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Mikhail Blinkin
Elena Koncheva *Editors*

Transport Systems of Russian Cities

Ongoing Transformations

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Contents

Introduction

This book is a collaborative effort from a team of authors, most of whom work at the Institute of Transport Economics and Transport Policy, a research center organized in 2011 as part of the National Research University "Higher School of Economics" (HSE).

The research fields of our institute include problems of operation and development of all transport modes and sectors. However, our primary field of research consists of urban transport issues. My own long-term scientific and sociopolitical interests have largely determined this priority. I have published many papers, scientific and journalistic, devoted to "city–car–public transport" issues since the 1970s.

I found one of them mentioned a few years ago in "The New Yorker" magazine. The journalist introduced me to his readers with high praise: "Mikhail Blinkin, the author of a legendary paper titled "The Etiology and Pathogenesis of Moscow Traffic Jam" (Gessen 2010). It is not for me to say whether the aforementioned article has really become legendary, but it has certainly played a constructive role judging by the paradigm shift in Moscow transport policy in recent years.

I should also add that many of my employees, the authors of the various chapters of this book, are actively involved in professional and public discussions that arise around the transport problems in Moscow and in other major Russian cities. Furthermore, they also participate to some extent in the decision-making processes in the field of urban transport policy all over the country.

Our interest in urban transport issues can also be explained by the close cooperation of our institute with the UITP,[1] the secretary-general of which, Alain Flausch, has become an honorary doctor of the HSE on our initiative.

Moreover, in addition to research, consulting, and project activities, our institute curates a master's program "Urban Transportation Planning" at the Vysokovsky Graduate School of Urbanism—one of the educational sections of the HSE.

[1]International Association of Public Transport.

HSE has traditionally been a university open to broad international dialogue. Thus, the previously mentioned master's program, as well as the work of our institute, constantly involves foreign colleagues, not to mention undergraduate and graduate students from foreign universities, who regularly come for internships to the Graduate School of Urbanism.

The idea of this book was largely dictated precisely by our experiences while communicating with our foreign colleagues—scientists and planners, and students and graduate students from all over the world.

Based on the results of this discussion, we have somewhat revised our own ideas about the world's best transport policies. At the same time, we were surprised to find out that even those of our colleagues, who have repeatedly visited modern Russia and the former USSR, have very incomplete (and even distorted!) ideas about the transport systems and problems encountered by Russian cities. Furthermore, we frequently found them to be confused about the fundamental differences between these issues and the issues faced by cities in the Western world.

In particular, many of them continue to believe in the myths of the great virtues of Soviet public transport, which was supposedly destroyed because of "haphazard and hurried privatization of the 1990s."

Some of our foreign guests have passionately recommended that we borrow solutions from current European practice (e.g., the creation of bicycle lanes), without understanding the unique planning specifics of Russian cities. They also fail to comprehend the behavior of Russian drivers, who, unlike their European counterparts, represent the first generation of Russian citizens to be able to drive.

However, the most curious thing we found out was that our foreign colleagues were often in the position of the character of a Moliere comedy, who did not know that he had been speaking in prose his whole life.[2] Here is a typical example.

I was driving down the Garden Ring with my American friend, a respected international expert in the field of urban and transportation planning, and I told him that Moscow, unlike US cities, had a one-level street and road network.

"I don't understand what you're saying," my friend interrupted me.

"I mean," I answered my guest, "that since the Robert Moses era streets (streets, avenues, arterials) in your cities belong to one level, and roads (freeways, expressways) belong to a different one. You do not have combinations. If it's a street, then it's not a road, and if it's a road, then it's not a street."

"Can it be any other way?" my colleague answered, puzzled.

After such conversations, you begin to remember how you unwittingly tried many years ago to fit the strikingly different workings of the transport systems of foreign cities, which you had seen since the fall of the Iron Curtain, into the Procrustean bed of your own Soviet experience. Unfortunately, each of us is an involuntary hostage of our past experiences…

[2]Monsieur Jourdain: "Par ma foi! Il y a plus de quarante ans que je dis de la prose sans que j'en susse rien."

As a result, we became more and more confident in the usefulness of this text, addressed to foreign colleagues, which contains systematic and professionally presented information on how transport systems in Russian cities are constructed, how these systems have changed over the last 100 years, and how they were planned and operated during different epochs…

I will mention a few typical cases, which we believe to be especially important when dealing with foreign readers.

The Soviet system of development and land use, the Soviet-style development model, initially focused entirely on public transport. This system may seem similar to transit-oriented development (TOD) to our foreign colleagues; however, there are vast differences between these models (described in detail in the book).

The "clash of cities and cars" has been discussed by urbanists on both sides of the Atlantic for many years. We would like to add to the international pool of knowledge on the subject a very interesting case in which all the key planning and transportation norms are fundamentally different from those faced by our foreign colleagues.

I will begin my explanation of our situation by stating the fact that the severity of this "clash" depends, primarily, on the interaction between three parameters:

- population density (in the built-up area),
- share of built-up area in streets and roads (ε),
- motorization level.

The first two parameters have been shaped in Russian cities by the Soviet system of development and land use. Population density (d) in Russian cities is as high as in cities of the Asian type: 60–80 residents per hectare or more. The share of built-up area in streets and roads, on the other hand, is extremely low, less than 0.1. Let me remind you for comparison that in North American cities, the parameter ε usually equals 0.3–0.35, and even in the "compact" cities of Western Europe, it is about 0.2–0.25.

The third parameter, motorization level (m), was artificially capped at a maximum of 60 cars per 1000 inhabitants until 1990, and in the next 25 years, it increased exponentially to 300–400 or more cars per 1000 inhabitants. The number of square meters of asphalt per car is therefore extremely low compared to foreign cities. Currently, the motorization rate in Moscow is rather high (more than 400 cars per 1000 inhabitants), while the share of trips by public transport is more than 80 %.

Let us now turn to a standard criterion for any transport planner: total vehicle kilometers of travel (VKT). Applying it to Russian planning norms, we find that given an equal Euclidean distance, network distance is always larger for a Russian citizen than for his counterpart in North America or Western Europe.

The explanation for this phenomenon is that street and road network connectivity has traditionally been very low in Russian cities. This is due to many things, including the deficit of bridges over rivers and overpasses over railways, as well as the goal of old Soviet planning to be able to block exit from any residential area with "one armored personnel carrier."

