modern systems. In response, the state supports the upgrade of the system. Capital money for these upgrades has been provided through EIB loans guaranteed by the state. One such loan for 209 million euros (\$245 million) was used to buy 18 trainsets, while another loan was used to modernize the balance of the rolling stock and to invest in system infrastructure. A third such loan for 220 million euros (\$257 million) from EIB for work on a fifth main rapid transit line came with the condition that a metropolitan transit authority be formed. The proposed transit authority would be controlled

equally by the mayor of Bucharest, the State Ministry of Transportation, and the State Ministry of Public Infrastructure.

Despite the capital woes of both RATB and Metrorex, enhancement of services and expansion of the system is considered important to retaining existing customers and attracting new ones.

The concept of privatization of public transit does not engender much support in Bucharest, where public transit is viewed as a money-losing operation best run by cities. Transit managers there consider public transportation to be a gift from the city to its population, not a service that could likely be let competitively. Very few efforts have been made toward privatization, although small van-like vehicles, or “maxi-taxis,” were in evidence. RATB managers consider it very unlikely that there would be any private-sector candidates for the larger bus-type service, tram service, or metro service.

## Moscow

Mosgortrans has a 3-year operating and capital budget plan, which is linked with the city’s 3-year plan. Mosgortrans has two basic sources of revenue: fare revenue, which accounts for one-third of all operating costs (2.8 billion rubles [\$92 million]) and a city subsidy (5.7 billion rubles [\$187 million]). Total operating cost for Mosgortrans is about 8.5 billion rubles (\$279 million). The reason for such a low fare recovery ratio is that 60% of all passengers do not pay fares, as they are eligible for subsidized or zero fares. The system last had a fare increase in October 2002, when fares rose to 7 rubles (\$0.23) per ride.

The Metro has a number of sources of income: farebox revenue of 5.1 billion rubles (\$167 million), a city subsidy of 2.25 billion rubles (\$74 million), a state subsidy of 76 million rubles (\$2.4 million), other income (real estate, advertising, and so forth) of 233 million rubles (\$7.7 million), and amortization that provides 5% of all resources. Fare income has increased within the past year as a result of a 512-million-ruble (\$17-million) increase in fares and 518 million rubles (\$17 million) due to the introduction of AFC. These funding sources are the primary sources of support for two budgets: an operations budget of 6.5 billion rubles (\$213 million) and a capital investment budget of 3.8 billion rubles (\$124 million). Of these budgets, 20% is funded by

the state and 80% by the city. The farebox recovery ratio for the operations budget is in excess of 75%. Metro expects that the mechanics of its finances will change so that it will no longer require direct subsidy from the city or state. With the new fare collection system, Metro would prefer that the city and state provide the riders with direct subsidy and allow Metro to charge the fares necessary to cover 100% of all operating and maintenance costs. Capital investment costs for renewal and/or expansion would continue to be the responsibility of the city.

Mosgortrans’s capital comes from two sources: amortization and city capital contribution. The level of city capital contribution changes annually. The city gave 2.4 billion rubles (\$79 million) in 2001 and 1.8 billion rubles (\$59 million) in 2002; in 2003 it is estimated that the city will contribute 1 billion rubles (\$33 million). Amortization averages about 500 million rubles (\$16 million) per annum. Loan discussions have been held with the EIB and the World Bank without success. The two-third decline in capital funding has obvious implications for Mosgortrans’s ability to maintain its rolling stock, track, and catenaries in a state of good repair. Mosgortrans staff reported that the capital needs of the system in 2003 were four times the capital funding it will be receiving.

For both systems, the useful life of rolling stock and average age were reported as shown in Table 1.

The implications of these average ages are obvious to the state of good repair of the system. Two elements that impact the condition and useful life of surface transit rolling stock are the Russian climate, with its very severe winters, and the aluminum bodies of surface rolling stock. The cars—based on a New York City model that dates from the 1930s—are very simple, a fact that contributes to their longer-than-expected lifespan. The car-borne systems are simple but functional, easy to maintain, and with few elements to break. This simplicity makes car maintenance a more manageable task.

Mosgortrans is eager to reduce bus emissions. Staff at each transit property discussed their commitment to reducing bus emissions through use of low-sulfur fuel, the purchase of low-emission buses, and/or the use of compressed natural gas (CNG) buses. In Moscow, more than 4,100 buses have had exhaust neutralizers installed. The agency is purchasing 300 CNG buses as part of a pilot project. If all goes well, Mosgortrans is committed to switching to all CNG

**TABLE 1**  
**Moscow Public Transit State of Good Repair of Vehicles by Service Type**

State-of-Good-Repair Indices	Tram	Bus	Trolley Bus	Metro
Asset Intended Life	18	10	10	20
Average Age	15	6	8	30*

\*The actual life of this asset was reported to be 40 years, twice as long as the asset’s intended life.



buses; natural gas is very plentiful and cheap in Russia, which enables Mosgortrans to dramatically lower fuel costs. All new buses purchased will comply with the Euro 3 standard, which includes low emissions, safety and passenger comfort requirements, and low-floor technology.

Infrastructure costs are low relative to western Europe and the United States. Purchase costs were reported to be \$75,000 for a new bus, \$120,000 for a new trolleybus, and \$200,000 for a new tram. These vehicles are manufactured in Russia. The average cost for a metro car is approximately \$500,000.

Neither Mosgortrans nor Metro shows any interest in privatization. However, Mosgortrans does face some competition for passengers; about 130 private firms operate minibuses and are estimated to serve 600 routes with a 25% market share, mostly acquired through pirating passengers from Mosgortrans. A major difference with the private carriers and the more traditional public transit is that private carriers are not required to carry all passengers (subsidized and nonsubsidized); thus, private carriers can target only the full-fare passengers.

The city of Moscow is developing an integrated smartcard system called the Moscow Social Card that provides social benefits (housing, food subsidies, medical benefits, and pensions), as well as transit benefits. It will also serve as a Visa debit card. Both Mosgortrans and Metro seem to be developing AFC systems on their own and in a manner to be compatible with the city's social card. Mosgortrans is experimenting with barrier entry (turnstiles) on buses, using smartcards, magnetic strip cards, and flexible fares. This pilot project has led to revenue increases of 250% on the affected routes. Although the fare evasion rate was not discussed as a motive for this project, it is obvious that closing the system was the only way to substantially increase the number of fare-paying customers as opposed to simply increasing the passenger counts. It was described as pointless to increase fares if the majority of passengers don't pay fares. The experiment's success in generating revenue allows the system to increase pay for drivers, and the barrier entry system generated more accurate passenger counts, leading to better use of capacity and scheduling. Prior to this system, surface transit would run the same schedules all day long. Now, accurate forecasts can be made for peak and off-peak service, allowing service to be scheduled accordingly. Addressing the boarding congestion and long dwell time generated by turnstiles on buses will necessitate off-board fare collection, such as paid zones in bus terminals. A private company is running this effort for Mosgortrans. For the Metro, this same company is only the contractor for installation.

## MARKETING AND COMMUNICATIONS

In the decade following the breakup of the Soviet Union, the transit systems in Warsaw, Gdynia, Budapest, Bucharest,

and Moscow made great strides in implementing the concepts of public involvement and marketing.

The world is embracing a global consumer economy, and the evidence for this is everywhere in the former Soviet countries. Warsaw has 27 suburban shopping centers. McDonald's restaurants are ubiquitous. Advertisements for Burger King in Budapest feature the Simpsons. Moscow billboards promote American cosmetics and cigarettes. The shopping mall under Moscow's Red Square, complete with a food court, looks like that found in any city in America—only the language is different. Bank cards can be used to get cash anywhere, and Internet cafes abound.

Transit system staff are up to speed on the latest technology. For example, PowerPoint presentations are commonplace in business meetings. In Budapest, more than 7,000 transit employees have undergone training in the use of computers. Executives carry cell phones and rely on personal digital assistants (PDAs). Websites are used to communicate information to the public, as well as to transit agency staff. Trip-planning software is commonly used to improve operational efficiency.

Advertising space on transit vehicles and at transit facilities is sold. Bright graphics appear on transit vehicles, and fully wrapped bus advertisements are common.

The transit systems visited understand the need to monitor the public's attitudes in order to better plan and market transit services. Several transit systems conduct regular surveys of riders and nonriders to gauge public opinion and garner information that can be used to improve service development planning. Customer reactions and complaints are sought and analyzed to help provide better service.

It is evident that the transit professionals in the cities visited are concerned with the quality of their services. The director of MZA in Warsaw stated he wants the agency to have a better image, relate to the customer more effectively, conduct more marketing, implement more technology, and provide more training in transportation demand management. Moscow Metro officials said they would rather have fewer riders on their very heavily traveled system and be able to provide more comfortable service.

Warsaw has a unique public involvement plan that involves stakeholders from the community who deal with a variety of transportation issues on many levels, including policies for transit and automobile transport and safety. Called the Warsaw Transport Roundtable, the concept was built on a Canadian model, and its members are appointed either by the mayor or by community groups.

Warsaw adopted an ambitious transport policy in 1995, but has had difficulty implementing it. Charging for parking and a moratorium on new road building are the only parts of the plan that have taken place (but there has been little leadership support for collecting the parking fees).

Warsaw transit officials say the car is king and users are not prepared for constraints. There was great opposition to lowering speed limits in the city of Warsaw. Polls show that the people favor transit (66%) over cars and that they are

concerned about congestion, noise, and air pollution. Still, they want roads. In a survey, 61% of the drivers favor having bus-only lanes, but yet these lanes are not enforced.

Faced with growing competition from automobile use and shifting urban patterns, Polish transit authorities are studying customer preferences. Customer expectations reflect a desire for high-quality, dependable service. In a 2000 study in Gdynia, punctuality was the most sought after attribute, at 57.2% (availability was rated desirable by 52.9% and frequency by 50.1%; direct connection, low cost, and comfort received less support).

ZKM, Gdynia's urban transport authority, has an aggressive market research program. Every other year, 1% of the residents are interviewed by surveyors going door-to-door. The survey focuses on how the citizens perceive the management of the service and what they want from the transit system. Information is gathered on mode split and why people prefer the mode they use. People are asked where they would like to see new service developed and how they feel about new operations that have been implemented. Questions are also asked about city policies regarding transit service. The survey results are provided to the city, along with budget requests. Authorities often respond to public opinion. For example, efforts to further privatize the transit system were curtailed 7 years ago after polls showed that the public was concerned about sales to foreign interests.

Since 1998, BKV has focused on providing better quality service to the citizens of and visitors to Budapest. The company's goals are to increase revenue, boost market position to meet competition, and create a better public image. An extensive market segmentation study conducted by BKV found that its core customers are adult commuters. Other groups include occasional riders, such as car drivers and visitors. Residents of satellite towns and tourists compose substantial segments of the ridership, along with the 18–24 age group and families.

There is an effort to enhance the travel culture in Budapest. School-age children are now only occasional riders, with many traveling to school by family cars. To make the students more familiar with the system and encourage them to use public transit, BKV distributes special magazines geared toward school-age children to 400 schools every 6 to 8 weeks. BKV also solicits feedback from schools and parents to help improve its services and communicate better with the students.

BKV makes extensive use of publications, newspaper ads, electronic media, posters, direct mail, public relations campaigns, incentives at ticket offices, and outreach activities that include participating in fairs and exhibitions with tour operators. A "car-free" Transport Day was launched in Budapest in September 2002. BKV's web site includes updated traffic information. BKV also produces 10 or 11 films each year that are used to inform the public about transit improvements (these films are costly, but effective). In all of its marketing pieces, BKV stresses the continuing improvement of its services, the customization of products for cer-

tain groups, and the importance of quality and a better partnership with customers.

In 2002, BKV began a frequent-rider program by introducing an annual pass; in the first 2 months, sales of the pass reached 9,000. BKV has developed a special publication for these heavy users of the system. BKV is also using the passholder customer base for research on service. An initial questionnaire netted 1,500 responses, providing valuable information on demographics, ridership, and trends. BKV is extending its research efforts by conducting quarterly focus groups.

Another of the new programs that has been initiated is BKV-Plus. New or upgraded service has been implemented on 21 lines. The benefits to the customer include improved on-time performance, upgraded schedules, more comprehensive passenger information, and cleaner buses.

Twice a year, BKV conducts public satisfaction surveys in addition to automated passenger counts. The most recent findings, covering a 1-year span, show that the public understands the financial woes of the transit system. Forty-five percent of survey respondents believe that BKV is making efforts to improve service, 79% believe comfort has improved, 15% believe riding time has been reduced, 13% believe there is less crowding, and 75% are satisfied with information provided at bus stops. To improve interpersonal interactions, BKV is enhancing its training program to include internal communications. Operator training to upgrade quality service is also being implemented.

Priority improvements for the transit system in Bucharest include taking the first step toward integrating the modes by implementing an integrated fare system. Developing a seamless fare system to facilitate intermodal ridership was a common theme throughout the cities visited. Most fare collection is currently done off the vehicles, with validation systems of varying degrees of technical sophistication implemented onboard (Figure 6).

