

# Metropolis on the Move —Public Transport in Berlin

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## Introduction

As a result of the German unification on 3 October 1990, the federal government decided on 20 June 1991 to move the nation's capital from Bonn to Berlin. After nearly 8 years of comprehensive planning and preparations, Berlin is on the verge of becoming the new federal capital just in time for the new millennium. In the interim period, the opening up of eastern Europe has shifted Berlin from the edge of Europe to a more central position on the European axis, making the city a European communication and transport hub.

Berlin's skyline today is dominated by construction, and its new government functions and role at the heart of Europe mean that it requires an advanced transport system. Deutsche Bahn AG (DB AG) is investing about DM20 billion (DM1 = US\$ 0.55) in developing the region's ICE high-speed train network as well as the regional and suburban express trains (S-Bahn). DB AG is coordinating the planning and implementation of many building projects in Berlin, the largest and most spectacular of which is the construction of the 9-km north-south link with a 3.4-km quadruple-track tunnel under the inner city. This link will connect with the east-west main line at the new Lehrter Bahnhof to become a main junction on the European railway network in 2004. Lehrter Bahnhof will be located in Berlin's central Tiergarten district and will integrate urban rapid transit systems with suburban, regional, and long-distance railway traffic. When completed, the station is expected to handle 240,000 arrivals and 110,000 changes each day. Passengers arriving at the station will travel directly into the government, business, and cultural centres of this historic city.

## Berlin's Growing Capital Role

Berlin's growing role as federal capital will act as a magnet for even more activities, creating further demand for more frequent air connections to more destinations. In June 1996, it was decided to designate Schönefeld Airport as the future principal airport for Berlin. Before assuming this role in 2007, the airport will be expanded and renovated. A new north-south rail connection will provide a direct link between the city centre and the new airport on the periphery.

The expected increase in urban traffic will also place major burdens on the city's future public transport systems, not least because road capacity is restricted and needed for commercial transport.

## S-Bahn Suburban Railways

Berlin's suburban railway system (S-Bahn) is basically a loop line with radiating arms quite similar to that of Tokyo. The Berlin S-Bahn was built in the 1920s and 1930s and was being used by 2 million passengers daily in 1943. Reinstating the S-Bahn after the unification has been a massive undertaking. Today, most investment in the S-Bahn is in the form of reconstruction and modernization based on the pre-war network structure. Finally, the S-Bahn circle will be complete again. Reconstruction in the south finished in December 1997 and the north link between the Jungfernheide/Westhafen and Gesundbrunnen stations is expected to be finished in 2000. The old network, which was built in the first half of this century to match the city arrangement at that time, has been modernized to match the present-day arrangement. As a result, some stations have been given additional access according to new or changed relations. Some new stations have been built to serve new housing complexes in

the north-eastern suburbs.

Until recently, 50% of the S-Bahn rolling stock was built between 1927 and 1942, resulting in higher operating and maintenance costs. To solve these problems, 500 new double-cars were ordered and the first 100 are now in service.

## U-Bahn Subway System

Berlin's subway system (U-Bahn) is nearly 100-years old and carries the largest number of passengers in Berlin's public transport—about 440 million per year—due to its reliability, frequency, high capacity, and speed. It has been chosen as the transport mode serving the newly built government districts housing the Bundestag, and the offices of the German Chancellor and President. A new city line is under construction but financial restrictions have delayed its opening until 2004. One new station at Mendelssohn-Bartholdy Park was opened in October 1998 and the extension of Line 2 to Pankow is under construction.

From the tunnel viewpoint, the U-Bahn consists of two networks composed of two lines with narrow tunnel profiles and the rest with wide tunnel profiles. The carriage width in the narrow-profile tunnels is 2.30 m and power is drawn from a live overhead rail. The longest possible train is eight cars. To increase the capacity of the system, later wide-profile tunnels were built with a width of 7.1 m. The carriage width is 2.65 m and power is drawn from a live third rail. The longest possible train is six cars. For comparison, the body width of S-Bahn cars is 2.95-3.00 m.