Accordingly, the rerun coefficient (average value of network distance to Euclidean distance ratio, ς) in Russian cities is extremely high. This ratio is equal to $4/\pi$ ($\approx$1.27) for the perfect "Manhattan Grid" (1) and rarely exceeds 1.2–1.25 (Newell 1980) for well-designed foreign cities. In Moscow, unfortunately, $\varsigma \approx 1.7$[3]; so the amount of "extra" mileage is always at least 40 %.

$$\zeta = \iint \frac{|x| + |y|}{\sqrt{x^2 + y^2}} \mathrm{d}s \tag{1}$$

Let us return to the above-mentioned problem of stratification of the road network: the functional division of roads and streets. The value of such stratification is best revealed by employing the classic "two-fluid model" devised by Herman and Prigogine (1979). More precisely, this can be seen through the examination of the parameter n of this model, treated as an "indicator of the quality of traffic service in the network."

Williams J.C. notes in an article that "field studies have shown that n varies from 0.8 to 3.0, with a smaller value typically indicating better operating conditions in the network. In other words, n is a measure of the resistance of the network to degraded operation with increased demand. Higher values of n indicate networks that degrade faster as demand increases" (Williams 1997).

A lengthy digression was required for us to observe the most interesting feature of Moscow's road network. The "indicator of the quality of traffic service," n, is equal to 1.25 for high-density ($\varepsilon = 0.28$!) street networks in the center of the capital, but is several times higher (2.62 and 3.62, respectively) for the key Moscow highways—the Third Ring Road and the Moscow Ring Road, which are typical examples of Moscow's hybridization of streets and freeways.

These figures demonstrate the sad fact that Moscow's key multilane highways, which were constructed to match the parameters of an urban freeway while preserving the functions of urban streets (such as not being separated from developed areas), "degrade faster as demand increases" compared to ordinary urban streets.

The consequences arising from all these very unusual combinations of key planning and transport parameters are the subject of detailed analysis in many chapters of this book.

Let me draw your attention to another case. Formal institutions of transport systems management in Russian cities have passed through real "roller coasters" since 1991:

- from the total centralization and directive planning, characteristic of the Soviet period, to almost complete "laissez-faire" approach, observed in the 1990s;
- later, in the 2010s—a return of many central legislative and enforcement requirements, with neither ideological nor financial security.

[3]The assessment is based on the processing of more than 1 million tracks of mobile phones of Moscow car owners, conducted in 2015 by the Big Data research group at HSE under the direction of Andrei Zhulin.

In the majority of Russian cities, the major role in the public transport sector is played by paratransit, specifically jitneys, which are typical of Third World countries. Very few cities in Russia, such as Moscow and Kazan, have succeeded to some extent in getting rid of this archaic transport. In many other cities, local authorities balance the need to support the remaining Soviet public transport networks that completely duplicate their paratransit networks and confronting car owners and their demands to widen and build new roads. A number of Russian cities simply lack proper understanding of the essence of the problem and how to solve it.

We also believe that the implementation in Russian practice of road pricing and demand management ideas had some interesting consequences that could be useful to our international colleagues with respect to the planning and operation of urban transport systems. It appears that the collective subconscious of Russian citizens is governed by a few simple ideas of free riding and paternalism. In particular, the belief is that the city government can and must solve all of the city's transport problems with its limited budget, providing car owners with roads and parking lots, and other residents with high-quality public transport.

At the same time, standard road pricing and demand management measures are unpopular,[4] and willingness to pay for paid parking and toll roads (and, especially, for the paid entrance to some areas) is not shown even by the owners of cars such as the Bentley or the Porsche Cayenne.

Recently, in an international forum, I happened to discuss this problem with Kenneth Livingston, the former mayor of London, and the creator of the congestion charge zone (CCZ). Ken pessimistically noted that British car owners were not very happy about the introduction of the London congestion charge. However, after learning that most Muscovites do not need to pay for the residential storage of a car and that until 2013 parking was free even in the capital's "golden mile," and he agreed that Moscow's case would be harder to resolve than London's.

Let us add to all this the characteristics of the behavior of Russian drivers. The majority of Russian car owners are car owners of the first generation, that is, young or middle-aged people whose parents did not have (and could not have!) their own car. Two serious problems result from this circumstance for transport planners.

Firstly, Russian citizens are extremely sensitive to the standard and necessary steps the city's authorities take, such as increasing the cost of car ownership, reducing the attractiveness of everyday car trips, and redistributing roadway traffic into public transit systems.

Secondly, and perhaps most importantly, the prevalence of first-generation car owners (as well as poor road conditions and institutional defects common in Russia) results in abnormally high accident rates. Russia (along with China, India, Brazil, Cambodia, Egypt, Kenya, Mexico, Turkey, and Vietnam) is included in the group of "Risky States – 10": the ten countries with the highest level of transport-related risks (annual road fatalities per 10,000 vehicles). These 10 countries account for

[4]For example, the practice of canceling already entered dedicated lanes for buses in some cities.

more than half of the total number of road fatalities in the world. The indicator of transport risks in Russia is about five units, which is approximately 10 times (sic!) higher than in Western Europe. Therefore, the Russian transport planner is obliged to be very careful when implementing standard Western European measures in the field of pedestrian and bicycle infrastructure.

All these and many other related subjects are disclosed in great detail in the various chapters of this book. Due attention is also paid to the history and current practice of urban transport planning, the Russian experience of applying sociological methods to study the transport behavior of citizens, analysis of the state of municipal and private segments of public transport, and much more.

I hope that the book will be quite helpful to foreign colleagues from the sphere of urban and transportation planning, willing to expand their understanding of the specific nature and possible scenarios for the development of urban transport systems.

Mikhail Blinkin

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Chapter 1
Transport Planning and Transport Modeling

Alexander Kulakov and Konstantin Trofimenko

Abstract This chapter focuses on the evolution of transport planning in Russia during the 20th century. Since transport planning is a socio-economic practice, it is not surprising that it has been drastically influenced by the ideologies that succeeded each other in Russia during the period. On the other hand, the evolution of transport planning also took place due to technical progress and change of the traditional paradigm of urban mobility. From this point of view, this chapter will be of interest not only for specialists in transportation studies, but also for researchers in the field of interconnection of humanitarian and technical sciences. In addition, the chapter covers and evaluates formal documents of transport planning adopted in Russia, as well as the history of the use of transport models.

1.1 Russian Transport Planning in the 20th Century: Historical Practices and Current Consequences

Historically, the practice of transport planning (and of urban planning in general) in Russia has mostly been a reflection of the socio-economic processes happening in the country during the 20th century.