RATB, which provides bus, tram, and trolleybus services, has 60 trams slated for modernization. New technologies are being studied and implemented. Public transit operators in Romania are fully aware of the need to upgrade and improve their infrastructure, and they realize that good customer service is key to attracting more riders. (RATB must compete not only with the automobile, but also with private operators using small buses and cars.)

Plans are being made to conduct more personnel training, including making drivers more customer service oriented. Drivers can be fired on the basis of customer complaints.

In 1997, RATB took a low-floor trolleybus to several Romanian cities, where free rides were offered to generate enthusiasm for transit and to obtain public input on the new-style vehicles.

Officials talk about the need for a master plan for Romania, and there is progress being made in that direction. Bucharest is doing a study on the mobility of the population, studying entry points of the city. Every 5 years, a major origin and destination study is conducted. Students are used



*Figure 6. Various types of validation systems are used to provide proof of payment on Bucharest's buses.*

to do the survey work, which takes 2 or 3 months, with another 2 or 3 months to analyze the data. The study provides more accurate data and enables mapping of traffic flow. Peak-service needs and low-need areas are also analyzed in the study.

Mosgortrans posts phone numbers on vehicles for customers to call with concerns and problems. The calls are carefully analyzed to pinpoint areas needing attention. Surveys are done on a ongoing basis by both Mosgortrans and Moscow Metro. Customer comfort and ease of access to the transit system are high priorities.

## **URBANIZATION, CONGESTION, AND PRIVATIZATION OF PUBLIC TRANSPORT**

The four countries visited presented a continuum with respect to the implementation of policies commonly referred to in the United States as “privatization”—the substitution of private corporate organizational structures for previous governmental forms of organization, primarily through “tendering”—competitive contracting—for services. Warsaw and Gdynia have moved the furthest in inaugurating priva-

tized public transport operations. Budapest and Bucharest have progressed less far along that path, while Moscow remains completely a public enterprise.

The World Bank sought to fill the void caused by the Soviet Union's collapse by actively promoting privatization of infrastructure in general and transportation facilities in particular, using investment of the readily available venture capital associated with the booming western stock markets of the 1990s. In its initial five loans, the bank required establishment of public-sector companies, acceptance of cost recovery targets, and attainment of a 100% operating ratio—the ratio of operating expenses to operating revenues, expressed as a percentage. Subsequent project funding expanded the first requirement to insist on direct market competition in some form.

Such conditions required transit systems to dramatically increase fares and frequently reduce service. Coupled with the increasing availability of the automobile and dispersal of housing, these policies spurred the reduction of modal share served by public transport from a high of 80–95% in the early 1990s to a typical 65% or less by the decade's close.

The EIB does work similar to that of the World Bank; however, the EIB appears to have been much less insistent on requiring particular social policy shifts as conditions for its investments.

The EU is similar to the World Bank in its policies and approach. Poland, Hungary, and Romania all aspire to “accession,” or membership, in the EU. While the World Bank's involvement in social policy change in central Europe began in the 1990s, the EU's influence in advancing privatization of public transit is pervasive, but relatively recent.

Although EU policies support and require pursuit of a privatized model, the staff at the agencies visited perceive acute dissention on this subject within the EU, particularly in Paris, London, and various German cities. Managers in Budapest, for example, publicly accepted the EU's mandates, yet privately expressed the hope that internal dissent from these strong EU states would spare them the need to continue down an unpopular path.

The policies of the World Bank and the EU as applied in central and eastern Europe can be summarized as directing the organization of public transport service enterprises to progress toward privatization in the following stages:

- **Stage 0: State Enterprise.** This is, or was, the initial condition in each city visited and indeed represents the typical condition throughout western Europe prior to the economic policies imposed by the EU beginning in the 1990s. It may be characterized as public transport service being provided by a monopolistic governmental entity, typically underwritten by state (i.e., national) funding.
- **Stage 1: Municipal Incorporation.** This initial stage of transition represents the establishment of a stock corporation to replace the state entity, but with all stock held by the municipal government. While local subsi-

dies may still be offered, direct state funding is no longer provided, triggering significant fare increases. Typically, private operators, franchised or strictly market driven, may also provide some transit services to supplement the municipal corporation's activities.

- **Stage 2: Disaggregation.** In this stage, the municipal corporation has been divided into separate corporate components. Typically, the operating divisions will be established singly or in modal groupings as monopolistic corporations, contracting their services with the shell of the former corporation, which no longer directly conducts any operations or provides services.
- **Stage 3: Divestiture and Tendering.** In this final stage, the corporate offspring are sold to private owners and bid for contracts ("tenders" is the accepted European terminology) to provide transport services for the central corporation. The private operators may freely bid—or not bid—for any services, both locally or in other districts, and must compete against any other private operator that enters the competitive arena.

Both critics and advocates acknowledge the probability that this transition will result in increased fares and reduced services for the user, thereby accompanied by reduced costs to government, enforced by competitive tendering.

The attitude of many managers encountered in Warsaw, Gdynia, Budapest, and Bucharest showed little enthusiasm toward either the institutional or the societal consequences of these transitions. The managers' perspectives were often reminiscent of U.S. colleagues when faced with the budget crises caused by the current economic malaise: their approach is professional ("I am a manager" in the words of one), and they were confident that they could optimally manage, and perhaps even thrive under, the circumstances forced upon them.

In contrast to the interventionist policies of the EU with respect to public transit operations stands an almost *laissez faire* approach toward land use and the growing use of the private automobile for trips previously made by public transit.

Each city visited has witnessed the growth of a true middle class that now has the means to seek higher quality and more spacious housing than it could in the former socialist societies. In turn, this opportunity has been accompanied by a second transition: a staggering growth in use of the private automobile for trips that previously took place by public transport. This automobile use may be by choice or by necessity when the new housing is not well served by the remaining public transport service structures. The pent-up demand for improved housing in the cities visited has spurred outward pressure on traditional urban boundaries.

Despite the intentionally manipulative national policies toward the organization of transport services, there appeared to be a virtual absence of policies toward the automobile that might avert some of the derivative problems that have overwhelmed the congested cities of the West.

In American cities, parking fees are collected at curbside parking meters and from taxes imposed on parking in public garages. In some areas, such as San Francisco, such revenues are transferred directly to the transit agency as a direct subsidy for transit operations, taking the place of legislated year-to-year allocations—essentially replacing the equivalent of the vanished state subsidies of the eastern European systems. By contrast, the cities visited portray an earlier era. In Warsaw and Gdynia, parking is allowed on sidewalks, with free parking permitted wherever it is not specifically prohibited. (Generally, this is now enforced by stanchions and fencing along the curb.) But no revenue is generated.

### Warsaw and Gdynia

Poland had advanced further down the path toward privatization of its public transport industry than the other nations visited on the mission. Following recommendations from Washington, the Polish state withdrew from local involvement in helping underwrite operations in the early 1990s.

Urged by the World Bank and other financial institutions, the state began to disinvest from public transport in the early 1990s, leaving this role to local government but not giving additional funding to support this role. Private-sector involvement was encouraged, and prices were to reflect true cost.

As a result, fares rose, ridership (particularly on suburban railways) dropped, and farebox recovery increased to approximately 65%. Maintenance and investment were deferred to meet financial targets, further hurting patronage and system congestion. But enterprises were restructured and functions separated to assist privatization's advance.

As a result of the organizational transformations in Poland, the modal share of transit has declined from upwards of 80% (sometimes 90–95%) to about 65% transit; private car now has 35% modal share (and in some cities the car percentage is as much as 50%). The reasons given include

- Increasing numbers of private cars,
- High unemployment—up to 35%,
- Relatively high fares,
- Dispersal of residences from the central city to the suburbs,
- Construction of suburban shopping malls and business developments at sites not near transit,
- Declining availability of urban transport services, and
- Deteriorating reliability of transit service as road congestion increased.

Significantly, the costs of owning an automobile, relative to changes in income levels, actually declined from 1990 to 1998, while the costs of public transit, as measured by a decrease in the number of tram tickets that could be purchased for the average employee's net salary, climbed until 1997. This increased affordability of private automobiles

helped fuel the increase in automobile registrations. Automobile purchases did not see a decline until 1998, accompanied by a reversal of these trends.

Official recognition of the desirability of “sustainable development” and associated pro-transit and constrained automobile usage policies was generally stymied by the political pressures of an effective pro-car lobby, combined with transit policies that fixated almost exclusively on economic structural reformation. Nationally, in 1992 about 30% of public transport was provided by state-owned enterprises and 60% by local governmental “budgetary units”; only the remaining 10% was provided by corporate entities.

By 2001, the state’s involvement had been virtually eliminated (under 1%). Almost 64% of transit enterprises had been reorganized as “joint-stock, limited-liability companies”—“corporations” in American usage; 35% remain as municipal budgetary units. In smaller cities, service is typically provided by small incorporated bus operators providing service under contract to the municipality.

In larger cities, criteria that justify the establishment (or retention) of a local transport authority include multimodal operations—essentially tram or metro—or merely a sufficiently large scale of operation. (Thus, Warsaw is structured around a local transport authority.)

Public transport in Warsaw is organized under ZTM, operating through a number of wholly owned monopolistic subsidiaries that provide service on buses (diesel and trolleybus), trams, and metro. Newly instituted services, however, are competitively bid, and many are consequently operated by private operators, mostly using minibuses. All services, including services by subsidiaries, are performed under contract, with payments to operators on the basis of vehicle-kilometers operated. Where bus routes are competitively bid, tenders are similarly based primarily on a rate per vehicle-kilometer of service.

In 1994, MZA provided 97.5% of bus services in Warsaw. By 2001, private operation had tripled—but MZA still provided over 90% of service.

Fares in 2002 covered about half of the authority’s overall \$200 million budget; the remainder was provided half by the municipality and half by 11 smaller community units (gminas).

In January 2003, MZA was scheduled to transform from a municipal governmental unit to a corporate structure, a “joint-stock company.” Effective 2003, the gminas would also cease to be part of the fiscal equation.

The following characteristics of the new corporate structure contrast with the then-existing governmental structure:

- Employees will feel like officers of the company, not just employees of the city.
- The organization will have its own accounting system.
- Finances will depend less on fluctuations of city budgets.
- There can be a relationship among productivity, efficiency, quality of work, and corporate profits and personal income.

- Depreciation of assets will be reflected in cost structures.

MZA management described their task as seeking to maintain market share, while significantly reducing personnel costs and making better use of available fixed assets. Again, Poland’s plans to join the EU and “liberalize” its economy were cited as driving the transition. The statement was offered that “it is necessary to reduce costs a minimum of 12–15%,” and “a 20% reduction of costs would guarantee success.” Negotiations with labor unions were recognized as essential, because cost reductions could be achieved only by the following admittedly unpopular steps, which would be phased in over 3 to 6 years:

- Reduction of positions
  - A 60% reduction of maintenance staffing was seen as achievable based on experience elsewhere, providing that obsolete rolling stock was renewed.
  - Computerization could replace one-third of personnel.
  - In some areas, up to half of all positions could be eliminated because of current institutional pressures to accept low performance.
- Reduction of fixed assets
  - The number of depots could be reduced from 7 to 5 (presumably reflecting past reductions in the levels of service offered).
- Reduction of wages, such as establishment of a progression for entry-level driver salaries. (Current wage levels are set without regard to experience.)
- Introduction of performance assessments for certain administrative and salaried positions.

An overall strategy remained in preparation, but it was recognized that certain costs could not be reduced, such as fuel costs and higher per-vehicle repair costs of newer buses. However, it was felt that radical moves were necessary and had been postponed during worse economic times. As recently as 2 years ago, inflation stood at 12%; by late 2002 it had been reduced to 2%, making the climate more tolerant of the potential dislocations.

As a fixed-guideway operation, TW, the tram company, was not facing as drastic a restructuring as the bus operator. While TW is also a joint-stock company, the restructuring did not appear to represent a drastic change in operations, as TW would remain a monopolistic venture. However, instead of competing with other municipal budget units for funding, as it currently does, in the future TW will cost out services and contract with the city at cost. TW’s principal concern appeared to be not the prospect of any private corporate operating competition, but rather the competition for investment capital with the far more costly mode of the Warsaw Metro’s subways. A program for financing the over 400 trams in need of renewal (50% of the fleet) remained undefined.

The metro (built with Soviet assistance and opened in 1985) also faced restructuring in 2003, and like TW it would remain a monopolistic subsidiary of the authority. While public-private partnerships on the British mold were an option under consideration for operation of the future Metro Line 2, no decisions for major change had been made regarding the present operation of Line 1. Still, managers proudly noted that 10% of Metro's budget was supported by commercial activities, including subleasing of space (some shops, built to accommodate rolling stock for future lines, were being rented as movie stages) and advertising on vehicles.

Management was also awaiting results of the mayoral election scheduled the Monday following the team's visit. Some Metro managers saw the election as a historic moment of "change in the organizational structure of Warsaw."