The new Subway 2000 (H-series) trains serving both the wide- and narrow-profile tunnels of the Berlin U-Bahn are fully walkthrough, creating additional standing room and distributing passengers more evenly throughout the train. A low-floor design makes it decidedly easier to get

Figure 1 Berlin S-Bahn Suburban Rail Network

- suburban rail system
- extensions
- - - options
- · · subway
- 1 Hauptbahnhof
- 2 Alexanderplatz
- 3 Friedrichstraße
- 4 Lehrter Bahnhof
- 5 Zoologischer Garten
- 6 Charlottenburg
- 7 Westkreuz
- 8 Ostkreuz
- 9 Nordbahnhof
- 10 Potsdamer Platz

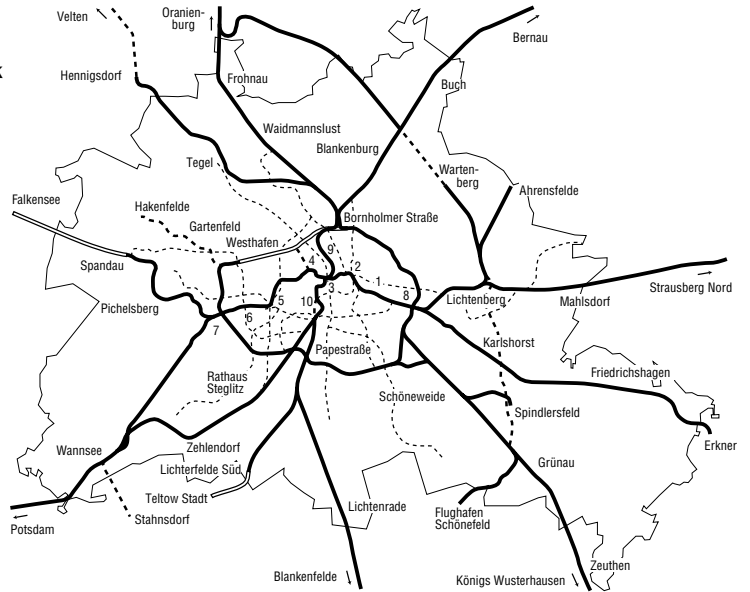


Figure 2 Berlin U-Bahn Subway Network

- subway
- extensions
- - - suburban rail system
- 1 Wittenbergplatz
- 2 Hermannstraße
- 3 Warschauer Straße
- 4 Lehrter Bahnhof
- 5 Zoologischer Garten
- 6 Uhlandstraße
- 7 Innsbrucker Platz

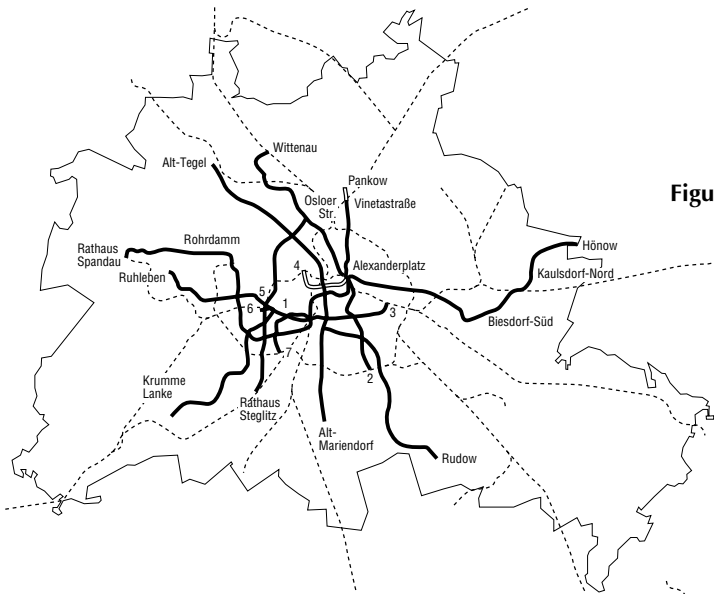
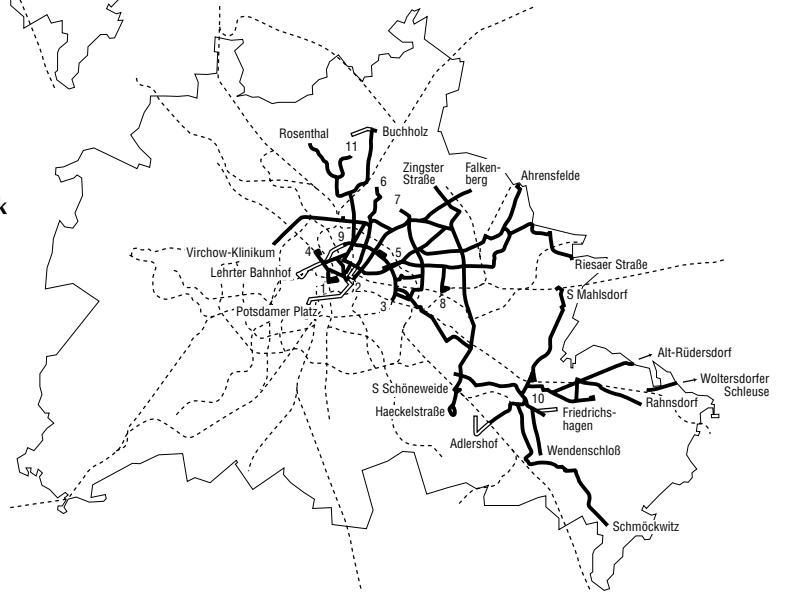