Before World War I, urban planning norms were determined by The Construction Charter of the Russian Empire, the last edition of which dates back to 1912.

The sixth section of the Charter "On the construction of cities and on urban buildings and facilities" contained, in particular, a rule that "the city is built in accordance with plans approved with respect to the established order". At the same time, the Charter contained quite liberal regulations of the free land market. Article 178 of the Charter stated that; "urban inhabitants", i.e. the owners of "vast" land

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parcels, had the right to sell their parcels entirely or partially, without any restrictions, except for "caution in case of fire".

The Charter also contained fairly reasonable standards for planning the proportions of the built-up area of the city and the parameters of urban streets.

Russian transport planners—well educated urban engineers and thinkers—attentively studied the best foreign practices. A good example of this is the monograph on urban railways by the engineer Girshon, published in St. Petersburg in 1900 and containing a detailed analysis of urban transport systems in the industrialized world.

At the end of the nineteenth century, these urban engineers, together with the representatives of the educated classes, believed the mass appearance of cars on roads to be inevitable and desirable. Thus, in September 1896 the Russian Minister of Railways M. Khilkov[1] signed a letter "On procedure and conditions of transport of goods and passengers in self-propelled carriages on the roads of the department of communications", which became one of the first governing documents in the history of world motorization. It is necessary to pay tribute to the wisdom of the minister, because "self-propelled carriage" used to be a technical exotic like the lunar rover is today. In fact, even the word "automobile" didn't exist in the Russian language (Goltz 2005) back then.

The first fruits of the national automotive industry—the first "road-vehicle-factories"—appeared at the turn of the XIX century. In the Imperial Russian Technical Society, as well as in the merchant clubs of both capitals, the prospects of mass motorization in conjunction with the creation of a network of highways were actively discussed. These discussions were quite substantive. In 1913, a group of the most influential businessmen in Russia came together to begin the formation of a "large scale" automotive industry in accordance with "Ford's model" in Russia. In 1914 the Road Fund was established as a fiscal institution charged with target financing of the road network development. This event occurred more than forty years before of the creation of the famous and extremely efficient US analogue—"The Highway Trust Fund".

[1]Prince Mikhail Khilkov (1834–1909) is a legendary figure in transport history. Here is a brief summary of his life and achievements. He was a graduate of the St. Petersburg Corps of Pages (1853), and later an officer in the Life Guards (1853–1859). He later worked as a railway lumberjack, stoker, machinist, chief of service of rolling stock and traction at the Transcontinental Railroad in the US (1864–1871), mechanic at the Liverpool locomotive repair plant (1872–1873). Then, he became minister of public works, communications, commerce and agriculture in Bulgaria (1882–1885). He was later the head of a number of Russian railways, and the organizer of railway construction in various parts of the country, including Siberia and Turkestan. Finally, in 1895 he became the minister of communications of the Russian Empire, a post he held until 1905. Khilkov was an outstanding theorist and practitioner of construction and operation of railways, concession agreements and tariff policy. The educator and reformer-Westerner was also a passionate motorist—he participated in the first Russian automobile races, including the automobile race on the Black Sea coastal highway (1903). He was also the initiator of the opening of the first urban and suburban bus routes in Russia.

The business, scientific and technical elite in Russia came to a consensus about the need to adapt the theory and practice of urban planning to the realities of high motorization and business in the future. A number of serious publications reflect this consensus, in particular, the monograph by Professor Dubelir (1910), in which the trend of "increasing intensity of the traffic of carriages and, in particular, of automobiles" is accepted as the most important urban development fact that must be taken into account in urban planning. Based on his observations of this trend, G. Dubelir gave the very reasonable recommendation of changing parameter ε—the share of land used for streets and roads in the built-up areas of the city, which will be further discussed in Chap. 2—from 0.2 to 0.4 depending on the planning parameters.

Here we should pay attention to the fundamentally different interpretations of the concepts of "urban planning" and "urban planner", which have been used in Russia during the last 100 years (Table 1.1).

In the pre-Soviet era, the norms in accordance with which the city had to be built were developed by urban engineers, called "gradoustroitel", as was required by The Construction Charter of the Russian Empire. The literal translation of the term is "an engineer working to improve a city". Urban engineers engaged in this profession, who knew foreign languages (as was customary at the time), called themselves "stadtplaners" or "urban planners".

The Soviet era witnessed the appearance of the term "gradostroitel", which literally means "a city builder", but officially has had the same translation ("urban planner"), both during the Soviet era and today.

The essence of the difference was studied in depth by the famous Russian urbanist Professor Glazychev (2011).

> "The term "gradostroitelstvo"", says Glazychev, "has no direct analogue in the world dictionary, it comes from the absolutist tradition dating back to the Assyrian king Sennacherib. It is a symbolic reflection of the phenomenon of a ruler building something new on an empty space or on a space that the ruler perceives as empty".

Let us add a poetic reference for clarity:

> Here a new city shall be wrought,
>
> Defiance to the haughty neighbor.[2]

It is clear that the ruler who decides to build a city—the only stakeholder and the decision maker in the situation—does not take into account anyone else's interests or coordinate his or her decisions with anybody.

"Gradoustroistvo" (urban planning), according to Glazychev, in contrast to the "gradostroitelstvo" "involves the formation of a framework in which the development of the city takes place when a lot of players are involved, including stakeholders willing to implement various solutions".

[2]Pushkin (1993) The Bronze Horseman. Translated by Walter Arndt.

Table 1.1 Urban planning concepts in Russia

Field		Profession	
Transliteration	Literal translation	Transliteration	Literal translation
Gradoustroistvo	Improvement of a city	Gradoustroitel	An engineer working to improve a city
Gradostroitelstvo	Construction of a city	Gradostroitel	A city builder

Source Created by author based on Glazychev (2011)

A historical essay (Zhukov et al. 2008) notes that Russian urban engineers have formed a "planning framework within which the activities of the private developers have not come into conflict with the rights of the owners of the "old" property, as well as the interests of the urban community as a whole". It is easy to see that this definition is almost identical to the contemporary definition of urban planning.

On the eve of the October Revolution, leading Russian engineers used this concept because of their good education and knowledge of the latest world practices. In the early years of Bolshevik rule (before the 1930s) issues of urban planning and development in the USSR were still dealt by urban and provincial engineers (Bocharov 2003).

Many young intellectuals (of left wing views) believed in the possibility of combining socialism with the ideas of rational and humanistic urban planning and, accordingly, continued their "seditious" research until the mid-1930s. Zilbertal[3] and Sheleyhovskiy[4] were among the most prominent representatives of this generation.