The port city of Gdynia, part of the tri-cities of Gdynia, Gdansk, and Sopot, exhibited a structure not much different from what Warsaw would become in 2003—i.e., Stage 2 privatization, moving toward Stage 3. Gdynia's system uses both diesel buses and electric trolleybuses.

In 1994, ZKM succeeded MZK (Miejski Zakład Komunikacji, Municipal Transport Enterprise) as organizer of the city's public transport services. The assets of MZK were distributed to three incorporated operating subsidiaries:

- The municipal transportation company, operating diesel buses and electric trolleybuses;
- The bus transport company, operating diesel buses; and
- The municipal transport fleet repair company, providing major repair services for both diesel and electric buses and manufacturing new trolleybuses.

In 1998, the municipal transportation company shed its trolleybus operations, transferring them to the trolleybus transport company, and remained as exclusively a diesel bus operator.

Near the end of 2002, transport service in Gdynia was being offered by three joint-stock companies owned by the municipal authority, ZKM, and providing 80.2% (in 2000) of the vehicle-kilometers of service. In 2000, 6.2% of service was provided by two independent private operators; now there are five. The remaining 13.6% of service (in 2000) was provided by two state-owned firms. (These include the suburban railway service and longer-distance bus service.)

Although the dominant carriers are publicly owned, all lines are tendered every 3 years, with the three ZKM public operators competing with the five private contractors. (A 28% corporate income tax is levied in Poland, as well as a property-based municipal tax, bringing corporate taxation to about a 50% rate. Both state-owned and private companies are equally subject to these tax burdens.) The public was reportedly opposed to privatization, whereas "the economists want more privatization." For the time being (pre-accession to the EU), the situation was considered stable.

However, quality of service under competition has improved. Missed service has dropped from 6% in 1992 to under 0.15% in 1999, while in the same period departures ahead of schedule dropped from over 8% to under 2%. While routes and frequencies were rationalized based on market research, annual vehicle-kilometers of service offered grew 30% from 14.7 million to 19.1 million. Passengers carried also grew from 98.4 million in 1993 to 114 million in 1998, but then dropped to 112 million in 1999, a 2% decline attributed to rapidly increasing private automobile use.

## Budapest

Compared with the other cities visited, Budapest remains a step further away from the brink of privatization. BKV was organized as a state-owned enterprise in 1968 to consolidate four modal companies acquired by the Hungarian state in 1949. In 1990, BKV was transferred from state to municipal ownership. As an initial step toward participation in a market economy, it was again reorganized on January 1, 1996, forming the present "BKV Ltd.," a municipally owned, limited-liability corporation that is the organization the team encountered in 2002: a single Stage 1 municipal corporation responsible for both organizing and directly operating public transport in Budapest.

The Municipality Act commits the city to provide transport services, and a contract between the city of Budapest and BKV establishes both the quantity and quality of service provided, but it does not comply with EU regulations. BKV understands and accepts that change in the form of a competitive corporate environment is coming, hastened by the planned 2004 accession of Hungary into the EU. As stated in its 2001 annual report, BKV is "thoughtfully preparing to join the European Union. Training of our colleagues, EU-related improvements, preparation for the competition we are going to face in the forthcoming years, are all in the forefront of our activities."

While the operating units are organized as directorates, generally by mode (the principal exception being two separate bus units for Buda and for Pest), functions were also reorganized between 1996 and 1998 as corporate subsidiaries under the same reorganization plan that established BKV, Ltd. These subsidiaries provide such functions as construction, vehicle repair, health services, and waterborne transport (boat charter services).

Budapest has also experienced a significant decline in trip making by public transport. BKV saw a 25% drop in "place kilometers" (representing both seats and standing capacity) from 1987 to 1993, but little change since then. Changes on the supply side of services offered were, as in most places, slow to reflect this decline, but capacity was reduced, along with associated staffing, in the mid-1990s to an again stable level, well matched to demand, by 2001. BKV currently provides about 58% of the person trips made in Budapest, and 36% of trips are made by private auto use. Regionally, growth in travel by private car is even more

pronounced, and 55% of externally originating trips into Budapest are now by private car.

The shrinking of BKV's scale of operation made 10% of BKV's premises surplus. In all, 154 properties were disposed of, raising 6 billion forints (\$27 million). Most staffing reductions were accomplished by attrition.

Despite these contractions in organizational scale, BKV management says it does not see a reason to turn BKV into a profit-making enterprise. Problems BKV has not resolved include establishing a process for renewing assets, still perceiving a need for capital funding from the state or municipality, or some combination of the two—although since “the change” (the end of state socialism), the trend has been increasing withdrawal of state and municipal participation. BKV managers do see the EU as a potential (if unlikely) solution to their capital financing needs, but are seeking an organizational solution that achieves local desires, while still being compliant on a municipal and state level with EU regulations.

The mayor of Budapest announced a 10 billion forint (\$46 million) subsidy to BKV in October 2002, but it was not clear whether this was a one-time subsidy or an annual subsidy. EU regulations do not preclude such municipal subsidies, though the EU overtly encourages both state and municipal disinvestment. What the EU does require is that fares be set to allow a breakeven operation—unless some agent agrees to subsidize any deficit. The EU will furthermore require that a municipality put transport service out to international tender, and any service that is not subsidized and operates at a deficit may be discontinued by the operator. (The Union Internationale de Transport Public [International Union of Public Transport, UITP] lobbies against this, arguing that public transport's urban benefits are more important than the EU's goals.)

BKV acknowledges it would not be able to compete in such an environment unless sufficient subsidies were made available by the municipality. Given such subsidies, BKV and the municipality have developed a strategy for EU compliance that could avert the need for Budapest to submit BKV's services to competitive procurement; this strategy is focused on the company's subsidiaries. As explained by BKV staff, if BKV itself operates at breakeven or better, including local subsidies, but still receives 80% of its income from transit operations, it will have satisfied the EU without competitive tendering. Similarly, if only 80% of the subsidiaries' income is derived from BKV, the subsidiaries can avert competitive tendering for providing their services to BKV. To do so, the subsidiaries seek to develop 20% of their income from market participation for their services outside BKV. In other words, if BKV and its subsidiaries function as market competitors to derive 20% of their revenue, they need not become subject to market competition for the remaining 80% representing local service to Budapest, provided that this can be achieved on a breakeven basis. The subsidiary units also permit BKV to isolate potentially unprofitable support functions from core transit

operations' balance sheets, thereby reducing the core activities' internal costs.

The only other alternative that would allow BKV's survival more or less intact would be to obtain sufficient funding to allow breakeven at a 100% (rather than 80%) level, which did not seem likely.

While ridership and service supply have contracted, BKV has increased fares and focused on service quality and marketing to maintain ridership and increase revenue from passengers. BKV has been able to limit fare increases and track fare revenue closely to inflation, seeming to avoid the downward spiral described by Polish colleagues.

Three possible alternative financing systems were described: development of a “normative grant system” in which regular guaranteed and predictable funding on the basis of place miles or a similar mechanism would be provided, a “level playing field” to provide investment on a basis similar to other modes (such as the state investments in western European railways), and financing from the EU. BKV managers appeared to have the most confidence in the first approach, and accordingly BKV was seeking to develop a long-term, place-mile-based mechanism with Budapest.

As the recipient of World Bank financing since 1999, BKV has had to meet the Bank's requirement for directly subcontracted private operators on newly introduced services. Currently, 50 of BKV's fleet of 1,100 diesel buses are operated under subcontract.

## **Bucharest**

While RATB is a municipal agency, Metrorex is formally a corporation, with all stock held by the state Ministry of Public Works, Transportation, and Housing. Both RATB and Metrorex receive government subsidies for up to 70% of operating costs (RATB gets its subsidy from the municipality and Metrorex from the state), with the balance coming from fares.

The World Bank has apparently not been involved in funding public transportation in Bucharest, and this is reflected in a minimal transition to a market economy in the public transport sector. The EIB has financed transportation investments in Bucharest. This loan finances four principal projects—three tailored to automobile accommodation and one to public transit. This is seen as a strong focus on public transport and a diminished role for private cars. As opposed to mandating privatization, EIB is requiring reorganization, but in the form of a new-to-Bucharest centralized metropolitan authority, with power shared between the mayor and the ministry, to oversee or consolidate both RATB and Metrorex. This would be a precondition for loans under negotiation, which would be repaid by the state and would finance construction of metro lines 5 and 6.

With respect to future efforts toward privatization, it was noted that some functions had been tendered out, primarily involving minibuses. The continued financial involvement

of the municipality was stressed, recognizing that the issue of corporation versus governmental agency is not explicitly important to passengers as long as the goal of “sure, secure, quick, safe transport” is met. But RATB management felt that retention of a municipal subsidy was necessary to achieve that goal, as in most American systems. RATB managers cited the trend in western Europe, particularly in the larger cities of Germany and Scandinavia, to consider public transport a social matter, on to which you “cannot apply the rules of the free market.”

Romanian law does, however, provide a basis for competition. While vehicles must remain owned by their municipalities, the law states that services, at least outside Bucharest, “must be obtained by tender,” and in smaller localities that may typically be the rule. Current transport law requires traditional public operators to transfer operations to contract operators by 2004. However, an exception is made for Bucharest, which conforms to RATB managers’ distinction between large and small operators. Bucharest must establish its transport authority—but can do so in the context of a still primarily publicly owned operator.

## Moscow

Moscow is distinct from the other cities visited in that Russia is not a candidate for accession to the EU and thus is not directly influenced by EU policies. Similarly, it appears that neither the World Bank nor the EIB has been heavily involved in the public transport sector in Russia. The World Bank’s activities in Moscow, unlike in Poland and Hungary, do not appear to be linked to any mandatory privatization initiatives. It was therefore not surprising to encounter more independent perspectives on privatization in Moscow than elsewhere.

Mosgortrans, the principal operator of surface transport in the Russian capital, describes itself as a not-for-profit state unitary enterprise under the jurisdiction of the government of Moscow—essentially, a municipal corporation. It operates under a contract with the city, which specifies service routes and frequencies. Operating costs of 8.5 billion rubles (\$279 million) in 2001 were met by a city subsidy of 5.7 billion rubles (\$187 million), with 2.8 billion rubles (\$92 million) generated by fares.

Capital investments are also directly subsidized by the city, but at an apparently decreasing level: 2.4 billion rubles (\$79 million) in 2001, 1.8 billion rubles (\$59 million) in 2002, and 1 billion rubles (\$33 million) expected in 2003.

Ten years ago, three state monopolies provided surface transportation service to Muscovites: Mosgortrans, a taxi company, and a minibus company. Initially, Russia made a hasty transition toward a market economy, and the latter two companies were privatized, while Mosgortrans remained a state enterprise. One minibus operator, Autoline, emerged as the dominant minibus operator and remains as the largest private operator today.

The minibuses operate under what may be described as

open entry (using the EU’s terminology): they set their own routes and fares, although a permit must be obtained for routes they wish to serve. But to understand their operating environment, it is necessary to understand how fares are structured in Moscow.

Private operators do not receive any public financing of operations, but neither must they provide any concessions to any of the 56 classes of “free” riders. Mosgortrans sees the minibuses as “skimming” revenue fares, while Mosgortrans is left serving the huge, non-revenue-generating market.

Mosgortrans’s 52 internal subsidiary enterprises are state-owned, independently chartered units, but under a recent federal law these will all be merged into the mother entity, Mosgortrans. After the merger, new state enterprises will be permitted only if the activity cannot be operated privately (e.g., because of state security issues).

Even without formal pressure from the EU, some Mosgortrans executives privately acknowledge an expectation that privatization may come some time and that operators would be interested in competing for contracts.

The Moscow Metro is likewise a creature of the state, but functions under the city government’s Department of Transport and Communications. Operating subsidies of 2.3 billion rubles (\$75 million) are contributed by the city. Forty-five percent of riders pay no fare or pay a reduced fare. Significantly, the state subsidizes 77 million rubles (\$2.5 million) of concessionary fares, raising the total subsidy to 2.4 billion rubles (\$79 million). Fares contribute 5.1 billion rubles (\$167 million), a far higher proportion than for Mosgortrans, while advertising and other revenues contribute 233 million rubles (\$7.7 million).

With fares already covering about two-thirds of costs and a lower proportion of concession fares—and those supported by the state—it is understandable that Metro officials anticipate that Metro could become a profitable enterprise, provided it can “solve its social problems”—meaning expenses for below-market fares. For Metro, that goal may be achievable, but still only with changes in policy. Being discussed, for example, is a future of raising fares to attract a reduced clientele at a higher level of service quality. However, in common with their colleagues at American properties, a key impediment to fiscal prudence—or as Metro envisions it, even profitability—is identified as the cost borne by the transit agency by discounted or free fares. Metro’s goal is to seek external funding for the concessionary fares, and Metro is pursuing smartcard-based fare collection technology as a means for billing for subsidies.

“Profitable” does not mean “privatized” to Metro’s managers, who seek to cover operating costs, still look to the state for capital investment, and do not envision contract service providers in their future.