Figure 3 Berlin Tramway Network

- tramway
- extensions
- - - subway/suburban rail system
- 1 Am Kupfergraben
- 2 S+U Alexanderplatz
- 3 S+U Warschauer Straße
- 4 U Schwarzkopfstraße
- 5 Landsberger Allee
- 6 Heinersdorf
- 7 Pasedagplatz
- 8 S+U Lichtenberg/Gudrunstraße
- 9 Eberswalder Straße
- 10 Köpenick
- 11 Schillerstraße





Subway 2000 rolling stock (H-series)

(Author)



Latest 'big yellow' double-decker bus with low-platform technology and three doors

(Author)

on and off the trains, especially for wheelchair users. Side bench seating caters to the growing passenger traffic. The control system is also designed to permit fully automatic operation with or without operation personnel.

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## Tramways

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Tramways started operating in Berlin more than 130 years ago and the Berlin Horse-drawn Railway Company E. Besckow was already carrying 960,000 passengers in 1866. Former West Berlin closed its tramway system in 1967, and put emphasis on the subway for fulfilling transport duties. In contrast, former East Berlin retained and expanded its tramway network. In the eastern housing complexes, the trams carry large numbers of passengers approaching the densities of the U-Bahn lines. Since October 1997, one 5.4-km tram line now extends from the old network in the east to former West Berlin. The first priority is to modernize the old tram routes and stops, to match the railway systems as well as to renew the rolling stock. The tramway power supply systems are being expanded and

renewed in some cases. Planned tramway investments cover extensions to connect housing and commercial areas as well as to improve tramway development in the eastern part of the city centre. However, the massive necessary investment in the S-Bahn and U-Bahn has deferred addressing the imbalance in the city's trams.

The majority (60%) of the tram network runs on its own right of way and the remaining 40% shares its tracks with normal road traffic. As a result, the progress of trams is impeded by traffic jams, so a special programme is underway to adapt traffic signals for trams and to implement appropriate traffic separation regulations.

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## Buses

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Berlin's buses function as city-wide feeders for the other transport systems. The easy accessibility of buses and the short distances between stops offer special advantages for elderly people.

Since 1993, nine longer-distance routes with fewer intermediate stops are served by so-called ExpressBus services with

average route speeds of about 31 km/h. Early this century, Berlin was famous for its characteristic open-roof omnibuses, the predecessor of the double-decker omnibus. This tradition of visual identity continues today with Berlin's 'big yellow' double-decker buses. However, to improve efficiency, the metropolitan bus operator runs many different types of vehicles: articulated, single- and double-deckers, midibuses and minibuses. Many pleasant minibus services are offered in the late evening and night to housing complexes. At night on weekdays, the Berlin transport system depends mainly on buses. Sixty-one night buses and four tram lines offer services from midnight until the early morning hours at intervals of 30 minutes or less. On weekends, two U-Bahn lines operating at 15-minute intervals, and the main S-Bahn lines operating at 1-hour intervals form the backbone of public transport at night.

About 100 km of priority bus lanes have been designated mostly in crowded city street sections to improve average speeds and punctuality.

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## Improving Transport Systems

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The Berlin metropolitan government has decided that rail systems have priority in solving the city's transport needs, so future bus networks will be adjusted to feed new railway links.

### Barrier-free access

The standard of vehicles is an important factor in user acceptance. It is important to provide comfortable transport for people with different mobility requirements. New buses and trams are meeting the needs of disabled passengers by use of low-floor technologies and more flexible use of space. Not only do low floors provide better access for mobility-impaired passengers, they also speed passenger flows which leads to reduced journey times.