Zilbertal noted (Zilbertal 1932, 1937) that "… the issues of movement (judging by the context of the phrase, it is about transport planning) are not a purely mathematical problem, and really depend on the extent to which people value their time and convenience".

Sheleyhovskiy (1946), who worked in the Soviet design office, believed that cities are designed for people who are free to choose their place of residence and mode of transport "…unlike the inhabitants of a zoo". He insisted on the need for

[3]Abram Zilbertal (1890–1942) was an outstanding Russian engineer and scientist in the field of urban transport, settlement patterns and transport behavior of citizens. In the 1930s he was the chief engineer of the Leningrad tramway trust. His monographs (Zilbertal 1932, 1937) are cited in this chapter. These books, which have never been reprinted and have long become a bibliographic rarity, have remained relevant in modern times.

[4]Georgy Sheleyhovskiy (1892–1946) was an outstanding Russian engineer and scientist in the field of urban studies, settlement patterns, transport systems and urban ecology. His book (Sheleyhovskiy 1946), cited in this chapter, was banned from publication. Sheleyhovskiy was urged to stop writing on similar topics in order to avoid serious consequences. Copies of Sheleyhovskiy's manuscripts have been preserved by his students and colleagues. During the thaw of the 1960s, copies of these copies were distributed as "*samizdat*" (self-published) texts. The electronic version of the book, prepared in 2008 by the initiative and under the editorship of S. Vaksman is available online at http://waksman.ru/Russian/Vehi/shel/p.htm.

"…the synthesis of at least four essential planning categories—settlement pattern, transport, street network and the form of the city plan". Here are two of his quotes:

> …what consequences arise for the residents of a city in which the free or natural settlement pattern is violated? The answer is simple: the majority of the residents of the city will be uncomfortable;
>
> …we will not make any hypotheses about the pace of motorization in our cities … streets should be designed to accommodate for demand in 50 years. When dealing with such time periods we have no reason to impose any restrictions on the car as a transport mode. When designing a city, we must check its highways in terms of their ability to let through maximum possible traffic flow …. Let us define the maximum scope of what we can expect in the future to 1 car per household….

By the 1930s the Soviet Union had developed a rather effective transport planning methodology, which included studying population mobility and travel distance, surveying passengers on different transport modes, searching for ways to increase capacity of individual links and nodes of the transport system, and evaluating the various options from an economic point of view. There was also a search for patterns in transport demand in urban areas, as well as a mathematical apparatus to model them (Figs. 1.1, 1.2, 1.3 and 1.4).

It is important to note that early Soviet researchers were very well versed in the statistics of urban transport systems and the practice of transport planning in Western countries.

However, the westernized views of Russian urban engineers did not fit into the new Soviet reality.

The Soviet government did not make its decision about cities, roads and cars immediately, but when it did, it did so firmly and permanently. The date and circumstances of the adoption of these historic decisions is well-known: June 1931, the resolution of the plenum of the Central Committee on the report of L. Kaganovich on municipal services in Moscow.

The party strongly condemned the "bourgeois theory of urban planning" in its entirety. Academic M. Bocharov has compared this decision with the way the Soviet Union's later dealt with the sphere of genetics and cybernetics. Participants on both sides of the hot theoretical debate over "socialist cities" and the "socialist settlement pattern" were all repressed together. The very best urban engineers (in particular, S. Shestakov—the head of "Large Moscow" project) were repressed in the same way as people who barely merited the title "urbanist" (L. Sabsovich) and "unurbanists" (L. Ohitovich).

Some urban engineers, including P. Balinskiy, the most famous of that generation, managed to emigrate long before the described events took place.[5] A couple

[5]Pyotr Balinskiy (1861–1925)—graduate of the St. Petersburg Institute of Civil Engineers, the author of subway projects in St. Petersburg (1901) and Moscow (1902). The developer of the scheme of high-speed railways in both capitals, integrated with the mainline railway network. Balinskiy emigrated from Russia in 1920, and died in Paris 5 years later.

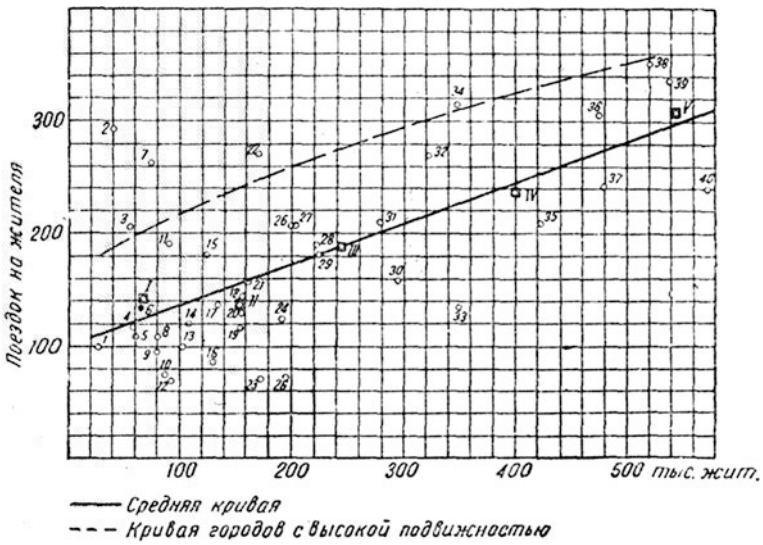

Fig. 1.1 Data on mobility in cities of the former USSR [*Source* Zilbertal (1937)]

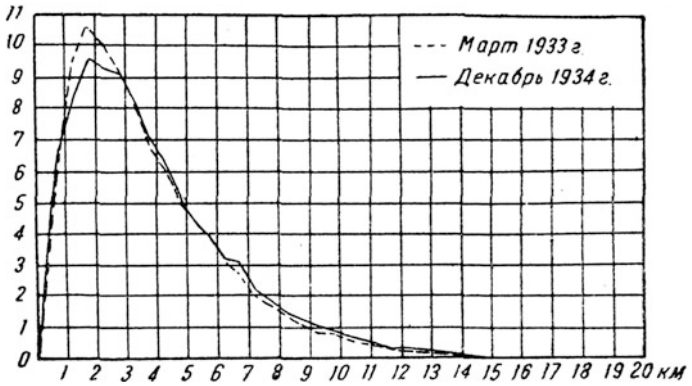

Fig. 1.2 Data on the distribution of passengers by trip length in Leningrad tramway [*Source* Zilbertal (1937)]

of them, such as professor Dubelir, managed to switch to purely engineering subjects just in time.