Retention of an essentially public noncompetitive structure has not shielded Moscow from the invasion of the private automobile. Ten years ago, 99% of workers commuted by public transit. As a middle class has flourished, it has, in a familiar pattern, forsaken the city for the suburb—and now





*Figure 7. Buses in Moscow move slowly on congested thoroughfares.*

drives on a road system inadequate to the demands placed upon it. Traffic engineering solutions to help manage the swarms of cars and improve transit service seemed to be wanting. There was no evidence of bus lanes in Moscow; buses move slowly on congested thoroughfares (Figure 7). The imposition of one-way street patterns has complicated or even threatened the existence of the trolleybus lines themselves.

## **TRAM OPERATIONS**

### **Warsaw and Gdynia**

The Warsaw Tram Company was created 10 years ago as one of the first in Poland. The scope of operations includes 32 tram routes operating over 122 km of dual-track tram lines. The tram fleet consists of 860 vehicles operating from four tram depots.

Thirty-five percent (300 vehicles) are 35 years of age or older. Fifteen percent of the fleet was purchased in 1975–76, meaning about 130 vehicles are more than 25 years old. According to Warsaw Tram Company staff, one-half of the Warsaw tram fleet (430 vehicles) is due for replacement. The tram company recently took delivery of 30 new Alstom low-floor tram vehicles at a cost of \$2 million per vehicle. Embarking on an aggressive fleet replacement program would mean a capital funding commitment of \$860 million. Given the scarcity of public funds, it is unlikely that a fraction of the required funding for tram fleet replacement will become available soon. (The tram company is presently undertaking a tram vehicle procurement. Three previous procurement cycles have been canceled for assorted reasons. If the fourth procurement attempt proves successful, the new trams will not be expected until 2005.)

Managers at the Warsaw Tram Company see three options for addressing the critical need for tram replacement:

- The first option would be for the Warsaw Transport Authority to provide funding.
- Second, direct participation from the private sector could bring capital dollars to the tram company. In this scenario, the Warsaw Tram Company would competitively solicit private tram operators to operate a portion of the system. The tram company would continue to own the rolling stock and tracks. The tram company would charge a contract fee to the private operator per track-kilometer or vehicle-kilometer, which could generate new money to be used for fleet replacement.
- The third option is similar to the second option except the private tram company would be required to supply the rolling stock. This creates other coordination challenges in that the tram company would retain ownership of the infrastructure, including the depots. A private tram company would likely be required to operate in the same depot as Warsaw Tram Company. Although all the private operating staff would be represented employees, the tram company employees may feel threatened for their jobs as the private company may successfully bid on future tenders that could bump the public employees from their current positions.

If none of these options prove viable in the near term, there are interim measures that will be pursued. Primarily, the tram company will undertake a mid-life rehabilitation program for those vehicles 15 to 30 years old. Tram management believes such a rehab program is cost-effective if the vehicle will continue in revenue service for at least 15 more years.

While focusing on effectively managing the current tram operation, Warsaw Tram Company management is looking to the future. Warsaw Transport Authority and the operating companies all consider their services to be critical to the prosperity of Warsaw's economy. The last tram extension was 4 km added in 1997. No new extensions are currently funded. However, upgrading existing tram lines is considered a prudent investment to improve dependability and travel time.

Tram management has looked at upgrading key segments of the tram system to "rapid" tram standards. This would entail updating the track bed, upgrading signal systems (including traffic signal preemption features), and providing low-floor trams. A 30-km rapid tram program could be implemented in 4 years at a cost equivalent to extending the metro 2 km.

While Gdynia does not have tram service, it has sought to institute a progressive transport organization to promote market competition in the delivery of its public transport.

## Budapest

Nearly 43% of the capital budget has recently been invested in new tram infrastructure and rolling stock. Total

capital investment has totaled about \$100 million, while BKV management states that \$200 million over the same 4-year period would be more appropriate. BKV stated its concern over capital disinvestment during the past 10 years.

Looking into the future, BKV will continue to explore finding an acceptable normative financing allocation formula to fund its operating deficit and perhaps the capital investment program. As in other capital cities like Washington, D.C., in Budapest this objective of stable and reliable public transport financing has remained unattainable over the years.

Normative financing schemes have been successfully implemented in France (where a 1% employer tax is dedicated to public transport) and in Germany (where a three-tier transit fund is levied at the local, county, and state level). The idea being advocated by BKV is to seek municipal buy-in from the Budapest General Assembly for a formula grant based on the number of seat-miles operated. This appeared to be similar in concept to what is already in place in Poland.

The Budapest tram network includes 159 km of dual-track network and 788 tram vehicles, including 14 cogwheel rail cars, that transport 367 million passengers per year (Figure 8). Tram tracks compose 14% of the urban transport network, but the tram system carries 27% of the passenger-kilometers. Despite this productivity, the tram network experiences the lowest cost recovery of any mode in Budapest (18%).

Forty-three percent of the capital investment made over the past 4 years has been for tram infrastructure and rolling stock. This would translate to an investment of about \$43 million over this timeframe.

One of the prime examples of the benefit of this investment is the BKV-Plus Tram Line 56 that was implemented on March 18, 2002. It operates between Moszkva ter Metro and Huvosvolgy every 3 to 4 min during the morning peak period, every 4 min during the afternoon peak, every 5 min midday, and so on up to 10-min headways early morning and late evening. Total travel time terminal to terminal is 17 to 18 min.

Another example of where capital reinvestment is being made is on the tram fleet. Of the 788 vehicles in the fleet, 175 have been overhauled in the past 5 years. Assuming a 20-year useful life, general overhaul of 39 tram vehicles should occur each year. At the current 5-year rolling average overhaul rate, 35 vehicles have been overhauled per year. However, the trend line over the 5-year period is steadily declining from a high of 58 overhauls in 1997 to only 13 in 2001.

There also appears to be disinvestment in the tram operating network. Although still shown on the BKV system map, the tram line that formerly connected with the Nepstadion Metro Station on the M2 line has been abandoned.

BKV has remade itself in the past decade by reorganizing and rightsizing its operation to the changing market. It has not been successful in securing a normative funding formula from the Budapest Municipal General Assembly that would



*Figure 8. The Budapest tram network includes 159 km of dual track.*

provide a more stable, reliable, and predictable source of financing for its operation and capital investment program.

### **Bucharest**

The Bucharest tram network includes 153 km of dual track and 362 vehicles operating on 31 routes. Annual tram ridership is 320 million passengers. The tram fleet and infrastructure reflects a general lack of investment. Trams are designed to have a useful life of 20 years, yet the current average age of the tram fleet is 30 years. Many vehicles are approaching twice the age of their expected useful life. Tram infrastructure has experienced recent reinvestment exemplified in Tram Line 41, now repositioned as Metro Line 41.

RATB is able to secure capital investment financing through two primary sources. First, credit is provided by the EIB on a 50/50 basis. The government of Romania provides the local match share of 50%, which is then repaid by the

city of Bucharest over 20 years. The second capital financing mechanism for RATB is from the Bucharest City Council, whose loans are repaid over a 15-year term.

The first mechanism is what RATB tapped to finance the Line 41 rehabilitation. In fact, the EIB loan of about \$108 million paid for Line 41 and is programmed to upgrade four more tram lines. The second tram line slated for reinvestment is the 32 line. The project would entail 19.3 km of dual-track tram rail between Soseaua Alexandriei and Piata Unirii at a cost of \$21 million. In total, the tram line capital investment program would address five key lines with 120 km of the dual-track tram network. The second project has been competitively solicited and awarded to a construction consortium; work will begin during the winter of 2003.

The new fast Line 41 initiated revenue service on October 21, 2002. The tangible passenger benefits accruing from the investment include terminal-to-terminal travel time of 26 min (versus 40 min on the old Line 41), average vehicle



*Figure 9. Tram Line 41 in Bucharest has been completely updated to serve as a fast surface metro and is expected to carry 150,000 passengers/day.*

speed of 22.4 km/hour (versus 14.8 km/hour), and average headway of 2.2 min (versus 2.6 min). Each terminal has an extensive off-street multimodal facility where passengers can transfer to and from 9 bus routes at the north terminal and 12 local bus services at the south terminal. Daily ridership is expected to be about 150,000 passengers on Line 41 (Figure 9).

### **Moscow**

The tram depots in Moscow are five of the key operational enterprises of Mosgortrans. The tram network includes a fleet of 854 tram vehicles that operate 38 routes over 152 km of dual-track lines. Average weekday ridership is 1.8 million passengers, but this has been slowly declining over the past decade.

As in all other cities visited on this mission, the tram fleet in Moscow appears old and is getting older. While the expected useful life of a tram vehicle in Moscow is 18 years,

the average age of the tram fleet is currently 15 years. The bulk of the fleet appears to consist of trams manufactured in Czechoslovakia in the 1970s and 1980s. Mosgortrans plans to rehabilitate these reliable trams at its tram maintenance enterprise plant.

Mission participants visited the Krasnaya Presnaya Tram Depot in Strogino in western Moscow. The depot, opened for service 2 years ago, is the largest tram depot in Europe. Nine routes operate from Krasnaya Presnaya, and 380 operators and 240 tram vehicles are assigned to the depot.

Krasnaya Presnaya staff indicated that there are very few newly purchased trams housed at their depot. Only one new tram vehicle was observed. It is a prototype of the new-generation tram manufactured by the Russian tram-building company in St. Petersburg. It had not been commissioned as yet, but the depot managers were expecting that, if all goes well, additional trams from the same Russian plant would be ordered in the future. A new tram built to Russian specifications costs about \$200,000. Capital dollars will be scarce in

the future for acquisition of new tram rolling stock. The trend line of Mosgortrans capital budget for the entire surface public transport system is rapidly falling: \$75 million in 2001, \$56.3 million in 2002, and \$31.3 million programmed in 2003.

The Moscow Duma is facing difficult policy choices about surface transportation in its city. Car ownership continues to grow exponentially, which further clogs the city's main arteries, competing with trams, trolleybuses, and buses for street space to operate. Some argue that tram service should be removed from the streets in the center of Moscow to clear the way for more private cars, while others campaign to restrict auto access into the center (as in many European cities). This debate will undoubtedly continue for years to come. Meanwhile, the Moscow Duma is underfunding the Mosgortrans capital program by approximately a factor of four. The tram system has no currently funded plans to aggressively replace aged vehicles, upgrade existing lines, or expand the city's tram network.

## SERVICE SCHEDULING

Scheduling transit service in the cities visited is, as in the United States, a factor of ridership (demand), resources (modes and fleets), standards (service parameters and evaluation), and environmental issues (political and financial). Although these factors are seen consistently throughout the world, each area uses an assortment of policies, practices, and resources unique to its situation.

The various organizational structures for urban transport in each of the four countries visited means that the responsibilities for routing and scheduling are located in associated business units and at different organizational levels. Warsaw and Gdynia have a centralized transport authority that develops and manages routing and scheduling of all modal services. The service is then tendered or contracted out to mainly city-owned service providers, although private contractors are also used. In Budapest, the reorganization of the municipally owned transport company, BKV, in 1996 to a joint-stock company (which remained 100% owned by the city) resulted in individual operational divisions. Separate divisions exist for bus, tramway, trolleybus, subway (Metro), and suburban train, and schedule development is handled within each division. In Bucharest, the scheduling of service is a responsibility of the city government. Surface transportation scheduling in Moscow is determined by the city, and all changes are coordinated, managed, and approved by the city via the Institute of General Planning; in contrast, the Moscow Metro's scheduling is done by its operations department.

## Service Modes and Fleet Resources

Buses are the backbone of public transport in the cities visited, with the exception of Moscow, where the subway is the predominant mode. Numerous models, sizes, and manu-

facturers of buses were observed in the cities. A large number of fleet types and sizes makes scheduling more complex. Bus lengths included the standard 12 m (40 ft), 15 m (50 ft), 16.5 m (54 ft), and 18 m (60 ft), and many buses had three or four doors to expedite boarding and alighting. In some cases, 9-m (30-ft) minibuses were used for specialized or experimental services (such as late-night service or routes with low midday ridership). Typically, when discussing bus fleets, gross numbers of inventory levels were noted, although the use of different sizes having varying seating and passenger load configurations (especially when using manufacturers stated passenger loading ratings for sizing of service) have to be factored into the scheduling of resources. Spare ratios ranged from just over 20% (common in the United States) to a much higher percentage, depending on the operator and condition and age of the fleet. PKM in Gdynia had 98 buses at one depot, when 80 are required during the peak period, while BKV in Budapest operated 1,107 daily buses and had an average fleet size of 1,408.

In the area of tram service, Warsaw uses 710 units daily, out of an inventory of 860 units, to form 350 trains. This results in a spare ratio comparable to that of bus service. Budapest has 788 units, while Bucharest has 362. In most places, the role of the tram is declining as a result of the public's poor perception of them, as well as because of the limitations on route adjustments. With the change in economic conditions and in light of trams' cost-effectiveness, several cities are rethinking the use of trams. The average expected life of a tram is about 20 years. Budapest's BKV did not formally address the spare ratio in discussions, but its 2001 annual report noted a daily tram usage of 588.