The new double-deckers carry a maximum of 90 passengers but possible conflict between passengers getting on and off are avoided by a second staircase in the rear of the bus.

All new subways and railway stations throughout the transport system offer barrier-free access to wheelchair users and people with other disabilities through use of lifts, etc. A financial support programme is also in place to retrofit existing stations with similar aids.

### Better public transport quality standards

The competition between automobiles and public transport has increased customers' awareness of quality aspects, such as punctuality, information, passenger-oriented services, cleanliness, and security. In many big cities around the world, public transport is perceived as dangerous, although the statistics show that it is not. However, passengers' subjective feelings about security govern their quality evaluation and acceptance of public transport modes.



Low-floor Berlin tram

(Author)

To counter these problems in Berlin, vandalism and personal safety issues have been tackled by using open spacious designs with tough materials and security systems for the buses, S-Bahn and U-Bahn. Federal and State police patrol the S-Bahn and U-Bahn stations and railway carriages. In January 1998, the Berlin Senate passed the '1998/99 Plan for Urban Public Transport' to set standards governing operating quality. The plan includes the goal of good-quality public transport matching the requirements of each customer group on the basis of their culture, occupation, travel purpose, etc. The plan is expected to be confirmed in January 2000.

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## Passenger Demand

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Berlin covers 889 km<sup>2</sup> and is home to 3.4 million people (3825 people/km<sup>2</sup>). Its polycentric structure of several urban areas with mixed housing, business, and leisure functions, as well as the long isolation of West Berlin from the surrounding country have resulted in shorter-than-average travel distances until very recently.

After the unification, Berlin is now surrounded by the Brandenburg Land (a German Land is a semi-autonomous regional government) with a sparsely populated countryside covering 29,500 km<sup>2</sup> with about 2.5 million inhabitants (86 people/km<sup>2</sup>)—the average figure for Germany is 225 people/km<sup>2</sup>.

In recent years, many housing and commercial projects have sprung up on the outskirts of Berlin, creating a so-called fat belt and resulting in more commuters. At present, 131,000 people commute daily into the city, while 64,000 commute out of the city to Brandenburg. Families with small children tend to live outside the city in their own homes, closer to nature with less traffic and noise pollution. Car ownership is increasing in the sprawling housing estates. Many households in the city itself consist only of one or two persons.

Every Berliner makes about three journeys each day, giving a daily total of around 10.2 million journeys of which 28% are on foot, 5% by bicycle, 40% by private car, and 27% on public transport. This totals some 1.2 billion passenger journeys annually on Berlin public transport. For

**Table 1 Berlin Public Transport**

	S-Bahn	U-Bahn	Trams	Buses
Length of network (km)	318	143	179	1,261
Number of stations/stops	167	169	359	2,706
Average distance between stations/stops (km)	1.90	0.85	0.45	0.40
Lines				
• Day	13	10	28	157
• Night	11*	2*	4	61
Length of lines (day) (km)	569	164	250	1,899
Maintenance depots	4	6	6	9
Passenger-km/year (million)	2,533	2,427	442	1,311

\* On weekends

**Table 2 Berlin Age Groups in 1998**

Under 6 years	4.9%
6 to under 14 years	9.2%
15 to under 19 years	5.4%
20 to under 44 years	39.6%
45 to under 64 years	27.1%
65 years or older	13.8%

comparison, German local transport as a whole carries 9 billion passengers per year.

### Changing Post-unification Travel Patterns

Travel patterns are changing greatly since the German unification, and a transport survey targeting about 80,000 people was completed in 1998 to assess the nature of the changes. The growing number of commuters has created an urgent need to reconstruct the S-Bahn tracks. Reconstruction increases the network speeds, which, in-turn draws more passengers from the buses, trams, and U-Bahn. The regional railways are also seeing

positive passenger trends since the network was revitalized after unification by upgrading lines, timetables, and quality. The east-west line through the city between Ostbahnhof and Zoologischer Garten was rebuilt in May 1998, allowing RegionalExpress (RE) trains to serve the Ostbahnhof. However, due to the line's limited capacity—it also serves main-line and international traffic—DB AG will build five more RE lines, two of which will connect Schönefeld Airport to Berlin.