The bourgeois-liberal term "urban development" was replaced by "planned management of municipal services" and Soviet urban development, the main target of which was "propaganda to show the monumental achievements of the Soviet regime".

The "time and convenience" of the population (as well as their quality of life in general) was viewed as completely irrelevant, and was covered up with banal

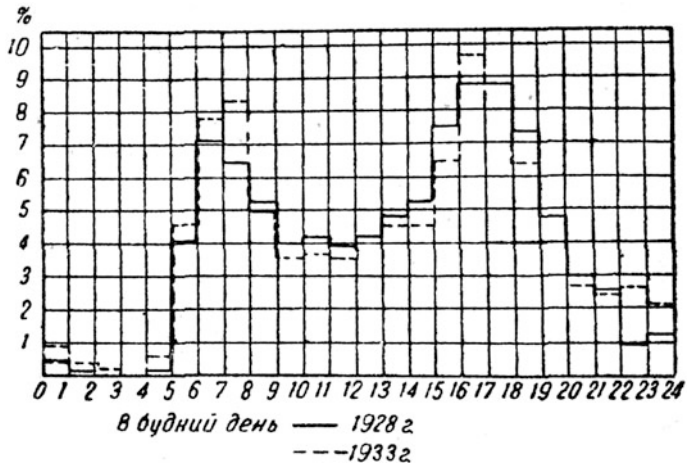

Fig. 1.3 Data on the distribution of passengers by hour in Berlin tramway [*Source* Zilbertal (1937)]

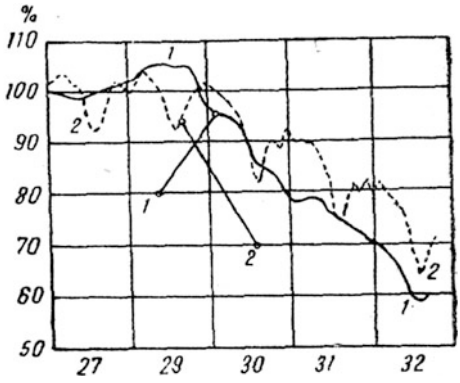

Fig. 1.4 Index of the relationship between the mobility level and the level of unemployment in the US [*Source* Zilbertal (1937)]

populism that used terms such as "model city" and "the growth of capital of the socialist type" to justify itself. The chief architect of the city was accountable to the Soviet authorities not for the quality of the "environment of the urbanized municipalities and local communities", but rather by achievements in the field of large-scale propaganda. The fact that architects, who replaced urban planners, were by definition not as skilled at planning calculations and mathematical formulas, was not a drawback, but instead, remarkably, turned into an advantage. Pictures, and not calculations fully met the Bolsheviks' interpretation of the idea of "… architectural design of the city, giving it proper beauty" (Kaganovich quote by Medvedev 2005).

Under these conditions it was quite natural that the "*basis for planning decisions was founded to accommodate processions and workers' demonstrations in front of tribunes of the authorities (everywhere) and military parades—in capitals*"

(Glazychev 2008). The newly created industrial cities, according to same author, were dominated by "*the appearance of super-large villages near the factories*".

Thus, concepts of "*gradoustroystvo*" and "*gradostroitelstvo*", synonymous to the casual observer, are in fact polar opposites.

Traditional "*gradoustroystvo*" (urban planning), both as a science and a practice, initially focused on the coordination of multiple (often conflicting) interests of owners of real estates and vehicles, private developers and, most importantly, the urban community as a whole.

Soviet architectural "*gradostroitelstvo*" concerned itself with state propaganda, focusing on military needs and communal concentration of manpower in certain geographic locations, with the specific tasks of "socialist construction".

General plans for Moscow and Leningrad, developed in the early 1930s (Fig. 1.5), became milestones in the history of Soviet transport planning. On the one hand, an official format for documents regulating transport planning issues—the transport section of the General plan—appeared for the first time. On the other hand, transportation planning (as well as urban planning in general) was declared to be purely secondary in favor of architectural and planning activities aimed, as already noted, to display the "monumental achievements of the Soviet regime".

Similar processes took place in the field of roads and vehicles. It is clear that this area is tied to the military needs of the state from top to bottom in every country; a typical example is the "National System of Interstate and Defense Highways" in the USA. However, in the traditional liberal paradigm roads and cars are, first and foremost, tools for freedom of choice and transport self-sufficiency of a household, time saving and increment of citizen's facilities. These critical aspects were considered purely harmful by the Soviet ideology.

In 1935 a division of the People's Commissariat of Internal Affairs of the USSR (GUSHOSDOR NKVD) was established, and was put in charge of highways. In 1936, traffic police, which was in charge of registration of vehicles, control of their use, "the regulation of traffic" and "education of drivers" was merged with the NKVD. One of the aforementioned Soviet institutions existed until 1953; the second one still operates.

Just as all other unauthorized manifestations of social or economic activity, transport self-sufficiency was seen as unwanted by communist leaders. It is no coincidence that construction under socialist rule began with a slogan typical of the Soviet mindset "take the horses away!".

Surveys of the real foreign transport planning experience were replaced by the same banal demagogy: "While in capitalist countries different modes of transport—tram, bus, subway—compete with one another, here, in a socialist economy, these transport modes will not compete among themselves. Instead, they will complement each other and give us transportation efficiency unprecedented anywhere in the world and impossible anywhere else".[6]

[6]The report of L. Kaganovich on the June session of Central Committee of the Communist Party of the Soviet Union in 1931.

Fig. 1.5 "Stalin's" general plan of Moscow (1935) became the standard in Soviet urban planning documentation for years ahead

Soviet transport planning in the middle of the 20th century was roughly in the same predicament as other applied disciplines. This point was very accurately reflected in a novel by classics of Soviet scientific fiction, the Strugatskiy brothers, describing life on a habitable planet, lost in deep space. State ideology there required considering the home planet a concave hollow world; however, for secret artillery calculations the military was allowed to take into account the true curvature of the surface.

Let us turn to the already mentioned parameter ε—the share of land used for streets and roads in the built-up areas of the city. In world practice, this parameter was initially oriented towards a high level of motorization, which, as already noted, contradicted the Soviet ideology. The motorization at the time was less than 60 cars per 1000 inhabitants and was planned to reach 180 cars per 1000 inhabitants "after

the construction of communism". The plan relied mostly on public transport, thus there was no need to keep this parameter at a high level. However, according to the recommendations of the Academy of Architecture of the USSR (Levchenko 1947) referred to in Chap. 2, "the percentage of the territory occupied by streets" had to be changed from 15 % (in small towns) to 25 % of the total residential area.