Warsaw Metro currently has 108 cars: 60 cars that operate in 4-car trains and 48 that operate in 6-car trains. A new procurement is under way to double the fleet size by 2005. Budapest's fleet totaled 403 vehicles used in a maximum 6-car train configuration. Bucharest's Metrorex has 502 cars that operate in 6-car trains. Metrorex typically operates approximately 60 trains per day, which generates a high spare ratio, which is required to accommodate the frequent equipment failures. The Moscow Metro has 4,165 cars that operate in varying numbers of cars per train. The maximum number of trains that operate on a single line is 71. The average useful life of a metro car was typically cited as 40 years, and the average current age of the fleets studied was about 30 years.

## Service Evaluation and Adjustments

With the number of service modes and high ridership levels, service levels must be monitored and adjusted to match supply and demand. Ridership data must be timely, accurate, and available. Since most of the validation technologies for proof of payment are mechanical, not electronic, there are no ready means of capturing, validating, storing, or reporting ridership data. Alternative means of collecting data on ridership levels are thus used in most areas, including

surveys and ticket sales. The unlimited-use tickets that most of these systems offer make collecting this information somewhat more difficult, as these tickets are time based—i.e., they allow unlimited use for a specified time period. Surveys over time help develop benchmarks that are used to evaluate demand when ticket sales data are used. Most metros, which have barriers to ensure fare collection, can collect ridership data as the tickets contain a magnetic strip that is read and electronically reported. Metros also offer unlimited-use tickets for a specified timeframe, which thus requires that additional data be collected to properly determine ridership and hence demand for service.

At some properties, electronic technology for data collection is in use to some degree. In Warsaw, some of the buses use infrared technology to offload ridership information collected from the ticket machines when they pull into the garage and are being fueled. About 400 of Warsaw's buses incorporate technology that assists in tracking, monitoring, and reporting service operations.

In Warsaw, the transport authority includes approximately 15 people responsible for tracking and monitoring operators to ensure that service was delivered and ridership data were collected. The staff used Visum, a computerized modeling tool, loaded with ridership boarding and alighting data, to prepare traffic pattern simulations for various service configurations. The database includes demographic layers of data, which allowed service standards to be applied to routes. This software also helps model dwell and transfer times within schedules and covers all modes of service. Traffic check data, purchased from an outside contractor, was used to apply passenger data to service based on an origin-destination survey. The validity of the data is proven by sample testing of field data by staff, and the underlying demographic data are updated regularly to help in the programming of efficient service levels.

In Moscow, a pilot AFC system on buses included turnstiles on approximately 200 buses, along with electronic ticket validation equipment. Boarding is allowed only through the front door. A color was used to denote a bus having this configuration, and patrons quickly adapted by lining up in a single file at the front door when a vehicle so designated approached. Schedules did not have to be modified to accommodate any increased dwell time on these buses because the patron behavior change more than compensated for this configuration. The project far exceeded expectations and resulted in an increase of revenue recovery on these buses. It also provided more real-time electronic data that can be used to address who is riding (via the various ticket fare media used, especially on the regulatory mandated free-fare media), how many are riding, and when they are riding. These data also facilitate the evaluation of the economic effectiveness of each route by way of the calculation of the subsidy per passenger to be achieved and factored into schedule decision making.

In Warsaw, the public transport authority typically re-allocates resources to address changing service demands,

such as the opening of new capital facilities. This proves to be a difficult task with the limited resources available; the agency typically has to negotiate with each community affected by routing and service changes.

In Budapest, ridership on each line is counted twice per year to determine if any changes to service levels should be pursued. If a route is operating within 90% of capacity, the agency considers launching an express route in the area.

Gdynia uses monthly ridership evaluation data on each route in order to adjust service levels. Adjustments are made when warranted, and changes in schedules are typically communicated to the customers through updated timetables on the company's website.

## BUSINESS PLANNING/FINANCING

Poland's financing of operating subsidies and capital investments are out of synch with municipalities promoting road building over public transport expansion. This is particularly crucial to Warsaw's ZTM, which has a \$200 million budget for operating expenses and three sources of revenue:

- Fare box revenues from transport ticket sales at 2,000 locations throughout Warsaw and surrounding communities (covers 50% of operating costs),
- Central city budget (25%), and
- Eleven district budgets (25%).

Capital investments in Warsaw are not secure for fleet renewal. There is a permanent drop of state budget participation in metro development. Therefore, Warsaw Metro is searching for new sources of money in the form of public-private partnerships. Bus and train renewal get second priority from municipal officials, who provide only 40% of what is needed.

Warsaw Metro's capital budget is \$100 million per year, with 25% expected from the state and 75% expected from the city, whose highest priority is the metro construction. With limited funds, there is very limited progress with either capital investment programs. Further complicating this infrastructure issue is this fact that medium- and long-term infrastructure tendering, acquisition, and delivery (and planning) are stymied by an out-of-synch annual budgeting system that makes execution of transport projects difficult.

This problem is a result of the state's withdrawal from public transport oversight. Management is making every effort to reduce cost and increase revenue. Initiatives such as automatic monitoring of bus performance and single-fare tickets for metro and railway are now in place after 40 years of debate. New Visum traffic-modeling system software, cutting-edge technology, management information systems for ticketing, validation and traffic pattern analysis, ridership analysis, peak and off-peak analysis, trends analysis,

and fare evasion detection systems not only improve performance but also reduce cost and increase revenues.

More optimism is warranted by public opinion supporting priorities for buses and trains in Warsaw, even if it means worsening traffic conditions for the automobile. This public opinion, complete with growing public approval of parking charges in the central business district, will give the Warsaw Transport Roundtable a greater positive perspective on the issue.

All this optimism springs forth from demands for performance and efficiency of a developing market economy. As cities promote and adopt best practices, Poland is realizing that its economic future also depends on participating in financing loan guarantees and policy development to accelerate Poland's entry into, and sustainability within, into the EU.

Compared with Warsaw, Gdynia exhibits a higher level of customer satisfaction according to staff attitudes and information gleaned from public opinion surveys. Steps have been initiated to take a regional approach to transportation coordination between cities, with the railway system integrating ticketing systems and route schedules.

Entrepreneurial and commercial activity currently covers about 10% of operating costs at Warsaw Metro. Most of this income comes from rents from retail space at stations and fees collected from station-based cash machines, parking, and panel advertising. There appears to be a huge opportunity to expand public- and private-sector incentives in an effort to grow this revenue stream. But first the state and municipalities must put in place the correct incentives, joint-venture development opportunities, and capital leasing formulas to motivate private investors and business interests to put their money into transit's future.

By aggressively moving toward EU standards and adopting transit best practices, Poland is motivating the state government to review levels of decentralization and to recognize the role public transit plays in the state's responsibilities to its citizens. Transit management contingency plans seem to have been discussed and analyzed for most scenarios, and the political leadership is becoming more educated about urban transit issues as transport problems rise in priority throughout Warsaw and Gdynia.

In spite of its very positive image, successful operations, and impressive service performance, BKV in Budapest faces financial challenges that slow progress. Some downsizing was necessary after decentralization, causing dissension among the union rank and file. The state subsidy for student fares and passes does not coincide with the municipal budget year (which is the BKV budget year), causing financial confusion and cash flow problems. Short-term yearly budgeting also causes planning difficulties.

BKV is working diligently to "normalize" financing practices because these practices affect BKV's business plan. For example, the national budget impacts local budgets because the state also sets service requirements. Under state law, municipalities must provide the level of public trans-

portation service set by the state; the municipality must also set fares, which are negotiated with the various service providers it owns.

Over the years, both the state and the municipalities have been withdrawing their support of public transportation. This is forcing BKV to develop self-support. Some of BKV's alternative financing solutions include the following:

- Define a new standard calculation for operating subsidies.
- Modify the calculation of the social subsidies (students, officials, and so forth).
- Look to the EU for rail financing.

Demand for public transport services, enormous debt transfer, draining of state coffers, and the introduction of personal income tax have strained finances in Hungary. Previously, 50% of taxes collected went to municipalities; today, only 22% does.

Management and politicians have differing business plans and ideas on "normative" financing, including the following:

- Impose a 1% payroll tax, paid by the employer, that would be dedicated to public transportation (such as is done in France).
- Provide state grants to municipalities based on population.
- Provide municipal grants to BKV; the amount would be based on seat-miles and the state's mandated service levels.

No single idea has gained popular acceptance to date.

BKV-Plus is one entrepreneurial innovation started by BKV to provide contract service for outlying municipalities and communities; payment is based on certain quality-of-service parameters. Other entrepreneurial activities include having revenue contracts, hiring profit-making "fare evasion" controllers to collect fines, increasing advertising sales, and having frequent-rider programs.

BKV's vision and mission goals are clear, well executed, and closely tied to increasing revenues, boosting market position, and creating a better transit image. BKV's all-inclusive market segmentation, continuous service improvements (which emphasize quality over quantity), and wide-ranging use of media (films, expos, web page, newsletters, surveys, education programs for school children, and so forth) show an extraordinary commitment to the future.

The capital improvement wish list for Bucharest's RATB is long, including modern vehicles, next-generation trains, an AFC system, and a modernized dispatching center. In November 2000, RATB received a 7-million-euro loan from the EIB to purchase a ticketing system for better fare management and to control fare evasion. The 15-year loan is also expected to link fares between RATB and Metrorex. The EIB is providing another loan to improve street and tram infrastructure in collaboration with financial commitments and matching grants from the municipal government.



The RATB staff expressed a willingness to let a private company take it over, but it believes that no private company would dare do so: “public transit is public” and market principles do not apply. RATB also recognizes that private interest in public transport is discouraged by the social aspect that must be taken into account, the hidden costs, and the expense involved in maintaining infrastructure and rolling stock.

There is no dedicated source of money for RATB, but the municipal subsidy appears stable. There did not appear to be any urgency to come up with private-sector or market-driven solutions to the money problems.

Metrorex has experienced a slight increase in passengers in recent years (currently 350,000 passengers per day); fare evasion is less than 8%, and the farebox recovers 40% of operating costs. The balance comes from state government, which also supports a wide campaign of capitalization from bank loan guarantees.

RATB is in negotiations with Metrorex to create a fare integration system. There is some private entrepreneurial interest in a design-build project for a line to the airport.

The URTP (Uniunea Română de Transport Public, Romanian Union of Public Transport) is addressing problems facing transit operators in all of Romania, such as the following:

- A lack of a master plan at the municipal level, which should be at least a 5-year plan in accordance with local municipal resources and conditions.
- A lack of an organizational network of public transit.
- A shortage of buses (there is market for 4,000 to 5,000 buses, with the average fleet now between 10 and 12 years old).
- A lack of modern trams. In the next 5–10 years, all 600 trams now operating in Romania will be obsolete.
- A lack of private entrepreneurs and investors for local projects.

Private investors are doing very little with public transit outside of recycling materials (oil, batteries, and tires) or operating competing, licensed services, such as the maxi-taxis.

Moscow Metro has two budgets:

- An operating budget consisting of 75% from the farebox and 25% from the city, with additional revenues from advertising, retail trade, and joint ventures.
- A capital budget, in which the government invests 20% and the city 80%.

Moscow Metro does not outsource cleaning, fare collection, or maintenance; instead, those responsibilities are handled by companies owned by Moscow Metro. Entrepreneurial activities have also started to generate revenue for Moscow Metro, which now has the freedom to establish joint ventures. For example, telecom companies and fiber-

optic networks are in development, and there is a joint venture with a German company to provide cleaning services.

Developing alternative revenue sources to decrease dependence on the city of Moscow is a goal for management. Moscow Metro also wants to revamp the social subsidies and invoice organizations whose members ride for free (such as the military). Management’s goal is to break even on the operational costs (i.e., have those costs covered by fares) and let the state or city provide capital for infrastructure. Moscow Metro is looking at cutting-edge fare systems, smartcards, social cards, and easier access for people with disabilities.

## SERVICE COORDINATION

Service coordination has many aspects and can occur in the form of reciprocity of transit fares; coordination of transit routes, service frequencies, and span of service; and service integration at multimodal facilities. In each of the cities investigated, transit service coordination was, in fact, occurring, but at different levels.

There are two levels of service coordination that can occur in major cities: (a) coordination between transit providers and intercity carriers and (b) coordination among public transit providers.

### Coordination Between Transit Providers and Intercity Carriers

Within each of the cities investigated, public transit services can be coordinated with two major intercity carriers: national railway systems and airports. In all cities, buses, trams, and subways served the national railway system terminal(s) on a very frequent basis until the evening on weekdays and weekends. This is quite understandable since railway systems were the lifeblood of European cities and were used not only to transport passengers but also to transport goods. As a result, many terminals are located near or in the center of a city and have become major transit service generators because they were a short walk or travel distance for residents and businesses.