### Competition with Automobiles

In 1990, 1.16 million automobiles were registered in Berlin. By 1998 the figure

had risen to 1.27 millions or 374 cars per 1000 inhabitants. This figure is still modest compared to other German cities—497 for Düsseldorf, and 427 for Dresden. The main reasons for the lower rate in Berlin are the good public transport network, the polycentric urban structure, and the many small households. On average, there are 699 cars per 1000 Berlin households. Some of the main aims of Germany transport research are to develop strategies for promoting public transport demand and to create attractive and efficient public transport for smaller numbers of passengers, such as better mobility in the suburbs, in the late evening and night, and at weekends.

### User Interface

An important topic in German public transport policy is to integrate the different transport systems. In Berlin today, 57% of passengers change lines or transport modes during a journey, so buses, trams, the U-Bahn and S-Bahn are all really different parts of the same transport 'product'. A comprehensive unified information and fare system, as well as convenient physical connections, greatly simplifies the difficulties of changing between lines or modes.

**Table 3 Growth of S-Bahn Passenger Levels**

	S-Bahn/passengers per year (million)
1991	171
1992	187
1993	232
1994	249
1995	245
1996	264
1997	264
1998	269

In Berlin, all rail transport operators use the same uniform fare system so there is no need to buy a new ticket when making changes. For fare simplicity, the city is divided into three fare-zones: A (inside the S-Bahn loop), B (outside the S-Bahn loop), and C (the belt outside the city). A marketing strategy using discounted 1-month and 1-year passes supports public transport by 'locking' customers into long-term use and cuts operating costs by reducing the numbers of ticket offices and sales staff. As a result, 85% of Berliners buy passes, which also save time queuing at ticket machines and when leaving the station because passes do not need to be shown. However, this leads to problems of fare dodgers. In the future, electronic ticketing and exit gates will probably be used to prevent this abuse. Another problem caused by joint ticketing is how to divide the revenues fairly between the three operators. Since each operator has different costs, division based only on passenger-km is unjust. A model based on a mix of counted passenger-rides and passenger-km could harmonize the differences between the Berlin transport companies. The ultimate aim is to establish a single ticketing system for the entire Brandenburg region, with Berlin at the centre.

### Changing Public Transport Organizations

German public transport is more under the influence of different government levels—federal, regional, and municipal. Three cities: Berlin, Hamburg and Bremen/Bremerhaven have a government status of both Land (region) and city, so they are responsible for both the municipal public transport—subways (U-Bahn), trams, and buses—and the regional suburban trains (S-Bahn). Before the German railway reforms, the S-Bahn was operated directly by German federal

**Table 4 Operator Train-km (million) in 1996/97**

Berliner Verkehrsbetriebe (BVG) – Subway, tram, bus –	260.30
S-Bahn Berlin GmbH – Suburban railway –	24.00
Deutsche Bahn AG (DB AG) – Regional railway (part Berlin) –	2.15 *

\* Reduced because of extensive constructions; increase of 93% expected from 1996/97 to 1998/99.

Railways (DB). When the railways of former East and West Germany were integrated and unified in 1994 as German Railways (DB AG), the company created a special unit to operate the S-Bahn. Responsibility for providing subsidies shifted from the federal to the regional governments. The federal government granted subsidies for transport duties to the regional governments by levying a federal tax on fuels. However, in some new projects, private investors take full responsibility for the financing. For example, two stations on the Berlin S-Bahn near new housing complexes were financed by the real-estate developers. Berlin tram and bus shelters are financed by income from advertising posters. In Germany, good public transport is seen as an important social and environmental requirement and politics has played a major role in service and fare levels. The German public expects frequent, extensive, fast, comfortable, and safe trains with low fares. As a result, German railways require high subsidies for investment and operations. The regional governments play an important role because they plan which services are to be retained and how they are to be provided. They also contract with DB AG or other existing independent operators to run the services. One serious problem is that ticket revenues often do not cover costs. Shortfalls are

covered by public subsidies. For example, the average shortfall in Berlin is about 50%. Better services and efficiency are seen as the answers. Fare hikes are not a solution because higher fares would reduce demand as customers transferred to private cars.

The transport operators also play a significant role. Today, Berlin has three transport companies: Berliner Verkehrsbetriebe (BVG), S-Bahn Berlin GmbH, and DB AG.

Berlin's subways, trams, and buses are all operated by BVG, which belongs to the regional government. In the future, BVG will be privatized and is discussing separation of infrastructure and operating divisions. Both BVG and DB AG own the infrastructure and rolling stock. S-Bahn Berlin GmbH is a new S-Bahn operating company formed by DB AG.