Notice that $\varepsilon \approx 0.25$ is a typical figure adopted in the design practice of Western European cities, where administrative restrictions on the ownership and use of private cars did not exist. So, accounting for the "the true curvature of the surface" was not forbidden for experts from the Academy of Architecture of the USSR.

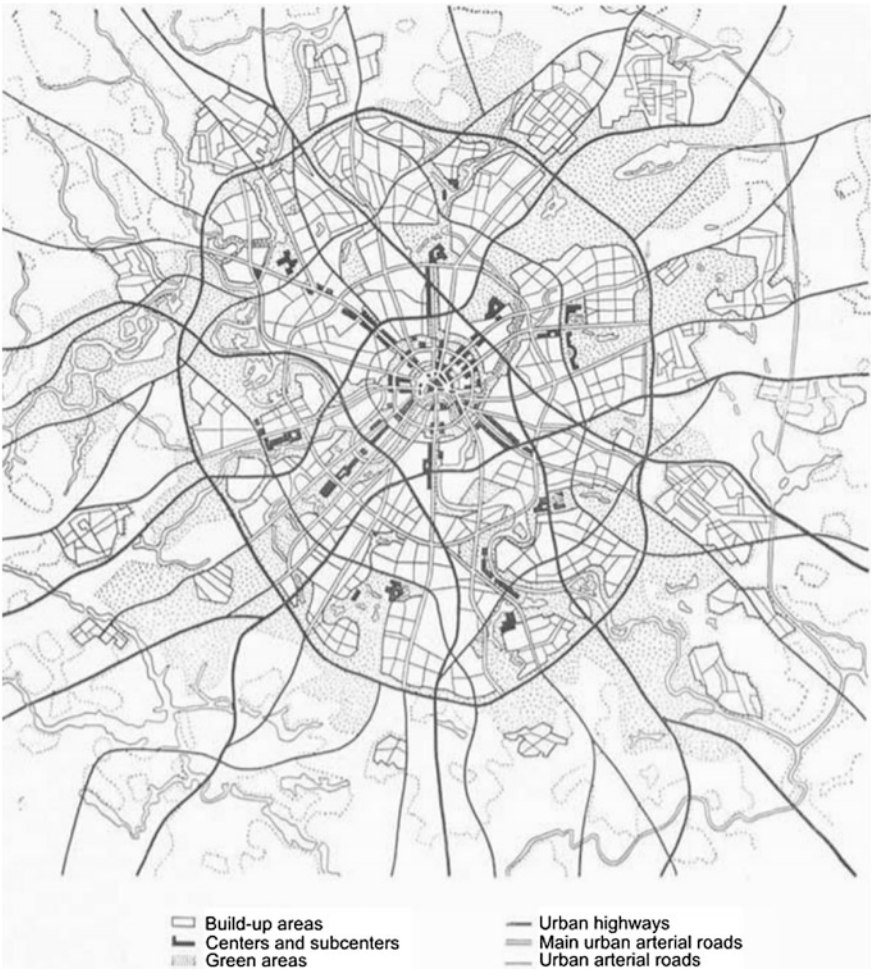

Fig.1.6 General plan of Moscow, 1971—a document, that has not lost its relevance to this day. In many cities of the Russian Federation large-scale solutions in the field of transport planning are blindly copied from documents (such as this one) developed in 1970s. In some cases this even turns out to be beneficial to the cities in question

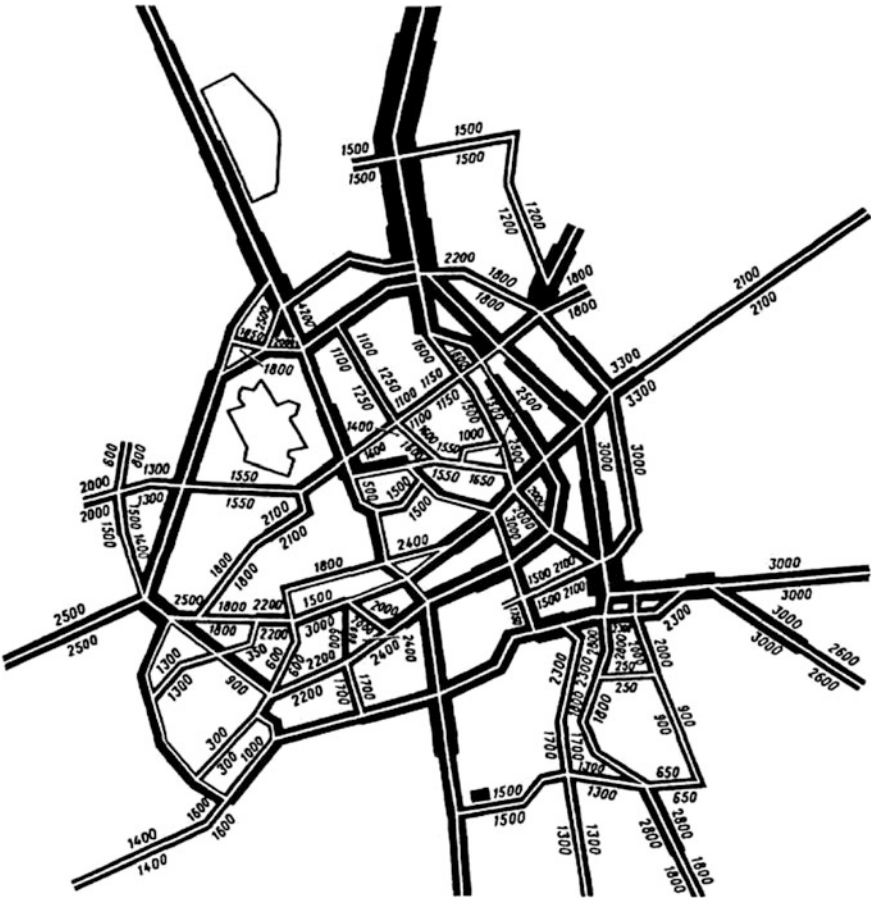

Fig. 1.7 The cartogram of the average daily traffic flow in the city [Source Klinkovshteyn (1975)]

The most prosperous phase of Soviet transport planning took place from 1960–1980 (Fig. 1.6), that is, at a time when ideological pressure became less pervasive. Soviet planners could therefore use foreign experience and foreign scientific literature without having to fear for their life and career. During this time several elite research and design schools that dealt with the field of transport planning were formed in Moscow, Leningrad, Kiev, Minsk, and Sverdlovsk. Even though ideological pressure significantly decreased, the Soviet practice of urban planning continued to be defined by the semi-compulsory settlement system (where people had little choice as to where they lived) and the total dominance of public transport. Thus, the achievements of Soviet transport planners from the 1960s to the 1980s

were mainly of the engineering and mathematical kind. In this field a relatively effective set of engineering calculations was developed, including, in particular:

- A model for predicting urban mobility and traffic volumes;
- Algorithms for origin-destination matrix calculation based on gravity and entropy models;
- Techniques for constructing cartograms of transport and passenger flows (Fig. 1.7);
- Methods for constructing transport accessibility isochrones in urban areas;
- Algorithms for solving optimization problems of urban transport networks, etc.