Transit service to airports, on the other hand, is almost nonexistent in the cities investigated by the mission. In all cases, airports are located about a one-half hour to more than an hour travel distance from the center of the city, depending on the time of day and traffic conditions. In speaking with representatives of the various transit agencies, two major reasons were identified for the lack of service to airports: (a) travel time and travel distance and (b) the small number of passengers using the airports. Although there are identified needs, such as transporting workers to the airports, most agencies felt it was better to use the public transit resources to provide service to the general public and to allow jitneys and taxis to provide service to workers and air passengers. Of the cities visited on the mission, only the



Gdansk Airport (where the study team boarded a flight to Budapest) was served by public transit.

Two of the five cities visited are contemplating initiating transit service to their regional airport. In Warsaw, there are plans to study the feasibility of extending subway service to the airport in the coming years. However, many other portions of planned subway extensions must be constructed before a line is extended to the airport. Bucharest Metrorex is also currently investigating service to the airport through a public-private partnership with a Japanese company.

### **Coordination Among Public Transit Providers**

The basic types of coordination that occur among public transit providers involve passenger fares and transfer arrangements, as well as service coordination with routes and schedules, frequency of service, timed transfers, and shared use of multimodal facilities.

Accurate tabulation of passenger trips by each mode of public transit is very important to the operators in each of the cities visited. The many subsidized riders make it necessary for each operator to accurately track and report these trips in order to receive the appropriate fare subsidy and hence meet operating expenses. In order to reduce fare evasion and to accurately account for subsidized passengers, each of the cities investigated will be introducing ticketing through smartcard technology within a year or two.

#### *Warsaw*

Each agency is very protective of the services it offers and wants to maintain service levels in order to retain its market share and employee base. Passenger fares are similar for each mode (subway [Metro], bus [MZA], and tram [TW]). On surface modes, the fare is valid on buses and trolleybuses and for transfers between the systems for a 2-hour period. There are no transfers between any of the surface systems and the subway; a separate ticket is required for the tram and for the subway system.

Coordination of routes and schedules works quite well in Warsaw as a result of the integration of bus and trolleybus services and the need to streamline operations to reduce costs. Service duplication does exist among buses, trolleybuses, and trams, but it is primarily due to the need to serve the central area of Warsaw from various points throughout the city.

Service frequencies on all systems usually range from 3 to 10 min in the peak period and from 5 to 10 min off peak and weekends into the early evening, dropping to 10 min or more at night. As a result, the need for schedule coordination and timed transfers is minimized. Significant growth in traffic congestion due to the growing predominance of the single-occupant automobile has caused all the surface operators to experience problems in maintaining headways and service reliability. In the future, this may require a greater

level of coordination among the surface and subway modes and eventually lead to timed transfers.

Span of service differs marginally between surface and subway systems. All systems begin operations at about 4:30 a.m. and operate until about 11:30 p.m., with some late-night bus and tram service.

Shared use of multimodal facilities is very important to the success of transit services. In most cities visited, including Warsaw, buses and trolleybuses commonly share bus stops where routes merge. In some cases, stops are also shared between buses and trams, but there is less evidence of this level of service coordination. In this instance, the coordination occurs between the subway and the tram at the Ratusz station. This is a major transfer point between an interim terminal station of the subway and three tram lines. The tram station area provides significant surface area capacity for passengers and a lively atmosphere of retail establishments and small merchants selling goods at street kiosks.

#### *Gdynia*

The 112 million annual passengers in Gdynia use a system that has highly coordinated routes and schedules. Passenger fares of 2 zloty (\$0.50) are the same for buses and trolleybuses. Most residents, however, use either a 1-month or 6-month pass.

Coordination of routes and schedules occurs quite well in Gdynia as a result of the integration of bus, trolleybus, and tram services into one agency. Service duplication does exist between these systems, but it is primarily due to the need to serve the central area of Gdynia.

Service frequencies on all systems are usually 5 to 10 min during the peak period and 10 to 15 min off peak and weekends into evening. Service and schedule coordination is conducted through ZKM and monitored on a real-time basis. Through the use of GPS and component software, ZKM receives updated schedule adherence data every 3 to 5 min and exception reports as soon as major delays occur. This information is used not to make real-time adjustments to service but rather to make schedule adjustments in future run cutting. According to planners at ZKM, the use of timed transfers between bus routes is not necessary because of the frequency of service. Span of service is the same among all the systems. Operations begin at approximately 5:30 a.m. and continue to about 10:30 p.m., depending on the service area.

Shared use of on-street facilities, primarily bus stops, is in wide use in Gdynia for buses and trolleybuses. Bus pull-outs allow vehicles to move close to the curb to provide easy boarding and alighting of passengers. Passenger shelters provide schedule information and also serve as clearly identifiable bus stops.

#### *Budapest*

Passenger fares are similar for bus, trolleybus, and trams,

but different for the subway and suburban trains. Buses, trolleybuses, and trams have a boarding charge of approximately \$0.40; tickets are validated onboard. The ticket is good for up to 1.5 hours and allows for transfer between systems. The subway uses a combination of a zonal and timed system. Fares are distanced based, and there is also a limit on the amount of time the ticket is valid, with the shortest time span in the central zone. The suburban rail systems also use a distanced-based fare structure, with no transfers between the surface systems and the subway or the suburban rail services (a separate ticket is required for each system). More than two-thirds of all passengers use monthly passes.

The routes and schedules are well coordinated in Budapest, chiefly as a result of the integration of bus, trolleybus, and tram services. Service duplication does exist on routes served by buses, trolleybuses, and trams, but it is primarily due to the need to serve the central area of Budapest and the various origin and destination pairs throughout the metropolitan area.

Service frequencies on all systems are usually between 3 and 10 min during the peak period and between 5 and 10 min off peak and weekends into the early evening, dropping to 15 to 20 min on surface systems at night. Because of the high levels of service, the need for schedule coordination and timed transfers is minimized.

All systems begin operations at approximately 4 a.m. and continue operations until 11:30 p.m. Some bus routes provide service throughout the night.

BKV has developed a significant number of facilities that are used jointly by buses, trolleybuses, trams, subway, and the suburban rail system. Four multimodal facilities were examined during the visit to Budapest. Each facility was designed for the modes and environment it served. Typical among all facilities that link to the subway is the use of underground passageways to move patrons from the subway to the surface systems without having to encounter vehicle traffic at major intersections. This simple design feature gives the impression of a seamless transfer between modes. Another feature that stands out at two of the multimodal facilities is the incorporation of news stands, pastry shops, and other small retail establishments that are used by patrons while waiting to transfer from one mode to the other.

### *Bucharest*

Passenger fares are similar for bus, trolleybus, and trams, but different on the subway. Buses, trolleybuses, and trams have a simple boarding charge and ticketing system. The subway also uses a flat fare system, but it is different from the fare structure on the surface systems. There are no transfer arrangements between surface systems and the subway.

Coordination of routes and schedules between RATB and Metrorrex was not obvious in Bucharest, although with frequent service, the need for schedule coordination and timed transfers is minimized.

Service frequencies on all systems are usually between 4

and 10 min during the peak periods and between 5 and 10 min off peak, weekends, and into the early evening; at night, frequencies drop to 15 min on both the surface systems and the subway.

Span of service differs slightly between surface and subway systems. All systems begin operations at approximately 4:30 a.m. and operate until about 11:30 p.m., with some late-night bus and tram service.

There are few multimodal transfer facilities between RATB and Metrorrex services except for typical on-street bus stops located adjacent to Metrorrex stations. RATB, however, has recently opened a new terminal facility that serves the number 41 tram line and a number of bus routes in the area. The facility has a ticketing booth, with a waiting area and bathrooms for patrons.

### *Moscow*

While Mosgortrans has developed and is pilot testing its own smartcard for use on the surface systems, Moscow Metro is developing, in conjunction with the city of Moscow, a universal smartcard—the Muscovite Social Card, which will be used for transportation services, medical services, banking, pensions, and other social functions. While these two cards are being developed independently, the Mosgortrans card will have to be adapted to meet the requirements of the Muscovite Social Card in order to provide seamless transfer between the systems.

The city of Moscow is providing funds to Moscow Metro to expand fixed-guideway services with three modes currently not operating in the city: light rail transit (in tunnels); a monorail service in high-density commercial, office, and residential development; and a mini Metro (a personal rapid transit type system) that will operate as a circulation system in an area close to the central city. Mosgortrans has been successful only in obtaining funds to upgrade maintenance facilities for the tram system, not for expanding it.

Specific information on routes and schedules and multimodal facilities operated by Mosgortrans and Moscow Metro could not be adequately determined during the team's brief stay in Moscow.

## **ACCESSIBLE AND SPECIALIZED TRANSPORTATION**

The availability of accessible and specialized transportation in the cities visited was mixed. Although the need for accommodating those with disabilities is recognized, a number of factors, including the economy, availability of funding, and role of the automobile, create an environment where accommodating those with disabilities has not been among the highest priorities.

Transit systems have seen their government subsidies cut, and they have had to increase fares rather dramatically, all

while enduring difficult economic conditions that affect people's ability to afford public transportation. At the same time, the increasing availability of personal automobiles has had an impact on transit ridership. The cities visited on the study mission are now realizing that deferred maintenance and antiquated equipment must be dealt with and that better service and marketing are needed in order to rebuild the passenger base and lure riders back from their reliance on cars. As traffic becomes more and more congested in these cities, the agencies are seeing a resurgence of interest in buses, trolleybuses, trams, and subways.

When new equipment is purchased, it typically includes a low-floor configuration. Additional amenities, such as a kneeling feature, ramps, and lifts, are increasingly being included on buses. Such improvements are a bit slower coming to trolleybuses, trams, and subways, but as new facilities are built, improved means of access is usually included.

One item common to all the transit systems visited is a policy of free or reduced fares for broad categories of the population. For example, in Warsaw, those entitled to use of the city transport services free of charge or at up to a 50% discount include various combatants with specific service medals, victims of Nazi Germany, children from families with more than five children, invalids and people with disabilities up to age 26 and their guardians, people with serious disabilities, those unable to live and work independently, blind people, people with mental disabilities, donors of more than 30 liters of blood, seniors over age 70 (a 50% discount is given to pensioners under age 70 and their spouses), employees, the police, students, and retired judges and prosecutors. It is estimated that about \$2.5 million a year in farebox revenues is lost due to these free or reduced-fare passes, although government-provided subsidies partly make up for the lost revenues.

To a large extent, the availability of free or reduced fares and the increasing number of low-floor buses and trams have made transportation theoretically possible for many people with disabilities. However, the popularity of public transportation, and the associated standing-room-only conditions on many of the buses, makes travel for many with disabilities difficult at best. Transportation on the subways is not as accessible due to the lack of elevators and the crowded conditions on the subways.

Based on general estimates that about 10% of the population of a given country may have a physical disability affecting mobility, the need for accommodations in the countries visited is substantial. There have definitely been some advances. Curb cuts and marked crosswalks are becoming more prevalent. Low-floor buses, while not specifically purchased just to accommodate those with disabilities, have served to assist those with limited physical disabilities, as well as the population in general. Although some transit systems have low-floor buses equipped with manually operated ramps, it is difficult to envision an operator deploying the ramp during rush hour.

## Warsaw

In 1995, the city of Warsaw adopted a Resolution on Transportation Policy, which outlined its objectives for efficient and safe transportation of people and goods. Priority for public transit, economic development, environmental effects, and quality-of-life issues were all included in the policy. Recognized within the policy was the need to ensure that the needs of people with disabilities were taken into consideration.

In the area of adapting the system for use by people with disabilities, there has been some progress in providing curb cuts and better marked crossing areas. Some Metro stations have elevators to provide access to the stations.

All new buses and trams are being delivered equipped with low floors. In 2000, 17% of the bus fleet had low floors, a significant increase from the 1.2% with that configuration in 1995. Signage on the low-floor buses and accessible stations shows not only the wheelchair symbol but also a baby carriage symbol.

There are also nine minibuses for specialized transit. These are available by telephone reservation.



Figure 10. Buses in Gdynia are clearly marked to indicate which doors should be used by persons with disabilities or persons pushing baby carriages.

## Gdynia

Gdynia passed a resolution on transport policy in 1998, which included strategic objectives to restructure the system into an efficient element for the region. One of the enhancements specified in the policy is the need to include technologies that fully satisfy the needs of people with disabilities.

Gdynia's bus fleet includes 150 low-floor buses. The trolleybus fleet of 79 vehicles includes 5 equipped with low floors. The low-floor buses are very well marked, and all Gdynia buses are clearly marked to indicate which doors should be used by people with disabilities or people pushing baby carriages (Figure 10). Passengers with disabilities can also call in a reservation for a minibus, which will pick them up at their door.

The large proportion of passengers for whom fare reductions or exemptions are granted results in greatly reduced farebox revenue. In Gdynia, only one-third of passengers pay full price for a ticket.

## Budapest

BKV currently has about 100 low-floor buses out of its fleet of 1,100 vehicles. The new-model buses are also equipped with a kneeling feature, as well as manually lowered ramps at the middle door of their three-door configuration. The buses are assigned to 17 routes within the city. In addition, there are two new and two retrofitted Ikarus buses equipped with ramps and tie-down devices that are available on a demand-responsive basis to transport people with disabilities. The fare for the demand-responsive service is double that of a regular fare, but a companion can ride at no cost. Passes are not valid for the service.