The public ownership of German transport is facing radical change. Market forces and reduced government involvement are pushing publicly owned companies towards privatization, which should make services more competitive. However, the market has yet to open up due to fears that entry of more operators will lead to severe competition.

As a solution, Germany has developed a model of transport consortia composed of regional and local governments, and transport operators. The government and

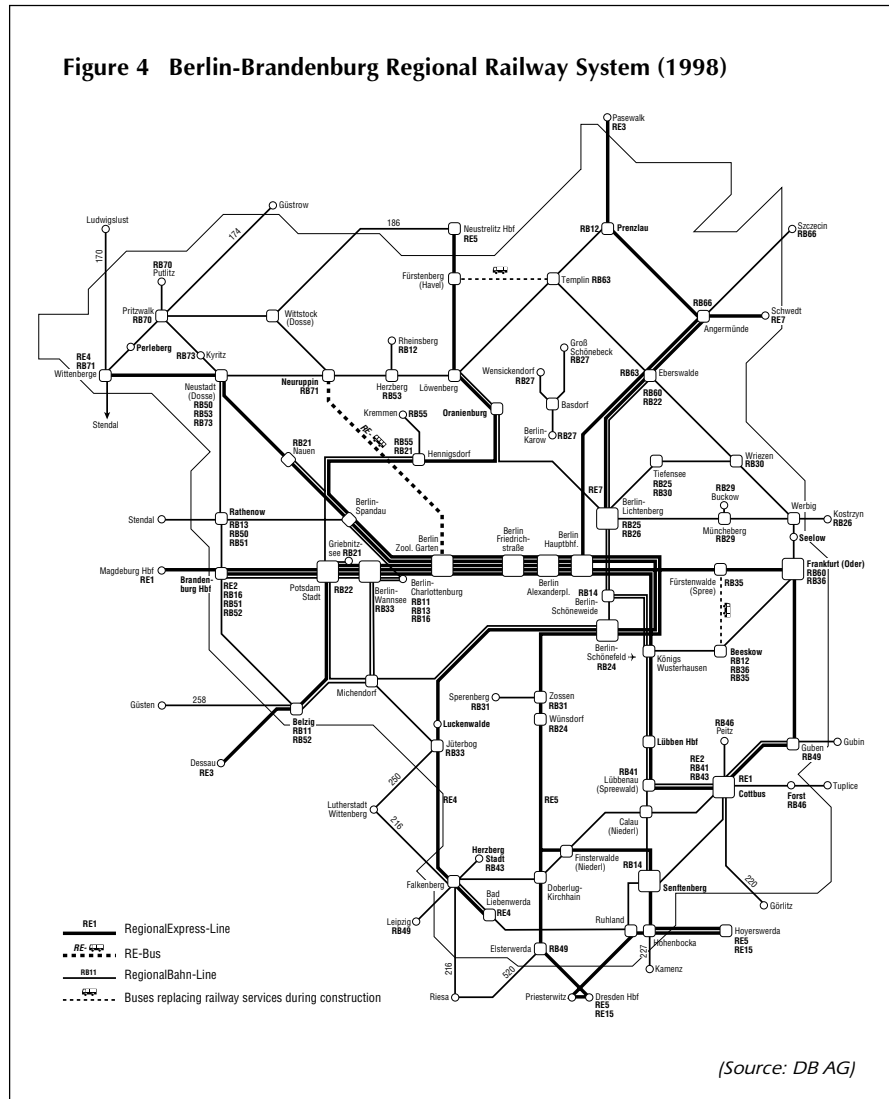
consortium agree on the service levels and the consortium contracts services with operators. The consortium is responsible for market development, timetables and fares. In this model, the government retains some influence over public transport and it is hoped that this will prevent excessively severe competition. A new consortium with responsibility for coordinating public transport in the Berlin-Brandenburg region was established on 1 January 1997.

The experience of Tokyo where both JR East and many private transport operators provide integrated services may offer an alternative model to the German cities. Similarly, the wide business diversification of railway companies in Japan could be a model for better profitability, reducing the overall need for transport subsidies in Germany.

## Conclusion

Berlin faces great challenges and opportunities at the start of the next century. It is Germany's new federal capital located at the heart of an ever-expanding Europe and will require a modern transport infrastructure matching its new status. Customer-oriented services that attract large numbers of passengers are the key to commercial success in an increasingly competitive European transport market.

Figure 4 Berlin-Brandenburg Regional Railway System (1998)



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