Moreover, a number of books on urban modeling, traffic engineering and traffic flow theory were translated into the Russian language at this time (Wilson 1970; Institute of Transportation Engineers 1941; Transportation Research Board 1965; Drew 1968; Height 1963; Inose and Hamada 1975). During the same years a number of technical universities in the country, especially the State Technical University—MADI, formed strong traffic engineering departments that prepared highly qualified specialists.

Attempts were made to create original software for transport macromodeling, as well as an urban planning management system. However, due to a lack of computing capabilities, Soviet planners could not achieve serious progress in these areas. In the 1990s, when foreign software for transport modeling and design became available to Russian planners, these attempts almost completely ceased. Finally, in the early 1970s special documents exclusively concerning transport planning—comprehensive transport schemes (CTS)—started to be developed in addition to general city plans. Accordingly, the field of transport planning was finally distinguished as an independent profession. During the same years numerous rules and regulations governing all aspects of transport planning appeared. These detailed regulations had, of course, some advantages: formal adherence to these rules and regulations guaranteed that the planner could not make any serious mistakes. On the other hand, this severely limited the capability of the newly recognized transport planners to create new solutions, forcing them instead to employ a standardized set of solutions that was partially obsolete.

At the same time a very specific aspect of transport planning suddenly appeared and evolved to gargantuan sizes in Russia: central planning of mass transport of cargo using linear programming transportation. This interest was largely caused by the 1975 Nobel Prize in Economics, which was jointly awarded to the Soviet academician Leonid Kantorovich and American professor Tjalling Charles Koopmans for the creation of linear programming theory. The main difference between Soviet and American experiences was that, in America, the problem of optimal routing of deliveries between factories fundamentally assumed that they could have surpluses and that distributors could have varying demand. This was traditionally included in the scope of corporate governance, but was transferred to the city as a whole. It is clear that the possibility for such a formulation of the

problem was impossible under total state ownership which included all the companies, suppliers, customers and carriers.

Computing centers dedicated to solving the problem of route optimization were organized in the largest Russian cities. They did so by assigning suppliers to consumers, and on this basis directive plans for mass transport of cargo were developed. Officially, this planning method created a significant positive economic effect. However, transport planners involved in the process understood that these "optimal plans", were, in reality, not very effective.

Nevertheless, Soviet transport planning in the seventies and eighties was at a high level in all major aspects of the field:

- methodology for mobility surveys and modeling;
- detailed regulation of different elements of transport planning;
- technologies for calculations relating to passengers and freight capacities of the various elements of the transport system;
- mathematical apparatus, etc.

It is safe to say that this level was considerably higher than the level of transport planning in cities of the former Soviet Union today, or in third-world countries.

However, the Soviet practice of transport planning had a fundamental methodological defect, since it was based on strictly controlled patterns of transport behavior of the population and commodity producers. This reflected the realities of a "socialist city", which had several main distinguishing features, such as:

Semi-compulsory settlement patterns. For example, a residential neighborhood for the AVIASTAR plant in Ulyanovsk was planned with the basic requirement that 100 % of the population must be connected to the workplace: everyone who lived in the neighborhood had to work at the plant, and all the employees of the plant had to live in that neighborhood. Given the fact that the plant and its symbiotic neighborhood were situated on the left bank of Volga river, and the rest of the city stood on the right bank, it is easy to understand the problems this planning caused a few years after construction.

Directive freight transport planning, mentioned above.

Artificial capping of the motorization rate, explained earlier, which lasted almost until the end of the 1980s. The motorization rate in 1938 was 6 cars per 1000 inhabitants, and 60 cars per 1000 inhabitants in 1991. For comparison, in the UK these figures in the same years were 68 and 436, respectively. These figures for the same years were 128 and 575 in Australia, and as high as 231 and 710 cars per 1000 inhabitants in the US.

While the motorization rate was low, the flaws of this urban planning system stayed invisible. Moreover, in a situation where a "citizen's own feet" (Zilbertal 1932) were the only alternative to public transportation for the majority of the population, there was no way for the average citizen to notice a lack of car related infrastructure. It should be noted that the effective replacement of individual car ownership with Soviet public transport, "the best in the world", was sold to the people as part of the official mythology.

In the foreign practice of urban and transport planning, at least since the 1960s, it has been assumed that individual and public transport are not substitutes but complements for each other (Jones 1981).

Moreover, objective comparisons of Soviet public transport with the best world analogues were clearly not in favor of the former. Since the easing of censorship of the press, which occurred in the late 1980s, objective data on the actual difference between "socialist" and "bourgeois" public transport appeared on the pages of specialized journals. The quality of public transport in Moscow, according to the survey conducted in 1985 (see Chap. 3), can be considered "very low" in comparison to any objective criteria or international transport systems. Obviously these quality control standards were never incorporated in Soviet transport planning regulations, but the gap between the planned parameters (good and optimistic) and the actual circumstances (usually very poor) was an everyday reality for the Soviet people.

By the end of the Soviet era, transport planning documents and practices that were quite decent in methodological and instrumental terms developed in the country. Unfortunately, these documents and practices were based on very artificial hypotheses about the transport behavior of citizens. In addition, the transport realities of Russian cities were far from the standards included in these documents.

1.2 Transport Planning in the Post-Soviet Period

The basic personal freedoms finally granted to the residents of Russian cities after the fall of the Soviet regime automatically led to a rapid increase in ownership of cars and small businesses. The trajectory of Russian motorization growth is lagging behind the phase their foreign counterparts were in 40 years ago (in the case of the UK), 55 years ago (in Australia) and even 80 years ago (in the US). However, the difference is much smaller compared to Japan, South Korea or Brazil, but, regardless, a continuous 20-year growth rate of 5–8 % per annum is impressive. By the end of 2015, there were 350 cars per 1000 people in Russia. Of course, in big cities, their concentration is much higher: about 400 cars per 1000 inhabitants (more than 550 cars per 1000 people in Vladivostok).