The funicular, which takes passengers to the upper part of the city, is wheelchair accessible.

## Bucharest

RATB's crowded conditions are not conducive to transport of those with physical disabilities. Those entitled to ride for free include people with disabilities, veterans, and heroes and successors of those injured or killed in the revolution of December 1989. Half-off fares are provided for students and the retired. Farebox provides about 25% of the system's revenue. The loss of fares is reimbursed by local government subsidies.

RATB is currently in the midst of buying new low-floor buses to replace vehicles in their fleet, the average age of which is 13 years. A new generation of trams equipped with low floors is starting to be delivered as the city tries to greatly expand and rehabilitate the tram service. Raised sidewalks will also be added. Transportation was one of many systems neglected after the collapse of the government in 1990.

The new underground stations for Bucharest's subway are being equipped with elevators. Metrorex provides the same subsidized or free fares as the surface system.

## Moscow

In 2002, Mosgortrans took delivery of ten 30-ft buses equipped with lifts and wheelchair tie-downs. The special accessibility features of the bus are prominently displayed on the sides and front of the vehicles. The service runs on a demand-responsive basis, with the Social Department involved in arranging service.

Moscow has a pilot project with a wheelchair lift at one of its Metro stations. Any new stations built for the new light metro planned for the city will be equipped with lifts. It is expected that access for those with disabilities is something that will be implemented over time.

The metro is ill suited to transporting those with disabilities. Between the incredibly fast escalators and the intense crush of passengers on each train, anyone without the strength or stamina to maneuver the metro would be better served choosing another means of transportation.

A new fare collection system being implemented in Moscow has greatly increased farebox revenue by making it more difficult to evade fares. It also provides the system with extensive information on how many so-called concessionary passengers are carried and the amount of subsidy received on behalf of each of them. On a sample day in March 2002, there were 104,000 free trips, of which 60% were pensioners and 11% were people with disabilities. The remainder of the free rides included orphans, veterans, and a variety of government employees.

## FARE COLLECTION

Transit agencies in the cities visited are finding it necessary to create a business model based on the private sector, where a healthy bottom line is required. Two sources of revenue exist for the provision of public transportation: farebox revenue and public funds. With dwindling national support and limited local government resources, transportation agencies now must turn to the farebox to meet their operational needs, as well as their capital requirements.

Looking to the farebox to fund the operation poses a number of challenges. Though the state may have divested itself of the operation, it still maintains control of the social welfare portion of transportation; fare discounts and exemptions remain a national responsibility. This results in over one-half of all riders either not paying or paying substantially less for the services. In addition, even if the state were willing to pay the subsidized portion of the fare, no reliable method for identifying those riders for reimbursement exists.

Fare evasion has the significant effect of diminishing the necessary funds to support the operation. Fare evasion—with estimates ranging from 8% to 20% for the systems visited—has a significant deleterious impact on the bottom line. Even the cost of enforcement has a negative impact on the cost of operation and the provision of service. Fare evasion creates the impression of a system that lacks control, thus encourag-

ing still more fare evasion and making discretionary riders less willing to ride.

Another challenge lies in the fact that in privatization of service, private providers are often paid according to kilometers traveled, rather than number of passengers. This makes sense when the route is not economically attractive to private operators but important to meeting a public need. It is obvious that little incentive exists for fare collection and enforcement on the part of the private operator.

In this environment, transportation providers find themselves on the slippery slope of service reductions, poor maintenance, and no service improvements. As was learned in the United States, this situation results in more people in autos, which in turn creates increased congestion, reductions in productivity, and degradation in air quality.

### **Current Status**

Fare collection and enforcement remain city functions in Warsaw and Gdynia. Fare collection systems currently are proof of payment for bus and tram. Fare media can be purchased at a variety of outlets, including post offices, shops, transit offices, and buses. Almost 50% of all riders in Gdynia and Warsaw receive partial or total fare exemptions. In Warsaw alone, these exemptions result in a loss of \$25 million a year.

In Budapest, the entire transit system is based on proof of payment. Fare pricing is done through the Hungarian Ministry of Finance and is a flat fare per line system. For example, a rider who transfers to a different subway line must pay a new fare.

Fare evasion is approximately 8% with a very aggressive enforcement program (500 controllers) and a marketing campaign. Guidelines stipulate that 1 in every 20 riders should be stopped and asked to provide proof of payment.

Bucharest is faced with many of the same problems as Hungary and Poland, but given Romania's current economy, the impact is more severe. The tram and bus systems use proof-of-payment systems, whereas the metro uses a barrier system. Fare evasion rates are estimated to be approximately 15%.

Moscow, with its ever-growing population of people and cars, faces the need to provide increased service while reducing operational expenses. Here, too, costs are shifting from the state to the municipal government. Fare evasion is high, and more than 60% of all transit riders—which include students, passengers with disabilities, pensioners, military personnel, orphans, employees, and others—receive some sort of ride subsidy.

### **Automated Fare Collection**

In all cities visited, the transit properties are planning to implement AFC systems—i.e., smartcards. Several are in the tendering stage, while others are already implementing them. All systems will be multimodal and will link bus,

tram, metro, taxi, and parking using the same fare media. In the transit properties' view, electronic systems will offer convenience for the customer, improved system efficiency, a reduction in operating costs, and improved revenue collection. With the new technology, the operators plan to adjust the fare structures to accommodate time of day or distance. Operators will be able to more accurately plan their route structure, since they will know their ridership better. Furthermore, they will be able to identify their special-fare riders to seek reimbursement from the state. Transit properties will be able to seek other smartcard applications outside of the transportation arena, thus generating additional revenues. Budapest's BKV foresees eventually spinning off revenue collection into a separate company in which it owns shares. This will allow BKV to remove a noncore function from its core balance sheet, thus reducing its operating cost and making the agency more competitive with private providers, as well as generating additional revenue.

In developing its fare collection strategy, Moscow looked to Hong Kong as its model. Moscow implemented a three-stage process: switching first to magnetic tickets, then to contactless smartcards, and finally to flexible tariffs. The process will allow one ticket to be used for all modes of travel: metro, railways, buses, and trams. With the implementation of these new technologies, the transportation providers are seeing increased revenues and more efficient operations.

In 1999, Moscow railways implemented a barrier system equipped to handle both magnetic and smartcard ticketing at the Kievsky Railway Station. Revenues increased by 60%, and the return on investment was achieved in 1.5 months.

Mosgortrans is implementing a fare collection system with barriers on the system's buses and trams. This system is designed to accept both magnetic cards and smartcards. A validator and gate are being installed in the front of the bus. Boarding will now be done through the front door and will require a ticket. Tickets can be purchased in advance from a kiosk, agent, authorized outlet, or the operator.

A pilot application in Zelenograd, an area outside of Moscow, revealed that passengers adapted quickly to the new system, forming lines to enter the bus. Bus entry is quick, without congestion or bottlenecks. More importantly, Zelenograd A/K saw a 60% increase in revenues from the area.

In 1997, Moscow Metro launched a program to incorporate magnetic and contactless smartcard readers, barriers, a data collection infrastructure, and a card personalization and issuing system. Magnetic media are being used for all single, multiride, and monthly tickets. Initially, only metro employees had smartcards. In 1998, Moscow Metro introduced a smartcard for students. Local government and benefit providers have joined with Moscow Metro to participate in the smartcard program. By 2002, more than 1.7 million cards were in use for transportation, and 21,000 cards are being used for the collection of welfare benefits. In April 2002, Moscow City Government, Bank of Moscow, Rosan

Finance, Moscow Metro, and Visa teamed up to provide Visa debt payment functions on the smartcard. With this change, the card can be used to meet the social, transportation, and financial needs of the card holder. Additionally, the partnership allows for sharing the cost of development, improving service to the customer, and maximizing the return on investment.

## HUMAN RESOURCES

Transit systems in the cities visited are responding to vastly changing economic conditions in the countries that they serve. Each of the systems is struggling with maximizing the productivity of their human resources while at the same time minimizing costs. These efforts have to be balanced with providing overall compensation packages that allow the systems to hire and retain quality employees.

### Privatization

With the exception of Russia, all of the countries visited are striving to obtain membership in the EU. One of the requirements of joining the EU is to privatize services and industries that were previously provided via public entities. This drive to achieve privatization is one of the fundamental drivers of change in the management and delivery of public transit services.

Privatization has been positive for many of the systems visited in that it has required these systems to focus on both improving efficiencies in the delivery of service and enhancing customer service. Throughout the region, auto ownership is increasing and transit usage is decreasing. Thus, it is critical that these systems deliver economical and high-quality service to retain their ridership levels.

#### *Warsaw*

MZA, the surface transport operator in Poland, is scheduled to transition from being a city budget unit to a joint-stock company in January 2003. Eventually, MZA will have to compete against other transit operators for the right to operate service. This transition has caused MZA to focus on cutting costs while at the same time improving quality. One of the ways that the system has done this is to conduct an assessment of the number of personnel needed to deliver service. The focus on personnel requirements has been particularly on technical personnel, which includes mechanics and support personnel. Under socialism, personnel were paid the same regardless of their skills and abilities. Furthermore, many staff members had the attitude that they had “civil service” protections and thus did not have to deliver results. Under this new approach, some employee groups may see turnover of up to 50%.

Transitions are also occurring at the management levels within the organization. Senior members of management

have participated in training that has focused on private-sector management practices. Management now wants to expand this training to mid-level managers.

#### *Gdynia*

The city of Gdynia has made significant progress in moving to privatize its transit operations. One of the key changes that this transition has created is that employees are no longer public employees. Although the new operating entities are solely owned by the city, they are subject to the same employment conditions that private companies face. The private companies must periodically compete against each other for the service that they operate. If a company is not competitive, the amount of service it is under contract to deliver could be reduced. Accordingly, the number of employees needed to deliver that service also would be reduced.

#### *Budapest*

In response to the dramatic decrease in ridership, BKV implemented a massive reorganization plan, the end result of which was a reduction in its workforce from 22,000 employees to 12,400 employees.

One of the strategies that was implemented as part of the reorganization plan was to outsource noncore activities. In some cases, functional areas were established as either independent businesses or as small internal units of the company. Although the new business units operate independently, they are still owned by BKV. However, these new businesses now have the ability to pursue work outside BKV as a way to achieve growth.

BKV organized its operating units into five bus divisions and divisions for tram and subway operations. Each of these divisions has the ability to operate independently to the same extent that BKV can operate independently. For example, BKV cannot change the fares that it charges and its operating units have similar restrictions.

In creating this significant change in the staff size of the organization, management elected to take a “soft approach.” Those eligible to retire were encouraged to do so, and many staff members were encouraged to establish independent operating entities. The staff cuts required were primarily achieved through retirements and resignations.

#### *Bucharest*

One unique challenge that will be faced in Bucharest is a planned merger of RATB with Metrorex. While plans for this merger are at the preliminary stage, it will likely have a significant impact on the personnel for both organizations.

#### *Moscow*

Moscow has taken a very different approach to privatization. Instead of having private companies operate transit

services, the operators in Moscow have focused on using private management concepts to operate public transit service. All support functions are conducted by internally operated enterprises.

There are areas in which privatization has occurred. Taxi operations, which were previously state operated, are now privately run. In addition, minibus services are largely privatized. There are 130 minivan operators that serve 600 lines. These actions have allowed private entrepreneurs to create job opportunities for the delivery of these services.

In 1999, Mosgortrans was reorganized. What were previously 60 business units were reduced to 52 business units. Discussions are now under way at the federal level to consider further reorganization of the system. The focus of this effort is to have fewer state-owned business enterprises.

### Labor Unions

Labor unions played an important role in each of the systems visited while the economies of the countries were dominated by socialism. These unions must now play an entirely new role. In many cases, the unions are struggling with this transition.

#### *Warsaw*

MZA has five labor unions. Employees are not required to join a labor union, and today between 45% and 50% of the employees belong to a union. Unlike in the United States, unions in Poland are exclusive to certain positions within an organization.

New unions can be created with as few as 15 members. Union chairs and their deputies cannot be terminated from employment. Furthermore, the transit system must pay the union chairs and provide them with an office. Thus, the creation of unions can be quite costly to the organization. Because of the protections afforded union officials, it is reasonably easy to abuse the right to form unions.

One of the key roles of the union is to regulate the use of social funds, which include funds for housing and medical care. National law provides a regulatory framework for these funds; however, final discretion is delegated to the unions. The unions negotiate jointly.

As the transit operator prepares for privatization, the

union will play a key role in the success of the newly privatized enterprise. Management representatives indicated that it might take between 3 and 6 years to fully restructure to be cost competitive. Because of this long transition period, the system may lose market share.

#### *Budapest*

In Budapest, over 80% of the employees of BKV are organized into labor unions. There are 27 unions and 3 federations of unions, with 1 federation covering more than 50% of the employees. In many ways, the unions are a vestige of communist times when they had significant rights.