Mass motorization in the city turned out to be a very difficult challenge for the traditional national urban development paradigm, as well as for many government (municipal, civil) institutions, one way or another associated with this process.

When there was a low level of motorization traffic jams were exotic and only happened in the case of force majeure. The official methodological documents from the 1970s suggested measuring capacity of road sections by intentionally causing "short-term congestion using a road police employee". It is unlikely that transport planners could have ever predicted that in 40 years congestion would become an everyday reality on almost all the urban streets and suburban roads.

In most cases, the causes of these bottlenecks can partially be explained by extremely weak institutions governing the use of cars (movement, daytime parking,

storage, etc.) and traffic management in general. However, they are caused, first and foremost, by inadequate planning of cities as a whole, and their street and road networks in particular.

In the 1990s and 2000s Russia faced the "clash of cars and cities" and degradation of traditional systems of mass public transport, which largely repeated similar processes that had taken place in the western world during the initial stages of motorization growth.

The graphs of growth and decline in urban land-based public transport ridership in US cities and Russia ones, presented in Chap. 10, reveal the degree of similarity of these processes. In both cases, the process of degradation of public transport took place under the same slogan: "Public transport is an option either for the poor or for a self-supporting business".

Accordingly, funding (in those cities where it was available!) was allocated only to the needs of road infrastructure, which in Russia mainly meant widening the streets and the constructing multilevel interchanges in the city center.

The "Vicious Circle", described by Professor V.R. Vuchic, accurately describes the processes which took place in the wealthiest Russian cities from 1990–2000 (Fig. 1.8). However, in poorer cities even these processes did not take place, as their transport systems did not develop in the slightest during these crucial last 15–20 years.

The process of transport planning in the 1990s also underwent significant degradation. Many skilled workers retired, emigrated, or changed their profession. Qualified teams of transport planners survived mainly, and in much smaller numbers, in planning organizations in Moscow and St. Petersburg.

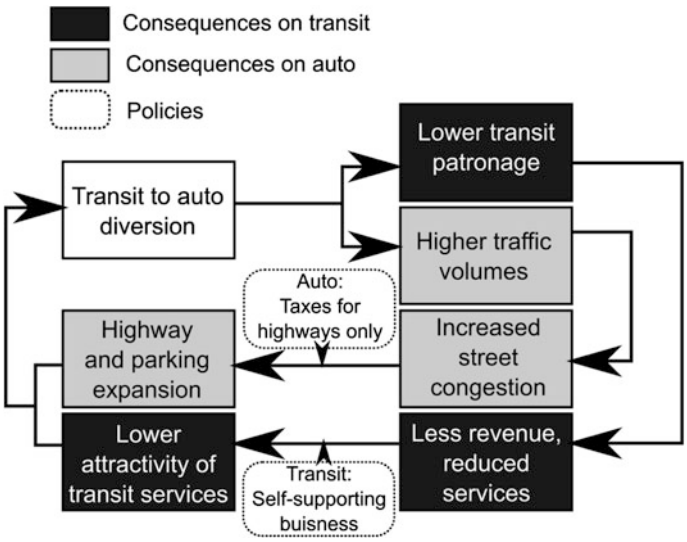

Fig. 1.8 The Vicious Circle of urban transportation [*Source* Reproduced by authors from Vuchic (1999)]

From 1990–2000 Russian cities developed next to no planning documentation. Comprehensive transport schemes were no longer mandatory documents. Even in cities where transport plans were created, the degree of their implementation was extremely low.

Trends in spatial development of Russian cities during the period in question are presented in Chap. 2. Let us add to this that the development of Russian cities was determined mainly by two factors:

- Short-term financial interests of developers somehow affiliated with the local authorities. These developers were given the opportunity to build new facilities with a complete disregard for the availability of sufficient transport capacity at the construction site: both in terms of public transport, and especially in terms of the road network;
- The aforementioned "absolutist tradition" dating back to Joseph Stalin, if not to the king Sennacherib. This "absolutist tradition", oddly enough, has only strengthened despite the new socio-political conditions. Mechanisms for independent expertise and citizen participation in the process of urban planning were still in their infancy. The mayor's power was no longer constrained by the framework of the General plan or urban development regulations, approved by the central government authorities.

The most striking examples of this occurred during the development of Moscow's transport system during the mayorship of Yuri Luzhkov (Fig. 1.9). Billions of dollars from the budget were invested in projects committed to widening old Soviet avenues and the construction of multilevel road junctions and tunnels. The effect these projects had on transport problems was mostly either negligible or nonexistent.

A typical example is the so-called Halabyan-Baltic tunnel. The mayor, sincerely believing that the main causes of traffic congestion are traffic lights, ordered the construction of a deep tunnel (situated deeper than the subway line!) between two ordinary urban streets (Alabyana street and Baltiyskaya street).

Investments in the project have exceeded 2 billion dollars, which is an amount sufficient to renew the entirety of the land passenger transport grid in Moscow with the world's best (and therefore, most expensive) buses and trams. The transport effect of Luzhkov's project was obviously inconsequential.

The main official documents in the field of transport, which were issued in the 1990s and 2000s at the level of local administrations, were comprehensive schemes of traffic management (CTMS) and projects of traffic management (PTM). In world practice, these documents belong to the area of traffic engineering rather than to the area of transport planning. Additional information about these documents is provided in the next section.

Real interest in transport planning was revived in the 2010s, not only in Moscow and St. Petersburg, but also in other major Russian cities. This interest was caused by the fact that traffic congestion moved from being a hypothetical threat to a daily and highly inconvenient reality. In these circumstances, even the most self-confident and

Fig. 1.9 General plan of Moscow during the mayorship of Yuri Luzhkov (1990–2005). The emphasis on the reconstruction of road junctions is clearly visible (*large* and *small circles*)

stubborn mayors began to turn to recommendations from world science and practice. Unfortunately, the appeal of "world science" in most cases resulted in an attempt to reproduce old Soviet practices instead of copying the fruits of foreign experience. This can be explained by a long pause in professional tradition, as well as by the majority of Russian planners being ignorant of the best foreign practices and theoretical developments.

Demand, as usual, has created supply: since the turn of the 21st century, transport planners from Western Europe and the United States have started to come to Russian cities to give lectures and classes. Some other English-speaking