A key testament to the approach that BKV management has taken in reducing the size of its workforce is the number of labor disputes that have resulted in court action. With over 3,000 departures from the organization, only 10 have resulted in court action.

#### *Bucharest*

Labor unions also play a role in Bucharest. Out the 15,600 employees at RATB, 14,000 are members of a union. Management reports that relationships with the union are good, but there have been two strikes in the past 10 years. Effective communication has been key to maintaining a good relationship between union and management.

From the perspective of URTP, unions are seen as partners in advancing public transit's importance in the community. There is a contract between the government and all trade unions that covers general issues. Each union then develops specific contract terms (e.g., discipline) for specific trades.

#### *Moscow*

More than 86% of the employees of the Moscow Metro are members of the union. The collective bargaining agreement with these members is negotiated with the city of Moscow and Moscow Metro. The labor agreement specifies protections for staff members and sets minimum salary levels.

Most of the employees of Mosgortrans also belong to labor unions. The chief of the union plays an important role in working with management regarding labor issues and leg-

**TABLE 2 Comparative compensation levels**

System	City	Type of Operation	Average Monthly Compensation (US\$)
MZA	Warsaw	Surface transport	800
PKM, PKT, PKA	Gdynia	Surface transport	500
RATB	Bucharest	Surface transport	100
Metrorex	Bucharest	Subway	300
Mosgortrans	Moscow	Surface transport	270
Moscow Metro	Moscow	Subway	400

islative issues. Protections that the labor unions have negotiated include prohibitions on reducing salaries and on reducing the workforce. In addition, the unions are consulted regarding efforts to reorganize the organization.

In Moscow, the transit operators provide a wide range of social programs. For example, Mosgortrans operates 34 cafeterias and 11 preschools and has both fitness and medical centers at each of its operating divisions.

## Compensation

Compensation levels vary greatly among the transit systems that were visited. In some cases, such as in Poland, compensation levels are locally competitive. In other situations, such as the case at Mosgortrans, compensation levels are low even given the local economic conditions. Table 2 compares compensation levels for bus and train operators at several of the transit systems visited.

In order to effectively move to privatization, MZA realizes it must lower costs. A tiered-wage strategy is planned. Currently, transit operators earn approximately \$800 per month, with little variation for skills or length of service. The system plans to implement a new compensation system that allows senior operators to earn up to \$900 per month, but with new operators starting at only \$600 per month.

In Gdynia, the average compensation for a coach operator is \$500 per month. The wage is lower than MZA's, partly because Gdynia is smaller than Warsaw.

Budapest's BKV uses compensation as a tool for improving employee performance. One of management's priorities is to create a better public image for the system. The elements of this effort include focusing on continuous improvement, customizing services, and committing to a partnership with customers. BKV operators have the opportunity to earn bonuses, but these bonuses can be cut if an operator is found to be rude.

The average transit coach operator in Bucharest earns between \$80 and \$100 per month. This is considered adequate given the economic conditions in the country, which has faced rapid inflation and double-digit unemployment in recent years.

In terms of job security, front-line staff members in Bucharest do not have civil service protection. There is a concerted effort to change the behavior and attitudes of the coach operators to improve service. Driver checks are periodically conducted via a "secret shopper" program. In addition, service inspectors monitor performance. Labs are used to test for and correct certain types of behaviors. Operators who receive excessive complaints are terminated.

Because of the high unemployment rates in Bucharest, the transit operators have little difficulty in hiring operators. At the time of the study visit, Metrorrex was authorized to employ 4,440 people, and there was only one vacancy.

At Moscow Metro, a typical subway operator earns approximately \$400 per month, which is considered reasonable compensation. Moscow Metro subway personnel all

wear uniforms. This practice is part of a longstanding tradition: In the past, Moscow Metro was a part of the Ministry of Rail, where all personnel wore uniforms. This practice ensures that customers can readily identify Metro staff when they need assistance.

Moscow Metro will only hire men to serve as subway train operators, and this practice is supported by legislation. According to the senior management of Moscow Metro, "Men are better able to handle the stress of being a train operator." Women serve as customer service agents and escalator attendants. All escalators in the systems are attended when they are in operation.

The situation at Mosgortrans is substantially different. Mosgortrans will hire any qualified individual to serve in any position. Mosgortrans pays an operator approximately \$270 per month. Because of this relatively low wage, the system must often recruit outside the Moscow area to fill all positions within the organization.

Mosgortrans operators wear a coat to identify themselves as vehicle operators, but the staff is not required to wear any other specific type of uniform.

At both Mosgortrans and Moscow Metro, the operators must undergo daily medical tests. These tests check blood pressure and pulse. If an operator fails the initial test, they are sent for additional testing, which might include drug and alcohol screening. Once a year, all operators must undergo a full medical exam. These exams are conducted in the medical clinics operated by the transit systems. The benefit to the operators of these daily and annual exams is that stress or medical issues can be identified and treated early.

## Role of the Vehicle Operator

Transit systems in Europe carry significantly more passengers per hour than most systems in the United States do. Because of this, the role of the transit operator is much different.

In general, the transit operator is focused on the safe operation of the vehicle, and not on customer service. The operator's compartment in all modes of transit is separated from the customer by a physical barrier.

Coach operators do not assist customers with disabilities with boarding the vehicle. Operators are required to maintain radio contact with their dispatcher. In addition, systems are beginning to install automatic vehicle location systems.

Operators do take on some roles that, in the United States, are conducted by others. For example, in Poland, the coach operator is required to refuel his/her vehicle and take the vehicle through the bus wash.

## MANAGING CHANGE

In the past decade or so, Poland, Hungary, Romania, and Russia have experienced a great deal of change. Much of the impetus for change can be attributed to the fall of the Soviet



Union in 1991. When the Soviet Bloc alliance was dissolved and Soviet troops withdrew, countries were left to figure out how to provide public services for their citizens. Literally overnight, the central governments turned over public transport operations to local municipalities, which had neither the organizational framework nor the financial resources to operate them.

During the 1990s, countries in eastern Europe experienced an economic recession and governments were hard-pressed to fund transport operations and maintenance. Historically low passenger fares rose dramatically to help pay for the cost of operations. Municipalities were unable to invest in the replacement of aging transit infrastructure and rolling stock. Some of these transport systems fell into disrepair. The increasing fares, declining quality of service, and unattractiveness of deteriorating facilities resulted in ridership losses.

Financial constraints have forced public transport systems to restructure in order to reduce costs, increase cost recovery, and improve the efficiency of their services. Another reason for restructuring was to make public transport more attractive to private-sector capital investors, particularly from the West. To date, little of the anticipated investment by the private sector has been realized. However, lending institutions such as the EIB and the World Bank have loaned money for transport capital projects, such as rolling-stock replacement and capital modernization. Some of the public transport reforms and restructuring have occurred because lending institutions have mandated that they occur before loans will be made. For Poland, Hungary, and Romania, the desire to gain membership into the EU has created an additional incentive to restructure.

With the movement toward democracy and the birth of a free market economy, citizens in these countries are now experiencing personal freedoms. Many who have the financial means are now choosing to purchase automobiles and relocate away from the central city. Changes in land use and travel patterns associated with automobile ownership are producing urban sprawl and air and noise pollution. The tremendous increase in the use of personal automobiles, in cities ill equipped to accommodate them, has resulted in an increase in travel times, traffic accidents, traffic congestion, and parking problems. While there is clearly a need to deal with the problems associated with the use of the personal automobile, there seems to be a lack of political will to restrict the personal freedoms of automobile users.

During the past decade, the political and economic changes that have impacted each of these cities have also impacted their transport services. All have been confronted with the loss of market share to the personal automobile and the challenges of providing efficient, effective, on-time transport services in an environment with increasing parking and traffic problems and inadequate funding. Each of the cities visited has had to restructure and change its transport services to adapt to a new and changing environment. Each of these cities has managed that change differently.

## Changes to Organizational Structure

One of the most significant changes that the public transport systems have had to manage is organizational restructuring, as discussed earlier in this digest. The basic framework for administering and funding transport services had to be recreated by municipalities in 1991, when central governments eliminated the institutional framework that had previously existed.

In the past, centralized planning in eastern European countries controlled land use and development. Public transport was the primary mode of transportation for most citizens, and development occurred where public transport was available. A new free market economy and the availability of private automobiles have put developers in control of the planning process in many eastern European cities. A lack of coordinated planning has caused a change in travel patterns and shifts between travel modes. Some cities have begun to deal with the issues of transportation and development by adopting transportation master plans.

Warsaw adopted a sustainable urban transport policy in 1995. The policy outlines a strategy for sustainable development and calls for limiting the role of automobiles in the city, particularly the city center; elimination or reduction of through traffic in cities by constructing bypasses or ring roads; rehabilitation, modernization, and more effective use of existing transportation infrastructure and equipment, including better use and upgrading of existing tramway systems, installation of advanced traffic management systems with prioritization for mass transit, and implementation of revenue generation techniques such as parking fees and congestion pricing.

Although the plan was unanimously adopted by the Warsaw City Council, implementation has been slow. Impediments to implementation include resistance from automobile users, a lack of regional cooperation, and a lack of political will by policy makers. However, there have been no efforts to change components of the plan, and public opinion regarding public transport has provided optimism for the future. Surveys indicate that citizens favor priorities for buses and trams, even if such priorities worsen traffic conditions for private cars. Citizens also favor parking charges and speed limits.

Warsaw has developed a traffic model with three separate traffic priority zones. The inner zone gives priority to public transport modes. The outer zone gives priority to the automobile. An intermediate zone provides priority to the automobiles, with priority arteries for public transport modes.

In Gdynia, the city council adopted a transport policy in 1998. The policy calls for balanced development of the transportation system and the creation of proper conditions for effective and safe transport of people and cargo. The strategic objective of the policy is to restructure transport in Gdynia to ensure that the living conditions of its residents meet European standards and to create opportunities for

development, international trade, and tourism. Although the policy has been adopted, it has for the most part not been implemented.

In Bucharest, a transportation master plan was developed in 2000. The objectives of the plan were to ensure smooth mobility, create an attractive city center, plan for subcore centers, and protect the urban environment. The plan recommends improving circulation around the city, reducing traffic congestion, and introducing a new type of tram and transport fare system improvements.

In Moscow, much of the transportation planning is still centrally controlled. Moscow's planning institute employs 600 people, who deal with social concerns such as public transport. When asked what was being done to address parking and traffic problems, the chief engineer of planning indicated that the planning institute is hesitant to impose restrictions that would limit the freedoms of citizens.

Many of the transport organizational structures in the cities visited were such that service parameters and funding levels were imposed on the transport operator. While the operators were charged with containing costs, improving operational efficiencies, and operating like a for-profit business, they had little or no ability to control their revenues.

## APPENDIX A—TEAM MEMBERS\*

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\*Titles and affiliations appear as of the time of the study mission.

## APPENDIX B—HOSTS

### Warsaw, Poland

Izba Gospodarcza Komunikacji Miejskiej  
 Wojciech Suchorzewski, Warsaw University of Technology  
 Zarząd Transportu Miejskiego (ZTM)  
 Miejskie Zakłady Autobusowe (MZA)  
 Tramwaje Warszawskie (TW)  
 Warsaw Metro

### Gdynia, Poland

Zarząd Komunikacji Miejskiej (ZKM)  
 PKM  
 PKA

### Budapest, Hungary

Budapesti Közlekedési Részvénytársaság (BKV)

### Bucharest, Romania

Ministry of Public Works, Transportation, and Housing  
 Regia Autonomă de Transport București (RATB)  
 Metrorex  
 Chamber of Commerce and Industry of Romania and  
 Bucharest  
 Uniunea Română de Transport Public (URTP)

### Moscow, Russia

Union Internationale de Transport Public (UITP)  
 Mosgortrans  
 Moscow Metro

## APPENDIX C—ACRONYMS

AFC—automated fare collection  
 BKV—Budapesti Közlekedési Részvénytársaság (Budapest  
 Transport Limited)  
 CNG—compressed natural gas  
 EIB—European Investment Bank  
 EU—European Union  
 GPS—global positioning system  
 JICA—Japan International Cooperation Agency  
 LED—light-emitting diode  
 MZA—Miejskie Zakłady Autobusowe (municipal bus  
 company in Warsaw)  
 MZK—Miejski Zakład Komunikacji (Municipal Transport  
 Enterprise [Gdynia])  
 OCS—overhead catenary system  
 PDA—personal digital assistant  
 PKA—a Gdynia bus service  
 PKM—a Gdynia bus service  
 PKT—a Gdynia trolleybus service  
 RATB—Regia Autonomă de Transport București (Bucharest  
 Transport Authority)  
 TW—Tramwaje Warszawskie (Warsaw Tram Company)  
 UITP—Union Internationale de Transport Public (Inter-  
 national Union of Public Transport)  
 URTP—Uniunea Română de Transport Public (Romanian  
 Union of Public Transport)  
 ZKM—Zarząd Komunikacji Miejskiej (Gdynia Urban  
 Transport Authority)  
 ZTM—Zarząd Transportu Miejskiego (Warsaw Transport  
 Authority)